Environmental Report 2016

Environment and Health & Safety

aalborgportland
CEMENTIR HOLDING

Environmental Report 2016

Environment and Health & Safety

Aalborg Portland A/S
The company has been manufacturing cement at the Aalborg factory for more than 125 years and is the sole producer of cement in Denmark. The development towards sustainable production began in the 1970s when the energy crisis meant closure of three competing Danish cement plants. Improved energy efficiency came into focus, and in 1988 Kiln 87 entered service equipped with an efficient semi-dry production process for grey cement. The first installation for recovery of waste heat with desulphurisation of flue gases in white cement production entered operation in 1990.

Further energy and environmental initiatives have been developed subsequently, and sustainable production remains of major importance for employment, technology development and export.

Some of these initiatives – both solutions implemented and planned sustainable projects – are described in the section "Sustainable production".

Formal details relating to Aalborg Portland A/S appear in the section "General information" – see also www.aalborgportland.dk.

Environmental Report 2016 – target group
Aalborg Portland's Environmental Report 2016 is intended to provide interest groups with easy access to the company's principal environmental impacts as well as initiatives on health & safety and ongoing improvements.

These interest groups are:
Customers, employees, suppliers, present and future investors, financial institutions, insurance companies, authorities, neighbours, political groups and interest organisations.

Part of the Aalborg Portland Holding Group
Aalborg Portland A/S is a part of the Aalborg Portland Holding Group, which is owned by the Cementir Group, an international supplier of cement and concrete based in Rome and listed on the Italian stock exchange in Milan. For more information on Cementir, see www.cementirholding.it/index-eng.php.

Environmental Report 2016 covers the Aalborg Portland cement factory situated at Rørdalsvej 44, 9220 Aalborg Øst, Denmark.

One of Denmark's leading industrial companies, Aalborg Portland owns 1,200 hectares in the Rørdal area. In addition to the cement factory the site contains a variety of nature and agricultural land and a lake in the chalk pit.

The cement factory and chalk pit (actice quarry) covers a total combined area of 190 hectares. In addition to production of cement and district heating, there is a recycling depot and two on-site landfills, one now closed.

Aalborg Portland A/S has 261 employees. A number of external contractors also work there.

This Environmental Report covers the period 1 January – 31 December 2016.

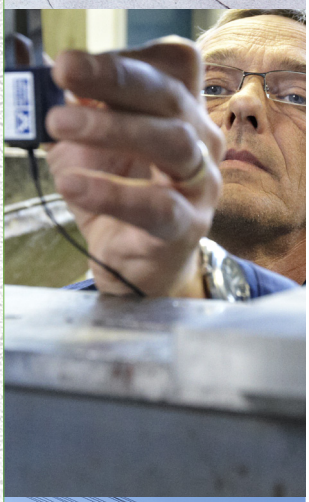
EMAS verification has been performed by Bureau Veritas Certification (Accreditation No. 6002) in accordance with the EMAS scheme, cf. section "Environmental verifier's report and EMAS registration".

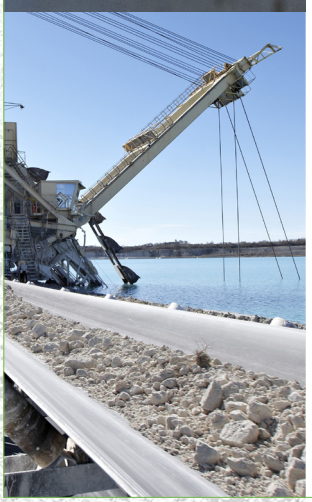
Certifications
Aalborg Portland's management system for quality, environment, energy and health & safety energy has been certified by Bureau Veritas Certification.

Aalborg Portland is certified in accordance with the following standards:

ISO 9001 – since 1989
ISO 14001 – since 1998
OHSAS 18001 – since 2002
ISO 50001 – since 2013
EN 197-1 product certified – since 2002

Furthermore, Aalborg Portland's environmental management has been EMAS-registered since 2000.
Reg. no. DK-000132





CONTENT

AALBORG PORTLAND
ENVIRONMENT, ENERGY AND HEALTH & SAFETY IN 2016

Aalborg Portland's Environmental Report 2016 is the Management's review of the year's most significant environmental, energy and health & safety activities relating to Aalborg Portland's Danish cement production and Danish shipping terminals.

Kiln 87 – cyclone tower

Michael Lundgaard Thomsen,
Managing Director,
Aalborg Portland A/S

In 2016 we initiated investment amounting to EUR 10.3m in design improvements to our calciners on Kiln 87 that produce grey cement clinker. The purpose of the investment is to reduce dust emissions at greater stability in production. At the same time it will enable us to increase the proportion of alternative fuel and improve the production. In the long term it is our target to supply 60% of energy input for Kiln 87 from alternative fuels.

In 2016, more than 45% of the energy used to produce grey cement was supplied by alternative fuels. With the investment in calciner improvements we are coming closer to our target, but continued alternative thinking will be required to achieve 60% substitution for production of grey cement and 20% substitution for white cement.

More information about the new calciners can be found in the section "Investments with climate and environmental improvements".

Alternative fuels and raw materials

One of Aalborg Portland's focus areas in sustainable production is use of alternative fuels and raw materials, and we are constantly on the lookout for new possibilities. Alternative fuels we have used in 2016 have included wastes from industry, meat and bone meal, and dried sewage sludge from the City of Aalborg. All with view to limiting our consumption of non-renewable resources and reducing CO_2 emissions.

In 2016 our factory has used approx. 450,000 tonnes of alternative raw materials, including power station fly ash, sand dredged from the Limfjord at Hals Barre, and power station desulphurisation gypsum from Nordjyllandsværket. In 2016 a new alternative raw material was introduced – bottom ash supplied by DONG Energy. Alternative fuels replace natural resources and are a part of Aalborg Portland's sustainability principle.

Improved energy efficiency

In the period 2011-2016, activities to improve energy consumption efficiency in existing production facilities have resulted in projects which provide an annual saving in fuel and electricity that corresponds to the energy consumption of approx. 15,000 households.

There will be continued focus on efficient energy consumption by optimising production and on fully use of electricity and fuel. In that way Aalborg Portland will contribute to realising the aims of the Danish government for Denmark's future efforts to save energy.

In 2016, waste heat from our cement production used to provide district heating for the people of Aalborg corresponded to the annual consumption of 23,500 households. And work continues on developing new ways to increase this supply in the future.

Work environment

The company's most important resource is its people. They are the ones who inspire and drive ongoing improvements in routines, equipment and processes. This makes heavy demands on our employees.

Heavy demands are also made on both managers and employees by the presence at Aalborg Portland of large numbers of external tradesmen engaged in building and installation of new facilities. To unite production and construction work with a work force that is sometimes three times larger than normal demands structure, planning and above all co-operation.

In 2016 a three-year plan was established with focus on making our safety culture even better. With a strong health & safety organisation, capable managers and employees who are aware, we have good potential to make Aalborg Portland one of the safest workplaces in the heavy industry domain. Work performed at Aalborg Portland must at all times be performed safely. This calls for clear guidelines, and thus consequences if these guidelines are disregarded. A clarification and effectuation are a part of the work relating to safety culture that is vital for a "Safe Workplace".

Motivation

In 2016 a motivation survey was conducted. A motivation survey is a tool for identifying and initiating measures intended to ensure that Aalborg Portland continues to be an attractive workplace. The purpose of the survey was partly to monitor employee satisfaction and motivation levels, and partly to follow up on our ability to strengthen the business through ongoing improvement of work processes, organisation and management.

The 2016 survey showed that 90% of employees wish to be part of Aalborg Portland's long-term future, and that 86% are happy working in their department and with their tasks, while 30% are less satisfied with the physical work environment and see no clear career opportunities at Aalborg Portland.

In connection with the three-year plan to improve the safety culture, there is focus on the physical work environment. In addition, with a view to strengthening the opportunities for personal development, the Cementir Group's Leadership Competency Model is being introduced. This tool is intended to establish a common frame of reference for the behaviour of all employees and managers in order to create integration across levels and organisations, promote efficiency and drive strategic changes. Furthermore, we have initiated a two-year graduate programme for newly qualified academics with the aim of challenging and developing the programme participants both professionally and personally through on-the-job training and direct responsibility for own projects.

Green investments

At Aalborg Portland we wish to continue our development in both environment, energy and health & safety. For green investments, this is dependent on the politicians pursuing a continued long-term, stable and future-oriented policy that avoids discriminatory green taxes in Denmark – a prerequisite for our ability to invest in improved energy efficiency, environment, climate and health & safety, and to support sustainable development.

Michael Lundgaard Thomsen
Managing Director, Aalborg Portland A/S
May 2017

Aalborg Portland – Cement factory

Excavator in the chalk pit

ENVIRONMENTAL VISION, ENVIRONMENTAL AND ENERGY POLICY

ENVIRONMENTAL VISION // AALBORG PORTLAND SHALL BE A RESPONSIBLE COMPANY PROMOTING SUSTAINABLE DEVELOPMENT.

This policy is applicable to the cement factory in Aalborg and shipping terminals in Denmark.

Our policy is to:

- Respect statutory legislation and relevant official requirements. If a limit is exceeded we will inform the authorities and prepare remedial action plans.
- Promote sustainable development and cleaner technology within the scope of economic feasibility.
- Set pro-active targets for our future work and review our targets once a year at Management's seminar established for that purpose.
- Support our customers in achieving their environmental targets by developing and helping to develop sustainable cement and concrete products which improve the life cycle of concrete.
- Protect the environment by reducing emissions and consumption of energy and raw materials per tonne of cement product through energy efficiency measures, energy management and other means.
- Inform our suppliers and subcontractors of relevant procedures and requirements.
- Adopt an active and open communication, knowledge and dialogue with customers, employees, authorities, neighbours, organisations and other collaboration partners.
- Educate and motivate our employees to ensure that we live up to the requirements contained in our policies, targets and action plans.
- Oppose introduction of further anti-competitive environmental levies and work for a reduction of the existing tax burden.

To realise these objectives we undertake to:

- Maintain and develop a Management System that embraces environment, energy and CO_2. The system is certified according to ISO 14001, ISO 50001 and the Danish Energy Agency's supplementary requirements hereto and is registered under the EMAS scheme.
- Publicise our policy, targets, action plans and results in the form of an annual Environmental Report.
- Formulate and use indicators as guidance mechanisms to achieve defined targets.
- Assess our products, facilities and significant renovation projects in relation to the scope of this policy, and support energy-efficient procurement and eco-friendly project planning.
- Be an active collaboration partner in Danish environmental and energy policy by utilising alternative raw materials and fuels.

Conveyor belt for alternative fuels to Kiln 87

SUSTAINABLE DEVELOPMENT

AALBORG PORTLAND IS COMMITTED TO PROMOTE SUSTAINABLE DEVELOPMENT BASED ON THE FOLLOWING PRINCIPLES:

- Environment shall be an integral part of the development in the company's activities, including reduction of environmental footprint.
- Our environmental activities shall be anchored through involvement of all employees and in dialogue with the community.
- Key performance indicators shall track sustainable development.
- Production and economic growth shall take place without relative increase in energy consumption, emissions, use of chemicals, creation of waste, and other consumption of resources for the individual products.
- Resource efficiency shall be promoted i.a. by substitution of non-renewable resources and introduction of new technologies.
- The global perspective shall be invoked – i.a. by CO_2 emissions trading, Joint Implementation and the Clean Development Mechanism.

SUSTAINABLE PRODUCTION

In the development and manufacture of Aalborg Portland's cement products focus is placed on sustainability and responsibility.

Central control room – operation and monitoring of production


Land owned by Aalborg Portland at the Limfjord


Stack – 120 meters high

Aalborg Portland is committed to contributing to socio-economic sustainable development. We strive to improve our environmental and energy performances year on year. Current initiatives include the following:

CO_2 and alternative fuel
Aalborg Portland is focused on reducing emission of CO_2 by increased use of waste fuels that contain biomass, which is CO_2 neutral as a substitute for fossil coal and petcoke. Use of waste as fuel thereby contributes to reducing global consumption of fossil fuels.

CO_2 and products
In order to reduce our CO_2 emission per tonne of cement produced we have introduced mineralised operation in the manufacture of grey and white cement clinker. This is a less fuel-intensive kiln process and therefore causes less CO_2 emission.

Energy savings and switch to alternative fuels have resulted in a reduction in relative emission of CO_2 in the period 2000-2016 of 9%.

To reduce CO_2 at source, we have also begun production trials with types of cements that contain less cement clinker. These cements are less energy-intensive in the production phase and thus cause less CO_2 emission. The work of developing these new cements is a protracted process as the market must subsequently also accept them.

Heat recovery and gypsum production
Aalborg Portland has established a system for heat recovery and desulphurisation. Our system removes up to 98% of the sulphur contained in the flue gases.

We recover heat from our flue gases for supply to the City of Aalborg's district heating network, and we have the capacity to meet the annual heat requirement of 36,000 households. Desulphurisation gypsum is formed as a by-product. This gypsum is recycled in cement production as a substitute for natural gypsum.

NO_X reduction
In the mid-2000s, as NO_X reduction measures, we introduced SNCR technology in grey cement production and mixing air technology in white cement production. As a result, relative NO_X emission has been reduced by 70% in the period 2003-2016.

Water resources
In 2005 we installed a water recycling installation. This installation today recycles, for example, the condensate produced in our heat recovery and in flue gas desulphurisation. In 2016 the volume of filtrate water exceeded 385,000 m^3. This water was previously released into the Limfjord. The installation also saves on recovery of an equivalent volume of water from Aalborg Portland's own wells, thereby helping to relieve the burden on local groundwater resources.

Future initiatives
Plans for setting up 5 wind turbines and studies of the possibility of remote cooling of a new super hospital can furthermore contribute to the transition to green industry in Denmark. Read more in section "Energy".

THE RESOURCE-EFFICIENT PARTNERSHIP

Aalborg Portland converts raw materials, by-products and wastes into cement and district heat. We focus on promoting a sustainable development by basing substantial parts of our cement production on recycling flows of materials from society and industry in a resource-efficient partnership. This is consistent with the Danish government's desire that wastes should be used as resources in a circular economy.

For Aalborg Portland, wastes and homogenous residues constitute a resource. We recycle and utilise wastes and homogenous by-products from other industries as fuel and raw materials in production of cement. Waste heat from our production is supplied to the City of Aalborg's district heating system and on to the city's consumers.

By recycling and utilising fuels and alternative raw materials in cement production, wastes and by-products are used up completely. All constituents are consumed and no new residues formed. High temperatures and special process conditions make cement kilns ideal for use of alternative fuels and raw materials. At the same time the kiln flue gases are effectively cleaned in filters and scrubbers so that the factory's environmental impact is not increased.

In 2016 Aalborg Portland substituted approx. 600,000 tonnes of alternative fuels and raw materials for an equivalent volume of natural raw materials and fossil fuels that would otherwise have had to be sourced in Denmark or imported. Aalborg Portland has the capacity to handle 700,000 tonnes of alternative fuels and raw materials annually.

MUSSEL SHELLS RECYCLED IN CHALK PIT

COLLABORATION ON RESOURCES

Mussel shells from a food processing plant on the Limfjord are utilised as a recycled waste in the Aalborg Portland chalk pit.

After unloading, the mussel shells are deposited in the active part of the chalk pit to provide a support surface for the deep-excavator and conveyor belt. The mussels ensure stable operation particularly in wet and frosty weather. The shells are removed concurrently with the chalk and recycled in cement production.

SOCIETY AND INDUSTRIES	WASTE PRODUCT	CEMENT PRODUCTION	CEMENT AND DISTRICT HEATING WITH CLIMATE AND ENVIRONMENTAL IMPROVEMENTS
Power station →	Fly ash and desulphurisation gypsum	Consumption of alternative fuels and raw materials	Recycling of alternative fuels and raw materials
Navigation channels →	Sand		Utilisation of waste from other industrial production
Sulphuric acid factory →	Iron oxide		Lower CO_2 and NO_X emissions
Paper recycling factory →	Paper sludge		Smaller quantities of residues
Aluminium recycling factory →	Aluminium by-products		Lower overall environmental impact
Biomass-fired plants →	Bottom ash		
Collection schemes →	Waste from industry		
Daka Bio-Industries →	Meat and bone meal		
Sewage treatment plant →	Dried sewage sludge		
Fishing industry →	Mussel shells		

Shredded waste fuels

MANUFACTURE OF CEMENT

The manufacturing processes for grey and white cement are essentially identical except for differences in kiln configuration.

Sourcing of raw materials

Cement is manufactured principally using the natural raw materials chalk and sand, which are the core components in all cements produced at Aalborg Portland. Chalk is sourced from Aalborg Portland's chalk pit, while the sand is quarried at Sandmosen and dredged at Hals Barre. This dredging also helps keep the Limfjord navigable.

Initial processing of raw materials

The chalk is first processed in a slurry drum, while the sand is ground in a sand mill. The two ingredients are then mixed to form the finished kiln slurry.

Kiln process (grey cement)

The slurry is injected together with fly ash and pyrite ash into a dryer-crusher where the material is converted with the help of hot flue gases into raw meal. The raw meal is conveyed via a separating cyclone to the cyclone preheaters where it is heated to 750° C.

The raw meal is further heated in the calciners to 900° C, at which temperature the carbon dioxide is released. The material then enters the 74-metre long rotary kiln where it is gradually heated to a temperature of 1500° C to form cement clinker. The clinker is then cooled in the clinker cooler.

Process heat for the kiln is provided by coal, petcoke and alternative fuels, including waste products, dried sewage sludge and meat and bone meal.

Heat recovery

In 2016, heat recovered from the kiln process during production of white cement and supplied to the city of Aalborg was sufficient to meet the heat consumption of 23,500 households.

Grinding in cement mill

After stockpiling in the clinker store the clinker is ground in the cement mill to a fine powder to which a small percentage of gypsum is added to produce the types of cement required.

Packing and distribution

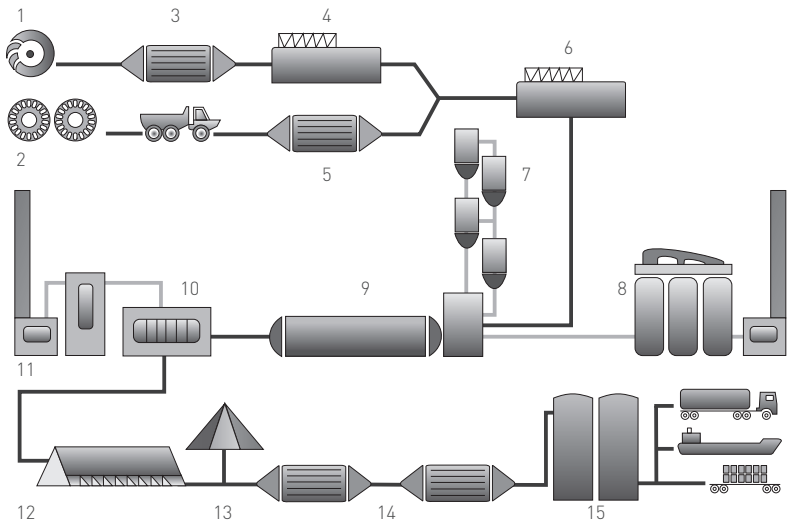
The cement is distributed in bags or in bulk by road or ship.

A quality product

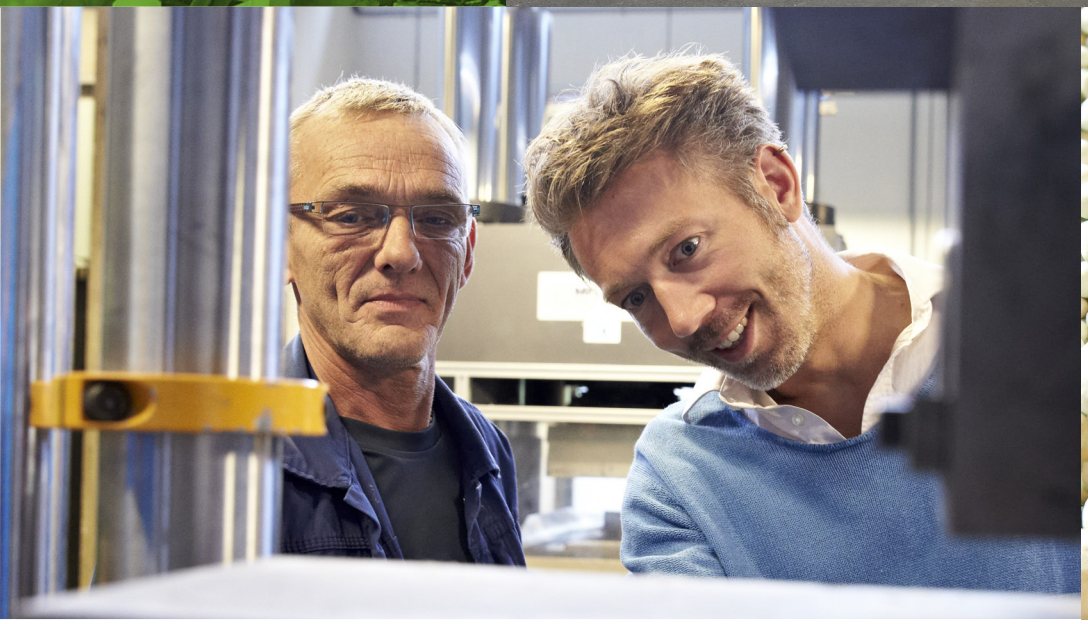
The finished cement product is ready for use in all sizes of building projects worldwide. The cement is a quality product which is used in concrete, mortar etc. and adds strength, stability and long life to buildings and constructions everywhere.

FROM RAW MATERIALS TO CEMENT

1. Chalk excavator
2. Sand dredger
3. Slurry drum
4. Chalk slurry
5. Sand mill
6. Finished slurry
7. Cyclone tower
8. Electrostatic precipitator
9. Rotary kiln
10. Clinker cooler
11. Electrostatic precipitator
12. Clinker store
13. Gypsum store
14. Cement mills
15. Cement silos



Shipping terminals and delivery of cement



Cement clinker

CEMENT FOR BUILDING WITH AMBITION

Cement is used for making concrete – and is the most widely used construction material in the world. Buildings, bridges, runways, curbstones and garden paving are examples, and architects, engineers and manufacturers are constantly seeking new areas of application.

House of Music, Aalborg, Denmark

The Great Belt Bridge, Denmark

AALBORG PORTLAND'S PRODUCTS

Aalborg Portland manufactures both white and grey cement, quality products which are distributed in bags and in bulk to the domestic and export markets.

Aalborg Portland's cements are subject to Bureau Veritas Certification, which verifies that they comply with the requirements of product standard EN 197-1, and they are therefore CE-marked.

Product information

It is important for us as manufacturers that information about our products is readily accessible. The intended use for each individual product must be stated in the product information and in the technical documentation prepared with view to compliance with relevant legislation.

Information about our products can be found on our website www.aalborgportland.dk and relevant documents can be downloaded.

Declaration of Performance (DoP)

Declarations have been prepared for our individual products bearing cement designation, CE marking and declared properties required in the cement standard.

Safety Data Sheets (SDS)

Safety Data Sheets accompany our products and therefore form the basis for the preparation by customers of workplace instructions for use in their own businesses. The sheets contain details of any risks associated with working with the product along with information about relevant protection equipment etc. The Safety Data Sheets are prepared in accordance with CLP (Classification, Labelling and Packaging) regulations.

European Chemicals Agency and REACH

All our products are registered with the European Chemicals Agency (ECHA), and relevant documents are compiled in accordance with the REACH regulation.

Environmental Product Declarations

The environmental profile of a product appears from declared values for climate and environmental impact, consumption of resources, waste, etc.

To ensure compliance with these new product information requirements we have joined forces with Aalborg University to develop Life Cycle Assessment (LCA) models for identifying the environmental hotspots in our value chain – from extraction of chalk to packaging of products.

Cement products manufactured for the Danish market include the following:

BASIS® cement
Suitable for pre-cast concrete units and concrete products.

RAPID® cement
Suitable for ready-mixed concrete, pre-cast concrete units, concrete products, floors and screeds. Also suitable for masonry mortars, including lime cement mortars used in building, rendering etc.

BASIS® AALBORG cement
Suitable for general concreting and construction work on building sites, such as foundations, floors, masonry, rendering etc.

MESTER® AALBORG cement
Suitable for lime cement mortars used in construction, pointing, rendering, roofing etc.

AALBORG WHITE® cement
General-purpose cement, but the preferred choice when the specification calls for white or pigmented concrete.

LOW ALKALI SULPHATE RESISTANT cement
Specially developed for concrete used for civil engineering structures such as bridges or constructions in contact with sulphate-containing groundwater.

CEMENT AND CONCRETE OF THE FUTURE

Aalborg Portland is involved in developing a variety of cement types for the future.

The aim is to create cements that in the long term can be produced with lower energy consumption and lower CO_2 emission.

Concrete breaks with traditions
A new road bridge on the motorway between Herning and Holstebro is the first demo project in the project "Green conversion of cement and concrete production". One half of the bridge deck is cast with a typical bridge concrete and the other half with a "green" concrete.

In the development project "Green conversion of cement and concrete production," which is supported by Innovation Fund Denmark, the project partners are working on the development of concretes that use alternative cementitious materials. For the newly constructed road bridge the project partners developed a concrete that is produced with reduced energy consumption and CO_2 emission without compromising on the requirements of the consultant, contractor and concrete manufacturer regarding the behaviour, strength and durability of the concrete.

Past experience has shown that the use of alternative cementitious materials can lead to sticky concretes, which is a major barrier to widening their use. Observations from production and execution of the new road bridge showed no noticeable difference between the new concrete and the typical bridge concrete.

New design concept implemented
The new concrete has been developed on the basis of a number of functional requirements defined by the consultant, the contractor and the manufacturer with regard to the construction and the concrete.

New road bridge on the motorway between Herning and Holstebro, which is the first demo project in the project "Green conversion of cement and concrete production".

"The function-based approach differs from the current approach to bridge design in which standards and regulations impose strict requirements on choice of materials, material properties and concrete composition. This method opens up new opportunities to reduce CO_2 footprint, but at the same time it also requires properties to be tested and documented fully in the types of concrete used.

The preliminary testing has shown that in quality terms the green concrete is on a par with a normal bridge concrete in the extra aggressive environmental class. The used concrete is therefore the project's best input for a concrete that with the chosen materials is considered to meet the same requirements to the bridge as a typical bridge concrete, but with a reduced CO_2 footprint.

It is important and crucial to see the new technology in full scale. This is where the concrete must show its value. Long-term, real-world experience is ultimately crucial to whether the new technologies will be implemented and applied.

The future

The work of the project is not finished, however, and tasks head include work with other cementitious materials. In addition, a new exposure site was established in autumn 2016 along a busy expressway in the City of Taastrup, Denmark, that will open the way for long-term experiences with further concretes, and enable comparison of field observations with results from accelerated lab tests. The hope is that in the long term up to 30% reduction in CO_2 emissions can be obtained by construction of bridges and roads.

This project is very important for the cement and concrete industry as it provides the opportunity to test new solutions instrumental to keeping concrete at the forefront in terms of sustainability and low environmental impact.

ABOUT THE DANISH INNOVATION CONSORTIUM

The Danish Innovation Consortium started on 1 March 2014 and will run until February 2018. It is co-financed by Innovation Fund Denmark and has a total budget of EUR 3.9m.

The consortium members are Aalborg Portland A/S, Femern A/S, Rail Net Denmark, Sweco A/S, Rambøll Denmark A/S, MT Højgaard A/S, Unicon A/S, Fabriksbetonforeningen, DTU Civil Engineering, Danish Road Directorate, Danish Energy Agency, Copenhagen School of Design and Technology (KEA), Business Academy Zealand, Lillebaelt Academy, Via University College – Campus Horsens, Centre for Concrete Education (AMU North Jutland) and Danish Technological Institute.

ENVIRONMENT AND ENERGY IN FOCUS

Aalborg Portland is a large industrial company in terms of area and includes a cement factory and a chalk pit where environmental and energy factors are in focus.

The principal environmental and energy factors relating to Aalborg Portland are covered in pages 26-39 under the following headings: Raw materials – Energy – Emission to atmosphere – Noise – Water – Waste – Land use – and Sustainable distribution.

As a control framework for environmental and energy factors, Aalborg Portland has introduced a Management System. We focus on ongoing improvements by working to environmental and energy goals. Our related activities and results appear in pages 22-23.

Burner zone in a rotary kiln with cement clinker

Re-established raw material area

ENVIRONMENTAL MANAGEMENT

Aalborg Portland is equipped with integrated Management System that covers quality, environment, CO_2, energy, and health & safety. The Management System is an integral part of company life and helps to maintain focus on the significant factors and to make our policies a reality.

Requirements, goals and actions plans are defined within the Management System so that we can constantly improve our performance in the areas covered, cf. the section "Environmental and energy targets – activities and results".

Aalborg Portland is certified according to the following:

ISO 14001, EMAS III, ISO 50001, OHSAS 18001 and Danish Working Environment Authority Order No. 1191, ISO 9001, NF 002, DS/INF 135, DS/EN 197-1/-2 regarding product quality of cement with right to CE marking, Danish Maritime Authority Regulation No. 6 of 9 October 2002 on bulk carriers, ISPS regulations on security of port facilities against terrorism, and Danish Safety Technology Authority's quality management system for electrical and installation work.

Principal environmental impacts
Cement manufacture is associated with use of energy and raw materials, and therefore gives a number of environmental impacts such as flue gas emission, wastes, noise, effluent, etc. In addition, there are environmental impacts from product distribution, extraction of raw materials, and fuel reprocessing, etc. fuels.

Materiality criteria
The starting point is the list of pollutants and emission thresholds for reporting to the European Pollutant Release and Transfer Register – the "PRTR list".

In our environmental and energy work the primary direct and indirect environmental impacts have been mapped and chosen according to the following criteria:

- Spread of substances along with climate and environmental impact.
- Volumes.
- Terms of environmental approvals and consideration for neighbours.
- Optimisation of raw material resources.

Transport of alternative fuels to Kiln 87

- Receipt of waste products from other industries.
- Energy savings potential.
- Minimised energy consumption during distribution.
- Product development and research into sustainable production of cement and concrete.
- Biodiversity.

Environmental approval

The environmental impacts are regulated in Aalborg Portland's environmental approvals and permits, cf. list in "General information" section. Terms are stipulated for operation, including:

- Terms for atmospheric emissions, covering kilns, cement and coal mills, cooler stack and boiler plant.
- Terms for factory noise emissions.
- Terms for release of process waste water, cooling water, rainwater, etc.
- Requirements for handling and reporting of serious operating issues and accidents.
- Requirements for operation of stores for raw materials and fuels.
- Requirements for operation of on-site landfills and recycling facilities.

Environmental performance

As follow-up to our work with environment and energy, key performance indicators have been chosen for production of grey and white cement, cf. table below. Key performance indicators are relative values where consumption and emission are stated in relation to production. The section "Material flows" shows the development for production as a whole during the past five years.

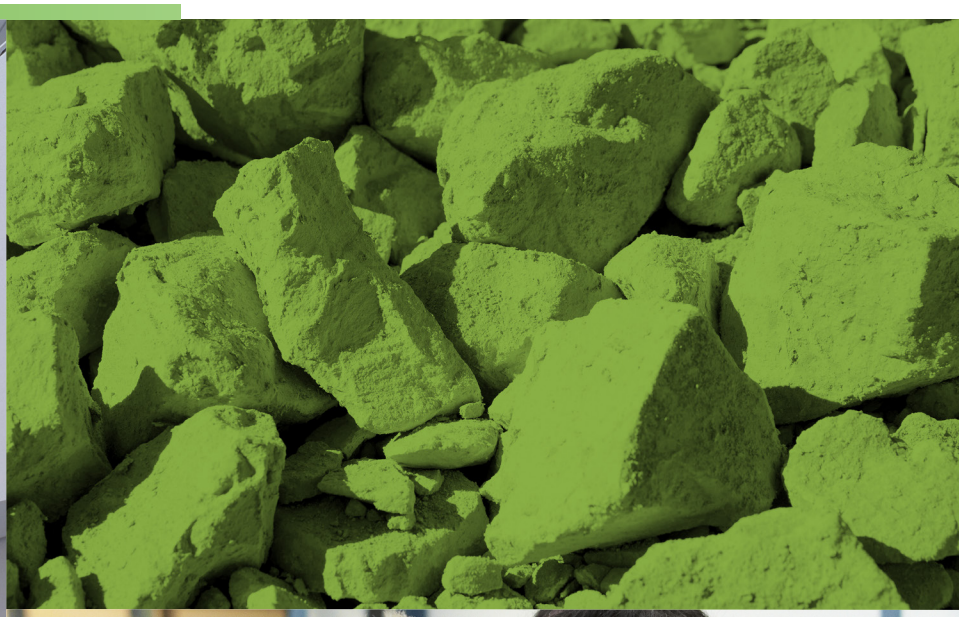
KEY PERFORMANCE INDICATORS	Unit	2012	2013	2014	2015	2016
Grey cement production						
Energy	GJ per tTCE	4.29	4.28	4.50	4.45	4.31
CO_2	Kg per tTCE	764	761	781	761	756
NO_X	Kg per tTCE	0.63	0.58	0.62	0.70	0.63
White cement production						
Energy *	GJ per tTCE	6.59	6.48	6.74	6.82	6.89[a]
CO_2 *	Kg per tTCE	1,139	1.124	1,144	1,155	1,173[a]
NO_X *	Kg per tTCE	1.54	1.25	1.39	1.51	1.69[b]

* Adjusted for heat recovered and supplied to the City of Aalborg's district heating network.
Adjustment for saved CO_2 and NO_X is calculated using Nordjyllandsværket's emission and energy values for coal firing.
The calculation is based on the 125% thermal efficiency method.

[a] In white cement production the adjusted energy consumption and CO_2 have risen as the adjustment has become smaller due to less heat recovery per manufactured cement product.

[b] In white cement reduction the increase in NO_X is due to adjustment of mixing air equipment to reduce dust for employees at the kiln burner stations.

ARoS Art Museum, Aarhus, Denmark



Research & Quality Center

ENVIRONMENTAL AND ENERGY TARGETS – ACTIVITIES AND RESULTS

TARGETS 2016	STATUS 2016	TARGETS 2017
ELECTRICITY SAVINGS Continued focus on reducing base power load and on power-saving measures.		Continued focus on reducing base power load and on power-saving measures.
In 2016 the target is to implement power-saving measures, including for baseload equipment, to achieve annual power savings of 2,351 MWh. Implement following projects: • Increase capacity for Cement Mill 8/9 regarding ROC cement (2,250 MWh). • Replace network switches (64 MWh). • Replace dockside compressor motor (16 MWh). • LED lighting in canteen and welfare building (21 MWh).	Target achieved with annual saving of 3,731 MWh by the following implemented projects: • Increase of capacity for Cement Mill 8/9 regarding ROC cement (3,630 MWh). • Replacement of network switches (64 MWh). • Replacement of dockside compressor motor (16 MWh). • LED lighting in canteen and welfare building (21 MWh). • Reorganisation of power supply to server and de-mounting of UPS (10 MWh).	In 2017 the target is to implement power-saving measures, including for baseload equipment, to achieve annual power savings of 1,130 MWh. Implement following projects: • Optimise boiler operation after Kiln 79 by replacing two boilers with one of new design (approx. 700 MWh). • Change to LED lighting in Kiln 87 cyclone tower and grey cement mills (approx. 180 MWh). • Replace DC equipment (motors) on Kiln 87 (approx. 250 MWh). In addition: Implement five special studies to identify potential for saving electricity.
Objective is to reduce the specific variable power consumption by 8% against 118 kWh per tTCE in 2010.	Target achieved. The specific variable power consumption has been reduced to 108.3 kWh per tTCE, a reduction of 8.2% against 2010.	Objective is to maintain the specific variable power consumption of 108 kWh per tTCE.
WIND TURBINES In 2016 the target is to replace 18% of power consumption relative to 2014 with renewable energy from five wind turbines on Aalborg Portland land.	Target not achieved. Aalborg City Council approved the 15 December 2014 local planning addendum for installation of five wind turbines at Bredhage. Objections from the 2015 public inquiry are being processed by the City of Aalborg. The parties have agreed to apply for dispensation from the overall noise picture in the local area to enable Aalborg Portland to install wind turbines at Bredhage. Final approval of the addendum by Aalborg City Council is pending.	In 2017, the approval of the local planning addendum by Aalborg City Council is awaiting for installation of five wind turbines on Aalborg Portland land.
FUEL SAVINGS In 2016 the target is to implement measures to achieve an annual indirect fuel saving corresponding to 8,528 MWh, by the following project: • Increase heat recovery from flue gases for district heat to match coal-fired district heat production.	Target not achieved but two measures were initiated. One has been implemented (1,496 MWh saved), and the other is a pilot project whose result is pending. • Pilot project using gypsum slurry in Kiln 87 to obtain cleaner filtrate water from condensate. The cleaner filtrate water will open the way for greater recycling in other installations. An added benefit will be increased heat recovery. The result of the project is pending. • In addition, a measure has been implemented to obtain a fuel saving of 1,496 MWh on Kiln 74 by using lining bricks in a ten meter test area, which reduces heat loss from the kiln.	In 2017 the target is to implement measures to achieve the 2016 goal of an annual indirect fuel saving, by the following project. • Increase heat recovery from flue gases for district heat to match coal-fired district heat production.

In 2016, five out of 10 environmental and energy targets were achieved.

TARGETS 2016	STATUS 2016	TARGETS 2017
ALTERNATIVE FUEL		
The long-term objective is to replace min. 60% and 20% respectively of the fuel energy for grey and white cement production by alternative fuel, reducing CO_2 emission.		The long-term objective is to replace min. 60% and 20% respectively of the fuel energy for grey and white cement production by alternative fuel, reducing CO_2 emission.
In 2016 the target is to replace 41.5% of the fuel energy.	Target achieved for Kiln 87 – 45.8% of fuel energy replaced.	In 2017 the target is to replace 43% of the fuel energy, which is lower than achieved in 2016, as no alternative fuel will be used during March de to replacement of both calciners for Kiln 87.The redesigned calciners are expected in the slightly longer term to contribute to increased substitution of fossil fuel.
The target for the white cement kilns is to replace 1.5% of the fuel energy.	Target achieved for white cement kilns – 3.7% of fuel energy replaced.	The target for the white cement kilns is to replace 2.6% of the fuel energy, which is lower than was achieved in 2016 due to expected reduced supplies of meat and bone meal.
CO_2 REDUCTION		
Continued focus on reducing CO_2 emission via increased biofuel input and, in the long term, development of new cement types*.		Continued focus on reducing CO_2 emission via increased biofuel input and, in the long term, development of new cement types*.
Target unchanged: Reduce CO_2 emission from grey cement production by 3% against 764 kg CO_2 per tTCE in 2012.	CO_2 emission from grey cement production has fallen to 756 kg CO_2 per tTCE, equal to 1.1%. The target was not fully achieved as the CO_2 neutral fraction from alternative fuel has not kept up with an increase in grey clinker production of 11% compared with 2012.	Target unchanged: Reduce CO_2 emission from grey cement production by 3% against 764 kg CO_2 per tTCE in 2012. As stated above for alternative fuel, redesign of Kiln 87's two calciners is expected to contribute to increased substitution of fossil fuel and thus increased CO_2 reduction.
Target unchanged: Reduce CO_2 emission** from white cement production by 2% against 1,139 kg CO_2 per tTCE in 2012.	CO_2 emission** from white cement production has increased to 1,173 kg CO_2 pr. tTCE, equal to 3%. Target not achieved due to relatively smaller recovery for district heating (saved CO_2) in relation to increase in white clinker production of 42% since 2012.	Target unchanged: Reduce CO_2 emission** from white cement production by 2% against 1,139 kg CO_2 per tTCE in 2012.
NO_X REDUCTION		
The target is to maintain low NO_X emission in the normal range 0.77 kg/tTCE – 0.96 kg per tTCE with the NO_X reducing technologies introduced, where consideration is given to dust reduction in the work environment and conformity with NH_3 limit.	Target not achieved. The specific NO_X emission was 0.98 kg per tTCE and just above the normal range, which was influenced by a 20% increase in white clinker production against 2015, and dust limitation in the work environment.	The target is to maintain low NO_X emission in the normal range 0.77 kg/tTCE – 0.96 kg per tTCE with the introduced NO_X reducing technologies introduced, where consideration is given to dust reduction in the work environment and conformity with NH_3 limit. Read more about this on page 20, note b.
WASTE		
Recycle 26,000 tonnes of landfilled microfiller for rehabilitation in the chalk pit.	Target achieved. In 2016, 75,816 tonnes were removed from the landfill for use in the chalk pit in connection with rehabilitation.	The target in 2017 is to recycle 40,000 tonnes of landfilled microfiller for rehabilitation in the chalk pit.

* "Cement and concrete of the future" is discussed on page 16 and included in research projects promoting sustainable development.

** Adjusted by CO_2 fraction relating to heat recovered for supply to the City of Aalborg for district heating. The adjustment is based on the 125% thermal efficiency method.

Target achieved Target not achieved

ENVIRONMENTAL DIALOGUE

Aalborg Portland is a part of the community – locally, regionally, nationally and internationally. It is important for us to have contact with our stakeholders in all areas, and to ensure and strengthen this contact Aalborg Portland pursues a range of activities.

- In 2016, Aalborg Portland was host to approx. 100 visits and 2,500 guests. Among other things, visitors were provided with an environmental briefing and given opportunity to ask questions.
- Aalborg Portland employees speak at external courses and meetings.
- Environmental information from suppliers is incorporated in supply contracts.
- Ongoing contact is maintained with Danish and EU environmental authorities due to continuous emergence of new legislation and regulations that will affect the company.
- Current and previous editions of our Environmental Report are available at www.aalborgportland.dk.

Our Environmental Report is distributed to numerous interested parties nationally and internationally, including neighbours, owners, authorities, politicians, the Danish Society for Nature Conservation, customers and suppliers.

The report is also freely available on Aalborg Portland's website.

To ensure optimum motivation and dialogue with internal and external stakeholders concerning our environmental activities, all parties are urged to voice opinions and suggest improvements regarding our reporting.

Complaints

Aalborg Portland has received 44 complaints in 2016, 39 about dust. We have therefore held a meeting at which we notified our neighbours about future measures to minimise the number of dust emissions.

Many of the dust complaints were due to electrostatic precipitator stoppages on Kiln 87. The precipitator is designed to remove dust, but in the event of a change in the internal oxygen level the unit will automatically shut down for safety reasons.

In 2016, work took place on designing a new calciner system on Kiln 87 more robust to operating changes that can impact the oxygen level. The new system have been installed in 2017, and after a running-in period a reduction is expected in the number of precipitator stoppages and thus also in the number of dust complaints.

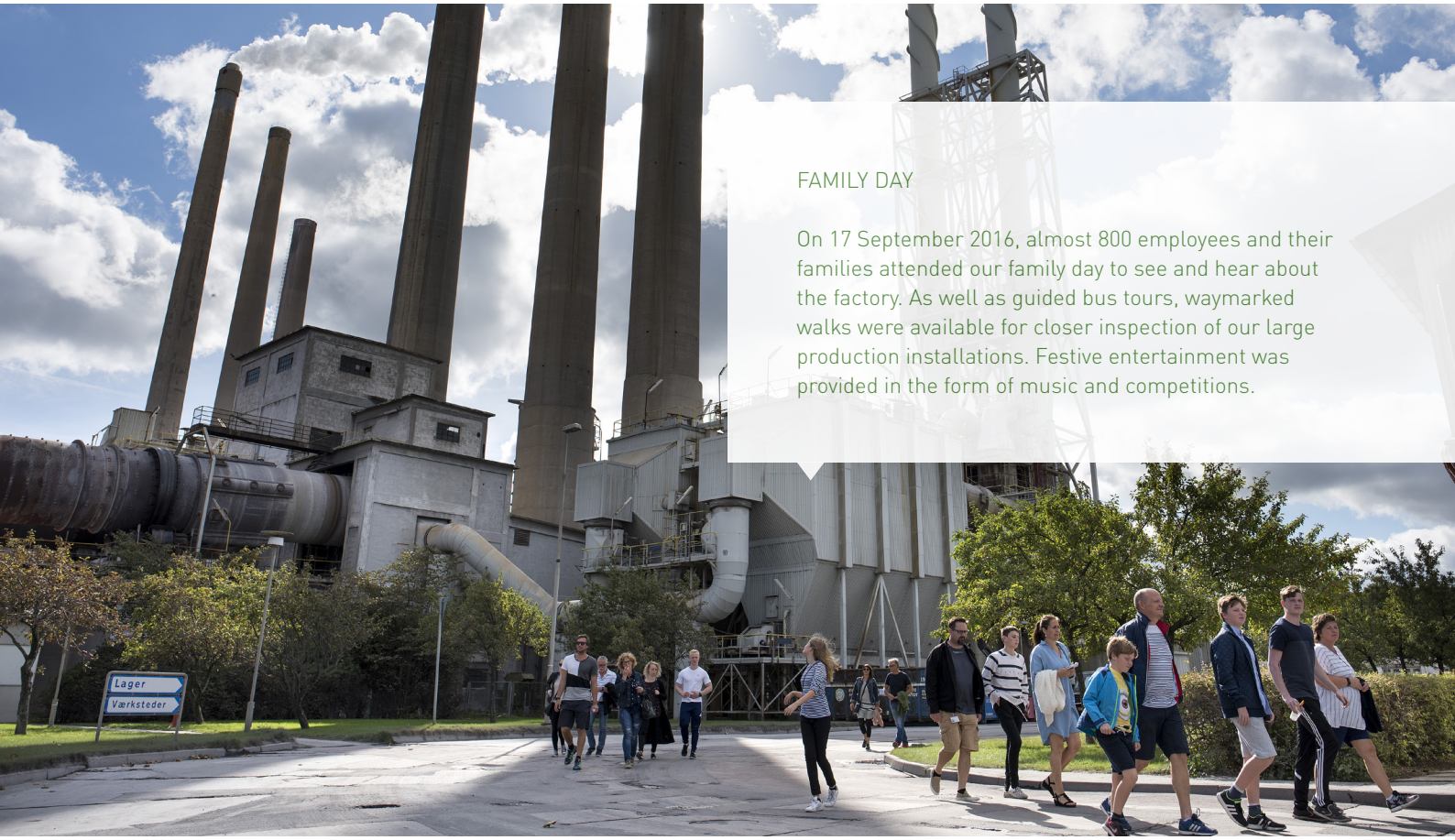
Number of releases resulting in inquiries

	2012	2013	2014	2015	2016
Dust	9	19	21	33	39
Noise	1	0	1	1	1
The Limfjord	0	2	1	1	1
Other	0	0	1	0	0

Demands on suppliers

Aalborg Portland makes demands of its suppliers. Each year, strategic suppliers are therefore called to an evaluation meeting where Aalborg Portland and the relevant suppliers review cooperation in the areas of quality, environment, energy and health & safety.

In 2016 a postgraduate student joined our Supply Chain Management department to research into the use of alternative fuels. This work will continue for the next two years and focus on identifying the most effective alternative fuels for minimising CO_2 emission.



FAMILY DAY

On 17 September 2016, almost 800 employees and their families attended our family day to see and hear about the factory. As well as guided bus tours, waymarked walks were available for closer inspection of our large production installations. Festive entertainment was provided in the form of music and competitions.

OPEN HOUSE AT AALBORG SUSTAINABILITY FESTIVAL

On 12 September 2016, Aalborg Portland staged an open house on the occasion of the Aalborg Sustainability Festival. Visitors received an introduction to Aalborg Portland's sustainable production measures and had the opportunity to see how CO_2 emissions are reduced by use of alternative fuels and raw materials, and how waste heat from cement manufacture is used to produce district heat. Visitors were also given opportunity to enjoy the view over the Rørdal chalk pit and climb the deep-excavator.

INSPIRATION MEETING ON ENVIRONMENTAL MANAGEMENT

On 26 October 2016, Aalborg Portland was visited by more than 30 members from the Network for Sustainable business Development in Northern Denmark to hear our experiences with environmental management. The visitors received a guided tour of the chalk pit and energy project installations.

RAW MATERIALS

Cement is manufactured using raw materials from natural resources, such as chalk, sand and gypsum. In 2016, to limit the impact on the natural reserves of these materials, Aalborg Portland replaced 10% with alternatives in the form of by-products and wastes received from industry and society which are thus used as a resource.

Aalborg Portland began using fly ash – a power station by-product – almost 40 years ago. Since then a number of further alternative raw materials have been included in our production.

Sand from dredging
Sand dredgers keep navigation channels at Hals Barre and in the Limfjord open for the passage of ships, a community interest to which Aalborg Portland contributes. The dredged sand replaces sand that would otherwise have to be sourced from quarries and the Kattegat, thereby impacting both the landscape and the marine environment. At the same time, Aalborg Portland's position beside the Limfjord offers an effective logistical solution as the dredgers can pump their sand directly into drainage basins ashore.

Desulphurisation gypsum
Gypsum from flue gas desulphurisation is used as an additive in cement manufacturing. This gypsum is supplied by both Aalborg Portland itself and a local power station, Nordjyllandsværket, and replaces natural gypsum and anhydrite sourced in Morocco and Germany. This also reduces the amount of long-distance transport by sea.

The local partnership between Aalborg Portland and Nordjyllandsværket is a good example of industrial symbiosis. We supply chalk slurry to the power station for desulphurisation purposes and take the desulphurised gypsum in return.

Fly ash
Fly ash, a mineral product resulting from generation of electricity and heat at coal-fired power stations, has been recycled at Aalborg Portland since the 1970s.

The fly ash is used in cement production to replace natural clay which would otherwise have to be sourced in Denmark.

Sand from navigation channels pumped from dredgers to drainage basins ashore

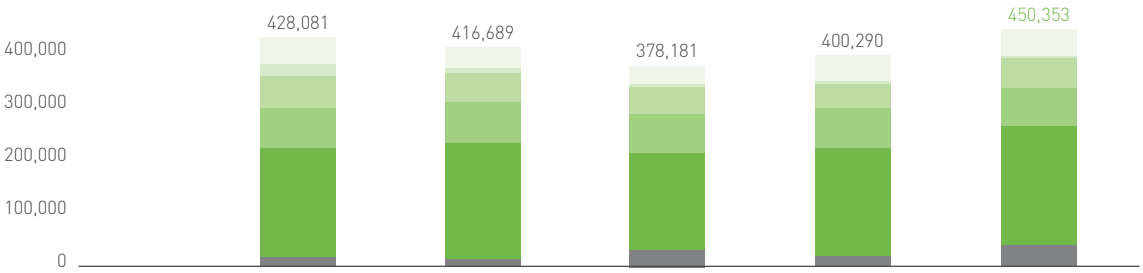
Paper sludge

Paper sludge is a residue from production of recycling paper. Since 2013 Aalborg Portland has reduced its consumption of paper sludge due to the closure of its Danish supply facility and is currently using up its remaining reserves.

Iron oxide

Iron oxide (pyrite ash) is a by-product from the manufacture of sulphuric acid and is a necessary source of iron for production of grey cement.

ALTERNATIVE RAW MATERIALS – tonnes



	2012	2013	2014	2015	2016
Iron oxide	44,728	41,769	39,102	42,763	45,154
Paper sludge	24,845	5,492	3,165	2,002	1,700
FGD gypsum	55,022	58,680	53,490	56,961	57,203
Sand	81,311	79,980	64,314	75,410	79,239
Fly ash	204,148	213,176	189,339	201,406	235,031
Other	18,027	17,592	28,771	21,748	32,026
Total	**428,081**	**416,689**	**378,181**	**400,290**	**450,353**

In 2016, usage of alternative raw materials increased to more than 50,000 tonnes due to higher production. The increase mainly related to fly ash used in production of grey cement clinker.

Excavator in the chalk pit with conveyor belt to the cement factory

ENERGY

Replacement of fossil fuels, such as coal and petcoke, by alternative fuels is an area of activity that began in the early 1990s. In 2016, input of these combustible wastes accounted for more than 45% of the energy used in grey cement production.

Waste is energy
Recycling of wastes contributes to a resource-efficient society. In cement production, wastes are recycled as a resource by replacing coal and petcoke.

Waste fuels are instrumental in reducing emissions of CO_2, NO_X, SO_2 etc. in kiln flue gases, and biomass content is recycled, benefiting global climate efforts. By way of example, meat and bone meal is considered wholly carbon-neutral, and in wastes from industry the fraction of biomass carbon is typically 30-40% when replacing fossil fuels.

Dried sewage sludge
Aalborg Portland receives dried sewage sludge from Aalborg as a CO_2 neutral biofuel replacement for coal and other fossil raw materials.

Heat recovery from kiln fuel
The cement factory supplies waste heat from production as district heat to the residents of Aalborg. In 2016, waste heat supplied from Aalborg Portland corresponded to the annual heat consumption of approx. 23,500 households.

Electricity
Electricity is key to operating a cement plant. Aalborg Portland's power consumption in 2016 was more than 290,000 MWh.

The distribution of power consumption is shown in the graph on the next page. The largest power users are the kilns and cement mills.

Consumption of power consists of a factory base load and a variable component that depends on the volume of production on primary equipment.

In 2016 the relative combined power consumption was 2% less than in 2015 due to increased utilisation of capacity.

Energy saving
Aalborg Portland has made determined efforts over many years to identify energy savings in the factory's electricity and fuel consumption.

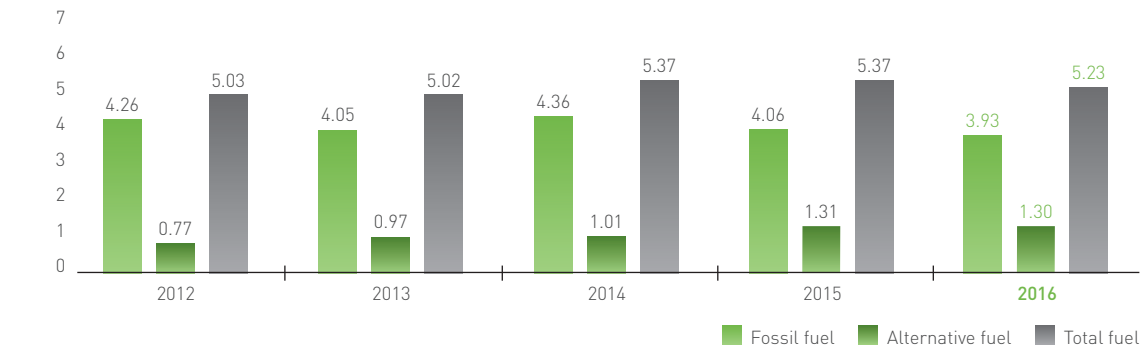
Activities in recent years, with heightened focus on improved energy efficiency in existing production installations, have led to projects between 2011-2016 that have delivered an energy saving – electricity and fuel – of 930,000 GJ. This corresponds to the annual energy consumption of approx. 15,000 households.

In 2016, the relative fuel consumption was reduced by 3% from 5.37 to 5.23 GJ per tTCE.

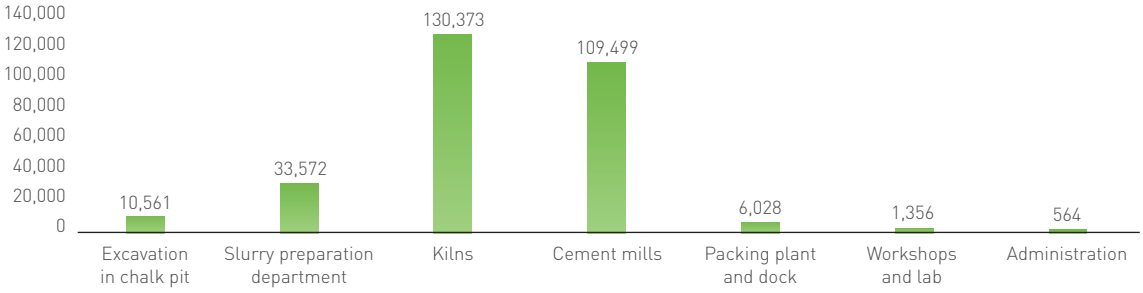

Sorting of waste fuels


Conveyor belt for waste fuels to Kiln 87

CONSUMPTION OF FOSSIL AND ALTERNATIVE FUEL – GJ per tCE

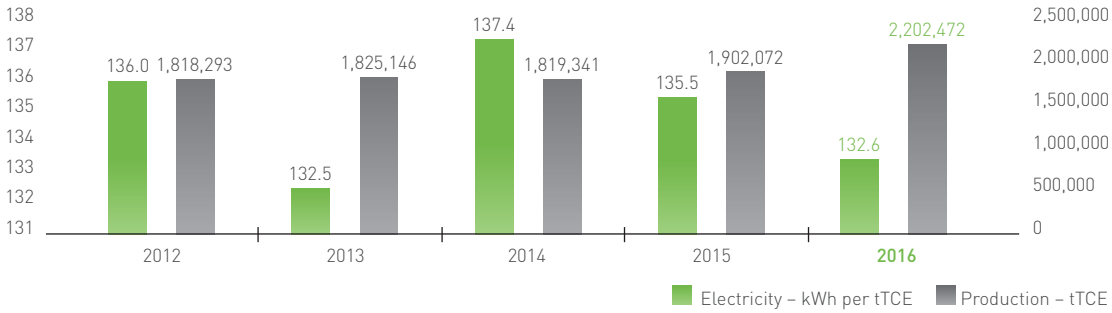


DISTRIBUTION OF ELECTRICITY IN 2015 BY CONSUMPTION POINTS – MWh



ELECTRICITY CONSUMPTION – kWh per tCE

PRODUCTION – tCE



FUTURE INITIATIVES

Wind turbines – renewable energy

Aalborg Portland has plans to install five wind turbines on company land close to the cement factory. This will lead to even more green energy being used in cement production.

In 2016 more than half the energy used in Danish cement production came from renewable energy sources, such as wind power, solar power and biofuel, which is considered CO_2 neutral.

Wind turbine installation at Aalborg Portland will reduce CO_2 emissions related to electricity consumption by 12%.

Energy saving by remote cooling

Aalborg Portland is committed to sustainable development in partnership with the community. Sustainable development contains many possibilities. Aalborg Portland has a large chalk lake with cold water. A study has been performed to determine whether this cold water can be used to provide district cooling for processes and indoor climate at the forthcoming new Aalborg hospital as an energy efficient alternative to the conventional electrical cooling installations.

District cooling is the cooling equivalent of district heating. Cold water is pumped through a closed pipe circuit to the buildings to be cooled. The water absorbs the space heat from the buildings and is pumped back for cooling, which in this case is accomplished by cold lake water.

EMISSION TO THE ATMOSPHERE

There is a number of sources of atmospheric emission at Aalborg Portland, ranging from chimney stacks to workshop extractors.

Overall there are around 400 emission points where the air is cleaned in different types of filters before venting.

The largest stacks are equipped with sensors that continuously meter the level of relevant emissions.

In addition, a number of vents are regularly sampled and analysed to provide further documentation of the contents. The sampling and analysis are performed by an independently accredited laboratory.

Flue gases

CO_2
Relative CO_2 emission decreased by 0.3% overall against 2015 due to falling specific fuel consumption. This reflects the effect of improved thermal transfer by the chain systems in the white cement kilns after reconditioning. In addition, fuel performance improved on Kiln 87 (grey cement) after sealing to prevent false air.

NO_X
In the period 2004 – 2007 cleaning equipment was developed and installed on all kilns. As a result, relative NO_X emission in 2016 was 70% lower than in 2003 when it was 3.26 kg per tTCE.

Optimised NO_X cleaning in 2013 has produced an optimised normal range. In 2016, NO_X increased from 0.96 to 0.98 kg per tTCE due to operating factors.

NO_X is reduced in the grey cement kilns by injecting aqueous ammonia. Since 2012 this has caused release of ammonia (NH_3) to increase. There is compliance with the limits specified in our environmental approval.

SO_2
Relative SO_2 emission has fallen over the years but has increased since 2013 from 0.32 to 0.43 kg per tTCE. This is primarily due to modified scrubbing, which is necessary to ensure low gypsum content in filtrate water produced. This water would otherwise cause clogging of pipelines when recycled for slurry production.

Note that SO_2 levels are in compliance with our environmental approval.

CO
Relative emission has risen by 6% since 2015, from 0.84 to 0.89 kg per tTCE, due to more alternative fuel being used in grey cement production. Alternative fuel is associated with a relatively higher CO level than coal and petcoke.

Note that CO levels are in compliance with our environmental approval.

Dust
Relative emission is unchanged at 0.05 kg per tTCE. Dust emission complaints due to operating challenges are described on page 24.

Emission limits
Aalborg Portland's 2009 environmental approval, as last amended with more stringent kiln emission requirements (BAT) in 2015, specifies operating and limit criteria.

In 2016 the limits for SO_2, NO_X, CO, NH_3 and dust were exceeded 24 times. These exceedings were notified to the Environmental Protection Agency in Aarhus, and preventive measures to avoid repetitions were disclosed in the monthly reporting. Overall, the number of limit overruns fell by 41% versus 2015, which was mainly due to measures to reduce CO emission.

The table over page shows the five main sources of air pollution, the associated emission limits, and Aalborg Portland's current average emission levels.

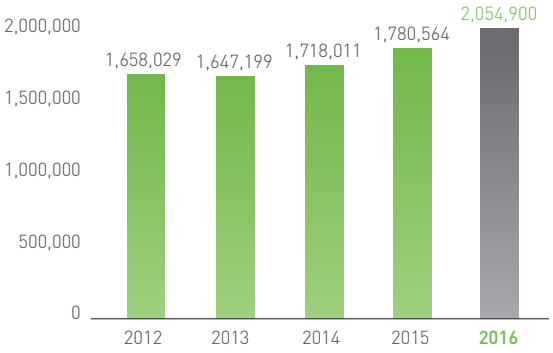
NO_X, SO_2 and dust emissions are determined by averaging continuously recorded data.

Limits stated are average emissions per 24-hour period.

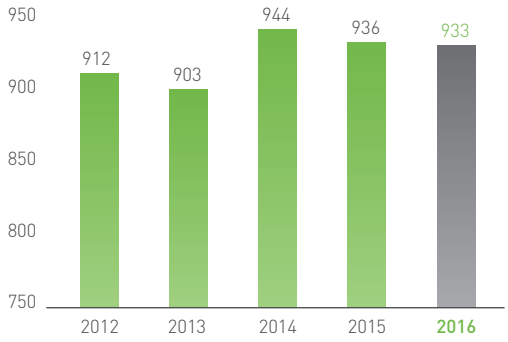
For clarity the table shows the average daily level over the year.

ATMOSPHERIC EMISSIONS – CO_2 / NO_X

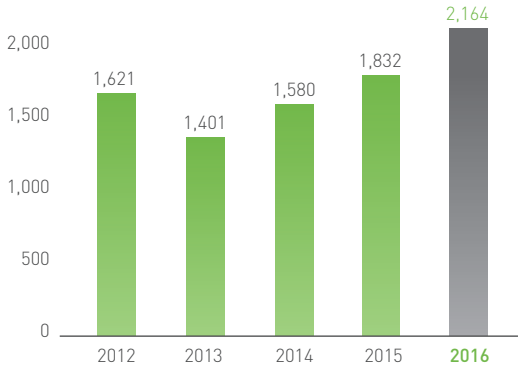
CO_2 – absolute figures – tonnes



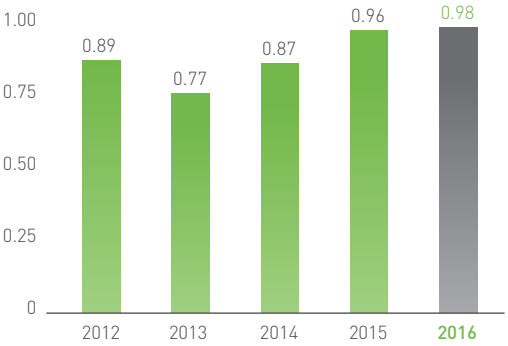
CO_2 – relative figures – kg per tCE



NO_X – absolute figures – tonnes



NO_X – relative figures – kg per tCE



LIMITS AND LEVELS DURING OPERATION – THE FIVE MAIN SOURCES

	NO_X		SO_2		Dust	
	Limit *	Averaged level 2016 **	Limit *	Averaged level 2016 **	Limit *	Averaged level 2016 **
Heat recovery kiln 73/79	500	358	375	212	25	2
Heat recovery kiln 74/78	500	306	425	237	25	0.5
Heat recovery kiln 76	500	207	250	210	25	0.8
Kiln 85	750	797 ***	500	71 ***	35	11 ***
Kiln 87	400	203	10	1.4	25	14

* Daily average according to enviromental approval valid at 31.12.2016.
** Daily average over the year.
*** The data relate to 2009. The limit value for NO_X was 800 mg/Nm³.

All values are stated in mg/Nm³ dry flue gas at 10% oxygen content.

NOISE

Aalborg Portland's noise emission is attributable to a large number of stationary sources, both indoors and outdoors, as well as internal factory traffic.

The noise sources include e.g. chimney stacks, kilns, cement and coal mills, belt conveyors, fans, ships loading and unloading, lorries, and excavation and rehabilitation operations in the chalk pit.

Aalborg Port has a noise map which is updated regularly, and most recently in conjunction with application to upgrade Cement Mill 4 with a separator and bag filter.

Noise calculation with all installations operating at full power simultaneously (worst case scenario) shows that noise limits in our current environmental approval would be complied with at all locations.

Aalborg Portland's noise contribution is considered in actual fact to be smaller than the theoretical maximum because it is seldom that all the installations are in operation simultaneously and because there is not full production.

In 2017 the noise barrier will be extended northwards from the south-east corner of the chalk pit to screen the village of Øster Uttrup from operations in the chalk pit.

CEMENT MILL 4 UPGRADED TO CIRCULATION MILL WITH SEPARATOR

The new Cement Mill 4 has been rebuilt with a separator and new bag filter with associated fan and extraction. The installation is designed to meet BAT noise and dust specifications for the cement industry.

Noise map in dB(A)
– evening conditions

WATER

Water is used in the various processes involved in cement manufacture and also for cooling production plant.

Aalborg Portland obtains technical water for production purposes from on-site wells in a limestone aquifer situated outside designated drinking water areas.

Aalborg Portland is licensed to extract a total of 5.2 million m^3 annually. In 2016, more than 4.5 million m^3 was extracted. This includes 1.3 million m^3 of water from chalk quarried below the water table in the chalk pit by deep-excavator.

The remaining 3.2 million m^3 includes 2.3 million m^3 sourced from 15 on-site wells close by the cement factory, and 1.0 million m^3 from groundwater lowering around Kilns 76 and 85.

Relative water consumption fell by 5% against 2015, due to reduced need for groundwater lowering and because baseload consumption for equipment cooling was spread over greater cement production.

A series of projects implemented to reduce water consumption are described below.

Groundwater lowering for plant cooling
Local groundwater lowering has proven an effective solution over the years for keeping dry underground basements, passages and conveyor systems in the factory area. More than 800,000 m^3 of this water is also recycled for cooling the factory's compressor plant. This water would otherwise have to be obtained from Aalborg Portland's water resources.

Split water system
Following bacterial contamination of drinking water in 1998 the water supply system was split into two parts – one for drinking water and one for technical water used for production purposes. In 2016, Aalborg Portland was supplied with drinking water from the municipal supply as pesticide residue was found in the company's drinking water wells. The contamination level is falling towards 0.1 µg/litre, the maximum permitted limit for drinking water.

Recycling of filtrate water
Filtrate water arises in the heat recovery and desulphurisation plant in production of gypsum for scrubbing purposes. Until 2004 filtrate water was released into the Limfjord.

At the same time, the 5.2 million m^3 of water which Aalborg Portland is licensed to extract, was close to being reached due to high level of production.


Water meter

The effective solution was, and still remains, to recycle filtrate water in cement production. In 2016 more than 385,000 m^3 of technical water was substituted in this way – water that would otherwise have to be extracted from Aalborg Portland's own resources. Release of filtrate into the Limfjord has ceased at the same time so this is a win-win situation.

Use of surface water from lake
In 2016 Aalborg Portland has applied for a continued licence to extract surface water from Lergravssø lake for use as process water, slurried with pyrite ash in cement production.

The lake, a former clay pit, is situated on Aalborg Portland's land at Bredhage. Drainage from the adjacent fields flows into the lake, from which it is channelled into the Limfjord. A part of this water is used by Aalborg Portland before release into the Limfjord as replacement for groundwater.

Capture of surface water
In 2016 approx. 9,000 m^3 of surface water was captured from the storage depot next to the slurry preparation department and used in slurry production. The extraction of technical water was reduced correspondingly.

Monitoring programme
Every year since 1991 an external company has performed a series of hydro-geological surveys and analyses of our water quality. Ongoing reporting provides an overview of development and provides effective protection and use of the water resource.

Surface water and waste water
Surface water and cooling water are released directly into the Limfjord. Waste water is sent by Aalborg Portland to the public sewer and passes through the municipal treatment plant before release into the Limfjord.

Waste water and surface water that may contain mineral oils and sand pass through oil-water separators and sand filters at Aalborg Portland.

Groundwater in chalk lake for district cooling
Cooling for Aalborg's new 'super hospital' may be provided by cold water from Aalborg Portland's chalk lake, cf. the section "Energy".

WASTES AND BY-PRODUCTS

Waste is sorted close to source and deposited in bins, skips and oil and chemical receivers located around the factory. The waste is recycled, incinerated in accordance with municipal regulations or landfilled on site at Aalborg Portland.

In 2016, more than 99% of our waste was classified as non-hazardous. The remainder was characterised as hazardous oil and chemical waste for recycling and mixed waste for external landfill.

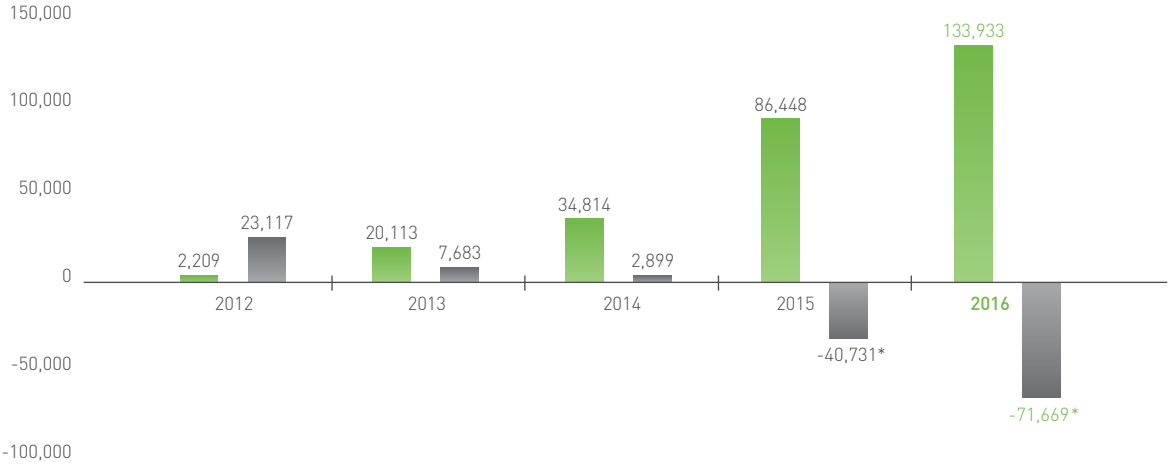
Waste strategy implemented
Since 2013 a marked shift has taken place at Aalborg Portland, from landfilling to increased recycling. Recycled waste has therefore increased by more than 131,000 tonnes compared with 2012, and in 2015 and 2016 more waste was removed from landfill for recycling than was sent to landfill.

Recycling of by-product
Aalborg Portland's waste statistics have been changed by the project to use microfiller – a kiln by-product – for rehabilitation in the chalk pit, cf. also page 37-38.

Waste recycling is in harmony with the Danish Government's resources policy, which encourages the substitution of wastes for natural raw materials. At the same time the need to find capacity for new public landfills is reduced.

Container site for waste sorting

WASTE – FROM LANDFILL TO RECYCLING – tonnes



* In 2015 and 2016 more waste was removed from landfill for recycling than was sent to landfill.

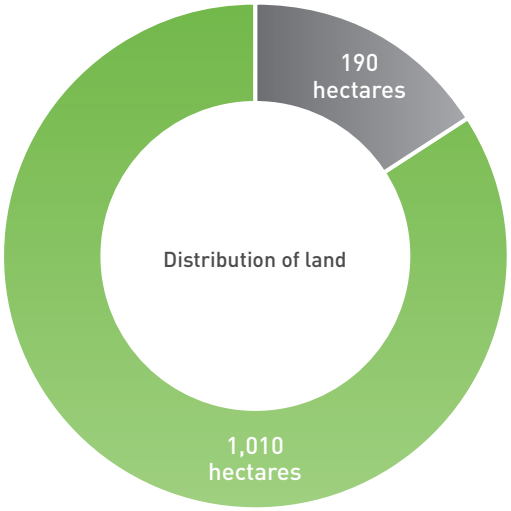
WASTE – amount in tonnes	2012	2013	2014	2015	2016
TOTAL WASTE	**25,655**	**28,052**	**38,260**	**46,904**	**62,773**
UTILISED NON-HAZARDOUS WASTE	**2,432**	**20,307**	**35,132**	**87,605**	**134,365**
Recycling	**2,209**	**20,113**	**34,815**	**86,448**	**133,933**
Microfiller from kilns	-	16,235	27,399	78,371	119,142
Sweepings	-	1,403	1,683	824	2,776
Sand and grate material	1,079	235	377	48	3
Building waste	37	92	1,191	1,060	1,850
Metals	610	555	414	736	741
Paper and cardboard	15	13	14	9	16
Glass	-	0	1	0,5	0.3
Plastics	4	703	649	746	620
Electronic scrap	6	-	1	0.3	4.4
Other recyclables	458	876	3,087	4,653	8,780
Incineration	**223**	**194**	**317**	**1,157**	**432**
Mixed combustible	209	180	301	1,139	415
Municipal collection	14	14	16	18	17
UTILISED HAZARDOUS WASTE	**106**	**62**	**229**	**30**	**77**
Oil	102	55	216	26.7	74.0
Chemicals	3	7	13.4	2.8	2.6
DISPOSAL OF NON-HAZARDOUS WASTE					
On-site landfill	**23,094**	**7,210**	**2,522**	**-40,809**	**-71,759**
DISPOSAL OF HAZARDOUS WASTE					
Off-site landfill	**23**	**473**	**377**	**78**	**90**

LAND USE AND BIODIVERSITY

The Aalborg Portland site comprises 1,200 hectares, of which 190 hectares are used for cement production. The remaining 1,010 hectares consist of lakes, woods, meadows, salt marshes, fallow and farmland.

The distribution of land use is as follows (hectares):

Aalborg Portland land in Rørdal area (hectares)	**1,200**
Factory	120
Chalk pit – active quarry	54
Landfill	12
Pyrite ash plant	4
Total land use	**190**



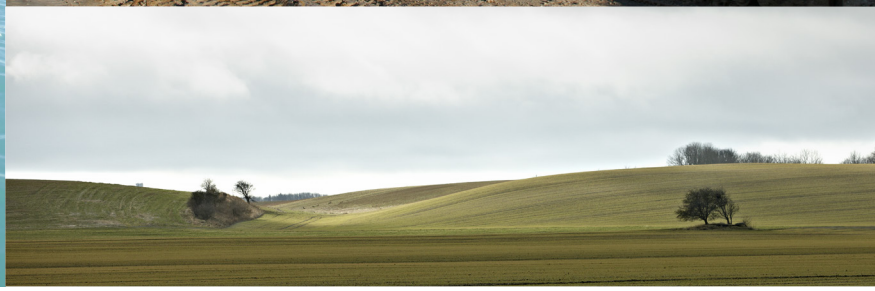
Nature and agriculture 84% 16% Industry

Aalborg Portland

Cement factory, chalkpit and lake by the Limfjord

Chalk pit with deep-excavator

Chalk pit rehabilitation plan – Rørdal Lake Park



Chalk pit

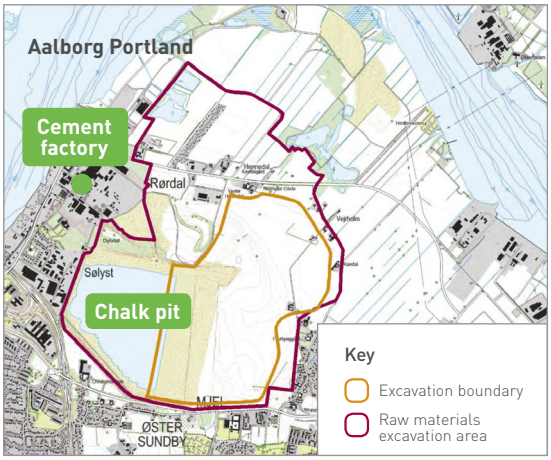
The chalk pit is situated close by the factory and will have an area of around 240 hectares when fully excavated. A significant part of chalk pit is the lake with its characteristic, striking, azure blue water.

Aalborg Portland is licensed to quarry chalk in the Rørdal area within the designated excavation zone in the Raw Materials Plan for North Jutland. The licence is valid until 2052 when excavation in the chalk pit is expected to be finished.

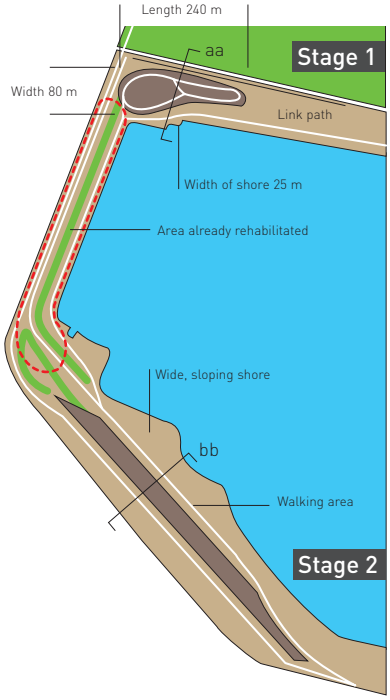
Chalk pit rehabilitation plan – Rørdal Lake Park

The concept of the rehabilitation plan is to develop the chalk pit as "Rørdal Lake Park", which will offer the local population a variety of leisure and sporting activities close to the city.

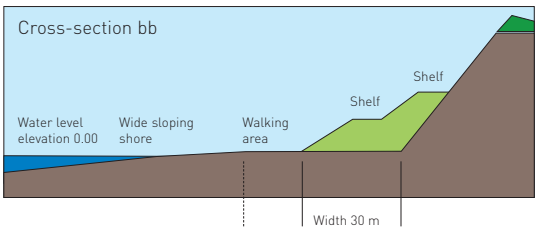
The lake is envisaged used for sailing, water-skiing, diving and bathing, while the areas surrounding the lake provide amenities for hang-gliding, mountain-biking, jogging, walking and similar pursuits.



The basic idea in the rehabilitation is to create a scenic space with steep, exposed slopes, soft green hills, and walking and leisure areas.



Stage 2



Banks and terraces
Establishment of banks and terraces has begun in defined areas in the chalk pit. The banks and terraces are constructed with microfiller capped with soil and vegetation.

Stage 1 is now in place, while Stage 2 is under construction and Stage 3 is on the drawing board.

Stage 1
The purpose of the embankment is to create a natural transition between the area at the transfer station and the lakeside. The embankment will also screen the factory from view and act as a partial noise barrier between the factory and the public access area planned for the northern and western parts of the chalk pit.

Stage 2
Consists of terraces in the western part of the chalk pit.

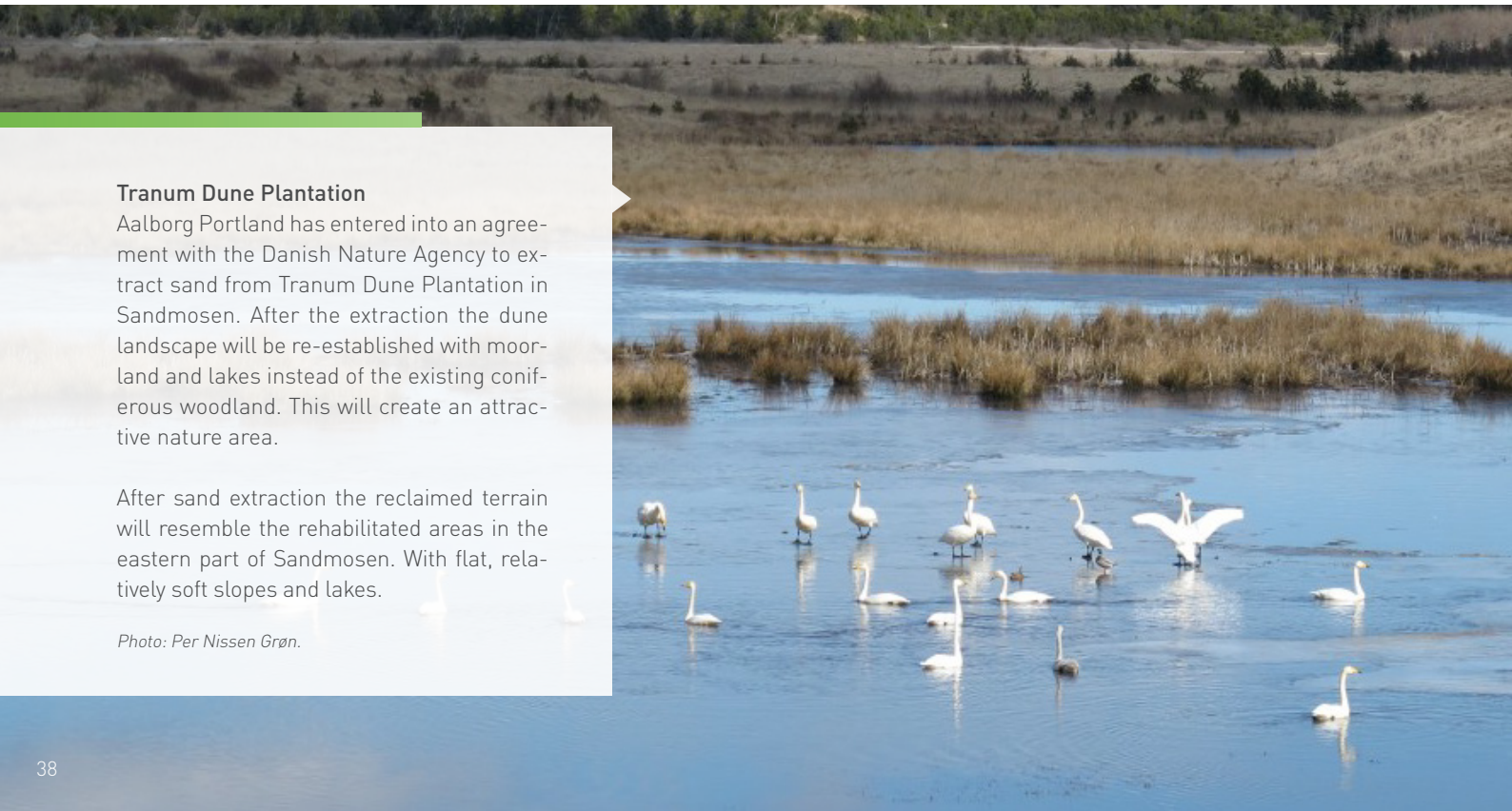
The terraces will be used for a variety of sporting activities, such as mountain-biking, jogging and hang-gliding. A path system and public spaces are also planned.

Stage 3
Planned as an extension of State 2.

Tranum Dune Plantation
Aalborg Portland has entered into an agreement with the Danish Nature Agency to extract sand from Tranum Dune Plantation in Sandmosen. After the extraction the dune landscape will be re-established with moorland and lakes instead of the existing coniferous woodland. This will create an attractive nature area.

After sand extraction the reclaimed terrain will resemble the rehabilitated areas in the eastern part of Sandmosen. With flat, relatively soft slopes and lakes.

Photo: Per Nissen Grøn.



SUSTAINABLE DISTRIBUTION

The distribution of cement in 2016 consisted of the handling and transport of approx. 2.2 million tonnes of cement to domestic and export customers.

Our influence on distribution to export markets is chiefly limited to choice of ship transport, and this part of the distribution may therefore be termed an indirect environmental impact.

In 2016, 72% of our cement was distributed by ship and 28% by road.

All our cement is manufactured in Aalborg, from where most of our production is forwarded by ship to our seven shipping terminals strategically positioned around Denmark and also to terminals abroad. From the terminals the cement travels on road to the customers in the different areas.

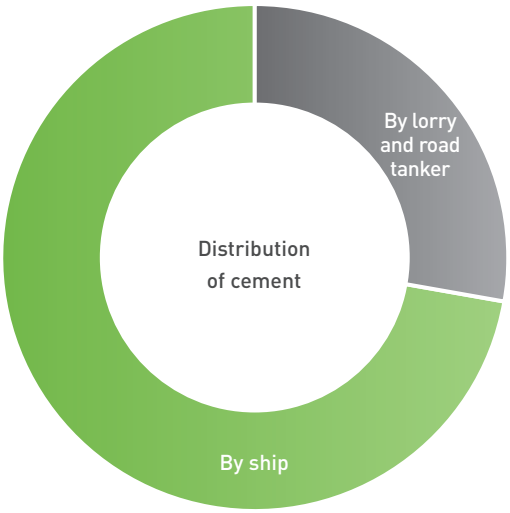
We thereby avoid long-distance road transport by heavy cement tankers, while having the benefit of ship transport, which is more environmental friendly.

In 2017, the environmental benefit of ship transport will be extended when the construction of white cement siloes is completed at a newly built shipping terminal in the French port of Rochefort. This terminal will serve the French market and avoid two 900 km return journeys on Dutch, Belgian and French roads, the cement travelling direct by ship from Aalborg to Rochefort rather than by road from the shipping terminal in the Dutch port of Moerdijk.

Some road haulage is contracted out to third parties. Customers in North and Central Jutland are supplied direct from Aalborg, and distribution of all bagged cement also takes place from Aalborg.

Cement factory in Aalborg
Shipping terminals in Denmark

Newly built shipping terminal in the French port of Rochefort



28% Cement distributed by lorry and road tanker

72% Cement distributed by ship

MATERIAL FLOWS

Key performance indicators 2016 – Aalborg Portland cement plant

Aalborg Portland's material flows are stated using both absolute and relative figures as key performance indicators.

The absolute amounts are calculated as tonnes in the wet state. The relative values are based on the quantity (kg) of materials in the wet state used to make one tonne of Total Cement Equivalent (tTCE), a standard unit for production. This is obtained by calculating the equivalent cement tonnage if all the clinker were processed into cement.

The relative values thus enable year-to-year comparison of the material flows, independently of any variations in volume of cement production, changes in clinker stocks and sales of clinker and also clinker imports.

INPUT

	Absolute figures – tonnes *					Relative figures – kg * per tTCE				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
COMBUSTION AIR										
(O2, N etc.)	557,128	543,819	593,783	592,568	676,406	306.4	298.0	326.4	311.5	307.1
RAW MATERIALS										
Chalk	2,939,060	2,963,408	3,064,648	3,173,982	3,649,362	1,616.4	1,623.7	1,684.5	1,668.7	1,656.9
Water	3,052,623	2,782,798	2,881,522	3,170,668	3,499,229	1,678.8	1,524.7	1,583.8	1,667.0	1,588.8
Sand	106,838	107,246	129,488	129,595	152,484	58.8	58.8	71.2	68.1	69.2
Gypsum	32,769	29,778	32,126	42,373	56,557	18.0	16.3	17.7	22.3	25.7
Other	39,442	27,013	24,536	33,290	35,394	21.7	14.8	13.5	17.5	16.1
Packaging	1,003	1,027	1,129	1,305	1,018	0.6	0.6	0.6	0.7	0.5
RECYCLABLES										
Fly ash	204,148	213,176	189,339	201,406	235,031	112.3	116.8	104.1	105.9	106.7
Sand	81,311	79,980	64,314	75,410	79,239	44.7	43.8	35.4	39.6	36.0
FGD gypsum	55,022	58,680	53,490	56,961	57,203	30.3	32.2	29.4	29.9	26.0
Paper sludge	24,845	5,492	3,165	2,002	1,700	13.7	3.0	1.7	1.1	0.8
Iron oxide	44,728	41,769	39,102	42,763	45,154	24.6	22.9	21.5	22.5	20.5
Other	18,027	17,592	28,771	21,748	32,026	9.9	9.6	15.8	11.4	14.5
Total	**428,081**	**416,689**	**378,181**	**400,290**	**450,353**	**235.5**	**228.3**	**207.9**	**210.4**	**204.5**
FUELS										
Coal	36,150	46,265	44,820	49,456	60,189	19.9	25.3	24.6	26.0	27.3
Petcoke	213,894	191,767	207,863	201,429	223,584	117.6	105.1	114.3	105.9	101.5
Fuel oil	5,615	4,689	4,447	4,637	4,831	3.1	2.6	2.4	2.4	2.2
Alternative fuel	81,899	97,250	100,817	126,618	149,491	45.0	53.3	55.4	66.6	67.9
Total	**337,558**	**339,971**	**357,947**	**382,140**	**438,095**	**185.6**	**186.3**	**196.7**	**200.9**	**198.9**
	(MWh)	(MWh)	(MWh)	(MWh)	(MWh)	(kWh per tTCE)	(kWh per tTCE)	(kWh per tTCE)	(kWh per tTCE)	(kWh per tTCE)
ELECTRICITY	**247,241**	**241,742**	**250,048**	**257,703**	**291,953**	**136.0**	**132.5**	**137.4**	**135.5**	**132.6**
INTERNAL RECIRCULATION										
Microfiller	107,376	115,816	109,429	100,549	116,082	59.1	63.5	60.1	52.9	52.7
Water	329,887	342,171	431,700	410,851	385,773	181.4	187.8	237.3	216.0	175.2
Own FGD gypsum	27,190	29,641	28,439	27,591	33,012	15.0	16.2	15.6	14.5	15.0
Recycling of clinker/raw meal	17,253	21,287	37,081	19,418	30,810	9.5	11.7	20.4	10.2	14.0
Recycling of cement from silo cleaning	268	753	1,505	4,054	216	0.1	0.4	0.8	2.1	0.1
District heat from heat recovery	(GJ) 24,278	(GJ) 21,197	(GJ) 24,090	(GJ) 19,672	(GJ) 24,486	(MJ per tTCE) 13.4	(MJ per tTCE) 11.6	(MJ per tTCE) 13.2	(MJ per tTCE) 10.3	(MJ per tTCE) 11.1

* Determined with water content of materials.

OUTPUT

	Absolute figures – tonnes *					Relative figures – kg * per tCE				
	2012	2013	2014	2015	2016	2012	2013	2014	2015	2016
FLUE GASES										
CO_2	1,658,029	1,647,199	1,718,011	1,780,564	2,054,900	911.9	902.5	944.3	936.1	933.0
NO_X	1,621	1,401	1,580	1,832	2,164	0.89	0.77	0.87	0.96	0.98
SO_2	504	587	682	844	948	0.28	0.32	0.37	0.44	0.43
CO	1,372	1,678	1,649	1,601	1,969	0.75	0.92	0.91	0.84	0.89
Dust	62	81	91	96	107	0.03	0.04	0.05	0.05	0.05
NH_3	28	38	39	40	46	0.02	0.02	0.02	0.02	0.02
HCl	2	2	6	7	7	0.001	0.001	0.003	0.004	0.003
Hg	0.01	0.04	0.03	0.03	0.04	0.000004	0.000020	0.000014	0.000014	0.000018
PRODUCTS										
Cement	1,798,013	1,796,553	1,877,284	1,971,721	2,256,013	988.8	984.3	1,031.8	1,036.6	1,024.3
Clinker **	19,591	12,839	-47,969	-60,456	-56,954	10.8	7.0	-26.4	-31.8	-25.9
Filler **	2,016	1,026	1,583	1,373	-2,022	1.1	0.6	0.9	0.7	-0.9
Chalk slurry to power station (Nordjyllandsværket)	4,358	10,109	17,945	8,846	10,893	2.4	5.5	9.9	4.7	4.9
Total	**1,823,978**	**1,820,527**	**1,848,843**	**1,921,484**	**2,207,930**	**1,003.1**	**997.4**	**1,016.2**	**1,010.2**	**1,002.6**
Adjustment	-	-	-	-	-	-3.1	2.6	-16.2	-10.2	-2.6
Total Cement Equivalent	**1,818,293**	**1,825,146**	**1,819,341**	**1,902,072**	**2,202,472**	**1,000.0**	**1,000.0**	**1,000.0**	**1,000.0**	**1,000.0**
Packaging	1,003	1,027	1,129	1,305	1,018	0.6	0.6	0.6	0.7	0.5
WATER										
Water vapour	1,317,884	1,371,187	1,361,211	1,407,063	1,880,371	724.8	751.3	748.2	739.8	853.8
Cooling water, incl. Kiln 85 groundwater	2,358,260	2,216,054	2,241,899	2,409,532	2,514,030	1,297.0	1,214.2	1,232.3	1,266.8	1,141.5
Groundwater lowering (Kiln 76)	272,284	96,102	221,125	313,543	201,436	149.7	52.7	121.5	164.8	91.5
Waste water	33,820	27,813	28,835	41,396	31,200	18.6	15.2	15.8	21.8	14.2
HEAT RECOVERY FOR DISTRICT HEATING	(GJ) **1,045,751**	(GJ) **1,072,975**	(GJ) **1,152,611**	(GJ) **1,214,257**	(GJ) **1,199,988**	(MJ per tTCE) **575.1**	(MJ per tTCE) **587.9**	(MJ per tTCE) **633.5**	(MJ per tTCE) **638.4**	(MJ per tTCE) **544.8**
WASTE ***										
Recycling	2,209	20,113	34,815	86,448	133,933	1.2	11.0	19.1	45.4	60.8
Incineration	223	194	317	1,157	432	0.1	0.1	0.2	0.6	0.2
Landfill	23,117	7,683	2,899	-40,731	-71,669	12.7	4.2	1.6	-21.4	-32.5
Oil and chemical waste	106	62	229	30	77	0.1	0.03	0.13	0.02	0.03
Total	**25,655**	**28,052**	**38,260**	**46,904**	**62,773**	**14.1**	**15.3**	**21.0**	**24.6**	**28.5**

** Incl. sales and changes in stocks and adjustment for import of clinker.

*** Waste volumes are classified as hazardous and non-hazardous wastes on page 35 stating whether the materials are utilised or disposed of.

OUR WORK ENVIRONMENT

A positive work environment with an open and trustful dialogue between management and employees is a prerequisite for safe and satisfactory collaboration and work performance.

A good work environment contributes to the safety, health and wellbeing of the individual employee, at the same time strengthening productivity, improving product quality and thereby contributing the company's competitiveness.

Expectations to the future

Aalborg Portland shall continue to be an attractive workplace with motivated employees. Our goal is to be happy at work, recognising one another's diversity and striving as a team to promote safety and wellbeing.

Safe and accident-free job performance – every day – is vital.

We will reach our goal through targeted focus on safety in everyday working and through behavioural change:

- By training in "Safe behaviour"
- By following "Safe Workplace" guidelines
- By effectuating consequences for disregard of safety rules
- By conducting risk assessment before starting on work

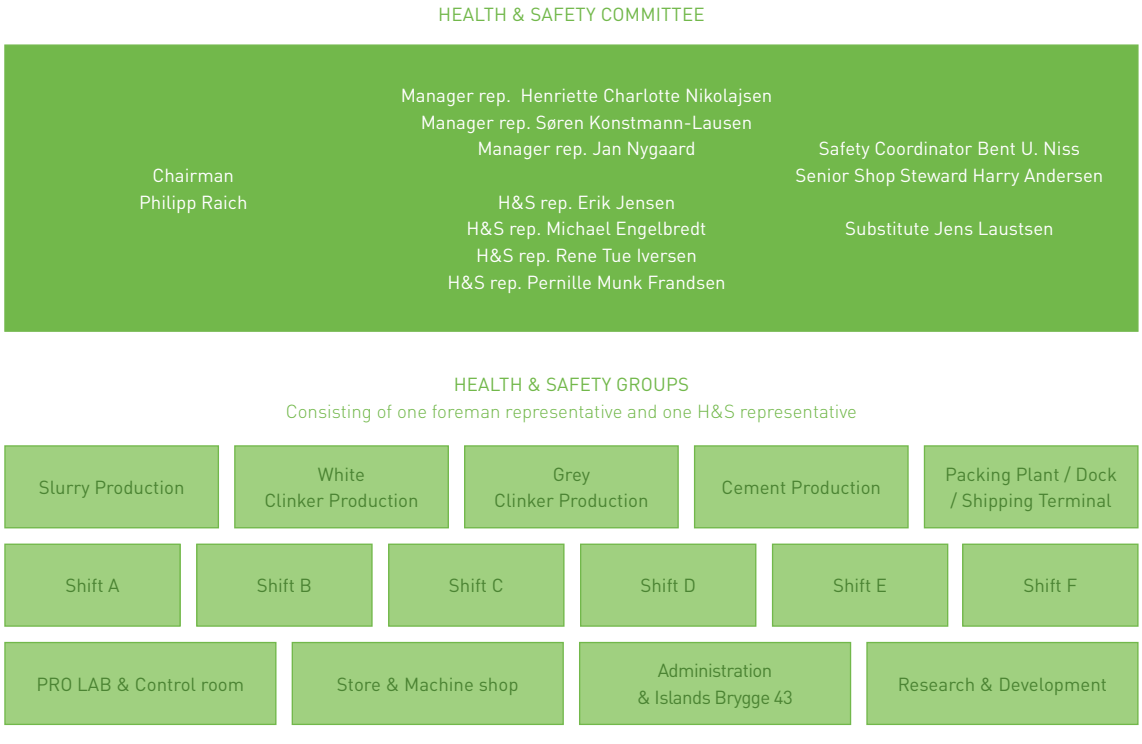
At a day to day level we have a number of processes available that help to support work satisfaction. For example, annual appraisal dialogues are held between managers and employees, and we conduct a motivation survey to illuminate areas that require greater focus to foster work satisfaction. Our managers have a special responsibility in this regard, and we are therefore currently developing a leadership competence model to assist them in their work.

We are also in the process of updating our core values. The values that must be a foundation for our future development and business.

Health & Safety organisation (H&S org.)

At Aalborg Portland the Health & Safety organisation is an active team player in implementation of "Safe Workplace". Managers and H&S representatives have an important part to play as role models for safe behaviour. They must help and motivate their colleagues, and they must intervene if an extra risk assessment is required to ensure safe performance of work.

HEALTH & SAFETY ORGANISATION (H&S ORG.)



Work accidents and prevention

In 2016 there were 13 work accidents by Aalborg Portland employees resulting in more than one day's absence from work and 18 accidents with no time loss. These were 31 accidents too many. The registered accidents typically consisted of injuries, such as sprains, muscle strains, knocks, cuts and abrasions.

In 2016 the accident frequency (number of accidents per one million working hours) was 23.3 and the average number of days lost per accident was 3.7.

In 2016, 99 near-accidents were reported, against 45 in 2015.

In the light of the above, a series of projects based on selected focus areas were initiated in second-half 2016 aiming to help to reduce the number of accidents going forward, cf. "Health & safety targets" for more details.

	2012	2013	2014	2015	2016
Accidents reported to the Working Environment Authority					
Number of accidents reported	10	9	14	13	13
Number of days lost	47	30	84	134	48
Accident frequency / Time lost – Hourly paid and salaried employees					
Accident frequency *	17.9	15.7	26.8	24.9	23.3
Time lost **	0.6	0.4	1.2	1.9	0.6
Accident frequency / Time lost – Hourly paid employees					
Accident frequency *	32.2	36.5	49.2	49.2	46.0
Accident frequency * – stone, clay and glass industries	19.2	20.0	10.0	13.3	***
Time lost **	1.3	0.9	2.3	3.8	1.3

* Number of accidents per one million working hours ** Number of hours lost per 1000 working hours

*** National work accident statistics for 2016 not yet published

HEALTH & SAFETY POLICY

Aalborg Portland is committed to produce quality products as per customer requirements and expectations. Health & safety is an integral part of the everyday working and there is constant focus on improvement.

Guidelines
All activities shall at all times conform to relevant legislation and the company's internal guidelines, ensuring a consistently safe and healthy work environment. The underlying platform is at all times Aalborg Portland's core values: Grow with passion for effectiveness, integrated diversity, act with concrete simplicity, rigorous flexibility, and accountability for the future.

Our employees
Within the scope of technical and economic feasibility Aalborg Portland will create the best possible framework for a healthy and safe work environment by using the best available tools and solutions.

Aalborg Portland will ensure that all employees are trained and motivated to work actively to improve the work environment.

It is the responsibility of each employee to help improving health & safety in and around performance of their work.

External contractors
Aalborg Portland recognises its responsibilities and obligations towards external contractors working in the production environment.

Society
Aalborg Portland adopts an open and active role in interaction with employees, authorities, customers, suppliers, organisations and other collaboration partners.

Policy, targets and objectives
Targets for the year ahead are proposed at the annual meeting of the Health & Safety organisation.

These targets are discussed at Management's QHS Review where the final targets for the period are established. Health & Safety policy is updated on an ongoing basis and at least every two years.

Target acheived Target acheived

HEALTH & SAFETY TARGETS

In 2016 two out of three H&S targets were achieved.

TARGETS 2016	STATUS 2016	TARGETS 2017
ACCIDENTS WITH MORE THAN ONE DAY LOST The target for 2016 is fewer than six accidents with more than one day lost.	Target not achieved. In 2016 we registered 13 accidents with more than one day lost.	The target for 2017 is fewer than nine accidents with more than one day lost.
PSYCHOSOCIAL WORK ENVIRONMENT AND WELLBEING The target is to reduce the number of stress victims and increase wellbeing. One means is through Project Wellbeing, which began in 2015 and will conclude in 2016.	Target achieved. Number of stress victims decreased and wellbeing increased.	Target discontinued. In future, psychosocial conditions will be mapped and measured by motivation surveys and Workplace Assessments.
FOCUS AREAS – H&S ORG. PROJECTS • Movement • Risk assessment • Ergonomics/Heavy lifting • Psychosocial work environment/Wellbeing	Target achieved, and targets set for next two years. Projects are in progress for the focus areas, and several will continue and conclude in 2017.	Target to continue under the title "Safe Workplace".

SAFE WORKPLACE

The target is to make Aalborg Portland a safe workplace as follows:

- 10 basic safety rules will be established for implementation over a three-year period. Six of these rules will be introduced in 2017.
- Consequence management will be introduced for disregard of rules.
- Success is measurable by the number of accidents, and in the long term by the results of Safety walks.

COMPETENCE AND AWARENESS

Increase behavioural awareness to create a safe workplace.

All employees must receive a qualified introduction to safe behaviour. The 2017 target is that all internal personnel must have completed training.

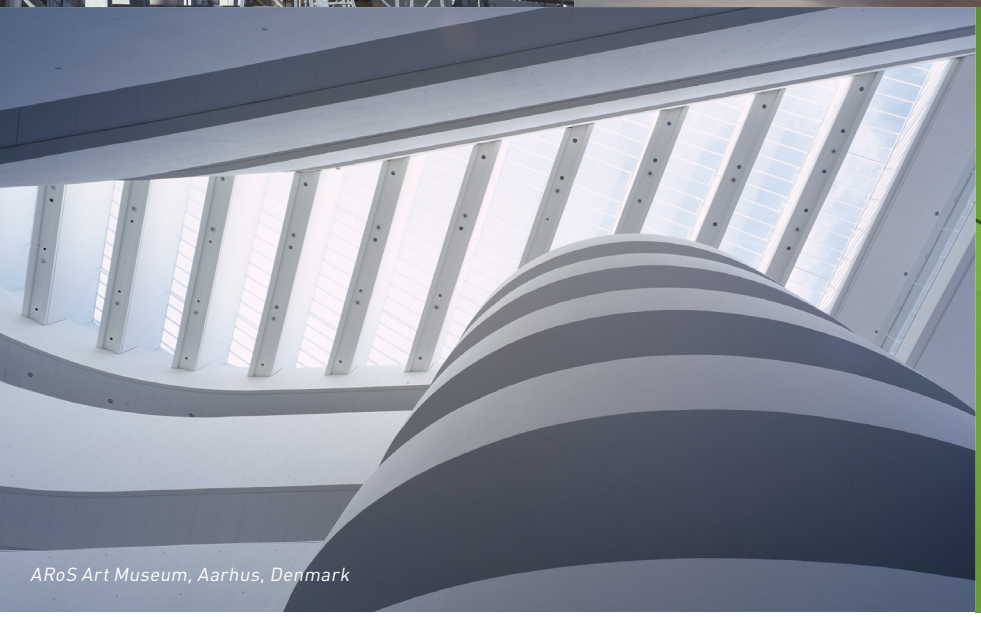
The project will be extended in 2018 to external tradesmen who must also have completed the training.

Success is measurable by the number of accidents and, in the long term by the results of the Safety walks.

BENEFIT TO SOCIETY

Aalborg Portland is one of the largest employers in northern Denmark. As well as the people employed directly, many more are employed in the companies that supply us with raw materials, goods and services and use our cement products. Our investments in the factory will generate still more employment.

The Great Belt Bridge, Denmark



ARoS Art Museum, Aarhus, Denmark

Rabalder Parken, Roskilde, Denmark

INVESTMENTS WITH CLIMATE AND ENVIRONMENTAL IMPROVEMENTS

Aalborg Portland has made significant ongoing investments in projects with climate and environmental improvements and in the area of work environment. In the period 2012-2016 a total of EUR 31m has been invested in a variety of technology improvement projects that benefit nature, environment and society.

In 2016, Aalborg Portland invested a total of EUR 5.5m in projects with climate and environmental improvements, including energy-saving projects, accident prevention and health & safety.

Investment projects in 2016 included:

- Planning and preparation for upgrade of calciners on Kiln 87 with view to more stable operation, increased use of alternative fuel and associated decreased CO_2 emission, and fewer dust emissions due to precipitator stops caused by excessive CO.
- Establishment of recovery facilities for chalk pit rehabilitation.
- Improved energy efficiency for Cement Mill 8/9 by establishing greater capacity.
- Upgrade of selected dedusting filters.
- New bottom for pyrite ash store to prevent pollution.
- Large-scale trials with white clinker and cement production for specific CO_2 reduction.
- Preventive safety measures relating to reconditioning of cyclone tower and dock installations, and a new silo for speciel white cement.
- Preventive safety by replacement of handrails and gratings.

Investment in environmental technology improvements also includes:

- New input materials in the form of alternative raw materials and fuels, cf. also page 10.
- Inclusion of more eco-friendly products in research projects with universities and other partners to develop cements for the future.

Aalborg Portland continues to plan initiatives that will reduce consumption and emission levels and have positive environmental effect. These initiatives are governed by our environmental action plan for which targets, activities and results are stated in pages 22-23.

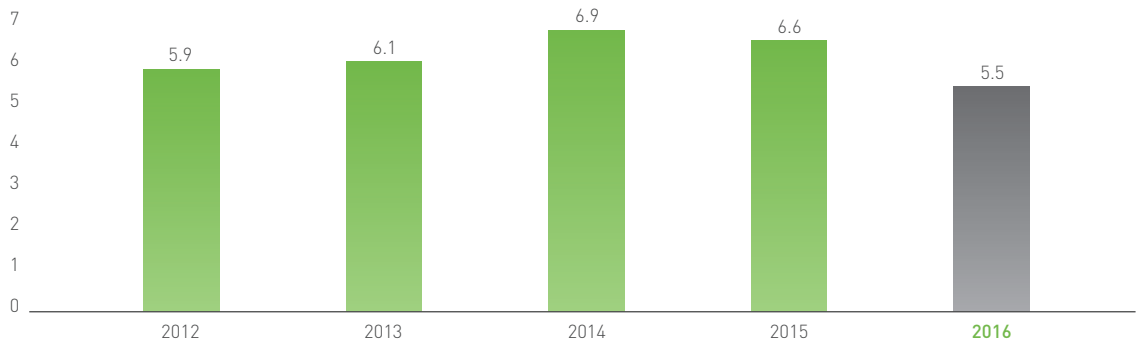
Preventive maintenance

Maintenance expenditure for production plant totalled EUR 6.2m in 2016. Preventive maintenance in the form of, for example, filter replacement will impact dust emission, while repairing leaks in the kiln system will prevent ingress of false air and thereby save on energy.

Furthermore, there is strong focus on production reliability in order to achieve the targets set. For example, timely replacement of kiln lining bricks minimises unscheduled kiln stops.

Preventive maintenance leads to stable, optimal operation of production plant and cleaning systems, thereby also minimising environmental impacts.

INVESTMENTS WITH CLIMATE AND ENVIRONMENTAL IMPROVEMENTS – EURm



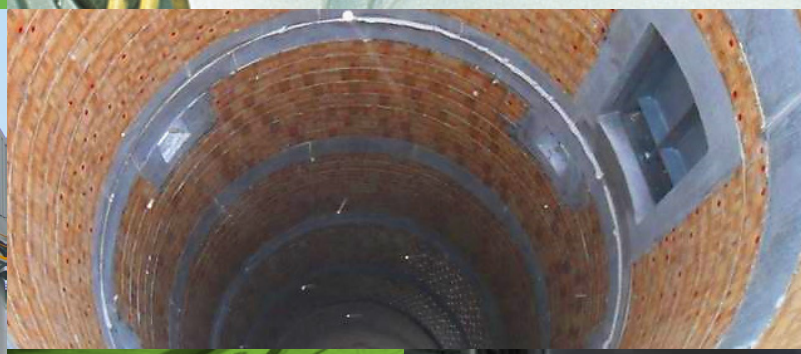
KILN 87 CALCINERS

In cement production the CO_2 contained in the raw material has to be released, and this is done by calcining. The calciner is a tubular steel construction clad on the inside with lining bricks and in which the temperature during production of grey cement clinker is more than 900° C.

Aalborg Portland has in recent years experienced a number of challenges with short-duration dust emissions. To mitigate this problem, both calciners on Kiln 87 have been redesigned to provide greater stability in production and reduce the risk of dust emission. The investment will enable more alternative fuel to be substituted for fossil fuel and thereby reduce CO_2 emission.

The installation of the two calciners on Kiln 87 is a major intervention, and was completed in February/ March 2017 during kiln shutdown.

The total investment cost was EUR 10.3m.



FINANCIAL HIGHLIGHTS AND SOCIAL CONTRIBUTION

Environmental levies

The Danish government had planned to abolish the NO_X tax in 2016. However, in the 2016 financial budget the tax was not abolished entirely, but reduced from EUR 3.4 to EUR 0.7 per kg with effect from 1 July 2016, and at the same time the basic allowance of the calculation of NO_X tax has been removed. The reduction is a step in the right direction but the production of cement in Denmark is still burdened by an annual NO_X levy of approx. EUR 1.3 - 2.0m.

The PSO charge is another significant burden on Danish business. The Danish government's decision to phase out the PSO charge over a five-year period from 2017-2021 therefore has very considerable importance for the competitiveness of Danish production companies. These special Danish levies continue to pose a significant disadvantage for Aalborg Portland in competition with other European companies not subject to these levies. A removal of these levies will enable long-term investments in new production equipment and employment in Denmark.

62%

increase in Aalborg Portland's PSO levy from 2012-2016.

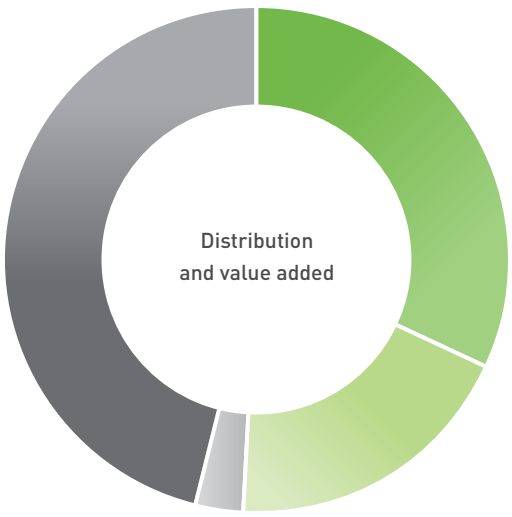
The company has incurred the following direct environmental levies:

EURm	2012	2013	2014	2015	2016
PSO levy	3.2	3.5	4.2	4.8	5.2
NO_X levy	2.1	3.9	1.9	2.4	2.1
Waste levy	1.5	0.4	0.1	0.2	0.3
Electricity levy	1.0	0.7	0.1	0.1	0.2
Energy levy	0.6	0.9	0.8	0.7	0.7
Raw materials levy	0.6	0.5	0.5	0.6	0.7
Sulphur levy	0.1	0.3	0.3	0.7	0.8
Total	**9.1**	**10.2**	**7.9**	**9.5**	**10.0**

Social contribution

Aalborg Portland's cement production in Denmark is of significant economic importance to the nation. In 2016 Aalborg Portland's value added was calculated as EUR 115m.

Of this, EUR 36m (32%) went to society in the form of VAT, company tax, other taxes and employee income tax. EUR 22m (19%) went to the employees in the form of wages and pension contributions (after tax). EUR 53m was transferred to the company's equity. A social contribution is also created through our subcontractors involved in transport, maintenance, facility management etc. at Aalborg Portland.



EUR 36m

of the value added went to the public sector in 2016, corresponding to an increase of 13% from 2012-2016.

Distribution and value added

EURm	2012	2013	2014	2015	2016
Revenue	185	188	192	210	232
Spent on materials, services, depreciation, etc.	94	107	85	109	117
Value added	**91**	**81**	**107**	**101**	**115**
Society	32	34	35	38	36
Employees	16	18	17	18	22
Interest on loan capital	2	4	5	4	4
Transferred to equity	40	25	50	41	53
Dividend to the owner	0	0	0	0	0
Total	**91**	**81**	**107**	**101**	**115**

- 32% Society
- 19% Employees
- 3% Interest on loan capital
- 46% Transferred to equity

MEASUREMENT AND CALCULATION OF MATERIAL FLOWS

The information used in compiling this Environmental Report was derived from Aalborg Portland's environmental database (SAP EnvDB) which receives raw data from a variety of recording systems.

The methods of measurement used in conjunction with data capture are described below:

- Raw materials, recyclables and fuels are determined by flow meters and weighing devices installed in the production process.
- Water consumption is measured by water meters.
- Electricity consumption is measured by kWh meters.
- Packaging is calculated from inventory statements.
- CO_2 emission is determined according to the approved CO_2 plan for Aalborg Portland and verified externally.
- NO_X, SO_2, CO, HCl, NH_3 and dust emission from kilns are determined by continuous metering in exhaust stacks. The same applies to dust concentrations in discharges from cement and coal mills, while air volumes from these sources are based on sampling.
- Hg quantity is calculated by continuous measurement of kiln air volumes and Hg concentration samples from yearly performance measurements. This does not apply to Kiln 87 where continuous measurement of Hg concentration was established in 2014.
- Products are determined by weighing and calculation.
- District heating production is measured by calorimeter.
- Wastes are determined by weighbridge and annual statements from external waste receivers.
- Cooling water is calculated on the "water balance principle" in which flow-metered outputs (water vapour, groundwater lowering at Kiln 76 and waste water, i.e. sanitation water and washing water) are deducted from measured inputs (water consumption, groundwater lowering and water content in materials and fuels).
- Combustion air is calculated indirectly by deducting the input side of the materials flow from the output side.
- Work accidents and time lost are determined from data reported to the Working Environment Authority.
- Noise calculation is performed by an accredited external firm based on measurement at source and subsequent computation.

Continuous emission and flow gauges and also weighbridges are subject to regular inspection and calibration by DANAK-accredited companies.


Research & Quality Center

ENVIRONMENTAL VERIFIER'S REPORT AND EMAS REGISTRATION

The environmental verifier of Bureau Veritas Certification (accreditation no. 6002) has reviewed the part of the Environmental Report dealing with external environment and issued the statement shown below. Based on this statement the Danish Environmental Protection Agency has issued a Certificate of EMAS Registration and endorsed the Environmental Report.

BUREAU VERITAS CERTIFICATION

18 APR. 2017

EMAS - MILJØVERIFIKATOR NR. DK-V6002

BUREAU VERITAS Certification

MILJØVERIFIKATORS ERKLÆRING OM FORETAGET VERIFIKATION OG VALIDERING

Bureau Veritas Certification Denmark A/S

registreret som EMAS-miljøverifikator nr. DK-V 6002 og akkrediteret til NACE kode 23.51, erklærer at have verificeret og valideret:
Miljøredegørelse for året 2016 af april 2017 og stemplet den 18-04-2017
for følgende anlægsområde eller organisation

Aalborg Portland A/S
Rørdalsvej 44, 9100 Aalborg
Registreringsnummer: DK-000132

opfylder alle kravene i Europa-Parlamentets og Rådets forordning (EF) nr. 1221/2009 af 25. november 2009 om organisationers frivillige deltagelse i en fællesskabsordning for miljøledelse og miljørevision (EMAS).

Bureau Veritas Certification Denmark A/S erklærer hermed at:

- verifikationen og valideringen er udført i fuld overensstemmelse med kravene i forordning (EF) nr. 1221/2009.
- resultatet af verifikationen og valideringen bekræfter, at intet tyder på mangler i efterlevelsen af gældende miljølovgivning.
- data og oplysninger i organisationens ajourførte miljøredegørelse, tegner et pålideligt, troværdigt og korrekt billede af alle organisationens aktiviteter inden for det omfang, der er angivet i miljøredegørelsen.

Dette dokument kan ikke sidestilles med EMAS-registrering. EMAS-registrering kan kun foretages af registreringsorganet i medfør af forordning (EF) nr. 1221/2009. Dette dokument kan ikke i sig selv anvendes som en meddelelse til offentligheden.

Verifikator har verificeret miljøredegørelsen på dansk og indestår ikke for oversættelse til andre sprog.

Dato for næste samlede redegørelse: 30-04-2018

For oplysninger om denne erklærings gyldighed, venligst ring (+45) 77 311 000.
Yderligere information vedrørende erklæringens gyldighedsområde og omfang, kan få ved henvendelse til virksomheden.

Erklæring nr. DK005183-3 *Dato:* 18-04-2017

DANAK DK-V Reg. 6002

Certifikat for EMAS-registrering
Certificate of EMAS-Registration

EMAS
VERIFICERET MILJØLEDELSE

Aalborg Portland A/S

Rørdalsvej 44
DK-9220-Aalborg Øst

Registreringsnummer
Registration Number
DK-000132

Registreret første gang
Date of first registration
02-03-2000

Certifikatet er gyldigt indtil
This certificate is valid until
01-06-2018

Udstedelsesdato
Date of issue
05-05-2017

Denne organisation har indført et miljøledelsessystem, og udarbejdet en miljøredegørelse i henhold til forordning (EF) nr. 1221/2009 med det formål at fremme en løbende forbedring af organisationens miljøindsats og resultater, og informere offentligheden herom. Miljøledelsessystemet og miljøredegørelsen er verificeret af en uafhængig tredjepart.

This organisation has established an environmental management system and prepared an environmental statement according to Regulation (EC) No. 1221/2009 to promote the continual improvement of environmental performance and to inform the public hereof. The environmental management system and the environmental statement are verified by an independent third party.

Lars Hindkjær
Direktør
Director-General

Miljø- og Fødevareministeriet

Sampling of cement clinker

GENERAL INFORMATION

Name and address
Aalborg Portland A/S
Rørdalsvej 44
P.O. Box 165
9220 Aalborg Øst
Denmark
Tel. +45 98 16 77 77
E-mail: cement@aalborgportland.com
Internet: www.aalborgportland.dk

Environmental supervisory authority
Ministry of the Environment,
Environmental Protection Agency Aarhus

Industrial sector
Raw materials processing.

Main activity
Production of cement for the domestic and export market.

List item
3.1. a) Production of cement clinker in rotary kilns with an output capacity of more than 500 tonnes/day (s).

Company reg. no.
36 42 81 12

Production unit no.
1.019.874.563

NACE code
23.51 – Production of cementt.

Land register title nos.
1a, 1k, 1l, 1m, 1n, 1p,1o Rørdal, 9a, Ø. Sundby and 9a, 10g, 11a, 16i, 17l, 21h, Uttrup under Aalborg Jorde

Significant secondary activities
K212. Facilities for temporary storage of non-hazardous waste prior to recycling or disposal with a waste feed capacity of 30 tonnes per day.

Ownership
Aalborg Portland A/S is 100% owned by Aalborg Portland Holding A/S, which is 75% owned by Cementir España S.L., Spain and 25% owned by Globo Cem S.L., Spain. The companies are part of Cementir Holding S.p.A, Italy and the ultimate owner is Caltagirone S.p.A., Italy.

Management
Environment, energy, quality and health & safety:
Michael Lundgaard Thomsen, Managing Director
Philipp Raich, Plant Director
Henriette Charlotte Nikolajsen,
Environment, Energy and QMS Manager

Principal environmental approvals

10 October 2016
Upgrade of Cement Mill 2 with separator.

21 June 2016
Upgrade of Cement Mill 4 with separator.

15 April 2015
Limits for atmospheric emissions and internal control.

21 January 2015
Environmental approval to modify existing installation for supply of alternative fuel to Kiln 87.

10 October 2012
Recycling of microfiller for rehabilitation of chalk pit.

10 October 2012
Permit for excavation of chalk.

10 October 2012
Amended conditions relating to changed use of alternative fuels and raw materials. Environmental approval for co-combustion of non-hazardous waste on Kiln 85. Changed emission limits and continuous measurement of mercury on Kilns 85 and 87.

7 April 2010
Use of meat and bone meal as fuel on Kiln 76.

18 December 2009
General environmental approval and review – comprising environmental approval of expanded activities at recycling site and review of older environmental approvals.

6 December 2006
Approval of transitional plan for on-site landfill.

6 December 2006
Approval of closure plan for tip.

5 November 2004
Permit for excavation of chalk.

28 July 1992
Establishment of on-site landfill.

29 November 1991
Final permission for water extraction.

29 June 1990
Permission under the Environmental Protection Act to send waste water to the municipal treatment plant.

Aalborg Portland is not covered by the Ministry of Environment's regulations for the safe storage, handling and transport of materials that may give rise to serious environmental hazard in the event of accident.

TERMINOLOGY

Alkali
Alkalis used at Aalborg Portland are sodium and potassium compounds.

Alternative fuels
Combustible waste products which replace fossil fuels and consist of a reprocessed fuel product, meat and bone meal and dried sewage sludge.

BAT
Intermediate product that results from the burning of slurry in kilns and is ground to produce cement.

Cement clinker
Intermediate product that results from the burning of slurry in kilns and is ground to produce cement.

Cement mill
Facility which grinds cement clinker to cement.

CO
Carbon monoxide. A result of incomplete burning of fuel. Converted in the atmosphere to CO_2.

CO_2
Carbon dioxide. Formed by burning of fuel and calcining of chalk. CO_2 emission is calculated according to EU guidelines.

dB(A)
Noise is measured in decibels, dB(A), which is a logarithmic scale. For example, the noise from leaves rustling in the wind is around 20 dB(A). The noise level in an ordinary living room is around 40 dB(A), in offices 60-65 dB(A), on a street with normal traffic 80-85 dB(A) and from a pneumatic drill approximately 100 dB(A).

EMAS
Eco-Management and Audit Scheme. EU scheme for the registration of environmental management systems.

Emission
Release of noise or gas. In flue gas emission the volumes released are metered continuously, except for CO_2 – see under CO_2.

Environmental Impact Assessment (EIA)
EU directive which prescribes that installations having material potential environmental impact cannot be established until the procedure stated in the directive has been implemented, including preparation of an EIA Report, holding of a public inquiry, etc.

Filtrate water
Waste water formed in heat recovery boilers by condensation of flue gases.

Flue gas desulphurisation gypsum (FGD)
Gypsum formed by the desulphurisation of flue gases.

Fly ash
Material produced by cleaning of flue gases in an electrostatic precipitator.

Fossil fuel
Coal, petcoke, oil and natural gas.

GJ
Gigajoule, a unit of energy equal to 1,000 MJ.

HCl
Hydrogen chloride.

Hg
Mercury.

Household energy consumption
Estimated average annual consumption per household: Electricity: 4,000 kWh. Space heat: 50 GJ.

Iron oxides
Iron-containing by-product of sulphuric acid manufacture.

ISO 14001
Standard issued by the International Standards Organisation with guidelines for establishment and maintenance of environmental management systems.

ISO 50001
Standard with guidelines for establishment of energy management systems.

Life Cycle Analysis (LCA)
Method for assessing the environmental and other impacts which a product has on its surroundings from raw material extraction until final product disposal.

Management System
Aalborg Portland's internal management system for environment, energy, quality and health & safety. Ensures that all related matters are handled uniformly and in accordance with policies, targets, guidelines and rules.

Material flows
Description of what resources Aalborg Portland uses in manufacturing cement, how much is produced, and what emissions and discharges the production entails, cf. pages 40-41.

Microfiller
Filler material with particle size < 50 µm.

Mineralised operation
Addition of small amounts of fluoride and alkali, which together with sulphur from fuels form especially reactive cement clinker.

NH_3
Ammonia.

NO_X
Nitrogen oxides. Formed by combustion of fossil fuel. Contributory cause of acid rain.

OHSAS 18001
International guideline for establishment and maintenance of health & safety management systems.

Petcoke
A low-ash coke by-product from the refining of crude oil into petrol.

PRTR
European Pollutant Release and Transfer Register.

PSO levy
Levy charged on electricity purchase and supporting producers of green energy.

Pyrite ash
See iron oxides.

Raw meal
Cement clinker and incompletely burned raw materials. Raw meal may result from e.g. kiln stoppage.

Safety walk
Safety rounding at the factory with focus on the employees' health and safety.

SO_2
Sulphur dioxide. Formed by combustion of fossil fuel. Contributory cause of acid rain.

Substitution
Replacement of a raw material by a waste product. For example, substitution of clay by fly ash.

tTCE
tonne Total Cement Equivalent. Standard unit for the production obtained by calculation of the equivalent cement tonnage if sales and changes in clinker stocks had been processed into cement. Each type of clinker is therefore multiplied by a factor that expresses addition of other materials for production of cement. Imports of clinker, which are consumed to produce cement, are deducted and are not considered as production.

WA
Workplace Assessment.

Environmental Report 2016
Environment and Health & Safety

Edited and published by
Aalborg Portland A/S
Environment, Energy and Management system

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