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The role of LNG

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1. Why do we care so much?

When my daughters were young, many years ago, they asked whether my work on LNG meant I did "gas station law". Understandably, this was their attempt to comprehend what it was that drew so much of their father's time and focus. (They also labelled it "pathetic" when I proudly showed them that my first social media post of an LNG speech had garnered two "likes".)

The underlying question is a fair one for anyone who has picked up this treatise: why do we care so much about LNG? On the one hand, we could say it is simply another energy source, another fossil fuel, with all the benefits and baggage that brings. But LNG occupies a vital and unique role in the energy supply of our planet – at least, it has for the past 50 years and it will for at least the next 25 to 50 years. Beyond that, your crystal ball is as good as mine.

To understand the unique role that LNG plays – and its positive and negative characteristics affecting economies, national development, geopolitics, climate change, finance and social justice – we need to consider LNG's two key elements: the 'NG', or natural gas; and the 'L' – the process of liquefying that gas into a globally transportable form.

2. The role of natural gas

2.1 Lifting a world out of energy poverty

Our discussion starts with an analysis of how much energy we will need and where it will come from. The good news is that energy intensity – that is, the amount of energy needed to produce a given unit of economic output – has been steadily falling in most Organisation for Economic Co-operation and Development (OECD) countries, largely as a result of enhanced efficiency and shifts from manufacturing to service economies. In these developed countries, improvements in energy intensity tend to outweigh the increased amount of energy needed as a result of a growing economy. The result can be a net carbon dioxide (CO_2) reduction while achieving economic growth.

However, these net efficiencies are offset from a climate perspective by other countries that understandably need more energy to realise the hopes and expectations of their populations, which in some cases aspire to a middle-class life and in others seek simply to achieve basic living standards. As the US Energy Information Administration (EIA) concluded in its most recent *International Energy Outlook 2023*:

> *Our projections highlight a key global insight – global energy-related CO_2 emissions will increase through 2050 in all IEO2023 cases except our Low Economic Growth case. Our projections indicate that resources, demand, and technology costs will drive the shift from fossil to non-fossil energy sources, but current policies are not enough to decrease global energy-sector emissions. This outcome is largely due to population growth, regional economic shifts toward more manufacturing, and increased energy consumption as living standards improve. Globally, we project increases in energy consumption to outpace efficiency improvements.*
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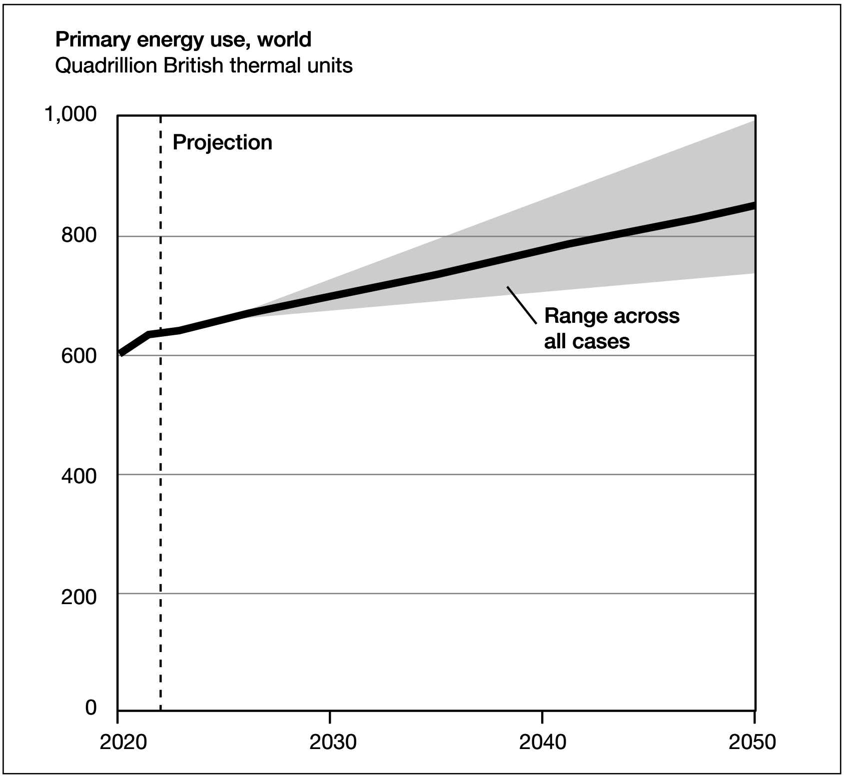
> *IEO2023 assumes that, as incomes and population rise over time, energy consumption increases as more people can afford to drive, use commercial services, demand goods, and control building temperatures…*

Figure 1: Primary energy use, worldwide



Source: US Energy Information Administration, International Energy Outlook 2023.

The amount of energy that the world is anticipated to require will increase through 2050 in each of the cases explored in the EIA's *International Energy Outlook 2023*. And the EIA is not alone in forecasting an energy-hungry world. The International Energy Agency (IEA) includes in its Stated Policies Scenario a 0.7% annual growth in global energy demand to 2050.[1] Others estimate between 1.5% and 2.5% annual growth in global energy demand during this period.[2]

These annual growth figures may sound small; but thanks to the miracle of compounding, they mean that we need to increase our production of energy by 50%–75% over 25 years, assuming that we maintain all current energy production resources with no retirements or depletions (an unrealistic assumption, of course). By some estimates, even this will leave some 4 billion people in the emerging world living on 60%–80% less energy per capita than most of those in today's OECD.[3]

Even the most hopeful forecasts for the expansion of wind and solar power, plus a nuclear 'renaissance', leave a substantial hole for sustainable, non-intermittent energy. There is a direct trade-off between the cost, measured in levelised cost of electricity (per kilowatt-hour (kWh)), and the CO_2 intensity (kilograms per kWh) of natural gas, coal, nuclear diesel, solar and wind. Today, countries continue to build coal plants whose carbon emissions outstrip gains made from renewables in OECD countries. And even in those developed countries, artificial intelligence (AI), data centres, electrification and crypto-mining will dramatically drive up electricity demand in the immediate future. Utilities and companies must invest and build for this heightened demand now or risk consumer shortages in the next few years. How we fill the energy gap while simultaneous reducing global carbon emissions and not producing a populous energy cost backlash will be the ongoing challenge of the next couple of decades.

2.2 Jump-starting progress at scale towards climate goals

Events seem to be accelerating; and esteemed philosopher and baseball star Yogi Berra was probably right when he said, "The future ain't what it used to be." Making trillion-dollar[4] policy and investment decisions based on predictions of future technological inventions and improvements can be perilous. But we can still learn some things from history.

1 IAE, "Overview and key findings", *World Energy Outlook 2023*, https://origin.iea.org/reports/world-energy-outlook-2023/overview-and-key-findings.

2 See, for example, Thunder Said Energy, "Global energy market model for the energy transition?", https://thundersaidenergy.com/downloads/the-2050-energy-mix-a-simple-model/.

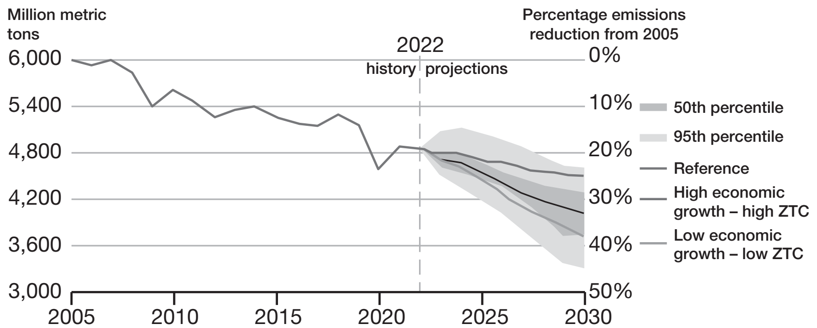
3 *Ibid.*

4 Energy Transition Commission, "Financing the Transition: How to Make the Money Flow for a Net-Zero Economy" (March 2023), www.energy-transitions.org/wp-content/uploads/2023/03/ETC-Financing-the-Transition_MainReport-.pdf.

From 2005 to 2022, the United States reduced its total energy-related CO_2 emissions by 20%. On a CO_2 per unit of gross domestic product (GDP) over the same period, the United States reduced its carbon emissions by almost 50%. The installation of new renewable wind and solar facilities played an important role, but the EIA is clear about what created the greatest reduction in CO_2 in the nation's history:

> *Of the 819 million metric ton decline in CO_2 emissions from 2005 to 2019, approximately 248 million metric tons (30%) of that decline is attributable to the increase in renewable generation. In comparison, almost 532 million metric tons (65%) of the decline in CO_2 emissions is attributable to the shift from coal-fired to natural gas-fired electricity generation.*[5]

Figure 2: Total energy-related CO_2 emissions



Note: Cone of uncertainty associated with total energy-related CO_2 emissions using empirical projection intervals. Historical values and AEO2023. Reference case is displayed as a solid black line. The projection error density forecast by shaded areas. The different shades correspond to the 50th and 95th percentiles. AEO2023 envelope side cases are in solid grey lines. ZTC = zero carbon technology cost.

Source: US Energy Information Administration, Annual Energy Outlook 2023 (March 2023).[6]

2.3 The coming AI power demand revolution

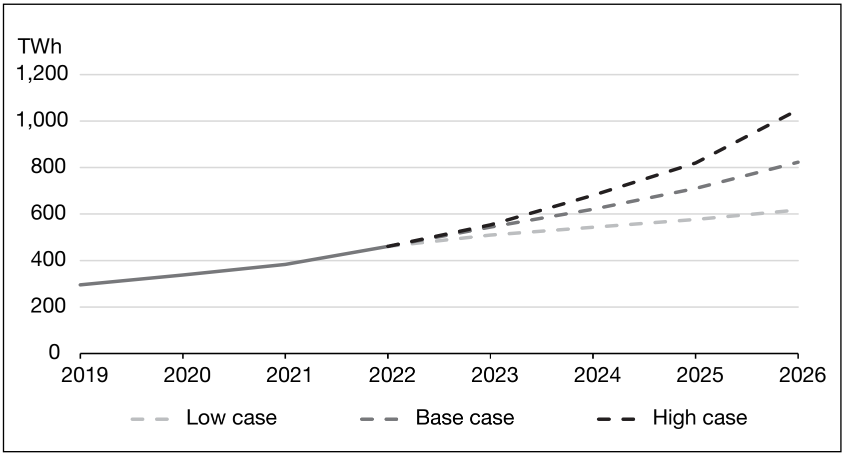
According to the IEA, the AI industry is forecast to expand "exponentially" and consume at least 10 times its 2023 demand by 2026. The IEA has further warned that electricity consumed by data centres globally will more than double by 2026 to over 1,000 terawatt hours – an amount roughly equivalent to what Japan consumes annually. And some have expressed even greater concern. The chief executive officer at one leading firm developing AI technology recently warned that by 2030, the "insatiable" energy demand of AI data centres will

5 US EIA, "Electric power sector CO_2 emissions drop as generation mix shifts from coal to natural gas", *Today in Energy* (9 June 2021), www.eia.gov/todayinenergy/detail.php?id=48296.

6 US EIA, "Narrative: Administrator's Foreword", *Annual Energy Outlook 2023*, 16 March 2023, www.eia.gov/outlooks/aeo/narrative/index.php.

likely consume as much as 20%–25% of all electricity in the United States – up from about 4% now – unless major changes are made.[7]

Figure 3: Global electricity demand from data centres, AI and cryptocurrencies, 2019–2026



Source: IEA, Electricity 2024, analysis and forecast to 2026.

In some locations which have made significant investments in high-technology infrastructure, the impact on electricity demand will be tremendous and is already being seen. In April 2024, for example, the Electric Reliability Council of Texas (ERCOT) tripled its predicted demand growth for 2030 compared to 2023's estimate, increasing the forecast by 40,000 gigawatts (GW). ERCOT explained that this "unprecedented and rapid" load growth was due to demand from new "crypto mining, hydrogen and hydrogen-related manufacturing, data centers, and electrification" of oil and gas equipment.[8]

In Virginia – adjacent to Washington, DC and home to new data centres and AI-related infrastructure – the major electric utility forecasts that its total electricity demand will double in the next 15 years, due to data centres driving stratospheric energy demand. The utility predicts that by 2035, data centres in Virginia will require quadruple the power they needed in 2022.[9]

Former US Secretary of Energy Ernest Moniz outlined the dilemma facing

7 Peter Landers, "Artificial Intelligence's 'Insatiable' Energy Needs Not Sustainable, Arm CEO Says", *Wall Street Journal* (9 April 2024), www.wsj.com/tech/ai/artificial-intelligences-insatiable-energy-needs-not-sustainable-arm-ceo-says-a11218c9.

8 ERCOT, Item 5: CEO Board Update (Public), 23 April 2024, www.ercot.com/files/docs/2024/04/22/5%20CEO%20Update.pdf.

9 Antonio Olivo, "Internet Data Centers Are Fueling Drive to Old Power Source: Coal", Washington Post, 17 April 2024, www.washingtonpost.com/business/interactive/2024/data-centers-internet-power-source-coal/#.

policy makers and utilities as they look for fuel sources to supply this expected imminent demand surge:

> *Former US Energy Secretary Ernest Moniz said the size of new and proposed data centers to power AI has some utilities stumped as to how they are going to bring enough generation capacity online at a time when wind and solar farms are becoming more challenging to build. He said utilities will have to lean more heavily on natural gas, coal and nuclear plants, and perhaps support the construction of new gas plants to help meet spikes in demand. "We're not going to build 100 gigawatts of new renewables in a few years. You're kind of stuck", he said.*[10]

This is an extract from the chapter 'The role of LNG' by Steven R Miles in *Liquefied Natural Gas: The Law and Business of LNG, Fourth Edition*, published by Globe Law and Business.

https://www.globelawandbusiness.com/books/liquefied-natural-gas

10 Katherine Blunt, "Big Tech's Latest Obsession Is Finding Enough Energy", *Wall Street Journal* (24 March 2024), www.wsj.com/business/energy-oil/big-techs-latest-obsession-is-finding-enough-energy-f00055b2.