

CONVERSATIONS

WITH BILL KRISTOL

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Guest: Mark Mills

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BILL KRISTOL: Hi, I'm Bill Kristol. Welcome back to CONVERSATIONS. I'm very pleased to be joined today by Mark Mills, experimental physicist and developmental engineer, senior fellow at the Manhattan Institute, faculty fellow at Northwestern University's McCormick School of Engineering and Applied Science. He's got a lot of experience in government and the private sector, and really one of our leading experts and scholars and analysts of energy policy, among other things.

So, author of a recent book that goes way beyond energy policy, *The Cloud Revolution: How the Convergence of New Technologies will Unleash the Next Economic Boom and the Roaring 2020s*. And I've talked with Mark enough to know that we should also do sometime, a separate conversation on science, technology, innovation, and a lot of other topics which are related to energy, but since energy is in the news and is important, I thought we would get the benefit of Mark's thoughts on, and analysis of, where we stand on energy and energy policy. So, Mark, thank you for joining me today.

MARK MILLS: Bill, thanks for having me on. I apologize in advance for my voice, which is still recovering from laryngitis, which I wish I could say was due to a night of hard cigar smoking and liquor, but it wasn't. It's just whatever's going around.

BILL KRISTOL: Screaming at the Green New Deal advocates on the one hand —

MARK MILLS: Or raging at the machine, as they say. I'll add one correction to your generous introduction. I used to be a useful person doing experimental physics and research invent stuff, back in the dawn of time at Canada's Bell labs. And I did semiconductor research, worked in a fab, I was a cold warrior of the classic kind. I worked on missile defense systems and anti-tank weapons, smart weapons, all that fun stuff. Then I got dragged into the energy debates in Canada, early in my career, working in uranium and nuclear energy stuff.

And so, I've lived a schizophrenic life ever since, of being fascinated by and writing about the two worlds; the world of what people called tech computing, cloud automation, and robots, great fun stuff, Twitter. And then the world of energy, which everybody thinks is disconnected. Of course, as a physicist, I'll say nothing exists — it's quasi-theological, it's actually anchored in physics —nothing exists, nothing, the universe, us, food, materials, transportation, everything involves understanding, supplying, and animating the inanimate world with energy. In fact, you could say energy is everything because you can create, destroy matter; you can't create, destroy energy. It's a law of physics.

BILL KRISTOL: No, fair enough. Even Twitter depends on energy.

MARK MILLS: A lot more than most people realize.

BILL KRISTOL: Yeah, that's funny. That's true. So, look, energy policy has been in the news a lot. Obviously, in many, many aspects of it now. In particular, I want to get to this on Ukraine and Russia, and Europe's dependence on Russia and how quickly that could change.

But I, at least, I'm naive, even pretty ignorant about this. So, let's begin with just some basic if it's okay.

Lay out some basic facts. Where do we, the US, where is the world, I guess Europe too, if you want, get our energy from? What's the breakdown of the basic sources of energy that make everything run, as you just said? How much is it? How fast is it changing?

And then we can get to sort of debunking various things and analyzing various things. And then I want to talk about national security implications and so forth, and what might happen in the future. But where do we stand? Where are we getting our energy from?

MARK MILLS: And of course, that's exactly the right trajectory. If you don't start with what exists, where we are, you can't reasonably figure out what you want to do different. And so, I mean, I always begin conversations, especially not just with students, but with boardroom or speeches, the large audiences or small ones, because, you have this impression, given what we read all the time, about the energy transition. It's accelerating, we're being told. And it's inevitable that we're not going to use hydrocarbons; oil, gas, coal. Okay. Timelines matter.

The state of a play is easy. The world gets 84% of all energy, for all purposes, from the hydrocarbons; oil, natural gas, and coal. And for a calibration —

BILL KRISTOL: How different is that 84% in the very developed world and the less developed world and so forth? What would the number for the US be, for example?

MARK MILLS: Well, the US is in the 80% range. And if you happen to live in Norway, it's different because they have a lot of hydro, dams, but they use a lot of natural gas and oil for other hydrocarbon purposes other than burning it, and heat for industrial production.

I think the important fact is, in most contexts, people are talking about changes for the world energy system, not to Gambia or just the Chinas or United States, but to the world. And so, the global energy infrastructure, which is what the International Energy Agency aspires to changing, overtly. It's not like a secret mission. So, the calibration that matters is, where were we 20 years ago, globally? And 20 years ago, 86% of the world's energy came from the hydrocarbons. So, roughly, five trillion dollars — Actually more than that, but let's just use the accepted number. Five trillion dollars of spending to avoid using hydrocarbons, has reduced the share of world energy from hydrocarbons by two percentage points over 20 years.

So, it's a very big system that's very difficult to change very quickly. If the rest of the bucket — So, where does it come from? Well, okay. Nuclear and hydro together, big part of it, twice as much energy from hydro powers, nuclear. And when you throw nuclear and hydro into the bucket with hydrocarbons, you're left with sort of 5 to 10% of energy from other stuff; a lot of wood, a lot of biomass, literally burned or consumed, including here. We convert food, corn, into ethanol, for which we could talk about the moral argument on that later. But we have lots of corn. We're good at growing corn, so whatever.

The wind and solar piece, which is the — I'll use an unkind modifier — the monomaniacal focus of the "energy transition," is essentially on wind and solar, and batteries. In fact, the IEA forecasts for energy transition are anchored in something like three-quarters of all the net new energy supply coming from wind, solar, and batteries. So, that's the focus and it's been the focus of much of the spending for well over a decade. So, about 3% of world energy today, after trillions of dollars, comes from wind and solar combined. Or for, again, a calibration point of the state of play, about twice as much energy in the world comes from burning wood —arguably, the oldest fuel source, other than animal labor — twice as much from burning wood than is from solar energy, globally. I mean solar electricity.

So, it's a big system. It's like moving a supertanker versus moving a speedboat. The analogies in physics terms is actually relevant, economic in social terms. The infrastructures are enormous. It takes a very long time to change them. The rhetoric won't move it. PowerPoint slides, as you said before, in other venues — You could put a PowerPoint out to show something, but you got to actually do physics things. You got to build machines, dig stuff up, install infrastructure, build power lines, build turbines, build motors, chemical refineries. Everything requires the same thing: lots and lots and lots of stuff.

BILL KRISTOL: So, even if we really aggressively and more effectively — This may not be policies you would think are worth it from a cost-benefit point of view, but if we decided to do solar and wind and nuclear, let's just say —

MARK MILLS: Let's throw it in. I like nukes.

BILL KRISTOL: — in a very big way, am I right to say that 10 years from now, or certainly, 5 years from now, probably 10 years from now, maybe 20 years from now, you're still going to be mostly dependent on hydrocarbons? There's just no practical possibility that this stuff can be ramped up fast enough. Is that right?

MARK MILLS: Absolutely. Right. So, when you say it or when I say it, one, you find a lot of responses, which we can talk about, but the reality is, the magnitude of the systems, the velocity with which we can build things, even with enthusiasm and a lot of money, subsidies, and taxes and mandates, is constrained just by how many backhoes you can build and deploy and how much labor you can put to work, how quickly. These things take time.

If I can sort of give a sense of velocity anchor in that, because, I thought about this a lot, and others have thought about — and are serious about, "Let's just go. Let's just push it hard." So, just as a calibration point, if we wanted, over the next couple of decades, to increase the amount of renewables, wind, solar, nuclear, so that they would replace hydrocarbons in just 20 years, which is a stated goal of many organizations and governments, so you'd have to have about a 9000% increase in the infrastructures of those systems, wind, solar, and batteries, in those 20 years. 9000% increase.

Okay, well, some things can increase that fast. So, for comparison, if you wind the clock back to roughly 1950, it's not that long ago, historically speaking, the world's oil and gas industry, in infrastructure mechanical energy terms, it was roughly equal to today's renewable wind, solar, battery industry, but the same size in terms of energy production and physical infrastructure. And it grew a lot. In fact, it grew by a thousand percent over 50 years, not from government subsidies because economies really liked the cheap energy that had a lot of density.

But anyway. So, growing from exactly the same physical infrastructure, energy production point, the world's hydrocarbon industry grew a thousand percent over a half a century. Now, we want to grow something from roughly the same size, nine times faster, in almost a third the time. And both of them involve exactly the same thing; lots of steel, lots of glass, lots of concrete, lots of backhoes and trucks and labor. There is no world — I mean, I'll go out on a limb. That is impossible. It would require a World War II level of effort on the part of every country, on a sustained basis for 20 years, and you probably still couldn't do it in terms [crosstalk].

BILL KRISTOL: And you impoverish all kinds of other things as a result because you'll be taking all the — Last, maybe factual question about the status quo, the oil, gas, coal, what's the rough breakdown of those within the hydrocarbon bucket?

MARK MILLS: Right. Well, they roughly divide in thirds. Coal is under the — Of global energy supplied, it's roughly like 40/40 oil and 40% of the bucket. 40.40. And it's not 30/30/30, but it's close, rough speaking. And the coal piece is actually increasing right now because what happens is, in the world where lots of natural gas increase came for electric generation because it got so cheap, people were able to switch off coal, not just because of climate mandates, it was affordable. As natural gas prices have soared in the last year, a lot of countries, notably China, India, Pakistan, a lot of Asian and South Asian countries have radically increased the coal burn. Even Europe, by the way, has increased its coal burn dramatically as gas prices have soared.

BILL KRISTOL: So, they're all still big chunks. Okay. So, let's get to Russia and Ukraine, which is so interesting, and the attempt of Europe, which I think is geo-strategically pretty important and pretty sound, I think, to be done to liberate themselves, if not thoroughly, at least much more from Russia. So, if you were back in the Reagan White House where you worked as a young scientist, and they call you and say, "Okay, Mr. Mills, you're the hardheaded guy who's dubious. You can't just snap your fingers and

make things change, but practically speaking, if Europe wants to maintain a modern economy and not go into massive recession for the next decade, and deal with the energy it needs, with maybe some conservation and all that — but that's going to be limited in its effect— is the system flexible enough, at least, that there are ways to substitute something else for Russian gas, basically, is what it comes down to, I guess? And what would that something be?"

MARK MILLS: Yeah. If I were still a kid in the White House Science Office, which is a great education, as you know, having served in a much more elevated position than my —

BILL KRISTOL: Not really, but yeah.

MARK MILLS: Than in my childhood, locked in a box, in the New Executive Office Building, not in the pinnacle, at the Old Executive Office building, which is — Anyway.

BILL KRISTOL: Still resentful about that, huh? [Laughter] Well, that's okay. At some point, you'll go back. They'll bring you back into the [inaudible].

MARK MILLS: Yeah, sure. Anyway, in another — It's like the alternative universe part. Anyway, we all gained baggage as we get older, and maybe the baggage prevents new things.

It's actually the right question to ask, obviously. And the question is being asked in the corridors of power around the world. Certainly, Putin is asking his people, what are they going to do? Because as you know, the overwhelming majority, something on over two-thirds of all the revenues that Russia gets from exporting goods, is oil and gas. And most of the rest are minerals that are used; nickel, copper, diamonds.

So, he's an export economy, he wants to know what could happen. Germany, they've asked. IEA has already issued a paper, of course, answering that question. And we would certainly ask it. And if you were thinking — And I hope the Biden administration has been doing this behind the scenes. I mean, I would do it quietly, not publicly. I mean, if I had any power, I would say these are the kinds of things you want to think through clearly, quietly. So, the answer is there's not much you can do in the short-term because the magnitude of dependencies. So, there's a box that's been built, courtesy of 20 years of — I'll use another unkind modifier — feckless energy policies on the part of both administrations and parties for 20 years.

BILL KRISTOL: And on the part of Europe itself, I suppose, right?

MARK MILLS: And both parties, whatever the parties are in power in Europe, 20 years is a long time. And they've now had 40% of their natural gas coming from Russia, a quarter of their oil from Russia. They cannot find that much new gas or oil from another source in months or —

BILL KRISTOL: So, that's Europe as a whole. Ballpark 40% and a quarter gas —

MARK MILLS: 40%. And Germany, it's 70% of natural gas and a third of all oil for Germany.

BILL KRISTOL: And we can't just turn some pipes up here in the US and get them to replace that 40%, 25%, pronto?

MARK MILLS: No. No prontos in infrastructure land, but there are differences of velocity. So, how many more batteries are built for cars? How quickly? How many more gas turbines get built quickly and increased the natural gas supply, more pipelines? So, these are answerable questions because they're engineering questions, not resource questions.

And the fastest velocity, they're already employing. Europe has already gone to Algeria and said, "Would you quit shipping more LNG to the world and pipe it to us?" Because the pipes that are being used are underutilized. So, what's going on now is you're looking at expanding the utilization of existing pipes and chips, and sort of rejiggering the world's system.

It is happening very fast, in fact. There's a great graph, an image. Ships are tracked always because of insurance, except Iranian oil ships, by the way, but that's a whole separate discussion. And an LNG carrier on its way from Texas, going through the Panama Canal, on its way to Asia — you can watch on the satellite tracking — reversed course, went back through the Panama Canal, and went to Europe last week, because, of a higher bid for gas in Europe to [inaudible]. So, what are the agents going to have to do? Well, if it was going to go to a power plant, they'll just buy more coal, which is what's going on. So, there's a trade —

BILL KRISTOL: From a strategic point of view, there's some liberation of Europe there for Russia.

MARK MILLS: Absolutely.

BILL KRISTOL: And how fast could that happen, I mean, if we all decided to? And what would be the key policy decisions to be able to help Europe supply. So, not be dependent. They presumably can't just drill and dig and build nuclear plants immediately there. So, it has to be partly from us or from others like Algeria and —

MARK MILLS: Exactly. Well, it does happen, already happened. That realignment happened, and it's — I'll pick a number. This is a shoot from the hip, honestly, but let's say 10% of the dependencies can be fixed and are already being fixed. Not 10% as points. 10%. So, Europe will go from 40% dependent to 36% dependent pretty quickly, probably almost already there, and could do the same for oil. Oil's easier, gas is much harder because you have to build big LNG, liquid natural gas, ships and you have to build big terminals and pipelines. And oil is one of the most fungible energy commodities on the planet. It's like literally like a dollar. It's no accident that the dollar is fungible. Benjamins are as fungible as a barrel of oil. It's just much easier.

That's happening very fast, but again, it's important to recognize that Russia is one of the three biggest oil and gas producers in the world. It's one of the largest exporters to the world, not just to Europe, and replacing that magnitude of supply is, as the Saudis have pointed out, as any energy expert will point out, is not possible in a short timeframe.

How fast could we do something? Well, in a year, you can do a lot of surging in the oil and gas realms, a lot. The cycle is kind of like planting wheat. If I wanted more wheat in a year, you got to wait for the growing cycle. You got to wait a year. You can't get a lot — And oil and gas are very similar. You have to spool up drilling. You have to hire people. Doesn't matter where the drilling would occur. They have to do more. You could take stuff out of storage as the Biden administration did, but that's very short term, and traders know that.

BILL KRISTOL: But a year isn't — that's not immediate, but a year, or two years, or three years is not nothing, right? Could we really radically increase gas and oil from here and elsewhere in a way that would take that instead of moving from 40 to 36% — I'm just making up these numbers, obviously, would get you to 25% or 18%, or a real fundamental almost change of —

MARK MILLS: The answer is no, you couldn't. My advice, if I were inside this administration or anyone, and I think you get the same advice from anybody in the oil and gas industry, similar to the solar wind. Doesn't matter what the industry is. If you wanted to really whack that dependence down a lot, there's not much you could do in a year substantively. It will take years, not a year. You could do a lot in several years, an awful lot, if you were to surge the construction of oil and gas.

You can't surge construction of wind, solar and batteries enough, which we can get onto, in a few years. It's sort of a five to 10-year surge as opposed to a two to three-year surge.

BILL KRISTOL: So, oil and gas is a two, three, four, five-year surge.

MARK MILLS: It's the ticket.

BILL KRISTOL: [crosstalk].

MARK MILLS: You want to replace Russian oil and gas? Yeah. You want to use somebody else's oil and gas. And the big impact though, would be a signal in politics and in commodity markets, signals that are real matter. If the United States were to say with Europe, but the United States in particular, we're the key to this because we are the biggest producer of both in the world right now. We still are.

BILL KRISTOL: Both oil and gas.

MARK MILLS: Oil and gas. We're the biggest producers in the world.

BILL KRISTOL: And we could be much bigger if we changed the environmental rules, and regulations, and permitting and so forth.

MARK MILLS: It could be bigger. Let's just say, "Speed them up," because speed — Warp speed them, to use now a tainted phrase. Back in the Star Trek days, we could use that word more generously.

But look, you know this, and commodity markets know this. If the United States said, "We're going to do an acceleration program to de-link Russia from oil and gas, and we're going to enact legislation to make it possible." And that legislation passed. Even though it would take several years for it to have substantive impact, it would change prices in months.

It wouldn't change the quantity of oil in months, but because these contracts that are engaged in globally are typically very long term, not on contracts, but decisions. If you're thinking about the price of oil two years from now, you're thinking about the supply demand ratio. And if you look at the state of play, but everybody knows the reason the price of oil is high, despite all the lip flapping about helping Europe, not much is going on to change the capacity of America to produce more.

Even as people are talking enthusiastically about what we can do in a parallel universe almost, the impediments to opening new pipelines is increasing, not decreasing, not universally. There's some green shoots, to use that expression, that maybe that'll change. But right now, there's no wholesale effort to improve and enhance the speed with which the American industry can produce oil and gas and ship it out of the country. And that's substantive.

BILL KRISTOL: If that price came down, that would, of course, to your strategic point of view, that weakens Russia, right? They're getting a ton of revenues from oil and gas. And if it costs half as much, they get roughly half as much.

MARK MILLS: Let's look at the inverse. If oil and gas are up over \$100 a barrel now compared to \$50, about a year ago. So, they're twice as high. And Russia was selling oil at \$50, then making a lot of money, been able to put a war chest in for the war they're fighting because oil was cheaper than that earlier. So, it's a lot of money flowing to them. Hundreds of billions of dollars. Oil goes to \$100 a barrel. It doubles their revenues. Gas has gone up more than that. So, it's tripled their revenues of natural gas.

Sanctions have caused them to have to sell that at a discount to countries that will take it like Pakistan, who have not sanctioned, and India, who have not sanctioned Russia. Let's say they have to do a discount of 50%. Let's do the arithmetic here. He's still getting the same amount of money he got pre-war.

And so, one of the big arguments I had over the decades on energy policy, including when we had arguments about ethanol accelerating more biofuels that were they and still are more expensive than gasoline. My argument was anything the United States does as a policy matter to implicitly or explicitly raise the cost of oil, because that's what that does, transfers wealth to people we don't want to give money to. Always does, always has, because it's a global market. And geopolitically, this is a really bad idea. And that's exactly what we're doing now by sending the signal that we're saying we're going to be serious about increasing oil and gas production, but we're actually not implementing anything. So, you see the prices stay high because of that.

BILL KRISTOL: And could we implement stuff — You said making the permitting more rapid. How much

of a fundamental change would it require? Would you have to throw environmental regulations to the winds and just give up on all notions of doing anything about keeping the country clean, and to say nothing of climate, trying to address climate change?

MARK MILLS: No.

BILL KRISTOL: Or would it require, obviously, some people on the green side wouldn't be happy about these changes, I assume. But what magnitude of sort of effect are we having on that side of things? Or is this really doable in a way that isn't like saying we're forgetting about the environment for 10 years?

MARK MILLS: Right. I would say, not some people on the green side. Based on evidence so far of the mere rhetorical exploration [crosstalk] possibility.

BILL KRISTOL: I have hopes for our green friends, Mark. You've dealt with them more over the years. I will give you that.

MARK MILLS: I have hopes for some of them because I've had Chatham House discussions with some of them where I —

BILL KRISTOL: In nuclear, you see some change maybe.

MARK MILLS: We see some change.

BILL KRISTOL: Anyway, I guess what I'm saying though, is how much of a radical change would this be? How much would it be just, you come out, let's just get the permits, and I'm making this up totally, in 150 days instead of 550 days?

MARK MILLS: Well, it's quite clearly the latter, and the data show it's the latter. What's happened is that the regulatory world has been cleanly bifurcated into two universes, which are conflated in the rhetoric and discussion about words like pollution and environment, be environmentally sensible. And they are all things, climate, and carbon dioxide and everything else. So, clean air, clean water.

There's nothing dirty about the air with carbon dioxide in it. It's a silly misnomer that carbon dioxide, not to go down a biochemical physics rat hole here, but it's what plants eat. It's their food. It's their fuel. So, it is a byproduct of combustion. Obviously, you burn carbon and oxygen, you get carbon dioxide. But plants eat carbon dioxide. It's what makes plants grow. Back in the day, we used to talk about not keeping plants in hospital rooms because people worried about somehow it was going to do something bad. No, they eat carbon dioxide.

Anyway, I digress. Look, there's two universes. The two universes are, could you accelerate permits and maintain all, all of the requirements that we have come to cherish properly for clean air, clean water? The things that environmental movements began around. Absolutely. In fact, every single oil executive, every single, including coal executive, but every oil and gas executive in the United States, these are not people who are looking to pillage the earth and have the smoke stacks of the Dickensian England of the 18th century and 19th century. What they would tell you is exactly what you said. It's clear we can meet all these right regulations. As difficult as many of them are, and demonstrate that we can and will meet them in permitting periods and instruction periods that are measured in weeks, not years.

It is also clear. And I'm not making this up because the environmental organizations that are climate hawks, we'll call them, write this, publish it and say it. They use a regulatory system to slow and stall oil and gas production specifically because of carbon dioxide, not because of nitrogen oxides, air pollution, or ozone, and smog, not because of clean water, but specifically, to impede this. And they are now saying specifically, publicly, it's not me saying this, that it would be a mistake. In fact, 250 scientists — They weren't all scientists. They were activists in the climate movement, sent a letter to Biden last week, to the president, saying it would be a huge "mistake" to double down on oil and gas production and export to Europe. It was because it would be very hard to undo that climate mistake once you build the LNG facilities, the export terminals, the extra tankers.

And they're right. It would be hard to undo it because once you have it, you're going to depend on it. Just like once they got the gas from Russia, they're dependent on it now. We want to shift it. So, they're right about that. And they're fighting it vigorously in the public space and the political space. But so, it's extremely important to keep in mind this clear bifurcation, this capture of the environmental regulations like carbon dioxide only —

BILL KRISTOL: So, the Chesapeake's not going to get dirtier, and the air in LA is not going to go back to where it was 40 years ago.

MARK MILLS: Correct.

BILL KRISTOL: Well, let's just finish up on this thing though, on the climate again. This is a question of magnitudes and philosophy. How much are you "giving away" on the climate front if you go with the "Mark Mills Marshall Plan" to accelerate a lot oil and gas here, partly to bring the price down worldwide and partly to Europe? What are we talking about? What kind of "setback" are we having, are we talking about in climate?

MARK MILLS: Well, that's obviously the right way to frame it because that's the real world. What are we "giving up" in carbon dioxide terms or hydrocarbon terms? And the Marshall Plan that you and I off channel talked about, which I will write about. In fact, I may call it the Marshall Plan. It will require those of a certain age to use Dr. Google to find out what the Marshall Plan was.

BILL KRISTOL: Let's call it the Mills Plan, the Mills Plan for — But the key intellectual thing for that is to overcome the reluctance to increase oil and gas structures, what it comes down to it, right?

MARK MILLS: Exactly.

BILL KRISTOL: And the initial response will be, "Oh my God, the climate." And what's your shorthand response to that?

MARK MILLS: Well, again, let's do two buckets. What we're trying to do is geopolitically de-link dependence on gas from Russia. Whatever path Europe was on to expand wind and solar, we're not proposing to stop. "You go, girls, keep it up." I disagree with it economically, and we're seeing some damage, but we don't have to have that argument. Just keep going.

What I want to do is de-link one for one, their oil and gas with our oil and gas, and maybe Australian gas and Saudi oil too, and cut our other allies in production, let's say. So, it's a one-to-one in that sense, which, look, let's be real here. Europe was building, and not going to sanction, increased use of Russian gas and Gazprom 2 pipeline. That's not going to happen now because of the Ukraine invasion. So, they are already on a path to use more natural gas from Russia, not less.

At a minimum, I would argue, we should at least give them that much gas from our gas fields. Why not close off Gazprom Pipeline One and give them that gas? So, it's one for one, first order.

Second order, if the United States, just to give you a calibration point of reducing our progress in "decarbonizing," just to give a sense of order of magnitude. If we were to decarbonize our electric grid with wind and solar, which I would just say, won't happen, isn't going to happen in terms of 100%. But if you were, and we burned nothing on the US electric grid to make electricity, and all of it came from unobtainium that had no upstream consequences in carbon dioxide, which doesn't exist, it would reduce global carbon dioxide emissions some 5% from today's level, and about 2%, key thing is about 2%, from the level that would exist in 10 or 20 years, by the time we decarbonize.

So, that progress is not meaningful, even though we've got this massive enthusiasm about doing it, if you look at the underlying arithmetic of the scales involved. And meanwhile, we're handing a geopolitical time bomb to the world that will get worse, not better, if we don't pick it up.

When someone says, "Well, we can't build a Keystone pipeline overnight." Because if you get more

Canadian oil from Canada, that would allow other countries like Europe to buy more Canadian oil. That's how the world works. You do these trades. In fact, you could build the pipeline — In fact, if you ask the Canadians right now, and I have, because I'm a Canadian and an American. But if you ask the Canadians right now, how long would it take to now build the pipeline? They had all the permits. They got permitted. Now, it's literally the stroke of the proverbial pen to say, "Oh, my bad, I'm sorry. Go ahead and build it." I'll bet they could build it in 12 to 18 months. That's fast. It's not a 10-year. If you said, "How long would it take to get that much energy from building a new windmills, solar power and batteries in Europe?" I guarantee you it's not 12 to 18 months.

BILL KRISTOL: So, the real short term and medium term, let's not say short-term, solution — if you want to solve for the problem of dependency, at least, and also, for prices — with oil and gas, is a big surge in oil and gas production, especially with permitting.

Say a word about fracking, which I think is such an interesting — I know little about, it's just a tiny bit, but been such an interesting development, wasn't really maybe expected, but whatever, over the last 10, 15 years. Is that sort of a model for how one can get more without, I think, paying a big price in terms of climate and really drive prices down and so forth? Or is that a one-off technology that happened, and that's not going to happen again?

MARK MILLS: Well, first, it's not a one-off technology. It's the arrival of a new, better way to extract oil and gas from what's called, geology terms, source rock. It's far vaster quantities of oil and gas mapped out a century ago by the geological survey. We know there's a lot there. A lot more can come from there. It's a technology play. Of course, all energy is a technology play, just fundamentally. We made a move to a technology a decade ago, that was years, years, and years, and years in development, frankly, decades in development. So, it's quite remarkable.

I think first, it is the perfect example, not only of what's possible in oil and gas fields, and not comparable in wind, solar, battery fields in terms of velocity, and velocity at the magnitude that we're talking about. As a calibration point, the increase in production of oil and gas in America, over roughly a 10-year period, which primarily overlapped the Obama administration —

Let me digress briefly. That phrase has an important political message in it. Primarily overlapped the Obama administration. If the Obama administration had decided that was a bad thing to do, which the environmentalist proposed they should stop, and acted on that to throw impediments up to that industry at its growth phases, instead of six years of slow growth, we would've had six years of recession, because the quantity of net new money flowing into the US economy from the shale revolution was measured in the several hundred billion dollars a year. It was enough to keep the United States in net positive growth territory all alone during those slow growth years. So, it was a big deal. The fact that he left it alone speaks volumes about, I think, I have no inside knowledge of this, internal 'real politic.'

You remember when Obama famously debated Mitt Romney, and took credit for the shale revolution, and Mitt Romney said it was a private sector? Well, both were correct. The private sector did it. The government didn't do it, which is the model that matters. It was private sector money, not subsidies, not gifts, not mandates. They just found a better way to make cheap oil and gas, and a lot of private money floated into it, and made a lot of money, and supplied more net new energy to the world at any time in human history. This is important. The rate and magnitude of growth of energy supply has never been matched in all of human history. The only thing that was close —

BILL KRISTOL: And that was primarily the shale revolution —

MARK MILLS: All shale. All shale.

BILL KRISTOL: I think people like me who don't know much about this kind of vague, they think, well, that's still, it's nice. That was interesting. It's kind of a small part of oil drilling or gas drilling, but that's not the case, right?

MARK MILLS: It's huge.

BILL KRISTOL: Like half of US oil and gas is now —

MARK MILLS: We were told we were running out of oil and gas for years, and as you know —

BILL KRISTOL: Right. Peak oil.

MARK MILLS: Peter Huber and I wrote a book called *The Bottomless Well* at the peak of the peak oil theory. Turns out we were right. It was nice to be right for the right reasons, but it wasn't hard to figure it out.

But anyway, the public discourse was silly. Shale, fracking is a word that's typical of engineers who create words that are scary. It's hydraulic fracturing of rock, using water pressure to fracture rock to release the oil and gas that's trapped in there. And you do the fracturing using pressure, water under high pressure from pumps.

Anyway, that doubled American oil and gas production. It added more oil production to the world than any other country except Saudi Arabia and Russia. It added twice as much oil production as Iran had going. And it added three times the oil production than all of Canada's oil production. It added more gas production than Russia produces now. It is massive increases in quantities. Earth shaking moves in energy in terms of geopolitics. It collapsed the price of oil and gas globally.

It's what inspired the Russians and the Saudis to co-conspire in 2014 to discipline the oil and gas industry in America by deliberately increasing production. Colluding publicly, I mean, it wasn't secret, to increase production when the world was already oversupplied, they supplied more to the world to push the prices down, to discipline the American shale industry. And it worked. Prices collapsed. A third of American oil and gas producers went bankrupt because of that over the next year. Prices went from \$140 a barrel back down to the \$20s within a year. So it worked. And they did that because of the geopolitical and economic consequences of the shale revolution.

So if you ask, is it consequential? Impossible, whether you're an environmentalist or not, to ignore the consequence. Their view would be it added too much more oil and gas to the world in terms of carbon dioxide, making it easier for the world to have cheap oil and gas. Okay. But it did.

If you're looking at geopolitics and the economy, it was consequential. If the United States announced a Marshall Plan anchored in trying to replicate that scale in the coming decade, it took 10 years. It didn't take 10 months. But the act of doing it pushed prices down just when it began. If we announced that we're going to do that again, within the decade, to use another political phrase, double American oil and gas production from the shale fields, it would push prices down today, because markets look at the future to price supplies today. And it would be geopolitically consequential.

BILL KRISTOL: And it could happen. I mean, there's no [crosstalk]

MARK MILLS: Technically, it could happen.

BILL KRISTOL: Yeah. Technically.

MARK MILLS: Well, let's be fair to the CEOs and the public companies that have to defend what I just said, because I don't run an oil and gas company. They will say, "Well wait, wait, wait Mark. Back off here, you're getting out over your skis. You're being kind of enthusiastic about how hard this is. We need a lot more labor. Labor is short now, it's never been shorter in American industrial sector. Our labor force is aging out because famously the industrial sector, all of it, oil and gas, manufacturing, have this silver tsunami of people of a certain age retiring. [inaudible] enough of this. And we have headwinds in the governance on the investment community saying, I'm not so enthusiastic, because I'm worried about the government punishing you as an oil and gas producer."

So they would say, "It's harder than you think, Mills. Back off this, you're getting out over your skis promising production.: They told me that by the way, when Peter and I wrote our book, and said we

would become an oil exporter and a gas exporter, and I testified as much before the Senate and House. They said, "That's not going to happen. It's too hard." I have much more faith in American entrepreneurs.

But I do want to caution that the velocities still are in timeframes of the physical production. They're rather slow from an absolute perspective. And that means that Putin knows what I just said as well.

We could turn off the supply. You could simply say, we're not going to take it and try to sanction like we did with Iran. Okay?

BILL KRISTOL: Right.

MARK MILLS: So Iran though, still sold oil illegally. And has ever since that embargo. Their oil exports publicly are down more than 50% over the embargo period, which is still in place. I think they actually sell more, but they have to sell at a discount. So Putin would still sell oil, but in at very, very deep discount. Still get money, it's just impossible to hide the barrels perfectly. But it would be as geopolitically consequential, more consequential than anything else we could do. And I hope that we do something like that in the coming months and years as Europe wrestles with what they can really do.

And the IEA plan, let me give you an idea of how — I don't want to say silly, but I just said silly — wishful thinking the IEA's plan is to eliminate half of the dependency of oil and gas from Russia. Half. Their plan, which is a very, very aggressive plan, half of their plan is anchored in what energy efficiency, more rapidly becoming more efficient. Come on. You're going to replace all the car fleet, it's going to be twice as efficient in a couple of years? No, you're going to make all the buildings twice as efficient in a couple years? No.

And worse than that, when you improve energy efficiency, this is economics 101, it makes the end product cheaper. If you make the input consumption go down by two, double efficiency, that means the output is cheaper. So unless you mandate the output to stay the same price, the market will use more of the thing for almost everything except the elastic commodities that don't move, like tobacco and leather.

So it's a very embarrassing response in many ways. So something that's extraordinarily serious, while there's carnage going on. And we see it in the daily news feeds, tanks rolling through cities and bombardments of modern European cities. We're on the other hand saying things that are sophomoric, and come on, Putin knows that these are sophomoric virtue signals.

BILL KRISTOL: Well, they're not serious. Yeah. So could there be an addition to the Marshall Plan, to use just another example from that era, a Manhattan Project where somehow there's really a technological breakthrough that really changes everything? It could be nuclear itself, of course, but how much are we being, what are the odds or what are the — You never know ahead of time, I suppose, but for a real game changer, so to speak, a moonshot, whatever metaphor people like that really would change energy in one of these areas or another?

MARK MILLS: Yeah, well, there's an easy way to produce it. And it sounds facetious. I mean, there's the no moonshot for energy, and there's no Manhattan Project for energy. There's a Manhattan Project for nuclear power plants, but that doesn't change the energy infrastructure of the world in —

BILL KRISTOL: Yeah, on the nuclear thing, that some of my conservative friends are more nuclear for, they're against the solar stuff, they're all skeptical about windmills, Trump hates windmills, but on the nuclear, if you wet full bore on nuclear, let's just say we resolve the safety issues, the waste issues. We just think this is — France is whatever they said, 70% nuclear, why can't everyone? What timeframe and what dent would one make if one went big with subsidies and insurance guarantees and all the other things that I take it would be necessary to do nuclear?

MARK MILLS: Yeah, you'd need an awful lot of subsidies and guarantees. So to depoliticize, because to your point, windmills and nuclear plants get politicized. Oil gets politicized, and has for a very long time, even more so in the era of climate anxieties and debates. And I like windmills. In fact, a lot of people don't like what they look like. I've been at wind farms in China that stretch to the horizon. I think they're

incredibly magnificent feats of engineering. Solar energy is phenomenologically, fascinating. Tesla, Elon Musk has done something nobody has done in a century, built a car company. And the subsidies can't explain it. You can't explain the whole success just from some subsidies. He's built a car company of consequence, nobody's able been able to do in almost a century. So for me, it's never been political. I like all the energy sources.

In fact, again, I'll use Obama as the example, when he used the politically brilliant phrase, he wanted to support "all of the above." "We're going to need all the above to fuel the world of the future." But the moonshot [crosstalk]

BILL KRISTOL: But what's the magnitude of those parts of the all of the above? Not so great, is what you're saying really.

MARK MILLS: They're in the noise. And the problem is both scale and framing. The framing problem, let's do a moonshot for green energy. A moonshot was \$200 billion in today's money and put 12 men on the moon, took a decade. To change the world's energy system will take \$200 trillion. I mean, the energy system is not like putting 12 men on the moon, or women, if you like. It's like putting all of humanity on the moon permanently, not just as a stunt to show that we have this great engineering capability. So you can't moonshot this stuff. It's —

BILL KRISTOL: The moonshot, I've always, just to interject, it always struck me is a very bad analogy, a very bad metaphor. Because the truth about the moonshot is we put 12 men on the moon, and then didn't go back for 40, 50 years. It's not obvious how much difference the moonshot made in terms of actual scientific progress, right? So it —

MARK MILLS: Well —

BILL KRISTOL: Maybe there were some good externalities and spinoffs, I'm just saying it's a funny kind of — The Manhattan Project did produce actual nuclear weapons, so that's —

MARK MILLS: Well, that's a better analogy, and it's sort of out a vogue lately because it produced nuclear weapon, and derivatively — And it wasn't derivative, by the way. The development of a nuclear weapon wasn't how we got to commercial nuclear energy. But you're absolutely right, and we could have a conversation about technology in another episode. The moonshot did a lot more than people realized, but not quite what people thought. The externality on that were people like me who was a space program junkie. As a kid, I loved physics. I loved space travel, it got wired into me pre-moonshot because I'm of a certain age. And the United States graduated more engineers and scientists in that decade than anytime before or since. And you know where they went? Because they couldn't all get jobs in NASA, they went to Silicon Valley. And they invented the revolution we have.

BILL KRISTOL: No, I take that point, and I've always been pro R&D. If you think of it as a broader R&D investment, it's —

MARK MILLS: But you don't know where it's going to go. And that's the same true today.

BILL KRISTOL: But even on nuclear, just to finish up on nuclear, so if we did the Manhattan Project on nuclear power plants, we all want to be France, we're all going to just build, how much of a delta, how much of a change does that make, even if you invest a huge amount in subsidies and guarantees? It sounds to me like you're saying it's still going to be a small part of the overall.

MARK MILLS: It will be. But first, let's just stipulate. You're absolutely right, it's a better analogy and it's a more doable framing, because what you really want to get is a next generation class of nuclear power plant that's smaller, cheaper, faster to build. So it's an engineering challenge, not a physics challenge. And it's not a scale challenge, the scale part comes later. Once you come up with a better design, and there's about a dozen really good new classes of designs. And this is by the way where government can have a role. If I want to speed some stuff up, I have to think about where I could accelerate or remove impediments, which are often regulatory, in all kinds of domains.

But let's just do the thought experiment. We do the moonshot and in a couple of years, a year or two, because it takes time, not just to appropriate the money. Let's assume we appropriate it tomorrow. You've got to issue the contracts, build the things, test them. Let's say we got it done in a couple years. We're testing a dozen new, two dozen new reactor designs, have a competition. And then you have to qualify they really work as billed, that takes usually five years. But let's just say you it's like building new airplanes. Another few years of testing qualification. These are big machines, they're serious, they have a lot of energy, have serious consequences if they don't work right. And then five years from now, we have a proven new design, and you start scaling it. And over the next five years you start building them. So we're a decade out from inserting into market.

And what we're impacting is the electricity generation market. And let's say it takes half of the entire electricity generating market, which is the track natural gas is going on right now. In the United States, it's about a third to 40%, depending on any given day in price. But let's say a third in America. That's where the world was migrating for natural gas. And that was a good thing, because maybe another third could be wind and solar and nuclear. But you got half, you're you're taking away about a quarter of the world's energy. So half of the quarter of the world's energy, you've decarbonized 12% of the world's energy system.

And 10 years from now, the world is using another United States worth of energy demand, greater than it does today. And a lot of that's going to be oil and gas because we need the petrochemicals. We need to use gas to make that glass to make the solar panels. We need to use oil to make the hydrocarbons to make the fiberglass blades for the wind turbines. We need to use all that combustion energy to make steel and to make the aluminum. So we still use more, and we don't get the proverbial transition. You get more of everything. You get all of the above.

But on a micro level, a Manhattan Project to find technologies that could more rapidly liquefy natural gas, let's say, make that cheaper. If I could get natural gas liquified cheaper, that's the most expensive part of getting gas to Europe from America. If we produce it for two bucks, let's say, two bucks a unit, whatever the measurement it is, it costs another two bucks a unit to make it into a liquid. And then it costs another buck or two to ship it. So the two bucks in America shows up at six bucks in Europe, which is still cheaper than what they were paying before, which was 10. Gas probably lowered its price to five and a half, kept market share. If we could cut the liquefaction and shipping cost by a buck each with a Manhattan Project in those technologies and get that done in a couple years, that'd be more consequential in many ways.

Similarly, what if we had a moonshot in internal combustion engines? The vilified internal combustion engine is a matter of physics reality. There's more headroom to get more efficiency out of the internal combustion engine in the basic thermodynamics of those engines than there is headroom to improve the efficiency of a Tesla.

BILL KRISTOL: Yeah, that's interesting. I've, yeah.

MARK MILLS: And so I get more bang for the buck.

BILL KRISTOL: So go from 40 miles per gallon to 50 or 60, and you're saving a ton of — Yeah.

MARK MILLS: And if you want to wave a pen and have impact on carbon dioxide emissions, instead of giving people \$15,000 to buy a car with a half ton battery that's made somewhere else, all the stuff is made somewhere else, you assembled it here. So the fiction on this building factories here, all the stuff is being sent here. All the jobs are being exported. But if I gave people 10 or \$15,000 to buy the most efficient internal combustion engine possible, that would reduce oil consumption and carbon dioxide emissions by five to tenfold more than EV subsidies twice as fast.

Now we're not doing, if we were serious about carbon dioxide emissions, high velocity, that's what we would do. We're not doing that, because we're spinning a fiction that there's some zero emissions future is possible, with all this net zero language. It's really unfortunate, because we could have a big impact if we really wanted.

And you're splitting the difference politically. As you know, the horse trading one does with this is obvious. Let's use that as the example, I'm not going to take away your electric vehicle subsidy. Let's just give me a coequal subsidy for a comparable impact on hydrocarbon consumption on the internal combustion engine side. Just give me the same thing. Let's just do a trade.

BILL KRISTOL: Trade in your crummy old car for a new one that is twice as efficient.

MARK MILLS: Or I'm not going to ask you to trade in. I'm going to say when you are ready to buy one —

BILL KRISTOL: Whatever. Yeah, yeah.

MARK MILLS: I'll write you a check for 10 grand. That's the kind of money we're spending right now to get people into electric vehicles, which by the way, won't end well, because the supply chain there is more difficult and more expensive and more environmentally damaging and more geopolitically challenging than anything to do with oil and gas. That's the story that's slowly emerging, and that will be the full stop to this nonsense.

BILL KRISTOL: It speaks, you mentioned supply chain, that's a whole other conversation, but just take a minute on how worried should one be about supply chain issues in terms of what we've been talking about?

MARK MILLS: Well, we should be worried about the supply chain. There's a lot of writing about the supply chain. IMF has written about it, the Fed writes, everybody. Supply chains always matter. This is self evident. And it's in fact impossible to de-link ourselves from global supply chain.

BILL KRISTOL: Right.

MARK MILLS: And that's a good thing, because there's a reason we have global trade. So I'm pro-trade. And I'm also for fair trade. I mean, whatever the politicized words come — It actually matters how we put our finger on the scale of how we trade without having grotesque asymmetries and subsidies that distort things and suck our jobs away from here to foreign lands. We don't need to do that kind of stuff.

So let's look at the mechanics and economics and physics of supply chains. Supply chains have become more complex. Of course, they have, because we build more complex things and we have more countries making more stuff. We consume more things that are more complicated.

So a car used to be made from a handful of mineral elements. Maybe seven different kinds of minerals. Now cars are made from about almost the entire periodic table. 80 different minerals and elements go in to making a car, nevermind a computer. And those supply chains and who does all this stuff are really important. So we should be very worried about it because we've been sort of lax in thinking about the exposures, economic exposures, political exposures. And a lot of people are paying attention to, just in time, to just in case. From things like COVID or political events like Ukraine. They're both co-equal in impact in terms of wake up. And it's going to be a mess that we can fix.

I'm going to pitch my book again because in *The Cloud Revolution*, what I write about is something that we can do different than any time in history. Throughout history, we would fix our supply chains by changing suppliers, adding diversity. One of the most important ways to fix supply chains is to know more about what's going on. Having information transparency. The information transparency that sensors in the "internet of things", and the cloud brings, to the relationship between consumers and producers and all the middlemen. That transparency and knowledge and security is made possible in ways that are inexpensive, easy, and important, that are unparalleled in history. And I think now, get accelerated. Which will both improve security and reduce costs.

And it'll take a little time. Industries are adopting them. That, by the way, if you want to talk about velocity, that's going to happen faster. That'll happen faster than anything else we've talked about. Because it's sort of a layer on top. I'm not going to change the ships. I'm just going to know more about where they are. I'm not going to change the containers. I want to know more about where they are and how I can —

I'm not going to change my relationships, so much more as have a heads up when there's a risk of the supply not being available because of a local event.

BILL KRISTOL: Interesting. So that could happen fast — And that is happening very —

MARK MILLS: Happening very fast.

BILL KRISTOL: Yeah. Yeah. So you get less problems by some change, like the Suez Canal getting blocked, or something like that, or whatever.

MARK MILLS: Well, that'll never change. You'll just know about it sooner.

BILL KRISTOL: Yeah. Well, but that's important. Right? Because then you would adjust —

MARK MILLS: Exactly. Exactly

BILL KRISTOL: — your contracts and your purchases and so forth.

MARK MILLS: Exactly.

BILL KRISTOL: So this has been great for me. Very informative discussion. I mean, I should come away from this being more hardheaded and realistic about how much things can change or really won't change, I'll put it that way, over the near and medium term.

But also, I kind of feel more optimistic that with sensible policies — Let's just bracket what the odds of those are. But I mean, let's assume it's not beyond the wit of man to, and woman, to come up with reasonable policies and trade-offs here, and maybe in other countries. A lot of this is more manageable than one would've thought. I mean, we really could change the relationship with Russia. We really could produce a lot more oil and gas without massively negative climate consequences, which presumably, could be handled in other ways —

MARK MILLS: Yeah, yeah.

BILL KRISTOL: — down the road too. And we could do nuclear and so forth, and not quite as fast as people hope. But I don't know. Looking out, the energy prospects are not bleak if we have sensible policies. Is that right?

MARK MILLS: Yeah. You framed it exactly right. I mean, if we're realistic about where the world state is today, then you'd be pessimistic if you believed in these magical thinking, quick fixes. By quick, I mean in weeks and months, in a year, and that we can magically do all these things about decarbonizing, to use that phrase, energy transition. So you'll be very depressed at my message if you really believe that stuff. You become pessimistic.

But if you're on the other side and you want to look at not what's politically possible, because I think that politics ultimately will bend to the reality. A lot of pain along the way. We'll probably have to suffer more pain, I think, financially with inflation, energy and energy driven inflation, to really hammer home, "We better do something different." But I am more optimistic now about our capacity to do something to de-link the world from Russian dependency than any time in recent history. It's a profoundly different situation. And it's driven by both technology and the technological capacity of the American industries. And not just the oil and gas industries, but the technologies that sit on top of it, the computing and communications supply chain that we —

BILL KRISTOL: I mean, we wouldn't just fall — It sounds like what you're saying. We wouldn't just fall into Chinese or Saudi dependency either, necessarily. Not that we would cut off —

MARK MILLS: Well, that's what —

BILL KRISTOL: Not that we would cut off trade or anything, but I'm just saying that you're not simply replacing one dependency on one autocratic regime with another. And that we actually can do a lot here.

MARK MILLS: Well, a lot of what's going on would replace the dependencies from one regime to another. So the Saudis are eager and Qatar is — To step up. And I'm not making the judgment on Saudi Arabia or Qatar —

BILL KRISTOL: Yeah, well, that's okay if it works for the short time or at least —

MARK MILLS: But we've spent 40 years talking about dependency on the Middle East. And most of the plans that are being talked about today are actually moving to more dependency on the Middle East. So we don't have a path to de-link the Middle East's role in the world energy, because we can't de-link oil and gas role in the world energy, maybe for half a century to a century.

But in terms of geopolitical dependence on places that are really demonstrated to be very bad places to depend on, we could do things very quickly, in concert with, Middle East nations, and in concert with Canada and United States — sorry, Australia. But we would be the anchor. We're the big dog in this that you see, that old expression. And we could be very optimistic about what we could do if we had the political will.

But it will take a lot of horse trading and political will to thread that needle. To do, I'll say my Marshall Plan again, we could do the Marshall Plan and it would actually happen faster than the original Marshall Plan to rebuild — Well, this is rebuilding Europe, to use another phrase that's political. We could "build Europe back better," in terms of its energy dependencies, if we gave them a lot more oil and gas.

BILL KRISTOL: That's good. I like that. And it sets the key intellectual part from just being intelligent about economics and physics and so forth, which is not a little thing. I mean, it seems that the key intellectual hurdle that you are saying people have to get over is the notion that we are, in the short term, going to be less — Are going to be, or should be, less dependent on oil and gas. I mean, we need to say, "Look, we're in an oil and gas world, at least for the foreseeable future. And it's either going to be an oil and gas world with the \$120 oil and Russia being strong and Europe being dependent on Russia. Or an oil and gas world with cheaper oil and gas and the US doing a heck of a lot more exporting and so forth." That's the key thing people just need to be willing to say, or at least act on, even if they can't quite say it. But —

MARK MILLS: A lot of people won't be able to say it. But they have to act on that reality. And let's just put a little bow on that. The money that is freed up for society in the \$50 world versus the \$150 barrel oil world will be used, not should be directed by government, put their finger on the scale with carbon taxes and silly things like that. Because that just re-raises costs. But that will be used to do this other stuff, because the wealthier world will buy more Teslas. They will want more solar power. People are locked into this, it's fine. But it takes a wealthier world to do that. So the wealthy nations will do a lot more of that if they have a lot more wealth.

The poorer nations want cheap oil to get wealthier, and that's the moral transition. And you get the two-fer. We get both. And that's the political trade that we're not making yet because of the hard-over narrative that we have to abandon oil and gas. That's a talking point, it's not possible in the real world and profoundly destructive talking point if acted on economically, geopolitically, and morally.

BILL KRISTOL: Now, that's a very important, I think, conclusion. Maybe it's a good place to end. I mean, this vision is not a, "Oh, we've got to take our medicine and eat our greens and sort of suck it up. We just have to live with oil and gas for longer than you'd like." I mean, there's some of that, maybe.

MARK MILLS: Yeah.

BILL KRISTOL: But it's also actually a future that's wealthier, cleaner, I think. Right?

MARK MILLS: Yeah, absolutely.

BILL KRISTOL: Better for poor nations and for poor people in rich nations, et cetera. We shouldn't have the attitude of, "This is a thing we have to endure." It's really an opportunity, if we seize it.

MARK MILLS: Well, that's exactly what the realistic and collaterally optimistic view of the world is. And it leaves begging the question of, well, surely we could do something really different in the long run? And the answer to that would be, of course, we can. And the answer to this, "surely something would be different," will be when we discover foundationally different new technologies and new science, which can happen.

But as Microsoft has pointed out in their climate pledge at their website, and it's a great line and they repeat it twice. I've said it earlier, I'll say it again, but I'm delighted that Microsoft has, at least as of this conversation, their climate pledge, that the kind of technologies people imagine to having a hydrocarbon free world, and the direct quote, "don't exist today." Not that they need more subsidies. They don't exist today for this transition.

And that doesn't mean it couldn't exist. It's that we're going to find them through the very politically annoying process of having confidence in lots more support and funding for the very basic sciences and research that are not directed to a specific outcome. The serendipity piece is annoying as hell to policy makers and politicians. They don't like that I can't order the perfect new solution because they're used to doing that in war fighting. Give me a better tank. A better missile. You can't do that in basic science.

But it will happen. And I'm very optimistic about that. Bill Gates used a line that "there's no predictor function for that." There is no predictor. You can't predict it. You can predict it will happen, someday. But you can't predict when it'll happen.

BILL KRISTOL: But there is a pretty big role for government there. So you're not —

MARK MILLS: Well, that's the good and bad news. A lot of my conservative friends don't like my enthusiasm for government finding a way to support basic research. My enthusiasm is muted when even that basic research is perverted, which it frequently is, to being directed and controlled and mandated. It's always the hazard. It's never perfect. And right now, the figure is heavily on the scale to directed research, as opposed to inquiry for inquiry's sake. We need to push that back to the other end of the spectrum.

And there's debates about that in Congress right now. The new legislation that is a bipartisan approach to putting more money into basic research. But they really have to examine the perversion of the word "basic," so they understand that they're not giving it to basic science. They're giving it as corporate giveaways to build more things that already exist in subsidizing yesterday's inventions, as opposed to funding tomorrow's.

BILL KRISTOL: It does feel like with mRNA and the pandemic and now [inaudible] that there's a little progress though, and people understanding —

MARK MILLS: There is. Because if you look at the mRNA's history, it's a 50 year, overnight miracle.

BILL KRISTOL: Yeah. Right.

MARK MILLS: We discovered mRNA more than 50 years ago and the science took three decades to get to the point. And no one looked for mRNA because a government program said, "You should find this messenger." But government money was certainly involved in supporting the research at the universities and the scientists that were chasing this domain, because they were curious about it and interested in it.

Remember the Proxmire Awards. Politicians like to make fun of research that doesn't seem to have a directed purpose. And there's some fairness to that too. But we're now pushed too far in the other direction. That's the problem.

BILL KRISTOL: Yeah. Well, that's another conversation we should have, because I do think that there's a

real learning opportunity. Now that people have taken it, if you think about the whole COVID vaccine thing, it's a sort of interesting case study of the case, in my opinion, for globalization, for immigration, for research, both government and private sector. For having massive private sector entities, one might want to criticize big pharma, and I'm open to that too, that can produce these things in unbelievable quantities, extremely fast, once the breakthrough is made, which is sometimes made more by smaller entities and so forth. So thinking through, really, and that's a pretty good thing for the world, right? So saves a lot of lives, so —

MARK MILLS: Sure. I think it always falls into the old "devil is in the details." What's massive and when? What stages and all those things. But now we're on the same page in that regard. And that's why I have a podcast. I joined the podcast world. And I called it The Last Optimist because I'm a realist about the politics of the day we live in. But we have so much opportunity to do something, both about de-linking from Russia, but also in the long term things we were talking about. So if people realize how exciting the future could be, if we marshaled — used the marshal wording — if we marshaled the political will to do the right thing, and obviously the word, "right thing," everybody gets to define what they mean by that. But I think this harsh x-ray of Ukraine and Russia has already illustrated what some of the right things are.

BILL KRISTOL: Thank you, Mark. That's a very good note to end on. And you have to figure out whether, are you — and I guess I'll associate myself with you too, on this — are we realistic optimists, or optimistic realists? I don't know which is the — But I don't know. Maybe both.

MARK MILLS: Depends on the day.

BILL KRISTOL: Right. Right. Exactly. Which needs to be emphasized more. I mean, this is funny. We live in a world where the realism needs to be emphasized against the wishfulness and just silliness. But then the optimism needs to be identified against the kind of fatalism and "it's all running down, "kind of thing.

MARK MILLS: I agree. Yeah.

BILL KRISTOL: Mark Mills, thank you very much for joining me on this very interesting conversation. And thank you all, for joining us.

[END]