

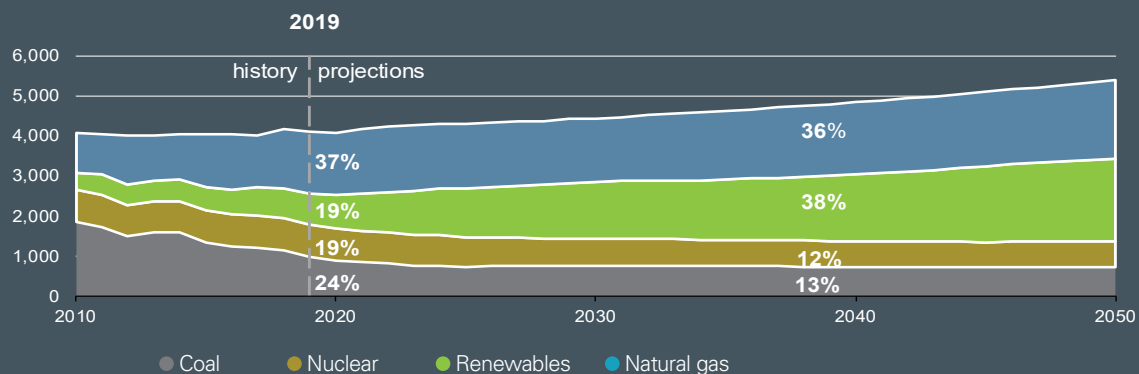
# The energy evolution story and the current investment opportunity

## What is the future of energy demand?

The two primary drivers of energy demand are population and GDP growth. As of last year, energy demand growth has increased 35 of the past 36 years, with the 2008/2009 recession being the only dip. With GDP temporarily declining across the world, we are expecting a short term reduction in global energy demand. However, with continued population growth globally along with the electrification of the developing world and the continued development of technologies that require more energy input, it's very likely that energy demand will continue to intensify and accelerate into the future.

To meet that increasing demand, as we stand today, we have a global energy supply that's made up of:

**Electricity generation from selected fuels  
(AEO2020 Reference case)  
billion kilowatthours**



Source: EIA AEO 2020. These charts contains projections, there is no guarantee these projections will be met.

## What are the environmental concerns with current global energy generation?

The biggest concern is the growth of CO<sub>2</sub> emissions. Power generation is the single largest driver with more than a third of all CO<sub>2</sub> emissions. The fundamental challenge for the global energy sector is this: generating more energy to meet demand, but doing so with less CO<sub>2</sub> emissions.

## With energy demand increasing year over year, and power generation increasing to keep up with this demand, how can CO<sub>2</sub> emissions decline?

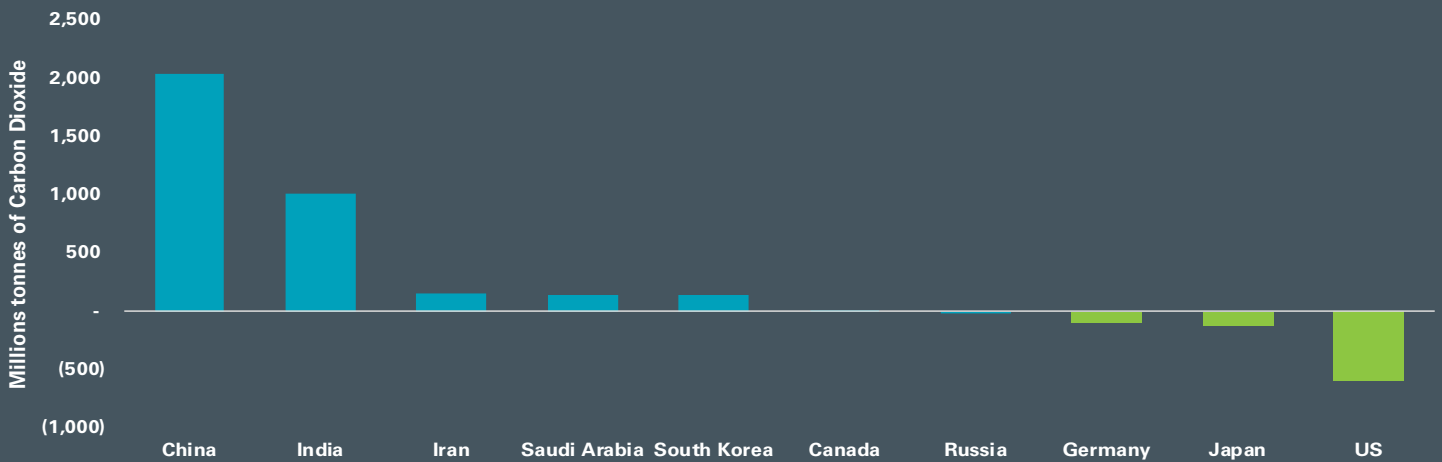
The single quickest way to do this through the reduction, and eventual elimination, of coal globally with a shift to natural gas and renewables, specifically wind and solar.

Natural gas has about half the CO<sub>2</sub> emissions of coal. Until wind and solar energy generation are scalable across communities and countries, natural gas is the quickest and most efficient way to effectively reduce CO<sub>2</sub> emissions today.

### How does the U.S. factor into the growth of CO<sub>2</sub> emissions?

While energy demand in the U.S. continues to grow each year, and the U.S. has been producing more oil and gas over the past couple of years than at any other time in history to meet this demand, overall CO<sub>2</sub> emissions have decreased substantially.

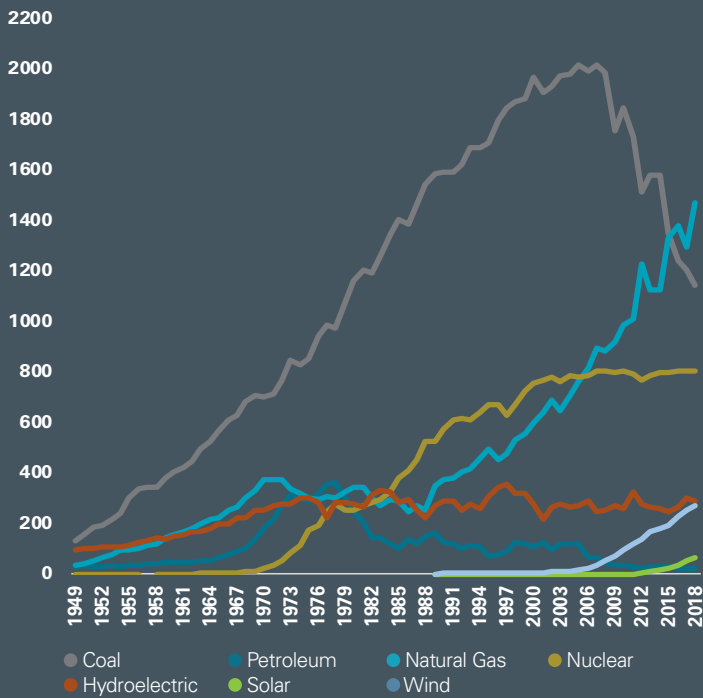
10-Year Change in CO<sub>2</sub> Emissions by Top 10 Emitters



Source: BP Statistical Review

The reason for this decline is mainly the displacement of coal with natural gas. Over the past 10 years, coal's market share within the U.S. has decreased from close to 50% to about 20%.

Rapid change in U.S. power generation



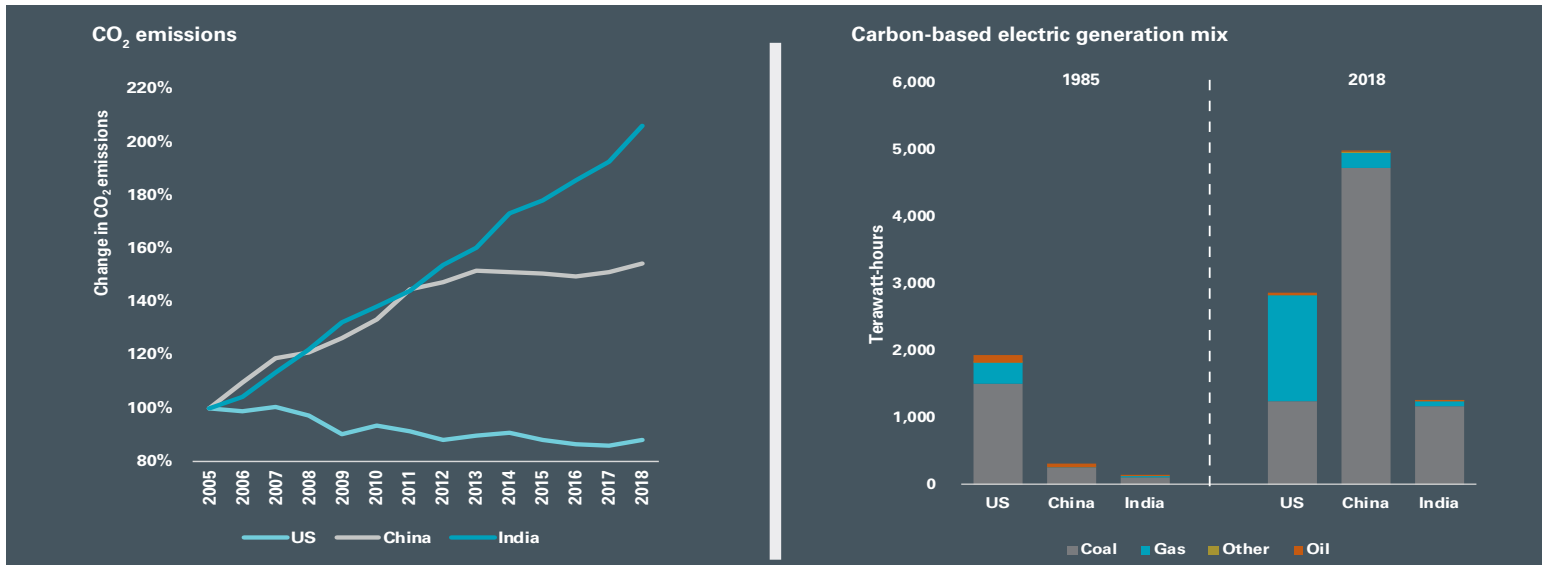
Coal is being displaced by natural gas and renewables

Wind and solar are a growing part of the electric power stack

Source: EIA 2019

## If the U.S. is decreasing its CO<sub>2</sub> output, what is responsible for the global increase of CO<sub>2</sub> emissions?

Other countries around the world, like China and India, which have historically relied more heavily on coal, have not followed the same roadmap as the U.S. About 67% of the domestic energy supply in China comes from coal, while that number is around 75% for India. These countries have increased global CO<sub>2</sub> emissions in aggregate because of the substantial increase in energy demand and energy consumption these countries have seen, and the significant amount of coal each of these countries uses to meet that demand.



As of 6/30/2019. Source: BP Statistical Review of World Energy 2019

These countries are in transition to cleaner sources, they're just taking a lot longer to get there than the U.S. has. There's a clear path to reduce CO<sub>2</sub> emissions by displacing coal with natural gas and renewables. As countries around the world adopt a similar playbook to that of the U.S., we will see significant improvements in reduction in global CO<sub>2</sub> emissions globally.

## Why are some countries turning to natural gas instead of focusing on building out their renewable energy infrastructure?

Wind and solar energy generation have been gaining traction because of the decline in costs of the components and the materials used to generate those projects. As of today, there is no way to store excess wind and solar energy that's generated in order to use it when the sun's not shining or the wind's not blowing, which has hindered the broad adoption of wind and solar. Progress is happening, and there are a lot of resources being deployed to improve energy storage, but it is still in the early phases of development.

## If countries or communities are committed to decreasing their CO<sub>2</sub> emissions, do they have to choose one alternative power source to do so, or can energy sources be used in conjunction with one another?

Many communities are starting to utilize wind and solar assets to generate a significant amount of electricity during periods when the sun is shining and the wind is blowing, and then in the intermittent periods, when that's not the case, supplementing that electricity generation with natural gas. By combining a natural gas facility with a wind or solar farm, or a combination of all three, enough energy can be generated to satisfy and meet the demand of a particular area in an environmentally friendly way.

## **How can the U.S. be part of the broader global CO<sub>2</sub> emissions solution?**

The U.S. has become a major exporter of low-cost energy to the rest of the world over the past 5 years. As energy demand continues to increase across the world, namely in developing countries, U.S. natural gas exports will be critical to replacing coal across the globe.

## **How else are U.S. exports helping communities across the world?**

U.S. natural gas exports to emerging countries will be crucial to helping decrease the global poverty rate. Reducing poverty requires access to energy. The UN states that more than 80% of the world's population lives in countries that consume less energy than deemed necessary for proper human development and well-being. Economic poverty and energy poverty go hand in hand.

To address global poverty, emerging countries will require increasing energy for electricity and other uses. More than 100 million people gained access to electricity over the three-year period ending in 2015. More than half of that number utilized coal as a primary fuel source. More than 3 billion people worldwide rely on polluting energy sources such as wood, dung and charcoal for cooking. Almost 1 billion rely on kerosene lamps and other polluting devices to light their homes. U.S. exports of LPG, such as LPG canisters containing propane or butane, offer a lower emission solution that is dramatically safer for those citizens and the environment.

As emerging countries evolve and seek to provide a better quality of life for their citizens with improved access to electricity and transportation, U.S. energy exports will be critical to help accomplish this in a low carbon footprint way.

## **Is there an opportunity for investors to have a positive impact on society through these themes, while benefiting from attractive returns?**

At TortoiseEcofin, we focus on energy evolution. This takes into account climate action and lowering global CO<sub>2</sub> emissions, while also aiming to reduce poverty through affordable clean energy, by better utilizing industry and infrastructure.

To capture this thematic shift, TortoiseEcofin believes the investible opportunity is in the companies that are adapting their business models and balance sheets to be beneficiaries of this energy evolution. This includes those that are focused on U.S. exports of low cost and low carbon fuel sources globally, as well as those companies focused on utilities in transition and the growth of renewables.

Specifically, the beneficiaries of this theme are:

### **1. North American Midstream Energy**

The role of midstream energy and the transition to cleaner energy sources are often incorrectly assumed to be mutually exclusive; however, we believe they should be viewed more as mutually dependent for the future of energy consumption.

We believe pipelines are in a good position to benefit from global decarbonization by both replacing coal, and by providing back up and intermittent coverage for renewables. Further, pipelines will continue to play a key role, as they are able to accommodate hydrogen as well.

Additionally, as mentioned previously, the U.S. has become a major exporter of low-cost energy to the rest of the world over the past 5 years. As energy demand continues to increase across the world, especially in developing countries, U.S. natural gas exports will be critical to replacing coal across the globe.

Lastly, midstream companies have been open about looking for investment opportunities outside of the conventional midstream footprint. For example, Enbridge has renewables and European offshore wind; TC Energy has renewables; Williams is planning to spend on solar across its footprint.

## 2. Global Utilities

Around the world, the electric power sector is undergoing a profound transformation driven by the decarbonization of the global economy and the electrification of energy demand. Utilities are at the forefront of this multi-decade transition. By adapting and, in many cases, substantially overhauling their business models to accommodate new greener technologies and decentralized power sources, utilities are bound to be beneficiaries of secular growth and attractive returns from significant capital investments.

Utilities are amongst the largest emitters of CO<sub>2</sub> on the planet. As such, they are at the forefront of decarbonization trend. Over the past 5-10 years, utilities have been switching away from the most carbon emitting technologies - above all coal-fired power generation – and have expanded their exposure to clean power sources, primarily wind and solar. The fast development of renewable capacity worldwide is a source of secular growth for utilities.

## 3. Global Renewable Infrastructure

We believe electricity will continue to increase its market share at the expense of other sources of energy and that we will witness an acceleration of growth in the sector, with companies exposed to this growth as the largest beneficiaries in the years to come. In this context, renewable developers and power generators, which are migrating quickly to clean power, will capture a large share of the growth in electricity and will create value for investors.

Specifically, we see electricity gaining market share in a few areas: 1) transportation from broad adoption of electric vehicles and electric trains 2) homes migrating away from fossil fuels 3) industries moving away from energy-intensive and carbon-emitting processes to green hydrogen, carbon capture and the rise of automation, onshoring and nearshoring.

Wind and solar generation capacity is expected to increase by over 11% per year between 2020 and 2030, significantly outpacing all other types of energy, due mainly to technological advances and significantly reduced costs. Costs from fossil fuels in the U.S. have ranged between ~5 to 20 cents/kWh for a while now. Conversely, the cost of renewable energy has continued to decrease year over year. Last year, the levelized cost of electricity for PV solar was down to under 7 cents/kWh and onshore wind was around 5 cents/kWh, both at the very low end of the fossil fuel range. Because of this, renewable power sources accounted for 72% of all new capacity additions in 2019, and we expect this trend to continue.

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