

# Carbon Math

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Recorded on November 9, 2012

**Greg Dalton:** Welcome to Climate One, a conversation about America's energy, economy, and environment. I'm Greg Dalton. Coal mining, gas prices and oil drilling were all frequently mentioned in the recent presidential campaign, but the consequences of burning fossil fuels were not. For the first time since 1988, climate disruption was not mentioned in the presidential or vice presidential debates, and then came Sandy. Comments by New York Mayor Michael Bloomberg and Governor Andrew Cuomo ended the climate silence, and put carbon pollution back in the national conversation. Some observers say Sandy will be a game changer in America's love-hate relationship with hydrocarbons. Other say concern will quickly fade with time, and many are wondering how President Obama will address energy and climate in a second term.

Over the next hour, we'll discuss pointing America toward a prosperous and low-carbon future with a live audience at the Commonwealth Club in San Francisco. We are joined by one of the country's leading environmental advocates and a Texas oilman. John Hofmeister is CEO of Citizens for Affordable Energy and former president of Shell Oil Company the U.S. Subsidiary of Royal Dutch Shell. He's also author of the book "Why We Hate the Oil Companies: Straight Talk from an Energy Insider. Bill McKibben is founder of the advocacy group 350.org, an author of "Eaarth: Making a Life on a Tough New Planet." Please welcome them to Climate One.

[Applause]

I'd like to begin by asking you both to respond to a recent article that appeared shortly after the election in Politico, and the lead of that article was, "The energy world is wondering which Obama it will get in a second term: the liberal that greens love or the moderate that oil industry tolerates?" John Hofmeister, which President Obama do you think we will see?

**John Hofmeister:** Let me start by saying the relationship between the president and the oil industry is viscerally negative, viscerally negative. The oil industry is one industry that candidate Obama, Senator Obama has blasted from time when he first became in the public domain. And having dealt directly with the president when he was senator and having had conversations with him, this is a subject that he finds great difficulty with. His single-handed determination to tax the oil companies, which did get a lot of campaign attention during the course of both campaigns, 2008 as well as 2012, I think, is reflective of what he considers a deliberate animosity. It's a group of executives he's never met with, while he's met with many other executives from many other industries, he's never met with the oil industry. We're debating - I'm debating whether we should try to set up such a meeting between now and say the end of the year, and try to get off on a good foot next year because we've got four more years, four more important years.

It was announced this week that the U.S. has produced more oil in terms of quantity than in any time since 1994, based upon developments on state lands with private landowners, not federal efforts, 6.8 million barrels a day. But I think that the problem we face is, there is essentially a standoff between the oil and gas industry and the president, because the actions and the words are inconsistent from -

**Greg Dalton:** Because he says he supports expanding domestic drilling.

**John Hofmeister:** He says he does. The actions are completely inconsistent with the words from

the perspective of the oil industry. And I think there's a lot of symbolism in the words, but I don't think there's a lot of intent in the words. The question will be in the new administration is I think how much the animosity will play out through increased regulation, and the industry is expecting its considerably increased regulation. This is a very unfortunate circumstance for the American economy and the American people, in my opinion, because a cooperative effort, one that meets both sustainability objectives and feeds the existing machine.

Let's remember, we have an existing machine that needs to be fed, meaning the 250 million cars on the road, the tens of millions of trucks and so forth, were not going to - those aren't going to disappear any time soon, and we can either feed the machine with imported oil or feed the machine with domestic oil. The oil and gas industry is really neutral on the issue of domestic or imported. I happen to be very one-sided in the sense that domestic production does a lot of good for the country, provided it's done under sustainable regulatory regime, and I'm fine with increasing the regulations if it's consistent across the industry. But to not develop our own domestic resources, knowing we're going to need more oil and more gas going forward is inconsistent, I think, with the economic objectives of the rest of the country.

**Greg Dalton:** Bill McKibben, do you think we'll see what kind of posture from President Obama on energy?

**Bill McKibben:** I think the question comes down to whether or not he takes seriously in the end the climate change issue which is the underlying problem here. It is the legacy issue of all legacy issues because it will last in the geologic time, and it is going to be very difficult because of the incredible obstructive power of the fossil fuel industry, we're in a real box.

They've, for 25 years, kept us from doing anything about it and now we're going to have to do big things if we have any hope of heading it off. You know, we're going to have to make an all out effort not to produce more coal and gas and oil here and around the world, because we've already got way more carbon in the atmosphere than we can deal with.

You know, I sometimes - since I wrote the first book about all this 25 years ago, sometimes I have to resist the impulse to say, "If only you'd paid attention then you know because there are a lot of things that we could have done 25 years ago that we can't do now because we've filled the atmosphere." Look what happened in this last year, the most important story in the last year was not in the end of the presidential election. The most important story of the last year was, A, the warmest year in American history; B, epic drought across the most fertile farmland in the world, we made it too hot to grow corn and soybeans across the Midwest; C, we broke one of the largest physical features on earth by the time the melt season ended in the Arctic in September, basically summer sea ice in the Arctic was clearly on its way out; and D, as a kind of metaphor for all the other extreme weather of the year, Hurricane Sandy truly amazing new set of images for our mental scrapbook of what this looks like, the greatest city in the world under water or water pouring into the subway tunnels, into the Holland Tunnel.

I mean, you know, would that we had listened when this happened in Bangladesh or Pakistan or Africa or any of the other places where we've seen this kind of stuff. But when it happened in Manhattan, people looked at it in a different way and the proof of that, I think, was the cover of that radical rag Business Week, the week after in big yellow letters, it said, "It's Global Warming, Stupid."

Global warming is the only sort of existential question that we face right now and the only question is whether we get down to work on it or not. And, you know, the president will have some say on that but the rest of us we'll have more say. If we build the movement that forces action on it, then

we'll get somewhere. If not, then the incredible political and financial power of the fossil fuel industry will do what it's done for the last quarter century, which is obstruct real progress.

**Greg Dalton:** John Hofmeister, two things in there. Is there urgency around climate or do you believe this is something that will happen over decades in time? And has the oil industry been blocking progress defending its incumbent technologies?

**John Hofmeister:** I'm not a climatologist. I do not have the science in my mind or the understanding to profess the linkage between what is arguably a changing climate and the relationship to carbon in the atmosphere, my mind can't connect it. I'm a practical person. What I can connect, what I can connect is the irresponsible waste management or lack of waste management that occurs in this country and around the world. It is irresponsible of any human being to pollute their neighbor's air, water or land. And yet we have as a society continuously and getting worse not better, we are polluting our neighbor's land. When we prepare a meal, we make a mess in the kitchen, we clean up the kitchen, both we clear the air, we wash the dishes, we get rid of the dirty water. But what we don't do, from the standpoint of the economic relationship and the social relationship, is require that that be done in all of our activities.

And so, I understand the point of global scientists, I understand the point of global warming, I understand the point of public policy needed to address this ominous forecast that Bill describes. But if you can't get down to the basic practical balance between managing our wastes which can be done, we have the technology, we've done wonders on physical wastes, we've done a lot of good work on liquid waste but we have done marginally almost nothing on gaseous waste and that's what I describe in my book.

I think that we can and should aggressively across the board deal with waste management because absent that, I disagree with Bill on the fossil fuel industry operating some homogenous faction or fashion because I was part of the United States Climate Action Partnership during my time at Shell, which advocated a Cap and Trade system and actually helped design the Cap and Trade system that went up to Waxman and Markey until the process of the Congress created an unsupportable bill, and the Senate didn't even take it up, and the House barely passed it because it was unworkable in its design versus what was presented to them when it was originally designed. So I'm not opposed to climate change advocacy but I don't think you'd get there through rhetoric, you get there through action.

**Greg Dalton:** Well, one way to get there is to internalize the cost of fossil fuels. We currently use the atmosphere as an unpriced sewer, and that would mean raising the price of fossil fuels and perhaps affecting fossil fuel company profits, et cetera. You're head of a company called Citizens for Affordable Energy. If we start to put - internalize that waste, prices may go up.

**John Hofmeister:** And I think that's an affordable proposition because we're healthier, we drive more fuel-efficient vehicles, et cetera and we shift away from the internal combustion engine.

If we cannot get off the internal combustion engine, with all the technology that we have available to us, shame on us. And so I'm a strong advocate of moving away from the internal combustion engine, which eliminates 40 percent of the oil we consume. But getting support for that, it is pricier, in the beginning, until we reach the tipping point of scale manufacturing. But whether it's battery cars or hydrogen fuel cells or public transportation, we don't need internal combustion engines any longer than it takes to transition away from them. That would be a big step forward.

**Greg Dalton:** Bill McKibben?

**Bill McKibben:** I mean, the reason that we haven't made that transition is not because we lack the technology, it's because the fossil fuel industry has made sure that we keep the price of fossil fuel artificially low. This is the only industry in the world that doesn't have to pay to take out its waste, and they have defended that right zealously for a very long time. They were the biggest contributors to this last election cycle just like the one before, and most of that money, you know, the U.S. Chamber of Commerce was the biggest contributor in the 2010 election cycle visibly defending against any serious legislation on climate. They lent 93 percent of their campaign donations to climate deniers.

We need to say, we need to face once and for all the fact that we've got to now keep carbon in the ground, that we cannot be doing what we're doing. So I mean, think for example about what Shell did in, you know, seven or eight years ago. It looked around at the fact that global warming was melting the Arctic, and instead of saying, "We need to transition into becoming a renewable energy company", they said, "This is a great opportunity to go up and apply for permits to drill in this melting Arctic so we can get some more carbon out of it."

In fact, Shell sold off its renewable energy divisions, you know, in the last part of the last decade. That's the kind of stuff that we just can't keep doing. And saying that, you know, one can't connect in one's mind, carbon and the changes going around on the planet now, just isn't acceptable anymore.

[Applause]

The world's scientists have made that connection in profound and deep ways. They do it over and over again. There's a story in the front page of the Washington Post today from the National - Kevin Trenberth at the National Oceanic and Atmospheric Administration saying, "Very bad news that all our - the new - the series of new studies on water in the atmosphere showing that we can expect results from global warming to come in at the very top range or the worst estimates of what have been going on." This just gets worse and worse and that's why there's this movement starting to build. You know, we managed to have the biggest civil disobedience action in 30 years last year about any issue. Twelve hundred and fifty-three people who went to jail to stop at least for a while that keystone pipeline that would have poured as much oil out of the tar sands of Canada as the new automobile mileage regulations would save.

[Applause]

No. We can't keep making these trade-offs anymore. We've got to get serious finally and that means continuing to build that kind of popular uprising. We just launched at 350.org, this 21 - if I seem a little groggy, it's because we're doing 21 cities in 21 nights and crossing the country on a bio-diesel bus and it's a lot of fun sleeping in the back of the bus. All my rock star fantasies are diminishing - [laughter] - you know, by the - but we've got huge crowds and the politicians are starting to listen.

The mayor of Seattle stood up on stage two nights ago and said, we're figuring out, I'm talking with my treasurer about how we're going to divest our money, city money from fossil fuel companies.

Yesterday, the first college in America to make the decision, they made the announcement yesterday, Unity College in Maine that they would divest all their portfolio from fossil fuel companies because this is a moral issue like say, apartheid in South Africa 25 years ago when 200 colleges did that exact thing and helped bring to an end one of the scourges we faced then. We're showing a piece of film as we go around the country from one of our advisors at 350.org, Desmond Tutu, who won the Nobel Prize for his work on apartheid. And what he says in that is, this is the next great moral challenge that we face on top of the physical and practical challenge. It is the moral challenge

of all time because what we're doing, as we raise the temperature, is not just make our own lives hard. If that's what we're doing, well, you know, we'd be fools but it would be one thing. What we're doing is, making life impossible for the poorest people on the planet. We're grappling this summer with the 40 percent rise in food prices and we're making life impossible for everybody who has to come after us on a planet deeply degraded. We've already taken this earth out of the Holocene. The question is, how far into whatever comes next we're going to go and that's why we're rising up.

**Greg Dalton:** So John Hoffmeister, let's get you on pressuring oil companies divestiture, will that have an impact? Is this a moral issue?

**John Hoffmeister:** I think the moral issue that should be faced first and foremost, is to take special interest money out of the American political process.

[Applause]

As long as special interest money from any source, from any special interest group dominates the voice of the people of this country, I think it's an abuse of free speech which was never imagined by the founders who wrote freedom of speech as a basic right of Americans. There was no such thing as lobbyist and special interests and so forth. And so we have perpetrated upon ourselves as a nation, \$6 billion spent in the last election to stay even? To make essentially, no change? Lowest voter turnout in the last three elections? With the issues we face as a country? Because how many people give up when the special interests were buying candidates here and candidates there? So to me, if we're not going to deal with special interest money in the political process, any other kind of conversation is just an academic exercise because it's the political process. Now, it's fine and it's wonderful for intelligent people to come together and discuss what the scientists know and to try to act on what the scientists know.

And I'm not going to argue against the scientist. I'm not qualified to do that. But I would indicate that scientists over the years have not always been correct and I'm not saying that they're incorrect on this issue of linking carbon in the atmosphere to climate change. But what I'm saying is that to your point, if the activity is directed against a particular industry as in the case of fossil fuel, in the United States, all that will happen in the United States of America is this nation will get poorer and the rest of the world will have more oil and natural gas. Because we don't run the world in this country. We're part of the world, we share the world. We perhaps use more than our fair share in the current scheme of things because we're wealthier, but there is no affordable energy mix that can be imagined today and implemented today to achieve the lifestyles that people practice today without carbon energy. It just can't happen with what we know today.

**Greg Dalton:** But Shell Oil seemed to be giving up by selling its renewable energy portfolios, not even trying but -

**John Hoffmeister:** No. But I was part of that. I was part of that decision-making process. We were selling to consumers junk technology and it felt that it was just wrong to do that. Silicon based photovoltaic cells. What a waste of money, ladies and gentlemen. To get 8 percent to 9 percent efficient electricity when the sun shines and to pretend that this is going to take care of your electricity needs. We felt that it was just wrong that this technology was outdated. We took all the money from the sale of photovoltaic. We put it into the next generation of technology called thin film because that would double the efficiency from photovoltaic to thin film. And let's put that money into better technology. I still think thin film is nowhere near what it needs to be to compete with other sources of energy. Shell's still in the wind business because the wind business makes a lot more common sense. And why wouldn't you take advantage of a free source? But we're not going to

spend shareholder money on technology that you know doesn't work. That's why.

In the case of the arctic, Bill brought up the arctic, I was part of that as well. If a company like Shell which has some of the best technology in the world, doesn't get to help set the standard for arctic production, knowing that arctic production will occur because the U.S. Congress or the U.S. country can't stop it? The Russians, the Chinese, other companies will go to the arctic. There's no way to stop that.

If the standard can't be set to protect the environmental risk and Shell is probably best positioned of any company to set the standard, then let's go do that because the world as we know it will demand carbon fuel every day, from now for the next 30, 40, 50 years. If you look at the gas lines in the aftermath of Sandy in New York, they've had to go to odd-even rationing. And I'm glad they did. I recommended it a week ago on CNBC. Because the demand is so great, people are tied to their gas tanks and if we don't find a way to keep those gas tanks full while we find a replacement technology

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**Bill McKibben:** You know, we found a lot of the replacement technology. The German energy minister in the conservative government of Angela Merkel said Monday, that Germany was going to blow past their target for renewable energy, that they'd be at 50 percent by 2025 and nearing. They might be at 66%. They're the one big country that took this seriously that didn't let the fossil fuel industry stop them from doing things. You're absolutely right that special interest money is a problem and that special industry interest money comes from the fossil fuel industry. You know, when you were running Shell, you were a faithful member of the U.S. Chamber of Commerce and of the American Petroleum Institute which are the two biggest sources of this dirty, energy money that you know, works - you know, it's not only that carbon warps our atmosphere, it's that that money warps our politics and we'll get both of them now. I mean, our demand, as we talk about divestment from fossil fuel is two-fold. One, that companies stop lobbying in Washington. So they were in agreement. And two, I guess, and two, that they stop exploring for new hydrocarbons.

I wrote a piece this summer in Rolling Stone that went oddly viral. It was the issue with Justin Beiber on the cover.

But the editor said, you know, called me a couple of days later, he said something very strange is happening. Your piece has ten times more likes on Facebook than Justin Beiber and the reason was that it laid out finally the math in a way that people could understand. The one thing that the world has agreed on every country including China and the U.S. is that two degrees of global warming is too much. It's definitely too much because one degree, what we've had so far, melts the arctic. Two degrees is way too much, but it's the one thing we've agreed on. We know how much carbon it would take to take us past two degrees. We can burn about 550 gigatonnes more CO<sub>2</sub> between now and 2050. But what the article pointed out and just new stuff that came from financial analyst around the world, the fossil fuel industry, the Shells of the world, already have in their reserves, 2800 gigatonnes worth of carbon. Five times more than we can burn. Shell, in its reserves alone, has 5 percent of the carbon necessary to break the planet.

One company with one CEO, one board of directors, this is - you know, this is the gravest problem we've ever faced and all this sort of talk about, let's take a long time and figure out all the easiest possible ways to do it and whatever, we're passed that. It's time now that we grapple with the fact that it's our generation that will or will not decide how old this comes out. The good news is that the engineers and entrepreneurs given a chance, will do an awful lot of work. The other good news and this is a place where I very much agree with John is, that it's gonna have to be done globally. That's why 350.org works in 191 countries around the world. Every country but North Korea. In India, on Saturday, we're having a huge "Quit Coal India Day".

On Saturday, across the Arab World, we're working with the Arab Youth Climate Movement on a huge series of rallies and demonstrations. We've had about 20,000 of these in the last four years all around the world. It's a big growing movement and it's starting to bite. The year-long delay in the Keystone Pipeline and we'll see what happens now that the President's been re-elected, it was something that nobody in the fossil fuel industry expected and they spent a lot of money trying to make sure that that thing would go through as planned. But people started getting in the way and people are going to start to get in a way in a lot of places. The more they see things like Sandy and the more they realize, stranded after Sandy, that they'd be a hell of a lot better off instead of waiting in gas lines, with a good dispersed, diffused, renewable energy network where, you know, their electric was running off the solar panel on their roof. That's completely possible. That's how, you know, my house's roof is covered with solar panels and I can plug in the plugin hybrid to run right off it. That's what the future of the world looks like and it's not - unless you're far off, you can go to the Ford GM dealership today and come home with the car that you can run off the sun and it works just as well as anybody else's car.

[Applause]

**Greg Dalton:** Let me remind - if you're just joining us, our guests today at Climate One are Bill McKibben, founder of 350.org and John Hoffmeister, former president of Shell Oil Company and CEO of Americans for Affordable Energy. John Hoffmeister, Shell used to be heavily invested in coal and it exited coal. Why?

**John Hoffmeister:** In the late 1990's, I would submit that Shell - Royal Dutch Shell as a company was, in a sense, ahead of its time relative to its competitors in looking at the global effects of fossil fuel and decided that to put more shareholder money investing into coal, with all the obstacles that coal would face as time moved on, was not a good use of the money.

And so, it determined to divest itself of coal, let others who prefer to fight that complexity, how about the assets? And then in 1998, Shell decided in its strategic outlook on the future to move away from oil and towards natural gas without making a big public splash in either case. On the reality of, let's not promise what we can't deliver. Let's not build on expectation that isn't realistic because for as long as anyone sitting around that table, when I was sitting around that table back then, said, "Look, we're all be dead and we're still going to be using fossil fuels."

Let me tell you how hard the alternative is. Next Thursday, I convene, as the chairman of the Department of Energy's Hydrogen Technology Advisory Committee, our last meeting of the year. We're going to review the national petroleum industry's report out from last August that looks at the future as requested by Secretary Chu, that looks at the future of transportation fuels and the opportunity to reduce greenhouse gases by 50 percent by 2050. The National Petroleum Council conclusion, looking at all of the objectives, looking at all the possibilities, looking at all fuels including electrification of transportation --

**Greg Dalton:** That report really did soft-pedal electric cars. It didn't look at it that seriously.

**John Hoffmeister:** But it made the point and Secretary Chu actually toughened the requirement, what will it take to go to 50 percent lower greenhouse gases? They couldn't get there by 2050. You could argue they weren't aggressive enough. But I'm sitting there - [laughing] - some groups -

**Greg Dalton:** -- had a study because it wasn't aggressive.

**John Hoffmeister:** But I'm sitting there with this committee - I'm now the chairman, they elected me as the chairman. We're facing an administration that has cut back on the spending for hydrogen

fuel cell technology from the prior administration.

The administration actually zeroed the budget for hydrogen fuel cell technology for transportation when I first came into office. Congress reinstated it. We have a group of dedicated volunteers, we're all special government employees which means we're government employees and we don't get paid. It's a special category, we're volunteers. But the resistance is not just an industry. The resistance is the bureaucracy, the resistance is the politics.

**Greg Dalton:** Well, in that case, Secretary Chu believes that hydrogen is not a very promising form of energy. It takes a lot of energy to generate hydrogen and we can debate hydrogen. But what I wanted to get at with that coal example was that Shell exited coal because it saw it as a loser of a business and it's moving away from oil to gas. Do you think Shell will ever exit oil? Does it see the horizons for oil also diminishing or facing more social resistance because of climate change?

**John Hofmeister:** Well, if we stand back and look at all of the literature across the industry when it comes to transportation, the world's headed for two billion cars. How much percentage of those cars will be based on internal combustion engines that fundamentally only use gasoline. Unless we find an alternative to gasoline, unless we find an alternative to petroleum-based fuel, I think we're stuck with growing demand of oil over the next 25 years not reducing the demand, unless we could find a substitute.

Now, I work with someone on the Energy Security Council which is a group of some 25 former presidential appointees and a few business leaders and our advocacy is to take natural gas, half the carbon of oil and make methanol from natural gas which with flex fuel internal combustion engines can displace significant amount of oil and have a more favorable environmental impact at the same time. The methanol opportunity is huge with all the natural gas we have in this country. We're pursuing it, it was on the phone this morning. How do we build the kind of reformer units across the country that could supply methanol as an alternative but we need flex fuel engines.

**Greg Dalton:** Let's get Bill McKibben's natural gas as seen by some people as a promise, as a bridge, it's American, it's cleaner, is that a good step to make?

**Bill McKibben:** Well, there are two huge problems. One is we say it's cleaner because you produce less carbon when you burn it. The trouble is natural gas is CH<sub>4</sub> methane, it's molecule for molecule 25 times more potent greenhouse gas. So do the math. If two percent leaks out in the course of the process, then it's dirtier than coal. The only study we really have of how much leaks out was in Science in January, the big gas field in Colorado and it was finding four percent leakage rates. So that's one problem.

The other problem is--and this is exemplified by this plan to do a lot of natural gas, vehicles and things, it undercuts the transition to gas, undercuts renewables more quickly even than it undercuts coal. The IEA, the International Energy Agency modeled what happened with a world that converted very quickly to gas, got off everything else in that world because renewables get aced out of the picture, that world is 660 parts per million CO<sub>2</sub> and the temperature goes up three and a half degrees Celsius, twice as much almost as the most conservative government on earth says would be safe.

Our job is not to figure out how to, you know, keep the fossil fuel industry going with some other, you know, fossil fuel that's a little marginally better. Our job is to figure out how to provide the energy that people need in ways that will allow the planet to keep working. So to the degree that we have to have cars and you know, there are lots of other things we can substitute in lots of places like, say, trains and bicycles and feet.



But to the extent that we continue to have to have cars, well, the clear answer is to electrify them and to get the electricity from renewable sources. It's entirely doable. It's not cheap to do but we've got to start figuring out what real cost economics looks like, you know. The one good set of estimates we have about what the economic impact of global warming will be from the STERN Report in the UK a few years ago, was that it might add up to 20 percent of the planet's GDP by the end of the century.

I don't know what the number is for Shell, you could probably tell us, but Exxon spends -- boasts about spending \$100 million a day, \$100 million a day looking for new hydrocarbons even though we already have five times more than anybody says we can safely burn. Think what a \$100 million a day from just one company would do spent on solar panels. Think how quickly we'd be rolling this out.

[Applause]

**Greg Dalton:** Bill McKibben mentioned electric cars. John, you know, the book by Steve Coll, Pulitzer Prize-winning author on ExxonMobil's private empire and in there, he writes that the one thing that ExxonMobil worried about was a breakthrough in battery technology. That could really threaten their business model and their profits. And what do you think about the breakthrough in battery technology in electric cars?

**John Hofmeister:** Well, I've already stated my position on internal combustion engines. And so I pray for a breakthrough because I think some of -- Bill and I actually agree on the end-game, we just don't agree with how quickly we can get there and I'm a privatist in that regard, not a theorist. And so I think that the breakthrough in battery technology is still elusive. We watched 300 Fisker cars in the Port of New Jersey get flooded and about a dozen of them caught fire in the midst of a flood.

That's not going to do a lot for Fisker's reputation. The battery technology of today is just not going to get as there as a mass market vehicle. Niche vehicle, fine, those who can afford it. But for a mass market vehicle, I spent yesterday at -- I teach in Arizona State in the Global Institute of Sustainability, I took my students through an exercise yesterday. What would a mass market of electric cars look like in Phoenix, Arizona on a holiday weekend, and how would we go about supplying batteries if the vast majority of cars in the fleet were electric? And it was a tremendous exercise for the students to go through but it pointed out challenges that we face.

**Bill McKibben:** You know what? We solved this battery problem by doing the plugin hybrid. Ninety percent of the time people don't need -- the amount they drive in the course of a day just falls within a range of that battery and then you have this backup for the engine, small engine for the times you need otherwise and it's not unaffordable. You can go buy a Ford Fusion today it's a plugin hybrid vehicle and it's, you know, with -- it's about 30-some thousand dollars, it's less than the average cost of an average vehicle in this country and it works just fine. We don't -- this is not like some science fiction thing that's impossible to imagine, it's at the showroom now.

**John Hofmeister:** I think in terms of the broader implications of your question, we can ultimately innovate and use ever-increasing valuable technology as we should, that's our history as a people. But we have to, you know, invest in it and whether it's companies or the U.S. government, we have fallen down as a nation, as a society in tolerating and paying for real serious research and development.

If we go back to the 1960s and the John F. Kennedy led "Race to the Moon" and the amount of technology, the amount of research and development that went into the nation, you saw upward slopes in spending. The slopes are all now flatter down and that's not what's going to get us for. I will support President Obama's statement the other day on the -- I guess it's this morning he said it,

on the need for more investment in technology and innovation so that we're the leaders, not the followers, but we haven't done it that's why I think we've slowed down so much --

**Greg Dalton:** And should oil companies also invest more in cleaner technologies?

**John Hofmeister:** I think you have to leave that to the individual oil companies. Some will, some won't. Anybody that thinks the oil companies are monolithic or homogenous, think again. They're not. They compete vigorously and there is research going on in the Exxon laboratories today for biofuels that exceeds what any other company is doing. Good for them. There's research going on in other oil companies, Chevron and Shell and so forth, to figure out what is its competitive advantage? What will its niche be to turn the tables on the future to earn returns for their shareholders? They don't think alike, they don't act alike. And you know, so they're not organized -- they're organized around API, yes, I wouldn't deny that. Or the Chamber of Commerce and American Petroleum Institute or Chamber of Commerce, but the important point is to be at the table. If I wasn't at the table with the Chamber of Commerce or the American Petroleum Institute, I wouldn't be expressing my views. But I express the same views to Francis Beinecke at NRDC.

**Bill McKibben:** Yeah, but you stuck right with the Chamber of Congress when they were sending 93 percent of their campaign money off to Climate deniers. I mean you might have been behind the scenes expressing your views, we wouldn't know but in public, that's what happened.

**John Hofmeister:** I didn't quit. I didn't quit. If you quit, you're gone. You're out of there.

**Bill McKibben:** Well, you would have had exactly the same results and people would have known that you were upset with them which with what they did.

**John Hofmeister:** The process doesn't work that way. If you're not at table, there's not voice there. And then it becomes reactionary problem.

**Bill McKibben:** You said a minute ago that you were a pragmatist, not a theorist, but I don't think that that's really correct. At this point, pragmatism demands all-out grappling with this problem.

We melted the Arctic this summer. When you start losing your big physical features of the planet, that's a pragmatic threat that needs to be dealt with not in the long distance sometime far out from now, it needs to be dealt with now and urgently, and not by saying let's try to keep our advantage going for a while and maybe we'll think of something to come up with next. It means taking -- I mean, it's a good idea to go do some more research, but in the meantime, let's deploy every single tool we have as fast as we can and the way that we'll do that is overcoming -- one of the ways is overcoming the fossil fuel industry's unwillingness to put a price on carbon.

You guys are the only ones --

[Applause]

**Bill McKibben:** You're the only ones in the world who get to put your waste out for free. You go down the street to a restaurant, you know, kitchen closes at the end of the night, they're allowed to just shovel the garbage out into the middle of the street, that would be uncivilized. Only the fossil fuel industry gets to pour CO2 out without a price. Economists for a quarter century have said internalize that externality but always it's the APIs of the world that keep it from happening.

**Greg Dalton:** Bill McKibben is author of Making a Life on a Challenging New Planet, also founder of 350.org. Our other guest today at Climate One is John Hofmeister, former president of Shell Oil Company. I'm Greg Dalton. Bill McKibben, I'd like to ask you about climate and poles and then we're going to go shortly to audience question. But the reality is when Americans are asked about

climate change, it ranks very low toward the bottom in terms of their concerns, economy, jobs, health, et cetera. So politicians get criticized for not mentioning climate but the fact is American people in polls it's not a top concern.

**Bill McKibben:** So here's the good news, that's changing fast. The Rasmussen Poll out this morning showed 68 percent of Americans think that it's a very serious problem. Seventy-four percent of Americans are clear that the climate is warming. It's hard to get 74 percent of Americans to agree on anything, okay? I mean half of this country believes Elvis is still alive, you know, so this is a start. Those responses have all spiked dramatically in the last couple of years because 80 percent of Americans have lived in counties that have a federally declared disaster. I mean we watch what's happening. Now, what we need is some real leadership from government, from industry to take that in run with it hard to -- and that's why -- that's why theoretically we call them leaders, you know as opposed to, you know, poll-following devices or whatever.

**Greg Dalton:** I think John would agree with you there. John, leadership has not been what it should be.

**John Hofmeister:** Well, leadership in this country needs a broom handle down its back if you ask me, to be blunt about it. But I have to -- I can't let Bill's -

**Bill McKibben:** That's very blunt.

**John Hofmeister:** I can't let Bill's last statement stand on the fossil fuel industry being the only industry that gets to put its garbage out for free. The American consumer, ladies and gentlemen, is not paying the price, the full price for electricity across this entire nation because every state in this country is emitting, one way or another, gaseous waste that we all get the benefit of a lower electricity price because the public utility commissions around this country, virtually all 50 states know that if they put a price on emissions that affected the electricity price, they wouldn't hold their jobs. So this is not to be blamed solely on the fossil fuel industry.

This is a societal issue that affects every consumer of electricity, every consumer of transportation fuels and let's not just focus and concentrate on a pejorative associated with an industry called fossil fuel industry. This is an endemic problem and while 74 percent may agree, go back to the polls, may agree this is a big problem, how much more are people willing to take in their electricity price or their gasoline price to do something about it?

**Bill McKibben:** That's why we need -- one of the good things that's happened in the last year or two is the real emergence of really forward-thinking solutions and the best is this thing fee and dividend that people have begun talking about --

[Applause]

**Bill McKibben:** You put up honking price on fossil fuel, you know, make Shell at the wellhead pay a lot of money and they passed the price on at the pump which is good. You know, we should be paying European levels at the pump because then each time we went to the pump, we'd be reminded that it does not require a semi-military vehicle to collect your groceries, you know. But then you take all the money that you collect from that, and you just write a check for everybody in the country for their share, because if the sky belongs to anybody, it belongs to all of us, not to Shell, you know. Eighty percent of Americans come out ahead in that kind of scheme, if you use huge amounts of energy, you don't. If you own a Learjet, you don't. But at this point, you probably shouldn't really be owning a Learjet, you know.

**Greg Dalton:** As some environmental liberals do, the -- [laughter].

**Bill McKibben:** I have a bio-diesel bus, you know, for the month, so I'll --

**Greg Dalton:** British Columbia, by the way, is doing exactly what Bill McKibben just said, they have their carbon tax and it's refunded to people, so that it is revenue neutral. We're going to invite your participation. If you're on this side of the audience, please go around. The line starts over there, with our producer, Jane Anne. We're going to get as many as we can. We'll promise brisk questions and brisk answers. I invite you, one one-part question.

If you need help keeping it brief, I'm here for you. And then we'll get through as many as we can, and our apologies in advance to those we can't get to. If you're just joining us, our guests here at Climate One today are John Hofmeister, former president of Shell Oil, and Bill McKibben, the environmental advocate. I'm Greg Dalton. We're talking about energy and the recent election. Let's have our audience question. Yes, sir?

**Angelo Fest:** Hi, my name Angelo Fest. I'm a resident in San Francisco. I just wanted, more than anything, share with this audience the fact that since April of 2011, I have driven about 20,000 miles, without purchasing a single gallon of gasoline. What that means is, when BP announced a \$4 billion quarterly profit, I didn't contribute a cent. I just want you to know folks, it's a great feeling to drive an electric car because you sleep better at night. You know, you're not part of the problem. And it's very doable. The technology is here. You don't have to wait for better batteries. The technology is here, and there are affordable models. Thank you.

**Greg Dalton:** As an EV owner, I would say, they're fun to drive, too. Let's have our next audience question. Yes?

**Carlene Collin:** Okay. Hi, good afternoon. My name is Carlene Collin and I'm a Bay Area mom, who started a climate change program for kids about six years ago. It's expanding now to 23 states, and we're reaching about 250,000 kids and their families. These kids are young. They're K-5. They're so full of hope. When we teach them about carbon and climate change, and we tell them, they could be part of the solution, they're so energetic. They run home to mom and dad. They get them to start engaging. I would like, for both of our speakers, to pretend this is a group of K-5 kids, 7- to 8-year-olds, 9-year-olds. Talk to them about the future of climate change. Thank you.

**Greg Dalton:** John, I don't know if you have grandkids that age or kids so, I mean, let's -- what would you say to youth about the urgency of the solution.

**John Hofmeister:** Well, I founded Citizens for Affordable Energy, for the very purpose that she just described, but children of all ages not just K-5. My story would be, we are where we are over a long history of getting to where we came to. But that doesn't necessarily predict the future. That the future can be very different, because we have something called technology. The technologies that we have going forward will create a very different future, and we can start describing what those technologies look like. And I would say the same thing as the other gentleman about hydrogen fuel cell vehicles. Having driven a hydrogen-fuel cell vehicle, I never want to drive anything else.

**Greg Dalton:** But technology is not enough. Would you admit that policy has to be a part of the equation?

**John Hofmeister:** K-5 as well as children of all ages in this country have a very difficult time with policy. You're absolutely right. I agree with you.

**Greg Dalton:** So do adults.

**John Hofmeister:** You're absolutely right. But getting from where we are to public policy, we just spent \$6 billion to stay in place, as I said earlier, in the past election. Americans have a difficult time grappling with the complexity of getting public policy to where it actually has meaning.

**Greg Dalton:** Bill McKibben?

**Bill McKibben:** I find K-5 deals really well with policy. Clean up after yourself is a, you know, sort of universal that's really good with young kids. But we're now -- and when I talk with young kids like that, what I say is, "Here are some of the pictures, the 40,000 pictures in our Flickr account at 350.org from actions all over the world. Look at them, because you'll see that they're led by young people all over the world and many of them quite young, that you can be a part of this powerful growing movement. And that's what people of all ages need. The thing that's scary about global warming is, it seems too big for anyone of us to take on by ourselves.

And indeed it is too big for anyone of us to take on by ourselves. But we're no longer by ourselves. When you talk with kids, you have to give them some sense of urgency, of power, that coming together to make this thing all right. And we are. I don't know whether we can do it in time, because we have very powerful forces on the other side. But by God, we're giving it a good fight.

**Greg Dalton:** Do you accept though, John Hofmeister's point, that it's individual responsibility that -- those individuals, everyone listening to this on the radio, in this room have to accept some responsibility --

**Bill McKibben:** Absolutely.

**Greg Dalton:** -- not just blaming the bad oil company.

**Bill McKibben:** Absolutely. Absolutely. But, nobody that I know of, cares at all, whether their power comes from the sun and the wind, or fossil fuel. In fact, almost everybody, would rather it came from clean sources. The only people who were spending hundreds of millions of dollars a day lobbying to make sure that it keeps coming from dirty sources, are the fossil fuel industry. That's -- because that's where their bacon is, you know. And so that's why -- I mean, I don't mean to hurt anybody's feelings, and you know, we're all, you know, very few of us are past -- you know, we're beyond the K-5 level here, so I figure we just talk absolutely openly. But that's why we have to. We have to oppose the fossil fuel industry in vigorous and powerful ways, because they're at the bottom, the driver of this continued craziness that's, you know, melting the arctic, acidifying the ocean, doing things that 5-year-olds should not have to hear about. Because as adults, we should've stepped up long ago and not looked at the melting arctic and said let's drill for oil there, looked at the melting arctic, and said, "My God, what are we doing?"

**Greg Dalton:** Let's have our next audience question.

[Applause]

**Jerry Hinkle:** Jerry Hinkle, I'm an economist and a member of Citizen's Climate Lobby, and I have a question for you Mr. Hofmeister. Economists pretty much universally believe that charging firms for pollution will improve both our environment and the economy.

Bill has provided a great suggestion, raise those revenues, give them right back to people. It sounds consistent with your objectives. Would you be willing to ask the API and the Chamber of Commerce to support a price on carbon?

**John Hofmeister:** Well, I've been public in exactly that, to the point they're tired of hearing me.

Because to me, it's why I was for a cap and trade system, which effectively, in a different way, puts a price on carbon. I consider it incentive-type system, rather than a punitive-type system. But whether it's one or the other, the price on carbon is, you know, I think it's a manageable proposition. I think how we go about it, and who pays is an important policy discussion. But I haven't been opposed in principle, ever, to putting some kind of responsibility on consumers and producers, to do what can be done in order to, you know, move this whole thing forward. And I thought long and hard before I joined Shell, back in 1997, about whether I wanted to get into this game, and decided that was the right thing to do, because you can work inside the tent more effectively than outside the tent.

**Greg Dalton:** Why did ExxonMobil support a carbon tax?

**John Hofmeister:** Because it wouldn't pass.

**Greg Dalton:** So --

**John Hofmeister:** I mean, I'm saying that rather cynically. And I realize that. But at the time, when -- if you notice, there's been dead silence on the carbon tax ever since the election of 2010, and ever since [crosstalk] have been marketing themselves.

**Greg Dalton:** Though some conservative circles are looking at British Columbia as a model and thinking about recognizing if cap and trade is political poison, carbon tax fee and dividends, some mechanism, people recognize there's going to be a price on carbon.

**John Hofmeister:** And to be fair to Exxon Mobil, because I was just cynical about them, they promoted the carbon tax because they felt the cap and trade was too complex for people to understand. We disagreed. I sat at the table with ExxonMobil across. We discussed it, we debated it.

And so, we found out the cap and trade couldn't get through Congress. So maybe a carbon tax could. We'll see what happens, if anything. But having just listened to all of the president's remarks over the last two years, the deafening silence on climate has been remarkable. And we'll see if anything changes come January 20th.

**Greg Dalton:** We're discussing America's energy future with John Hofmeister, former president of Shell Oil, and the advocate Bill McKibben. I'm Greg Dalton. Let's have our next audience's question.

**Clara Vondrich:** Hi everybody. My name is Clara Vondrich. I'm the Director of Leadership Initiative at the ClimateWorks Foundation. I want to thank you both for being here, especially Mr. Hofmeister. You're really brave to come into this liberal hotbed known as Climate One. I really appreciate you being here. It's important to have the debate with all sides. But I did want to say in the same breath, don't believe the hype, you know. I disagree with almost everything that you said, aside from the need for campaign finance reform, which I think is vital and I think most people would agree. But as far as the delay tactics, the smokescreens, the red herrings, such as, you know, we need to just put much more money on R&D. We need to be the first people in the arctic so we can set the right standards. If we don't drill the oil, somebody else will. These are smokescreens. These are red herrings. They're reasons for delay, and I'm not going to buy into them.

There is hope, on the other hand, I'll just mention that the carbon tax debate is really heating up, and there's this amazing groundswell among conservatives. We just had at ClimateWorks, Eli Lehrer, who's the former member of the Heartland Institute, who left this summer to start his own

shop in opposition to Heartland's really kind of skiving billboard campaign, where they likened climate believers to Ted Kaczynski other serial killers. He left because enough was enough, and he's actually now starting a new shop in Washington, calling for a carbon tax. He's working with Bob Inglis. He's working with others in the same field. And next week, AEI-Brookings Institute, will have a big carbon tax debate.

These are not liberal -- liberals as you know. And it can be streamed live. Everyone can check it out. And the tide is turning. And I hope that companies like Shell will indeed see the amazing opportunities ahead. You guys could be first movers in this field. You guys could take the lead and make a transition to a new paradigm. It's up to you.

**John Hofmeister:** Thank you.

[Applause]

**Greg Dalton:** John Hofmeister? Will you get out front of that parade?

Thank you. And I have to say for the record that I'm no longer a part of Shell. I retired in 2008. But I still have great affinity for what the company has been and is doing today. I don't agree that these are smokescreens -- no, I don't agree with the smokescreen attribution. I've been at this a long time. I've been giving it a lot of thought. I've dealt with the realities. There's a difference between theory and practice. If you can't fill your tank this week, you're berserk, if you're a consumer. And I'm saying you in a generic sense. Some of you in the room may say, "Well, I don't have a tank. That's fine. I don't have to worry about it." That's great for your lifestyle.

But everyday, millions and millions of people get to work because that's their only way to get to work. And if those people aren't taken care of, somebody could rise above it all and say, "I will tell you the better way." But that's an autocracy. I don't believe in autocracy. I believe in democracy. I'm all in favor of spending the rest of my days helping to educate people so they can perform an intelligent task or intelligent opportunity called voting. To vote for what makes common sense for them and their family. But to tell people what they should do, doesn't work in our society. And the more telling that goes on, the longer it's going to take to get anything done, in my opinion.

**Greg Dalton:** And would you agree that the faster we get off oil, the better?

**John Hofmeister:** Absolutely. I've been doing -- I've been practicing that for years. But there is a reality today.

And we're not getting off of it today, or tomorrow, or the day after. So, we need substitutions and technology. We don't have them yet. I disagree that the Prius or the Hybrid is the solution. That maybe is a solution for some, but what a big country, with a lot of people, with a lot of different aspirations and needs. And they're not going to buy a Prius, or a Volt, or what's on offer today. The market share is growing, but very, very slowly.

**Greg Dalton:** That's true. Bill McKibben?

**Bill McKibben:** Well, yeah. I mean, but if that's the reality that you're, you know, worried most about, instead of the reality that each degree increase in global average temperature from this point is projected, the Stanford agronomist say they cut green yields 10 percent, or that the ocean is becoming -- it's pH is steadily changing, or on and on and on. If those are the -- if the reality that really concerns you most is that someone might have to, who wants something else might have to settle for a Prius --

**John Hofmeister:** The reality that --

**Bill McKibben:** -- that's --

**John Hofmeister:** The reality that scares me the most is we don't learn. We just don't learn. And I'm committed to teaching. The point about not learning --

**Bill McKibben:** The best way to teach at this point, probably, is not to tell people what to do. It's to put a serious price on carbon in the ways that we're describing, so that people can then quickly learn what it is that is, you know, that our behaviors are costing. Not just us, but everyone who comes after us. And that price, because we've delayed for so long, that price has to keep getting higher and higher. The one thing that no one has taken issue with, is the fact that we have to keep 80 percent of the declared reserves we've found underground at this point. That's going to be expensive because we keep delaying. And every time we say, "Well, let's have another presidential commission," or "Let's spend some money on research," or whatever else, we get a few more years down this road.

We go past the current rates of burning carbon, that 560 gigatonne figure, we go past in 15 years. That's when we go past that two-degree threshold. We don't have time for all of this. We have to make our democracy work correctly. And it won't work correctly, as long as API and the fossil-fuel industry is pouring money here and elsewhere into making sure that nothing ever changes.

**Greg Dalton:** Can you envision those assets in the ground becoming liabilities, John Hofmeister?

**John Hofmeister:** At this point, no. Because China was a 5 million barrels-a-day of oil consumption in 2005, 10 million barrels-a-day in 2011, they'll be a 15 million barrels-a-day in roughly 2015. They'll be a 20 million barrels-a-day consumption by 2020. Those assets in the ground will not be liabilities on a global basis. China's going to grow its demand, and there's nothing the U.S. is going to do to stop it.

**Greg Dalton:** Let's get another audience question in here at Climate One. Yes, sir.

**Felix Kramer:** I'm Felix Kramer. I actually liked the first part of this better when Bill was just talking about the reality of the issue, and not engaging. Because in a certain way, we hear ads around here of Chevron saying, "Let's talk." But I wonder, Bill obviously did a lot of research about Shell. And he talked about it. I wonder if you read his Rolling Stone article. And if you've done that math, because if you, as a former CEO, you understand that you have a fiduciary responsibility to your company. What if you're -- if the things you support, getting corporate money out of the elections, and taxing carbon succeed in getting to a situation where 80 percent of your industry's reserves are prescribed, and globally, the National Oil Companies of the, you know, the nationally-owned oil companies around the world, which owned far more oil than the private companies, if they're prescribed also, what happens to your industry at that point?

**John Hofmeister:** I think the industry would, if the scenario played out as you describe it, the industry would shrink.

But society would -- the economies of the world would shrink even more. And relatively, in a democracy, people wouldn't tolerate it. We don't have the consensus, ladies and gentlemen. In a democracy, we don't have the consensus. Bill and I are actually helping to contribute to the consensus, by bringing separate points of view, but with common ends. And our difference, as I said earlier I think, he may disagree, is largely in the timing. But until we achieve a consensus on any aspect of this, no public policy will come into effect. And you could penalize the oil companies all



you want, they'll go somewhere else. They don't want to be where they're not wanted. And they pull out of countries where they're not wanted. But the world is a bigger place than the United States.

And I have great respect for what ClimateWorks is doing, because it's helping to contribute to a consensus. But the reality is, people live everyday in an economy and a society, where they like the way they live.

**Bill McKibben:** The world is capable of changing. And one of the things that would help it change most is some leadership from the country that poured the most carbon into the atmosphere over the last century.

[Applause]

The Chinese are actually are installing more renewable capacity than anybody on earth. Twenty-five percent of Chinese, when they take a shower at night, the hot water is coming off the roof. I spent a day with the head of the biggest solar hot water company in China, Himin Solar, a guy named Huang Ming, an engineer, at the end of this great day, he took me into his private museum. Under the ground was a solar panel. "You know what that is?" "No, what is that?"

"That's one of the solar panels that Jimmy Carter put on the White House in 1979, and Ronald Reagan took down in 1985, because basically, the fossil fuel industry didn't like the idea of solar panels up there." That's proof to me that what we lack is not technology, it's political will, and the people who've been getting in the way of that political will are the fossil-fuel industry, and if they get out of the way, or if they help, then we'll make some progress.

**John Hofmeister:** With all due respect, people who are in the way of what you are espousing are your fellow citizens, and their leaders, and their leaders. It is the American people who buy cars, the American people who buy gasoline, the American people who over air-condition their homes, and overheat their homes, they are the people who are contributing to this.

**Bill McKibben:** Fair enough. Fair enough. But instead of -- instead of trying to make everybody feel even more guilty than they already do, think for a minute about the fact that the biggest contributors in this last election cycle were people like the Koch brothers, third and fourth richest people in the country, fossil fuel barons. Think about the fact that the last election cycle, it was the U.S. Chamber of Commerce. The U.S. Chamber of Commerce filed a brief with the EPA. This was to demonstrate the extent of how engaging with them didn't work.

They filed a brief with the EPA saying, "Don't regulate carbon because, if on some strange chance that all the scientists turned out to be correct, and the planet warms, it won't be a problem because humans will be able to alter their behavior and physiology in order to cope with this problem." I mean, that's the level of denial that we've had to deal with. And I'm glad now that you're out of the industry, and I really do admire your work, in coming to deal with us. But I admire even more of the work of people all around the world, many of whom did nothing to cause the problem that we're dealing with, but are now standing up to say, "We can come together and figure out how to make this happen."

Not 50 years down the road, when the temperature is 5 degrees higher, and things like Sandy are an everyday occurrence. We can figure out, not easily, but we can figure out how to make it happen now, before we break the planet.

**Greg Dalton:** Let's get one more audience question. Yes sir, welcome to Climate One.

**Dave Masen:** Thank you. I'm Dave Masen. I'm also a member of Citizen's Climate Lobby. And

John, first, I also appreciate your being here today on a bit of a hot seat. And I'm wondering if you're familiar with Mark Jacobsen's research at Stanford that indicates we can convert the entire world to renewable energy in 20 to 40 years, using technology we have now, at no greater cost than what we're already spending on our energy system. And if you're not aware, I'd be happy to send it to you.

**John Hofmeister:** Thank you.

**Dave Masen:** But I do have a question --

**Greg Dalton:** We're really tight, so we got a big line behind you, so let's get John to respond. Thank you.

**John Hofmeister:** I'm aware of his work, and admire it. And you know, again, public policy is either an enabler or a disabler. And so, I've been, even while at Shell, so my voice is the same outside of Shell as at Shell, because I was promoting the enabling of public policy to help these things occur, help the transition develop, but it all has to also be economic. I think we're struggling here with how does renewable energy compete commercially. And I know there are arguments that just - it has to reach a certain scale. I would argue also, we have to reach a certain level of technology to be efficient in order to reach that scale. So, let's put the enablers in place, but let's not deceive ourselves to believe that somehow the status quo is suddenly going to be overcome in a timeframe that's not realistic. I think we mislead ourselves, or mislead our young people, if we say something that just not going to happen. So in that sense, I'm a pragmatist.

**Greg Dalton:** Yes sir, welcome to Climate One. Let's have another question.

**Ross Grant:** Hi. I'm Ross Grant, Citizen. If the United States Congress implements some sort of economic incentive, whether it's a tax or cap and trade, and technology outperforms all expectations, and we do a great, great job, but the rest of the world, China in particular, but many others don't come along, and in fact increase, at what point, when we'd worry about Greenland and arctic melting, do we go to a heretical solution like some sort of geo-engineering. And as hopefully a transition, or you know, who knows, but do we rule that out entirely, because it's so crazy or is it part of the thinking?

**Greg Dalton:** Bill McKibben?

**Bill McKibben:** Geo-engineering is, you know, they may come a time if things, you know, if the industry stays as intransigent as they have, when we have to have some kind of break the glass solution, I suppose. But if we do, it's horrible. I mean it's -- it would be the last thing to which we should turn. The idea that having filled the atmosphere with carbon, maybe now we should pour in a lot of sulfur in order to try and somehow mirror it. The modeling of it isn't good. The effects, the side-effects will be enormous. And also in the end, it's just kind of this horrible admission of defeat, you know, that we weren't able as a society to constrain ourselves, restrain ourselves, make the kind of creative leap in a new direction. Instead, almost like an addict just, you know, unable to come to terms with that addiction and clean up their lives. We just have to find some you know, weird fix, in order to try and keep going our way of life.

So I hope very much that it doesn't come to that, especially since there's no real reason to think it would work even if we did it.

**Greg Dalton:** Steve Schneider once called it Planetary Methadone. We have to end it there. Our thanks for John Hofmeister, former president of Shell Oil, and Bill McKibben, founder of 350.org -

[Applause]

**John Hofmeister:** It was very good. I had some fun.

**Greg Dalton:** -- for coming to Climate One today.

**John Hofmeister:** You're good at this. Absolutely.

**Greg Dalton:** I'm Greg Dalton. Thank you all for listening.

[End]