



> GWP* – An Inappropriate and Dangerous Measure of Livestock Methane’s Contribution to Global Warming

KEY MESSAGES

This briefing strongly advises against the adoption of GWP* as a climate metric at country or company-level – either for reporting the Global Warming Potential (GWP) of greenhouse gas (GHG) emissions, or as a guide for climate mitigation policies. We instead recommend maintaining the use of GWP100 (or GWP20) for measuring the atmospheric heating caused by greenhouse gases aggregated at the country and company level, alongside increased reporting of individual greenhouse gases to reduce reliance on equivalence metrics in general. We also recommend maintaining the use of GWP100 (or GWP20) as a guide to climate mitigation policies. There is a high risk that adoption of GWP* at country or company level would:

- 1) Allow livestock companies to greenwash their production systems or products as “climate neutral” or “climate negative” whilst continuing to cause large amounts of emissions
- 2) Unjustly reward historically high methane emitters (at country and company level, usually those in the Global North) whilst heavily penalising countries in the Global South for comparatively low methane emissions
- 3) Seriously undermine international efforts to reduce global greenhouse gas emissions in line with the Paris Agreement target of 1.5°C:
 - a) Severely damage international efforts to restrict global methane emissions from the livestock sector, and
 - b) Significantly compromise efforts to reduce global CO₂ and N₂O emissions in other sectors by allowing potential for minor methane reductions to be used as offsets for other emissions

WHY REDUCING METHANE IS IMPORTANT IN THE FIGHT AGAINST CLIMATE BREAKDOWN

Methane (CH₄) is an extremely powerful greenhouse gas – causing about 80 times more warming per kg than carbon dioxide (CO₂) over a 20-year period (GWP20) and on average 27 times more warming than CO₂ over a 100-year period (GWP100).¹ The Intergovernmental Panel on Climate Change (IPCC) estimates that methane has contributed an estimated 0.5°C of global warming since 1850-1900, second only to CO₂'s contribution of an estimated 0.75°C warming.² Methane is also more short-lived in the atmosphere than CO₂ – with an average lifetime of approximately 12 years, it gradually breaks down into CO₂ and H₂O – meaning its warming power declines, although not completely. This means that reductions in methane would rapidly reduce global warming – and thus could be crucial to efforts to avoid breaching the 1.5°C warming limit set by the Paris Climate Agreement,³ and to avoid reaching climate tipping points where feedback loops begin – such as melting of permafrost releasing further emissions.⁴ The IPCC states that methane emissions need to be reduced by at least a third by 2030 to meet the Paris Climate Agreement.⁵ Methane reductions of at least 47–60% are required by 2050 to stay within 1.5°C of global warming.⁶

LIVESTOCK SECTOR IS A MAJOR SOURCE OF METHANE

The livestock sector accounts for an estimated 31% of global methane emissions, followed by oil & gas (26%), landfills (14%) and coalmining (11%).⁷ Massive increases in livestock numbers led to an estimated 332% increase in methane emissions from ruminant livestock between 1890 and 2014⁸ - and livestock methane emissions are projected to increase by a further 30% by 2050 without policy interventions.⁹ There is high potential to reduce livestock sector methane emissions without the need for new technology – for instance, simply reducing EU meat and dairy consumption in line within EU member states' *current* nutritional recommendations, and an associated reduction of EU livestock production, would lead to an estimated 29-37% reduction in livestock methane emissions.¹⁰

LIVESTOCK INDUSTRY LOBBYING FOR GWP*

Faced with the prospect of regulation to curb its significant climate impacts, the global livestock industry has begun to aggressively push for the adoption of GWP* – a dangerous and distorting new climate metric, when used as the industry wants, at country or company level. For instance, the US National Cattlemen's Beef Association (NCBA) said in 2022 that GWP* "is the methodology we need to make sure everybody is utilising", describing their efforts to "[make] sure that our government recognises it" and work with international partners such as the International Beef Alliance "to ensure that everybody is working towards adoption of GWP*"¹¹ Livestock industry and agribusiness lobbying groups in New Zealand and the UK, including the NFU, also push for the adoption of GWP*¹² - which is also often pushed by the livestock industry under alternative names such as "no added warming". The industry's incentive for pushing GWP* is clear – in most cases, it gives the biggest livestock companies license to continue polluting, rewards them for minor methane reductions, and allows false offsets of CO₂ and N₂O.

THE DIFFERENCES BETWEEN GWP* AND THE WELL-ESTABLISHED METRICS GWP20 AND GWP100

Firstly, it is important to examine the differences between GWP* and well-established metrics such as GWP20 and GWP100, which are widely used by the IPCC, scientific institutions and in Nationally Determined Contributions towards the Paris agreement. All these metrics measure the Global Warming Potential (GWP) of greenhouse gases in CO₂ equivalent, but in different ways:

- **GWP20** and **GWP100**: Measure the **total** global warming potential of greenhouse gas emissions averaged over a 20-year and 100-year period respectively, *compared to an alternative scenario/baseline where these emissions are not emitted.*
- **GWP***: More narrowly measures **changes** in the global warming potential of greenhouse gas emissions *compared to their warming impact in a chosen historical baseline year.* In other words, GWP* treats a consistent unchanging warming impact as neutral, even if this warming impact is considerable, and measures increases and decreases in warming impact relative to this.

Applying GWP* to measure an entity's climate impact is a deeply flawed approach because what matters in assessing the contribution of a country or company to global warming is not the *change* in its warming impact (as GWP* measures), but the *total* warming impact of greenhouse gases it emits into the atmosphere – *including emissions which are replaced in the atmosphere*, which exert a continued upward pressure on global temperatures. Put another way, as a recent peer-reviewed article said, an effective climate metric should answer the question “If I emit this ton of substance X, how much more or less warming do I cause compared to a world in which I had not emitted anything?” – GWP* fails to do this¹³, because it measures the global warming potential of emissions compared to a scenario where emissions continue to have the same warming impact, rather than compared to a scenario where emissions no longer occur. GWP* is thus a useful model for narrowly measuring the *change* in warming impact of methane emissions over time at global level, but is totally inappropriate as a metric for measuring progress on climate impact by businesses and countries.¹⁴

WHY GWP* IS A DANGEROUS AND INAPPROPRIATE CLIMATE METRIC

Below, we analyse why GWP* is an extremely unsuitable metric to hold companies and governments accountable for their contribution to climate change – and leads to dangerous outcomes which reward historic polluters, penalise lower-income countries, greenwash livestock companies, and harm global efforts to avert climate crisis.

ADOPTION OF GWP* LETS HISTORICAL METHANE EMITTERS CONTINUE POLLUTING, IN CONTRADICTION WITH THE POLLUTER PAYS PRINCIPLE

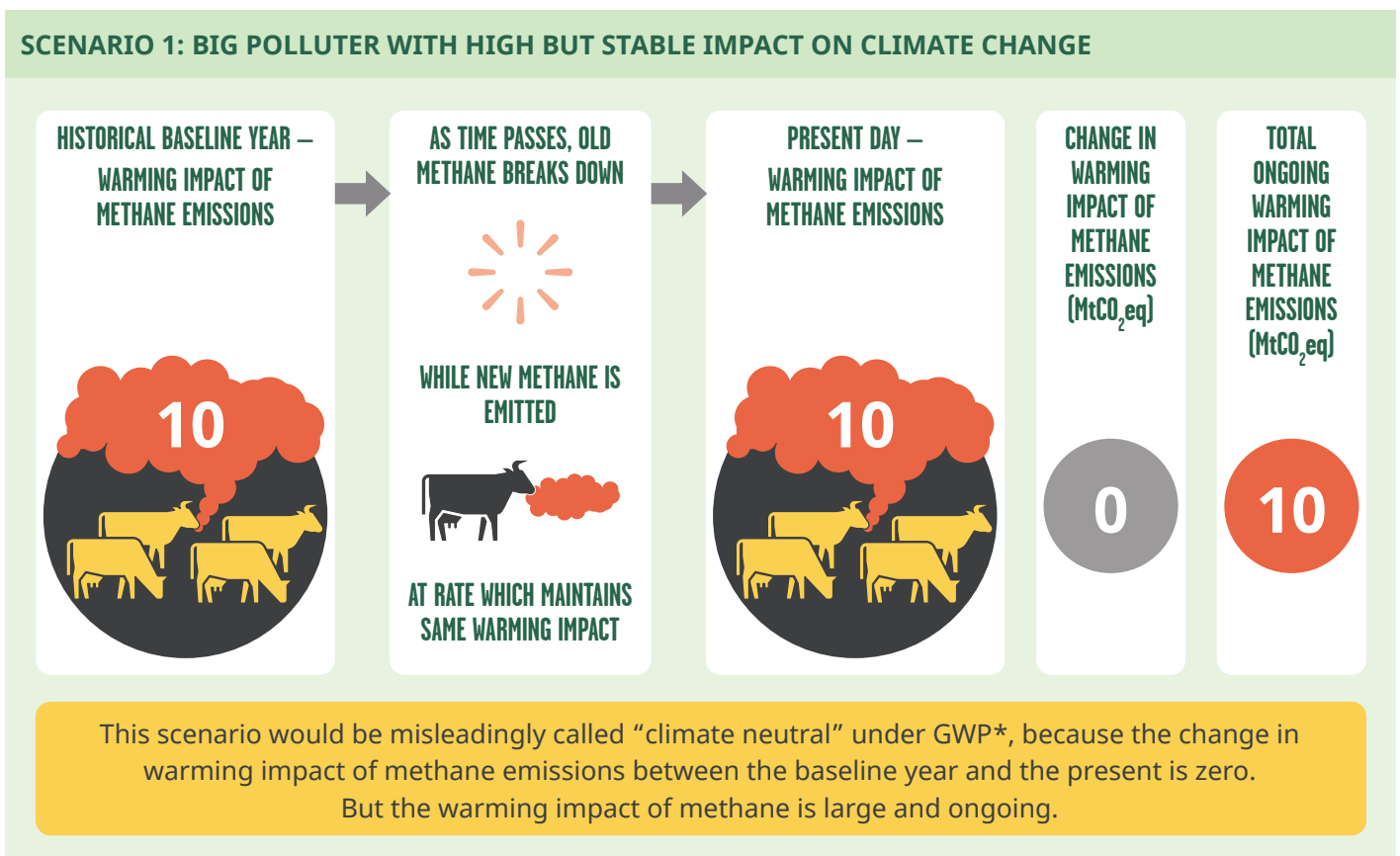
GWP* effectively erases the historical methane emissions of companies through use of a historical baseline, and allows them to be offset against continued methane emissions, giving the biggest polluters license to continue polluting – even rewarding them for minor reductions – and allowing them to offset CO₂ and N₂O emissions for themselves and others.

This is because GWP* assigns a Global Warming Potential of *zero* to a company's methane emissions if they have the same continued warming impact as the company's historical

methane emissions – if the warming impact doesn't *change*. This is nearly, but not quite, the same as the company having constant methane emissions (partly because when methane breaks down after on average 12 years, it leaves some CO₂) – to keep the warming impact of its methane constant, a company needs to reduce methane emissions very slightly, by just under 0.3% per year.¹⁵ Some livestock industry advocates have called this “climate neutrality”¹⁶, but this ignores the continued *total* warming impact of ongoing emissions.¹⁷

An appropriate climate metric needs to value *continued* harm as important – in this case, a company actively taking a decision to continue a polluting activity and replace methane it emitted in the past with new emissions, thus creating a continued upward pressure on global temperatures. To use an analogy: imagine a company is pumping sewage into a river at the rate of 10 units per day, and the river on average takes one day to wash away any sewage. If the company continues to make the active choice to pump out 10 units of sewage every day, then the *total* amount of sewage in the river would remain constant at 10 units, but the *change* in sewage would be 0 units. To regulate this system effectively and fairly in line with the polluter pays principle, the sewage company should clearly be penalised for the continued harm of the total 10 units of sewage – because it is actively choosing to replace pollution in the river every day. But under a GWP* style metric, it could be treated as “sewage neutral” because the amount of pollution in the river as a result of its activities is not changing. An effective metric would measure its impact compared to a scenario in which it stopped polluting altogether.

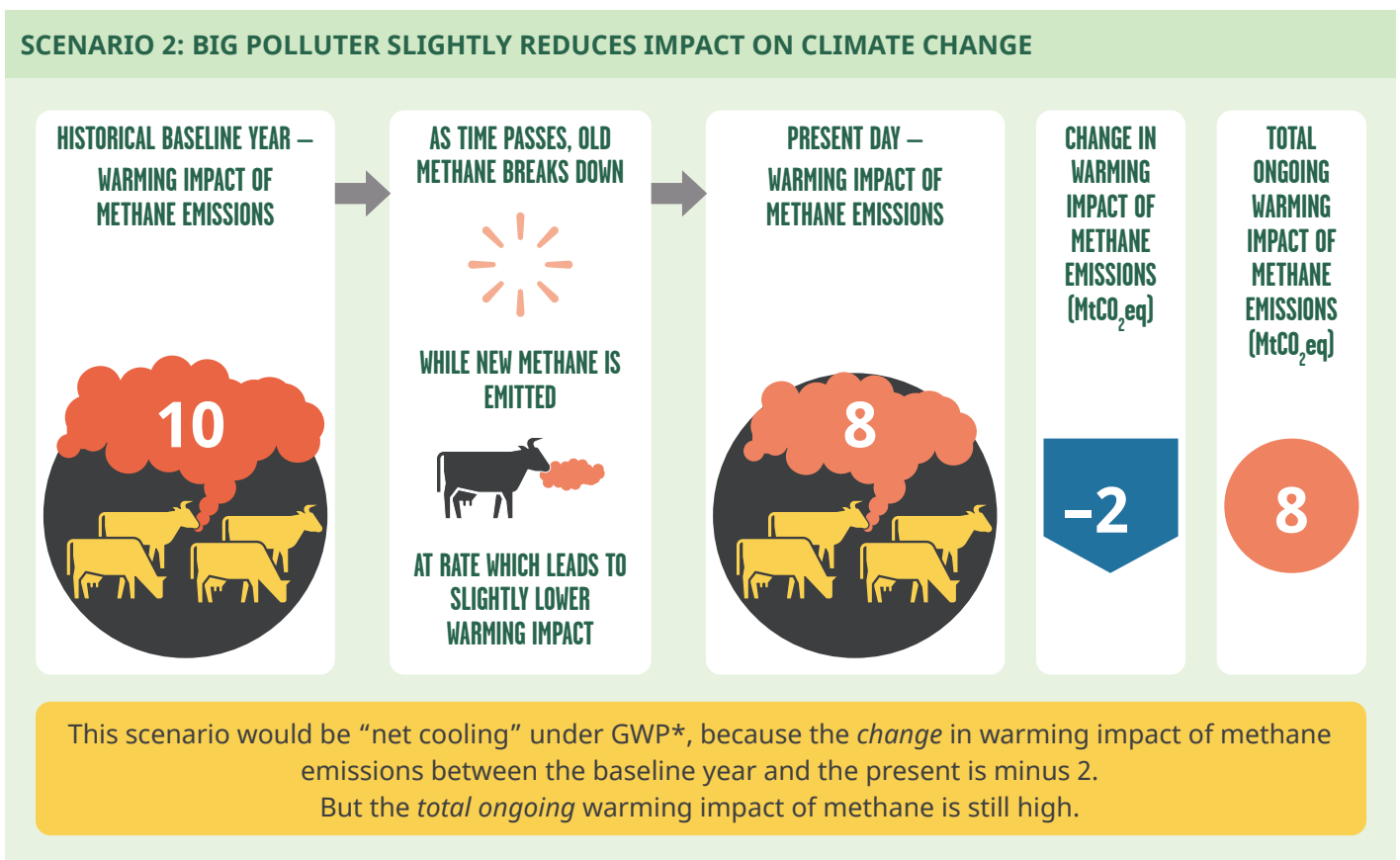
GWP* performs a similar function for methane emissions – declaring reductions of just under 0.3% per year¹⁸ “climate neutral”, because this means the warming impact of the company’s methane emissions is ongoing but does not change – even through in reality, the methane is being replaced and doing continued harm. An illustration of this is shown below:



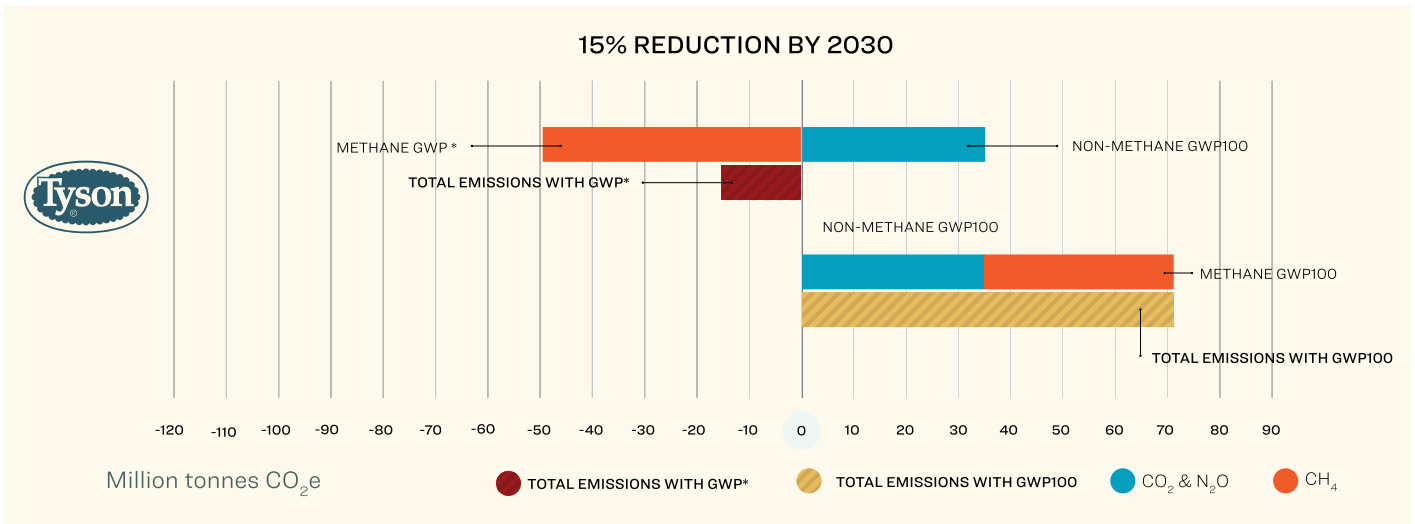
If a baseline year was chosen from before the company or country emitted any emissions, usually in the distant past, this this would not be so problematic – but usually polluters advocate for a more recent baseline year where they were already emitting substantial methane emissions – and measure change in warming impact compared to this.

ADOPTION OF GWP* REWARDS POLLUTERS FOR MINOR METHANE REDUCTIONS, AND HELPS CO₂ EMITTERS CONTINUE POLLUTING THROUGH CARBON OFFSETTING

Under GWP*, any reductions in methane greater than the roughly 0.3% per year required to meet “climate neutrality”¹⁹ result in a company appearing to have a net-cooling impact on climate change – but this is highly misleading, as this is only a *change* in warming impact compared to their historical impact. Returning to the sewage analogy, if the company pumped out 8 units of sewage compared to 10 units previously, the *total* sewage in the river would become 8 units, but the *change* in sewage would be -2 units. Under a GWP* style metric, the company would be considered to be “sewage negative” and rewarded for its -2 change in sewage impacts, but in reality, it is continuing to pump out 8 units of sewage per day – replacing 8 units of sewage in the river, causing continued harm. An illustration of how GWP* would measure this kind of scenario for livestock methane emissions is shown below:



If a livestock company claims that changes in its methane emissions have a net-cooling impact via the GWP* metric, it can then use these “negative” emissions to offset its own CO₂ emissions (often referred to as insetting). The graph below²⁰ shows an example of how a small 15% reduction in livestock corporation Tyson Foods’ methane emissions would be reported under GWP100 and GWP*. The higher bars show that GWP* only registers the cooling effect of Tyson reducing its methane emissions by 15% compared to its historical methane emissions (only measuring *change*) - and uses this to offset Tyson’s remaining CO₂ emissions, so that on average Tyson appears to have a net-cooling impact across all emissions. But in reality, what the GWP* metric conceals is that Tyson’s CO₂ emissions continue exactly the same, and the warming impact of its *total* methane emissions is still 85% of what it was previously – shown more accurately in the GWP100 bars at the bottom:

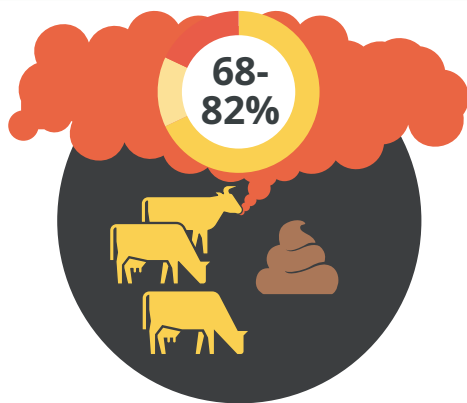


Source: Changing Markets²¹

Using GWP* would thus allow livestock corporations to falsely claim to have a net-cooling impact on climate change – allowing them to greenwash their environmental impact – whilst also giving them the option of selling carbon offsets to other companies – including fossil fuel companies. GWP* could also therefore significantly harm the fight against fossil fuel emissions, by providing false offsets.

Through methods like those shown above, Frank Mitloehner of the livestock industry-funded CLEAR Center makes explicit that “climate neutrality” for the US beef and dairy industry under GWP* requires only an 18-32% reduction in beef and dairy herd methane emissions by 2050²² (which under GWP* would offset the industry’s sizeable CO₂ and N₂O emissions from land use change, feed production and manure too) - with particularly limited action in the immediate term, only 0.5-1% decreases per year in methane between 2020-30.²³ This distorting metric would thus enable the US cattle and dairy industry to continue emitting 68-82% of its current methane emissions by 2050, plus all of its current CO₂ and N₂O emissions, and misleadingly claim to be climate neutral – likely achievable through only minor changes such as the use of feed additives and manure management. For any methane reductions beyond this, the industry could claim to be carbon negative, and potentially sell offsets to other industries. As a result, the president of the US National Cattlemen’s Beef Association recently said at a meat industry conference that it was “going to be pretty easy to” become climate neutral by 2040 “without reducing the number of cattle” – and GWP* “would speed up the ability to meet this part of the goal that we have in carbon neutral by 2040.”²⁴

USING GWP*, THE US BEEF AND DAIRY INDUSTRY COULD MISLEADINGLY CLAIM TO BE “CLIMATE NEUTRAL”, WHILST STILL EMITTING (BY 2050):



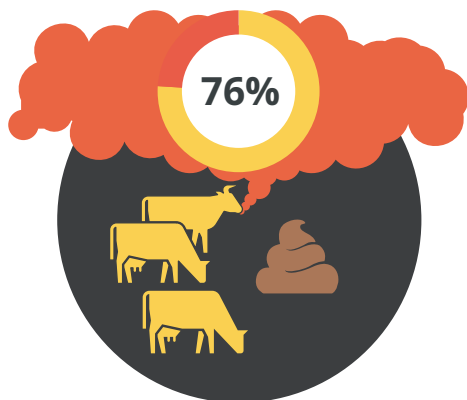
68-82% of its current methane



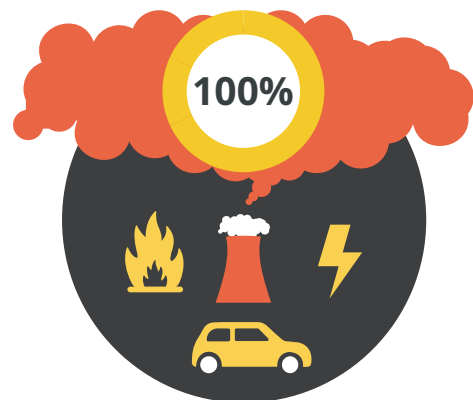
100% of its current carbon dioxide and nitrous oxide

For high methane-emitting countries, the perverse impacts of GWP* are even more dangerous. Michelle Cain, one of the academics who developed GWP*, argues that if New Zealand’s farmers cut methane by just 24% by 2050, then this “would offset the warming impact of all the other emissions” – from *all* economic sectors, not just agriculture – such that “New Zealand could declare itself climate neutral almost immediately, well before 2050, and only because farmers were reducing their methane emissions”, saying “that’s a free pass to all the other sectors, courtesy of New Zealand’s farmers.”²⁵ This “free pass” would in reality enable New Zealand’s livestock sector to continue emitting 76% of its current methane *and* all other economic sectors in New Zealand (energy, heating, transport and industry) to continue emitting current levels of CO₂ and N₂O – but claim to be climate neutral. It is perhaps not surprising, then, that the New Zealand (and UK) livestock industries have strongly lobbied for GWP*.²⁶ The effect would be less pronounced for other rich countries, because ruminant livestock make up an unusually high 43.3% of New Zealand’s total emissions²⁷ – but the greenwashing effects would still be extremely damaging to global efforts to tackle climate change.

USING GWP*, NEW ZEALAND COULD MISLEADINGLY CLAIM TO BE “CLIMATE NEUTRAL”, WHILST STILL EMITTING (BY 2050):



76% of its agricultural methane (mainly from livestock)



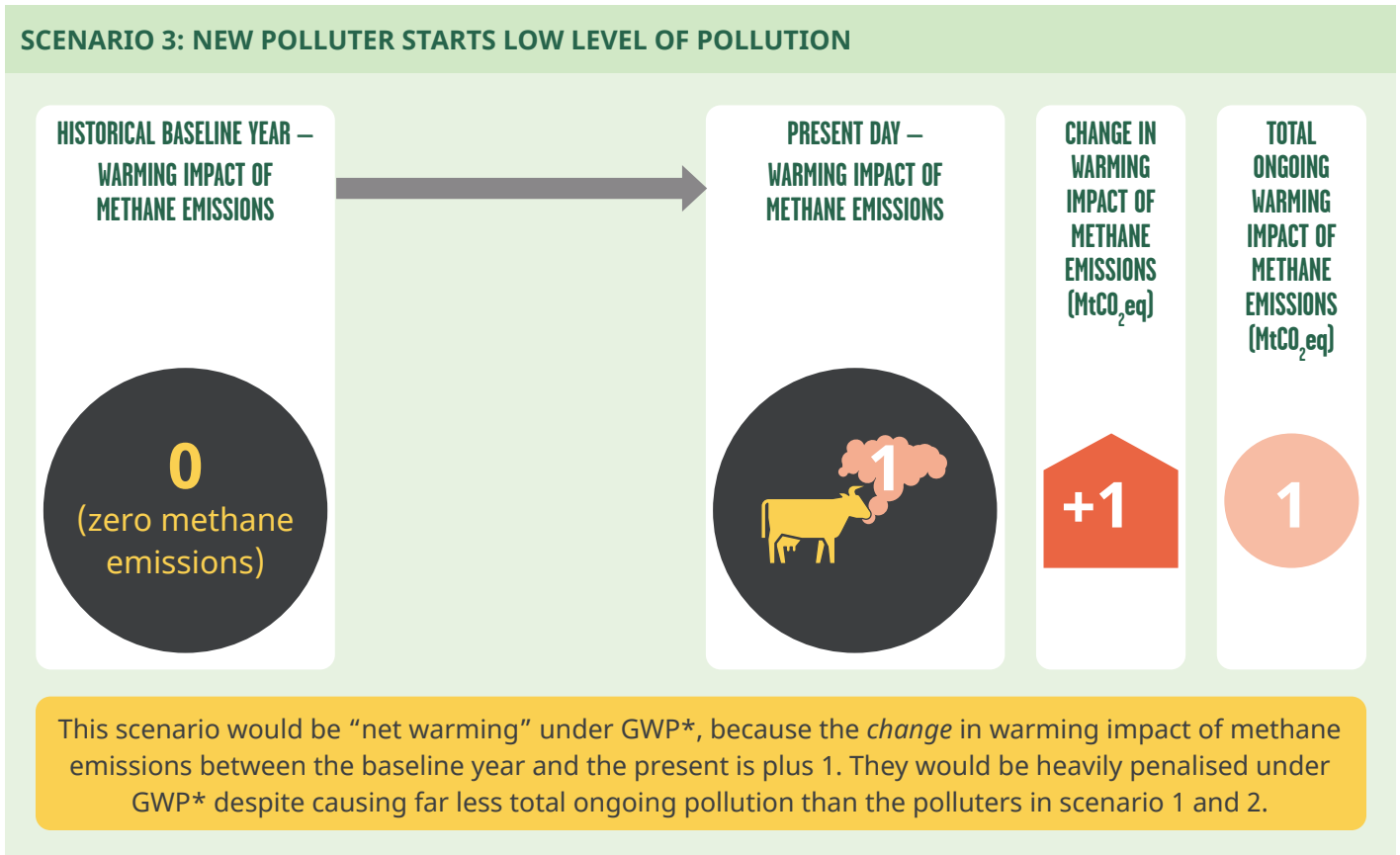
100% of its emissions from all other sectors, including energy, heat, transport & industry

ADOPTION OF GWP* WOULD BE EXTREMELY INEQUITABLE – HEAVILY PENALISING COUNTRIES IN THE GLOBAL SOUTH

Most principles of climate justice recognise that countries causing the largest emissions – particularly those with high historical emissions – should carry the largest responsibility to cut emissions deeper and more quickly, leaving lower-income countries some space to increase their emissions a little in the shorter-term to help with international equity and development, before eventually converging on a lower level of emissions globally. This is equally important for emissions related to food and agriculture. GWP* incentivises precisely the opposite of this.

We have already examined how GWP* removes accountability for historically high-emitting countries and companies for huge ongoing emissions of methane, actively rewards them for even small methane reductions, and helps them offset large volumes of CO₂ and N₂O. The flipside of this is that GWP* disproportionately penalises countries or companies which have emitted no or little methane before. This is because it only assigns high global warming impacts to *increases* in methane emissions. GWP100 and GWP20 already measure changes in methane emissions, but more usefully as part of broader total emissions. GWP* only punishes new or extra methane emissions – assigning it a 16x larger global warming impact per tonne of methane emitted than an established source (more than 20 years old).²⁸

Returning to the sewage analogy, recall that if a company pumped out 8 units of sewage compared to 10 units previously, the *total* sewage in the river would become 8 units, but the *change* in sewage would be -2 units. If another group started pumped out 1 unit of sewage compared to 0 units previously, the change in sewage would be +1 units. Under a GWP* style metric, the company which is still causing 8 units of sewage would be rewarded as “sewage negative” from its -2 reduction, whilst the group which is only pumping out 1 units of sewage would be disproportionately punished for its +1 addition. An illustration of how GWP* would measure this kind of scenario for livestock methane emissions is shown below:



Similarly, whilst GWP* would allow a free pass or actively reward a large multinational livestock corporation like JBS, which is estimated to cause as many greenhouse gas emissions as Spain²⁹, GWP* would heavily punish small-scale livestock farmers in the Global South if they increase their methane emissions from a low baseline – for instance, by expanding the size of their cattle herd.

This is why Dr Joeri Rogelj, director of research at the Grantham Institute at the London School of Economics, has said that whilst GWP* rewards high-income countries, “countries in the south that are gently increasing their national emissions for development would be severely penalised” and “using GWP* as suggested by some industries today can therefore go directly against the idea of climate justice or international fairness.”³⁰

GWP* UNFAIRLY REWARDS BIG LIVESTOCK CORPORATIONS WHILST PENALISING SMALL PRODUCERS



JBS: World's largest meat corporation, estimated to cause more emissions than Spain



GWP* lets JBS off the hook for ongoing methane emissions and rewards it for minor methane reductions



Small producer: Many based in low-income countries, little or no initial methane emissions



GWP* punishes small producers with low or no initial methane emissions for new or slightly increased methane emissions

OTHER IMPRACTICALITIES OF GWP*

GWP100 is embedded in the Paris Climate Agreement and countries' Nationally Determined Contributions.³¹ Changing to a radically different metric would require renegotiation of global climate agreements, NDCs and other mechanisms like emission trading systems to accommodate this – which is completely impractical, and as noted above would have profoundly damaging consequences.³² Furthermore, depending on the choice of baseline year for GWP*, the same volume of methane emissions can be described as causing warming, no warming or even cooling.³³ This leaves significant potential for countries and companies to abuse this through selective choice of baseline year. The baseline for comparison used by GWP100 and GWP20 – that is, a scenario where the country or company no longer emits a given greenhouse gas – is a far more reliable and appropriate baseline. Finally, since significant reductions in methane are required by 2030 and 2050 to meet the Paris Agreement, merely stabilizing the impact of major methane emitters is insufficient, particularly in a context where likely overshoot of 1.5 degrees global warming makes temperature reduction necessary.³⁴ The Paris Agreement calls for governments to implement policies which reflect their “highest possible ambition”³⁵ – a “no added warming approach” is directly contrary to this, diminishing ambition.

POLICY RECOMMENDATIONS AND FURTHER READING:

This briefing strongly advises against the adoption of GWP* as a climate metric – and instead recommends maintaining GWP100 and GWP20 as appropriate metrics. For further reading on this issue, see:

- [Changing Markets \(2023\), *Seeing Stars: the new metric that could allow the meat and dairy industry to avoid climate action*](#)
- [Unearthed \(2022\), *How the beef industry is trying to change the maths of climate change*](#)
- [Unearthed \(2022\), *Revealed: How the livestock industry funds the ‘greenhouse gas guru’*](#)
- [Donnison \(2024\), *The meat and dairy industry is not ‘climate neutral’, despite some eye-catching claims*](#)
- [Fassler \(2023\), *The Livestock Industry’s “Climate Neutral” Claims Are Too Good To Be True, DeSmog*](#)
- [Donnison and Murphy-Bokern \(2023\) “Are Climate Neutrality Claims in the Livestock Sector Too Good to Be True?” *Environmental Research Letters* 19, no. 1³⁶](#)
- [Rogelj and Schleussner \(2019\), “Unintentional Unfairness When Applying New Greenhouse Gas Emissions Metrics at Country Level” *Environmental Research Letters* 14, no. 11³⁷](#)
- [Meinshausen and Nicholls \(2022\) “GWP* is a Model, Not a Metric” *Environmental Research Letters* 17, no. 4³⁸](#)
- [Hayek, Samuel, and McClelland \(2023\), ‘Methane Metrics: The Political Stakes’, *Nature* 620, no. 7972³⁹](#)
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ANNEX: THE MYTH THAT “BIOGENIC” METHANE DOES NOT MATTER

A myth pushed by the livestock industry is that “biogenic” methane from animals, plants and waste is part of a natural cycle, and therefore not important for global heating. The livestock industry argues that whereas fossil methane has been locked up in the ground for millions of years (as e.g. fossil gas), “biogenic” methane such as methane from ruminant livestock like cows and sheep is part of a natural cycle: plants absorb CO₂ from the atmosphere through photosynthesis, ruminants eat these plants and convert it via enteric fermentation to methane, which then breaks down into CO₂ and is absorbed back by plants and soils.

However, the IPCC AR6 report categorically shows that biogenic (non-fossil) methane has only about 3% less warming impact over a 20-year period and 9% less warming impact over a 100-year period compared to fossil methane⁴¹ – an almost identical effect:

Species	Lifetime (Years)	Radiative Efficiency (W m ⁻² ppb ⁻¹)	GWP-20	GWP-100
CO ₂	Multiple	1.33 ± 0.16 × 10 ⁻⁵	1.	1.000
CH ₄ -fossil	11.8 ± 1.8	5.7 ± 1.4 × 10 ⁻⁴	82.5 ± 25.8	29.8 ± 11
CH ₄ -non fossil	11.8 ± 1.8	5.7 ± 1.4 × 10 ⁻⁴	79.7 ± 25.8	27.0 ± 11

Source: IPCC⁴²

This table shows that:

- Over a 20-year timeframe (GWP20), biogenic methane is 79.7 times as potent as CO₂; whereas methane from fossil fuels is 82.5 times as potent as CO₂.⁴³
- Over a 100-year timeframe (GWP100), biogenic methane is 27.0 times as potent as CO₂, whereas methane from fossil fuels is 29.8 times as potent as CO₂.⁴⁴

Methane from livestock is not part of a naturally balanced cycle because the unsustainable number of livestock currently produced globally mean that biogenic methane accumulates in the atmosphere far faster than photosynthesis by plants can cycle it back into ecosystems. As previously mentioned, massive increases in livestock numbers led to an estimated 332% increase in methane emissions from ruminant livestock between 1890 and 2014⁴⁵ – and the IPCC AR6 WGIII report says that “continued global livestock population growth between 1990 and 2019, including increases of 18% in cattle and buffalo numbers, and 30% in sheep and goat numbers, correspond[s] with CH₄ emission trends”.⁴⁶ Biogenic methane emissions have been a significant driver of increased global methane emissions since the year 2000.⁴⁷

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