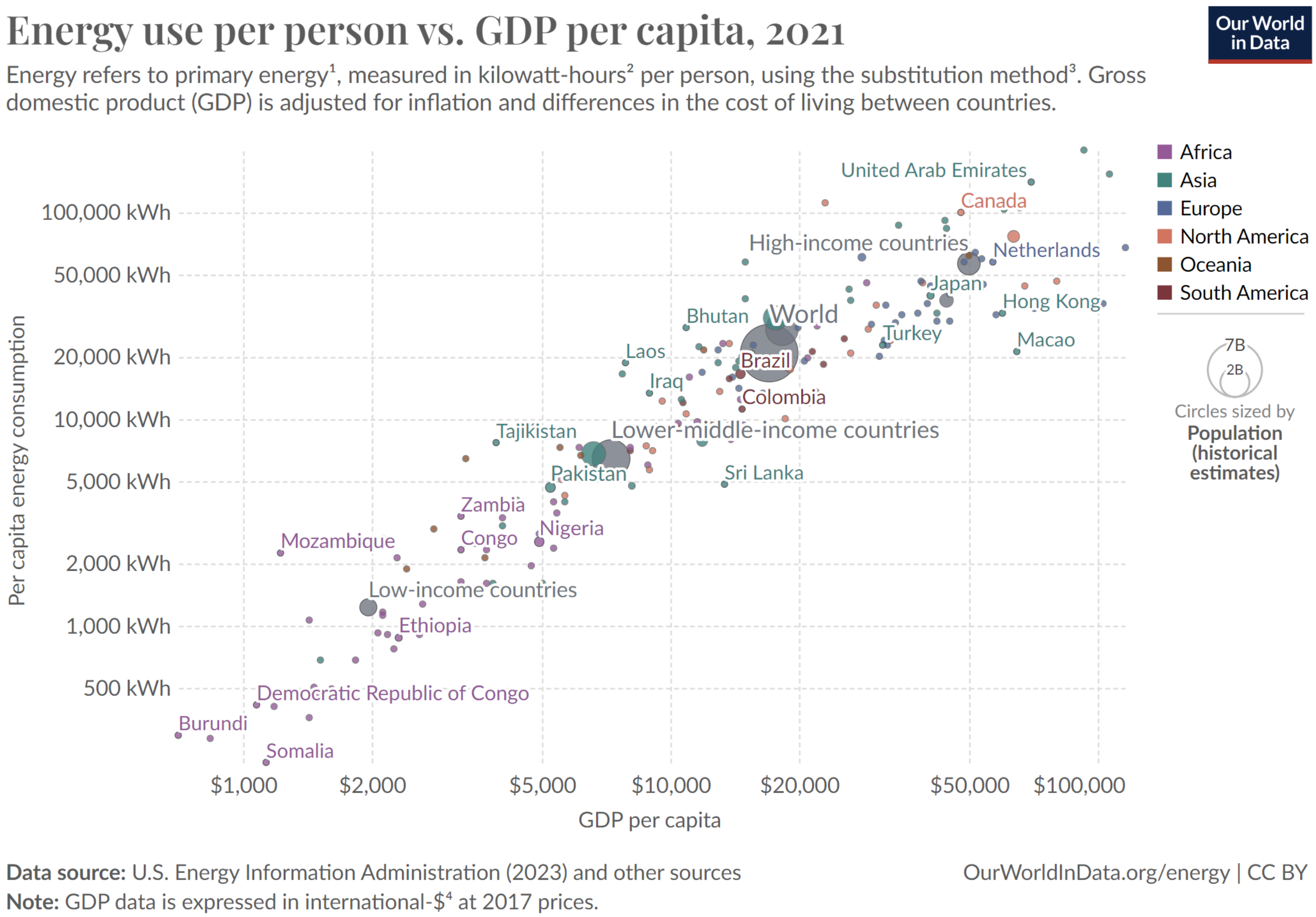
AI and Energy Sobriety

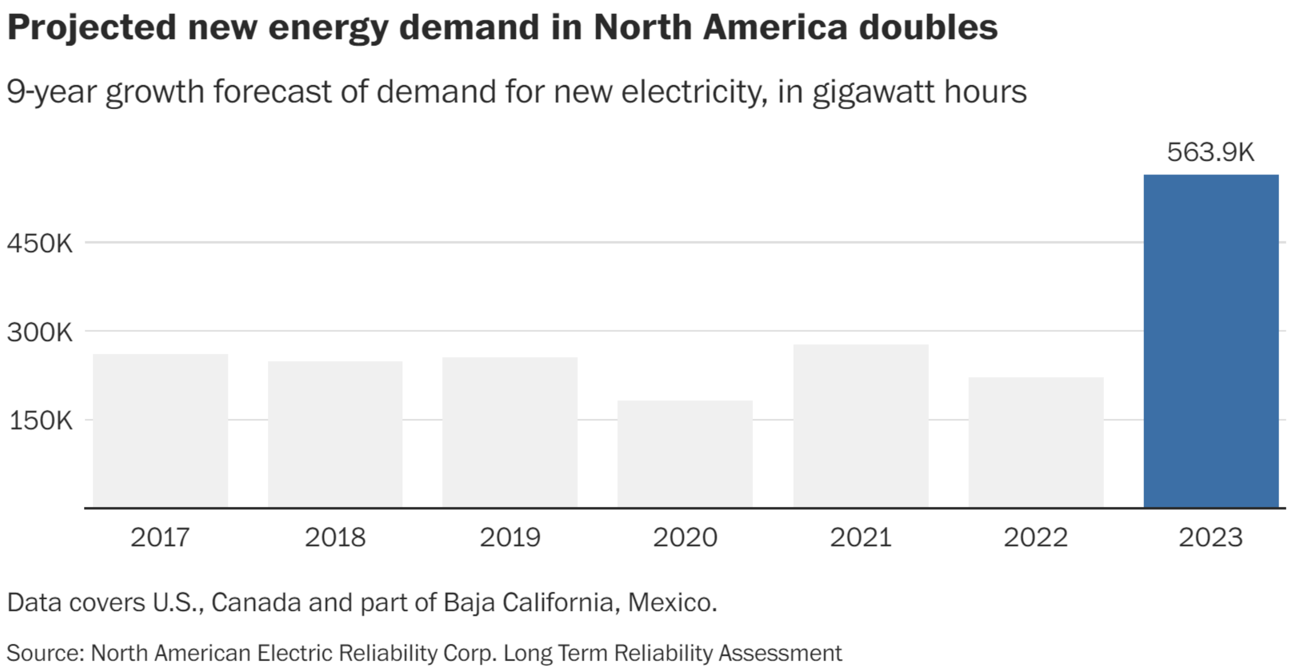
Energy is the lifeblood of economic activity. While developed economies are making strides in energy efficiency (for instance, between 1997 to 2019, the amount of energy the U.S. consumed per each unit of GDP declined by 36%),[1] a nation's quality of life and economic output is still highly dependent on energy consumption.[2]



Over the past several years, many analysts adopted the view that the world was close to peak energy consumption and that we were on track to hit Net-Zero emissions targets by mid-century. Regardless of one's aspirations, investors fare better when dealing in the realm of reality. And what is that reality? That although the percentage of non-carbon energy sources may increase, total energy demand will continue rising (as will total fossil fuel consumption) driven by living standard improvements in developing nations and – pertinent to a key subject in our recent correspondence – the insatiable power-appetite of artificial intelligence ("AI") and cloud computing.

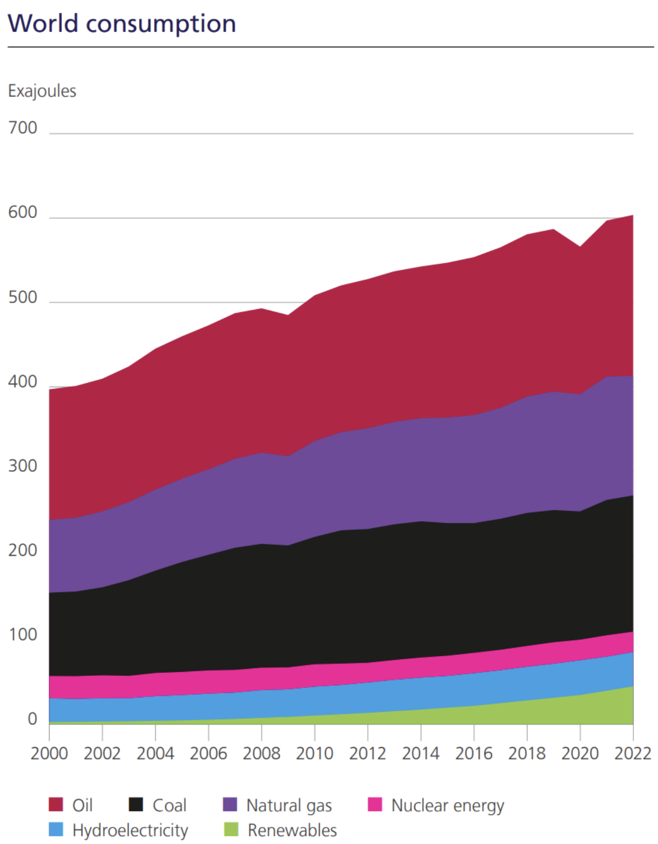
Per Paul Churnock, Principal Electrical Engineer of Datacenter Technical Governance and Strategy at Microsoft, Nvidia's much-touted H100 GPU chip: "has a peak power consumption of ~700W. At a 61% annual utilization, it is equivalent to the power consumption of the average American household occupant (based on 2.51 people/household). Nvidia's estimated sales of H100 GPUs is 1.5-2mil H100 GPUs in 2024. Comparing to residential power consumption by city, Nvidia's H100 chips would rank as the 5th largest, just behind Houston, Texas and ahead of Phoenix, Arizona."[3] According to Dell – as divulged on its recent earnings call – Nvidia's next generation GPU, the B100, will have a 1000W draw, which is a 40% increase over the H100.[4] All that, and we're just in the infancy of AI.

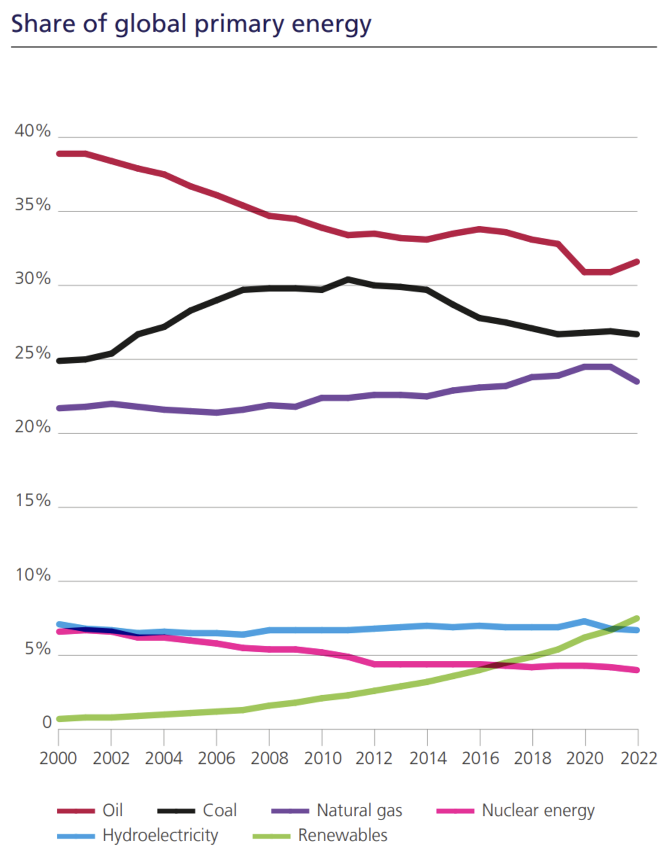
To be sure, Nvidia and other semiconductor firms are working on more power efficient products, but power consumption tied to the increased demand for advanced chips is likely to exceed any efficiency gains in the near term. The increased demand for computing is already showing up in electricity data (see below chart).[5] U.S. power demand – only a short time ago thought to be stagnant – is now projected to increase 4.7% over the next five years, with data centers consuming as much as 7.5% of all U.S. electricity by the end of the decade.[6] The electrification of vehicles and industrial processes would add to these figures.



The anticipated U.S. growth in power demand is consistent with broader global trends. Per scientist Vaclav Smil, Professor Emeritus at the University of Manitoba (and author of the 2022 acclaimed book How the World Really Works), "global energy demand (reduced by higher conversion efficiencies) is set to grow by at least 10-15% by 2050," with electricity growth increasing at 3.3% annually over the same period.[7] Nuclear, renewables and batteries are all likely to play a role in meeting increased power demand, but Professor Smil highlights the enormity of their required growth to create a "clean" power grid: "even if hydro and nuclear were to cover 20% of that total [of 72 PWh of power demand in 2050], wind and solar would have to reach about 58 PWh in 2050, about 17 times their 2022 output and almost exactly twice the 2022 electricity generation from all sources (and their inherent intermittency would require further substantial investments in mass-scale storage and [high voltage] transmission to ensure interrupted supply)."[8] Bringing all this clean power online would require developed countries to invest an equivalent of 20-25% global GDP annually until 2050, compared to a 0.3% GDP cost for the Manhattan project[9] – such an amount seems like a non-starter.

Professor Smil notes that at the hallway point between the 1997 Kyoto Protocols agreement on reducing emissions and the Paris Agreement 2050 Net-Zero goals that the "[n]umbers are clear. All we had managed to do halfway through the intended grand global energy transition is a small relative decline of fossil fuel's share in the world's primary energy consumption, from nearly 86% in 1997 to about 82% in 2022. But this marginal relative retreat has been accompanied by a massive absolute increase of fossil fuel combustion: in 2022 the world consumed nearly 55% more energy locked in fossil carbon than it did in the year 1997."[10]





The reality is that energy transitions take time: "Coal surpassed global wood combustion only in 1900, and its share of energy supply peaked only in the mid-1960s; oil began to supply more than 25% of all fossil fuels only during the late 1950s, nearly a century after its first modern commercial extraction, and natural gas began to contribute more than 25% of fossil energy supply just before the end of the 20th century, after some 130 years of the industry's development."[11] And while we have focused on power demand, note that our analysis ignores the massive investment required to decarbonize industrial processes like mining, metallurgy, air travel, shipping and agriculture (all of which are arguably not technically feasible yet).

The point is that the conventional energy sources have a long demand runway aided in part by the increasing power required to run AI models and data centers – an unexpected development just a few years ago. The energy mix of the future will undoubtedly include more wind, solar, batteries, nuclear and perhaps hydrogen and geothermal. However, it will likely include a similar amount of oil and gas that we consume today.

This has profound investment implications for all energy assets – from renewables to nuclear to oil and gas. What the global economy will require to keep running and to lift living standards in developing nations is an all-of-

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the-above strategy, where the resources that have the most reliable, affordable, safe and clean attributes – depending on the location and end-uses they serve – are part of the energy solution. As we scan the investment landscape right now, the AI story is much appreciated and reflected in the valuations of tech firms. What is less appreciated is the energy component. General demand trends are a sufficient tailwind to make energy assets attractive investment. Adding the AI angle to the investment thesis has the potential to accelerate returns and materially alter valuations for an asset class that many investors consider to be in terminal decline.

In the appendix, we have included a mix of firms with exposure to the emerging energy renaissance – from conventional to renewables – as well as some mining and industrial firms producing the raw materials or providing the key services necessary to build out a larger and more robust grid. Please let us know if you would like to discuss how any of these stocks may fit in your portfolio. We think it is a compelling opportunity that combines an attractive story with attractive valuations.

We hope you and your families are well. As always, please reach out with any questions.

Sincerely,

Peter Karmin	Stuart Loren
Managing Member	Director

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March 19, 2024

Energy, Mining and Related Industrial Firms

(USD in Millions)

Company Name	Market Cap	Net Debt To EBITDA	Dividend Yield (%)	Profit Margin 2024 E	Profit Margin 2025 E	FCF Margin 2024 E	FCF Margin 2025 E	PE Ratio 2024 E	PE Ratio 2025 E	EV to EBITDA 2024 E	EV to EBITDA 2025 E	ROCE 2023 A	ROA 2023 A	ROIC 2023 A
Exxon Mobil Corp	$ 435,219.75	0.24	3.46	11.07%	11.66%	9.87%	10.87%	12.27	11.68	6.06	5.68	19.29%	10.35%	11.88%
Chevron Corp	$ 286,390.90	0.38	4.23	12.79%	13.61%	11.48%	13.83%	12.19	10.68	5.74	5.18	14.81%	9.13%	10.45%
Shell PLC	$ 210,547.78	0.68	4.21	7.86%	8.15%	8.94%	9.68%	8.16	8.02	4.05	4.09	14.64%	6.50%	9.26%
ConocoPhillips	$ 138,522.09	0.56	2.65	16.88%	17.75%	15.42%	17.59%	13.82	12.33	5.90	5.65	21.85%	11.20%	16.25%
Canadian Natural Resources Ltd	$ 78,120.19	0.65	4.27	24.57%	27.24%	24.89%	26.19%	12.43	10.14	6.66	6.14	21.11%	10.83%	13.56%
EOG Resources Inc	$ 71,398.23	-0.04	2.96	27.96%	28.20%	20.89%	19.93%	10.86	10.35	5.42	5.18	22.52%	13.97%	15.96%
BP PLC	$ 105,224.15	0.67	4.76	5.99%	6.62%	5.94%	6.67%	7.57	6.99	3.60	3.59	17.99%	4.36%	9.00%
TotalEnergies SE	$ 161,160.53	0.34	4.88	9.16%	8.91%	7.21%	7.13%	7.52	7.41	4.19	4.27	19.68%	7.65%	11.72%
Schlumberger NV	$ 75,376.56	1.10	2.09	13.66%	14.56%	11.66%	13.05%	14.81	12.57	9.09	8.11	23.23%	9.66%	13.26%
Halliburton Co	$ 33,476.72	1.32	1.81	12.46%	13.14%	10.05%	10.78%	11.02	9.50	7.17	6.48	31.42%	11.36%	20.62%
Liberty Energy Inc	$ 3,622.36	0.30	1.28	9.80%	10.38%	9.88%	10.65%	7.92	6.91	3.50	3.28	33.13%	19.70%	27.26%
First Solar Inc	$ 17,006.08	-1.16	-	32.34%	40.10%	-6.78%	21.53%	11.70	7.59	7.73	5.13	14.47%	9.73%	12.88%
Vestas Wind Systems A/S	$ 28,596.94	-0.03	-	3.49%	6.08%	3.06%	5.24%	43.67	21.17	14.81	9.93	4.10%	0.58%	7.33%
NextEra Energy Partners LP	$ 2,752.86	17.53	11.96	15.85%	17.61%	173.59%	75.69%	14.38	13.74	9.69	9.45	-15.85%	-2.40%	-1.72%
Atlantica Sustainable Infrastr	$ 2,072.76	6.27	9.97	4.25%	5.17%	57.77%	57.84%	38.63	31.92	8.63	8.37	2.87%	0.49%	4.40%
Brookfield Renewable Partners	$ 15,503.80	9.22	6.07	-3.22%	-2.95%	23.18%	22.45%	-	-	28.80	26.92	-2.11%	-0.14%	1.79%
Enterprise Products Partners L	$ 62,472.57	3.35	7.15	11.16%	11.35%	8.23%	9.46%	10.71	10.24	9.45	9.13	20.70%	8.08%	11.20%
Energy Transfer LP	$ 51,190.25	4.18	8.29	7.76%	8.35%	8.38%	9.15%	9.79	9.06	7.95	7.69	13.78%	4.02%	8.46%
Plains All American Pipeline L	$ 11,876.14	3.15	7.50	2.12%	2.07%	3.21%	3.18%	11.95	11.58	7.96	7.91	11.83%	4.32%	6.18%
ONEOK Inc	$ 45,655.55	4.54	5.06	11.99%	12.76%	12.72%	15.31%	16.04	14.57	10.94	10.39	24.22%	8.11%	10.14%
Kinder Morgan Inc	$ 40,170.60	4.97	6.24	15.76%	15.76%	16.46%	18.85%	14.76	14.23	9.09	8.90	7.65%	3.33%	4.90%
Vistra Corp	$ 20,973.99	2.37	1.43	9.99%	9.33%	13.99%	14.83%	13.45	13.53	7.96	7.79	39.27%	3.42%	9.21%
NRG Energy Inc	$ 13,090.76	3.27	2.59	4.57%	4.09%	6.11%	6.14%	10.24	8.80	7.24	6.97	30.33%	3.54%	15.24%
Dominion Energy Inc	$ 40,140.00	5.86	5.57	15.97%	18.09%	-14.67%	-4.07%	16.08	14.03	11.91	11.15	10.13%	2.45%	3.56%
NextEra Energy Inc	$ 121,382.37	4.42	3.43	24.74%	25.01%	-18.90%	-16.96%	17.65	16.34	13.21	11.98	14.63%	3.77%	6.19%
AES Corp/The	$ 11,464.18	7.59	4.28	10.45%	11.62%	8.65%	9.23%	8.47	7.79	15.21	14.09	58.40%	2.28%	4.50%
Freeport-McMoRan Inc	$ 61,069.96	0.58	1.41	9.39%	11.90%	9.08%	14.64%	27.22	20.45	8.26	7.29	13.77%	4.29%	10.35%
Rio Tinto PLC	$ 106,529.36	0.23	7.03	23.48%	21.76%	13.97%	13.17%	8.00	8.63	4.37	4.62	22.17%	11.65%	18.40%
Vale SA	$ 53,906.97	0.53	9.05	24.70%	22.97%	15.56%	15.14%	4.81	5.21	3.50	3.59	23.85%	9.92%	26.00%
Cameco Corp	$ 18,508.91	2.74	0.21	18.38%	22.59%	15.51%	19.89%	38.01	25.05	19.17	17.71	6.06%	3.90%	3.50%
NuScale Power Corp	$ 1,614.44	-	-	-465.43%	-131.81%	-620.93%	-204.55%	-	-	-	-	-16.69%	-8.90%	-89.41%
Quanta Services Inc	$ 35,146.74	1.70	0.15	5.52%	5.59%	6.68%	5.34%	28.89	25.30	17.67	15.86	14.52%	5.70%	9.45%
Itron Inc	$ 4,157.37	2.57	-	7.12%	8.12%	7.79%	8.52%	25.38	21.26	17.91	15.03	6.58%	3.28%	4.45%

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Citations and Disclosures

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