

# Climate Change and the Transition From Fossil Fuels to Renewables



October 2021



AleSpa, CC BY-SA 3.0 <<https://creativecommons.org/licenses/by-sa/3.0/>>, via Wikimedia Commons  
[https://commons.wikimedia.org/wiki/File:Photovoltaik\\_Dachanlage\\_Hannover\\_-\\_Schwarze\\_Heide\\_-\\_1\\_MW.jpg](https://commons.wikimedia.org/wiki/File:Photovoltaik_Dachanlage_Hannover_-_Schwarze_Heide_-_1_MW.jpg)

# Current Vs. Projected Worldwide Energy Consumption

580M Trillion Joules

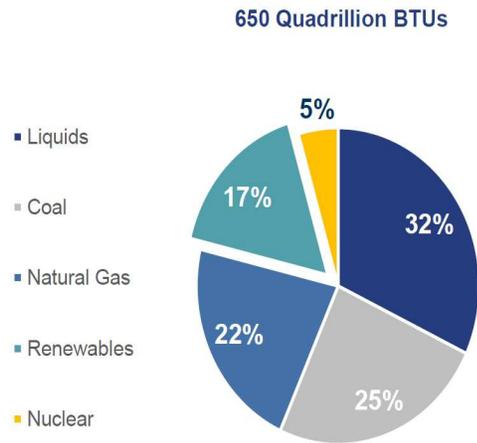
171,000 Terrawatts (Terrawatt = 1 Trillion Watts)

650 Quadrillion BTUs

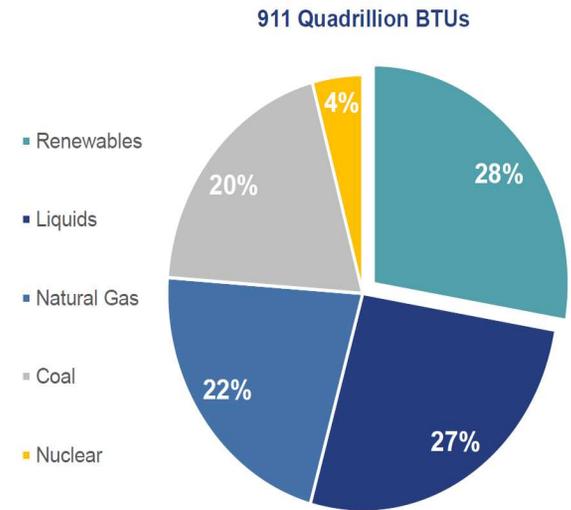
13,685 MTOEs (Million- Ton-of-Oil Equivalents)

**Energy consumption is projected to grow by 40% between now and 2050, and only 17% of production comes from renewable sources currently.**

2020 Energy Consumption (by Fuel Type)



2050E Energy Consumption (by Fuel Type)



Overall energy consumption is estimated to grow by 40% through 2050 with renewables expected to increase by 137% over the same period, becoming the single largest source.

Sources: [iea.org](http://iea.org); [theworldcounts.com](http://theworldcounts.com);

Sources: Goldman Sachs Asset Management, EIA's 2019 International Energy Outlook, and Bloomberg's New Energy Outlook 2019; latest data available as of 30-Jun-2021. BTU: British Thermal Unit. The economic and market forecasts presented herein are for informational purposes as of the date of this presentation. There can be no assurance that the forecasts will be achieved.

# Environmental Impact of Energy Consumption and Response

33 Gigatons of Carbon emitted into Atmosphere in 2019

412.5 parts per million concentration of CO<sub>2</sub> in atmosphere in 2020 – highest in 3.6 million years

**131 countries have committed to net-zero carbon emission.**

**3,067 companies have committed to net-zero carbon emission.**



Photo: By Janak Bhatta - Own work, CC BY-SA 4.0, <https://commons.wikimedia.org/w/index.php?curid=77436055>

Sources: [iea.org](http://iea.org); [noaa.gov](http://noaa.gov), [motleyfool.com](http://motleyfool.com)

## Change Requires Substantial Investment in Alternatives, Etc.

Estimated \$4T in capital required annually for decades for new energy infrastructure.

Transition to include more renewable energy sources, new power storage methods, and carbon capture technologies.

**Could be as much as \$100T in total investment in renewable energy projects and infrastructure over coming decades.**



Sources: [iea.org](https://www.iea.org/); [forbes.com](https://www.forbes.com/)

By Matthew T Rader, [https://matthewtrader.com](https://matthewtrader.com/), CC BY-SA 4.0,  
<https://commons.wikimedia.org/w/index.php?curid=101799395>

## Energy Market Response – Increased Focus on Renewables, Reduced Prioritization of Fossil Fuels

Expansion of renewables requires viability studies, permitting, construction, and integration - which can take a number of years to bring online.

Some renewable energy methods require expensive materials and rare earth metals (e.g. solar panels, wind turbines components).

Meanwhile, general demand for energy is increasing, causing recent price spikes in traditional. Diminished fossil fuel production domestically rewards foreign producers.

**Pace of transition might be more gradual than people expect - and could lead to higher energy prices in short run.**



Photo by Kristelle Batucal. – U.S. Department of Energy from United States, Public domain, via Wikimedia Commons

## Renewable Sources Expected to Increase Dramatically Over Coming Decades

Unprecedented investment in renewables should lead to marked increase in percentage of energy coming from clean technologies in coming decades.

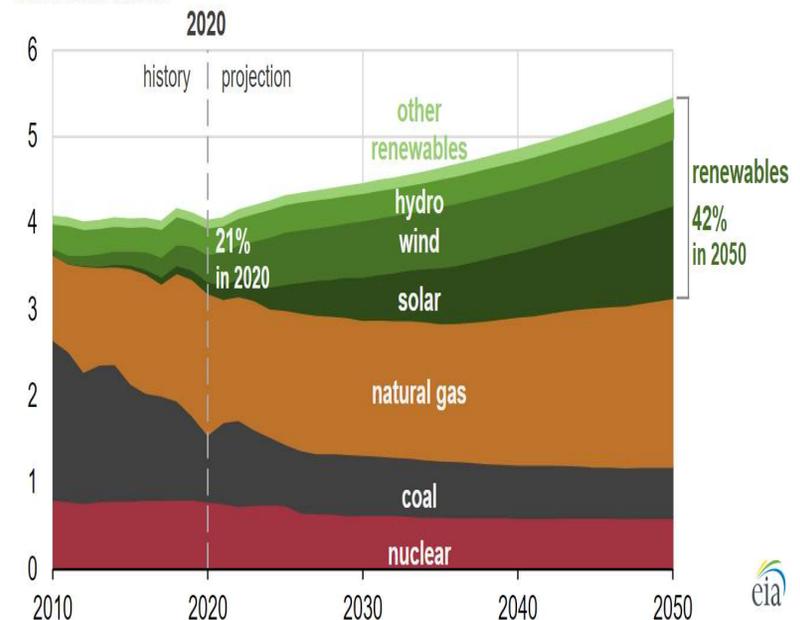
Fossil fuel still projected, however, to be backbone of energy production for at least the next 15 to 20 years.

To get to carbon-neutral, intermediate steps could be to transition fossil fuel consumption to lower CO<sub>2</sub> emitting sources (e.g. shift from coal to natural gas because natural gas emits half as much CO<sub>2</sub>.)

**Energy consumption is projected to grow, and renewables are anticipated to increase even faster than the overall energy market.**

**Use of renewable energy, along with substitution effect within fossil fuel, may improve CO<sub>2</sub> emission levels during this growth phase.**

U.S. electricity generation, AEO2021 Reference case (2010–2050)  
trillion kilowatthours



Source: eia.gov

## Short-Term to Intermediate Term: Renewables Growing Quickly, But Can't Yet Provide Enough Power to Meet Overall Demand

Wind, Hydro, and Solar rely on weather and waterflow to meet ongoing energy demand.

Without efficient long-term power storage during off-peak periods, renewables can't yet adequately feed the grid during peak hours especially when wind doesn't blow, river levels are low, or sun doesn't shine. (2020 California blackout is an example.)

**A transition period could find renewables needing to co-exist with fossil fuels for an extended period of time to balance energy demand.**

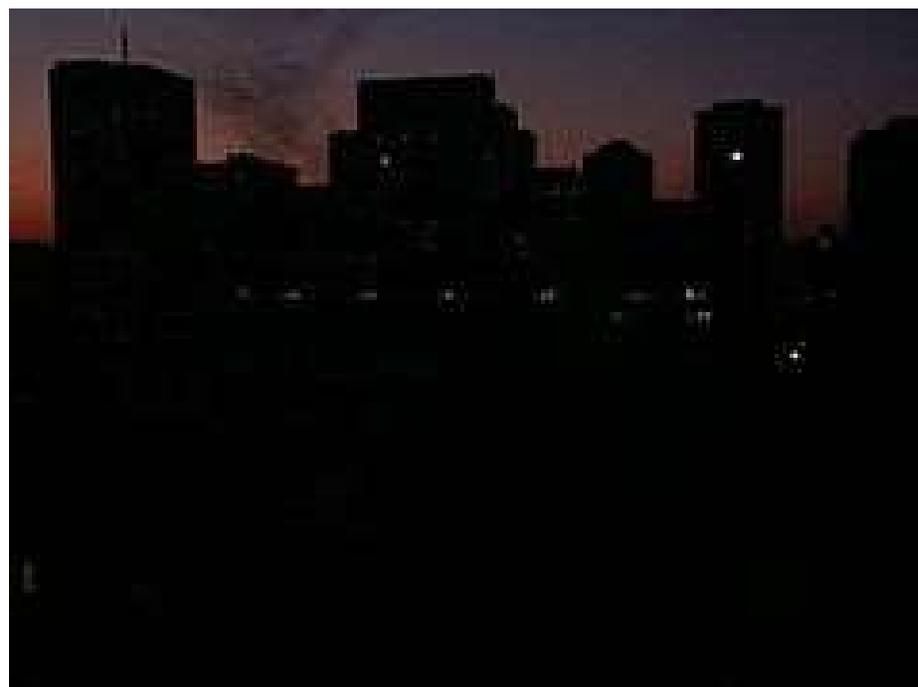


Photo: Camerafiend at English Wikipedia., CC BY-SA 3.0 <<http://creativecommons.org/licenses/by-sa/3.0/>>, via Wikimedia Commons [https://commons.wikimedia.org/wiki/File:Toronto\\_ON\\_2003\\_Blackout.jpg](https://commons.wikimedia.org/wiki/File:Toronto_ON_2003_Blackout.jpg)

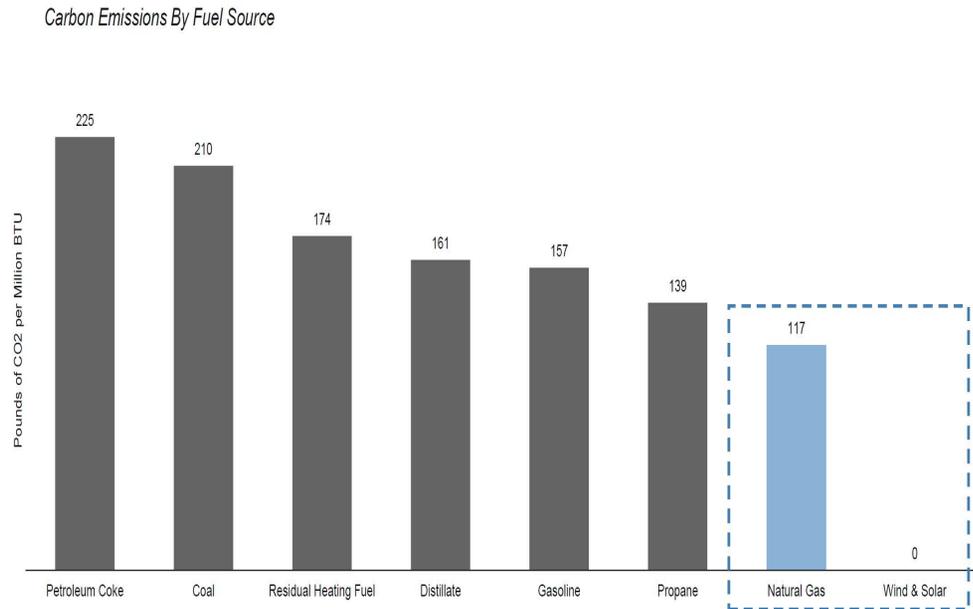
## What Might Co-Existence Look Like?

Oil and coal will probably remain important components of the energy consumption “pie” in short to intermediate term. However, as electrification of various industries takes hold (e.g. automotive transportation), natural gas could serve as a so-called “bridge fuel” longer term. An added benefit is that, from an environmental standpoint, it burns cleaner than other fossil fuels, particularly coal.

Natural gas is also available domestically, is relatively cheap, and is abundant.

Additionally, infrastructure is already in place for natural gas production, transport, and storage.

**Renewables could complement natural gas to address both environmental concerns (to a certain degree) and energy demand.**



Graph: Brookfield Asset Management, US Energy Information Agency

## What Other Fuels Might Have A Niche?

Hydrogen (combining hydrogen and oxygen atoms to create an energy producing reaction).

Biofuels (e.g. Ethanol from sugarcane, biodiesel from vegetable oil, wood pellets from trees)

Nuclear Power (Microreactors)

Natural gas from non-traditional sources (e.g. dairy farms and landfills)

**In addition to wind, hydro, and solar, other novel fuels could fill a valuable niche for energy production over time.**



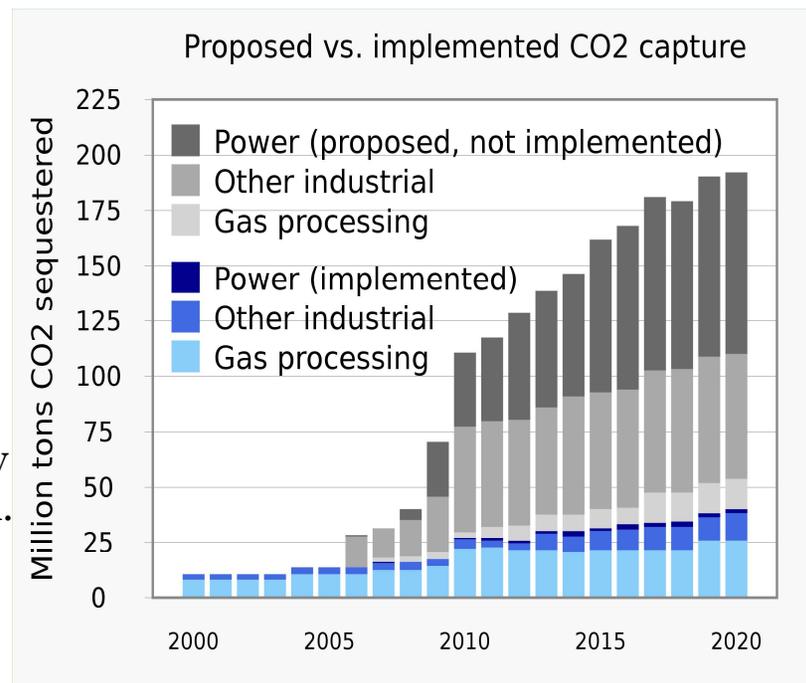
Photo: Vince Reinhart, CC BY-SA 2.0 <<https://creativecommons.org/licenses/by-sa/2.0/>>, via Wikimedia Commons  
[https://upload.wikimedia.org/wikipedia/commons/2/2d/Gas\\_flare\\_from\\_a\\_landfill\\_in\\_Ohio.jpg](https://upload.wikimedia.org/wikipedia/commons/2/2d/Gas_flare_from_a_landfill_in_Ohio.jpg)

# What Are Ways to Reduce Carbon Emissions During Period World While Fossil Fuels Continue to Be the Standard?

## Carbon Capture Technologies

- **At-the-Source:** Attaching carbon-capture devices to the source of emission, particularly in processes that are hard to electrify e.g. heavy industry. The captured carbon is then put into a pipeline and pumped back into the ground.
- **Direct-Air:** Facilities which literally pull carbon from the atmosphere and put it back underground.
- **CO2 Injection** – Technique of extracting oil and natural gas from by injecting CO2 back underground, thus producing “cleaner” fossil fuel.

**Various technologies could reduce carbon emissions at the source of production, or even pull carbon from the atmosphere directly.**



By RCraig09 - Own work, CC BY-SA 4.0,  
<https://commons.wikimedia.org/w/index.php?curid=103611926>

## What Key Factors Underpin Growth of Renewables?

Battery / Storage Technology – Batteries that can store large quantities of power for long periods of time are required in order to provide constant power to the grid from renewable sources.

Many emerging technologies may take years to research, develop, enter proof-of-concept stage, and become viable at scale. They also may require government initiatives and tax credits to attract investment.

Governments in emerging and developed countries need to coordinate and prioritize renewables for mainstream adoption to take hold.

Popular support from consumers could also accelerate change in energy consumption habits.

**A combination of public and private initiatives need to come together for rapid change to occur.**



By Sandia National Laboratories - <https://www.sandia.gov/ess-ssl/publications/SAND2015-5242.pdf>, Public Domain, <https://commons.wikimedia.org/w/index.php?curid=90112254>

# What Are Some Risks to the Renewable Energy Transition Trajectory?

**Political:** Regulatory changes and lack of coordination among key energy-consuming nations could impact the willingness for risk capital to pursue renewable energy projects.

**Economic:** Rising interest rates could change the investment assumptions for the required rate of return on renewable energy projects. If projects are not anticipated to beat expected hurdle rates, they may not be pursued.

**Other:** The financial health of the entities that purchase power from renewable providers, construction delays, competition in the sector, and slow innovation (particularly in battery storage) are among other risks to the viability of renewable energy projects.

**There is great promise for this burgeoning industry, but we need to recognize that there are a number of political, macro-economic, and micro-economic factors which could impact investments in the renewable energy space.**



By kallerma - Own work, CC BY-SA 4.0,  
<https://commons.wikimedia.org/w/index.php?curid=103494974>

## Summing it Up: Key Takeaways

**Energy consumption is projected to grow by 40% between now and 2050, and only 17% of production comes from renewable sources currently.**

**Incremental energy consumption growth is coming largely from developing countries (e.g. China, India, etc.)**

**131 countries, and 3,067 companies have committed to net-zero carbon emission goals.**

**There could be as much as \$100T in total investment in renewable energy projects and infrastructure over coming decades.**

**The pace of transition might be more gradual than people expect - and could lead to higher energy prices in the short run.**

**Energy consumption is projected to grow, and renewables are anticipated to increase even faster than the overall energy market.**

**A combination of renewable energy, and substitution effect within fossil fuels, may help reduce CO2 emission levels during this growth phase.**

**A transition period could find renewables needing to co-exist with fossil fuels for an extended period of time to balance energy demand.**

**Renewables could complement natural gas to address both environmental concerns (to a certain degree) and energy demand.**

**In addition to wind, hydro, and solar; other novel fuels could fill a valuable niche for energy production over time.**

**Various carbon-capture technologies could reduce carbon emissions at the source of production or even pull carbon from the atmosphere directly.**

**A combination of public and private initiatives need to come together to accelerate transition to renewables.**

**There is great promise for this burgeoning industry, but we need to recognize that there are a number of political, macro-economic, and micro-economic factors which could impact investments in the renewable energy space.**

**©Investment Partners Group**

General Disclaimer for this Presentation:

Opinions and views expressed in this Presentation are solely those of the speakers and panelists, and not necessarily the opinions of Investment Partners Group, its affiliates, employees, or subsidiaries (Collectively "The Company", "We", "Us", or words of similar import).

The content of this Presentation does not constitute or form part of any offer to issue or sell, or any solicitation of any offer to subscribe or purchase, any shares or other security, investment interest or provide investment advice - nor shall it form the basis of, or be relied on in connection with any contract there of. Any information referred to in this Presentation should not be considered a complete analysis of every material fact with respect to any company, industry, security or strategy. Any and all investments discussed therein may not be suitable for all investors and may be subject to a high degree of risk. Past performance of any company, industry, security or strategy is **not** a guarantee of future results. For this and other reasons, Investment Partners Group does not recommend that investors buy or sell any securities mentioned in this Presentation, if any. Furthermore, there is **no** certainty, and we make **no** representations, that any strategy discussed may be executable in an appropriate size or amount and/or at the prices described therein, if any. Moreover, although the information contained therein has been obtained from sources believed to be reliable, its accuracy and completeness cannot be guaranteed. Investment Partners Group and/or its affiliates (including but not limited to Investment Partners Asset Management ("IPAM")) may effect transactions, including transactions contrary to any views expressed therein for themselves or their clients. Furthermore, Investment Partners Group and/or its affiliates (including but not limited to IPAM) may have positions in securities mentioned therein (or options with respect thereto), and may also have performed consulting services for the issuers of such securities. In addition, Investment Partners Group and/or its affiliates (including but not limited to IPAM) , their employees, employee's families, and other affiliated persons may have positions and effect transactions including transactions contrary to any views expressed therein in the securities or options of the issuers mentioned therein, if any, and may serve (or may have served) as directors of such issuers. Accounts are not FDIC insured. Investing involves risk. Accessing this Presentation will be deemed to be acceptance of the terms of this General Disclaimer.