PLANET IN PERIL

Turning up the heat – why is our climate changing?

THE Earth would be a very cold place if there were no greenhouse gases in the air to retain the warmth of the sun. In fact, scientists believe the average temperature of the Earth would be a freezing minus 18°C if there was no natural greenhouse effect. Luckily the natural greenhouse effect has provided the more cosy 14°C average surface temperature we enjoy today and which has allowed nature and humanity to flourish.

These gases remain in the Earth's atmosphere and act like a kind of invisible blanket, retaining some of the heat of the sun, much like the glass greenhouses which allow plants to grow in cold climates.

GREENHOUSE GASES

THERE are hundreds of different greenhouse gases, but one of the most important is carbon dioxide (CO_2). This is a natural gas which is released into the air when volcanoes erupt, when animals breathe through their lungs and when plants die. However, CO_2 is also one of the main gases released into the air from burning coal, oil and other fossil fuels. It is also released when people cut down forests and other vegetation to create new farming areas.

Methane is another powerful natural greenhouse gas which gets released from rotting plants and human rubbish dumps. One of the most potent greenhouse gases is nitrous oxide, which is a by-product of farming fertilisers and burning fossil fuels and is 310 times more potent than CO_2.

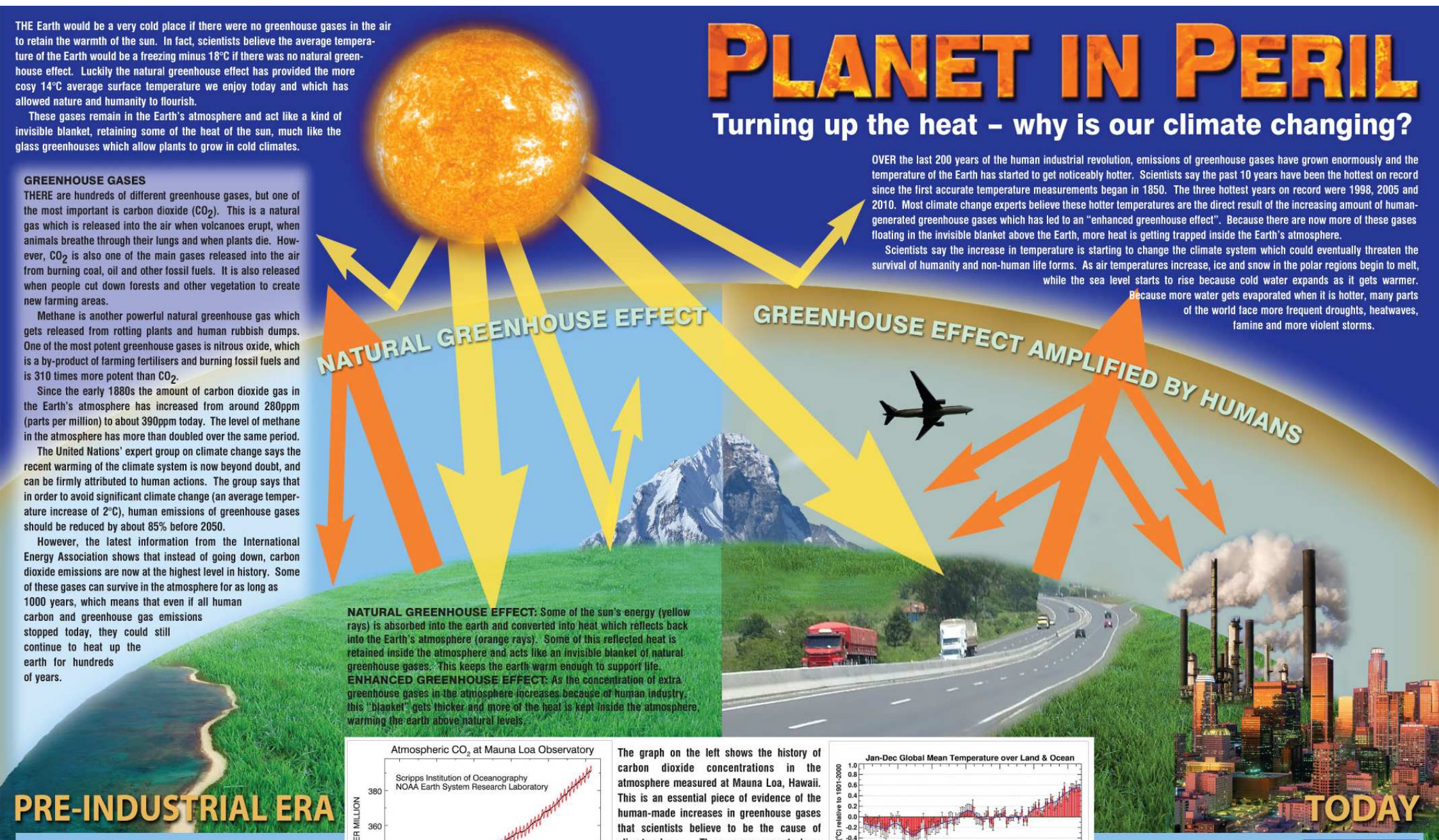
Since the early 1880s the amount of carbon dioxide gas in the Earth's atmosphere has increased from around 280ppm (parts per million) to about 390ppm today. The level of methane in the atmosphere has more than doubled over the same period.

The United Nations' expert group on climate change says the recent warming of the climate system is now beyond doubt, and can be firmly attributed to human actions. The group says that in order to avoid significant climate change (an average temperature increase of 2°C), human emissions of greenhouse gases should be reduced by about 85% before 2050.

However, the latest information from the International Energy Association shows that instead of going down, carbon dioxide emissions are now at the highest level in history. Some of these gases can survive in the atmosphere for as long as 1000 years, which means that even if all human carbon and greenhouse gas emissions stopped today, they could still continue to heat up the earth for hundreds of years.

OVER the last 200 years of the human industrial revolution, emissions of greenhouse gases have grown enormously and the temperature of the Earth has started to get noticeably hotter. Scientists say the past 10 years have been the hottest on record since the first accurate temperature measurements began in 1850. The three hottest years on record were 1998, 2005 and 2010. Most climate change experts believe these hotter temperatures are the direct result of the increasing amount of human-generated greenhouse gases which has led to an "enhanced greenhouse effect". Because there are now more of these gases floating in the invisible blanket above the Earth, more heat is getting trapped inside the Earth's atmosphere.

Scientists say the increase in temperature is starting to change the climate system which could eventually threaten the survival of humanity and non-human life forms. As air temperatures increase, ice and snow in the polar regions begin to melt, while the sea level starts to rise because cold water expands as it gets warmer. Because more water gets evaporated when it is hotter, many parts of the world face more frequent droughts, heatwaves, famine and more violent storms.



NATURAL GREENHOUSE EFFECT: Some of the sun's energy (yellow rays) is absorbed into the earth and converted into heat which reflects back into the Earth's atmosphere (orange rays). Some of this reflected heat is retained inside the atmosphere and acts like an invisible blanket of natural greenhouse gases. This keeps the earth warm enough to support life.
ENHANCED GREENHOUSE EFFECT: As the concentration of extra greenhouse gases in the atmosphere increases because of human industry, this "blanket" gets thicker and more of the heat is kept inside the atmosphere, warming the earth above natural levels.

The graph on the left shows the history of carbon dioxide concentrations in the atmosphere measured at Mauna Loa, Hawaii. This is an essential piece of evidence of the human-made increases in greenhouse gases that scientists believe to be the cause of climate change. These measurements have been independently confirmed at many other sites around the world.

As carbon levels rise, the average global air temperature has also increased (right) and is expected to get even hotter.

Image: NOAA National Climatic Data Centre.

THE MERCURY

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