

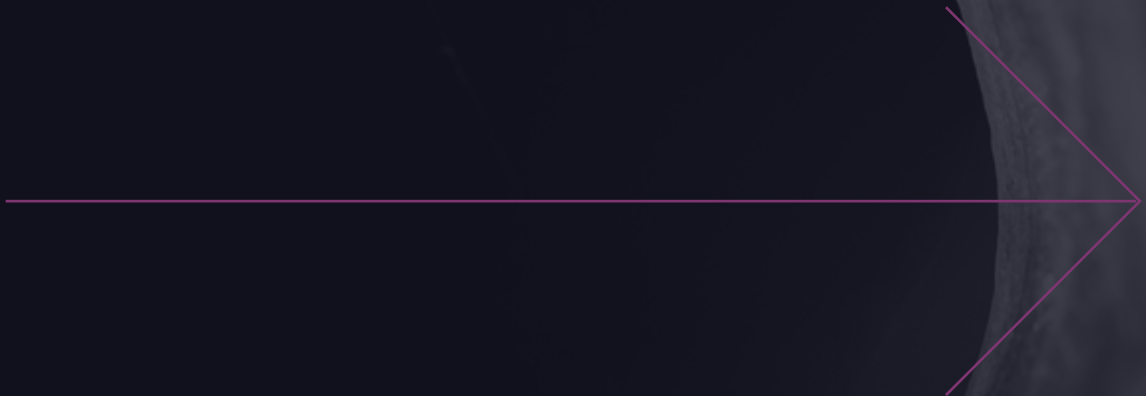
climate tech

for a Sustainable Planet

Quarterly review
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FOR TOMORROW

Perspectives from Capgemini





Pascal Brier

Group Chief Innovation
Officer and member
of the Group Executive
Committee

Pascal Brier was appointed Group Chief Innovation Officer and member of the Group Executive Committee in 2021. Previously, and starting in 2005, Pascal was a member of the Executive Committee of the Altran Group. Since September 2018, he was Executive Vice-President of the Altran Group in charge of Strategy, Technology, and Innovation, based in the Silicon Valley. In this position, he drove Group strategy, the portfolio of offers, marketing, and service lines, as well as the implementation of the research and innovation roadmap and the Group's high-value-added activities (Altran NextCore). Prior to this, he was Executive Vice President in charge of Altran's global accounts and business development for the Group.

INCREMENTAL
AND
DISRUPTIVE
INNOVATION IS
THE ROUTE TO
SURVIVAL

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The struggle for sustainability is a game with high stakes. Global targets to reduce carbon emissions are being set against the backdrop of a fast-growing global population and untenable pressure on our finite natural resources. We believe the only answer to this seemingly impossible equation is to innovate.

Let's consider the equation in more detail, beginning with carbon-reduction targets. To limit global warming to no more than 2°C – and avert the worst impacts of climate change, as called for in the Paris Agreement – global greenhouse-gas emissions would need to be cut by 45% by 2030 and reach net zero by 2050.¹

Let's also consider in parallel population and economic growth. Fifty years ago, there were just under 4 billion people on the planet; since then, that figure has doubled to more than eight billion. The UN predicts the global population could rise to close to 10 billion by 2050.² Combine this with the rapid growth of developing economies and aspirations of improved standards of living across the globe and, by 2050, we may need 40% more water and energy to sustain ourselves.

Finally, let's consider our resources. Fossil fuels – including coal, oil, and natural gas – currently supply about 80% of the world's energy needs. However, these resources are finite and nearing exhaustion: we have already passed peak oil and coal, and peak gas is on the horizon. In addition, their detrimental effect on the environment and our own health is well documented.



1 <https://www.un.org/en/climatechange/net-zero-coalition>
2 <https://www.un.org/en/global-issues/population>



Combine these factors and the complexity of the equation is alarming:

How can we produce sufficient energy to support 10 billion people, while also slashing carbon emissions, all as macro-economic chaos rages around us, arising from pandemics, geopolitical tensions, and other, as yet unknown, exogenous shocks?

In short, we are in a climate and energy emergency. We are all the time asking more of a planet that will soon have no more to give.

To solve the equation, we believe there is only one solution, consisting of two interdependent approaches: frugality and innovation.

"We are all the time asking more of a planet that will soon have no more to give."

The energy transition: aiming for responsible frugality

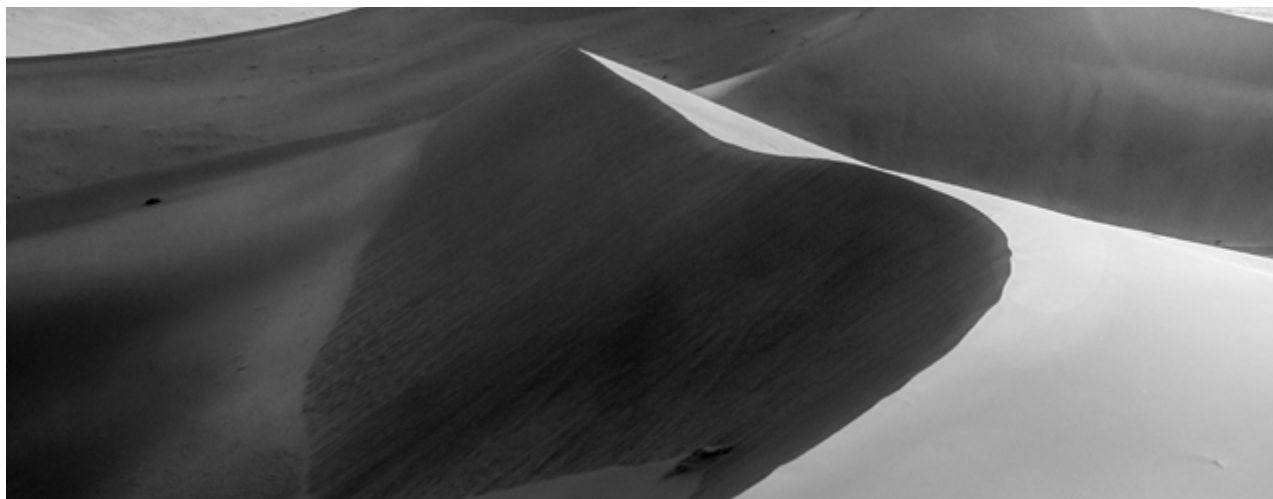
Frugality boils down to a global commitment to an economy of both production and consumption.

The first level of frugality – which I would describe as “responsible frugality” - means choosing to do things differently. This kind of frugality **halts** unnecessary waste and emissions, but allows for the continuation of everyday activity, albeit in a **more sustainable manner**.

For example, individuals will still be able to drive a private car, but car manufacturing would be systematically optimized to require fewer natural resources. We would build cars using lighter materials; maximize recycling in the manufacturing process; replace road-supply chains with more efficient rail and shipping infrastructure; encourage car dealers to reduce their energy and water use; and actively develop alternatives to individual ownership. With

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responsible frugality, it should still be possible to enjoy motoring without causing devastation to the environment.

However, getting to this point involves major challenges, whether that's encouraging behavioral changes, setting regulations, or evolving economic imperatives. Moreover, as populations rise and finite resources dwindle, moderate frugality of this nature is unlikely to be enough to maintain equilibrium. Full frugality would involve a radical change to our current way of life: no air travel, no devices, no concrete, no meat – and that's just the start.

However, such an austere approach is both unfair and fundamentally unrealistic. It is unfair to expect developing countries, who have done comparatively little to contribute to the current climate-related issues, to give up on their dreams of economic prosperity. The developed world has long been accustomed to a consumerist lifestyle and, understandably, the developing world wants to experience the benefits of that as well. Equally, citizens in developed economies will not take kindly to being asked to degrade their lifestyles precipitously. It is not realistic to ask people to give up all their personal comforts and aspirations, for themselves or for posterity.

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PINNING ALL OUR HOPES ON FRUGALITY GOES AGAINST HUMAN NATURE.

So, while there is much to be said for the frugal route, pinning all our hopes on frugality goes against human nature. The notion that we can put a hard break on established patterns of behavior is both unrealistic and counterproductive, leading people to believe there is no longer anything worth fighting for.

This is where **innovation** comes to the fore.

Essentially, **the more we are innovative, the less frugal we will have to be.** By investing in innovation now, we can develop an answer to the intractable equation of a fast-growing global population balanced against finite natural resources, and an increasingly jeopardized overall climate balance.

Changing the world for the better

This innovative route will include both incremental and disruptive paths.

Incremental innovation involves a concerted effort to reduce energy consumption and carbon emissions in both production and consumption, targeting true efficiency from the design phase onward. This is valid for all industries; all companies should be cognizant of their current emissions (scope 1 to 3) and energy consumption. It is the responsibility of all business leaders to reduce their company's environmental footprint by improving product and service design, engineering and manufacturing processes, supply chains, and – at a fundamental level – behaviors and company culture.

The IT sector, for instance, which accounts for a growing 4% of total emissions, is full of new technologies that are deployed alongside the

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legacy systems they are replacing, creating what I call a “technical debt.” As an example, cloud computing is often touted as a major pathway to green IT, but as older systems continue to run in parallel, they will continue to do damage.

Here’s another example: nuclear fusion promises limitless, carbon-free energy. This disruption in power could have a life-changing impact on our economies and societies. But we are a long way from unlocking the potential of nuclear fusion. Scientists will need to figure out how to produce energy on a large scale. They’ll also need to work out how to harvest the energy produced and transfer it to the power grid as electricity. While pioneering developments occur all the time, and while renewables such as solar and wind power are developing, we must also turn the lens of innovation on our existing technologies. For nuclear energy, this could take the form of building smaller, modular nuclear plants that consume fewer resources, are cheaper and faster to build, and allow us to scale up our energy generation without adding to the climate crisis.

Incremental innovation can help to transform our manufacturing chains. Most industrial processes currently rely on traditional methods, such as molding and milling, where only a fragment of the raw material is used, and the rest thrown away or (less than efficiently) recycled, with a significant environmental impact. As an alternative, 3D printing offers a less wasteful approach, where manufacturers use 3D printers to create products using precise amounts of resources with upgraded designs instead of extracting shapes from blocks of raw material.



Fostering disruptive innovation

Disruptive innovation permanently changes the way our societies and economies operate. While disruptions on the horizon could help us address the climate emergency, there's also a series of enduring challenges that we must overcome. Take the example of the transition to new energy sources such as wind, solar, and – notably – hydrogen.

Green-hydrogen fuel cells would be a true disruption: energy for a new generation of devices, emitting water vapor instead of greenhouse gases. Hydrogen-powered vehicles could reduce life-cycle CO₂ emissions to around 60g/km, well below the emissions produced by even electric vehicles (EVs) powered by renewable electricity.³

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³ The Week, “Hydrogen cars explained: fuel cells, efficiency and zero emissions”, September 2021

However, the shift to hydrogen-powered cars will require huge investment in research and infrastructure, whether developing and refining fuel cells or building the gas stations to power vehicles.

Also, the much-vaunted “clean” fuels are inherently problematic; hydrogen is created with electricity powered by fossil fuels. Many people are also concerned about the combustible nature of hydrogen; understandably, no-one wants a potentially explosive fuel cell in their car.

As we create game-changing innovations, we must ensure we disrupt with care. The disruptive impact of nuclear power has been limited because people are afraid of something going wrong with devastating consequences. The past disasters of Chernobyl and Fukushima are still fresh in people’s minds.

Just as nuclear power became associated with a fear of impending disaster, high-profile failures could mean hydrogen struggles to gain public trust. Dealing with the climate emergency successfully will entail ensuring the disruptive technologies we adopt are not hamstrung by an unfavorable public perception.

A natural solution

Another example of an innovation for which there is great hope is synthetic biology, which involves the application of engineering principles to redesign natural systems. Synthetic biology holds the alluring promise of replicating the bounty of nature without depleting natural resources.

One often-cited example is lab-grown “meat,” a synthetic food source that could sustain the ever-growing global population without the carbon-intensive farming of animals. Forecasts in 2020 suggested spending on cultivated meat could reach \$150 billion by the end of this decade.



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Synthetic biology could also give us the means to eradicate disease and bacteria and boost agricultural production. Nevertheless, despite these appetizing opportunities, people retain deep-seated suspicions about the application of such synthetic products.

While the technology that could power disruption continues to proliferate at a searing pace, the governance required to pave the way for innovation is often lacking. We as a global society need to start thinking about this aspect of innovation now, and begin to prepare for true disruption incrementally, so that, when it arrives with full force, we are ready.

Everyone has a part to play

All business leaders must start investigating creative solutions to the climate challenges we face. Sustainability is now a must-have objective, not a long-term nice-to-have. Incremental innovation will be crucial, but at some point, we will be required to intensify our activities and focus on “moon-shot” efforts. All organizations can play a role in this.

Enterprises in the automotive and aerospace sectors, for example, can investigate hydrogen fuel cells and batteries manufactured without rare-earth materials. General manufacturers might think about how advances in synthetic biology could



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help reduce global emissions.

To deliver effective solutions will also require business leaders to understand the role and significance of technology – today, **every business is a technology business**. They must acquire a thorough understanding of how digital innovation can help their organizations achieve sustainability targets.

Let's be clear: there is a huge amount to do in a very short timeframe. We must remain both positive and realistic; humanity is capable of finding solutions to all the problems we face. However, we can't sit back and leave it to someone else to find the answers.

The innovative solutions to our challenges will come from a collective approach. We must each engage with the equation and think about how our organizations will develop an answer to the climate emergency. By working together, we can continue to develop as a society and keep frugality at bay.

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