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Science-based target setting

Part One of Three: The Science

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Over 300 companies from across the world are now committed to setting evidence-based corporate carbon targets. The Science-Based Target Initiative (SBTi) – a collaborative project between the CDP, UN, WRI and WWF - has recruited dozens of global giants from many economic sectors to the 'Call To Action', including Coca-Cola, Procter & Gamble and Walmart[1]. As investor interest in climate risk is increasing, the ability to demonstrate emissions reduction in line with the latest climate science is becoming the new 'normal'.

The alignment of corporate objectives with the imperative to cease Greenhouse Gas (GHG) emissions caused by human activities by 2050, to avoid climate breakdown, is a positive development and gives hope that the Paris Agreement may be effective. But with so much riding on corporate action in response to climate change, the underlying basis for science-based targets must stand scrutiny: how robust are the methods, are they based on acceptable future climate scenarios, do they adopt the precautionary principle which would suggest leaving a margin for error in order to avoid dangerous, runaway climate change?

In the first of a three-part series on SBTs, we explore the latest findings of climate change science, the consequences for corporate target setting, and the challenges faced by the SBTi in developing a standard which sets emissions reduction criteria consistent with climate science.

The evidence for climate change

In the 2010 book Merchants of Doubt[2], American science historians Naomi Oreskes and Erik M. Conway draw parallels between the public debate around global warming and earlier controversies such as the clinical evidence for the impacts of tobacco smoke on human health. While the scientific consensus on climate change's man-made origins is almost unanimous (97%, according to multiple studies in peer-reviewed journals[3]), the public debate is characterised by misinformation and a lack of balance, with climate

[1] http://sciencebasedtargets.org/companies-taking-action/

[2] http://merchantsofdoubt.org/

[3] J. Cook, et al, "Consensus on consensus: a synthesis of consensus estimates on human-caused global warming," Environmental Research Letters Vol. 11 No. 4, (13 April 2016); DOI:10.1088/1748-9326/11/4/048002

change scepticism overly represented[4]. The message from leading researchers is of a growing emergency, one that policy makers and corporate leaders should be acting on urgently now.

The 21st century has seen more temperature records broken than any other in recorded history. 2016 was the hottest year on record since modern recordkeeping began in 1880, according to NASA[5] and the USA's National Oceanic and Atmospheric Administration (NOAA)[6]. It was the third year in a row to set a new record for global average surface temperatures. Average temperatures are now 1 degree Celsius warmer than the average for the mid-20th century.

The changes occurring in the Arctic region – where temperatures are rising two to three times faster than the global average[7] - are alarming. Striking visible evidence of this is the vanishing extent of Arctic sea ice in summer. This is a consequence of global warming which is occurring more rapidly in Polar Regions than even the experts predicted.

In his 2016 book A Farewell to Ice[8], Peter Wadhams - former director of the Scott Polar Research Institute and professor of ocean physics at Cambridge – states that the rate of decline of Arctic sea ice is such that the entire ice cover may collapse to zero in summer in just a few years from today.

In 1970, when Wadhams completed his first of 50 polar expeditions, Arctic sea ice coverage was around 8 million square kilometres at its September minimum. 45 years later, it has more than halved to 3.4 million square kilometres and is shrinking by 13% per decade.

[4] https://www.theguardian.com/environment/climate-consensus-97-per-cent/2013/dec/06/media-failure-iraq-war-climate-change

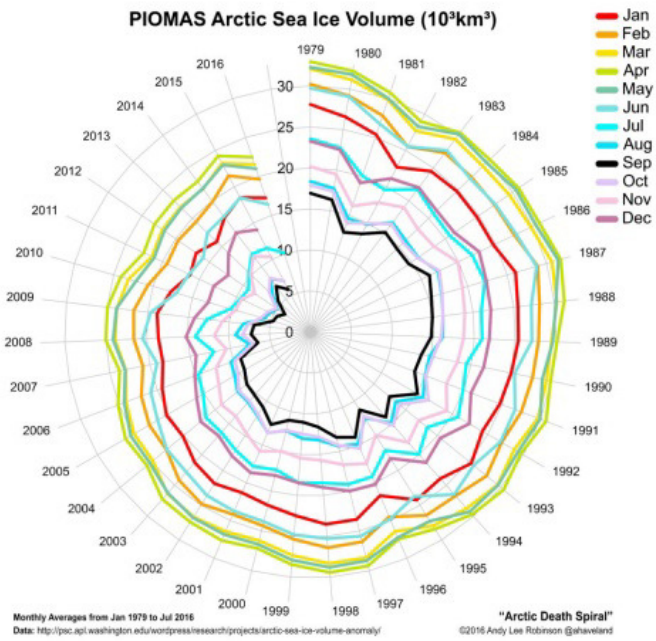
[5] https://www.giss.nasa.gov/research/news/20170118/

[6] https://climate.nasa.gov/news/2537/nasa-noaa-data-show-2016-warmest-year-on-record-globally

[7] https://www.economist.com/news/leaders/21721379-current-trends-arctic-will-be-ice-free-summer-2040-arctic-it-known-today

[8] https://www.penguin.co.uk/books/273799/a-farewell-to-ice/

The sea ice is thinning as well, and its volume has shrunk even faster than its area. This is clearly shown in the now infamous 'Arctic death spiral' produced by Andy Lee Robinson and Haveland.[9]



The probability of total sea ice loss in summer is heightened by positive feedback effects[10]. Wadhams believes these make the likelihood of sea ice recovery, once lost, virtually zero, at least on a timescale of centuries.

The consequences of such radical changes to a significant portion of the planet's surface are highly uncertain. They are predicted to include more extreme weather events and potentially also an eventual slowing or even cessation of the Gulf Stream.

The dramatic reductions in Arctic sea ice extent are the most glaring canary in the climate change coal mine.

Looking beyond sea ice, a warmer world leads to increased concentrations of water vapour in the air – itself a greenhouse gas. The liberation of carbon dioxide and methane trapped in the Earth's deep soil layers[11] and permafrost[12] presents a further previously untapped source of planet-warming gases.

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[9] https://haveland.com/share/arctic-death-spiral.jpg

[10] The feedback mechanisms caused by melting Arctic ice alone are highly consequential and are already being detected. With reduced ice coverage, the level of reflectiveness of the Earth's land mass – known as the 'albedo' – is reduced, and more of the Sun's heat absorbed by the darker-coloured land and oceans. With greater areas of open sea, the average size of waves increases, breaking up more ice.

[11] http://science.sciencemag.org/content/355/6332/1420

[12] http://www.nature.com/nature/journal/v520/n7546/full/nature14338.html

Forecasts of climate change

The IEA's Energy Technology Perspectives 2016 report concludes that if the world were to continue on its current global emissions trajectory, the most likely result is predicted to be 6°C of warming by 2100. With current pledges triggered by the Paris Agreement, this comes down to 4°C of warming, but both those scenarios entail catastrophic outcomes.

The key objective of the Paris Agreement is for policy makers to ratchet up their commitments to the level which produces a good chance of limiting warming to 2°C and a prospect of limiting it to 1.5°C. This is where understanding the underlying argument is critically important.

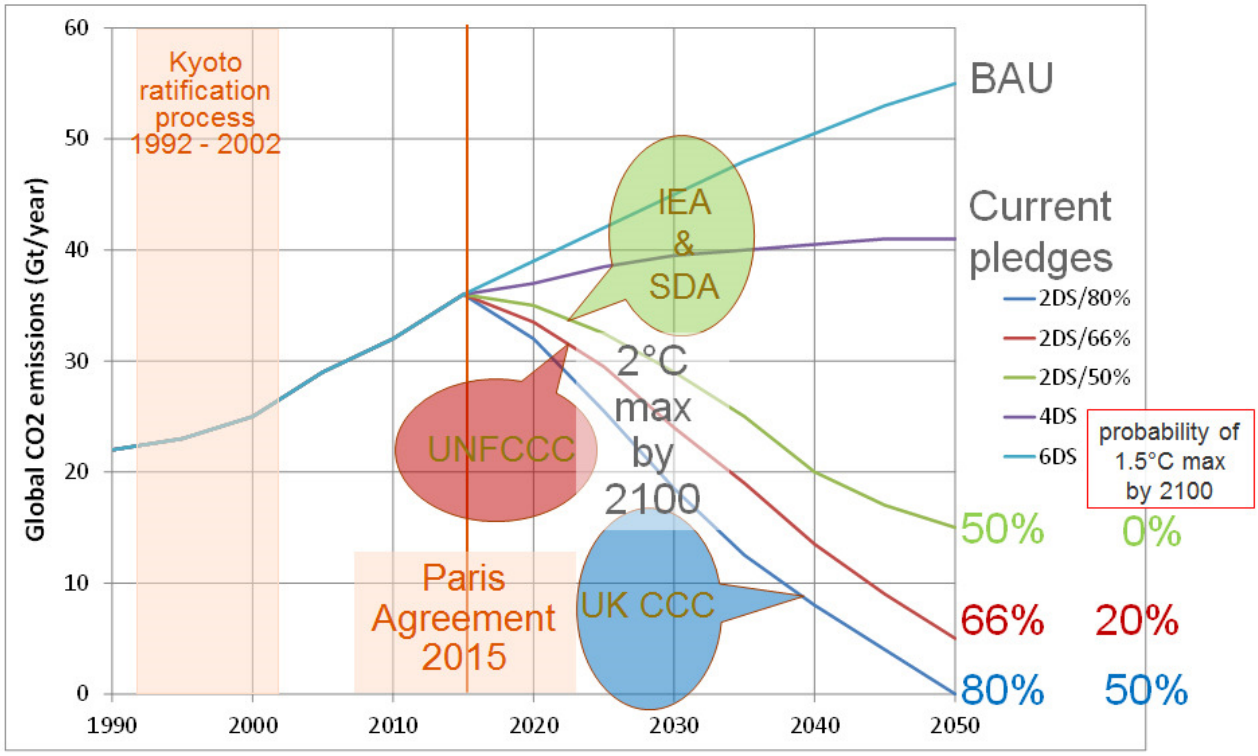
Different levels of future emissions are an input to models. The number of degrees of warming that is predicted to result from those emissions trajectories is an output. The predictions are of course subject to great uncertainty, not least due to the assumptions made in the model. However, to put it simply, the modellers undertake thousands of runs with the same emissions trajectories, but with different other plausible assumptions. Each run produces a predicted level of warming, and by combining all the results, the modellers can create a probability distribution for the number of degrees of warming for a given future emissions trajectory. In summary, an extraordinary amount of modelling ends up with the ability to quantify the probability of constraining warming to a given number of degrees by 2100, assuming global GHG emissions are held within a given carbon (equivalent) budget.

This approach is illustrated in the graphic below, which includes three different “2 degree” scenarios. The one with the highest carbon budget (green line) was adopted by the IEA in 2014 as a pragmatic option to promote before the Paris Agreement was reached. It has only a 50% probability of limiting warming to 2°C and a 0% probability of achieving a 1.5°C maximum. In 2015 it was adopted by the Sectoral Decarbonisation Approach (SDA) promoted by the SBTi.

Also in 2015, the UNFCCC urged the world to target the middle “2 degree” emissions trajectory (red line) which has a 66% probability of achieving a 2°C outcome, but only a 20% chance of a 1.5°C maximum. This recognised that the 2°C limit should be seen as an upper limit that needs to be stringently defended. It is not considered a safe limit: it carries a high risk of serious consequences including extinctions, extreme events, tipping points, sea level rise over 1m, total loss of Arctic sea ice, excessive ocean acidification, loss of

tropical coral reefs, food stress in many regions, etc.[13]. The UNFCCC paper states that a 1.5°C limit would avoid or significantly reduce these risks and should be adopted by the Parties to the Paris Agreement on the basis of the precautionary principle.

In October 2016, the UK's Committee on Climate Change argued that the lowest "2 degree" emissions trajectory (blue line) should be the ambition because it has a 50% chance of achieving a 1.5C maximum and an 80% probability of achieving a 2°C outcome[14].



Scientists can make their predictions, but it is politicians and the general public who must interpret them. There is a grand tension between the risk to humanity of allowing a higher level of future emissions and the political and financial challenge of implementing policies which can achieve a lower level of emissions and hence a lower risk of climate breakdown. The tension is heightened by the entrenched inequalities that exist both in developed countries and between developed countries and developing countries. The plummeting

[13] UNFCCC Report on the structured expert dialogue on the 2013–2015 review, Message 5 (p18), May 2015

[14] UK climate action following the Paris Agreement, Committee on Climate Change, October 2016

cost of renewables is heralded by some as the cavalry coming to the rescue. But will it arrive before it is too late?

To conclude, Paris has put the world on the right track, but those who have ratified it must "pursue efforts to limit global temperature rise this century to 1.5°C above pre-industrial levels." We hope this article explains why that means emissions must be reduced much more deeply and faster than most people realise. Our next article in the series will examine how science-based targets can secure the engagement of businesses in facing up to this challenge, and the options that the SBTi makes available.

Coming next... The corporate embrace of science-based targets

Solutions for a zero carbon world

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