

# Environment

## Contents

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48 Energy efficiency, renewable energy  
and climate

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51 Resource efficiency

# Energy efficiency, renewable energy and climate

## Striving to reduce energy use and climate impacts

ABB's mission is to help our customers to use electrical power efficiently, to increase industrial productivity and to lower environmental impact in a sustainable way. Just as we target mitigation of climate change, and energy and resource efficiency for ABB's customers through our product and solution portfolio, we have also been working for many years to manage and reduce the impacts of our own operations.

As part of our Group-wide sustainability objective to progressively increase the efficiency of our own operations, we have set ourselves the target to reduce the energy intensity of our business by 20 percent by 2020 from a 2013 baseline. This is measured as megawatt-hours (MWh) of energy per million US dollars of sales and includes both direct fuel consumption and the use of electricity and district heating for manufacturing processes and to operate buildings.

To implement the objective, our most energy-intensive sites were required to undertake energy audits and all sites were required to develop an energy saving program. At our plants and offices, and along our value chain, actions to reduce energy consumption and greenhouse gas emissions take many forms, as reported below.

### Energy efficiency in operations

During 2014, we recorded a 1.6 percent improvement in the energy intensity of our operations, resulting in energy consumption of 66.02 MWh per million US dollar sales. Absolute energy consumption declined by 6 percent year on year, driven by reductions in electricity and gas consumption and a significant decrease in district heating. Approximately one-third of the absolute energy reduction was due to business divestments during 2014, which primarily impacted Group electricity and gas consumption.

A wide variety of energy savings projects were implemented across the company to achieve our 2014 result. More than 200 individual energy efficiency projects were reported across the Group, estimated to result in 34.4 GWh of energy savings.

Most commonly – and cost effectively – facilities implemented energy-efficient lighting solutions. Other activities included optimizing heating, ventilation and cooling processes, investments in more efficient equipment, investigating and optimizing compressed air systems, behavioral change programs, and implementing or updating heat recuperation from machines and processes, often using our own technology.

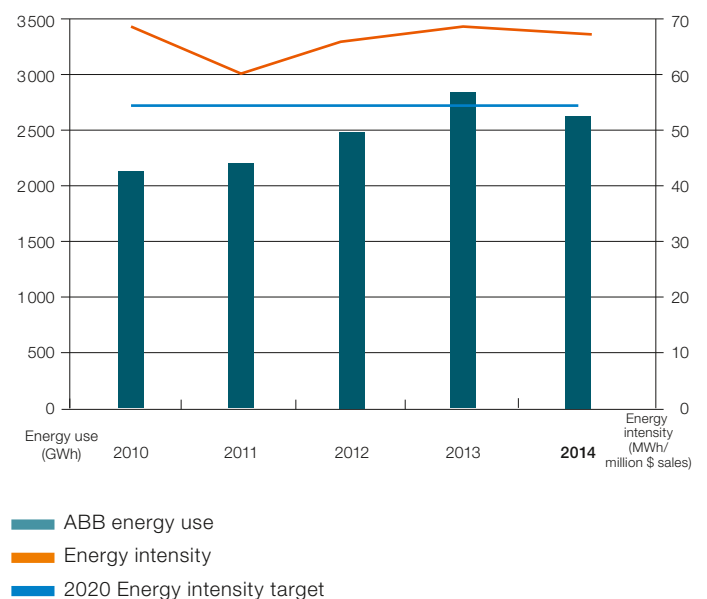
Some actions were as simple as reducing the temperature of a varnish oven, which not only reduced energy consumption at our facility in Ozark, Arkansas in the US, but also saved over \$24,000 during the year.

Other activities were planned as part of multi-year, facility-wide or country-wide programs. For example, our plant at Ludvika in Sweden – one of our top five energy intensive facilities with more than 2,800 employees on-site – undertook a systematic review of energy consumption during 2013. With cross-functional coordination between real estate, environment and production engineering, they began a step-by-step improvement plan that is continuing into 2015.

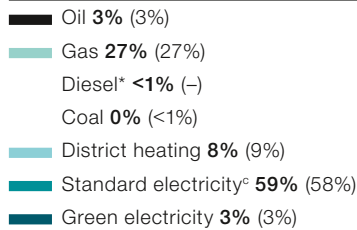
Measures taken so far include upgrading lighting systems, repairs and upgrades in the compressed air systems, installation of energy metering, introducing timers on drying ovens and significant training for employees. The program is already showing results and is even exceeding expectations in some projects, such as installation of LED lighting and sensors. With further activities planned for 2015, including installation of heat recovery in the painting area, additional energy metering and further lighting upgrades, we expect to see increasing savings in future.

In other areas, ABB businesses are choosing to implement certified ISO 50001 energy management systems (EnMS) to guide their activities. In 2014, ABB in Spain decided to implement a unified EnMS for six of its manufacturing and service centers, while ABB in Egypt implemented an EnMS at its most energy-intensive site, covering three different business units, which will later be extended to other sites in the country. The program in Egypt not only focuses on energy efficiency but also includes investigation of renewable energy generation and alternatives to fossil fuels in transportation equipment.

Total energy use and energy intensity



### Energy use by type for 2014 (2013)



\* Diesel consumption reported separately for the first time in 2014. Previously reported with oil consumption.

### Building an efficient real estate portfolio

ABB's corporate real estate management also plays a key role in our energy efficiency performance. Acquisition, development, refurbishment and management activities related to our worldwide portfolio of about 8.8 million square meters of building space are guided by the ABB Green Building Policy.

In refurbishment projects, our real estate managers are expected to consider a range of factors, including energy efficiency and renewable energy opportunities, flexibility of spaces, working conditions for employees plus site-specific factors related to building use. Addressing these factors not only improves the environmental performance of the buildings, but leads to financial savings and greater employee satisfaction.

For example, there was a significant focus on improving overall design and functionality, as well as energy efficiency during the 2014 refurbishment of ABB's staff restaurant in Dättwil, Switzerland. Installation of skylights and LED lighting provide a bright and friendly atmosphere while reducing electricity consumption by over 11 MWh per year. Heat recovery systems, ABB control technology for heating and ventilation, and upgraded building insulation will improve comfort levels for staff and also save over 200 MWh per year. Rooftop solar panels will produce almost 20 MWh of electricity each year, which can be used in-house or fed back into the grid. Additionally, building materials were chosen to ensure no hazardous indoor emissions and all wood-based materials were selected on the basis of sustainable forest management.



To supplement site by site improvement projects, in 2013 ABB Real Estate kicked off a significant project to systematically introduce real estate energy efficiency programs across Europe. The project covers 100 sites in 14 countries and aims to identify improvement potential according to a common methodology and to initiate measures to reduce energy consumption. By year end, kick off workshops had been conducted in 13 countries, and detailed reports for three countries completed, outlining the results of energy monitoring, technical assessments and evaluation of efficiency measures. As part of the program, a total of 36 locations in eight European countries were integrated into the central Energy Monitoring System.

Many of the LED lighting upgrades undertaken at our office and manufacturing facilities during 2014 were part of ABB's collaboration agreement with Philips. The collaboration aims to provide a solution to simplify the integration of connected lighting systems and building device control for commercial buildings. ABB and Philips are working together to develop a simple, scalable solution to streamline the introduction of this technology in commercial buildings.

### Reducing carbon intensity of energy

As well as working to improve the efficiency of our energy consumption, ABB also seeks to reduce the carbon intensity of our energy sources. Several ABB countries – Belgium, Netherlands and United Kingdom – have decided to purchase all of their electricity from renewable sources. Thomas & Betts plants in these countries will also join these programs as their current contracts reach expiration. In Sweden, almost 20 percent of electricity purchased was "green" energy, while globally, more than 4 percent, or 68 GWh, of ABB's 2014 electricity was purchased as certified "green" electricity.

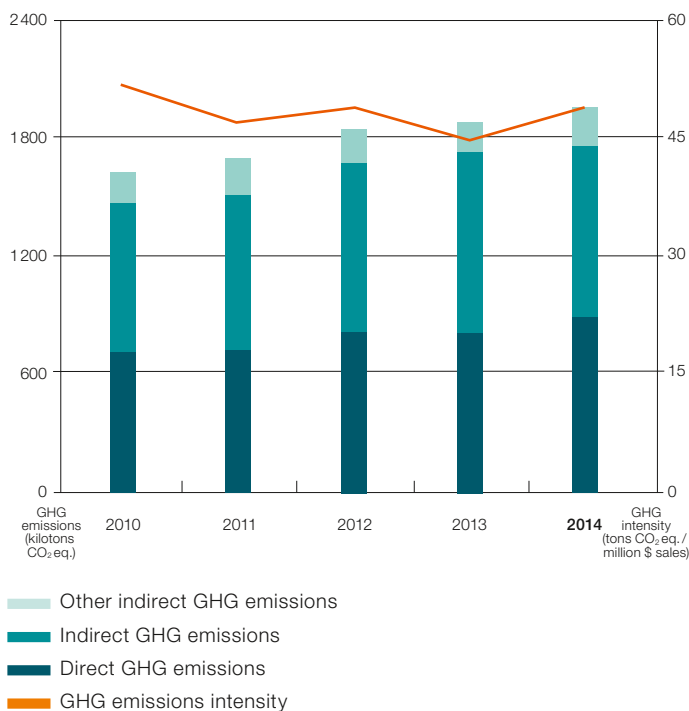
During 2014, two more ABB facilities in Egypt and Australia installed on-site photovoltaic (PV) power plants to reduce environmental impacts as well as to demonstrate ABB's solar capabilities. PV plants are now installed at 22 sites in 13 countries across Asia-Pacific, Latin America and Europe. While contributing only a small proportion of our global electricity needs, these plants are often a key part of local energy strategies, designed as a reminder to employees of ABB's energy efficiency and low carbon commitments.

## Greenhouse gas emissions

Despite reductions in gas, district heat and electricity consumption, ABB's total greenhouse gas (GHG) emissions (direct + indirect) increased by 4 percent in 2014, from 1.87 million tons in 2013 to 1.95 million tons. ABB's direct GHG emissions are mainly from fuel used in our operations, as well as from SF<sub>6</sub> emissions during production processes and gas handling on site. During 2014, our SF<sub>6</sub> emissions increased by over 30 percent due to increased production at several units that handle high volumes of the gas and to unsuccessful trials of a new gassing process at one plant. As part of ABB's energy and climate objective, we are focusing on strengthening local SF<sub>6</sub> management plans to improve handling, leak detection and storage procedures.

Indirect GHG emissions from purchased energy declined due to decreased consumption, while indirect GHG emissions from air travel increased by 29 percent. This increase was, in large part, due to the first time inclusion of Thomas & Betts travel data and full inclusion of ABB China employees' air travel. (See [Approach to reporting section](#) for details of our GHG calculation methodology.)

### Total greenhouse gas (GHG) emissions and GHG intensity



## Logistics and packaging

Programs to optimize logistics continued during 2014, resulting in cost savings, improved quality and reduced emissions. The Transportation Management Center (TMC) project in China, providing coordinated transport management for all ABB business units around the regions of Xiamen, Beijing and Shanghai, was expanded to include international service during the year. This program is now realizing sustainable logistics cost savings of more than 10 percent.

ABB in India began implementation of a TMC project at one site during 2014, with the intention to cover the remainder of ABB operations in the country and all transport modes by the end of 2015. We will also investigate the feasibility of TMC roll outs in Dubai, Brazil and South Africa in 2015.

200+ energy efficiency projects under way in 2014

Our global packaging optimization project continues to make progress. The project involves systematic review of packaging needs and assessment of the potential to optimize packaging type, size and weight. Improved packaging and loading can increase transport efficiency, thus reducing emissions and material consumption, improving ergonomics and providing better product protection.



More than 80 facilities have systematically reviewed their packaging needs, with 20 sites at implementation stage. Some sites are already seeing the benefits. For example, in Faridabad in India, a change from hand-built rubber wood crates to manufactured plywood improved health and safety, reduced storage space for empty packaging, improved product protection and reduced lifetime CO<sub>2</sub> emissions. Similar improvements have been observed in Shanghai, China with a change from rainforest plywood packaging to a lighter, more sturdy solution. At Dalmine in Italy, several projects related to both inbound and outbound transports are under way, and are expected to yield annual savings of well over \$300,000.

# Resource efficiency

## Reducing impacts

Our stakeholders are increasingly focusing their attention on ABB's operational efficiency – how we optimize the use of resources and minimize waste. They have also confirmed their interest in how we reduce the use of natural resources during production and ensure our products are safe and compliant.

**5,200 kilotons of water saved through reuse and recycling**

Addressing these issues contributes to our business success by reducing costs and risks, improving the work environment for our employees and helping to maintain our license to operate.

### Water reduction commitment

Although the majority of our manufacturing processes do not consume significant amounts of water, ABB is nonetheless committed to reducing our impact on local water resources.

In order to focus reductions where they are most needed, during 2012 and 2013 we targeted our manufacturing facilities in water-scarce and extremely water-scarce watersheds,<sup>1</sup> rolling out an in-house tool for mapping and analysis of water flows. Facilities were required to review water flows systematically and develop water action plans to minimize risks and to leverage opportunities. The newly acquired businesses of Baldor and Thomas & Betts were not required to implement the ABB Water Tool during this phase due to their participation in specific integration programs.

Our Sustainability Objectives 2014-2020 expanded the scope and quantified this target. We are committed to reduce absolute water use by 25 percent by 2020 at facilities in water-stressed, water-scarce and extremely water-scarce watersheds, compared to a baseline of 2013. The initial focus will be on 30 selected facilities.

Following a range of business divestments in 2014, we will update our facility mapping during 2015 and define the 30 facilities included in the initial program.

### Water in our global operations

Looking at ABB's global operations in 2014, there were no significant changes in our water withdrawal, use or discharge results compared to 2013, apart from a decrease of about 12 percent in the volume of reused and recycled water. Business divestments during 2014 did not have a material impact on our water profile.

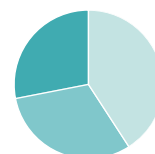
In 2014, more than 50 percent of ABB's water withdrawals were used for cooling processes, almost 30 percent for domestic purposes such as sanitation, cooking or garden maintenance and the remainder for manufacturing processes.

Of those sites that use water for process purposes, more than 30 percent use closed-loop systems. Excluding cooling water returned to the source of extraction, the use of closed-loop processes and the reuse of water in other ways saved approximately 5,200 kilotons of water in 2014. Without this recycling and reuse, ABB's water withdrawals would have been more than 50 percent higher.

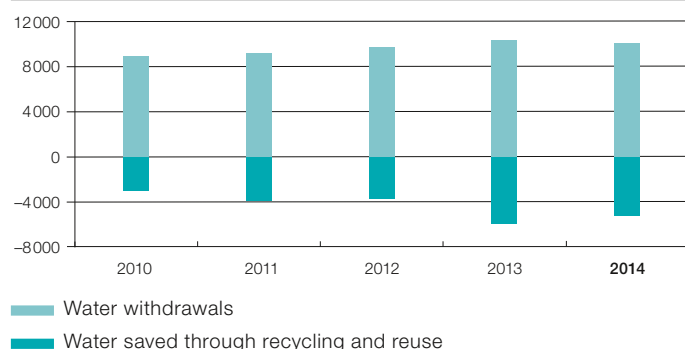
About half of our water discharge was to public sewers (48 percent), with approximately one-third of that volume first processed at our own treatment plants. Another 46 percent was discharged to surface or ground water, with almost 90 percent of that volume pre-treated. The remainder was handled by hazardous waste water treatment companies.

### Sources of water withdrawals in 2014 (2013)

- Purchased from water companies **41%** (43%)
- Ground water extracted by ABB **31%** (31%)
- Surface water extracted by ABB **28%** (26%)
- Collection of rain water **<1%** (<1%)
- Waste water from external source **<1%** (<1%)



### Water withdrawals and water reused / recycled (kilotons)



<sup>1</sup> Food and Agriculture Organization of the United Nations (FAO) (2003). *Review of world water resources by country. Water Reports 23*. Rome. According to this methodology, a watershed is considered water-stressed if the total actual renewable water resources (TARWR) are below 1,700 m<sup>3</sup> per person and year, water-scarce if below 1,000 and extremely water-scarce if below 500.

Our San Luis Potosí facility in Mexico reports that its water withdrawals are likely to have an impact on its water sources due to local water scarcity. Therefore, in 2014 the facility stopped withdrawing ground water – previously about 50 percent of total water withdrawal – and now treats and reuses all sanitary waste water from the campus. This saved over 11,000 m<sup>3</sup> of water in 2014.

Many other site-level water efficiency projects were undertaken during 2014, with most creating significant benefits for the facility. Projects ranged from major repair and refurbishment of water systems at facilities in China, Canada and Germany, resulting in substantial water and cost savings, to collection of rain water for use in all process work at a facility in Australia, and the installation of waterless urinals at facilities in Finland and Spain. Many locations report the effectiveness of continued water conservation training and awareness-raising programs for employees.

A number of facilities examined their water flows and re-designed processes to enable increased recycling or reuse of waste water. Additionally, closed-loop systems were expanded in China, Italy, Saudi Arabia and the United States, or were newly installed at a large facility in the United States. In Peru, the entire sewer network at one plant was redesigned to enable separation of domestic and industrial waste water, with the potential for future treatment and reuse of domestic waste water flows.

### Waste and recycling

ABB products contain mostly steel, copper, aluminum, oil and plastics, and the majority of this material is reclaimable at the end of the product's life. We enhance the ability to recycle by designing products that can be dismantled more easily and by providing users with recycling instructions.

Consequently, the main waste streams at ABB facilities are metal, oil and plastic, as well as wood and cardboard from packaging materials and paper from office activities. We aim to optimize material use and increase the share of waste that is reused or recycled.

We are committed to reduce the amount of waste sent to final disposal – both hazardous and non-hazardous – by 20 percent by 2020. This will be measured as the proportion of total waste sent for final disposal and compared with a 2013 baseline.

There was a nine percent decrease in total waste generated in 2014 compared with 2013. The majority of this is due to business divestments during 2014. Due to the significant amounts of scrap metal and non-hazardous waste reported by those

businesses in 2013, we consider that approximately 100 percent of the observed reduction in scrap metal, 70 percent of the reduction in recycled non-hazardous waste and over 35 percent of the reduction in non-hazardous waste sent for disposal in 2014 was due to the impact of the divestments. The divested businesses reported negligible hazardous waste and on-site recycling in 2013.

## 20% increase in materials recycled and reused in-house

In 2014, ABB sent 79 percent of total waste for recycling, compared with 81 percent in 2013. Again, this apparent reduction in the recycling rate is due to the impact of the high volumes of scrap metal reported by the divested businesses in 2013.

In-house recycling, mainly of packaging materials and thermoplastics, reduced the amount of waste by more than 4,980 tons, an increase of around 20 percent from 2013. In total, we generated almost 18,000 tons of hazardous waste in 2014, but sent about 25 percent of that amount for recycling rather than disposal.

### Waste and recycling

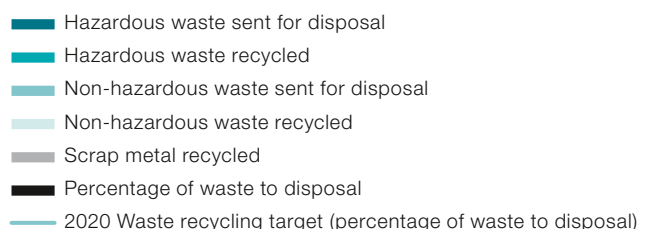
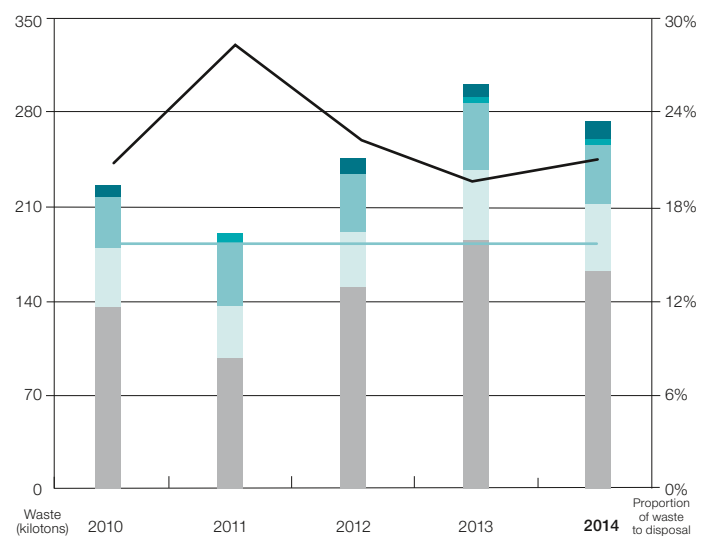


ABB operations undertake a wide range of waste reduction and recycling initiatives, bringing both environmental and cost benefits for the business. The nature of the improvement activities generally depends on the characteristics of the production processes and the local waste infrastructure, but there were common themes.

### W E B

Many locations have conducted detailed on-site analyses and are working with their waste management vendors, or have selected new vendors, to optimize recycling options. Revenues realized from a range of waste streams along with the reduced costs of waste disposal reinforce these efforts within our businesses.

During 2014, many facilities pursued operational excellence projects to optimize material use and reduce waste, but a number of our operations also invested in novel processes aimed at reducing and reusing waste. For example, a plant in China upgraded its filtration process to enable reuse of a specialized oil, not only reducing oil waste by 20 tons, but reducing costs by more than \$100,000. At an insulation and components manufacturing facility in India, an in-house lamination process was developed to reuse offcuts from other processes. In Sweden, installation of a special room for chemical waste allowed for better sorting and labeling options, thus improving recycling and cutting disposal costs.

Reduction and reuse of packaging, such as repurposing wood from transport crates and encouraging the use of reusable, bulk containers by suppliers, are also helping to reduce waste volumes on sites. A number of locations adapted administrative procedures to avoid or minimize the use of paper, and many sites are focusing on improved recycling of beverage containers or have ceased using disposable water bottles and cups altogether.

### Reduction of hazardous substances

ABB is committed to minimizing our environmental impacts and to ensuring the health, safety and protection of people who come into contact with our products and business. We continue to phase out hazardous substances in products and processes, where technically and economically feasible, with the ambition to use these substances in closed loops or not at all.

This requires attention to product design and manufacturing processes, as well as to our supply chain, to ensure that the materials and components we use and the products we produce comply with our own and our stakeholders' standards.

To guide this process, we have compiled lists of prohibited and restricted substances, which reference international regulations. These lists are updated regularly and help both our engineers and suppliers to comply with regulatory requirements and to manage potential risks caused by the presence of chemicals in various products.

### Use of hazardous substances (tons)

	2014	2013	2012	2011	2010
Phthalates – softener for PVC	258	21	28	47	31
PBB and PBDE –					
flame retardants	1.9	2.9	~0	~0	~0
Lead in submarine cables	7,842	7,236	5,633	5,725	3,632
Organic lead in polymers	0.1	0.6	0.9	1.3	52
Lead in other products, e.g.					
backup batteries and counterweights in robots	1,884	2,601	363	227	265
Cadmium in industrial batteries delivered to customers	4.4	4.4	5.6	1.6	1.7
Cadmium in rechargeable batteries	75.1	67.6	6.3	10	5.9
Cadmium in lead alloy and other uses	6.0	5.7	4.5	4.3	2.9
Mercury in products delivered to customers	0.071	0.012	0.011	0.030	0.038
SF <sub>6</sub> insulation gas (inflow to ABB)	1,483	1,438	1,139	1,052	968
SF <sub>6</sub> insulation gas (outflow from ABB)	1,466	1,425	1,118	1,040	959

Our suppliers are requested to comply with these regulations, which are also part of ABB's Global Terms and Conditions and Supplier Code of Conduct. We have developed a [Guide for Suppliers to the ABB List of Prohibited and Restricted Substances](#) to help our suppliers understand and implement the ABB List and to provide guidance on suppliers' obligations.

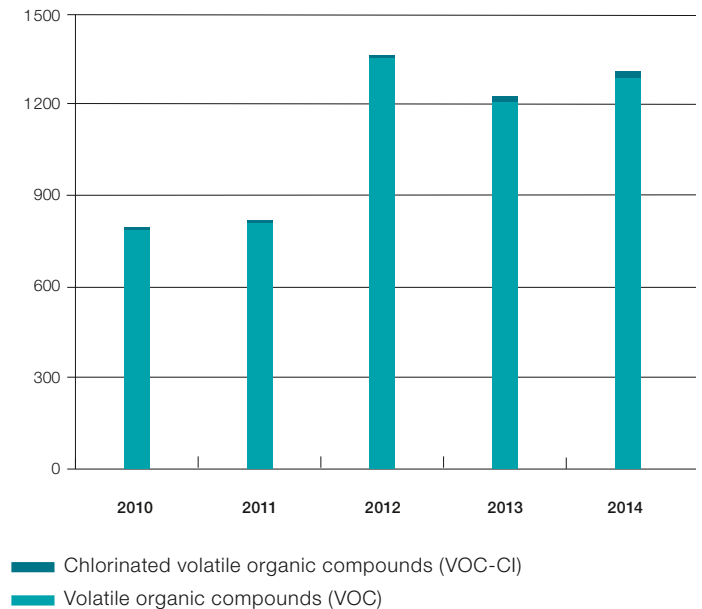
ABB facilities are required to ensure compliance with the ABB List and to work to phase out hazardous substances in their processes and products.

As we integrate our recent, large acquisitions, Baldor and Thomas & Betts, we are seeing changes in our Group profile of hazardous substances due to the different product portfolios and manufacturing processes undertaken by these businesses. In particular, in 2013, the first year both companies reported on their environmental performance, we saw an increase in lead and cadmium in batteries delivered to customers and in polybrominated flame retardants used in polymers. A substitution program resulted in reductions in the use of these polybrominated flame retardants in 2014.

During 2014 we worked to improve the quality of hazardous substances reporting through further investigation of complex mixtures and polymers. As a consequence, we report a significant increase in phthalates, used as plasticizers in polymers, mainly due to raw material used at one plant in the United States. Use of lead in rubber compounds in two plants in the United States also impacted the category lead in other products.

Ongoing activities at other plants are beginning to show results. We are making progress in the elimination of lead in solder, with a reduction of 24 percent in 2014, and with the substitution of various chemicals used in metal cleaning processes. For example, the construction of a new interrupter facility at one of our plants in India provided the opportunity to install an ultrasonic alkaline degreasing facility – an investment of over \$100,000 – resulting in the phase-out of chlorinated solvents from January 2015. Also in India, extensive testing led to the replacement of solvent-based degreaser with a neutral soap solution.

Emissions of volatile organic compounds (tons)



### Promoting material compliance

ABB's network of environmental specialists works alongside our product development and supply chain functions to promote material compliance. During 2014, we reinforced our continuing work around REACH compliance through the delivery of eight training sessions on different aspects of the regulation to our cross-functional REACH network.

As well as targeting the phase-out of hazardous substances in our products and processes, ABB has also initiated programs to monitor the source of certain minerals more closely.

ABB is aware of and concerned by the conflicts occurring in the Democratic Republic of the Congo. We are actively working to identify which products and material from suppliers may contain conflict minerals and are engaging with our customers regarding their disclosure obligations.

In 2014, we provided our first report regarding conflict minerals to the United States Securities and Exchange Commission according to the requirements of section 1502 of the Dodd-Frank Wall Street Reform and Consumer Protection Act.



### Improvement by design

ABB's Research and Development (R&D) engineers and scientists are key to ensuring that our environmental, and health and safety ambitions are designed into ABB's products and solutions.

The ABB Gate Model process defines our Group-wide approach to product and technology development and is designed to ensure appropriate consideration of all aspects needed to satisfy a project's defined objectives. These include consideration of legal, technical, strategic, manufacturing, customer and other requirements.

Sustainability aspects are built into the Gate Model and include a standardized Life Cycle Assessment (LCA) procedure and a handbook to guide consideration of environmental, and health and safety aspects during design. We have developed support materials such as a Health, Safety and Environment (HSE) checklist and training packages for our research technologists to improve understanding and ensure these aspects are incorporated into design.

During 2014, we updated the HSE checklist to reflect ABB's 2014–2020 Sustainability Objectives and strengthened the sections related to hazardous materials and other potentially controversial materials, such as conflict minerals, rare earth elements and palm oil. Rolling out these changes, we trained 132 R&D engineers on the updated checklist, with over 80 percent of the project leaders at our largest R&D center trained.

To further increase awareness of how technologists can influence environmental performance through product and process design, ABB's Corporate Research Center (CRC) in Sweden established a "Green Project of the Year" award in 2013. With the second round of entries submitted during 2014, the awards program is now providing feedback to improve the sustainability support materials for R&D engineers. For example, one of the projects evaluated for the award prompted questions around rare earth elements. These questions were investigated through a small research project, with the results now incorporated in the updated HSE checklist.

The Swedish CRC also undertook a first-time "materiality" survey in 2014 to better understand the sustainability topics prioritized by R&D technologists and their various customers. The results of the survey were still being analyzed in early 2015, but will be used in part to improve communication of sustainability within ABB.

LCA is not only required as part of a product's research and development phase, it is also used in the concept development phase for next generation products. ABB develops Environmental Product Declarations to communicate the environmental performance of our core products over their life cycle. Declarations are based on LCA studies, created according to the international standard ISO/TR 14025. Approximately 80 declarations for major product lines are published on our [website](#).