



Due Diligence Analysis of 'Three Years to Safeguard Our Climate'
Conducted by: [The Envisionation Ltd core team](#) and its external advisers
October 2017

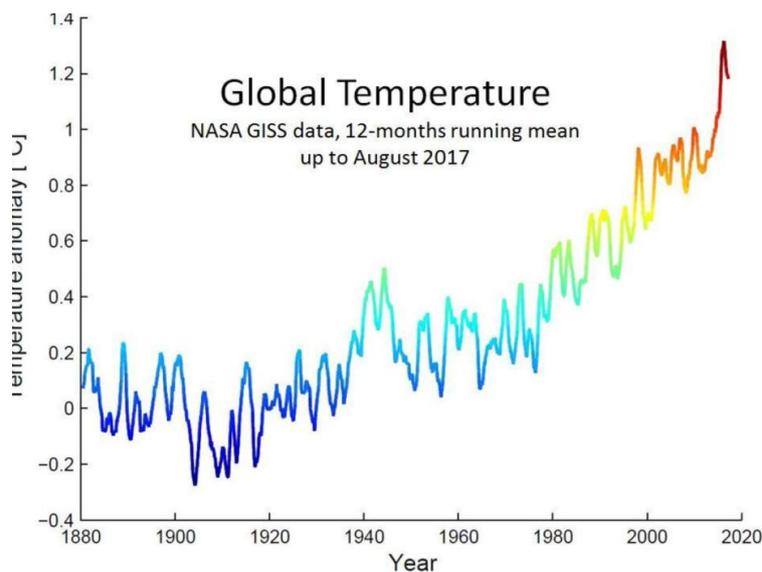


Figure 1 ~ Record of Global Average Temperature

In February 2017 Johan Rockström made a presentation to the World Economic Forum titled '[Beyond the Anthropocene](#)'. The key points were that the rate of climate change has entered a highly dangerous non-linear or accelerating mode and a non-linear response is immediately required to avert extremely deleterious outcomes. The nearly 140-year record of the observed change in global average temperature, as compiled by NASA, correlates well with Rockström's conclusions.

In March, Rockström et al. published a '[Roadmap](#)' that specified the elements of a non-linear response and in June, with an expanded team, issued the report '[Three Years to Safeguard Our Climate](#)' (3Years). This document was, as we understand it, the basis for a briefing to the leaders of the G20 at their 2017 meeting in Hamburg. We also believe that this report led French President Macron to call for a meeting on December 12, 2017 to address financing the suggested plan to deal with the ongoing, non-linear increase in global average temperature.

We judge that the threat has been correctly analyzed, but consider there to be major weaknesses in the responses that are proposed.

Preface

Opinions among public officials, and private citizens about climate change, vary all the way from 'it's a hoax' to 'the sky is falling'. The Envisionation Ltd team does not have opinions - it has positions based on observations, model simulations, and very careful analyses. Our positions are based on literally decades of collective evaluation and consideration, including on and off-the-record consultation with extensive networks of recognized subject matter experts in relevant fields.

Our team's initial approach was based on best-business practices, namely dispassionate due diligence to assess the various claims and counter claims regarding the potential problems that are proposed to emanate from human-induced climate change. This phase was followed by development of a blueprint for an appropriate response to the due diligence findings and included identifying: the critical components of an optimal organizational structure, an initial set of leapfrogging technologies that would enable the nonlinear response, and a mechanism for generating and deploying independent financial resources on a scale commensurate with the overall analysis.

We do not consider it productive to enter the opinions debate. For us, best-business practice dictates that we specify and assess risks and then address them appropriately.

- Is there a risk that 97% of peer-reviewed climate centric scientific papers are correct that there are multiple problematic changes and impacts developing within our climate?
- Is there a risk that the majority of the remaining 3% are financed and thus influenced by vested interests?
- Is there a risk that an ever-growing number of leading climate scientists are correct that breaching a 1.5°C increase above pre-industrial in global average temperature is likely to lead to extremely deleterious societal impacts and that the former specified level of 2°C is too high?
- Is there a risk that, given the current temperature increase is about 70% of the way to 1.5°C, it will be close to impossible to avoid breaching the 1.5°C threshold?
- Is there a risk that given the current observable trends breaching 1.5°C could occur well within the current credit cycle, which is about a decade?
- Is there a risk that we are ill-prepared to respond effectively to the situation?

The logical answer to all of the above questions, and many more, is an emphatic 'Yes'. The questions then arise, 'How should we frame this situation,' and 'How could we respond effectively'?

Our analyses suggest that the most realistic framing is in the context of insurance. The world expends approximately \$4.7 trillion a year on insurance for policies based on calculated odds of unacceptable outcomes that are in the range of one in a hundred to one in thousands years. By comparison, the world is spending less than a tenth of that amount on reducing the quite-high likelihood risk profiles posed by climate change (e.g., the likelihood of breaching the 2°C threshold is roughly 50%, and the likelihood of breaching 1.5°C is much higher).

Our analyses indicate that, were the current level of capital invested in transitional measures organized with best-business practices and administered via the standard back to basics approach used to turn around failing entities, identifiable risks could be significantly reduced.

Our analysis of the needed response identified in '3Years' differs in important ways. We do not question that the co-authors are well-meaning and deeply concerned individuals. Additionally, we do not question that highly esteemed scientific academies and scientists specializing in the research of climate change are expressing increased concern regarding the associated rate of change - indeed, we think even greater attention must be given to the possibility of an even more severe risk.

Our concerns center on what we consider identifiable flaws in the structuring and proposed execution of the response that is outlined in '3Years', coupled with a lack of clarity that seems likely to confuse the business community. Speaking very candidly, less than three months after the world was told the Paris Accord was an unprecedented advance to resolving the climate change challenge, the world was informed that: the climate is in a non-linear, accelerating rate of change; that a much greater effort would be needed; it must start within three years; and this was reported by a team whose members participated influentially in the Paris negotiations!

The potential consequence of 'we've made a good start' (stated by many after Paris even though the Paris Accord was viewed by the scientific community as totally inadequate, at that prior to the recent

declaration regarding the identified non-linear rate of increase of global warming), and 'we'll periodically reassess' (now required merely 3 months after negotiation of the Accord) is that credibility will become an issue. Given that there are identifiable risks requiring immediate attention, there is absolutely no time to be wasted on such issues.

An unequivocal statement and acceptance of the identifiable risks and of the appropriate actions to fully deal with them is needed; a failure to accomplish and act on this need places all global assets at increasing risk even in the short-term.

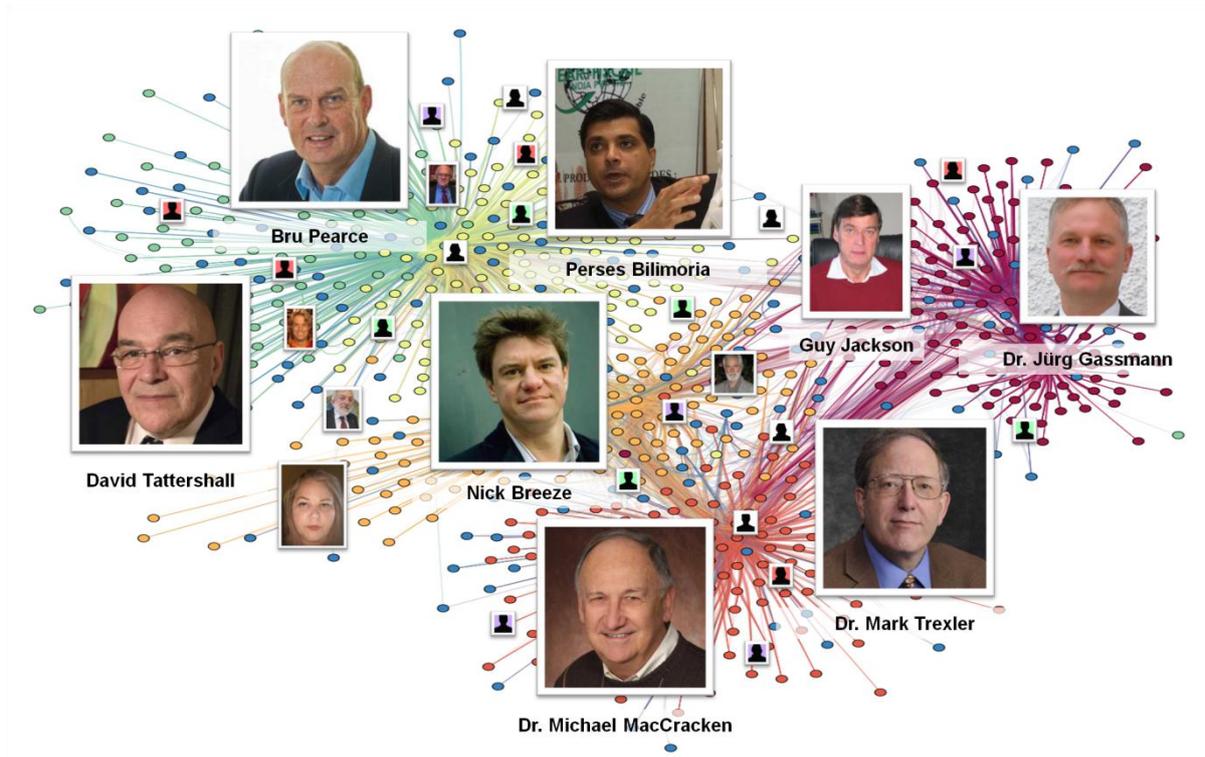


Figure 2 ~ The Envisionation Ltd core team

Summary

The key 'findings' of our due diligence analysis of the '3Years' report, along with pertinent comments are:

1. The words '*we call on them*' (the G20 leaders) suggests that the thrust for an adequate solution is envisaged as regulatory driven. Although there has been a modicum of success in this area, overall this approach has failed to achieve the required transitional rate of emissions reduction even though the world has moved, as the report indicates, into a highly dangerous non-linear or accelerating mode! Why are alternatives not discussed?
2. Business, not governments, will be the entities that must create and deploy the essential transitional measures and yet there is no effort to stimulate their involvement. The essential transition has been quantified as a \$90 trillion opportunity in infrastructure alone by the [Global Commission on the Economy and Climate](#), [Lord Stern's team](#), and [Hank Paulson](#) (former CEO of Goldman Sachs and US Treasury Secretary). Why is there not the slightest mention of this huge economic opportunity?
3. There is no linkage of the chronology of events that led to the publication of '3Years'. Viewing 'Beyond the Anthropocene' and reading the 'Roadmap' enables a more complete understanding of '3Years' and yet even though a single sentence would have sufficed, with hyperlinks, it is as though the other modules don't exist.
4. The dots have not been connected, leading directly to difficulty in understanding the need for the specified response.
 - What will be the additional impacts and implications of a non-linear rate of climate change?
 - What happens next?
 - What are the identifiable risks?
 - What is their timing?
 - How will the proposed capital be assembled, administered and deployed effectively?
5. There is an identifiable lack of attention to detail and thorough research leading directly to errors. Consider 'Findings' 4 & 5, which, as calculated in 'Finding' 6, combine to project a minimum error of 27% in the emissions reductions calculations that are used to specify the response plan.
6. Given the very serious nature of the very recently acknowledged accelerated rate of change, why did the co-authors at a minimum not ask the 'leaders' attending the G20 meeting in Hamburg to invoke the precautionary principle. At a minimum this would have raised worldwide awareness; an essential component of the required response.
7. Were the \$1 trillion of capital raised predominantly in the private sector, that would be 10,000 tranches of \$100 million. It is highly unlikely that any investor, or group thereof, would invest at that level with zero due diligence. The potential consequence of the involvement of due diligence teams is that they will uncover the majority of 'Findings' our team identified. Should that exposure of shortcomings transpire, the identifiable risk is that it might well lead to the investment being withheld, holding off until a plan more assured of succeeding is developed. The exposure of the shortcomings would also likely diminish the credibility of the co-authors, and perhaps also for others offering such plans from this point forward. Plans that are offered must be clearly sufficient, or at least on a path toward this goal.
8. Recognition of the acknowledged non-linear or accelerating rate of change that preceded '3Years' puts a much larger fraction of society's economic assets at risk, with more at risk than is currently acknowledged even in the short term. The near absence of a response in the investor community suggests that they have been lulled to sleep thinking that the Paris Accord has taken care of the problem. Nothing, however, could be further from the truth!
9. Our view is that the shortcomings of '3Years' resulted from not appropriately framing the analysis in terms of the type of risk analysis inherent in the type of due diligence considerations recognized in the business and investment communities. This may well have been a consequence of not recognizing that the analysis traditions of the scientific community tend to understatement in their seeking of very high statistical confidence that permeates the normal standards of researched and published science. Basically, neither side appears to fully understand and account for the

needs and traditions of considering their findings and associated consequences in the other side's analyses - there remains a significant communications gap.

10. The bottom-line for the investment community is that they either elect to take care of the situation that the '3Years' report projects or they accept the consequences of the accelerating level of risks - right now they do not seem to be doing either. It is for that reason we advise investors to carefully consider our analysis prior to making decisions on their proposed courses of action.

Upon request, Envisionation Ltd will supply drill-down details supporting our Findings.

Finding #1 ~ The Plan to Finance a Non-linear Response

Extract: *The financial sector has rethought how it deploys capital and is mobilizing at least \$1 trillion a year for climate action. Most will come from the private sector. Governments, private banks and lenders such as the World Bank need to issue many more 'green bonds' to finance climate-mitigation efforts. This would create an annual market that, by 2020, processes more than 10 times the \$81 billion of bonds issued in 2016.*

Comments:

- A major problem we foresee is that, prior to investing trillions of dollars, financiers and market participants will conduct their own due diligence. It is highly unlikely that trained professional analysts will not, as we have, discover the shortcomings of the proposed response. There is thus a significant risk that, due to flaws in the proposed plan, that investment will be restricted or withheld pending development of a plan that will fully address the worsening situation. As a result, the limited time available to us is very likely to be lost.
- Either there has been a complete collapse of 'green' financing or the report's comment regarding "*the \$81 billion of bonds issued in 2016*" is completely misleading. [UNEP reported](#) that investments in renewable energy alone reached a record of \$270 billion in 2014; [Bloomberg New Energy Finance](#) (a contributor to the UNEP report) corrected this figure to \$316 billion and quoted \$329 billion for clean energy in 2015. With such conflicting numbers, a professional analysis is likely to conclude there has been a lack of attention to detail!
- The thrust of the final sentence suggests 1:1 financing, with the constraint that loans will be limited by the need to raise \$1 trillion a year of new capital, year-on-year, by issuing 'green bonds'. Presumably individual projects will be shopped to various potential financing units until they are either accepted or ultimately rejected. 1:1 financing' is ponderous at best and it is highly questionable whether the rate of loan approval/issuance that could be achieved would be commensurate with the Rockström et al. defined non-linear response requirement.
- We have found no evidence that the *financial sector has rethought how it deploys capital and is mobilizing at least \$1 trillion a year for climate action*. What is the basis of '*at least \$1 trillion a year*'? The 'Global Commission on the Economy and Climate' issued a [report](#) in 2016 that specifies a \$90 trillion economic opportunity in sustainable infrastructure alone for an effective transition. In 2006 Lord Stern, a key participant in the above referenced report, issued 'The Stern Review'. Stern stated in his review (paraphrased) that if adaption was left until 'late,' expenditures of 5% of world GDP per annum would be required to avoid unacceptable outcomes; based on the 2006 world GDP that is approximately \$3 trillion (this was confirmed with Nicholas Stern in a meeting he held with the Envisionation Ltd team). The title of '3Years' most certainly implies that we are very late in the cycle. Then, also considering the recent identification of the non-linear rate of change, how can the \$1 trillion per year estimate be even close to enough capital to address the rapidly deteriorating situation?

Conclusions Relating to Finding #1:

- It is beyond question that the co-authors and co-signatory's to '3Years' are well-meaning and committed individuals who are dedicated to averting a crisis that is inarguably on the horizon. That being said, however, consider the opening of the penultimate paragraph; *Our co-signatory list, which includes eminent scientists, business leaders, economists, analysts, influencers and representatives of non-governmental organizations, is an example of the strength of radical collaboration across unusual partners.*
 - There is a maxim in the investment community when due diligence findings detect errors of omission, lack of attention to detail, or flawed reasoning: "What else is wrong?" Investors have options and, rather than resolve discrepancies that they discover, they will invariably withhold their hard earned dollars for opportunities with a less identifiable risk of failure.
 - *Business leaders, economists, [and] analysts* are included within the quoted sentence, and yet no one experienced in business or fundamental economics would remotely consider rearranging major components of the economy of the world based on raising and deploying capital using 1:1 financing; leveraging is an essential component of effective financing. Suggesting such an unusual and under-productive approach is highly

likely to raise questions regarding who the *analysts* were and why they advocated the approach that they did.

Finding #2 ~ An Unclear Objective

Extract: *The year 2020 is crucially important for another reason, one that has more to do with physics than politics. When it comes to climate, timing is everything. According to an April report¹ (prepared by Carbon Tracker in London, the Climate Action Tracker consortium, the Potsdam Institute for Climate Impact Research in Germany and Yale University in New Haven, Connecticut), should emissions continue to rise beyond 2020, or even remain level, the temperature goals set in Paris become almost unattainable. The UN Sustainable Development Goals that were agreed in 2015 would also be at grave risk.*

Comments:

- What were 'the temperature goals set in Paris'?
- For clarity why are the 'goals' not stated?
- One goal of the Paris COP21 meeting was to avoid breaching a 2°C temperature increase above the pre-industrial baseline (PIB). The aspirational goal was to avoid breaching a 1.5°C temperature increase above the PIB. Which goal is the issue?
- During the Paris meeting the UN announced that if all the INDCs (Intended National Determined Contributions) were implemented, perfectly, the result would be a potential increase of 2.7°C above the PIB. Independent subject matter experts projected the potential increase to be 3.5-4°C. At a minimum the consequences of 'Finding #4' are missing from these calculations and it is more than likely that the consequences of 'Finding #5' are also missing; consequentially the temperature increase may be much higher.
- Following the Paris meeting the majority of participants commented enthusiastically that the result was somewhat remarkable in that so many nations were in agreement, that it was a 'good start', and that the core issue of emissions reductions would be revisited in 5 years.

Specific comments regarding 'temperature ceilings' from Dr. Michael MacCracken, who is currently reviewing the first order draft of the IPCC 1.5°C report:

I consider it contains two fundamental problems:

1. The UNFCCC objective in 1992 indicated that it would "stabilize" the climate at an appropriate level. In my view, scientists (like Hansen, etc.) consider the 1.5°C a ceiling value, indicating that the impacts at this level would be very large, and that if society wants to have the type of conditions met that are stated in the UNFCCC objective (so, roughly, ability to produce food and have a stable environment), the temperature increase must be brought back down to less than say 0.5°C. The text of the IPCC draft report essentially views 1.5°C (versus 2°C) as the new long term temperature level - and Oliver Morton agrees that is how the negotiators are generally viewing the value - so not as a ceiling one does not want to exceed, but a new acceptable level. So clarity is needed to make the point of whether the temperature increase values being discussed are ceilings or new long-term stability levels, making clear that the ultimate consequences will differ greatly depending on how the value is interpreted.
2. In the IPCC report they use a naming convention for pathways to stability that uses the stable temperature they are aiming at, so say 1.5°C, and not the peak value that the temperature might rise to along that 100-200 year pathway. So, a "1.5°C pathway" in their terminology could allow the temperature to go up to 4°C and then come back to 1.5°C, somehow apparently thinking that everything (species loss, ice sheet melting, and so on) are all reversible and not seeming to realize that what is most likely to determine consequences will be the peak warming reached (and perhaps its duration) and not the ultimate sustainable level for temperature. What this means is that there can be all sorts of 1.5°C pathways (with any potential amount of overshoots) and yet the negotiators can sound quite satisfied about their accomplishment because they are on a 1.5°C pathway. Very misleading.

The two points above were the major issues for me, and evident throughout the report. Huge confusion, and the IPCC authors seem to be allowing the confusion to go forward, even supporting it. Much of what is said makes the point that the consequences of 2°C pathways will be worse than

1.5°C pathways (which is technically not true as it really depends on peak values reached) and not really saying how serious 1.5°C will be (e.g., most low-lying atolls will be flooded even with 1.5°C - so much for the push by island nation leaders for seeking a lower value).

Conclusions Relating to Finding #2:

The continual vagueness is perplexing as discussed in the foregoing comments by Dr. MacCracken. Why have we suddenly only three years left to safeguard our climate, just a few months on from Paris? What will happen if we don't, i.e., the potential impacts, their timing and intensity? Why is all of this not explained clearly in terms of the risks we face? What does a non-linear rate of change mean and what are the consequences? The implication is either we do this or else; or else what?

There is a distinct overall sense of understating the severity of the situation in favor of positive spin; presumably the reason is that telling it how it is triggers rejection due to categorizing the messenger(s) as a merchant(s) of doom and gloom. Nevertheless the co-authors of '3Years' have specified raising and applying \$1 trillion a year, year-on-year, to accomplishing emissions reductions. A likely reaction of those sectors of the market that have to date not responded, with the exception of fossil fuel industries, is one of confusion and thus hesitancy. In the defined circumstance, and adding a large library of supporting detail, a failure to take effective and timely action could impart a catastrophic blow to civilization, severely threatening all assets even in the short term.

From '3Years', even adding the proceeding modules, is that clear and readily comprehended?

Finding #3 ~ The Precautionary Principle

Extract: *As 20 leaders of the world's largest economies gather on 7–8 July at the G20 summit in Hamburg, Germany, we call on them to highlight the importance of the 2020 climate turning point for greenhouse-gas emissions, and to demonstrate what they and others are doing to meet this challenge. Lowering emissions globally is a monumental task, but research tells us that it is necessary, desirable and achievable.*

Comments:

Given:

- The very serious nature and potential consequences of a non-linear or accelerating rate of climate change;
- That it is essential as an integral component of a successful transition that we attain zero CO₂ emissions as soon as is possible to minimize forward risks (one should note that it is more than likely, due to the accelerating rate of change, that some impacts may be impossible to avoid and they could have extremely deleterious consequence for society).
- The fact that even though CO₂ emissions have reached a plateau for several years and yet the atmospheric CO₂ concentration continues to increase along with other greenhouse gases (particularly Arctic based methane) and the average world mean temperature;
- That an identifiable risk, or plausible explanation, for the circumstances described in the above bullet point is that one or more positive feedback loops have been triggered;
- That positive feedback loops require no further energy as they are self-reinforcing;

Then, given these findings, it is questionable that any so-called allowable carbon budget remains. In fact, the reality is likely that we are already in a deficit position. If this is the case, the response plan needs a complete rework and intervention, something we are ill-prepared for, will more than likely an essential component of that reworked plan; and yet this possibility is not discussed!

That leads to the question of why the '3Years' team stated '*we call on them.....*': Given the identifiable level of the risks, why did the authors not ask the G20 leaders to consider immediately invoking the [precautionary principle](#)? The precautionary principle is Article 3.3 of the UNFCCC charter and Christiana Figueres, a member of the author team, is Executive Secretary of the UNFCCC; surely, all team members plus the external advisers must be aware of the precautionary principle's relevance to an issue so affecting society and the environment.

Conclusions Relating to Finding #3:

Considering the 'Carbon Crunch' graphic contained in '3Years,' it is apparent that achieving the required pace of change is a nigh-on impossible goal. Especially after acknowledging that the errors

in the analysis result in a minimum error (underestimate) of 27% as outlined in the following two Findings, facts must be faced: the required rate of transitioning is inconceivable. And yet the co-authors 'call on them' to recognize a sudden and highly dangerous change with a problem they (the leaders they call on) collectively addressed just a few months prior in Paris.

If the situation is as serious as the co-authors imply, and it is, why not bring sharper focus by stating unequivocally that the clock is running out and it is time to face facts. If not now, when? Let us not forget the premise; we have three years or else! Invoking the precautionary principle would seem to be a way to bring sharper focus and cut through the hoping that everything will be all right. The truth is that very serious action is required immediately and must be sustained for decades.

Were this entire situation framed as taking place in a major corporation, the shareholders would be up in arms and heads would roll because all assets are now at very serious risk.

Finding #4 ~ Coal-fired Power Plants

Extract: *No coal-fired power plants are approved beyond 2020, and all existing ones are being retired.*

Comments:

- With a simple Google search we discovered [this article](#) in *The New York Times*, which outlines in considerable detail realities that more than likely doom the 'plan' to failure before there is even any attempt at deployment. In short, the article outlines plans for 1600 new coal-fired power plants, in 62 countries, which will increase existing capacity by 43%.
- A review of the article reveals that the information on which it is based was sourced from an NGO whose domicile is 35.4 km from Potsdam. Potsdam was a key participant in the initial analysis of non-linearity, the subsequent 'Roadmap' and 'Three Years to Safeguard Our Climate' and yet apparently had no knowledge of the NGO in their own backyard and the critical data it was compiling.
- Added to the above is the emphasis within the document regarding the depth and quality of external input; consider this statement – 'these (the 'six milestones' outlined, including the one related to coal fired power plants) were reviewed and refined in collaboration with analysts at Yale University, the Climate Action Tracker consortium, Carbon Tracker, the low-carbon coalition We Mean Business, the Partnership on Sustainable, Low Carbon Transport (SLoCaT), advisory firm SYSTEMIQ, the New Climate Economy project and Conservation International' and yet apparently not one of these organizations could perform a simple search on Google to locate *The New York Times* article or a slew of information on this issue!
- This is a very easy 'find' by any professional analyst and seasoned investors will not be impressed.

Analysis:

Let us consider the impact if 'No coal-fired power plants are approved beyond 2020, and all existing ones are being retired' but that the 1600 new planned plants in 62 countries are completed.

Anthropogenic emissions of CO₂ for 2016 were 41 gigatonnes. Of those emissions, [around 26%](#) were attributable to coal-fired power plants or $41 \times 0.26 = 10.66$ gigatonnes.

A 43% increase in existing capacity would amount to $10.66 \times 0.43 = 4.58$ gigatonnes.

The identifiable error is an understatement of the task by $(4.58/41 \times 100\%)$ [11.2%](#) minimum, and this error will increase depending on how many existing coal-fired power plants end up not being retired.

Conclusions Relating to Finding #4:

- The investment maxim of 'What else is wrong', will be conjoined by seasoned investors with problem solving 101. It is well recognized that if a problem is not defined correctly, the proposed answer will be inadequate, with the potential for a lack of confidence to emerge in existing and future statements by members of this world-renowned team.
- A favored tactic by those campaigning for an effective response to our deteriorating climate is to get the ball rolling and plan to progressively increase (i.e., ratchet up) the rate of response. One identifiable problem with this approach is the sudden declaration that the climate is in a highly dangerous non-linear or accelerating mode. If one views the situation from the

perspective of seasoned investors, their impression is that matters were attended to in Paris. Without fully laying out the problem, questions will arise such as 'What is next' and 'Tell me when you've made your minds up' may dominate the discussion and delay the required investment.

Finding #5 ~ A Potentially Critical Missing Factor: Loss of the Natural Forest Sink

In 2009 the International Union of Forest Research Organizations (IUFRO) delivered a [report](#) to the UN that stated the natural forestry sink could flip to becoming a source at an increase in the global average temperature of 2.5°C; in other words, instead of absorbing 20-22% of anthropogenic CO₂ emissions, the forest regions would become sources of CO₂. By any standard this is a colossal consideration that completely upends all calculations relative to countering climate change on the singular basis of emission reductions. There is not the slightest mention of this potential transformation in IPCC's Fifth Assessment Report (AR5), which was the primary basis of the Paris Accord, nor is there any mention of this in the Fourth National Climate Assessment in the United States, which was based on the scientific understanding presented in AR5.

Comments:

- Professional analysts might not discover this finding. The primary reason it is known to the Envisionation Ltd team is that we have established unusually extensive networks to ensure as complete an understanding as possible of the situation that we face.
- Because the findings of IUFRO's report have not been described in any of the major official assessments, it is reasonable to assume that this changing situation was also not included in the emission reduction calculations presented in '3Years'.
- Our external adviser, Dr. Reese Halter (author of several books about trees), states that the IUFRO's prognostications are more than likely conservative, that this sink could pass a critical threshold at an increase of 1.5°C, and that the flip is likely to occur by or before a 2°C increase.

Analysis:

If indeed the natural forest sink were to flip at a temperature increase of 2.5°C, using the lower value for how much forests are now absorbing (i.e., 20%), at an increase of merely 2°C (the warming that negotiators are suggesting as 'dangerous'), the sink capacity would likely be reduced by roughly 80%.

The gross impact with an increase of 2°C, neglecting the progress of emissions reductions programs, would be a failure to absorb $41 \times 0.2 = 8.2$ gigatonnes (the assumed amount of CO₂ absorbed by the forest sink) and a potential shortfall of absorbing $8.2 \times 0.8 = 6.56$ gigatonnes of CO₂.

The minimum error would be $6.56/41 \times 100\% = 16\%$.

Conclusions Relating to Finding #5:

One should consider that the required rate of emissions reductions specified by the three paths in '3Years' is nigh-on impossible; now add a potential error of this magnitude to the calculations used to develop the requirements of those paths.

In the time between the original drafting of this document, and its current status, it was announced that the [Tropical Forests had flipped](#) to become a source. The authors of that research do project the consequential level of emissions from those forests but do not quantify the assumed CO₂ absorption when these worldwide forests were acting as a sink. The overarching point is that climate change is not a static situation but one that is dynamic and thus effective plans to ensure control is maintained must be multi-dimensional, flexible, with dots connected, and the input of all major aspects of society.

Finding #6 ~ The Combination of the Coal and Natural Forest Sink Errors

Analysis:

4.58 (coal-fired power plants) + 6.56 (natural forest sink) = 11.14 gigatonne combined potential shortfall of CO₂ absorbed.

$11.14/41 \times 100\% = 27\%$ potential minimum error in certain calculations within the '3Years' plan.

Conclusions Relating to Finding #6:

- The error associated with coal-fired power plants is more than likely understated; it could be considerably understated. It is difficult to conceive that *'No coal-fired power plants are approved beyond 2020, and all existing ones are being retired'*. The consequence, particularly as 43% more capacity is progressively added, is that the calculations for emission reduction requirements to safeguard our climate in the next three years are highly questionable.
- The error associated with the natural forest sink has complex variables. For instance, even though the forest sink is pretty clearly declining (consider the laconic headline ['An American Aerosol in Paris'](#) prompted by raging forest fires on the West Coast of the US), all calculations projecting paths for emissions reductions aimed at averting a 2°C increase appear to assume that the tree sink is operating at full capacity *ad infinitum*.
- One should note that, at least in part due to the increasing stress that climate change is having on forest species, increasingly intense forest fires are raging on all continents with the exception of Antarctica. Fire seasons are extending longer and intensity is growing as tree mortality is increasing due to insects (bark beetles), drought, and deforestation.

Finding #7 ~ Lack of Consistency - Intervention

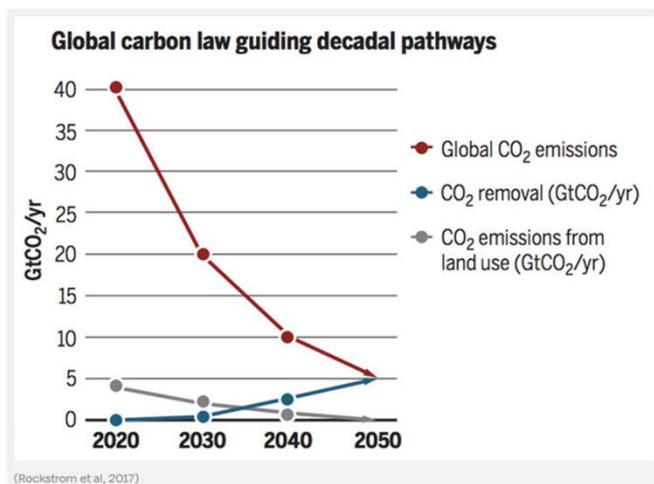


Figure 3 ~ Graphic from 'The Roadmap'

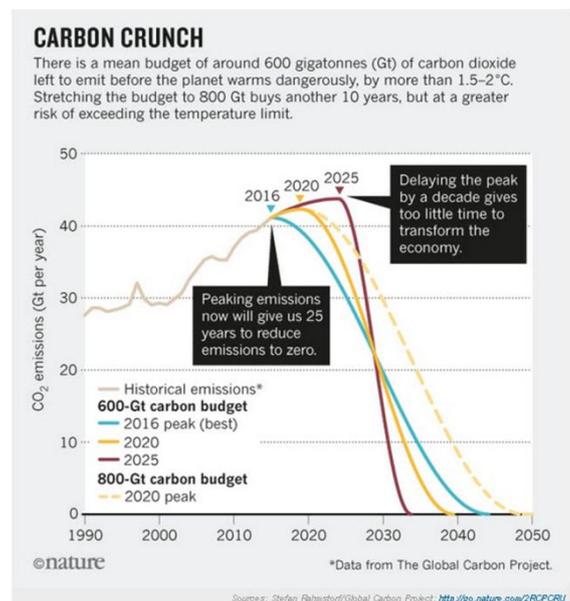


Figure 4 ~ Graphic from '3 Years'

Comments:

- Figure 3 is from the 'Roadmap' published by Rockström et al. following the 'Beyond the Anthropocene' presentation made at the World Economic Forum. The blue line is most interesting. It shows that starting in 2020 the 'Roadmap' specified the progressive removal of CO₂ from the atmosphere, reaching a level of 5 gigatonnes per year by 2050.
- Figure 4 is from '3Years', a document published 4 months later involving the same co-authors, plus an expanded team, and one wonders why there is no indication of the need to remove CO₂ from the atmosphere?
- RCP2.6 (Representative Concentration Pathway), from the IPCC's AR5 report, specifies initiating CO₂ removal from the atmosphere in 2070 and attaining a level of 5 gigatonnes per year by 2100. RCP2.6 then requires this level of removal to be maintained for a minimum of two centuries. One has to wonder what has changed and what the Rockström et al. team knows that apparently no one else does?
- Alarmingly RCP2.6 is the only IPCC pathway that is allegedly capable of avoiding the 'dangerous' 2°C threshold with a calculated probability of 66% success, at that assuming RCP2.6 is implemented perfectly.

Conclusions Relating to Finding #7:

- With respect to the calculated odds of a 66% chance of avoiding a 2°C increase if RCP2.6 is implemented perfectly, this can be alternatively stated as a 2:1 chance of avoiding disastrous to catastrophic outcomes. These are odds that are more appropriate to gambling as opposed to anything close to what one might consider an acceptable level of risk for the survival of civilization on Earth!
- No underwriter would issue an insurance policy relating to the consequences of the failure of RCP2.6 and we are nowhere near to implementing its requirements. All competent professional analysts would come to this conclusion; especially given that the Swiss re-insurance company Munich Re warned in an article [published in a periodical called Insurance Daily](#) that the 2°C alleged safety limit was “no longer attainable”.
- There is no connection in the text of ‘3Years’ with ‘Beyond the Anthropocene’ and the ‘Roadmap’ and thus the risks associated with non-linearity.
- There is no explanation of the consequential impact of non-linearity; specifically, that all of the projected adverse events outlined in peer-reviewed publications will more than likely occur earlier than has currently been projected; and, it could be much earlier! There is thus no adequate discussion of what is most likely to happen next and approximately when!
- There is no attempt to explain the root cause of the new finding that the temperature increase has become non-linear, as originally presented by Rockström to the WEF. A plausible explanation for the non-linearity, and the identifiable risk, is that one or more highly dangerous positive feedback loops have been triggered and that, if this is the case, it is possible that we have entered the initial stages of climate change beyond that in the geological record of the Earth.

One positive feedback loop could be sufficient to cause climate change to gradually spiral out of control and in the event that more than one has been triggered, a further risk is that they are interacting, thereby applying more energy to cause the non-linear rate of change to increase.

If this is the case figure 4, on the proceeding page, is simply not an adequate characterization of the situation. In a nutshell, not only is there no available ‘carbon budget’ that would accommodate ongoing emissions, we are potentially in a highly dangerous deficit position! The characteristic of a positive feedback loop is that it has reached a stage where it is self-reinforcing and needs no additional energy to increase in intensity. On that basis every pound of CO₂ emitted from this point forward will merely serve to intensify positive feedback loops and increase the rate of non-linearity or acceleration.

Added to the above is that positive feedback loops will not only cause the rate of temperature change to continually accelerate but they will also amplify the loss of mass from the Greenland and Antarctic ice sheets. There is extensive material, and concern, regarding the damage that will be caused by the consequential sea level rise associated with the loss of mass by these major ice sheets; potential asset loss has been assessed in trillions of dollars.

The key issue in that risk assessed scenario is, ‘When was the threshold crossed that potentially triggered a positive feedback loop?’ Calculating the emissions between that point, and where we are according to Rockström et al. would reveal the deficit amount.

- Given the risk that we are potentially in a deficit position, in tandem with the potential combined shortfalls identified in ‘Finding #6’, why is no fallback plan mentioned? Let us consider:
 - The entire premise of ‘3Years’ is that even though it is stated that the rate of climate change is now non-linear, or accelerating, that control can be reestablished by the singular approach of emissions reductions. The risk that this cannot be achieved is glaring if one considers what must be achieved even without the errors in ‘Finding #6’.
 - While the co-authors of ‘3Years’ are appealing to the investment/business community to respond to the situation they have defined, with a substantial financial investment, they have not provided the slightest explanation of how the capital will be deployed or who, or how, this will be administered. At a minimum could there not have been a supplementary paper with appropriate details?

- The rate of economic change required to attain any of the transition curves shown on figure 4 is dramatic and would probably only be possible if the entire world adopted a war footing basis. In that such a change would seem highly unlikely to occur given other pressing challenges for society, why is there no consideration given to a supplementary approach.
- Added to the rate of economic change needed in the reported analysis, there is a plausible chance that there is no allowable 'carbon budget' for ongoing emissions and that the reality of our circumstance is an existing deficit!
- In the investment/business environment seasoned operatives anticipate that their assets are being managed with an operational plan 'A', that plan 'B' is in standby mode, and plan 'C' is in development. The approach of '3Years' is plan 'A', which is identifiably flawed, and not even a hint is presented of a fallback or plan 'B'.
- An extensive drill-down of matters related to climate intervention, or geoengineering, will discover considerable resistance from multiple sectors of society. One has to wonder what pressure the investment/business community will exert when the actual immediacy of identifiable risks to their assets are fully comprehended?
- Given the complexities mentioned, we find it inexplicable that potential climate intervention options are not, at a minimum, in advanced stages of research and supported as a plan 'B' by this team.

Finding #8 ~ The Trigger for Action

Extract: *First, use science to guide decisions and set targets. Policies and actions must be based on robust evidence. Uncensored and transparent communication of peer-reviewed science to global decision-makers is crucial. Academic journal articles are not easily read or digested by non-experts, so we need a new kind of communication in which Nature meets Harvard Business Review. Science associations should provide more media training to young scientists and hold communication boot camps on how to make climate science relevant to corporate boards and investors.*

Comments:

- What is meant by 'robust evidence'? A non-scientist may well interpret this in the legal context of 'a robust defense'. A scientist will interpret it as having sufficient data to perform a statistical analysis and thus be able to ascribe levels of confidence to their analysis of a given situation. The second, and confusing sentence, serves to exemplify the overall context of the paragraph
- The confusion continues with the third sentence, which is arguably nonsensical. There is no evidence that scientists are either hiding or deliberately clouding peer-reviewed science. How would it be possible to peer-review, an open process by definition, and simultaneously deliberately censor or cloud communications for decision-makers?
- The reality of the situation surrounding this statement is not a failure of either science or scientists, but a complete failure of the administration that supports the collation and analysis of scientific data. Consider our 'Finding #5'. A scientific report by the IUFRO was presented to the United Nations Forum on Forests in April 2009. The UN funds and administers the IPCC and the UNFCCC and yet this report was not included in the IPCCs AR5 report published in 2013! Had such an omission occurred in the corporate world, given the substantial errors this report implies in all emissions reductions calculations, it is beyond doubt that there would be severe consequences.

Overall Conclusions:

Our 'Finding #8' does lead to questioning how the status of the climate situation being faced could have so suddenly been raised to a highly dangerous non-linear or accelerating mode. That this has occurred so suddenly suggests a complete failure by the international governmental structure in the past to fully understand, accept, and translate the cautiously stated findings of the scientific community into terms that would accurately identify and quantify risk and the associated consequences facing society.

Science is merely one component of assessing the risks associated with climate change. Admittedly it is an extremely important component and it is equally important that the thoroughness of research

and skepticism associated with peer-review are maintained. This framing allows for scientists to analyze data that has garnered broad acceptance by their peers and make statistical predictions, or stated probabilities. That: the international scientific community was expressing such near-unanimous concern; these findings were very strongly endorsed by virtually all of the national academies of science in the world, and a very large number of scientific professional societies; is so unusual that the issue clearly merited greater and earlier attention than has been the case.

Other sectors of society, the military, the business community (particularly the financial industry), and parents, are rarely able to await a thoroughly consolidated analysis of the type that science produces. Scenarios, or possibilities, are the predominant driving forces in risk assessment and consequential decision-making by the majority of societal sectors.

To put this in stark perspective let us consider unstoppable, irreversible, climate change and fully absorb the associated consequences. A logical conclusion of 'Beyond the Anthropocene' is that we have already initiated that process. Why then is there not the slightest mention of this risk in any of the documents produced by Rockström et al? One reality is that generating scientific assessments takes time, especially when one counts the time for scientists to publish their findings; a situation that the results presented in the assessments may lag the cutting edge of scientific understanding by up to a decade. If now the IPCC assessments are to be the only source of findings to be considered in the international negotiations conducted under auspices of the UNFCCC, the slow pace of international action is perhaps not surprising, but this delay has resulted in an increasingly dire situation for society.

Given the situation, it is very clear that '*we need a new kind of communication in which Nature meets Harvard Business Review*'. Indeed we do, but in order for that to be effective, we require an international administrative structure appropriate to the task of assessing the risks to society posed by climate change. On the other hand, it is hard to agree with the statement that '*Science associations should provide more media training to young scientists and hold communication boot camps on how to make climate science relevant to corporate boards and investors.*' This statement is borderline ludicrous. It fails to recognize the very unusually high agreement that there has been in the scientific community, the basic difference between the framing that credibility necessitates the scientific community to rely on, and the probabilities and possibilities that are central to the effective and timely risk assessment by all sectors of society.

Our extensive research suggests that, given the growing pressures of increasing population, the adverse impacts of climate change on farming and food production in many regions of the world, and the rising demand for quality food, the risk of an international food crisis has been increasing and is approaching a 50/50 risk in any year from this point forward. Over the coming decades, there is a risk that the crisis could become semi, or near-perpetual. A frequent consequence of such crises has been conflicts over the limited resources and then potential impacts on currency exchange and interest rates across the economy as expenditures increasingly are devoted to purchase of food. Currency exchange and interest rates are approximately 80% of the derivatives market and the risk is that sector of the market will be triggered in the event of a severe world food crisis. The theory of the derivatives market is that counterparties will be paid as notional resolves to actual; a highly unlikely outcome based on the experience gained in 2008. **The most likely outcome is an implosion of the financial system and a considerable loss of assets.**

It is implausible that a scientist, fresh out of communication boot camp, could effectively explain all of the above. This points directly to the urgent requirement for a restructuring of the manner in which risk is assessed by governments and for a much greater involvement by the active business/investment community in risk assessment.