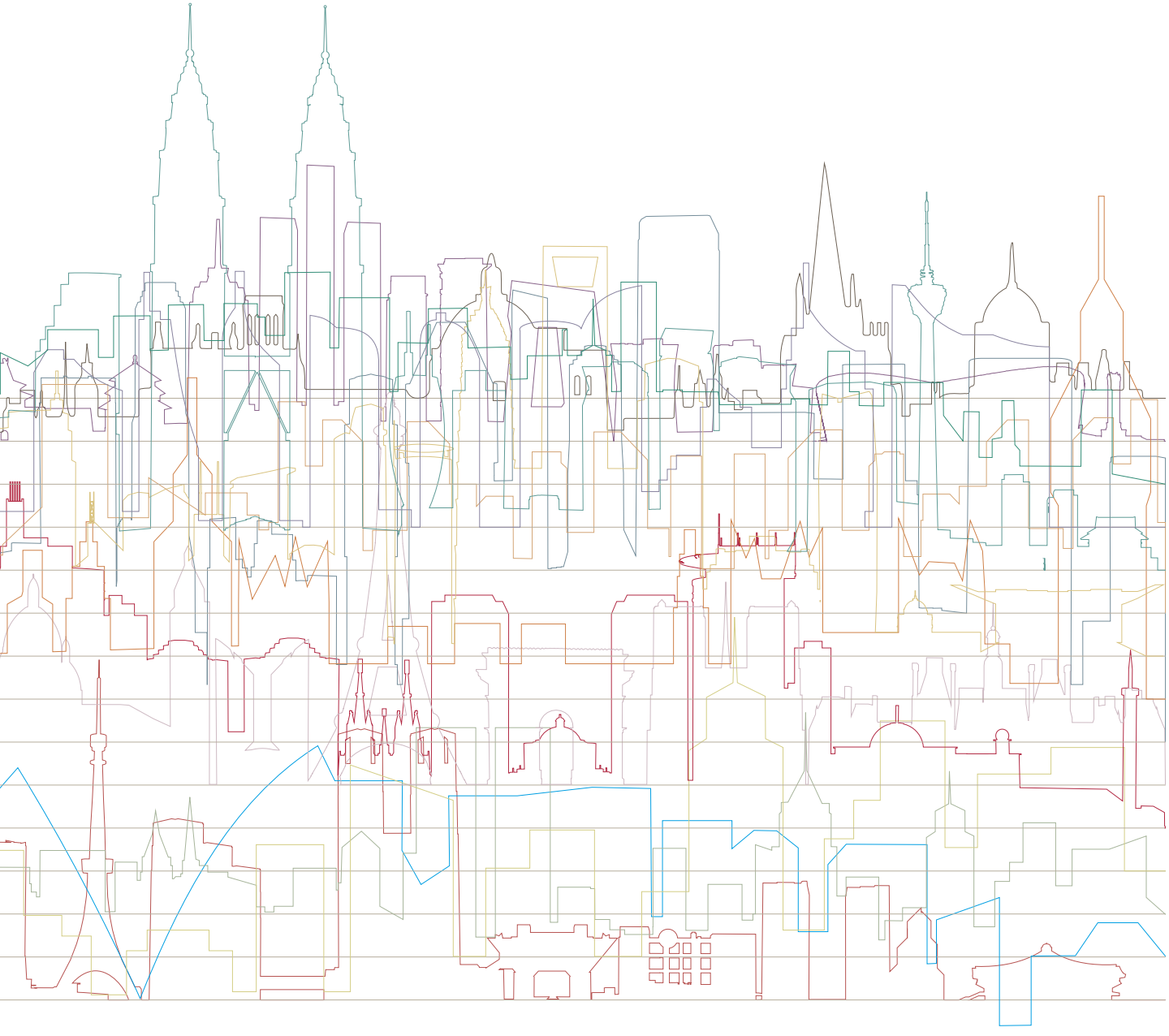
THE OXFORD METRICA REVIEW

# DIVERSITY THE KEY TO THE ENERGY TRANSITION



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*Rory Knight and Allister Wilson of Oxford Metrica argue retaining a diversity of sources will be key to ensuring future energy security*

The Paris Agreement to keep global warming to below 2°C and limit it to 1.5°C rests on a major shift from fossil-based systems to renewable energy sources. Climate scientists and politicians eagerly assert that there must be an inevitable and accelerating move away from hydrocarbons. However, the idea that wind and solar will solve the world's energy crisis ignores hard realities.

Carbon emissions have soared as the global economy has got back on its feet from Covid lockdowns. Oil and gas demand has come surging back. By contrast the solar and wind industries have failed to capitalise fully on the opportunities for expansion and still only account for approximately 12% of global power generation, and 3% of global primary energy supply. According to the International Energy Agency (IEA), despite promising growth in renewables, power sector emissions had the largest sectoral growth, and the largest absolute sectoral increase in emissions in 2022 was from electricity and heat generation.

Whilst currently there are record sales of electric vehicles and very substantial plans are envisaged for solar and wind installations, a rapid transition away from the existing energy infrastructures is not evident from the data. Electric vehicles still only comprise 2.2% of the total vehicle population and now face increasingly high electricity prices.

***Solar and wind are not a panacea***

In the belief that wind and solar can deliver net-zero carbon emissions by 2050, global governments have spent over $5 trillion over the past two decades to avoid using fossil fuels generally and promote and subsidise wind and solar. But oil, natural gas and coal still supply approximately 84% of all the world's energy – a figure that represents a reduction of only 3% from twenty years ago. The IEA reports further that 2022 reductions in emissions from natural gas were more than replaced by emissions from coal, which grew to a new all-time high.

FOSSIL FUELS STILL SUPPLY 84% OF THE WORLD'S ENERGY

Oil still fuels nearly 97% of global transport. Crop-derived liquids supply most of the rest with batteries powering less than 1%. And research published by Nature estimates that by 2025, the IT industry could use 20% of all electricity produced and emit up to 5.5% of the world's carbon emissions. That's more than most countries' total emissions. The massive data centres at the heart of the Cloud alone are estimated to consume almost ten times more electricity than the world's ten million electric cars.

Worryingly, advocates for solar, wind and lithium-ion batteries as the solution to achieve net zero by 2050 blindly ignore the impact the necessary expansion in mining will have on both the environment and energy security. Green technologies are significantly more materials-intensive than our current energy mix. Obtaining the same amount of energy from solar and wind that the world currently derives from fossil fuels, will demand a huge increase in mining because a wide range of non-renewable minerals mined from the earth are needed to make up the physical components of renewable energy systems.

Manufacturing the solar panels necessary for such a huge increase in solar power will require an unprecedented increase in mining raw materials, which account for 50% to 70% of the cost of manufacturing solar panels and batteries. Myriad problems are created by the mining of silicon, silver, aluminium, copper and other minerals needed to make solar panels. Until now that has not mattered, as wind and solar have only accounted for a small percentage of total energy supply.

China produces over 80% of the world's polysilicon, a high-purity form of silicon that serves as an essential material component in the solar photovoltaic (PV) manufacturing industry. It is the primary feedstock to produce solar cells today. Because the manufacturing process is highly energy-intensive, coal-fired electricity is used to manufacture polysilicon.

Even today 10% of the world's silver is used in the manufacture of solar panels – consumption that has already brought its own share of problems to the supply chain. By 2050, in a 100% renewable energy scenario that assumes current solar technology and current recycling rates, solar power's demand for silver could absorb more than 50% of world reserves. Silver mining, based mainly in Mexico, China, Peru, Chile, Australia, Russia and Poland, also causes heavy metal contamination and community displacement.

Copper presents similar challenges. According to the United States Geological Survey, 27% of copper production occurs in Chile, 10% in Peru, 8% in China and 8% in the Democratic Republic of Congo. The IEA predicts that in a scenario of 100% renewable energy by 2050, copper demand for solar projects will have to almost triple.

Substantial ethical dilemmas arise therefore with a massive increase in mining to manufacture the machines required for the generation of renewable energy without damaging or endangering the world's envi-

ronment and its peoples. The Institute for Human Rights and Business has stated that of the top 300 undeveloped copper ore reserves in the world, 47% are located on or in indigenous lands, 65% are in high water risk areas, and 65% are in or near biodiversity conservation areas. Can governments and companies ensure that workers in the solar supply chain will benefit from safe, fair and well-compensated lives?

GEOGRAPHICAL CONCENTRATION OF RARE MINERALS ELICITS MAJOR ENERGY SECURITY CONCERNS

The reality is that many of the essential minerals for clean technologies are produced in only a small number of countries. China accounts for over 80% of global production of graphite used in batteries and has a dominant position in the processing and refining of many other minerals and metals: it processes almost two-thirds of rare earth elements, critical to a plethora of technologies including wind turbines and EV motors. The Democratic Republic of Congo mines 70% of the world's cobalt. Russia is a significant producer of battery-grade nickel and platinum. As is clear from the Ukraine war, geographical concentration elicits major security concerns as geopolitical events can instantly affect the global supply of a wide range of commodities, including food, rare earth minerals and energy.

Do governments want to give repressive and non-democratic countries such as China and Russia even more political and economic leverage?

If the West has learned anything from the war in Ukraine, it must surely be the overriding need for energy security. Russia's invasion of Ukraine has had an extreme impact on the global energy sector, restricting access to energy and creating new turbulence in energy markets (especially in natural gas). 25% of Europe's energy comes from natural gas, nearly 45% of which is imported from Russia. In addition, China remains the single largest source of most of the world's critical energy materials.

There remains, of course, one technology that could provide the reliable energy the world needs: nuclear. Climate activists, regulators and the public have only a partial understanding of the economic potential of nuclear power. Small Modular Reactors (SMRs) being developed by companies such as Rolls-Royce. A single SMR can power approximately one million homes and have the capacity to generate 470MW of power, which would be the same produced by more than 150 onshore wind turbines.

However, Greenpeace has been demonising nuclear power for decades. In their view, "Nuclear energy has no place in a safe, clean, sustainable future. Nuclear energy is both expensive and dangerous, and just because nuclear pollution is invisible doesn't mean it's clean. Renewable energy is better for the environment, the economy, and doesn't come with the risk of a nuclear meltdown."

So, whilst nuclear power might play a significant role in a secure path to net zero by 2050, the public, activists and governments will need a lot of persuading that modern nuclear power stations are inherently safe and can provide the low cost, low emissions heat and electricity that the world needs.

NET ZERO WILL REQUIRE TECHNOLOGY THAT DOES NOT EXIST TODAY

The harsh and inescapable reality is that the capabilities and technologies necessary for such a net-zero path do not yet exist. This is acknowledged by numerous serious analyses including those from the IEA. Microsoft, too, in its 2020 climate-policy position, notes specifically that net zero energy plans "will require technology that does not exist today. This means we will need truly radical inventions or, in effect, a whole new science". Such a goal will need to be underpinned by massive government spending on "blue sky" research, rather than by just subsidising or mandating existing technologies.

***A more balanced approach***

Currently the debate on the switch from fossil sources to renewables and nuclear remains strikingly polarised, with fossil fuel producers denigrated by opponents who argue that fossil fuels cannot, and should not, be part of the future. It attributes infinite costs to fossil fuels and infinite benefits to renewables.

This contrasts with the view of Prime Minister, Rishi Sunak, who stated in an interview on LBC recently that "If you look at the independent forecasts and estimates, even when we meet our net zero target in 2050, around a quarter of our energy will still come from fossil fuels".

Noticeably absent is a rational public policy framework supported by empirical data identifying the expected direct and missed opportunity costs associated with the various alternatives. This can only be achieved through the introduction of balance into the debate – a debate urgently crying out to to be de-politicised.

Transforming today's massive global energy system in order to deliver a secure and sustainable future for everyone, represents a truly formidable task. It confronts us with a worldwide problem that will need to be resolved without unfair discrimination and without denying the peoples of the developing world the right to improve their living standards.

Oil and gas will – and must – continue to play a key role in the energy transition for the foreseeable future.

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**Dr Rory Knight** is Chairman of Oxford Metrica. He is a member of the John Templeton Foundation where he chaired investments. Formerly he was Dean of Templeton College, Oxford and before that the Vize Direktor at the Schweizerische Nationalbank (SNB), the Swiss Central Bank. He has served on numerous boards.

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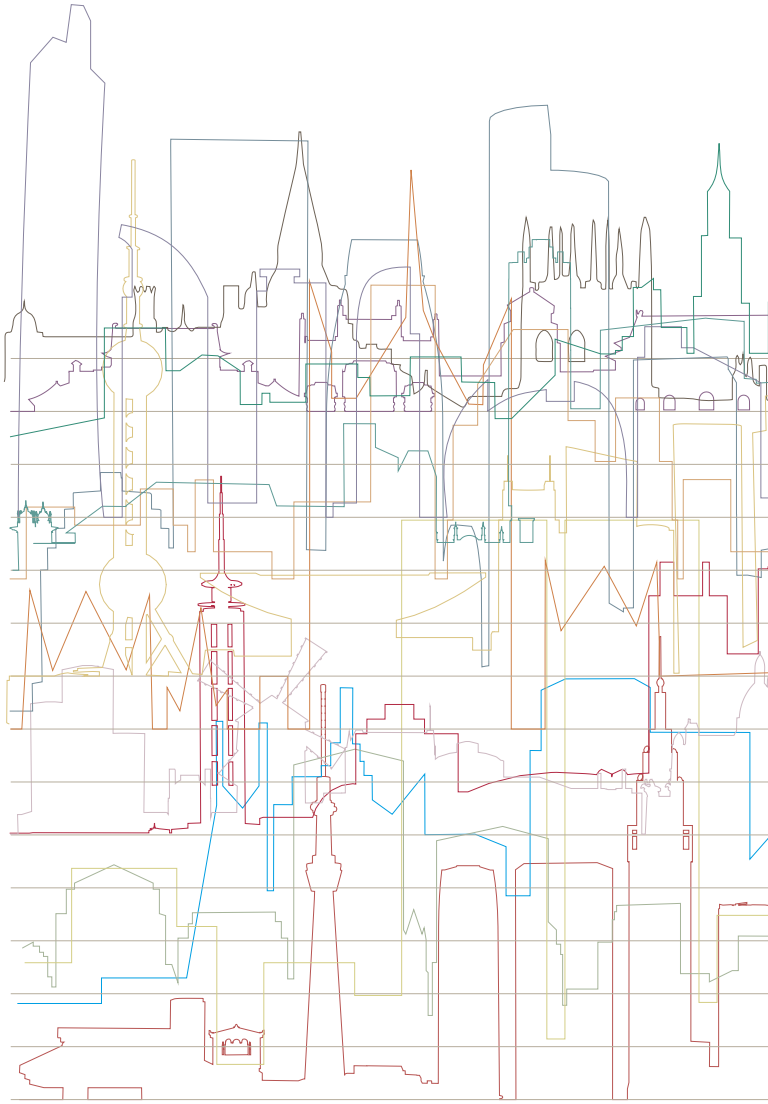

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