

ICCA – Worldwide Voice of the Chemical Industry

Chemical industry contributions to energy efficiency and mitigating climate change



ICCA Technology Roadmaps on Energy & Climate Change

November 2013

Introduction

Chemistry provides solutions

The chemical industry is central to mankind's effort to enhance energy efficiency and reduce greenhouse gas emissions. In a series of three roadmaps, the International Council of Chemical Associations (ICCA) and their partners have drawn up strategies for maximizing the industry's contribution to more sustainable growth. This summary charts the way ahead.

Enabling modern life

With global sales of US\$4 trillion and more than seven million employees in 2012, the chemical industry is one of the largest manufacturing sectors in the world. Output from the chemical industry covers three wide ranges of products: base chemicals, specialty chemicals and consumer chemicals. These three product ranges provide benefits to consumers and a multitude of industries, and have a strategic role in the generation, usage and storage of energy.

More than 95% of all manufactured products rely on chemistry (ICCA, 2010). In areas ranging from alternative energy, transportation, communications and information technology to buildings, chemistry provides the solutions to manufacturing and efficiency challenges.

In transportation, chemicals aid the creation of lighter, more fuel-efficient vehicles. In buildings they are key to insulation, reflective coatings, and a host of construction materials. And as we strive to develop and enhance techniques for generating renewable energy, chemicals have a vital role to play, from the manufacture of solar panels to turning crop waste into biofuels. The chemical industry is central to mankind's efforts to enhance energy efficiency and reduce greenhouse gas emissions.

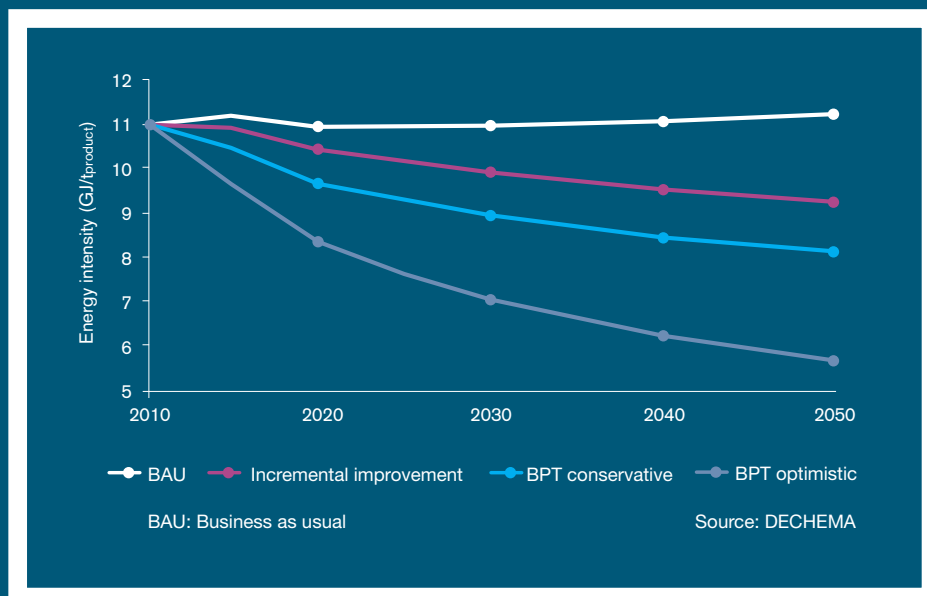
Enhancing chemical industry efficiency

Many chemical production processes are energy intensive. Therefore, the global chemical industry is a large energy consumer, accounting for roughly 10% of total worldwide final energy demand and 7% of global industrial greenhouse gas (GHG) emissions. With a long history of improving its own energy efficiency and lowering GHG emissions from its operations, the industry leads by example.

Achievements

Since 1974, the chemical industry in the United States has halved its energy use per unit of production; since 1990, it has cut its GHG emissions by 13% (ACC, 2012). In Europe, energy used per unit of chemical output in 2010 was 53% lower than in 1990 (Cefic, 2012). In Asia, the Japanese chemical industry reduced unit energy consumption by 2012 to 85% of the 1990 year level (JCIA, 2013). Since 2001, the Brazilian chemical industry has lessened its GHG emissions (fuel and process) by 17% (Abiquim, 2012).

Around 90% of chemical processes involve the use of substances added to increase the rate of a reaction, known as catalysts, and related processes to enhance production efficiency and reduce energy use. Improvements in catalyst technology therefore offer important potential for greater efficiency and further curtailing GHG emissions.



Evolution of energy intensity for incremental improvements and deployment of best practice technology (BPT)

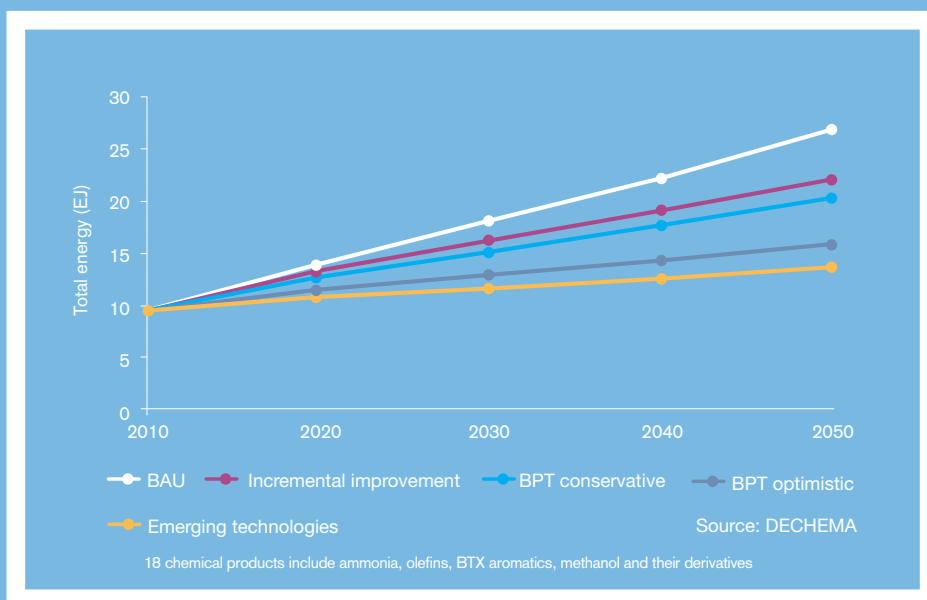
Ambitions

Technology Roadmap: Energy and GHG Reductions in the Chemical Industry via Catalytic Processes, published in June 2013, charts the way ahead. This joint study by the ICCA, the International Energy Agency (IEA) and the Society for Chemical Engineering and Biotechnology (DECHEMA) describes the path toward further improvements in energy efficiency and GHG reductions in the chemical sector.

Deploying the best current catalyst technologies and related process improvements could reduce energy intensity for relevant products by 20% to 40% by 2050 if all scenarios are combined. These improvements could save as much as 13 exajoules of energy (equivalent to the energy consumption of Germany) and 1 gigatonne of carbon dioxide equivalent (CO₂-eq) per year by 2050 versus a “business-as-usual” scenario. The report shows significant differences in energy savings potential between different regions of the world. The larger savings potential is either in regions where significant new capacity is planned such as Asia and the Middle East, or in regions where re-industrialization is occurring such as North America. This is good news: the largest potential for saving energy and GHG occurs when new investments are being made.

A further step change in the sector’s energy consumption and GHG emissions would require the development of “game changer” technologies, enabling for example sustainable biomass feedstocks and hydrogen from low-carbon energy sources. These are not yet economically feasible.

The industry, policymakers, and other stakeholders must work together to deliver energy savings and emissions reductions via advances in catalytic processes. This includes implementing policies that reward energy efficiency, investing in research and development, and encouraging best practice technologies.



Energy impact of improvement options for the top 18 chemical products to 2050

Helping other industries enhance efficiency and cut emissions

The chemical industry is unique in its ability to enable other industries and society at large to save energy and reduce GHG emissions. This is especially well illustrated in the building sector. Enhancing the energy efficiency of buildings, which consume nearly one-third of energy used worldwide, is critical at a time when urbanization is proceeding apace and developed countries are overhauling or replacing their stock of buildings to reduce the amount of energy used.

Achievements

Building products derived from chemicals saved 100 mega tons of oil equivalent (MtOe) of energy in 2010 – approximately 10 percent of all energy consumed for space heating in buildings. Products such as wall and roof insulation, plastic pipe and pipe insulation, air barriers and air sealing products, reflective roof coatings and pigments and windows prevent heat and energy loss, either by reducing heat flow transfer – through the roof, walls, and windows -- or by reducing the infiltration of outside air. Because these products last a long time, energy savings accumulated over the product life cycle will become much larger.



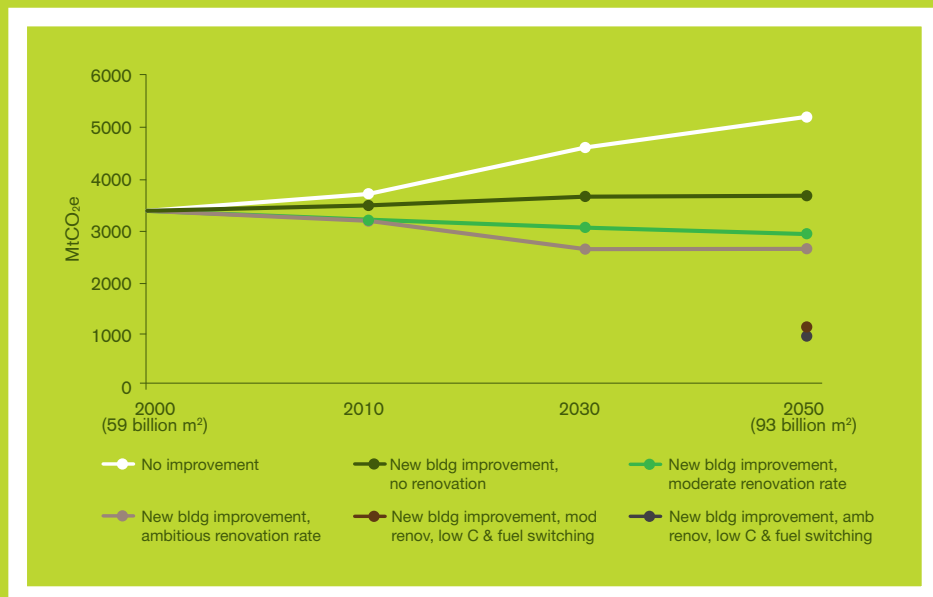
Building products derived from chemicals

Ambitions

Building Technology Roadmap: The Chemical Industry's Contribution to Energy and GHG Savings in Residential and Commercial Construction, published in November 2012 by the ICCA, sets out how the chemical sector can help tackle the consequences of global urbanization.

By 2050 the amount of energy used in buildings is forecast to surge by 62%, while CO₂ emissions will soar more than 87%. Combining **ambitious building enclosure improvements**, using chemically derived building products, with use of lower-carbon fuels and electricity could cut building energy use by 41% and GHG emissions by 70% by 2050. In addition, advances in building material technologies – in which chemistry is a significant factor – would likely result in even greater efficiencies and emissions reductions. Promising technologies include **water resilient insulators and films** and **reflective roofing products** that save energy and could reduce the 'heat island' effect, and **smart windows technologies**. The global chemical industry is taking a lead role in researching and developing new and improved products that are more energy efficient over longer lifetimes, leading to greater GHG savings.

National and international stakeholders must act to ensure that the potential of chemically-derived building products is realized, so that the energy savings and emission reductions needed in coming decades are achieved.



Scenarios for cutting building GHG emissions

The more widely chemically-derived and alternative products are adopted, the less the GHG emissions. Study assumes use of wall and roof insulation, hot water piping materials, air barriers and air sealing materials, cool roofing, and high-tech windows. (Residential and commercial building stock in Europe, Japan, and the United States.)

Enabling sustainable energy generation, storage and recovery

Chemical products play a vital role in many renewable energy technologies, from turbine blades and solar panels to efficient batteries for energy storage. Bioenergy, meantime, accounts for around 10% of world primary energy supply, and is widely used for cooking and heating in developing countries. The chemical industry, which touches disciplines from farming and forestry to microbiology and nanotechnology, can help develop more efficient use of bioenergy and biofuels.

Achievements

The chemical industry facilitates the development and deployment of renewable energy such as biofuels and bioenergy through various advanced technologies. **Special films** that allow vaporization while preventing water penetration provide a simple and effective way of drying biomass with less energy. **Membrane technologies** efficiently reduce energy required to recover ethanol from fermentation broth. In addition, catalysis technology and chemical process technology are essential in developing biofuels and bioenergy technologies.

Ambitions

The role of the chemical industry in achieving targets of IEA roadmaps on biofuel and bioenergy, published in May 2011 by the ICCA and SRI International, details the chemical industry's drive to help develop biofuel and bioenergy technology.

This includes the improvement of enzymatic processes for biofuel production using **cellulose as feedstock**. New bio-refinery systems using value-added chemical products will enhance access to energy and feedstock. The goal is to provide technologies that allow food and fuel to be produced to meet growing demand from a global population forecast to reach 9 billion by 2050.





About ICCA

The International Council of Chemical Associations (ICCA) is the worldwide voice of the chemical industry, an industry with a 2012 turnover of more than €3,000 billion (including observers & Responsible Care members). More than 20 million people around the globe are employed directly or indirectly by the chemical industry. ICCA members account for more than 90 percent of global chemical sales. ICCA focuses on key issues for the chemical industry such as the promotion and coordination of Responsible Care[®] and other voluntary initiatives. Learn more about the ICCA at www.icca-chem.org.

Learn more about the ICCA Roadmaps

www.icca-chem.org/buildingsroadmap

www.icca-chem.org/catalysisroadmap

www.icca-chem.org/biofuelsroadmap

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