What is the Carbon Ask?
It’s the reduction in wealth experienced by participants in the global fossil fuel enterprise as the result of strong policies to limit global warming.

We published our first estimates of the Carbon Ask in 2016 in the peer-reviewed Journal of Environment Studies and Sciences.¹ This update, which has not been peer-reviewed, uses virtually the same methodology but reflects more recent data.

Which fossil fuels are you talking about?
Oil, natural gas, and coal.

What is the global fossil fuel enterprise?
The enterprise comprises all governments, investors, firms, workers, and consumers involved in the exploration and production, transportation, refining, distribution, sale, and use of fossil fuels.

How big is the Carbon Ask?
We estimate the Ask at $233 trillion, about three times the annual value of the world’s production of all goods and services (i.e., global GDP).

How did you estimate the Carbon Ask?
The Ask is the difference between two values. We first compute the present value of fossil fuels at $314 trillion over the next 100 years (2019 to 2118) in a world not constrained by climate policy (our business-as-usual, or BAU, case).

We then re-compute this value assuming strong energy policies are in place to achieve the Paris Agreement, ensure universal access to modern energy, and make large reductions in other energy-related pollutants.² The Paris Agreement is intended to hold warming to well below 2° C above pre-industrial levels and aspires to hold the increase to less than 1.5° C. We estimate the global value of the fossil fuel enterprise in this scenario at $81 trillion.

The estimated Ask of $233 trillion is the difference between these two values.

Why is there such a big difference between the business-as-usual case and the policy case?
The Carbon Ask is driven by two, related, phenomena. First, a strong climate policy will reduce demand for fossil fuels; as a result, a smaller quantity will be sold over the next 100 years. Second, reduced demand will lead to lower prices for those fossil fuels that are sold. In short, both prices and quantities – and hence total revenues – will be lower in a policy-constrained world.

<table>
<thead>
<tr>
<th>2019 - 2118</th>
<th>Business as Usual</th>
<th>Sust Dev Scenario</th>
<th>Carbon Ask</th>
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<tbody>
<tr>
<td><strong>Oil</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Avg price/ barrel</td>
<td>$213</td>
<td>$60</td>
<td>-$153</td>
</tr>
<tr>
<td>Quantity (billion barrels)</td>
<td>5,343</td>
<td>1,373</td>
<td>-3,970</td>
</tr>
<tr>
<td><strong>Gas</strong></td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Avg price/ Mbtu</td>
<td>$14.03</td>
<td>$8.43</td>
<td>-$5.59</td>
</tr>
<tr>
<td>Quantity (trillion meters³)</td>
<td>760</td>
<td>404</td>
<td>-356</td>
</tr>
<tr>
<td><strong>Coal</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Avg price/ tonne</td>
<td>$130</td>
<td>$68</td>
<td>-$62</td>
</tr>
<tr>
<td>Quantity (giga-tonnes)</td>
<td>959</td>
<td>114</td>
<td>-845</td>
</tr>
</tbody>
</table>


² The International Energy Agency refers to this collection of polices as the Sustainable Development Scenario (SDS).
With a 100-year long period, the discount rate is very important. Right?

Absolutely. Available data suggest that about 91% of all fossil fuels are owned by governments, with the rest in private hands. We used a different discount rate for each. For government resources, we used a rate of 3% and for corporate resources, a rate of 9.5%. The blended rate is about 3.2%.

You can use the graph below to pick your favorite rate and figure out the size of the Carbon Ask. Even a discount rate of 6% yields a very large estimate of $75 trillion, or about one year of global GDP.

Is the Carbon Ask spread equally across the three major fossil fuels (oil, gas, and coal)?

No. The impact depends both on the projected price and quantity trajectories for each fuel and on the relative abundance of each of the three subsurface resources. For example, while 80% of the existing value of oil and of coal resources are lost to the Carbon Ask, in absolute terms, oil faces a much larger Ask ($170 trillion versus $20 trillion). And while natural gas incurs less than 20% of the Carbon Ask, more than half of the value of subsurface gas is lost to the Ask.

How can you possibly predict fossil fuel prices and quantities over the next 100 years?

We can’t. We’re not trying to omnisciently compute the “right” value of the Ask which, with hindsight in 2118, will match 100 years of history. We are interested in current politics, so we just have to be “right” about what key players think the value of the Ask is today and how climate policies affect their wellbeing. Like these stakeholders, we have no choice but to apply reasonable assumptions to available data.

What economic data did you use to estimate the Carbon Ask?

The forecast trajectories of prices and quantities of oil, natural gas, and coal come from the International Energy Agency’s 2017 World Energy Outlook. IEA projects these values from 2016 to 2040; we used simple straight-line extrapolation for prices and quantities from 2041 to 2118. (We also tried other methods for projecting prices and quantities through 2118, but they didn’t change our conclusions in any significant way.)

How did you figure out how much oil, natural gas, and coal remain underground?

Just to be clear, we didn’t collect any original information but used data from the 2017 World Energy Outlook which in turn relied on information from various sources such as the US Geological Survey (USGS) and the German Federal Institute for Geosciences and Natural Resources (BGR). We included conventional resources and unconventional resources (like shale gas and tight oil). We also looked at both proved reserves and estimates of resources that haven’t been developed yet, but could be recovered with today’s technologies.
Does your quantitative estimate capture the full magnitude of the Carbon Ask?

No. Due to data limitations, we monetize the Ask only for entities involved in the production of fossil fuels. We do not capture its impact on consumers.

$233 trillion is a huge number! What are its implications?

Common sense suggests that when the holders of this wealth are asked to surrender it for the greater good of the planet, they will have powerful incentives to resist a strong climate policy. To the extent they also hold political power, they may very well be able to stop or slow climate policy.

Aren’t big multinational companies like Exxon and BP wealthy enough to cope with a carbon-constrained world?

While the oil and gas majors are extraordinarily large, the global fossil fuel enterprise is much, much bigger than just these companies. In the United States alone, there are about 99,000 companies and over 2.2 million workers engaged in some aspect of the fossil fuel industry (and that doesn’t even include railroads or the tanker industry!). What’s more, like it or not, multinational companies have considerable clout. Measuring the threat to their economic interests created by the Carbon Ask thus helps us to understand climate politics.

What does the historical record show when it comes to technological transformations?

Decarbonization of the world’s economy will be a massive undertaking, but it is not unprecedented. The Industrial Revolution, the shift from horses and sailing ships to mechanized transport (trains, planes, automobiles, and container ships, for example), and the rapid growth of the Internet and mobile technologies, are just three examples of radical technological change experienced around the world.

So these historical examples prove that decarbonization is just a matter of time. Right?

Not so fast. Several studies – one looking back two centuries – have found that when new technologies threaten established economic and political interests, industry incumbents routinely exert power in the policymaking process to impede the diffusion of new technologies.

But, what about iPhones? They didn’t even exist until 2007 and now they’re everywhere! Why can’t it be the same for wind and solar?

What almost all successful new technologies have in common is that they were driven by their superiority in the marketplace. People didn’t replace their landlines and flip-phones with an iPhone because of government policy. They did so because of great new features and conveniences delivered at a price they deemed reasonable. Remember, electricity is just a commodity. Your refrigerator works the same with coal-fired electricity as it does with wind-generated electricity. Other than your concern for the environment, as a customer, you have no reason to prefer one type of electricity over another.

Government has already made great progress on air and water pollution, land conversation, and protection of the ozone layer. Why is climate policy so different?

We struggled to come up with examples of economic transformations that were at the same scale as global decarbonization and the result of intentional government action. Substantial environmental progress has taken place in the past few decades, but it’s not been at the same scale as a radical, worldwide shift in the global energy enterprise. While campaigns to reduce tobacco consumption seem to have been successful, the U.S. experiment with alcohol prohibition is widely viewed as failed policy. While a more thorough historical analysis might yield other cases of large, policy-driven economic transformation, it is important to appreciate the limited precedents for such actions.

Your study focuses on underground fossil fuel resources. Is there any evidence that such resources really make a difference when it comes to climate politics?

Though it only scratches the surface, our analysis of EPA’s Clean Power Plan (CPP) suggests that the answer is yes. Sixty-seven percent of the states with coal reserves have sued to block the CPP, while only 28% of states without reserves have joined the suit. In other words, fossil fuel interests have not confined their efforts to lobbying lawmakers and trying to influence the public, but also have activated the policy apparatus within government to take action on their behalf.
The plight of the shrinking U.S. coal industry is often in the news and was a major issue in the last election. Does your study shed light on the situation?

Keep in mind that our study was global in nature; we didn’t parse out the Carbon Ask across countries. But there is no doubt that a strong climate policy will undermine the coal industry. We estimate that the Carbon Ask for the global coal mining industry is about $20 trillion, which is a 80% reduction over the Business-as-Usual Case.

When it comes to the U.S., the bitter political fights in coal country are almost certainly a sign of things to come if and when climate policy starts to radically shrink other parts of the fossil fuel enterprise. After all, of the more than 2 million U.S. fossil fuel related jobs, “only” about 90,000 are in the coal mining industry.

What will it take to achieve decarbonization of the world’s economy?

Well, we don’t have a crystal ball but it seems like few things need to happen. First, carbon-free energy needs to become cheaper than carbon-based energy. If clean technologies can outcompete fossil fuel technologies in the marketplace, then strong economic forces may negate the political power of industry incumbents over the long run. A price on carbon and an end to fossil fuel subsidies would help level the playing field.

Second, as the clean-tech industry grows, we would expect its political influence to increase commensurately. We note that some politicians – who deny climate change – still support wind power because of its economic (and political) benefits back in their home districts. Politics can be a tough game, but there’s no reason to think that the clean-tech industry can’t play it as well as the fossil fuel industry does.

Finally, if strong climate policies do move forward, we should expect intense political resistance across all fossil fuel industries. Transitional assistance to workers, communities, and possibly even firms, could not only improve the welfare of those entities on the receiving end of the Carbon Ask, but might also temper political opposition to climate policy.

How does this update differ from your earlier work?

Please refer to our 2016 article in the Journal of Environmental Studies & Sciences for a detailed explanation of our methodology, original data sources, and prior results. Differences between this update and the 2016 article relate almost exclusively to data inputs; the methodology is virtually the same. Major differences in data inputs include:

- For this update, we used IEA’s new Sustainable Development Scenario, rather than its earlier 450 Scenario, to represent a stringent climate policy case. As in the original article, IEA’s Current Policy Scenario is characterized in this update as the “business-as-usual” case.
- We used price and quantity trajectories from IEA’s 2017 World Energy Outlook rather than from its 2015 Outlook.
- We also used the 2017 Outlook to update our estimates of subsurface resources. Oil resources are now estimated at 5,653 billion barrels (up 22% from the earlier estimate of 4,436 billion barrels), natural gas resources at 782 trillion cubic meters (up 92% from 465 trillion cubic meters), and coal at 8,934 metric gigatons (down 58% from 19,494 metric gigatons).
- Monetary estimates are now denominated in 2016 dollars, rather than 2014 dollars.
- A very small change in the weighted cost of capital for the fossil fuel industry raised the private sector discount rate from 9.4% to 9.5%.

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3 The original article (open access), as well as the electronic version of this update, can be downloaded at tsppa.gwu.edu/carbon-ask-article-updated.

4 IEA did not simulate the 450 Scenario as part of its 2017 World Energy Outlook.