

Economic Analysis

# The Energy Mix: A Balancing Act

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- Natural gas is a vehicle towards renewables, but LNG supply shortfall to emerge in next decade
- Policies such as Clean Power Plan accelerate growth of wind and solar
- Shale still has key role as link between storage and long-term projects

## Introduction

The debate on where to focus efforts to meet energy demand has intensified, given the favorable price and availability of options such as gas and renewables. For many, natural gas is the best option to move towards a sustainable energy economy because of its reliable supply and relatively low emissions. However, policies such as the Clean Power Plan also boost the role of renewables in accelerating the clean energy transition. Despite shifts away from coal-based energy in the U.S., many developing countries, such as China and India, continue to depend on fossil fuels to power their economic growth.

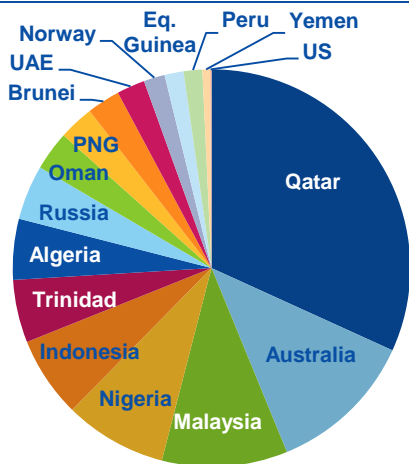
## Natural Gas

*"I subscribe to the view that natural gas is a very helpful bridge fuel to an energy efficient future."*

— John Holdren, White House Office of Science and Technology Policy

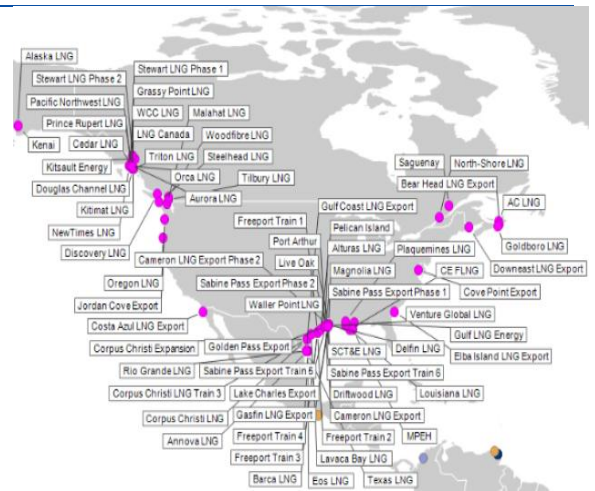
Among government and oil and gas sector experts, there is wide consensus that natural gas is a bridge fuel towards renewables, given its ability to meet climate objectives and energy needs. In particular, most of the LNG that's coming into the market now is a substitution fuel competing in the clean energy arena against alternatives, which are increasing in availability and rapidly decreasing in price.

Chart 1  
**2015 LNG Exports by Country**  
MTPA



Source: IHS, IGU

Chart 2  
**Existing and Proposed North American LNG Export Projects**



Sources: Wood Mackenzie

LNG needs to compete with low-carbon options such as wind and solar, but not with oil. Oil-linked pricing made sense when LNG was scarce and there was significant oil substitution in the demand pool, but it is nonsensical now.

Global LNG supply outweighs demand in the short and medium-term (through 2024), creating a buyer's market, but a steady increase in long-term demand and a supply shortfall should emerge in the next decade. One exacerbating factor of global LNG oversupply is the more than 100 mmtpa of LNG that is uncommitted from existing ventures and projects under construction in places like Qatar, the U.S. and Australia.

There are several contenders vying to fill the forecasted supply shortfall. North America is well-positioned to fill the gap, especially as natural gas exports to Mexico are booming. However, Australia is expected to be the single biggest LNG exporter in the world, with ~86 mmtpa of LNG export capacity by 2020, but it faces some challenges such as geographic isolation and a lack of skilled labor. East Africa is also a contender, particularly Tanzania and Mozambique.

The North American LNG export market is overcrowded, but not all projects will be successful. There are five projects currently under construction, as well as others at various stages of progress in their permitting. Successful projects will be those that are innovative in their approach to technology choices and find ways to respond to customers' shorter and shorter terms.

The LNG export industry hasn't really changed in the last 30-40 years, but now there's some innovation coming on board in terms of size and technology. Existing U.S. LNG export projects, based in Texas, Louisiana, Mississippi and North Carolina, are mostly large-train, meaning they have a design capacity of approximately 5 mtpa, but because bigger isn't necessarily always better, there are now several projects beginning to consider mid-scale trains (1-2 mtpa). In addition, most U.S. LNG export projects are based on liquefaction technologies developed 20-30 years ago, but the competitive market, along with mature construction capabilities, are driving project sponsors to consider lower-cost and higher-efficiency technology, which should ultimately benefit customers.

## Clean Power Plan (CPP)

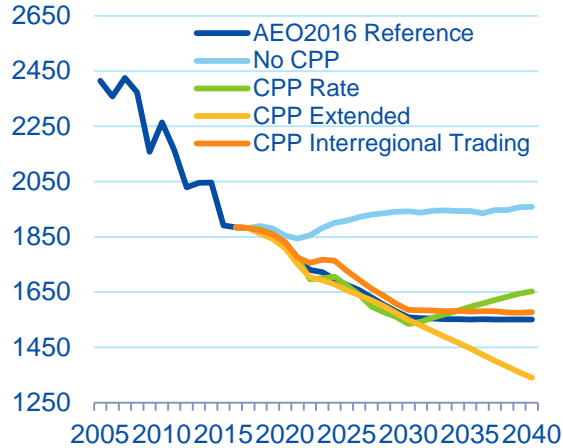
*"The CPP accelerates a shift in the generation mix that is already underway."*

- Thaddeus Huetteman, EIA

With the CPP in place, the EIA projects that CO<sub>2</sub> emissions from the electric sector will decline 32-36% from 2005 levels by 2040. Without the CPP, emissions would still decline by 19% because the extension of the production and investment tax credits should result in strong renewables additions and less dependence on natural gas. In the EIA reference case with the CPP, gas eclipses coal by the mid-2020s, with renewables surpassing coal in late 2020s. With no CPP, only gas eclipses coal (by the late 2020s). Despite the many benefits of the CPP, it has its limits. The Plan only runs until 2030 and needs to encourage more nuclear power at the state-level.

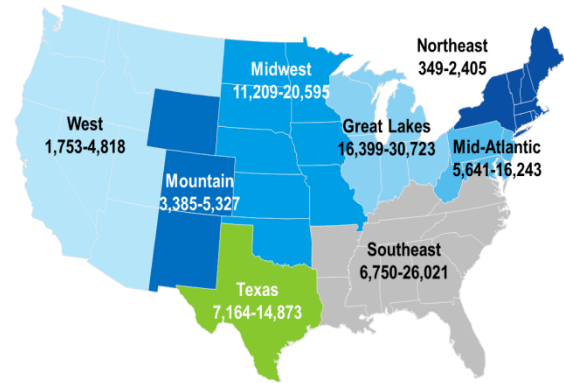
For the states that choose to continue to cut carbon pollution from power plants despite the CPP stay, the EPA has developed tools such as the model rules and the Clean Energy Incentive Program (CEIP). The model rules allow states to choose between rate-based trading using emission rate credits and mass-based trading using allowances. The CEIP is an optional early action program to help states meet their emission goals under the CPP and to encourage early investment in renewables. One of the biggest benefits of the CPP is that more states have started the conversation on how to reduce their emissions.

Chart 3  
**CO2 Emissions from Electric Power Sector in 5 Cases (million metric tons)**



Source: EIA

Chart 4  
**Wind Energy Demand Driven by CPP MW**



Source: EIA

## Wind

*“Wind is the biggest, fastest, cheapest energy to comply with the Clean Power Plan.”*

- Andrew Gohn, American Wind Energy Association

The U.S. is the world’s number one wind producer, followed by China. In terms of capacity additions, wind leads the way among renewables with a 34% share. Some experts even consider wind to be the new base load, with the potential to meet 24-hour demand. Every year, wind’s growth has exceeded the expectations outlined in the Department of Energy’s 20% by 2030 Wind Vision goal; however, 900 miles of transmission per year are still required to achieve this goal.

Much of U.S. wind power comes out of Texas, which, with more than 17 MW, has twice the wind power of any state. It’s easy to build a wind project in TX, given its friendly state policy, relative lack of local objections, greater land mass and lower land value. In terms of wind’s share of in-state energy production, South Dakota, Iowa and Kansas currently lead the way, but Texas is expected to have a higher than 20% share very soon. The Southeast also looks promising in terms of generation and transmission opportunities, as new technology is capturing higher wind speeds and making wind energy more possible in areas like the Southeast.

One major trend driving wind energy growth is corporate purchasing, from companies such as Google, Procter & Gamble, Mars and Dow. These companies are a source of long term contracts for wind, with total deal size exceeding 3000 MW in 2015—twice as much as in 2014. Companies with big data centers are actively looking for states with local wind energy and supportive policies.

In regards to U.S. offshore wind, one of its biggest challenges is obtaining permits, partly because of local resistance movements, such as NIMBY (not in my backyard) and NOPE (not on planet Earth). However, Denmark-based company, DONG Energy—the world’s largest offshore developer—recently opened an office in the U.S. and is actively buying leases, particularly in the Northeast.

## Solar

*“The Clean Power Plan is a huge opportunity for solar. It is the long-term driver of renewable power in the U.S.”*  
-Sean Gallagher, Solar Energy Industries Association

The U.S. installed 7.5 GW of solar in 2015—an increase of 19% YoY. Solar is 1% of total energy generation, up from 0.1% just five years ago, and is projected to hit 3.5% by 2020. 2016 is expected to be a strong year for solar because of the rush of projects started before the Investment Tax Credit (ITC) extension. After the extension, some demand has shifted to 2017-18; however, a downward shift in demand is still anticipated during these years. The ITC was a major foundational policy for solar growth, but the tremendous drop in prices is the other part of the story—solar prices have dropped over 70% since 2006.

The U.S. is becoming a 50 state market for solar, with California making up almost half of the market. State-level policies have driven growth in other regions as well, including the Southwest and the Northeast. The CPP will drive an additional 20 GW of additional solar capacity by 2030, opening up solar markets in additional states, especially in the Midwest and Southeast.

Net metering, which requires utility companies to buy back excess electricity generated from solar installations at retail cost, was a prominent, but controversial, driver of PV installation in most states. Utilities were accused of pushing unrecovered costs onto customers who didn't have solar installations. States with high solar generation, such as Hawaii and New York, are transitioning away from net metering by focusing on distributed energy resources (DER), including storage and advanced renewable technologies, to help facilitate the switch to a smarter grid. However, in states where renewables are less than 1% of electricity generation, there is little need to move away from net metering as a way to jump start the local renewables industry.

## Oil / Coal

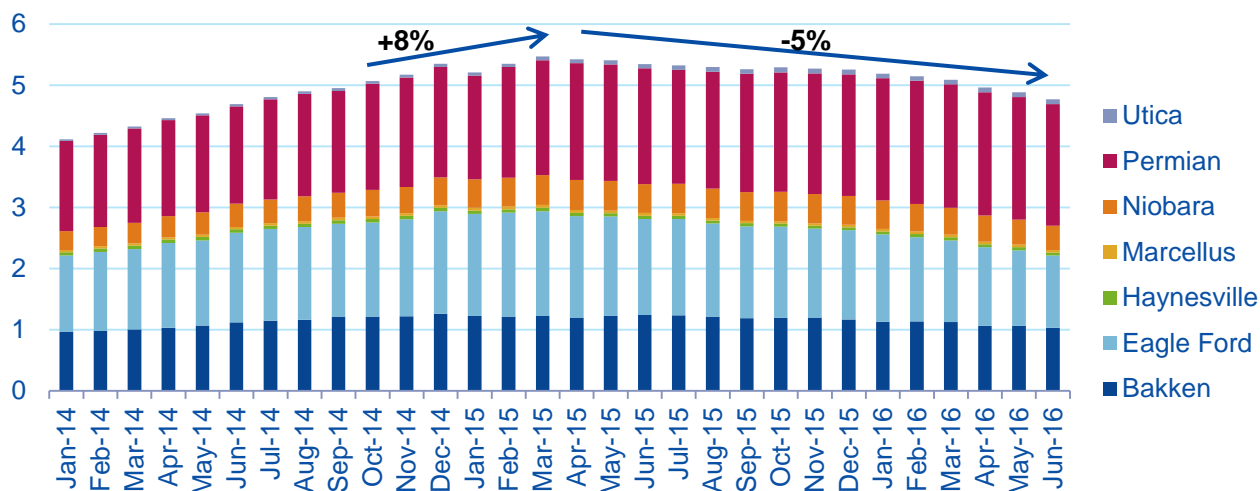
*“The oil market is becoming multi-polar for near-term balancing.”*  
- Jamie Webster, Columbia University Center for Global Energy Policy

**U.S.:** Shale is not a swing supplier, but rather a bridge between fast-moving storage and long-term projects. As a swing supplier, shale would need to have sufficient flexible volumes to counteract supply demand differences; however, despite growth, shale is still too small and slow on its own. For example, it took U.S. shale production nearly six months to halt growth after the price drop in late 2014.

On the other hand, storage has the potential to give the U.S. flexibility in the absence of a swing supplier. During the oil price drop, stock builds absorbed oversupply, with storage capacity up almost 90 mmb. There is increased energy security through storage diversity; however, many experts still believe that storage needs to be drawn down in order to balance the market.

Global E&P CAPEX underwent a record contraction in 2015—declining 25% or \$220B. In 2016, this contraction is projected to decrease 20%, with a marginal uptick in 2017. According to Rystad Energy, in order to deliver on long-term demand, prices need to be above \$70/bbl. Current prices are insufficient to incentivize steady-state levels of project sanctions, and further non-sanctioning of projects will happen towards 2018 and reduce global supply potential.

Chart 5  
Total New-Well Oil Production by Region  
Mmb/d



Source: EIA

**Developing countries:** China is the biggest market in terms of every power generation technology, including coal and natural gas. Because coal remains the cheapest, less developed regions in China, mainly inland, will continue to depend on coal, but coal demand in coastal areas has already peaked. The national peak for coal demand is expected to take place in the 2020s, as the economic transition and long-term restructuring make China less energy-intensive, lowering its energy demand trajectory. Carbon emissions in China should peak by 2028, with total emissions growing only 9% between 2015-28 because of slower economic growth. Between 2015 and 2020, half of Chinese power generation will come from non-fossil sources, supported by environmental and climate policies. The big question for China and other developing countries is where the financing for renewables will come from.

The EIA projects that India will be the world's second largest consumer of coal by 2030. Fossil fuels remain a major driver in Indian energy mix, with a 44% share. Gas is a recent entrant into the market, but no new gas-based plants have been permitted because of fuel availability issues. Domestic manufacturing of coal is strong, with import growth stabilizing, but most of the coal mined in India is low-grade, which encourages coal-dependent industries to import from the U.S. and South Africa. Industry expansion, in cement and steel for example, will also lead to more imports. In a twist of irony, growth in renewables in India is actually triggering more coal-based generation. Because solar remains expensive, providers bundle it with cheap coal to make a more attractive package.

## Bottom Line

Natural gas is a hot topic in the energy industry as it competes with renewable sources of energy. While current LNG supply outweighs demand, a supply shortfall is anticipated by the mid-2020s because of a steady increase in long-term demand. Although the U.S. energy mix is shifting away from coal, policies such as the CPP are instrumental in boosting the growth of renewables, particularly wind and solar. With the CPP, both gas and

renewables generation is expected to surpass coal by 2030; however, without the CPP, only gas does. Although the U.S. is projected to move towards natural gas and renewables for power generation, developing countries such as China and India will continue to depend on coal as a primary source of fuel for more time.

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