Natural gas likely to play a critical role in lowering carbon emissions

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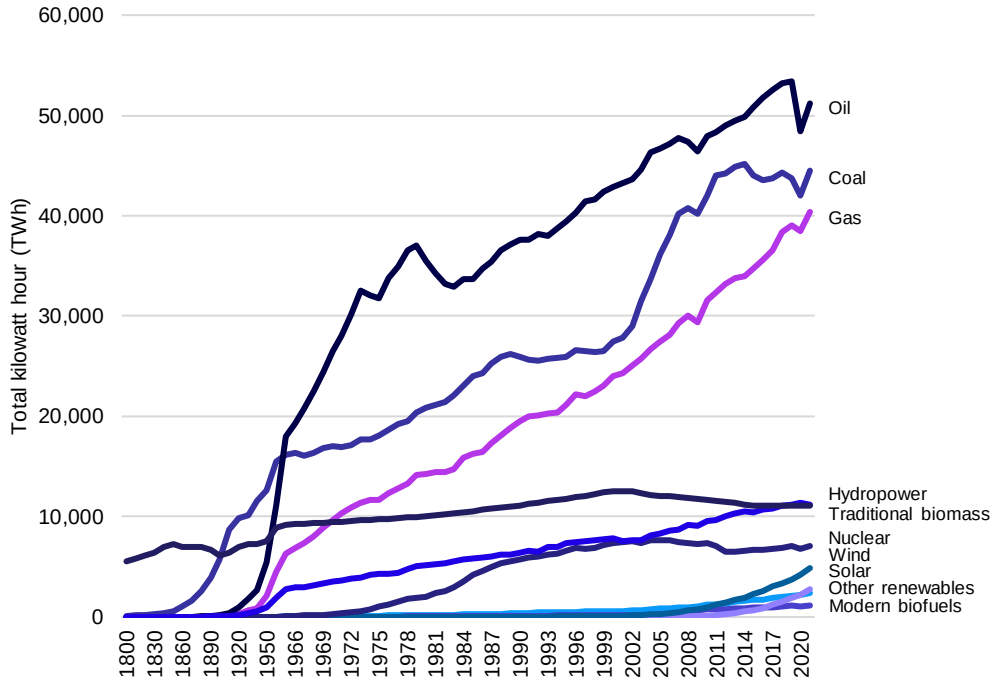
Renewables are projected to contribute a growing share of the globes' future energy needs. However, the deployment of these facilities to a sufficient scale to materially reduce the need for hydrocarbons will take many decades, carries significant complexities, and will be very expensive. Further, renewables are ill-suited to meet many sources of hydrocarbon demand.

Because fully replacing traditional hydrocarbons with renewables faces significant challenges, it is important to manage the use of hydrocarbons in an environmentally conscious way. Natural gas offers relative carbon efficiency and affordability and is, therefore, set to play a growing role in meeting this demand.

Replacing hydrocarbon energy in context

Though windmills have been in use for centuries and large-scale solar farms have been around since the 1980's, renewable energy still only accounts for 6.7% of today's global energy consumption.[1] Traditional hydrocarbons in the form of oil, gas, and coal have largely supplied the globes' incredible increase in energy demand over the past century.

Global primary energy consumption by source[1]



The reason behind this trend is simple. Hydrocarbons work. They are abundant, provide reliable energy, are easily transportable, and are affordable. Though wind turbines and solar panels continue to improve, there remain limits to renewable energy sources implementation. For example, both wind and solar energy:

- carry high upfront costs relative to comparable baseload capacity coal or natural gas generation
- provide only intermittent energy (the sun does not always shine, it is not always windy)
- have shorter useful life spans[2]

- work best only in locations with certain environmental conditions (reliable wind or infrequent cloud cover)
- require very large footprints, limiting the ability to place facilities in congested locations
- generate electricity, which cannot help meet the high heat requirement of many industrial processes
- are not a substitute for hydrocarbon feedstock for the manufacture of materials (plastics, textiles, etc.)
- would require substantial modification of existing homes/businesses currently using natural gas, fuel oil, or propane to meet winter heating needs

Of the above shortfalls, utility scale batteries offer the potential to mitigate intermittency. However, batteries of a sufficient scale add considerable costs to already very high upfront costs and exacerbate concerns around material availability, the energy intensity of the construction process itself, and the challenge of environmentally friendly disposal.[3]

Producing less carbon counts too

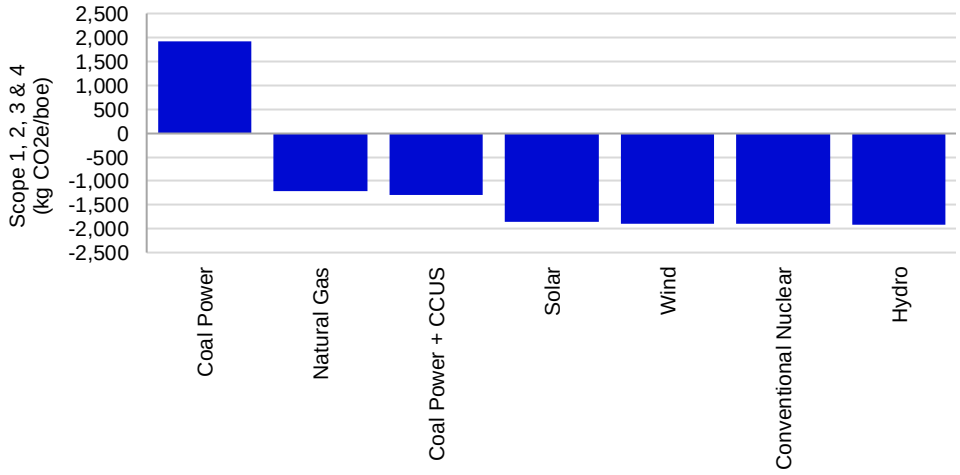
Because fully replacing traditional hydrocarbons with renewables faces significant challenges, it is important to manage the use of hydrocarbons in an environmentally conscious way. Therefore, understanding relative greenhouse gas emissions (GHGs) amongst hydrocarbon alternatives is important. A new term, referred to as "Scope 4 emissions"[4] has been coined to aid in this effort. Scope 4 is used to measure how a company's actions or investment avoids CO2 emissions against an initial baseline of its current and forecasted plan (Scope 1, 2, 3 emissions are commonly used measures of existing emissions).

"replacing the energy produced by a coal power plant with a natural gas power plant **reduces emissions by up to two-thirds** the amount as replacing coal power with wind or solar power"

For example, installing a new gas-fired generation facility to replace a coal plant scores well on Scope 4 metrics as natural gas power plants release approximately 60% less carbon emissions than coal. Conversely, installing a new solar farm to replace a current nuclear plant would not score well on Scope 4 emissions since the nuclear plant already produces low emissions.

Importantly, when including Scope 4 emissions in an analysis, replacing the energy produced by a coal power plant with a natural gas power plant reduces emissions by up to **two-thirds** the amount as replacing coal power with wind or solar power (see chart below).

Scope 1-4 emissions avoidance[5]



The reduction in emissions by natural gas power is accelerated when you include the cost of building a gas fired power plant vs renewables.[5]

"Every $1 billion invested in natural gas power plants **offsets more than 3x as much CO2** as wind or solar"

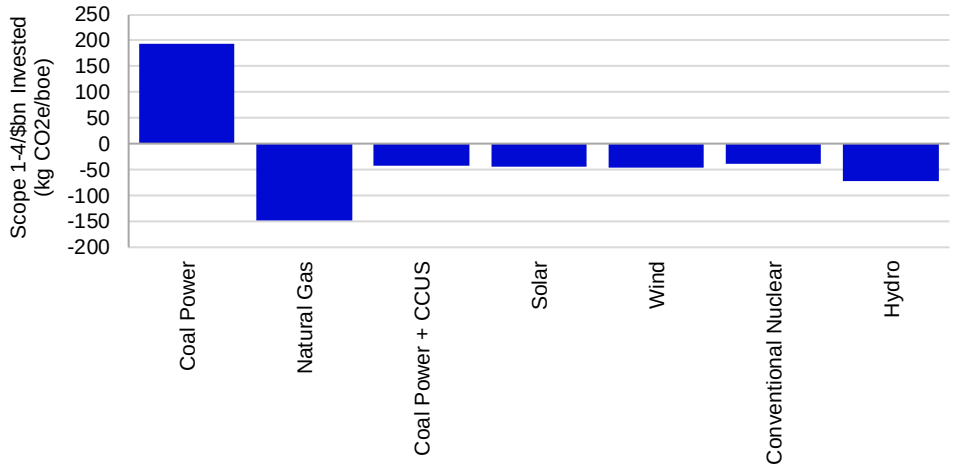
Natural gas may be more cost effective too

Every $1 billion invested in natural gas power plants offsets more than 3x as much CO2 as wind or solar when taking the full emissions lifecycle of the project into consideration.[5] This is because:

- natural gas generation has a lower initial investment than renewables, nearly 50% less per kilowatt of installed wind capacity and 75% less than installed solar capacity. [6]
- natural gas generation plants provide 10-15 year longer lifespans compared to wind farms and have comparable lifespans to solar farms.[2]

The chart below reflects per dollar comparison and highlights the efficiency of natural gas at reducing C02 emissions.

Scope 1-4 emissions avoidance/ $B invested[5]



Natural gas replacing coal would be a huge step in the right direction

What is clear from this analysis is that if world leaders are looking to make a large step change in CO2 emissions and meet the Paris Agreement goals, dramatically decreasing coal's market share of energy production is a very productive effort. Coal provides 30% of the world's energy but is the source of 50% of the world's CO2.[5]

Unfortunately, according to Bloomberg New Energy Finance (BNEF), in 2021, coal-fired power plants were the top contributor to power generation growth.[7] Coal has been the fuel source of choice for many developing countries. China and India, two of the fastest growing economies over the last 20 years, have added 6.5 billion tons of C02 emissions via coal power plants that produce about 1,200 gigawatts of electricity.[8] If Asia switched just 20% of its coal-fired power generation to gas, the continent could reduce its CO2 emissions by the equivalent of all emissions from Germany.[9]

The good news is that plans to utilize natural gas generation have been on the rise and are expected to slowly decrease the use of coal. China alone has increased its consumption of natural gas by 23% between 2019 and 2021,[8] and it's anticipated that natural gas demand could double over the next 20 years.[9] India's liquefied natural gas (LNG) demand is forecasted to triple by 2050.[10] In aggregate, global LNG demand could grow by 40% by 2030.[11] These actions may meaningfully reduce carbon emissions.

Conclusion

It appears likely that increasing both natural gas availability and renewable energy capacity will be required to meet the world's dual mandate of growing energy availability and environmental consciousness. Energy analysist and forecasters, including BP[11], Shell[12], and McKinsey[13], all see natural gas as playing a significantly larger role in meeting the world's energy demand in the near and medium-term future.

We believe the US energy sector and US midstream operators are positioned to potentially materially benefit from the outlook for natural gas demand growth.

Sources:

1. BP Statistical Review of World Energy 71st Edition.
2. The average operating life of a coal plant in the U.S. is 45 years and tend to be retired after 50 years of service. Solar farms have an operations lifespan of 30-35 years. Wind farms have a lifespan of 20 years. Source: United States Environmental Protection Agency
3. Redox flow batteries can provide cycle times of 8-12 hours but has a current market of $850mm versus an overall grid scale battery storage market of $8 billion and have several short comings. Source: Power Technoclogy, June 2022 and Global News Wire, September 2022.
4. World Research Institute, Do we need a standard to calculate avoided emissions? November 2013.
5. Thunder Said Energy, "Scope 4 emissions: avoided CO2 has value?" August 22, 2022.
6. ProEst, "Power plant construction: how much does it cost?" February 22, 2021.
7. BloombergNEF Power Transition Trends 2022 report
8. Global Energy Monitor, January 2023 https://globalenergymonitor.org/projects/global-coal-plant-tracker/summary-tables/
9. Shell 2022 LNG Outlook
10. The U.S. was able to reduce CO2 emissions from 2005-2019 by 959 million metric tons through coal-to-gas switching (61%), wind (31%), and solar (8%). Sourced from EQT's Unleash U.S. LNG report
11. BP Energy Outlook 2022 edition
12. Shell LNG Outlook 2022
13. McKinsey Global gas & LNG outlook to 2035, as of 2019

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There is no guarantee that forecasts will come to pass.

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Investments focused in a particular sector, such as energy, are subject to greater risk, and are more greatly impacted by market volatility, than more diversified investments.

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