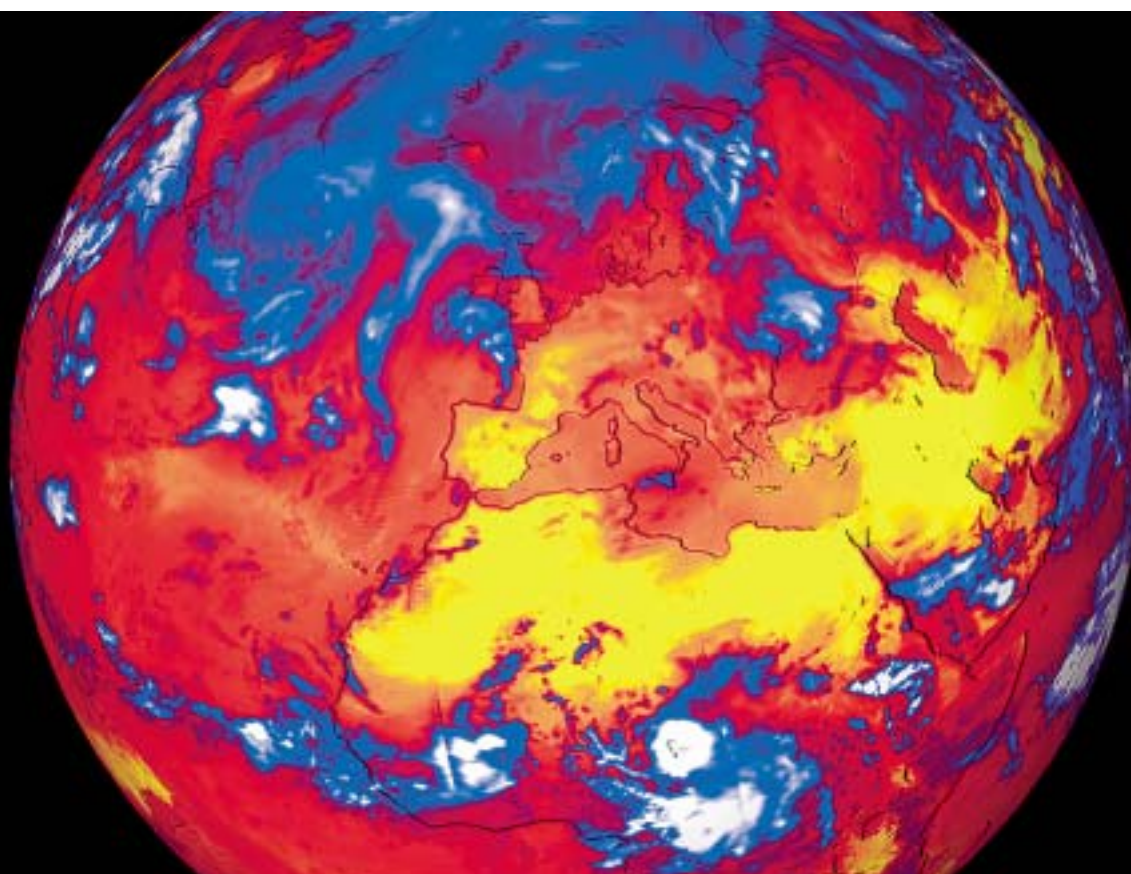


Environment 2005



**ROCKWOOL®**  
F I R E S A F E I N S U L A T I O N

Make a difference!

**Eelco van Heel**  
CEO  
The Rockwool Group



Energy is a hot topic these days. A sharp rise in fuel prices once again highlights the fact that a sure supply of cheap energy – a crucial factor in modern society - is uncertain in the future.

How long will the resources last? There is no easy answer to this question. But it is undisputed that fossil fuel reserves are limited and that their use has a number of negative side effects including poorer urban air quality and rising CO<sub>2</sub> levels. There is more than enough reason to act.

For many years the Rockwool Group has worked to encourage energy efficient buildings. To many people it comes as a surprise to learn that buildings are society's largest energy consumers and CO<sub>2</sub> polluters. They are responsible for over 40% of the energy use in Europe and North America, with heating and cooling as the biggest items.

Even fewer people realise that we can reduce energy use for heating buildings by up to 90%. Saving energy could actually save money, CO<sub>2</sub> and even create jobs!

Providing cleaner and better buildings should be at the top list of any politician seriously interested in our energy future. They can make a difference by introducing stricter energy efficiency demands for both new and old buildings.

To move the process forward, the Rockwool Group has engaged in a number of construction and renovation projects. These energy efficient building solutions demonstrate to the authorities, house owners and building professionals that the expected savings are both a reality and easily achievable. The documentation is here. You can read more about it in this report – and hopefully get inspired to make a difference. There is no reason to wait.

### **Own house in order**

What do we at the Rockwool Group do to secure the environmental standards of our own products and production facilities?

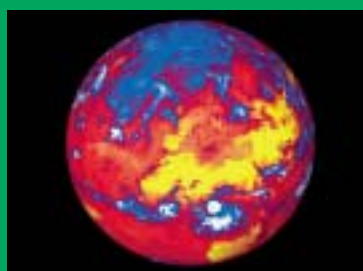
Building our activities on scientific information is a key value. Thorough lifecycle assessments document the overall positive environmental impact of Rockwool insulation. The negative environmental impact of producing insulation (e.g. energy use and CO<sub>2</sub> emissions) typically represents less than 1% of the positive environmental benefits derived from the use of the product.

Rockwool environmental management has won many green awards over the years. These skills produce very convincing results in the factories that we have acquired, not least in Eastern Europe. With Rockwool know-how and investments, we typically reduce the resources needed to produce one unit of insulation by 50%. In 2005 our Canadian subsidiary, Roxul Inc. in Milton, won a prestigious green award.

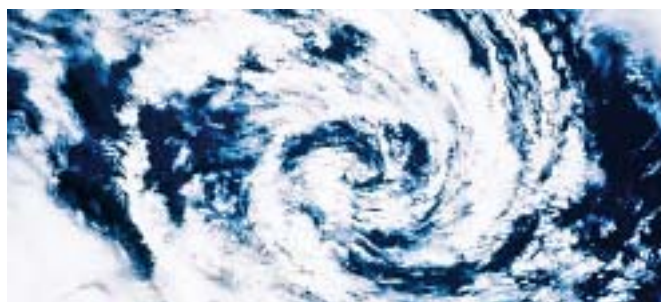
Environmental responsibility is vitally important. It requires action from us both as individuals, and as a company. If we want savings on our energy bills and a cleaner more sustainable life for millions of people, we must act now.

Eelco van Heel  
September 2005

**Cover page:** Global warming. A thermal image of Earth shows the Sahara's high temperatures spreading north, engulfing Europe in a heat wave in August 2003.



Buildings are the biggest energy consumer and CO<sub>2</sub> polluter. Every year energy waste worth €102 billion and some 400 million tonnes of CO<sub>2</sub> pollution could be saved cost effectively. And some 300,000 jobs created in Europe alone. It's time for action!



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## Why save energy?

Energy is the cornerstone in the evolution of mankind. The discovery of how to make fire, the steam engine, making use of oil – all have improved the standard of living for billions of people.

We have become dependant on cheap fuels. Most of our energy, some 86%, comes from non-renewable sources.

The world's energy consumption is growing. But our access to cheap energy is declining. Our energy inefficiency makes us vulnerable to soaring energy prices. The hardships do not seem to become less severe in future. Within only a few generations we will have depleted most of our key energy resources to a bare minimum. To extract the last remnants, it will take more energy or more money than they actually contain.

### Energy supply – how safe, how cheap?

Energy power and pricing power is being concentrated in fewer hands, some in politically unstable regions. 80% of the world's 64 largest oil producing nations have peaked and are facing declining production.

The volatile, high energy prices feed the anxiety that energy demand can actually begin to outstrip the supply capacity for 'the black gold'.

Most of the oil reserves lie in just four countries. This makes the safe and cheap energy supply, on which we rely, sensitive to even small technical or political disturbances.

### Better to save than burn more

Without electricity all activity in modern society stops. Electricity blackouts are no longer restricted to poor countries. They can also paralyse 'developed' countries.

Should we build extra power plant capacity and burn more energy to prevent electricity shortages? New power plants and distribution networks cost billions of dollars and take years to build. They also make the problem of dwindling and more expensive reserves of fossil and nuclear fuels far worse.

Preventing energy waste in the first place is both more economical and more sustainable. According to the EU Commission it will cost 50%-400% more to produce an extra kilowatt of electricity than to save it.

### Environmental relief

Burning less fossil fuel also has crucial environmental benefits. Energy savings are absolutely essential if we want to reduce air pollution and global warming.

Recent research from the respected energy consultancy experts of Ecofys who also advise the EU Commission stresses the necessity of energy policies with a more efficient and sustainable set of priorities. First, stop energy being wasted by the end-user. Second, produce energy from sustainable resources. Third, make energy production with fossil fuels more efficient.

### The sixth fuel

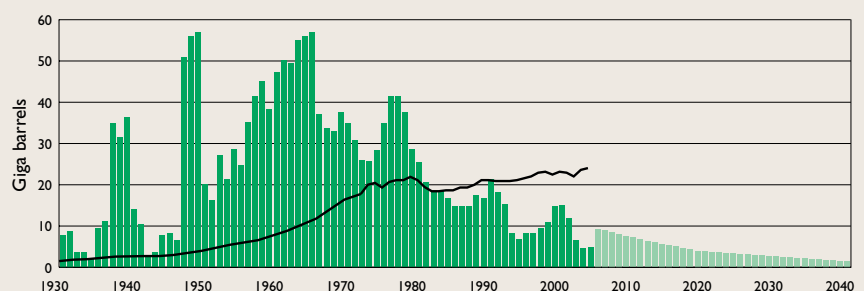
Energy efficiency has become the largest 'energy source'. Bigger than oil. And much bigger than wind, solar and hydro power and bio fuels combined. These renewable energy sources would need to increase more than 7-fold to substitute for fossil fuels. Today, this is not technically – let alone economically – possible. Additional energy efficiency is both needed and possible. Energy efficiency obtained through better insulation of buildings is a cheap, almost un-ending 'sixth fuel'.

### Oil enough?

We consume 3 times more oil and gas liquids than we discover. The gap between growing consumption and diminishing new discoveries is becoming wider.

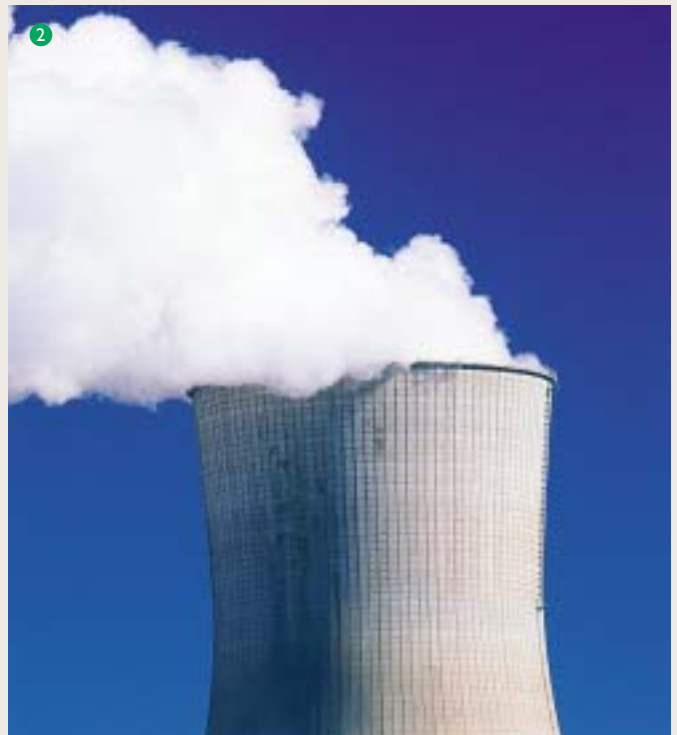
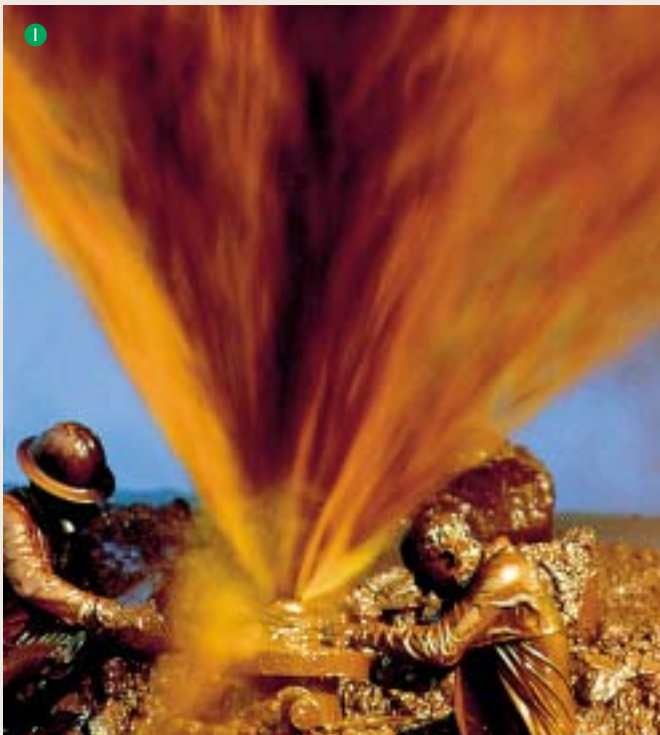
- Past discovery
- Future expected discovery
- Production

Source: The Association for the Study of Peak Oil (ASPO), Newsletter No. 51, March 2005, compiled by C.J. Campbell, Staball Hill, Ballydehob, Co. Cork, Ireland, [www.peakoil.net](http://www.peakoil.net)



...'Energy efficiency will be my key priority for 2005. The cheapest, most competitive, most secure form of new energy for the European Union is in fact energy saved'...

**Andris Piebalgs**, EU Commissioner for Energy, 13 April 2005.



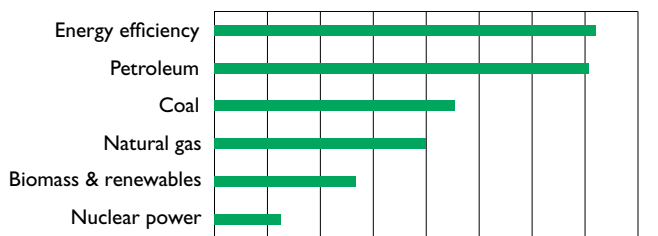
1 The last oil. Energy power and pricing power is being concentrated in fewer hands - often in politically unstable regions. 80% of the large oil producing countries are facing or already struggling with declining production.

2 Energy efficiency is more economical, sustainable and cleaner than building extra power plant capacity.

**The sixth fuel: Energy efficiency is the largest 'energy resource'**

Oil production would need to double if no energy savings had been made since the oil crises.

The role of different resources in the world energy balance (1999)



Source: Cenef Bulletin no 35, April-June 2002

Million tonnes of oil equivalent



## How much energy is used in our buildings?

Our buildings consume more than 40% of the energy used in Europe and North America. They are the key CO<sub>2</sub> emitter, larger than transport and industry. Most of the energy in buildings is used for heating and cooling. A growth in living space and increased used of air conditioning in many countries add to the strong need to curb this energy waste.

Buildings hold the largest potential for energy savings which are profitable to the building owner and beneficial to society. With well-known and tested technology,

energy loss in buildings can be reduced by up to 90%. Unlike giving up our car and mobility, making buildings energy efficient will increase our standard of living and create more jobs.

### Building for the past or the future?

A building may have a lifespan of 100 years or more. What will be the energy prices and environmental taxes over the next ten decades? Hardly any houses are constructed to counter the risk of rising energy prices.

## Preventing uncool cooling bills

Energy efficiency of buildings has been on the political agenda for decades in most countries where a cold climate means expensive heating costs. Many countries in hot climates are only just starting to realise the heavy burden that cooling of poorly constructed buildings implies. The use of air conditioning is sky rocketing. And so is the strain on the electrical grid and on the pockets of private individuals and public finances.

Today Southern European countries have the poorest insulation standards in Europe. In the developing countries, where growing prosperity and air conditioning go hand in hand, the problem is even more acute.

In Malaysia, for instance, energy is heavily subsidised by the state. High air conditioning growth rates can thus undermine public budgets. So far no thermal insulation requirements have been made in the building regula-

tions. On sunny days, a roof temperature of 70°C is not unusual. Without insulation the scolding heat can penetrate the building and transform it into a sweatbox where people find it uncomfortably difficult to work, live – or sleep. The annual energy consumption in typical new office buildings in Malaysia and the Asian region is 200-300 kWh of electricity per sq.m. This is equal to approx. 60-90 litre oil equivalents of primary energy, which is much more than is used in colder Northern Europe.

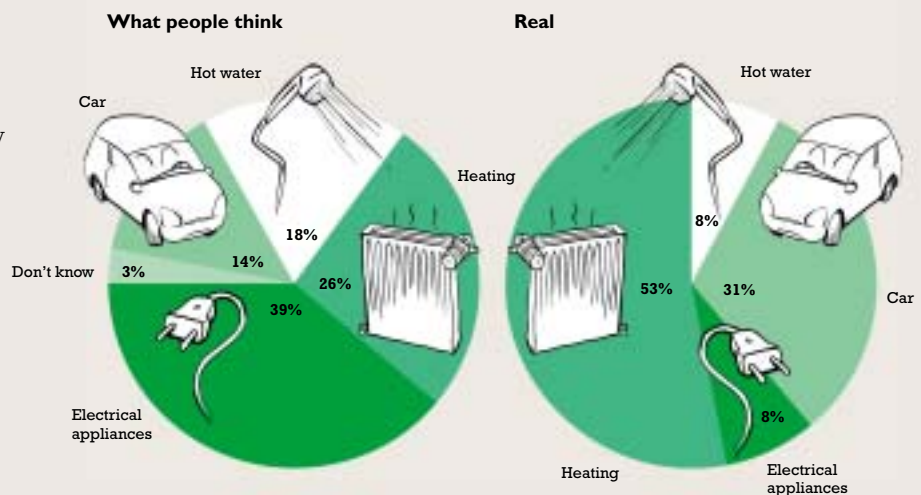
This energy waste can be reduced by nearly 50% with just a small amount of insulation in the roof and the façade combined with solar protection. Instead of a large expensive air conditioning, a smaller model with a corresponding lower energy bill can be used. The investment is often paid back in less than 2 years.

### Where do you spend most energy?

#### Heating

#### – an underestimated energy guzzler

74% of German respondents did not know that heating is their biggest energy guzzler. Nearly 30% did not even know their monthly heating expenses.



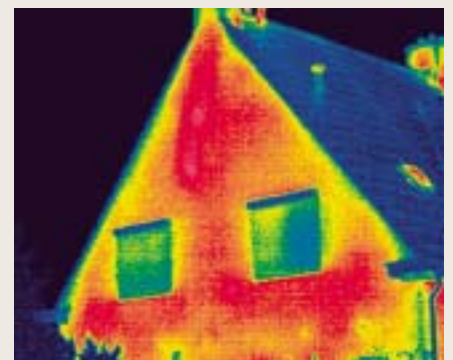
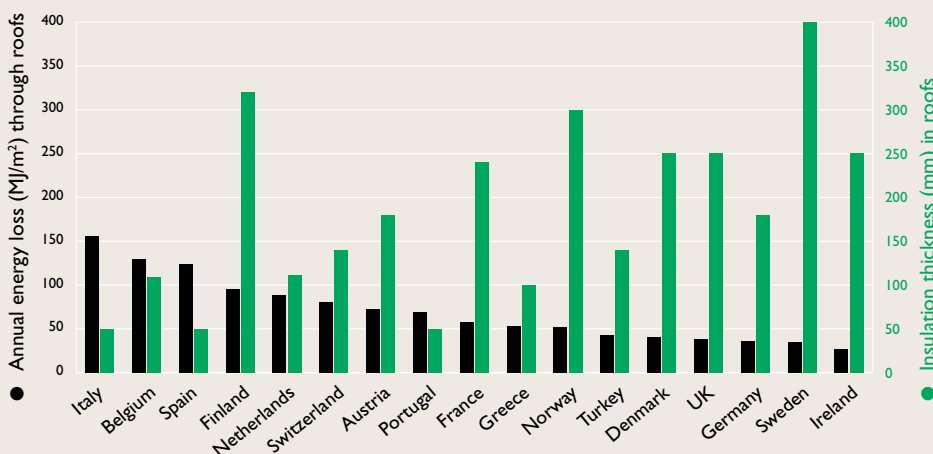
Source: Emnid survey "zukunft haus 2003" for Deutsche Energie-Agentur. <http://www.zukunft-haus.info/page/index.php?id=1519>

'Sustainable architecture is when the building not only looks nice, but people feel truly comfortable - also about their energy bills the next 50 years.'

**Roman Delugan**, Architect, Vienna.



**Poor insulation increases energy waste. Insulation thickness & energy loss through roofs**



● Thermographic photos reveal energy loss. Red areas are the most poorly insulated.

Source: Eurima, The critical importance of building insulation for the environment, Bruxelles, 2002.

## How much can be saved in buildings?

Save 70-90% of your heating costs and improve your indoor climate. The Passive House is the well-tested house of the future. Good insulation of up to 50 cm and an energy efficient ventilation system help prevent sleepless nights over rising energy prices. With minimum energy loss, free passive energy from sunlight, body heat and heat from appliances all help to make an important zero-cost 'radiator'.

The energy savings more than compensate for the approximate 5%-15% extra investment. Compared to a standard new German house, a 120 m<sup>2</sup> Passive House can – over a lifetime of 100 years – save approx. 660,000 kWh just for the heating alone.

So far more than 5000 Passive Houses have been built. A Passive House uses a maximum 15 kWh per sq.m. heated floor area – per year. Its annual consumption of primary energy for all energy use in the building (including appliances) must not exceed 120 kWh/m<sup>2</sup>.

A modern house loses the thermal energy in three ways – through the building envelope (its walls, loft and foundation), through its windows and through ventilation – in particular through gaps and cracks. Low-energy buildings must tackle all 3 weak spots. With proper insulation, good windows, and gaps and leaks all sealed, the full benefit of a ventilation system with heat recovery is realised. Similar to a lung where ventilation must be controlled and accurate, rather than through leaks.

The Rockwool Group is active in many projects to promote energy efficiency. In 2005 a price competitive low-energy prefab house of high architectural quality was launched in Denmark. In Italy a Passive House, tailored for hot climates, is now under construction. And in Poland a Passive House competition for student architects is being run.

## How to build a Passive House

- 1 Thick insulation of 300-500 mm helps reduce heat loss from the building envelope (U-value below 0.15).
- 2 Low-energy, triple-glazed windows and super-insulated window frames (Window < 0.8 W/(m<sup>2</sup>K) G-value ~50%).
- 3 No thermal bridges. Careful installation methods especially around joints, corners and materials causing high energy loss.
- 4 Controlled ventilation with a heat recovery of at least 75% ensures good indoor air quality with low-energy use.
- 5 The building must be airtight (n<sub>50</sub> < 0.6 h<sup>-1</sup>) without any gaps in order to reduce uncontrolled ventilation by approx. 90%.
- 6 Optimising the building orientation for solar gain (or protection) helps save energy.
- 7 Use low energy refrigerators, TVs and other appliances in order to save energy and prevent extra heat loads during hot summer months.



Better comfort! Good insulation of windows and walls prevents draught, condensation and mould. Passive House tenants are more satisfied with their indoor climate.



This building from 1929 in Nürnberg was modernised and insulated with Passive House techniques. Energy for space heating shrunk 88% to just 25 kWh per sq.m. This is 3 times as energy efficient as most new buildings in Germany!

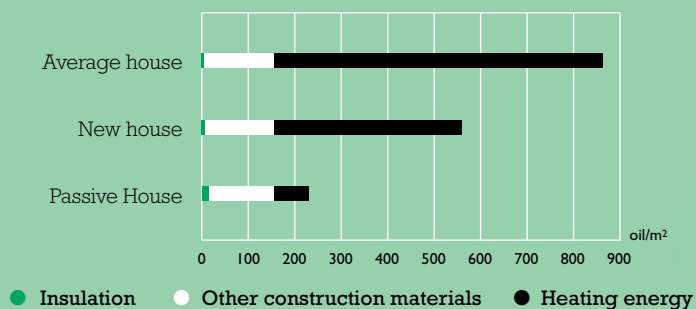
'The Passive House is an extremely comfortable way to save energy. It puzzles me why building owners and politicians still accept houses with poor insulation. What a waste of money.'

**Dr. Wolfgang Feist**, Leader of the Passive House Institute, Darmstadt, Germany



Passive House: Heating energy can be reduced by 70-90%

**Litre oil energy, consumed over 50 years, per m<sup>2</sup> floor space in differently insulated buildings.**



Sources: LCA data from Sverre Fossdahl, NBI, Energi og miljøregnskap for bygg Prosjektrapport 173 - 1995; EU, COM(2001) 226 final 2001/0098 (COD), Bruxelles, 11 May 2001; Danish Energy Authority, Danmarks Energifremtider, 1995; Danish Building Code (Bygningsreglement 1995); Passivhausinstitut, Darmstadt, Germany; and Cepheus work group.



## How can we turn the potential into practice?

'We are requiring new buildings to meet energy efficiency standards since better insulation can reduce energy consumption by up to 90%.'

**Stavros Dimas**, EU Commissioner for the Environment



- 1 €1,000 each year in net savings for this family. In 75% of surveyed houses in Denmark it is economical to insulate and improve energy efficiency.
- 2 Air conditioning of buildings is a heavy economic burden. The Rockwool Group cooperates with Malaysia's Energy Management



- 2 Centre to build its zero-energy office. This role model building will be inaugurated in 2006.
- 3 How can the landlord be motivated to invest in energy efficiency, if the tenant pays the energy bill? In the UK, landlords who insulate are allowed an income tax deduction up to £1,500.

### Beyond ignorance and non-action

Most political decision makers sympathise with the idea of energy savings in buildings. They are necessary and technically possible. Despite this fact, much more could still be done to help improve the energy efficiency in our buildings. Far too many people believe erroneously that it is very costly to invest in energy savings. The truth is that energy waste is not cheap - it costs billions of euros and dollars, and millions of tonnes of air pollutants.

Today it is possible to build new houses (see p. 8-9)

that consume 70% less energy for heating than Europe's strictest requirements. The indoor climate of these well insulated houses is better. Lifetime cost savings on energy expenses far outweigh the small investment in energy efficiency.

### Largest potential in old buildings

New buildings have a long economic and environmental impact, but only constitute a fraction of the building stock. The biggest energy loss today is from our old buildings.

In many old houses, the heating bill can easily be reduced. If energy efficient technology is used, reductions of even 88% have been obtained. These refurbished houses can waste less heating energy than brand new houses fulfilling the minimum requirements of Europe's strictest energy codes.

### **No renovation without improved insulation**

The potential for profitable energy savings in existing buildings is massive. How can this potential be realised cost-effectively? The cheapest way is to take advantage of modernisation projects and improve energy efficiency each time the building is renovated. It is relatively cheap to add extra insulation when the roof or the façade is being renovated and the building professionals and scaffolding are in place anyway. Many buildings may only be modernised every 30 years, or 3-4 times during their lifespan. Not improving energy efficiency as part of modernisation is a costly missed opportunity.

### **Saving money, energy & CO<sub>2</sub>**

If buildings undergoing refurbishment were also brought up to modern energy standards, €102 billion could be saved in energy costs in the 15 original EU countries alone. This is more than twice the annual capital costs for the investment in energy efficiency. At the same time nearly 400 million tonnes of CO<sub>2</sub> would be saved annually on the completion of the renovation cycle, show Ecofys figures. In addition thermal comfort would improve, and some 300,000 jobs could be created.

From January 2006, the EU directive on the Energy Performance of Buildings (see page 13) requires that buildings larger than 1000 m<sup>2</sup>, undergoing major renovation, must also be modernised to contemporary energy standards. Yet, most buildings are much smaller, so the directive misses most of the savings potential. However countries like Germany, Sweden, UK, Norway and Denmark are among the first to make energy efficient modernisation mandatory for all buildings anyway.

## Energy savings in the US

The US holds massive unused potential for energy savings. According to the US Energy Authority (EIA) a savings potential of 57%-68% exists in residential buildings. As the world's biggest energy user, the quality of life for US citizens could be improved by energy savings in buildings as opposed to unpopular restrictions on car traffic.

In general, the average American uses twice as much energy as the average European. The poor energy efficiency of US society makes it dependent on energy imports. Instability in supplier regions can undermine the sure supply of cheap energy.

Single family homes are big in the US - 237 m<sup>2</sup> on average. A well-insulated home is thus crucial to reduce energy use for both heating and cooling.

As in Europe, buildings consume 40% of all energy, but 70% of all electricity.



77% of all homes in the US use air conditioning. In the hottest climate zone, 92% of all buildings have air con. Hot summer temperatures can cause electricity black-outs. Many states need to decide whether to improve energy efficiency or to invest massively in new power plants.



From 1 January, whenever a German house is sold or rented out, an “Energiepass” – a certificate documenting the energy consumption of the building – will become mandatory. The Rockwool Group’s BuildDesk services supply essential tools for calculating energy performance.

Over 60% of the European building stock is more than 30 years old and built to poor energy standards from before the oil crises.



## Large potential in Eastern Europe

The potential for energy savings in buildings is huge in Western countries. The challenge of energy efficiency is even greater in Eastern Europe where 8 countries are now EU members and therefore must adhere to stricter environmental standards.

It’s not unusual to see roughly twice as much energy for heating being wasted, per the same living area, than in Western European countries, even under similar climate conditions.

For decades, energy prices were heavily subsidised giving little incentive to insulate and conserve energy. These times are over. Energy prices have risen sharply

and continue to do so. For some, fuel poverty is now reality in Eastern Europe. Poor people in poorly insulated homes cannot afford the higher heating bills – turning off the heat is an unhealthy necessity.

Making buildings energy efficient would be healthier. For a start it could create nearly 200,000 jobs in the 8 new EU member states alone. And, even with energy prices that have not yet reached the level of Western Europe, the potential for economical, CO<sub>2</sub> reducing energy savings is 20% larger per sq.m. living area than in EU-15, according to Ecofys.

### The Energy Performance of Buildings Directive

As of January 2006 all 25 EU countries plus Norway and Switzerland must follow the directive on the Energy Performance of Buildings. For decades building and calculation methods have varied considerably across Europe's regions. The EU is seriously concerned about the fact that its dependence on energy imports will grow from 50% to 70%. The member states are now revising their building codes, setting stricter demands for new buildings – in some countries by up to 30%. The Directive is a first wake-up call for a slumbering building industry that is still not constructing buildings as energy efficiently as they could be. It means that:

- Energy codes must be updated at least every 5 years. Previously it could take 10 or in some countries even 20 years between each update.
- All buildings that are constructed, rented, sold or have public access must have an energy certificate no older than 10 years.
- Buildings undergoing major modernisation must be brought up to the new energy efficiency standards. Countries like Germany, UK, Sweden, Norway and Denmark make this mandatory for all buildings and not just buildings larger than 1000 m<sup>2</sup> as the EU prescribed minimum.
- Focus is put on the energy use of the entire building with improved calculation methods and better detection of energy loss.
- Boilers and air con systems must be inspected regularly.

## 10 actions to save energy, money and pollution

Despite the huge profitable savings potential, almost no investments in optimal energy efficiency of buildings are being made. Nor do building codes fully profit from Best Available Technology. This is what can be done to build a better, cleaner and richer future:

### AUTHORITIES

#### 1 Better energy codes

It is technically and financially possible to erect buildings that are many times more energy efficient than the low demands for new buildings today. Improve energy demands by 30% every five years - then today's Passive House technology will become standard within 15 years in the best countries.

#### 2 Energy efficient modernisation

All buildings undergoing renovation should be brought up to modern energy standards. Not just buildings larger than 1000 m<sup>2</sup>.

#### 3 Information & incentives

There is a lack of knowledge among building owners about the huge potential for energy savings in buildings – and the ways to bring improvements into practice. Information campaigns and incentives, such as tax and VAT relief and subsidies, are needed.

#### 4 Remove owner-tenant dilemma

Building owners must be given strong incentives to insulate their buildings. Today few do, because it's the tenant who pays the energy bill.

#### 5 Don't subsidise energy waste

Low energy costs can be vital for the poor. But wouldn't it be more prudent to subsidise energy savings instead of subsidising energy use as many governments do today?

### BUILDING OWNER

#### 6 Use best practice

Use the best available low-energy technology. An efficient house will save you massive energy costs and improve your indoor climate too.

#### 7 Energy audit – and implement

Let a professional find your leaks! Most houses have significant energy savings potential. Carry out the energy savings today, not tomorrow.

#### 8 Modernise energy efficiently

No modernisation without insulation! Adding extra insulation to a roof or façade that needs renovation anyway is very cost effective.

### BUILDING INDUSTRY

#### 9 Sell good quality!

Offer energy efficient solutions with the lowest lifetime costs. Selling energy inefficient buildings that are slightly cheaper to buy, but much more expensive to heat or cool, is not good customer service.

#### 10 User-friendly solutions

Develop total packages including solutions for building owners with few or no technical skills.

## Indoor environment

My home is my castle! But is it a pleasant one – or a sick building? Most of modern life we spend indoors. Our indoor environment is extremely important for our health and well being. We'd like to take a warm dry home for granted, but cold damp homes still abound putting the health of many of us at risk. Even in relatively rich countries, it is not unusual to find moisture damage in 20% of all homes, and visible fungi in nearly 10%.

### Good comfort

Properly fitting insulation helps provide a pleasant and stable indoor temperature. It protects against both freezing cold and stifling heat. If windows and walls aren't insulated properly, keeping the indoor temperature steady between 20-24°C during cold winters or hot summers is difficult. Even excessive (and expensive) heating or cooling cannot eliminate unpleasant draughts caused by temperature differences.

### Prevent condensation

You can never insulate too much! But if you insulate too little, use incorrect installation methods or ventilate too little, then there is a risk of warm humid air condensing on cold or poorly insulated surfaces. Condensation must be avoided, because it can create the damp conditions that allow moulds and fungi to grow. The toxins from some of these fungi can provoke allergic reactions.

According to the Swedish National Testing and Research Institute (SP) approximately 40% of the population have, or have had, symptoms of asthma, eczema or hay fever. This figure has grown considerably over the last 50 years. In buildings with moisture problems, the risk of allergic reactions is some 40-150% higher compared to dry buildings.

### How to ensure a good indoor climate

Insulation and controlled ventilation are the keys to a better indoor environment. Tenants in well insulated passive houses (see p. 8-9) with efficient ventilation systems are

more satisfied with their new indoor environment than with the traditional building they used to live in. According to a survey by the University of Kassel, these higher satisfaction levels were reported both during summer and winter months. Many tenants felt a positive effect on their well being too.

### Fresh air

An average family of four members contributes up to 15 litres of moisture to their indoor air every day. Moisture must be ventilated out of the building. Fresh air also improves poor indoor air quality that can be the cause of headaches, discomfort and can impair concentration.

If, like most people do, you live in an old building without an automatic ventilation system, you must remember to open your windows briefly several times a day. In this way the air is swiftly refreshed without a dramatic cooling of the warm surfaces in the building. During cold winter months 5 minutes (with radiators off) may be enough for a complete air exchange while on hot, windless summer days, 30 minutes may be necessary.

### Mould resistance

Research by Denmark's Technical University shows that not all materials are equally attractive to moulds. Wood based materials, for instance, can nourish moulds even at relatively low moisture levels. Moulds also find it more difficult to thrive on mineral wool than on both plaster board and concrete. Rockwool stone wool typically contains only 2% organic material.

### Indoor climate labelling

In some countries indoor climate labels help identify products that have no critical emissions of either smell, particles or toxins. Rockwool products are qualified to use the Finnish "M1" indoor climate label that has the strictest requirements in Europe. Furthermore the Danish Indoor Climate Label has been given to a number of Rockfon acoustic ceiling products.



Most of our lives we spend indoors.  
Insulation and controlled ventilation are the keys to a better indoor environment.



1 Good protection against extreme temperatures is vitally important. In order to prevent daily temperatures below 10°C or over 30°C, which are critical, especially for the elderly and the weak, our homes must offer proper protection.

2 Tenants of wellinsulated homes with energy-efficient ventilation systems tend to be more satisfied with their indoor climate.

3 A family can produce 15 l of moisture per day. Insulate and ventilate well if you want to prevent moulds growing.

### Seven tips for a good indoor climate:

1 Insulate well, avoid thermal bridges. This improves comfort and prevents condensation.

2 Ventilate well. Depending on the activity, air needs to be exchanged every 2 hours. If the building is airtight, a ventilation system with heat recovery can do it automatically and energy efficiently.

3 Keep the materials dry, prevent leaks and keep moisture membranes intact. Moisture contents below 15% in wooden building materials prevent the growth of moulds and fungi.

4 Noise is best absorbed by materials with open structure surfaces, such as textile curtains or mineral wool acoustic ceilings.

5 Ensure good light and light reflection.

6 Keep clean.

7 Choose low-emission materials that don't release critical amounts of gases, particles or smell. In some countries indoor climate labels may help you.

## Noise pollution – what can we do?

'It's not your neighbour who makes too much noise.  
It's your building that has been insufficiently sound proofed.'

**Prof. Jens Holger Rindel**, Noise expert  
Denmark's Technical University

Noise pollution is a major environmental problem affecting millions of people around the world. According to the World Health Organisation, noise-induced hearing impairment is the most prevalent irreversible occupational hazard and it is estimated that 120 million people worldwide have disabling hearing problems.

Noise causes stress and loss of concentration and well being. It can provoke stress-related heart problems and has severe negative economic impact.

### What's a good sound environment?

Noise should be dampened to such an extent that it no longer interferes with the activity you were set out to do. Just 30 dB (A) is disturbing to sleep. Noise with sound levels of 35 dB(A) or more interferes with the intelligibility of speech in smaller rooms. Even lower background levels are needed for adequate speech intelligibility for vulnerable groups - such as the hearing impaired, the elderly, children in the process of language and reading development, and individuals who are not familiar with the spoken language.

Rooms with many hard surfaces may result in disturbing 'echo' which must be avoided. A reverberation time below 0.6 seconds is desirable, even in a quiet environment.

### Insufficient sound proofing

Inside buildings, the recommended maximum ave-

rage for indoor background noise levels is 35 dB (A). In practice many tenants suffer from noise above this level because their building hasn't been sufficiently sound proofed. Further improvements of national requirements – and especially their implementation - are needed. It is not unusual to see noise reduction building standards that haven't been improved for several decades. Lack of sound proofing not only reduces the quality of life of the pestered neighbour. It also prevents many of us from free expression of music and other happy, noisy activities.

### Traffic noise

According to the WHO about 40% of the population in the EU are exposed to road traffic noise exceeding 55 dB(A) during daytime. More than 30% are exposed at night.

Very extensive traffic noise exposure mapping and noise abatement are required of the member states to comply with the EU maximum limit of 55 dB (A). Investments in improvements such as noise screens, façade insulation, better windows and dampening asphalts are necessary. The economic loss incurred by traffic noise is considerable. Noise from a motorway will typically reduce the value of a property by 1.6% for every decibel above 55 dB according to the Environment Protection Agency in Denmark. For a house worth €200,000 the cost of 65 dB will be €32,000.

A 10 dB difference is perceived by the human ear as a doubling (or halving) of the audible sound.

## Rockwool solutions to noise pollution

Most of our lives we spend indoors. It is thus crucial that the buildings we live and work in are made in a way that reduces noise inside a room, between rooms and prevents noise from the outside penetrating into the building.

Rockwool stone wool has an open fibrous structure making it ideal for absorbing and regulating noise. Rockwool products reduce ear-deafening noise from machines or the activities of people, and provide ambient situations that allow normal conversation.

The widespread use of hard reflecting building materials

in modern architecture amplifies the problem of noise indoors. The use of Rockfon acoustic ceiling systems can dramatically reduce sound reverberation, and prevent echoes, in a room, thereby improving the quality of life for building users.

RockDelta green noise barriers along roads and RockDelta vibration control under rail tracks abate frustrating noise from traffic. Rockwool insulation in walls, roofs, around machines, and under floors effectively dampens noise from, or to, the neighbours.



1 Insufficient soundproofing reduces our quality of life. It denies us tranquility, but also the freedom to enjoy happy, noisy activities.

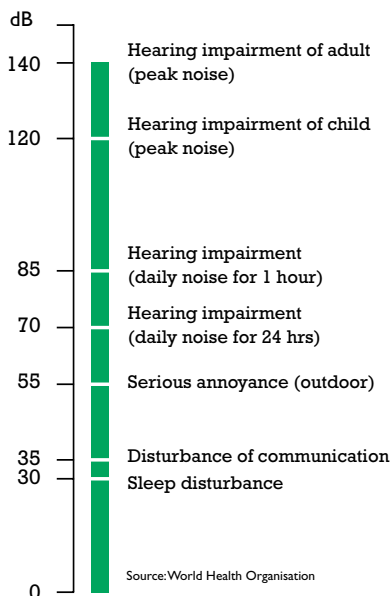


2 Rockfon acoustic ceilings absorb noise inside the room. Rockwool insulation reduces the noise escaping in or out of the room.

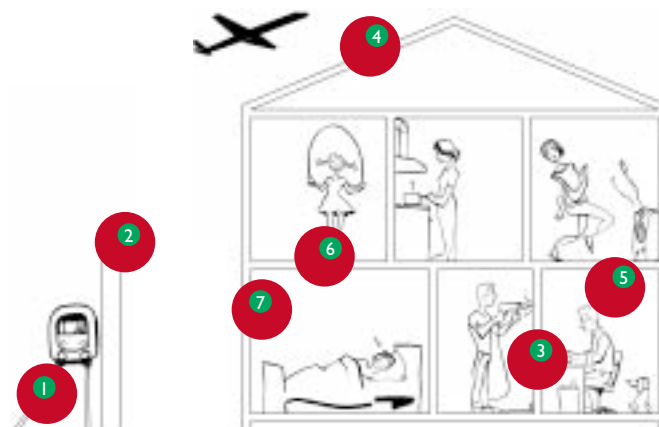


3 Some 40% of the population in the EU are exposed to traffic noise pollution above 55 dB. RockDelta green noise barriers along roads, and vibration control under rail tracks, can abate this frustrating noise.

**Critical health effects from noise**



**Rockwool solutions to noise pollution**



- 1 RockDelta vibration insulation under rail tracks
- 2 RockDelta green noise barrier
- 3 Rockwool wall insulation
- 4 Rockwool roof insulation

- 5 Rockfon acoustic ceiling
- 6 Rockwool insulation under floors
- 7 Rockwool façade insulation

## Own house in order – the impact of Rockwool products and production

### Summary of the Group Environment Policy

With the commitment of all the subsidiary companies, and in consultation with their managing directors, the Rockwool Group has drawn up an environment policy. In accordance with this, our companies undertake:

- to carry out an environmental analysis of all projects involving new production equipment or new products before they are initiated;
- to have an environmental management system which describes responsibility and control procedures, and to make constant improvements to this system;
- to ensure that the factories do not cause problems for their neighbours of a more serious nature than is normal in an area also housing industry;
- as a minimum, to comply with the conditions imposed on them by the regulatory authorities; if this is not happening in any given area, then to inform the authorities immediately and take steps enabling compliance;
- to maintain an open dialogue with stakeholders – customers, regulatory authorities, investors, employees, suppliers, and neighbours – in order to ensure that relevant interests and requirements concerning environmental issues are met;
- via the Group's environment department, to carry out audits at the plants to assist the environmental work of the manufacturing companies.

The Rockwool companies have acceded to the International Chamber of Commerce (ICC)'s Business Charter for Sustainable Development – Principles for Environmental Management.

Energy efficiency is crucial. But what are the exact environmental effects of Rockwool products and production processes? The Rockwool Group is committed to environmental responsibility. But good intentions alone do not guarantee results.

#### Life cycle assessment

The true litmus test of the environmental impact of an activity or a product is a scientifically based Life Cycle Assessment (LCA). All positive and negative environmental consequences over an entire lifetime are calculated. From the extraction of raw materials to its end disposal, reuse or recycling. This report is based on a thorough LCA that fulfils the quality standards of the ISO 14000 series and has undergone third party scrutiny and peer review. The LCA is based on a typical Rockwool loft insulation product (250 mm) manufactured in Denmark and installed in accordance with the regulations for new buildings.

#### Environmental management

The Rockwool dedication to environmental management has, over the years, resulted in environmental awards in a number of countries. In 2005 the Canadian Council of Ministers of the Environment gave a prestigious Pollution Prevention Award to the Group's subsidiary, Roxul Inc. in Milton, Ontario. Good progress is repeatedly being made in improving our factories' efficient use of resources and in demonstrating local responsibility and respect towards our neighbours.

11 out of 13 key performance indicators show a positive trend from 2001 to 2004 (see p. 24).

The cornerstone of our efforts is the Group environment policy. In many cases it tells us to go beyond local legislation requirements. The policy prescribes that each subsidiary must have an Environmental Management System (EMS), which covers responsibility and control procedures. The individual subsidiaries are responsible for the day-to-day safeguarding of the environment at our factories. Some subsidiaries have chosen certified management systems like ISO 14001 or EMAS, whereas others apply an internal standard, audited by the Group environment department. This department acts as advisor to, and auditor of, the subsidiaries, and co-ordinates the corporate environment policy and strategy.

#### High environmental standards

In 2004 8 environmental audits and 9 fire and safety audits were carried out. In addition, 16 audits were made by independent external assessors. All Group companies must fulfil strict Rockwool environmental standards specifying safety procedures, responsibilities and assessment methods. Audits involve many diverse factors, everything from emissions in the working environment (e.g. noise), measurements for external emissions, handling and treatment of combustion fly ash etc. On average our factories are audited once a year. The Rockwool Group is not involved in any environmental court cases.

## Energy and the Rockwool impact

### The impact of our products

Rockwool insulation is one of the rare industrial products that saves more energy than it requires. Over 50 years, a typical Rockwool insulation product can save over 100 times more primary energy than was used for its production, transport and disposal. The energy balance becomes positive only 5 months after installation. For a product that insulates hot pipes, the energy payback can be less than 24 hours - the return on invested energy is more than 10,000-fold.

### The impact of our production

Energy comprises a major part of our total financial and environmental bottom-line. So energy efficiency improvements are top priority and have been so for many years. Energy efficiency is also the key to reducing other

environmental impacts of production, such as CO<sub>2</sub>, NO<sub>x</sub> and SO<sub>2</sub> emissions.

The melting process, where at temperatures above 1500°C diabase rock is turned into lava and then spun as fibres, is the most energy-intensive part of the Rockwool production process. The Rockwool Group has some of the world's leading experts in energy efficient production of stone wool. This is clearly demonstrated when newly acquired factories are modernised with Rockwool know-how. Energy efficiency improvements of 50% per production unit have been achieved while at the same time enhancing product quality, environmental performance and delivery precision.

Since 2001 energy efficiency improvements of 10% have been obtained on Group level.

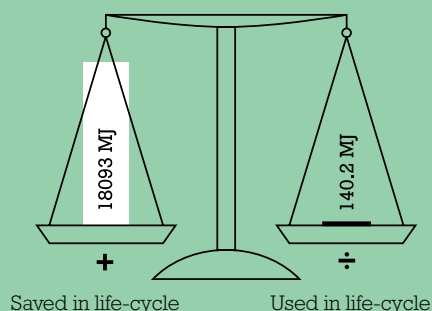


1 Energy efficiency improvements of 50% per production unit have been achieved when newly acquired factories are modernised with Rockwool know-how. Rockwool Polska has twice been awarded Leader of Polish Ecology.



2 The Rockwool Group's Dutch company declares LCA data for all its 8000 products. This information is available online at [www.rockwool.nl](http://www.rockwool.nl)

### Rockwool Eco-balance: Energy



Life-cycle assessment of savings (+) from product use and emission/consumption (-) during production of 1 m<sup>2</sup> 250 mm loft insulation produced and installed in Denmark and used over 50 years.

The energy pay-back is more than a 100-fold. The LCA fulfils the quality standards of the ISO 14000 series and has undergone third party scrutiny and peer review.

## Climate change and the Rockwool impact

The last decade has produced a series of troubling records in average global temperature unseen in the history of temperature recording. Life on earth depends on a temperature interval of only a few degrees. Even small changes in global temperature may have critical consequences for our climate and living conditions.

Our combustion of fossil fuels releases unprecedented amounts of CO<sub>2</sub> into the atmosphere. High levels of CO<sub>2</sub> mean heat from the earth is retained in the atmosphere thus accelerating the 'green house effect' and global warming. Gases such as nitrous oxide (N<sub>2</sub>O), methane (CH<sub>4</sub>) and fluorine further add to global warming.

Global warming means more extreme weather with a growing risk of windstorms, flooding, heat waves and desertification. The polar ice caps and inland glaciers are melting and retreating rapidly. Islands will be submerged. Natural ski slopes and coral reefs with good diving spots will both become rarer luxuries.

Climate change affects everyone. Higher wind speeds and water levels cause higher insurance premiums for everyone – even for those not directly affected.

According to the United Nations Intergovernmental Panel on Climate Change (IPCC) the average temperature is expected to increase 1-5°C over the next century.

### Kyoto Protocol ratified

Finally, after 7 years of negotiation, the world's first concrete international commitment to reduce greenhouse gas emissions came into effect. In 2004 Russia's president Putin signed the accord. The pressure on the US and other major CO<sub>2</sub> polluters to follow suit is increasing.

The Kyoto Protocol requires a 5.2% reduction of CO<sub>2</sub> emissions before 2012 compared to the level in 1990. It is a small, but important first step.

Negotiations on the next climate convention have begun. The EU has set the goal that by 2020 CO<sub>2</sub> pollution from industrialised countries must be reduced by 15-30%

compared to 1990 levels. The Environment Ministers have further recommended reducing CO<sub>2</sub> emissions by 60-80% before 2050, if the average global temperature is 'only' to increase by 2°C. Buildings are one of the few sectors where this reduction can be obtained most easily and most cost-efficiently. The technology is available today.

### The impact of our products

Rockwool insulation is one of the major CO<sub>2</sub> savers. A 250 mm Rockwool loft insulation product will, over 50 years use in a Danish building, save 162 times more CO<sub>2</sub> than was used for its production, transport and disposal. The CO<sub>2</sub> balance switches to positive 4 months after installation.

This year's sale alone of Rockwool insulation will, over 50 years, save more than 100 million tonnes of CO<sub>2</sub>.

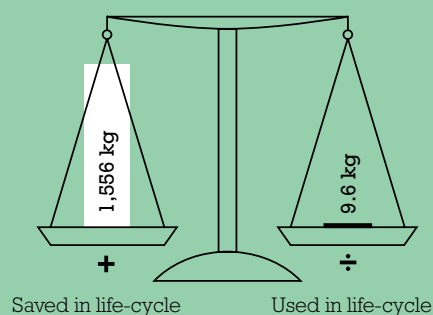
### Further potential

In many countries there is a misconception that CO<sub>2</sub> savings might block the economic growth urgently needed by billions of people around the world. Yet in fact, today's excessive energy use and CO<sub>2</sub> emissions can be reduced markedly with an economic gain. According to the IPCC, greater energy efficiency in buildings and industry worldwide could cut CO<sub>2</sub> emissions by more than a billion tonnes a year. The bulk of these CO<sub>2</sub> savings will even be profitable.

In the EU-15 alone, as new Ecofys studies show, not just 400 million tonnes of CO<sub>2</sub> but also €102 billion could be saved every year if all buildings undergoing renovation were brought up to modern energy standards. This is more than twice the annual capital costs for the investment.

Better insulation of both old and new buildings, and of thermal processes, can thus save more CO<sub>2</sub> emissions than are required by the EU Kyoto Protocol commitment, while at the same time improving quality of life.

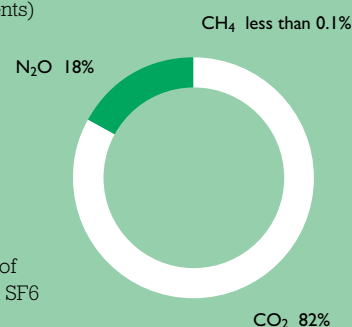
### Rockwool Eco-balance: CO<sub>2</sub>



Source: FORCE TECHNOLOGY/dk-TEKNIK

### Green house gas emissions from Rockwool production

(CO<sub>2</sub> equivalents)



The emission of HFC, PFC and SF<sub>6</sub> is negligible.

'With Russia's ratification the Kyoto Protocol has finally come into force. We have a huge unused potential for energy and CO<sub>2</sub> savings in buildings. If we waste fewer resources it will make this country richer and cleaner.'

**Alexey Kokorin**, Head of WWF Russia's Climate Change Programme



- 1 Antarctic's Ross Ice Shelf holds back several large glaciers, preventing them from sliding into the sea where they would melt. If the ice shelf breaks off this could have unfavourable consequences. If all glaciers behind the Ross Ice Shelf melted, the global sea level might rise by approx. 4 metres.



- 2 CO<sub>2</sub> emissions must be reduced by 60-80% before 2050 if the average global temperature is 'only' to increase by 2°C.



- 3 The consequences of a more extreme climate can be devastating.

### The impact of our production

CO<sub>2</sub> comprises approximately 82% of the Rockwool factories' total greenhouse gas (GHG) emissions. Nitrous oxide, mainly from curing oven afterburners and from cupola ovens, constitutes 18%, whereas methane is less than 0.1%. Other GHG (e.g. fluorine carbons) are negligible.

Since 2001 the Group's CO<sub>2</sub> emissions per production unit have been reduced by 6%. This is the result of our improved energy efficiency and the increased use of low CO<sub>2</sub> emitting fuels.

### CO<sub>2</sub> trading

In January 2005 the EU emission trading scheme took effect. So far only the Rockwool Group's factories in Denmark and the Netherlands are included under the CO<sub>2</sub> quota scheme. Nevertheless, all Rockwool plants in the EU have implemented procedures for detailed monitoring and documentation of their CO<sub>2</sub> emissions.

CO<sub>2</sub> savings now represent a value and can be traded. Prices fluctuate, but have shown a growing trend over the last year.

## Air pollution and the Rockwool impact

### SMOG

A healthy life requires ample supplies of fresh air. The combustion of fuels is the source of many types of air pollution.

According to the World Health Organisation every year 800,000 deaths are attributable to urban air pollution that is largely the result of the combustion of fossil fuels for transport, power generation and other human activities. Alarmingly this combustion is increasing.

Particles and smog (photochemical ozone) can cause serious lung diseases and cardio-respiratory mortality. Asthma patients are among the high-risk groups.

### The impact of our products

A Rockwool loft insulation product will, in its lifetime, save more energy and thus smog components than were emitted during its production. Insulation alone cannot eliminate the problem of smog. But it can make a contribution, especially where sulphur rich fuels are used, combustion temperatures are low or particle filters inadequate. The complexity of photochemical processes prevents a reliable quantification of the precise smog reduction potential.

### The impact of our production

Carbon monoxide (CO), formaldehyde and phenol are the main contributors to the smog emissions from Rockwool production. The CO comes from the melting process whereas the phenol and formaldehyde stem from the small amounts of resin binder used to stabilise the stone wool fibres. The Rockwool factories use afterburner plants and other environmental equipment to minimise smog emissions. At temperatures exceeding 700°C, most of the airborne organic remnants from the production process are burnt off.

In 2004 world market shortages in supplies of high quality coke resulted in higher CO emissions. Nevertheless, the Group has been able to reduce its total smog emissions since 2001.

### NUTRIFICATION

Too many nutrients can disrupt the eco-balance in water or soil. Eutrophication feeds poisonous, foul-smelling algae in bathing water. Dead fish that appear to have "suffocated" are a sign that algae have consumed most of the oxygen. In nitrogen enriched soils some endangered plants cannot survive.

The main sources of excessive nutrients are ammonia and nitrogen oxides that may emanate from manure, fertilizers or the air pollutants from burning fossil fuels. These nutrients accumulate in the atmosphere and then precipitate in raindrops and snowflakes.

### The impact of our products

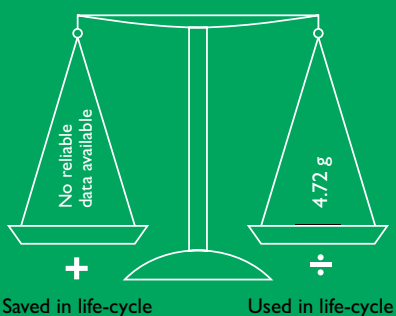
A typical Rockwool loft insulation product will, in its lifetime, save 61 times more eutrophication components than were emitted during its production. The environmental balance for prevented airborne nutrients tips to positive 10 months after installation.

### The impact of our production

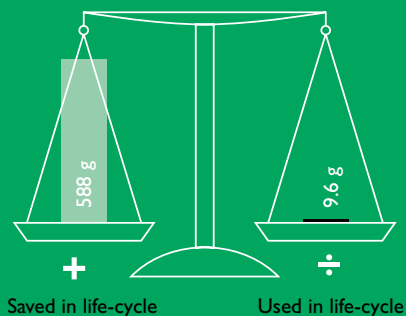
The main source of unwanted nutrients from the Rockwool process is the ammonia evaporating from the binder during the spinning and curing processes. Nitrogen oxides are emitted in the melting process, where fossil fuels are needed, and in the curing process.

The environmental equipment that cleans the flue gases by burning off ammonia and other organic residue also has its drawbacks. Afterburner plants need energy and thus elevate the emission of nitrogen oxides. The total emission of nutrients has thus remained stable.

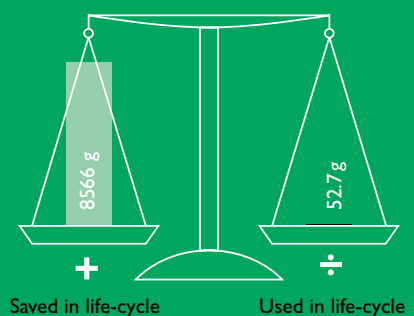
#### Rockwool Eco-balance: smog (C<sub>2</sub>H<sub>4</sub> equivalents)



#### Rockwool Eco-balance: Nutrification (PO<sub>4</sub><sup>3-</sup> equivalents)



#### Rockwool Eco-balance: acid rain (SO<sub>2</sub> equivalents)



A typical Rockwool loft insulation product will, in its lifespan, save 61-162 times more air pollutants than were emitted during its production.



1 Fresh water? Excessive nutrients help poisonous algae grow.

2 A healthy life requires ample supplies of fresh air.

3 Energy savings improve air quality too as less fossil fuels are burnt.

### ACID RAIN

Acid rain can damage trees and dissolve the surfaces of buildings. In lakes that do not have neutralising calcium buffers, fish and the general bio-diversity will suffer. Fossil fuel combustion is responsible for most manmade acid rain.

When sulphur and nitrogen compounds are emitted as gases into the atmosphere, they react with water and form acidulous raindrops.

### The impact of our products

Rockwool insulation reduces acid rain. A typical Rockwool loft insulation product will, over 50 years, save 162 times more acid rain components than were emitted during its production. The environmental balance for acid rain abatement swings to positive 4 months after installation.

### The impact of our production

The main contributor to acid rain components from Rockwool production is sulphur dioxide (SO<sub>2</sub>). Ammonia and nitrogen oxides also play an important role. SO<sub>2</sub> emissions come from our use of coke in the melting process and from the sulphur content of the cement used in the process to recycle waste. Filters and other cleaning equipment are used to reduce acid emissions into the air.

The Group's increased use of waste recycling is positive. The negative side of the medal is higher SO<sub>2</sub> emissions. Yet our improved energy efficiency has outweighed this effect. The total emission of SO<sub>2</sub> has thus decreased slightly over the last few years.

## Environmental production figures

Excluding impact from product use. The total life cycle eco-balance for a typical insulation product is illustrated in the Eco-balance charts on pages 19-23.

2001 = Index 100	2001	2002	2003	2004	Comments
Factories included in key figures	23 (100%)	23 (100%)	20 (100%)	21 (100%)	Page
Energy	100	95	93	90	19
Carbon dioxide <sup>1</sup>	100	96	93	94	20-21
Carbon monoxide <sup>1+3</sup>	100	104	112	137	20-22
Sulphur dioxide <sup>2</sup>	100	101	107	97	23
Nitrogen dioxides <sup>2+3+4</sup>	100	94	99	101	22-23
Ammonia <sup>3+4</sup>	100	106	99	99	22
Formaldehyde <sup>3</sup>	100	106	71	65	22
Phenol <sup>3</sup>	100	97	97	76	22
Water	100	99	87	86	26
Dust	100	74	89	71	26
Waste to landfill	100	141	98	87	27
Recycling – residual products from other industries	100	110	114	105	27
Accidents per million working hours (not indexed)	24.4	19.1	15.8	15.6	24-25

<sup>1</sup> Green house gas factor, <sup>2</sup> Acid rain factor, <sup>3</sup> Smog factor, <sup>4</sup> Nutrification factor

These key environmental figures include consumption and emissions in the production phase at the Rockwool factories. The energy consumption is calculated in MWh and the water consumption in m3. All other key figures are calculated by weight. The key figures are indexed and shown per tonne line stone wool, except accidents among factory workers (direct personnel) which are indicated per million working hours. 3 plants were closed during 2002. Our second plant in Hungary, which was acquired during the last few days before year end, 2003 is included in the 2004 figures. For one of the newly acquired factories in 2001, some of the data was not registered.



1 Safety first. Historic low accident figures were achieved in 2004.



2 Vital fire safety. Rockwool stone wool is non-combustible and withstands temperatures of up to 1000°C. It acts as a fire resisting barrier that can keep fire in check, offering vital extra minutes for the rescue of people and property. The environmental benefit of using fire safe Rockwool products is the prolonged life of buildings and the prevention of toxic smoke, polluted water and debris from fires.

## Safety of workplace & product

The Rockwool Group will be the preferred supplier to its customers of our competitive branded solutions - including expertise - enhancing energy efficiency, fire safety, acoustics and improving indoor climate.

### The Rockwool Group's mission

The safety of the workplace and product are key priorities in the Rockwool Group. Our Health & Safety management system for employees has achieved impressive results in recent years. It is also our policy to inform customers how to install and handle products correctly.

#### Historic low accident figures

2004 became the year with the lowest accident frequency ever. On average, the Frequency Rate of Accidents (FRA) was reduced to 15.6 accidents per million working hours. Compared to 2001 this is an improvement of 36%. If we look even further back, the FRA was as high as 50 in 1992.

In 2004 18 factories reached the new, tougher Group environment goal that no factory should have an accident frequency exceeding 19. One factory even had no accidents at all in 2004.

#### WHO confirmed safety of Rockwool fibres

The World Health Organisation's International Agency for Research of Cancer (IARC) concluded in 2001 that rock (stone) wool should be removed from classification as a "possible human carcinogen" (IARC Category 2B). This positive re-classification is because epidemiological studies and long-term inhalation studies have provided no evidence of increased risk of lung cancer from occupational exposure to stone wool fibres.

#### Skin contact

Handling Rockwool products can result in transient itching due to the mechanical effect of coarse fibres – a similar experience to having contact with coarse textiles. Due to this well-known effect, in 1997 the EU classified mineral wool products as irritating to the skin. Together with trade unions and the authorities, the mineral wool industry has made a set of recommendations about how to handle products in a way that minimises transient itching of the skin.

#### Binder components

Rockwool stone wool typically consists of 98% inorganic (stone) materials and only 2% organic material: a

little oil to make the insulation water-repellent and reduce dust, and – to keep the stone fibres together – a urea modified phenol-formaldehyde binder (also used in chip-board furniture and previously in Bakelite door handles and telephones).

Before the product reaches the customer, the binder has been cured in an oven at temperatures above 200°C. Indoor climate tests demonstrate that for building use at normal temperatures no emission problems exist. Rockwool products qualify as M1 - the best indoor climate category according to the strict requirements used in Finland. It is also possible to buy Rockfon acoustic ceilings with the Danish Indoor Climate Label.

In the production of the wet, uncured binder a number of chemicals are present, including ammonia, phenol and formaldehyde, which is a known carcinogen and skin irritant. A safety system is used to prevent our employees from having skin contact with uncured binder. Ventilation and other environmental equipment help minimise air emissions and protect workplace safety.

In the final, cured product no free formaldehyde is present.

#### Good ventilation at high temperatures

Rockwool stone wool is one of the safest materials when it comes to fire or extreme heat due to its high content of inorganic (stone) material that cannot burn or give off smoke.

Like all organic compounds, the small amounts of binder and oil can give off smoke and decomposition products when heated. To cover the special circumstances where insulation is heated up to more than 90°C (industrial insulation around hot pipes e.g. in power plants), the Rockwool Group has published a material safety data sheet recommending good ventilation during the initial heating phase. For normal temperature use in buildings, no such protective measures are needed.

## Local impacts

Our neighbours are key stakeholders. Practising local responsibility and open dialogue is of paramount importance, especially since our products are destined to alleviate environmental problems on a regional and global basis. Our plant must work professionally to keep our own house in order and to minimise any nuisance from our activities.

### **Saving water**

In most regions, clean fresh water is a scarce resource. The Rockwool Group works actively to recycle and thus reduce our consumption of water, and to minimise emissions of waste water.

Over its entire lifecycle, 1 sq.m. of Rockwool loft insulation will 'use' 26.4 litres of water. This corresponds to approximately 2 toilet flushes.

The Rockwool Group uses water to produce the binder, for cleaning, and for cooling purposes. The cooling and cleaning water is recycled. Most of the water used in a Rockwool factory ends up as water vapour in the air. Only a small part (sanitary water and regeneration water from water purification plants) ends up as waste water in compliance with local authority agreements.

Since 2001 the Group's water consumption per production unit has been reduced by 14%.

### **Dust and fly ash from production**

The Rockwool factories use filters to collect dust and fly

ash from the furnaces. The introduction of best available technology (BAT) has had a very positive effect on the emissions of dust from several of our newly acquired factories. Since 2001 dust emissions have decreased by 29%.

To ensure that fly ash is not a risk factor for the environment, nor for the health of our employees and business partners, an investment project in 2004 successfully implemented the Group's new standard for the safe handling of fly ash.

### **Control of chemicals**

In 2004 the new Group policy for the use and control of the risk from chemicals was successfully integrated into our factory management systems as planned.

### **Smell from production**

Filters and afterburners help to reduce the smell from organic binder components. The increased recycling of stone wool waste has many advantages, but it also increases odour emissions from ammonia and burnt Bakelite binder.

Dialogue with neighbours is important. It helps us to rectify our production process swiftly if it does not run as smoothly as it should. In 2004 further improvements of production processes and environmental equipment were made in order to minimise odour emissions.



## Recycling – from waste to valuable resource



1 Green prize. The Canadian Council of Ministers of the Environment (CCME) gave top honours at the 2005 Pollution Prevention Awards to the Group's Canadian subsidiary Roxul Inc. in Milton, Ontario. The prestigious award applauds Roxul Inc.'s environmental success in reducing energy consumption, the impact of air emissions, and production waste going to landfill. From left: Jack Silva, Factory Manager, Trent Ogilvie, President, and Bent Soegaard, Operations Manager of Roxul Inc. in Milton.



2 The more recycling the less landfill sites. Rockwool furnaces turn more than 300,000 tonnes of 'waste' into valuable resource. The Rockwool process resembles the natural action of the volcano: stone wool is made by melting diabase rock, limestone and recycling briquettes with other raw materials at 1500°C in a coke-heated cupola furnace. The liquid stone mass cools rapidly as it is spun into fibres – stone wool. Binder and impregnating oil are added to make the fibres stable and water-repellent. The stone wool is then heated to about 200°C in order to cure the binder and stabilise the material for final processing. Environmental equipment – filters, pre-heaters, after-burners, and other cleaning and collection systems – make the 'tamed volcano' an environmentally responsible process.

The volcanic Diabase rock used in our production is not a scarce resource, being present in large quantities in most regions. Every year the earth's volcanoes and plate tectonics produce 38,000 times more rock material than is being used to make Rockwool stone wool.

Land, however, is a scarce resource. Finding good locations for new waste disposal sites is becoming increasingly difficult and unpopular in our congested modern society. The Rockwool Group has thus invested intensively in recycling systems.

### Reuse valuable resources

The cupola furnace used to make Rockwool products operates at temperatures of more than 1500°C. This means it is ideal for substituting virgin raw materials, such as rock and fuel, with waste materials of a similar chemical composition. Today, the Rockwool Group turns more than 300,000 tonnes of 'waste' into a valuable resource. This industrial symbiosis benefits the environment, our industry partners and the Rockwool economy.

Since 2001 the relative use of residual materials from other industries has increased by 5% which is positive. However 2004 was atypical despite a historic record in the absolute tonnes of reused residual material, the relative use per production unit decreased by 8%.

### Less landfill waste

In the Rockwool Group's internal recycling system, stone wool waste and residue materials from other industries are compressed into recycling briquettes that are melted and processed into new stone wool.

Over the years our investments in recycling facilities have been significant, and today three quarters of the Group's stone wool waste is recycled. Gone forever are the old days when mountains of stone wool residue could be seen on the landscape.

By introducing the Group's recycling technology into our most recently acquired factories, waste levels have been reduced considerably. Compared to 2001 the amount of waste to landfill has decreased by 13%, impressively since 2002 the improvements have actually been 38%. Stone wool residue is also used in other industries, for instance as raw material in bricks.

Numerous leaching analyses confirm that stone wool process waste and used products can be deposited without problems at ordinary landfill sites for mineral waste with low organic content.

# The Rockwool Group

The Rockwool Group is the world's leading supplier of stone wool solutions. Our Mission is to be our customers' preferred supplier of competitive branded solutions – including expertise – enhancing energy efficiency, fire safety, acoustics, and improving indoor climate.

The Rockwool Group was founded in 1937. Today 7,400 employees in more than 30 countries service customers all over the world. In 2004, sales reached € 1,229 million.

Stone wool improves the environment and the quality of life for millions of people. This versatile material is used to insulate against loss of heat and cold. As a result, stone wool reduces air pollution by decreasing the need to burn fossil fuels. Made of rock, stone wool is naturally fire resistant,

tolerating temperatures of up to 1000°C. This makes it ideal to protect lives and valuable assets when used as vital fire protection in buildings and for marine applications.

Stone wool protects against noise pollution and is used in acoustic ceilings, noise screens, around noisy machines, in walls and roofs, under floors and even underneath rail tracks. Stone wool is also used as a growing medium for vegetables and flowers, in façade cladding boards, as reinforcement fibres in cars and for other industrial purposes.

The Rockwool Group is the world leader in stone wool technology. Our 'tamed volcanos' are producing stone wool solutions in 22 factories across Europe, North America and Asia.

## The Rockwool Group's factories:

Rockwool International A/S  
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