KAURI
Oil & Gas (NZ) Ltd

21 January 2021

**Open Letter to Prime Minister's Chief Science Adviser**

**Introduction**

The Climate Change Commission is currently preparing the first three five-year emissions budgets, extending out to 2035, following the enactment of the Climate Change Response (Zero Carbon) Amendment Act 2019. The recommendations of the Commission will be open for consultation from 1 February to 14 March 2021. This submission is likely to fall outside the scope of the consultation and so is provided to assist in the development of those recommendations.

Given the consequences of current government Climate policy on every aspect of the New Zealand economy, but in particular the oil & gas industry, the dairy industry, air travel (and hence tourism), and the professional and life opportunities for young New Zealanders, Kauri Oil & Gas (NZ) Ltd has completed a review of current climate science. I preface my conclusions by stating I am a petroleum geologist and an unapologetic advocate of fossil fuels, and in particular natural gas which is plentiful, cheap, reliable, and environmentally benign. I make no claim to being a climate scientist, but then do not consider any of the government's scientific advisers to be climate scientists either, as none has the breadth or depth of knowledge necessary. As an exploration geologist, however, I am experienced in integrating disparate data and testing multiple hypotheses. I have documented my understanding and am happy to be corrected on factual errors.

The review (*A Geologist's Perspective on Climate Change 18 January 2021*) can be accessed on our website www.kaurioilandgas.co.nz and contains details of references etc, which are not included here.

**Summary of Conclusions/Position**

- Climate change is real and continuous. The earth is a dynamic system and constantly readjusting and re-equilibrating.

- Climate is the result of interactions between hundreds, if not thousands, of factors and processes, many of which are still poorly understood (e.g. the frequency and scale of volcanism and associated emissions of carbon dioxide or the scale of emissions of carbon dioxide and methane from sedimentary basins).

- Almost half of the warmth in the atmosphere is provided by the earth. The remainder comes from the sun. Temperature profiles in the troposphere are extensions of the subsurface temperature profile.

- The atmospheric concentrations of the so-called Greenhouse Gases (water, carbon dioxide and methane) have increased over the last 100 years and human activity is demonstrably a major cause.

- Temperatures in some areas have consistently increased since the 1950s; others have remained stable or decreased – while there is an anthropogenic component to climate change this is not global warming.

- The Greenhouse Model was developed in the 1850's and it is only recently that remote sensing technology has provided the capability to measure the components of earth's energy budget. These measurements show several of the assumptions associated with the model to be wrong.

- The main driver for temperature increases has been an increase in the high-intensity shortwave solar radiation reaching the troposphere and striking earth's surface. This is due to depletion of ozone as a result of emissions of chlorofluorocarbons (CFCs). The effects of this are widely known – the ozone hole and the high melanoma rates in Australia and New Zealand. This shortwave radiation is then transformed into downgoing longwave radiation through evaporation etc, increasing the net radiative flux.

- The impact of increased shortwave radiation on water vapour is an order of magnitude more significant than the impact of increased carbon dioxide concentrations – and these have both been measured.

- The increased concentration of carbon dioxide and methane in the atmosphere have an inconsequential effect on temperatures. **Fossil fuels are not the cause of climate change**.

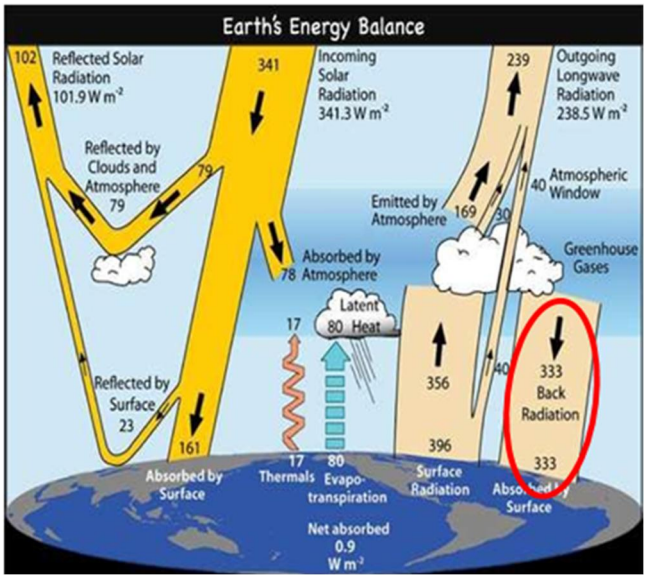
- A decarbonisation strategy is misdirected, futile, and potentially ruinous to western economies.

**Greenhouse Model**

The Greenhouse model was developed in the 1850s as a possible explanation for the warmth of the atmosphere and the occurrence of glacial periods. The theory states that shortwave electromagnetic radiation from the sun is transformed into long wave (infrared) radiation at the earth's surface and re-radiated back into space. A portion of the longwave radiation is trapped by so-called Greenhouse gases (mainly water, carbon dioxide and methane) in the atmosphere,warming the planet.

Satellite measurements of incoming and outgoing radiation are detailed in the diagram below. The first point to note is that the model assumes all energy driving the climate is solar, discounting heat from within the earth as inconsequential.

Secondly, incoming short wavelength solar radiation (341.3 W $m^{-2}$) is equivalent to outgoing radiation (101.9 W $m^{-2}$ of reflected shortwave plus 238.5 W $m^{-2}$ of longwave radiation). On this simple basis, the Greenhouse model is invalid.




*Earth's Energy Balance, (after Trenberth et al 2009 as used by IPCC)*

Of the 341 W $m^{-2}$ that enters the atmosphere, 102 W $m^{-2}$ is reflected as shortwave energy and 78 W $m^{-2}$ is absorbed by ozone,water vapour and oxygen, leaving 161 W $m^{-2}$ to reach the surface. 80 W $m^{-2}$ and 17 W $m^{-2}$ are utilised in evaporation/thermals, leaving only 64 W $m^{-2}$ to be converted directly to outgoing longwave radiation, yet outgoing longwave radiation is 239 W $m^{-2}$ .

The average surface temperature of the earth is 14 deg C. Blackbody radiation calculations indicate a body at this temperature radiates 396 W.$m^{-2}$. This surface recycled solar radiation is combined with 333 W $m^{-2}$ of longwave radiation in the atmosphere to make the total radiation of 396 W $m^{-2}$. The question, therefore is where does the 333 W.$m^{-2}$originate? Once we add shortwave converted in atmosphere (78 W $m^{-2}$) plus longwave emitted by evaporation and thermals (80+17 W $m^{-2}$) this still leaves a **shortfall of 157 W $m^{-2}$**

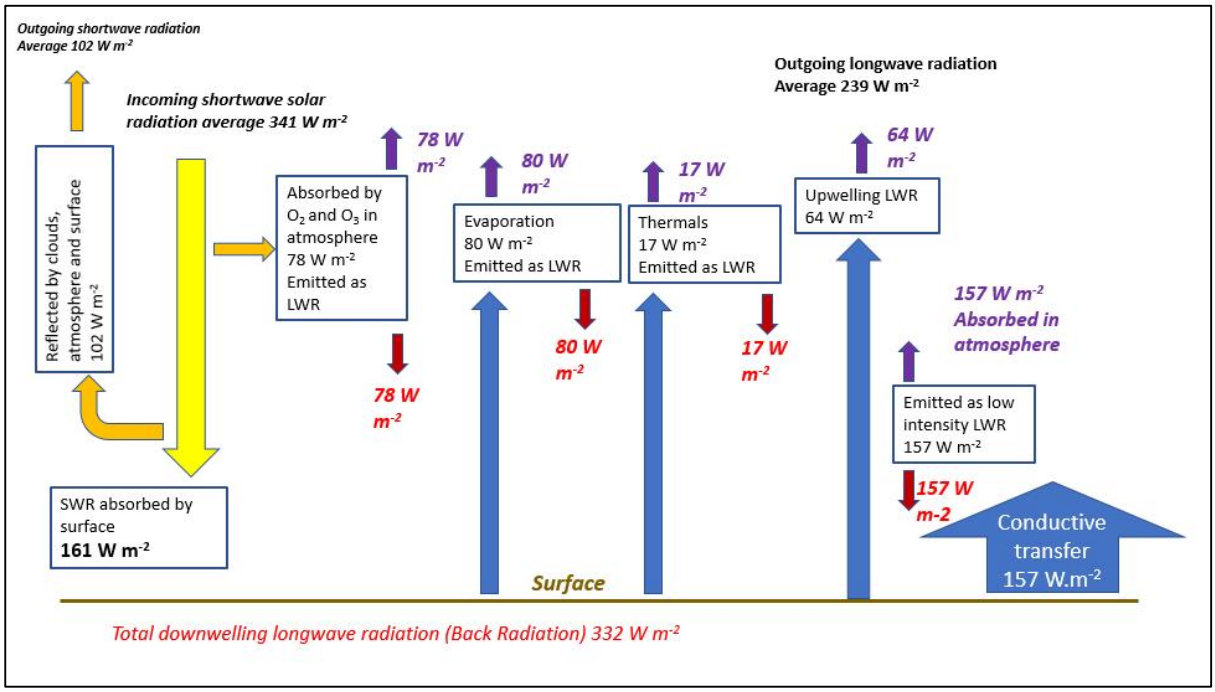
The IPCC model has input energy of 239 W $m^{-2}$ (incoming shortwave radiation absorbed by atmosphere + shortwave reaching the surface) and output of 239 W $m^{-2}$, but creates 157 W $m^{-2}$ in the atmosphere to explain measured back radiation of 333 W $m^{-2}$.

**Rutherford Model**

The earth is hot and temperatures increase with depth. This is a combination of a cooling core and radiogenic decay in the crust, which generates heat. This is transferred to the atmosphere via conductive and convective transfer through the water phase. The heat flux at the earth/atmosphere interface is a function of the temperature difference across the boundary. Subsurface temperature measurements, taken in oil and gas wells and deep mines, indicate temperature equilibrium across the earth/atmosphere boundary – the atmospheric lapse rate is a continuation of the subsurface geothermal gradient, but with a lower gradient reflecting vapour. The average temperature of the subsurface is the same as the average temperature of the surface (14 degrees C).

The heat flow from the earth, without the buffer provided by water, is 157 W $m^{-2}$. This confirms that, far from being 100% solar, the energy in the atmosphere is contributed roughly 60/40 by solar and subsurface. This heat flow is spread across the atmosphere and oceans/groundwater.

The Energy Balance can then be redrawn as below; this is informally referred to as the Rutherford Model, as it was Ernest Rutherford who identified heat generation in the crust due to radiogenic decay. The 157 W $m^{-2}$ is low intensity energy, transferred to the atmosphere via conduction and convection and emitted as longwave radiation, part of the 332 W $m^{-2}$ of Downwards Longwave Radiation recorded at the surface.




*The Rutherford Energy Model incorporates energy from the earth*

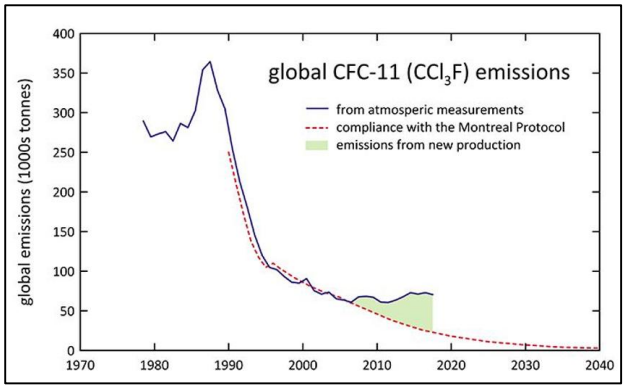
The lower 10m of the atmosphere accounts for 36% of total surface downward longwave radiation.

**Ozone Depletion**

The probable cause of a warming trend since the 1950s is ozone depletion. The destruction of ozone enables more high-intensity short-wavelength radiation to enter the atmosphere and reach the earth. This is absorbed not only by ozone but also by oxygen and water (vapour and liquid). It also increases evaporation, increasing the water vapour concentration in the atmosphere and thereby absorbing more incoming shortwave radiation.

The production of CFCs commenced in 1928 and associated emissions reached a peak in the 1980s. When the environmental damage was recognised the Montreal Protocol (1987) was signed by all nations. Emissions fell and this reduction created a pulse or signature that can be tracked through a number of climate-related datasets – ozone density, shortwave radiation at surface, UV Index, water vapour and ultimately temperature (the temperature pause of 1998-2012). In contrast, none of these bear any relation to the $CO_2$ concentrations which have consistently tracked upwards at 4%.

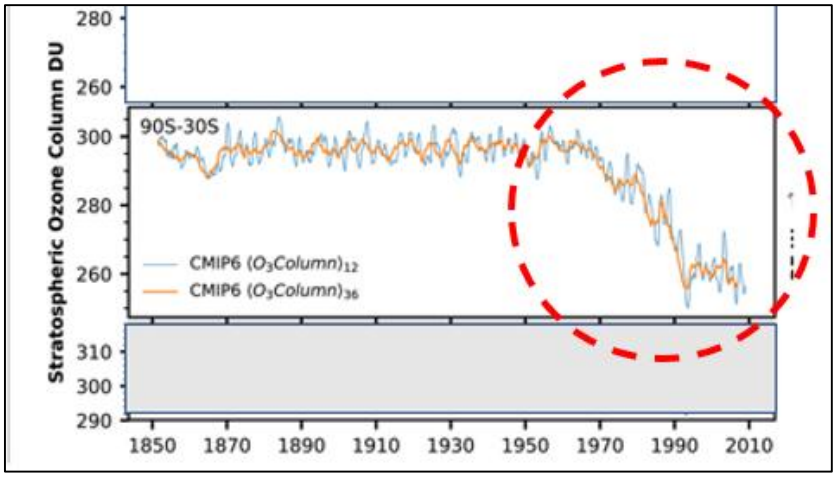
China recommenced production around 2008 and emissions are estimated to be growing by 7,000 tonnes/year. The plots below show global CFC emissions (the area in green reflects new production in contravention of the Montreal Protocol).




*Global CFC Emissions (Paul Crumell, CSIRO)*

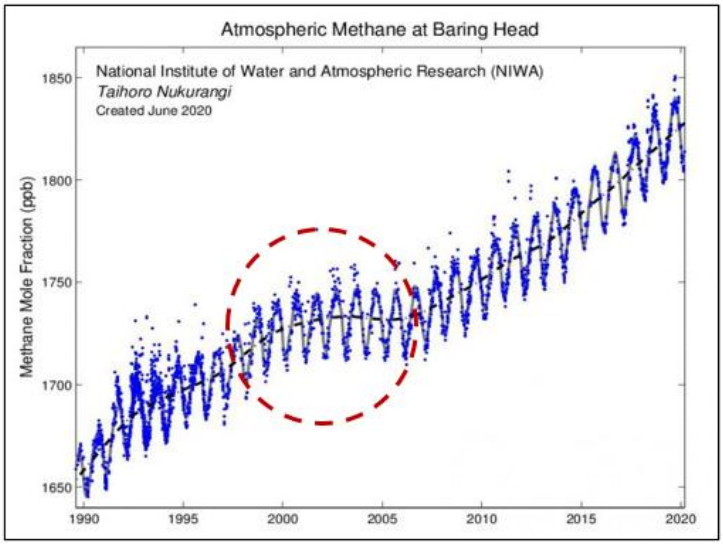
The correlation between CFCs and temperature has been noted numerous times, but only in the context of their capacity to act as Greenhouse gases. The mechanism proposed here is a sequence of reactions and physical processes.

Ozone is generated by high-intensity UV radiation splitting oxygen molecules in the thermosphere (approx. 80 km altitude). The oxygen recombines as ozone and falls towards earth. Chlorofluorocarbons (CFCs) deplete ozone by breaking molecules down with Chlorine; this is most marked in the southern hemisphere stratosphere. Ozone depletion started in the southern hemisphere in the 1950s and increased until the 1990s.



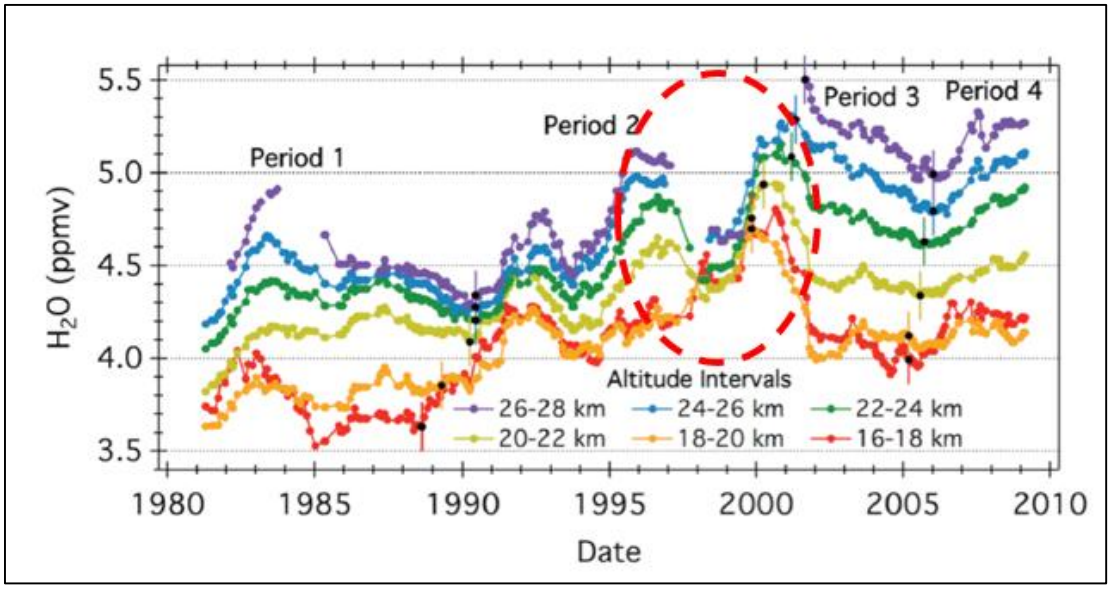

*Ozone column in southern hemisphere (Checa-Garcia et.al, 2018)*

Ozone reacts with methane rising from the surface to generate water and CO2. As ozone concentrations decline, more methane survives in the troposphere; hence increasing methane levels have little to do with increased emissions. The pause is evident as a plateau in methane concentrations.



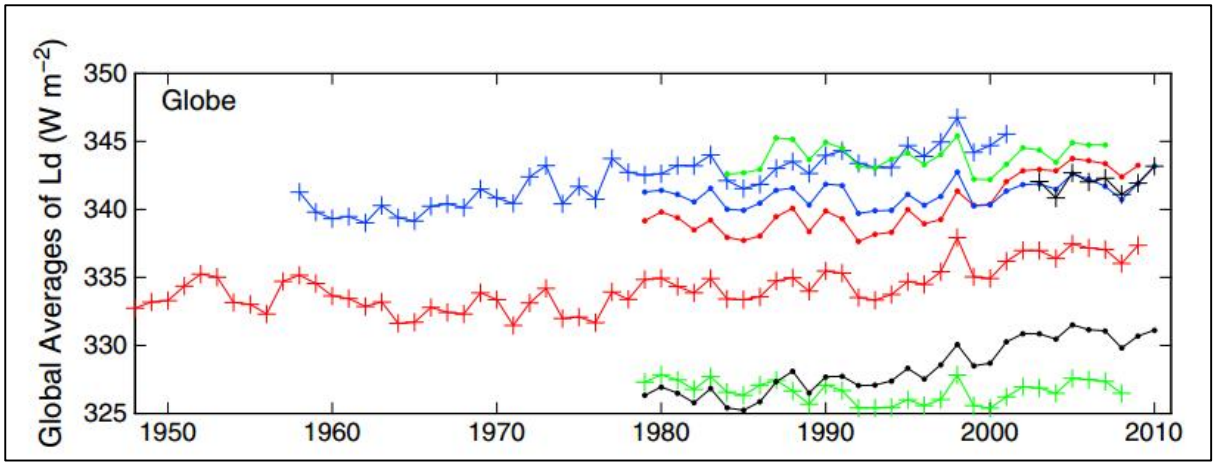

*Methane concentrations, Baring Head, N.Z. (NIWA)*

The increased UV leads to increased evaporation, reflected in water vapour concentrations. The plot below shows data above Colorado, with a significant decrease in the period 1997-2002. Water vapour is therefore the magic ingredient. Depletion of ozone allows more UV to reach the surface and in turn results in more evaporation; evaporation increases water vapour content, which absorbs more UV radiation and condenses.

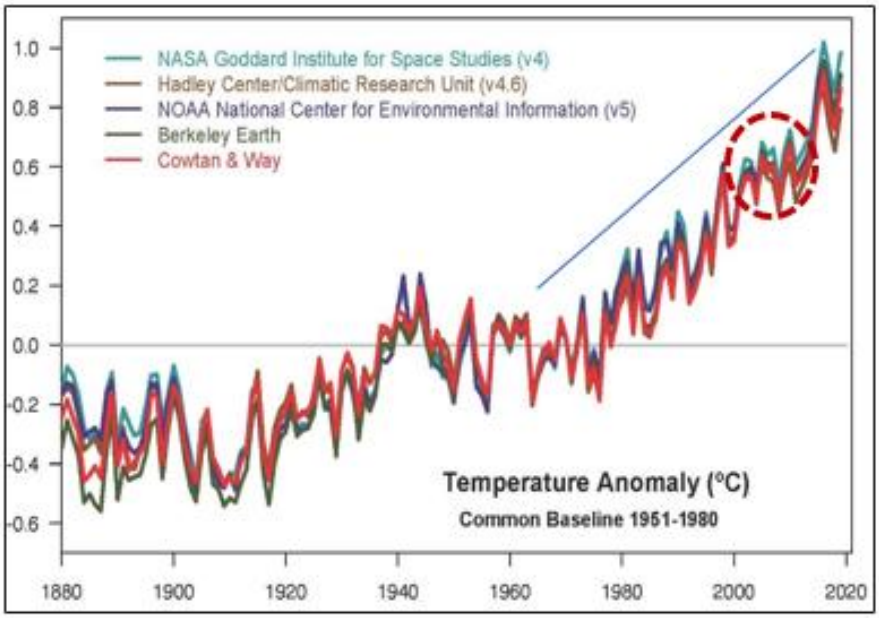



*Stratospheric water vapour trends over Colorado (Hurst et.al, 2011)*

This in turn leads to increasing downward longwave radiation (plot below).

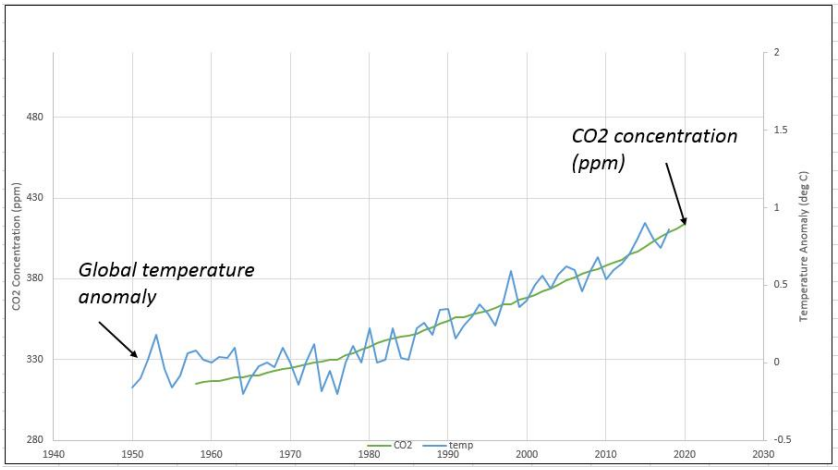



*Global Averages of downward longwave radiation compiled from different sources (Wang and Dickinson, 2013)*



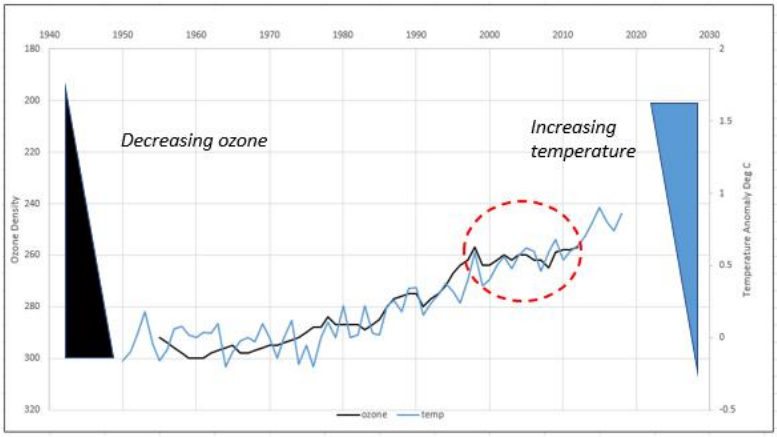

*Global Temperature Anomalies (NASA)*

The current trend of increasing temperatures started in the 1950s and continues to the present day at a rate of around 0.12 $^{o}$C per decade, except for the period 1998 – 2012 (widely referred to as the **Temperature Hiatus**) when it slowed to 0.05$^{o}$ C per decade.



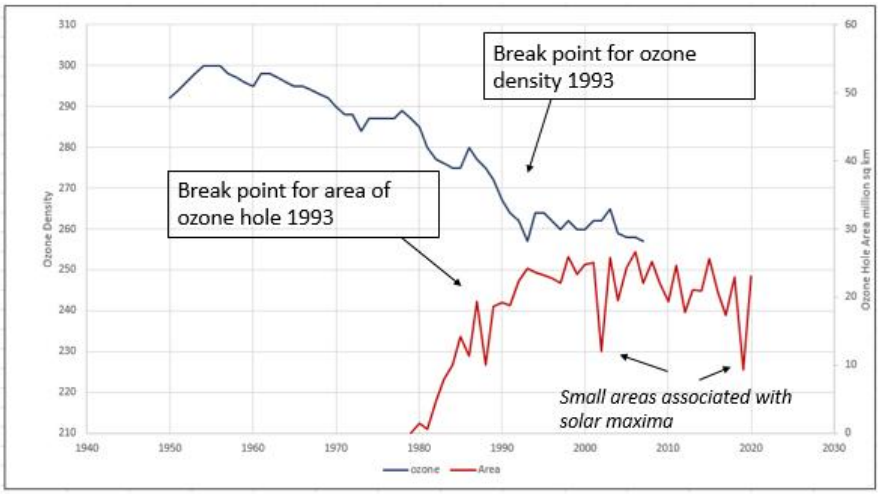

*Plot of atmospheric carbon dioxide levels and the Global Temperature Anomaly*

This apparent correlation is the basis for the current climate science. $CO_2$ concentrations have risen steadily at 4% . The correlation of temperature with ozone concentration is a better fit.

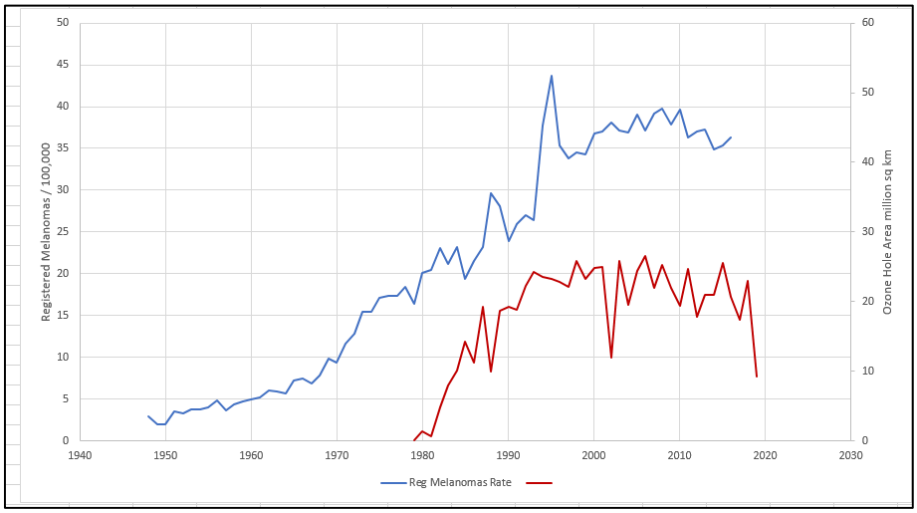



*Plot of Global Temperature Anomaly and Ozone concentration (with a lag of 5 years)*

CFC production decreased by 57% between 1990 and 1999. Ozone depletion stabilised from 1993 (a lag of 3 years). The rate of temperature increase decreased by 58% between 1998 (a further lag of 5 years) and 2012. $CO_2$ concentrations increased steadily by 4% during both of these periods.
It is not Greenhouse gases that are to blame for rising temperatures and falling ocean alkalinity.
**Ozone depletion** is the cause of accelerated temperature increase since the 1950s. The Greenhouse Effect is slight, and carbon dioxide produced from combustion of fossil fuels is not responsible for current trends in climate. We know ozone depletion can be repaired and this is urgent – the southern hemisphere Ozone hole is healing very slowly and is still as large as it was in the 1980s and 1990s (23 million sq km in 2020, 19.3 million sq km in 1987).




*Southern hemisphere ozone density (blue) and ozone hole area (red)*




*New Zealand melanoma rate (blue) and ozone hole area (red)*

**Quantification of Carbon Dioxide Contribution to Temperature**

Recent measurements have quantified the effects of increasing Greenhouse gases (details in Kauri review document):

1. The atmosphere comprises approximately 78% Nitrogen, 21% oxygen, 1-5% water vapour, 410 ppm carbon dioxide, 1900ppb methane, plus other minor gases

2. Carbon Dioxide constitutes 0.0004% of the atmosphere and around 2% of the Greenhouse Gases. Water vapour constitutes 96% of the Greenhouse Gases.

3. Detailed measurement of $CO_2$ over 10 years confirms radiative forcing of 0.2 $W.m^{-2}$ with an increase in concentration of 22ppm. This is an average of .009 $W.m^{-2}$/ppm, or 3.7 $W.m^{-2}$ for 410ppm.

4. Based on average atmospheric water vapour content of 2.5% (25000 ppm), the water emissions component of downward longwave radiation (around 96% volume) is 326 $W.m^{-2}$ or 0.013 $W.m^{-2}$ per ppm. This is consistent with the absorption spectra which show water absorbs over a wider frequency range.

5. The total downward radiation at the earth's surface is 490 $W.m^{-2}$ (shortwave 160 $W.m^{-2}$ longwave 330 $W.m^{-2}$) so $CO_2$ constitutes 0.008%. Of the 410ppm $CO_2$, 120-130ppm has been added during the last 100 years. If 50% of that is the result of human activity, fossil fuels are responsible for 0.52 $W.m^{-2}$ (0.001%) of the total energy.

6. Shortwave radiation reaching the earth's surface increased by **2.4 $W.m^{-2}$ over a decade** while incoming shortwave radiation at the top of atmosphere remained relatively constant. This was primarily due to anthropogenic damage to the o-zone

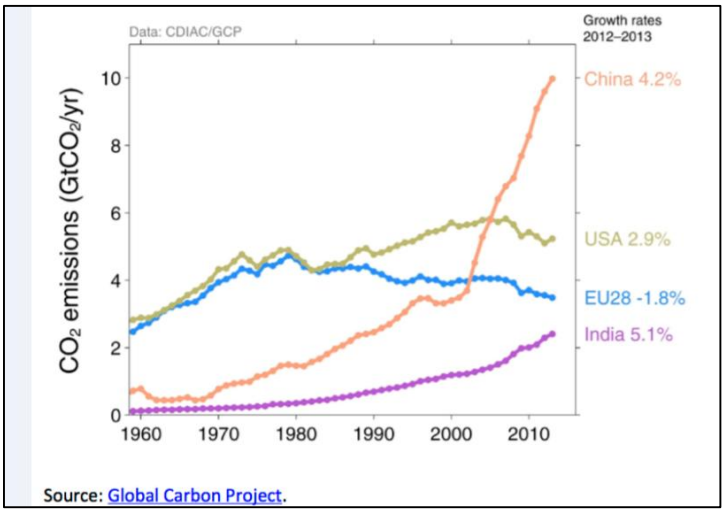
7. Longwave (downward) radiation has been increasing since the 1970s by up to **5 $W.m^{-2}$ /decade**.

8. Carbon dioxide is being added to the atmosphere at a higher than usual rate (22ppm/decade) however the shortwave radiation from ozone depletion and the longwave radiation each had an order of magnitude more impact on the climate.

**Conclusions**

The Greenhouse model was proposed in the 1850s and has been retained, virtually unchanged, despite a growing body of direct evidence showing it to be unrealistic. The Montreal Protocol was adopted in 1987, and the IPCC was established in 1988, with Greenhouse gases already (mistakenly) identified as the problem. Huge volumes of data have been acquired since the IPCC was established. The IPCC has completed 5 Assessment reports, the last of which was completed in 2013-2014 and provided the scientific input for the Paris Accord in 2018. The key data are the direct measurements of Feldman et al 2015, which confirm emissions from carbon dioxide are inconsequential and proportional to the volume in the atmosphere. Even these could be minimised simply by chilling exhausts.

Decarbonisation will not fix the problem. This seems self-evident but apparently not. If you accept climate change, if you accept temperatures are increasing and think we should slow or reverse this trend, then we need to identify the problem correctly. There is no evidence that increased concentrations of carbon dioxide in the atmosphere causes harm, but direct evidence that it is beneficial. Decarbonisation will have no effect on climate but the cost is crippling. Recently the Minister for Climate Change stated New Zealand should emulate China in setting aggressive goals to reduce emissions. As the chart below shows, despite the rhetoric China has no intent to reach net zero emissions and is on a path of industrial expansion. There is no reason to expect they will not ignore the Paris Accord as they have the Montreal Protocol.




*CO2 emissions by country showing China's industrial expansion*

The future is not bleak and children need to be reassured. We have allowed climate scientists to travel around the country fearmongering in schools and bullying councils (and now our government) into declaring emergencies. Climate change resources provided to schools include statements such as '*there is no alternative explanation that does not involve rising* $CO_2$*"*. This is simply false. It is not science, it is propaganda.

The proposed solution is likely to have unintended consequences that are worse than the perceived problem. China plans to build a weather modification system by 2025 to actually try and control weather – where and when rain falls, restricting the extent of snow etc. The west has its own wealthy elite prepared to start geo-engineering projects to interfere with the atmosphere when we demonstrably do not yet understand how the system works.

The costs of decarbonisation are huge and are not transparent. On top of the costs of achieving 100% renewable electricity generation, replacing the vehicle fleet, additional taxes on individuals and businesses based on supposed climate impact, there are huge international commitments being made. The gap between New Zealand emissions and commitments is likely to be around 20 million tonnes/year and will be closed by purchasing carbon credits. These are expected to be around $170/tonne, so over the next 10 years New Zealand will be liable for in excess of $34 billion. On top of COVID-19 debt this is building a debt that will cripple the next two generations at least. If it is difficult for first home buyers to get a house now, it will be simply impossible in future.

New Zealand is a trading nation. We need to sell goods or services that people beyond our borders want – natural gas, tourism (including movies), agricultural products, IT (games, software etc). Spending vast amounts of money rebuilding our domestic energy supply systems and infrastructure may create jobs and allow us some pious posturing, but it is diverting funds from real problems – housing, health, education, child poverty. Current policies are preventing us from deriving the economic benefit associated with hydrocarbons. An LNG export industry would be worth $360 Billion over 30 years, $100 Billion in government revenues over 30 years, $40 Billion to regional economies and 30,000 jobs over the project lifetime. Norway now has US$1 trillion in its Sovereign Fund (Oil & Gas Revenues). There is an emerging market for LNG on the east coast of Australia and a discovery offshore Taranaki or Canterbury will take several years to develop.

**Recommendations / Actions**

The data clearly show $CO_2$ has very little direct impact on climate or temperature, and methane even less. I am copying this to relevant ministers in the hope one of them is willing to request NIWA answer the following questions:

1. Has surface shortwave radiation increased over the last 20 years? If so, by how much?

2. Has surface longwave radiation increased over the last 20 years? If so, by how much?

If the answer to either question is more than 0.2 $W.m^{-2}$/decade then, contrary to what is claimed by climate scientists and being taught in our schools, $CO_2$ is not the primary driver of climate change and the decarbonisation strategy must be revisited.

If this government is indeed making evidence-based decisions led by science, the Climate Change Commission's recommendation to the government should include the following:

1. That NIWA provide a report presenting the following data for New Zealand and globally (where available) for the period 2000-2020:

   a. Incoming shortwave radiation at top of atmosphere

   b. Incoming shortwave radiation at surface

   c. Downgoing longwave radiation at surface, total and split into $CO_2$ and water bands

2. If the time series data confirms what the available data already indicate, New Zealand should:

   - withdraw and/or cancel membership of IPCC and the Climate Accords

   - repeal the Zero Carbon Bill and the ETS

- reverse the ban on new exploration Permits

- enable quick access to new Permits to capture the Australian east coast LNG opportunity

- update the resources used in education to accurately reflect the science

3. Instead, apply resources to the goal of reversing ozone depletion, including

- using our position at the UN to demand compliance with the Montreal Protocol;

- investing in research to repair and replenish the stratospheric ozone layer

**The data presented here will only be added to and the wrongful charges against $CO_2$ will only become more obvious with time as trends continue. This is indeed New Zealand's nuclear free moment and bold leadership is required to act against the entrenched conventional wisdom.**

**Mark Webster**
**Director, Kauri Oil & Gas (NZ) Ltd**