

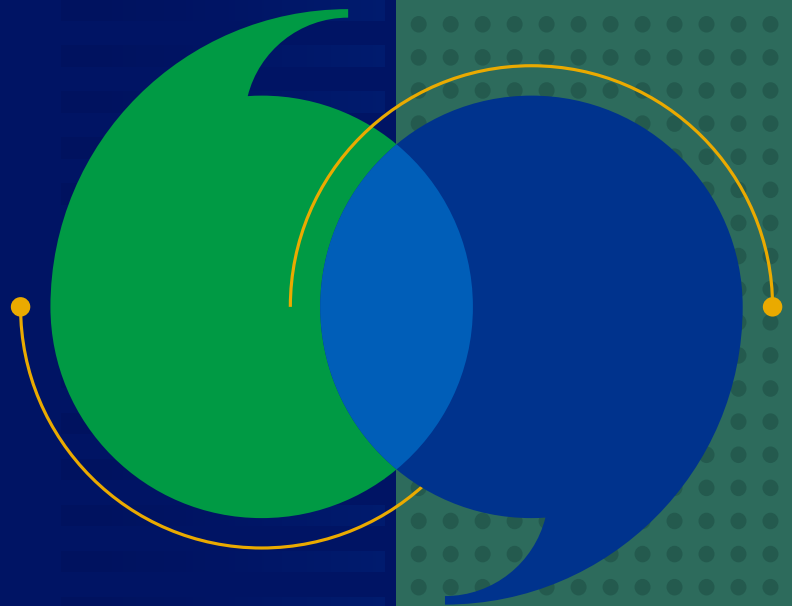


ENRich 2021

Voices on Decarbonisation

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From Anish De

**Global Sector Head – Power and Utilities, KPMG
and National Head – Energy, Natural Resources
and Chemicals, (ENRC), KPMG in India**

This edition of Voices at ENRich 2021 inevitably focuses on the event theme and the issue of our time – Decarbonisation. Post COP 26, there is a new momentum on the initiatives to decarbonise rapidly. We are, of course, still far from the 1.5 degree goal with the current commitments. However, there is a sliver of hope, a cautious optimism that with concerted efforts, we can eventually solve this existential challenge.

There are also, however, grave concerns. Irrespective of the trajectory of decarbonisation, there will be heavy costs for the planet, and especially life on the margins. Extreme weather events have come to be all too frequent already. Consequently, climate adaptation needs much greater attention and resource commitment. The means for both mitigation and adaptation substantially exist already, and will only get better as the best of human intellect applies itself with

greater energy. Behind and beyond the technical approaches, we need humane spirit to be at play. We will be tested on how resilient we are as a society. However, if we put the issues in the open, ideate and play to clear goals, and are principled in our actions, we can possibly overcome those challenges.

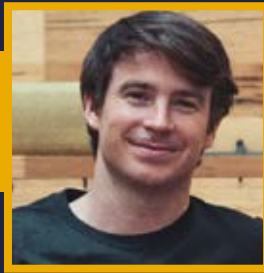
'Voices on Decarbonisation' at ENRich 2021 carries twenty-one expert opinion pieces from within and outside KPMG. Some of these pieces have appeared earlier in the thought leadership publication by KPMG in Australia in September 2021 titled '30 Voices on 2030: The Future of Energy' where the experts imagined themselves to be in 2030 and commented on the theme. These opinions, set in today's time and 2030, provide a well-rounded set of views that I am sure you will find relevant and informative.

List of contributors¹

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The views and opinions expressed herein are those of the persons quoted and do not necessarily represent the views and opinions of KPMG in India.

1. All 'Voices' are arranged in an alphabetical order (as per last names).



Dan Adams

Co-Founder and Co-CEO,
Amber Electric

Consumers have embraced renewables - they can reduce their electricity bills while supporting the energy transition²

How has the consumer affected the push for green energy over the past decade to 2030?

The consumer has played a critical role in driving the energy transition towards renewables. As they became more concerned about the environment and climate change, they sought out more sustainable solutions and this has been accelerated by the falling cost of distributed energy technology including solar, batteries and electric vehicles. Today, consumers are also more circumspect regarding the decisions they make, for example, about what kinds of energy retailers they deal with or the type of smart devices they purchase for their homes. This is particularly true regarding the younger generation.

In Australia, government policy continues to play catch up with the consumer regarding the energy transition. In the early 2020's, when we reached a point of cost advantage for renewables against more traditional fuels like coal and gas, a rush of new businesses appeared focusing on securing more value for the consumer. While some state government policies that came about in the early 2020's were fundamental in the uptake of large-scale renewables, it has been this better value of renewable energy -cheaper power prices - which has facilitated the conversion of consumers to greener energy.

What are the different considerations consumers have about their energy provider today in 2030?

Through Amber Electric, we pioneered a different electricity retail model in Australia. We give consumers direct access to real-time wholesale electricity prices, which incentivises them to use cheaper renewable power when it's available. The traditional retail power model was not doing this - consumers were always paying the same price, whether cheaper renewables were available or not.

They trust us to empower them to take advantage of the cheapest market prices.

In today's market, companies like Amber have enabled consumers to be the driving force in the renewable transition via millions of smart connected devices. We have enabled our customers to move a major part of their energy consumption to periods of the day when power generation is primarily renewable and therefore cheaper; this has facilitated the closure of most coal fired power stations. The coordination, orchestration, and automation of all these devices searches out the most value for customers and supports the transition to renewables. There are a wide range of smart devices out there, so we also integrate with other technology companies to create a seamless experience for customers. By becoming a trusted partner and helping customers navigate this complex world of renewable energy, we help users participate in and progress the energy transition while reducing their own electricity bills simultaneously – it's a win-win.

What impact has technology and data had on the energy sector of 2030?

The green transition is primarily enabled by technology. It is not only about investment in large scale batteries, for example, but is also being driven by software and more intelligent use of existing devices in the home. Giving consumers the tools and technologies to shift their usage to those periods of the day when cheaper renewables are available has been an effective way of both integrating renewables into the grid while making the market much more flexible and resilient. Flexibility has always been valuable in the electricity market. Previously it was flexibility in terms of large scale dispatchable coal and gas generators, but today it's to do with the control and automation of millions of devices in customers' homes - household batteries, electric vehicle chargers, electric hot water systems, air conditioners and heaters.

2. The interview was first published in KPMG 30 Voices on 2030 : The Future of Energy, KPMG in Australia, September 2021

The consumer is still in control - we just provide them with the tools to help them use their devices more intelligently. We allow customers to tell us the constraints of how they want their devices used; we then automate and optimise within those boundaries. For example, we will enable a customer to plug in their electric vehicle at 8:00pm and tell the Amber App "I'd like my electric vehicle charged by 8:00am tomorrow morning". The app will automatically charge the car at 2:00am when, say, cheaper wind power is available, rather than at 8:00pm when power is perhaps being generated by more expensive natural gas power stations. Of course, the consumer can also override the algorithm and still charge their car whenever they like.

If you were a start-up founder in 2030, where do you see the greatest opportunity over the next 10 years - to 2040 and beyond?

Ten years ago, the energy start-up landscape in Australia was nascent but it has evolved as new investors have come into the market. More capital is available that has allowed new start-ups to scale. Australia has been leading the renewable transition

globally, particularly in distributed energy through rooftop solar and household batteries. It is the ideal test market to develop the technologies of the new energy future, like hydrogen, which can then be exported all around the world. This, combined with the growing availability of capital, has accelerated the start-up ecosystem in Australia. This innovation foundation continues to support other opportunities, for example, in transferring our energy technology overseas. Amber and other smart device companies have been using Australia as a technology training ground, improving technology, and then licensing and selling that technology overseas.

The other big opportunity is in the automation of smart devices in the home. This is helping to integrate renewables into the grid and new business models are being developed to enable it. Up to now, energy business models were built around utilities trying to match their retail book with more flexible supply. In the new world, the focus is all about the consumer - how can we help customers use the flexibility of devices in their home to best access renewable power when it's available. To be honest if a business hasn't already realised that - it's probably too late.





Nishant Bhardwaj

**Country Representative, India,
Community of Practice Lead
(Energy), Green Growth Planning
and Implementation Division,
Global Green Growth Institute**

Transition to Net-Zero Future

A clear message that has emerged from the recently concluded COP26 climate summit is that countries and businesses will need to evolve to contribute to net-zero goals. Countries and organisations will be required to adjust their economic and business models, develop actionable plans for transition to low-carbon future and seamlessly execute their plans.

'Net-Zero' is being dubbed as 'Next Industrial Revolution' for businesses, as adequately reflected in the theme for ENRich 2021. Those who adapt and evolve will sustain and thrive and others may perish. While the Indian energy sector is not incognizant of the energy transition, the increased sense of urgency (and rightly so) to meet climate goals will accelerate the transition. Some of the fundamental drivers of energy transition in India will be emerging technologies, sustainable finance and digitalisation. Financial Institutions and investors are increasingly wary of risks associated with 'fossil-fuel based' projects.

Previous decade has already seen the sharp rise in share of Renewable Energy (RE) technologies, particularly solar and wind. With India's pledge to reduce emissions by 50 per cent and achieve 500 GW non-fossil fuel capacity by 2030³ as well as Production Linked Incentives (PLI) for domestic manufacturing of advanced cell chemistries and solar modules, the share of RE is likely to grow further, substituting coal to certain extent. However, India must strive to achieve leadership position in development and adoption of some of the more emerging technologies such as Green Hydrogen, Bio-CNG, Floating Solar, and Carbon-Capture and Storage (CCS) etc.

Digitalisation will remain a continued theme but with greater adoption for managing and balancing the dynamic electricity-grid with high RE content. Digitisation will be key for the financial viability of

electricity distribution utilities. The recently launched reforms-based and result-linked flagship scheme of India's Ministry of Power, which aims to install millions of Smart Meters, will increase the penetration of digital at retail consumer level. It's a great opportunity for utilities and start-ups to work together to improve efficiency of the sector and deliver more consumer centric services.

Over 160 firms, with USD70 trillion in assets have formed the new Glasgow Financial Alliance for Net Zero (GFANZ) with a common goal to steer towards Net-Zero emissions. In the U.K., financial institutions have been directed to lay out their Net-Zero plans by 2023, to meet U.K.'s climate goals. In addition, there are increasing regulatory pressures for disclosure of Environmental, Social and Governance practices. All this means that gradually, clean and Net-Zero compliant projects and businesses will only be able to garner investor interest. It also means that at domestic level, rules for regulating capital markets as well as financial instruments to channelize capital investments will need to evolve.

Finally, institutional capacity creation will remain an underlying need of the hour. Whereas there are outliers (companies), who are already preparing for the energy transition and are revamping their business models, there are many (utilities in particular) who need to acknowledge the emerging reality and take the first steps. For this, continued efforts are required to bring in required awareness, extend support in chalking out an actionable energy transition plan.

Global Green Growth Institute (GGGI), as an international intergovernmental organisation, will continue to support developing and emerging economies governments as trusted advisors, to achieve 'Green Growth' i.e., 'sustainable and inclusive economic growth'.

3. National Statement by Prime Minister Shri Narendra Modi at COP26 Summit in Glasgow, Press Information Bureau, 01 November 2021



Tim Buckley

Director (Energy Finance Studies), Institute for Energy Economics and Financial Analysis (IEEFA)

Capitalism has been redefined – companies who destroy the environment find it very hard to operate⁴

What has been the financial market response to the energy transition by 2030?

The financial risks of climate change have played a huge part in redefining attitudes in global financial markets. Over the last 10 years, weather-related disasters have been pivotal in changing investment behaviour. Governments realised the extreme cost of inaction, while high carbon emitting companies understood that they could see swathes of their operations become uninvestable and uninsurable. Without insurance, business activity is virtually impossible.

In financial services, these changes started to gain traction back in 2021, following the former Bank of England Governor, Mark Carney's net zero emissions finance alliance. This was a pledge by over 160 institutions, with \$88 trillion in assets, to steer the global economy towards net-zero emissions and a 1.5 degrees C limit. In 2030, net zero goals are entrenched across all mainstream financial sectors.

The energy transformation intensified the risk of stranded assets for fossil fuel companies. Today, many younger investors haven't even heard of some of the oil companies; they have fallen out of the top indices and headed into terminal decline. This is not true for all energy companies. Some transitioned fast; with change led by a new CEO, chair or board, like the CEO of BP, Bernard Looney, who announced a radical climate alignment back in 2020 on his appointment. Strong independent leaders implemented new stakeholder engagement policies which were open about the company's core business having no future. They were brave enough to say: "we are in terminal

decline, we will clean up the mess we spent over 50 years creating, and we won't just fob off onto someone else the rehabilitation liabilities our firm created."

The legal system has also played a key role. Back in the early 2020s there were landmark legal cases, including in Holland and Australia, which enacted that governments and energy companies owed a fiduciary duty of care to young people to not cause physical harm from climate change. These cases took evidence from the Intergovernmental Panel on Climate Change to stop the expansion of the fossil fuels industry, recognising that their decisions would have consequences for the future generations. Judges decided that, in the absence of any leadership from politicians, they would institute court-imposed leadership predicated on intergenerational equity.

What financial instruments or initiatives have influenced clean energy investment during this decade?

The most impactful has been the emergence of the now universal price for carbon. Back in 2015-20, a globally accepted high carbon price seemed fanciful - particularly here in Australia, where the mere idea of it was politically toxic, and a repeated Prime Minister killer. The EU introducing first their Emissions Trading Scheme (ETS) and then the carbon border adjustment mechanism in the 2020s changed everything; this EU and US border tax on high carbon imports meant companies throughout the world had to reassess their global supply chains. Now in 2030, it's the global norm that we have a carbon price of \$150/tonne and it has been one of the best performing commodity indices.

4. The interview was first published in KPMG 30 Voices on 2030 - The Future of Energy, KPMG in Australia, September 2021

Another important change was earlier this decade when both the EU and the USA mandated that key development banks cease funding fossil fuels. The only subsidised funding for fossil fuel development came from Chinese banks. But even this has been in decline in recent years with China's renewed world leadership in clean energy and its relaunch back in 2022 of its Green & Belt Road Initiative. The G-BRI has been a huge success, helping developing countries across the Middle East, Eurasia and Africa and allowing two billion people to leapfrog the now obsolete fossil fuel energy system and transition to cleaner energy centred on rooftop solar, batteries, electric scooters and microgrids.

In Australia, the government and financial community have had to introduce policies and take risks to catch up with the clean energy leaders. Australia was a clean energy laggard, sitting in the naughty corner along with a few recalcitrant Middle Eastern and Latin American countries. Change came with the states selling out of fossils fuels and new federal legislation making it illegal for fossil fuel companies to do government lobbying, "greenwash" and/or to divest their way out of the clean energy challenge. This gave many of Australia's leading companies the confidence to invest in new energy. We forget that it was only in this last decade that Australia became the world's largest exporter of seaborne traded green ammonia and green iron ore, and soon to be the largest in green hydrogen, as the "blue" hydrogen figleaf has been retired as the desperate last roll of the dice by the fossil gas industry.

How have banks and rating agencies developed solutions and risk assessments for cleaner energy?

The financial community was asleep at the wheel in the early days of the energy transition. While trillions of dollars of capital were at risk from stranded

assets, the central banks in the early 2020s seemed to accept that the large financial risks just had to be accommodated. The major rating agencies were buying up independent ESG and climate risk analysis firms to get skills in evaluating climate risk on property, businesses, fires, flooding and satellite tracking of methane leaks. But it then took a long time for that analysis to be integrated into their financial products and indices. Today, climate change and clean energy are an integral part of financial risk assessment, as modern slavery was back in 2021, and tobacco the decade before that. What was once niche is now fundamental to good corporate governance, with companies required to report under the Task Force on Climate-related Financial Disclosures as a pre-requisite to accessing global capital markets.

What is the role of activists in this new energy world of 2030?

In 2030, environmentalists aren't actively campaigning on climate change anymore, they have stopped locking themselves to buildings and heavy machinery. Boards gave in when their young staff would just leave to join the protesters, and the police were too busy locking up corrupt politicians caught by the Federal ICAC to worry about protesters like the now Swedish Prime Minister Greta Thunberg working for the public good. Companies have had to stop and listen, with social licence becoming critical to their right to operate once we had the redefining of capitalism that McKinsey called for back in 2020. In 2030, you cannot operate a company which destroys the environment or doesn't treat workers of all ages, genders and races respectfully - and in many countries you cannot legally build new fossil fuel infrastructure due to the now legally mandated 'intergenerational equity' protections. Companies have realised their brands were bound up with their workforces' values; sustainability, respect for the environment and operating within our planetary boundaries.





Anish De

Global Sector Head – Power and Utilities, KPMG and National Head – Energy, Natural Resources and Chemicals, (ENRC), KPMG in India

COP 26 achieved a fair bit, but did not bend the curve enough

Six years ago, CoP 21 at Paris brought global awareness on the fact that we need to act fast to contain global warming within a rise of 1.5 degrees C. What followed in the intervening years up to recent CoP 26 in Glasgow was inconsistent and inadequate. The U.S., among the largest emitters in the world, stepped out of the Paris Accord in 2017. Implementation of Nationally Determined Contributions (NDC) by other countries was also rather patchy. The large financial transfers between the rich and the poor world which premised many of the actions on part of the latter has been wanting. The goal of USD100 Bn in annual transfers has been reset to 2023 as compared to 2020 earlier.

The intervening Covid-19 disruption also showed that despite severe disruption of the global economic order and slowdown of human activity, GHG emissions have hardly been affected. In fact, GHG emissions are nearly back to pre-pandemic levels⁵. With this as the background CoP 26 went into play with high expectations from global communities on keeping global temperature increase within the set goals. Upon the conclusion of CoP 26 that goal just about hangs on a thread. In contrast the risks of going above the 2.0 degrees C failure limit is a lot higher. Current modelling by Climate Action Tracker suggests that with the present NDCs and the Glasgow Climate Pact, global temperatures will well exceed that limit⁶.

However, the period has also seen some positive developments. For one, there are markedly fewer climate change deniers visible. Also, corporates have come to realise that they must play a much more significant role in carbon abatement and in containing the effects of climate change for themselves and for society. The global corporate community has come to acknowledge that climate change is an existential risk for businesses and must be acted upon. That awareness and acknowledgement has been backed

by significant financing commitments – to the tune of USD130 trillion under the Glasgow Financial Alliance for Net Zero. The last moments of CoP 26 also witnessed historic acknowledgement of the need for “phasing – down” unabated coal emissions. While the terminology has disappointed many, even getting the elephant in the room on the table was no mean achievement.

However, despite these achievements the world remains on an unsustainable path. The goals in themselves have to be updated quickly beyond the present commitments if we have to really give ourselves a chance. In many instances the commitments are premised on very shaky and fanciful assumptions which bring to question the seriousness of those nations in addressing the issue. The underlying assumptions and premises do need careful scrutiny. Equally important is the need for methods to back the announcements made thus far. While definition of the methods in detail would have been far too much to expect from the CoP itself, serious effort now needs to go in to define the ‘how’ of it along with the ‘what’.

The CoP also failed to adequately address the adaptation questions. Given the almost certain prospect of escalation of adverse weather events that will affect those on the margins the most, serious attention is required to what is termed as “loss and damage”. This is not so much for the historic injustice on disproportionate emissions, but the plainly practical need of protecting the poorest in the world who are exposed to the worst effects of climate change, and for allowing developing nations to follow the path laid out by the UN Sustainable Development Goals of 2015. After all these goals were set at the same time as the Paris Accord and the world cannot forget that those goals – including on climate - remain as real goals to achieve.

5. Global Carbon Emissions Have Returned to Pre-Pandemic Levels, Time, 4th November 2021

6. Glasgow’s 2030 credibility gap: net zero’s lip service to climate action, Climate Action Tracker. November 2021



Vikas Gaba

Partner and Lead, Power and Utilities, KPMG in India

In hope lies the opportunity: COP26 and the way forward

The COP 26 ended mid-November 2021 with the Glasgow Climate Pact signed by 197 countries. While many countries announced new and enhanced commitments, the final agreement was a mixed bag with measures not enough to reach the 1.5°C ambition. The summit saw progress in some areas and fell short of expectations on several others.

On the mitigation front, the agreement calls for a stronger action from the countries to strengthen their 2030 actions plans, by end of 2022. Analysis indicates that current 2030 targets would lead us to an increase of 2.4°C in global temperature by 2100, far above the 1.5°C ambition. This additional window in the near term will be critical for nations to upscale the commitment and bridge this gap. Optimistic scenarios that account for full implementation of announced targets do indicate ability to reach 1.8°C⁷. Experience of various countries esp. India and the U.K. since the Paris accord does offer useful lessons.

First – ‘power of target’. Targets have the power to elicit collective action towards their achievement. India being the case in point wherein what was ambitious is 2015, as achieving 40 per cent installed capacity from non-fossil fuel by 2030, with the right policies and action got achieved eight years in advance, creating room for increasing the ambition. Similarly, in 2007 coal provided a third of power in U.K., which was estimated to be 15 to 25 per cent in 2020. In actual, it came down to 1 to 2 per cent. UK has progressively advanced the target for phase out of conventional cars from 2040 to 2030 and upscaled its offshore wind target from 20 GW to 40GW by 2030.

Second – ‘new technologies and innovations lead to progressive cost reduction at much faster pace than anticipated’. Back in 2003, U.K. estimated costs of delivering a 60 per cent emission reduction target by 2050, as 0.5 to 2 per cent of GDP. In 2008, cost of 80 per cent reduction was estimated at 1 to 2 per cent of GDP. Subsequently, analysis has indicated that same cost envelop can deliver net zero by 2050⁸. New innovations have happened, and businesses have come forward to support the target leading to progressive cost reductions.

Third – ‘net zero leads to a behavioural shift’. When the target was 80 per cent in U.K., there were lots of debates and arguments particularly from hard to abate sectors. Every such Industry calls for exemption to be in the remaining 20 per cent. A net zero brings a behavioural shift - everyone has to align and do it. It brings an unprecedented convergence of governments, businesses, investors and civil society.

Fourth – ‘priority sectors leading the way’. Over 70 per cent of GHG emissions are energy related⁹. Energy sector has been one of the early targets in both countries. Clean energy targets, obligations for clean energy procurement, supportive regulations, energy efficiency targets for equipment and use, private sector involvement early on, have led to significant momentum. This has cascaded to other sectors including transportation, manufacturing, agriculture etc.

Last - ‘focussed action to unblock the blockages’. Bringing full package of policies, guidelines and initiatives at the right time helps in creating rapid progress. Progress of renewable energy (RE) both in India and U.K. are live examples. In India, besides the RE target, designating a Central Public Sector Undertaking as a nodal agency, standard bid documentation, series of large-scale auction, must run states, exemption of transmission charges etc all led to record low prices and rapid scale up. Similarly, in U.K., offshore wind progressed from being a risky investment to favourite of pension funds, owing to range of actions including sea-bed licensing, contracts for differences (CfD) auctions, and initiatives to support technological innovations around turbines, cable design, voltages, and operation and maintenance.

The Glasgow pact calls upon the nations to return next year with tougher 2030 targets. In this hope lies the opportunity to bridge the 0.9°C gap. Never before has the call for collective action been so explicit. Never ever before has the science been clearer and been so abundant about risks and catastrophe that climate change is causing. Time for more meticulous planning and scaled up action is now.

7. Glasgow's 2030 credibility gap: net zero's lip service to climate action, Climate Action Tracker, November 2021

8. Net Zero the UK's contribution to stopping global warming, Committee on Climate Change, May 2019

9. Global Emissions (Energy/ Emissions data), Centre for Climate and Energy Solutions, November 2021



Dr Jemma Green

**Co-Founder and Executive
Chairman, Powerledger**

Blockchain technology is building the trust needed in this new energy world¹⁰

What are the key technologies that have transformed the energy landscape over the past decade and what do you think have been some of the key drivers?

Our company Powerledger was built on a clean energy vision. We have developed an energy and flexibility trading platform that allows households, organisations, and the grid itself to trade with each other. In 2030, we are much closer to having predominantly clean energy in a system that works for everyone, with many people having access to electricity generated in large part via local, low-cost, stable and clean energy sources. This electricity is delivered through the main grid meaning the market is now both distributed and decentralised.

As the market has changed, the role of technology has become increasingly important. New technologies were needed to better enable renewable energy trading, renewable asset financing and more efficient carbon and renewable energy certificate and credit markets. New technologies also allowed individual consumers and organisations to participate in wider market supply for energy, ancillary and network services as well as on the demand side.

From my perspective, the major driver has been the emergence of two-sided energy markets and the need for efficient and transparent markets and operating systems, supported by technologies that seamlessly connect buyers and sellers and authenticates and settles transactions. The Powerledger system uses blockchain technology to certify the origin and source of renewable energy. As an example, households can choose their own energy mix from a variety of

sources such as solar farms, wind, biogas and P2P with their neighbours – they can choose the certified source and origin of the energy purchased. Trust will be of increased importance in this new energy world – people want to know they are getting the specific things they are purchasing and supporting.

What have been the key steps of the power market evolution to 2030?

It is key to understand that the energy transition was not just a matter of swapping coal or gas for solar and battery systems. Energy is not like cocoa beans. The system has moved from centralised planning and centralised pricing to this decentralised hyper local market signalling, which balances local energy supply and demand and reduces the need for more costly upgrades to the grid.

Looking back, the first part of the energy transition was around energy self-supply from solar and then batteries and the move to microgrids. Here in Australia everything changed in 2025 with the rollout of two-sided markets and adoption of new regulations. By 2030 we have a fully-fledged two-sided market where households are paid variable rates for their energy based on the value they provide to the grid or the wholesale electricity market.

So in 2030, we have a more flexible, independent, and more automated energy system which consists of many microgrids and local energy markets within the grids. This has meant less autonomy for the big utilities as any household or business can connect to and trade directly with wholesale electricity markets and be paid for it.

10. The interview was first published in KPMG 30 Voices on 2030 - The Future of Energy, KPMG in Australia, September 2021

What does the utility or retailer of 2030 look like?

New players have entered the energy market - cities, new utilities and corporates like shopping centres, supermarkets, and hardware stores. Incumbents still exist but they are seeing immense competition from new commercial and business models from the big technology companies which typically have a large customer base. At the beginning of this decade, they were already offering things like credit cards, insurance and other services, so it was a natural next step for big tech to become power retailers.

Existing market incumbents had three choices as they lost market share and their margins were squeezed – they could fight, flight or innovate. Some fought against regulatory changes. Back in 2021, the grid was not set up to deal with the large influx of power coming into it from rooftop solar. At that time, the Australian Electricity Regulator was even recommending bringing in charges for this excess electricity to help the grid cope¹¹. Utilities started their flight from the market by divesting or separating old energy assets from new and demerging.

The rest chose innovation – and there are broadly two types: cannibalistic and non-cannibalistic. Cannibalistic innovation is where you cannibalise your own market share, because if you don't, someone else will. So, if I am a retailer, I offer customers solar panels and batteries before someone else does even if it means I sell that customer less electricity, and I make margin on the sale of the solar and battery system, which offsets or supplements the loss of income from selling them electricity. Non-cannibalistic means targeting new markets, so, for example, setting up in

parts of Australia where you didn't operate before, like regional areas. Those who have chosen innovation are succeeding.

How has the energy consumer changed?

Under the old model, the customer was more of a passive recipient, of energy just buying what the utilities sold. Over the past decade customers have been engaged in the subject of energy in a more personal way, to identify what matters to them with the goal of better targeting products and services.

It has been interesting for me to see renewable energy households and communities emerging and becoming more active market participants. They now think, "shall I connect my energy system to a platform that allows me to access many market opportunities?". Customers may have different energy suppliers - for their electric vehicles (EVs) and for their houses, so they think - shall I charge my EV tonight as there's a high price event coming and that can pay for my dinner at a restaurant? Consumers may invest in a large battery system to allow them to play energy markets like investing in the stock market. They watch the price of electricity like they watch the price of Bitcoin, with settlements happening in real time. Consumers make choices like this about energy all the time today.

This has however, generated a greater need for managing customer privacy. There are exceptionally large volumes of data being generated and it needs to be protected. What we are seeing is a whole new electrical world of energy emerging – a root and branch market change, and it needs to be managed seamlessly, securely and efficiently. This will be a key focus area as the industry continues its evolution.



11. State of the Energy Market Report 2020, Australian Electricity Regulator, July 2020



Brian Janous

**GM (Energy and Sustainability),
Microsoft**

The more intelligence we can build into the energy system, the more resilient it becomes¹²

Back in 2020, Microsoft, made a pledge to become carbon negative by 2030 - have you met that target and what happened for you to achieve it?

We not only met the target, but we met it faster than we thought, and more importantly, helped others along the way to achieve similar goals. We made a commitment by setting a bold vision - clarifying it and making it both measurable and close enough to force immediate action. And to ensure impact beyond our own operations, we launched the Microsoft Cloud for Sustainability that was designed to help companies measure, understand and take charge of their carbon emissions, set sustainability goals and take measurable action. Microsoft's other leaders and I all accepted personal responsibility for meeting the zero-carbon goal; we knew that we could still be around in 2030 to see if it had worked, to witness the achievement, and here we are.

In the years leading to 2020, there was a massive shift in the business world regarding zero carbon commitments. Before then, few companies had given much attention to the subject, but it soon became a core priority, and this resulted in a tidal wave of companies making similar commitments. These pledges continued to outpace regulations - as governments were focused on 2040 or 2050, we were making commitments that were a decade or two ahead.

Our company's pledge triggered a wave of people within Microsoft who leaned in on the issue. We extended the scope to include not only electricity and direct emissions, but our entire supply chain - from software design to procuring components for our data

centres. We met the target initially by leveraging what we already had, largely low-cost wind and solar, and accelerating what we knew worked. We executed almost six Gigawatts of net new renewables in only the first year. We also established a billion-dollar Climate Innovation Fund¹³ which has continued to grow over the last decade. In this case, what helped was that the renewable energy market is far more distributed - so you can be a smaller company and still bring innovation. Today, innovation scales faster and is easier to do than when the market was dominated by fossil fuels.

Going forward, we know we will run into challenges - particularly with intermittency issues from all the zero carbon resources we're putting on the grid. These resources must be more balanced and better integrated - this requires new software, more intelligent grid operations, greater volumes of storage and new technologies. Fortunately, we invested early in start-up companies to develop some of these technologies we knew would be crucial for the success of this next stage of energy transition.

What kinds of innovations have you developed as part of your net zero mission?

We needed to become more intelligent in terms of how we operate. Through new hardware, technology and software we've accomplished, for example, longer duration storage. In 2020, we didn't have a battery that could run cost effectively for 150 hours; it was probably more like two to four hours. To help to balance grid operations for longer durations when we lacked wind and solar generation, we have developed better batteries.

12. The interview was first published in KPMG 30 Voices on 2030 - The Future of Energy, KPMG in Australia, September 2021

13. In 2020 Microsoft established a new environmental sustainability strategy focusing on carbon, water, waste, and ecosystems. As part of the commitment, it announced it was investing \$1 billion over the next four years in new technologies and innovative sustainability solutions.

We have also created a smarter grid. A decade ago, there was a lot of talk about smart grids, but really there was nothing smart about them. We couldn't see what was happening on the grid, what was being dispatched, what resources were available. Today, with the creation of deep models of grid operations, we're able to better measure energy supply and demand across the grid, not just when it dispatches, but also where it should be best located for the fewest emissions. It means we can better orchestrate and optimise across our entire operation.

With energy demand growing from Cloud¹⁴ services, what steps have Microsoft taken to ensure a reliable energy supply while reducing emissions from such services?

There used to be a real fear that the Cloud would just gobble up all the world's electricity. It hasn't happened, primarily because we've been able to leverage the infrastructure which supplies the data much more efficiently. Previously, workloads deployed in the Cloud were migrating from far less efficient environments - enterprise data centres and servers - which weren't optimised or running on clean energy. As our zero-carbon commitment was not only for electricity, but also for things like cement and steel that go into the construction of a data centre, we have been able to achieve more productive and less carbon intense data centres. It means that - despite global power demand continuing to increase – generally, overall data centre power demand, has not.

In what ways are 'big tech' companies like Microsoft supporting this new energy system in 2030?

We're about enabling the success of all companies and individuals, and we think about electricity, the Cloud, Artificial Intelligence and Quantum Computing in the same way. They are utilities and we want to create a level playing field around them that allows others to come in, innovate and drive efficiencies - be it in transportation, food production or medicine. No one goes to the doctor and thinks I'm thankful for Microsoft, but we are working with the backbone of these different industry systems – which are often very complex - so they become intelligent. It means they operate more productively; with precision, and their optimisation can facilitate, in medicine, for example, a much better decision making and diagnoses process.

The great thing about more intelligent systems is that they are also more resilient. If you orchestrate everything well together it also becomes safer and more secure - even if individual devices fail, the whole system does not as it isn't dependent on just one device. So, in a power grid, for example, now that we understand the systems better, we can prevent cyber-attacks, as we can isolate different parts of the grid. If you are concerned about a particular power plant staying online, then you just don't have a resilient system.



14. Cloud computing allows remote access to computing, storage, and networking resources within a data centre or through a public cloud service provider. Clouds are employed by many companies to enable more reliable, scalable, workload-optimized performance across their enterprise applications.



Robert Johnston

Special Advisor Energy and Climate, Eurasia Group

The green transition has led to new geopolitical tensions¹⁵ ...

The geopolitical energy landscape in 2030 is markedly different from previous decades. The biggest change has been that while the Middle East is still a major oil and gas producer (due to its low cost and low carbon intensity production), the dynamic between the United States (USA), the European Union (EU), China, Russia, and Japan is now less about securing oil and more about electricity grid security and access to those critical minerals needed to support low carbon energy.

The shift to a greener energy landscape is resulting in new tensions in countries producing materials like lithium and cobalt, which are needed for cathodes and anodes in battery production as well as platinum group metals and rare earth elements used in electrolyzers for hydrogen production. The Democratic Republic of Congo, Bolivia, Australia, Indonesia and Canada produce the resources but most are still refined and processed in China, which now dominates the geopolitics of energy rather than Petro-States like Saudi Arabia, Russia or Venezuela, pre-dominant in the 20th century.

China, has continued to grow throughout the decade, has progressed from being one of the largest emitters of greenhouse gasses to mass electrification through the rapid scaling of renewable and zero-emissions technology.

Tensions have also surfaced where states have imposed carbon border adjustment mechanisms that essentially tax fossil fuel imports. The EU and other mature economies¹⁶ have advanced their green taxonomy and broader sustainability principles, particularly across the financial sector, while their consumers are increasingly green aware.

This is having a knock-on effect on climate politics in other large economies, but not in the way we originally predicted. The EU's more confrontational approach in terms of carbon border mechanisms and

placing tariffs on states without appropriate climate policies has motivated countries like Russia and China to increase the stringency of their own greenhouse gas regulations.

The pace of the green transition in most countries has, however, been uneven. It has been hard to match job creation in renewable energy sectors with workers dislocated from fossil fuel industries like upstream oil and gas production or production of internal combustion automotive. Also, while the COVID-19 crisis in 2020/21 set conditions for governments to create green stimulus packages, the impact was temporary, with people quickly getting back to global travel and commuting. The bigger change has been where governments injected liquidity and stimulus into key green sectors such as hydrogen or large battery plants in Europe and China.

The transition has been much more challenging for countries in the developing world. Major oil and gas producers in parts of the Middle East, North Africa, West Africa, Central Asia, and Latin America, are now searching for new engines of growth to replace stranded oil reserves and infrastructure. Countries that have not had a successful transition to a post petroleum economy are at risk of becoming failed states in the face of economic crises, corruption, and weak political institutions.

Additional geopolitical concerns have also emerged in 2030 around so-called 'geo-technologies' which support grid resilience and grid security. Critical infrastructure and integration of electrical grids into broader cloud-based IT systems has created new vulnerabilities and these are being exposed by hostile actors, whether they are nation states, criminals, or terrorist groups. While distributed generation, local small-scale micro grids and renewables appear more resilient, they are also creating new openings for attacks at a more local level.

15. The interview was first published in KPMG 30 Voices on 2030 - The Future of Energy, KPMG in Australia, September 2021

16. For example countries such as Australia, Canada, China, France, Germany, India, Italy, Japan, Republic of Korea, the United Kingdom, the United States, as well as the European Union.

Data has become an important feature of the green energy landscape and a growth industry has developed around tracing the source of a commodity. For example, important to show that a fossil fuel like natural gas was processed with no flaring, or that a raw material has been mined at a site with responsible tailings management and been produced using green power. There has been rapid growth in data to verify company ESG claims, which they need to maintain their market share and access to capital. Digital verification is increasingly necessary in consumer and industrial transactions to ensure people get the clean product they think they're paying for.

It's a very challenging geopolitical landscape. Leaders today need to understand that, as businesses are being transformed, they remain as engaged with their investors and consumers as they are with governments. These new energy supply chains need particular attention - not only on their efficiencies or on their new products and services but also on their wider ESG footprint; climate impact, human rights, gender and racial diversity and similar considerations. It is important to be aware of the impact of the energy transformation in its entirety.





Dr Jennifer Holmgren
CEO, LanzaTech

Rethink. Reuse. Repeat.

The United Nations Intergovernmental Panel on Climate Change Sixth Assessment Report (IPCC AR6) points to climate risks. These risks demand the immediate attention of nations and businesses around the world. The pledges we made in Paris must be met and exceeded and this must not come at the cost of leaving the vulnerable behind. It seems like we are faced with a seemingly impossible challenge.

We need to disrupt and completely change our current carbon economy.

And that's easy to say, but it's quite difficult to do when you consider that fossil carbon is not just in gasoline or power.

Fossil carbon is in everything we use in our daily lives. From our clothes and shoes to our cleaning products, toys, and toothpaste!

All these products start life in a refinery and are based mostly on petroleum or natural gas which is converted in central locations and then distributed around the world, creating the lives that we have today.

Unfortunately, in 2021 this carbon economy is not fit for purpose because we now understand the impact of putting carbon on a one-way street into our atmosphere.

To me, every single carbon atom that goes into our atmosphere represents more people and creatures suffering and dying. We must stop, and we must stop now.

But how? How do we achieve the scales we need to displace the fresh fossil carbon that is in our everyday lives? I believe that the answer is to reuse all carbon waste. Globally, there is enough waste carbon already above ground to enable us to make all the products that we use in our daily lives. If we consider how much carbon there is in industrial emissions, farm and forestry waste, garbage and even CO₂ in our atmosphere, the possibilities are limitless and there is sufficient carbon to make everything we need. In addition, if we recycled the waste carbon from

farming, industry, and garbage alone, we could save around 7 per cent of global CO₂ emissions.

Making everything we use from waste carbon sounds like science fiction, but it is not. Consider that LanzaTech has already shown that we can make ethanol from gaseous and solid waste resources and have accomplished this at commercial scale in both a steel mill and a ferroalloy plant.

Furthermore, we have also shown that ethanol is an intermediate to make all the things that we need for our daily lives.

With our partners we have already made cleaning products and packaging for these cleaning products, laundry detergent, clothing, shampoo bottles and perfume. We have also made sustainable aviation fuel (SAF) and have shown it is possible to fly on recycled carbon emissions having flown two commercial flights on SAF made from ethanol whose carbon started out life as industrial emissions.

This is real and an important proof point in what is possible when you start with waste carbon. Instead of carbon being on a one-way street to pollute our planet, we've converted it into things that would normally come from petroleum.

We're building plants all over the world to take waste resources to ethanol. In India we have projects using agriculture waste that would be burnt on the fields and another project using refinery emissions.

This must be the future.

Everything around us, including the waste carbon in our atmosphere, can be the resource for everything we need, the resource that powers our new carbon economy. Importantly, by disrupting our current carbon economy, we ensure a liveable planet for all.

Let's rethink how we source, how we use, and how we dispose of carbon.

Rethink. Reuse. Repeat.



Santhosh Jayaram

Global Head – Sustainability, HCL Technologies Ltd.

Digital Traceability: important element to decarbonisation

Last week SBTi released the Net-Zero Standard, which is a clear guidance to companies to align their net-zero plans in line with science. The standard emphasises the need to cover the entire value chain emissions and not just the scope 1 and scope 2. In many industry segments the scope 3 emissions are significant and unless there are reliable systems to monitor these emissions it will be a challenge to move towards net-zero. It is not just in this scenario digital traceability becomes important, but in every claim of any product and service which claims sustainability impact. Even every carbon offset should be digitally traceable. Hence, it is an essential element in the decarbonisation pathway.

Digital traceability, while being important from the sustainability perspective, is also becoming important for improving the resilience and security in the supply chain post the pandemic. It is becoming critical component of the next phase of business transformation. The objective is to help companies and even customers track the exact nature of materials and resources that go through entire value chain. Not just tracking the origins or source of materials, but also the practices and the process metrics during the conversion, the logistics and even during the life of the product to its end of life. Think of the significance of the data that is generated in this process. While it is an assurance to the claims in the sustainability pathway, it also helps understand scenarios, make changes and respond faster. The early adopters will set the standard and also the leverage the customer preferences.

Almost every company understands the importance of traceability, but also realizes the complexities and

hence the delay to start with. The complexities are not just the number of institutions to collaborate with but also the interface of the varied technologies each of the value chain partners use. But the time is right now, if the traceability code is not cracked, the decarbonisation journey will be challenging. It will be one of the best enabling systems in the pathway. As we might move into a compliance regime of decarbonizing economies, the digital traceability will be critical to ensure transparency. It also will establish a standard and comparable process for each company in the same sector.

The visibility of information and in this case the visibility of emissions is the first step. With a wide variety of standards for accounting the emissions, the sector based standardisation will be a critical next step. Information standardisation is not just enough, it needs to be attributable to the right streams. Each unit of emission needs to know to which stream it belongs. There are various potential technologies that are being tested towards evolving the digital traceability system. A number of pilots are happening even as I write this article, but the real proof will be one that can scale.

In the journey towards decarbonisation, there should not be a vulnerability to be green washed. It is something that cannot be afforded. We need a transparent and trustworthy wholesome system that can avoid all leakages. There is a need to accelerate the Digital Traceability efforts and integrate them in the pathway to decarbonisation. It is a must, it is which cannot be delayed further.



Regina Mayor

**Global Head of Energy,
KPMG in the U.S.**

A public-private partnership funding mechanism can further accelerate technology innovation in the energy sector

As identified in the Accelerating Sustainable Energy Innovation white paper published by the World Economic Forum (WEF) - in collaboration with KPMG International - in January 2018¹⁷, one of the six areas that would help facilitate and accelerate innovation in the energy sector is: establish an independent international fund to finance energy technology projects, blending public and private sources of capital.

While we are yet to see true public-private partnerships in this domain, the good news so far is the emergence of unique funding vehicles and rapid advancement of significant technological innovation. This presents an optimistic picture that the innovation engine is really starting to come at full tilt all around the globe. Today, majority of companies in the global energy space is talking about current and planned innovations, spanning an array of technologies – renewables, hydrogen, battery storage.

The rise of unique funding

Large corporates are providing start-ups with angel funding, taking stakes and supporting those companies much earlier through their corporate VC arms. Another example is direct air-capture technologies for removing carbon from the atmosphere. Many of the large oil companies are partnering with those smaller start-ups to work out how to scale them.

Furthermore, a lot of the economic stimuli during these recent times had a substantial 'green infrastructure' bent to them. Now we have the potential for billions of dollars to be spent in the EU on hydrogen technologies. In the U.S., there are tax

credits for carbon capture, renewable development and other incentives. There's seemingly even more money being allocated than we contemplated in 2018. So, it does come back to putting in place the institutional processes to efficiently access and direct those new sources of funding.

Importance of public-private partnerships

The COVID-19 crisis has undoubtedly disrupted the pace of progress of funding. The fragmentation of the public and private components in different countries and jurisdictions; even across governmental agencies in countries such as the US and the UK, poses a challenge. Despite a world economic crisis and much political change all around, the positive has been the overwhelming agreement around the importance of addressing climate change. There's a lot more alignment than four years ago.

A wide range of agencies could play a role in the funding process and public-private partnerships are a must-have. There are some good examples of institutional approaches to energy innovation. For instance, the ARPA-E (Advanced Research Projects Agency-Energy) in the US, and the EU's KIC-InnoEnergy programmes. Also, the EU Commission has played a key role in the creation of Breakthrough Energy Ventures Europe. In both instances, the agencies have streamlined project approval processes, portfolio approaches, hands-on relationships with project awardees and supported communities of venture capitalists (VCs), companies and universities to move innovations faster to market. Replication worldwide depends on national circumstances, and rules and procedures may need to be customised.

¹⁷. Accelerating Sustainable Energy Innovation, World Economic Forum (WEG) and KPMG International, January 2018

Promisingly, recent government public announcements around green infrastructure investing have focussed on the need to support nascent energy transition technologies. I anticipate we will see more public-private partnerships in the coming months. The appetite for innovation has become bigger and bolder. We have seen how the world can come together to develop many vaccine options in an accelerated period. That's opened everyone's eyes to what is possible if public and private efforts are coordinated and work to innovate. However, with the pandemic

and other trade issues, governments have turned inwards, in general, instead of outwards. Today, there's more protectionism, which can make it more difficult for countries to collaborate.

While some of the public-private financing questions have been addressed, however progress has been limited on putting the funds together. The blueprints are still there and they are ready to go once the world can set a forward-looking agenda for addressing climate change together.





Roni Michael

**Global Head of Innovation,
KPMG International**

Trust: the next frontier

The energy sector has been undergoing a major shift over the past years. Energy companies have always focussed on delivering their services to end consumers, meeting customer satisfaction and helping ensure that they receive their energy when they need it. This traditionally met the needs of the everyday consumer; however, customer values and behaviours are changing. They want more than just energy delivered to their homes, they want to see energy companies doing more about ensuring the safety of our planet and our people. This has been heavily influenced by the increasing focus and attention given to carbon emissions, sustainability and the needs of our environment.

In response to this shift in the value chain, we are now seeing energy companies provide more innovative carbon conscious services for their customers and are even educating them on how they can consume less energy within and outside of the home.

They are fundamentally changing their value proposition. Energy companies have always sold trust, but they were focusing on the kind of trust where consumers can rely on them to provide energy to keep the lights on in the house. This has now evolved to selling the next frontier of trust: trust that they can deliver energy whilst reducing the impact they make on the environment. Without the trust of their consumers and the wider market, energy companies will struggle to maintain and grow in line with

increasingly carbon-conscious consumer demands. Trust will ultimately continue to be critical for players in the energy sector.

As consumers around the world demand more action to tackle climate change, they will expect their energy companies to lead the way in the decarbonisation of the energy sector. They want their energy providers to live and breathe the values that they hold dear to create a world that is more sustainable and can provide for the next generation. In a sector that is increasingly decentralised and with more innovative, renewable energy companies looking to challenge the status quo, traditional energy players need to be on the front footing – or they risk losing the loyalty and relationships with their customers.

The biggest challenges lie with the largest and most dominant energy companies, who are looking at longer time frames to take action and decarbonise – and consumers are becoming increasingly impatient. They want to see action being taken with visible results. Talking the talk will not be enough – you must walk the walk.

In spite of the pressing priorities, the decarbonisation of the energy sector has not only lacked the speed to move forward in line with customer trends and environmental needs, but it has also stagnated over the last five years. As surprising as it might sound, fossil fuels make up 81 per cent of the global energy system – which means that there has been no change in the past 30 years¹⁸.

18. Renewable energy becomes cheaper in a bid to tackle climate change, World Economic Forum, October 2021

The new generation of energy consumers are not just looking for promises, they are looking for commitment and action, and this requires energy companies to build a long-term strategy whilst investing in innovative green-solutions to deliver on their promises. Moving away from fossil fuels and using more renewable sources of energy, such as wind and solar, as well as investing in clean energy technologies and training their staff for green energy jobs will go a long way to show the commitment to net-zero – and to the future of our planet.

By aligning their values and purpose with that of their consumers, energy companies will ensure that they acquire, earn and maintain their trust in this emerging greener energy landscape. Investing in what was traditionally considered customer satisfaction will

simply not be enough. Consumers will not tolerate any less from their energy providers. Not when so much is at stake.

So looking forward: as the definition of what trust means for energy consumers continues to shift, and energy companies are finding themselves confronted with a basic question: 'Can I trust you to put what I value most ahead of what's most important to you?'. And this is where the battleground for trust is being set these days.

In preparing for the future - energy companies need to look at the bigger picture. Climate stability is probably the most pressing topic, but consumers will expect a holistic approach that will also tackle issues around transparency, corporate governance, diversity and social responsibility.





Manas Majumdar

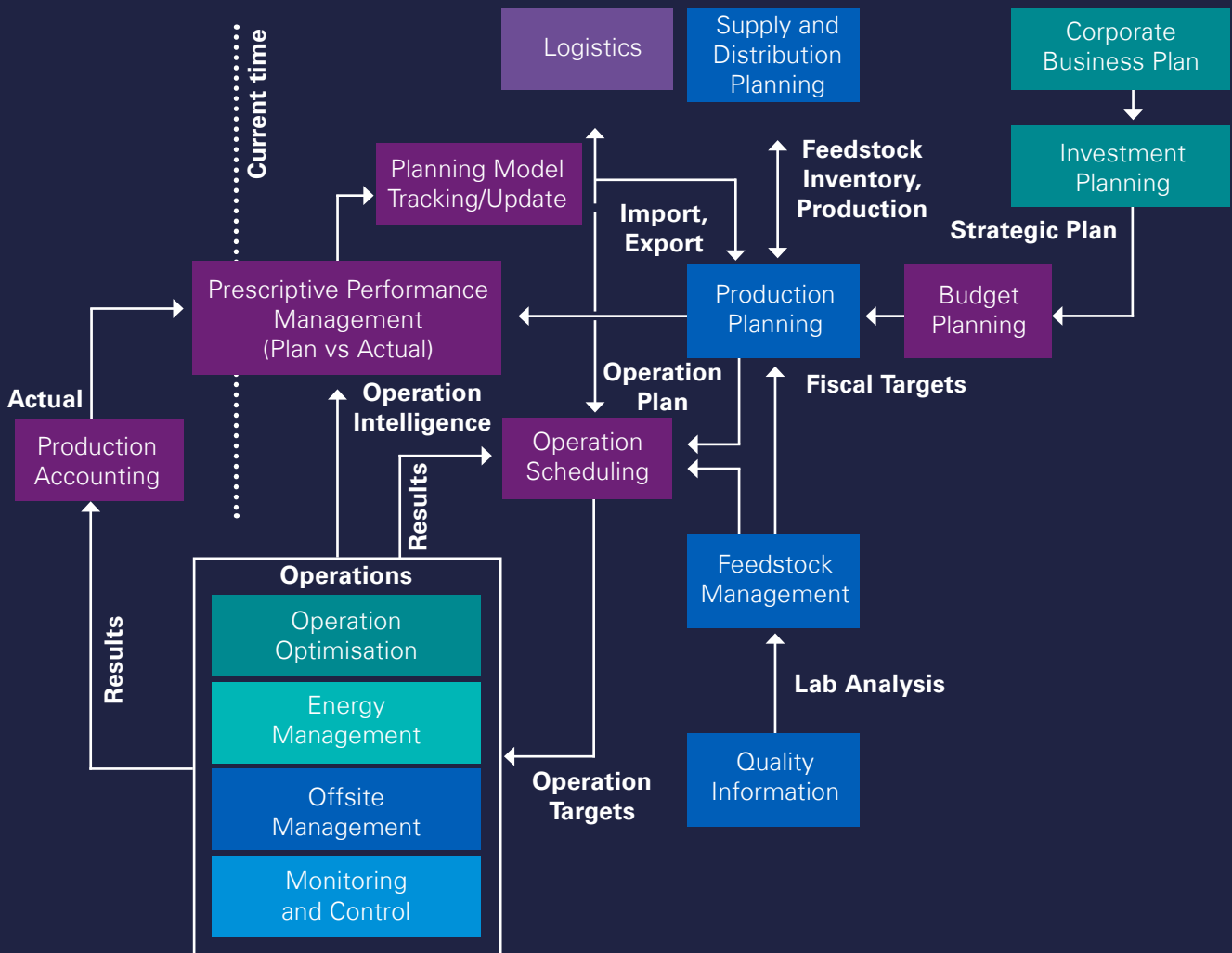
Partner and National Leader – Oil & Gas, Chemicals, KPMG in India

Digital pathways along the Decarbonisation journey

Worldwide, manufacturing facilities are becoming more complex, larger, and more integrated in nature. Departments are stretched to manufacture and bring new products to market quickly and sustainably. And a new generation of engineers are joining the industry bringing different expectations for the workplace and how they contribute to the environment. The broader industry is also keenly looking to enable the circular economy for plastics and petrochemicals.

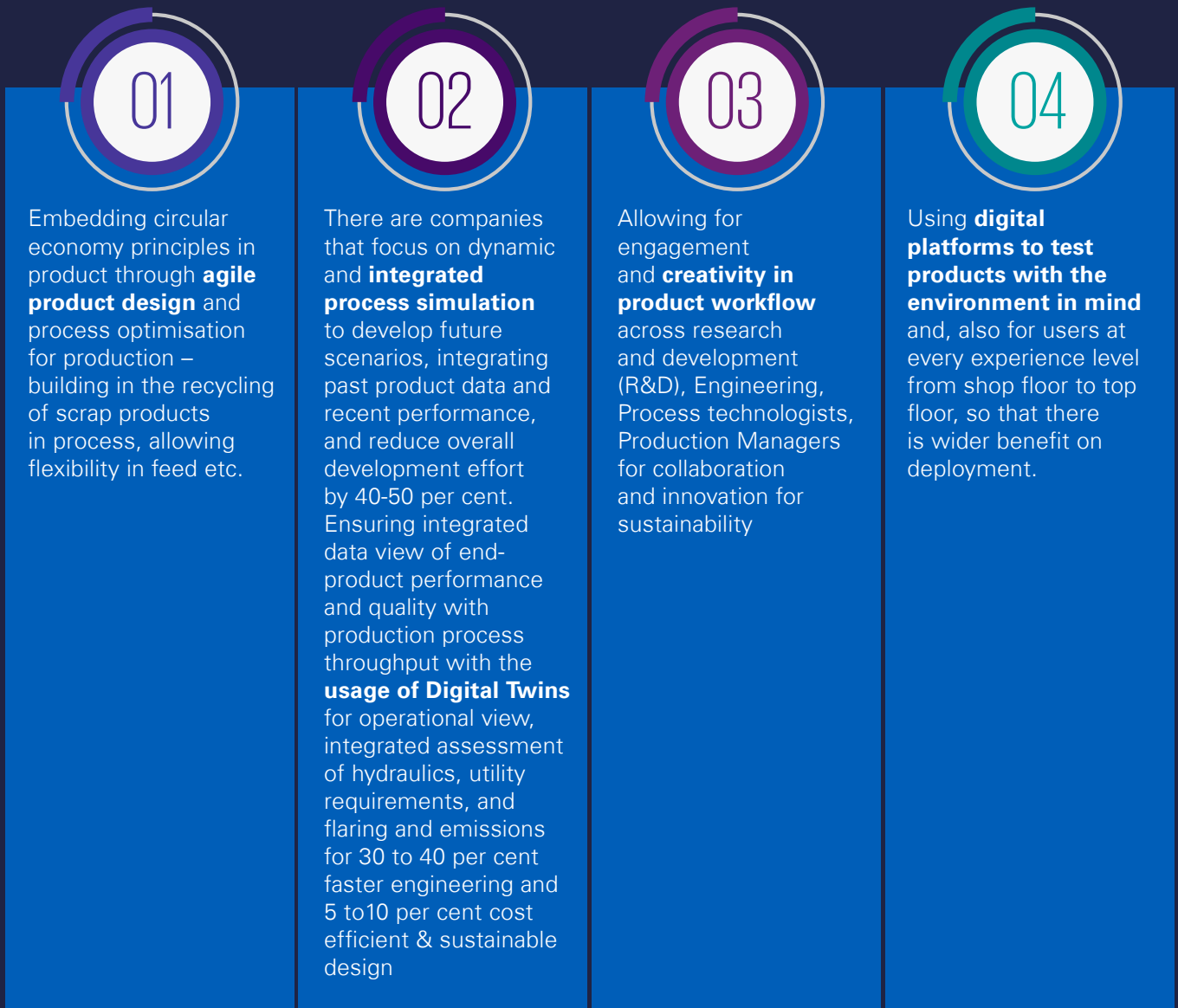
In addition, we are in turbulent COVID times - oil prices are volatile, demand is increasing, supply is trying to ramp up, and storage capacity and supply chain is constrained. In these times, we need to

swiftly act to keep the business viable to come back strong as conditions improve. Digitalisation of the value chain then becomes an essential part of staying competitive. However, it is also an undeniably complex task, whether we are talking about a single petrochemical complex or a major company with multiple plants, or even an integrated refining and petrochemical operation. Part of the complexity comes from the number of plants and interconnected unit (see Figure), but the other part of the complexity comes from the industry itself, and the diversity of challenges that occurs in different areas of the value chain within each operation.



In this context, there is a need to digitally transform, so as to transform how one does business in a low-carbon world and solve engineering problems for a greener and cooler planet. Several companies are working on this digital revolution, and many acknowledge its importance by setting up teams to define a coherent digital transformation strategy.

But there are still many companies that fail to obtain economic value from their investment in digitalisation. We believe a winning digital strategy for low-carbon footprint, needs an end-to-end focus from design to deployment to decarbonize the value chain:



While the above are key success factors in digitalisation, which individually can be pathways for decarbonisation and collectively will drive a cohesive and sustainable enterprise-wide journey – at the core needs to be the people who will execute this. Technology wields the power, but it is the people that will drive the results – it is therefore critical that change management and implementation process of this journey must be developed carefully to address the human aspect and the organisation culture for the transformation to be truly value enhancing.



Espen Mehlum

Head of Energy, Material and Infrastructure Program, Growth Markets and Benchmarking, World Economic Forum

This is how AI will accelerate the energy transition

The IPCC Sixth Assessment Report is unequivocal: more action is urgently needed to avert catastrophic long-term climate impacts. With fossil fuels still supplying more than 80 per cent of global energy, the energy sector needs to be at the heart of this action.

Fortunately, the energy system is already in transition: renewable energy generation is growing rapidly, driven by falling costs and growing investor interest. But the scale and cost of decarbonizing the global energy system remain gigantic, and time is running out. The future energy system will be much more electrified, and this electrification will need to rely on clean energy sources and being optimized across the system with energy storage, grids and smart control. There is huge potential to accelerate electrification of major energy use sectors such as industry, transportation and heating.

To-date, while most of the energy sector's transition efforts have focused on hardware another critical tool for the transition that needs focus are next-generation digital technologies, in particular artificial intelligence (AI). These powerful technologies can be adopted more quickly at larger scales than new hardware solutions to become an essential enabler for energy transition.

Trends such as (i) transition of energy-intensive sectors towards decarbonisation, driven by growing government and consumer demand for rapid reductions in CO₂ emissions; (ii) increased electrification of sectors implying increased deployment of intermittent renewable energy¹⁹ and (iii) rapid growth of distributed power generation, distributed storage and advanced demand-response capabilities, requiring a more networked, transactional power grids are driving demand for AI application.

AI is already proving its value to the energy transition in multiple domains, driving measurable improvements in renewable energy forecasting,

grid operations and optimisation, coordination of distributed energy assets and demand-side management, and materials innovation and discovery. But while AI's application in the energy sector has proven promising so far, innovation and adoption remain limited. That presents a tremendous opportunity to accelerate transition towards the zero-emission, highly efficient and interconnected energy system we need tomorrow.

AI holds far greater potential to accelerate the global energy transition, but it will only be realized if there is greater AI innovation, adoption and collaboration across the industry. This is the crux of the World Economic Forum report 'Harnessing AI to Accelerate the Energy Transition'. The report defines the action required for catalysing AI adoption. The report, written in collaboration with BloombergNEF and Dena, establishes nine 'AI for the energy transition principles' aimed at the energy industry, technology developers and policymakers. If adopted, these principles would accelerate the uptake of AI solutions that serve the energy transition by creating a common understanding of what is needed to unlock AI's potential and how to safely and responsibly adopt AI in the energy sector.

AI is not a silver bullet, and no technology can replace aggressive political and corporate commitments to reducing emissions. But given the urgency, scale, and complexity of the global energy transition, we can't afford to leave any tools in the toolbox. Used well, AI will accelerate the energy transition while expanding access to energy services, encouraging innovation, and ensuring a safe, resilient, and affordable clean energy system. It is time for industry players and policy makers to lay the foundations for this AI-enabled energy future, and to build a trusted and collaborative ecosystem around AI for the energy transition.

19. Increased supply from intermittent sources creates demand for forecasting, coordination, and flexible consumption to ensure grid stability and reliability.



Chris Reed

**Managing Director/CEO,
Neometals**

Using Lithium, we have stored enough energy in a small space to transform mobility²⁰

The element lithium is essentially a portable energy enabler - once you've got a portable store of electricity, you can then use energy much more efficiently. Lithium is the lightest, most reactive element in the periodic table - it was lithium batteries which enabled mobile phones to become irreplaceable - it enabled the energy they stored to be placed in a compact space and now it is doing the same for mobility. At the start of last decade, we saw every major car company commence investing in Electric Vehicles (EVs) and today, the internal combustion engine represents the minority in new fleets. This fleet transformation accelerated as battery ranges improved - a typical range is now supported by around 75 kilowatt hours of storage capacity per car - capable of running an average household for a couple of days.

Lithium is enabling an energy revolution - you combine that battery power with renewable energy, and you become your own generator; you've decentralised the power grid so you can harvest sunlight during the day, store it, and use it for mobility when you need to. A key development this decade in this area has been around households selling excess decentralised power on peak days to the utility generator which can be credited or given back to the household during the night.

In Australia, our primary energy mix is working well in terms of supporting current EV adoption and EV architecture. We can charge off our own domestic infrastructure with no problems for the grid operators or energy traders.

Europe's push towards climate change mitigation can be seen as a lead indicator domestically. Widespread EV adoption and climate commitments have been slower in Australia. However, changes in the market, particularly as they relate to technology raw materials, are being felt strongly. Raw material demand and prices have gone up and reset the dial in our industry. It has changed from scrimping and saving - trying to maximize recoveries - to investing in more environmentally sustainable processes, acids, neutralising tailings and capturing emissions. We've responded to what the market wants, which is a much more carbon and environmentally conscious minerals processing industry.

Previously, internal combustion engine vehicles had a far smaller carbon footprint than electric cars during the production phase due to the materials and minerals used to create the chemicals for EV batteries. OEM's²¹ were attempting to retrofit a lot of their existing vehicle platforms but the battery packs were hard to access at end of life and recycle. Cars are now designed to be much easier to recycle and batteries more easily replaced. The big EV car companies are, for example, using the batteries as part of the strengthening mechanism for the frame of the car and because the battery is utilised in this way, it also means that EV's are safer to drive in terms of impact. The industry had to take some pain because we needed to get batteries into cars - they needed to last longer. Ultimately there was a massive net benefit; we've been able to lower the pay-off from seven years down to two years on a carbon balance in EV's versus internal combustion.

20. The interview was first published in KPMG 30 Voices on 2030 - The Future of Energy, KPMG in Australia, September 2021

21. Original Equipment Manufacturers in the automotive industry

New regulations have tightened the requirements on what is mandatory recycling in many jurisdictions. There is more electronic waste recycling, more carbon efficient recycling, carbon labelling, regulated recoveries and minimum use of recycled content. Stakeholders want to see more transparency on sustainability of companies and their supply chains. Over the last decade, we have had to fundamentally change how we've approached processing minerals and looking at it more holistically. What are our tailings like? What are the least green processes? What and where are we emitting - we realised that you really can't manage what you can't measure. It was a big challenge though - the battery minerals supply chain is very large and long - from mining lithium, nickel or cobalt in Australia or China to chemicals production in Europe or North America or Asia. Neometals has been able to develop a recycling process which basically enables you to regenerate those materials because they've already been mined and used once. We can't sell a product into the supply chain today unless we know the carbon footprint, because the car makers must also declare it, as must the battery cell makers.

The provenance of everything in that car is verified in a digital certificate right back to the point of origin testifying and attesting to its ethical, environmental and sustainability credentials. This is also forcing minimum amounts of recycled product in the cars.

Innovation in the operating and the safety systems, utilising things like Bluetooth, wireless and satellite, has made us all super connected and safer. Services provided by NRMA, RAV etc just aren't required for anything more than flat tires now. The ability to not have to own a car, but to summon a car on demand, is also fantastic.

Now, in 2030, we are recycling 100% of the world's batteries being to generate ~10% of what is needed to make new batteries and it's improving all the time. By 2040 or 2050 we should be close to self-sufficiency. Our industry today is much more mature about working collaboratively so everyone gets the value they want. Consumers not only get a cost benefit - better value for money - but also a sustainable benefit too.





Sumant Sinha

**Founder, Chairman and CEO,
Renew Power**

Slowing the effects of global warming: The Role of Clean Energy

Human activities have already caused irreversible damage to the climate and have already set in motion more changes yet to come. It is now a fact that the world must not only work on climate mitigation, i.e. reducing future emissions in the atmosphere but also on climate adaptation, i.e. dealing with and adapting to the changes that have already been caused. While there isn't much we can do to repair the damages already caused, we do not have a choice but to avoid future emissions into the atmosphere. The survival of all species on the planet depends on it.

To reduce future emissions, we must identify the source of emissions and find solutions for the most emissions-intensive sources. Nearly three-fourths of the global emissions come from various energy uses, therefore we need to rethink our entire energy ecosystem to reduce these emissions. Within our energy systems, the end-use applications primarily include electricity, industry, transport and buildings amongst others.

About a quarter of energy use is towards electricity, this is the sector that has made the most progress in terms of decarbonisation. Renewable energy technologies have gone through an evolution that has driven down their prices and made the technologies more mainstream. While there are still issues to solve in the renewable energy space such as intermittency, there are solutions available or being developed already.

Transport makes up about 30% of the energy mix. This is across land, air and water. Electrification of transport is the emerging trend within the land transportation sector. There has been a lot of investments as well as policy push in this regard and many companies are coming up to accelerate the adoption of electric vehicles. Storage and batteries are also expected to become cheaper going forward – this will serve the dual purpose of faster adoption in electric vehicles as well as solving the intermittency issue in renewable energy. Aviation and shipping, on the other hand, are difficult to decarbonize and will require a replacement of fuels.

The other components—industry and buildings which make up about 40% of the energy mix are the sectors that are the hardest to abate.

For the sectors, whose stories are yet to play out, there are many emerging technologies and low hanging fruits that can be tapped. One such solution is green hydrogen. Hydrogen is one of the most abundant elements in the universe and if produced through renewable energy it does not emit any carbon dioxide upon combustion. Hydrogen can serve as a bridging fuel that can potentially help decarbonise the hard-to-abate sectors such as aviation, shipping, commercial vehicles, steel, refining, fertilizer manufacturing, etc.

The other technology that needs to be developed to further decarbonise industry is Carbon capture and storage. This will be useful to capture the emissions instead of releasing them into the atmosphere. This will be a useful step towards decarbonising the sectors that have not yet found emission-free solutions.

Many more innovative solutions are still being developed. I expect to see the efficiency of energy increase with the existing technologies being made more proficient. I expect a deepening of electrification in most energy use cases. I imagine a future, where people will be able to produce energy all around them, with windows in the houses serving as solar panels. There is no end to the limit of innovations possible. However, it is important to take advantage of the opportunity we are sitting on right now.

There is immense scope in this sector and a lot to do to save our future generations from the fate they are likely to encounter. A collaboration between stakeholders across the spectrum from governments to companies and even at the individual level is necessary to achieve net-zero and stay below the 1.5-degree threshold. Clean energy technologies and human ingenuity will be the biggest contributors towards a greener future for all of us. I am confident that if everyone does their part to enable the clean energy revolution, we can move to a sustainable future, resilient against the effects of climate change.



Anvesha Thakker

Global co head Climate change and decarbonisation – KPMG IMPACT and Partner & Lead, Renewable Energy – KPMG in India

The seven-point climate action bucket list

At COP 26 this year, progress was made in a number of areas but there were also disappointments. The commitments made were not sufficient to put the world on a track to limit global warming to 1.5 degrees above pre-industrial levels. However, 90 per cent of the world economy now signing up to Net Zero, in itself, is a significant leap in the right direction. No doubt much more has to follow. What was also encouraging at COP 26 was the bottom-up intent and action demonstrated by businesses, investors, and other stakeholders.

Organisations have taken the baton compelled by pressures from government, customers, investors and employees to decarbonise and move towards Net Zero. However, real change will not happen unless there is genuine ambition, vision, and commitment to make an impact. Corporates need to set measurable targets and draw up clear strategy and road map to move towards this.

I would advocate a seven point 'climate action bucket list' " in this regard.

1. **Aim for quick wins.** Almost three quarters of global emissions come from energy and a significant part of this comes from electricity use. There are mature products like corporate renewable power purchase agreements that enable businesses to procure renewable energy directly. These can help organisations in significantly reducing their emissions while also simultaneously improving the bottom line as renewables are often the cheapest sources of energy in most countries. Additionally, with technologies such as hybrid, storage gaining strength, businesses now have the ability to procure reliable, schedulable as well as round the clock green power.
2. **Look ahead,** especially in industries like steel, cement, transport and others where it's harder to decarbonise. Businesses should plan for emerging technologies like green hydrogen which are the critical "missing links" in the decarbonisation pathways. While such technologies may look expensive now, we anticipate that cost parity will be advanced by innovations, rapid scale up as well as effective carbon pricing.
3. **See outside an organisation's four walls to its supply chains.** We encourage businesses to take a collaborative approach — to work with vendors to find solutions that help them move toward Net Zero. The way organisations act now will shape how they're valued by stakeholders in the future.
4. **Strengthen capabilities and energize your people.** Three-quarters of directors and C-Suite executives from more than 500 global majors interviewed last year²², indicated that organisations did not have significant expertise to deliver on decarbonisation strategies. I believe organisations need to plan not only for diverse capabilities but drive a deep culture as well as behavioural change. To build momentum internally, it is important to have a clear climate strategy and create internal transition teams that can help you stay on course. Executive performance also must take into account the environmental performance of businesses.
5. **Re-assess business portfolio:** Assess the risk of climate on your business portfolio and strategise to alter course or radically pivot towards businesses which will help you deliver sustainable value in an increasingly climate conscious world.

22. Climate Change and Corporate Value, what companies think. KPMG and Eversheds Sutherland Survey. Eversheds Sutherland 2020

6. Capitalise on the availability of 'green' funding.

Look to mobilise cheaper capital for funding the decarbonisation investments by tapping sources such as sustainability-linked bonds and explore innovative financing to accelerate adoption of climate related initiatives. Corporates who will act swiftly will be able to meaningfully reduce the cost of equity and debt as ESG investing is gaining momentum.

7. Focus on innovation. Finally, businesses need to drive innovation in technologies (both core and enabling) as what we have is not perhaps

enough to address all the climate issues. Further, we need to make the existing ones work harder to deliver larger impact and we need to drive down the costs as never before. Of particular importance is leveraging technologies such as IOT, AI/ML and other digital tools to bring in credibility by transparent measurement and reporting of achievements. This is likely to come under significant focus as we move forward, driven by new global disclosure standards.

Businesses need to be bold in pursuing innovations and experimenting with newer technologies, newer processes. Teams on ground need to be assured that even if some of the experiments do not yield the desired result the top management is willing to back them to innovate and invent. Only then businesses can wholeheartedly progress towards creating real impact.

Adapted based on remarks published in Forbes by Anvesha Thakker in the article '**How Organisations Can Unleash The Positive In Net Zero**'. Anvesha Thakker, Global Co-head of Climate Change And Decarbonisation, KPMG IMPACT. Forbes November 2021





Richard Threlfall

**Global Head of KPMG IMPACT
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Need for immediate collaborative action at an unprecedented scale required to address the climate challenge

Something really exciting is happening in the world. A critical mass of governments, businesses and individuals is embracing a sense of responsibility that goes beyond their own interest, or even that of their own generation — sharply focussed by the recognition that climate change is the existential threat to humanity. It is now, at last, well accepted that if we do not urgently limit the rate of global warming, the future for our children and grandchildren is very bleak, indeed.

This reality is challenging businesses to report on their impact, reassess their purpose in society and become a force for good — for employees, customers, suppliers and the communities in which they operate.

And we are seeing progress. Over the last year more and more governments have committed to 'Net Zero' - which means stopping most greenhouse gas emissions completely, with mitigation measures to cancel the effects of those remaining. It is the world's greatest common challenge, requiring an unprecedented alignment of human effort from individuals, businesses and governments.

Agreements to cut emissions and reach Net Zero are made at a national level and all countries have a role to play. This is recognized by the 2015 Paris Agreement, ratified by 186 countries and territories, which aims to keep global temperature rises this century well below 2 degrees Celsius and try to limit them to 1.5 degrees.

As the world prepared for the COP26 UN Climate Change Conference in Glasgow in November, KPMG IMPACT produced its first-ever **Net Zero Readiness Index** (NZRI). The NZRI compares the progress of 32 countries in reducing the greenhouse gas emissions that cause climate change, and assesses

their preparedness and ability to achieve Net Zero emissions of these gases by 2050. The NZRI considers 103 indicators for each of the 32 countries. These have been split between national preparedness, which considers a country's national commitment to decarbonize, its past decarbonisation performance and the national enabling environment for decarbonisation; and sector readiness, covering electricity and heat, transport, buildings, industry, and agriculture, land use and forestry.

The hope from this is that other countries can learn, copy and adapt their own roadmaps to Net Zero. Progress is rapid, with new technology solutions, market and policy mechanisms and consumer behaviours emerging every day. Unfortunately, notwithstanding this progress, the world as a whole has not only failed in the last five years to reduce emissions, they have actually increased.²³ The scale of the challenge can therefore seem daunting, but as Christiana Figueres, former Executive Secretary of the UN Framework Convention on Climate Change, argues, we have a collective responsibility to focus optimistically on how society will solve this problem rather than be overwhelmed by it.²⁴

Ultimately, the climate challenge can only be met if society as a whole changes behaviours. Although not all countries are equally responsible for the problem, and consequences will vary, as with COVID-19, no one and no country is safe until the world is safe. It is vital that every country and business does everything they can to contribute. Individuals, organisations and countries must collaborate to an unprecedented degree. We need to work together, transparently and honestly, and with absolute determination to do whatever it takes.

23. Net Zero Readiness Index 2021, KPMG, October 2021

24. Message from the Global Head of KPMG IMPACT, KPMG, October 2021



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Businesses implications of the commitments and plans at COP26

With the world at a critical point in its fight against climate change, the recently concluded COP26 Summit was the most significant climate-focused event since the 2015 Paris Agreement. The commitments made and the plans outlined during the summit have deep-reaching implications for businesses, globally. COP26 has aptly been called the 'Business and Finance COP' for the prominent role of the business and finance community, as compared to previous conferences.

The summit held on to the aspirations of the Paris Agreement of limiting global warming to 1.5 degree Celsius – a target that seems unlikely to be met, going by the way things currently stand. Nevertheless, since the time of the Paris Agreement, there has been a marked shift from the 'top down' reliance on governments to a 'bottom up' approach by businesses, investors, NGOs and consumers, who have undertaken a vast array of climate-focused initiatives that will likely gain momentum of their own.

Clean financing will greatly influence business strategy

Today, businesses are far more engaged and proactive in taking the initiative on climate action. This was

demonstrated by the Glasgow Financial Alliance for Net Zero, which has assets worth USD130 trillion under its control.²⁵ It has become clear that clean finance can play a critical role in driving or stopping business activity. Banks, insurers and capital markets are expected to promote and drive climate action to a far greater extent than ever before. Institutional investors are exercising great influence through investment policy and are demanding increased climate focus from their investee companies. Importantly, these investors are as focused on private companies as on public companies.

Net zero actions will come under greater scrutiny from all business stakeholders

COP26 witnessed new climate commitments by India, Russia, Brazil, Saudi Arabia, Australia and others. At least 90 percent of the world's economy is now signed up to net-zero targets, as compared to 30 percent a year ago.²⁶ The new requirements for all listed companies in the UK to produce net-zero transition plans by 2023 will increase transparency and scrutiny of the companies that have credible plans and those that don't. This is likely to be replicated in other countries.

25. Amount of finance committed to achieving 1.5°C now at scale needed to deliver the transition, Glasgow Financial Alliance for Net Zero, November 2021

26. COP26 reflections: Implications for businesses, KPMG, November 2021

Today, not only institutional investors, but employees and customers too are paying close attention to how businesses perform on the net-zero agenda. Given that most carbon emissions come from businesses, this is a welcome development. Government policy and regulation will continue to be critical, but it is also true that global corporations are now moving faster than governments in the race to net zero.

Sustainability will become a very important part of reporting

COP26 has established a new International Sustainability Standards Board to develop global reporting standards for carbon emissions, building on and incorporating initiatives like the Task Force for Climate-related Disclosures. As a result, there will be sharper focus on reporting and disclosure by businesses. Governments are expected to continue to pursue policy initiatives to drive the agenda, not just for reporting, but across the wider carbon space. Institutional investors are taking this agenda very seriously, as it directly relates to the value of their investments. Commitments alone by companies will not suffice; they will need to be backed by meaningful and well-thought-out plans and swift action. Companies should expect to report their progress yearly between now and 2030.

Climate action presents opportunities in many new and emerging segments

The Glasgow Breakthroughs establish innovation programmes for clean power, zero emission road transport, clean steel, hydrogen and sustainable agriculture. There is great optimism that solutions to climate change can be found, with a big role for renewables, electric vehicles, low-carbon hydrogen, batteries, carbon capture and storage, direct air capture and long-duration energy storage. There is also strong focus on green innovation and emerging technologies.

It is essential that businesses see the value of the opportunities that arise from the ongoing response to the climate crisis. Society is entering a phase where low-carbon goods and services have great value, and this trend will likely continue to dominate the marketplace. Businesses should be prepared for widespread changes. Those that have a credible, quantified plan for emissions reductions can breathe easy; those that don't should develop one as soon as possible. The shift to net zero is the next great industrial revolution. Businesses that seize the opportunity are most likely to thrive; those that don't might not.





Dr Priyantha Wijayatunga

**Chief of Energy Sector Group,
Asian Development Bank**

Decarbonisation: let us do our part

Developing nations had only a minimal contribution in the past to climate change. However, as countries with limited resources to deal with the consequences of climate change, they suffer most. Also, these developing countries are contributing significantly to the emissions which will decide what will happen to all on the planet regardless of the level of past responsibilities. Therefore, it is only through collective action we will succeed in overcoming this greatest challenge of our time.

Climate action and meeting energy needs of the populations are not mutually exclusive. These two challenges can be and should be addressed together and in a balanced manner. In particular, developing countries need to provide essential energy services to keep on uplifting the living standards of their people while ensuring minimal or no additional adverse contribution from those services to climate change. This can be achieved only through cohesive action on all the fronts, including commitment to gradually and rapidly to move away from fossil fuel use in their economies. At the same time, developed countries, while taking own actions to reduce significant greenhouse gas emission reductions, need to support the developing economies with appropriate technologies and financing for them to contribute effectively to this common course.

On the part of development financing, Asian Development Bank recently approved its new Energy Policy after more than a decade since the last. The new policy formalised ADB's current practice of not financing coal-fired power generation and heating facilities. ADB will finance midstream and downstream gas projects and oil-fired power generation projects under strict guidelines only in circumstances where there are no other cleaner alternatives, which can provide equivalent energy services to satisfy energy access requirements of the developing member countries. Its support will be extended to accelerate decommissioning of coal-fired

power generation plants complemented by support for communities affected by such energy transition. ADB will provide all the assistance for the countries to develop, design and implement their clean energy programmes, acquire and deploy latest technologies to leapfrog in energy sector development and to create an enabling environment to leverage maximum private sector investment against every dollar of its sovereign assistance.

ADB has already committed to align all its sovereign operations with Paris Agreement by 2023 and private sector operations by 2025. It has enhanced climate financing ambition to a cumulative investment of USD100 billion from 2019 by 2030, including doubling of adaptation financing to USD9billion by 2024. With this vision and the strategies, ADB's energy sector operations will now gradually shift from traditional areas of support towards engaging with counterpart governments on those investments and technical assistance mostly to enable and accelerate investments in clean energy including improving policy and regulatory environments and financial sustainability of the sector utilities. This includes, among others, deployment of emerging technologies and operational regimes to improve flexibility of transmission and distribution systems, minimising the use of fossil fuel fired power generation, increasing e-mobility and the piloting technologies such as hydrogen and bio-fuel.

It is time that all stakeholders work together in unison to confront energy sector development and climate challenges together in a holistic manner considering diverse needs within countries' economies and also recognising that energy is cross-sectoral in nature. International Energy Agency has estimated that 55 per cent of the emission reductions required to achieve net zero emissions by 2050 to give a chance to keep global temperature rise within 1.5 degree target, are linked to consumer choices. Let us do our part to succeed in this endeavour.



Audrey Zibelman

Vice President, X'S
Electric Grid Moonsho

In this energy transition, the innovation has been in consumer services as opposed to investment in supply²⁷

What have been the biggest transformations to the energy system over the past decade?

The biggest change has been in the use of technology at more affordable costs to make the whole energy system much more efficient, which has enabled a more cost-effective decarbonisation of the grid. A decade ago, the grid was dominated by large scale resources and demand was static - the most efficient utilities were meeting large volumes of predictable industrial demand. As we retired older units and replaced them with wind and solar generation, and more and more batteries, electric vehicles and other forms of longer duration storage come online, the system not only became more distributed but also less predictable. When we realized that we could use technology to better harness resources like electric vehicles (EVs), batteries and internet-connected appliances to optimize the grid, it opened the door for industry innovators. They have since been able to seize the opportunity to create greater system automation, allowing more precise decision making and widespread efficiencies.

Today the grid operates with large-scale power systems and billions of devices, like EV's or HVAC, which connect to it through inverters. Using technologies like the Cloud, Artificial Intelligence and Machine Learning, we have been able to put more automation in, building system efficiency and predictability. Now, we are not only paying less for our renewable energy resources supplying our electricity, but utility service providers - through the consensual management of devices such as charging EVs during the night, when wind is available, and demand is low—can manage that demand much more efficiently.

As a result, innovation has been more services focused— supporting consumers to maximize demand patterns for the best cost and efficiency gains—rather than supply side focused. This network autonomy, automation, and ability to remotely manage devices means the energy system has become more intelligent.

This intelligence gives us more confidence to solve further inefficiencies right at the system edge. Without it, any decarbonisation of the grid would never have worked as well as it does today.

What does the 2030 energy market look like from the perspective of energy incumbents and other service providers?

We imagine a world and are now advancing one where, as in IT, AI and machine learning have transformed the operating environment such that all players have access to the full system operating information in real time.

We are still seeing experimentation in how to make this market perform best. We have not yet resolved whether the network and gentailers are best placed to move into other services, building on their incumbent position operating the system, or a whole range of aggregators have effectively provided the full range of energy services.

This market won't automatically emerge. Markets are ineffective at this kind of transformation because of all the uncertainties and the difficult risk/ reward trade-offs. In a future world where we once it is understood how this new operating environment works, companies can start layering services on top of existing offerings, rather than moving straight to new markets.

27. The interview was first published in KPMG 30 Voices on 2030 - The Future of Energy, KPMG in Australia, September 2021

In 2030, like in 2021, the market still has incumbent utilities with access to customers and other assets in a strong place, but the survivors have reinvented themselves into true service companies, building on strong customer information and existing relationships. These companies drove greater efficiency in the grid and had the advantage of implementing storage at scale. Up to now, this has worked as the best business model from the consumer perspective, but this is in the process of changing. For example, with customer information becoming more ubiquitous, we are seeing consumer retailers or other new entrants challenging for market share.

How important has technology been in developing the new energy system in 2030?

Technology has been fundamental to market development during this energy transition. It has transformed our ability to forecast demand changes and predict system disruptions. Even in the last decade, we were at the point where power systems could be virtualised and we were creating digital twins. Since then, the power of simulation technology has allowed us to better anticipate events and resolve them - creating a single source of truth for decision making.

As our natural resources like wind and solar dependent on the weather became our dominant source of power generation and climate change and cloud cover became central to managing its complexity, technology has allowed us to not only run the system more efficiently but forecast its behaviour more accurately. It's been a massive game changer—we're able to understand the nature of the issue, have innovators help solve it, while being very comfortable that we are making strategic operational decisions.

As energy technology becomes more fast paced and interoperable, Australian policy makers have had to

take new interest in product standards. This allows new energy products and services to plug and play more easily, allowing more rapid innovation, driving down costs for the consumer.

What cultural changes do you think energy market participants need to employ to be able to deal with this period of rapid change?

In the past, policy and compensation incentives have constructed the energy industry to be one with a lot of long-lived technologies, generally meaning it does not prioritize the implementation of new technology or new design considerations well and is often dealing with legacy system issues. By 2030, energy companies and utilities have developed a better willingness and ability to take on greater technology risk. They have alleviated some of this risk by developing deeper technology partnerships and collaborations – so they do no longer need to go it alone. We've seen the success of this approach in other sectors, particularly the airline and financial services industries.

Energy regulators too, have become more comfortable with risk and allowed for more R&D experimentation. This is a period of great change in our energy system, and it means that a lot of things will not work out the way people might anticipate; allowing time for learning and sharing and not penalizing companies for failures is important.

But perhaps the biggest change has been with policy makers. In 2030 energy and climate policy is no longer a cultural or tribal signifier, so it has become less political with everyone rowing in the same direction for a decarbonized, efficient, reliable, and cost-effective energy system. This has allowed policy to focus much more on problem solving for the issues thrown up by the rapid energy transformation which is now proceeding apace.

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