

PRESS RELEASE

GHG science analysis: for 1.5°C cut emissions 100% now, for 2°C cut emissions now 4.5% per year which means INDC's must increase 1,100%, as they are 2°C locked in 22 years continuing on past 4°C.

Analysis of the best current cumulative greenhouse gas science findings - the cause of climate change - applied to the Purpose of the Paris Climate Agreement shows the following:

Greenhouse gas (GHG) concentrations in the atmosphere are the cause of climate change. "THE PURPOSE of this (draft Paris) Agreement is... **cuts in global greenhouse gas emissions...** to hold the increase in the global average temperature [below 2°C or 1.5°C] above pre-industrial levels... on the basis of the best available scientific knowledge".^a

Analysis shows that:

- 1.5°C is possible by cutting global GHG emissions 100% now; using "negative" emissions is unproven, not scientific reality.
- 2°C is possible by cutting global GHG emissions NOW, 0.4% per month, increasing with inaction; cutting emissions by some year in the future has failed for 20 years and is failing today.

^a *The cause of climate change is increase in cumulative greenhouse gas concentrations in the atmosphere by anthropogenic emissions. IPCC cumulative emission limit for 2°C (> 66% probability): 1,000 GtCO₂ in 2011, with intergenerational equity, excluding unproven negative emissions, no overshoot, warming does not stop at 2100,*

- By the standard of cumulative emissions, the cause of climate change, current Paris Agreement emissions reduction intentions for 2°C must increase 1,100%^b – and if they don't, 2°C will be locked into the atmosphere in 22 years continuing on past 4°C, "the end of human life on earth as we know it".

The above is based on the IPCC cumulative emission limit for 2°C (>66% probability): 1,000 GtCO₂ in 2011; with intergenerational equity, with no overshoot, excluding unproven negative emissions, warming does not stop at 2100.

The general findings of the analysis have been confirmed by the IPCC, WMO, UNFCCC and other scientists, including:

Dr. Nicolas Beriot, Secrétaire général de l'ONERC and Focal point France of the Intergovernmental Panel on Climate Change (IPCC),
Dr. Valérie Masson Delmotte, Chair Workgroup 1, IPCC
Dr. Youba Sokona, Vice-chair IPCC
Dr. Oksana Tarasova, Chief, Atmospheric Environment Research Division, World Meteorological Organization,
Dr. Katia Simeonova, Manager, GHG Reporting and Analysis Programme, UNFCCC Secretariat

hsfound.org/pdfs/cop21-purpose-science

^b *By the standard of cumulative emissions and compared to pre-INDC intentions.*

COP21 Agreement: 1.5°C and 2°C physical science reality

“THE PURPOSE of this Agreement is... **cuts in global greenhouse gas emissions...** to hold the increase in the global average temperature [below 2°C or 1.5°C] above pre-industrial levels... on the basis of the best available scientific knowledge”:¹

Prevailing opinion	Physical Science Reality
1.5°C is still possible.	1.5°C is possible by cutting global emissions 100% now; using “negative” emissions is unproven, not scientific reality.
For 2°C, global emissions must be cut by 2030, by 2050, by 2075, by 2100.	Cutting emissions by sometime in the future has failed for 20 years and is failing today: for 2°C, cut global emissions NOW, 0.4% per month, increasing with inaction.
Agreement emission reduction intentions for 2°C are halfway, they must increase only 200% - and even if they don't, only 2.7°C warming will result.	By the standard of cumulative emissions - the cause of climate change - Agreement emissions reduction intentions for 2°C must increase 1,100% ² - and if they don't, 2°C will be locked into the atmosphere in 22 years continuing on past 4°C, “the end of human life on earth as we know it”.
<p>The cause of climate change is increase in cumulative greenhouse gas concentrations in the atmosphere by anthropogenic emissions.</p> <p>¹ IPCC cumulative emission limit for 2°C (>66% probability): 1,000 GtCO₂ in 2011, with intergenerational equity, excluding unproven negative emissions, no overshoot, warming does not stop at 2100,</p> <p>² compared to pre-INDC intentions.</p>	

Analysis.¹

“The purpose of this (UNFCCC) Agreement is... **cuts in global greenhouse gas emissions**... to hold the increase in the global average temperature [below 2°C or 1.5°C] above pre-industrial levels... on the basis of the best available scientific knowledge”².

Cumulative greenhouse gas concentrations in the atmosphere are the cause of climate change. Since pre-industrial times about 2,030 gigatonnes CO₂ (GtCO₂) have been anthropogenic emitted, with annual emissions relentlessly increasing, unabated³.

1.5°C.

To hold global average temperature rise below 1.5°C with a

>66% probability requires limiting further emissions to about 0 GtCO₂ by reducing emissions 100% now. With about 2,030 GtCO₂ already emitted, experts conclude that a likely chance (>66% probability) to limit temperature rise to 1.5°C during the 21st century no longer exists^{4,5,6}.

>50% probability plus ‘temperature overshoot’ for 1.5°C. These require “immediate stringent emission reductions”^{7,8} plus an extraordinary 800 [430–1000] GtCO₂ negative emissions (*see below*) to be removed from the atmosphere by 2100⁹.

Reducing probabilities to >50% is “playing climate roulette with a 2 shooter”, 1 bullet, 1 empty chamber, with only a greater than 1 in 2 chance of “staying alive”, limiting “urgent threat and danger”.

2°C.

IPCC scientists conclude that “to hold the increase in the global average temperature below 2°C above pre-industrial levels” with a likely >66% probability requires limiting cumulative emissions from all anthropogenic sources to 1,000 GtCO₂ by 2011¹⁰, or 870 GtCO₂ by now^{11,12}.

To stay within the 2°C emission limit requires cutting global greenhouse gas emissions now by about 0.4 % per month, increasing with inaction¹³.

This means that to be on-limit for likely 2°C - based on cumulative emissions and excluding unproven negative emissions - current Intended Nationally Determined Contributions (INDC) intentions for the Paris Agreement must increase by 1,100:

by 2030, the end of the INDC period, cumulative emissions will be:

- about 780 GtCO₂ with pre-INDC policies implemented¹⁴;
- about 750 GtCO₂, with INDCs implemented, a reduction of 30 GtCO₂^{15 16};
- about 420 GtCO₂ reduction is required to be on-limit for 2°C, 330 GtCO₂ more than the 30 GtCO₂¹⁷;

This means that to be on-limit for 2°C, current INDC emission reduction intentions must increase about 11 times, 1,100%.

4°C. With current INDCs implemented: by 2037, in about 22 years, cumulative emissions will reach the IPCC 1,000 GtCO₂ emission

limit, locking into earth's atmosphere a global average temperature rise of 2°C above pre-industrial levels¹⁸;

By 2100, the average global temperature will be 3°C to 4°C above pre-industrial levels, and because on INDC trends annual emissions will be far from zero by 2100, temperature will continue to rise to more than 4°C^{19,20}.

Negative emissions: are “unproven”, with “unresolved bio-physical, technological and societal problems”, “a dangerous distraction”²¹ from cutting emissions now.

Most scenarios consistent with limiting warming to 2°C rely on large-scale removal of atmospheric CO₂, “negative emissions”, requiring a massive 465 [400–800] GtCO₂ to be removed from the atmosphere by 2100^{22,23}. Such amounts of negative emissions “are not known to be achievable”^{24,25}, they are not scientific reality.

In perspective, if we burned all of humanity's annual food supply, and captured and stored the carbon (negative emissions), it would amount to only about 3 GtCO₂^{26,27}.

In sum, analysis shows that the best strategy for both 2°C and 1.5°C “catastrophe avoidance” is “immediate stringent emission reduction”: cut global emissions 0.4% per month now, increasing with inaction.

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¹ UNFCCC Synthesis Report on the Aggregate Effect of the Intended National Determined Contributions, 30 October 2015 <http://unfccc.int/resource/docs/2015/cop21/eng/07.pdf> and UNEP Emissions Gap Report Executive Summary, 6 November 2015 <http://uneplive.unep.org/theme/index/13#indcs>.

² Draft agreement 23 October 2015, Article 2, Purpose <http://unfccc.int/files/bodies/application/pdf/ws1and2@2330.pdf>

³ “Carbon dioxide (CO₂) emissions from fossil fuel burning and cement production increased by 2.3% in 2013, with a total of... 36 GtCO₂ emitted to the atmosphere, 61% above 1990 emissions (the Kyoto Protocol reference year). Emissions are projected to increase by a further 2.5% in 2014. Total cumulative emissions from 1870 to 2013 were 1960 GtCO₂. Projected emissions for 2014 - 2015: 70 GtCO₂.” Le Quere C. et al, Global Carbon Project (2014).

“Total anthropogenic GHG emissions have continued to increase over 1970 to 2010 with larger absolute increases between 2000 and 2010, despite a growing number of climate change mitigation policies.” IPCC Climate Change (2014), Synthesis Report Fifth Assessment, Summary for Policymakers

“Every year we report a new record in greenhouse gas concentrations. Every year we say that time is running out. We have to act NOW to slash greenhouse gas emissions if we are to have a chance to keep the increase in temperatures to manageable levels.” World Meteorological Organisation Secretary-General Michel Jarraud, 9 Nov 2015.

⁴ “Only a limited number of studies provide scenarios that are more likely than not to limit warming to 1.5°C by 2100 (after peaking at higher levels); these scenarios are characterized by concentrations below 430 ppm CO₂-

eq by 2100, and by immediate deep emissions reductions and extensive large scale deployment of Carbon Dioxide Removal (or negative emissions).”

“Note that the CO₂-eq concentration is estimated to have passed 430 ppm in 2011.”

IPCC Climate Change (2014), Synthesis Report Fifth Assessment, Summary for Policymakers

⁵ “No scenarios that have a high probability (including >66%) of limiting warming to below the 1.5°C limit during the entire 21st century exist”, Rogelj, J. et al, *Mitigation choices impact carbon budget size compatible with low temperature goals*.

⁶ The INDC Aggregate Effect and Emissions Gap Reports do not include an assessment to hold warming to 1.5°C with >66%.

⁷ Fuss, S. et al, (2014) *Betting on negative emissions* Nat.Clim.Change 4, 850 – 853.

⁸ Rogelj J. et al (2015), *Energy system transformations for limiting end-of-century warming to below 1.5C*. NATURE COMMUNICATIONS | 6:7958 | DOI: 10.1038/ncomms8958.

⁹ From figure 3e, *Global Cumulated Carbon Dioxide Removal between 2010 and 2100*, Rogelj J. et al (2015), *Energy system transformations for limiting end-of-century warming to below 1.5C*. NATURE COMMUNICATIONS | 6:7958 | DOI: 10.1038/ncomms8958.

¹⁰ “limiting total human-induced warming to less than 2°C relative to the period 1861–1880 with a probability of >66% would require cumulative CO₂

emissions from all anthropogenic sources since 1870 to remain below about 2900 GtCO₂ (with a range of 2550 to 3150 GtCO₂ depending on non-CO₂ drivers). About 1900 GtCO₂ had already been emitted by 2011”.

IPCC Climate Change 2014, Synthesis Report Fifth Assessment, Summary for Policymakers.

¹¹ “A two in three probability of holding warming to 2°C or less will require a budget that limits future carbon dioxide emissions to about 900 billion tons, roughly 20 times annual emissions in 2014”. Science Conference Our Common Future Outcome Statement, July 2015.

¹² Since 2011, 130 GtCO₂ of the 1000 billion tonnes have been emitted, 13% of the limit, leaving 870 GtCO₂ today. Annual emissions from Le Quere C. et al, *Global Carbon Project 2014*.

¹³ Not exceeding the IPCC >66% probability emission limit of 1,000 GtCO₂ 2011, without relying on negative emissions, and with intergenerational equity requires an average global emission reduction rate of about 0.38% per month (or 4.5% per year) starting now. Delayed action will increase the required reduction rate and will inequitably burden future generations.

“Even excluding fairness principles, accepting lower probabilities of staying below 2°C and assuming net zero emissions within this century, global mitigation rates still need to be around 5% per year when accounting for the need to turn around growing emissions.” Anderson, K. et al, *Radical emission reductions*, Carbon Management (2014) 5(4), 321-323.

“Regarding scenarios corresponding to RCP2.6, .. the decarbonization rate should be ... an average of 4.5% for 2010-2050.” UNFCCC, Report on the Structured Expert Dialogue on the 2013-2015 review, SED2013-2015, 31.

“In our best case illustrative assumption of conventional mitigation (fossil fuel emission reduction of 5% per year starting in 2015) negative emissions of 0.5-3GtC per year and a storage capacity of 50-250 GtC are required.”
Gasser, T. et al, *Negative emissions physically needed to keep global warming below 2°C Nature Communications* (2015)
DOI:10.1038/ncomms8958.

“The IPCC’s own 1,000 GtCO₂ carbon budget for a “likely” chance of 2°C, requires global reductions in emissions from energy of at least 10% per year by 2025, with complete cessation of all carbon dioxide emissions from the energy system by 2050.” Anderson, K. (2015) *Duality in Climate Science. Nature Geoscience* doi:10.1038/ngeo2559

¹⁴ *Cumulative CO₂ emissions over the period 2012-2030 are calculated in two steps. First, GHG emissions are linearly interpolated between benchmark years for UNEP Current Policy (2014: 53 GtCO₂, 2020: 53 GtCO₂, 2025: 57 GtCO₂, 2030: 60 GtCO₂) and for UNFCCC pre-INDC emission levels (2025: 58 GtCO₂ and 2030: 61 GtCO₂). UNEP Emissions Gap Report (2015) and UNFCCC Aggregate Effect of INDCs (2015).*

Second, annual CO₂ emissions are defined as a fraction of the GHG emissions trajectories. The fraction of CO₂ emissions is estimated from the RCP scenario database (version 2.0.5) International Institute for Applied Systems Analyses

¹⁵ *“Global cumulative CO₂ emissions after 2011 are expected to reach 748.2 (722.8– 771.7) Gt CO₂ in 2030”. UNFCCC Synthesis report on the Aggregate Effect of the Intended National Determined Contributions (2015).*

¹⁶ *Cumulative CO₂ emissions over the period 2012-2030 are calculated in two steps. First, GHG emission trajectories are linearly extrapolated between the benchmark years for UNEP Conditional and Unconditional INDC emission levels (2014: 53 GtCO₂, 2020: 53 GtCO₂, 2025: 53-54 GtCO₂, 2030: 54-56 GtCO₂). UNEP Emissions Gap Report (2015) Executive Summary*

Second, annual CO₂ emissions are defined as a fraction of the GHG emissions scenarios. The fraction of CO₂ emissions is estimated from the RCP scenario database (version 2.0.5) International Institute for Applied Systems Analyses.

¹⁷ *Not exceeding the IPCC emission limit of 1,000 GtCO₂, without relying on negative emissions, and with intergenerational equity requires an average global emission reduction rate of about 0.38% per month (or 4.5% per year).*

Cumulative CO₂ emissions over the period 2012-2030 are calculated for a trajectory with an average annual emission reduction of 4.5 % (0.38% per month)

¹⁸ *Cumulative CO₂ emissions for INDC scenarios are calculated and projected from:*
Carbon Action Tracker Public Data Emission Pathways 10 October 2015;
PBL Netherlands Environmental Agency Data INDCs Policies 28 November 2015;
Climate interactive, Climate Scoreboard Output 1 October 2015 To Share;
London School of Economics and Political Science, Grantham Institute, Policy Brief August 2015;
IEA World Energy Outlook Special report 2015, Energy and Climate Change;
IEA Clean Energy Technologies Perspectives 2015.

OECD Climate Change Mitigation: Policies and Progress October, 2015. Synthesis Report on the Aggregate Effect of the Intended National Determined Contributions, 30 October 2015

¹⁹ “Warming will continue beyond 2100 for all RCP scenarios except RCP 2.6.” IPCC Climate Change 2014, Synthesis Report Fifth Assessment, Summary for Policymakers.

²⁰ Figure 12.5 and Table 12.2 in Chapter 12, Long Term Climate Change, Projections, Commitments, Irreversibility. Climate Change (2013) The Physical Science Base, WGI, IPCC AR5

²¹ Fuss, S. et al, (2014) Betting on negative emissions Nat.Clim.Change 4, 850 – 853.

²² From figure 3e, Global Cumulated Carbon Dioxide Removal between 2010 and 2100, Rogelj J. et al (2015), Energy system transformations for limiting end-of-century warming to below 1.5C. NATURE COMMUNICATIONS | 6:7958 | DOI: 10.1038/ncomms8958.

²³ “The median gross BECCS requirement compatible with a 2°C climate target is 166 GtC (608 GtCO₂) within the IPCC scenario database. The highest net estimate presented here is 130GtC (476 GtCO₂) implying that deploying enough BECCS within land-use constraints may be highly challenging.” Wiltshire A and T.Davies-Barnard, Planetary limits to BECCS negative emissions, March 2015

²⁴ “All scenarios analyzing 2°C pathways that follow the Cancun pledges until 2020” have “negative emission requirements that have not shown to be achievable, be it the yearly flux of combined carbon capture and removal or the storage capacity”. Gasser, T. et al, (2015) Negative emissions

physically needed to keep global warming below 2°C; Nature Communications DOI:10.1038/ncomms8958.

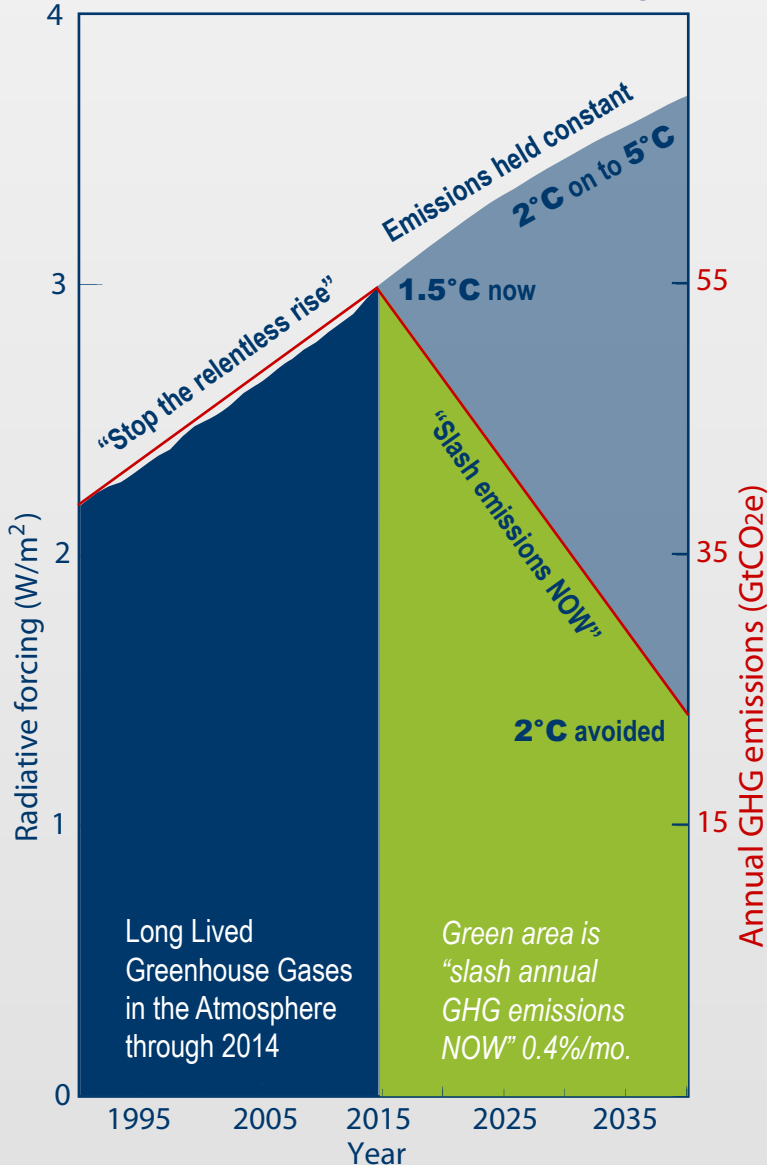
²⁵ Friedlingstein P et al (2014) Persistent growth of CO₂ emissions and implications for reaching climate targets, Nat.GeoSci 7, 709-715.

²⁶ Global Food Supply in 2013 is 2,870 kilocalories per capita per day (FaoStat3Fao Food balances); world population in 2015 is about 7.3 billion (UN pop stat 2015 revision), therefore Total Global Food Supply is about 32 EJ per year. Direct CO₂ emission factor for all biomass is 100 [85 – 117] kg CO₂ / GJ (from IPCC 2006). Combustion of the entire annual global human food supply would release about 3.2 GtCO₂.

²⁷ Total global food biomass < 2 Gt dry matter / year, the energy equivalent of 1 kg dry biomass is 18.5 MJ and 1 kg biomass dry matter contains about 0.5 kg Carbon. 1 kg C = 3.664 kg CO₂. Combustion of all global food biomass would release < 3.7 GtCO₂. Haberl, H., Competition for land: A sociometabolic perspective, Ecol. Econ. (2014), <http://dx.doi.org/10.1016/j.ecolecon.2014.10.002>



GHG: the Cause of Climate Change



UN Climate Conference Paris - 30 Nov to 11 Dec 2015

“THE PURPOSE of this (Paris) Agreement is... cuts in global greenhouse gas emissions... to hold the increase in the global average temperature [below 2°C][below 2°C or 1.5°C] above pre-industrial levels... on the basis of the best available scientific knowledge”:¹

- For 1.5°C: cut global emissions 100% now;
- For 2°C: cut global emissions an average of 0.4% per month now, increasing with inaction;
- Current Agreement intentions must increase 1,100%², or the result will be 2°C locked into the atmosphere in 22 years continuing on past 4°C.

¹ IPCC, >66% probability, cumulative emission limit for 2°C: 1,000 GtCO₂ in 2100, with intergenerational equity, excluding unproven negative emissions, no overshoot, warming does not stop at 2100, ² compared to pre-INDC intentions. HSfound@gmail.com

1.5°C

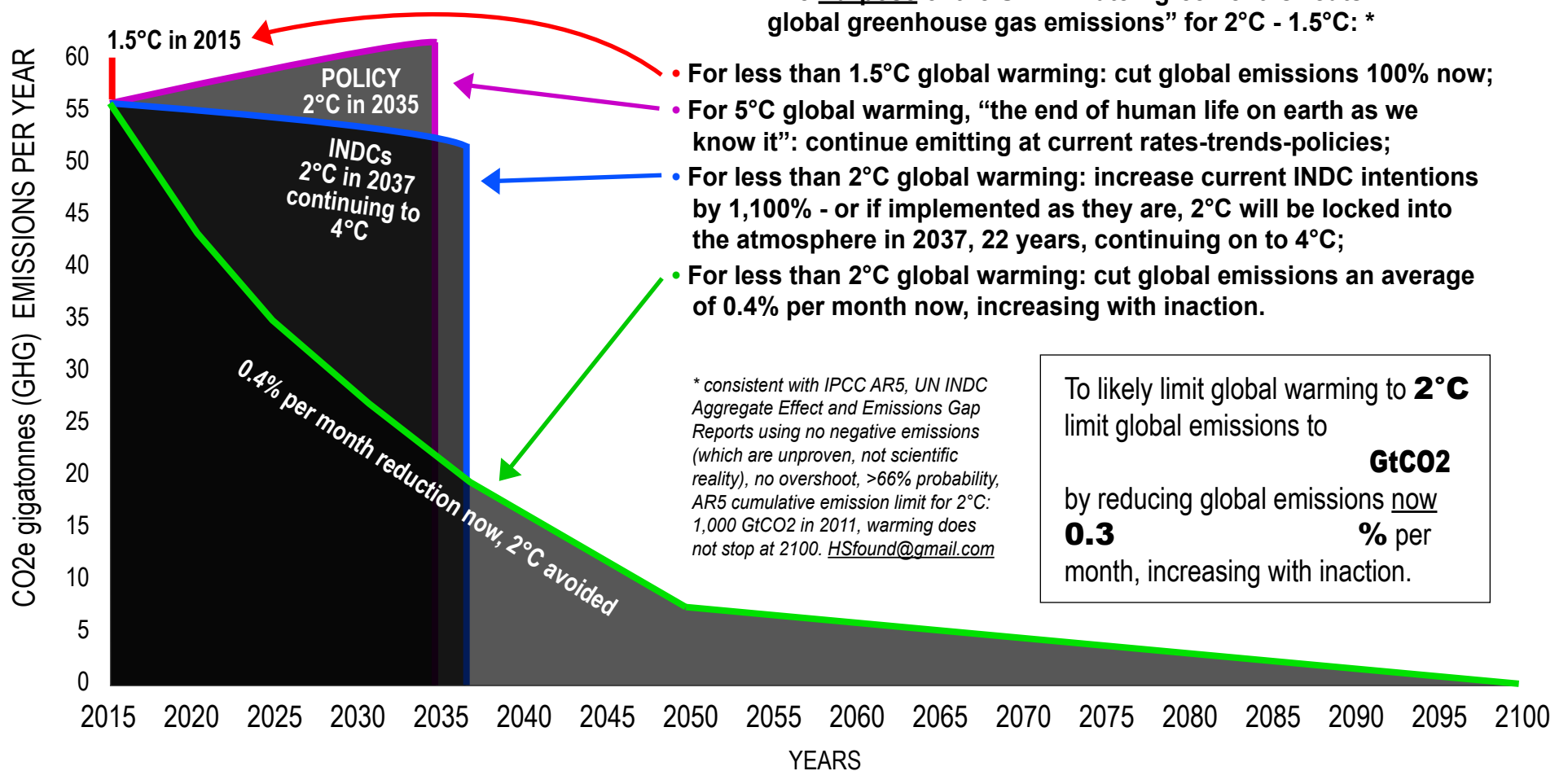
2°C

5°C



choose

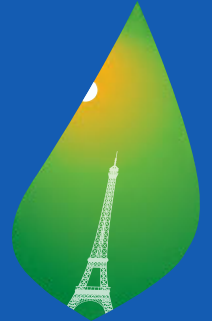
The Purpose of the UN Climate Agreement is “cuts in global greenhouse gas emissions” for 2°C - 1.5°C: *



INFORMED DECISIONS



“THE PURPOSE of this (Paris) Agreement is... cuts in global greenhouse gas emissions... to hold the increase in the global average temperature [below 2°C][below 2°C or 1.5°C] above pre-industrial levels... on the basis of the best available scientific knowledge”:¹



PREVAILING OPINION

1.5°C is still possible.

For 2°C, global emissions must be cut by 2030, by 2050, by 2075, by 2100.

Agreement intentions for 2°C must increase only 200% - and even if they don't, only 2.7°C warming will result.

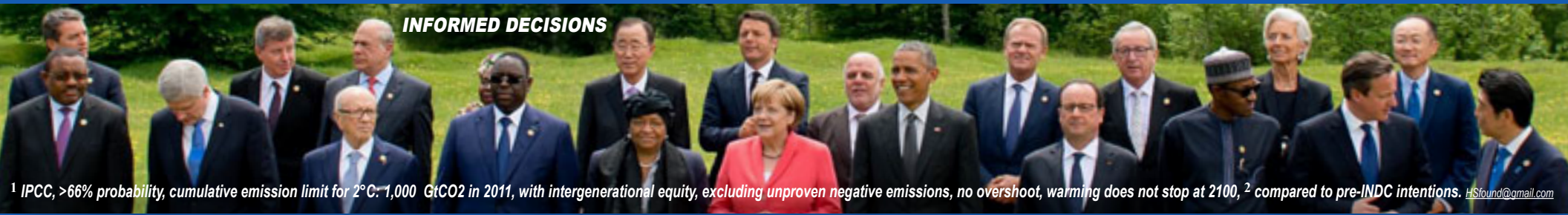
SCIENTIFIC KNOWLEDGE

1.5°C is possible by cutting global emissions 100% now; using “negative” emissions is unproven, not scientific reality.

Cutting emissions by sometime in the future has failed for 20 years and is failing today: for 2°C, cut global emissions NOW, 0.4% per month, increasing with inaction.

Science shows that Agreement intentions for 2°C must increase 1,100%² - and if they don't, 2°C will be locked into the atmosphere in 22 years, continuing on past 4°C, “the end of human life on earth as we know it”.

INFORMED DECISIONS



¹ IPCC, >66% probability, cumulative emission limit for 2°C: 1,000 GtCO₂ in 2100, with intergenerational equity, excluding unproven negative emissions, no overshoot, warming does not stop at 2100, ² compared to pre-INDC intentions. HStovind@gmail.com