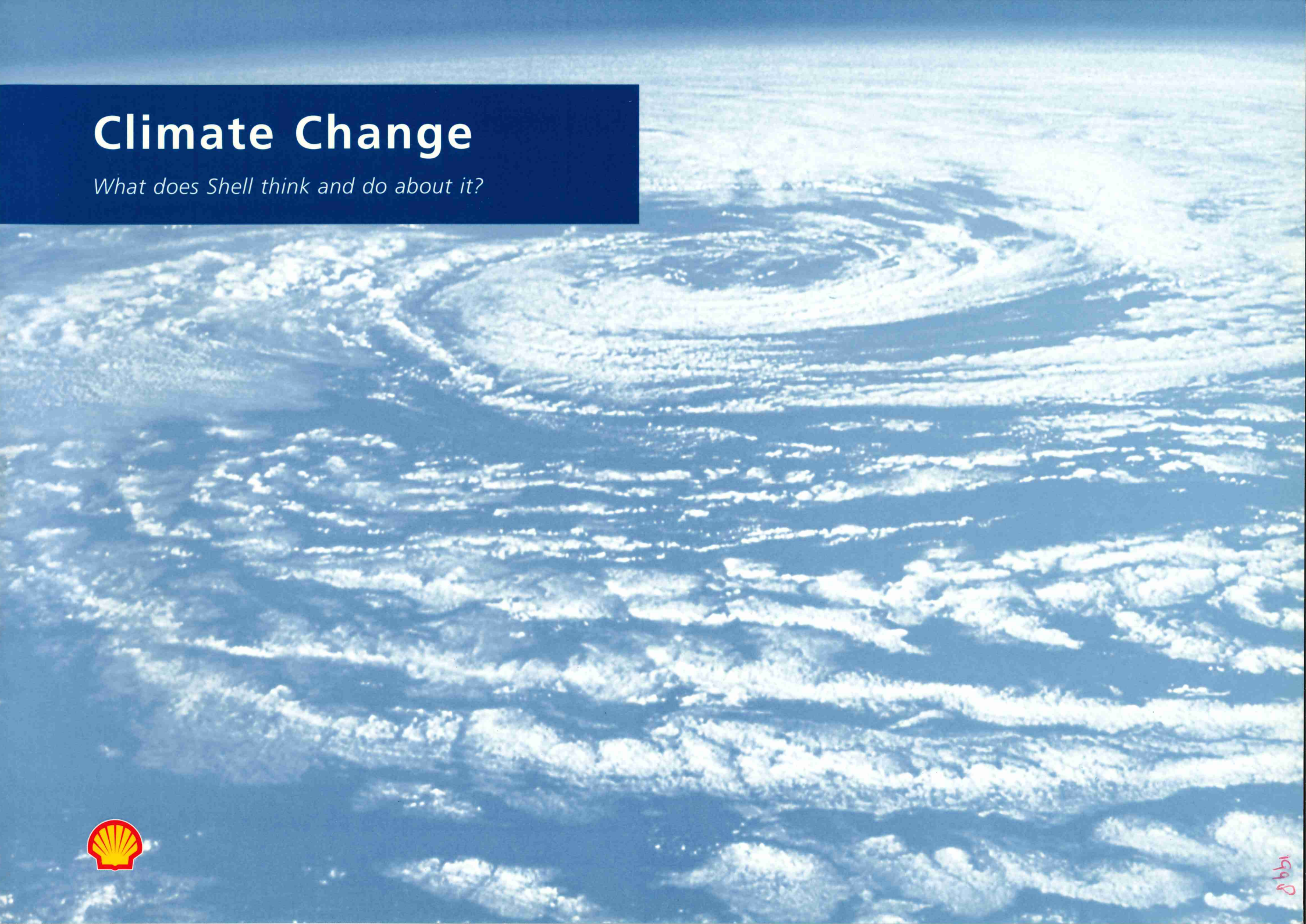
# Climate Change

*What does Shell think and do about it?*



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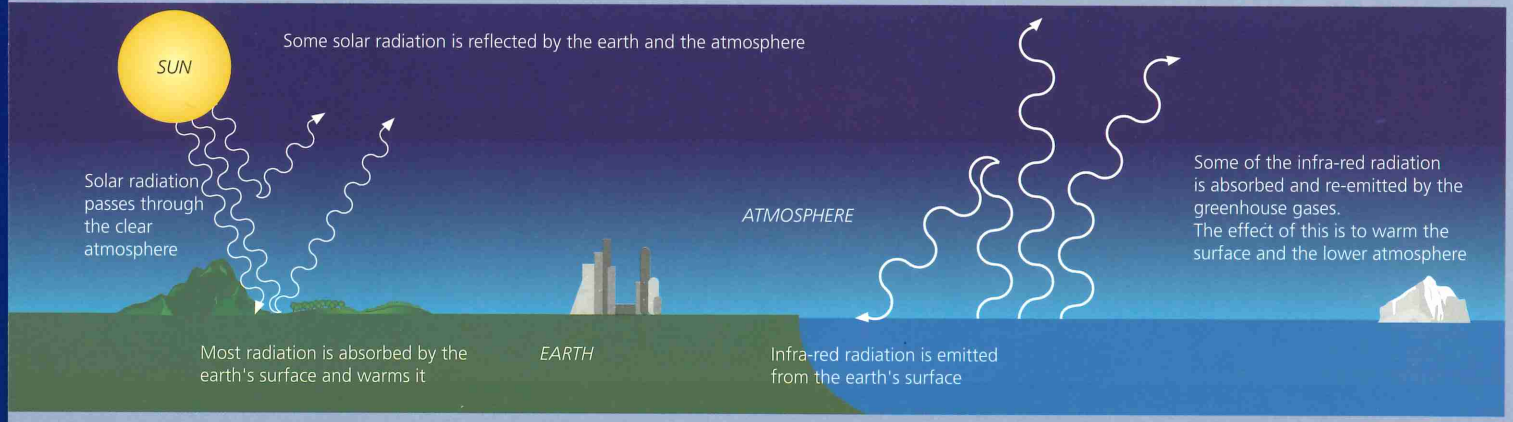
*Each of the companies within the Royal Dutch/Shell Group of companies is a separate and distinct entity. In this report, the expressions Group and Royal Dutch/Shell Group are used to refer to the companies of the Royal Dutch/Shell Group as a whole. The words 'Shell', 'we' and 'us' are used in some places to refer to the Group and in others to an individual Shell company or companies where no useful purpose is served by identifying it or one of them more particularly.*

# CLIMATE CHANGE -WHAT IS IT?




Gases present in the atmosphere, such as water vapour, carbon dioxide and methane, keep the earth warmer than it would otherwise be by acting as an insulating blanket and trapping some of the sun's rays - the natural 'greenhouse effect'.

The burning of fossil fuels such as coal, oil and natural gas, together with other human activities such as deforestation, releases greenhouse gases, especially carbon dioxide ($CO_2$) into the air. Their concentration in the atmosphere has been rising since the industrial revolution. This has led to an increase in the greenhouse effect.

There is concern that an enhanced greenhouse effect will cause the world to warm up. This could cause a change in climate and local weather patterns, possibly with increased droughts, floods, storms and sea level rise. The average temperature of the earth has risen by about half a degree Celsius over the last century, possibly due in part to human greenhouse gas emissions.

## WHAT THE WORLD HAS DECIDED TO DO.

Most of the world's nations were sufficiently concerned to sign a United Nations agreement, the Framework Convention on Climate Change (FCCC), in 1992. Industrial countries agreed to reduce emissions of greenhouse gases to the level they were in 1990, by the year 2000. Very few countries will meet this target.

At a conference in Kyoto (December 1997), stronger commitments under the Convention were agreed. Rich countries will be legally bound to reduce their greenhouse gas emissions by at least 5% on average relative to 1990 levels by the years 2008 to 2012. This is the first real step in what will likely be a series of further international negotiations to tackle the issue globally.

# A CAUSE FOR CONCERN ...

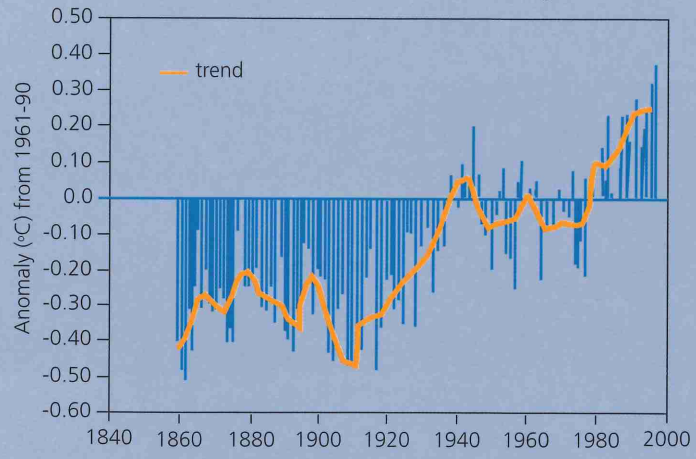
The temperature of the Earth has been rising over the last century.

The causes are not clear but ...

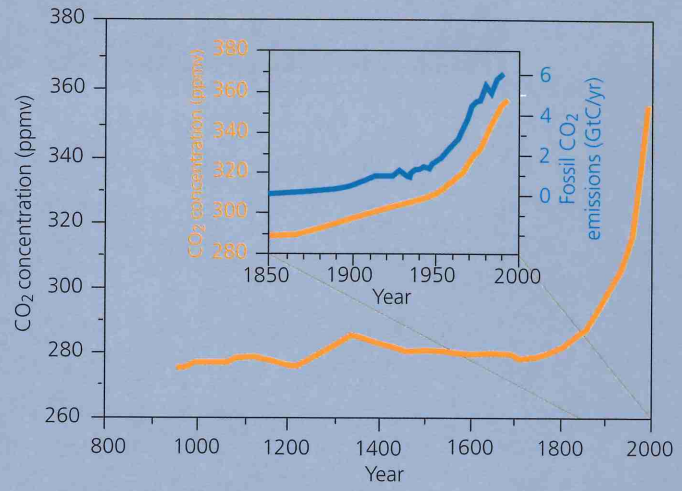
... emissions of greenhouse gases, especially carbon dioxide, from human activities have caused their concentrations in the atmosphere to increase.

We don't know what the consequences of this will be but the projected rise in carbon dioxide concentrations in the air far exceed the levels the planet has seen in at least the last 150,000 years.

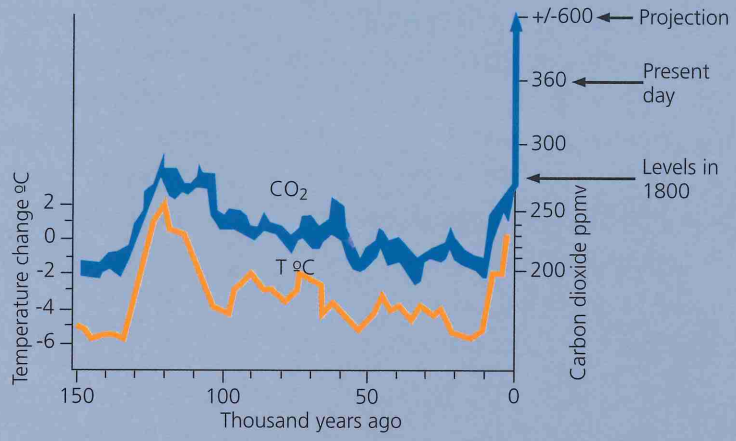
Combined global land and sea surface temperatures 1860-1997 (relative to 1961-90 average)




Atmospheric carbon dioxide concentrations and fossil fuel emissions




Atmospheric carbon dioxide concentrations and global temperatures over the last 150 thousand years



# WHAT SHELL THINKS ABOUT CLIMATE CHANGE AND WHY

The balance of scientific evidence suggests a link between human activities - especially the burning of fossil fuels - and climate change. There are still tremendous uncertainties, which makes it difficult to estimate the size, nature, distribution and speed of any future changes resulting from man's actions. More research is clearly needed to increase understanding of the scientific, social, and economic aspects of the problem.

But much is already known about climate systems. At the very least, mankind is carrying out a risky experiment with the planet by raising the levels of greenhouse gases in the atmosphere to levels far above any seen in the last 150,000 years or more. We don't know whether this will be catastrophic, or whether it might on balance be slightly beneficial. But we do know that it is in effect irreversible. We in Shell share the concern over the possible impacts of using fossil fuels. We believe that prudent precautionary measures are now necessary. The emission limits for greenhouse gases set in Kyoto provide the necessary signals to encourage such measures.

*"Despite the many remaining uncertainties about the nature and the risks of the process [climate change], I believe that there is now sufficient evidence to support prudent precautionary action."*

*Cor Herkströter, Senior Shell Managing Director*

# WHAT SHAPES OUR THINKING

Our thinking on climate change - especially on the action it demands - is shaped by our view of sustainable development and the long-term energy scene.

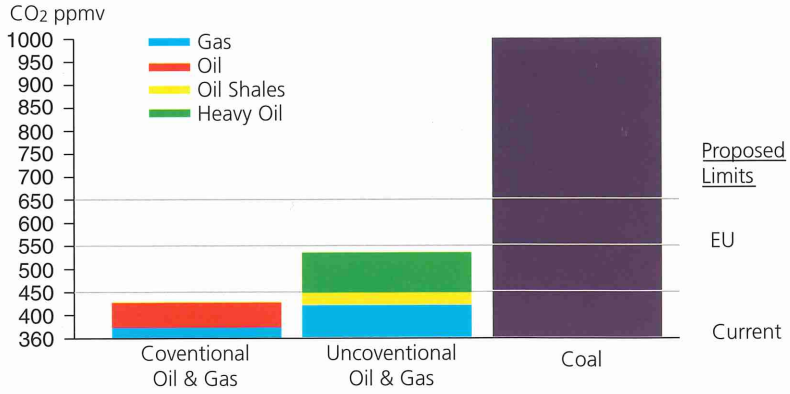
We believe that affordable, clean and reliable energy products are essential to sustainable development: meeting the needs of the present without compromising the ability of future generations to meet their own needs.

Fossil fuels supply around 85 per cent of the world's primary energy needs. They have brought tremendous benefits to an ever increasing world population through economic growth. There are no alternatives available now in sufficient amounts at the right price to replace fossil fuels. However, wind power and some biomass (plant matter) sources are already competitive with fossil fuels in certain cases. We expect solar panels that generate electricity (photovoltaics) and other renewable sources of energy to become increasingly cost-effective over the next decades.

We can draw these conclusions because of our considerable experience in making educated guesses on what might possibly happen in the future. We call this process "scenario building". We have developed two long-term energy scenarios which cover the next century and these have helped us with our thinking on climate change.

- One scenario sees energy consumption continuing to rise at about one per cent a year less than the growth in the world's economy. For the next 20 years the world continues the current shift away from fuels with a high carbon content (e.g. coal), towards lower-carbon fuels, such as natural gas. After 2025 renewable energy sources start to make an important contribution because innovation continues to lower their costs while dwindling reserves lead to higher prices for oil and gas.
- The other scenario sees more radical changes in energy consumption. The world's increased needs are met with less energy and fewer materials. This is because new materials and different ways of working allow a more efficient use of energy. Examples are the growth of information technologies (less need to move goods and people) and dramatically more efficient cars (lower gasoline consumption).

ATMOSPHERE CONCENTRATION FOR TOTAL RESOURCE USE*




Note: * Proven plus undiscovered resources at the 50% probability level

*Source: based on IPCC 1995 SAR and Masters, 1994*

If we were to burn all the fossil fuel resources, the resulting levels of carbon dioxide in the atmosphere could be shown as in the chart

Although these scenarios are very different in their assumptions, they agree on three important points:

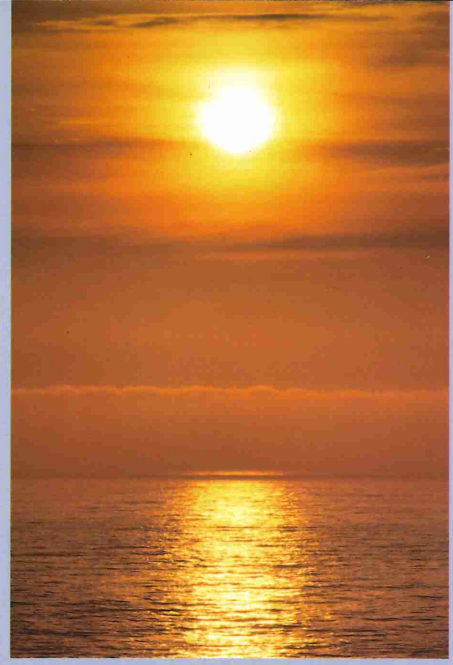
- The eventual consumption of most of the world's conventional oil and gas, mainly because these fuels are highly effective, convenient to use, and easy to transport.
- Use of coal will grow, but not to the same level as some others would suggest when oil and gas resources are running down.
- Carbon dioxide ($CO_2$) emissions could peak in the period 2020-2030, at a level below that of many long-term estimates made by others. This would lead to stabilisation of atmospheric $CO_2$ levels at just over twice the pre-industrial level, close to the 'target' proposed by the European Union.

Our thinking is also influenced by the difference in the amounts of $CO_2$ emitted when various types of fossil fuels are burned.

We do not know exactly how much $CO_2$ in the atmosphere would be dangerous. However, if all known and probable reserves of fossil fuels - of which coal is the biggest component - were burned, it would lead to $CO_2$ concentrations in the atmosphere about twice the EU target. On the other hand, burning only the oil and gas resources would lead to atmospheric $CO_2$ levels well below this and not much above today's levels [see above chart].

If we are to stabilise concentrations at a reasonable level, say twice the pre-industrial level, we will have to be much more efficient in our use of energy. It is likely that we will eventually have to choose oil, gas and renewables, and perhaps even nuclear, in preference to coal. We may also find effective ways of capturing and disposing of $CO_2$ from combustion gases in some cases.

# ROLE OF GOVERNMENT



Governments have an important role to play in setting the policy frameworks that will help deal with the climate change issue.

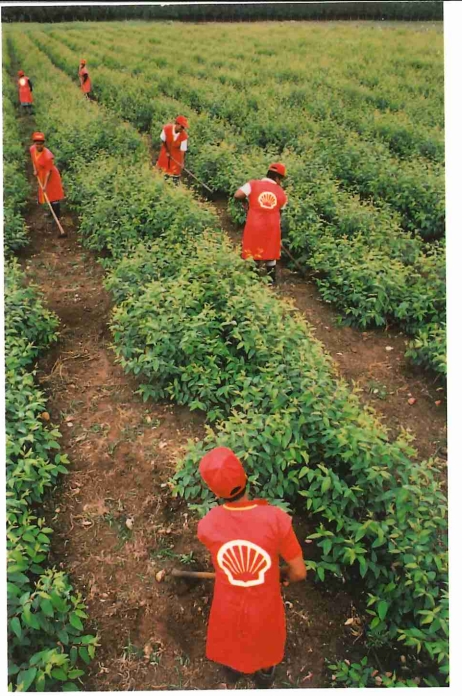
Governments should consult with industry and others on how to achieve their national commitments to greenhouse gas reductions without undermining industry's competitive position. They should consider all the policy options open to them. Policies selected should:

- Work with the market, not against it - this is the most efficient way to allocate resources
- Remove subsidies and other market distortions
- Encourage the development of "climate friendly" technologies
- Help reduce emissions in the cheapest way through tradable emissions permits and joint initiatives with other countries

Governments should also be the main funders of research into the climate system and its impacts, because such information benefits society as a whole.

Shell companies believe their knowledge of energy markets enables them to contribute to the debate on the right sorts of policies and to discuss practical measures with governments in countries where they operate. Much of this is done through industry groups in which they participate, especially at national level. Shell companies also contributes positively through international industry bodies such as the International Petroleum Industry Environmental Conservation Association (IPIECA), the International Chamber of Commerce and the World Business Council for Sustainable Development.

# WHAT IS SHELL DOING ABOUT CLIMATE CHANGE?



Energy markets are always changing. Shell companies have to plan for these changes and meet their responsibilities to shareholders, employees, those with whom they do business and to society at large. They must play their part in the necessary precautionary measures to limit greenhouse gas emissions.

Shell companies expect to do the following:

- **Continue to produce oil and gas** to fuel the next 20-30 years of economic growth, particularly in developing countries. With populations rising, this is quite a challenge. This means Shell companies have to continue to **find more reserves.**

- **Provide more natural gas.** This fuel will be in high demand for the next few decades because it is abundant, can be converted efficiently into electricity, can be relatively cheap to find and transport and emits far less carbon and other pollutants than competing fuels. Shell companies are developing natural gas resources and bringing them to market through liquefaction, conversion to diesel type fuels, and through pipelines. They are increasing their investments in these businesses e.g. liquefied natural gas projects in Oman and Nigeria, gas exploration in Peru, and the partnership with Gazprom in Russia.

- Develop their businesses in gas-fired **power generation** which produces less than half the amount of $CO_2$ per unit of electricity generated compared with coal. For example, Shell International Gas Ltd has recently taken a 50% stake in InterGen, a major independent power producer, and has a number of plans for new power stations within its own power business unit. Electricity is essential for development and improvements in the quality of life,


especially in developing countries.

● **Develop renewable energy sources.** Shell companies aim to be a major force in renewables, which are seen as gaining a major share of the world energy market beyond 2020. They will invest $500 million over the next five years on renewable resources, especially forestry, solar power and biomass energy. The newly formed Shell International Renewables Ltd now represents the Group's fifth core business. Its substantial forestry business absorbs large amounts of carbon dioxide.

● **Reduce emissions** of greenhouse gases in their own operations as well as helping their customers to do the same.

● Fund programmes that help **improve our understanding** of climate change and its impacts, such as the science and policy work at the Massachusetts Institute of Technology in the USA.

# REDUCING EMISSIONS OF GREENHOUSE GASES

The daily operations of Shell companies produce greenhouse gases when they burn off (flare) or release (vent) unwanted gases in the production of oil and gas; and when they transport, store and distribute their products. Shell companies also burn fossil fuels when they refine oil and manufacture chemicals, and this releases greenhouse gases.

Refineries have invested heavily to improve **energy efficiency** over many years. This has not necessarily reduced their overall fuel use in recent years, because increased demand for cleaner road transport fuels, such as low-sulphur diesel, has increased the amount of energy needed to refine a given amount of product.

**Flaring.** About 85% of overall flaring takes place in Nigeria. The Shell company in Nigeria is committed to stop all continuous flaring by 2008, or sooner. Shell companies have reduced flaring by over 20% in aggregate between 1992 and 1996. Norske Shell, for example, has already eliminated continuous flaring.

**Venting**. This releases mainly methane, which is a much more powerful greenhouse gas than $CO_2$. It is better in the short term to burn this gas rather than release it to the atmosphere. Consequently, the plans are to convert vents to flares and subsequently to stop the flaring. Venting has been reduced by 26 % since 1992.

**CFCs and halons.** These are powerful greenhouse gases. Shell companies use relatively small amounts (mainly for fire fighting) and have reduced emissions by 85% since 1992. They aim to eliminate the use of the most damaging of these gases.

Shell companies contribute to reducing their **customer's greenhouse gas emissions** mainly by providing them with lower carbon fuels, especially natural gas and renewable energy sources. Many Shell companies have promoted automotive LPG, a fuel with a lower carbon content than gasoline.

Modern petrochemical products produced by Shell chemical operations allow the substitution of energy intensive materials such as steel with **less energy intensive plastics.** This has made a major contribution to reducing the weight of cars, and therefore improving their


fuel efficiency. A number of Shell products are used as insulators to reduce heat loss from buildings and refrigerators.

Further improvements, albeit small in $CO_2$ emissions, come from the **additives** used in fuels and lubricants that improve or maintain engine efficiency.

More information on these activities may be found in the various Health Safety and Environment reports of the Royal Dutch/Shell Group, its main businesses and its operating companies, obtainable from the Shell web site at: http://www.shell.com or from SLBPA-PXX, Shell Centre, York Road, London SE1 7NA, UK.

The Group's contribution to targets for greenhouse gas reductions may be small in global terms. Greenhouse gas emissions come from so many of society's activities that no single source is ever a large part of the total. Nonetheless, we must all play our part, according to our capabilities and circumstances.

*"...given the risks and uncertainties, it is clearly prudent to develop alternative ways of generating energy, learn to use energy more efficiently and reduce the environmental impact of producing and burning fossil fuels."*

*Sir John Jennings, former Shell Managing Director*

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