THE SUSTAINABILITY SERIES: ENERGY SECURITY

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What impact will climate change have on your energy future?

WHEN the Apollo 11 mission reached the moon's Sea of Tranquility on July 20, 1969, the pictures that the spacecraft sent back to earth captured the imagination of people everywhere, for with the first moonprint and other iconic images that were flashed across television screens and printed in newspapers, we were able to see our planet for the first time as an exquisite blue and white sphere shimmering with radiance against the dense blackness of outer space.

What those images also unequivocally brought home to us was the vulnerability of our world as it spun in silent solitude on its inexorable path around the sun. Nearly four decades later, this perception of planetary fragility has been deeply reinforced by the threat of climate change on a scale that could well make many regions, and particularly many sections of our coastal metropolitan cities, uninhabitable for generations to come.

Chacaltaya, meaning "cold road" in Aymara, the language spoken by the Aymaran people of the Andes, is one of the highest glaciers in South America. Thought to be as much as 18 000 years old, it previously provided much of the area's water supply during the dry season from the slow release of its glacial melts.

However, having lost more than 80% of its area in the past 20 years, Chacaltaya has become a universal symbol of the effect that global warming is having on our planet, as the glacier's once 500-metre length has dwindled to just two, smallish patches, which Bolivian glaciologists believe could disappear altogether within a year.

Because a vast amount of energy is needed to thaw ice, glaciers and icecaps act as an energy barrier against the planet overheating. They also act as vast mirrors reflecting a significant proportion, as much as 70%, of the sun's heat into space in an albedo effect.

To lose northern hemispheric glaciers, such as Chacaltaya, could be extremely serious in terms of global warming, especially if seen in the context of positive feedback mechanisms whereby a relatively small increase in temperature causes a vastly disproportionate increase of carbon dioxide in the atmosphere, thereby amplifying carbon-induced climate change.

ABOVE AND BELOW: PHOTOGRAPHS COURTESY OF ESKOM

Dramatic disequilibrium and shock waves

Climate and weather patterns are powered in a continuous, interactive cycle of energy exchange with the atmosphere, hydrosphere, lithosphere and biosphere impacting on each other in a synchronicity of processes that have maintained a thermostatic equilibrium of around 15ºC for the past 10 000 years, or since the last Ice Age ended.

At the heart of earth's thermostat lies carbon dioxide, a colourless and odourless gas that plays a critical role in maintaining the balance that is necessary for life to exist on the planet.

As a key component of photosynthesis, it occurs naturally in the air, however, it is also a particularly long-lived anthropogenically produced greenhouse gas associated with global warming, and by far the biggest contributor towards an increased level of carbon dioxide in the atmosphere, is the burning of fossil fuels, which power human progress with its ever-upwardly spiralling dependence on energy consumption.

Over the past 10 millennia, the planet has warmed by a global mean average of 5ºC, which is the fastest rise recorded in recent earth history.

By 2030, when the world's demand for electricity has climbed to around 8 000GW and carbon emissions have risen by an estimated 52%, the global climate could have warmed up to such a degree that a rapid increase in temperature, occurring in tens of years and not thousands of years as has predominantly happened before, could send the world's climate into a state of dramatic disequilibrium and with it shock waves throughout every natural and human system on the planet.

Closing window of opportunity

On February 1 this year, a date which marked the eve of the release of the Intergovernmental Panel on Climate Control (IPCC) Fourth Assessment Report on global warming, Parisian authorities switched off lights around the city, extinguishing Paris's most famous landmark, the Eiffel Tower, for five minutes. This eloquently symbolic gesture was intended as a worldwide climate call-to-arms, for if we continue on a course of business as usual for the first half of this century, we put civilisation as we know it at risk.

Already, there is evidence of a global weather machine being pushed beyond stability as hurricane activity has intensified in the United States, and parts of Britain have had to mop up after the worst flooding for 60 years. A heat wave in Hungary has claimed up to 500 lives and wildfires in Greece and Italy have devastated thousands of hectares of forests and national parks. In parts of Asia, there has been massive monsoon flooding and across Africa climates have reached new and dangerous extremes of flooding and drought.

If our civilisation is to avoid catastrophic devastation brought about by climate change, it has been estimated that the global mean temperature needs to be kept within the bounds of a further 2ºC and as .63ºC of warming has already occurred, there is a latitude of only 1.3ºC of temperature increase.

According to the IPCC, keeping the mean temperature rise to between two and 2.8ºC will require the stabilisation of atmospheric carbon dioxide concentrations at between 445 parts per million (ppm) and 490ppm. Although still catastrophic for ecosystems and huge numbers of people around the world, it is hoped that this limit will keep the global climate from crossing a dangerous and perhaps irreversible threshold.

However, as atmospheric concentrations of carbon dioxide are already at 380ppm and rising at a rate of 2.54ppm a year, as opposed to an average increase of 1.8 ppm a year over the previous decade, the window of opportunity for reducing carbon emission levels is closing more rapidly than previously thought and a more realistic scenario may be stabilisation of atmospheric carbon dioxide at 550ppm, with a corresponding increase in global temperature of around 3ºC this century.

With global warming having the potential to bring about the end of our civilisation by plunging the world into a climate-induced dark age, the only way forward is to impose a stringent carbon budget on humanity through sustainable, long-term emissions reductions. In purely monetary terms, the cost of taking action could be around 1% of world GDP a year, however the cost of not taking remedial action could be much higher – around 5% of GDP. Beyond that, failure to take timely precautionary action could literally cost the earth.

Threats to a sustainable future

Sustainability is a simple idea. Recognising that the planet has ecological limits to growth and that resource depletion occurs when resources are consumed faster than nature can produce or renew them; it is a dynamic process whereby a balance is sought between society's demand on nature and nature's capacity to meet that demand, taking into account the ability of future generations to meet their needs.

In a nutshell, sustainability means caring for natural resources so that they can be used indefinitely, thereby averting an ecologically insolvent future. It means living within the means of our one planet in a way that is responsible and accountable, looking after people, protecting the environment and ensuring economic growth.

When Edison's first central power generating station began operating in Pearl Street, New York, in September 1882, lighting about 3 000 lamps in the area, a steam-powered way of life ended and a less sustainable, electricity-powered one began.

Clean to use, reliable, smoke-free and fume-free, electricity was a marvel of modern ingenuity, powering progress and pushing human aspiration, initiative and productivity to new heights, opening the way to a booming world economy and increased standard of living.

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