Payden&Rygel
POINT of VIEW
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Our Perspective on Issues Affecting Global Financial Markets

OIL'S OBSOLESCENCE AND THE BRIGHT FUTURE FOR ENERGY

The days of burning wood to provide our energy are no more. Today the world depends on fossil fuels to power our homes, drive our cars, and even wrap our children's sandwiches. But some think the era of fossil fuels is coming to an end as we harness new energy sources. Will solar power finally flip the switch on the world's energy landscape?

Oil's Obsolescence and the Bright Future for Energy

It allowed the industrial revolution to occur, created economic prosperity for billions and provided light to let us read in darkness while cruising 30,000 feet in the air. We carved up mountains and waged war for it. We are, of course, talking about energy. In one year the average individual in the US will use 90,000 kilowatt-hours of it. That is enough energy to watch TV non-stop for 100 years (a record many teenagers are keen to break) or toast 4.5 million slices of bread.[1]

Creating that energy has been one of humankind's largest projects. To generate the average American's annual energy use, one would have to either run 14 horses nonstop for a year, burn more than 19 tons of wood from their three acre forest, burn 47 tons of coal or burn 158 barrels of oil.[2]

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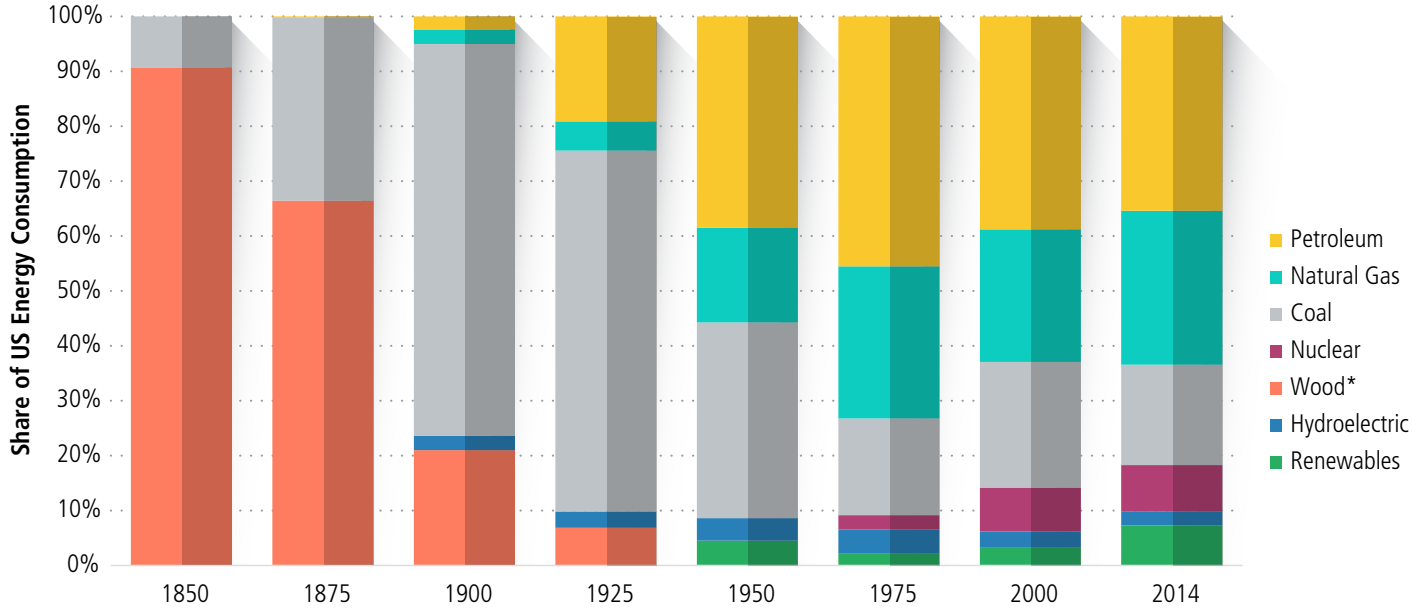
Today, we might be on the edge of discovering an alternative fuel source, one which burns all the time millions of miles away: the sun. After laying nearly enough oil and gas pipelines to make 4.5 trips to the moon and back[3], is it possible to find an alternative energy source? Could fossil fuels be replaced by solar panels? Could oil become obsolete?

A BRIEF HISTORY OF ENERGY

The history of energy use in the United States can be told in a few episodes. In antebellum America, wood was the primary energy source. The first major shift occurred during the industrial revolution as burning coal replaced wood and powered steam engines across the country (and across Europe and the UK). But as the world crept into the 20th century, the widespread use of the internal combustion engine meant that oil would replace coal as the energy source of choice.

Today, petroleum, natural gas, and coal provide more than 86% of the world's energy.[4] Such a strict dependence on these fuel sources (and questions about their environmental impact) have an army of scientists, engineers, and activists calling for a major transition in the way humans power their world. But if fossil fuels are so bad, why have they been the prominent source of energy for more than a century (see figure 1)?

fig. 1 WOOD YOU BELIEVE IT? US ENERGY CONSUMPTION BY SOURCE SINCE 1850



Source: US Energy Information Administration

*'Wood' category was discontinued in 1950 and is included in the 'Renewables' category since that time.

FOSSIL FUELS: THE GIFTS OF THE PAST

The massive amount of energy we use today is a gift from the living organisms that passed away millions of years ago. Their decaying remains created coal, oil, and natural gas, the fossil fuels that provide energy to an increasingly thirsty world. These fuels were relatively easy to extract, transport, and store and combusted easily to produce a spectacular amount of energy.

Oil allowed us to travel longer distances. The advent of oil drilling helped us avoid the near certain extinction of oil-producing fauna, whales and seals. Burning coal slowed the deforestation of the world. But what if we don't find a new source? What if the coal/oil revolution fails to give way to a more sustainable means of generating energy?

Long have humans feared the prospect of exhausting our natural, non-renewable resources. A 1922 US presidential commission pointed out that the "output of gas has begun to wane," and in 1977 President Jimmy Carter said that "we could use up all the proven reserves of oil in the entire world by the end of the next decade."[5] Yet human innovation continued to find new reserves while energy efficiency rose sharply.

«TODAY, PETROLEUM, NATURAL GAS, AND COAL PROVIDE MORE THAN 86% OF THE WORLD'S ENERGY»

For example, the boom in natural gas occurred because technological innovations (and high prices) made formerly inaccessible gas profitable to extract via drilling.

As we continued to diversify our energy sources, we were able to produce great amounts of energy with lower carbon dioxide emissions per unit of GDP. Our rate of growth outpaced the rate of emissions (see figure 2). However, this trend was not enough for the critics of fossil fuels. As voices on climate change became louder and oil prices reached historic highs, public perception shifted against fossil fuels. Scientists, policymakers, activists, and a growing number of private industrialists began to call for a transition to renewable energy. But is it as simple as building vast numbers of solar plants?

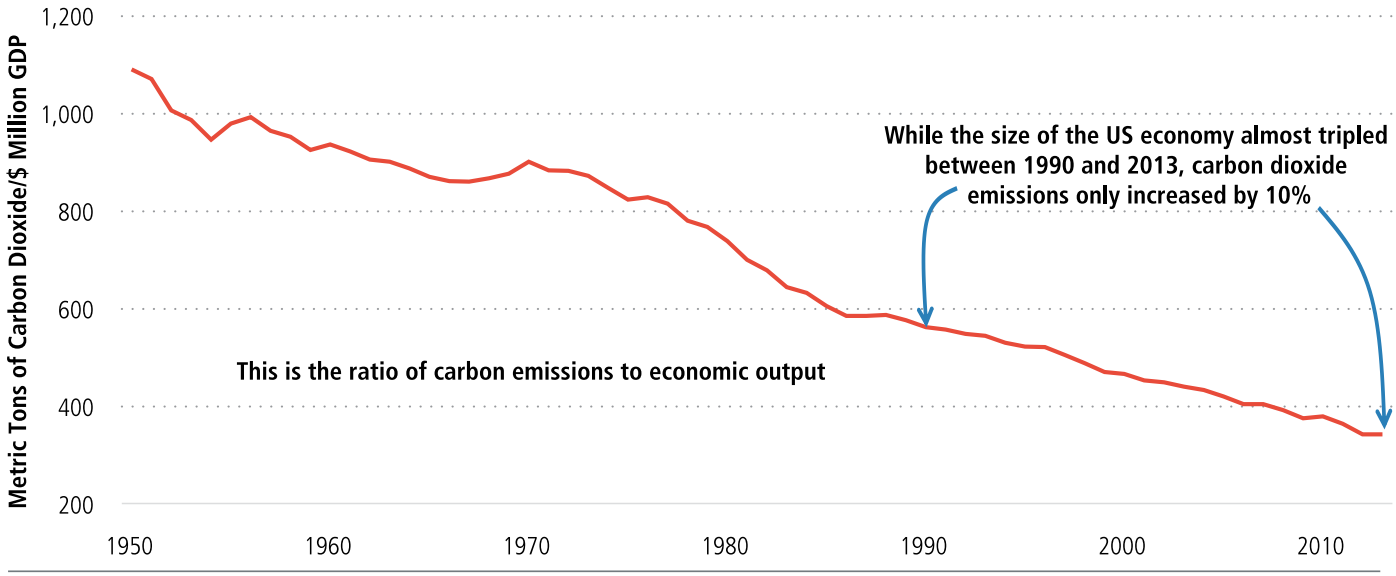
THE SUN ALSO RISES

As a clean, renewable source of energy, solar power is often envisioned as the next logical energy source. Consider the possibilities: if we could capture all the solar energy that strikes the state of Texas alone and convert it into electricity we would have 300 times the energy of all power plants around the world.[6] The issue is capturing all that energy without losing too much in the process.

This is where solar plants come into play. In the past few years, solar energy has become the fastest-growing energy source in the world. In fact, of all the new energy created in the US last year, one third was solar.[7]

Earlier this year, luxury electric car manufacturer Tesla made headlines when it released an industrial scale battery that fits in your garage. Who needs a home battery, you ask? You do–a home-battery unit can store energy from solar panels during the day and utilize the stored power to run your entire house at night.

fig. 2 THE CARBON INTENSITY OF THE US ECONOMY IS IMPROVING ALL THE TIME



Source: US Energy Information Administration, Environmental Protection Agency

BRINGING IT FROM THE SCIENCE LAB TO YOUR ROOFTOP

Transitioning to a new energy source for the world is not that simple. As a way to think about the switch, consider four factors critical to any energy transition in the context of solar.

First, the price of solar panels. The price of photovoltaic cells (the "panels") has dropped from around US$80/watt to US$0.65/watt (see figure 3). Yes, you read that right, it fell from 80 dollars to 65 cents. This can be largely attributed to greater panel and component supply from China. Supply in China was in turn driven by easy credit and government support, which spurred a solar manufacturing bubble and drove prices down as much as 40% in 2011 alone.[8]

Second, solar panels need to efficiently convert sunlight to energy - otherwise they cannot provide for the growing demand around the world. Current technology converts around 16% of sunlight into energy, but scientists argue that further research could bring that number up to 50%. Lower costs coupled with increased efficiency could eventually make solar as cheap as conventional sources of energy in use today.

Third, transitioning to solar requires significant help from the government. Subsidies have played a huge role in making residential solar power (the panels on your rooftop) cheaper. In fact, when you take away subsidies, residential solar is not even close to grid parity in any of the 50 US States. For larger solar plants, the levelized cost of energy, a measure that includes the cost of installation, is 10.5 cents per kilowatt-hour in California, a state with abundant sunlight and ideal conditions for solar panels. This is still higher than the cost of a natural gas power plant which does the job for 6.6 cents per kilowatt-hour.[9] As a result, any transition would require continued support from the government until innovation catches up.

Fourth, one must consider the issues of space and storage. Opponents of solar power often argue that solar power takes away too much land and does not work when the sun is not present. However, by just covering 4% of the world's deserts, or just the Gobi Desert in China, we could supply the world's entire electricity demand. We could then store that energy in batteries to use when the sun is not outside. (The great thing about the sun is that it has thus far always come back!)

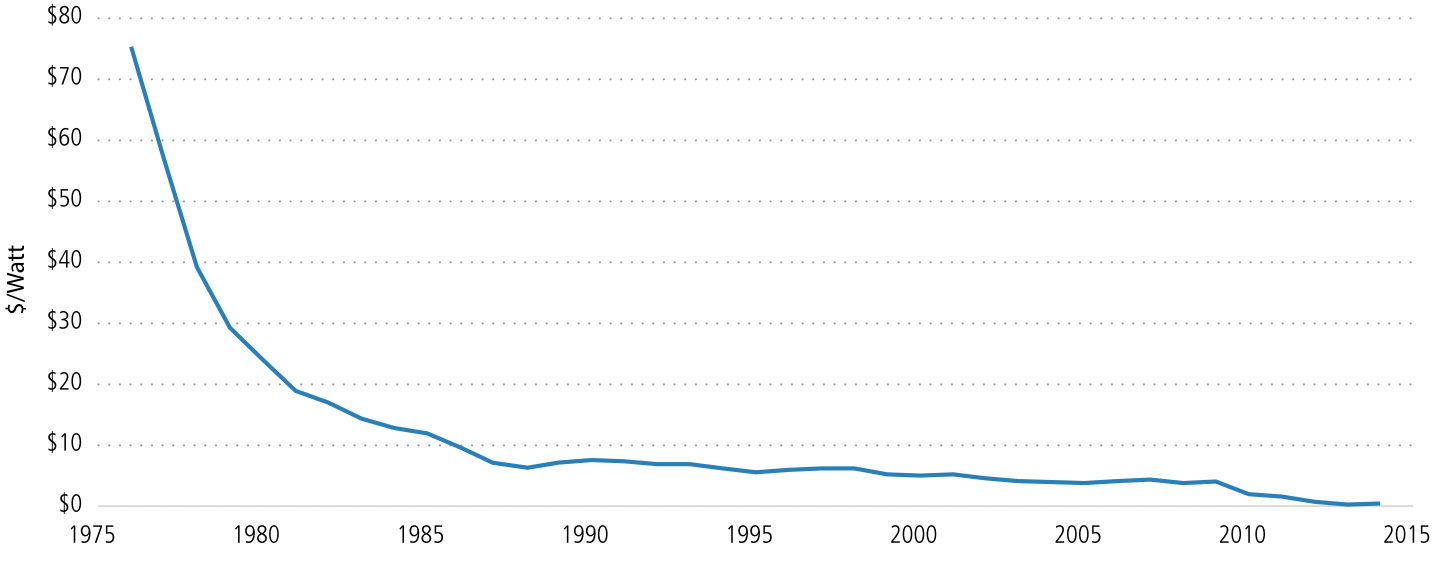
The future of battery innovation is bright, with the efficiency of batteries growing by 8% every year. As newer and more technology arrives in the marketplace, prices should drop while quality increases.[10]

If we are optimistic about technology and innovation driving this revolution ahead and addressing these four factors, are we ready for a transformation?

HOW RENEWABLE IS RENEWABLE?

People often overlook that the resources which go into producing solar panels and the batteries needed to store their energy might not be as unlimited as the sun. Silver is not unlimited, and mining for more silver for the numerous panels needed would replace the search for gas and oil reserves. Another "rare-earth" metal used in thin solar panels, tellurium, is three times rarer than gold. The main material in today's batteries is lithium. A majority of the lithium reserves in the world can be found in Bolivia and Chile. It remains to be seen whether or not sufficient quantities of recoverable lithium exist to make the batteries needed to store all the solar energy needed.[11]

fig. 3 SUN'S UP, PRICES DOWN FOR SOLAR PANELS



Source: Paul Maycock, Bloomberg New Energy Finance

Note: Prices inflation indexed to US PPI.

As a result of the scarcity of these basic battery materials, we might run into similar doomsday scenarios opponents of fossil fuels have been describing. That said, much of these resources can be recycled from old panels while oil and gas are not recyclable once used.

«IN 50 YEARS, WOOD LOST ITS DOMINANCE TO COAL. IN THE 50 YEARS FOLLOWING THAT, COAL LOST ITS DOMINANCE TO OIL AND GAS. LET'S SEE WHAT HAPPENS IN THE NEXT 50»

SO, WILL THIS TRANSITION OCCUR?

Energy transitions have happened in the past and they will happen again. But time and time again a new technology appears that is the "answer" to the world's thirst for energy. In the end, investments in alternative energy sources will be driven by demand for them and the return on investment they provide, not by social pressures.

Don't forget, it wasn't just the government that spent billions of dollars to set up power plants. The private sector, willing to take the risk on natural gas, fracking, and deep ocean oil drilling, spent that money. As innovation continues, do not be surprised if 50 years from now, you find yourself scoffing on the prospect of a new energy source we have not yet discovered replacing the solar panels around the world.

In 50 years, wood lost its dominance to coal. In the 50 years following that, coal lost its dominance to oil and gas. Let's see what happens in the next 50. In an energy-dependent global economy, the only constant is change.

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