# MANAGING THE CLIMATE CRISIS

ENABLING INDIAN INDUSTRY TO PROMOTE, ADVOCATE AND ACT FOR ACHIEVING THE LIMITS NOW URGENTLY NEEDED FOR THE NATION'S NET CARBON EMISSIONS





INDIAN NATIONAL ASSOCIATION

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### FOREWORD

The Intergovernmental Panel on Climate Change (IPCC), which is the primary body providing scientific information and evaluations for the current international climate negotiations is an intergovernmental body. As such, it is heavily constrained by the need for consensus among its government bosses on what findings it presents and how these findings are highlighted. Moreover, its scientific protocols and administrative procedures limit the speed and completeness with which it can report on emerging risks and the rapidly changing understanding of climatic systems. Its Assessment Reports (AR), which are published after rigorous and time consuming "negotiations" every six years or so, cannot even aspire to deliver up to date information so critically needed for dealing with a rapidly evolving phenomenon such as today's climate system.



This lag time between the last (i.e., currently accepted) AR data and the newly acquired state of scientific evidence is so long that it can cause inordinate delays in decisions and action to deal appropriately with the threats posed by the rapid changes taking place in the climate regime. The costs to our social, economic and environmental wellbeing can be enormous. Other, deeper methodological issues intensify these problems. For example, the more extreme consequences of climate change tend to be disregarded as the IPCC is subject to the consensus constraints of any international organization that typically focuses on averages rather than variability. As climate change is essentially a non-linear process, with different possible "tipping points", the decision-making process should contribute to the essential requirement to expect the unexpected. This means that governments and companies must revisit the cost-benefit analysis results of plausible "worst-case" outcomes in their planning and investment choices.

The aim of this consultation was to help companies in their understanding about the appropriate management of the climate crisis, in order to satisfy their forward expectations. COP26 which will take place at Glasgow in November is an opportunity to ensure that global temperature rises are not more than  $1.5^{\circ}$ C – the lower Paris Agreement limit.

Climate change will affect everyone on the planet. Dealing with it is everyone's problem and responsibility. Unquestionably, the industrialized countries are the major cause of this life-threatening phenomenon and must bear the bulk of the costs of remedying it. But it is for all, rich and poor to do what they must to avoid collective suicide on a planetary scale.

Dr. Ashok Khosla Chairman, Development Alternatives Former Co-President, Club of Rome; Trustee, The Club of Rome, India



### ACKNOWLEDGEMENT

The objective of CoR–India, for the period 2021-22 is to identify ways for our nation to transition to a healthy planet and to create a society that is just and green; enabling resilience through climate management and biodiversity. The first interactive conversation on "Managing the Climate Crisis and Answering the Challenges to Indian Industry for Achieving Net Zero Carbon Emissions" was successfully held by the Indian National Association for the Club of Rome, on 22 July 2021.

We express our gratitude to the renowned climate scientists, corporate leaders and the well-informed delegates for meaningful and stimulating deliberations and are thankful to the Chief Guest, Shri Suresh Prabhu, Member of Rajya Sabha, for sharing his views and perspectives on this important subject.



We acknowledge the assistance of our knowledge partners Development

Alternatives and the Balipara Foundation. Thanks to team CoR-India, for organising a very exciting and weighted panel of speakers, an incisive concept note and a detailed report of the proceedings

The pandemic and recent climate related catastrophes, in different parts of the world, has emphasized the urgency for instituting adaptive and mitigation strategies to address climate risks and institute measures for human well-being. These issues demand nature-based solutions to safeguard our societies. Additionally, people and wealth must be combined together with a long-term intervention plan to realign our traditional industrial activities for environment protection.

The Climate Emergency Plan and the recently released AR 6 by the IPCC, once again reiterate the need for meaningful urgent actions, by all nations. There is an urgency to implement the commitments that were ratified in the Paris Agreement of 2015, while working towards net zero emissions.Let us not postpone implementation of hard decisions before it is too late.

Lt Gen Arun Kumar Sahni PVSM, UYSM, SM, VSM, Former Army Commander Indian Army, Club Of Rome – India and The India Foundation





Greetings to my friends and colleagues at CoR- India,

I have been an Independent Climate Change Researcher for the past two decades and together with a few of my global colleagues, all with expertise in the space of Climate Science, Economics, Risk Assessment, Industry and Policy making, have realised that there has been lacking a "bridge" for effective, credible and simple communication between the scientific community and key business policy makers.

It was towards addressing this anomaly and potential challenge, coupled with the threat of abrupt non-linear climate change, that, together with our Trustee at CoR India, Ashok Khosla and Director General Arun Sahni, we decided to organise an exclusive Round Table for Business/ Industry/Insurance /Banking leaders and Policy makers in India to correctly "define the problem" they face from Climate Change and the



"trillion dollar" opportunities before them in resetting themselves to a more sustainable world.

It was crucial to identify global scientist's and think tank experts who could, without any hesitation and more importantly, with credible validation, portray the ground level realistic scenario that we all face on account of climate change and the "dead on arrival" Ne-Zero-by-2050 Mantra.

It was indeed a stimulating webinar and we cannot but send out our deepest gratitude to all the Speakers from near and afar for their honest and path breaking contributions towards the enlightenment of the Indian business community.

We at CoR-India understand the divide between the developed North and the developing South with respect to net-zero, financing of leap frogging technologies towards rapid decarbonisation, intervention, and would like to emphasize that in this vastly interconnected world, where biodiversity and ecosystems have no silos; abstaining from dialogue and no action is not an option anymore! We shall be happy to once again hand hold policy makers in their quest to balance this gross inequality for the survival of mankind and our future generations.

Best wishes, Perses Bilimoria Director Club of Rome - India chapter



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### Managing the Climate Crisis and Answering the Challenges to Indian Industry for Achieving Net - Zero Carbon Emissions

Indian National Association for the Club of Rome Webinar (Zoom, online platform: 22nd July 2021)

### **INTRODUCTION**

India plays a significant role in climate change issues, and these types of discussions are expected to provide an opportunity for deep reflection before the G20 Summit, which will be held in Rome on October 30th and 31st 2021, and the COP26 UN Climate Change Conference, which will be held in Glasgow, UK.

Many business and science professionals from India participated in this dialogue, additionally to foreign leaders from all corners of the globe and across time zones, who also shared their views. This discussion considered several pertinent ideas related to climate change and net-zero emissions from many business viewpoints that need immediate consideration. The gathering included representatives from the media, academics, other civil society leaders and stakeholders, and was held through the Internet (Zoom); it was also broadcasted on YouTube for observer viewing.

It was an event intended to provide meaningful input to all geopolitical thought leaders in an electronic room. The Club of Rome was founded in 1965 and came into the limelight in 1972 shortly after the publication of the Club's first major report, "The Limits to Growth". It was a progenitor of the entire environment-led movement. As a result, it was discovered that business-as-usual is no longer viable, given the limited resources of the environment when considering productivity and population increase, and thus Mother Earth's inability to maintain these on an exponential basis. Now, some fifty years later, everyone recognizes that "The Limits to Growth" was a significant contribution and many subsequent studies have emphasized its richness in thought. The Club of Rome is a well-known think tank around the world; the Indian Chapter of the Club of Rome was founded approximately seven years ago. It has dealt with a number of high-profile initiatives and activities aimed at drawing public attention to food, energy, land, soil, and forest security, among other issues. Last year, it attempted to address regional issues such as the Himalayan Region and newly carved out united territories of India- Jammu and Kashmir, and Ladakh. Development Alternatives and the Balipara Foundation are the Club of Rome's knowledge partners in India for this gathering. As this meeting comes soon after the catastrophic second wave of the pandemic and the emergence of abrupt, non-linear, climate change events globally, we have entered a phase of Climate Emergency.

This consultation looked deeply into the business, insurance, banking and other policy sectors, and perceived their role on an emergency basis, as attention is now required globally at international and national levels.



### **WELCOME ADDRESS** Padma Bhushan Shri S. Ramadorai Former Vice Chairman, Tata Consultancy Services and Chairman, Club of Rome India

Shri S Ramadorai welcomed Shri Suresh Prabhu, Member of the Rajya Sabha (Upper House of Parliament of India), and erstwhile cabinet minister, for participating in the meeting. He emphasized and acknowledged that Shri Prabhu has been actively addressing environmental issues more than any other political leader in recent times. He also welcomed all the speakers and participants who joined the meeting. He pondered that we are in a critical year at the beginning of a critical decade and that the focus of all international discussions as we emerge from this devastating pandemic is to tackle the climate



crisis,to strengthen global ambitions by expediting climate action and build on the foundations of the 2015 Paris Agreement.

There seems to me to be nothing more important today than to collaborate and mobilize all sectors of society to reorient and drive our economy into a more sustainable and resilient pathway to the future. The dimension and the scale of the problem is huge and the time available to solve it is very short; no one can disagree on that. The top of mind slogan for climate action now has to be "Scale and Speed".

Over the past two decades, much dialogue and negotiation has taken place to achieve this goal. Governments now recognize the gravity of our situation and are gradually putting in place policies, infrastructure, and incentives to help change the direction. Civil society has been highly vocal and has made solid constructive contributions to both thought and action for the mitigation of, and adaptation to, climate change. Increasingly, enlightened business leaders and financial institutions have demonstrated real social responsibility in this field. Yet, the goal seems far away and even appears to be receding. It is the need of the hour to carve out a roadmap that is technologically feasible, cost-effective, and socially acceptable to all stakeholders.

It is important to highlight the role that the corporate sector can play in building a green global economy. That would entail judicious investments, innovation, skillful policy design and implementation, technology deployment (with acknowledgement of the problems at hand), infrastructure building, international co-operation, skill development and concerted efforts across many other areas.

India and the world today are witnessing adverse impacts due to climate change. In the Global Climate Risk Index of 2021, India appears to be in the top 10 most affected countries. A decline in agricultural productivity will be a major area of climate change impact in India. Climate change will also give rise to transition risks due to large shifts in asset values and higher cost of doing business.

Another area of extreme concern is the rising social and income inequality in the world that is leading to increasing polarization in society and is itself a threat to achieving sustainable development. Inequality will lead to more rapid environmental degradation because low incomes result in low



investment in physical capital and education.

The Club of Rome, India, is committed towards enabling a constructive dialogue on climate change where perspectives and ideas of business thought leaders, governments and politicians, and civil society actors come together to essentially build a resilient approach towards climate risk mitigation, ecological conservation, and sustainable livelihood creation for the vulnerable regions and communities at large.

It is recognized that there can be technological and policy interventions that could bring about rapid sustainable changes. Also, businesses can focus on creating "eco-consumers" who are made aware about the implications of greenhouse gas emissions. There is a need to promote sustainable consumption patterns, strengthen climate education and engagement, and instill a sense of "moral responsibility" for everyone to participate in this fight against climate change. A new world view is needed that embraces a climate-friendly and sustainable stance for everyone.

Ecological economics can play an important role in redefining our relationship with the environment and in achieving a more equitable distribution of resources (between groups and generations of humans and between humans and other species).

The global technology sector, having demonstrated how information and communication technology has transformed the lives of billions across the world, has bestowed a lot of faith in technology and in its power to solve real-world problems.

Technologies and innovation in the areas of renewable energy and carbon capture systems will play a key role in mitigating climate risks. Technology will also play a significant role in enhancing our natural processes that can improve the absorption of atmospheric carbon in the soil and oceans.

The Tata group is cognizant of the enormity of the challenge posed by climate change and acknowledges the role of Tata companies in working proactively towards combating it. The Tata group started engaging on climate change as early as December 2007 and has adopted a two-pronged approach; at one level, a behavioural change among Tata companies was initiated by incorporating climate change in the Tata Code of Conduct, at another level, a series of plans, policies and initiatives were drawn up for companies by setting up a Centre of Excellence (later renamed as the Tata Sustainability Group). Over the years the group has worked on its climate aspiration by integrating climate change issues with business strategy and has focused on three key aspects: mitigation, adaptation, and responsible advocacy.

The creation of a low-carbon culture and economy, and the development of low carbon strategies, will require concerted efforts, sensitization, and a portfolio of technologies and measures. The pathway to net-zero emissions will require an unprecedented level of international co-operation between various governments and stakeholders. Given collective ingenuity, and resilience, we will be able to mitigate this unprecedented challenge of achieving carbon neutrality at the earliest.



### **KEYNOTE ADDRESS** Shri Suresh Prabhakar Prabhu, Member of Parliament

Shri Suresh Prabhu appreciated that the programme was really comprehensive and interesting and highlighted that worst of climate change has already occurred in many regions of the planet. He compared old times, when anyone could assess the poster of a horror film, but the Internet has changed the viewer's paradigm and the trailers of such movies are readily available, but, before you watch there is the warning that certain age groups can see it, as it might increase the level of panic;today climate change is doing the same. Western Europe has recently suffered the worst, possibly not for centuries, of



the floods. China is currently experiencing the greatest floods ever, and though it has ultra-modern infrastructure, despite that it is submerged. In such a circumstance, you must ask who is safe; those who haven't had the worst experience may likely reply that it's someone else's problem. A pandemic began in a region of the world two years ago, nevertheless, it spread through the whole world, starting from a level perceived as a localized problem, in a tiny span of time, to one impacting more than 200 nations.

Pandemics may probably be controlled with certain measures during the infection phase by attending to the infected individuals. In contrast, because the ecosystems are interrelated, the climate crisis lies in every corner of the planet. With such toxicity greenhouse gases, and their emissions, cause many to suffer on a localized basis, but others need to remember that they are next in line. All the 7.6 billion people worldwide at this moment are threatened. The world's complex biodiversity is in danger of being lost, indeed much biodiversity has already been lost permanently and the further loss of biodiversity puts life on this planet more progressively and adversely more susceptible. He also remarked that during Rome's burning, Nero was allegedly fiddling, but it is time that wise leaders will choose to listen to the Club of Rome and act.

The corporate sector and businesses, and all have a stake. After all, what is business end of the day? A relationship with buyers. If buyers don't exist a company's existence is not possible, some groups can argue about their buyers being business-to-business, but eventually they are selling to people at the end. The planet and people living on it are at ever-increasing risk due to climate change. Examples are floods, heat waves, agricultural failures etc., that create challenges for the insurance sector, tourism sectors, food processing, healthcare, agriculture sector and many more. There will be a huge loss if the situation persists in a "same-as-usual" mode.

In every black cloud there's always a silver lining and opportunities in challenges.Greenhouse gases, a black cloud, are the reason for climate change but the opportunity for business is to generate better business concepts, solutions, and practices with energy saving devices, to minimize greenhouse gases emissions, and thereby modify the global energy mix. Innovative business ideas and solutions must be developed todeliverimproved living opportunities for changing our lifestyle so that consumers may live better and yet save the world as it is. The need of the hour is better solutions for the climate crisis; it is an opportunity to develop a course for a better life for all and business leaders and common people can build it by working together.



In fact, the choice is very simple; it's not whether to live a better life, it is whether to live life or not. Plants and animals, flora and fauna don't have a voice, however they are speaking through the work of climate scientists in various discussions, research papers and reports. Often business leaders have not given enough weight to them. It is important to listen to them with all sanity and sensibility; consider that what we are seeing in Europe today was already written in a scientific report of the IPCC.

Corporate leaders sometimes hear what they want to hear. Only human beings are responsible for the present catastrophe. Anthropologists, climatologists, and archaeologists have proved that humans damage biodiversity in all the places, wherever they go.

Can we at least be sensitive to preserving what remains? The world of businesses has the capacity, the equipment, and the resources to manage the essential thought process. We need to only followa religion; religion with respect to the creator, and worship the creation (creation is biodiversity and what we see around us). Enough imagination is needed to accomplish the task; unfortunately, some has already been lost. Let us hope that we continue down the road of rational thought.



### INTERNATIONAL PERSPECTIVES ON CLIMATE CHANGE

### This session was moderated by Dr Ashok Khosla, Chairman Development Alternatives, Former Co-President of the Club of Rome, and Trustee, CoR - India

### **SIR DAVID KING** Former chief scientific adviser to the UK

Humanity depends on a reasonably stable environment but many catastrophic events are taking place across the planet. We are observing enormous floods in China, India, Germany, Belgium and Holland, and record temperatures have happened in the Pacific North-West and western Canada

Everything is interlinked: what happens in the Arctic region affects everybody over the world. There are several aspects. The Arctic Sea has long-standing ice, but it has melted rapidly during the last 15-20 years and, in the Arctic summer when the sun shines 24 hours a day,



extremely high temperatures have been experienced in northern Finland, with extreme warmth in the Arctic area in northern Siberia 32-35 degrees Celsius (recently a record of 48 degrees Celsius).



### **Consequences of Arctic Warming**

The ice is melting at an ever-increasing rate in Greenland; when all the ice melts, sea level will increase 7.5 metres. This is going to be a huge challenge for civilization.

In the Arctic region methane is being released explosively from craters measuring approximately 50 metres diameter and 60-70 metres deep. The methane was covered by permafrost but when the permafrost melts, the formerly constrained methane is released explosively due to rapid expansion.



In the past 5-6 years there have been around 1000 such craters. Methane is a very serious greenhouse gas; many times more powerful than  $CO_2$ .



Another Arctic issue is that the ice of the Arctic Sea is melting quite fast; considerably ahead of projections.

Then, around the Arctic region there is a strong jet stream. Historically it kept the cold air contained around the north pole, but recently, a much warmer portion has developed in the middle of the Arctic region and the weather has changed, distorting the Jet Stream.



The graphic on the right above shows the distortion of the Jet Stream, which pulled cold air down from the Arctic and certain places to become quite cold relative to earlier times. For instance, in Texas, Jan 2021, there was a very unusual temperature -16°C.

And in certain places, warm air patterns are changing significantly. Warmer air holds more water and this causes a significant amount of rainfall as witnessed by the recent flood in New York City. The recent hot areas of California and Canada, which were powered by a "stuck" Jet Stream, recorded 40-45°C, the hottest temperature ever in Lytton, Canada.



### Extraordinary Local Extreme Temperatures in the Pacific Northwest and Canada.

Lytton, British Columbia on June 29, 2021 recorded Canada's highest ever temperature of 49.6 C (121.3 F).



As the sea level rises, there are many parts of the planet at risk. The following graphic shows a blue area flooded by 2 different Vietnamese forecasts for 2050. After just another 29 years the updated projection shows that 90% of the land in Vietnam will be flooded once in a year. It should be noted that this is one of the world's largest rice production areas. It is located on the delta of the Mekong River, in close proximity to the ocean and increasing sea levels pose a threat to such regions.

Indonesia is also under attack. Jakarta has also been threatened for many weeks by floods already this year. As a consequence, Jakarta's government is relocating its capital to higher elevations; this is wasting considerable former investments by Jakarta and requiring reinvesting in the future of different areas. In the near future, too, Calcutta and Mumbai will experience such threats





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The Centre for Climate Repair at Cambridge is working on:1) Deep and rapid emissions reductions; 2) Creating new GHG sinks with the objective of restoring the atmosphere from 500 ppm to  $<350 \text{ CO}_2$  eGHG level; 3) Re-freeze the poles; and, 4) Promote agile political and investment responses.

Focus of Feasibility for Projects: 1) Technological feasibility; 2) Scalability, in particular the potential of  $CO_2$ sequestration and the need to



Mumbai, every year is flooding

remove billions of tons of  $CO_2$  pa.; 3) Cost; and, 4) Potential adverse impacts, especially on: energy consumption; rainfall and water supply; biodiversity and food production; land use; wider co-benefits; economic incentives and governance structures; and public acceptance.

### **Interventions: Ocean Surface Iron Fertilization**

1) Imitates the natural ocean fertilization processes restoring the oceans' biosystems; 2) Creates a green layer with phytoplankton resulting in  $CO_2$  uptake and increased ocean fish stocks; and, 3) Calcium carbonate deposition into the ocean crust which will firmly sequester  $CO_2$ .

#### Interventions of Cloud brightening, as a solution





David King's team consists of the world's top marine engineers with wave power systems. The system features an extra-fine salt spray mechanism. The droplets evaporate to produce microscopic salt crystals, which are launched into the sky through the natural circulation of the air. These crystals then act to brighten the clouds; when clouds are brightened the surface underneath the cloud is darkened and cooled

The next stage would be to cool the surface water in the North Atlantic Ocean; this cooled water would be transported to the Arctic via existing currents. The calculation has been conducted and indicates that this method can cool the Arctic, at least enough to avoid further declines: indeed it may stop the blue ocean phenomenon.

For several reasons fossil fuel companies don't want to cool the Arctic. They appear to be happy to swiftly lose the sea ice. They also appear to be delighted when they claim that geoengineering i.e., marine cloud brightening is hazardous.

They have an alert from Google regeoengineering and 99 of 100 papers are opposed to geoengineering, if not 100%. However, sea salt is benign when it is used to brighten a cloud. No side effects are unfavorable. It was suggested that the Indian monsoons would have a remote knock-on impact and was refuted. Why, therefore, are we not cooling the Arctic and preventing disasters? It would make the future safer for us and our children.



**DR. JOHAN ROCKSTRÖM** Director, Potsdam Institute for Climate Change Research, Potsdam, Germany

Dr. Johan Rockström supported David King's conclusion that we were in a critical decade for mankind and the fate of earth. The possibility that irrevocable changes could place the future generations on an adverse sliding plane is an ever-increasing risk.

He stated that David King had already spoken about how warm the Arctic is becoming. A projection was first published in 2008; by John Shelby. His projections were updated for 10 years and showed the



symptoms of climate instability. Indeed 9 out of the 15 known climatic tipping points were found to be possibly unstable and potentially achieving, or passing, their tipping points.

The most dramatic interpretation of this circumstance is in line with David King's views. The arrows shown in the above graphic indicate, from scientific evidence, that these tipping elements not only have multiple stable/instability states but also are interconnected. If the Greenland Ice Sheet and other regions of the Arctic melt fast, it will not only impact the Jet Stream, but it will also release massive amounts of cold fresh water in the North Atlantic. This will further slowdown the Atlantic meridional overturning circulation (AMOC), which transports warmer water to the Arctic region where it sinks and cools. This slowing of the AMOC has impacts on the South American monsoon, which explains the rising frequency of droughts and dry spells and increasing rates of fire in the Amazon Rainforest. Those fires, at least in part, have caused the world's richest biome of the terrestrial ecosystems to flip from a natural sink to a source of GHGs

But not only that, the slowdown of the AMOC results in warming of the Southern Ocean, which will accelerate the melting of the so-called Doomsday Glacier (the Thwaites Glacier); the ultimate consequence is that it will increase sea levels by several meters. This is a cascade risk, what



is happening in the arctic is not confined here, it is the Ground-Zero interconnectedness of the complex planetary climate system.

The implications of the potential consequences of temperature increase can be interpreted by



reviewing the range of temperature the planet has experienced in the last 3 million years, as shown by the following graphic, and what happened in other epochs; the potential consequences are very serious in terms of impacts on civilization.

The history of planetary temperature is shown in green, including ice ages and interglacial periods. There are variations due to the cycling of natural orbital forcing around the sun, but looking carefully, there is not a single time in that period when the mean planetary temperature increased by over 2°C. In fact the planet's highest, or warmest temperature, was below 2°C and the coldest deep ice age temperature was minus 4°C; note in that period sea levels were 70 meters lower. That's the corridor of life. This is all about the earth system feedback and its resilience. It is about the Arctic, Antarctica, the AMOC, and other tipping elements which are the global commons. All the biomes, indeed the entire ecosystem, have climatological boundaries that must be kept within specific parameters in order to dampen the interconnected stresses caused by anthropogenic activities.

The geophysical and geopolitical impact of climate change is devastating. The scientific paper coauthored by "Chi Xu - Future of Human Climate Niche", is a very dramatic and pertinent analysis. It shows the sensitivity and fragility of society as the mean planetary temperature increases, thereby exposing humans to intolerable heat index levels.

The darker areas are the projected fragile economies where the average temperature may exceed 30°C; that is the threshold for medical wellbeing as above an average of 30°C living conditions are difficult, with a high risk of mortality as living conditions are almost the same as they are for humans in the Sahara Desert.



- If the current emissions trajectory continues, by 2070 3.5 billion people likely to become exposed to Sahara-like temperature conditions (MAT > 29°C) — shaded on map
- Optimum MAT for humans, agriculture and non-agricultural economic output is ~11°C to 15°C



OCK-DEMONS TO

If we continue the journey projected by the above graphic, many places in the world with poor communities, including India, may find that their populations are progressively displaced with more difficulty to secure livelihoods. This could be seen as a recipe for disaster with challenges to all manner of food, water, livelihoods, forest and soil security. The path to success is therefore nothing less than a total worldwide shift towards sustainability.

This is an overview of the worldwide IPCC scenarios used to negotiate the Paris Accord. Decarbonization, achieved by reducing the use of fossil fuels, must reduce emissions by half each successive decade to achieve net-zero emissions by mid-century.





However, this will not suffice since we need to transition from a net source (shownin brown) to a next sink (shown in orange), and account for the capacity of the global food system. That requires extracting a minimum of 5-10 gigatons per annum of  $CO_2$  from the atmosphere well into the future.

Even that is not enough; we must begin to scale negative emissions, indicated on the graph in orange, upgrade all the CCS and the technologies and will hold earth resilient, displayed in green and blue. By making these efforts, IPCC scientists assess the probability for us to maintain the earth below 2°C is 60-66% and to stay under 1.5°C the probability is 50 %.



Whether we achieve the Paris Agreement or not, the entire battlefield is not only a separation from fossil fuels but also preserving the earth system in its completeness, which requires living within well-defined planetary boundaries.





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A third version of the exponential roadmap has been developed and is needed. In nine years, which is until 2030, can existing technologies reduce pollution by half? The answer, which will also be delivered in COP-26, is more than likely yes. We have the technology to reduce emissions and it is available sector by sector.



These are energy, industry, construction, transport, food, agriculture and forestry sectors, to look deep into in order to achieve well-defined and essential objectives.



Strong sustainability goals are required. The UK Government's Economics of Nature was led by Sir Partha Dasgupta. Some months ago he published its findings and they very strongly support the development of new economies across global borders.

Finally, sustainable development objectives, human well-being, all equity, and every innovation and economic item we're talking about needs to be underpinned by science, in order that we clearly understand the problems we face and more importantly how to effectively solve them.



### **DR.** IAN DUNLOP Chairman, Safe Climate, Australia

Ian Dunlop dealt with the challenges posed to business by climate change; the reality of a company's perception, the consequences of their policies, the consequential implications for business and what is actually needed. The businesses' commitment, simply, is not close to achieving the required result, as already discussed during the meeting.

The UN Framework Convention on Climate Change (UNFCCC) created an international convention for the environmental protections of essential actions limit the impacts of climate change; in particular by stabilizing greenhouse gas atmospheric concentrations, to fight dangerous human interference with the climate system. 154 governments signed the Earth



Conference (UNCED) in Rio de Janeiro, June 1992. These goals have, however, already failed to materialize. The problem now is, can we achieve the Paris Accord pledges?

Ian stated that irrespective of implemented measures the mean global temperature will be 1.5°C around 2030.

The increase is already 1.2°C, which has led to disastrous floods and extreme weather. 2°C would be potentially disastrous, 3°C would be potentially catastrophic, and 4°C would result in many areas of the planet becoming unlivable. In most regionsthe temperature increase would vary, possibly as much as 10-12°Cfrom the recent past. It is possible that a so-called "Hothouse Earth" may be triggered by certain tipping points at increases between 1.5-2°C, due to non-linear, irreversible and self-sustaining warming. We are currently in danger of losing control to prevent warming from escalating.

In setting policy, the safety and prosperity of the people should be the main goal of the governments. The greatest identifiable threat to a safe future, as everyone here understands, is climate change; best described as an existential threat to human civilization. Since the growth in our emissions continues, and whatever we did in the last 30 years was inadequate, the threat is unquestionably current and not years ahead.

The present mode of net-zero emissions commitment by 2050 is completely insufficient; "Soft denial" of climatic reality equates to NZ2050. It is necessary, ideally by 2030, that net-zero be accomplished; a huge task! Climate inertia implies that it takes years to demonstrate the influence of rising atmospheric carbon. The effects of previous emissions merely add to the current escalation. It must be a priority to avoid matters deteriorating further. Moreover, atmospheric CO<sub>2</sub> must be decreased to a maximum of 350 ppm from its current level of 420 ppm using technologies still in their infancy; another risk!

Business Leaders are accountable for acting honestly, in good faith and in the best possible interests of their business. In addition, they must ensure that risks are recognized and that appropriate mechanisms are in place to manage them. Now, even in the near term, climate change is the greatest danger and threat to business existence and yet many corporate leaders continue to be stuck in denial. However, it is their obligation to grasp and act assertively on the entire effects of climate risk. This requires a different risk-management framework; one which concentrates



on timely action and does not wait for repercussions. Fortunately, there are technological, and economically increasingly appealing, alternatives available: energy efficiency, renewables battery storage, electrification, distributed energy and so on. But this problem cannot be solved by the market alone; extensive changes in regulations are crucial in order to build a sustainable and a just society. If industry wants to thrive, fundamental social reform is still needed.

Societies that succeed in conquering the dangers of COVID-19 pandemic will do so by putting politics, economics and society's top priorities on the basis of the finest scientific knowledge available. A far larger threat, climate change demands the same thing. It is not simply another item, but an existential menace to our common future. It must be assessed with ruthless honesty. It must be accepted that disrupting the environment calls for immediate action, similar to war. And, the world must act quickly with respect to net zero emissions by 2030. The consumption of fossil fuels must be cut rapidly and alternatives created. The conversation about social transformation and the development of global collaboration should be started without precedent.

## Technologies and solutions are now accessible that bring huge social and economic benefits; there is a need to overcome climate denial and move quickly.

On the economic growth side, failing dramatic change, there'll be a systemic collapse at some time; the rebirth or rearrangement of the economy is necessary. If humanity persists in prolonged expansion, however, everything will fall at the catastrophic breakdown.





### **PROF. ERNST VON WEIZSAECKER** Former Co-President, Club of Rome

With ruthless sincerity that reminds me of the movie and book "An Inconvenient Truth", we must analyze actual hazards. At the time this book was released, a cartoonist produced and made it into a film; one of course based on an inconvenient truth, while the other was reassuring lies.

It was the political fact that he knew for quite a long time, when he was a Member of the Parliament in Germany, that it was highly unpopular to tell the truth.



One thing about the reality is that we have seen the growth of the gross domestic product (GDP), and a per capita increase in the last century, and more recently the directly proportional increase in carbon emissions per capita - greenhouse gases! Of course, the objective for every government is to increase the per capita GDP, thereby driving up carbon emissions knowingly and unknowingly. Politicians think, and they must, that it is genuine politics. It is difficult to find political answers in this circumstance. Therefore, we need to convey the brutal reality about the great catastrophe for the input of the scientific community, while also requiring new routes and ways to make policy. First of all, it is possible to decouple the GDP emissions of carbon dioxide from GDP per person, this is technologically and politically important. Secondly, set up an international regime. This makes emission reductions and carbon capture activities particularly beneficial for underdeveloped countries.

At the annual meetings of the Member States of the Conference of the Parties (COP) on various actions on climate change, the North, make a lot of rhetoric about what we have to do; and if you ask G77<sup>1</sup> what they are doing, their answer is it our business, the north has done everything they can to remedy it and have made a commitment to give us a \$100 billion annuallyto take care of the damage they have done on this planet. It is very difficult to meet the true issues of climate change with these arguments. This climate diplomacy leads us nowhere. But consider that a few months in advance of COP15 (Copenhagen), the German Consul for the Environment, proposed a budgetary approach which mainly stated that an identical right should be granted (in effect a license or permit to pollute the atmosphere) to all countries of the world, during which time the upper limit was specified as 2°C; but the old industrialized nations were more or less already above their authorization. The Indian Economic Affairs Minister was quite optimistic in selling their extra licenses to the northern nations those days. The new COP plan was seen as having monetary advantages in many developing nations; 'lucrative for misconduct.'

The political problem consists of changing the international situation where the affluent believe in purchasing power to do evil things. The budgetary strategy should now be accompanied and backed with further technical advances. For each new form of enlightenment there are difficulties. The older enlightenment was utilitarian, pragmatic, mechanistic, materialistic, individualistic and was not good enough to solve the problems, but new enlightenment can solve the problem. The professor then referred to the book "Come On".

<sup>1</sup> Seventy-seven developing countries signed the Group of 77 on 15 June 1964, in Geneva.



#### "Come On" has three Parts:

1. Today's trends are unsustainable; they are hazardous and make the whole world vulnerable.

2. It is necessary to remodel our economic growth paradigm; for the whole world we need a new enlightenment.

[Balance stands at the core of anew enlightenment. Balance of human nature, short and long-term balance, market forces and the rule-making state, private consumption and public benefits, justice and excellence rewards]

3. But it is urgent to act now! The book here is filled with hope and shows a wide range of technology and various methods of organising things in the current system which will bring the world towards sustainability. One fundamental guideline is to charge appropriately for the use of natural scarce products and reduce labour tax. There are also some new issues for global governance and how the financial markets may be controlled.

Professor Ernst's whole argument was predicated on the 3rd part of 'Come on' and that urgent action is necessary.



### **MS. MRIDULA RAMESH** Author and Founder, Sundaram Climate Institute

Ms, Ramesh stated that the account of the terror underlying why we need to reduce emissions and alter the climate situation is fundamentally different from the story of how we can change.

Her entire focus was on tactics and her discussion was in three parts:

Part 1- How we can assist small and medium enterprises to cut their emissions;

Part 2- The need to adapt as we are in a different climate zone that climate inertia has put us in and it is progressively worse, India is

vulnerable to Climate change and the industries of India have to look at adaptation; and

Part 3- How expanding the narrative beyond carbon, can actually help.

Looking at reducing industrial emissions, investors have sufficient pressure to minimize their carbon impact in small industries but those pressures are not so powerful for the objectives of the Ministry of Small and Medium Enterprises (MSME). It is important to assess the proportion of overall emissions from given industries. The World Bank said that according to the sectoral participation, the SME sector contributes 35-75%.



But in the context of emission cutting, SME are confronted by a completely different problem: nowadays, in the context of emissions reduction by solar, as industrial users are eminently obliged to do so, SME pay extremely high-power prices and they have no money to invest in solar power.

The payback for the majority of investments for energy efficiency improvement are shorter than 9 months, many are from 1 to 3 months, and over the course of this year we have witnessed a 20%







emission cuts in that sector. The words net-zero looks too big to SME, and for Indian SMEs it's crucial. As a listener, net-zero isn't a language, therefore industrial associations play an essential role in spreading and clarifying the message.

The above chart shows the increased cost of the damage from flooding, earthquake and storms that occurred in India during the last 100 years. It implies there are huge hazards and no place to hide, but also opportunities. The reason that any organization can consider cutting emissions is the availability of data; our organization did this as we have very granular data.

Two key aspects of adaptation are water and waste; they must be managed and frequently they cannot be controlled by agencies. The few startups in both areas have enormous opportunities for creating jobs, and jobs are another world issue. The political economy builds on jobs and is fairly simple to persuade politicians of the necessity to ensure subsistence, excellent and dispersed work. Last, we must think about water as an energy issue. India needs to move away from coal





energy a chart from India's upcoming book on water shows that thermal energy needs a lot of water toproduce a unit of electricity.

Most people argue that coal provides a stable source of power, it is considered a good source of basic electricity, but a World Resource Institute (WRI) study states that in high water stress regions where thermal power stations have been built e,g,. Tamil Nadu, the plant capacity has actually been down 21%. Hence, Coal is therefore no longer a viable source, and we have to consider how to move away from that scenario in the context of both emission reductions and including water.





### DIALOGUE ON CLIMATE CHALLENGES AND SOLUTIONS WITH DOMAIN EXPERTS

The initial section of the dialogue was moderated by Mr. Perses Bilimoria . The primary subject of the debate was risk assessment, especially for business, finance, and industry; two of the panelists discussed the interaction of Earth system science.

**DR. MICHAEL MACCRACKEN** Former Chief Scientist, Climate Change program, USA

People live in different climates, while the climate is changing; it's vital to know that in the future they can continue to do so. Disruptions to the environment are now occurring everywhere. The way this is going to progressively force adjustments is very problematic and the root cause of the impacts is the combustion of fossil fuels. Not everybody will be affected by these impacts, everywhere, in the same manner, nor at the same time.

All the responses and adaptations will be distinct. It is vital for us to understand the existing conditions and that various conditions will influence not only individuals, or enterprises, but also suppliers,

consumers, local economies and communities. Thus, there may be effects, simultaneously throughout the world, and this will require numerous adjustments.

First let us consider human health and safety. The human body cannot tolerate extremely high temperatures, the consequential heat stress and discomfort as the heat index rises. Speaking frankly, these conditions will make it unlivable outside in many places as not everyone can manage to be inside in the comfort of air conditioning; it may occur in Texas, but this does not indicate that it will happen elsewhere. The amount of extreme heat which is now occurring is really dramatic. There are very interesting charts showing that warm conditions in the middle of the 21st century happened one in a thousand times; they are now occurring about 20% of the time.

Another increasing threat is extreme weather. Warmer oceans result in more water vapor in the atmosphere, when that water vapor condenses the consequence is increasingly intensive rainfall which is overtopping river banks and creating storms and floods. Eventually, farmers who need moderate and fairly frequent rain, not all at once flooding their fields, or some time ending up too dry, will experience continual crop failures. Extreme weather has also impacted infrastructure, and though building standards were in place, they were unsuitable for the ever-increasing impacts. The third is a general threat to water resources. For instance the melting of glaciers, which have fed critical rivers for many years, added to which are further changing tendencies of the water cycle, an example of which is that dry subtropical regions are increasing.

The fourth issue is the change in the landscapes i.e., the vegetation that grewin the past fifty or maybe a hundred of years; they are increasingly stressed ecosystems. One example is increasing





wildfires; California, Australia and Siberia being perfect examples. The fifth issue is local and international food production i.e., what is happening locally that increasingly impacts farmers (though they are adapting by planting different varieties).But, the international trade of grains and rice, involving all the major crops, are produced in very few agriculture regions. Climate change is impacting these regions and they are facing the challenge of regular crop failure. Eventually demand and supply balance is disturbed and price fluctuation is high and on the upper side resulting in food price inflation. The UN Food and Agriculture Organization (FAO) Food Price Index shows clearly that food price inflation is linked directly to social unrest

Hot weather, beyond disturbing the food supply chain, is creating threats for many living animals and impacting ocean systems too where many fish are now not able to survive and the biodiversity is changing.



MANAGING THE CLIMATE CRISIS

### **DR. MARK TEXLER** Climate Change risk and opportunity management

Dr. Trexler focused on how people understand the risks of climate change and how business decision-making is communicated. It truly has huge knowledge management aspects and numerous assumptions are in play which obviously pose sectoral risks.

Many companies may deny this, but the facts cannot be denied; therefore to analyse the risks actually posed by climate change they must receive accurate information.

The communication gap is enormous and yet business leaders are tasked with the management of these issues and business consultants

are constantly trying to update assumptions. However, climate change is a complex dynamically changing topic. The good news is that there is 'active knowledge' which people, business people and politicians require. The bad news is that in the face of information drift is difficult to locate and most individuals will never find their 'actionable knowledge', leading directly to far less efficient measures to fight climate change being implemented.



We have built a programme called the Climate Web, which contains the papers of hundreds of renowned climate scientists, and a continuous updating of all publications related to risk and ways to address these risks. It is an ideal source of information for making business decisions; easy to access, and rapidly comprehend the news, reports, blogs, scientific papers and videos, of all pertinent information.







The above graphic is a typical Climate Web page.

### **MR. DAVID TATTERSHALL** Business consultant and a former external

advisor to the Nordic Council

Mr. Tattershall drafted the briefing for the meeting (shown in Appendix III); edited by Dr. Michael MacCracken. He stated that any plan without appropriate funding was merely talk and unfortunately the current financial system is incapable of an adequate response in the required timeframe.

A perfect example is one-to-one financing via green bonds. From conception to implementation this process is ponderous at best and fails to take advantage of leveraging.

If an appropriate financial approach is instituted, millions of jobs will be created and many who have formerly opposed change could now feed their families, put a roof over their heads and become converts. Others witnessing this would then demand political change and put pressure on local and national governments. Put money in people's pockets and there is little need to communicate with them. Hence it is essential to create a dedicated financial system ASAP; otherwise an effective transition is not possible.





**PROF. WILL STEFFEN** Research Scientist; author of multiple climate change articles and scientific papers

Professor Steffen agreed with what had already been said. He started his thoughts from Ian Dunlop's views about the urgency of the issue, i.e., that net zero by 2050 is far too late; it is required much earlier than that.



In Canberra, Jan 2020, in the southern suburbs flames from fires were more than 70-80 meters high. The fires were bearing down on the city but luckily the wind shifted and a catastrophic situation was avoided. The point being that we don't have to wait for very-very serious impacts; they are in the here-and-now.



This is a significant biome in Australia; the Great Barrier Reef (GBR), which is the world's largest marine environment and spans over 2300 km. Yet another major bleaching incident occurred in 2020 and placed it on the radar screen because simultaneously parts of the nation were burning. Prior to this attention to the status of the reef was limited, but for the first time ever the bleaching extended around 2,000 km and along the whole reef. Warmer waters and an increase in acidity lead to coral bleaching. If water is excessively hot corals expel the zooxanthellae (which feeds the coral) from their tissue. If corals are bleached they are not necessarily dead; corals can withstand bleaching but are more stressed and mortally exposed.

The GBR has suffered mass bleaching events in 3 of the last 5 years, 2016, 2017 and 2020. Now 50% of GBR is dead. Anything much more than 1.5°C will be devastating and the GBR will be gone completely. The loss of the Earth's largest biome is already locked in and will eventually be the loss of the world's largest marine ecosystem.





A 2020 Most severe bleaching No or negligible bleaching Cairrs Townsville Townsville Mackay Machay Mackay Mackay Mackay Ma

To put in the perspective what we are actually facing the graphic on the next page shows the long term temperature records; it is a 2,000-year temperature reconstruction. The coloured lines are 4 reconstructions by different research groups and they are all pretty similar. Since the time of the Roman Empire there has been very little change in global average surface temperature; a little bit of a dip from about 1,300-1,800 AD, as was the case in the Little Ice Age, but tiny compared to what is happening now. The black spike is completely human driven climate change and we are now touching 1.2°C above the preindustrial benchmark.

This is why we are experiencing the fire events that are occurring in Australia and elsewhere, the heat domes in the Pacific Northwest of North America and the destabilization of the Jet Stream, as the system is being forced at an extraordinary rate of change.

How fast is the system changing? The rate of carbon dioxide increase in the atmosphere over the





past two decades is about 100 times the maximum rate during the last deglaciation and since 1970 the global average temperature has risen at a rate about 200 times higher than the background rate over the past 7000 years of the Holocene. The current rates of carbon dioxide and temperature increase are almost unprecedented in the entire 4.5 billion-year geological past. The Geological Society of London found that the only time that temperature changed as fast was 66 million years ago at the K-T boundary (Cretaceous and Tertiary periods of geologic time characterized by a mass extinction of many forms of life including the dinosaurs); hence theevent happening now is extraordinary in terms of geological scale and is why ecosystems are finding it extremely hard to cope with and adapt to.

From IPCC projections the Paris Accord targets were to avoid an increase of 2°C with an aspirational goal of avoiding an increase of 1.5°C. On our current trajectory, if we just keep doing what we are doing, it will be up to 3°C, and if we are unlucky go even higher to 4°C degree or so; that's going to be an exceptionally difficult world for humans to deal withand contemporary civilization would probably collapse under those sorts of conditions. The real problem is the potential for a global tipping cascade when for instance the polar ice sheets, jet steam, and Atlantic Ocean circulation interact. This could occur with a 3-4°C temperature increase and to escape from this absolutely rapid and decisive actions are needed. Assessing the timing of tipping points is a risk assessment; in 2018 the IPCC estimated that we already have a moderate risk at 1.2°C of tipping some of these major elements of the whole Earth ecosystem.



Each one of these tipping points have positive and negative reinforcement characteristics. Coral Reefs are not connected as they are not going to influence other reefs but the Atlantic circulation (AMOC) slowdown is an interesting one because it is a positive reinforcement on the Amazon, a positive reinforcement on West Antarctica and a negative reinforcement on Greenland because it slows the flow of warm water up the North Atlantic. The consequence is Greenland gets wedged between one that is trying to actually stabilize, the AMOC, and one that is destabilizing, which is the declining Arctic sea ice. The last assessment of Potsdam is that the stronger of those two is actually the Arctic sea ice so the overall effect will still be to accelerate melting of the Greenland ice sheet, but maybe not as fast as we thought. A comment made in a paper by Tim Linton noted



that if these tipping cascades occur, a global tipping point cannot be ruled out and this is then an existential threat for civilization. He further noted that no amount of economic cost benefit analysis is going to help mankind, it is just a matter of risk assessment and we must do everything possible to ensure control.

The real dilemma that humanity faces is the emission curve from 1850 onwards. Based on IPCC climate assessments policy measures have been agreed to by countries starting with the Kyoto Protocol through many COP meetings prior to the Paris Accord, but there has been no demonstrable effect of any policy settings, or any bit of science, on that emission curve and that is the problem we face! The only things that actually put a tiny dent in that curvet was the 2007/8 global financial crisis, recently the COVID-19 pandemic and they are temporary. This is the challenge that the entire world is facing. There is no other option; we should try to get net zero by 2030. Act Now!!!





### **Experience sharing** This Session was moderated by Lt Gen Arun K Sahni PVSM, UYSM, SM, VSM

### **MS. MAHUA A CHARYA** Managing Director and CEO, CESL Ltd.

In the prior 20 years Ms. Acharya has worked on many aspects of climate change; lately with a lot of emphasis on finance. The reason; financial instruments are used to collectively attain environmental goals. Moving to public policy she explained that the tools and structures, which normal commercial mainstream finance have to provide to deliver environmental services to larger communities, must utilize the mechanics of risk allocation.



Around eight months ago she was invited to set up a new company by India's government; the focus, the massive essential shift to renewable energy.

The reality of climate change, and the essential response, requires large-scale capital investments and business models must reflect this aspect. After all this is an opportunity, and the government is desirous of combining state funds with commercial capital as soon as possible, with suitable methods of risk mitigation, and with as many structures as feasible including the monetization of carbon credits (such as a monetization of air quality). Air quality and the necessity for it is frequently discussed, but it is difficult to quantify and then monetize after projects or major programmes finish.

There is a potential for the company to provide for the dispersed generation or distribution of renewables - renewable energy as opposed to large-scale power plants. Thesewould be smaller units, unlike large solar farms, that would offer the rural community inexpensive, high-quality and accessible power. At scale, and in perspective, it's around 1.2 giga watts and almost INR 40 million, that is just under a million dollars per megawatt, which indicates a very significant investment. Yet every project is actually modest, supplying farm consumers in rural areas and adding to future greening demand. The opportunities here are on a scale. Electrical mobility is the second major area of attention, it is difficult to incentivize transportation, or at least economically encourage a change in public transport, but it is an opportunity since we all have the technology, enough passion and the motivation to again sell it at scale.

Ms. Acharya closed by saying that most of the theories currently being discussed can be applied; unfortunately not all of them. The focus of the Government is the economic return rate and this is what is being used rather than return on investment. If the basis was expanded, the economic return rate should cover such things as the worth-of-life and capture the generation of livelihoods. CESL carries out livelihood-based initiatives across the world, and after all this should be a responsibility of the public sector, she added.



### **DR. PRAVEEN SINHA** Managing Director and CEO, Tata Power Ltd.

Tata power is a hundred year old company; it started with hydro power. The founder, Jamshedji Tata, said 120 years ago that clean, green and affordable energy should be available in abundant quantities; what he said over a century ago has not materialized. With the same ethos, Tata Power, whilst it had been in conventional power generation for many decades, took a stand two years back to move away from conventional sources of generation and targeted being a net-zero carbon emission company by 2050; probably before 2050, inline with our current goals. This is in spite of the government of India's stand, and it is to demonstrate that the government could get a boost from industry leadership. There is no better way than to do action on the ground, and speaking of what



we can do, we are fully committed to supporting the government of India. Presently, 30% of power generation by the company comes from non-carbon sources, by approximately 2025 it will become 60% and about 75% by 2030. The company has a highly aggressive plan, in the utility space. There are three large areas where we are carrying out a lot of work:

- 1) **How to empower the customer:** Encourage the masses to generate their own clean energy electricity, use it for their own needs and also provide give-back to the distributors; there is a program ongoing in 100 cities and this is possibly the biggest player in the country in rooftop solar;
- 2) Solar pumps: India has around 22 million solar pumps, out of which 9 million pumps are on diesel, which is a highly polluting substance; further it is a source that spoils the land in the vicinity of villages due to spillage. India has currently only 300 thousand solar pumps but is targeting 4 million by 2025. Tata Power has sufficient resources to be the single largest player; and
- 3) **Microgrids:** This is a program which Tata Power initiated 2 years ago with the support of Tata Trust. The objective was to bring clean energy to villages, 24 hours per day, 7 days a week. Next is a huge program to provide universal access to energy, intent on supplying more than 10,000 villages with microgrids. It should be noted that India has more than 600 thousand villages that must be powered by micro grids but unfortunately the last 15 months were challenging for all in India. However, this programme continued in more than 200 villages during the COVID-19 period with all precautions and protocols set by the government; the hope is it will be ramped up once situation improves. When microgrids are installed the focus is creating an ecosystem for the development of micro enterprises, within the ecological niche of the village and where many livelihood activities take place.

These are good but tiny actions on a much larger international canvas, but if policy makers, academia and researchers join together, Tata Power believes the solutions that they are pondering can be achieved. The bottom-line is that they are looking for a paradigm shift with the technologies they own.



Mr. Malhotra stated that there are many ways to get to net-zero and described one, land use systems, and the objectives for communities to benefit as well.

MR. SAURAV MALHOTRA

Architect – Rural Future, Balipara Foundation

He described a small case study from the Eastern Himalayas and how restoring land use can affect livelihoods in the region and help with large scale carbon sequestration,

The Eastern Himalayas connect India and China, two of the world's most populous and bio-diverse nations; making an ecological bridge between 250 million people from over 100 distinct indigenous tribes.



This region is endowed with immense natural capital, which unfortunately remains largely untapped, also highly under-leveraged and this is viewed as an impediment to the growth of the economy of the region. It is also a battleground for increasingly endangered species such as the Asian elephant and the one horned rhinoceros.

In the last 20 years the Eastern Himalayan region has lost over 10% of its forest cover, which is an area larger than 2 times the kingdom of Bhutan. In total about 80% of the population in the region is employed directly in agriculture, or other forms of livelihoods linked to nature, and long-term ecological degradation has contributed to a severe decline in income, and a decline in agricultural yields in a region that is primarily agricultural, which has forced people to exploit the forest there by degrading of the local ecology and critical ecosystems. Today livelihoods in the region are threatened by this vicious cycle of ecological degradation, leading to shrinking incomes, which leads to further deforestation and degradation of ecosystems.

We are now beginning to realize that some of the greatest the terrestrial carbon sinks in the world, such as the Amazon rainforest for example, may also be emitting more carbon in totality than they are sequestering. This is spurred on by deforestation, by increasing forest fires to clear lands to make way for monoculture plantation industries which don't benefit the indigenous communities that have guarded these forests, for the past thousands of years, but do benefit large agriculture corporations.

So, the goal of the Rural Futures innovation, we have been spearheading for the last five years at the Balipara Foundation, is to try and create diverse and stable income streams for rural and indigenous communities.

We attempt to revive traditional ecological knowledge and enhance the resilience of communities to climate change by restoring habitats, and through this, help to achieve the global goals of netzero by sequestering carbon. Ultimately we are trying to create a first of its kind system where nature capital is paying for the socio-economic mobility of indigenous communities and make this process pretty much autonomous, run by communities themselves. Through the application





of Rural Futures innovation over 5,000 hectares of land have been impacted, habitats have been secured for migrating Asian elephants and other large mammals. Additionally this has enabled a process to generate natural capital base incomes for over 10,000 individuals in the last four years. To make this entire value chain more sustainable Rural Futures has focused on building leadership in communities, managing land, managing forest and in being able to sustainably harvest natural resources for the long-term.

Currently Rural Futures is in the process of scaling this entire initiative to one hundred thousand hectares over the next five years and that is the reason forexpanding this initiative into Nepal. Through these programmes mini natural capital economies across the Eastern Himalayas will be created. Contributing toward this, the support and stewardship of global Indian corporations will be instrumental increating large global scale carbon capture programs through the restoration of forests, through the conversion of land use from mono crops to other intercropping based systems with higher carbon value and to try and create a system where nature capital is the real engine for the future.

It will repair the disrupted symbiosis between nature, humans and economics. All of this should function in addition to rapid and immediate decarbonizing pathways to be implemented by large carbon emitters. So, not only focusing on decarbonizing within the value chains but using other systems which make communities more adaptable and more resilient to climate changes and in this process sequester carbon as well.



### **MR. JYOTINDRAN KUTTY** Chief Sustainability Officer, Tata Motors

Tata Motors are doing many things for sustainability with regard to climate change; we deal with three types of emissions that we call scope-1, scope-2 and scope-3, by using ESG protocol language. Essentially, most of the emissions related to any automotive sector is associated with tailpipe emissions and tailpipe emissions contribute around 90-95% of all emissions that any auto company generates.

For the last several years auto companies have been finding ways and means to improve the fuel economy; either because of regulatory processes or simply because the customer demands more for less as far as mileage is concerned with reference to fuel consumption.



One of the biggest sources of Indian foreign exchange reserves is basically the purchase of fuel and fuel related services from different parts of the world. As we move into the sorts of economies, which are based on nature-based fuels that can probably replace fossil fuels, Tata has recognized that these are only going to be partial solutions.

As other companies, corporations and governments move to the net-zero scenario, Tata Motors is also making its move. They are focusing on reusing tailpipe emissions, by improving efficiency of products, and also ensuring that technology is constantly evolving to make this transition towards net-zero of a product possible. Diesel and gasoline have inherently polluting characteristics, therefore, despite all the modelling and work that they would be able to do to improve "IC engines", they are pretty sure now that the transition away from fossil fuels i.e., the contribution of scope-3 emissions (that is tailpipe emissions), is going to be extremely limited. The transition to an electric vehicles scenario, or hydrogen economy, is not an option for motor companies anymore; it is a necessity. They are therefore working very closely with the Tata Power team and with the rest of the Tata companies inside the group, to transition from fossil fuel-based scenarios to products which are going to be based on new technologies that would make things as carbon neutral as possible and move towards net zero emissions.

In the commercial space Tata Motors have more than a 60% market share in the sale of diesel vehicles, therefore this transition requires a huge amount of effort and they have kicked off this journey in a manner to ensure that they will probably lead in this future space and still complete their climate change agenda. They are shifting all of their plants, which are associated with cars, to move towards Copenhagen scope type emissions; this involves the running of plants and also the generation of electricity bought from sources which are greener. They have a target that scope-1 and scope-2 emissions will be completely carbon neutral before 2040.



### **CONCLUDING REMARKS**

*Mr. Ranjit Barthakur* Founder, Balipara Foundation and Advisor, Tata Consultancy Services

Mr. Barthakur complimented all the presenters and attendees for participating in this webinar on "Managing the Climate Crisis" and providing answers for the challenge to Indian Industry to achieve netzero carbon emissions. The "Limits of Growth," the first inspiration for the knowledge of the Club of Rome, was considered, which has been studied quite intensively in the current paradigm.



An array of measures are necessary to adapt and mitigate carbon emissions in order to attain net-zero. In this direction, stronger legislation is required. The major challenge is identifying, understanding and delivering natural assets that do not really have a fiscal worth.

However, there is no science for this evaluation. GDP-based economic growth is not necessarily green as it concerns all the factors of growth and this is also a concern for corporations and governments.

## "Why do nations not publish the countries' ecological budget – and value their natural assets, the depletion of nature, and progress?"

The major focus of the meeting was on mitigation and adapting climate emissions to attain netzero, what is going on, the evidence and what actually has been offered. This was delivered through several presentations along with discussions regarding the value assigned to natural wealth that will assist in steering the net-zero emission trajectory.

We are striving hard but not hard enough to enable attaining a 45% reduction of emissions by 2030. In 2050, we will be net zero. As matters stand that is a ridiculous statement; in reality many may not survive till that time. For far too many there is no justification to change. The main cause for this is GDP or industrial performance; a major reason individuals are not acting.

During his interactions with the world's leading industrialists in the previous 4-5 months, who are also facing this difficulty, he attempted to persuade them that immediate action was essential, but the current approach is at best to partially mitigate the problem at this moment and to do something fresh to the plan 2/3/5 years from now. Meanwhile the large deficit related to the whole ecology of the globe continues to grow. Decarbonization and carbon removal also involves farmers; the sustainability of their products depends on food and water, sustainable forestry and revenue flows,



presumably agro forestry too is linked with them and also the management of biodiversity.

Main emphasis:

Mitigation action points to achieving net zero are:

- Reducing Emissions
- Decarbonization through technology
- Carbon Removal
- Land
  - Sustainable forestry
  - Bio-diversity management
- Energy
  - $\circ$  Smart grids
  - $\circ$  Energy efficient buildings and smart micro-grids building automation and management
  - $\circ$  Renewable integration into energy mix
  - $\circ$  Zero carbon green data centres
- Water
  - $\circ$  Nanotechnology for water purification (eg TATA Swach)
- Waste
  - $\circ$  Waste to energy innovation
  - $\circ$  Sustainable recycling of waste eg. eco-cements
  - Bio-plastics migration
- Air
  - $\circ$  Air quality monitoring systems enabled by ICT
- Carbon
  - $\circ$  Carbon capture and storage (CCS)
  - $\circ$  Sequestration through forestry
  - $\circ$  Life cycle assessment for carbon (LCA)
  - $\circ$  Enterprise carbon accounting and management
- What is the government supposed to do?
  - National agenda and plan on climate change
  - Compensation mechanisms: 2 techniques are employed to provide compensation systems that recompense the countries and organisations, which adopt efforts on climate change, and



penalize polluters, such as tradable and green tax credits.

- Establish systems for carbon trading (eg EU-ETS)
- Green taxation: an economic tool which can force manufacturers and consumers to switch to greener alternatives.
- Set standards and criteria for example, BEE energy ratings
- Linking green ratings to economic advantages
- Promoting green curriculum development at universities and educational institutions.
- Implementing green initiatives with examples in government and the public sector (eg green secretariat, energy efficiency in public sector companies, etc)



### **KEY TAKEAWAYS**

### SCIENTIFIC COMMUNITY

- The scientific and civil society participants were extremely outspoken and contributed soundly and constructively both to the thinking, and to the actions, necessary for climate change mitigation and adaptation.
- Plants and animals, flora and fauna have no voice. Scientists said that this is not compensated enough by means of discussions, debate, study papers and reports. The difficulties we face now have already been recorded in the IPCC scientific study, which must be re-examined.
- All are common; what occurs in the Arctic results in impacts all over the world. In the Arctic circle region explosive emissions of methane from craters have been increasingly observed. In the past 5-6 years there have been around 1000 such craters. Methane is a very serious greenhouse gas (GHG). Due to the solar irradiance interacting with GHGs, the Arctic region has heated 3+ times more than the rest of the planet. One consequence is that the patterns of the jet stream have been disrupted.
- As the sea level rises, many regions of the world are in danger. An example is that by 2050 much of Vietnam will be inundated at least once a year and this is one of the largest producers of rice in the world. The risk is also no less for other parts of the world, Mumbai and Kolkata for instance.
- Of the 15 climate tipping points, 9 are now considered unstable and may have reached the tipping point threshold. Scientific evidence reveals that these tipping points not only have multiple stable states but are interconnected. If the Greenland ice sheet and Arctic melt rapidly, it not only impacts the jet stream but it will also release large amounts of cold fresh water into the North Atlantic which will cause the Atlantic meridional overturning circulation (AMOC) to slow down.
- The circulation of heat in the North Atlantic in turn impacts the South American monsoon which explains the rising frequency of droughts and dry spells, and fires in the Amazon Rainforest, the world richest biome of the terrestrial ecosystems, which has recently flipped from a sink to a source of GHGs.
- The slowing of the AMOC also results in warmer water in the Southern Ocean, which will accelerate the melting of Doomsday Glacier (Thwaites Glacier), that ultimately will increase sea levels by several meters. It is a cascade risk, what is happening in the arctic is not confined there; it is the Ground-Zero for interconnectedness within the complex planetary climate system.
- The Great Barrier Reef (GBR) has suffered mass bleaching events in 3 of the last 5 years, 2016, 2017 and 2020. Now 50% of GBR is dead. Anything much more than 1.5°C degrees will be devastating and the GBR may be gone completely. One of the biggest biome losses is already locked in, eventually it will be a loss of the world's largest marine ecosystem.
- Each one of the tipping points have positive or negative reinforcements. For instance coral



reefs are not connected; they are not going to influence other ones but increasing ocean acidity affects them all. The Atlantic circulation slowdown is an interesting one because it is a positive reinforcement on the Amazon and West Antarctica, but a negative reinforcement on Greenland because that actually slows the flow of warm water up to the North Atlantic; so the Greenland is wedged between one that is trying to actually stabilize it and one that is destabilizing, which is the Arctic sea ice.

- Habitability of various regions is deteriorating with an increase in mortality as people are exposed to a heat index that is virtually the same for people in the Sahara Desert i.e., above an average of 30°C. It is a pretty similar issue. This may be viewed as a difficulty for; producing all types of food, water, livelihoods, forests and soil security, if it expands to many areas in the globe, including India and its impoverished communities.
- To solve the problem, emissions reductions in isolation are now not sufficient and negative emissions must start ASAP. By making such efforts the probability of staying below a mean temperature increase of 2°C is 66%; conditional on certain timeframes for implementation.
- At 1.2°C we are already experiencing disastrous floods and extreme weather, 2°C could be disastrous, 3°C could be catastrophic as many societal issues will surely arise, and 4°C would make the majority of the planet uninhabitable. In many regions of the globe the temperature increase would vary from specified averages from the recent past. Finally, a "Hothouse Earth" may be induced at tipping points between an increase of 1.5-2°C; this would be triggered by non-linear, irreversible and self-sustaining warming.
- Since Roman Empire and there has been very little change in the global average surface temperature, a little bit of a dip, around 1300 AD for the next 500 years or so, as it was in the Little Ice Age, but that was pretty tiny compared to what is happening now. The present escalation is completely human driven climate change and is now touching 1.2°C above the long-term average. The system is changing faster over the past two decades, about 100 times the maximum rate during the last deglaciation.
- Since 1970, the global average temperature has risen at a rate of about 200 times higher than the background rate over the past 7000 years of the Holocene, and in the opposite direction! The Geological Society of London conducted research and discovered that the only time the temperature changed as fast was 66 million years ago at the K-T boundary (Cretaceous and Tertiary periods of geologic time characterized by a mass extinction of many forms of life including the dinosaurs); the present rate of change is an extraordinary event is in terms of geological scale.
- The UK Government commissioned Sir Partha Dasgupta to publish his results a few months ago which strongly support the formation of new global transborder economies; these efforts are needed worldwide.
- It actually contains a great deal of knowledge management and a lot of assumptions about the different types of conclusions drawn in this consultation that obviously offer sectoral risks.
- Many companies may deny climate change but the case cannot be made that they did not receive accurate information, so that they could analyze the risks posed by the climate. Business consultants are constantly trying to update different assumptions, however, climate change is a complex topic. The Climate Web, which updates climate risk profiles by curating 1000s of related scientific papers/articles/videos, is an excellent source of business decision



information; all of this material is readily accessible, easy to read and understand.

• The goals of sustainable development, human well-being, equity, innovation and economics, must be underpinned by science.

GEO POLITICS

- The pathway to net-zero emissions will require an unprecedented level of international cooperation between various governments and stakeholders. With collective ingenuity and resilience, we will be able to mitigate this unprecedented challenge of achieving carbon neutrality. The UN Framework Convention on Climate Change (UNFCCC) created an international convention for environmental protection from climate change. The problem now is, can we achieve the pledges to the Paris Accord?
- The present goal of net-zero emissions by 2050 is completely insufficient. "Soft denial" of climatic reality equates to NZE2050, which should ideally be accomplished by 2030, or as soon as feasible. The effects of previous emissions cannot be avoided but it must be a priority to avoid things from getting worse.
- We must stop the growth of fossil fuels by cutting fossil fuel consumption quickly and create carbon alternatives. We must also start a conversation about social transformation and develop global collaboration without precedent.
- At the annual meetings of the Member States of the Conference of the Parties (COP), on various actions on climate change, the North expounds a lot of rhetoric about what we have to do. If you ask G77 members what they are actually doing, their answer is, "It is our business."The North states they have done everything that they can to remedy climate change and have made a commitment to give developing nations \$100 billion annually to essentially take care of the damage that they have done on this planet. It is very difficult to resolve the issue of climate change with these arguments. A few months in advance of the Copenhagen Summit (COP15), the German Consul for the Environment proposed a budgetary approach which mainly stated that an identical right, license, and permit to pollute the atmosphere to all countries of the world.
- The budgetary strategy should now be accompanied and backed with further technical advances too. The older enlightenment was utilitarian, pragmatic, mechanistic, materialistic and individualistic, and was not good enough to solve the problems we face, but new enlightenment can solve the problem.
- Already observed is the growth of the gross domestic product (GDP) and a per capita increase in the last century, and more recently, the directly proportional increase in carbon emissions per capita i.e., GHGs. Of course, the objective for every government is to increase the per capita GDP, thereby driving carbon emissions knowingly and unknowingly. Politicians think, and they must, that it is genuine politics. It is difficult to find political answers in this circumstance. Therefore, we need to convey the brutal reality about the great catastrophe forecast by the scientific community, while also finding new routes and ways to make policy. First of all we must decouple GDP from emissions of carbon.



• A pandemic began in a region of the world two years ago, nevertheless, it spread through the whole world. From the level perceived as a localized problemit changed in a tiny span of time to more than 200 nations' problems. Ecosystems are interrelated and the climate crisis lies in every corner of the planet. All 7.6 billion people worldwide are threatened at this moment; the world's biodiversity is in danger of being lost, much biodiversity has already been lost permanently, and the further loss of biodiversity puts life on this planet ever-more susceptible.

### BUSINESS- OPPORTUNITIES AND CHALLENGES

- In a dark cloud there is always a silver lining. Difficulties are also apparent, for instance greenhouse gases are the cause of climate change. Best business practices enable improved thinking that generates solutions and practices to minimize greenhouse-gas emissions through energy-saving devices and can change global energy mixes. Innovative ideas and solutions from business will also offer better livelihoods so that customers may live and save the Earth as it is. Better answers to climate issues are necessary and this is an opportunity for business leaders and common people to set a route for a better life.
- It is important to highlight the role that the corporate sector can play in building a green global economy. That would entail: judicious investments; innovation; skillful policy design and implementation; technology deployment with respect to the problems at hand; infrastructure building; international co-operation; and skill development plus efforts across many other areas. Corporate businesses allhave a stake, after all what is business at the end of the day, a relationship with buyers, and if buyers don't exist how can a company's existence be possible? Corporate leaders sometimes hear what they want to hear; this approach needs to be changed.
- Technologies and innovation in the areas of renewable energy and carbon capture systems will play a key role in mitigating climate risks. Technology will also play a significant role in enhancing the natural processes that can improve the absorption of atmospheric carbon in the soil and oceans.
- All the responses and adaptations will be distinct. It is vital for us to understand that the existing conditions influence not only individuals, or enterprises, but also suppliers, consumers, the local economy and communities. Thus, it will all be a series of effects, simultaneously throughout the world, and this will require numerous adjustments.
- The words net-zero look too big a task to Micro Small and Medium Enterprises (MSME), and yet for Indian MSMEs net-zero is crucial. To the listener net-zero isn't easily understood. The industrial association plays an essential role in bringing clarity as it spreads the message.
- Most of Indian companies continue to target net-zero by 2050, perhaps a few years before they become the net carbon neutral companies. They will have to reconsider this! The initiatives like rooftop solar energy, Solar Agriculture Pumps, Micro grids, "scope-1, scope-2 and scope-3" by using ESG protocols, improving "IC engines", etc., are good efforts but all such, and even more, massive changes are needed at this juncture.



### INDIAN GOVERNMENTS (CENTRAL AND STATES)

- Indian Government is now recognizing the gravity of our situation and are gradually putting in place policies, infrastructure, and incentives to help change the direction.
- Ecological economics can play an important role in redefining our relationship with the environment and in achieving a more equitable distribution of resources (between groups and generations of humans and between humans and other species). The safety and prosperity of the people should be the main goal of the governments.
- Technological solutions are now accessible that bring huge social and economic benefits. There is a need to move quickly. Further, government support and subsidies, tax relief, and liquidity through financial institutions will boost results.
- MSMEs are confronted with a completely different problem. Currently in the area of emissions reduction, industrial users are obliged to comply; MSMEs pay extremely high-power prices and they have no money to invest in solar power.
- The argument that coal provides a stable source of power is no longer viable. A World Resource Institute (WRI) study on certain States, particularly in Tamil Nadu, shows the thermal plant capacity has actually been down 21 % due to water stress and this is a problem in many other areas. Governments need to move away from coal at the earliest possible time.
- Other governmental issues are:
  - Develop a national and provincial agenda with plans for climate change;
  - Establish systems for carbon trading (e.g., EU-ETS);
  - Explore green taxation; an economic tool which can force manufacturers and consumers to switch to greener alternatives;
  - Set standards and criteria; for example BEE energy ratings;
  - Link green ratings to economic advantages;
  - Promote green curriculum development at universities and educational institutions; and,
  - Implement green initiatives with examples in government and the public sector (i.e., Green secretariat, energy efficiency in public sector companies, etc.)



### **APPENDIX I**

### LIST OF SPEAKERS AND KEY PARTICIPANTS

- 1. Dr. Ashok Khosla, Development Alternatives, Club of Rome
- 2. Padma Bhushan Shri S Ramadorai, Tata groups, TISS and CoR-India
- 3. Mr. Suresh Prabhu Member of Parliament as Chief Guest gave keynote address Indian Sherpa for G20 and G7
- 4. Sir David King Former Chief Scientific Advisor, UK Government
- 5. Dr. Johan Rockström Director, Potsdam Institute for Climate Impact Research, Potsdam, Germany
- 6. Dr. Ian Dunlop Chairman Safe Climate Australia
- 7. Prof. Ernst von Weizsäcker Former Co-President, Club of Rome
- 8. Ms. Mridula Ramesh Author & Founder Sundaram Climate Institute.
- 9. Mr. Will Steffen Research scientist & author on anthropocene and climate issues
- 10. Dr. Mike MacCracken Former Chief Scientist Climate Change programs, USA
- 11. Dr. Mark Texler– Climate Change Risk & Opportunity Management
- 12. Mr. David Tattershall Former External Advisor to the Nordic Council
- 13. Lt Gen ArunSahni, CoR-India
- 14. Ms. Mahua Acharya MD & CEO Convergence Energy Services Ltd.
- 15. Mr. Praveer Sinha CEO, Tata Power
- 16. Mr. Saurav Malhotra Balipara Foundation
- 17. Mr. JyotindranKutty Chief Sustainability Officer, Tata Motors
- 18. Mr. Ranjit Barthakur, Balipara Foundation, CoR-India
- 19. Mr. Perses Bilimoria, Director CoR-India
- 20. Dr. Vishal Massey, COO & Secretary CoR-India
- 21. Dr. Ing. Yi-Heng Cheng, The Club of Rome, member of Executive Committee



- 22. Mr. Sanjiv Paul, Vice President (Corporate Services) of Tata Steel Limited
- 23. Mr. Nadir Godrej, Managing Director, Godrej Industries Limited
- 24. Mr. Sandeep Maini, Chairman, Maini Group of Industries
- 25. Mr. R Mukundan, Managing Director and CEO, Tata Chemicals
- 26. Brig. Rajiv Williams, Head of Corporate Social Responsibility (CSR) at Jindal Stainless
- 27. Mr. Mohsin Khan, Rajiv Gandhi Institute for Contemporary Studies, RGF.
- 28. Prof. Shashidharan Enarth, Senior Visiting Fellow, Rajiv Gandhi Institute for Contemporary Studies
- 29. Mr. Moses Manoharan, Chairman, Global Dialogue Forum
- 30. Ms. Shruti Karkare, Cipla Foundation
- 31. Mr. Shailesh Nayak, Director, National Institute of Advanced Studies
- 32. Mr. SharatShyam, Edelman
- 33. Mr. Bahram Vakil, Co-founder, AZB Partners
- 34. Mr. Debarati Ghosh, Tata Consultancy Services
- 35. Mr. Jeet Singh, Rajiv Gandhi Institute for Contemporary Studies, RGF
- 36. Mr. Tanmay Nayak, Tata Institute of Social Sciences
- 37. Mr. Leon Simons, Board member Club of Rome NL. Netherlands
- 38. Ms. DipaliSikand, Founder, Les Concierges Group, Bangalore Urban, Karnataka
- 39. Ms. Mayuri Chaukhande
- 40. Ms. AnubhutiVishnoi
- 41. Ms. Esha Roy
- 42. Mr. Shreyas Sawardekar
- 43. Mr. Surinder Mehta
- 44. Mr. Madhavan Nambiar
- 45. Mr. Sunil Srivastava
- 46. Ms. Surbhi Auditto, CoR-India



### **APPENDIX II**

### **MEDIA COVERAGE**

### THE ECONOMIC TIMES News

English Edition | 28 July, 2021, 08:24 PM IST | E-Paper

# Experts warn of climate change impact on businesses

#### Synopsis

"This climate crisis is the beginning of a horror film. Europe has just experienced the worst of floods in centuries as has China which is just now suffering from worst-ever floods in an ultramodern infrastructure setting. Who is safe? We have deliberately ignored impending danger at our own peril," Prabhu said.



"Corporate business has everything at stake... entire businesses will become redundant due to climate change." The impact of <u>climate change</u> will be increasingly felt across all economies, upending <u>businesses</u> and social structures in alarming ways, global <u>experts</u> have said.

Industry must come forward to proactively choose sustainable and low-carbon growth models with zero net targets in mind, they said during a think tank discussion on the subject last week. Corporate business had 'everything at stake' given that while it is various parts of the world that are experiencing the worst of climate change, the economies are all inter-connected, Suresh Prabhu - India's Sherpa to G 7 and G20 – said, addressing the Club of Rome-India Meeting on the Risks and Responses of Corporates to the Climate Crisis.

"This climate crisis is the beginning of a horror film. Europe has just experienced the worst of floods in centuries as has China which is just now suffering from worst-ever floods in an ultramodern infrastructure setting. Who is safe? We have deliberately ignored impending danger at our own peril," Prabhu said.

He, however, said a silver lining does exist, provided industry responds to the crisis with the right energy solutions, technologies to cut emissions and ensure sustainable and responsible growth.

"Corporate business has everything at stake...entire businesses will become redundant due to climate change. But there is always a silver lining in the darkness. There is an opportunity," he said. "Green House Gases are the key cause of climate change and one can always develop business ideas on the subject, change the energy mix of the world, bring in commodities, ideas, technology for new business. While we are seeing threat to business due to climate change, if we act on it in a positive manner, we can come out of it," Prabhu pointed out.

# Experts Warn of Climate Change Impact on Businesses

#### Our Political Bureau

New Delhi: The impact of climate change will be increasingly felt across all economies, upending businesses and social structures in alarming ways, global experts have said. Industry must come forward to proactively choose sustainable and low-carbon growth models with zeronet targets in mind, they said during a think tank discussion on the subject last week. Corporate business had 'eve-

rything at stake given that while it is various parts of the world that are experiencing the worst of climate change, the economies are all inter-connected, Suresh Prabhu- india's Sherpa to G 7 and G20 – said, addressing the Club of Rome-India Meeting on the Risks and Responses of Corporates to the Climate Crisis."This climate crisis is the beginning of a horror film. Europe has just experienced the worst of floods in centuries as has China which is just now suffering from worst-ever floods in an ultramodern infrast-

ructure setting. Who is safe? We have deliberately ignored impending danger at our own peril," Prabhu said.He, however, said a silver lining does exist, provided industry responds to the crisis with the right energy solutions, technologies to cut emissions and ensure sustainable and responsible growth-"Corporate business has everything at stake...entire businesses will become redundant due to climate change. But there is always a silver lining in the darkness. There is an opportunity," he said. "Green House Gases are the key cause of climate change and one can always develop business ideas on the subject, change the energy mix of the world, bring in commodities, ideas, technology for new business. While we are seeing threat to business due to dimate change, if weacton it in a positive manner, we can come out of it," Prabhu pointed out.



### **Appendix III**

### The Unconscionable Risks of the Net-Zero-by-2050 Objective

Drafted by David Tatershall | Edited by Dr Mike MacCracken

#### The Guardian

#### **Overview:**

The graphic portrays some of the consequences of a 4°C world (note especially the projected impacts on India):

- The impacts indicated in the source article are based on the assumption that 4°C will be reached in **2100**, but the plausible worst-case projection is for single years, or more, of such warmth occurring by the early **2060s** (Note that a 2°C increase, considered potentially catastrophic, will more than likely have been permanently breached prior to this date).
- Hans Schellnhuber, Johan Rockström and others, project that such warmth could reduce the ultimate carrying capacity of the planet to 1 billion or less in the absence of unimagined technological advances.
- Without question, considerable population displacement, starvation and resource conflicts would result.
- In the face of the inevitable population contraction, the interdependent global economic system that the global community depends on would likely unravel, with much of the damage occurring well before formally breaching 4°C.
- Net-zero-by-2050, which is projected to lead to global warming of over 3°C, is an objective that is far too little, far too late, especially because its formal definition does not account for induced carbon-cycle amplification of the warming (e.g., emissions resulting from permafrost thawing and forest degradation).
- For society, the upshot over coming decades will place all assets, lifestyles, and personal and familial well-being at ever-increasing and untenable levels of risk; indeed, there are major identifiable risks on the immediate horizon.

A critical consideration in evaluating the intensifying threats of, and essential responses to, climate change, is the frameworks used to assess risk and make decisions. Due to scientific protocols and administrative procedures, the risk-assessment process used by the IPCC, presently the primary basis for national and international decision-making regarding the appropriate policy responses to climate change, lags the cutting edge of observations and is consensus-based, generally being restricted to focusing on the central portions of the normal distributions of both observational trends and model simulations; low-probability, but high-consequence events, commonly referred to as 'fat-tail' events and impacts, are generally not considered. For example, the measure of change in the global average temperature being used by the IPCC represents, in effect, the few-decade running average of this change, so that, even if sufficient mitigation were carried out to limit IPCC's global warming metric to the Paris goal of 2°C, half of the individual years would be at or above this



level of harmful, even dangerous, warming. Given that most ecological and societal impacts are dependent on the high-end extremes of conditions, rather than the multi-decadal running average of the perturbation, basing risk assessments on the IPCC's projections in changes in global average temperature will lead to significantly under-estimating the likely damage and disruption.

It is for this reason that many sectors of society, including governments when evaluating existential threats, seek to identify and prepare plans to counter the risks associated with plausible worst-case scenarios, or 'fat-tail' events. And in dealing with a time-dependent positive forcing, it is essential to consider the latest available data, or intelligence, in order to minimize risk exposure. With regard to the increase in global average temperature, while the multi-decadal averaging indicates the warming to date is only about 1.1°C, two of the most recent years have been warmer than the preindustrial average by about 1.3°C. While this may seem a small difference, many important impacts such as coral bleaching, water resources, wildfire likelihood, crop yields, and more are dependent on the conditions of a particular year rather than the running multi-decadal average.

In preparing this document, our intention is to present the available evidence in the manner a dispassionate "due-diligence" team would use in presenting their findings to seasoned investors contemplating making a substantial investment aimed at building their long-term wealth and wellbeing. In seeking to fulfill this role, we identify, and to some extent quantify, the risks that merit being thoroughly evaluated by all in their applicable risk-assessment and decision-making frameworks so that they can fully define the problems they face from climate change and take the most effective actions that they can to improve their risk-exposure in terms of forward desired outcomes.

### June 2021

#### **Executive Summary:**

- The Net-Zero-by-2050, as presently specified, will not achieve the desired objective of limiting the increase in global average temperature to the values called for in the Paris Accord due to several omissions. These include the set of climate-affecting substances being considered (e.g., the effects of sulfate and black carbon aerosols are not included) and the use of the 100-year Global Warming Potential approximation to calculate required emissions cutbacks.
- Based on current trends in emissions and mitigation, it is likely that the increase in global average temperature for a month and quite possibly a year will first breach 1.5°C prior to 2030 and 2°C prior to mid-century, even though the multi-year averages that are reported may take a decade or so longer to be evident. And without very substantial reductions in global emissions, the warming for an individual month or year may exceed 4°C by the early 2060s, especially because of positive carbon-cycle feedback loops (e.g., from emissions due to thawing permafrost) that are starting to appear.
- A comprehensive presentation of the associated effects on climate, ecological and societal impacts that are likely occur at a 4°C increase in global average temperature, written by David Spratt, can be viewedhere. Among other findings, a 4°C world would seem likely to be characterized by, as an alternative to moving into air-conditioned space (arguably impractical): a major disruption to, and likely contraction of, the world's peoples; widespread migration of those remaining to middle to high latitudes due to intolerance to the rising heat index; regional mass starvation and increasing conflicts due to the increasing likelihood of persistent shortfalls in food and water resources etc.



- It seems unlikely that anything close to global security and the interconnected global economy as we know it could persist, possibly beginning its decline decades prior to reaching the 4°C increase in the multi-decadal average of the increase in global average temperature used as the metric in international negotiations. Such an occurrence would place all assets, lifestyles and families at ever-increasing untenable levels of risk.
- Emissions reductions, although absolutely essential, are highly unlikely to achieve the stated objectives when one considers alone the magnitude of the task, inherent limitations of manufacturing capacity, and the reticence and inertia created by existing investments and their leadership.
- A situation analysis carried out as a component of a dispassionate due-diligence risk-assessment framework of the nature predominately applied by business, makes clear that emissions reductions must be augmented with climate repair (e.g., CO<sub>2</sub> draw-down, for instance via the use of ocean nutrient flakes) and selective intervention (e.g., via injecting reflective aerosols into the stratosphere).
- Presently, there is no Plan 'B' (i.e., contingency plan) to supersede the emerging inadequacy of Plan 'A', the Paris Accord, which is inarguably failing to halt further changes in the climate. With the pace of global warming possibly accelerating, it is highly questionable whether sufficient emissions reductions can be implemented to meet the temperature objectives of the Paris Accord, and even if sufficient emissions reductions are made, if this will avoid the "dangerous anthropogenic interference with the climate system" as called for in the UN Framework Convention on Climate Change.
- While there is much discussion among policymakers and the public regarding the potential of a 3°C increase by 2100, it is essential to understand that this is a central IPCC estimate, and a good bit less than the plausible worst-case generally identified in due-diligence analyses. The business/investment/banking communities (BIBCs), the military, medical professionals, and responsible parents, all are expected to conduct contingency-based risk assessments prior to making important decisions, and in doing so to use plausible worst-case scenarios to ensure that they can identify and then reduce critical vulnerabilities through both prevention and preparation. At present, this is far from the approach that is being used by 'official' bodies such as the Conference of Parties to the UNFCCC. Given that we all live on our singular Spaceship Earth with no exit possibility, the world's present approach seems to have a high probability of failure, which is simply not an acceptable option.

#### The facts about "Net-Zero":

There are several assumptions hidden in the calculation of "net-zero" that merit exposure and consideration in evaluating the effect that achieving net-zero will have on the climate. For example, many of the calculations of net-zero presume that, as is the case at present, roughly half of anthropogenic emissions will continue to be absorbed by natural sinks (i.e., the terrestrial biosphere and the world's oceans), leaving only about half in the atmosphere to contribute to further warming. However, the global warming being induced by earlier emissions of greenhouse gases is leading to a reduction in the natural sinks uptake capacity; the result is that "net-zero" becomes time-dependent. As another problematic consideration, "net-zero" as defined by the IPCC only includes the warming influences of the Kyoto basket of gases (i.e., direct emissions of the primary gases); societal emissions of the substances that create tropospheric ozone and the changes in natural emissions caused by human-induced warming (e.g., emissions resulting from thawing



permafrost) are not included in the definition. As a result, it is not at all clear that the world getting to net-zero emissions will halt global warming. We list below various of the factors that we think a formal due-diligence analysis must consider for confidence to be placed in an effective plan for moving forward:

- Account for the increasing CO<sub>2</sub> emissions from the Arctic resulting from it flipping from a sink of emissions to a source. In 2019, the Arctic is estimated to have contributed roughly the equivalent of 6.3% of that year's anthropogenic CO<sub>2</sub> emissions, plus unspecified quantities of methane, which, on a mass basis, is 100+ times as powerful a warming influence as CO<sub>2</sub> over 20 years, and nitrous oxide, which on a mass basis is roughly 300 times more powerful a warming agent as CO<sub>2</sub> on a 20-year basis (which has recently been estimated as 12 times more being released than previously thought);
- Compensate for the continuous contraction of the tree sink worldwide, now including the apparent flip of the Amazon region from a sink to a source of CO<sub>2</sub>;
- Compensate for the worldwide emissions from rotting tree debris, which is being added to as a result of vast forest areas not continuing to be vibrant as the world warms. In terms of scale, the authors of the Amazon reference above noted: *Over the same 10-year period, degradation caused by fragmentation, selective cutting, or fires that damage but do not destroy trees, caused three times more emissions than outright destruction of forests.;*
- Compensate for any changes in ocean outgassing of CO<sub>2</sub> resulting from changes in ocean circulation and warming as a new balance is achieved between the atmosphere and ocean surface;
- Compensate for any changes in climate sensitivity and the ultimate temperature that is reached as the climate warms and eventually reaches a new equilibrium. Note that it is estimated that if all emissions ceased tomorrow, the mean temperature of the planet would continue to increase and ultimately exceed 2°C as the sulfate cooling influence is reduced;
- Compensate for the release of  $CO_2$  sequestered in soil as temperatures continue to increase. Note in the referenced article: in a warmer climate, soils will be a less efficient carbon sink: storing less  $CO_2$  and even releasing some of the previously stored carbon. In this case, at 2 degrees of temperature increase, these additional emissions could represent the equivalent of more than 5 years of global  $CO_2$  emissions. Or twice as much  $CO_2$  as the United States has emitted for nearly 100 years.
- Ensure consideration of China's, India's, Mexico's and Australia's plans to continue the use of coal;
- Compensate for the progressive reduction of the SO<sub>2</sub> shield. Note that the value of the SO<sub>2</sub> shield, or how much it is inhibiting temperature increase, was formerly assessed as 0.5 to 1.1°C. Recent research, however, suggests that the cooling influence could be double that amount.

An indication of the complexity of the factors involved in making a net-zero calculation is provided in the UNEP 2020 Emissions Gap Report. The calculation that was done anticipated that anthropogenic emissions would decrease by 7% in 2020 as a consequence of COVID-19 pandemic and the resulting economic contraction (the peak month was estimated to have a 17% drop). Irrespective of the drop in emissions, however, from December 2019 to December 2020, the



atmospheric CO<sub>2</sub> concentration increased by 2.91 ppm, which is an annual record!

A consequence of the many complexities is that all the 'officially' specified requirements pertaining to calculating net-zero as currently considered could be fulfilled and actual net-zero would not be achieved. What will really be required is going to zero fossil-fuel emissions as rapidly as possible, and at the same time building up the capacity to pull emitted  $CO_2$  back out of the atmosphere (sometimes called "climate repair") to buy back lost time and deal effectively with the warming influence that will be exerted as a result of the loss of the SO<sub>2</sub> shield as the use of coal is phased out.

In light of these factors, there is no so-called allowable carbon-budget (i.e., an amount of future  $CO_2$  emissions that can be accommodated without exceeding the Paris Accord's temperature objectives). Given all the various considerations, it is a complete illusion to think that further emissions will not have serious impacts, resulting from both scientific reticence, in considering risks, and certain interested parties wanting to justify a continuance of BAU.

#### 2050?:

The goal of attaining so-called net-zero by 2050 is to meet the goals of the Paris Accord, which were to (a) avoid breaching a 2°C increase and (b) pursue as an aspirational goal a pathway to avoid breaching 1.5°C, and then, presumably, staying as close to that increase as possible. While perhaps admirable in that there was world-wide agreement in their adoption, there are several problematic aspects.

First, global warming could well be entering a non-linear mode, a finding put forth several years ago by a team including members from Potsdam (PIK), which is one of the world's most prestigious climate change research academies. Observations through 2020, as reported by James Hansen, also show that global warming appears to be accelerating , with last year's warming calculated to be 1.3°C above preindustrial.

While applying a linear trend-line analysis covering the observations back to 1970 suggests the longterm average of the warming may not exceed 1.5°C until the mid-21st century, applying this approach to the most recent five years of data (which is not unreasonable given the suggestion that the temperature increase appears to be becoming non-linear) suggests the risk of a potential one-year breach of the 1.5°C threshold before 2030, and a risk of a potential breach of 2°C between 2035 and 2040. Note that in figure 1 a range was estimated by



Figure 1 ~ James Hansen's advisory re global warming acceleration (based on NASA/GISS data)

applying two trend-lines to allow for a range of natural variability.

With global  $CO_2$  emissions remaining persistently high, and the additional warming influence that



will result from reduction of the sulfate shield as a result of the primary mitigation efforts being focused on reducing use of coal, near-term slowing of the pace of warming will be very difficult to achieve. Because of this, achieving net-zero emissions by 2050 will be far too late for limiting even decadal-average warming to the Paris Accord's objectives, much less avoiding single year exceedances. To be effective, actions to effectively counter the ongoing temperature increase must be thoroughly defined, planned, undertaken and accomplished well within the next decade.

#### Plausible worst-case scenarios:

For a thorough due diligence analysis, the ability to withstand plausible worst-case scenarios needs to be considered; a classic one in the banking community being a run on the bank. One plausible worst-case scenario for a climate-change analysis is a projection derived from a highly credible study by the UKs Met Office Hadley Center, published in 2009, involving a potential breach of 4°C by 2055. Note within the text of the referenced article: *The Met Office ran 17 different variants of their model assuming slightly different strengths of important, but not definitively determined, feedbacks. In every case, the simulations suggested that a year or more with a 4°C warming was likely to occur by 2055 if emissions continue to rise at their current pace. Even if emissions reductions were imposed, it was still likely that a year or more could exceed a 4°C warming by 2070.* 

An additional plausible worst-case scenario, one that corroborates the above scenario, was published in 2011 in the UK's *Philosophical Transactions of the Royal Society;* an extremely credible source. At the end of the 'Introduction' of the referenced article, the authors noted: Using these GCM projections along with simple climate-model projections, including uncertainties in carbon-cycle feedbacks, and also comparing against other model projections from the IPCC, our best estimate is that the A1FI emissions scenario would lead to a warming of 4°C relative to pre-industrial during the **2070s**. If carbon-cycle feedbacks are stronger, which appears less likely but still credible, then 4°C warming could be reached by the early **2060s** in projections that are consistent with the IPCC's 'likely range'.

A1FI is the worst-case fossil fuel intensive scenario of the IPCC's 4th assessment. It is the only scenario that has accounted for carbon feedback emissions. As a result, the upper range of the A1FI scenario projects a 6.4°C warming by 2100, much higher than the mean estimate of 4.5°C. When including climate uncertainty, the IPCC's 5th assessment put the upper limit at 7.8°C by 2100 (IPCC 2014 AR5 WG3 SPM page 8 and Table SPM.1). In addition, the 2009 paper "Greenhouse gas targets for limiting global warming" by Malte Meinshausen et al., projected a 5°C mean for the A1F1 scenario and over 7.5°C as the two-sigma upper limit from their ensemble of model simulations.

Given these upper bounds for 2100, using a worst plausible outcome for a single year of 2°C by 2035 and 4°C by early 2060s appears reasonable to consider. What is particularly disturbing is that the present push to reduce emissions and adapt provides no assurance of being adequate to avoid severe environmental and societal impacts, and there is no Plan 'B' as a back-up set of measures to avoid a 4°C temperature increase, which has been said to be catastrophic for civilization. The executives of any corporation in such circumstances would have already prepared a list of additional measures to be taken (quite possibly, corporate executives might even have thought about an additional Plan 'C'). And facing such a threat, military leaders would already have prepared a contingency plan that they would be constantly reviewing and adapting based on the



latest intelligence. Given the severe risks being faced, that the international community is not yet developing and testing additional mitigation and intervention efforts seems a failure to forthrightly face the consequences for having taken so long to get seriously started on mitigation.

#### **Risks on the horizon:**

#### 1. A semi-or persistent world food crisis:

- As the mean temperature of the planet is increasing, adverse changes in the planet's ecosystem are progressively occurring that impact food production. Such changes concern the jet stream, ocean currents, and wind patterns, all of which since the onset of the industrial revolution have provided the reasonably stable weather patterns that are essential for mass agriculture; considerable evidence reveals the ongoing and ever-increasing adverse changes.
- Since the dawn of the 21st century, there have been multiple food crises. While IPCC's early assessments projected an enhancement of yield in key commodity-growing regions due to longer growing seasons and the fertilizing effects of elevated atmospheric CO<sub>2</sub> levels, suggesting that world food supplies would be adequate for at least the early decades of the 21st century: What is being seen is an increasing likelihood of shortages of key commodity crops. A partial list of such shortages includes: in 2008, widespread food riots; in 2010 Russia, due to crop failures in Siberia and the Ukraine in tandem with crop failures in other major grain producing regions, placed a moratorium on wheat exports to suppress internal price increases and potential unrest (note that this served to increase global commodity prices and Russia, for the identical reasoning, placed a short-term ban on exports in 2020). in 2010, Arab Spring being triggered in part when regional food prices increased; in 2011, sustained drought leading to over 1 million hungry people emerging from the countryside in Syria and, at least in part, triggering the still on-going conflict; in 2012, a major drought in the US resulting in culling back cattle herds to 1956 levels; in 2015, the UN predicting that by 2020, 50 million people would ultimately be displaced from their homes in sub-Saharan Africa due to desertification and associated crop failure; in 2019, ominous signs of yet another world food crisis on the horizon; and in 2021, the UN FAO Food Price Index heading towards, if not on the verge of reaching, a crisis level.
- Cumulatively, the world has already experienced the typical impacts of what might be expected in year 1 of a worldwide food crisis. As climate change proceeds and the frequency of regional extremes increases, and crop failures become more likely in key growing regions, food price and refugee impacts can be expected to become more intense and more widespread in food-importing nations as reserves are exhausted and food-growing nations cut their exports to limit price increases. If the situation continues to intensify, which is expected as what is really being experienced are shifts in storm tracks that is foretelling long-term aridification rather than termination of a random drought, changes in currency exchange and interest rates are likely to be more and more severely disrupted, quite likely triggering a significant share of the international derivatives market (possibly up to 80%). The potential consequence would be to implode the financial system and render the global economic system that is so essential to sustaining global well being literally facing its the gravest problem ever.
- The bottom-line is that a semi- or persistent world food crisis could be triggered in the nearterm if there are coincident failures in just two or more of the very limited set of regions that provide large fractions of the exports of key food commodities to the world market. If climate



change is not rapidly controlled and global average temperature increases continue to head toward 3 to 4°C, there is a clearly identifiable risk that a persistent world food crisis could become the root cause of mass starvation that is so severe it might lead to a collapse of the generally peaceful civilization that we now enjoy.

#### 2. Uncontrollable climate change:

- The IPCC assessment process has been established in order to provide the most authoritative consolidation of scientific research and economic commentary. The very nature of the process, however, leads to its findings being well back from the cutting edge of scientific findings and economic projections that represent the worst plausible outcomes appropriate for considering in traditional risk assessments. Among the factors contributing to this are the time it takes for scientific research to be conducted and confirmed (which is inherently difficult given the unprecedented climatic and cryospheric transition that is underway and is often 15 to 30 years in duration), the several year cycle time of the IPCC assessment process, and the smoothing of findings that occurs in IPCC's pursuit of unanimous agreement in its findings by member nations, a number of which have strong investments in the ongoing use of fossil fuels. Earth system history provides alarming indications of how drastic changes could be, and there are early signs that uncontrollable long-term transformation, if not already started, could be triggered at any time over the next few decades (e.g., in the accelerating loss of mass from the Greenland and Antarctic ice sheets; in the release of climate-warming gases from thawing permafrost; in the increasing dislocations and loss of species). To the extent that traditional scientific protocols and IPCC administrative procedures are followed, it is likely that 'official' confirmation that mitigation of emissions and related actions cannot halt significant further climate change will not come until decades after this critical point has been reached, so far too late to ensure the recovery of the climatic conditions that have been so beneficial for society during the Holocene (i.e., the last 8 thousand years or so).
- As described above, the Arctic has flipped from being a sink to a source of formerly sequestered GHGs, primarily CO<sub>2</sub>. This region of the planet contains so much sequestered GHG (as shown in figure 2), however, that there is a risk that ongoing warming could lead to sufficient release of CO<sub>2</sub> and or CH4 that the resulting temperature increase could trigger uncontrollable climate change, meaning that even climate intervention proposals may be unable to bring the global average temperature back to near present levels. While the exact level of global warming that would lead to uncontrollable warming is not known, there are indications that as small a warming as 1.5°C to 2°C may trigger such a transformation (e.g., see Anton Vaks et al.).
- As shown on the image at the right of figure 2, the quantity of GHGs sequestered in onshore and offshore Arctic permafrost is estimated to be several times the current atmospheric loading.
- The last few years have experienced record temperatures over regions where permafrost resides and scientists have been shocked that the warm weather conducive to permafrost thawing is occurring roughly 70 years ahead of model projections.

The bottom-line is that as the mean temperature of the planet increases, the Arctic is experiencing an increase in annual average temperature that is roughly three times the global mean as a result of various amplifying factors. If uncontrollable climate change is triggered, it might well be starting in the Arctic. Disturbingly, the international community has neither developed nor tested an alternative response strategy. With no plans to counter the potential for uncontrolled warming, the world is thus totally exposed to the consequences of this risk.





Figure 2  $\sim$  The Siberian cave Anton Vaks et al. discovered, plus the quantities of onshore and offshore GHGs sequestered in Arctic permafrost

#### **Building toward a Plan 'B':**

- As a general guideline, the fundamental step required is to derive all needed energy services from sources that do not emit CO<sub>2</sub> or other greenhouse gases, doing so in the most efficient way possible. Electricity generated by wind turbines and solar cells is a leading example of a CO<sub>2</sub>-free source and LED light bulbs of an efficient way of providing light. There are, however, many other approaches, some available now, some that may take decades to become useful contributors to the global mix of sources, and some still to be conceived.
- A productive starting point for corporations wanting to take more effective actions would be to contact Paul Polman's organization. Polman is the retired CEO of Unilever, a company he progressively and profitably structured to be carbon neutral, and is now dedicated to dispersing that knowledge to as many corporations as possible. Corporate action is essential to creating a more effective approach to moderating climate change and minimizing risk. An additional option is to contact the Development Alternatives Group.
- The comprehensive approach that is needed is to decrease from roughly 80% to near-zero the use of fossil fuels to provide energy services. Accomplishing this will require many actions, some individual and some collective, each tuned to a particular situation or sector; there will inevitably be both some overlap and some gaps. At a minimum: tens of millions of buildings must be weatherized; current electric power generation must be converted to non-CO2 emitting technologies; over 1 billion cars (plus many trucks, buses, and other vehicles) must be replaced or retrofitted; roughly 53,000 large sea going vessels (plus small craft) must be repowered (though the many vessels involved in transporting petroleum and coal will no longer be needed); and the transportation services of 23,600 commercial aircraft (today's number, a number forecast to double in the next 20 years) and an unknown number of smaller and military aircraft must be converted. The task is enormous.



- Minimizing what in the past has been a level of totally unacceptable, even existential, risks that would have the potential to devolve organized society and the productivity and diversity of the environment if left unattended even have the potential of species extinction, it is essential that:
- The current assessment framework, which has been focused on dealing with central tendencies identified in scientific assessments, be replaced by the comprehensive risk-assessment, duediligence framework, which has long been the approach successfully used by the investment, business, national security, and infrastructure planning communities to ensure the relatively stable conditions that have been conducive to peace and overall economic development;
- The prevailing short-term planning time horizon be lengthened to one more appropriate to addressing the long-term sustainability and environmental problems being faced by society;
- The actual problem that society faces be better defined, including by increasing the focus on increasing resilience to plausible near- and longer-term extremes and worst-case situations, such events being the ones that lead to the greatest societal and environmental impacts;
- Recognition not only of the high risk that society will face as the global temperature objectives of the Paris Accord (i.e., 1.5 to 2°C) are exceeded, but also the very significant and unacceptable risk that will exist if the global average temperature, and so consequent sea level rise, is not rapidly brought back to a level near its mid-20th century value; and
- Those with sufficient influence in the 'market' act collectively in short order to accelerate the effort to limit climate change and return to typical 20th century conditions, doing so, if necessary, by applying political pressure. The reality is that in this circumstance, a problem of a magnitude not previously successfully addressed by modern civilization, individual exposure to risk can only be minimized or eliminated through concerted collective actions.

#### **Conclusions:**

- The basic premise of the current economic model is unlimited growth that depends upon unlimited resources and a limitless environment. The planet, however, has limited resources and boundaries, or critical thresholds, that we are now approaching that if passed will lead to potentially irreversible tipping points that in turn will lead directly to disastrous, even catastrophic, outcomes. A pro forma balance sheet for the entire planet makes clear that the world community is consuming replenishable assets at 1.7 times their recovery rate and liquidating essential fixed assets to generate near-term profit (e.g., forests and corals are being lost because the atmosphere is being used as if dumping CO<sub>2</sub> into it will have no impact). Unfunded liabilities for repairing the climate now total \$100 to \$200 trillion, and ongoing emissions of CO<sub>2</sub> from combustion of fossil fuels are adding to these unfunded liabilities at a rate of \$2 to \$4 trillion per annum.
- Were the planet a business, say Earth Inc., the Board of Directors would undoubtedly declare the equivalent of Chapter 11 bankruptcy as considerable reorganization is essential to ensuring its successful operation will continue (and neither liquidation nor failure are options). As matters stand, were the Board to attempt to issue bonds to fund reorganization, and the identifiable risks pertaining to those bonds were correctly assessed by rating agencies, they would at best be considered to be at 'junk' status.
- The alternative to literally risking everything being put at risk by the slow pace of actions being taken under the UN Framework Convention on Climate Change (UNFCCC) is to create a new sustainable paradigm that will ensure forward prosperity for all stakeholders; particularly



children. This is unquestionably the greatest, and most necessary, economic opportunity of all time, and yet it languishes on the sidelines as the risks associated with the current paradigm are frequently unacknowledged and thus continue to mount.

• The bottom-line is that as climate change continues, largely unabated, the window of opportunity to remediate it is rapidly closing and options for doing so are rapidly diminishing. It is not a question of listening to the science, as some assert; it is a question of evaluating observed trends and scientific analyses within an appropriate risk-assessment framework that will ensure the optimum outcome for society. Our slogan must be "Pay attention to the risk."

#### Footnote:

This document was prepared by a multidisciplinary team, with extensive ever-increasing international networks, in order to raise awareness that the decision-assessment framework being used to generate 'official' response plans to climate change under the UNFCCC is considerably different than the risk-assessment frameworks that are being used in many sectors of society and have been an essential underpinning for successful economic development. The discussion presented here represents a mere fraction of the subject-matter knowledge that we have assembled over years of working together and with others. Members of the team have devoted thousands of hours to the subject of climate change, several their entire careers. All of us see the current approach to dealing with climate change to be inadequate, held back by focusing too much on waiting until there is high confidence in findings as risks are not only worsening, but being realized at a pace exceeding the pace of scientific understanding. With only one spaceship Earth available to us, risks must be addressed aggressively if society as we know it is to survive.

We stand by to help in any way possible, and invite others to bring their contributions to understanding and addressing our increasingly dire situation.





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