RUSSIAN ROULETTE:

HOW FAR ARE WE FROM A JUST NET-ZERO TRANSITION?

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"Things are highly interdependent…War is out of date because our neighbours are part of ourselves…and destroying our neighbour is destroying ourselves"

- Dalai Lama XIV

Illuminating the Path to Enlightenment

Russia's invasion of the Ukraine is proving the Dalai Lama's point. Vladimir Putin's war has lit a touch paper in a world still counting the economic, social and environmental costs of Covid-19, the repercussions of which could see millions of people thrown into extreme poverty. More than that, it has exposed the fact the world is not at all ready to complete a net-zero transition, let alone one that is just for the most vulnerable communities.

The zealous drive towards lowering emissions and developing clean energy alternatives does not actually guarantee that individuals in developing, or fossil-fuel reliant countries will have access to affordable energy. Moreover, those same countries are also unlikely to have the means to achieve food autonomy. In countries where survival is the priority, net zero is unlikely to be a consideration.

Now, however, the correlation between food security and energy interdependence has been thrown into the spotlight by world events. It can no longer be ignored that inflation in the price of oil is a harmful risk that threatens the security of both energy and food.

Since the first oil price shock in 1973, energy economics has followed the impact of oil price hikes and the impact on food prices has always been positive. One study even showed that the 64.17% in food price variance was explained by oil price movements[1].

NET-ZERO WILL REQUIRE A TRANSFORMATION OF THE GLOBAL ECONOMY

In a highly interconnected world, solving the net-zero equation cannot be divorced from pursuing economic development and inclusive growth that guarantees a stable future. What has become clear is that more thoughtful, decisive and urgent action is needed to secure an orderly and just transition.

As evidenced by an increasing demand for coal, and the price of renewable energy soaring by nearly 30% in a year[2], reaching net-zero emissions will require a transformation of the global economy. Or as Sir Ronald Cohen writes in his book *Impact: Reshaping Capitalism to Drive Real Change*, modern capitalism needs an impact revolution[3].

Not only did the pandemic highlight the inequalities globally, but it has also seen global public debt rise by 28% to 256% of GDP; GDP to shrink by 3.3%; and inflation making the cost-of-living rise across the globe. The war has simply pushed the prices of energy and essentials through the roof.

As the world's third largest oil producer, after the US and Saudi Arabia, Russia exports half of its crude to Europe[4]. But now sanctions have been imposed, world leaders are trying to figure out how to sever their energy dependence on Russia.

Brent Crude oil rose to beyond $135 per barrel in March; its highest point since 2012[5], and crude oil prices remain, as at July 2022[6], above $100 per barrel. And according to the International Energy Agency´s (IEA) May Oil & Gas Report, soaring pump prices and slowing economic growth are expected to significantly curb the demand recovery through the remainder of the year and into 2023, with high crude prices supporting strong inflation trends[7].

THE CORRELATION BETWEEN ENERGY AND FOOD SECURITY

The impending global catastrophe, however, is not just about the geopolitics of energy, but the access to a different kind of oil, which, along with other commodities such as wheat, threatens a global food shortage that could last for years, according to António Guterres, UN secretary general.

"For every 1% increase in food prices, 10 million people are thrown into extreme poverty worldwide"

This is according to a joint statement[8] from the heads of the World Bank, International Monetary Fund, UN World Food Program and the World Trade Organization. The threat is so real that the World Bank is making $30 billion available to address food insecurity over the next 15 months[9].

Combined, the Ukraine and Russia account for 29% of global wheat exports and 75% of sunflower oil[10]. Overall, the FAO Food Price Index averaged 159.3 points in March, up 12.6% from February when it had already reached its highest level since its inception in 1990[11].

Meanwhile, world wheat prices soared by 19.7% during March further exacerbated by concerns over crop conditions in other 'breadbaskets' globally: China where rains delayed planting; and India where extreme temperatures have led to export suspensions.

The FAO Vegetable Oil Price Index rose 23.2%, driven by higher quotations for sunflower seed oil, of which Ukraine is the world's leading exporter. Palm, soy and rapeseed oil prices also rose on the back of higher sunflower seed oil prices, with palm oil fluctuating even more

pronouncedly following Indonesia's temporary export ban[12]. India is the world's biggest importer of palm oil and relies on Indonesia for nearly half its requirement of 700,000 tonnes a month[13].

In short, Russia's blockage of the port of Odessa meant that Ukraine's exports were no longer reaching the 400 million people that they used to reach globally, although a week ago, the United Nations brokered a deal to allow wheat exports from the Ukraine[14].

Ukraine is the leading supplier of wheat to Tunisia, Libya and Syria, while Egypt is the world's largest wheat importer, buying 12 to 13 million tons annually[15] with the majority coming from Russia and Ukraine.

GAS PRICE HIKES:
A FOOD AND FUEL DOUBLE WHAMMY

But it is natural gas, or more precisely naturally-sourced renewable white hydrogen, which could potentially become part of a global solution to energy independence, and help to avert a global food crisis.

The price hike of hydrocarbon-based natural gas is a double whammy in the current inflationary environment. European gas has surged by as much as 17% in price after Russia's state-owned Gazprom suspended supplies to Poland and Bulgaria[16].

In addition to importing 27% of its oil and 46% of coal imports from Russia, in 2021 the EU imported more than 40% of its total gas consumption[17] too, a quarter of which flowed through the Ukraine. Germany alone gets half of its natural gas from Russia.

Natural gas, however, is not just an energy source, it is a key ingredient in nitrogenous fertilizer and the weak link to food security. In addition to energy dependency, the war has highlighted fertilizer vulnerability.

Ammonia is a combination of nitrogen and hydrogen. The latter is obtained from natural gas, which means that currently ammonia production relies almost exclusively on natural gas and is therefore closely linked to energy prices.

Ammonia-based fertilizers, most commonly in the form of urea, artificially introduce nitrogen in the soil, accelerating plant growth and are a much safer and cleaner alternative to chemical fertilizers and are useful in regions where the soil lacks enough sulphur and nitrogen.

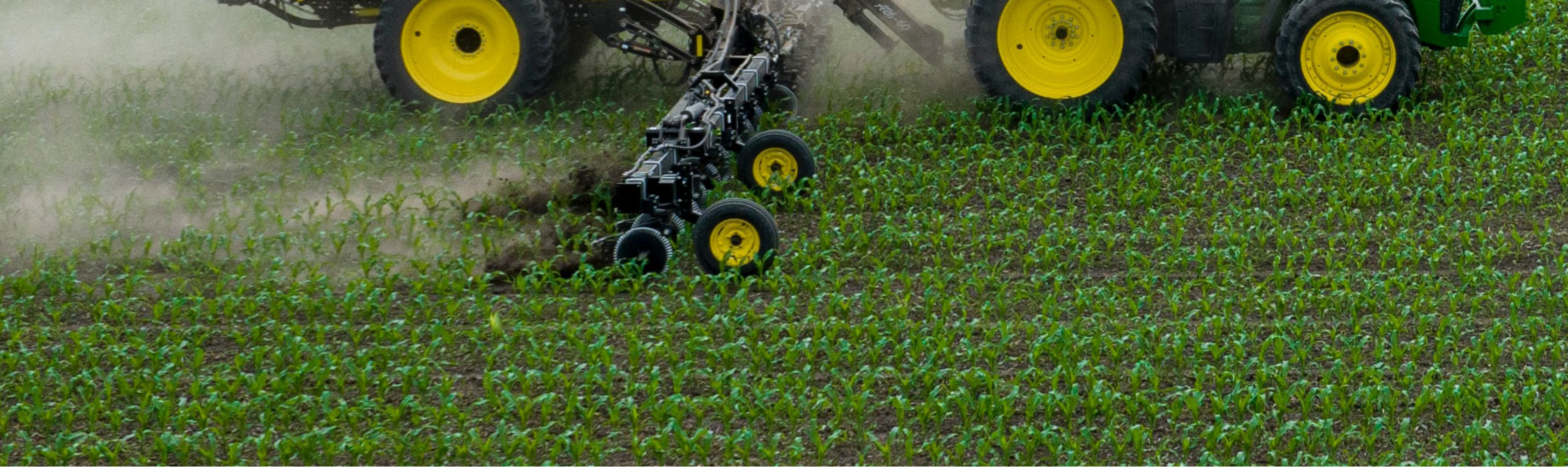
India, Brazil and the US remain the largest markets for imported urea worldwide[18]. In 2020, Brazil imported $7.8 billion in fertilizers, making it the largest importer in the world, with $1.43 billion tonnes coming from Russia alone[19].

The dramatic increase in the cost of natural gas is going to have a knock-on effect on the price (and availability) of fertilizers, and thereby further increasing the price of food. Since the invasion, futures prices for urea fertilizer have jumped 32%[20], surpassing their 2008 peaks.

In addition to the increase in the price of food (on the back of an increase in the cost of fertilizer) is the real risk that farmers start to reduce their use of fertilizers, which in turn will impact the yield of crops and therefore decrease the volume of food produced.

Sri Lanka’s ban, albeit temporary, on the use of all chemical fertilizers last April is likely to see an annual drop of at least 30% in paddy yields[21].

Even before Russia’s invasion magnified the effects of the pandemic, unpredictable deluges and droughts have been destroying crops. The climate crisis was already creating a threat to food security, but the huge jump in food and energy prices is threatening the most vulnerable disproportionality and could potentially lead to a massive humanitarian crisis.



Diversifying the sources of hydrogen for fertilizer production would not only alleviate pressure and dependency on natural gas and oil markets, but ammonia production closer to point of consumption will create carbon neutral fertilizer. Moreover, the cleaner the hydrogen production is, the cleaner the ammonia manufacturing process will be as well, making the overall process more cost effective and sustainable.

NATIONAL ENERGY SELF-SUFFICIENCY IS KEY FOR A SUCCESSFUL ENERGY TRANSITION

There is no doubt that Russia's military aggression against Ukraine has massively disrupted the world's energy system. For this reason, in March 2022, EU leaders put forward a detailed REPowerEU plan[22], as part of a plan to phase out Europe's dependency on imports of oil, gas and coal from Russia, effectively fast forwarding the transition to clean energy.

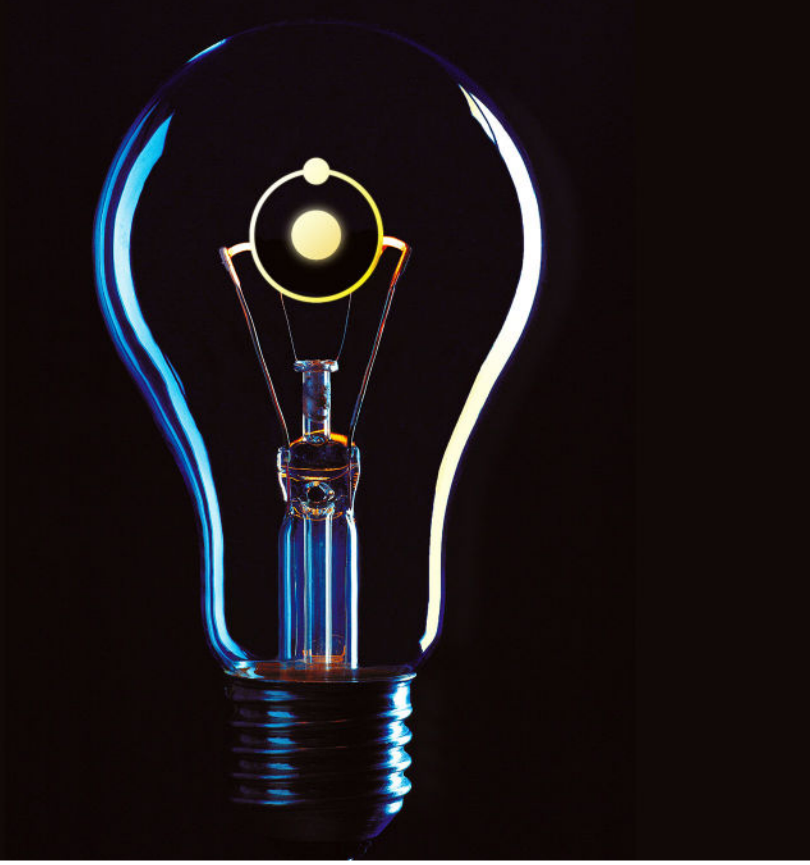
Renewable hydrogen will be a key component of Europe's strategy to replace natural gas, coal and oil in hard-to-decarbonise industries and transport. REPowerEU sets a target of 10 million tonnes of domestic renewable hydrogen production and 10 million tonnes of renewable hydrogen imports by 2030.

It could not be clearer that hydrogen is a key component to a just net zero transition from being a core component of fertilizer and therefore a key to de-risking food security, to, along with coal and nuclear energy, bridging the gaps to renewable energy power supplies. It is a well-known fact that power grid production peaks and lows are completely desynchronized from what the market needs.

The power grid needs additional power that can be turned on to compensate for the inherent seasonal intermittency of wind and solar power and hydrogen is seen as a potential solution. Hydrogen-burning combustion turbines could replace natural gas to provide additional capacity.

According to McKinsey & Co.[23], energy policies rotating towards secure access and source diversification, is one of 12 war-related disruptions that will change the world. And it is under this heading that hydrogen could emerge not only to offer localised sources of energy, but also fertilizer with a low carbon footprint.

HOW CAN HYDROGEN BE NET ZERO'S WHITE KNIGHT?



Hydrogen, which can be used as a feedstock, a fuel or an energy carrier, is starting to make headway as a critical component of a decarbonized energy system. According to the European Commission's recently published report, *A hydrogen strategy for a climate-neutral Europe*[24], hydrogen's share of Europe's energy mix could grow from 2% in 2018 to 13% to 14% by 2050.

According to the Hydrogen Council, in a net-zero world, demand for clean hydrogen could reach approximately 660 million metric tons in 2050, making up 22% of the final energy demand globally[25]. Policy support for clean hydrogen is strengthening globally with more than 30 national countries, including much of Europe, Japan, Korea, Australia, Canada, Chile, Colombia, Russia and the UK adopting hydrogen strategies[26] and roadmaps explicitly pledging c.130GW of capacity by 2030; more than 400 times the 2020 level.

An estimated $5 trillion of investments[27], however, will be required in the global clean hydrogen supply chain to reach net zero. Hydrogen as a core part of the energy transition is not without its challenges, primarily related to emissions from production.

Hydrogen production is already a $150 billion market globally and according to the International Energy Agency, global hydrogen use is predicted to expand to 122% by 2030. This goes to explain why, according to *Hydrogen Insights*[10], McKinsey and the Hydrogen Council estimate that $300 billion will have been invested in hydrogen projects by 2030.

It is clear that hydrogen is not only a potentially key player in the energy transition as a fuel source, but also as a sustainable alternative to chemical fertilizers. But, not all forms of hydrogen production are either cost effective or contributing to the reduction of the energy industry's carbon footprint.

Out of the 75% of the hydrogen produced from natural gas, most of it is produced by methane reforming, a process that emits some 10Kg of carbon dioxide for each kilo of hydrogen produced. The production of the majority of hydrogen was responsible for CO_2 emissions of around 830 million tonnes of carbon dioxide per year, equivalent to the CO_2 emissions of the United Kingdom and Indonesia combined in 2019, according to IEA.

Blue and green hydrogen have been handed the baton as clean energy sources, but in reality, even they are not as green as they look.

Blue hydrogen is obtained from converting methane—a greenhouse gas that is 100 times stronger as an atmospheric warmer than carbon dioxide when first emitted—into hydrogen and carbon dioxide. Removing carbon dioxide and other impurities using Carbon Capture Technologies not only increases the price of hydrogen but also creates a significant carbon footprint.

Meanwhile green hydrogen, which is produced by electrolyzing water molecules into hydrogen and oxygen, is currently the only 'clean' industrial solution. The problem with green hydrogen, which makes up only 2% of the total hydrogen produced, is the amount of energy used in the electrolysis, which needs to come from renewable sources to keep the carbon footprint low.

Right now, green hydrogen produced with renewable resources is not cost competitive when compared to $1.80 per kilo of hydrogen produced from methane reforming. Precise cost estimates vary widely in range with the EU's strategy document[28] alone quoting the range as $3 per kilo to $6.55 per kilo. Key to this will be the variations in cost of renewable electricity.

Moreover, according to the European Commission's July 2020 hydrogen strategy, the estimated cost of blue hydrogen, which pairs carbon capture with steam methane reformation of natural gas, stands at about $2.40 per kilo. At the time of writing, the Inflation Reduction Act passed by the US Senate on August -with tax credits of up to $3/kg- could make the renewable hydrogen produced in the US the cheapest in the world[29].

But, even if green hydrogen could be made cost effective, it is still very energy intensive, requiring more energy to produce than the energy contained in the hydrogen itself. According to the International Renewable Energy Agency (Irena), the world will need 19 exajoules of green hydrogen in the energy system in 2050[30], which equates to between 133.8 million and 158.3 million tonnes a year.

Realistically, producing such a volume would require at least 6,690TWh of dedicated electricity every year — the equivalent of 1,775GW of offshore wind farms, 2,243GW of onshore wind, 4,240GW of solar PV or 957GW of nuclear power, according to calculations by *Recharge*[31].

According to Irena and the World Nuclear Association numbers to the end of 2018, the world had installed 540.4GW of onshore wind, 23.4GW of offshore wind, 480.4GW of solar PV and 397GW of operating nuclear reactors, none of which is being used to produce green hydrogen, according to *Recharge*.

The other hydrogen production processes include: pink hydrogen, derived by using nuclear energy to electrolyze water; yellow hydrogen that uses solar power for electrolysis; turquoise hydrogen generated from methane pyrolysis through molten metal and solid carbon is a by-product; and hydrogen extracted from waste and biomass gasification, which solves the problem of mounting waste stocks and, at $2.7 per kilo of hydrogen, is also more economically viable than other sources.

Some 6% of global natural gas and 2% of global coal has been going to produce grey hydrogen and brown hydrogen, respectively, and yet very little mention has been made of naturally occurring, renewable 'white hydrogen', as a legitimate contender in hydrogen's bid to be the protagonist in the race to net zero.

When comparing different hydrogen production processes, naturally occurring white hydrogen is undoubtedly the most environmentally friendly solution, not needing a large amount of energy or fresh water for the extraction process making it the most cost-effective.

In fact, according to the analysis of the production process of naturally occurring white hydrogen by MJ Hudson[32], it has been concluded that white hydrogen can go one step further than the other hydrogen sources and can be considered an energy source, delivering 11 times more energy than needed in the production process.

Brazil along with central Africa, Australia, US, UK, Russia and Ukraine all have vast reserves of naturally occurring geological hydrogen that can be turned into fertilizer almost in situ, resulting in carbon neutral fertilizers.

With the fear that the net zero transition could be hampered by a return to coal, naturally sourced white hydrogen, which has been documented since the early '1960s, is an almost untapped energy source that can also help to lower the global greenhouse effect.

Production is not dependent on new infrastructure, as a lot of the technology required for production can be adapted from oil and gas production. Although still in the early stages of exploration, experts such as Isabelle Moretti and Alain Prinzhoffer[33] believe geological hydrogen is continually 'renewed', potentially making it an 'endlessly' abundant resource instead of a finite one.

With reservoirs located in almost all continents, it looks like natural sourced renewable white hydrogen could be a true winner in driving energy independence, potentially staving off food insecurity in the more vulnerable nations and, as importantly, become a credible solution in the race to a sustainable, stable and just net-zero energy transition.

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