



Pillars of the Green Transition

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There has hardly ever been a more ambitious undertaking than the global fight against climate change. This is a task requiring an unusual kind of deftness - an ingenuity which must go beyond the carefully crafted strategies of individuals or even countries. Effectively tackling climate change means that the interactions between all social entities, from international organizations and states, down to local communities, corporations, and individual consumers, must be oriented towards the same goal. There is no better way of achieving that than by transforming the way we think about climate change - from a costly obligation, a homework inviting procrastination, to an opportunity for the generation of prosperity. United by this optimistic mindset, our interlocutors testify to the richness of possible approaches to the creation of the green economy of the future - remarkably, both competition and collaboration are lauded, these not being mutually

exclusive in a world where the right guiding lights and incentives are set in place. And here is where governments must clearly step in: not as voluble central planners, but as direction-pointers, consensus-establishers, traffic cops of sorts, whose fundamental role is to set the rules of the game.

Based on conversations with over 100 different industry leaders and policymakers, this report, with its special COP 28 distribution, presents the reader with a unique overview of the global fight against climate change. Focusing on the opportunities also means highlighting the challenges, so that private and public actors alike can get valuable information and, hopefully, transform the latter into the former. While not claiming exclusivity, this piece zooms in the key pillars of the green transition: finance, green energy, transportation, circularity, and the built environment.

Global Vision



MINISTER GRACE FU
| MINISTRY OF SUSTAINABILITY AND ENVIRONMENT,
SINGAPORE

There is a need for affordable, impactful, and scalable technologies accessible to all nations. Trade friction and obstacles to technology transfer must be minimized to facilitate the global transition to low-carbon economies. Collaborative efforts, involving political, business, academic, and financial sectors, are essential.



DR. FATIH BIROL
| EXECUTIVE DIRECTOR,
INTERNATIONAL ENERGY AGENCY

Clean energy is moving fast. Only two years ago, one out of 25 cars sold globally was electric. This year the figure is one out of five cars. Last year, of all the power plants built globally, 85% were clean energy. Thirdly, the amount of investment last year going into solar energy was, for the first time, higher than that going into oil production.

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7 out of 10 large companies
↳ will seek out sustainability skills
when hiring within the next 2 years*

*2023 Morning Consult global study of large businesses with over 1,000 employees

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The Case for Sustainable Finance

For good and for bad, sustainable finance has been center stage for a long time now. For bad, since only about 16% of climate finance needs are being met annually. For good, because it is no longer a niche escapade, but a market driven by a growing number of stakeholders. Best of all, investing in the green transition should make a lot of economic sense today, as estimates predict that global GDP would be 4% higher by 2030 under a net-zero pathway. The key challenge is that benefits would accrue predominantly in the long term, often obfuscating incentives to invest. To remedy that market failure, a combination of awareness, government policies and regulations, and public pressure is needed.

Spearheading the Transition



ZAK BROWN | CEO, MCLAREN RACING
Sustainability is a journey that never reaches its final destination. It is a race with no finish line.



TAMARA VROOMAN | PRESIDENT & CEO, VANCOUVER INTERNATIONAL AIRPORT
I do not see why we would not be able to achieve a “circular airport” in the future where all the energy and waste we consume and produce are regenerative.



JUSTINA NIXON-SAINTEL | VP & CHIEF IMPACT OFFICER, IBM
95% of organizations have set ESG or sustainability goals but only roughly 10% of them have made significant progress. And we believe that data poses the greatest challenge for many of these corporations.



TRISTAN GRIMBERT | EXECUTIVE VP, NORTH AMERICA, EDF RENEWABLES
Besides awakening social consciousness regarding the green energy transition challenges, we would like to continue moving forward in a stable geopolitical environment, rid of conflicts and disruptive events.

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For the right amount of capital to be channeled to the right projects, which are both sustainable and economically viable, the involvement of large financial institutions (FIs) like insurers and banks is critical. Given the track record of underinvestment of global FIs, it is hardly surprising that they are often subject to criticism from the climate-conscious public. Fortunately, under internal and external pressures, as well as due to the growing awareness of climate-related long-term financial risks, more and more major FIs are refocusing their portfolios towards green activities. We spoke with Jennifer Livingstone, VP of Climate Strategy of the Royal Bank of Canada (RBC), which has committed to transition its lending portfolios to net zero by 2050. In the shorter term RBC has pledged to mobilize C\$500 billion in sustainable finance by 2025: “This initiative is steered by a sustainable finance framework that we pioneered in Canada, which not only ensures transparency but also encourages our client teams to develop solutions that align with social and environmental goals,” Livingstone tells us.

Only about

16%

of climate finance needs are being met annually

Source: Boston Consulting Group



One of the principal roles of financial institutions is risk management. As climate-associated risk is increasingly on the agenda of stakeholders, we see it being internalized in FIs’ strategies. Insurers must be particularly sensitive in that regard, since the consequences of climate change may render their whole business model untenable. As Dr. Günther Thallinger, Member of the Board of Management of Allianz, exemplifies: “We now see insurance companies withdrawing from offering services in parts of Texas, California or Arizona, preventing house owners to build on formerly approved spots due to droughts and other climate-related issues that render insurance unaffordable. This clearly illustrates the need for insurers to act on climate change.” The same message is echoed by the CSO of Manulife Financial, Sarah Chapman, who emphasizes that fighting climate change is also a “pivotal business strategy.” Climate risk internalization by large insurance companies is great news, since they are particularly well-placed to accelerate the green transition due to their capacity to make long-term investments (essential for pricy green infrastructure projects) and their risk management expertise.

But neither are private investors alone endowed with the right instruments, nor is public money in itself sufficient to close the financial gap. Synergies are therefore key. Enter PPPs, or public-private

CREATING MUTUAL FUTURES

“As the biggest investor in sustainable infrastructure across the African continent, transforming the way we do business is an imperative. We acknowledge the interconnectivity between the economic, social, and environmental systems we operate in, and we strive to create a sustainable impact across our value chain. There are many opportunities to drive sustainable socioeconomic growth and the only way to champion a sustainable positive future is to create a mutually beneficial ecosystem.”

Iain Williamson, Old Mutual CEO



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Old Mutual Life Assurance Company (SA) Limited is a licensed FSP and Life Insurer.

▶ partnerships - investment collaborations crucial for projects with bulky capital costs, such as energy infrastructure undertakings. PPPs are especially important for developing countries, which tend to lag behind in green investments and where the impacts from climate change are predicted to be most deleterious. For such partnerships to work, investors must improve their expertise and understanding of local specificities, and, above all, discern the rich economic opportunities that the transition offers. Iain Williamson, CEO of Old Mutual Limited, a financial services group operating across Sub-Saharan Africa, testifies to the business case for investing there: “Due to the deficit of energy infrastructure in Africa, there is a great opportunity to ramp it up significantly using only climate-friendly means. Globally speaking, green financing is projected to grow to \$152 billion by 2050 from the present \$20 billion. This growth is skewed in favor of countries that have an energy infrastructure deficit. People often talk about these developments in negative terms, but I think that this is quite compelling, business-wise.” But to attract more investors like Old Mutual, the capacities of local institutions also need to be upgraded.

Resolving the Green Energy Dilemma

There is today a congress of propitious circumstances for renewables. Enhancements in technology, incentivizing legislation, higher fossil fuel prices, energy security concerns, and indeed, the question of reputation have all coalesced to bring unforeseen momentum to the green energy industry. Renewables today account for about 30% of global electricity generation and, for the aforementioned reasons, talking of a trade-off between affordability and environmental protection is becoming obsolete: renewables are presently the cheapest sources of new electricity in most parts of the world.

Falling prices are attracting more and more large corporations to different forms of collaborations with green energy providers. Dan Balaban, CEO and Executive Chair of Alberta-based Greengate Power Corporation, tells us: “Many of the world’s largest companies that are looking to achieve net zero targets have started by making 100% renewable energy commitments.” Greengate has recently struck PPAs (power purchase agreements) with Microsoft and Amazon. PPAs are one form of collaboration that can speed up the green transition.

Transparency and Standards



DR. GÜNTHER THALLINGER | MEMBER OF THE BOARD OF MANAGEMENT OF ALLIANZ
Allianz is fully supporting standardization of green investment practices, as it would dramatically diminish project development time.



DANIEL HANNA | GLOBAL HEAD OF SUSTAINABLE FINANCE FOR THE CORPORATE AND INVESTMENT BANK, BARCLAYS
We urgently need a solution. Interoperability across existing standards and taxonomies is a practical, more immediate action. It helps create a level playing field across different markets and will promote transparency.



IAIN WILLIAMSON | CEO, OLD MUTUAL LIMITED
Although Africa is a heterogeneous continent, clarity is needed from policymakers concerning the framework for public-private participation and joint-infrastructure projects.



FREDRIK EKSTRÖM | PRESIDENT OF NASDAQ STOCKHOLM
There is a need for global transparent disclosures. A lot of good work has been done under the International Financial Reporting Standards Board to align reporting standards globally. A harmonized global framework will benefit not just the corporates but also the investors who are looking for consistent data points.

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Another illustration of the fruitfulness of intra-industry partnerships comes from Africa, where Coca-Cola Hellenic Bottling Company (HBC) seeks to become fully reliant on renewable energy. “We are expanding our renewable energy solutions to Africa, exemplified by our solar panel initiative in Nigeria, a collaboration where we provide the space while the investment partner funds the project. For us, this is a great example of the key role of partnerships for the green transition,” tells us Marcel Martin, Chief Corporate Affairs

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Energy Transition 2.0: Carbon Management's Crucial Role in Global Decarbonization

Carbon capture, utilization, and storage (CCUS) or "carbon management" is a burgeoning industry that can unlock a reliable, scalable, and sustainable energy transition.

Canada-based Svante is making significant strides in the carbon management sector with its innovative, environmentally responsible approach to carbon capture and removal. The company specializes in nanoengineered filters and rotary contactor machines designed to capture carbon dioxide (CO₂) emissions from heavy industrial sites, preventing them from being released into the atmosphere. These filters can also remove existing CO₂ emissions that are already in the atmosphere.

Claude Letourneau, President & CEO of Svante, affirms, "We have the technology to decarbonize heavy industries we all rely on today, such as cement, steel, fertilizer, pulp & paper, hydrogen, and more, in an environmentally and socially responsible manner."

"Preventing CO₂ emissions and removing excess CO₂ from the atmosphere is crucial to achieving a net-zero world."

Traditional carbon capture methods in heavy industries involve liquid chemical solvents, which separate and absorb CO₂ but come with potentially toxic emissions. Svante offers an alternative using solid materials known as solid sorbents. The company's breakthrough technology employs sustainable metal-organic frameworks coated on sheets and stacked to form filters that are integrated into rotating moving bed contactors adjacent to CO₂-emitting industrial facilities. These contactors rapidly trap and concentrate CO₂ from industrial flue gas into a usable, pure form that can be safely stored underground or used in products such as sustainable aviation fuels or consumer goods.

Svante's carbon capture technology is being piloted by leading enterprises in the energy and cement sectors. Their direct air capture technology is also being piloted by Climeworks, a tier 1 direct air capture company, with support from the US Department of Energy.

CCUS in Focus at COP-28

COP-28, the largest annual climate event, brings together global representatives from governments, businesses, and civil society to drive climate action. The challenge at COP-28 is to define a new *Global Energy Transition 2.0* where the fossil fuel industry

becomes part of the climate solution. While this industry has contributed to the problem since the Industrial Revolution, it possesses the technology, expertise, and financial means to rapidly scale and implement CCUS solutions. In the quest for large-scale CCUS deployment, we cannot overlook the role of energy companies.

CCUS is a necessary resource as we scale other decarbonization pillars, including renewable energy and energy storage. We must recognize that transitioning away from fossil fuels cannot happen overnight, especially considering the substantial CO₂ embedded in today's products and economies.

CCUS: The Most Cost-Effective Solution

Preventing CO₂ emissions and removing excess CO₂ from the atmosphere is crucial to achieving a net-zero world. According to the IRENA World Energy Transitions Outlook 2022, achieving net zero requires \$120 trillion in investments by 2050. CCUS solutions offer the most cost-effective path, costing \$2 trillion for a 20% CO₂ reduction.

Governments must incentivize technology providers and industries with CCUS tax policies and build social license for CCUS projects.

The Commercial Path Ahead

Svante is completing the construction of its first commercial filter manufacturing facility in Canada and aims to produce filters capable of capturing one million tonnes of CO₂ from 10 industrial plants worldwide annually by 2025.

Creating a large pool of project examples is crucial, as achieving the necessary number of capture plants to remove 10 gigatons of CO₂ annually by 2050 requires rapid scaling and commissioning of at least two carbon capture plants per week.

As we anticipate the rapid scaling of CCUS, we must continue to work toward the Energy Transition 2.0, as our future generations depend on it.

Svante

Carbon management solutions built for the Energy Transition 2.0.

www.svanteinc.com



“ Long duration storage is critical in the transition to carbon-free electricity grids. Proven, reliable, emissions-free energy storage solutions, like Hydrostor’s A-CAES technology, fills an important gap in a sustainable energy future. ”

Curtis VanWalleghem
CEO of Hydrostor



HYDROSTOR



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and Sustainability Officer for Coca-Cola HBC. The company also is proud of its partnership with Manna Drone Delivery, a company whose drones make deliveries in Ireland. “Coca-Cola HBC appreciated the technology for its potential to revolutionize last-mile delivery services and, importantly, its eco-friendly credentials align with their emissions reduction goal,” Manna’s CEO and Founder, Bobby Healy, tells us. But for such collaborations to become more commonplace, a set of favorable policies and regulations is often necessary.

4%

higher global GDP by 2030



Under a net-zero pathway, as compared to other models.

The New Cold War is Green

Collaborations are vital, but green competition also makes a lot of sense, as some predict that the new green economy may be valued at \$10.3 trillion by 2050. This prospect has incited states and geopolitical blocs to compete for investments in an attempt to spearhead the global green transition. China has had the lead for some time, as Beijing had perceived early on the opportunity to capitalize on the new demand created from the green transition (e.g. the country produces around 80% of the world’s solar panels). But the recent U.S. Inflation Reduction Act (IRA) has challenged that. The IRA is partly meant to serve as a tool to re-industrialize the American economy in a context of pressures for geopolitical regionalization. “If in the past some players in our industry were wary of expanding into the U.S., the IRA completely turned the situation around. This act creates the demand, the incentive to be local, and the visibility of the wind industry necessary to accelerate foreign investment



SANTIAGO SEAGE |
CEO, ATLANTICA
SUSTAINABLE
INFRASTRUCTURE

Green transition is no longer an initiative that needs to be put into effect, it is a reality. And, today, this implies moving beyond solar and wind energy and remaining ambitious about achieving completely green generation of electricity, heat, and energy for industrial applications.

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in this space,” tells us Olivier Fontan, CEO of LM Windpower, a multinational wind turbine rotor blades manufacturer.

Most of our interlocutors have echoed the message of the IRA’s significance. Perhaps surprisingly, given its resounding ambitions, the EU is lagging behind: “There seems to be a mismatch between the political ambition and the practical reality, the gap between the 30 GW-per-year goal and the 15 GW-per-year actual achievement speaking volumes in this sense,” Fontan adds. Giving us the Asian perspective on the attractiveness of the U.S. and EU markets, Nat Vanitchyangkul, CEO Asia of ERM, a global sustainability consultancy, shares: “The IRA is more of a carrot, whereas the EU Green Deal acts as more of a stick. Companies in Asia will respond quite differently to the two. When considering the carbon tax they need to pay in the EU, the majority of businesses in Asia may decide to invest on home soil.” The stick, it seems, is not as attractive as the carrot.

Still, the picture for the EU is not all bleak. For instance, some speak today of the EU’s return to the PVs scene. The 27 EU Member States saw 41.4 GW of new solar PV capacity connected to their grids in 2022, a 47% increase compared to 2021. Whoever has the lead, this new global competition is probably good news, as it is poised to spur innovation and investments.

The Infrastructure Challenge

Despite these developments, some of the principal challenges for renewables remain. Expensive energy storage and grid capacities which were not designed to sustain the volatile nature of renewables are pending issues. Indeed, herein lies the crux of the matter: while the energy renewables generate is cheap, its storage and transmission in many cases render it uncompetitive with traditional sources. For years, policymakers have focused on power generation, forgetting the corresponding investment in grids. “As a result, today a huge amount of renewable capacity in the world is in the queue, waiting to be linked



ESTER BAIGET |
CEO, NOVOZYMES

Biosolutions, such as enzymes and microbes, can cut emissions by 10% and fuel a sustainable world. We need to speed up the green transition – there is no future in a dead planet.

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ANDY COSTER |
CEO, HAMMERFORCE



To achieve net zero, the bottom-line matters. The private sector must take the lead, as government regulations alone won't suffice. Economic viability, backed by global corporations, is the key to adopting sustainable practices across industries.

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to grids. It is like manufacturing the best car in the world—efficient, chic, fast—but forgetting to build the road to drive it on,” as Dr. Birol from the IEA puts it. Adducing a telling example, the CEO of BASF Renewable Energy, Horatio Evers, shares: “The challenges in that respect can be illustrated by our investment in the Netherlands. Grid bottlenecks make it hard to transfer the produced power to our sites in Belgium and Germany, so more investment in grids is essential.” The chemicals giant’s newly founded green energy subsidiary expects that their offshore wind park in the Netherlands will be the largest in the world once it is in full operation this year. Yet, delivering all this new energy to where it is needed remains a hurdle.

Despite the much-commended IRA, the U.S. government has also fallen short of addressing the infrastructure challenge. “While extremely valuable for power generation, the IRA is overlooking the importance of energy transmission, which is further hindered by the regulatory structure in the U.S. Now that we need to move vast amounts of low-cost clean power from Arizona to California, the whole imagination of a local power company does not match the obligations of the 21st century,” notes the CEO of the American Clean Power Association, Jason Grumet.

Governments are essential to channel resources, but so are private actors that generate innovative ideas. We spoke with Prysmian, a global electrical cables manufacturer. Pointing to the significance of innovative solutions of companies like his, Prysmian’s Chief Innovation and R&D Officer, Srinivas Siripurapu highlights: “Our advanced cables facilitate bidirectional power transmission, offering a solution to the varying energy production patterns in different parts of a country or even between continents. Such technology not only allows for more efficient transmission of power but also provides redundancy to cope with fluctuating renewable energy production.” Solutions like Prysmian’s also promise to alleviate geographical disparities by, for example, supplying Germany’s industrial South with green energy from the North’s offshore wind power.

The Storage Challenge

Transmitting green energy is an issue, but so is storing it cost-efficiently. The intermittency of wind and solar entails that we need considerable storage capacities that can absorb superfluous energy in peak generation moments and plug it back into the system in low generation periods. “Long-term storage solutions are as of today still the Achilles heel of renewable technologies. Today there is no commercially viable option for transferring large amounts of energy from summer to winter,” explains Christoph Brand, CEO of the Swiss energy giant Axpo. The good news is that more and more energy companies, such as Axpo or EDF Renewables, are investing in storage, looking for ways to reduce costs. Sonia St-Arnaud, CEO & President of EVLO, a Canadian company providing lithium-ion battery energy storage solutions, confirms that costs are already going down: “The cost of battery storage systems decreased a lot during the last years, and the final expense also depends on the price of electricity at the location of the project. The U.S. and Canada have proved to be receptive to our product, so we must have made a compelling selling proposition cost-wise.”

While work is ongoing to optimize traditional batteries, alternatives are also emerging. An example of a company providing a different solution is Toronto-based Hydrostor, which offers Advanced Compressed Air Energy Storage (A-CAES). “We store compressed air in a rock cavern under water pressure as potential energy. This entails that our sites require less water and space,” Hydrostor’s CEO, Curtis VanWalleggem explains, noting that, unlike more established compressed air techniques, theirs does not burn gas, nor does it require sited salt caverns, rendering their energy storage systems flexible. Regardless, the costs for storing the huge amounts of energy needed if our grids are to become fully green remain too high at present. Once again, innovation and investments are the answer.



BRUNO LOPEZ |
PRESIDENT &
GROUP CEO, ST
TELEMEDIA GLOBAL
DATA CENTRES



The Wustermark data center campus is an ambitious project we are quite excited about, as it stands to be possibly the largest green data center campus in Europe. Central to this project is the adjacency to one of the country's most expansive contiguous onshore wind farms, which provides vast quantities of renewable power to the region.

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\$338 Bn

Global investments in energy storage and power grids in 2022

Source: Statista Research Department



The Many Shades of Green



ROD VAUTIER | PRESIDENT, BIOWISH TECHNOLOGIES

We want to underscore that profitability and sustainability are not mutually exclusive; in fact, they should and must co-exist.



SONIA ST. ARNAUD | PRESIDENT & CEO, EVLO

Velocity and focus are required for the global green transition and that's why we must work together starting today, across industries and across countries.



DAVID EVA | CEO, CAPSTONE INFRASTRUCTURE

Batteries today are made almost entirely in China. As the security of supplies and core materials comes to support the energy transition, the question of diversification of supply chains becomes more and more pressing.



CHRIS ASHTON | CEO, WORLEY

We are now collaborating with Occidental to deliver the world's largest direct carbon capture facility in West Texas; in South Texas, we are working on a direct capture hub. We have a project in Malaysia, called Kasawari, which will be the world's largest carbon capture facility.



LUIS CABRA | DEPUTY CEO, REPSOL

We are committed to a balanced energy mix that evolves to become more decarbonized each year. Our objective is not to abandon oil and gas abruptly but to balance their production with a robust expansion into renewables

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CHRISTOPH BRAND | CEO, AXPO

Energy sources are highly dependent on geographical locations and while there is no one-size-fits-all solution, it seems likely that thanks to their cost benefits, PV solar and wind will gain a much bigger share of the energy mix overall.

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The Parallel Way

Solar and wind might be the most popular forms of renewable energy, but they are not the end of it. Santiago Seage, CEO of Atlantica Sustainable Infrastructure shares his vision that “a green transition requires having a diversified mix of technologies, which is why we are working on projects ranging from the development of traditional photovoltaic plants to more innovative hydrogen-powered technologies that both generate green energy and lend themselves to industrial uses.” Many of our interviewees share this approach, insisting on the perils of overlooking other eco-friendly energy sources, including nuclear. Christoph Brand from Axpo highlights the ongoing relevance of controllable energy: “With inconsistent climate conditions, controllable energy forms will continue to play an important role in the future. Thankfully, today we have more than enough technological solutions to generate carbon-free electricity.” NexGen Energy is a Canadian company focused on delivery of uranium whose ROOK I is “the world’s largest and highest-grade uranium project,” in the words of its President & CEO Leigh Curyer. Curyer highlights the innovative and sustainable approach its company has to uranium mining. Regarding the acceptability of nuclear energy, Curyer insists: “Public perception of nuclear energy is shifting thanks to the growing awareness of the science and global policy momentum. Nuclear energy is the linchpin of the energy transition. It offers a zero-carbon emission alternative - a critical advantage in the worldwide effort to mitigate climate change.”

Geothermal energy also comes to the fore today. Unlike wind and solar, geothermal does not require expensive storage and transmission capacities. We spoke with Ormat Technologies, a geothermal energy company that also makes use of its technology to capture waste heat (e.g. from cement or glass manufacturing plants) and convert it into electricity. Its CEO, Doron Blachar, points out: “While the upfront cost may be four times that of solar or wind facilities, geothermal plants operate 24/7, 365 days a year, making them more cost-effective

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LEIGH CURYER |
PRESIDENT,
DIRECTOR AND CEO
NEXGEN



The world is at a critical juncture where the shift towards sustainable energy sources is not just necessary but urgent. NexGen is ready and uniquely positioned to be at the forefront of this transition.

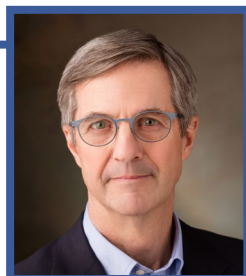
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in the long run.” The drawback, Blachar acknowledges, is that this type of energy is geographically constrained.

There is still another way of looking at the green transition. Rather than focusing exclusively on not generating emissions, a whole industry is in motion today with the aim to prevent carbon from leaking into the atmosphere, and to remove that which has already been released. We spoke with a leading actor within the Carbon Capture Utilization and Storage (CCUS) industry, the Canadian company Svante, whose President & CEO, Claude Letourneau, said that CCUS should capture 20% of the CO₂ in the atmosphere by 2030. This is a daunting prospect, but equally a great opportunity for companies in this space to capitalize on that gargantuan and, crucially, vital for our planet effort. Svante’s focus is on decarbonizing industries that work on fossil fuels, such as the cement and steel industries. “We are building a factory as we speak in Vancouver, BC, Canada, involving a



BILL WYATT |
EXECUTIVE DIRECTOR
OF AIRPORTS,
SALT LAKE CITY
CORPORATION



Salt Lake City Airport is on a mission to electrify the entire campus as a critical step towards enhanced sustainability. This ambitious goal will more than double the airport’s electrical load, underscoring the commitment to transition to green energy sources like solar and wind power.

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\$100 million investment. That plant will have the capacity to equip ten carbon capture plants, each holding 1 million tons of CO₂ per year, every year. That means that our filter technology will prevent 10 million tons of CO₂ from entering the atmosphere annually.”

In summary, there are many potential paths which could lead to the green energy system of the future. At least for the moment, none of them is perfect. But that should not be discouraging, for, as Letourneau phrased it, “we should think of the urgency for action as if a tsunami were approaching. In other words, it is fine to start deploying imperfect solutions, since one learns by acting.”

The Green Journey

Connectivity, fast and efficient transportation are indispensable elements of the modern world. It was not so long ago that taking a flight or boarding a ship to go on a trip across the ocean was mostly a luxurious undertaking reserved for the few. COVID-19 showed us what it means to revert to the parochial ways – nobody liked it, least of all the economy. Perhaps less conspicuously, but a similar dilemma may hover over us when we think of climate change – should we save the planet, or should we travel, get the economy going, have fun, see our loved ones? As with COVID-19, the answer may seem straightforward – preservation comes first. Luckily, the dilemma may prove to be false. Transportation can, and in fact it is, transforming into a more sustainable industry. The main question is: At what cost? Should traveling become a luxury again? The short answer is no. The long answer is more complex.

It is not the easiest time for aviation. The pandemic was a huge blow to the industry, and so was the war in Ukraine with corresponding spikes in energy prices. “Covering our costs, after the 2022 timeframe when they grew astronomically, is no easy feat,” admits Marie Owens



MAURICIO GUTIERREZ |
PRESIDENT & CEO NRG



The essence of a smart home is connectivity, where NRG acts as a pivotal touchpoint, optimizing and managing home energy just as we have managed power plants. This involves reducing consumption when prices soar and vice versa, underscoring a shift from a supply-centric to a demand-responsive energy model.

**as of Nov 20, 2023, Mr. Gutierrez is no longer with NRG.*

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Vancouver International Airport (YVR) is leading the way in decarbonizing aviation

To reach global net zero targets, the aviation community must combine efforts to remove carbon emissions from air travel while maintaining connectivity and supporting the green economy.

Airports and airlines can't do this alone — we need all industries to work together on solutions that will protect the planet for generations to come. Join a team of global innovators to take real action towards decarbonizing aviation at yvr.ca/NetZero2030.

President & CEO
Tamara Vrooman
speaks to YVR's
commitment to
Net Zero 2030.

Learn more in
this special issue.

How YVR is achieving Net Zero 2030



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- Modernizing EV charging infrastructure for a fleet of electrified airside and passenger vehicles
- Utilizing a specialized, battery-powered de-icing truck to transport and heat de-icing fluid
- Transporting passengers via electric buses



ADVANCING THERMAL ENERGY SOLUTIONS

- Building one of Canada's largest geexchange systems to harness the earth's own heating and cooling properties, backed by high-efficiency boilers using renewable natural gas



CONVERTING TO RENEWABLE FUELS

- Uniting industry leaders to bring sustainable aviation fuel (SAF) to YVR and exploring a supply chain for made-in-British Columbia SAF
- Using renewable fuel (hydrogen and renewable diesel) in vehicles that can't be electrified today



UPGRADING OUR WATER SYSTEMS

- Using solar thermal collectors to heat water in our main terminal building
- Exchanging gas water heaters with efficient heat pumps, some of the first to be installed in British Columbia



LIGHTING A BRIGHTER FUTURE

- Powering airfield lighting systems with electricity instead of diesel generators thanks to energy storing flywheels
- Replacing lights across the terminal with energy-efficient LED equivalents



Learn more about
YVR's climate
initiatives and join
us in pursuit of
net zero



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OUR GOAL IS TO BE NETZERO BY 40

Over the past 12 years, we have halved our direct emissions and reduced emissions across our entire value chain by 30%.

Thomsen, Senior VP Sustainability & Chief Economist of the International Air Transport Association. “The weight of the energy component for airlines is now almost 30%. Compared to crude oil, there has been a much greater price increase for jet fuel over the same period of time,” she adds. It is hardly surprising, therefore, that the sector is transitioning slowly. “In 2022, the volume of sustainable aviation fuel (SAF) produced was 0.1% of what we

Faster. Better. Greener



HARRY SOMMER | PRESIDENT & CEO,
NORWEGIAN CRUISE LINE HOLDINGS

We are pioneering the use of green methanol and biodiesel, while still actively exploring other future fuel alternatives like hydrogen and ammonia. We are not solitary in this journey - collaboration with entities like the EU underscores our collective pursuit of innovative and sustainable solutions



JIM SZCZESNIAK |
COO, HOUSTON AIRPORT SYSTEM

Sustainability and affordability are closely intertwined, and we address this by focusing on the long-term benefits of our initiatives. We invested around \$28 million in 18 sustainability projects, yielding annual savings of approximately \$7 million when combining natural gas and electricity reductions.



JULIA PALLE | SUSTAINABILITY DIRECTOR,
FORMULA E & SUSTAINABILITY ADVISOR,
EXTREME E

Our ambition is to showcase the fact that electric vehicles are powerful and reliable. Because we have been continually updating the battery capacity of our vehicles, now all cars can reach 320 km/h, whereas the first generation cars were not even reaching 200 km/h.



JAN PETERSON |
MANAGING DIRECTOR SPORT, NEOM

As part of our strategic partnership, McLaren will become a tenant of OXAGON's Research and Innovation Campus. The Campus will house researchers, innovators, and entrepreneurs from corporates, applied research institutions and start-ups focused on using next-generation technologies to drive clean industry and manufacturing.

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MARCEL MARTIN |
CHIEF CORP. AFFAIRS &
SUSTAINABILITY OFFICER,
COCA-COLA HBC

Our investment in innovation and partnerships has been instrumental in advancing our sustainability agenda. These innovations are pivotal in reducing emissions and waste, marking significant strides towards our overarching sustainability goals

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consume. Differently put, this whole market is simply non-existent at scale,” Thomsen shares. SAF is produced mainly from vegetable oil and other feedstock. It can presently be blended with traditional jet fuel in a proportion of 50%, but this is to grow in the next few years. The problem with SAF is its cost, as it is currently two to four times more expensive than traditional fuel.

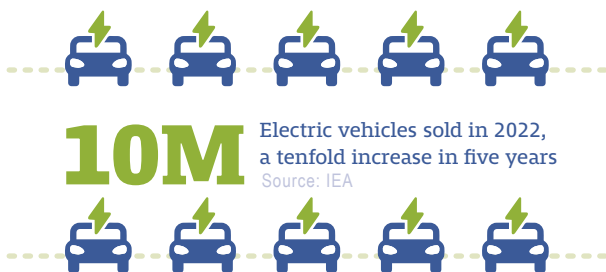
The biofuels market in general, and specifically that for SAF, is still small, making production at scale a challenge. To accelerate biofuels and SAF production, incentivizing regulations are key. These can have a broad impact, as biofuels can be adopted not just by aviation, but also by the marine, rail, and other sectors. It is largely due to regulations that SAF is expected to reach 10% of aviation fuel in North America by 2030.

Simultaneously, some industry players, particularly in the business aviation segment, have already started deploying SAF on a voluntary basis. Victor, a charter broker based in the UK, has partnered with Neste, a leading SAF producer, to enable its customers to voluntarily buy SAF for their private jet bookings. To our question whether the wider utilization of SAF should make flying an exclusive affair, Victor's co-CEO, Toby Edwards, notes: “if one in five of all flights included 30% SAF today, that would equal 18 million tons of SAF, getting us roughly to where we need to be to achieve aviation's Net Zero ambition in 2050.” In other words, the financial burden need not fall on economy-class flying passengers. But for SAF to be adopted at scale, it is essential that the right policies are in place to incentivize its mass production. Some countries, like the U.S. and Canada, are already progressing on that front. Andrew White, CEO of CHAR Technologies, a company specializing in the production of renewable gasses and biocarbon, corroborates: “While getting through that scalability is a challenge in itself, nowadays we are fortunate that there are incentives like the IRA to get to a more competitive price point for the products that we are trying to commercialize.”

CHARTECH

In addition to the type of fuel it uses, aviation can improve its sustainability credentials by making the design of jets more efficient. Holly Boyd-Boland, VP Corporate Development of Virgin Atlantic, emphasizes the airline’s achievements on that front: “We are a 41 aircraft fleet, all twin engine, approximating 80% next-generation engines (the most efficient available). By 2027 we will have 100% next-generation engines. Accordingly, over the last decade, we have reduced our carbon footprint by 35%.” Working in the direction of improved airplane design, the Canadian business jet manufacturer Bombardier has the ambition to be the industry leader in the ongoing transformation toward sustainability having committed to that end 50% of its R&D investment by 2025, its Senior VP of Engineering and Product Development, Stephen McCullough, informs us. The company is presently working on its EcoJet design, which is set to reduce the amount of energy consumed by an airplane by 20% once it becomes operational.

Airports are often overlooked in the talk about sustainable aviation. But their key role for the transitioning of the industry made us approach some of the greenest airports on the globe. Tamara Vrooman, the President & CEO of the Vancouver International Airport, which has committed to investing C\$135 million to achieve net-zero carbon emissions by 2030, highlights the relevance of airports: “Our airport is the largest building in all British Columbia, which means that making our operations net zero from end-to-end is no small feat.” As if to exemplify all the invisible aspects of an airport that would need transitioning, Vrooman shares: “In all our gates we have installed plug-in capabilities that allow our airplanes to charge using hydroelectric power, saving hours of “idle” fossil fuel emissions. We are also working to electrify or use biodiesel for all the airport’s baggage systems and the handling of ground equipment.”



Northeast of Vancouver is the important regional hub of Edmonton. Myron Keehn, the President & CEO of Edmonton International Airport, illustrates how an airport can also become a testing ground for sustainable innovations: “Our team works with local companies looking to scale up as well as international companies interested in entering the North American market by leveraging our airport ecosystem to pilot and demonstrate their technology.” Keehn is particularly proud of its partnership with Dragon Heat, one of the Airport’s incubator companies, which created an oil gas technology that Edmonton co-developed to put together an aircraft heating system that considerably reduces carbon emissions. “The new aircraft heating system eradicates problems seen with existing solutions that generate moisture, undesirable for aviation equipment. Our approach created a dry heat solution that significantly reduces carbon emissions, with the potential for zero emissions. This technology has since found applications beyond aviation.”



ISHAN PALIT |
CHIEF OPERATING
OFFICER, TÜV SÜD

Independent verification and validation of measurable outcomes of sustainability efforts will be the single biggest driver of widespread adoption of meaningful commitments

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From the skies we move to the ground. Motorsport is fun, but it is not all about fun. Believing in the exemplary role of sport, we spoke with Zak Brown, CEO, and Kim Wilson, Director of Sustainability of McLaren Racing, which has achieved a 22% reduction in GHG emissions since 2021. “McLaren Racing is uniquely placed as we are the only F1 team that races across five series: F1, IndyCar, our two electric series Formula E and Extreme E, as well as eSports. That gives us an incredible opportunity to share insights, learnings and best practices around sustainability and use our global platform to advocate for positive change,” they declare. Brown is certain that McLaren’s green commitments will have an impact on the public by popularizing, for instance, electric vehicles among their fanbase.



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SRINIVAS SIRIPURAPU |
CHIEF INNOVATION AND
R&D OFFICER, PRYSMIAN



Cables are acknowledged to be key to the energy transition and digital transformation of communities. To meet the ever more challenging market needs, we have boosted our R&D investments to launch sustainable solutions with tenets of circularity, smartization and carbon footprint reduction of the whole value chain.

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► Mindsets are indeed quickly changing, as only two years ago, one out of 25 cars sold globally was electric, whereas this year the figure is one out of five cars. But competitions like Formula E and Extreme E have another important role to play. Julia Palle, the Sustainability Director of Formula E, highlights the technology-generation function that Formula E has: “The cutting-edge technologies developed by our teams for race cars will be transferred to everyday road cars. Maximum long-term innovation transfer is four years, not more. Jaguar, for example, after developing new technology in its racing cars, soon after introduced a software update to all its circulating I-PACE models, enabling all users to increase their battery life by 10%.”

The Circular Economy

Large consumer goods corporations are juggling to incorporate sustainable practices while keeping prices affordable. “Despite surveys suggesting a high readiness, the practical scenario in stores reflects a stark contrast as the majority of consumers will not pay a premium for sustainability alone,” Virginie Helias, CSO of Procter & Gamble (P&G) tells us. To retain competitiveness and achieve sustainability, therefore, companies like P&G choose to focus on innovation. “Being able to deliver sustainability with no trade-off requires significant innovation,” Helias shares.

Recyclability is one potential answer to the cost-sustainability dilemma, but it comes with its challenges. “Products like diapers and feminine hygiene items are difficult to recycle. However, the company is exploring innovative materials and end-of-life solutions to promote circularity in business processes,” says Lisa Morden, Kimberly-Clark’s Head of Sustainability. The packaging industry faces similar obstacles. Ole Rosgaard, President & CEO of Greif, a global packaging company, shares insights concerning Greif’s plastics portfolio: “The primary challenge in plastic recycling is reaching our customers’ customers to collect used products. While technology exists to repurpose plastic, the collection remains a challenge.” Greif is working hard to improve collection of used packages, including by communicating actively with policy-makers to ensure the right regulations and incentives for consumers to return their packages are in place. To improve collection rates, such dialogue is essential. Tarun Manroa, EVP & CSO of Berry Global, a large producer of plastic packages, confirms: “There is a pressing need for a multi-faceted approach involving governmental support, consumer education, and innovations in recycling technology to address this issue effectively.” Action on this front is called for by all our interlocutors, as beyond its positive impact for the environment, recycling can lead to profits for consumers and companies alike.

The Silent Revolution



Sustainable building rarely makes it into the news. There is to this day a concerning underestimation of the importance of the built environment for the green transition - of all the countries that have submitted NDCs (Nationally Determined Contributions under the Paris Agreement), one third do not cover buildings. Yet, investment in the sustainability of the construction and buildings sectors is fundamental - 40% of annual global CO₂ emissions come from the built environment.

The great news is that, quietly but steadily, the sector is transforming. To gain a proper understanding of this process, we spoke with MIT Professor and architect Carlo Ratti: “In the past century, architect Le Corbusier epitomized two dominant approaches to city planning: a top-down approach, where a single person or entity decides for the whole, and a strict separation between the natural and the artificial world, often failing to harmonize the two.” Ratti and likeminded architects are bringing a new kind of thinking to architecture, one where nature and urbanity are in union. Quoting an example, Ratti tells us: “In the Helsinki Hot Heart project, we leveraged sustainable technology to deal with city heating by utilizing wind power stored in thermal batteries, which are essentially floating islands filled with hot water, a solution much more affordable and sustainable compared to electric batteries. This project beautifully intertwines with nature, resembling floating forests.”

Circularity is in Fashion



KATHLEEN TALBOT | CSO, REFORMATION

The current state of recycling infrastructure in the U.S. is a challenge, with only a handful of states offering effective systems. To tackle this issue, Reformation launched a recycling program in 2014, which we relaunched in 2022 to focus on textile-to-textile recycling.



STEFAN SEIDEL | SENIOR HEAD OF CORPORATE SUSTAINABILITY, PUMA

We aim to make nine out of ten products more sustainable by using preferred materials, for example by increasing the use of recycled polyester up to 75% in 2025.



HENRY HANSEN | CEO, WISEWOOL

Now that we are all starting to recognize the effects of climate change and how it affects our lives, we would like to see more people realize the importance of buying and using sustainable products. In our view, wool is a major piece of the puzzle.



JOANNE HOWARTH | CEO, PLANET PROTECTOR PACKAGING

There are a lot of sheep being raised for their meat, leaving their wool as a by-product with no commercial value. We have taken this waste-stream, diverted it from landfill, monetized it—generating new revenues for sheep farmers—and developed a disruptive product that is replacing a problematic plastic.

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Data's Duality



LARRY LAWRENCE | HEAD OF SUSTAINABLE FINANCE PRODUCTS, INTERCONTINENTAL EXCHANGE

Data is at the core of the decision-making process surrounding the green transition; hence, the need for reliable and transparent data is paramount.



CASSANDRA GARBER | VP FOR CORPORATE SUSTAINABILITY AND ESG, DELL TECHNOLOGIES

AI is expected to significantly increase compute demand, making sustainable IT and data centers essential.



BRUNO LOPEZ | PRESIDENT & GROUP CEO, ST TELEMEDIA GLOBAL DATA CENTRES

To address the conflicting megatrends of exploding AI growth and need for sustainability, we constantly innovate in areas like liquid cooling and clean hydrogen to achieve carbon-neutral operations.



NEELAM SANDHU | HEAD OF SUSTAINABILITY, BLACKBERRY

We are carbon neutral today and, since 2013, we have reduced our direct and indirect emissions by 88%.

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But the more challenging aspect of the revamp of buildings concerns the transformation of already standing edifices – about 80% of the buildings that are to be there in 2050 already exist. Fortunately, the green buildings market is projected to grow at an annual rate of 9.50% until 2030, reaching more than \$1.3 trillion at the end of the decade and allowing retrofitting companies that offer both quality and affordable pricing to obtain significant profits.

KONE is a global elevator company that focuses more broadly on developing sustainable smart urban environments. Its CEO, Henrik Ehrnrooth, reiterates: “If you look at the high energy costs in the building industry, you see that there is a strong case for incorporating sustainable technologies. And higher costs associated with installing basic infrastructure like windows, insulation, facades, and elevators also improve the lifecycle of buildings that in turn help reduce emissions.” More than a reasonable cost, investing in the sustainability of a building can reap profits. The multinational construction and development company Skanska is committed to turning buildings into energy generators: “We have introduced the ‘Powerhouse’ concept, where we develop buildings that produce more energy than they consume throughout their lifetime,” says Lena Hok, EVP Sustainability and Innovation, Skanska.

Conclusion

We asked each of our interviewees about the message they would like to send to the attendees of COP28 in Dubai. A common thread that emerged is that there is, indeed, a strong business case to be made for the green transition. Yes, institutions, governments, major corporations, and consumers still have a lot of work to do - policies are falling short, money is insufficient, and mindsets are hard to change. But today, more than ever, the global community is prepared to look at the fight against climate change as a great opportunity to create a world that is greener, but also richer. Differently put, the affordability-sustainability dilemma may soon be a thing of the past.

Building Sustainably



TOBIASZ STASZAK | AREA MANAGER, NORTH AMERICA, REYNAERS ALUMINIUM

We guide architects and contractors in developing energy-efficient buildings, for instance through the incorporation of passive ventilation, sun shading, and high insulation systems.



GAYLE SCHUELLER | SENIOR VP AND CSO, 3M

We are focusing on enhancing energy efficiency in homes. We have window films that help manage the home's interior temperature to reduce energy usage and roofing solutions that reduce the urban heat island effect and even pull smog out of the air.



GAVIN TOWLER | CHIEF SCIENTIST FOR SUSTAINABILITY TECHNOLOGIES, HONEYWELL

As global temperatures rise, the need for air conditioning is to skyrocket, consequently increasing power demand. It is pivotal to focus on making buildings thermally efficient to mitigate the adverse impacts of climate change.



DOMINIC WRIGHT | CEO, GENERATION 3D

For COP28, we are set to 3D print a pavilion using a mix of recycled plant-based plastic and wood fiber. This project underscores our dedication to innovation and recycling, providing a glimpse into our strategy of weaving together technology, sustainability, and cost-effectiveness



MAHA ALQATTAN | CHIEF SUSTAINABILITY OFFICER, DP WORLD

The current trade landscape often relies on outdated 20th-century infrastructure and cumbersome paperwork, hindering efficiency and sustainability. Through data and digital solutions, we're working to revolutionize cargo movement.

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