INSULATION MATTERS 2016

KNAUF INSULATION
it's time to save energy

Knauf Insulation is one of the world's largest manufacturers of insulation products and solutions. With more than 30 years of experience in the industry, we represent one of the fastest growing and most respected names in insulation worldwide.

We are committed to our customers and to helping them to meet the increasing demand for energy efficiency and sustainability in new and existing homes, non-residential buildings and industrial applications by creating innovative and customer-friendly solutions designed for real performance.

To see more on our organisational profile, see the 'about us' section of our website **www.knaufinsulation.com**

MR. THIES KNAUF
CEO OF KNAUF INSULATION

When the Knauf Group first took the reins of a business based in Shelbyville, Indiana in 1978, it was a small €28 million-a-year company. Today Knauf Insulation is one of the leading global players in insulation with operations across the world.

When I returned as CEO of the company at the end of 2015, I was energised by this success and by the possibility of creating a more sustainable built environment. Knauf Insulation can play an important role in making a difference.

Take one of the most important challenges of our age, **climate change**. Buildings are responsible for 40% of global energy use and one third of global greenhouse gas emissions. To make our buildings more sustainable we have to make them more energy efficient.

Another challenge is innovation. Technologically advanced materials may be transforming buildings to create exciting new high-rise skylines from London to New York, from Shanghai to Dubai, but it is vital that we do not sacrifice sustainability or safety — particularly fire safety — for the sake of innovation.

Innovative new building practices must also take into account respect for sustainable resource use and the health of those who occupy buildings. Increasingly, legislators are placing emphasis on building characteristics such as acoustic health and good air quality, while ensuring resource use is maximised through circular economy initiatives.

Knauf Insulation is working hard to meet all these challenges.

As this **sustainability report** shows, we are continuously campaigning to keep energy efficiency, sustainability and building safety at the heart of political debate around the world while working to pioneer better green building practice. Innovations such as our ECOSE Technology are helping to contribute to the health of buildings while the creation of new products such as Mineral Plus or our Green Roof Urbanscape solution offer both cutting-edge energy-saving performance and user-friendly installation.

However, although our solutions may have changed, what has not changed is our commitment to customers. Caring about the challenges they face is still the bedrock of the business.

That is why we are training our sustainability experts to be Green Building Rating System (GBRS) assessors to help specifiers get the most from every green system; offering easy online information about gaining GBRS points with our solutions and providing Environmental Product Declarations faster than ever.

That is why we are initiating tests in occupied homes in Europe to demonstrate the real-life benefits of insulation and researching new solutions to tackle poorly insulated 'two-layer roofs' installed on hundreds of thousands of apartments worldwide. And, that is why, in our laboratories and training facilities, we work tirelessly to ensure our products perform as effectively as possible when they are installed.

Of course we also have to challenge ourselves. Knauf Insulation is on track to achieve many of the ambitious 2020 sustainability targets that we set five years ago.

Since our 2010 baseline year we have reduced energy use by 17.5%, cut CO_2 emissions by 16.4%, reduced waste to landfill by 58% and have already achieved our 2020 target of cutting water discharge by 50%.

The challenges we face are significant, but as this report demonstrates, Knauf Insulation has never been in a stronger position to make a difference to the future, and to future generations.

Contents

THE YEAR AT A GLANCE

GREEN ROOFS

INTERNATIONAL SUPPORT FOR GREEN ROOFS

Knauf Insulation has become a corporate member of the **World Green Infrastructure Network**. The network promotes green building technology and infrastructure, such as living walls and green roofs, that can help tackle climate change and provide healthier urban environments. We offer a wide range of green infrastructure solutions through our Urbanscape range.

FIRE SAFETY FORUM

FIRE FORUM TOLD TO PUT SAFETY FIRST

Combustible insulation has no place on the façade of a super high-rise building, **Barry Lynham, Group Director of Strategy** at Knauf Insulation, told the UAE's Civil Defence Authority Annual Fire Safety Technology Forum in Dubai. He said that plans to update the country's building regulations following recent high-profile skyscraper fires in the region offered an unprecedented opportunity to become a world leader in building fire safety.

"As we change the nature of our buildings it is vital that there are standards in place that reflect the real life performance of façade systems during a fire," he said. *"Unfortunately, no-where in the world are standards good enough yet. We are hopeful that the UAE will lead by example with its current review of regulations."*

SLOVENIA SHOWCASE

SHOWCASE EXPERIENCE IN SLOVENIA

More than 500 industry professionals ranging from contractors to architects attended a special **'Knauf Experience' in Ljubljana, Slovenia**. The event was organised by Knauf Partners in Slovenia, Knauf Insulation, Knauf Ljubljana and Knauf AMF Slovenia. At the close of the event, a donation was made by the Knauf Group to the Association of Friends of Youth Ljubljana Moste-Polje.

Highlights included showcasing ECOSE Technology for roof renovation with TERMOTOP on rafters, the benefits of Urbanscape Green Roof Solutions as well as products such as Diamant, Silentboard, Fireboard and Comfortboard.

SUPPLIER OF THE YEAR IN THE UK

Knauf Insulation has been named Supplier of the Year at the Builders' Merchant News Awards. *"We firmly believe that developing strong relationships with our customers is key to an effective supply chain and so winning the award is a testament to the hard work our dedicated resource teams undertake to support our merchant customers day in, day out,"* says John Gaunt, Commercial Manager at Knauf Insulation UK.

"Indeed independent and national builders' merchants have grown significantly within the construction industry, so it is of utmost importance that suppliers like ourselves help merchants increase the package offers that they have available for their contractor customers – big or small," says Gaunt.

GAIA AWARD HONOUR

Knauf Exeed Insulation has won the **Gaia Award (HVAC Category)** in the UAE for its Glass Mineral Wool with ECOSE Technology.

The award is designed to showcase companies' environmental achievements and is significant because Knauf Exeed Insulation has been actively highlighting the use of non-formaldehyde-based binder in its products to promote indoor air quality.

Environmental awareness is becoming increasingly important in the Middle East's construction industry as new building regulations encourage or require that all new buildings meet international green standards.

DISCOVERY DAYS

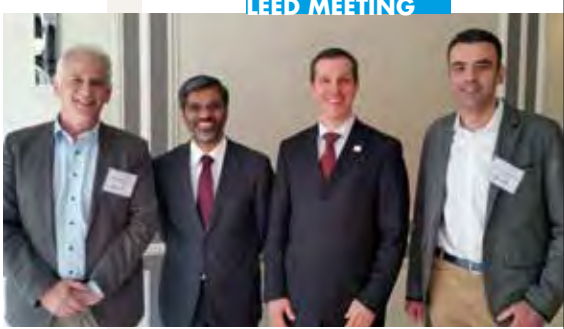
AUREA AWARD

SUPPLIER OF THE YEAR

SUPERBRAND

GAIA AWARD

LEED MEETING



DISCOVERY DAYS IN BELGIUM

Knauf Belgium organised four days of activities in Belgium to showcase its products in March and April 2016. The '**Knauf Discovery Days**', inspired by our highly popular 'Knauf Werktage' events in Germany, were held in Liege and Brussels and featured seminars, workshops and demonstrations covering the entire Knauf product portfolio. More than 2,500 people visited the event days with 50 members of staff on hand to demonstrate products.

SUPERBRAND IN SERBIA

Knauf Insulation has received the prestigious **Serbian Corporate Superbrands Award for 2015-16** in recognition of the company's reputation, consistency and corporate responsibility.
The award, presented by the Superbrands Expert Council, comes after ECOSE Technology was introduced at our Surdulica plant in January 2016. We started operations in 2005 and we employ 130 people and produce more than 40,000 tons of Rock Mineral Wool every year in Serbia.

KNAUF INSULATION SERBIA WINS MAJOR INVESTMENT AWARD

Knauf Insulation Serbia has won the **AUREA Award for Best Investment Of The Year 2015** following the introduction of ECOSE Technology to its Surdulica Rock Mineral Wool plant in 2016. The eKapija award was presented by Serbian Deputy Prime Minister Kori Udovicki to Knauf Insulation. This award acknowledges the serious development and improvement of our Rock Mineral Wool products.

LEED MEETING SUCCESS IN BERLIN

Knauf Insulation sponsored a **LEED Technical Meeting** held in Berlin for more than a hundred LEED European practitioners. The event was organised jointly by the German Green Building Association and the US Green Building Council to discuss how to make Europe's existing buildings greener as well as identify Europe-specific improvements to LEED.

Our sustainability team introduced the topic of low-emitting materials by explaining the added value of ECOSE Technology into LEED assessment.

EUROPEAN HISTORY IN THE MAKING

2017

SHOULD BE REMEMBERED AS A YEAR OF ENVIRONMENTAL AND ECONOMIC SUCCESS AND AS

THE YEAR ENERGY EFFICIENT BUILDING RENOVATION STARTED

TO FUTURE-PROOF EUROPEAN LIVES

How will European history remember 2017? Will it be simply the year that political power plates shifted and the United Kingdom took the decision to leave the European Union?

Or will it be the year that Europe started to seriously tackle climate change powered by an exciting new energy policy that created millions of new jobs, transformed the European economic landscape and improved society.

Politics are built on ever-changing public opinion with uncertainty the only certainty of any political life — but there is no doubt that something has to be done to curb emissions, there is no doubt that Europe needs an economic boost and there is no doubt that the energy efficient renovation of buildings is the solution.

"A 50% reduction in energy use in European building stock would by itself cut our total CO_2 emissions in half by 2030," says Knauf Insulation's Siân Hughes, Director of Public Affairs for Europe.

Buildings are the biggest consumers of energy in Europe accounting for 40% of the EU's total energy bill and 36% of its CO_2 emissions. Much of that energy is used for the heating and cooling of inefficient buildings that are likely to leak energy for many decades to come unless decisive action is taken.

The time for that decisive action is now following Europe's backing of the Paris Climate Agreement — signed by 187 countries — to keep global temperature increase well below 2°C.

To achieve this, two-thirds of Europe's low carbon energy infrastructure investment to 2040 will need to be in energy efficiency, says the International Energy Agency. This adds up to at least an eightfold increase in annual energy efficiency investment compared to 2013 levels — or an average of €178 billion a year.

Such investment would not only help tackle global climate change, it would hugely improve standards of living and global air quality and provide a massive boost to Europe's economy creating millions of jobs in the process.

2017 cannot be remembered as a year of political failure, it must be seen as a year of environmental and economic success, the year building renovation began to future-proof European lives.

Installing our Mineral Plus solutions. Read more on page 38.

COUNT ON RENOVATION TO TACKLE CLIMATE CHANGE

The 187 countries that signed the Paris COP21 agreement in December 2015 are now legally bound to make on-going emission reduction commitments. Here are the big numbers that highlight why building renovation should be at the top of their action list.

€178 BILLION

The International Energy Agency (IEA) has said that two-thirds of Europe's low carbon energy infrastructure to 2040 needs to be in energy efficiency to achieve Europe's pledge to keep global warming below 2°C. An average of €178 billion every year needs to be invested to keep the EU on track. *"That equates to at least an eightfold increase in energy efficiency investment compared to 2013 levels,"* says the IEA.

40%

President of the European Commission, Jean- Claude Juncker has said: *"When it comes to buildings, I'm in favour of an ambitious binding target. A 40% energy efficiency target for 2030 is the lowest objective to adopt to meet the COP21 agreement,"* says the European Alliance for Companies for Energy Efficiency (EuroACE).

75%

Insulating 75% of the inefficient buildings in the European Union could reduce CO_2 emissions by 204 million tonnes per year, says the European Insulation Manufacturers Association (Eurima). This is the equivalent of 43 million cars taken off the road for a year.

SEVEN KEY REASONS
WHY RENOVATION MATTERS

Buildings consume 40% of Europe's energy and 75% of our current buildings were built with no minimal energy-related requirements. By 2050 at least 75% of these buildings will still be in use. Renovating buildings is an historic opportunity to create new jobs, improve energy security, unlock money and end fuel poverty

1 LESS FUEL POVERTY

54 million Europeans cannot afford to heat their homes

x 1,000,000

So, how can we help? Energy subsidies may work in the short term, but drastically reducing energy consumption in our buildings can provide a long-term and sustainable solution

2 MORE JOBS

Energy Productivity and Economic Prosperity Index research has found there could be between

900,000 & 1.8m new jobs if Europe's energy bill was cut by **€200bn**

3 ENERGY SECURITY

The total import bill of the EU is more than **€1bn** every day

So how do you cut the bill?

European Commission research found that gas imports would be slashed by 2.6% for every 1% in energy savings

4 CLEANER AIR

Buildings are the primary cause of EU air pollution. Cutting building related emissions in half by **2030** would reduce the cost of air pollution to Europe by

€6.64bn and save **78,678** lives **each year**

5 BETTER HEALTH

There are clear links between cold housing and excess winter deaths among the elderly. Renovation can contribute to the creation of warmer buildings

In the UK, for example, fuel-poverty related illnesses cost the government on average

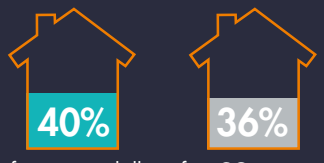
£ 859m every year

6 BETTER HOME ECONOMICS

The difference in heating bills for an average-size house in each class (300kwh/m²/year, 150kwh/ m²/year and 15kwh/ m²/year) has been estimated to be €1,350 a year for an inefficient home, €670 a year for a modern house, and just €90 a year for a passive home

7 A SAFER CLIMATE

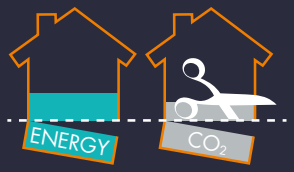
Buildings are the biggest consumers of energy in Europe accounting for

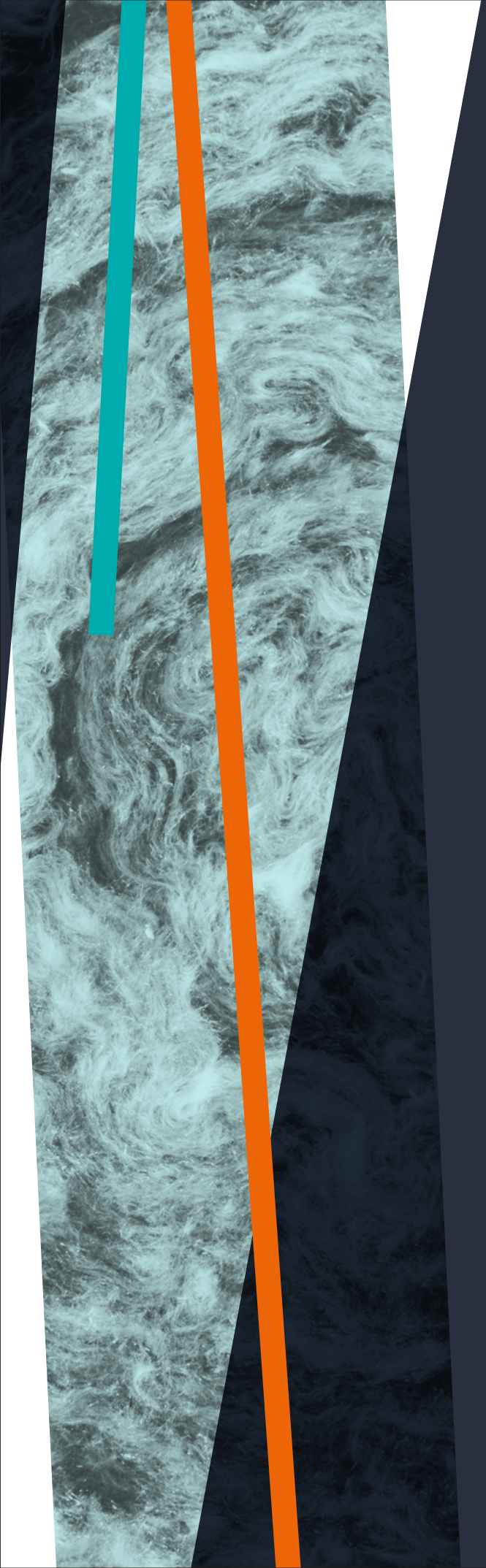


of its energy bill

of its CO_2 emissions

A 50% reduction in energy use in European building stock would cut total CO_2 emissions by 18% by 2030





TURNING THE ENERGY MODEL UPSIDE DOWN

PUTTING ENERGY EFFICIENCY FIRST

Energy efficiency has to be at the heart of any country's energy policy and treated as infrastructure in its own right. In the EU for example, this would create millions of new jobs and inject €100 billion a year into the European economy.

The EU's current flagship strategy for a European Energy Union has ambitious aims — secure supply, reduce emissions, increase innovation, end fuel poverty and make energy efficiency 'Europe's first fuel' by applying the principle of energy efficiency first.

"To increase our energy efficiency is not a matter of political preferences or agenda — it is pure common sense," says Maroš Šefčovič European Commission Vice-President in charge of Energy Union. *"Our traditional energy sources are expensive, pollutant, finite and not always reliable. But the energy we won't consume is by definition the cheapest and most sustainable source we will ever find."*

Nice words. But to make this vision a reality, Europe needs to give projects that reduce energy use a proper seat at the table during discussions about infrastructure.

In other words it needs to turn the traditional energy infrastructure model upside down.

Infrastructure is always focused on energy supply — such as roads, reactors, pipelines and power plants — but this model needs to be equally focused on infrastructure projects that save vast reserves of energy.

As buildings consume 40% of Europe's energy, mobilising a massive EU-wide energy efficiency renovation project is the ideal place to start.

Like any other infrastructure programme this will require huge levels of investment, free up massive energy capacity in other areas of the economy and — like roads, reactors, pipelines and power plants — ultimately provide long-lasting benefits for everyone by creating jobs, services and contributing billions to the economy.

In Germany in 2011, for example, a huge programme involving the insulation of outer building walls and roofs and heating system renovation created €14 billion in added value to the economy and 280,000 jobs. In Hungary a national energy efficiency programme enhanced the balance of trade by €2.6 billion and created 50,000 new jobs.

"If these initiatives were scaled up the impact would be enormous. A 50% reduction in energy use in European building stock by 2030 would mean a capital injection of €100 billion into Europe's economy requiring the creation of more than two million new jobs," says the European Insulation Manufacturers Association (Eurima).

HOW TO BUILD SUCCESS IN A NEW ENERGY LANDSCAPE

Powering up European directives, cutting red tape and refocusing financial resources will drive building renovation success in a new Europe where energy efficiency is an infrastructure priority.

Transferring words into action is not easy, but Knauf Insulation has drawn up a proposal for a long-term strategy — Mission Renovation — designed to boost the European economy by €1.3 trillion and create two million new jobs in the process.

Critical to achieving this is a long-term political commitment to cut by half the energy used in existing buildings by 2030 as a first step towards transforming Europe's buildings to nearly zero energy levels by 2050. At the heart of the mission are five major calls for action.

1 CUT RED TAPE

Building renovation in many towns and cities is being hampered by European rules. The rules need to change.

CASE IN POINT

Current EU accounting rules make it difficult for many local authorities to develop energy efficiency investment programmes. This is because these investments, even when delivered and mainly financed by third parties, are counted towards public sector debt and recorded on the government balance sheet. **We are calling for the current interpretation of public accounting rules to be adjusted to allow energy efficiency investment to flow unhindered.** In parallel, energy efficiency investments need to be treated the same as wider energy infrastructure and be 100% exempt from State Aid rules.

2 IMPROVE REGULATION

Key improvements include closing loopholes in the EU's Energy Efficiency Directive (EED) and strengthening the Energy Performance of Buildings Directive (EPBD) to support an upscaling of energy renovation.

CASE IN POINT

It is essential that the EU sets a long term vision for renovating the European building stock to progressively target the worst performing buildings and a focus on the root of the problem in buildings: the energy used for heating (and cooling). **The revised EPBD should improve building level requirements and ask for a maximum absolute value for Heating & Cooling energy demand, to be defined at national level (for new and existing buildings).**

3 EMPOWER PEOPLE

Energy data must belong to consumers not energy companies and EU laws should enable people to be offered new services.

CASE IN POINT

Energy Performance Certificates should be transformed into **'Building Passports'** to provide a clear roadmap of actions to make benefits visible.

4 LEVEL THE PLAYING FIELD

Energy efficiency must be able to compete for other energy infrastructure spending.

CASE IN POINT

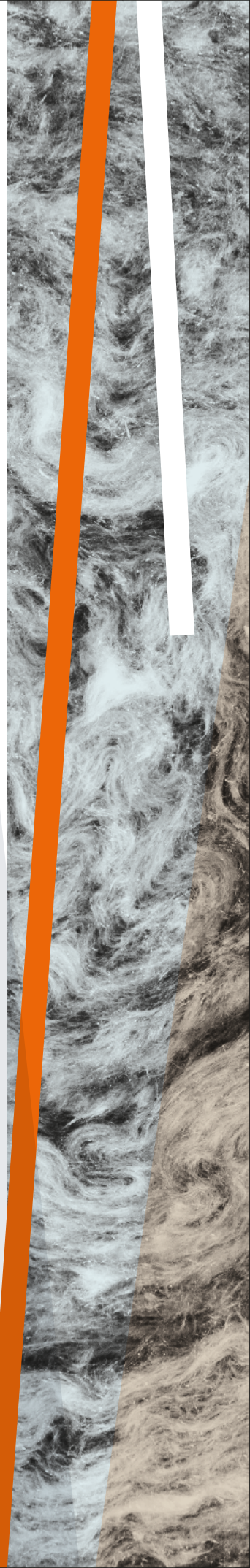
Negative energy infrastructure projects — such as **major energy saving building renovation** — must have equal access to capacity markets.

5 FOCUS FINANCE

Access to finance for energy efficient renovation needs improvement.

CASE IN POINT

There is already substantial finance available but it needs to be focused. **Fifty percent of Emission Trading System** revenues should be focused on low carbon measures and the other 50% on thermal renovation of buildings.



BUILDING ON BEST PRACTICE

Sometimes you don't need to reinvent the wheel. There are inspirational examples of renovation programmes that have made an enormous difference from around Europe. Here are some recently showcased by the Building Performance Institute Europe (BPIE).

IMPROVE STANDARDS

PROPOSED REVISION Buildings in the lowest energy performance class should be deemed unsuitable for occupation.

IDEAS IN PRACTICE In France 3.4 million households live in fuel poverty with the majority of homes falling into the least efficient energy ratings. From 2010 to 2017 the government's €1.4 billion 'Habiter Mieux' programme has been working to improve residents' quality of life through renovation, for example, by replacing out-dated heating and installing thermal insulation. The average household's energy saving is 41%.

NEXT STEPS France has committed to renovate 500,000 residential buildings every year and cut fuel poverty by 15% by 2020.

HELP THE VULNERABLE

PROPOSED REVISION Social housing should be in the top quartile of energy performance ratings to help those at risk of fuel poverty.

IDEAS IN PRACTICE Social housing associations in The Netherlands have accepted an objective to refurbish 111,000 rental houses to zero net energy by 2020 using energy cost savings over a 30-year period. Critical to this has been €6.6 billion in capital cost funding by WSW social bank to underwrite Government-backed loans to the associations. Tenants continue to pay the same rent and energy costs before and after renovation.

NEXT STEPS Other countries are looking to replicate the scheme with Britain establishing an offshoot 'Energiesprong UK'.

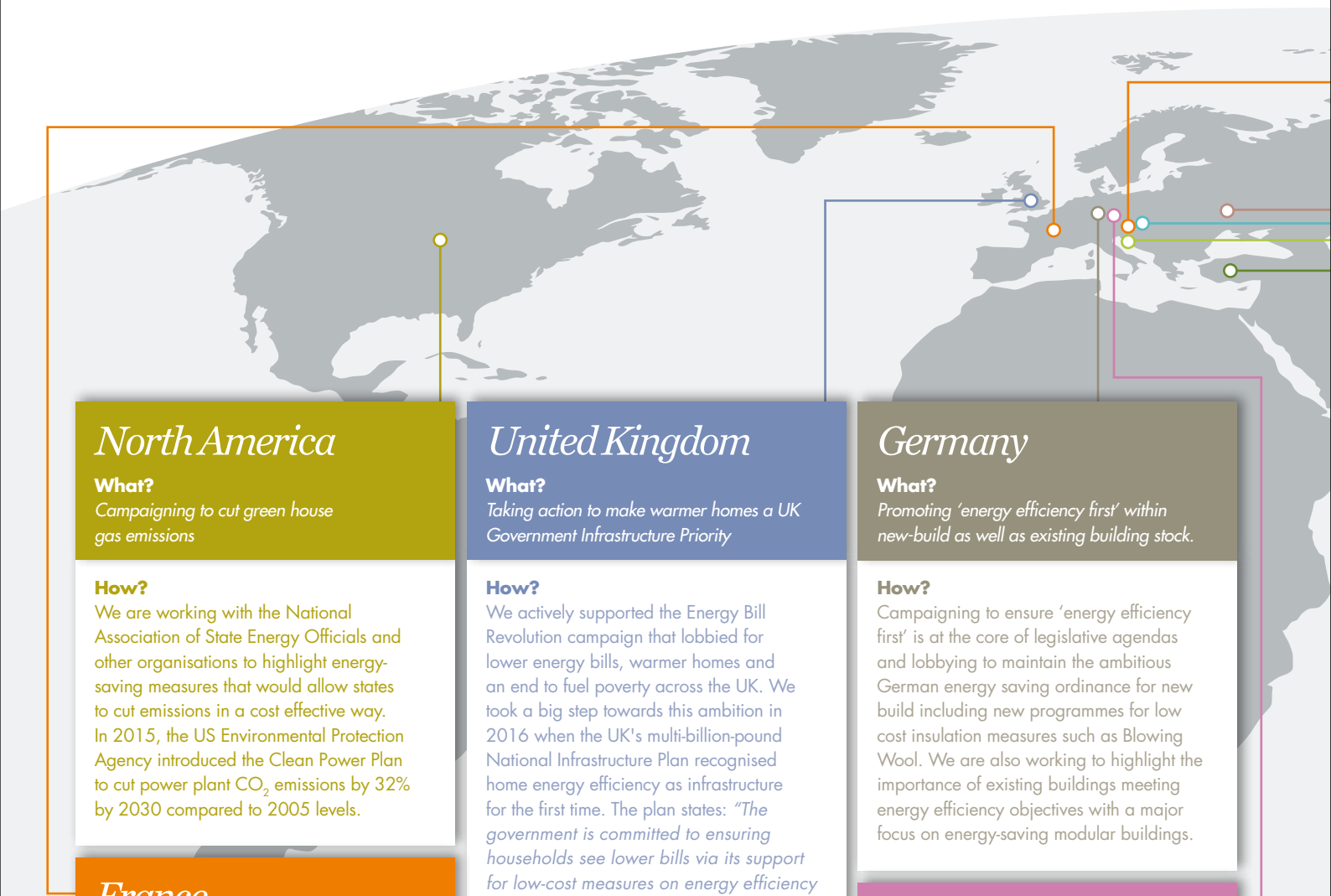
ENFORCE CHANGE

PROPOSED REVISION Energy inefficient buildings should be improved before they are sold.

IDEAS IN PRACTICE On behalf of the German Government and federal states, the KfW Development provides subsidies and loans for deep energy efficient building renovation. The loan can cover up to 100% of costs to a maximum of €100,000 and is available through commercial banks. The annual public budget for KfW building sector schemes was €1.8 billion from 2012 to 2014.

NEXT STEPS The KfW scheme is internationally regarded as a best practice example of support for building renovation.

CAMPAIGNING FOR CHANGE



North America

What?
Campaigning to cut green house gas emissions

How?
We are working with the National Association of State Energy Officials and other organisations to highlight energy-saving measures that would allow states to cut emissions in a cost effective way. In 2015, the US Environmental Protection Agency introduced the Clean Power Plan to cut power plant CO_2 emissions by 32% by 2030 compared to 2005 levels.

France

What?
Keeping the issue of renovation centre stage in French legislation

How?
Throughout discussions leading to France's Energy Transition Law, we have consistently highlighted the importance of renovation as a way to tackle fuel poverty as well as meet new ambitious energy efficiency targets in the country. During 2016 we launched an information campaign to highlight how nation-wide renovation was required to put an end to 'leaky' energy inefficient homes.

United Kingdom

What?
Taking action to make warmer homes a UK Government Infrastructure Priority

How?
We actively supported the Energy Bill Revolution campaign that lobbied for lower energy bills, warmer homes and an end to fuel poverty across the UK. We took a big step towards this ambition in 2016 when the UK's multi-billion-pound National Infrastructure Plan recognised home energy efficiency as infrastructure for the first time. The plan states: *"The government is committed to ensuring households see lower bills via its support for low-cost measures on energy efficiency with the goal of insulating a million more homes over the next five years."* The next step is to increase the 'number of homes' insulated significantly.

Germany

What?
Promoting 'energy efficiency first' within new-build as well as existing building stock.

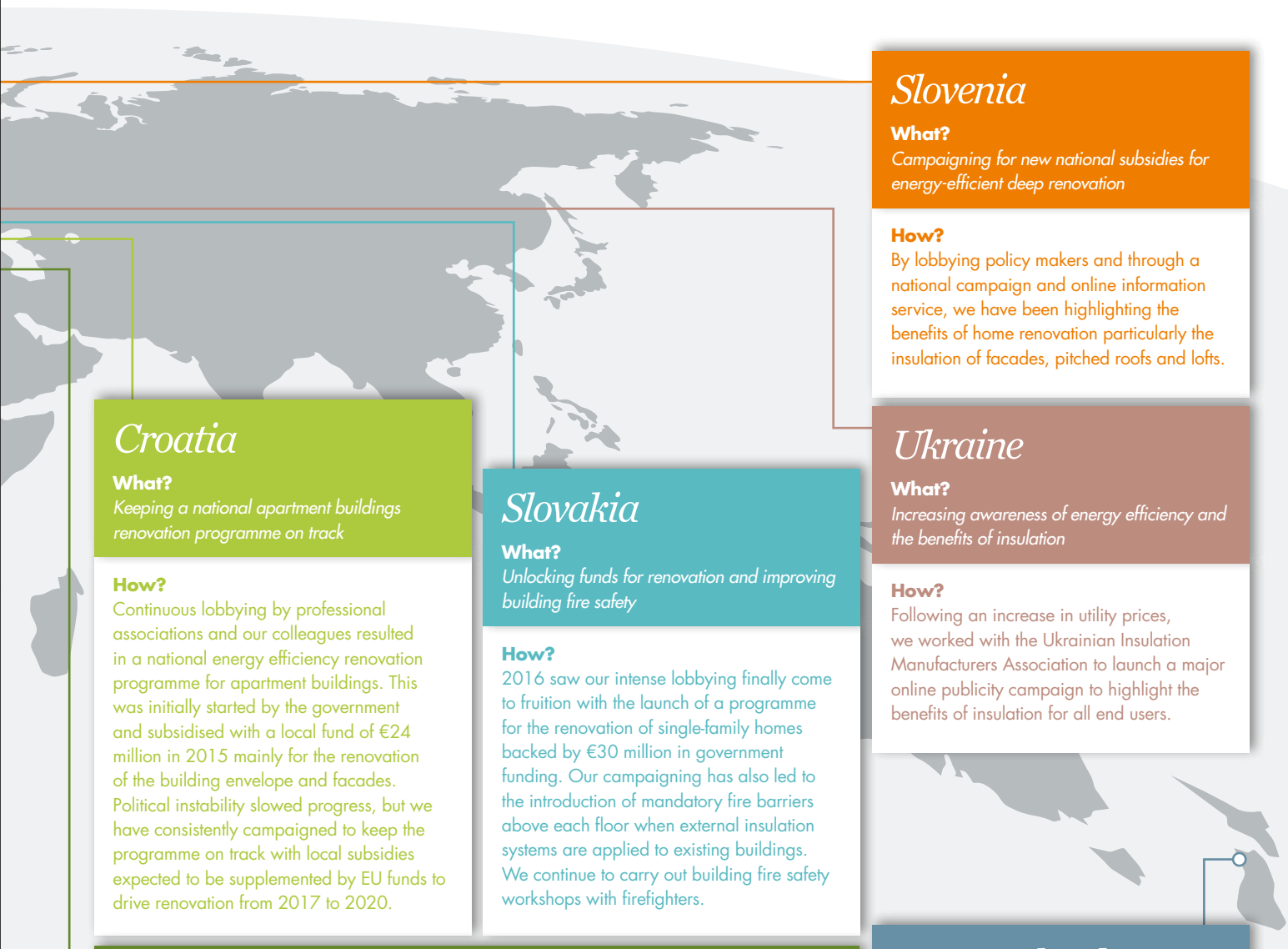
How?
Campaigning to ensure 'energy efficiency first' is at the core of legislative agendas and lobbying to maintain the ambitious German energy saving ordinance for new build including new programmes for low cost insulation measures such as Blowing Wool. We are also working to highlight the importance of existing buildings meeting energy efficiency objectives with a major focus on energy-saving modular buildings.

Czech Republic

What?
Unlocking potential for energy efficient renovation

How?
After years of campaigning, a government energy efficient renovation programme for single-family dwellings was finally changed from a 'start-stop' system to running continuously as of 2015. Since October that year renovations have steadily increased.

From North America to New Zealand we are continuously campaigning to keep energy efficiency and building fire safety issues at the heart of public debate across the world.



Slovenia

What?
Campaigning for new national subsidies for energy-efficient deep renovation

How?
By lobbying policy makers and through a national campaign and online information service, we have been highlighting the benefits of home renovation particularly the insulation of facades, pitched roofs and lofts.

Croatia

What?
Keeping a national apartment buildings renovation programme on track

How?
Continuous lobbying by professional associations and our colleagues resulted in a national energy efficiency renovation programme for apartment buildings. This was initially started by the government and subsidised with a local fund of €24 million in 2015 mainly for the renovation of the building envelope and facades. Political instability slowed progress, but we have consistently campaigned to keep the programme on track with local subsidies expected to be supplemented by EU funds to drive renovation from 2017 to 2020.

Slovakia

What?
Unlocking funds for renovation and improving building fire safety

How?
2016 saw our intense lobbying finally come to fruition with the launch of a programme for the renovation of single-family homes backed by €30 million in government funding. Our campaigning has also led to the introduction of mandatory fire barriers above each floor when external insulation systems are applied to existing buildings. We continue to carry out building fire safety workshops with firefighters.

Ukraine

What?
Increasing awareness of energy efficiency and the benefits of insulation

How?
Following an increase in utility prices, we worked with the Ukrainian Insulation Manufacturers Association to launch a major online publicity campaign to highlight the benefits of insulation for all end users.

Turkey

What?
Improving U-values for energy efficiency and to meet climate targets

How?
We led the Energy Efficiency Commission of the National Insulation Association to complete a study to determine new U-values aligned with the Energy Performance of Buildings Directive's (EPBD) cost-optimum methodology for residential buildings. The new U-values for all components of the building envelope could lead to 14% energy savings by 2030, and 28% by 2050, while at the same time offer potential to reduce CO_2 emissions by 12% by 2030. We are lobbying the Ministry of Environment and Urban Affairs for the adoption of the new U-values during the harmonisation process of the EU's Building Directive (EPBD).

New Zealand

What?
Improving living standards in rental properties

How?
We have been lobbying for improved energy efficiency and health benefits for rental properties through higher levels of insulation. Now new laws require all rental homes in New Zealand to have floor and ceiling insulation by mid 2019. The measures will see 500,000 New Zealanders enjoying warmer and drier homes, said the government.

GREEN BUILDINGS TREND

© MARKUS KAISER, GRAZ

An increasing number of buildings are certified through Green Building Rating Systems such as BREEAM, LEED, DGNB and HQE with most are still certified on a voluntary basis. However, we are starting to see minimum environmental performance requirements being applied through regulations. We are playing a proactive role in this new dynamic.

We are at the tipping point of a green construction revolution. Evolving Green Building Rating Systems (GBRS) are pushing up standards, construction regulation is incorporating more demanding sustainable practices and new legislation is starting to highlight the importance of environmental impact, building wellbeing and health.

This is great news for building users and great news for the industry because it enforces good sustainable practice based on 'people, planet and profit' — considering social and environmental impact as well as traditional bottom lines of profit and loss.

And that is why we are working with key stakeholders by providing our expertise to improving GBRS standards as well as continuously contributing to future directives, regulations and laws that will impact sustainable construction.

Critically, we also share this insight and expertise with specifiers at every step of the way. It is vital we play such an integral role because the trend for green building is shaping the future of construction. For example, research from 69 countries by the World Green Building Trends Smart Market Report in 2016 found that global green building had doubled since 2013, when it last studied this trend.

"Emerging economies will be the engines of green growth in the next three years with development varying from twofold to sixfold over current green building levels," said the report. *"Across all regions 37% of survey respondents forecast that more than 60% of their projects will be green by 2018."*

New green construction requirements are pushing standards upwards to a future of buildings that will tend towards zero impact (see graph below). They have also started to be driven by green building regulations that demand greater information about a building's environmental performance. For example, in France, the 'Réglementation Bâtiment Responsable 2020', which is the future new buildings regulation, will include health and environmental impact criteria.

At Knauf Insulation, we are providing our expertise at every level, for example, we are actively contributing to the work of the European Insulation Manufacturers Association (Eurima) and the European Regional Network of the Green Building Council — both of which are influential stakeholders to the European Commission.

Through Eurima we are involved in the preparation of research that will ultimately inform common EU Framework of Core Indicators in the context of the Resource Efficiency Opportunities for the Construction Sector, one of the programmes of the current Circular Economy Package of the EU Commission. This is an historic development that will have a major impact on the construction industry.

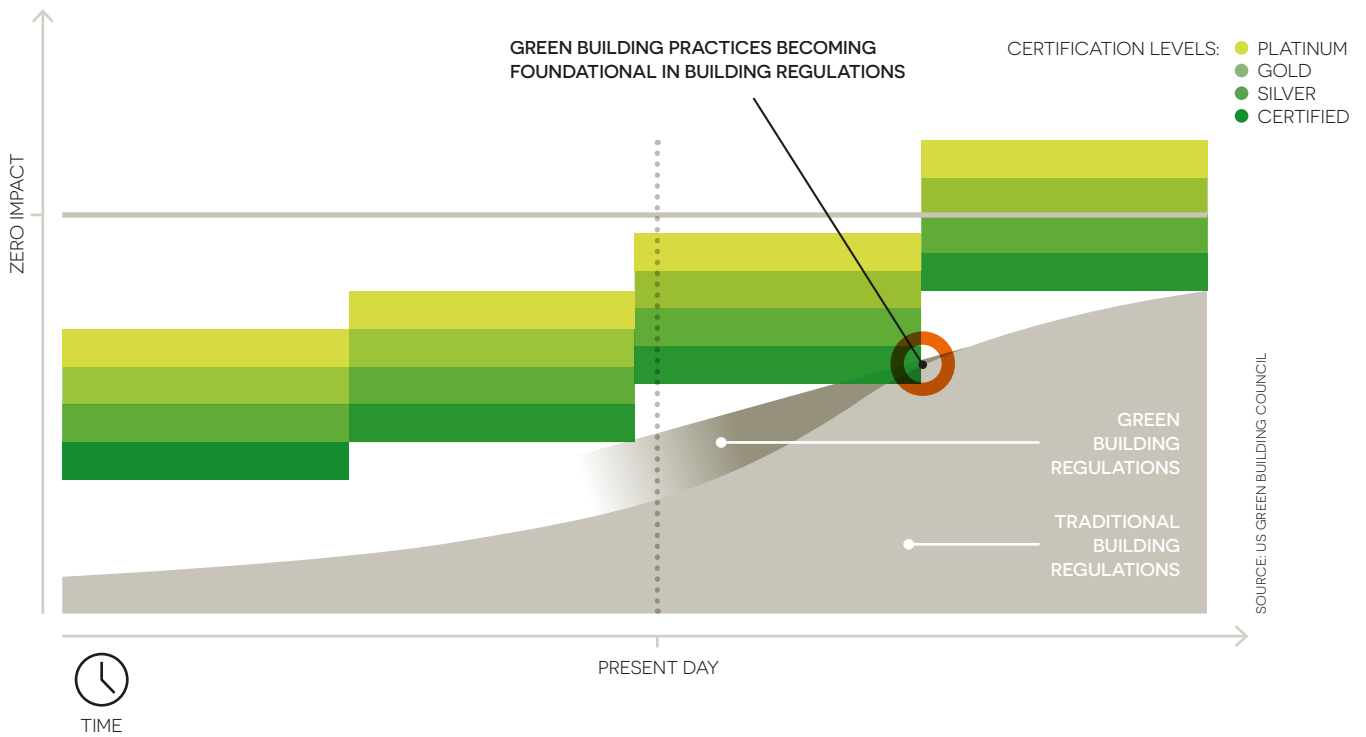
Green Building Rating Systems are also constantly evolving. LEED, for instance, has a new focus on existing buildings and is working towards systems that are 'beyond platinum', the highest rating offered by the scheme. Additionally, it is developing a 'dynamic plaque' platform that continuously monitors and benchmarks a building's performance in areas such as energy, water, waste and human experience.

The upshot is that this green system evolution represents a huge opportunity to shape the industry and we are actively involved in this process.

During a Berlin meeting in April 2016 with Mahesh Ramanujam, who takes over as CEO of the US Green Building Council at the end of 2016, our sustainability team shared their views and expertise in a variety of areas of sustainability.

"The U.S. Green Building Council is grateful to Knauf Insulation for its leadership in creating a more sustainable built environment and their focus on life cycle thinking, product disclosures, indoor air quality and other topics that are critical within the existing buildings market.Knauf Insulation's commitment to ensuring their products support LEEDv4 requirements can be seen in both their organisation's sustainability report and product factsheets," Mr Ramanujam said.

Impact of Green Building Rating Systems on the evolution of building regulations



HOW WE CAN HELP

ACHIEVING POINTS IN GREEN BUILDING RATING SYSTEMS – GBRS – IS A CHALLENGING TASK – WE MAKE IT EASIER FOR ARCHITECTS, SPECIFIERS AND GBRS ASSESSORS.

1

As we launch new solutions we want the market to know the points they contribute. Whether it is our innovative Urbanscape Green Roof Solution or our SUPAFIL Blowing Wool, a factsheet showing how they add points can be instantly downloaded from our website.

2

Our most important contribution is related to energy performance, but our products also contribute in areas related to thermal and acoustic comfort, indoor air quality and resources used. Mineral Wool also has an impact on the fire performance of buildings, which is taken into account in DGNB.

3

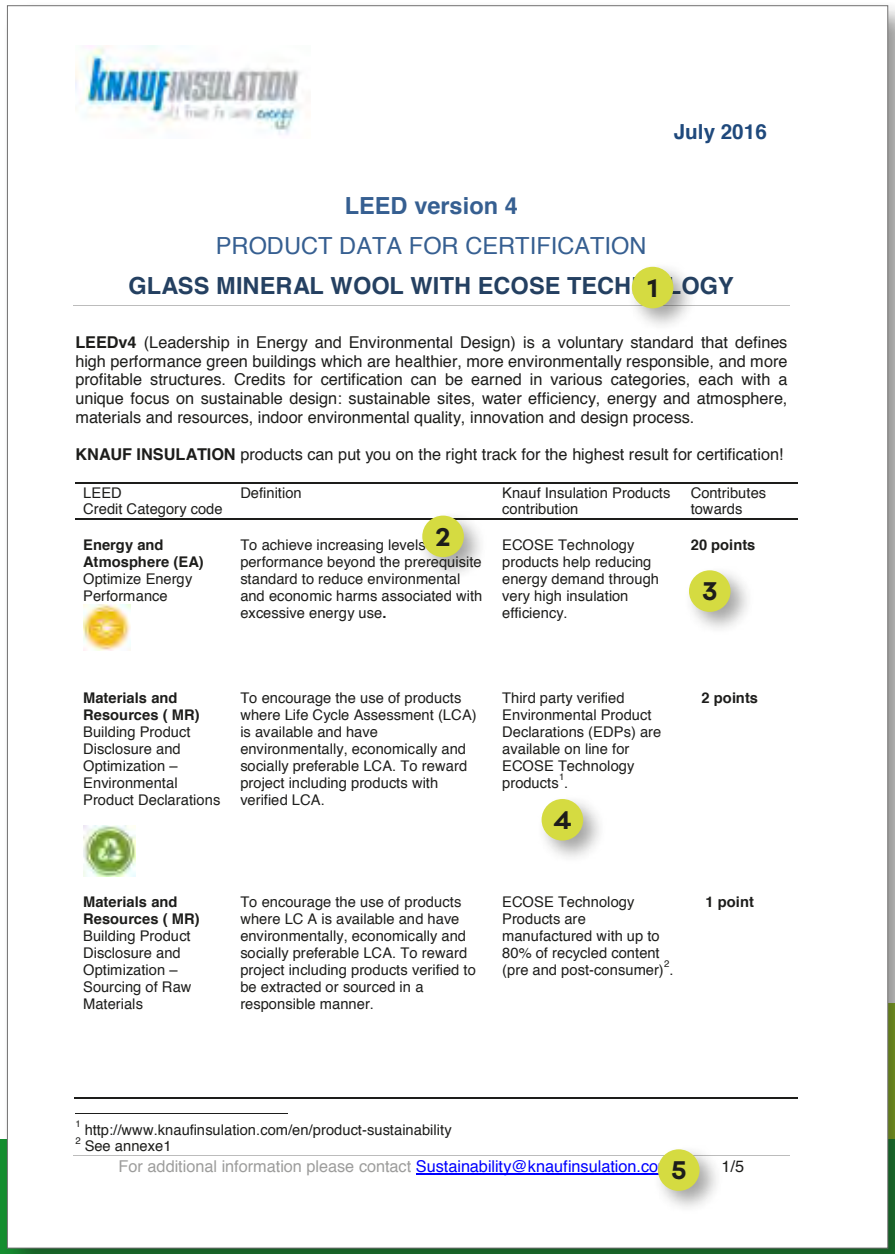
The number of points our solutions can contribute for each category.

4

Verified Environmental Product Declarations (EPDs) are now a criterion in LEEDv4 and BREEAM International 2016. Points are distributed in the Materials and Resources categories for projects including products with Life Cycle Assessments (LCAs) and EPDs.

5

The key contact to help you find additional information about our contribution to GBRS.



KNAUF INSULATION

July 2016

LEED version 4

PRODUCT DATA FOR CERTIFICATION

GLASS MINERAL WOOL WITH ECOSE TECH 1 LOGY

LEEDv4 (Leadership in Energy and Environmental Design) is a voluntary standard that defines high performance green buildings which are healthier, more environmentally responsible, and more profitable structures. Credits for certification can be earned in various categories, each with a unique focus on sustainable design: sustainable sites, water efficiency, energy and atmosphere, materials and resources, indoor environmental quality, innovation and design process.

KNAUF INSULATION products can put you on the right track for the highest result for certification!

LEED Credit Category code	Definition	Knauf Insulation Products contribution	Contributes towards
Energy and Atmosphere (EA) Optimize Energy Performance	To achieve increasing levels 2 performance beyond the prerequisite standard to reduce environmental and economic harms associated with excessive energy use.	ECOSE Technology products help reducing energy demand through very high insulation efficiency.	**20 points** 3
Materials and Resources (MR) Building Product Disclosure and Optimization – Environmental Product Declarations	To encourage the use of products where Life Cycle Assessment (LCA) is available and have environmentally, economically and socially preferable LCA. To reward project including products with verified LCA.	Third party verified Environmental Product Declarations (EDPs) are available on line for ECOSE Technology products[1]. 4	**2 points**
Materials and Resources (MR) Building Product Disclosure and Optimization – Sourcing of Raw Materials	To encourage the use of products where LC A is available and have environmentally, economically and socially preferable LCA. To reward project including products verified to be extracted or sourced in a responsible manner.	ECOSE Technology Products are manufactured with up to 80% of recycled content (pre and post-consumer)[2].	**1 point**

[1] http://www.knaufinsulation.com/en/product-sustainability
[2] See annexe1

For additional information please contact Sustainability@knaufinsulation.co 5 1/5

Visit our website to see how our solutions contribute to points in the latest versions of BREEAM and LEED. Simply click on the 'Sustainable Buildings and Green Building Rating Systems' section of **knaufinsulation.com**.

SHARING OUR EXPERTISE

Members of our sustainability team are trained in BREEAM for new construction, several national variations and BREEAM International 2016 that offer more focus on indoor air quality and EPDs. We also have LEED and LEEDv4 Green Associates in the US and Europe as well as DGNB and HSE specialists. Our experts can offer unique insight into sustainable construction challenges, technical, legal and financial support and offer customised solutions. Our colleagues **Christophe Barrau (CB)**, Sustainable Buildings Officer, providing national level specifier support in France, and **Jean-Pierre Pigeolet (JPP)**, Sustainabilty Technical Manager, responsible for coordinating this expertise at Central level, explain how.

How can Knauf Insulation solutions contribute to green buildings?

JPP: Our solutions contribute to well-being, improve internal comfort, acoustic performance, indoor air quality and energy efficiency. They can also provide effective fire barriers. As such they add significant points in Green Building Rating Systems. But all these benefits are lost if our sustainability expertise is not communicated to the people in charge of building projects. That is why we have invested significantly in training members of our sustainability team in Europe, Turkey and North America to become experts in BREEAM, LEED, DGNB and HQE to offer a unique advantage to the market.

How do our customers benefit?

CB: Our role is to understand and answer to the real final needs for new buildings and for existing buildings in cases of renovation. There are never unique solutions. So the challenge is to find the right answer to the right need regarding multiple parameters such as fire protection, acoustic and thermal comfort, environmental impact, building energy efficiency, health and Indoor Air Quality whilst helping our clients stick to their budget. We need to speak the language of building owners, investors and specifiers, to have insight into the challenges of Green Building Rating Systems and offer solutions based on solid sustainability expertise .

What are the new challenges of Green Building laws in France?

CB: New laws focusing on indoor air quality and the Volatile Organic Compound (VOC) levels in materials have become huge topics in France, particularly in buildings for children, the elderly or hospitals.

Moreover, a new version of FDES ('Fiches de Déclarations Environnementales et Sanitaires') will be mandatory by mid 2017. It will go beyond the general European level of information, for example, by providing additional details on sanitary and carbon savings levels. A new labelling of buildings is also expected to precede the new 2018 Environmental Regulation (RE2018) that will be qualified as 'environmental' and not only 'thermal'. This shows enormous progress towards a higher level of environmental protection for buildings in France.

What solutions do you recommend?

CB: Our ECOSE Technology solutions contribute to indoor air quality because they have no added formaldehyde and use a bio-based binder. Urbanscape, SUPAFIL, Mineral Plus and many other Knauf Insulation products are also incredibly innovative and appeal to end users looking for that innovation, it's the job of our sustainability team to communicate those benefits.

How do you help specifiers maximise Green Building Rating Systems?

JPP: Using green building materials makes sense economically, environmentally and ethically. Our solutions add points in Green Building Rating Systems in significant categories. For example, with our Glass Mineral Wool with ECOSE Technology under LEED certification we can contribute to points for recycled content as the products are manufactured with up to 80% of glass cullet. In the Netherlands, for BREEAM NL in the category for volatile organic compounds, our Glass Mineral Wool products ECOSE with no added formaldehyde can contribute maximum points.

What about EPDs?

JPP: We have EPDs that cover 85% of our Glass Mineral Wool products and 60% of our Rock Mineral Wool range. We have also a unique EPD for entire systems such as our Green Roof Solution Urbanscape. EPDs are increasingly being seen as playing a critical role in adding points in Green Building Rating Systems as well as in future sustainable regulation because of their forensic examination of the environmental impact of every component that makes up a product. Having an EPD underlines sustainability credibility (see our section on EPDs on page 20).

EIFFAGE REFERENCE CASE

Project: A €200 million mixed-use campus for 5,000 Societé Générale employees in Paris featuring 90,000m² of office space, wooded areas, a gym and restaurants.

Challenge: Eiffage Construction Grand Projects, which aims to certify the construction HQE exceptional and LEED Gold, had requested information from suppliers of 700 different construction products including information such as Volatile Organic Compound (VOC) emissions.

How did Knauf Insulation help? We supplied 7,000m² of ECOSE TP 138.

Feedback from Caroline Pin, Environmental specialist and BREEAM International Assessor at Eiffage Construction Ile-de-France: *"By using Knauf Insulation products the project was able to achieve a LEED point for post construction indoor air quality assessment. The project has to be certified to a high Green Building Rating System level and we welcomed Knauf Insulation's expertise and insight."*

EIGHT CRITICAL PERFORMANCE CRITERIA OF GREEN BUILDINGS

AT KNAUF INSULATION WE BELIEVE THAT FUTURE GREEN BUILDING REGULATIONS SHOULD CONCENTRATE ON KEY PERFORMANCE CRITERIA WHICH HAVE THE GREATEST IMPACT ON THE SUSTAINABILITY OF A BUILDING THROUGHOUT ITS LIFE CYCLE. OUR FOCUS IS IN LINE WITH INDICATORS BEING DEVELOPED BY THE EUROPEAN COMMISSION.

1 ENERGY

All our thermal insulation products reduce energy use and save customers money in new and renovated buildings.

Case in point

The three most important pillars of sustainability are energy use, energy use and energy use. We are investing heavily in quantifying exactly how significant these energy savings are by scientifically monitoring dozens of occupied homes across Europe. We are examining how our insulation can make a difference by monitoring the properties before insulation was installed and after.

2 WATER

Water consumed during the lifetime of a building and water management on site are important building sustainability aspects. Our Green Roof Solution Urbanscape can contribute significantly to the management of storm water run-off. It can store up to three times more storm water than traditional green roof substrates and this helps limit accidents caused by heavy rainfall and leads to a decrease on the burden put on sewer systems by 70%-95% depending on the roof design and local climate.

Case in point

We have developed a Performance Evaluation Tool (PET) and a storm water laboratory in the US to monitor the on-site performance of green roofs.

3 ACOUSTIC

Noise pollution has been linked to sleep disturbance, heart disease, high blood pressure and increased stress, according to new research presented to the European Commission. Working with the European Insulation Manufacturers Association (Eurima), we are contributing to an industry 'white paper' report to highlight the importance of good acoustic health in buildings and how this can be achieved with Mineral Wool.

Case in point

Our Mineral Wool products in combination with Knauf plasterboards offer excellent acoustic performance making them ideal, for example, in partition walls and pitched roofs *(see page 42)*.

4 INDOOR AIR QUALITY

Air quality in buildings is increasingly becoming an important issue in many countries. In France, for example, interior building health legislation is set to include new air quality standards.

Case in point

In this context, our team of sustainability specialists are working to create a document that enables end users to find sustainable solutions to indoor air challenges. Expertise for the document is being gathered from a variety of different industries from paint and carpet manufacturers to HVAC producers.

5

THERMAL COMFORT

Thermal comfort is a vital component of well-being in buildings, particularly in the light of climate change. It is about ensuring that appropriate thermal comfort levels are achieved through design, focusing first on the fabric of the building — with the important contribution of insulation — supported by the benefits of smart technology.

Case in point
We have developed thermal insulation solutions that are designed to improve the energy performance of buildings. Our Mineral Wool products and technical guidance reduce fabric heat loss, minimise thermal bridging and ultimately make buildings more comfortable.

6

FIRE SAFETY

As we increase the levels of insulation we put in buildings — particularly during renovation which can change the fabric of a building — we should make sensible choices about what construction products we use, so we make buildings safer.

Case in point
Our Mineral Wool products offer the highest Euroclass A1 fire classification according to European standards. Through our advocacy work we also want countries to follow the examples of Croatia, Serbia and Slovakia and introduce minimum requirements such as fire barriers to improve the fire safety performance of their buildings.

7

RESOURCE USE

We believe that an Environmental Product Declaration (EPD) is the best way to assess the environmental impact of a product because it examines in minute detail every stage of its lifecycle from the sourcing of materials to the product's disposal or recycling. An EPD also helps us improve our manufacturing process as we aim to have zero negative impact on resource use. Reducing our impact includes research and development to substitute our ingredients with those that have a lower environmental impact, for example, increasing recycled content.

Case in point
Our Glass Mineral Wool with ECOSE Technology is made using recycled glass such as bottles or window glass — up to 80% in some locations — and is recyclable at end of life.

8

LIFE CYCLE COSTING

Sustainability is about people, planet and profit. The first seven criteria listed above relate to planet and people while Life Cycle Costing is a way of evaluating the economic impact of an asset over its lifecycle. Knauf Insulation products play an important role because our high performance insulation is affordable and designed to cut operational energy costs over a long period of use.

Case in point
We have trained our sustainability team in how to systematically integrate the Life Cycle Costing of buildings into project management to help our customers as regulation begins to place greater emphasis on this aspect of sustainability.

WHAT'S NEW IN GREEN BUILDING RATING SYSTEMS

LEEDV4 AND BREEAM 2016

In the new version of the US Green Building Rating System, LEEDv4, it is easier than ever to earn points with our products . For example, in the insulation category, our solutions with ECOSE Technology can gain a maximum number of points in 'Indoor Environmental Quality' thanks to being certified Indoor Air Comfort Gold from Eurofins which meets Europe's most demanding indoor environmental standards such as Blue Angel and A+ labelling in France.

Knauf Insulation is also now closely involved with the BREEAM certification scheme. Key members of our sustainability team are trained in BREEAM for new construction as BREEAM Licensed Assessors — including various national variations — and the BREEAM International 2016 that offers more focus on indoor air quality and EPDs.

HQE

In France the 'Fiches de Déclarations Environnementales et Sanitaires' (FDES) which examine in minute detail the complete life cycle of products from cradle to grave are being revised in line with the EN 15804 norm. The new FDES system will be incorporated into the 2017 version of HQE and enable the total life cycle assessment of buildings.

DGNB

DGNB along with BREEAM is the Green Building Rating System (GBRS) that places emphasis on the principle of Life Cycle Costing. At Knauf Insulation we believe this is important. Also significant is how DGNB will be influenced by Building Information Modelling (BIM). It is not directly incorporated in any GBRS at present, but could be influential when assessing the overall sustainable performance of a building. Our innovative products such as Urbanscape and SUPAFIL are now available in the most commonly used BIM format files.

LIVING BUILDING CHALLENGE

Living Building Challenge (LBC) is a cutting edge buildings certification system that was developed 10 years ago in the US. Its uptake in Europe is limited to a handful of buildings. The selection of materials used in construction is important to LBC and there is a specific products certification system — DECLARE — based on a 'Red List' of banned substances. Our Glass Mineral Wool with ECOSE was the first Mineral Wool product to get the certification, and the only one to be 'Red List Free'. This position gave us the privilege to be specified in a number of outstanding LBC projects in the US.

ANOTHER KNAUF INSULATION EPD FIRST

OUR EPD FOR URBANSCAPE EXTENSIVE GREEN ROOF SYSTEM IS AN INDUSTRY BREAKTHROUGH

When it comes to information about the environmental impact of our products we are at the cutting edge of innovation.

Not only is our Environmental Product Declaration (EPD) process faster, easier and more detailed than ever, but we are now taking EPDs to a whole new level by launching the industry's first 'system EPD' for an Extensive Green Roof System.

The EPD — based on information required for our innovative Green Roof Solution Urbanscape — is a major breakthrough because it examines the environmental impact of several different components that contribute to a 'system solution'. Previously EPDs only examined the impact of individual components, not combinations.

Our sustainability teams have also contributed their innovative expertise to the German programme operator IBU (Institut Bauen und Umwelt) in order to draw up the product category rules (PCR) that form the backbone of the new system EPD.

A highly important aspect of the entire process has been ensuring that other manufacturers can use the PCR to verify their own Extensive Green Roof System EPDs.

This EPD breakthrough is also good news for specifiers. Our Urbanscape EPD can provide additional points in Green Building Rating Systems.

For example in LEED version 4, there is one point if there are 20 EPDs for a complete building from five different manufacturers and in the new April 2016 version of BREEAM there is one point for just five EPDs for a building. For specifiers who now want to achieve EPD points for Extensive Green Roofs our new Urbanscape System EPD offers the only source of detailed environmental impact information.

OUR EPD BENEFITS IN NUMBERS

Our EPDs can be delivered in 6 weeks

4000 downloads since 2015 from our EPD section at www.knaufinsulation.com/en/environmental-product-declaration

85% GMW 60% RMW

We have verified EPDs for 85% of our Glass Mineral Wool products and verified EPDs for 60% of our Rock Mineral Wool range

100% All of our new products have EPDs

✓ urbanscape ✓ SUPAFIL ✓ MINERAL PLUS ✓ JetSpray Thermal

25 Number of our EPDs in IBU website, one of the key EPD platforms

2 The maximum number of points that can be obtained with EPDs in Green Building Rating System LEED v4

1 2 3 We are the first three EPDs on the ECO-Platform

True love since 2009

For craftsmen it's a case of "love at first sight"

Knauf Insulation Glass Mineral Wool insulation materials with the no-added formaldehyde ECOSE® Technology. Efficient, sustainable and pleasant to use. The original from Knauf Insulation, so unique that you simply won't want to let go of it.

www.ecose-liebe.de

KNAUF INSULATION
it's time to save energy

NOTHING BEATS THE ORIGINAL

ECOSE Technology, a revolutionary formaldehyde-free binder innovation mainly derived from rapidly renewable materials was a significant step change for the Mineral Wool industry when it was launched by Knauf Insulation seven years ago. It continues to impress today and we continue to be proud of our leading innovation that has great benefits for specifiers and installers alike. Here's why:

1 Recycled ingredients

Our range of Glass Mineral Wool with ECOSE Technology has up to 80% recycled glass with the remaining content mainly derived from rapidly renewable materials.

2 No added formaldehyde

There are no added artificial dyes, acrylics or formaldehyde in our Mineral Wool with ECOSE Technology.

3 Air quality Gold standard

Our Mineral Wool with ECOSE Technology is a very low emitting product. It was awarded by Eurofins first Indoor Air Comfort Gold certificate.

4 Lower embodied energy

Our Mineral Wool with ECOSE Technology has lower embodied energy than our traditional Mineral Wool. For example, our Glass Mineral Wool will typically save — during a 50-year lifecycle — over 500 times more energy than was used in its manufacture.

5 Extensive EPD coverage

More than 70% of our Mineral Wool with ECOSE Technology is covered with externally verified Environmental Product Declarations (EPDs).

6 Green Building Rating Systems advantage

Our Mineral Wool with ECOSE Technology can contribute to the total rating in Green Building Rating Systems — such as BREEAM, LEED, HQE and DGNB — by adding points, for example, through the level of recycled glass being up to 80%, having no added formaldehyde; being REACH compliant, as well as having externally verified EPDs for the majority of our products.

ECOSE® TECHNOLOGY

What our customers are saying

"For years we have relied on the great quality of Knauf Insulation products and we're very happy with the innovative technical solutions that are available with ECOSE Technology – they fully meet our expectations."

Ugo Bortolami,
General Manager of Termit Srl, Italy

"Green Building Rating Systems – such as BREEAM – are becoming more and more important. It's really beneficial that Knauf Insulation products with ECOSE Technology are mostly made of recycled materials and do not contain added formaldehyde."

Hans V Gastel,
General Manager of Hanko BV, Netherlands

WORKING WITH ECOSE – BENEFITS FOR INSTALLERS

"More pleasant smell"

"Softer feel"

"Easier to cut"

"We are proud of high quality standards in Switzerland and as a reseller we know that customers put strong emphasis on achieving the highest level of indoor air quality. The HVAC range with ECOSE Technology from Knauf Insulation achieves Eurofins Gold Standard. These products fit perfectly into our portfolio, meeting the requirements of the Swiss market."

Armin Toscan,
CEO of Iso-Center AG,
Switzerland

"Rock Mineral Wool with ECOSE Technology feels better than before and is visually more appealing. We also get a very positive reaction from end-users when we show them the products in retailers' shops. We sincerely believe that Knauf Insulation's ECOSE range will prove to be highly popular with our customers and demand will continue to grow."

Dragan Lisavac and Ivan Budimac,
Owners of Offer Trade Ltd,
Serbia

Building on the success of our Glass Mineral Wool range, we have launched HVAC Rock Mineral Wool solutions with ECOSE Technology. This marks a major milestone for Knauf Insulation.

Customers have welcomed the launch of our ground-breaking Rock Mineral Wool products for heating, ventilation and air conditioning featuring ECOSE Technology.

The move is a major step forward in the conversion of all our Rock Mineral Wool products to ECOSE Technology and builds on the success of our Glass Mineral Wool product range. ECOSE was integrated into the entire range in 2009.

Customers from all over Europe have spoken of the importance of our new eco-friendly ECOSE Rock Mineral Wool product range in meeting their building challenges.

"Customers are particularly impressed that the range is certified 'Indoor Air Comfort Gold' by Eurofins institute for Volatile Organic Compounds (VOC) emissions. Being awarded Eurofins Gold means that our ECOSE products meet the most stringent criteria for VOC emissions laid down in national regulations such as France, Germany or Belgium. ECOSE has no added formaldehyde and is made without the addition of any artificial dyes or any acrylics," said Saša Bavec, Knauf Insulation's Group Marketing Director.

Naturally, our new Rock Mineral Wool solutions continue to provide the same levels of insulation and reaction to fire as the previous range.

Following a major conversion of capacity at our Rock Mineral Wool plant in Surdulica in Serbia, our Rock Mineral Wool products with ECOSE Technology are now closer than ever to our Balkans customers.

CUSTOMISED ADVANTAGES OF OUR TECHNICAL SOLUTIONS

Solutions are tailored to fit perfectly

Our Technical Solutions experts can tailor bespoke insulation solutions to meet all requirements for industrial plant insulation and heating, ventilation and air-conditioning systems (HVAC) for non-residential buildings such as airports or schools.

Fire resistance is critical

Our research and development team is working to ensure that when it comes to fire safety and fire testing our Technical Solutions – particularly for HVAC – achieve the most important national and international certification.

Logistics are straightforward

Based at our plant in Novi Marof Croatia, our Technical Solutions division is a one-stop shop for Europe. Once an order is processed, our solutions are delivered efficiently from one point and – where needed – individual delivery plans are offered.

Our solutions are making waves

Technical Solutions provide marine insulation to ship builders. Space is restricted at shipyards so our logistical edge and our commitment to offering certified solutions are both highly valued.

Plant insulation saves millions

A major audit of 180 industrial plants in Europe by the European Industrial Insulation Foundation (EiiF) has found that plants are losing out on yearly energy savings of more than 750,000MW/h. The EiiF audits revealed how the energy cost savings of industrial insulation, in some cases, paid back in less than one or two years, resulting in a total cost saving potential of at least €23.5 million. Our Technical Solutions experts can show plant owners how to make these savings.

Professionals choose innovative solutions

KNAUF INSULATION
Technical Solutions

BINDER WITHOUT ADDED FORMALDEHYDE. Products made with ECOSE Technology **contain no added formaldehyde or acrylics.**

USER FRIENDLINESS. Products with ECOSE Technology are easy to cut and handle.

TECHNICAL PERFORMANCE. Products with ECOSE Technology ensure high insulation efficiency for thermal comfort as well as non-combustibility for personal safety, **being compliant with all relevant European standards.**

ENVIRONMENTALLY FRIENDLY. Renewable components in the binder are replacing most fossil-fuel based materials. **We are saving energy as well as reducing energy bills and CO_2 emissions.**

Mineral Wool with ECOSE® TECHNOLOGY

Change in the air

We spend 90% of our time inside buildings and air quality both outside and inside buildings is becoming increasingly important.

That is why we are working to ensure our products are contributing to the good health of all buildings with good indoor air quality a key priority.

Insulation can also contribute significantly to the reduction of outdoor concentrations of air pollutants. Independent research commissioned by the European Insulation Manufacturers Association (Eurima) found that reduced outdoor concentrations of air pollutants could be achieved by improving the insulation of buildings.[1]

Using a model based on an annual retrofit rate of 2% across 25 European countries from 2005 to 2020 — compared with a business-as-usual scenario — the survey found that in North Western Europe, for example, particle matter could be cut by up to 9% and sulphur dioxide by 6.3%.

The Eurima study also concluded that 78,678 life years could be gained across Europe every year with 7,173 cases of persistent chronic bronchitis avoided annually. The saved health costs to society could total €6.64 billion every year.

[1] *EURIMA publication, 29 October 2015, Influence of Increased Insulation Levels on Regional Air-Quality*

OUR MINERAL WOOL WITH ECOSE MEETS THE HIGHEST REQUIREMENTS IN TERMS OF INDOOR AIR QUALITY EMISSIONS

Our Mineral Wool with ECOSE Technology is manufactured without the use of formaldehyde-based substances which not only makes our manufacturing and work sites great places to work but it has also enabled us to receive the highest Gold certification by Eurofins for Indoor Air Quality emissions criteria. Compliance with this criteria means that our ECOSE products meet the most stringent regulations in EU countries. Furthermore our ECOSE products successfully pass criteria by voluntary VOC emissions certification schemes such as the Blau Engel in Germany or the Finnish M1 label.

WE ARE WORKING ON NEW AIR QUALITY TOOLS FOR END USERS

Our sustainability team is bringing together a task force of experts from different industries — such as paint and carpet companies and HVAC systems manufacturers — to create a document that will help end users navigate issues of indoor air quality and find sustainable solutions. Issues of building well-being are gaining significance in many countries, particularly in the construction of schools, hospitals and homes for the elderly. In France, for example, new legislation will place greater emphasis on air quality in buildings. When that happens we will be ready.

WE CONTRIBUTE TO GREEN BUILDING RATING SYSTEMS EXPERTISE

From 2016 there has been increasing emphasis on indoor air quality and emissions in new versions of Green Building Rating Systems such as LEED and BREEAM. Knauf Insulation has been contributing expertise to these systems. For example, we presented the criteria for indoor quality for LEEDv4 during the annual European technical workshop for the industry to demonstrate the positive advantages of ECOSE technology. We also sponsored the event.

OUR ECOSE TECHNOLOGY SOLUTIONS ARE MAINLY DERIVED FROM RAPIDLY RENEWABLE MATERIALS

By having no added formaldehyde, along with other factors such as being composed of up to 80% recycled content, our Glass Mineral Wool with ECOSE Technology can contribute to additional points in Green Building Rating Systems. In BREEAM-NL (Netherlands), which has a higher focus on volatile organic compounds, our ECOSE products can contribute to maximum points.

WE ARE LEADERS IN U.S. INDOOR AIR QUALITY CERTIFICATION

We were the first insulation manufacturer in North America to meet rigorous air quality and emissions requirements leading to certification from the GREENGUARD Environmental Institute in 2001. When Greenguard launched Children & Schools Certification in 2005, once again our products were certified to this more demanding standard. Today our ECOSE Technology continues to build on this pioneering tradition. Knauf EcoBatt insulation with ECOSE Technology is certified formaldehyde-free by GREENGUARD.

SATISFACTION GUARANTEED

AT KNAUF INSULATION WE RECOGNISE THAT THE SUSTAINABLE FUTURE OF OUR COMPANY IS BUILT ON PROVIDING THE PRODUCTS AND SOLUTIONS OUR CUSTOMERS NEED WHEREVER THEY ARE IN THE WORLD. WHEN THEY TALK, WE LISTEN.

"WE HAVE MANAGED TO WIN SOME OF THE MOST COMPLICATED TENDERS IN MY HOMETOWN OF YAROSLAVL THANKS TO KNAUF INSULATION. FOR EXAMPLE, WE SUPPLIED ACOUSTIC SOLUTIONS TO A CINEMA, HOTEL, MODULAR HOUSE PRODUCERS AND MANY OTHERS. WHENEVER I NEED SUPPORT THE KNAUF INSULATION TEAM IS ALWAYS READY TO HELP AND THE QUALITY OF PRODUCTS IS ALWAYS HIGH."

ANDREY SAVIN OF RULAKIE IN YAROSLAVL, RUSSIA, WORKING WITH KNAUF INSULATION SINCE 2010

"WE HAVE BEEN USING KNAUF INSULATION PRODUCTS FOR 40 YEARS SINCE PRODUCTION STARTED AT SURDULICA. IT IS IMPORTANT THAT THE PLANT IS IN SERBIA AS WE CAN REACT QUICKLY TO ANY SITUATION THAT REQUIRES FAST DELIVERY AND, WHEN WE NEED TECHNICAL KNOWLEDGE, KNAUF INSULATION'S SUPPORT PEOPLE ARE ALWAYS READY TO ASSIST."

DRAGAN LISAVAC, OWNER OF THE DISTRIBUTION COMPANY OFFER TRADE, SERBIA, WORKING WITH KNAUF INSULATION FOR 40 YEARS

"EMERGO HOUTCONSTRUCTIES WORKS DAILY WITH KNAUF INSULATION PRODUCTS. THE MAIN REASON IS THAT NATUROLL GLASS MINERAL WOOL WITH ECOSE TECHNOLOGY IS EASIER FOR OUR PROCESSORS TO WORK WITH WHEN THEY ARE INSULATING PREFABRICATED STRUCTURES. WITH KNAUF INSULATION WE ALSO DEVELOPED A PLAN-SPECIFIC PRODUCT WHICH PERFECTLY MATCHES OUR NEEDS AND RESULTS IN BETTER PRODUCTION."

BEN MATEMAN, BUYER AT THE WOODEN BUILDING SECTIONS MANUFACTURER EMERGO HOUTCONSTRUCTIES, THE NETHERLANDS

"KNAUF INSULATION REMAINS AT THE PINNACLE OF DEVELOPMENT AND INVESTS WISELY IN TECHNICAL SALES SUPPORT, PARTICULARLY SUPPORTING SUSTAINABILITY CONCERNS WHERE IT HAS MADE SURE ITS PRODUCTS ARE WELL PLACED AS CIRCULAR, RESPONSIBLE AND HIGH PERFORMING. KNAUF INSULATION HAS ALSO BEATEN US TO THE CONCLUSION THAT ENVIRONMENTAL PRODUCT DECLARATIONS (EPDS) ARE IMPORTANT NOW AND WILL BE CRITICAL IN THE FUTURE."

JEZ CUTLER, HEAD OF ENVIRONMENT AND SUSTAINABILITY AT TRAVIS PERKINS, UK

"EVERY BUILDING WE PRODUCE IS CUSTOMISED TO REQUIREMENTS DEPENDING ON THE ARCHITECTURAL PROJECT. WE CHOSE KNAUF INSULATION MINERAL WOOL FOR ITS OUTSTANDING MECHANICAL PROPERTIES. THE WORKERS INSTALLING KNAUF INSULATION MINERAL WOOL APPRECIATE THAT IT DOESN'T CRUMBLE AT THE EDGES OR BREAK AND THAT THE PACKAGES ARE LIGHTER. THE WORKERS ALSO LIKE THE FACT THAT THE INSULATION CONTAINS NO ADDED FORMALDEHYDE AND THAT THERE IS A WIDE RANGE OF PRODUCTS IN DIFFERENT FORMATS FROM WOOL ON ROLLS TO SLABS."

ANTANAS NORVAIŠAS, DIRECTOR OF THE TIMBER FRAME HOUSES PRODUCER JSC LISKANDAS, SCANDINAVIA AND LITHUANIA

AUSTRALIA

KNAUF INSULATION'S EARTHWOOL RANGE WAS INTRODUCED INTO BATTMANS INSULATION SERVICES PRODUCT LIST IN 2009. DIRECTOR ROD KAYE SAYS THE MOVE HAS GROWN SALES IN ALL SECTIONS BOTH COMMERCIAL AND DOMESTIC.

How can you quantify this success? Sales have soared. Earthwool is now the preferred brand of insulation for our customers. It quickly developed a reputation as a much softer and user-friendly Glass Mineral Wool product making it easier to install. The use of colour-coded packaging — differentiating 'external wall', 'ceiling', 'underfloor' and 'acoustic partition' products — makes it easier to select the right product for the right application.

The packaging has also proved popular? Earthwool is in strong bags with heavy duty wrapping and that minimises damage making the product more presentable. Knauf Insulation's compression technology means we can maximise shelf value and customers have fewer bags to handle on sites.

What are the most popular Knauf Insulation products? The most popular are wall and ceiling batts but increasingly architects, builders and homeowners want thicker and denser products to maximise energy efficiency and comfort.

ROD KAYE

Why do you use Knauf Insulation solutions? We like the quality, delivery and the facilities and support Knauf Insulation offers. We also appreciate the fact that Knauf Insulation keeps up to date with innovative products and knows the market in which we work.

What are your most popular Knauf Insulation products and why? For most external wall insulation and solid wall insulation contracts we have delivered with Knauf Insulation products. This is due to the support and technical specification that is provided. Due to the way our business runs our most popular Knauf Insulation products are Earthwool Loft Rolls, SUPAFIL 34 and 40 and Timber Rolls.

Are there any specific challenges that Knauf Insulation has helped your company solve? We carried out one of the first hybrid internal/external solid wall insulation contracts delivered under ECO (a former UK government energy efficiency scheme) with detailed specifications in partnership with Knauf Insulation.

What has been the most significant project you have worked on with Knauf Insulation? We liaised with Knauf Insulation on a national project following the demise of a large retrofit installer. We ensured wherever we could that specified sites had Knauf Insulation installed and most importantly that those clients received the service they required in order to complete, finish and sell their properties. It was a joint venture.

NORTH AMERICA

LEE KURTAS IS A HIGH PERFORMANCE HOME CONSULTANT FOR SYNDER ENERGY SERVICES IN HOUSTON, AN ENERGY AND SUSTAINABILITY CONSULTANCY THAT FOCUSES ON CUSTOMISED HOME PROJECTS IN TEXAS.

How long have you been using Knauf Insulation solutions? We have been aware of the company for years, but our partnership grew more robust once Knauf Insulation hired their current territory manager. With his help and the promotion of Knauf Insulation and EcoSeal, we've made great strides improving our clients' thermal envelope performance.

Why do you use our products? And which are the most popular? We promote Knauf Insulation's ECOSE Technology because of its consistent quality. We're also big fans of EcoSeal as it's the best option for any non-foam insulated home. Even all-foam homes have many needs for EcoSeal.

What do you like about Knauf Insulation? We appreciate the company's commitment to the entire building envelope.

Any specific circumstances or projects where clients always use Knauf Insulation solutions? Whenever we have a project that we know will struggle to meet its ACH (air changes per hour) requirements — which impact thermal performance — we strongly recommend EcoSeal. Whenever we have a home along the coast, we recommend EcoSeal. Why? Because these structures have low tolerances to perform at high level. If air is allowed into the home it won't meet rigid testing parameters or will allow in high levels of moisture leading to mould or mildew.

UNITED KINGDOM

A&M ENERGY SOLUTIONS HAS BEEN USING KNAUF INSULATION PRODUCTS SINCE 2002. IAN MOLLARD THE COMPANY'S ECO DIRECTOR EXPLAINS WHY.

IAN MOLLARD

LITHUANIA

SINCE STARTING BUSINESS IN 1995, JSC LEMORA HAS BECOME ONE OF THE BIGGEST SELLERS OF BUILDING MATERIALS IN LITHUANIA. KNAUF INSULATION PRODUCTS ARE CONTRIBUTING TO THAT SUCCESS SAYS SALES DIRECTOR ROBERTAS HINZ.

Why are Knauf Insulation products so popular?
Lithuanian customers appreciate high quality and when Glass Mineral Wool with ECOSE Technology was introduced the market appreciated its natural feel and lack of added formaldehyde or acrylic. It revolutionised the market. Every year we see it grow in popularity. For our side, we appreciate the support and level of expertise provided by the Knauf Insulation team.

Which are your most popular Knauf Insulation products and why?
Glass Mineral Wool with ECOSE Technology is popular in the assembly of internal wood partitions and pitched roof frames. The fact that it has no added formaldehyde adds extra value. The range is also popular in the creation of Passive Houses and A, A+ energy efficient buildings. We have also started to sell Knauf Insulation solutions — not just products — and systems for a range of different applications which helps us fulfill client needs more effectively.

Are there any significant examples of a particular project challenge that Knauf Insulation products have solved?
Lithuania is building many business centres to LEED and BREEAM standards and customers say that Knauf Insulation products are contributing to significant energy-saving performance.

ROBERTAS HINZ

SERBIA

SERBIAN ARCHITECT DJORDJE BAJILO FOUNDED DBA ARCHITECTS IN 2007. THE COMPANY, RENOWNED FOR HEALTHCARE, HOTEL AND SPORTS PROJECTS, EMPLOYS 14 ARCHITECTS AND THREE CIVIL ENGINEERS.


DJORDJE BAJILO

Why do you use our products?
We have been using Knauf Insulation solutions for years, but intensively since 2010. They are very high quality and the wide range allows coverage of all requirements on a project at the same time.

What differentiates Knauf Insulation from other companies? It's the excellent technical support we receive. This is one of key elements that determines the producers we cooperate with. Knauf Insulation offers a unique level of support to architects and specifiers. An important contribution to our cooperation is the development of KnaufTerm energy efficiency software that is essential during the production of energy passports. Knauf Insulation has surpassed the competition in this field and positioned itself as a strong leader.

Which are your most popular Knauf Insulation products and why? All Rock Mineral Wool products and recently Urbanscape Green Roofs.

Have our products helped solve any specific challenges?
We had a few challenging moments in projects which were very important for us — such as several McDonald's restaurants, which had specific façade lining. Together with Knauf Insulation we came to a specific solution that included contact façade with Rock Mineral Wool.

FRANCE

LIONEL JACQUET IS THE PRESIDENT OF HAUT DOUBS CRÉER BÂTIR (HDCB) IN FRANCE. HE EXPLAINS WHY KNAUF INSULATION'S EXPERTISE AND INSTALLER-FRIENDLY SOLUTIONS ADD VALUE TO HIS PROJECTS.


LIONEL JACQUET

How long have you been using Knauf Insulation solutions?
As a manufacturer of traditional individual houses for 34 years, we have always integrated Mineral Wool products into our buildings. We have used Knauf Insulation's ECOSE Technology for about five years. We have standardised its use as it has the advantage of certified performance and is also better for the environment.

What do you like about our products?
The ECOSE Mineral Wool is odourless and softer. This provides our installers with exceptional ease of installation while ensuring continued thermal and acoustic performance. In addition, its binder is based on natural components and this limits its environmental impact. The naturally brown colour is also appreciated by our customers.

What are your most popular Knauf Insulation products and why? We recently standardised Knauf Insulation's RT Plus System — Glass Mineral Wool combined with an integrated vapour barrier and aluminum look — as it allows us to tackle air-tightness, thermal and acoustic performance as well as attic water vapour all in one. Along with RT Plus accessories, this system ensures optimal comfort.

Are there any circumstances in which you always use our products?
France's RT2012 thermal regulations enforce performance-related air-tightness and the mountain homes we build tend to have attic rooms. The RT Plus system allows us to meet both construction and regulatory demands while ensuring comfort. The system helps us make significant savings in time and effort.

NEW BUILD, NEW SOLUTIONS IN THE U.S.

New solutions by Knauf Insulation are ensuring we are ahead of the curve in the United States as the number of new build homes continues to increase.

Following the 2008 recession the number of new builds — known as housing starts — had dropped to 478,000 a year but by 2015 the market had recovered to 1.1 million.

New build represents the vast majority of residential homes in North America and we closely monitor building trends to ensure we have the solutions that our customers will need today — and in the future.

Perhaps the most significant trend has been greater awareness of the importance of environmentally responsible products that do not compromise health or comfort.

That is why we introduced ECOSE Technology into our core products such as EcoBatt.

Mainly derived from rapidly renewable organic materials, EcoBatt contains no added formaldehyde, no acrylics or artificial colours and is created from a minimum of 61.9% post-consumer recycled bottle glass.

In fact, EcoBatt with ECOSE Technology was the first Glass Mineral Wool brand to be given 'Red List Free' status on the International Living Future Institute's product database that independently certifies products in sustainability.

"**When it comes to putting products into their homes, customers are no longer prepared to compromise on comfort or health,**" says Shawn Dunahue, our Marketing Director for Residential Buildings. "**EcoBatt with ECOSE Technology offers the assurance that our insulation is highly effective when it comes to thermal performance.**"

Knauf Insulation was also the first insulation manufacturer in North America to meet demanding air quality and emissions requirements leading to certification from the GREENGUARD Environmental Institute.

"A major issue affecting products and brands now being specified by builders is concern for indoor air quality in environments where people spend a significant amount of time, particularly in schools, hospitals and offices," says our Regional Sales Director, Joe Hudock. *"This consideration has become nearly as important as the thermal performance of the insulating products themselves."*

Another key trend impacting new build has been regulation. It is vital that we keep ahead of any new changes or revisions.

For example, the highest Grade 1 of the new 2016 national code defined by the Residential Energy Services Network (RESNET) insists there should be no gaps or voids in the thermal envelope after insulation installation.

The solution? Our newly launched JetSpray Thermal fulfils the code's requirements perfectly. The spray-on insulation system quickly and easily fills any size or shape of wall cavity completely to offer exceptional acoustic comfort and thermal performance.

Another regulation change has been the introduction of new Energy Codes that demand strict improvements to air tightness in new builds.

Anticipating these changes, Knauf Insulation introduced EcoSeal Plus. The solution is a water-based elastrometric sealant that easily sprays on to joints, seams and gaskets to improve the air-tightness of frame construction homes without adversely impacting indoor air quality or fire safety.

"Building trends may change, but as the new build market continues to grow in North America our customers can be assured of one constant — We are always here to help," says Shawn.

ECOSEAL+

DRAWING THE LINE ON CONFIDENCE

ECOSEAL Plus air sealant helps builders meet the changing codes and demands of the housing market in the United States. Meeting and exceeding the stricter air-sealing codes and homebuyer expectations for energy efficient homes will set builders apart. Rely on ECOSEAL Plus - an air-sealing product you can trust.

PERFORMANCE

ECOSEAL Plus provides performance with the Gasket Pro Technology that is consistent. Energy efficiency means lower energy bills for your customer.

RELIABILITY

ECOSEAL Plus is reliable, which means fewer call-backs, happier homeowners, and more profits for you. Off the shelf equipment and replacement parts keep jobs on track.

SAFETY

With no job site quarantine needed, it is safe for other trades to work during installation. Install ECOSEAL Plus and insulate the home in the same day.

CONSISTENCY

ECOSEAL Plus provides quick and safe installs ensuring cost-effective, on-time job completion.

KNAUF INSULATION
it's time to save energy

KICM1021ADV-V1015

SOLUTIONS INSPIRED BY PERFORMANCE

PERFORMANCE THAT RAISES THE ROOF

CHALLENGE

To improve the thermal efficiency of 'two-layer cold roofs' – a type of roof that is installed on hundreds of thousands of pre-fabricated buildings around the world. Traditionally it has been difficult to insulate these roofs without impractical structural changes.

CREATE

Since December 2015, Knauf Insulation has been working with scientists from Budapest University to collect data from a 'two-layer cold roof' on a Hungarian building block to find ways to improve its thermal performance. The roof is being scientifically monitored – every 15 minutes, 24 hours a day – using temperature and humidity sensors as well as infrared thermography to record temperatures, moisture levels and condensation.

CARE

"We are examining the best systems that would make the thermal performance of these roofs more effective — such as our SUPAFIL Blowing Wool in conjunction with other elements," says László Brassnyó, Application Specialist at Knauf Insulation Hungary. However, the first step is to understand how they work during this trial. More countries are demanding stricter U-values in existing buildings as well as new builds and Hungary is no exception. Here new buildings require a U-value of 0.24 W/m²K for walls compared to 0.45 W/m²K previously and 0.25 W/m²K compared to 0.17 W/m²K for roofs. At Knauf Insulation, through this research, we aim to help.

CONSTANTLY CHALLENGING PERFORMANCE

Create new products that provide the best possible performance and achieve demanding international standards.

At our research and development laboratory at our Škofja Loka site in Slovenia the focus is on testing the properties of our solutions – and all the elements that make up these products – from every possible perspective. *"We have the expertise and the facilities to carry out a wide range of tests,"* explains Markus Mente, our Head of Product & Systems Development. *"These may range from examining the mechanical properties of a product and testing its chemistry to investigating its thermo-conductive qualities, but ultimately all the research is combined to ensure the highest product performance."*

The example of our new fire protection system demonstrates the importance of continuous testing. *"With this project we started with a theoretical evaluation followed by laboratory and small-scale trials,"* says Markus. *"When everything was OK we went ahead with large scale trials. The system was then independently examined in other large scale testing experiments by a range of certification bodies. Due to our previous work it performed exactly as expected."*

WE CONSTANTLY **CHALLENGE** OURSELVES TO FIND BETTER WAYS TO IMPROVE PERFORMANCE — FROM TRAINING COURSES AND LABORATORY TESTING TO RENOVATION TRIALS AND COMPARATIVE STUDIES. THAT IS BECAUSE OUR PRIORITY HAS ALWAYS BEEN TO **CARE** FOR OUR CUSTOMERS BY **CREATING** SOLUTIONS THAT THEY NEED.

IMPROVING PERFORMANCE IN NORTH AMERICA

ENSURING THE BEST INSTALLATION TECHNIQUES

Ensure that when our products are installed they deliver the best performance possible and ultimately the best energy savings.

Provide installers with the skills they need to maximise the performance of Knauf Insulation solutions.

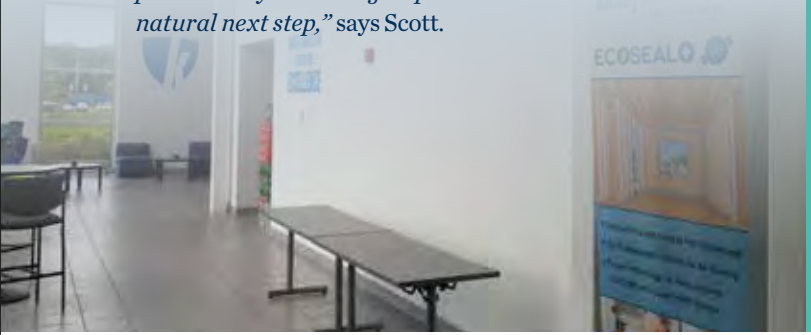
CHALLENGE

At the Knauf Insulation Academy at Shelbyville in the U.S., courses are customised to every requirement whether it is for new employees who need an overview of building science or external contractors who need to understand how our products can help them do their job better while maximising the performance of our solutions. *"We have many years of experience and knowledge within Knauf Insulation and it's a privilege to pass it on to our customers,"* says Scott Miller, our Director of Sustainability in North America. *"It's an important legacy of the company."*

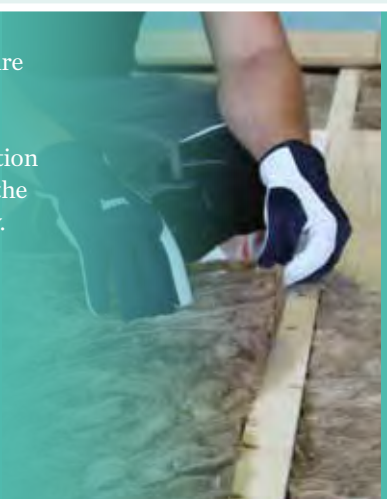
Our training centre in Lannemezan – the Ecole de l'Isolation™ – in France offers courses in the installation of solutions that range from internal insulation and Blowing Wool to exterior thermal systems and flat roof insulation. What is unique about the centre is that it offers a 700m² practical studio with a variety of real-life renovation scenarios where installers can enhance their skills and learn how to maximise performance of solutions through installation.

CREATE

The courses are held on site or at the academy but plans are in the pipeline to offer on-line training modules. *"We need to get our information out in the easiest possible way to the largest possible audience. This is the natural next step,"* says Scott.



The school's courses are certified and audited by CERTIBAT, a certification organisation in France focused on the construction industry.



CARE

Renovation breakthrough

We are joining forces with scientists in a unique 21-home project in Belgium to reveal the energy-saving benefits of insulation.

We have launched a major research project in Belgium to examine the energy-efficient impact of insulation on 21 renovated homes.

The aim is to show that when properly designed and installed, insulation can make big savings. How much? More than 50% from roof and wall insulation alone.

The findings were taken from analysis of the impact of insulation — before and after installation — on an empty three-up two-down semi-detached house. The test is the first step in a year of building physics research across 21 retrofitted homes.

Dozens of residents living in the homes as well as academics, the local social housing association (M.B. V. Eeklo) and Knauf Insulation's building physics experts are involved in the project.

In the first results released from the unoccupied test house, Leuven University researchers found that after roof and cavity wall insulation was installed, space heating demand dropped to 0.459 W/m³K from a baseline of 0.91 W/m³K (normalised to the internal volume). In other words, an improvement of over 50%.

"Heat loss testing prior to any insulation established a real world baseline for the space heating demand of 0.91 W/m³K (normalised to the internal volume). With insulation of the roof, this dropped to 0.69 W/ m³K. Once a combined package of roof and cavity wall insulation was installed, the baseline figure reduced from 0.91 to 0.459 W/m³K," says Leuven University.

The findings reinforce our understanding of what insulation can achieve, but there are a wide range of other reasons why this research is important.

Firstly, we are aiming to gain greater insight into the understanding of insulation installation techniques and how to achieve the best performance from insulation in real world conditions.

We have been pioneering this type of analysis for years (see 'Performance pioneers' right) but the scale of this project will help us to take another step forward in our understanding of how to deliver retrofits that really deliver energy savings.

Second, we know that insulation saves energy but calculating how much — backed up by real life numbers — will demonstrate how much inefficient homes have to gain from insulation. On a Europe-wide scale this information will reinforce the importance of putting renovation at the heart of any energy efficiency legislation.

The third reason is that it is essential to examine the 'real world' factors that influence the performance of insulation. Throughout our analysis we are discovering to what extent poor design, specification and installation processes may undermine energy efficiency if vulnerable junctions and details of the building fabric are ignored or if insulation is incorrectly installed or damaged during the retrofit process.

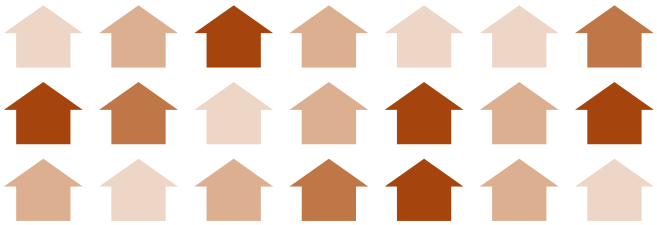
Installers are also sharing experiences with us that can be incorporated to make our future training programmes and installation guidance more effective.

In addition, we are examining the major challenges associated with different types of building. Issues such as ground-to-wall junctions, cavity wall sizes, shutter boxes and lintels are structural-related issues that can vary according to property often with a detrimental impact on overall thermal performance.

Add to this, issues of moisture, air-tightness, changing weather, varying temperatures and there is a huge amount of information to process across a wide range of influencing factors.

Finally, we are interacting with residents to understand how to improve the actual experience of renovation while the work is underway and what can be done to help residents get the most out of their retrofitted homes.

Ultimately, this project is vital because understanding performance distils a critical fact of life — if you can't measure it, you can't manage it.



21 homes, one mission – real performance

THE CHALLENGE

In the world of construction there is a need for hard data, not only laboratory test data or modelling but data based on in-situ monitoring and testing of renovated homes. Through analysis of these homes we are contributing significantly to this area.

PROJECT BELGIUM

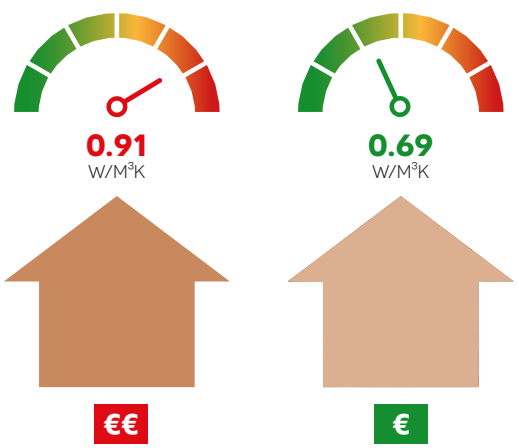
In partnership with the University of Leuven and social housing association M.B.W. Eeklo, we started with analysis of an empty three-up two-down semi-detached house. First, performance was monitored to establish heat loss from the house without insulation. This was followed by analysis with insulation installed in the roof, then with testing of performance with insulation in both the roof and cavity walls.

MATERIALS USED

The renovation aimed to deliver a highly cost effective solution addressing key issues such as air leakage, wind washing and vapour control. Solutions used included Knauf Insulation's Multifit Glass Mineral Wool with a lambda value of 0.035 W/mK, HQ Premium UV resistant water vapour permeable rainscreen, LDS 100 vapour control membrane, Solimur adhesive and Solitape sealing tapes.

WHAT WE HAVE LEARNED SO FAR

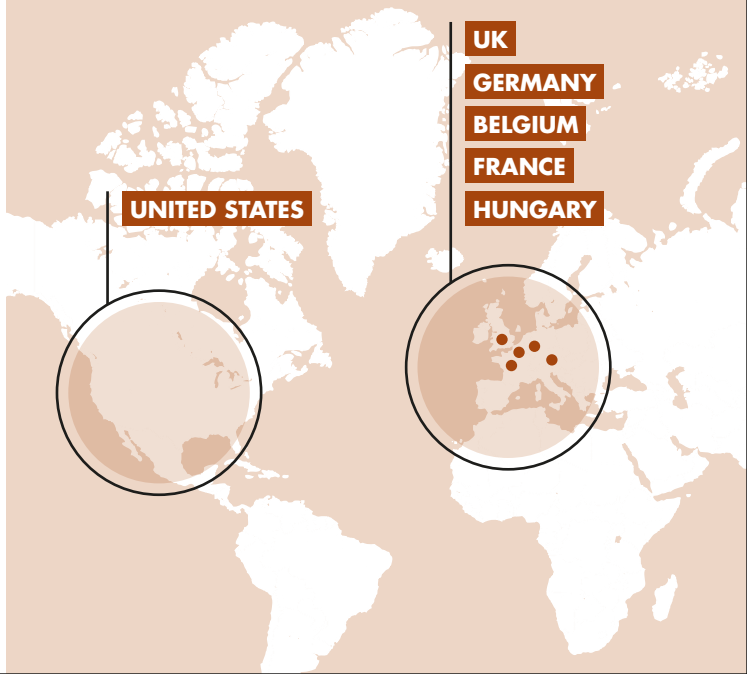
Insulation has been proven to improve a building's thermal performance dramatically. But important issues such as reducing thermal bridges, carefully managing air-tightness, moisture and air movement must be addressed as well as ensuring that installation procedures are well communicated.



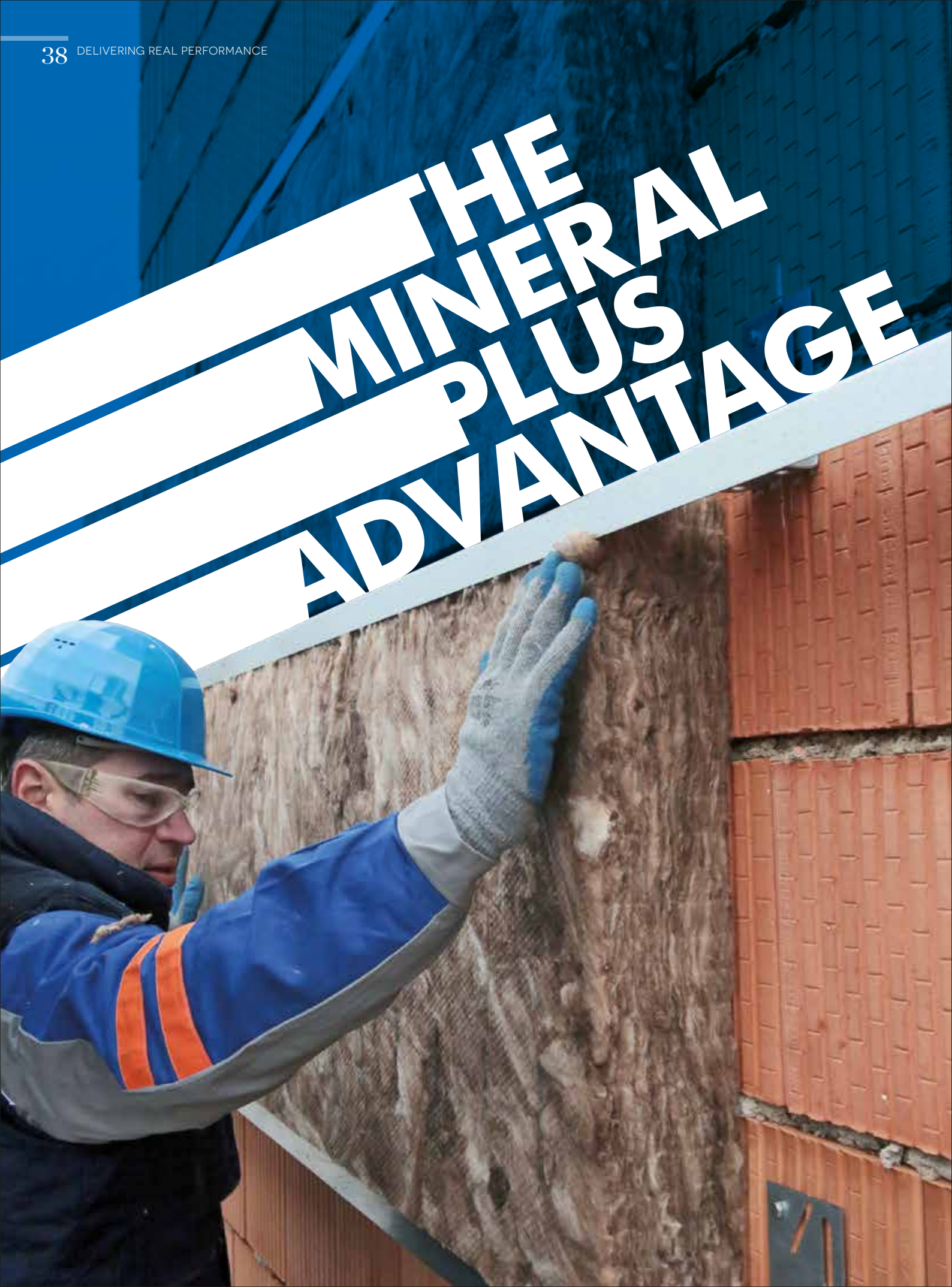
Performance pioneers

Since 2010 Knauf Insulation has been supporting research into building physics while creating solutions to tackle performance issues.

- We launched the first **'Reality Check' Building Science Programme** where we brought together world experts to define ways to ensure that the thermal envelope of buildings performs as designed.
- The results of our whole-house heat loss test with the **Belgian Building Research Institute** have been used to inform work of the European Standardisation Committee.
- In Hungary two comparable homes — one insulated by Knauf Insulation, the other not — had their energy use examined by our building physics team and Budapest scientists. They found that renovation cut energy bills in half. Now we are carrying out new tests on how to improve the **performance of 'two-layer cold roofs'**, installed on many Hungarian buildings *(see page 32)*.
- Our experts in conjunction with the **University of Leuven** and the Belgium Building Research Institute monitored the impact on heat loss in an unoccupied home designated for social housing — at various levels of insulation installation — and found that although insulation can perform as expected, good installation practice is critical to realising optimal performance.
- We help our installers to maximise the performance of our products through proper installation at our **training centres in the US and Europe** as well as full-scale laboratories — or centres of excellence — in which we investigate effectiveness of our solutions.
- We have developed a range of accessories such as our **Homeseal System** which, for example, improves air-tightness when used with our products.



THE MINERAL PLUS ADVANTAGE



Mineral Plus, our most recent innovation, has become a major game-changer for construction decision makers. It offers outstanding thermal, acoustic and non-combustibility performance. It is comfortable and straightforward to apply, easy to use on site and has impeccable credentials when it comes to low environmental impact.

Our reputation for innovation is built on caring for customers and creating the solutions that help them meet their challenges.

The launch of Mineral Plus in 2012 in Turkey was the innovative response to the problems facing construction's key decision makers — the building owners, designers, technical consultants, building contractors and installers.

They needed an insulation solution that provided exceptional thermal, acoustic and fire performance. They needed a product that offered the perfect balance between easy-to-cut stiffness and optimal-fit flexibility.

They needed a solution that was soft and comfortable to apply and saved time on site. Saving time is critical. According to consultants Roland Berger, construction workers spend 70% of their time 'transporting materials, cleaning up and looking for materials and equipment'. And they needed a product with a low environmental impact to meet the challenges of increasingly sophisticated green buildings.

The creation of Mineral Plus was the answer to all these challenges. When we launched the solution in Turkey, supported by a team of technical experts, it became a major game-changer for construction decision makers. Now the solution is available in Hungary, the Czech Republic, Austria and Germany.

We now continue to grow the Mineral Plus range to offer new products and systems for specific applications, from internal partitions and ventilated facades to timber and metal frames, making the solution ideal for demanding building projects.

So, why are the key advantages of Mineral Plus so significant?

REAL PERFORMANCE

One of the most important characteristics of any insulation is performance and here Mineral Plus really delivers.

First, it offers exceptional energy efficient performance with a thermal resistance of up to 0.032 K-m^2/W, depending on the application and country. Mineral Plus is also flexible, simple to cut and easily compressed. This means it fits tightly into spaces, even irregular areas, and fits flush to panels and compresses around cabling.

Through this ease of application, Mineral Plus effectively tackles the challenges that threaten to disrupt performance such as gaps created by insulation breaking or thermal bridges caused by poor installation.

When it comes to reaction to fire, Mineral Plus has the highest safety rating in Europe of A1 according to the EN13501-1 standard. Similar high standards also apply to acoustic performance. Its sound absorption is Class A under the EN ISO 11654 standard.

"We use Mineral Plus in hotel construction so noise absorption and thermal performance are very important. Mineral Plus meets all required values. Our clients also like the fact that it's an environmentally friendly product."

Can Elmas, architect and founding partner of Akyürek Elmas Architecture Office, Turkey.

EASE AND COMFORT OF APPLICATION

For installers, the application of Mineral Plus offers major benefits.

Firstly, it is quick and easy to install. The solution offers the ideal balance between a level of stiffness that makes it straightforward to cut and an ease of flexibility that ensures it fits easily into the most demanding spaces.

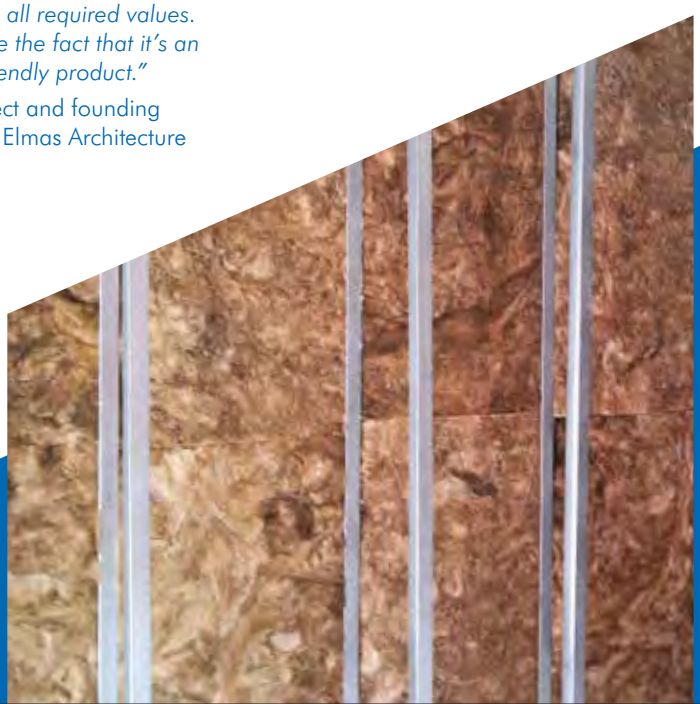
The solution does not break or chip during installation and it is designed to minimise dust caused by handling. Additionally, its excellent friction fit makes it quick and easy to install between metal studs or into timber structures.

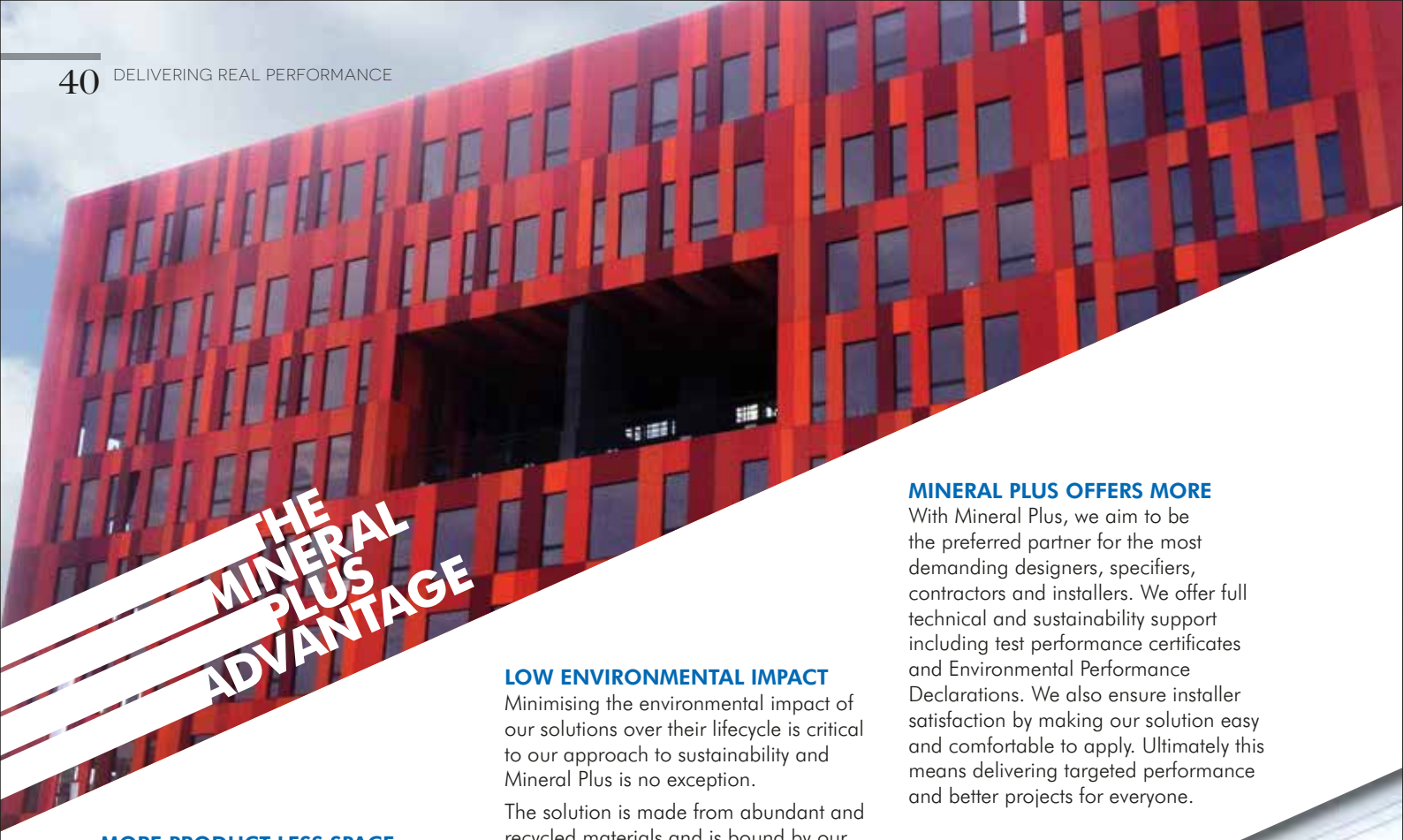
A slab of Mineral Plus is also half the weight of a slab of our Rock Mineral Wool and this makes it particularly easy to move around a site in fewer trips.

Finally, with a growing range of specific solutions for specific applications such as internal partitions, ventilated facades, metal buildings or timber frame buildings, Mineral Plus is becoming the insulation of choice for cutting edge construction.

"We used Mineral Plus in our Mevlana Hospital project in Konya. One of the benefits we appreciated was that it is very flexible and compressed easily into interior plasterboard walls. Our installers find Mineral Plus doesn't irritate their skin and it doesn't create dust."

Yüksel Şeker, owner of Detay Akustik, Turkey.





THE MINERAL PLUS ADVANTAGE

MORE PRODUCT LESS SPACE

Installers who use Mineral Plus benefit massively from our unique compression technology because saved space translates into saved time and costs.

More Mineral Plus can be delivered to a site in one delivery compared to our traditional Rock Mineral Wool. In fact, it takes just one trip to deliver 5,760m^2 of Mineral Plus in an 80m^3 truck. The same amount of Rock Mineral Wool in the same truck would take 3.6 trips meaning extra fuel, vehicle and driver costs.

When these space-saving benefits are moved to a site, we have found that Mineral Plus uses less than a third of the storage space on site for the same surface area of our Rock Mineral Wool.

In sites or warehouses where space is limited this means more product on fewer pallets and fewer trips backwards and forwards to the storage area. On a high-rise construction site across many floors, this is a huge advantage.

And, of course, less packaging ultimately leads to less waste and we are always happy about that.

"Large amounts of Mineral Plus can be easily transported because of its compressed packaging. This means we can use small transporters rather than trailer trucks in narrow streets and carry out work quickly and easily."

Semih Kadri Felek, architect at SKF Architecture, Turkey.

LOW ENVIRONMENTAL IMPACT

Minimising the environmental impact of our solutions over their lifecycle is critical to our approach to sustainability and Mineral Plus is no exception.

The solution is made from abundant and recycled materials and is bound by our award-winning ECOSE Technology.

Mineral Plus also meets the most demanding European standards for product emissions and is certified Gold for Indoor Air Quality by Eurofins – the highest possible level.

Over its entire life, Mineral Plus also generates less embodied carbon than Rock Mineral Wool due to its significantly lower manufacturing environmental impact.

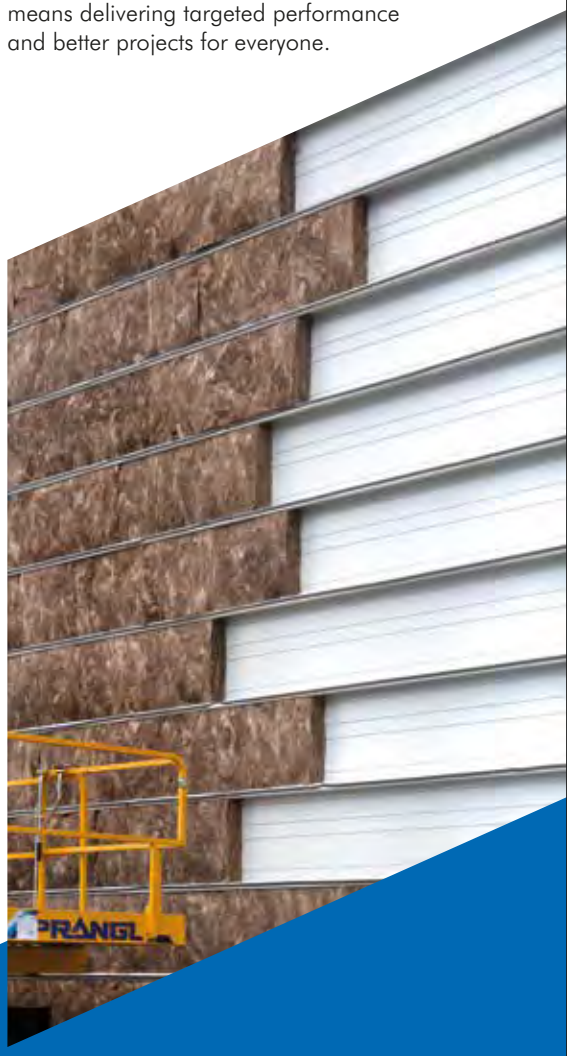
Naturally, we also have Environmental Product Declarations (EPDs) for Mineral Plus, which our range receives points in many Green Building Rating Systems.

"We aim to use Mineral Plus in our hotel and hospital projects because it is a natural product and we are constructing environment-friendly buildings. Selecting the correct products is important to these projects".

Aslıcan Kortan, Project Coordinator, EID Construction Company, Turkey.

MINERAL PLUS OFFERS MORE

With Mineral Plus, we aim to be the preferred partner for the most demanding designers, specifiers, contractors and installers. We offer full technical and sustainability support including test performance certificates and Environmental Performance Declarations. We also ensure installer satisfaction by making our solution easy and comfortable to apply. Ultimately this means delivering targeted performance and better projects for everyone.

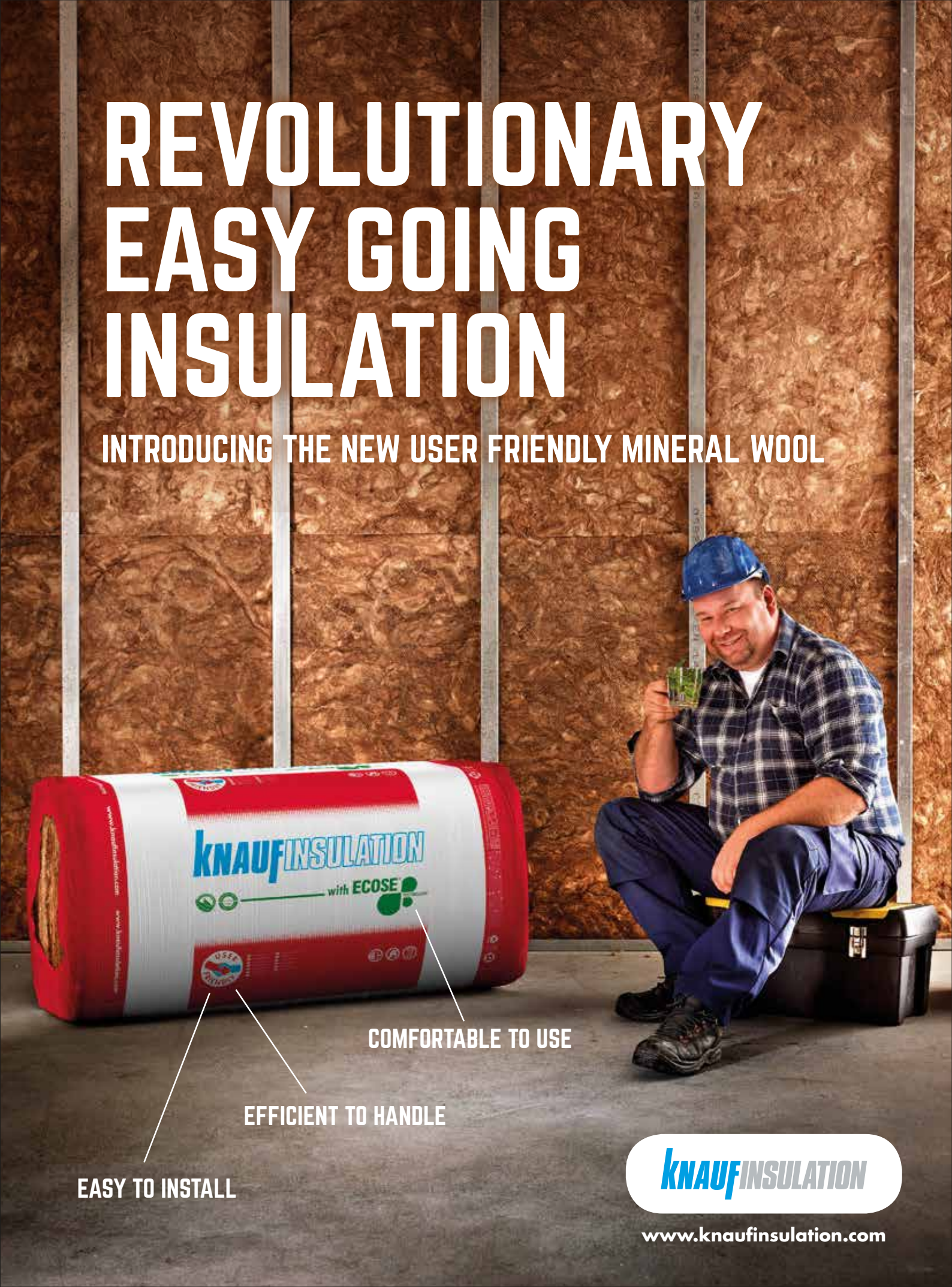


The availability of Mineral Plus can be confirmed by contacting our local commercial teams

www.knaufinsulation.com/en/addresses

REVOLUTIONARY EASY GOING INSULATION

INTRODUCING THE NEW USER FRIENDLY MINERAL WOOL



KNAUFINSULATION

www.knaufinsulation.com

QUIET REVOLUTION

Knauf Insulation is committed to creating healthier buildings by improving acoustic comfort.

Noise pollution is an increasingly serious issue. According to the World Health Organisation, 20% of Europeans suffer from noise levels that are a major threat to health.

Prolonged exposure to excessive noise disrupts sleep, causes agitation and impacts mental and physical wellbeing. Unfortunately, the world is getting noisier as the density of cities continues to increase.

To help tackle this issue, we offer a range of solutions that have proved highly efficient in reducing unwanted noise.

"From acoustic ceiling tiles and partition cavity fillings to floor insulation and wall linings, Knauf Insulation has a wide range of solutions that can improve the management of sound and contribute significantly to the acoustic comfort of a building."

Etienne Dheur, Manager of Knauf Insulation's laboratory in Belgium.

MINERAL PLUS

The tight fibre structure of our Mineral Plus solution offers significant acoustic performance. Equally important, Mineral Plus can be cut easily to fit neatly into cavities and is so flexible that it simply compresses around pipes and cables. This means that with careful positioning, any potential gaps that may allow noise transfer are avoided.

ROCK MINERAL WOOL

Our Rock Mineral Wool automatically contributes to dampening sound with its high-level noise-blocking fibre structure. Rock Mineral Wool also offers exceptional thermal and fire performance.

GLASS MINERAL WOOL

Our Glass Mineral Wool is lightweight, easily installed and provides outstanding thermal insulation as well as exceptional acoustic performance.

PLASTERBOARDS

Our partition wall systems incorporating sound-absorbing Mineral Wool and sound-deflecting Knauf plasterboards offer a range of solutions that can be combined to manage sound according to requirements. Whether to ensure sound does not travel from one room to another such as in a cinema or theatre or to manage difficult acoustics in an echoing school gym (see examples on page 43), we can find a customised solution.

HERAKLITH WOOD WOOL

Our Heraklith Wood Wool systems offer an ideal acoustic solution for applications such as garages, ceilings, external walls, loft floors or pitched roofs.

URBANSCAPE

Urbanscape is our Green Roof Solution. Urbanscape not only dramatically contributes to noise reduction in large cities, near industrial areas and airports but also provides excellent climate-friendly thermal insulation.

SETTING NEW STANDARDS

We are working with sound specialists and industry experts to upgrade international and European acoustic standards for buildings as well as promoting Mineral Wool as a highly effective barrier against noise

"Exposure to excessive noise in buildings is becoming an important health issue," says Etienne Dheur, Manager of our laboratory in Belgium. *"Our technological understanding of noise and its impact on people has significantly improved in recent years and it is vital that classification standards are upgraded to reflect new research."*

Working with colleagues at the European Insulation Manufacturers Association (Eurima), we are also contributing to an industry 'white paper' report to highlight the importance of good acoustic health in buildings.

HOME COMFORT

CASE STUDY 1

"Liaison with Knauf ensured the installation process went smoothly with regular site inspections from the Knauf team. This was a tight inner city site so it was important for us that the lead times for Knauf products were always accurate and timely."

Howard Winter, managing director of HOME's drylining subcontractors, Sound Interiors

PHOTO: PAUL KARALIUS

PROJECT Ensure the different venues within the UK's £25 million HOME cultural centre in Manchester — a 500-seat theatre and five cinemas — were acoustically isolated from one another as well as from a railway six metres away.

PRODUCTS USED Knauf's Soundshield Plus high performance plasterboard reinforced with Knauf Fire Panel where necessary.

SOLUTION The theatre is a box within a box — a steel frame on acoustic rubber pads isolated from the external concrete — lined with three staggered layers of 15mm Soundshield Plus incorporating 100mm Knauf Earthwool Acoustic Partition Roll. The five cinemas were separated by twin-framed partitions with each side constructed from two 15mm panels of Soundshield Plus on either side of 25mm Knauf Earthwool Acoustic Partition Roll.

RESULT An acoustic performance of 76dB Rw was achieved for the theatre — enough to keep out the noise of the nearby railway — while 63dB Rw of sound insulation was achieved for the cinemas.

SOUND OF SUCCESS

CASE STUDY 2

"Now two groups of students can enjoy activities at the same time in the gym without disturbing each other."

Gergö Karácsony, Chief Physical Education teacher

CHALLENGE Improve acoustic performance of a gym at the British International School in Budapest, Hungary. Children could not hear teachers' instructions or hear what was being said during events in the gym.

PRODUCTS USED Heraklith 35mm (190m^2) on 80 mm joists, Unift between joists and Tektalan 50mm on 182m^2 of ceiling.

SOLUTION 50mm Tektalan boards were installed into the gaps of the braced roof girders to reduce shiny surfaces and 35mm Wood Wool boards were fixed onto 80mm joists with Mineral Wool inserted between them on walls.

RESULT The weighted sound absorption of the board increased from α_w=0.35 to α_w=0.85 (α_w=1=100% complete sound absorption).

BURNING ISSUE

OF BUILDING FIRE SAFETY

NEW-BUILD BECOMES INCREASINGLY INNOVATIVE AND RENOVATION TRANSFORMS THE EXISTING BUILDING LANDSCAPE – IT IS VITAL THAT WE DON'T MISS AN OPPORTUNITY TO MAKE OUR BUILDINGS FIRE SAFE.

PHOTO: PA IMAGES

New Year in Dubai came to a dramatic close in 2015. Just hours before half a million fireworks were due to illuminate the sky above the world's tallest tower to celebrate the start of 2016, fire broke out at the 63-storey hotel opposite and flames quickly engulfed the façade.

Fortunately nobody was injured, but the issue of building fire safety was again pushed up global news agendas as millions watched footage of the blaze online on TV.

And that issue must continue to be kept at the centre of public attention because this was yet another example of building fire history repeating itself. In the United Arab Emirates alone there have been four fires in high-rise towers over a height of 34-storey in less than 18 months to July 2016.

But building fire safety is of course a global issue. In 2010 a fire in Shanghai killed 58 after sweeping up the exterior of a 28-storey high-rise apartment. The same year, seven were killed by a blaze in a nine-storey housing block in France.

"We must learn from the lessons of history to take legislative action before future disasters occur," says Juliette Albiac, Managing Director of Fire Safe Europe (FSEU). *"Right now – today – we have an opportunity to improve the fire safety of buildings. Failure is not an option."*

"There is an increasing sense of urgency because the construction sector is innovating at an unprecedented rate, but building fire safety regulations across the world have not kept up," says Albiac.

New buildings are bigger, higher and more complex than before. Often in line with increased requirements for sustainability these buildings use innovative new materials and systems such as ventilated metal-faced sandwich panels that often have combustible elements built in.

Furthermore, as the trend to renovate existing buildings continues to sweep Europe, it is important to see this as an opportunity to make them safer than ever.

"No-where in the world are the standards good enough yet. We need to develop more robust fire safety codes for buildings, implement more vigorous performance-based testing of construction materials and ensure these standards are enforced," says Albiac.

In the UAE, the government is in the process of updating building regulations with discussions focusing on the restriction of combustible material on facades on buildings above a certain height and with large populations of people.

In Europe, Fire Safe Europe and its partners, including Knauf Insulation, are calling for a holistic, coordinated approach to these issues through the implementation of a European Union Fire Safety Strategy.

This would include harmonised fire tests and classification schemes for façade systems across all EU countries based on test methods at the appropriate scale and representing all possible risk scenarios. We are also calling for the future-proofing of tests to allow for any future material innovations (see story below). At present, Europe is a patchwork of different fire testing requirements and this is not only bad news for safety but also goes against the principles of the internal market in which the free movement of goods, services, capitals and persons should be assured.

Barry Lynham, President of Fire Safe Europe, says: *"Many European countries have already taken measures to ensure that non-combustible insulation must be used on the facades of buildings above a certain height or designed to a certain use. It's common sense and we fully support this approach in other parts of the world."*

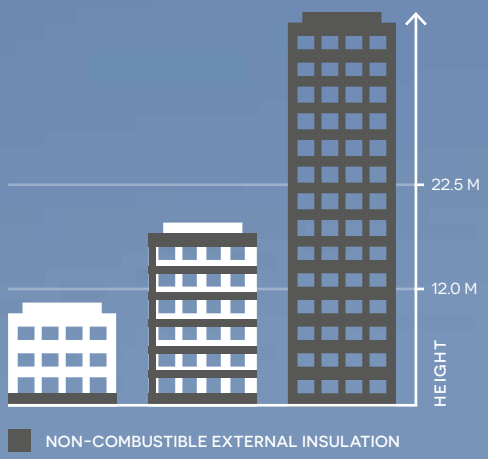
At country level we are working with regulators to develop and update fire safety standards that make sense for the buildings in that country. We have worked closely with government and fire protection organisations in Slovakia, Serbia and the Czech Republic to strengthen their building codes. In Slovakia, the Association of Preventative Fire Safety along with other interested parties has drawn up proposals to introduce more fire safe materials during the renovation of existing buildings.

In Croatia, following campaigns by groups such as the Croatian Association of Fire Protection, it is now mandatory to install non-combustible external insulation after a height of 11 metres in all new buildings and those being renovated.

In Germany, following a series of high profile facade fires, the Deutsches Institut für Bautechnik (DIBt), that provides technical advice to the German government, has recognised the risk to facades from fires started from the outside of a building, and has subsequently tightened the rules.

"These are striking first steps and offer vital contributions to better, safer buildings, but it is time more and more policy makers followed these examples and took the action required to make our built environment safer," says Lynham. *"It's time to work together to build a fire safe world."*

THE CASE OF MANDATORY INSTALLATION OF FIRE BARRIERS IN CZECH REPUBLIC



Height of safety

A Fire Safe Europe study of fire regulations for two types of high-rise building – hospitals and residential blocks – found major inconsistencies across 11 European countries in regulations covering insulation products used in facades. Although most countries insisted on non-combustible or the highest combustible class, Sweden and the UK allowed exceptions to this if the facade system passed a national large-scale facade fire test. However, in Belgium, Greece and The Netherlands there were no fire performance requirements for insulation products in facades.

INVESTING IN GROWTH

READY FOR JAPAN

Major investment paves the way for a new product launch to meet needs of Japanese customers.

Knauf Insulation is marking another landmark year in the Asia Pacific region following record sales across Australia, New Zealand and Korea and the success of a new product launch in Japan.

These achievements are paving the way for major investment in a new Knauf Insulation plant in Malaysia as regional demand grows for our products.

The launch of our new 'encapsulated' Glass Mineral Wool in Japan — the biggest insulation market in the region — was a major highlight and demonstrated how we invest significantly to meet the needs of customers.

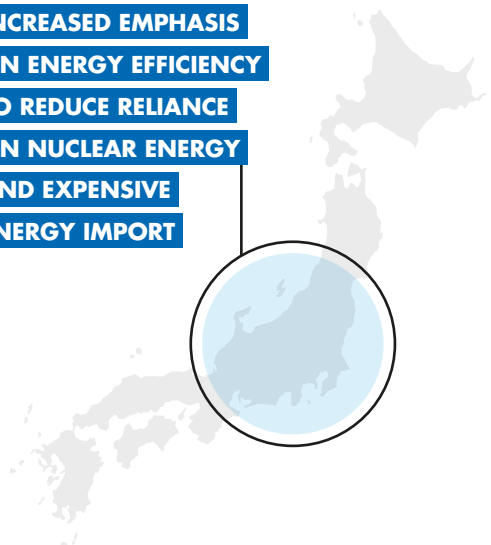
In Japan, following the nuclear disaster in Fukushima, there has been increased emphasis on energy efficiency to reduce reliance on nuclear energy and expensive energy imports. As a result the Japanese Government has continuously implemented programmes to encourage higher levels of insulation.

New equipment, processes and technology have been introduced to enable the manufacture of this new product which involves sealing — or 'encapsulating' — our famous Earthwool Glass Mineral Wool with ECOSE Technology.

In addition to ensuring the product met Japanese regulations, our colleagues in the region worked for several years in partnership with Chiyoda Ute, the second largest plasterboard company in Japan, to ensure the new range was customised to exceed customers' requirements.

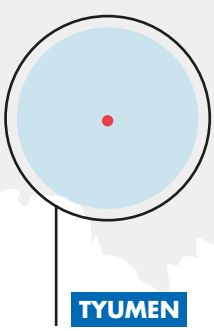
For example, the Earthwool range has not only been developed for compliance with current building regulation in Japan but also includes higher performance products in line with more stringent energy standards set by the government's 2020 energy efficiency targets.

FOLLOWING THE NUCLEAR DISASTER IN FUKUSHIMA, THERE HAS BEEN INCREASED EMPHASIS ON ENERGY EFFICIENCY TO REDUCE RELIANCE ON NUCLEAR ENERGY AND EXPENSIVE ENERGY IMPORT



RUSSIAN PLANT TRANSFORMED

Our transportation footprint in Russia has been slashed by 500,000 kilometres as a result of our investment in new facilities at Tyumen.



A major refurbishment of our Tyumen plant in Russia has reduced transportation needs by 500,000 km a year bringing our products closer than ever to customers with more than 50% of deliveries now being made within a day.

The construction of two new storage sites — a 1,320m^2 covered area for raw materials and a 20,000m^2 site with roads and ramps for 6,000 tons of finished products — instantly reduced the need to shuttle materials and goods to and from external storage sites and suppliers.

The impact was considerable. In the 12-month period from February 2015, a total of 3,988 delivery truck trips were avoided as a result of the new final goods storage area saving 22,332 litres of fuel and 55,832 km in truck transportation.

A staggering 430,000 km in further truck transportation and around 130,000 litres of truck fuel have also been saved in the year from September 2015 after a new oxygen plant was built in Tyumen.

Finally, huge savings in transportation have been achieved by sourcing local suppliers of sand rather than bringing in the raw material from 1,400 km away. Now sand is trucked to plant from a distance of just 30 km.

Customers have also been major beneficiaries of the logistics improvements with 50% of deliveries now being made in a day.

The changes are just the latest in a long history of continued major investment at the plant. After we bought the site in 2011, an upgrade was initiated to ensure state-of-the-art, energy efficient manufacturing processes.

In 2015 a new energy stabiliser was installed to end power cuts and a new oxygen plant was built to remove the need to transport gas from external suppliers — again reducing transportation needs by thousands of kilometres.

BIGGER AND BETTER IN THE U.S.

Our acquisition of Guardian Insulation sites in North America triggered a major round of investment in plants, processes and product improvements to bring our customers new benefits. That investment continues today.

The acquisition of Guardian Insulation and its 17 sites in mid-2014 instantly catapulted Knauf Insulation into a major leadership position in North America.

Our customers have been the major beneficiaries of the move. The integration of the two companies instantly doubled our North American network bringing our energy saving solutions closer than ever to growing numbers of new customers.

This new network has seen a significant reduction in freight miles driven and produced both savings and positive environmental benefit resulting in the reduction of more than 2,000 tons of CO_2 emissions.

During 2015, a second wave of planned investment has focused on upgrading manufacturing technology, improving quality and increasing our output and efficiency while replacing legacy phenol formaldehyde binder technology with Knauf Insulation's innovative ECOSE Technology, dramatically reducing formaldehyde emissions.

Legacy Guardian customers, keen to see a formaldehyde-free solution were elated with the binder change which enabled them to meet growing demand for more sustainable insulation solutions.

Tight labour markets represent a substantial headwind within the construction sector, so products that are easier to handle and faster to install are warmly received by both professional installers and DIY customers.

In addition to gaining a product line that exceeded the most stringent standards for emissions and indoor air quality, our customers appreciated the added benefits of a more comfortable, friendlier solution.

By the end of 2015, both the acquired Albion, Michigan and the Inwood, West Virginia facilities were converted to Knauf Insulation's proprietary fiberisation, forming, and curing technologies. Also included in the upgrades were improvements to emissions controls, bringing the two sites in line with Knauf Insulation standards and preparing them for increased production and future investment.

Additionally, the consumption of post-consumer curbside collected glass bottles has increased significantly bringing the number now recycled to more than a million a day.

The repurposing of this 'waste' into energy saving Knauf Insulation products decreases the amount of embodied energy in our solutions saving energy, every hour of every day that they are in service. In many applications, this is measured in generations, not years.

These investments in the acquired facilities also began paying back immediately as more efficient manufacturing processes helped reduce energy use and by-product production considerably.

The investments have paved the way for improvements for everyone.

The quality of life for our colleagues in North America has improved thanks to more efficient processes and enhanced industrial hygiene while our customers benefit from greater comfort and energy savings.

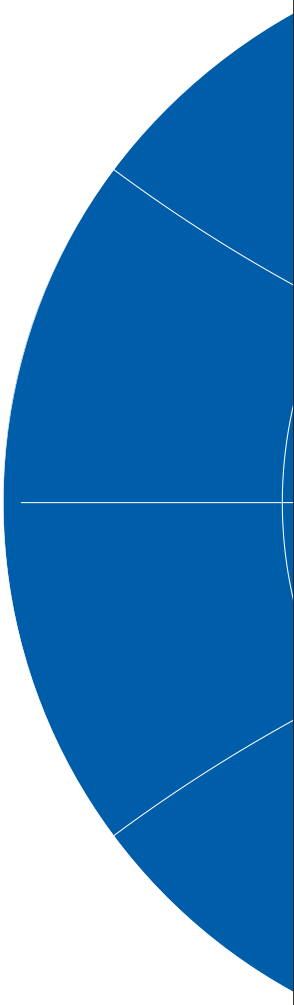
The processes, from the first day of service, benefited the planet through a reduction in emissions, waste, and the repurposing of post-consumer bottle cullet.

And finally, the investment is returning profits to Knauf Insulation that enable us to continue our mission to become a world leader in sustainable solutions for buildings.

During 2016 and beyond, further investments are planned to maximise our North American plant network to bring our solutions even closer to major population centres to meet demand.

Better customer service, more efficient manufacturing and an increased focus on sustainability are also the new hallmarks of operations at Silvercote, our customised lamination insulation manufacturer in North America.

Throughout 2015, a new centralised operations team has built on the success of our 11 manufacturing sites to improve productivity and inventory managemement leading to faster more efficient customer deliveries. This is being followed by significant investment in new equipment that will improve Silvercote's capacity while reducing waste. The new initiatives are expect to cut energy use by up to 30%.



NORTH AMERICA

→ 17 SITES

→ OUR EXPANDED NETWORK MEANS A SIGNIFICANT REDUCTION IN FREIGHT MILES DRIVEN AND THIS HAS PRODUCED BOTH SAVINGS AND POSITIVE ENVIRONMENTAL BENEFIT RESULTING IN THE REDUCTION OF MORE THAN 2,000 TONS OF CO_2 EMISSIONS.

→ OUR CONSUMPTION OF POST-CONSUMER CURBSIDE COLLECTED GLASS BOTTLES HAS INCREASED SIGNIFICANTLY BRINGING THE NUMBER NOW RECYCLED TO MORE THAN A MILLION A DAY.

When we acquired Guardian Insulation, it dramatically increased our footprint in the United States. It brought the total number of locations up to 17 — six Glass Mineral Wool plants and 11 lamination facilities.

The new sites instantly doubled our North American footprint, bringing Knauf's energy-saving solutions closer to millions of customers.

This move underlined the Knauf Group's commitment to sustainable growth as their investment included the revitalisation of the acquired plants, integration of innovative technology and new processes which are delivering greater throughput while eliminating emissions of phenol and formaldehyde.

So, what happens now? The man in charge of implementing the next chapter in our American story is CEO Christopher Griffin.

In a wide-ranging conversation, he talks about the critical role of improved customer care, inspiring company motivation and his biggest priority of all: people, people, people.

What is your primary focus?

We need to deliver on our promises: both to our shareholders, and to our own people. The acquisition was a great time of change for our team in North America. I want us to focus on people, so that they understand Knauf Insulation is positioned for growth, and this is a place where they can put their faith in the future.

How will this be achieved?

Right now, we're working on a strategy that defines us as a leading force in the market—and the most profitable. This strategy will be meaningful to our customers and to our people. We need a vision where, whether you are driving a forklift or working in a plant, you understand how your job contributes to this aim. And this can't just be my aim, it has to be our aim. We need to build on this. People need to feel good about coming to work every day, because if people are motivated, they can find solutions to any challenge.

How do you accomplish future success?

The key to success is always people, people, people. That's both our own people, and our customers.

And what do you plan to do for customers?

The first thing I need to say is that a lot of our biggest customers tell us that we make the best Glass Mineral Wool products on the market. The second is that they really like our people. For any company to have one of these things is significant; to have both is remarkable.

We want to build stronger customer care for our North American business. Our plants have brand new equipment to help us make our great products. Now, I want our teams to have the best tools possible to take care of our customers.

How important is sustainability?

Sustainability is critically important, and will always continue to be. We are selling sustainability. We are selling energy-efficiency. But beyond our products, we are selling how we conduct ourselves. For example, when ECOSE Technology was introduced, it completely changed the industry and forced everyone to look at the role of formaldehyde in binders. Innovations like these are going to continue pushing us forward and setting us apart.

What do you see as a major future opportunity?

It's important to focus the majority of our energy on our core business, but constantly scan the horizon for the next disruptive technology that will benefit our customers. The market is continuing to evolve and digital is a vital part of that evolution. We have an opportunity to own the digital experience for our customers. I don't think anyone is doing that well, so if we can be brave, this could be a huge competitive advantage for us.

In what ways will digital provide an advantage?

Contractors operate on-site with their mobile phones and their tablets. They're able to place an order that comes to us automatically and we are then able to get that order fulfilled automatically. Digital allows for immediacy that can push us ahead in the market.

Beyond that, there's an opportunity to own online content, whether through do-it-yourself videos or interactive sites to discuss trends and share best practices. A customer should be able to engage with us across any channel they want. For example, if they want to call up a customer rep, great. If they want to access a product or spec online, great. We must be the easiest company for customers to deal with in any space. We have an opportunity to be bold.

What was your first job?

My first real paid job was teaching adults to sail on weekends. I was 14 years old, and a junior sailor of some note.

And you still sail?

Yes. I have a sailboat, and sailing is one of the ways I relax. I also like to spend time hiking in the desert or golfing when I can.

What is an important life lesson you've learned?

I've learned to really enjoy the journey. When I was young, it was all about the destination. I think I didn't enjoy myself enough along the way. There's a saying I like: *"In the long-term the pessimist may be right, but the optimist has much more fun along the way."*

Putting People First

Christopher Griffin, our new CEO for North America, discusses the importance of customer care, the possibilities of a new digital future and his first job as a sailing coach at the age of 14. So how will he navigate the company's U.S. future?

OLLOW THE LEADERS

From 2013 to 2015, we have seen a drop of 34% in Lost Time Accidents (LTAs) frequency rate from 14.4 to 9.4, putting us on track to meet our 50% LTA reduction target by 2020.

We are reinforcing our safety culture by making managers more accountable and employees more responsible.

Physical safety barriers play an essential role in our production processes, but the most important safety barriers of all are those we install in our minds.

Most accidents are system induced — the result of numerous triggers in the work environment — and these may range from processes not being clear to specific problems with plant and equipment.

So if an incident occurs, it's fundamental to ask, 'Why did that person act in a certain way?' The answer is often found in gaps of leadership and process.

34%
DROP IN LTAS IN TWO YEARS

To tackle this issue, we are making leadership more accountable and our employees more responsible. For example, a set of Life Saving Rules has been put in place, including full compliance with the Lock Out Tag Out (LOTO) requirement when working on powered / energised systems.

Further reinforcing this system of accountability, 'root cause analysis (RCA) investigations' of accidents are monitored by senior Health and Safety (HSE) teams with key findings and conclusions circulated throughout our company to avoid similar incidents being repeated.

To reinforce a positive change in safety culture and develop a collective state of mind, workshops have been introduced during which a trained facilitator takes participants through a number of 'expected behaviours' in the workplace.

In the first part of the workshop participants identify behaviours that need most improvement and in the second part they define solutions aimed at 'closing the gap'.

By the end of 2015, a total of 17 out of 30 plants had completed the 'HSE Expectations Gap Analysis Workshops' with all plants on track to complete the workshops by 2016. We aim to roll out refresher workshops every two years.

As well as a focus on lagging key performance indicators — such as the number of accidents — there is also a growing emphasis on 'leading' performance indicators such as the number of hazard spotting tours at our plants.

Performing these kinds of 'shopfloor audits' helps to establish an increasing level of safety awareness. In 2015 a total of 2,200 hazard-spotting tours were carried out across all our plants.

IVE BASIC STEPS TO BETTER SAFETY LEADERSHIP

"Safety has to be at the heart of everything we do. Behind every accident is an impact that ripples out from that injured person to their career, health, their families, friends and colleagues, the so called 'reflected cost' of an accident, and this cost can be very high. We must never forget this."

Jef Snackaert, Knauf Insulation's Group HSE Director.

1

Strengthening accountability

We have established Knauf Insulation's 'Life Saving Rules'. In case of a violation of any of these rules, an investigation will be launched and if substantiated, a red flag issued in the annual appraisal of the responsible supervisor, team lead and head of department.

Key point Managers will be held accountable for creating a workplace environment that allows workers to comply with the Life Saving Rules.

2

Discussing LTAs with executive management

In the case of a Lost Time Accident (LTA), the plant manager must discuss the findings of the incident investigation with our executive management within seven days. Plant managers must notify the Group Technical Director and the affected Regional Managing Director by phone within the first 24 hours.

Key point A monthly conference call with the HSE Performance Review committee has been established for managers to discuss LTAs that have occurred in the previous month.

3

Rewarding good safety performance

A plant that demonstrates positive safety performance will be rewarded. To reinforce this, HSE metrics — such as the number of hazard spotting tours or safety dialogues carried out annually — are to be factored into managers' personal objectives.

Key point Our culture of safety is reinforced by incentivising pro-active positive actions and behaviours.

4

Clarifying accident causes

In the case of LTAs our focus on 'root cause analysis' (RCA) incident investigation by site-independent investigators has turned up the heat on many plants — actions taken as a result of an RCA are circulated throughout the company to avoid repeat incidents.

Key point RCA training workshops for the entire company will be completed by the end of 2016. Regular RCA follow-up calls by key managers are now standard procedure.

5

Digging deep into data

HSE stresses the importance of on-time-in-full (OTIF) reporting of all data fields, such as the return date following an accident or the system causes. Our new Management Information System — OneKI Intranet — enables executive managers to more effectively 'dig deep' into data, identify trends and create action plans.

Key point OTIF reporting of the full data set allows setting the strategic direction of performance improvement actions.

SAFETY FIRST IN NORTH AMERICA

At our plants in North America five major initiatives are making a difference.

HAZARD SPOTTING TOURS

Plant staff and front-line supervisors are responsible for conducting hazard-spotting tours to identify workplace risks such as slips, trips, falls, electrical issues and exits. Results are tracked and findings monitored.

GUIDANCE TO PERSONAL SAFETY (GPS) PROGRAMME

This is a training/mentoring programme for individuals who have been involved in a Lost Time Accident (LTA), Recordable Accident, or other serious High Potential Incident as well as new employees or those who have had a major job change. The programme involves the employee and their supervisor reviewing safety topics, training, specifics of the safety handbook, conducting safety observations and other significant subjects.

OBSERVATION PROGRAMMES

Plant staff and front-line supervisors are responsible for conducting a minimum of 10 observations per month focusing on areas such as vehicle safety, personal protection equipment, ergonomics and manual handling among others. Typically these conversations are a minute long.

SAFETY SUMMIT

In 2016 a Safety Summit with all plant managers, HSE managers, regional HSE, VP Manufacturing and the CEO gathered for a day to discuss what was working well and areas in need of improvement.

SAFETY AUDITS

Safety audits are now incorporated into the facilities' improvement methodoloy 6S which maintains workplace order.

SPOTLIGHT ON INNOVATION

Colleagues at our Krupka plant are rewarded with 'points' for innovative new ideas that can be implemented at the plant.

The best idea receives a cash prize and 15% of the money saved as a result of the innovation is given to community projects. In 2015 this added up to a new bus shelter and Petr Bohuslav, Plant Operator, was voted Innovator of the Year.

In 2015 a total of 47 innovations were submitted including — for the first time — health and safety initiatives.

Here's what our colleagues had to say about safety at the plant.

Vladimir Prusa, Storeman *: "I started suffering shoulder strain while off-loading products in the warehouse. So, I worked with my shift leader to find a better solution and we introduced simple rollers. The whole process is now faster and easier."*

Jiri Watzek, Technician*: "Our reporting culture at Krupka is very important. All accidents are immediately reported and even the smallest incidents are recorded because it helps prevent bigger problems. The rules are clear and everyone knows them."*

NEW LTA RECORD

Our Tyumen plant in Russia has achieved an incredible thousand days without an LTA. The record was celebrated in June 2016 and the plant's HSE & System Manager Elena Zelentsova said Tyumen's success was as a result of effective trainings, regular HSE meetings, plant forums, safety dialogue discussions and the introduction of behaviour-led hazard spotting tours, a permit-to-work system and ensuring RCAs for every incident.

COMMUNICATION IS KEY AT NOVI MAROF

Our Novi Marof plant has achieved major success in reducing its lost time accident frequency rate to 3.3 in 2015 from 6.8 in the previous year, and 9.5 in 2013.

HSE Manager Snjezana Janusic says health and safety risk assessments were introduced at Novi Marof three years ago bringing together all employees for safety workshops — a process reinforced by root cause analysis following any incident.

"We also started regular motivation talks between managers, shift leaders and shop floor workers in an area designated as safety corner," says Snjezana. *"We carried out 87 talks in June 2016 alone."*

CLOSING THE LOOP

At Knauf Insulation we are constantly working towards doing more with less, better

From cutting waste and reducing energy use to saving water and using recycled materials in our products, we are committed to ensuring that our solutions are produced using the least amount of resources possible.

Such initiatives are also driving the European Commission's new Circular Economy Package (CEP) — an action plan of proposals for policy makers with a focus on "closing the loop" through greater recycling and re-use by extracting "maximum value and use from all raw materials, products and waste".

At Knauf Insulation closing the loop by doing more with less is an on-going process. For example, the CEP has called for an "ambitious long-term vision to reduce landfill". At Knauf Insulation we set a high target of zero waste to landfill by 2020 and since 2010 we have already achieved a reduction of 58%.

The CEP has also stressed that the use of "cascading renewable resources" needs to increase. At Knauf Insulation our Glass Mineral Wool with ECOSE Technology is mainly derived from rapidly renewable materials while our binder is bio-based and contains no added formaldehyde, acrylics or dyes.

And significantly the CEP has highlighted the importance of maximising products at every phase of their life "from production and consumption to waste management".

At Knauf Insulation we believe that providing forensically detailed lifecycle information about our products — from extraction, use and disposal — through Environmental Product Declarations (EPDs) gives a more accurate picture of their environmental impact and opportunity to reduce it. We now have certified Environmental Product Declarations for more than 85% of our Glass Mineral Wool products and 60% of our Rock Mineral Wool range.

MANUFACTURING

Since our baseline year of 2010 we have reduced energy use by **17.5%** and decreased waste to landfill by **58%**. At the 2015 halfway point to achieve the objectives we set ourselves for 2020, we have already reached our target of cutting water discharge by **50%**. To see how we accomplished these reductions see pages 58 to 63.

RAW MATERIALS

Our Heraklith Wood Wool plants have used raw wood material that has been responsibly cultivated and harvested in line with the European Programme for the Endorsement of Forest Certification (PEFC) for many years. We now also use Forest Stewardship Council (FSC) woods. FSC is an internationally renown labelling scheme recognised by the LEEDv4 Building Rating System.

RECYCLING

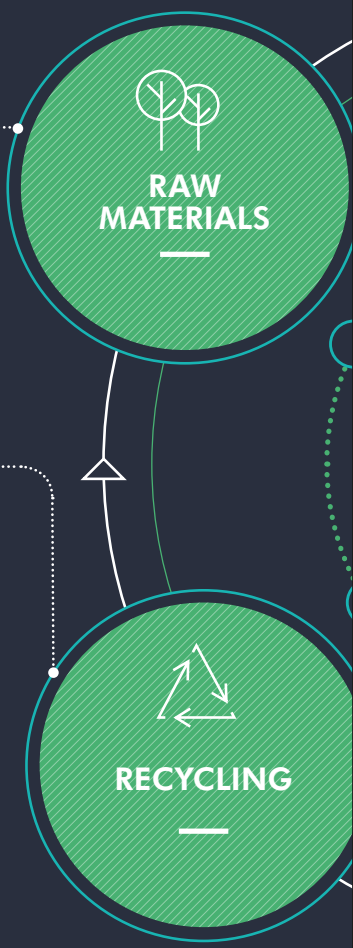
Our Glass Mineral Wool is made from up to **80%** of recycled glass such as window glass and used bottles. Up to **22%** of our Rock Mineral Wool at our Nova Bana plant is made from external recycled material and a further **35%** of waste materials from our Rock Mineral Wool production lines are fed back into the system for reuse.

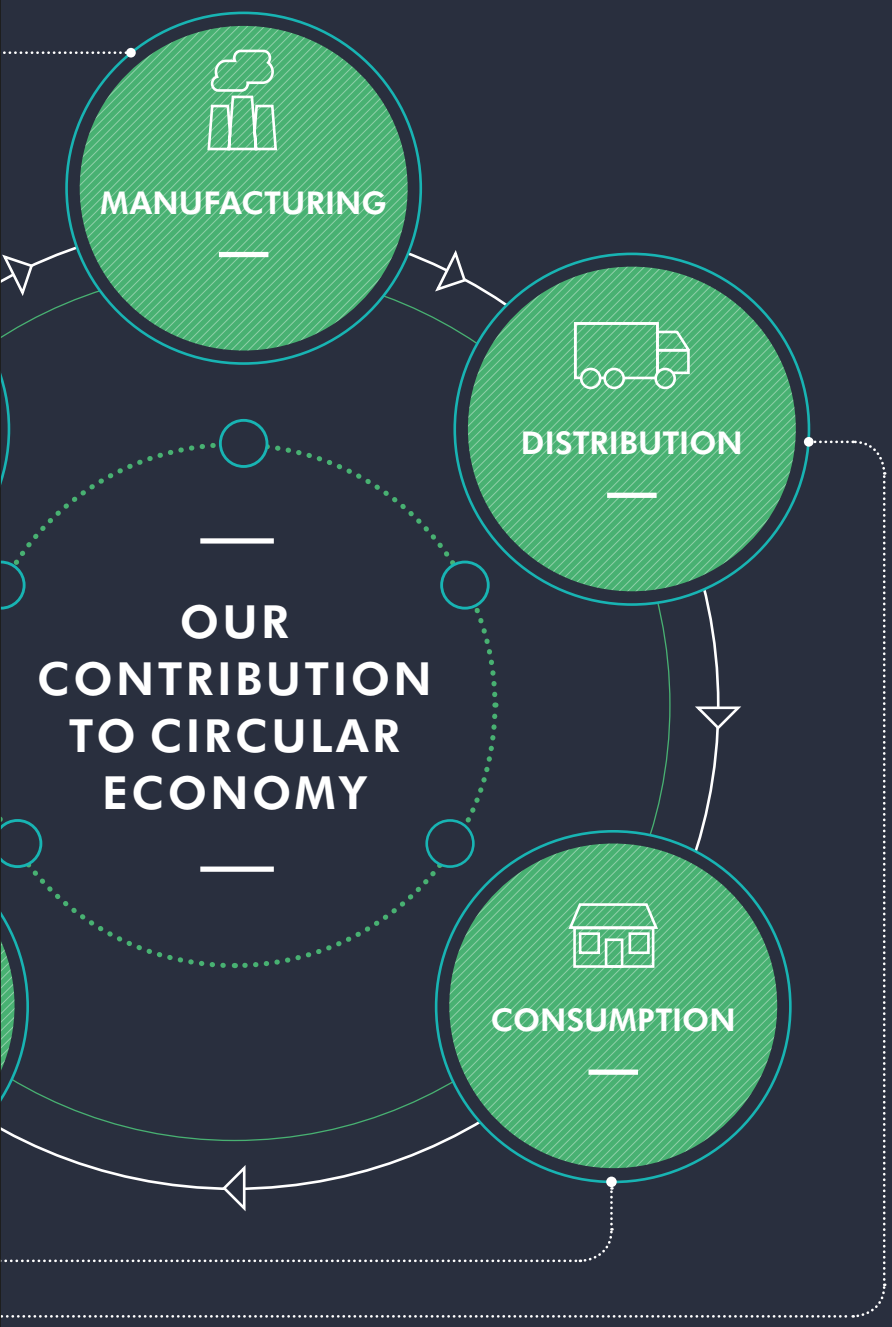
CONSUMPTION

In 2014 we started wrapping our products in thinner film reducing consumer waste by **27%**; at Technical Solutions we are minimising packaging at construction sites by delivering in bulk. We also avoid unnecessary installation waste with our FRICTION FIT products for pitched roofs which are designed to be precisely cut to fit any required space.

DISTRIBUTION

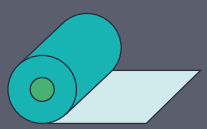
We transport more product per trip. For example, **5,760m²** of 50mm Mineral Plus can be delivered in one **80m³** truck. The same amount of traditional Rock Mineral Wool would require **3.6 trips**. In the Czech Republic we switched from road to rail logistics and saved **424 tons** of CO_2 equivalent in the first 15 months of operation.





ISO STANDARDS

As a responsible manufacturer, we have four of the most important International Management Standards for sustainability; ISO 9001 (Quality Management), ISO 14001 (Environmental Management), ISO 50001 (Energy Management) and OHSAS 18001 (Health and Safety Management). We also make sure that our suppliers are all certified ISO 14001.



POWER OF EFFICIENCY

Today a unit of energy used to manufacture a typical Glass Mineral Wool product saves

570 units in its 50-year use phase.

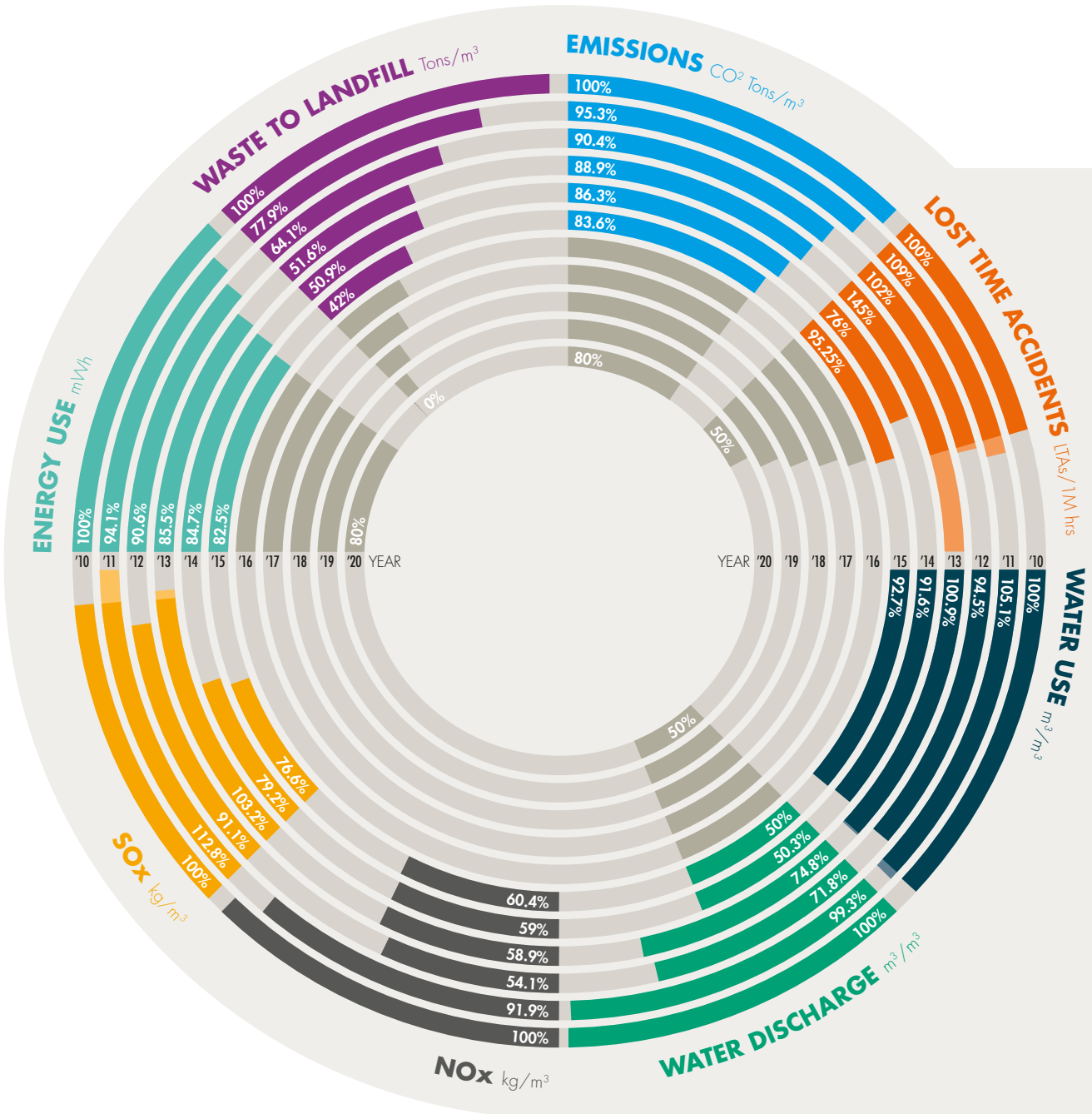
In 2008 one unit saved

489 units

That's

16% more today compared to seven years ago.

ON TRACK FOR SUSTAINABILITY SUCCESS



This Sustainability Report relates to Knauf Insulation, part of the Knauf Group. This report refers to data from 2015 and activities from 2015 and 2016 and for accuracy we may amend previous figures to new definitions. The data provided are now as comprehensive as possible following our 2014 acquisition of new Glass Mineral Wool plants in the U.S. The welcome addition of five more sites increased our global number of plants by 20% to 29 and led to a massive two-year integration programme of monitoring and project implementation to improve our sustainable practices in North America.

At the halfway point of our sustainability journey to meet the 2020 objectives we set in 2010 we are pleased to report striking successes.

Since our baseline year we have reduced energy use by 17.5%, cut CO_2 emissions by 16.4% and our water management has become so effective that we have already achieved our 2020 target of cutting discharge by 50% compared to 2010.

Waste to landfill, meanwhile, has been reduced by 58% compared to 2010 with a decrease of 17.5% in 2015 compared to 2014.

In fact, 2015 was a major landmark on our journey to zero waste to landfill with two of our Rock Mineral Wool plants reporting zero waste and many of our Glass Mineral Wool sites marking significant reductions, in some cases up to 20%.

We are also on track to reduce the number of Lost Time Accidents (LTA) by our target of 50% after a dramatic reduction of 34% in 2015 compared to 2013.

With NOx and SOx emissions we have also seen improvements as a result of new technology and processes. Against our 2010 baseline NOx emissions are down by 39.6% and SOx reduced by 23.4%.

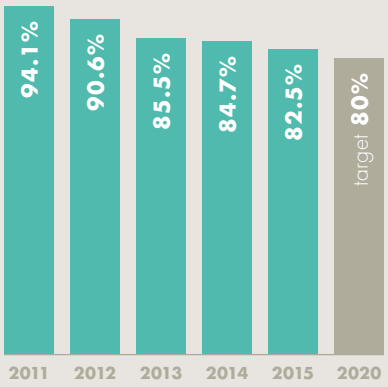
"2015 is a milestone year for us because it is the mid-way point on our 10-year journey to our 2020 targets," says Philippe Coune, Group HSE, Performance & Sustainability Manager, Knauf Insulation. *"We have come a long way in just five years. Today everyone understands the importance of sustainability, everyone is aware of the importance of energy efficiency, saving waste and lowering the number of lost time accidents. The next five years will be a great opportunity to build on this awareness and achieve even greater success."*

OUR SUSTAINABILITY GOVERNANCE

THREE OBJECTIVES	NINE LONG-TERM AIMS	TARGETS AND PROGRAMMES
BE RECOGNISED AS A RESPONSIBLE MANUFACTURER AND EMPLOYER	**Zero carbon production**	A 20% reduction target by 2020
	Zero negative impact on resource use	A mid-term target of substituting resources for those with a less negative impact on resources use as identified through Life Cycle Assessment, towards eco-design
	Zero waste to landfill	A target completion by 2020
	Zero waste water discharge (from production)	A mid-term 50% reduction target by 2020
	Zero harm	A 50% reduction by 2020
	Strongest Triple-E sustainable people strategy	To continue implementation of the Triple-E sustainable people strategy starting with best practice sharing programme
PRODUCTS RECOGNISED AS BEST IN CLASS IN TERMS OF SUSTAINABILITY	**Products best in class for sustainability**	To be in a knowledge position that contributes to a product offering that is right to improving the sustainability of the built environment through the LCA Programme
BE RECOGNISED FOR CHAMPIONING ENERGY EFFICIENCY IN BUILDINGS	**Leading advocate**	To ensure a robust regulatory framework for delivering low energy new build, mandatory renovation of buildings and mandatory real performance of buildings by 2020 through capacity building, informing the business and advocacy
	Zero carbon building stock	20% reduction of CO_2 from our building stock by 2020 through internal building programme

ENERGY
POWER SHIFT

Upgrading machinery, investing in new technologies and constantly ensuring energy awareness is part of daily life have cut our energy use by 2.6% in 2015 compared to the previous year.



ENERGY USE mWh

KRUPKA, CZECH REPUBLIC

We have reduced energy use by 17.5% compared to our 2010 baseline putting us firmly on track to meet our 2020 objective of reducing energy use by 20%.

"We have looked at best practices in plants and replicated them," explains Berin Onur Knauf Insulation's Group HSE Manager, Systems, Processes and Energy. For example, we have the same approach for compressed air leakages — which equate to energy loss — and we implement a process that checks and fixes leaks in every plant now. We are introducing best practices across plants, for example when it comes to glass cullet.

"Additionally, we have regular hazard spotting tours and always include energy efficiency in the process. Just as Health and Safety is the responsibility of everyone, not just the HSE manager, energy efficiency is also everyone's responsibility."

Driving this awareness has been improved teamwork and highly competent energy managers in the plants, a technology focal point in Glass Mineral Wool who pushes actions that can be duplicated and investment in new technology where necessary.

LOCAL INITIATIVES

KRUPKA, CZECH REPUBLIC

The furnace at our Glass Mineral Wool plant in Krupka has been given a multi-million-euro refurbishment.

"Knauf Insulation is committed to installing the best available technology and this new furnace represents the best the industry has to offer," says plant manager Jan Brázda. The new furnace uses less energy than the one it replaces — below 800kWh per tons of molten glass compared to 10% higher previously — and it is expected to achieve a target melting performance per square metre of the furnace footprint of 10,600 tons rather than 9,000 before.

ESKISEHIR, TURKEY

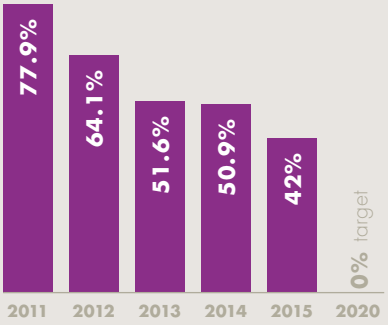
Our site in Turkey was voted Knauf Insulation's Best Improving Plant. Energy Leader Esat Özdemir says the success was down to teamwork. *"We have a great team here that aims to be more successful every day and a management that supports our development,"* he says. *"This sector was new for me and the energy targets were major challenges, but we never gave up improving."*

ARTIX, FRANCE

Laurie Vanicatte was voted Best Performing Energy Manager for 2015. *"We did not implement spectacular new projects or make major changes that required investment,"* explains Laurie. *"Rather we focused on staff awareness and the fight against waste. Even without capital expenditure you can make a major difference by communicating with teams and implementing simple ideas that can make a big difference."*

TARGET ZERO

2015 was a landmark year for our Rock Mineral Wool plants at Novi Marof in Croatia and Surdulica in Serbia with both reporting zero waste to landfill.



WASTE TO LANDFILL Tons/m³

Our plants in Novi Marof and Surdulica both achieved zero waste to landfill and this contributed to an overall reduction of 17.5% compared to 2014 — and 58% compared to a 2010 baseline — continuing the downward trend toward our target of zero waste to landfill by 2020.

So, what made the difference? A combination of training, improved processes and investment resulted in a major reduction in the amount of 'edge trim' sliced from the Rock Mineral Wool as it passes through the system, says Robert Agnic, Plant Support & Process Development Manager RMW Europe.

"For every centimetre of edge trim saved, an extra proportionate amount of recycled material can be added without compromising the quality of the final insulation. This has contributed significantly to the zero waste to landfill achievement of 2015."

Also contributing to our 2020 target has been an improved separation of the different components that contribute to waste and better crushing techniques. This has meant that more waste materials than before can be incorporated into the creation of reusable 'briquettes'.

Other initiatives that have helped 'close the loop' include the reuse of tons of process dust 'fly ash' that accumulates in cupola filters — rather than sending to landfill. During 2015, waste as fly ash dust from our Rock Mineral Wool plants was reduced to zero adding up to a total saving of 7,000 tons of waste for the year.

Surdulica and Novi Marof now join our UK plants at Queensferry and St Helens in contributing zero waste to landfill.

LOCAL INITIATIVES

SHELBYVILLE, U.S.

Our Shelbyville plant in North America that manufactures pipe Glass Mineral Wool has been able to maintain a 95-97% landfill reduction since 2012. This has been achieved through strong relationships with partners who take by-products from our manufacturing process and transform them into alternative products that can be sold.

VISÉ, BELGIUM

Our Visé plant has cut waste to landfill by 20% from 2014 to 2015 and is on track for similar reductions year on year for 2016. The plant reduced the by-product rate by 15% from 2014 to 2015 then improved classification processes were implemented to sort waste into clearer categories. Finally, to eliminate landfill made up of Glass Mineral Wool and quality by-product, HSE and production launched initiatives to improve the valorisation of by-product. Facing on leftover wool was removed to create 'valorised waste' that could be sold as raw material.

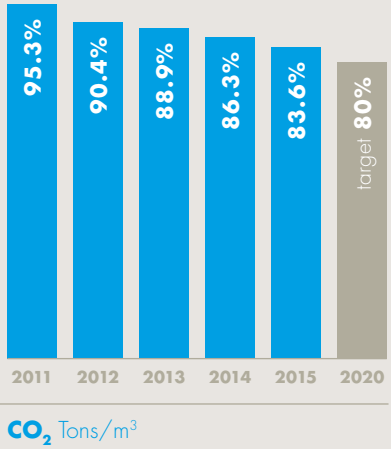
NOVI MAROF, CROATIA

In addition to improving processes and introducing a new briquetting system, regulation played a crucial role in reducing waste at Novi Marof. Under new Croatian legislation, certain waste types could be certified as by-product and reused. The plant successfully achieved certification for this waste following detailed laboratory tests and now the material can be reused.

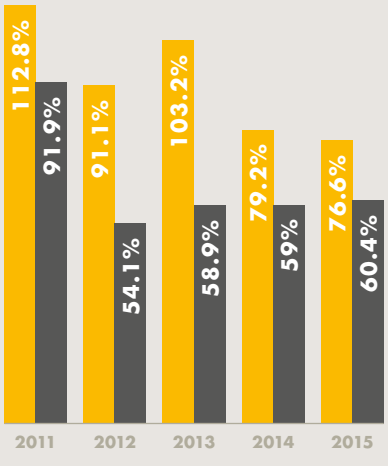
VISÉ, BELGIUM

EMISSIONS MISSION

We continue to make excellent progress in reducing emissions.



CO_2 Tons/m^3



SOx Kg/m^3 NOx Kg/m^3

More energy efficient technologies and greater awareness of energy efficiency have played a major role in reducing our CO_2 emissions by 16.4% compared to our baseline year of 2010. During the same period our NOx emissions are down by 39.6% and our SOx emissions by 23.4%

With a 2020 CO_2 target of 20% fewer emissions than in 2010 and with five more years to go, we are on track to meet our objectives.

The CO_2 reduction in 2015 is a tribute to the hard work of every individual plant. Our CO_2 emissions are closely linked to energy use and a series of energy-saving initiatives — such as replicating best practices, improving processes and checks, investing in new technology and reinforcing behaviourial change — have had a significant impact across our plants.

Additionally, all our Glass Mineral Wool and Rock Mineral Wool plants in the European Union are included in the European Emissions Trading Scheme — a system that regulates the plants and their CO_2 emissions as they are gradually reduced.

Although we do not have 2020 targets for emissions of nitrogen oxide (NOx) and sulphur oxide (SOx), we monitor them carefully. European Union regulation and standards are set to shrink NOx and SOx emissions by 55% and 50% respectively by 2040 — helping all business in Europe improve their processes. However, the International Energy Agency (IEA) has called on the EU to cut these emissions by an additional 15% to prevent 50,000 pollution related deaths by 2040.

At our plants NOx is linked to energy use and as we have improved our energy efficiency we have seen these emissions stabilise. In 2015 we saw their percentage increase by 2.4% compared to 2014, the year we acquired new plants. In line with new plans and actions, we expect a slight decrease in 2016.

As far as SOx emissions are concerned we have seen a drop of 3.3% from 2014 to 2015. SOx emissions are mainly caused by the use of recycled material at many of our plants. As we have improved the quality of these materials along with new technologies we have seen a decrease.

LOCAL INITIATIVES

CWMBRAN, UK

In just a year, an energy management system pilot project at the plant led to major improvements and Femi Olatunji was voted our Best Starter Energy Manager in 2015. *"To deliver on objectives I worked closely with colleagues outside my plant, learning from them and picking up any skills I could use to improve my ability as an energy manager."*

NOVA BANA, SLOVAKIA

By introducing more efficient ways of using raw materials, CO_2 emissions were reduced dramatically at Nova Bana with the site voted Best Plant in our Energy Awards.

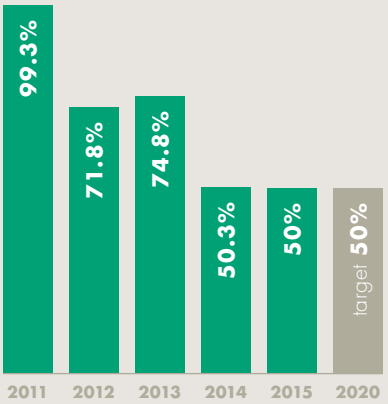
Miloš Plechlo, the plant's Energy & Automation Manager, said: *"There were clear targets and communication about energy awareness particularly in the light of the implementation of the ISO 50001 Energy Management System. We focused on the biggest energy consumers, had a lot of validated measuring points for all energy types and also focused on PLC/SCADA programming skills."*

ST EGIDIEN, GERMANY

At our St Egidien plant CO_2 emissions have been cut by 16% from 2010 to 2015 and during the same period energy consumption has been reduced by 13.4%. Driving this success forward in 2015 were initiatives such as a comprehensive maintenance drive to reduce leaks and the installation of new systems.

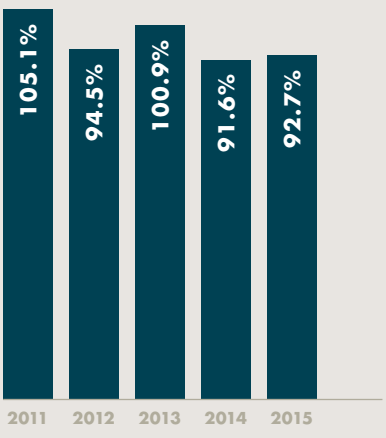
TARGET ACHIEVED

In just five years we have achieved our first 2020 sustainability target — water discharge across Knauf Insulation has been cut by 50%.



WATER DISCHARGE m^3/m^3

ST HELENS, UK



WATER USE m^3/m^3

Although we only discharge relatively small amounts of water we have recorded significant successes in 2015 and these have contributed to the fall of half compared to our 2010 baseline.

"It is also a major tribute to everyone at our plants that we have achieved our first 2020 target in just half the time we anticipated," says Philippe Coune, Group HSE, Performance & Sustainability Manager, Knauf Insulation.

As far as water use is concerned only minimal amounts are used in production, however we have seen an increase of 1.3% from 2014 to 2015 as a result of our recent acquisition of new plants in North America.

Still, the 2015 figure marks a significant 7.3% reduction against our baseline year of 2010.

About two-thirds of the water consumed by our plants is used for cooling — to take energy out of the system — and the remaining third is used for binder mixing, a percentage that cannot be changed.

LOCAL INITIATIVES

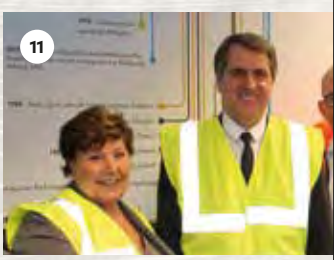
ST HELENS, UK

Foul sewer discharge at our St Helens plant has been cut by almost half to an average of 800m^3/per month following a rebuild at the plant that was completed in August 2015. Prior to the rebuild, the discharge averaged 1,500m^3/pm. Data for 2016 shows even further reductions in foul sewer discharge with only 40m^3 discharged in June after zero discharge in July and August 2016. Behind the dramatic transformation has been improved wash water control technology and new equipment installed during the rebuild. As our colleagues at the site have become more expert at managing the new wash water process, significant foul sewer discharge figures continue to be achieved which is a win-win for everyone. Energy used to treat the water is conserved, less water is wasted and significant cost savings are achieved.

NOVA BANA, SLOVAKIA

Following detailed analysis of spinners cooling water treatment process, the Knauf Insulation Process Excellence (KIPE) improvement project has been implemented in Nova Bana which resulted a significant reduction of potable water consumption (-20%). In addition, up to 90% of waste water produced by our water treatment process is reused in plant as technological (process) water.

COMMUNITY NEWS



1 'TRY MY JOB' IN VISÉ PLANT

If you want to gain greater insight you need to change perspective — that's been the thinking behind our 'Try My Job' experience that allows colleagues to swop jobs for a day. Since it was launched in 2015, more than 40 people have temporarily moved to another department with Visé in Belgium the latest to enjoy the initiative.

Feedback from those who have enjoyed the experience has included: *"I learned a lot technically"*, *"We see what other colleagues are facing"* and *"I would make it compulsory"*.

2 HISTORIC DONATION TO U.S. MEDICAL FOUNDATION

CEO of Knauf Insulation Mr Thies Knauf and Knauf Insulation were happy to contribute to the well-being of the community in U.S. with a donation to the new Medical Center in Shelbyville, North America in January 2016. The donation will help to support the construction of the new facility. *"This is our most visible recognition opportunity and we are thrilled to attach the Knauf name to it,"* said Angela Gill, executive director of the hospital foundation.

3 KNAUF INSULATION UKRAINE ENERGISES FUTURE INNOVATION

Knauf Insulation Ukraine is helping students develop the energy saving innovations of the future by supporting the annual Energy Management Student Olympiad at Kiev Polytechnic Institute. At the most recent event, 45 students and teachers from 11 Ukrainian universities took part with the winning teams praised for their work in electrical technology and heat power engineering.

4 DRAWINGS COMPETITION IN RUSSIA

Children of colleagues at Stupino in Russia were invited to draw a picture of their ideal job at Knauf Insulation following the success of a previous art competition that focused on sustainability. The competition was followed by a plant open day for the youngsters and their families and a calendar was printed featuring the children's work.

5 SIMBACH WELCOMES PARLIAMENTARY STATE SECRETARY

Energy efficiency policy was top of the agenda during a visit to our Simbach Wood Wool plant by Florian Pronold MP, Parliamentary State Secretary of the Federal Minister for Environment, Nature Conservation, Building and Nuclear Safety. Among the topics of discussion was the upcoming merger of the Energy Saving Ordinance and the Renewable Energies Heat Act.

6 TOUGH MUDDER IN AUSTRALIA

Fitness fanatics from Knauf Insulation Australia have battled through 500,000 litres of mud, 40 tons of ice and 25 'death defying' obstacles to complete one of the toughest team events in the country. The Tough Mudder event features obstacles such as Mud Mile, Arctic Enema and Everest 2.0 and covers a gruelling 20km course. By all accounts, our fitness heroes emerged from the physically and mentally demanding event as 'a strong and supportive team'.

7 SERBIAN EARTH HOUR

Our colleagues at Surdulica in Serbia participated in Earth Hour by switching off all external lighting and street lights for an hour on March 19. More than 10.4 million people across 172 countries took part in the event which is organised by the World Wide Fund for Nature (WWF) and took the theme #ChangeClimateChange!

8 CZECH PRIME MINISTER VISITS IN KRUPKA PLANT

In July 2015 Knauf Insulation welcomed Czech Prime Minister Bohuslav Sobotka and Michaela Marksová-Tominová, Minister for Labour and Social Affairs to our plant in Krupka, Czech Republic. They were accompanied by a delegation from the government as well as local political representatives from the Krupka region. The visit marked the 10th anniversary of the Krupka plant, one our most modern and efficient Glass Mineral Wool manufacturing facilities thanks to a recent rebuild and modernisation programme. Discussions revolved mainly around energy efficiency in buildings and the energy savings potential of new buildings and renovations in the Czech Republic.

9 SURDULICA'S DECADE OF SUCCESS

Our Surdulica plant in Serbia — acquired by Knauf Insulation in 2005 — has celebrated 10 years of success. The plant is the only Mineral Wool producer in Serbia and in 2015 it managed to exceed its projected capacity by producing a new record of more than 46,000 tons of Rock Mineral Wool. In 2016 the plant also celebrated another landmark achievement with the introduction of ECOSE Technology to its Rock Mineral Wool.

10 KRUPKA'S LANDMARK BIRTHDAY

Social events, sports competitions, theatre shows and a concert were held for our colleagues, their friends and families to mark the 10th anniversary of Knauf Insulation's Krupka plant in the Czech Republic. The plant is one the most modern Glass Mineral Wool plants in Europe and in 2009 introduced our innovative ECOSE Technology.

11 LEADING POLITICIANS TOUR UK PLANTS

Labour MPs Steve Rotheram and Marie Rimmer visited our plant in St Helens. This was part of Steve's on-going commitment to supporting businesses in the six boroughs of Liverpool. He is a candidate to be the next Mayor of Liverpool and plans to tackle fuel poverty and home energy efficiency issues. Steve said: *"It was great being shown around and to see all of the work Knauf Insulation do to champion energy efficiency. It's brilliant to see such an impressive manufacturing plant so close to home. Knauf Insulation recognises the need for greater measures to tackle the problems that the country has with energy efficiency in the home."*

Meanwhile, at Cwmbran, our colleagues welcomed Torfaen County Borough Mayor, Giles Davies, who took a tour of the plant to learn about our strong ties with the local community.

"At Cwmbran we have always employed local people and we've made great strides to ensure we function sustainably and that our manufacturing processes are as energy efficient as possible," said plant manager Darren Holt.

WORKING TOGETHER ON SOLUTIONS

Knauf Insulation being part of Knauf Group, we work together to deliver systems and complete solutions for buildings worldwide. Recently we initiated a roundtable with policy-makers and industry leaders to offer expertise to tackle Europe's migrant housing crisis.

Conflicts in Syria, Iraq and Afghanistan have lead to an unprecedented number of migrants and refugees crossing into Europe.

The influx of such vast numbers has created unique challenges for many countries but at the heart of the situation is the most fundamental challenge of all — finding these people a place to live after they have received a residence permit to stay.

To help tackle this issue, Knauf and Knauf Insulation brought together German policy makers and leading industry expertise for a roundtable discussion to examine possibilities offered by innovative modular constructions — lightweight, well-insulated wooden homes that can be built quickly, easily and in large numbers.

These sectional prefabricated houses consist of multiple modules and can be built in production plants before being easily assembled at building sites. Since high quantities can be digitally planned and produced to high standards, the costs of prefabricated houses are estimated to decrease as their quality is expected to increase. From the beginning, the highest energy efficiency standards within the building's envelope can also be applied. In this respect, modular constructions can disrupt the construction sector and provide reliable alternatives within wooden frames.

"At present many migrants and refugees are still being housed in public buildings such as gyms or in steel shipping containers which are often imported at great expense," said Mr Manfred Grundke, Managing Partner of the Knauf Group. *"At Knauf we believe that high quality modular constructions built in Germany offer a more humane and flexible option. That is why we brought together partners in the industry to present possible solutions."*

Demand for new ways to house migrants and refugees has grown considerably in recent years as the authorities struggle to create alternatives to controversial improvised camps that have sprung up all over Europe.

The roundtable was hosted at the Federal State Representation of Bavaria in Berlin and included national and regional politicians as well as key management from Knauf Gips, Knauf Insulation and specialists from leading German timber companies, which are all close partners of the Knauf Group. During the discussions, a range of modular building possibilities was presented by different partner companies as well as by Mr Grundke.

A few weeks after the roundtable, the German Building and Environment Ministry hosted a major exhibition in which a section was exclusively dedicated to showcasing potential modular home solutions that could also be used for migrant housing.

During the exhibition Federal Environment Minister Dr Barbara Hendricks visited the Knauf stand to discuss possible solutions by the company. Knauf's prefabricated home proposals would be insulated with Knauf Insulation Blowing Wool, made from prefabricated walls, ceilings and floors and could be constructed in less than a day.

The event was followed by a fact-finding trip by Dr Hendricks to Japan, a country that is at the cutting edge of modular building trends. Christoph v. Speßhardt, Knauf's Director of Public Affairs in Germany accompanied the minister as head of the economic delegation.

Housing and issues of integration for migrants and refugees continue to be at the top of most European countries' political agendas with 1.3 million asylum claims made in Europe in 2015. Germany has received more than 476,000.

"The possibilities of modular building offer an affordable, flexible and comfortable solution that would provide many vulnerable people with their first real home in years," concluded Mr Grundke.

Your voice!

Let us know your comments or email us your questions at sustainability@knaufinsulation.com

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www.knaufinsulation.com/en/sustainability

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Dallas, TX ●
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Greenville, SC ●
Inwood, WV ●
Jackson, MS ●
Kingman, AZ ●
Lanett, AL ●
Macedonia, OH ●
Marshfield, WI ●
Scotia, NY ●
Shasta Lake, CA ●
Shelbyville, IN ●
Sioux Falls, SD ●
Stockton, CA ●
Wright City, MO ●

Cwmbran, WAL ●
Queensferry, ENG ●
St Helens, ENG ●

Lannemezan ●

Visé ●

Oosterhout ●

Simbach Am Inn ●
St Egidien ●
Bernburg ●

Ajdovščina ●
Skofja Loka ●

Krupka ●

Novi Marof ●

Zalaegerszeg ●

Nova Bana ●

Surdulica ●

Eskisehir ●

Abu Dhabi ●

Stupino ●
Tyumen ●

● Mineral Wool
● Wood Wool
● Lamination
● Fabrication Shop

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