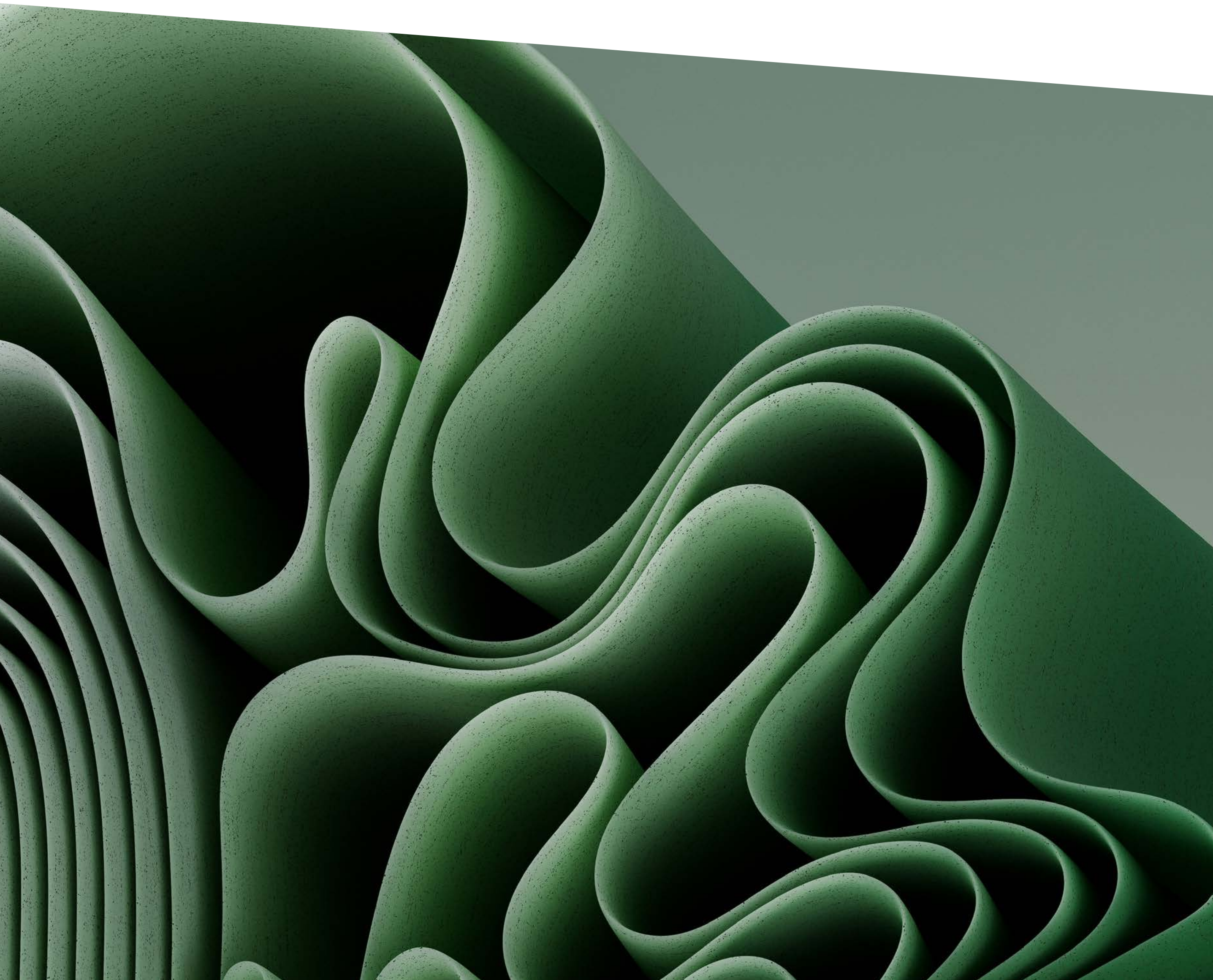
ONS 2026 COURAGE

ONS ENERGY AGENDA VOL.3



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- On 5 June 2026, the editorial team of Energy Agenda Volume 3 formally closed its work. The publication reflects contributions and perspectives submitted up to that date.

- *Disclaimer:* The content of these articles is the sole responsibility of the authors and does not necessarily reflect the views of the ONS Foundation.

From ONS and the Chief Editor

The word "Courage" was chosen as the theme for ONS 2026 many months before the latest Middle East war began at the end of February. The choice was not a prediction of what might happen. It was rather a recognition that the energy business is never simple and requires strong nerves and resilience in the face of challenges many of which tend to be quite unpredictable. Events over the last six months have certainly confirmed those judgments.

Energy has been central to the war between the US and Iran. The blockade of the Straits of Hormuz and the Iranian attacks on energy related infrastructure around the Gulf have reminded us both of the importance of a steady flow of energy to the continuity of the global economy and the costs which come when that flow is halted. The war has made energy supply a matter of insecurity across the world.

Many of the essays in this third edition of the Agenda address the issue of security from different perspectives. The war is far from over making it hard to calculate the impact in detail. What is certain is that the level of risk associated with reliance on supplies from the region has risen. That applies to shipments of crude oil and natural gas but also supplies of products such as jet fuel and feedstocks for fertilisers, petrochemicals, helium.

Cumulatively the impact on industries operating across the world is serious and damaging particularly to those without the ability to pay higher prices. Supply chains have been broken and vulnerabilities exposed. Several of the essays discuss the potential implications as the perception of risks rises. There is a flight to security where that is attainable but also an obvious desire to mitigate the risks which have been revealed.

The war has shaken the energy system and its effects will form a major topic for discussion at this year's global energy forum in Stavanger hosted by ONS. But it has not resolved or removed the other challenges which figured in previous editions of this Agenda. They include the pace of the energy transition and the continuing rise in global emissions of greenhouse gases; the continuing importance of oil and gas; the hundreds of millions of people still struggling to survive because of deep energy poverty and the impact of the changing geography of the energy sector on the pattern of trade.

The Agenda does not reflect a single view of the future of the sector, or advocate one technology over another. ONS does not seek to adopt policy positions. Our goal is to provide fact-based analysis and commentary to all those involved in the energy business – in governments, in the private sector, and in the NGO community on some of the key developments likely to affect their work. We cannot pretend to be comprehensive in our coverage, but the contributions published in this edition cover the issues we believe are of the greatest importance. We would welcome your comments and views – including views on the issues we should be covering in two years' time at ONS 2028.

Our contributors speak for themselves – in each case on the basis of deep knowledge in their particular field. We thank them all. We also thank our many friends in the organisations which support ONS. Their help is invaluable.

Finally, and most important of all we want to thank Rannveig Sofie Stangeland who has managed the process of producing this Agenda with charm and a calm efficiency which has made a complicated task a pleasure. We also wish to thank all her colleagues. The Agenda, in common with all the other work of ONS, is a combined effort involving many people and a great collective achievement.

Energy is more important than ever and perhaps recognised as such more clearly after the events of the last few months.

Leif Johan Sevland, President & CEO, ONS Foundation
Nick Butler, Chief Editor and visiting professor, King's College, London

The long view of the implications of the Gulf war of 2026

The war in the Persian Gulf which began on February 28th has seriously disrupted the global economy.

By Nick Butler, Chief Editor

__Nick Butler__ is a Visiting Professor for King's College, London. Formerly GVP for Strategy and Policy Develop

For more than six months, supplies of oil and natural gas have been trapped behind the blockade of Hormuz. So have the feedstocks for fertilisers and petrochemicals. The impact continues to ripple around the world breaking supply chains and driving up inflation. What has happened is destructive especially for those who have limited ability to adapt. But is the war more than a temporary shock? Is the conflict the trigger of more fundamental changes to energy markets which at the beginning of the year seemed calm and predictable?

The immediate consequences of the Persian Gulf war of 2026 remain unclear. We do not know if a durable peace can be achieved or maintained, or how much damage the war has done to energy infrastructure in the countries around Gulf. We do not know the scale or cost of rebuilding the facilities which have been destroyed or how long it will be before the normal flow of tankers and other ships through the Straits of Hormuz can be resumed. We do not know if global stock markets are correct in seeing the problems caused by the war as essentially temporary and capable of being resolved rapidly once some form of political agreement is reached or whether the war has shattered the old world order and will lead to a serious international recession.

Counterintuitively, the longer-term consequences seem clearer. The war has shaken some cosy assumptions on which we had lazily relied and accelerated some underlying trends of which we were only vaguely aware. Of course, there are no certainties. One drama could easily be followed by another. But the Persian Gulf war has exposed some of the realities of the global energy market in 2026 which

The first is that **energy is now a tool of conflict as well as a prize for victory.** Wars for oil are familiar events and the favourite territory of conspiracy theorists. Much commentary argues that the US decapitation of the Venezuelan government in January was driven by a desire to hand control of Venezuelan oil resources to US companies, even though the companies themselves seem cautious about rushing into a country still run by those in charge under Maduro. Some think that the war in Ukraine is really just a competition for the country's natural resources. Many believed the Iraq war in 2003 was designed to secure Iraqi's oil resources for the West – the irony being that most of those resources now flow to China.

The reality is that the role of energy in times of conflict is more complicated. In the months after the US/Israel attack on Iran began the most important strategic tool was the denial of energy supplies. The closure of the Straits of Hormuz and the very selective targeting of attacks on the energy facilities of America's allies were highly successful acts of retaliation on the part of Iran. The weeks through

April and May when the bombing stopped but the Straits remained closed allowed the new Iranian leadership to regroup and to begin to rearm. Seven thousand miles away America ships were denying oil tankers access to Cuba as part of a strategy designed to force regime change. Russia and Ukraine are both focusing drone attacks on energy targets such as power grids and export refineries. Closer to home, Russian trawler and submarine intrusion into Norwegian waters is designed to demonstrate the ability of Russian forces to disrupt supplies to Europe including Britain.

In future wars the initial preemptive strikes will no doubt target the enemies' energy supplies and the infrastructure on which energy dependent systems for communications, transport networks and food supply chains rely.

The continuous supply of energy is an imperative for modern economies. As Shell's Chief Executive Wael Sawan has said countries cannot have national security without energy security. Energy has been weaponised as Tatiana Mitrova explains in her article for this Agenda. Unsurprisingly every country in the world which depends on imports is now re-examining its own energy security position.

This year's ONS Energy Agenda covers many aspects of the energy security agenda from the exposition by Ulf Sverdrup and Nick Sitter of the changing geopolitics which are reshaping the global market to Alison Gordon's expert description of the subsea security challenges and Amani Abou-Zeid's article on the very different meaning of energy security in Africa where inadequate supplies are a constraint on development.

> The consequence of the renewed focus on security will be a substantial change in the shape of the global markets in which energy supplies are traded.

Until February 28th most of the world was happy to rely on open global markets. Prices might vary but supplies would always be available. At the beginning of the year there was even talk of a glut of oil with supplies outstripping demand.

The belief in frictionless globalisation has been destroyed by the closure of Hormuz. If one choke point in the global supply system could be closed, so could others. Choke points and many other parts of the global energy system are vulnerable to drones, sub sea sabotage or cyber attacks.

At the national level the competition for the most secure supplies will now be even more intense. Norway is surely the most reliable of trading partners but being a key source of supply carries risks as well as benefits. A disruption of the inter-connectors and pipelines linking Norway to the European continent and the UK would be hugely disruptive.

For many countries led perhaps by those in Asia who have been most immediately affected by the closure of Hormuz the best available option will be the development of bilateral barter trade – with oil and gas exchanged for defence equipment, direct investment and political support.

It is not inconceivable that China - now one of the world's largest importers of oil and gas – could become the lead investor in the reconstruction of Iran in return for a guaranteed supply of key resources. Chinese tankers would then certainly be allowed through Hormuz. The UAE, free now from the constraint of OPEC membership, could make comparable deals with importers. The terms would be bilateral with prices set at a point of mutual advantage which reflected the valuation put on security of supply. The remaining "open" market would be thinner and potentially more volatile.

For many the war in Iran marks an inflexion point in the transition to a lower carbon economy. Michael Liebrich – an acute observer of the global energy market and an active participant in the transition argues that we are about to see a "Great Clean Energy Acceleration"

Increased investment in wind and solar is likely but a shift in the energy mix sufficient to offset all the losses from the closure of the Straits of Hormuz seems highly unlikely.

As Amrita Sen argues in her essay in this Agenda low carbon supplies do not offer an instant solution to the immediate challenge. Growth in wind and solar comes from a low base – currently approaching 20% of the global electricity market, but only 5% of final energy demand.

Most energy consumption in homes, industry and transportation still relies on oil and gas. The expansion of renewable production also requires the expansion of matching infrastructure and an advance in electrification far greater than anything seen so far.

In 2024, according to the International Energy Agency, 72 per cent of daily consumption worldwide was provided by oil, gas and coal. The figure which excludes the continued use of solid biofuels, has fallen by only 6 % in the last 15 years. The energy transition to net zero has only just begun. Much of the low fruit of decarbonisation has been harvested. The next steps – large scale electrification, the development of hydrogen and the extension of carbon capture and storage will require huge, sustained investment.

At the same time a radical shift is necessary in the way energy is used. Freight transport, energy intensive manufacturing plants, and the homes we live in will all have to be fundamentally altered if we are to mitigate the risks of climate.

The essays in this Agenda by Peter Littlewood and Claire Coutinho set out what is possible given advances in low carbon technology and in the nuclear power sector. A new low carbon economy is possible but only if the cost challenges which have been enhanced by the inflationary impact of the war can be overcome.

Only when science and technology bring down costs and offer low cost, low carbon alternatives to oil, gas and coal will the transition become a natural process driven by straightforward economic choices.

Michael Leibreich suggests that the Persian Gulf war will trigger a shift sufficient to see the use of fossil fuels and the volume of global emissions falling by 2030. There are many assumptions behind such a conclusion. Emissions could fall if China reduces its consumption of coal. Conversely the use of fossil fuels (as well as power from renewables) could continue to grow if India's drive for higher living standards through economic growth continues.

The most likely outcome perhaps is that demand for all forms of energy will rise in line with population growth and the spread of prosperity and that the consequence of the current disruption will be a surge in the search for new sources of oil and gas in areas which enable importing countries which hope to reduce their dependence on the Middle East.

For the energy industry that means the deeper waters offshore Brazil and West Africa, the politics permitting, Russia and Venezuela. In addition there is the Arctic – a potential source of large volume of oil, gas and other resources but an area

where development is certain to be controversial. Håkon Gustafson Giæver our youngest contributor and one of ONS's global leaders of the future discusses the opportunities and the challenges involved in his article for the Agenda.

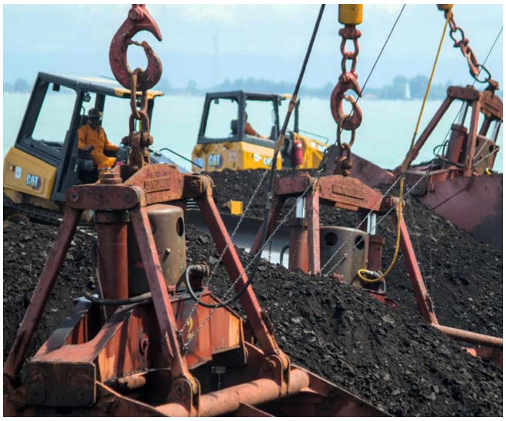
All these areas have resources which can be developed using current technology. But none are simple to access and in each case it will take years for new developments to make a material difference to the global energy balance.

The chances must be that since hydrocarbons will remain the dominant source of global needs, the Persian Gulf will remain an irreplaceable source of supply.

Nothing which has happened in the last six months seriously undermines the forecast of the International Energy Agency and many other public and private projections that the energy mix on the basis of current policies will continue to be dominated by hydrocarbons for at least the next 25 years with oil, natural gas and coal still providing around 60 per cent of final demand in 2050.

When the history of the Gulf war of 2026 is written the likelihood is that we see that "the greatest energy crisis ever" - to quote the Executive Director of the international Energy Agency Fatih Birol did not produce an overnight transformation of the global market but exposed and in some cases accelerated trends which were already at least partially evident.

Perhaps the most significant of those trends – visible and undeniable but still given too little attention - is the steady change in the geography of the energy markets of the world. Figure 1 shows the trend. Coal demand declines over time but oil and gas consumption continue to grow even as production of power from renewables becomes the largest single source of supply. Over the same period the emerging economies of the world led by China and India will become the key sources of demand.



Events in the Persian Gulf in the last few months have demonstrated the extent to which the pattern of trade has already changed. The Straits of Hormuz used to be the transit route for resources produced in the Middle East by Western based companies to be shipped to the major consuming markets of Europe and North America. By 2026 the Straits had been transformed into the major transit route for energy supplies and feedstock processed in Gulf refineries to Asia.

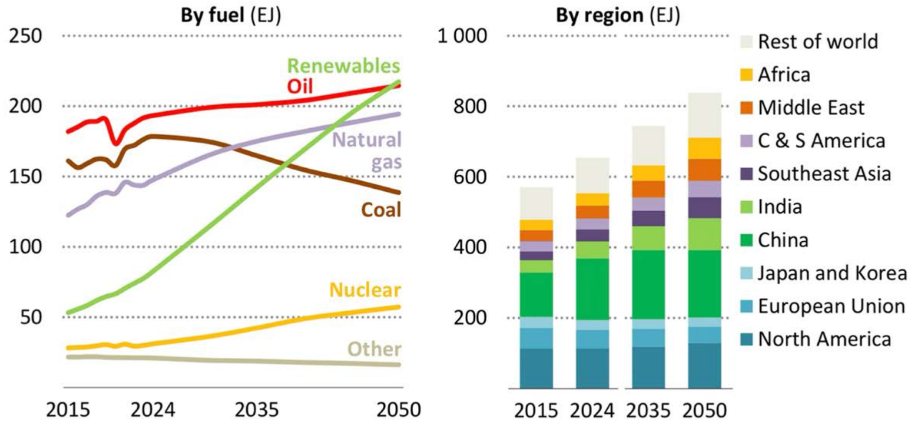
China, India and many poorer countries such as Bangladesh have been the primary victims of the loss of supplies over the last six months. The Asian petrochemical sector, established over the last two decades has been seriously affected with declarations of force majeure and closures forced in Korea, Indonesia and Singapore. Asian companies have struggled to find alternative supplies from around the world – for instance importing jet fuel from US refineries at a reported price of up $ 200 per barrel.

The reaction of Asia to what has happened over the last six months will shape the global energy market of the next decade. Asian countries led by China and India will determine when the use of hydrocarbons peak and which sources of supply will meet their industrial and consumer needs. They will also have to decide how far they will intervene in the Middle East to ensure the security of supplies on which they have now come to depend. They will know that they can no longer expect the US to do the job for them. As Tatsuya Terazawa explains in his article energy security has become an Asian issue.

The implications of the war for Europe are uncomfortable but also challenging.
The challenge is for Europe begins with the need to accept reality. What is happening is a sharp reminder of Europe's vulnerability to events far beyond our control. Economic power in the world has moved eastwards and is no longer centred on the Atlantic. America has it's own agenda and it's own problems.

Total Energy Demand by fuel and by region – 2015 to 2050.

FIGURE 1: IEA Current policies scenario. 2025



On climate change the actions which could make a real difference will be taken in Beijing and New Delhi not in Brussels.

Along with realism must come resilience as Christian Bruch spells out in his essay for the Agenda. Europe cannot isolate itself from the impact of events such as the Persian Gulf war. The risks must be managed and dependence limited wherever possible. Competitiveness is crucial and can only be achieved by a much stronger focus on the science and technology which can reduce costs, including the costs of the energy transition. Europe's goal should be to provide the tools which can offer energy security on all dimensions not just for ourselves but for the world as a whole.

As in the 1970s, after the last major energy crisis, the answer lies in the creative combination of public policy and private enterprise. 50 years ago ONS was at the heart of the success story of the development of the North Sea. In the face of the current challenge the unique ability of ONS to convene all parts of the energy sector from all parts of the world gives us the opportunity to repeat that success on a wider canvas.

Energy security and geopolitical risk in turbulent times

Over the last four years geopolitical developments have propelled energy security to the top of the energy policy agenda.

By Nick Sitter & Ulf Sverdrup

Nick Sitter *is a professor at Department of Law and Governance, at BI Norwegian Business School and the Department of Public Policy at Central European University.*

Ulf Sverdrup *is a professor at Department of Law and Governance at BI Norwegian Business School.*

Russia's full-scale invasion of Ukraine in 2022 and its weaponization of energy made security of supply a more urgent priority than price or climate change for most of Europe. In 2025 Donald Trump's second administration further weakened the rules-based liberal international order and raised the spectre of global geo-economic conflict. He has set out an ambition for US energy dominance, yet China is the dominant force in renewable energy. The new US posture and policy raise several strategic questions for governments and industry. The changing geopolitical order warrants new thinking about the roles of both regulation and firms, and their strategies for managing political risk.

From Globalization to Geopolitics

As soon as he took office as the 47th president, Trump made it clear that his second term would bring about a fundamental shift in US grand strategy. The president's view of the country's role in the world and its foreign policy tools took the USA in a direction that broke with all his predecessors, Republican as well as Democrat. The global international order that the USA had taken the lead in building after the Second World War was now seen as an impediment to US interests. International regimes were unacceptable constraints. Allies were regarded more as a burden than a source of strength, calling for radical burden-shifting in NATO. The White House would give priority to the Western Hemisphere, and pursue US interest by way of bilateral deals, also with the strongmen in Beijing and Moscow. In short: the USA is longer an upholder of the status quo. It is a revisionist power.

Although this shift in US foreign policy was dramatic, it was not entirely a bolt from the blue. The Republican Party began to abandon the grand strategy of Richard Nixon, Ronald Reagan and George W. H. Bush three decades ago, first with the TEA Party movement and then with the Bush Jr's global war on terror. Barack Obama's pivot to Asia also changed the Democrats' foreign policy. Meanwhile in Europe, a range of populist right parties championed nativist sovereignty and rejected international institutions and European integration. Some rejected liberal democracy as such. The UK voted for Brexit, Hungary built an 'illiberal' state, and by 2026 most of continental Europe had far right parties in government or as the largest opposition party. The US National Security Strategy of November 2025 endorsed the European far right's world view when it warned that Europe faced civilizational erasure.

Trump's new grand strategy aligned better with that of Vladimir Putin and Xi Jinping than the USA's traditional allies. The logic of geopolitics, where great powers seek to control territory to achieve security and hard power matters more than international rules and regimes, guided both Russia's war in Ukraine and China's approach to the South China Sea and Taiwan. Russia's annexation of Crimea in 2014 and its full-scale invasion eight years later was based partly on a misreading of the European liberal democracies as too weak, vulnerable and divided to come up with a significant response. The limited sanctions and continued expansion of gas trade after 2014 reinforced Putin's view that international law could safely be ignored. Even deals, such as the 1994 Budapest Memorandum or the 2014 and 2015 Minsk agreements, were but temporary agreements to be broken at will.

This geopolitical world reflected the shifting realities of political, economic, technological and military power. The liberal international order of the Cold War was a regional western phenomenon, based in its members' shared political values as well as a sense of community for security and trade. Its expansion to a global order, with illiberal regimes, was always going to be a challenge if the assumption that wealth brings democracy and economic liberalism did not hold for Russia and China. With the economic and military rise of China, Xi's increasingly authoritarian turn, and the regime's technological capabilities, the Western-dominated international liberal order seemed increasingly unsustainable. New tools of statecraft were called for.

Geo-Economics and the Weaponization of Everything

The dynamics of international relations began to change long before Trump entered the White House or Putin attacked Ukraine. Two themes were particularly important: the changing nature of security and the changing character of war.

During the Cold War, the concept of security was primarily associated with protecting the state from a military threat from a known adversary. Globalisation, digitalisation and interdependence brought about a very different world, where security increasingly also meant protecting the economy, energy supply, critical infrastructure and the integrity of political processes.

At the same time the character of conflict changed, from a word in which countries were either at war or at peace, to one in which conflicts were pursued in the grey zone between peace and conventional war. Hybrid war came to include espionage, political influence, cyber-war and economic warfare. Everything from trade to refugee flows could be weaponised.

If geopolitics involved states' quest for control of territory to enhance military security, geo-economics is about controlling markets, technology and supply chains with a view to security across all dimensions.

Liberal grand strategy was based on a view of the world as populated by states that seek wealth and welfare, a positive-sum approach to trade, and the idea that trade brings interdependence and peace. Mercantilism or transactionalism, by contrast, has security as the state's top priority, sees trade as a zero-sum game, and emphasises the risks of asymmetric interdependence.

The question that Western policy makers now face - with Moscow and Beijing's growing assertiveness - and with Trump's new grand strategy - is whether a liberal strategy can work in these turbulent times? Although it is too early to abandon the liberal international order and the rules governing international economic relations, at the very least, this requires rethinking our tools of statecraft.

Economic statecraft is as old as civilisation. The Greek city states and Roman emperors alike understood the power of economic instruments, and the importance of controlling chokepoints. History shows that trade and technology were as important as diplomacy and armed force in the expansion of European empires. Even the liberal idea of free trade is a doctrine of economic statecraft.

Today economic statecraft involves both positive and negative forms of power: open flows of goods and services as well as sanctions and other restrictive measures. The toolbox used is increasingly about finance, technology and know-how, as well as more traditional instruments such as tariffs and trade in physical goods. This has fundamentally changed energy trade.

The EU, Putin's Russia, and Energy Security

Energy is both a private good and a public good. But above all else, in today's geopolitical world, it is a strategic good. Even as a commodity, energy has features that make it more than an ordinary private good. Regulatory regimes establish ownership rights, contain rent-seeking, and address problems arising from inelastic supply and demand. As a public good, energy merits regulation both because its production and trade affects wealth and welfare, and because of its negative externalities in terms of pollution and climate change.

But significantly, since 2022, these two aspects of energy policy have been overshadowed by the strategic goods aspect of energy. Putin's weaponisation of gas trade in the context of the full-scale invasion of Ukraine taught three important lessons.

First, it killed off the idea that energy trade could prevent armed conflict. A key assumption in EU energy policy was that Russia's dependence on European oil and gas markets would limits Putin's use of armed force. An all-out attack would destroy energy trade and simply involve unacceptable costs. As it turned out, Russia openly unleashed its energy weapon. It reduced gas supplies to the EU in the run up to the war, ended supply to "unfriendly" states in the spring, and stopped all gas flowing through the Nord Strem pipeline in the summer. When the Nord Steam 1 and 2 pipelines were blown up in September, Russia had already suspended the flow of gas indefinitely.

Second, it showed how difficult it is to use economic deterrence. Although the loss of EU markets clearly involves a high cost for Moscow, Putin had good cause to believe that the EU had neither the will nor the means to break off oil and gas trade. In the winter of 2021-22 the EU looked politically and economically vulnerable to the threat to a Russian gas cut-off. Even as autumn turned to winter in 2021, it did little or nothing to deter Russia from launching the much-expected invasion. The EU did not deploy its regulatory toolbox; it did not send a unified message to Moscow; and it did little to signal that it could impose high costs on Russia. Whether or not Putin could have been deterred, this was a classic failure of deterrence in terms of poor communication of capability, credibility and costs.

Third, the EU proved far better prepared – and more willing - than it communicated to Russia, or even to itself. Within a few weeks of the invasion, as Russia began to reduce gas sales to some member states, the Commission presented its plan to secure more pipeline gas from other suppliers, increase its capacity to import LNG, use other forms of fuel to replace gas, accelerate renewable energy, reduce consumption, improve energy efficiency and shield consumers from some of the effect of rising prices. On the other hand, Russia struggles to find buyers for its gas. China can barely take more than a third of the 150 BCM that Europe bought, and even if pipeline capacity is expanded China will not pay European prices.

These three lessons have fundamentally changed the EU's energy policy. Both the internal market and the green transition are now seen thought the lens of energy security. Decisions involve the highest political level, not just energy or environment ministers. Both temporary crisis management measures (such as the gas price cap) and permanent changes (such as the gas storage regulation) suggest a change of paradigm. Whatever the outcome of peace talks in Ukraine, there is no going back to the liberal EU gas markets of the early 2000s and extensive imports of Russian gas.

War in the Middle East

The war that Donald Trump and Benjamin Netanyahu launched in February 2026, with the bombing of Iranian military and government targets and the killing of Ayatollah Ali Khamenei, quickly became far more consequential for energy markets than the American president had expected.

The initial aims included decapitating the leadership and weakening the Iranian military (particularly its ballistic missiles and nuclear program), as well as the far less realistic (in the CIA's assessment) regime collapse and a new secular leadership. Decisive strikes would supposedly degrade Iran's military to the point where it did not have the capacity to close the Straits of Hormuz.

However, the next three months saw Iran strike military, civilian and energy infrastructure in Kuwait, Saudi Arabia and Qatar. The US and Israel bombed the Kharg oil export hub and South Pars gas field. The Straits of Hormuz were closed, some ships hit, and hundreds were trapped in the Gulf. This points to three changing aspects of energy security.

First, closing off a major choke point like the Straits generates more than a price shock. The immediate effect was an increase in the global oil price, but with the Russian shadow fleet, Iranian sales to China, and US debates about banning oil exports, markets could fragment further.

Second, international energy trade has long been dependent on an international rules-based order where the USA provides key public goods, such as secure sea lanes. Under Trump the USA is less willing and less able to do so (and liable to do the opposite).

Third, in an asymmetric conflict that includes both conventional and hybrid attacks, disrupting energy trade can be a powerful tool for the weaker party. Iranian and Houthi attacks on shipping are likely to have long-terms effects on supply lines and shipping routes, far beyond the immediate costs.

Geopolitics, Geo-Economics and Energy Security

The European energy war and the Gulf conflict have three broader lessons for energy security.

The first lesson is that the weaponization of energy is the new normal. Even in Europe, this was an accident waiting to happen in the sense that it reflected deeper change in the role energy plays in security. Energy has always been a potential source of conflict, a means of funding that sustains conflict, and a tool of economic statecraft. As hybrid conflicts increase in frequency and importance, so do the geopolitical risks of energy trade. In 2009 and 2014 the signal drowned in the noise of geopolitics. Since 2022, not so much. Trump's war against Iran drives the point home. Once energy is weaponized, it cannot easily be returned to a normal commodity.

The second lesson is that a more geopolitical world merits new foreign policy tools. Until 2022, the EU stood out as a liberal actor in a realist world – both by design and by choice. But after 2014 it began to explore the external reach of its regulatory power, also in the world of energy. On some occasions, the EU tested fully-blown economic hard power. In 2022 this paid off. As for the USA, whatever the outcome of the war in the Gulf, its role in the region has changed. This also changes the role of regional powers. Political dynamics in the region are acquiring even greater geopolitical importance than they have had so far.

The third lesson is about the importance of economic and regulatory power in a world where conflicts often play out below the level of full-scale conventional war.

Russia is at war with Ukraine, and in a hybrid conflict short of war with the EU. Conventional and nuclear deterrence remains the cornerstone of European national security. But as long as deterrence holds, geo-economics is as important as geopolitics.

> Efforts to control trade, investment and supply chains are as are essential to the new broader concept of national security as territorial control was to security in the narrower military sense.

However long the closure of the Straits of Hormuz lasts, it will prompt many oil importing countries to accelerate their green transition (or at least decrease exposure to the geopolitical risks associated with fossil fuels). This in turn could strengthen China's hand, both as a supplier of green technology and rare earth minerals and more broadly in its quest to re-write the rules of the international order.

Energy Security and the New Geopolitics

The recent weaponization of energy in European and the Middle East shows clearly how firms may be the targets of security threats, but it also shows that they have a key role to play in resilience and Nordic-style total defense. Historically this has always been the case in the world of oil and gas. Today it is increasingly obvious that it applies to most sectors of the economy.

States are rethinking their grand strategies and the nature of alliances and commitments. They are experimenting with new instruments of economic statecraft. As a key part of this, they are also rethinking the role of energy in terms of both competitiveness, security and sustainability.

This affects business as much as governments, as well the relationship between them. In times of hybrid conflict, firms are both targets and instruments. In an uncertain and unpredictable world, the top priority for both government and business must be to strengthen their capacity to understand, analyze and manage geopolitical risk.

Navigating Africa's energy landscape at times of shocks

Africa faces a defining energy moment: a continent rich in resources yet constrained by access and infrastructure, navigating global shocks and climate pressure to build a secure, inclusive and sustainable energy future.

By Amani Abou-Zeid

***Amani Abou-Zeid**, Former AU Commissioner for Infrastructure, Energy and Digitalisation, African Union.*

Africa's energy landscape is undergoing significant changes. These changes are driven by global shocks, environmental demands, technological advances, geopolitical shifts and evolving consumer habits. Supply chain vulnerabilities, climate change and growing energy inequality have challenged the conventional fossil fuel-centric model with centralised infrastructure. As a result, priorities are shifting towards reliable and secure energy through increased deployment of sustainable sources.

Clean energy technologies have attracted a staggering $2.2 trillion in investment in 2025 – double the investment in oil, gas and coal. This positive shift reflects a global commitment to climate goals, renewable energy investment and a growing focus on energy security.

While fossil fuels still supply around 80% of global primary energy, the simultaneous growth of renewables presents an opportunity to shape a balanced energy future. This future could accelerate decarbonisation while ensuring access, reliability and affordability. For Africa, this is a crucial imperative that can unlock progress across various sectors.

Africa energy paradox

Africa, with over a billion people and 55 countries, boasts diverse economies, resources, ecosystems and cultures. The continent is rich in natural resources, including solar, wind, hydro and fossil fuels. Africa holds approximately 10% of global oil reserves, 8% of natural gas and 5% of coal, and possesses the world's highest solar potential. Furthermore, it is home to 30% of raw materials and critical minerals that drive global digitalisation and industrialisation.

However, this immense natural resources wealth presents a stark paradox. Almost half of Africa's population, over 600 million people, remain without electricity, and over a billion cook with unsafe fuels. This extreme energy poverty significantly hinders education, healthcare and economic growth.

Furthermore, Africa's electricity demand is projected to more than triple by 2040 due to factors like population growth, rapid industrialisation, urban migration, rising household incomes and climate change impacts. This necessitates a coordinated continental effort to plan and coordinate power generation and transmission infrastructure.

Africa's electricity mix remains heavily fossil fuel-dependent, accounting for 75% of total electricity in 2024. Natural gas contributed 42% and coal 28%. Renewable energy sources, including solar, wind, hydro, geothermal and waste, only accounted for 20% despite the continent's vast potential. Regional disparities are significant: Southern Africa relies heavily on coal while North Africa favours natural gas. East Central and West Africa prioritise hydro but face infrastructure limitations hindering the scaling of other renewables.

The Africa energy paradox primarily stems from a deficit in energy infrastructure. Underdeveloped grid systems and limited regional interconnection capacity hinder energy distribution. The continent's transmission and distribution networks are inadequate to meet growing demand, integrate renewable energy and support cross-border electricity trade. Network losses average 20%, significantly higher than the 5–10% seen in developed economies. Regional power pools offer promising integration efforts but full continental interconnection isn't expected until after 2040, limiting immediate benefits from electricity trade.

Critically, Africa remains trapped in a cycle of perceived risk and serious lack of affordable long-term finance at scale which prevent substantial energy infrastructure development. Despite housing 20% of the world's population, Africa receives only 2-4% of global energy investment.

Finally, policy and governance issues further exacerbate the problem. Political complexities, mismanagement of public utilities and reliance on expensive short-term solutions rather than long-term grid development all contribute.

Just transition

Energy is crucial across various sectors, and Africa's energy system choices significantly impact its development. Providing accessible, affordable, reliable and sustainable energy to tens of millions is a top priority using all available energy resources.

Africa, despite contributing less than 4% of global energy-related CO2 emissions and boasting the lowest emissions per capita, grapples with severe and frequent climate disasters. These disasters are eroding decades of hard-won development gains. The case for massive investment in adaptation and resilience is overwhelming. The limited amount of climate funding available significantly hinders the continent's ability to tackle climate change, requiring a fourfold increase in investment to meet its climate goals.

Despite this major obstacle, Africa's renewable energy transition has been impressive over the past decade. It's charting a balanced path, investing in clean technologies and considering regional differences in starting points and capacities.

In addition, the current geopolitical situation offers Africa a new chance to improve energy access and security, while also playing a larger role in global markets. The world is diversifying energy imports and logistical routes. Africa is well positioned to offer viable and reliable alternatives. Renewables have dropped almost 90% in cost over the past decade making renewable energy more affordable. Battery technology is improving, making renewables more reliable. In the medium term, these developments could help Africa become not only energy self-sufficient but also a key global energy supplier and battery manufacturer.

Key alternatives to traditional power grids in Africa

Clean energy provides a potential solution to meet much of Africa's energy demand growth: Africa has almost unlimited potential for solar capacity (10 TW) and abundant hydro (350 GW), wind (110 GW), geothermal energy sources (15 GW) and more than 30% of critical minerals.

Developing renewable energy capacity would offer several substantial advantages. Firstly, it would accelerate electricity access and tackle the severe energy poverty in most African nations. Secondly, the continent's abundant renewable energy resources would foster self-sufficiency,

energy security and reduce reliance on costly imports. This would ensure sustainable energy supplies, enabling Africa to achieve its social and economic goals. Thirdly, it would decrease fossil fuel dependence and lower future carbon emissions. Finally, Africa could emerge as a new hub for local manufacturing of renewable energy components like solar panels and batteries. This would create jobs, stimulate local economies and establish export partnerships with other nations, thus diversifying global supply chains.

Hydroelectricity has long been Africa's most popular renewable energy source. However, climate change and ongoing droughts have made hydropower generation increasingly unpredictable. Wind and solar power have recently become more commercially viable though they're also weather-dependent. Africa's favourable location offers significant solar energy potential. Power generation options include utility-scale conventional or concentrated photovoltaic (PV) and concentrated solar thermal power (CSP) systems, as well as small-scale PV systems for off-grid power. North African countries and South Africa are leading solar markets thanks to their supportive policies and investment commitments. Benban in Egypt and Ouarzazate Noor in Morocco are two of the world's largest solar power plants.

Wind turbines are widely used across most countries and are vital assets for many rural communities. The best regions in Africa for wind farms are the rugged Sahara, coastal areas and the Southern African mountains and the Horn of Africa. Sub-Saharan Africa's wind power production is currently booming, with East Africa leading the charge. Kenya's Lake Turkana Wind Power Farm stands as the largest wind farm in Africa.

Much like wind and solar power, geothermal energy holds the potential to support Africa's power sector as it shifts away from hydropower dependence and towards stdrought resilience. Africa's geothermal potential is predominantly found in the geologically active Great Rift Valley, stretching from Djibouti to Mozambique. This valley boasts over 30 active volcanoes and numerous hot springs. Remarkably, only 0.6% of Africa's known geothermal potential is currently being harnessed, making it a valuable resource for electricity production across the continent.

Several African countries are also exploring small nuclear modular reactors to meet future power demands. South Africa is the only African nation with an operational nuclear plant while Egypt is constructing a four-unit plant slated for completion by 2028. Ghana Nigeria and Kenya are also considering nuclear technology and ten other countries are exploring it.

By 2050 Africa's electricity capacity is projected to increase significantly. Nuclear capacity could triple by 2030 and grow tenfold by 2050 necessitating over US$100 billion. It's worth noting that African countries meaningfully contribute to global uranium production, a crucial raw material for nuclear energy generation, which can bolster energy security. Innovative financing methods and regional cooperation are also essential for attracting investment in nuclear projects.

What's next for Africa?

To remain economically competitive and thrive in the rapidly expanding global economy, Africa's future energy needs must be addressed at the legislative, technological and commercial levels. Urgent action is needed to meet power demand through extensive engagement with various energy sources by African governments, foreign direct investment (FDI) and regulators. This will help eradicate poverty and deprivation, stimulate economic growth and activity and ultimately benefit the African population. Furthermore, many African countries must also focus on grid development and last mile solutions to overcome obstacles that hinder the scale-up of renewable energy solutions and universal access to electricity.

From vision to action

Africa's energy vision is to build a reliable interconnected and future-ready energy system for all Africans. This will position Africa as a major player in global clean energy markets.

> Developing strong energy systems and services is crucial for Africa to realise its energy security and socio-economic development.

The African Union (AU) is leading continent-wide efforts to bring this vision to life. Some key initiatives include:

1. Energy efficiency is Africa's first line of defence against energy poverty. It boosts productivity cuts costs and frees billions in savings. The AU's energy efficiency strategy aims to increase the continent's energy productivity by 50% by 2050 and 70% by 2063. This strategy focuses on enhancing efficiency in power industry, agriculture, buildings and transportation to drive sustainable development and reduce energy poverty.

2. In 2021, Africa established the African Single Electricity Market (AfSEM), one of the world's largest electricity markets. This initiative aims to harmonise regulatory frameworks and integrate generation, transmission and distribution across the continent. The AfSEM is expected to drive energy diversification, enhance trade and investment exchanges, close energy infrastructure gaps between African regions and countries and leverage the African Free Trade Area (AfCFTA).

3. Furthermore, the AfSEM prioritises clean cooking solutions through finance partnerships and rapid deployment of clean cooking equipment. This is part of a broader effort to strengthen national and continental clean cooking policies.

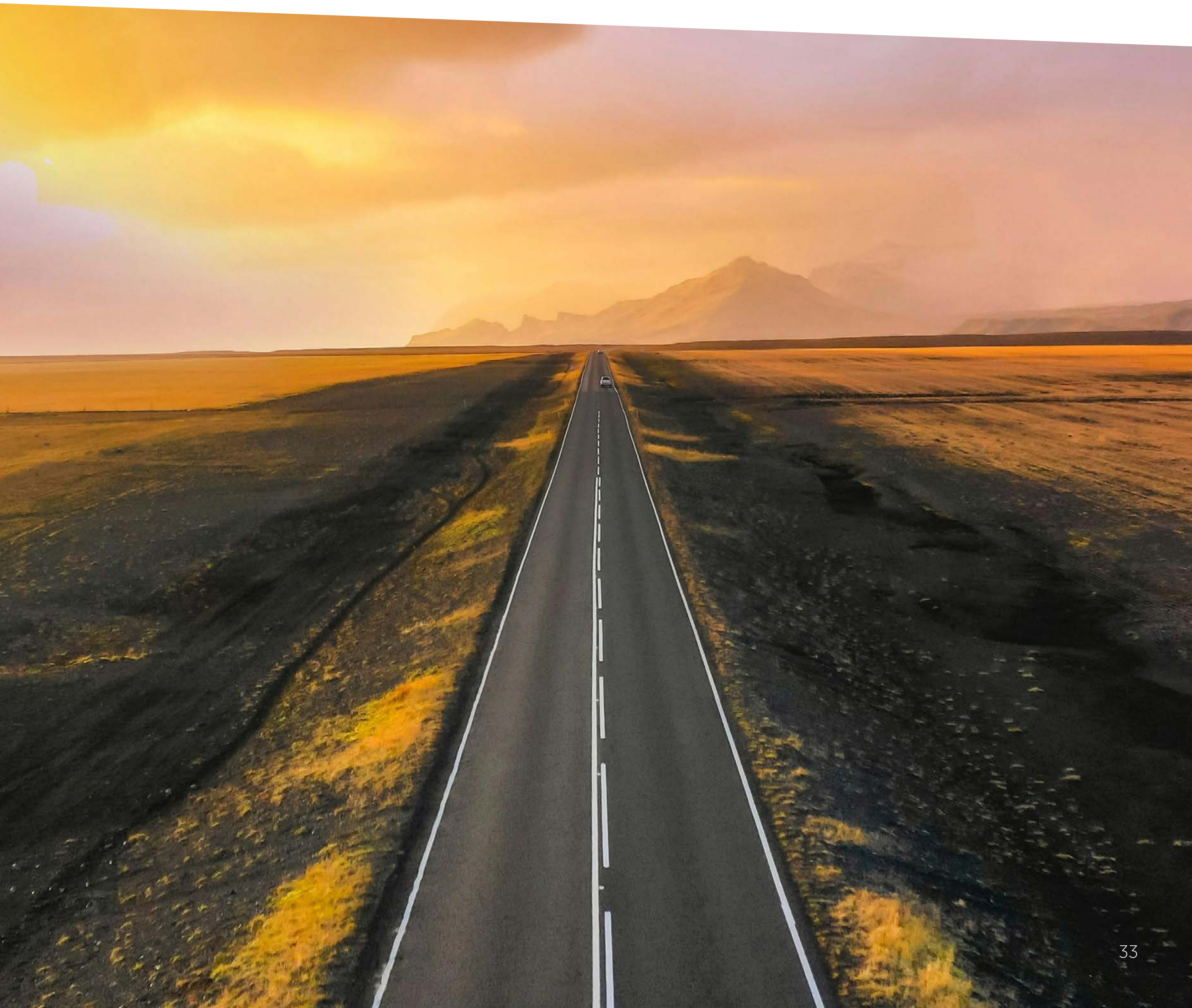
4. African development of minerals, particularly critical transition metals like cobalt, lithium and copper, are crucial to the continent's industrialisation and economic transformation. Driven by the AU Africa Mining Vision (AMV), initiatives are shifting from raw export to beneficiation. This involves refining, processing, catalysing structural transformation, developing regional value chains and manufacturing finished products on the continent. This approach aims to maximise economic benefits, ensure sustainable growth and job creation. Ultimately, African products will help diversify the global supply chain of critical minerals-reliant products.

5. Another important AU initiative in the renewable energy sector is the establishment of the Geothermal Risk Mitigation Facility (GRMF) in to promote geothermal energy development by de-risking early-stage project development. By 2025, the GRMF has awarded grants amounting to USD 100 million to project developers in a pipeline of 40 eligible projects with a capacity of 3.5 GW.

The road ahead

The road ahead demands bold new approaches to realise Africa's potential. This involves tackling the existential challenges posed by its own development and also external shocks and climate change. These bold actions must be driven by urgency while also considering medium and long-term strategies.

As African leaders prioritise stabilising economies, managing political and economic pressures and responding to emerging shocks, their responses to the crises will significantly shape future possibilities. In a world defined by shocks, unlocking Africa's full energy potential will hinge on strategic clarity and choices that safeguard future options for both Africa and the global community.



Where we are with the energy transition

The ongoing geopolitical crisis has fundamentally reshaped the energy transition, with energy security overtaking climate policy and splitting the world into diverging pathways.

While Asia is accelerating through rapid electrification and renewables deployment, the West is slowing under fiscal pressure, fossil reliance, and the need to shield consumers.

By Amrita Sen

***Amrita Sen**, Founder & Director of Market Intelligence, Energy Aspects.*

The war has changed the question

Any honest answer to where we are with the energy transition has to start with the ongoing US-Iran war. The conflict and the resulting blockage of the Strait of Hormuz constituted the biggest supply-side disruption in the history of the energy markets. Crude and condensate production losses are running at around 12 mb/d, or 15% of global supply, with another 5 mb/d in oil products and LPG. 85 Mtpa of LNG is stuck with the strait and over 35 mtpa of chemicals. The scale has parallels to the demand losses we saw during Covid-19; in many ways, this is the reverse of Covid.

The stockdraws seen in oil markets is unprecedented. Since 1 March, Asia ex-China has drawn down stocks at a pace of 1.2 mb/d, some of it SPR, with regional inventories likely to drop to 500 mb by end-May, around one month of forward refinery cover. By June, the oil market will have drawn down over 1 billion barrels from government and commercial stocks to cover the supply shortfall caused by the double blockade of the Strait. Those barrels will need to be replaced, whether to rebuild strategic stocks or restore commercial inventories to more normal levels. Japan and Korea are likely to add storage, and there may be further new strategic stockholding requirements across non-OECD Asia. If markets are efficient, some of that future restocking demand should already be reflected in prices. The need to return oil to government reservoirs will be a key driver of 2027 oil markets. December 2026 Brent is already trading around $87/bbl, $20/bbl above pre-conflict levels; December 2027 is over $75/bbl.

The market should also be pricing in the risk that some Middle East Gulf production capacity may not return quickly, or ever, to pre-conflict levels, particularly from the ageing heavy oil fields of Iraq and Kuwait. Qatari NGLs and gas-to-liquids production will be impaired for several years due to infrastructure damage. Demand has fallen by just over 3 mb/d, far less than supply losses, in part because prices have not stayed high enough for long enough, and also because governments around the world are subsidising consumers or capping price increases. That gap is what the next phase of the war will resolve, almost certainly through significantly higher prices and broader demand destruction.

A bifurcating transition: Asia accelerates, the West slows

The most consequential effect of the war on the energy transition is not what it does to oil and gas demand. It is what it does to the political economy of decarbonisation. Energy security has displaced decarbonisation as the binding policy constraint in importing economies, and the response is splitting the world into two very different transition pathways.

In Western Europe, the immediate priority is to shield households and industry from a third energy shock in four years. European governments spent an average of 2.5% of GDP on energy support packages during the 2022 crisis, more than two-thirds of it untargeted; in the first 17 days of the Iran crisis alone, the EU spent around €6 billion more on fossil fuel imports. The IMF now expects euro-area growth of just 1.1% in 2026, with a more severe scenario taking the EU close to recession with inflation near 5%, and warns that high-debt countries without fiscal space cannot afford to widen deficits. The political pressure to act with subsidies is enormous; the fiscal capacity to act and still finance the transition simultaneously is not there. That is the real Western European story for the next 24 months: not a reversal of climate policy, but a slowing of capex-heavy decarbonisation as governments choose between insulating consumers and funding grids, hydrogen, CCS and industrial reform.

Asia is taking the opposite turn. China installed 357 GW of solar and wind in 2025, surpassing its 2030 renewable capacity target six years early, and now operates three times more wind and solar than the US and India combined. EV and hybrid sales are above 50% of new car sales in China, which has already cut Chinese oil demand by over 1 mb/d. China shipped a record 68 GW of solar in March 2026 alone; battery exports hit $10 billion in the same month, up 44% m/m, with 50 countries setting all-time records for Chinese solar imports and another 60 hitting six-month highs. Africa's imports rose 176% m/m, India's by 141%. The Hormuz disruption is reinforcing this. For Asia, the cheapest and most secure energy is increasingly domestic electrons from Chinese-made kit, and the war is accelerating, not slowing, deployment.

China's energy security strategy is paying off in real time. China relies on imports for around 70% of its oil and 40% of its gas, but by entering this conflict with around

1.3 billion barrels of crude reserves, an industrial sector largely run on domestic energy, and a fast-electrifying car fleet, it has been one of the few large importers able to keep growing through the disruption. Beijing has also leant harder into coal: as we have flagged in our methanol coverage, China is now relying more on coal-based chemicals to substitute for lost Iranian and Middle Eastern supply, and coal-based methanol output has expanded as a result. India, at a much earlier stage of development, is following a similar electrotech-led pathway, with solar already at 9% of generation and per-capita coal use at roughly 40% of China's level when at the same income point.

The implication is uncomfortable but clear. The war helps the transition in Asia and hinders it in the West. In Asia, the marginal new megawatt is solar plus storage and the marginal new car is electric. In the West, fiscally constrained governments are cutting fuel taxes, capping prices and rebuilding strategic stocks, all of which crowds out the discretionary spending that pays for the transition itself. Our 2050 outlook still has the global fossil fuel share edging down towards 50% by 2050 from over 80% currently, with renewables breaking above 40%. The destination is unchanged. The geography of who builds it is now very different.

In general every country will want to rely on sources of energy within its geographical borders – that means both coal and renewables like solar win. This would be a win for renewables but potentially a step back for climate goals if the ramp up in coal becomes more than a temporary measure to ensure lights are kept on for the time being.

Coal returns where energy security beats emissions policy

Twelve months ago, our central case had global coal demand peaking in 2025. That base case is now under upside pressure on two fronts. In China, the Iran-related disruption has lifted coal-based methanol production, expanded coal-to-liquids economics and re-anchored coal as the back-up to renewable intermittency. In Europe, sustained TTF prices well above coal–gas fuel-switching triggers are quietly pulling coal back into the merit order in Germany and parts of Central Europe. None of this changes the long-run direction of travel: renewables continue to take share, and coal demand resumes its decline once Hormuz traffic normalises and gas balances loosen. But a late-2020s coal peak is now a credible alternative

to our 2025 base case, particularly if China's data-centre and industrial power load continues to surprise to the upside and Europe's storage refill challenge requires a second consecutive winter of fuel switching. For a country whose long-term gas demand depends in part on coal-to-gas switching elsewhere in the world, that delay matters.

Gas, energy security and the existentialist crisis for LNG

Of all the structural changes the war is forcing on energy markets, the most important is the loss of trust in LNG as a baseload supply for Europe. The 2022 shock taught buyers that pipeline supply could be weaponised. The 2026 shock is teaching them that LNG can be too. Two damaged Qatari trains, a blockaded Strait of Hormuz, US LNG cargoes redirected to Asia chasing better netbacks, and Russian fuel oil and product flows hit by Ukrainian drone strikes on Baltic and Black Sea ports: in the space of four years, every assumption about a deep, liquid, redundant LNG market has been tested and found wanting. Asian LNG demand is set to fall by 2.3 Mt y/y over bal-2026 even as Europe's rises by 6.7 Mt y/y, with global LNG exports growing by just 2.6 Mt y/y as North American gains of 18.7 Mt y/y barely offset the 18.7 Mt y/y drop in Middle East exports. Taiwanese chip manufactures, Pakistani industries, Indian fertilisers to name a few industries who have been heavily impacted by the loss of Qatari LNG.

The implication is that the next phase of the energy transition will not assume LNG can play the role of uninterrupted, scalable baseload. Storage targets are being recalibrated; the European Commission has signalled a possible 5-ppt flexibility in storage targets, lowering the headline from 80% to 75%. TTF near-curve and winter 2026–27 contracts are already pricing in a more pessimistic Hormuz timeline. Demand-reduction measures, fuel switching and industrial curtailments are doing more of the balancing work, and demand-side levers are being treated as part of the structural answer, not as emergency measures.

This is the environment in which Norwegian pipeline supply becomes strategically more valuable. Even as European gas demand falls structurally, the share of that smaller pie that comes from secure pipeline supply is rising. Our latest balances raise Other European demand by 12.2 bcm across the forecast horizon to correct for an underestimation

bias around heat pump installation trends and cold-weather pockets in Central and Eastern Europe. Western European gas demand is permanently lower than pre-2022 levels, but the call on Norwegian volumes is firmer and longer-dated than the headline demand path suggests. Our long-term outlook still has global gas demand peaking in 2038 at 4.7 tcm. Within that profile, Norwegian gas is among the most defensive volumes in the global complex: short pipeline distance, government-backed contractual reliability, no sanctions risk, and a customer base that has now lived through two acute lessons in why those things matter.

Power demand: electrification accelerates either way

Power demand is the part of the long-term outlook that the war does not really threaten. If anything, it reinforces it. Power markets dominate global primary energy demand growth through 2050, rising by approximately 5.3 btoe as the world increasingly electrifies. India and China account for 40% of incremental electricity demand. US power demand grows on reshoring and data-centre expansion, although short-term growth is constrained by grid infrastructure and supply chains. South Korean power demand is set to accelerate over 2027–29 by 8.4–11.1 TWh/y, supported by semiconductor clusters, data centres and electrification of road transport and heavy industry. ERCOT's preliminary load forecast points to 199.5 GW of new large loads by 2030, of which 94% are non-crypto data centres. We agree with regulators that ERCOT's forecast overstates near-term growth and see meaningful large-load demand more likely from 2028.

The war sharpens this story rather than blunts it. AI workloads, semiconductor manufacturing and reshoring are absorbing electricity faster than markets had modelled even two years ago, and energy security concerns make domestically generated, domestically owned electrons more attractive than imported molecules. That said, the Middle East is not going to be a source for new AI data centres.

Oil and gas: capital discipline meets a supply crisis

The signal from upstream oil and gas remains striking. Despite very strong Q1 26 earnings, management teams have stayed firmly on capital discipline. Capex as a share of cashflow has ticked up from the lows of the early 2020s, but it is not returning to the heavy-spending years of the early 2010s. Reserve-constrained companies still prefer to buy reserves rather than find them. Shareholder distributions remain sacrosanct. The negative reaction to ConocoPhillips' minor capex guidance increase to $12.0–12.5 billion this year, versus $12 billion before, shows that Wall Street has not forgotten two decades of sub-par returns. Energy is now under 3.5% of the S&P 500 versus 16.2% in June 2008, while Big Tech makes up over a third of the index.

The implication, even with Brent above $87/bbl on the back end of the curve, is that supply will not respond aggressively. Non-OPEC supply growth is set to stall by end-decade as US shale output peaks. We expect oil demand to peak in 2032, with only a 7% global reduction over 2024–50. Higher prices will be necessary to incentivise production and manage dwindling spare capacity. The UAE's departure from OPEC raises questions about the group's long-term cohesion; we do not think it unravels the group, but it is a setback. None of this points to an industry preparing to return to growth mode. It points to a structurally tighter market through the second half of this decade, with the war accelerating that path rather than diverting it.

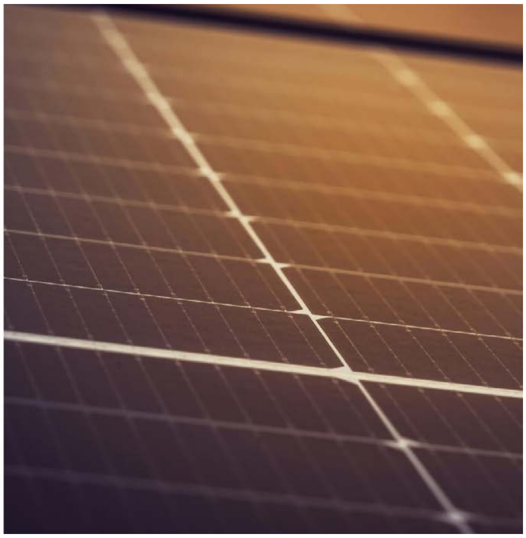
Implications

Three points are worth holding in mind for resource holders and producers in particular.

First, the long shadow of capital discipline means supply will not race ahead of demand. The years of US shale-led growth that flattened the cost curve are nearly done, and there is no comparable engine ready to take over. Investment through the cycle will be rewarded by tighter balances in the second half of the decade; the war has reinforced rather than reversed that case.

Second, the gas story is structurally longer than the oil story. European demand falls, but secure pipeline supply takes a higher share of what remains. The LNG-as-baseload assumption that underpinned much of the post-2022 European gas strategy has been damaged by Hormuz; that damage will not fully repair when Strait traffic resumes.

Third, the demand-side story has shifted to electrification, and the geography of electrification is bifurcating. Asia builds with Chinese cleantech because that is now the cheapest energy-security play available; the West slows because fiscally stretched governments cannot subsidise both fuel bills and the next phase of transition capex simultaneously. The policy decisions taken in the next 18 months, including the EU ETS review, the German capacity market launch, the UK–EU linkage timeline, the post-war stockholding regime, and the EU's response to fiscal pressure under a second energy shock, will set the cost of capital for the next investment cycle.



The transition is happening. It is happening more slowly in the West than the headlines suggested, faster in Asia than was credited a year ago, and within an energy-security frame that the war has now made permanent.

Ultimately both coal and solar win but that has important implications for climate change. That is the honest assessment of where we are.

The growing importance of Asia in the energy sector and its implications

With Asia now at the centre of global energy demand, the current geopolitical crisis exposes not just an energy shock—but a fundamental shift in global energy security.

By Tatsuya Terazawa

***Tatsuya Terazawa**, Chairman and CEO of the Institute of Energy Economics, Japan*

"Global Energy Crisis" and beyond

The attack on Iran by the US and Israel and the responses by Iran have resulted in the largest disruption of energy flow in modern history. In particular, the de facto closure of the Strait of Hormuz disrupted 34% of the global crude oil trade flow and 20% of the global LNG trade flow. This is truly a global energy crisis. With the disruption of supply of naphtha, aluminum, helium and fertilizers from the Middle East which is a major producer of such materials, the crisis is much broader than energy. Second order impacts could seriously affect the global food supply which depends on fertilizer and its feedstocks from the Middle East. Supply of semiconductor chips and servers essential for AI could also be affected by the possible shortage of power resulting from the disruption of LNG supply in Asia where many of them are manufactured.

"Asian Energy Crisis"

While the crisis is global, Asia has been hit much more severely than other parts of the world. Asia depends on the passage through the Strait of Hormuz for its energy supply much more than other regions such as Europe. 34% of the international trade of crude oil goes through the Strait which is substantial. But the dependence is much higher for Asian countries. Japan's dependence on Middle East crude oil was 94% before the attack. The dependence by the Philippines, Vietnam, Thailand and ROK were 97%, 87%, 74% and 69% respectively.

To make matters worse, the reserve level by the countries in Southeast Asia has been very modest. Japan and ROK have high level of SPR managed by the government, but many countries in Southeast Asia still lack such systems. Even if they have one, the reserve level is low. The reserve level combining the government and the private sector reserve for Vietnam, Indonesia, Cambodia and Lao are 75-80 days, 30 days, 35 days and 40 days respectively. Other countries in the region do not have government reserve systems yet.

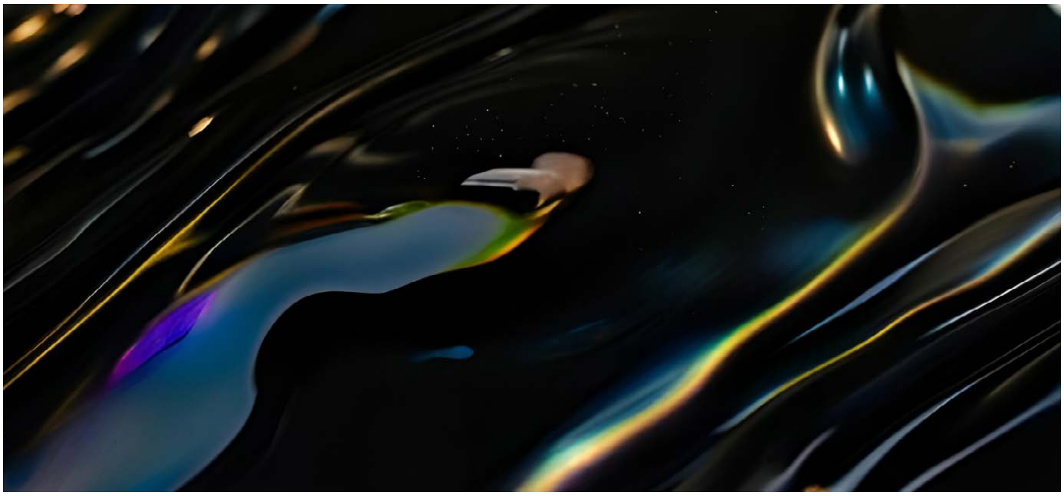
LNG has been very important for Asia as it lacks the pipeline connection that had supported Europe before Russia's invasion of Ukraine. Furthermore, Asia is more dependent on LNG coming through the Strait. Asia's dependence on the Strait for LNG was 27% in 2025 compared with 9% for Europe in 2025. Some countries/ regions in Asia are even more dependent. The dependence on LNG coming through the Strait in 2025 for Pakistan, Bangladesh, India, Singapore and Taiwan were 99%, 60%, 59%, 46% and 34% respectively. The reserve level of LNG is generally limited to a few weeks due to the difficulty caused by boil-off losses during storage, as well as the lack of underground gas storage capacity unlike in Europe which can make the crisis of LNG supply more serious.

Due to insufficient refining capacity, countries in Southeast and South Asia have been heavily dependent on oil products coming through the Strait. Shortage of LPG in India, shortage of gasoline and diesel fuel in the Philippines and Vietnam have already quickly become serious problems resulting in long queues at service stations.

Vulnerabilities in the energy supply have been exposed dramatically in Asia. While the energy crisis in Europe caused by the conflict in Iran is serious, the magnitude of the impacts in Asia is in a different level. This is why we may see the crisis particularly as the "Asian Energy Crisis".

The difference from the first oil crisis in 1973: Growing importance of Asia

The "Asian Energy Crisis" would have been a less serious problem from the global perspective if Asia's position in the global energy landscape were limited. But Asia is now a major player in the global energy sector. Asia has grown in its importance dramatically since the First Oil Crisis half a century ago. In 1973, the import share of North America and Europe combined for oil was 63%, tripling the import share of Asia of 21%. By 2023, the balance has completely shifted. While the import share of North America and Europe combined was 40%, the import share of Asia was 53%. Asia is now the center of demand and trade of oil surpassing North America and Europe put together.



In 1973, LNG was negligible. The first LNG cargo had just arrived in Japan in 1969, several years before the First Oil Shock. The Oil Shocks and the subsequent need to diversify were the drivers of LNG expansion led by Japan followed by other Asian neighbors. In 2025, Asia dominated the LNG import, comprising 63% of the global LNG import.

International trade of thermal coal was very modest in the 70's. The Oil Shocks promoted the use of coal for power generation, particularly in Asia. The import share of coal by Asia reached 86% in 2024. Asia is now the predominant market for internationally traded thermal coal.

Asia has thus become the most important international market for crude oil, LNG and coal.

The need to strengthen energy security for Asia.

While being the most important energy market, Asia has exposed its vulnerability in energy supply through the Iran conflict. What must be done then?

Half a century ago, the advanced economies painfully discovered their vulnerability. The painful lesson led to the creation of IEA. IEA developed the system of SPR to enhance deterrence among the advanced economies against the potential repeat of an embargo by the Arab oil producers. SPR eventually helped deal with other contingencies as well. IEA has served as a cornerstone to enhance energy security in the advanced economies. The original members of IEA were from Europe, North America and Japan. While members were added, including ROK and Association countries expanded, IEA remains largely an organization for the oil consuming advanced economies.

Asia must strengthen its energy security since the vulnerability has been exposed dramatically through the Iran conflict. This must be done not just for Asia but for the world considering Asia's growing importance as well. Each country and region in Asia must enhance its energy security individually. But collective actions can help enhance energy security in Asia furthermore.

I believe that Asia needs to engage in serious discussions on how to enhance energy security in the region. The discussions should take place within each country/region but also among Asian countries.

The future: Even greater importance of Asia

Asia is the growth center of the world today. Asia is expected to lead the world's economic growth even more in the coming decades. The position of Asia as the most important international energy market will be strengthened furthermore.

My institute, the Institute of Energy Economics Japan (IEEJ), has been issuing its long-term global energy outlook for two decades. The outlook is composed of two scenarios; the reference scenario which is the base case and the technology advancement scenario which assumes the maximum deployment of technologies. According to the most recent global energy outlook by IEEJ which was announced in October last year, the share of emerging Asia in the primary energy demand will reach 44% in 2050 up from 40% in 2023 based on the reference scenario. Within emerging Asia, China's share will drop from 27% to 20% but the other emerging Asia led by India will rise from 13% to 24%. On the other hand, the share of the advanced economies will drop from 33% to 24%. Asia will further advance its position as the most important international energy market. What will this mean for the global energy sector? I will share with you four points that I believe will have to be taken into account.

We must not underestimate the energy demand growth in Asia

For advanced economies, we expect the energy demand to shrink over time through energy efficiency improvement. But for emerging economies like Asia, the strong economic growth coupled with rising living standards will result in strong growth in energy demand. In fact, the IEEJ outlook reference scenario expects the primary energy demand for India and other non-China emerging economies to double between 2023 and 2050.

This may be hard to imagine for those living in advanced economies. But we have experienced the dramatic economic growth and the accompanying strong energy demand growth in China in the past quarter century. India is expected to follow the path of China in the coming decades. The penetration level of air-conditioners and four-wheel automobiles in India today is comparable to the penetration level in China in 2000. The penetration of air-conditioners and four-wheel automobiles in India in 2050 is expected to reach the level in China today. This is one of the reasons why the energy demand growth in India for the next quarter century may replicate the dramatic energy demand growth that has taken place in China in the past quarter century.

If we do not fully incorporate strong economic growth and rising living standards, we may be underestimating the future energy demand in Asia. In one of the IEA's reports for G7 in 2023, IEA compared the energy outlook for ASEAN with that by IEEJ. The scale of the economy of ASEAN assumed by IEEJ in 2050, which was aligned with the goals set by those countries, was 1.3 times larger than the assumption by IEA which expected growth to slow down. Energy efficiency improvement assumed by IEA towards 2050 was also 1.3 times larger than the assumption by IEEJ. IEA accelerated the speed of efficiency improvement whereas IEEJ assumed the improvement trend to continue. With rising living standards, improvement of energy efficiency can become more challenging. With the combination of these two factors, the energy demand of ASEAN in 2050 by IEEJ was expected to be 1.7 times larger than the outlook by IEA. It is not my intention to argue which is correct. Rather, this comparison tells us the future energy demand in Asia could be underestimated due to the difference in the assumption of economic growth and rising living standards.

Asia will be the main driver of demand for oil, LNG and coal.

According to IEEJ's reference scenario, the share of oil consumption by emerging Asia will rise from 28% in 2023 to 36% in 2050. The increase will be led by India and the other non-China emerging economies which will expand their combined share from 12% to 22%. On the other hand, the share of the advanced economies will drop from 38% to 24 % during the same period.

The share of LNG demand will rise for Asia from 64% to 80% between 2023 and 2050. The share of Europe will drop from 31% to 4% during the same period. Asia is the major market for LNG today. Asia will be the dominant market for LNG in 2050.

China, India and other Northeast Asia are the net importers of coal in 2023. The leading net importer will shift from China to India during the period. But Asia will continue to be the dominant market for internationally traded coal.

For exporters of oil, LNG and coal, they will have to closely monitor the developments in Asia to serve the strong demand in the region.

Policy efforts to reduce CO2 emissions must be focused on Asia in a tailored manner

With the strong energy demand growth and the demand for oil, LNG and coal, Asia will be the main region of CO2 emissions. The success of realizing carbon neutrality depends on the success in mitigating CO2 emissions in Asia. Policy efforts to mitigate CO2 emissions must be focused on Asia.

But the policy efforts must be tailored to the unique characteristics of Asia. As we cannot force Asia to accept low economic growth or lower standard of living, the

world must support Asia to enhance its energy efficiency substantially. Transfer of technologies and investment in energy efficiency must be accelerated. In this regard, I believe that "Transition Finance" which expands the scope of financing beyond "green investment" should be promoted by various players beyond Asia. "Transition Finance" may not turn CO2 emissions to zero right away but it can help reduce CO2 emissions significantly including through energy efficiency enhancement.

Renewable energies should be promoted in Asia. But the fact that Asia generally depends on solar PV more than wind power generation must be addressed. The need to deal with intermittency caused by solar PV is stronger than Europe which enjoys abundant wind resources. Asia will need vast power storage, but also dispatchable power sources. Asia will need batteries but also power storage with longer storage periods such as pumped hydro. Asia does not have the well-developed intraregional transmission line systems which Europe enjoys. In fact, many Asian countries have relatively weak transmission lines within their own countries which will impede the deployment of renewable energies. Strengthening the grid must go hand-in-hand with renewable energies in Asia.

Nuclear power is another option for reducing CO2 emissions while supplying power to support growth in Asia. Asian countries typically have much higher population density compared with Europe. The competition for land use, a precondition for broad deployment of solar PV, will be more intense as vast land is necessary for agriculture and forest must be protected. Wind resources in Asia are generally modest compared with Europe. These natural constraints should make more Asian countries look into nuclear power especially as the base load power to deal with the ever-growing 24/7 power necessary to run data centers.

Asia needs an Asian way to reduce CO2 emissions while supporting its strong demand for energy driven by economic growth and rising living standards.

Asia's voice must be heard more

As Asia will be the centre of energy markets and the major CO2 emitting region, the unique situation and challenges of Asia must be incorporated in the global policy formulation. But most international organizations and fora are led by Europe and the US.

Out of the 32 members of IEA, 24 are from Europe. Europe dominates IEA's membership. Other members are the US, Canada, Mexico, Australia, New Zealand, Turkey, ROK and Japan. Asia's representation in IEA is just three including Turkey. WEF's Davos meeting is heavily represented by European participants. Asia's representation in most leading international energy fora, such as the CERA Week and the World Energy Congress, remains modest.

I believe that Asia's voice must be heard much more in international organizations and international fora. Representation by Asian countries and participants must be enhanced.

At the same time, Asia should also strengthen its own efforts to make their voices heard more. Asia based international fora such as the GX week in Japan, SIEW in Singapore, Energy Asia in Malaysia and SETA in Thailand should be strengthened by increased participation from Europe and North America. Efforts to enhance collective actions through AZEC, the Asia Zero Emission Community, and through ERIA, the Economic Research Institute for ASEAN and East Asia, should be pursued as well.

I sincerely hope to see more Asian representation in the ONS 2026 this year!

When everything becomes a chokepoint

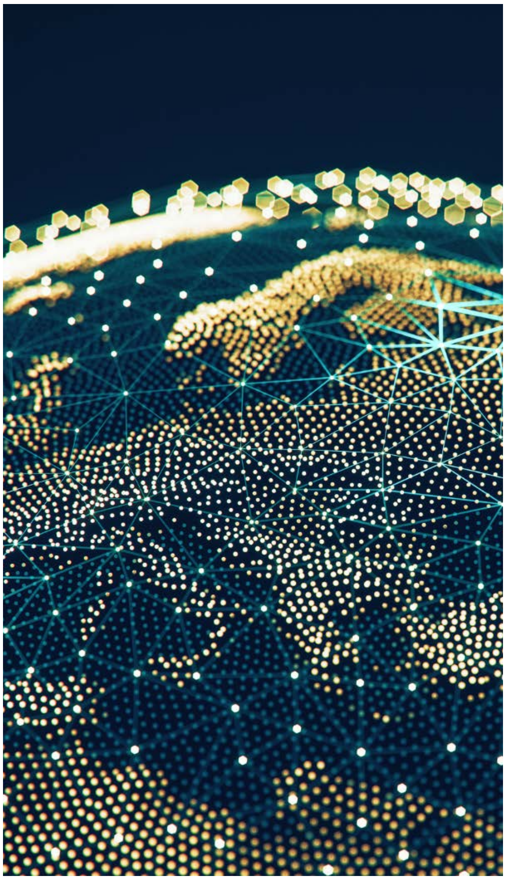
In an era of weaponized interdependence, energy security is shifting from a question of supply to a question of continuity across the full chain of resources, infrastructure, finance, technology and demand.

By Dr. Tatiana Mitrova

***Dr. Tatiana Mitrova**, Global Fellow, Center on Global Energy Policy, Columbia University*

Interdependence loses its innocence

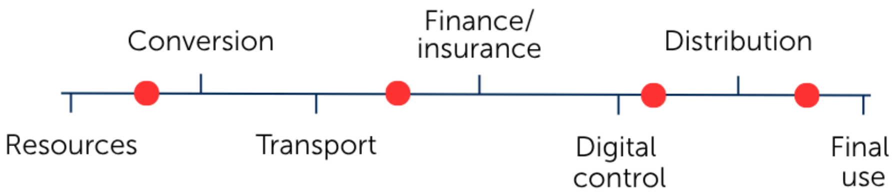
For much of the past fifty years, the global energy system was organized around a reassuring assumption: interdependence would produce efficiency, and efficiency would produce stability. Markets would deepen. Infrastructure would connect. Supply chains would stretch across borders. Capital, technology and energy would move to where they were most productive. Disruption would remain possible, but the system's growing connectivity was widely understood as a stabilizing force: the more connected the system became, the more costly it would be for any actor to break it.



That assumption has not disappeared. Interdependence still creates value. No modern energy system can function without trade, capital, technology, standards, data and cross-border infrastructure. But interdependence has lost its innocence.

We are now living through a geopolitical and economic bifurcation: the point at which the same connections that once generated efficiency also become channels of coercion. Energy systems are not simply exposed to geopolitical risk from the outside. Their internal architecture - routes, contracts, payment systems, ports, grids, software, minerals, insurance, standards and political permissions - has itself become strategic terrain.

This is why "thinking the unthinkable" has changed category. It is no longer only a provocative intellectual exercise about remote possibilities. It is becoming a practical discipline for operating in a world where tail risks are more probable, more connected and more capable of overwhelming flexibility. The real unthinkables are rarely cinematic catastrophes. They are often stacked disruptions: a chokepoint that remains formally open but commercially impaired; a cyber incident that creates physical consequences without visible destruction; a sanctions shock that reroutes trade faster than infrastructure can adapt; a regional crisis that becomes global because shipping, semiconductors, LNG, insurance and industrial supply chains are tied together.



Security as continuity

To understand this new environment, energy security needs a broader definition. Security is not the absence of threats - no serious system can promise that. Security is the ability of a system to keep delivering vital functions under stress.

For energy, the vital function is not the production of barrels, molecules or electrons as such. It is the continuous delivery of usable energy services: heat, power, mobility, industrial output, digital functionality and strategic capability. A barrel has security value only if it can be produced, transported, refined and turned into useful work. An electron has security value only if the grid can transmit it, balance it and deliver it to the consumer that needs it. The same logic applies to a solar panel, a gas cargo, a transformer, a refinery unit, a battery, a port or a software system.

This changes the core question. The old energy-security question was: where will supply come from? The new question is: what must continue to function for energy to reach society under stress?

The answer is no longer supply alone. It is energy continuity across the chain.

Energy security has traditionally been discussed through the language of supply diversity, import dependence, spare capacity, strategic stocks and affordability. These concepts still matter, but they are no longer sufficient. The global energy system has become too complex, financialized, digitized and politically contested for security to be reduced to the availability of primary energy. What matters is whether energy can move through the entire chain: from resource, equipment and infrastructure to conversion, transport, storage, finance, digital control, distribution and final use.

Energy continuity means the ability of the whole energy chain to keep delivering vital energy services when one or more layers are disrupted. It asks not only whether gas, oil, electricity, uranium, critical minerals or clean technologies are available somewhere in the world. It asks whether they can be produced, converted, financed, insured, transported, balanced, distributed and socially absorbed where and when they are needed.

This may sound like a technical distinction, but it is a strategic one. A country may diversify gas suppliers but still depend on the same maritime chokepoint, insurance market, tanker fleet, software system, LNG spot market or political coalition to keep the system functioning. A company may have assets in multiple geographies but still depend on a single equipment vendor, port corridor, digital platform, sanctions interpretation, transformer supplier or shipping class to operate. A clean-energy strategy may reduce exposure to imported fossil fuels while creating new dependencies on minerals, refining, manufacturing scale, grid components, inverters and software. The form of dependence changes, but dependence does not disappear.

The point is not to create an endless catalogue of risks. Risk should be understood as a pathway: stress acting on vulnerability and producing consequence. The stress may be an attack, a sanction, a storm, an accident, a price shock, a market panic, a cyber operation or a political decision. The vulnerability is the place where that pressure gains leverage. The consequence is what breaks when leverage succeeds: supply, affordability, industrial capability, public trust, political solidarity, or confidence that contracts and markets will function as expected.

Many energy-security debates still concentrate mainly on stress. Who might close a route? Who might cut supply? Who might attack infrastructure? These are important questions, but they are not enough. The more strategic question is why a particular stress gets so much leverage over the system. A small physical disruption can become

systemic if it hits the wrong bottleneck. A limited cyberattack can create market consequences if it undermines confidence in dispatch or measurement. A sanctions measure designed to constrain one actor can reshape global flows if traders, insurers and banks withdraw beyond what is legally required because the risk is too ambiguous. Insecurity does not come only from the size of the initial shock. It comes from the architecture through which the shock travels.

When every layer becomes a chokepoint

The Strait of Hormuz illustrates this logic. A chokepoint no longer has to be fully closed to become strategically disruptive. It can remain formally open while becoming commercially impaired, militarily contested, legally uncertain, underinsured and logistically unreliable. The distinction between "open" and "closed" may matter for diplomats, but it is less useful for traders, shipowners, insurers and buyers who must decide whether cargoes can move safely, predictably and at acceptable cost.

The UAE's exit from OPEC and OPEC+ illustrates the same institutional logic. On the surface, it looks like a familiar dispute over quotas and production capacity. At a deeper level, it shows how stress can reorganize market institutions before it reorganizes physical flows. When export routes are constrained and security becomes uneven, spare capacity is no longer simply a collective market-management tool; it becomes a national strategic asset whose value depends on whether it can be shipped, insured, protected and monetized. Institutions designed for relatively stable export architectures come under pressure when logistics, security and national optionality become uneven.

Cyber risk reveals another version of the same problem. Energy can be disrupted without spectacular physical destruction. A cyberattack on offshore infrastructure, ports, electricity grids or dispatch systems may not destroy a major asset, but it can damage confidence in operation, measurement, safety and market coordination. The war in Ukraine demonstrated a related point: pipeline dependence was not just a commercial exposure. It was an architectural vulnerability embedded in infrastructure, contracts, storage, political assumptions and market design.

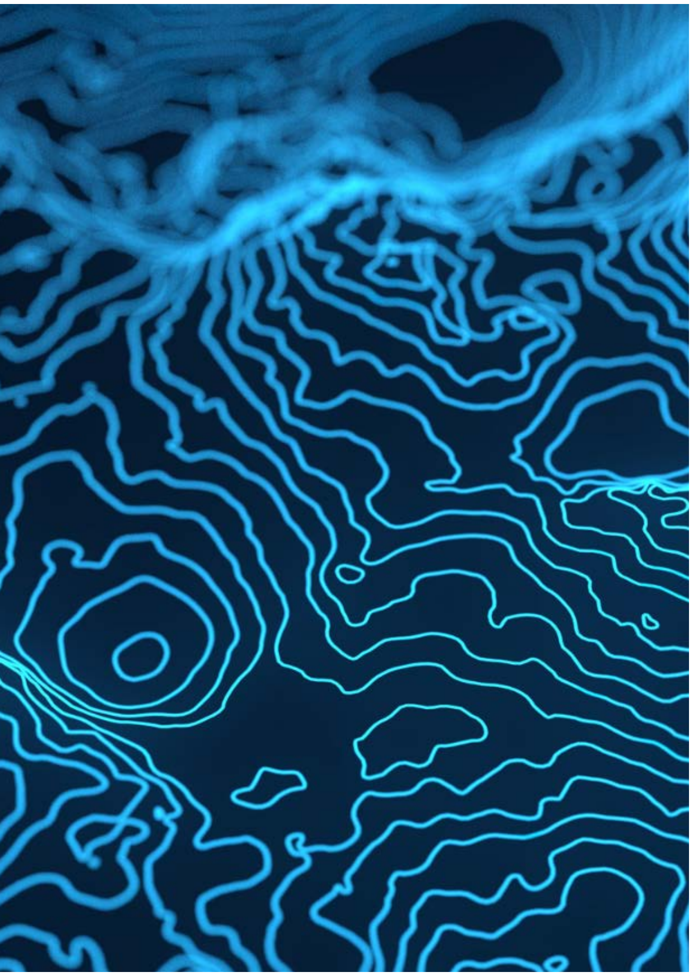
This is also why the distinction between security and safety is becoming less useful in practice. Safety is usually associated with accidents; security with intentional adversaries. Real systems rarely respect that boundary. Accidents create openings. Adversaries exploit chaos. Crises accelerate unsafe decisions. A storm, a cyberattack, a sanctions shock, a maritime incident and a market panic can produce similar systemic effects if they hit the same vulnerability. The energy sector therefore needs an integrated view of risk: not only protection against hostile acts, and not only operational safety, but preservation of function when causes overlap and attribution is unclear.

The transition through a security filter

The energy transition enters this story in a more complicated way than the political debate often allows. The conclusion should not be that energy security has returned and the transition is over. Nor should it be that decarbonization automatically solves energy security. Both views are too simplistic.

The next phase of the transition will be filtered through security. It will not be driven only by "decarbonization at any cost," but by technologies that can also strengthen continuity under stress. Technologies that provide local generation, reduce exposure to imported fuels, diversify supply, strengthen distributed resilience and give governments and consumers more room for maneuver will gain strategic value. Others will face harder questions if they create new concentrated dependencies on minerals, manufacturing, software, grids or foreign industrial ecosystems.
In this sense, the transition will be securitized, but not necessarily slowed. Solar, wind, batteries, grids, nuclear, geothermal, heat pumps, efficiency, demand response, storage and digital flexibility will all be assessed not only through their carbon profile and cost curve, but through their contribution to resilience. Distributed generation, when combined with storage, grid flexibility and demand management, can reduce exposure to imported fuels and centralized disruption. Electrification can improve resilience if the grid is strong, cyber-secure and diversified. It can increase fragility if the grid becomes an over-optimized single point of failure.

The central lesson is that decarbonization does not abolish energy geopolitics. It relocates it. Some vulnerabilities move from oilfields to mineral-processing plants, from pipelines to power grids, from producer cartels to industrial ecosystems, from fuel contracts to software platforms and standards. This does not weaken the case for the transition. It makes the design of the transition more important. A low-carbon energy system can still be strategically fragile if it is built without redundancy, repairability, transparency, cyber resilience, diversified supply chains and social legitimacy.



Designing for continuity

The new energy-security architecture must begin with a different organizing principle: vital function first. The unit of analysis should no longer be the fuel. It should be the function that fuel enables. The question is not only how much gas, oil, electricity or renewable capacity exists, but which vital functions must continue under stress. Heating, hospitals, water systems, food supply chains, ports, refineries, defence industries, data centres, mobility, communications and basic industrial processes do not all have the same tolerance for interruption. A serious energy-security strategy must distinguish between what can be priced, what can be delayed, what can be curtailed and what must continue.

This shift challenges the comfort of aggregate numbers. A country can have adequate energy in aggregate and still fail to deliver the right energy service in the right place at the right time. A global LNG market can be well supplied on paper and still experience localized shortages if cargoes cannot arrive, terminals are constrained, storage is low, prices move too fast or governments intervene unpredictably. A power system can have enough generation capacity over a year and still face reliability problems during peak demand, low wind, cyber disruption or transformer failure. Energy security now lives in the chain, not at one end of it.

The second principle is to treat redundancy not as waste, but as infrastructure. For decades, energy systems were optimized to reduce excess capacity, lower inventories, maximize utilization and rely on market liquidity to solve problems as they emerged.

That logic delivered real efficiency gains. But in a coercive environment, the most efficient system may also be the most brittle. Spare capacity, storage, alternative suppliers, backup routes, manual override, reserve equipment and emergency demand-response mechanisms may look expensive in normal times. In crisis, they are often the cheapest form of insurance.

The third principle is controlled interdependence. The answer to weaponized interdependence is not autarky. No serious energy system can or should be fully self-sufficient. The more realistic objective is to remain connected while knowing where dependence becomes coercion. Controlled interdependence means identifying critical dependencies, limiting single-point exposure, maintaining substitution options, diversifying standards and suppliers where possible, and building circuit breakers into strategic relationships. The future energy system needs circuit breakers not only in electricity grids, but in geopolitical dependencies.

The fourth principle is modular resilience. Highly optimized systems can also be highly contagious systems: failure travels fast. The future architecture must be integrated enough to benefit from scale, trade and flexibility in normal times, but modular enough to prevent cascading collapse in crisis. This is particularly important in an electrified and digitized energy system, where large grids, cross-border interconnectors, integrated markets and digital dispatch create both efficiency and new pathways for failure. The test of resilience is not whether nothing fails. Some failure is inevitable. The test is whether failure remains local, whether vital functions continue, and whether recovery is fast enough to preserve confidence.

The fifth principle is trust in information. In a digitalized energy system, security is increasingly about knowing what is real: which signal is authentic, which identity is authorized, which data stream can be trusted, which market movement reflects scarcity and which reflects manipulation. The more energy systems depend on digital control, automated trading, remote operations, sensors, cloud services and AI-supported decision-making, the more they require epistemic security: the ability to understand what is happening fast enough to act.

For decision makers in energy companies, this means resilience can no longer sit in the risk register as a low-probability item. It has to move into strategy, capital allocation, procurement, cyber governance, portfolio design, insurance, trading, crisis communication and board oversight. The relevant exposure is not only commercial exposure. It is coercive exposure: the points at which other actors can affect a company's ability to operate, finance, insure, deliver, maintain or legitimize its activity.

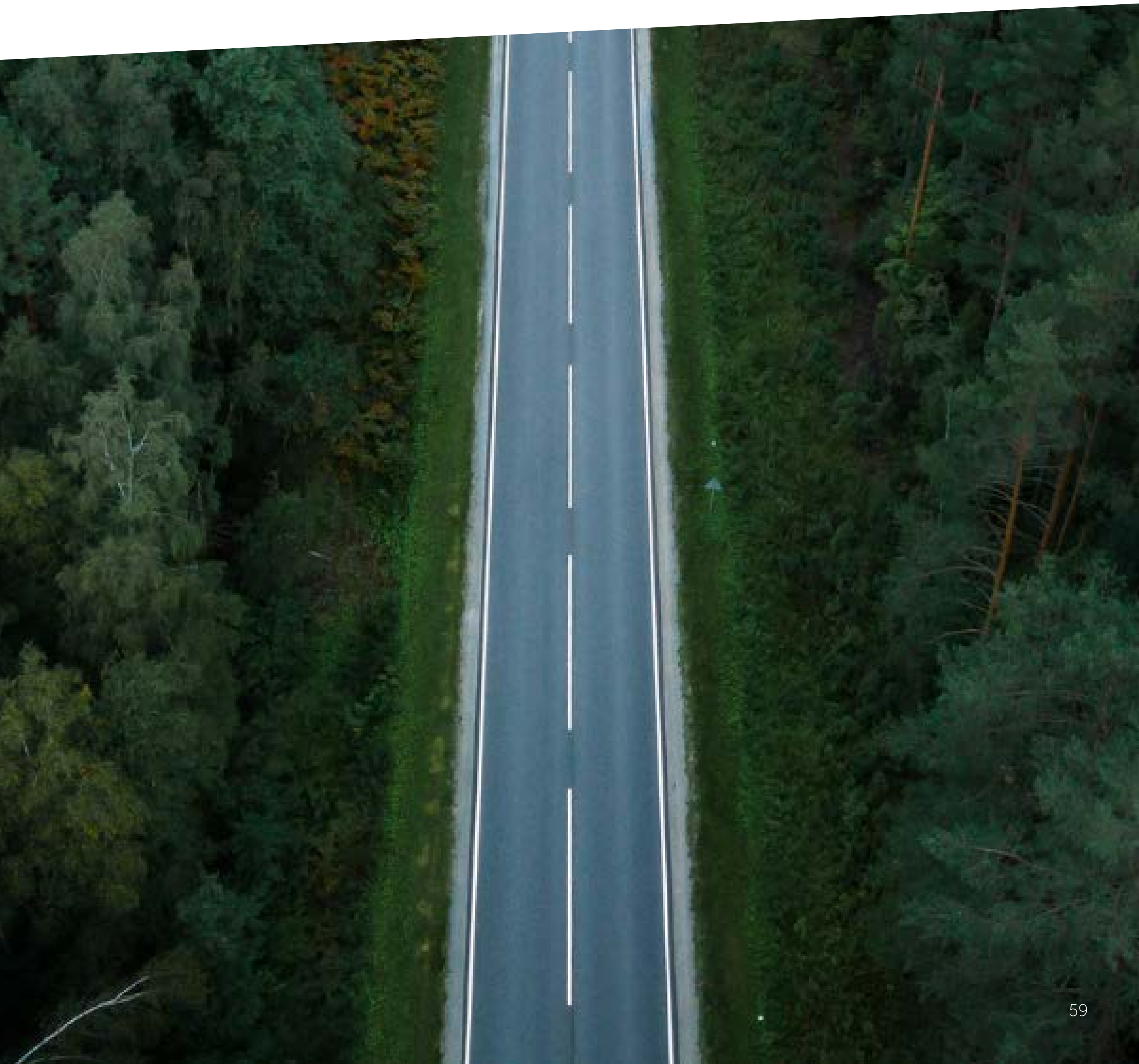
This also means stress testing must become more architectural. Financial stress tests remain important, but they are not enough. Companies need to ask what happens if two logistical routes fail at the same time, a critical supplier is sanctioned, insurance premiums jump, a digital system is compromised, a government imposes emergency allocation rules, and public tolerance for price increases collapses. This is not because such combinations are the base case. It is because the new risk environment is defined by simultaneity. The most dangerous shocks are not always the largest individual shocks. They are the ones that remove several buffers at once.

For companies investing in the transition, the same logic applies. Low-carbon projects should be assessed not only by emissions and returns, but by their contribution to continuity. Do they reduce exposure to coercive fuel imports? Do they strengthen local or regional resilience? Do they create flexibility in the system? Do they reduce peak vulnerability? Do they introduce new dependencies that are poorly understood? The winning technologies will not simply be the cleanest on paper. They will be those that improve the system's ability to keep delivering vital energy services under stress.

The hardest leadership challenge is that many future shocks will arrive with ambiguous labels. A strait may be open and unusable. A cyber incident may look like an accident. A market spike may be partly physical, partly financial and partly political. A clean-energy dependency may look benign until geopolitical relations change. Waiting for certainty can itself become a vulnerability. In this environment, leadership is not the ability to predict every shock. It is the capacity to design organizations, contracts, assets and decision processes that can function when prediction fails.

The old energy system was built to optimize supply in a world where cooperation could largely be assumed. The new system must preserve continuity in a world where cooperation is conditional, interdependence is weaponizable and disruption rarely respects the boundaries between physical, digital, financial and political systems.

> Energy security in this era is not the promise that nothing will break. It is the discipline of ensuring that when something breaks, the vital function continues.



What an Arctic childhood, Bodø/Glimt and America can teach Europe about leadership & innovation

The Arctic fosters patience and realism, while in the United States ambition is both a driving force and a magnet for capital.

By Håkon Gustafson Giæver

***Håkon Gustafson Giæver**, ONS Future Leaders 2026*

I grew up in the Arctic, where the landscape teaches patience and the climate teaches humility. Later, I spent two of my early adult years living in the United States, where I discovered something else entirely. I realized from spending time with the people there that ambition is not simply a virtue but also currency. The Americans I met on my path treated bold ideas the way our Arctic communities treat daylight in winter.

You hold onto it fiercely and refuse to let it fade, nurturing it with a kind of defiant optimism that refuses to accept limits.

In Europe, ambition is often wrapped in caution and precision. Growth forecasts are measured in decimals, scaling companies nationally, first. In the US, ambition sounds like a declaration of destiny. *"We will colonize Mars by the end of the quarter"*.

Velocity, capital and the power of narrative

Investors gravitate toward that confidence, even when it borders on improbable, because boldness magnetizes capital. It is not that Europe lacks this competence, infrastructure or creativity. What we often lack is the belief that world-shaping companies can actually come from here and should.

What shaped me as a young dreamer in the Arctic was discipline and resilience. What shaped me in the United States was speed. Europe tends to prepare, analyze and perfect. The US moves, tests and adjusts because they know that a product that barely works but launches today will in many instances outcompete a perfect product that just sits in a PowerPoint file.

From my experience working closely with research and innovation environments, I have seen the pattern clearly: Europe files patents; the US builds companies. The difference is velocity and behind velocity there is always capital.

In his 2024 report on European innovation competitiveness Mario Draghi argues that Europe must urgently "close the innovation gap" by dramatically increasing risk willing investment, noting that European startups rely heavily on bank loans instead of the kind of venture capital that fuels rapid experimentation.

Europe does not suffer from a shortage of ideas or research.

Europe suffers from a shortage of risk willing investment.

Bureaucracy is not the true barrier. Denmark as an example is one of the easiest countries in Europe for IPOs thanks to a supportive regulatory framework, simplified prospectus rules, and stable, transparent market conditions that reduce cost and complexity for companies going public. Yet the US, with its endless forms and higher complexity, continues to dominate.

Capital makes complexity irrelevant and when capital flows, innovation pushes through whatever stands in the way.

But capital is not the only difference. The cultures of communication are worlds apart. In Northern Europe, adequate is a compliment. In the US, awesome is merely the starting point. American founders are masters of framing: turning prototypes into revolutions and setbacks into temporary detours. This is not exaggeration. It is narrative strategy. It is the understanding that people do not invest only in what exists, but in what might exist.

It took me years to understand that storytelling is not a distortion of truth, but a multiplier of possibility. When paired with the Arctic instinct for realism, it becomes an extraordinarily powerful force.

Lessons from Bodø/Glimt can redefine the future arctic ambitions

In the Arctic, failure isn't fatal. It's information. You learn, adjust, and try again. That mirrors why a football club like my childhood team Bodø/Glimt from the far north who was relegated in 2016 goes on to reach the round of 16 in the world's biggest stage for football: the Champions League. They did not rely on privilege or spending power. They reinvented their culture, trained differently and built mental strength into their foundation. Above all, believed in something bigger than themselves.

That willingness to redefine norms; to challenge the status quo is exactly what the Arctic needs now.

The Arctic sits at the center of the global energy transition. It is warming faster than any other region. It is geopolitically sensitive and strategically essential. Yet sometimes it is still described as isolated, distant or fragile like a frozen museum.

In reality, it is the perfect testbed for the energy innovations of the future. Extreme climates expose weak technologies. Small communities reveal the limits of infrastructure. Remote environments reveal flaws in planning and high-quality proprietary data creates a unique environment for developing world-class AI-driven innovations.
The stakes are so much higher here and therefore, the solutions must be better.

Leadership in the Arctic means building systems that can endure for generations. It means being willing to innovate even when the path is unclear. It means trusting that daring and discipline together, as a team, like Bodø/Glimt has demonstrated; can unlock disproportionate impact.

If Europe and the Arctic is to realize this opportunitiy, it must unlock far more capital. Talent is not our problem. Research output is not our problem. Scale is.

Europe needs new incentives, new mechanisms and renewed courage behind investment decisions.

What if profits from newly issued European shares were tax-free?

What if early-stage investors were rewarded rather than punished?

What if our financial systems encouraged risk instead of penalizing it?

Innovation would not just grow. It would accelerate beyond anything we have seen before.

As a 29-year-old who grew up in the Arctic, I believe this region can lead the world in energy resilience, not despite its challenges but because of them. I believe Europe can match the ambition of the United States if we give ourselves permission to try.

Leadership is not preserving what exists.

Leadership is stepping forward when the world expects more.

The Arctic has done that before.

Europe has done that before.

It is time to do it again.

It’s time for a nuclear renaissance

In a world of energy insecurity nuclear offers a source of energy which has a proven technology, a secure supply chain and the potential to meet growing energy needs without adding to emissions. Nuclear’s negative reputation on costs and safety is unjustified and nuclear should be considered on its merits as a substantial contributor to the energy transition.

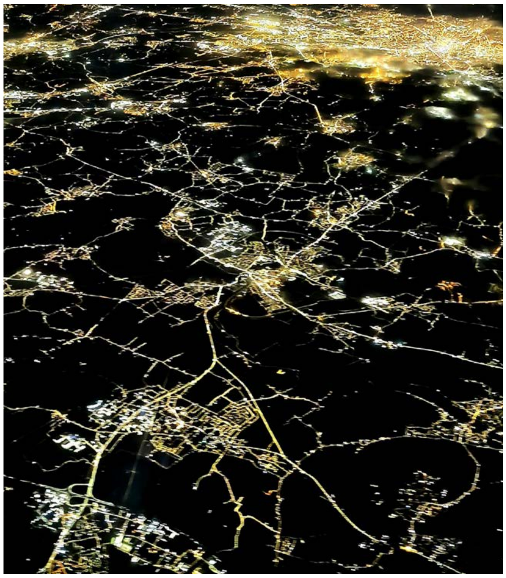
By Claire C Coutinho

*The Rt Hon **Claire C Coutinho** MP is Shadow Secretary of State for Energy in the United Kingdom. She was Secretary of State for Energy Security and Net Zero in the Conservative Government from 2023-2024*

In the last three years we have had three brutal supply shocks: the Covid pandemic, war in Ukraine, war in the Middle East. The closure of the Strait of Hormuz is the latest reminder that access to international supply chains is not a given in an increasingly unpredictable world. As the world gets more dangerous, energy security can no longer be something we in Europe treat as a nice to have, soothed by warm words about renewables or fantasy carbon accounting.

The lesson of Russia's invasion of Ukraine in 2022 should have been for Europe to maximise its own production of oil and gas and to stem the tide of our declining refining and manufacturing power. As Energy Secretary in the British Cabinet, I signed off new oil and gas exploration and legislated to protect licensing as the clamour of anti-hydrocarbon movements became louder and better funded. Even in the most rose-tinted view of decarbonisation, it is clear we will need oil, gas and its by-products for some of our energy needs. If we need it and we have the resources, we should get as much as possible from our own shores rather than importing fuel with higher emissions. That is just common sense.

However, our energy systems must also be able to survive the potential threats of the future: not just global oil and gas disruption, but conflict with a more hostile China and abundant, competitively-priced energy for industry and new technologies. Resilience therefore means having diverse sources of generation, being clear-eyed about the geopolitics of our supply chain reliance and the shape of our future energy demand.



Global electricity demand is set to skyrocket over the coming decades, driven by electric cars and heating, energy-hungry data centres for AI and air conditioning. The question policymakers must answer is what will supply that growing baseload of electricity demand as the world becomes more dangerous and supply chains more vulnerable? There are only five energy sources which can provide a reliable supply of electricity: coal, gas, hydro, geothermal and nuclear – of which only the last three are 'clean'.

Although experiencing remarkable breakthroughs, fusion energy is not yet deliverable commercially, although it may deliver in the future. For those countries without the geography for hydro or geothermal at scale, more nuclear is the obvious answer. Nuclear is the most energy-dense, zero-emission source of reliable electricity available to humanity. A single uranium fuel pellet the size of a fingertip contains as much energy as a tonne of coal and a nuclear reactor runs at a capacity factor of over 90% regardless of the weather or time of day. Nuclear should be the technology of choice for anyone serious about energy security and the environment.

How nuclear fell out of favour

However, nuclear energy has had a peculiar political journey. Despite the fact that it produces no carbon emissions, for decades, nuclear has been treated with suspicion or outright hostility by much of the green movement. Even in 2026, the British Green Party shows off its environmental credentials by campaigning to phase out our remaining nuclear plants completely, while in Germany, the decision to shut down all of their nuclear power plants in 2011 in favour of weather-dependent renewables left the country scrambling in recent years. To keep the lights on when the wind doesn't blow and the sun doesn't shine, Germany swapped zero-emission nuclear power for dirtier coal and imported gas, much of it from Russia which left it particularly exposed in the 2021 energy crisis.

In Britain, although we did not actively close functioning nuclear plants, we are also rebuilding a forgotten strength. We built the world's first civil nuclear power plant at Calder Hall in 1956. At one point in the 1960s we had more reactors than the rest of the world combined. We were building one every six months. But the discovery of cheap gas in the North Sea and modern combined-cycle gas turbines meant we fell behind in designing new reactors, and with long lead times and delays, an unofficial moratorium on new nuclear began.

For more than 20 years, new nuclear developments under successive Governments were largely regarded as uneconomic and unnecessary, not least because of the timescales involved in construction. Existing plants continued to operate, but their replacements were not brought forward until the Conservative Governments in the 2010s started Hinkley Point C and Sizewell C. The Russian invasion of Ukraine sparked an energy crisis which furthered support for nuclear as it reminded us all of the value of producing our own reliable energy rather than relying on imports.

The march of renewables

How did we lose our love of nuclear? The Renewable Energy Directive bears some responsibility. The Directive set binding targets for renewables but excluded nuclear entirely, on the technicality that uranium is not a renewable resource. The result was a continent-wide bias toward intermittent wind and solar at the expense of one of the only zero-emission technologies that actually works around the clock.

The view that electricity systems can and should be predominantly powered by 'cheap' intermittent renewables like wind and solar has become close to a religious orthodoxy, and to challenge it makes you a climate heretic.

Yet this orthodoxy is itself remarkably poorly substantiated. As Kathryn Porter, an independent British energy analyst has succinctly said, "the wind and the sun are free, the machines that extract energy from them are not." Once the full system costs are taken into account, such as building vastly more transmission and distribution capacity, grid stability and backup, they can make for a significantly more expensive system.

All the evidence shows that when weather-dependent solar and wind become too great a part of the generation mix, their unpredictability adds a huge amount to the cost of the system. This is not being measured properly across Europe, yet consumers and businesses are feeling the results. Japan's assessment of solar power found that in low quantities it is a cheap source of power, but in high quantities it becomes prohibitively expensive. All of these costs feed through to the consumer in the form of higher prices. The cheapest source for the system overall was, incidentally, nuclear.

Perhaps the most egregious consequence of an intermittent renewable-dominated system is the knock-on impact on the construction of baseload and dispatchable power. Every country that has pursued an aggressive wind and solar strategy without reliable baseload has found itself dependent on dispatchable generation. Without hydro, that means a baked-in reliance on coal or gas. However, with ever shrinking load factors and increasing carbon taxes, those plants which we rely on to keep the lights on are becoming ever more expensive to build and operate.

The consequences were laid bare during the Dunkelflaute, or wind drought, that hit Europe twice in late 2024, where German wholesale electricity prices spiked to an eye-watering €900/MWh – more than eleven times the annual average – where much of Northern Europe relied on Scandinavian hydro and French nuclear to keep the lights on. Norway, which exports hydro power to its neighbours, saw its own prices surge so dramatically that Norwegian politicians began calling for the undersea cables connecting them to the European grid to be dismantled.

Nuclear is the only proven zero-emission technology that provides reliable baseload power at scale, regardless of the weather, season, or whether our neighbours are willing to sell us their electricity when our own systems fail. It is also the case that for those of us in Western Europe, its supply chains are significantly more secure than any of the alternatives. If we truly want the world to turn to cleaner reliable power, then we must be clear-eyed about the limitations of a renewable-dominated system and far less prejudiced against nuclear power.

Supply chain security

The geopolitical argument for nuclear has strengthened enormously in recent years. The critical minerals used in wind turbines, solar panels, and battery storage are overwhelmingly dominated by China. China controls around 60% of global rare earth mining, 90% of rare earth processing, 75% of lithium-ion battery manufacturing, and over 80% of solar panel production. Beijing has already demonstrated its willingness to use this leverage, placing restrictions on the exports of rare earths during the Trump tariff wars in 2025. This is an explicit warning that we in the West should not ignore. Critical mineral supply chains can and will be weaponised against us in geopolitical disputes.

Similarly, if Europe is not willing to expand its own upstream and downstream oil and gas production, we will become increasingly dependent imports from outside our region. The events in the Gulf over the couple of months have made such dependence impossible to justify. We can no longer be dependent on LNG from Qatar, crude from Russia nor critical minerals from China. The Western Alliance must do more to ensure its supply chains are resilient.

Nuclear energy, by contrast, has the most geopolitically secure supply chain of any power source for the Western Alliance. Uranium is mined in politically stable, allied nations like Canada and Australia with no single country exercising a stranglehold on supply, and the volumes involved are tiny – the annual fuel load of a nuclear reactor can be transported in a few lorries - and operators routinely hold two to five years of fuel supply.

We should also be encouraged that many developments in nuclear coming down the track are taking place among our allies. Some of the most exciting discoveries in next-generation small and advanced modular reactor technologies are being made in the UK, USA and Canada. Private companies like X Energy and Last Energy are raising enormous amounts of private capital to develop pebble-bed and micro-modular reactors which could be routinely deployed at low cost across the world.

What is striking is that much of this innovation is being funded – without state subsidy – by major technology firms who are also behind the growth in artificial intelligence and data centres. Why? Because they recognise that the industries of the future require constant, reliable, affordable energy, and the fundamental economics of nuclear can provide it.

In the UK I signed off our High-Asset Low-Enriched Uranium programme, which would establish us the only commercial producer of advanced nuclear fuel outside of Russia. Creating more of our own advanced nuclear fuel in Western Europe will enable us to continue to march forward on nuclear innovation and benefit all of our allies.

Confronting cost

The most common objection to nuclear is cost. In Britain, a stop-start approach to nuclear, plus onerous regulations and anti-nuclear 'lawfarism' have drastically inflated costs.

But these are not intrinsic features of nuclear technology. They are the product of policy choices that can – and should – be

reversed. South Korea has demonstrated that nuclear can be built on time and on budget when designs are standardised and the regulatory environment is predictable, with a steady stream of projects in the pipeline. The Barakah plant in the UAE, built with Korean technology, delivered four reactors in under a decade at a third of the price-per-MW of Hinkley Point C in England. France built its entire fleet of 56 reactors in around 15 years during the 1970s and 80s.

Britain itself built its early fleet at remarkable speed. The Bradwell reactor in Essex was completed in five years, yet Hinkley Point C will take at least thirteen. The difference is not physics, it is paperwork and regulation. The environmental impact assessment for Sizewell C ran to thirty times longer than the complete works of Shakespeare.

However, nuclear is by far the most land-efficient form of energy generation. To generate the same amount of electricity as Hinkley Point C from wind or solar, you would need up to 3,000 times more land. On a small, densely populated island like Britain, where every acre of countryside is valued and large-scale renewable projects fiercely contested, this matters.

The environmental costs of the alternatives are also routinely understated by their advocates. The mining of lithium, cobalt, and rare earths for batteries and renewable components involves significant ecological disruption, often in countries with far lower environmental standards than our own in the West. The steel and concrete requirements of wind farms are substantial and their offshore foundations affect marine ecosystems, while solar farms displace agricultural land and make us more dependent on imported food. None of these impacts are disqualifying in their own right, but they deserve honest accounting against a technology that generates vast amounts of reliable, zero-emission electricity on a footprint measured in the hundreds, rather than thousands, of acres.

Conclusion

The world is entering a period of sustained geopolitical instability and energy demand is going to continue to grow. The countries that will thrive in this environment are those that can generate cheap, reliable, abundant energy securely.

Nuclear power meets every one of those criteria. It is dense, reliable, zero-emission, and backed by the most secure supply chain of any major energy technology. The high cost of new nuclear is a function of policy and regulation, not of physics, and the evidence from Korea, the Middle East, and Britain's own history demonstrates that costs can be brought down dramatically if the political will is there to do so. A wave of innovation in small and advanced modular reactors, many backed by private finance to power the expansion of data centres, is poised to transform the economics further.

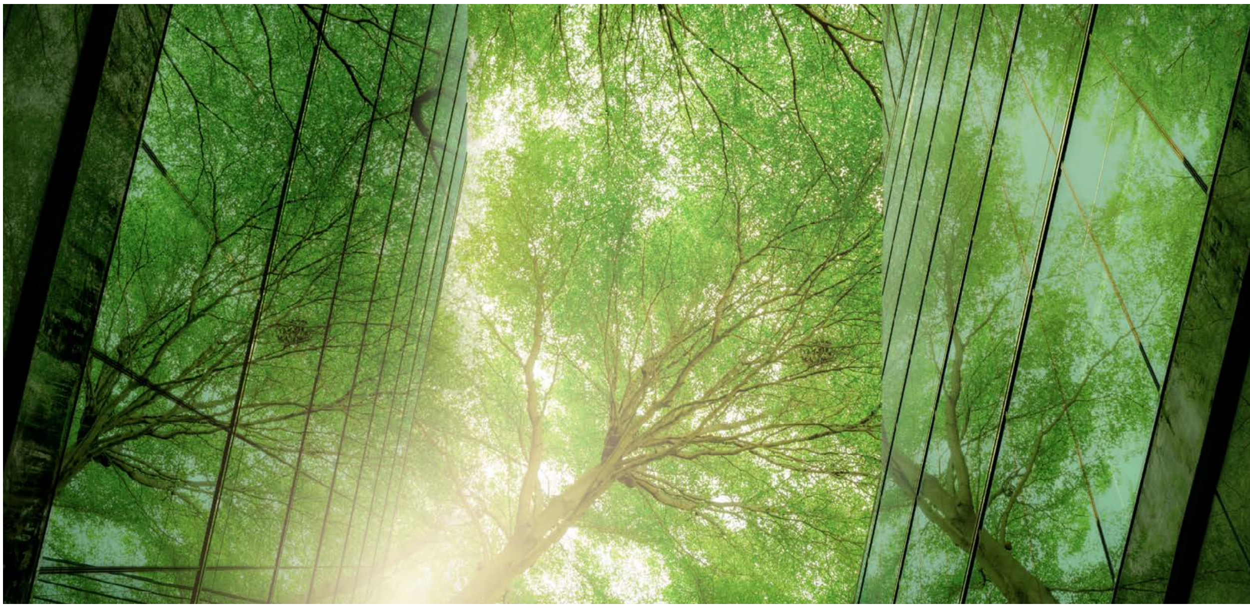
What is needed is political seriousness. We must break down the legal and regulatory barriers that stand in the way of building new nuclear, large and small, and recognise that secure, reliable, dense energy is the foundation of national resilience and industrial power.

Science and technology reshaping the future of energy

The continuous, and in many cases dramatic, advances in technology now being made allow us to look forward to a new Industrial Revolution in the production and use of energy. The immediate challenge is to ensure that the consumption side of the energy market keeps pace with the new supplies and that we are ready to deal with the challenges which change always brings.

By Peter Littlewood

Peter Littlewood *was a professor at the University of Chicago, Chair Department of Physics*



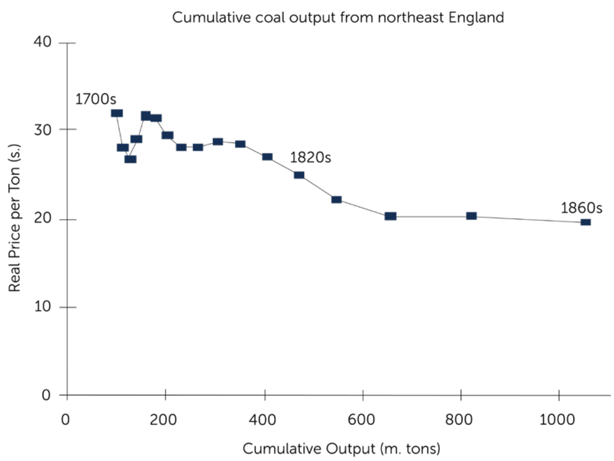
We live on a well-favoured planet. Fusion power from the sun radiates 366 Watts per square metre on every point of the Earth's surface, averaged over the year. That is a total power reaching the upper atmosphere of 1017 Watts, about 10,000 times humans' total power consumption, and a further order of magnitude larger than our consumption of food. The incident solar energy cascades down into wind, rain (hydro), wave energy, and biomass, so there are multiple ways to harvest it. The minerals we need for technology are widely available, and while some ores are more productive than others, we are overabundantly supplied.

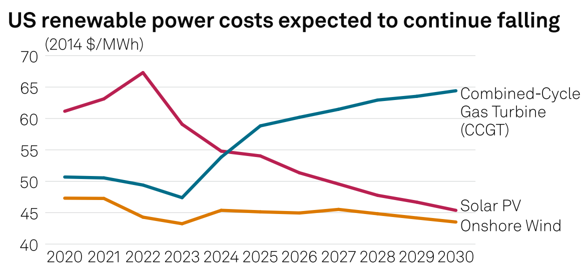
The progress of our species has been driven by our mastery of energy, and civilization has progressed through four distinct energy revolutions, two of which are prehistoric. The first is the control of kinetic energy, where with the spear we learned to kill at a distance, the use of weapons distinguishing ourselves from all other animals. The second is agriculture, both with crops and domestication of animals – and note that this also depended on the technology to manage water. The third (industrial) revolution replaced physical labour with machines, of course powered by fossil fuels, allowing productivity to be massively enhanced from the work of human and animal labour. While each revolution allowed us to thread a bottleneck of development and exert ever tighter domain over the planet, each generated their own challenges that remain with us. Among them are weapons of mass destruction; the commitment of about half the earth's habitable land to agriculture; species destruction; and climate change. We are compelled to move forward to solve the problems previous success created, but we should recognize that we will never reach the point where everything is solved. We are perhaps at the beginning of a fourth energy revolution, that we loosely term "renewable", but must reckon that it will have its own downsides that we poorly now perceive.

This article attempts to analyze the renewable landscape in very broad terms, and to look forward to what needs to be done.

We are witnessing early success in renewable generation of electricity by wind and solar and increasingly backed up by electrical storage. Electric vehicles are becoming ubiquitous. While there has been some policy and subsidy behind this shift, it is now dominantly cost-driven. Strike prices for solar and wind for new construction are now well below fossil and nuclear (see figures below). The genesis of this shift is however not because of technology investment in renewables per se. It is instead a spin-off of other technologies – largely consumer but also military. Silicon solar cells had their costs driven down by proximity to trillion-dollar investments made in computer chips over decades. Windmills are an ancient invention, but very large (and therefore very efficient) wind turbines have been enabled by aerospace R&D. Li-ion batteries were developed for portable consumer electronics beginning in the 1990's. Originally expensive, their cost was driven down so that by about 2015 one reached rough parity of the cost of an EV with an internal combustion engine powered vehicle. Since then the market by volume for Li-ion has been dominated by EV's, and the price has continued to fall so that EV's are ascendant. The issue for solar, wind, and EV is now scale – penetration (except for EV's in a few markets) is still light. I will come back to the scale challenge below.

FIGURES: The price of coal stayed roughly constant in the 18th and 19th centuries, while volume grew exponentially. Aside from occasional disruptions, the same has been true of oil. In contrast, solar and wind have deflated over a very short period, owing to their heritage in high tech.





Note: Shows Levelized Cost of Energy (LCOE) for US power generation by technology
Source: S&P Global Energy

Each of these – solar, wind, and EV – have significant technical advances over their fossil-driven precursors, but it was the market and not the technology that moved the needle. Disruptive technology is expensive. There are some other shifts that are worth noting from the fossil fuel era.

We are familiar with the idea that coal drove the industrial revolution from the 18th century onward and the volume mined grew exponentially for over a century – but historical data shows that the price per ton was remarkably constant. Similarly, the mobility revolution of the 20th century was spurred by oil, but that too kept a mostly constant baseline price as volume exploded (discounting the occasional wars and embargoes). High volume at a constant price is a good business and consequently the fossil energy industry is largely producer driven. In contrast, renewables are driven by consumer technology which as we have seen is deflationary in terms of energy cost.

The renewable energy revolution is therefore as much about finding markets for a deflationary input (energy) as it is about the technology itself.

While there is a lot of sunshine and wind available, the challenge is to build up manufacturing capacity to what is an agricultural scale, and at an agricultural cost. For the two dominant renewable power sources of solar and wind, we have taken scaled nanoscience to tens of meters at the price of growing wheat. This is a remarkable success.

The cost point for solar and wind is now agricultural (so that some farmers are turning over their land from crops to energy generation or indeed exploiting their easy coexistence).

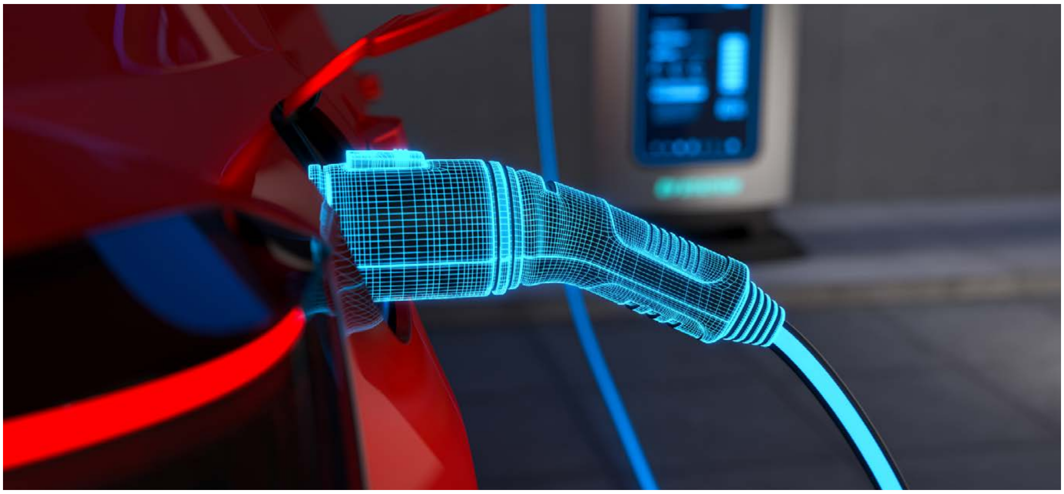
The slower take up of renewable generation is to be explained by other factors – the absence of the necessary grid connections, regulatory barriers, intermittency and the need for backup storage, and the challenge of displacing of existing power stations with lifetimes of many decades.

The problem is NOT availability of fundamental mineral resources as we are sometimes led to believe. The only serious dent is for lithium but note the very low base. Lithium is not a rare mineral, though as always there are better and worse ores, and there are better and worse mining techniques. But there is plenty of room for ingenuity to fill this gap, and while one should indeed be pushing for green mining techniques the scope for reducing the harm caused by hydrocarbons is overwhelming.

These challenges are manageable and it feels certain that over a few decades or less we will see the slow renewable electrification of large parts of the economy: land vehicle transport, residential and commercial and light industrial use. This is around half the energy usage in an advanced economy. But "slow" here means ten times faster than the first industrial revolution.

What about the remaining half of our energy use? This consists largely of marine and air transport sectors, heavy industry such as steel and ammonia production, agricultural fertilisers, polymer and specialty chemistry. Parallel to these use cases, there are energy technologies that we have not yet discussed, such as green hydrogen (or perhaps green methane or ammonia) both for energy storage and power through fuel cells, SMR nuclear, biofuels, and in some distant time nuclear fusion. I now run through some of these quickly.

Long haul air transport surely requires the energy density of liquid fuels and building capacity in sustainable aviation fuel, or alternatively creating new propulsion systems for (yet to be developed) green fuels will be challenging. Short haul (air taxi to 200 km-range small planes) is much more promising. For a four-seater vertical take-off and landing (VTOL) gyroplane or multi-rotor heliplane the energy efficiency is comparable to a large car with an internal combustion engine. There are enough attempts to build markets for air taxis that it seems like something will take off.



Since moving in three dimensions is easier than in two dimensions, the big societal win could be less congestion on the ground.

Polymer and chemical processing are ideal uses of hydrocarbon raw materials and will not (should not) go away.

Aluminium smelting is already an electrical process, and modern steel plants are heavily electrically powered.

Biofuels are challenging because of the typical inefficiency of plants in converting solar energy to fuel (around 1-2%). Only in a few places where the population density is low and there is a parallel agricultural industry from which to piggy-back (for example sugar cane in Brazil) do biofuels make sense. But it is conceivable that engineering of algae could change this calculus. The Prochlorococcus cyanobacterium – whose ancestor invented photosynthesis a few billion years ago – is a prolific consumer of atmospheric CO_2 and generates around 20% of the world's oxygen.
Though indeed the scale is beyond agricultural to oceanic – and perhaps we need to worry more about how environmental changes are impacting this carbon sink. It's a very poorly studied and complex arena.

Nuclear fission has a complicated history but if one has the fuel (and we do) a reactor is very easy to build – it is usually just a steam engine with a drop-in heat source. It took only 18 months for the first operating reactor at Hanford to be built in WWII following the demonstration of controlled fission in Chicago by Fermi's team. However in many countries nuclear is far out of the money (see Figure 1) though the excessive costs are usually caused by the long lead times involved, the expensive funding models involved and over regulation

Small Modular Reactors (SMR) are potentially a nice fit to data centers as well as to defense applications, and maybe they will provide a market for sustaining the technology. Nuclear fusion is very hard – one must recreate a star in miniature – and despite the large amount of speculative capital being invested seems likely to pay off only in decades. However, the money invested here will probably lead to other useful tech – for example better superconducting magnets which will impact power transmission and medical imaging.

Electrochemical fuel and storage are important. Following the arguments given above about the market leading there are now (at least) in three levels. One is the need for back-up for intermittent solar and wind, since batteries are not well suited for longer-term storage. Another is ammonia production (as a feedstock for nitrogenous fertilizer); this currently uses the Haber-Bosch process which consumes about 5% of the world's natural gas production and generates 1-2% of anthropogenic CO2. A further one is fuel cell propulsion which is well suited to marine or rail transport. Eventually, given the energy density of liquid fuels, fuel cells may well reconquer vehicle and air transport. However, unlike the case of battery technologies which found a consumer market even when inefficient and expensive, there is no evident path to the market. The technologies are all demonstrated in the lab, but none have been yet scaled to the applications above though surely surmountable technically with enough R&D. When there are superfluous electrons produced by wind, solar or nuclear, the current inefficiency of electrochemical generation of hydrogen is perhaps mitigated enough to create an entry point, perhaps in marine propulsion.

The development of the propulsion systems can be helped also by a path from non-renewable fuels through various colours of (almost-) renewable hydrogen. Judicious international regulation could aid this. Perhaps there are other paths, but when one of these levers are pulled, the others will follow.

I am very optimistic that there will be overwhelming substitution of renewables over the next few decades because the technology and most of the markets are now aligned. But rapid as this is in historical context, it may not be soon enough to defeat climate change impacts, and we will need to plan mitigations. Finally, the lesson of revolutionary change is that it brings unintended consequences and we should start to contemplate what will come next.

Note from the editor

Professor Peter Littlewood FRS died on June 16th. This article which he prepared as he went through his final illness will be his last publication – a fitting reassertion of the pragmatic optimism of all his work. He always believed that if well focused science, technology and engineering could deal with the challenge of climate change.

He served as Head of the Cavendish Laboratory in Cambridge, then as Director of the Argonne National Lab in Chicago and as Chair of the Faraday Institution in the UK researching the potential of energy storage.

He was also a wonderful and unfailing personal friend through all the years since we met on our first night as students at Trinity College Cambridge almost 53 years ago. I will miss him enormously. Peter - RIP.

Nick Butler, Editor

The weaponisation of energy infrastructure and sea lanes – and countering it

Energy infrastructure, subsea assets and strategic sea lanes are increasingly being weaponised in geopolitical conflict. Governments and industry must adopt a more coordinated, technology-driven approach to protect critical energy systems and strengthen resilience.

By Alison Gordon

__Alison Gordon__ is a former UK national security official and geostrategic advisor. She leads international government engagement at Ocean Infinity

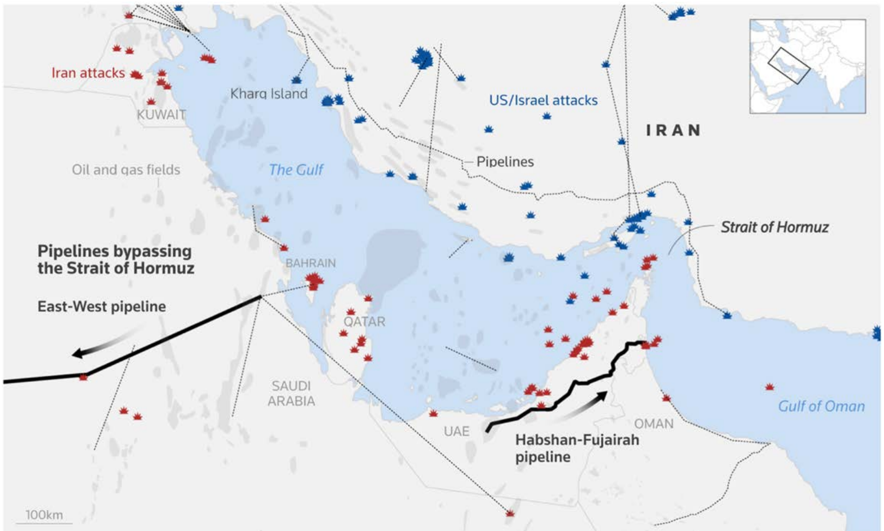
Never has the need to secure and protect energy sea lanes, logistics and subsea infrastructure been so clear. Iran's unilateral action blocking the Strait of Hormuz, a key energy transit point, brought short-term tactical advantage in the conflict with the US and Israel by sending energy prices soaring, markets tumbling and creating a "national energy emergency" in the Philippines, a fuel crisis across Europe and price hikes in the US. And the subsequent US 'checkmate' enforcing its own blockade on the Strait – to escalate the economic pain on Iran's own economy and secure a peace deal – only reinforced how the capture or control of critical energy transit points can bring strategic advantage or failure with near immediate effect.

Of course, wartime strategies of targeting energy supplies are not something new, especially in the Persian Gulf where energy has been central to every conflict in the region in the twentieth century. Indeed, it should not have come as a particular surprise that Iran would adopt the course of action it chose in Hormuz when faced with what it perceived as an existential threat from US and Israeli military action. This is exactly the response scenario that US military planners had mapped out for decades. And having watched first-hand the strategic success achieved by Russian tactics of cutting gas supplies to Europe in retaliation for Western sanctions over its invasion of Ukraine in 2022, Iran's tactics were made even more likely.

Asymmetric impact of new autonomous technologies

What is significant here, however, is the adoption of a low-cost offensive maritime playbook – deploying drones and uncrewed vessels to close a critical international[1] sea lane – to deliver an asymmetric impact in the conflict. For Iran (unlike the US) didn't achieve its objective by deploying expensive, traditional naval

FIGURE 1: Iran attacks in the Strait of Hormuz bring vessel transit to a standstill



Source: Global Energy Monitor, European Comission and Institute for the Study of War & AEI Critical Threats Project hardware. Rather it used relatively cheap autonomous platforms - unmanned surface vessels (USVs), unmanned aerial vehicles (UAVs) – together with lean-crewed, IRGC fast patrol boats, armed with cheap missiles and mines, to deliver a high level of operational and strategic effect. In just ten days[2], its actions and accompanying narrative raised the threat to shipping in the Strait to such a level that maritime insurance premiums surged and shipping lines and vessel owners baulked at the potential risk to crew and vessels, bringing vessel transit to a near standstill.

This playbook, coupled with the regime's targeting of regional energy infrastructure – such as the strikes on the liquified natural gas (LNG) facility at Ras Laffan in Qatar – gave Iran an early strategic advantage, or "upper hand"[3] as the former Chief of MI6 Alex Younger put it. It allowed Iran to widen the global economic impact of the conflict[4] which mounted intense pressure on the US to find an off-ramp to its war-of-choice. Younger summarised: "They've [The Iranians] understood the significance of the energy war and held the straits at threat and just globalized the conflict."[5]

Choke-point vulnerabilities elsewhere

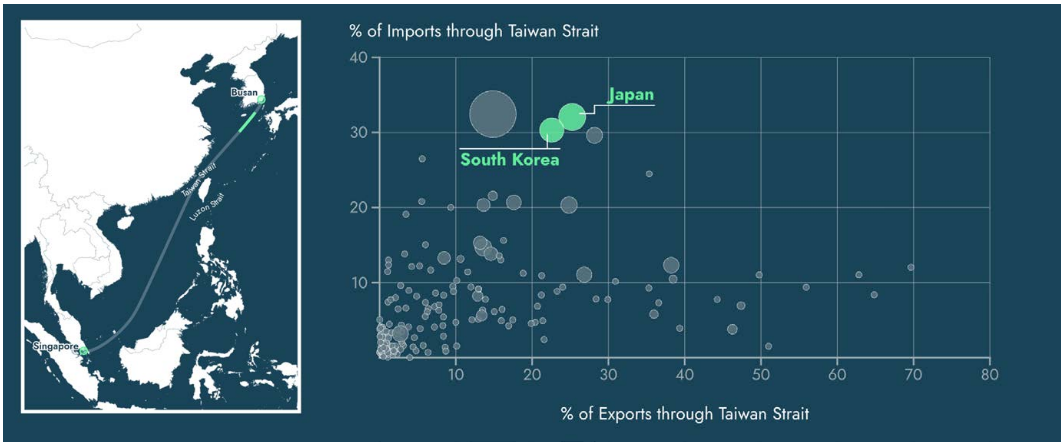
The reason the recent scenario in the Gulf should be a call to action for the enhanced protection of energy sea lanes, vessels and subsea pipelines is because it won't be a one-off. Iran's playbook is readily replicable to other maritime energy chokepoints and for Europe and Asia in particular, given their reliance on oil and gas imports, any blockade would have a similar economic impact to that seen in the Gulf. There are several other strategic supply sea lanes already at amber levels of risk given their location in highly contested geopolitical areas. The following three are prime examples:

- **The Danish Strait:** Considered an international waterway (with related due right of passage), the Straits connect the Baltic Sea to the North Sea and serve as a critical transit route for trade and energy in Northern Europe, especially for Russia. In 1H2025, 6% of global maritime trade of crude oil and petroleum products flowed through the Straits and large supplies of US LNG now add to this picture (replacing Europe's pipeline imports from Russia starting in 2022).[6] NATO and Denmark are deploying advanced surveillance technologies to secure the corridor but despite this, the Straits remain the main route for Russia's 'shadow fleet' of illicit tankers. The shallow, busy waters make them ideal for mine warfare and deployment of USVs in the event of escalation of conflict, as recently seen in the Gulf.[7]

FIGURE 2: Danish Strait maritime chokepoints

Source: U.S Energy Information Administration

FIGURE 3: Japan and South Korea's energy supply reliance on Taiwan Strait. Source: CSIS[9]

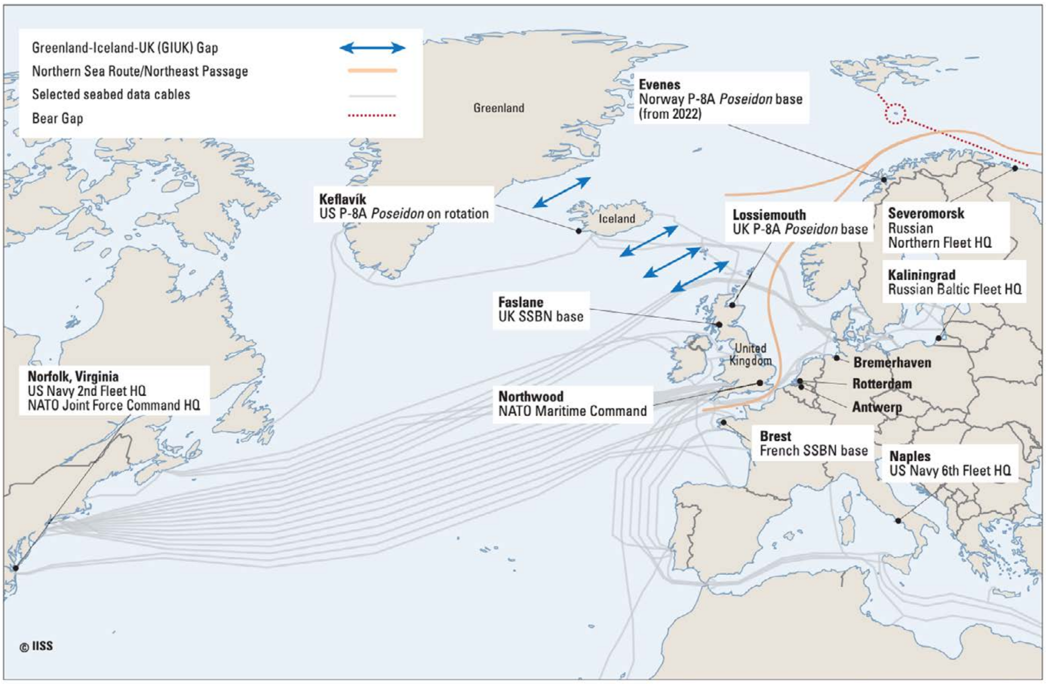


- **The Taiwan Strait:** The Strait is a key transit point for vessels carrying goods, raw materials and energy supplies from Singapore to the Indo-Pacific. Any disruption of maritime shipping through the Strait – for example, by a Chinese blockade of Taiwan – would have massive impact on two key US allies, Japan and South Korea. Over 95% of Japan's crude oil and 65% of South Korea's passes through the Strait,[8] so the impact in Asia would be potentially even more extreme than that witnessed due to the closure of Hormuz.

  Of course, the Strait is also crucial for China, with more than $1.3 trillion Chinese imports and exports, including raw materials, passing through the waterways annually. But this just underlines the value to China of controlling the Strait – a point highlighted by its twice-yearly, increasingly aggressive large-scale maritime operations surrounding Taiwan, simulating full maritime and air blockades and anti-access/area denial strategies. No doubt Beijing – which already possesses advanced drone and counter-drone capabilities – has been playing close attention to the drone-based tactics Iran has deployed in Hormuz with an eye to how it could adopt similar approaches in a quarantine scenario against Taiwan.

- **Greenland-Iceland-UK Gap:** The GIUK Gap, a gateway between the Arctic-Nordic region and the Atlantic, is a key strategic waterway for Europe and one of NATO's most serious maritime concerns given growing geopolitical competition in the region amongst the US, China and Russia. The impact of climate change in this region is opening both new strategic Arctic sea lanes and access to important energy reserves and minerals. NATO allies are monitoring increasing Russian and Chinese activities near Greenland and Iceland amidst calls for widening the current GIUK area of operations to include the Barents Sea.[10]

FIGURE 4: The North Atlantic and GIUK Gap – International Institute for Strategic Studies[11]



Source: IISS - International Institute for Strategic Studies

Given Europe's dependence on subsea energy supplies, pipelines and related infrastructure in this region, in large part due to Norway's extension of offshore energy fields and infrastructure far out into the Barents Sea, it is obvious to understand the strategic importance of the area and the imperative for Western allies to deploy robotic and autonomous technologies to safeguard its control – an approach which is central to the UK Royal Navy's innovative Atlantic Bastion concept, which will integrate crewed, uncrewed and autonomous platforms and AI-powered sensors to provide anti-submarine sensing capabilities to secure Britain from Russian undersea threats in the Gap.

Increasing energy infrastructure vulnerabilities

In addition to transit routes and choke points, offshore and seabed infrastructure is another major area of vulnerability for the energy sector. Referred to by policy makers as "critical undersea infrastructure" (CUI) and comprising offshore installations, subsea pipelines, interconnectors and power cables, these energy assets have become a "soft target" for increasing Russian and Chinese grey zone operations and activity.

Since Russia's invasion of Ukraine in 2022, Europe has witnessed a surge of CUI attacks – with the 2022 bombing of the Nord Stream 1 and Nord Stream 2 gas pipelines (between Russia and

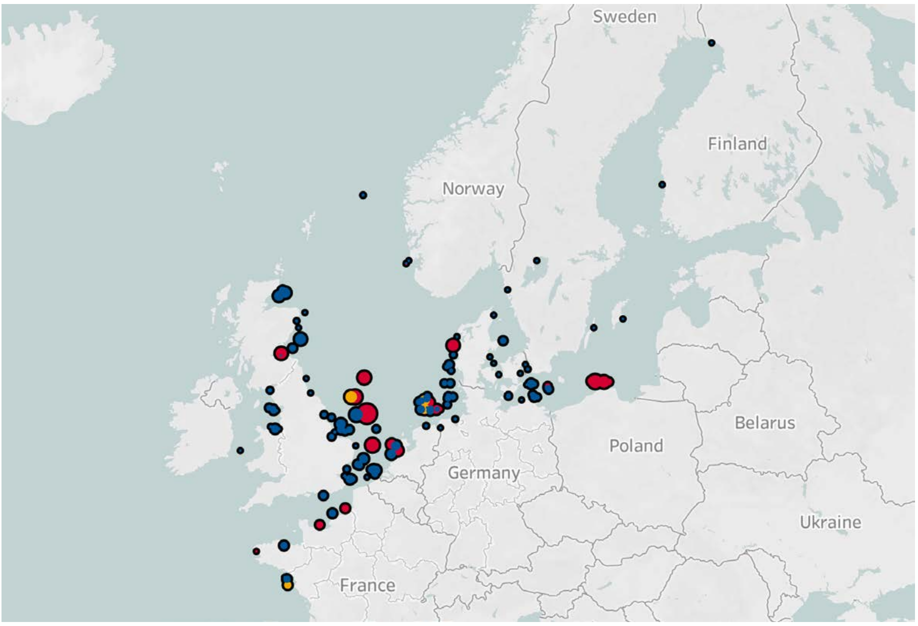
Germany) perhaps the most notorious. But others - including the rupture of the Baltic connector gas pipeline (between Finland and Estonia) by a Chinese vessel in 2023, the severing of the Estlink 2 power cable (between Finland and Estonia) by a Russian shadow fleet vessel in 2024 and damage to multiple data cables over the same period – highlight the expansive nature of the threat.

Russia's – and increasingly China's – playbook is clear: It targets subsea energy infrastructure in a campaign of sabotage, surveillance and deniable or non-attributable attacks to weaken European support for Ukraine and pre-positions devices (such as mines or explosives) to create strategic leverage in the event of a future conflict.

Former Nato deputy supreme allied commander Europe, Richard Shirreff, writing in the Financial Times earlier this year, was astute in summing up the shift of mindset needed to address the current threat: "We should treat energy security as de facto defence policy. That means moving beyond thinking about energy solely in terms of efficiency and decarbonisation, and prioritising resilience and strength in the face of aggression."[12]

The scale of the challenge to secure these assets is not to be underestimated. Not only has the area of operations for European subsea energy surged in the last decade with the expansion of fields much further offshore,[13] but the transition to Net Zero with its ambitious offshore wind-farm development strategy (see Figure 5), together with Europe's electrification network strategy, have massively multiplied the number of assets at play – and as a result, substantially increased the sector's exposure to risk.

FIGURE 5: Offshore windfarm development in Europe – a myriad of CUI targets. Source: Wind Europe[14]



Countering threats to energy infrastructure and sea lanes – funding and policy

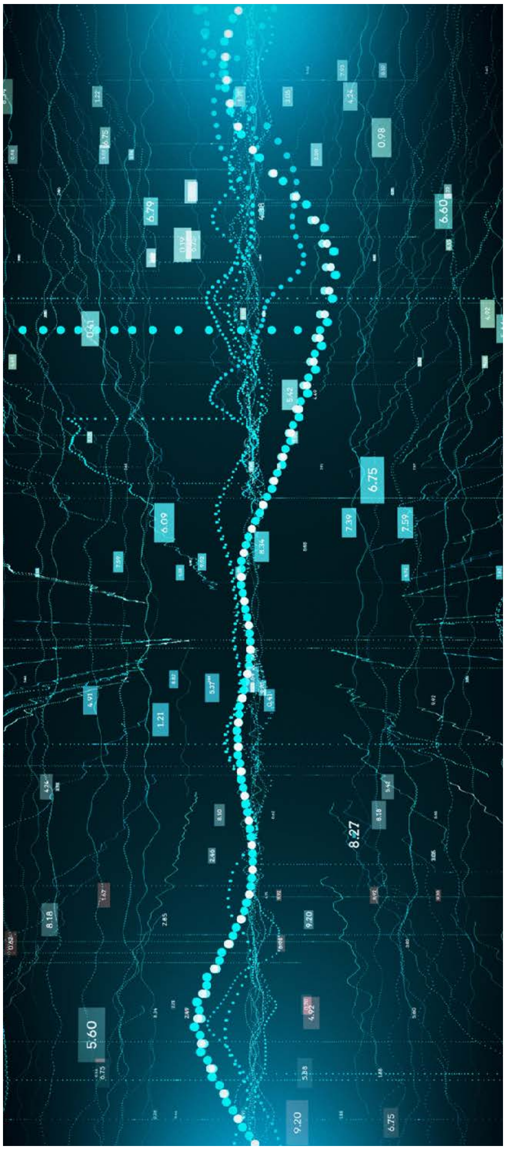
So, if the energy sector is now centre of the bullseye for economic warfare and its infrastructure a new "front-line" for nation-state hybrid warfare, how can asset owners, investors, operators – ideally with the support of Western governments – counter the new threat landscape?

The immediate imperative is to invest in the hardening of both infrastructure and key energy transit routes globally. Vice president at Blackrock, Tom Donilon, speaking at CERAWeek in March 2026 (as reported by Politico) suggested that following Iran's actions in the Gulf, energy investors have finally understood this: "There'll be a tremendous amount of resources required to kind of harden up the infrastructure and alternatives globally," he said, adding, "There's going to be a big investment agenda coming out of us in order to kind of move towards energy security."[15]

European governments and NATO member states, given their experience of Russian and Chinese grey zone activity over the last few years, have also articulated an urgent need to invest at scale to protect CUI. The European Commission committed to spend nearly Euro 1 billion to protect undersea infrastructure in February 2025,[16] and at the NATO Summit in the Hague (June 2025), member states, as part of their broader 5% defence spending pledge, committed to spending up to 1.5% of GDP on critical energy infrastructure, as well as telecommunications infrastructure and cyber defence.

However, for all the talk, there has been limited action by many governments – and importantly, limited funding released for operational execution. Many European governments – even those at pointy-end of Russian aggression, such as Poland – are hampered both by the sheer number of stakeholders involved – Navy, Coast Guard, intelligence, Border Guard, Energy and Infrastructure Ministries, energy companies – and by the politics this brings into play. The Netherlands, in its Programme for Protection of North Sea Infrastructure (PBNI) initiative launched in 2023, attempted to address this with a complex cross-government framework,[17] but to date this approach appears only to have further slowed decision-making, yielding limited operational results and scale. And for those governments outside of the traditional multi-lateral (NATO) or defence frameworks, even more challenges arise – Ireland's recently announced National Maritime Security Strategy, for example, highlights dependence on its neighbours, France and the UK, to help secure Irish-controlled waters and subsea infrastructure against Russian shadow fleet aggression.[18]

An exception is Norway – perhaps unsurprising given the importance of energy to the country's economy and its increasing role as Europe's energy lifeline.[19] Facilitated in large part by the state's majority (67%) ownership of Norwegian oil and gas company Equinor, Norway has approached offshore energy infrastructure protection from a national security perspective. In 2022, Norway amended its Security Act to broaden its scope to cover the petroleum industry and protect national security interests related to oil and gas production and pipelines.[20] This laid new duties on energy companies to take actions to protect and secure infrastructure and also set up a national coordinating entity which sees Equinor and other operators sitting with the Ministry of Defence, Norwegian Intelligence, Navy and Coastguard to share information relating to the offshore maritime domain, surface and subsea threats and operating issues.



While some energy operators may baulk at this approach, the merit has been to see coordinated action and data sharing at scale in the protection of CUI. Equinor has more than 100 leased surface and underwater vessels deployed across its field every day – in other words, a fleet larger than most European Navies. It seems sensible for the government to harness that investment through an effective military-industry partnership to align activity, provide greater maritime domain awareness to both sides and by so doing enhance the deterrent effect. It is a model we will need to see more of if Europe is really to tackle the threat.

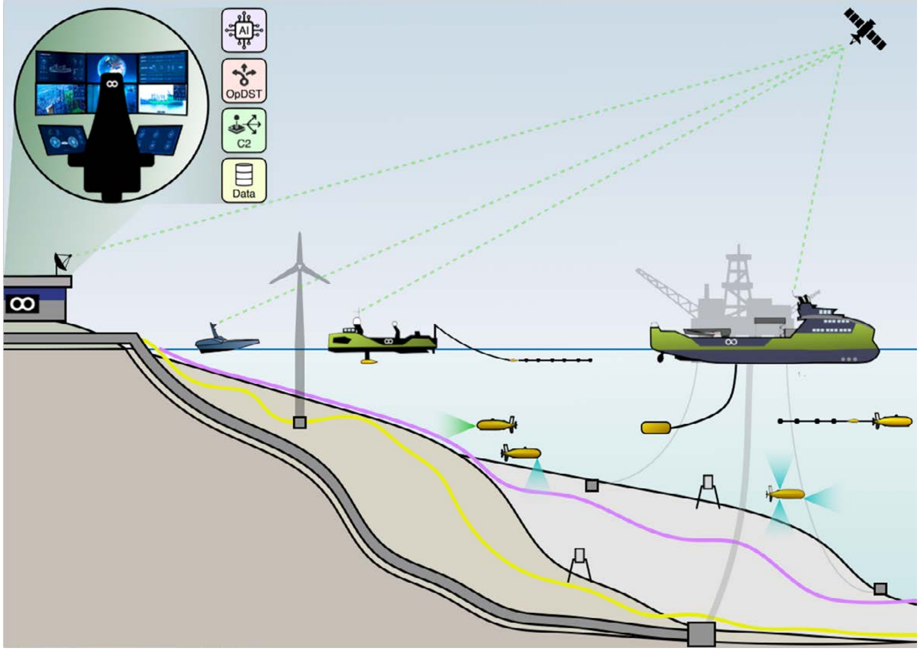
Countering threats to energy infrastructure and sea lanes – technology

The good news is that there exists today an array of advanced, affordable and proven dual-use technologies and platforms – many deployed sporadically by the oil and gas sector, and others now being adopted more systematically by defence and Navies worldwide – that can be readily deployed to secure energy sea lanes and undersea energy infrastructure.

The development of remote controlled and autonomous maritime platforms has surged in the last 20 years, initially driven by commercial or defence-adjacent start-ups working in data analytics, AI, automation and robotics and then accelerating rapidly after the 2022 Russian invasion of Ukraine. This has produced a boom in innovation in technologies that are suitable to protect CUI and ensure national resilience.

Business is responding to the challenge posed to energy security. The UK headquartered maritime robotics company Ocean Infinity is one leading example. Founded a decade ago to use software, robotics and AI to transform operations at sea, Ocean Infinity has designed, built and operates the world's largest fleet of lean-crewed and unmanned surface vessels (USVs) and autonomous underwater vessels (AUVs). Initially, we put these advanced platforms – hardware, software and operators – at the disposal of the commercial sector, primarily serving energy (oil, gas, renewables) and telecommunications industries. But today significant demand is coming from defence and national security audiences who want to integrate these technologies to create, as the UK Royal Navy describes it, an advanced hybrid naval force.

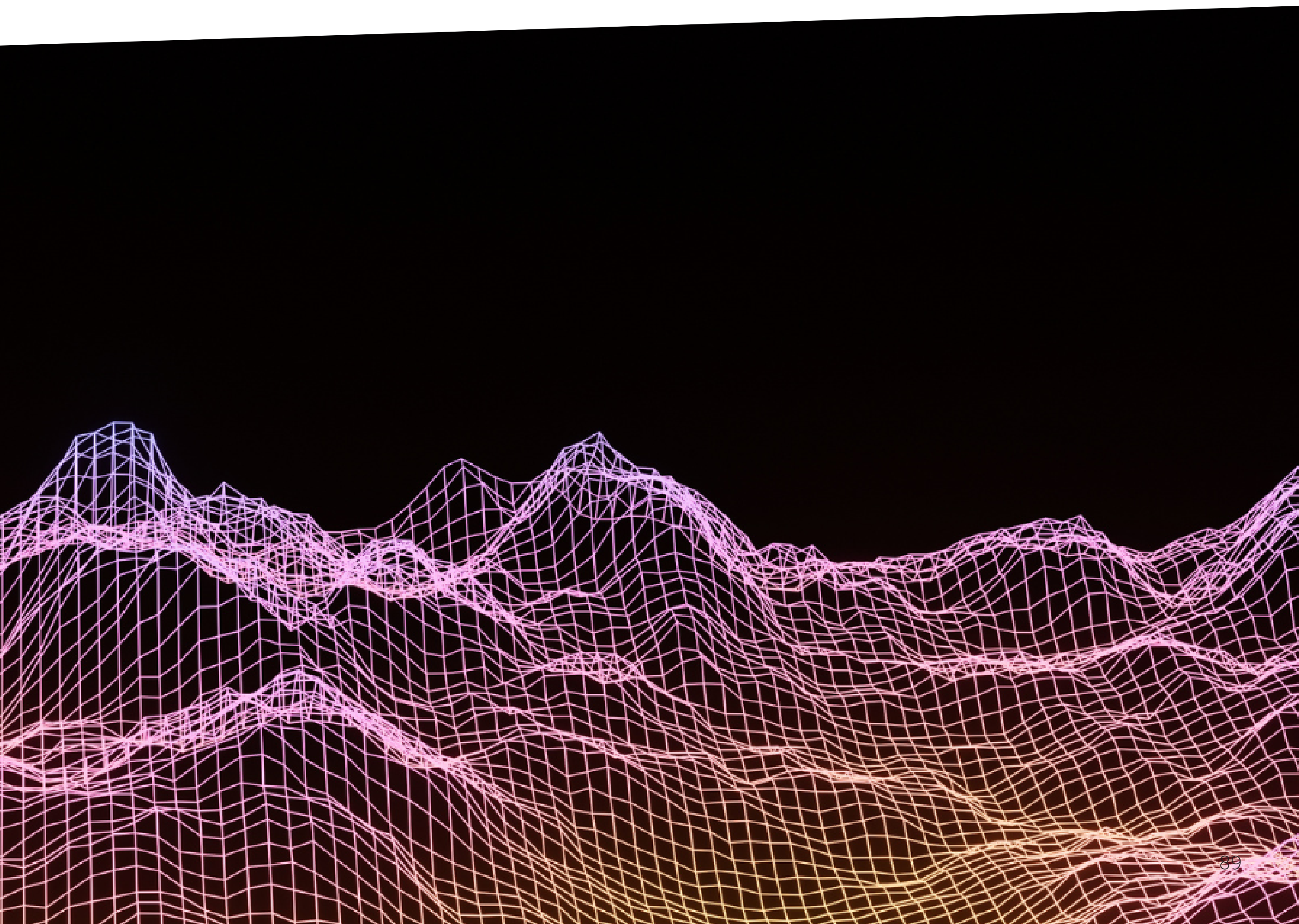
Ocean Infinity concept of layered defence for energy infrastructure deploying autonomous platforms



Source: Ocean Infinity © Ocean Infinity 2026

Securing energy: Harnessing technology-driven security for 'layered' defence

The Iranian playbook in Hormuz, the increasingly aggressive grey zone activities by Russia and the autonomous subsea arsenals being developed by China all call for a paradigm shift in how governments and asset owners think about subsea energy infrastructure security and securing energy supply lanes. We must move from basic compliance to much more active, collaborative and technology-driven security. We must move from reactive monitoring to proactive surveillance. And we must stop thinking about security as an afterthought and start thinking about security as a design principle. All of this is within our reach but only if we accept the need to build more innovative strategic partnerships – defence with industry; the energy sector with the national security sector and government – in order to pool assets, expertise and data. Only then can we achieve truly persistent, 'layered' defence that tells our opponents 24/7 365-days a year, "we see you."



What can courage do for our energy future?

Why Europe's ability to act depends on the courage to make decisions.

The energy landscape has fundamentally changed. Climate change, energy insecurity, rising costs, geopolitical tensions and a rapidly shifting business environment are piling up on one another. The result is a new reality: an energy landscape that is faster, more complex and more political than ever before. Energy is no longer just a technical enabler. It has become a strategic prerequisite for economic strength, social stability and geopolitical influence.

By Christian Bruch

__Christian Bruch__, CEO, Siemens Energy AG and Chair of the ONS Strategic Conference Committee 2026

When the gas stopped flowing – the moment of truth

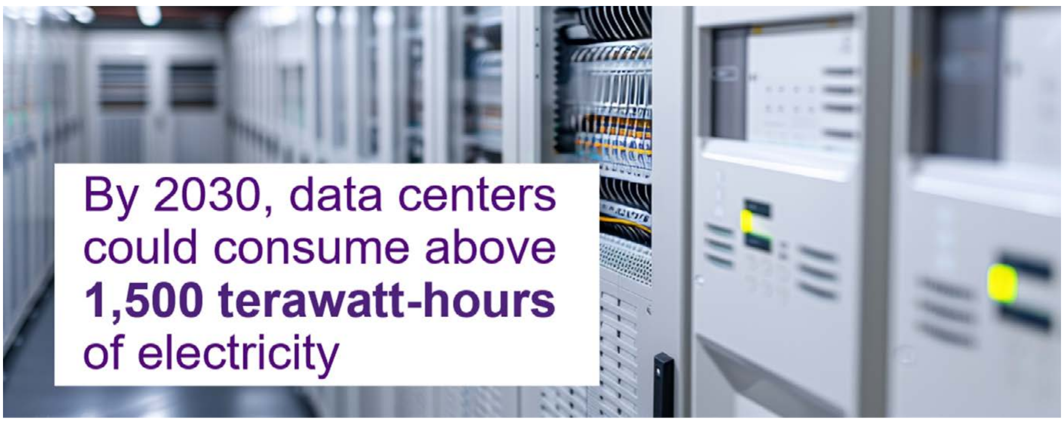
For decades, energy policy has been guided by the "energy triangle" of affordability, reliability and sustainability. Today, that framework is no longer sufficient. In a world of geopolitical tension, accelerating energy demand and real-time digital economies, resilience has emerged as the fourth, indispensable dimension.

When it comes to energy resilience, 2022 marked a decisive turning point, particularly for Europe. Russia's war of aggression against Ukraine shattered a belief that had shaped our energy system for decades: that energy would always be available, reliable and affordable. When Russia cut gas supplies, a commercial relationship turned into a geopolitical instrument of power. Energy became a weapon – with immediate consequences for households, industry and critical infrastructure. The Iran war and the closure of the Strait of Hormuz instantly exposed the interdependence of global energy flows. The world's thirst for energy is a powerful weapon – and it will be used when possible.

These situations unveiled an uncomfortable truth: when these situations occur there is no quick fix, it costs more money and the fewer options we have, the more painful these situations are. Resilience does not emerge from good intentions. It is the result of courageous decisions, early investment and functioning infrastructure – long before a crisis hits.

A resilient energy system is becoming a prerequisite for economic stability. But expanding the traditional trilemma – affordability, reliability and sustainability – to include resilience is still not enough. In an economy that operates in real time – from data centers to AI applications – it is no longer sufficient for electricity to be merely affordable, reliable, sustainable and resilient. What matters is how quickly new capacity can be delivered to the market.

In the fight for AI supremacy access to increasing amounts of electricity becomes critical – speed matters. AI develops faster than any other technology and it is confronted with an energy system which was used to changing slowly. It requires massive computing power – and computing power requires electricity:



continuously, reliably and at scale. The scale is unprecedented. By 2030, data centers worldwide could consume above 1,500 terawatt-hours of electricity – roughly the combined consumption of Germany and Japan today. In deploying additional electricity capacity to power data centers speed became the fifth dimension.

This surge is colliding with an already tightening energy system. Global electricity demand grew by around 3 percent in 2025, outpacing the historical average. Investment in power generation and grids reached a record €1.3 trillion in a single year and demand is expected to continue growing by more than 3 percent annually through 2035.

In this context, energy diversity becomes a strategic imperative. As the global AI race – led by the United States and China – intensifies, the ability to deliver new electricity capacity quickly will increasingly determine economic and technological leadership. However, this race is far from level: significant differences are emerging globally in how countries can meet the energy demands of AI.

Electrification therefore becomes a geo-economic question. In the digital age, the ability to act depends on power systems that deliver across all five dimensions: affordability, availability, sustainability, resilience and speed.

The five dimensions must be balanced

These five dimensions must be balanced depending on the underlying structure of the energy system. Strengthening one dimension often comes at the expense of another. It therefore takes the courage to make clear choices and to prioritize what matters most.

This is where energy diversity becomes critical. A broadly diversified energy system reduces strategic dependencies. Electricity generated from renewables such as wind and solar is produced domestically, lowering reliance on energy imports. Flexible gas-fired power plants – and, where politically desired, nuclear energy – provide firm capacity when the wind does not blow and the sun does not shine. Robust transmission grids ensure that electricity reaches consumers reliably. Energy storage and batteries help to balance supply and demand. Together, these elements form the backbone of a secure, resilient and well-balanced energy system.

Yet this balance does not emerge on its own. It must be actively shaped. Five priorities are decisive if electricity is to deliver across all five dimensions:

- Expand renewable energy at scale
- Provide firm capacity through flexible gas-fired power plants – and, where desired, nuclear energy
- Strengthen grids as critical infrastructure and integrate them across Europe
- Protect critical infrastructure and ensure rapid recoverability
- Electrify, decarbonize and maintain industrial competitiveness

What matters is not technology for its own sake, but system performance: reliable, scalable, maintainable and rapidly recoverable.

Power systems under pressure – vulnerability in a connected world

As electricity becomes central to industrial and digital value creation, dependence grows – and so does vulnerability. Ukraine demonstrates what it means when energy infrastructure is deliberately targeted. Power plants, grids, substations and district heating systems have been systematically attacked. Around two thirds of generation capacity has been affected. Energy infrastructure has become a primary target for undermining economic and societal resilience.

The war in the Middle East exposes an additional dimension of vulnerability. Attacks, escalation and uncertainty around key production sites, export terminals and maritime chokepoints are enough to destabilize global markets within days. Prices rise, insurance and transport costs increase, leading to investment decisions being delayed or abandoned. The effects are felt immediately – across industry and among consumers.

Dependence on China reveals yet another vulnerability. What would happen to our electrification value chains if the next critical chokepoint were Shanghai, Shenzhen, or Guangzhou?

There is also a structural deficit within power systems themselves. Many grids were built for a different era – one of centralized generation and predictable load profiles. Today, they must integrate volatile renewables, connect new large consumers and absorb disruptions in real time. In Europe, more than half of grid infrastructure is outdated.

At the same time, the threat landscape has expanded. Cyberattacks, sabotage and hybrid risks make clear that resilience is no longer a purely technical issue. It has become a core security challenge.

The war in the Middle East shows how quickly attacks, escalation and uncertainty around critical production sites, export terminals and maritime chokepoints can destabilize global markets.

Energy security today means more than access to energy. It means the ability to adapt quickly to unforeseen disruptions – and to operate systems reliably under stress, absorb shocks and recover rapidly. In short, it is about preserving the ability to act.

Rethinking the energy transition through a security lens

Viewed through the lens of security, the energy transition is not just a climate project – it is a strategic necessity.

Europe has one of the most interconnected and electrified energy systems in the world – yet it remains heavily dependent on fossil imports. This combination creates structural vulnerability.

The war in Ukraine and the conflict in the Middle East underscore how deeply energy markets are entangled with geopolitics. In both cases, oil and gas supplies are disrupted or constrained – driving up prices and reinforcing dangerous dependencies. If Europe is to remain capable of acting, it must reduce this exposure. Expanding renewable energy is therefore not just about climate – it is a security necessity. A security driven view of the energy transition goes further. It requires no longer assessing energy systems solely through the lens of economic efficiency, but also in terms of vulnerability. The central question is: which vulnerabilities are we willing to accept as a society – and which are we not? And how much are we willing to pre-invest into optionality to be prepared for crisis?

Expanding renewable energy is not just about climate – it is a security imperative.

If energy supply is the backbone of modern economies, its infrastructure becomes one of the first targets in conflict. Resilience therefore cannot be a "nice to have." It must be embedded from the start – in generation, grids, supply chains, strategic reserves, control systems and cybersecurity.

This paradigm shift has consequences. A stronger focus on security requires a new balance between efficiency and risk preparedness. Limiting risk costs money. Resilient systems are more complex, include reserves and are therefore more expensive than structures optimized solely for efficiency. System costs will rise. That is the price of strategic security.

The real political question is not whether resilience costs money – but how these additional costs are distributed. How can they be shared without undermining Europe's competitiveness, overburdening low-income households or eroding social cohesion? How do we ensure that electrification remains affordable for industry and citizens alike?

A security driven energy transition demands exactly this trade-off: between efficiency and resilience, short-term cost and long-term stability. It makes clear that energy security is not a pure market product, but a strategic good in the public interest.

Courage decides

We live in a world of permanent volatility. In such a world, energy security determines prosperity, competitiveness and social stability.

The honest assessment is sobering: Europe is once again late. Too many strategic decisions were postponed for too long. Dependencies were accepted, risks underestimated, preparedness deferred.

What is now required is the courage to make clear strategic choices – guided by a long-term perspective. These choices will inevitably reshape Europe's industrial landscape.

Stability was enforced in crisis – but at a high political, economic and social price. Anyone who believes this delay can be corrected without consequences is mistaken.

And yet, energy security can be shaped. It requires technological expertise, industrial strength, political clarity – and the willingness to act now: early, decisively and in a coordinated manner across politics, business and society.

Europe has shown that it can act when it must. The decisive question is whether we will also act before the next shock forces us to. Because courage will decide our energy future – and with it, Europe's ability to act in the 21st century.

Let us be courageous.

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FOOTNOTES

Chapter 5: Where we are with the energy transition

- EA: US–Iran conflict: the billion-barrel hole (May 2026); Buybacks and the billion-barrel hole (Weekly Digest, May 2026); Mayday (Weekly Digest, April 2026); Mine the gap (Europe Gas Panorama, April 2026); One chokepoint, two gatekeepers (LNG Outlook, April 2026); Methanol Market Weekly (May 2026); Methanol-Olefins Market Review (May 2026); Long-term Energy Outlook to 2050 (April 2025); New industrial cluster, data centres, electrification drive South Korean power load growth (November 2025); ERCOT sparks rebound above our expectation on ISO's preliminary load forecast (April 2026). External (see Word comments for direct attribution): Bruegel; IMF; Ember; Electrek; CNN; Open Magazine; consilium.europa.eu.

Chapter 11: The weaponisation of energy infrastructure and sea lanes – and countering it

[1] Although Iran and Oman have territorial sovereignty over the waters (at its narrowest, the Strait's shipping lanes are entirely within their 12-nautical-mile territorial waters), under the United Nations Convention on the Law of the Sea (UNCLOS), the Strait is classified as an international strait, as such giving all vessels the right of "transit passage" through these water.

[2] Between 1-11 March, the International Maritime Organisation reported 15 incidents of damage to commercial vessels from attacks in the Strait of Hormuz, Persian Gulf and Gulf of Oman. https://www.imo.org/en/mediacentre/hottopics/pages/middle-east-highlighted-incidents.aspx

[3] https://www.middleeastmonitor.com/20260325-iran-more-resilient-in-war-with-us-than-anyone-expected-ex-british-spy-chief/

[4] 80% of crude transported through the Hormuz Straits is destined for Asia, specifically China, India, Japan and South Korea. By late March 2026, only Chinese vessels had been given safe passage through the Strait by the Iranian government.

[5] Younger was speaking to the Economist on 25 March 2026. https://www.middleeastmonitor.com/20260325-iran-more-resilient-in-war-with-us-than-anyone-expected-ex-british-spy-chief/

[6] https://www.eia.gov/international/analysis/special-topics/World_Oil_Transit_Chokepoints

[7] International Centre for the Study of Eurasia, Analytical Brief March 2025, "The Danish Straits Conflict and the Coming War."

[8] Centre for Strategic and International Studies https://features.csis.org/chinapower/china-taiwan-strait-trade/

[9] ibid

[10] The Barents Sea is a marginal, shallow shelf sea of the Arctic Ocean located north of Norway and Russia. It acts as a critical gateway between the Atlantic and Arctic oceans.

[11] Map: "The North Atlantic: selected strategic elements" from IISS Report (April 2022), "Gauging the Gap: The Greenland-Iceland-United Kingdom Gap – A Strategic Assessment" by Nick Childs. https://www.iiss.org/research-paper/2022/05/gauging-the-gap-the-greenland-iceland-united-kingdom-gap-a-strategic-assessment/

[12] Article by Richard Shirreff in the Financial Teams, 18 February 2026: "Europe should treat energy security as defence policy." https://www.ft.com/content/f9d1402f-0ce0-4c68-8a4d-46c85ba0fed7

[13] A good example is Norway's launch of the Johan Castberg oil field in August 2025. The field, Norway's second largest, is the northernmost oil field on Norway's Continental Shelf, located in the Barents Sea approximately 240 km northwest of Hammerfest. It is operated by Norway's national oil company, Equinor. https://www.equinor.com/news/20250808-johan-castberg-officially-opened

[14] https://windeurope.org/data/products/european-offshore-wind-farms-map-public/

[15] Ben Lefebvre, Politico Forecast, 24 March 2026: "Iran war rattles world's biggest energy conference." https://www.politico.eu/newsletter/forecast/iran-war-rattles-worlds-biggest-energy-conference/

[16] EU Action Plan on Cable Security, European Commission, February 2025. https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52025JC0009#:~:text=While%20the%20protection%20of%20critical,pipelines%20or%20offshore%20wind%20fields.&text=This%20work%20builds%20on%20several,Directive%20%E2%80%93%20CER%20Directive%204%20).

[17] The managing authority is the Ministry for Infrastructure and Water Management (MIWM), working in coordination/partnership with the Ministry of Defence, the Ministry of Economic Affairs, Ministry of Climate Policy, Ministry of Justice and the Ministry of Foreign Affairs. In addition, PBNI also works with domestic energy and telecommunications companies, and coordinates with regional countries.

[18] As part of its cooperation, Ireland will allow French and British vessels to patrol Irish-controlled waters: https://www.irishtimes.com/ireland/2026/02/24/ireland-to-deepen-co-operation-with-france-and-britain-to-protect-seas/

[19] Norway is now Europe's largest pipeline gas supplier. All the gas and 90-95% of the oil that Equinor produces goes to Europe, according to its CEO Anders Opedal: https://www.politico.eu/article/norway-pitches-itself-as-europes-energy-lifeline/

[20] Norway designated pipeline transport of national gas and production on the Norwegian Continental Shelf (NCS) as "fundamental national functions".

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