

**Supplementary
Submission
No 5a**

**INQUIRY INTO CLIMATE CHANGE (NET ZERO
FUTURE) BILL 2023**

Name: Mr Geoffrey Miell
Date Received: 12 November 2023

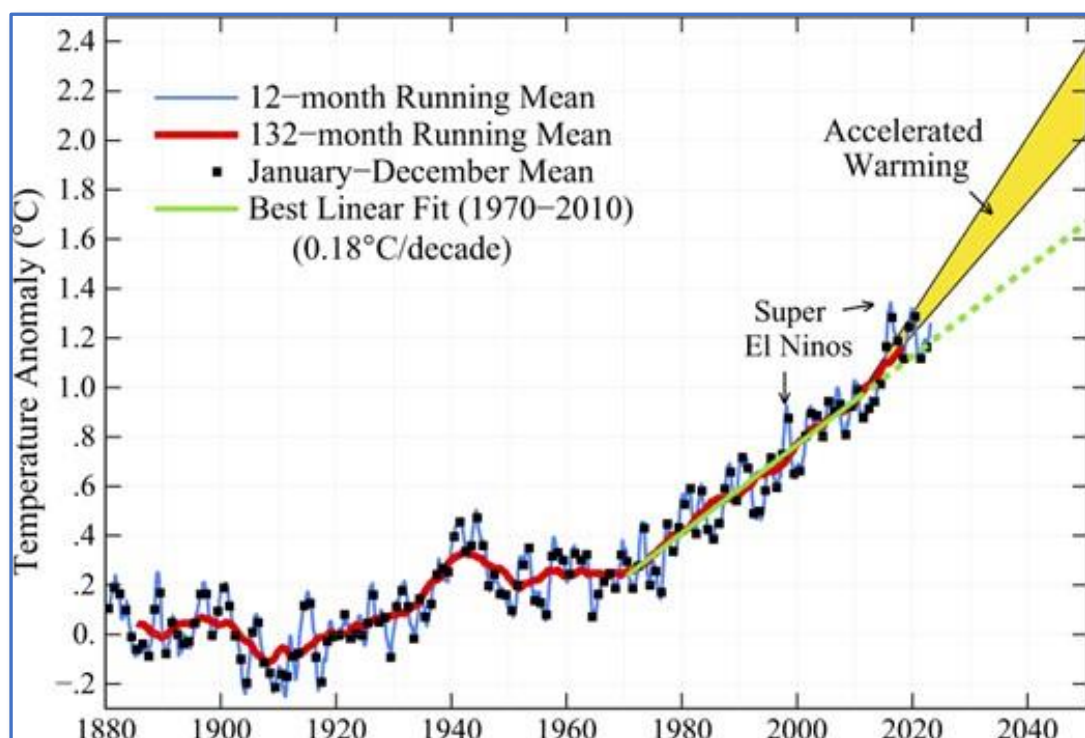
I wish to draw the Committee's attention to some additional information that I have recently become aware of that I think is relevant to the inquiry:

Hansen et al. paper *Global warming in the pipeline* published

On 2 Nov 2023, *Oxford Open Climate Change* published a peer-reviewed journal article titled ***Global warming in the pipeline*** by James E Hansen et al.¹ It includes:

With current policies, we expect climate forcing for a few decades post-2010 to increase 0.5–0.6 W/m² per decade and produce global warming of at least +0.27°C per decade. **In that case, global warming will reach 1.5°C in the 2020s and 2°C before 2050 (Fig. 24).** Such acceleration is dangerous in a climate system that is already far out of equilibrium and dominated by multiple amplifying feedbacks.

Figure 24.



Global temperature relative to 1880–1920. Edges of the predicted post-2010 accelerated warming rate (see text) are 0.36 and 0.27°C per decade.

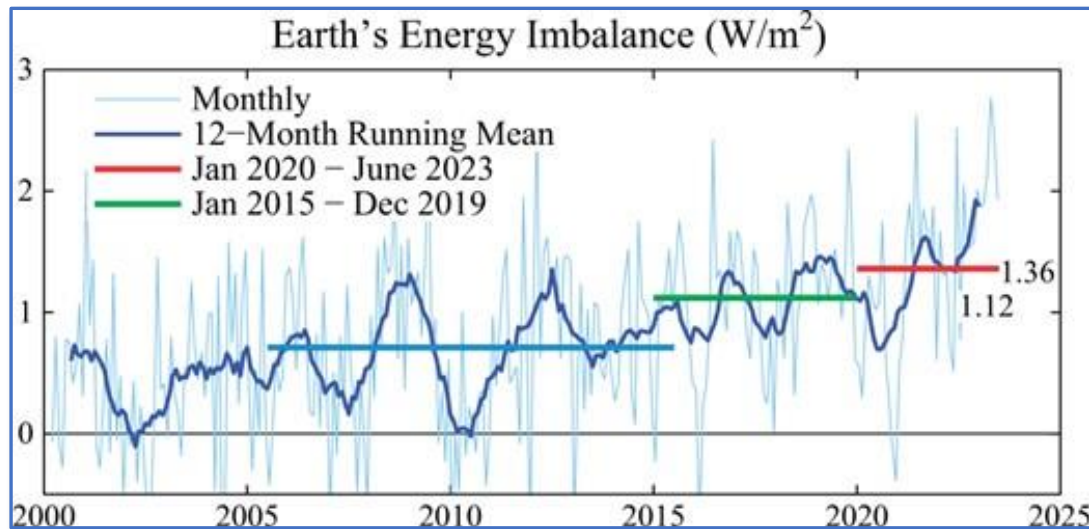
...

Earth's energy imbalance (EEI) is the net gain (or loss) of energy by the planet, the difference between absorbed solar energy and emitted thermal (heat) radiation. **As long as EEI is positive, Earth will continue to get hotter.** EEI is hard to measure, a small difference between two large quantities (Earth absorbs and emits about 240 W/m² averaged over the entire planetary surface), but change of EEI can be well-measured from space [81]. Absolute calibration is from the change of heat in the heat reservoirs, mainly the global ocean, over a period of at least a decade, as needed to reduce error due to the finite number of places that the ocean is sampled [80]. **EEI varies year-to-year (Fig. 25), largely because global cloud**

¹ <https://doi.org/10.1093/oxfclm/kgad008>

amount varies with weather and ocean dynamics, but averaged over several years EEI helps inform us about what is needed to stabilize climate.

Figure 25.



12-month running-mean of Earth's energy imbalance from CERES satellite data [81] normalized to 0.71 W/m² mean for July 2005–June 2015 (blue bar) from *in situ* data [80].

Oxford Open Climate Change also published an editorial titled **Editorial on Hansen et al. 'Global warming in the pipeline' (this issue)** by Eelco J Rohling and Anna S von der Heydt.² It includes:

This Editorial discusses the reasons behind the finding of Hansen *et al.* that the Paris Agreement limits for global warming may be breached so soon.

The UN Sustainable Development Solutions Network (SDSN) published on 3 Nov 2023 the *YouTube* video titled **An Intimate Conversation with Leading Climate Scientists To Discuss New Research on Global Warming**, duration 1:12:23.³ Ahead of the upcoming COP28, renowned climate scientist, Dr. James Hansen, and his co-authors presented their novel findings of their new paper *Global Warming in the Pipeline*.

From time interval **0:17:03**, James Hansen said:

"The 1.5-degree limit is deader than a doornail, and the 2-degree limit can be rescued only with the help of purposeful actions to effect Earth's Energy Balance. We will need to cool off Earth to save our coastlines, coastal cities worldwide, and lowlands, while also addressing the other problems caused by global warming."

From time interval **1:04:03**, James Hansen said on tipping points:

"Yeah, the, the most important tipping point is the, the Antarctic ice sheet, and in particular the Thwaites ah, Glacier, which who's grounding line has been moving inland at a rate of about a kilometre per year, and ha, in another 20 years, it will reach a point where it, it... the, the um, bed ah, is so-called ah, retrograde bed, so it gets deeper. The Antarctic ice sheet sits on bedrock below sea level, but it gets deeper as you go towards the centre of the continent, and it gets... It hits a canyon in about 20-years if we continue"

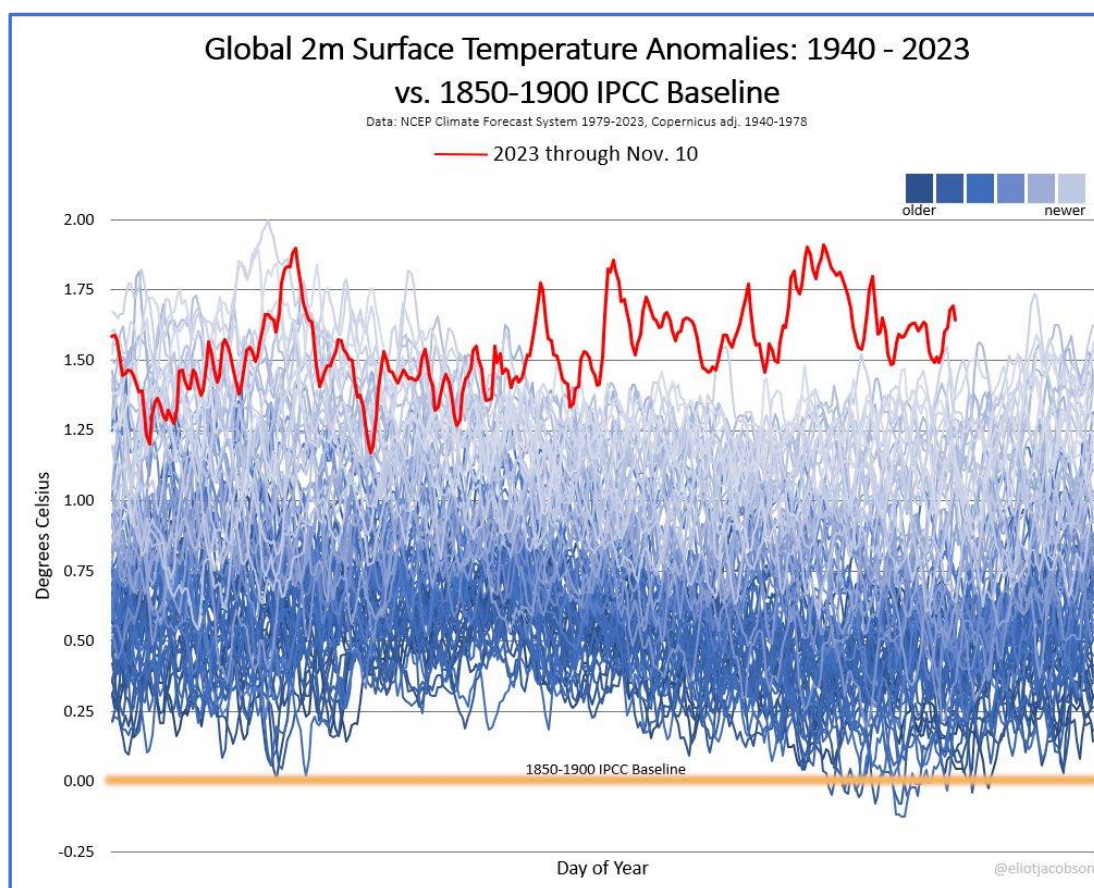
² <https://doi.org/10.1093/oxfclm/kgad010>

³ <https://www.youtube.com/watch?v=NXDWpBPCY8>

at one kilometre ah, per year. When it hits that canyon, you're going to get very rapid disintegration of that glacier, which is basically the cork that's holding ah, a lot of the West Antarctic ice ah, in the bottle. So, we don't want to get there. And if we want to prevent, to slow down, and even stop the melting of the Antarctic ice sheet, we have to cool off the planet. That's, um... And, and we need to do that because, hah, more than half the large global cities in the world are on coastlines, and there are a lot of lowlands. Ah, so, that, that's the tipping point which ah, I think dominates. But it so happens that there's so many other ah, climate impacts that we would be getting to see and it would be much more if we go beyond two degrees, that there are many reasons to want to cool off the planet. If we want to keep a planet that looks more or less like the one that has existed the last ten thousand years, we actually have to cool off the planet back to a Holocene-level temperature, and that's possible, but it's not easy.”

Global mean 2 m surface temperature anomalies: 1940–2023

The following graph shows the global mean 2-metre surface temperature anomalies relative to the 1850–1900 IPCC baseline for the period 1940 through to 10 Nov 2023:⁴



In early 2016, global mean surface temperatures (shown in blue) peaked close to +2.0 °C. The anomaly graph above shows how often the Earth System has already breached the Paris Climate Agreement ‘lower limit’ of +1.5 °C on a daily mean basis.

⁴ <https://twitter.com/EliotJacobson/status/1723395261370909169>

The 2023 state of the climate report: Entering uncharted territory

BioScience published on 24 Oct 2023 a journal article by William J Ripple *et al.* (including Johan Rockström, Timothy M Lenton, Leon Simons & Sir David Anthony King) titled **The 2023 state of the climate report: Entering uncharted territory**.⁵ It begins with:

Life on planet Earth is under siege. We are now in an uncharted territory. For several decades, scientists have consistently warned of a future marked by extreme climatic conditions because of escalating global temperatures caused by ongoing human activities that release harmful greenhouse gasses into the atmosphere. Unfortunately, time is up. We are seeing the manifestation of those predictions as an alarming and unprecedented succession of climate records are broken, causing profoundly distressing scenes of suffering to unfold. We are entering an unfamiliar domain regarding our climate crisis, a situation no one has ever witnessed firsthand in the history of humanity.

In the present report, we display a diverse set of vital signs of the planet and the potential drivers of climate change and climate-related responses first presented by Ripple and Wolf and colleagues (2020), who declared a climate emergency, now with more than 15,000 scientist signatories. **The trends reveal new all-time climate-related records and deeply concerning patterns of climate-related disasters. At the same time, we report minimal progress by humanity in combating climate change.** Given these distressing developments, our goal is to communicate climate facts and policy recommendations to scientists, policymakers, and the public. It is the moral duty of us scientists and our institutions to clearly alert humanity of any potential existential threat and to show leadership in taking action. This report is part of our series of concise and easily accessible yearly updates on the state of the climate crisis.

On 18 Oct 2023 in Edinburgh, Professor Johan Rockström presented the 44th TB Macaulay Lecture. The *YouTube* video titled **44th TB Macaulay Lecture – In conversation with Professor Johan Rockström**, published 20 Oct 2023, duration 1:37:47,⁶ includes:

- 0:00:05** Welcome from Prof Colin Campbell, CEO, The James Hutton Institute
- 0:04:14** Message from Prof Mathew Williams, Chief Scientific Advisor for Environment, Natural Resources & Environment, Scottish Government
- 0:10:00** Introduction by Fran van Dijk, Chair, The Macaulay Development Trust
- 0:13:03** 44th TB Macaulay Lecture by Prof Johan Rockström, Director, Potsdam Institute for Climate Impact Research
- 1:09:55** Panel Discussion with Prof Sir Ian Boyd, Laura Young, and Prof Johan Rockström

Professor Rockström's talk covers the latest scientific results of the health of the Earth System, including the recent work of the Earth Commission and an update on the "Earth for All" scenario, analysing pathways towards attaining the Sustainable Development Goals within planetary boundaries.

Professor Rockström says from time interval **1:02:25**:

"Incremental change is no longer an option. Now it's time to recognise the need for, for major, major non-linear positive changes."

⁵ <https://doi.org/10.1093/biosci/biad080>

⁶ <https://www.youtube.com/watch?v=h2VjdyqG-nY>

Rapid disintegration & weakening of ice shelves in North Greenland

Nature Communications published a paper on 7 Nov 2023 by R Millan *et al.* titled **Rapid disintegration and weakening of ice shelves in North Greenland**.⁷ The Abstract includes:

The glaciers of North Greenland are hosting enough ice to raise sea level by 2.1 m, and have long considered to be stable. This part of Greenland is buttressed by the last remaining ice shelves of the ice sheet. Here, we show that since 1978, ice shelves in North Greenland have lost more than 35% of their total volume, three of them collapsing completely. For the floating ice shelves that remain we observe a widespread increase in ice shelf mass losses, that are dominated by enhanced basal melting rates. Between 2000 and 2020, there was a widespread increase in basal melt rates that closely follows a rise in the ocean temperature. **These glaciers are showing a direct dynamical response to ice shelf changes with retreating grounding lines and increased ice discharge. These results suggest that, under future projections of ocean thermal forcing, basal melting rates will continue to rise or remain at high level, which may have dramatic consequences for the stability of Greenlandic glaciers.**

Rapid ocean warming driving West Antarctic Ice Sheet to collapse

Nature Climate Change published a paper on 23 Oct 2023 by Kaitlin A. Naughten *et al.* titled **Unavoidable future increase in West Antarctic ice-shelf melting over the twenty-first century**.⁸ The Abstract includes:

Ocean-driven melting of floating ice-shelves in the Amundsen Sea is currently the main process controlling Antarctica's contribution to sea-level rise. Using a regional ocean model, we present a comprehensive suite of future projections of ice-shelf melting in the Amundsen Sea. **We find that rapid ocean warming, at approximately triple the historical rate, is likely committed over the twenty-first century, with widespread increases in ice-shelf melting, including in regions crucial for ice-sheet stability. When internal climate variability is considered, there is no significant difference between mid-range emissions scenarios and the most ambitious targets of the Paris Agreement. These results suggest that mitigation of greenhouse gases now has limited power to prevent ocean warming that could lead to the collapse of the West Antarctic Ice Sheet.**

In the 9 Nov 2023 *YouTube* video titled **We can't save the West Antarctic. So what now?**, duration 0:14:28,⁹ Dr Ella Gilbert talks with lead author Dr Kaitlin Naughten.

From time interval **0:07:49**, Dr Kaitlin Naughten said:

"We need to prepare for some amount of sea level rise. It would be irresponsible to not do that. We are working hard on getting a handle on exactly how much sea level rise and how big the uncertainties are, but, but a world in which all the coastlines stay the same over the 21st century is, is, is just irresponsible. If we pretend that the sea level rise will stay the same until the ocean is literally at our door, we will have a refugee crisis. So, **we need to plan in advance, decades in advance, for how all the coastal communities in the world really, are going to respond to sea level rise. Are they going to try and stick it out, and build walls and defend against the rising seas, or are they going to abandon the area and relocate elsewhere?"**

Sea level rise will change every coastline. Time for courage to behave like adults!

⁷ <https://www.nature.com/articles/s41467-023-42198-2>

⁸ <https://www.nature.com/articles/s41558-023-01818-x>

⁹ https://www.youtube.com/watch?v=8_BoZDS1gIU

Paris Climate Agreement goals are already impossible to meet

On 10 Nov 2023, James Hansen, Pushker Kharecha, Norman Loeb, Makiko Sato, Leon Simons, George Tselioudis, and Karina von Schuckmann published a communication titled **How We Know that Global Warming is Accelerating and that the Goal of the Paris Agreement is Dead**.¹⁰ It begins with:

The drive for global temperature change is Earth's energy imbalance (EEI), the difference between the energy Earth receives from the Sun and energy Earth reflects and radiates back to space. We have good measurement of EEI today based on precise satellite data for change of reflected and emitted radiation calibrated by decadal ocean heat content change measured by deep-diving Argo floats. Interpretation of global temperature change and prediction of future temperature requires knowledge of the principal forcings that now affect EEI: human-made greenhouse gases (GHGs) and atmospheric aerosols (fine airborne particles). Aerosol climate forcing is not being measured, but information on aerosol forcing can be extracted from an ongoing "great inadvertent aerosol experiment" as a result of discrete changes in International Maritime Organization (IMO) regulations on the sulfur content of ship fuels. These limited assessment tools are threatened by the absence of firm plans to continue direct EEI observations. **A shortcoming of our climate science is failure to communicate well what is known from existing data. Global warming in the pipeline and emissions in the pipeline assure that the goal of the Paris Agreement – to keep global warming well below 2°C – is already dead, if policy is constrained only to emission reductions plus uncertain and unproven CO₂ removal methods.**

It's also suggested:

Within less than a decade, we must expect $0.4 \times 0.25 \times 4^\circ\text{C} = 0.4^\circ\text{C}$ additional warming.²⁶ **Given global warming of 0.95°C in 2010, the warming by 2030 will be about 0.95°C + 2×0.18°C + 0.4°C = 1.71°C. Global warming of 2°C will be reached by the late 2030s, i.e., within about 15 years.** The added climate forcing – presumed to be our first Faustian payment – is, indeed, a BFD.

2023 is "virtually certain" to be the warmest year ever recorded

According to Samantha Burgess, Deputy Director of the Copernicus Climate Change Service (C3S):¹¹

"October 2023 has seen exceptional temperature anomalies, following on from four months of global temperature records being obliterated. We can say with near certainty that 2023 will be the warmest year on record, and is currently 1.43°C above the preindustrial average. The sense of urgency for ambitious climate action going into COP28 has never been higher".

¹⁰ <https://mailchi.mpp/cao/how-we-know-that-global-warming-is-accelerating-and-that-the-goal-of-the-paris-agreement-is-dead>

¹¹ <https://climate.copernicus.eu/copernicus-october-2023-exceptional-temperature-anomalies-2023-virtually-certain-be-warmest-year>
