

# Water, Food & Energy with Marvin Odum

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**Greg Dalton:** Welcome to Climate One, a conversation about America's energy, economy and environment. To understand any of them, you have to understand them all.

Today, we're discussing food, energy and water. Petroleum and water are at the center of discussions about sustaining our economy while dealing with the rising population as well as rising carbon pollution. Scientists say freshwater supplies will decline as global temperatures increase, and many corporate leaders now see water supplies as a serious concern for their business. On the energy side, demand is rising at the same time that emissions from fossil fuels need to start declining in order to stabilize the earth's operating system. Food production uses large amounts of oil and water, and it takes just -- imagine, 15 gallons of water to produce just one ear of corn.

Over the next hour, we will probe the connection between food, energy and water with our live audience here at the Commonwealth Club in San Francisco. Joining us, we're pleased to have Marvin Odum, president of the Shell Oil Company, the U.S. arm of Royal Dutch Shell, the world's largest corporation by revenues. Before my conversation with Mr. Odum, I'm going to talk for 15 minutes with Cho-Oon Khong, Shell's chief political analyst. We'll talk about Shell Scenarios, and then Marvin will come up here and join us. So please welcome Cho-Oon to Climate One.

[Applause]

Cho Khong. Welcome. Thank you for coming.

**Cho-Oon Khong:** Thank you, Greg.

**Greg Dalton:** So, Shell Scenarios looks out at the future and paints different possible futures.

And the most recent one I think was Scramble and Blueprint and looked at a number of things in terms of the green revolution and flight to coal. So tell us the energy future that you see with the things I mentioned with such as rising demand and also increasing concern about carbon.

Okay. Well, could I just begin by saying something about where we come from? And may I just say, thank you, Greg, for providing us with -- providing me with this opportunity to talk Scenarios this evening, particularly scenarios on energy and just like to thank everyone for coming along hear what I've got to say. Now, the thing about Scenarios is that we look at the future. We paint alternative stories, alternative possibilities of how that future will develop, but the secret is they're really about understanding the present: where we are today, recognizing that the present just isn't constant -- it's always changing, and the question we have is in which direction will it change.

So, we've been looking at long-term energy issues ever since the Scenario team was founded more than 40 years ago in Shell. And I'd like to begin with the 2008 Scenarios which you referred to, Scramble and Blueprints, because those set out two alternative visions, one in which every country, every nation look to its own in a global competition for energy supply, we call that world Scramble. And the other one -- and the other world, Blueprints, we had a greater sense, a greater willingness of countries and, very importantly, of peoples to want to cooperate on energy and, ultimately, on dealing with the climate challenge.

So when you talk about a flight to coal or flight away from coal, and we'll see both over the course of the century, we're talking about trends which are impelled by what people want.

What do people want? They want growth. They want jobs. They want a sense of well-being. And it's when we think about how economic growth is -- yes, okay, the world as a whole may be getting more prosperous. It doesn't mean that everyone is feeling better off. If you look at a country like China today, it's recorded astounding rates of economic growth over the past 10, 20 years, but today people are increasingly questioning the price of that growth.

**Greg Dalton:** Uh-hmm.

**Cho-Oon Khong:** With looking at cities which are blanketed in black carbon. We're looking, if I could just take a non-energy example, pigs polluting a river that feeds into the water supply in Shanghai, all sorts of things going on which people say -- and which lead people to say, what's the price of this growth?

So, great complexities come in to the picture that, you know, we painted earlier on with Scramble and Blueprints, the idea that, yes, if we can get together and agree, we'll deal much better with the climate challenge. We'll manage supply and demand over time, of course. Well, it's inevitable as the developing countries, the large developing countries grow rapidly in the way China has grown, and China is only the first. India is following on. So is Brazil and others will follow on behind them. They will use more energy and a large chunk of that energy will be coal.

But, as they reach a certain level of development, their use of energy will start to flatten off and the percentage of coal will start to decline. The question is when. Can we bring that period... can we bring that turning point further forward closer to our time or will it be further away?

**Greg Dalton:** And the question is whether we sort of destabilized the climate further by doing that, but I want to pick up on a question you talked -- you mentioned earlier about sort of each country for themselves versus international cooperation or collective action.

That hasn't worked so well through the United Nations process. Copenhagen was a big failure. There's not -- the U.S. in its own political system hasn't been able to come together. So do you look at it now and say that the chances of collective or cooperation are much smaller than they were when you first looked at it in 2008 when Copenhagen was on the horizon --

**Cho-Oon Khong:** Look, Greg. At the end of the day, that's the only game in town, so far as the global community is concerned. So we do and we need to support that process. Having said that, there are two critical flaws. One is that it's a top-down process. It's driven by governments getting together, heads of state, political leaders, seeking agreement amongst themselves. Unless they have support from the bottom up, unless they get buy-in from their peoples, you're not going to build that critical mass. You're not going to build that really substantive support that this sort of agreement needs because it involves difficult decisions. People have to say -- people have to recognize that they need to sacrifice something today in order to get something else tomorrow. And unless political leaders act with the backings of their peoples, they're not going to get it. They're not going to get there.

The second problem of course is a well-known one, which is that you got 190 countries in the United Nations, and if one of them says, "I don't agree," how are you going to get global cooperation?

**Greg Dalton:** So, can U.S. and China do something, cut a deal to move everyone forward?

**Cho-Oon Khong:** In Blueprints, we actually are -- that's the scenario from 2008. We actually argue

that at the end of the day, one, you've got to get critical mass of support, which has to come from bottom up. It has to be grassroots support. We saw some early signs of that in 2008. They seemed to have faded a bit, but we hope they will come back again. Having said that, once you get that momentum building up from the grassroots, you then need some sort of move from top-down as well to -- top-down comes to meet bottom-up.

But that top-down move cannot come with all 190 countries. You've got to get the leading countries from both, and this is very important to emphasize -- from both the developed and developing worlds, to agree to a set of actions to deal with the climate challenge. So obviously, the leading developed country, the leading -- so it appears -- developing country, the U.S. and China, have got to take a pole position here and other leading countries have to follow on. I don't know how many, but if we get three, four, five countries, it's a bit like a snowball. You know, as it gathers momentum, it will accumulate more and more countries, more and more critical mass.

**Greg Dalton:** So, something like 60 to 70 percent of the people in the United States say they favor - respond to polls saying they favor some kind of action on climate. There's been some protest about the Keystone Pipeline. I don't know if you look at that as a favorable thing or a bad thing for this kind of, your grassroots support. Do you see that that's, you know -- how do you judge that? is that enough?

**Cho-Oon Khong:** I think the problem is people recognize in principle the need to act to deal with the climate. The question -- I think the crunch point comes when they are faced with difficult decisions that they have to take when the cost is an issue.

**Greg Dalton:** Well, personal cost. Let's find someone else who pays. But if I have to pay something else --

**Cho-Oon Khong:** Absolutely. And companies face that question every day. If you want to add CCS, carbon capture and sequestration to a power plant, you double the price of the power plant.

So it's something I think we need to think about. And the way to deal with it is to have an effective price on carbon. So whatever mechanism you've got in mind -- and we favor carbon trading -- whatever mechanism you've got in mind, you've got to value, you've got to put a price tag on the carbon that's being emitted from whatever activity you're engaged in.

**Greg Dalton:** And where, if you talk about China's leadership, China is testing some cap and trade systems, of different flavors, that could potentially put a price on carbon with -- for 20% of their 1.3 billion people.

That's a lot of people. Do you see that as the most promising area where pricing carbon could happen right now or is it somewhere else?

**Cho-Oon Khong:** No. Let's be clear. One thing about China -- and that's a very important thing to bear in mind. The leadership recognizes the problem. And they intend to deal with it but the important thing before you can deal with the problem is to recognize it exists. The second point to bear in mind --

**Greg Dalton:** They're ahead of the United States in that regard.

**Cho-Oon Khong:** Well, I think the penny's dropping here, too. So hopefully, we'll get both countries in pole position before too long. But the second point I was waiting to bring in was this whole issue of urban pollution, that it got black carbon. It's a huge issue. I don't know many of you picked up the stories in January of this year when Beijing was covered in smog.

**Greg Dalton:** People saw the photo of the guy jogging with a mask on.

**Cho-Oon Khong:** Yeah, absolutely. And they recognize that economic growth of which they're very proud of, has a price. And it has a price that needs to be costed in. And as far as the government is concerned, this cost is hitting the very people who benefited from growth the most, that's the urban population, and on which it critically depends for support and legitimacy.

So it recognizes, if we don't do something about this, they'll do something to us. So I think that recognition is dawning. They will act on it. And let me just give you another point of comparison.

We look at smog in China. We think how appalling. I don't think many people in the room perhaps were alive in 1952 -- some of you were. [Laughter] But most I would wager were not. But in 1952 -- I live in London. In 1952, we had the Great Smog, the Great Smog in London, in which 12,000 Londoners died.

And the smog was so bad that it seeped inside of buildings and people in cinemas complained they can't see the screen.

**Greg Dalton:** Wow.

**Cho-Oon Khong:** So it was as bad as that, and it finally impelled the British Parliament in all its wisdom to pass the Clean Air Act in 1956. It took them a further four years, but it finally got round to doing it. And we have, I would say, extremely clear air? But fairly decent air in London today. So you need to get that sort of impetus going -- public support saying we need to change.

**Greg Dalton:** The difference now is that scientists say we don't have 50 years to get the carbon down, that it's much more urgent in that. And LA had -- Los Angeles had a similar turnaround from really bad air to cleaner air today.

**Cho-Oon Khong:** Uh-hmm.

**Greg Dalton:** Not as clean as San Francisco. But the urgency is greater this time. Would you agree?

**Cho-Oon Khong:** I think the urgency is very great today. We -- I have to say this, Greg. We've been talking about -- I've been talking about Scramble and Blueprints, the scenarios we came up in 2008. In our later set up scenarios, the ones we came up with this year, 2013. We call those scenarios mountains and oceans. And those scenarios carry a very stark warning that regardless of the scenario, we're heading for an overall global temperature rise of somewhere between 3.3 to 4 degrees Centigrade, yeah, depending on which scenario.

**Greg Dalton:** So, no Americans know what that means, but that's some 7 degrees to 11 degrees, something like that?

**Cho-Oon Khong:** Okay. Yeah. But the benchmark which most people use is a 2 degrees Centigrade temperature rise. That's the benchmark that most people use. And so we are way over that benchmark regardless of the scenario, and therefore we need to think what are we gonna do about this.

Now firstly, we have to start moving now to begin to reduce the amount of carbon that we spill out into the air. In both scenarios I have to say by 2100, that's a long way into the future, we're going to get to zero carbon emissions. But it's all that carbon that's already spewed out between now and then that's going to cost the global warning. And we need to act to do something of bringing that level of carbon down. And so for us the lesson with these new scenarios, mountains and oceans, is

how do we combine the best features of both into a possible third scenario? We're still working on that.

**Greg Dalton:** Great. Well, it's interesting reading the scenarios of this and interesting outlook into various possible futures. It's on the Web, so, Dr. Cho Khong, thank you for coming.

**Cho-Oon Khong:** Thank you, Greg. Thank you everyone.

[Applause]

**Greg Dalton:** So, Marvin, welcome to Climate One.

**Marvin Odum:** Thank you.

**Greg Dalton:** Let's get a baseline here in terms of climate and talk about the scientific consensus that climate is disrupted by burning fossil fuels. Where is your position, Shell's position on climate change and man-made climate change?

**Marvin Odum:** Well, it is probably the easiest question you'll ask me all night because it's very clear for us as a company, and that is that climate change is real, that humans have an enormous impact on that, and that it requires some sort of action going forward.

**Greg Dalton:** And what kind of risk does it present for the United States and for Shell as a company?

**Marvin Odum:** Well, I think if you look at the policies that we advocate as company, so getting outside of our direct day-to-day business, working with governments around the world, that I'd say the number one element of that advocacy is putting a price on carbon. So we see it as a big enough issue and a big enough risk, though we were -- we need that sort of global framework to then drive this market to somewhere different than it's headed right now.

**Greg Dalton:** So a price on carbon meaning, like what is emitted now from our tailpipes and smokestacks goes into the atmosphere unpriced and putting a price on that. And that's -- where is that happening around the world in a meaningful way?

**Marvin Odum:** Well, it's happening -- I mean it's actually happening out -- I spent some time with the governor today, so you know, to a degree it's happening here in the state of California. We see some evidence of that in Australia. You see it happening in Europe, but to varying degrees of success. It's the design of these programs is critically important. So I think, you know, we have to both look at where it's happening but also say how can we do this in a more effective way.

**Greg Dalton:** And what do you think about California's plan to price carbon pollution, they have a cap and trade program that's something that Shell supports?

**Marvin Odum:** Yeah, so cap and trade would be the preferred solution from our perspective. And just to be clear, cap and trade, you know, there's a lot of complaints about it being a complex system and so forth. But the thing that we really like about it is it's a market-driven system and you get that full power of the market to bear than actually reducing carbon. Cap meaning it actually, you know, caps the CO<sub>2</sub> emissions and then you can lower that cap over time. So you actually design it to get to the result that you're after.

And then a trading system, because the importance of the trading system is it allows that CO<sub>2</sub> reduction at the lowest cost to the economy overall. Because you really do, you know, again, if you

think about the concern that people will have on the price on carbon, it's, you know, what's the impact on my pocketbook, what's the price of energy going to be, what's the impact on the economy in total. So you really want to go after the low-cost options to eliminate carbon from the atmosphere.

**Greg Dalton:** But some businesses in California complain that the price on carbon will drive up the cost of doing business. And they're -- actually there's litigation. Is that something -- what's your position on the litigation and some of the complaints against California's cap and trade system?

**Marvin Odum:** Well, I think the -- I mean let me just back up a little bit. Because it's, you know, about much more for us than just what's happening in California.

**Greg Dalton:** Uh-huh.

**Marvin Odum:** And so I'd ask you to look at what we're doing inside the company. And so we already have a price of carbon inside -- a price on carbon inside of our company.

We charge ourselves -- as we do our project economics and we roll these projects out, we decide of the, you know, \$33 billion we're going to invest every year and we look at the economics of those and rank those, we've priced in \$40 a ton for carbon emissions.

**Greg Dalton:** Which is much higher than any other price in the world?

**Marvin Odum:** Much higher than any of those trading systems that we talk about right now.

**Greg Dalton:** Right.

**Marvin Odum:** And so now, that's funny money in a way, right? I mean we're not actually charging ourselves \$40 a ton. But we're checking a couple of things. One is the resiliency of these projects in a world where we anticipate there will be a price on carbon. As well as it gets our people to put these projects together, that engineer these projects, to actually think in terms of, you know, is there a way for us to reduce the carbon emissions from this project.

**Greg Dalton:** Uh-hmm.

**Marvin Odum:** If I'm going to be burdened by \$40 a ton, I'm going to think about that and see if I can find ways to bring that down. But it also results in -- I'll give you a fairly straightforward example where if you're going to build a facility, one of the -- and there's a lot of facilities built around the world right now -- one of the big challenges is capturing carbon from these facilities is very difficult, because they weren't designed at carbon capture. So you've got a little bit coming out of here, you've got some coming over there, and retrofitting that is incredibly expensive.

So now if you've got a project team that's thinking about it then in advance, they might not, as Cho said, you can double the price of a power plant, so you might not put in the carbon capture and storage right now, but you'll work this power plant, design it in a way where you have a capture point that can capture that CO<sub>2</sub> that you're after.

**Greg Dalton:** That's interesting that you actually have a price, and you stated. I think Conoco has a price, but not every oil company has a shadow price on carbon. There seems to be some different views, whether that's a good idea, whether that's strategic or -- I'm interested in whether there's a debate in the company about having that price and disclosing it. Because -- I mean is that competitive in any way?

**Marvin Odum:** Well, no. I mean I think it's still again, it's... if you're going to seriously advocate for a price on carbon and you do something like that into your internal, so the company will need to be pretty transparent about that.

So there's no controversy about discussing it. There's no controversy about discussing how we use it. And I would advocate that it's a very powerful thing to do and an important thing to do if you believe in this.

**Greg Dalton:** So the price on carbon pollution -- California has a new cap and trade system. The price is now around \$10 a ton. Is it fair to say that your pricing -- you're charging yourselves 40, that you're prepared for that to go up to 40, you'll be okay because you've designed your systems to be -- live successful on a \$40 per ton world?

**Marvin Odum:** Well, I can tell you that we understand what the impact would be. So it's clearly not saying that there wouldn't be an impact.

**Greg Dalton:** Okay.

**Marvin Odum:** And it very much depends on how a project or how a system is designed, but for the price range that we're talking about, yes, we're prepared for that.

**Greg Dalton:** And California system may have some issues tweaks here. I wasn't quite sure whether you're involved in the litigation against California's cap and trade system?

**Marvin Odum:** I don't think we're -- actually, we've been a strong supporter of AB32. We were openly opposed to Proposition 23. I think it was Proposition 23, wasn't it?

**Greg Dalton:** Which was a ballot initiative to basically cease California's main climate law. Yeah.

**Marvin Odum:** Yeah. So I have no idea who -- there hadn't been a lot of controversy on that for us. Now, one of the things we will continue to do and I will, as I said, you know, in some of the conversations I had earlier today, we'll never be hesitant about recommending ways to improve the design of a program. And that includes tweaks to AB32 or the LCFS or whatever.

**Greg Dalton:** The Low Carbon Fuel Standard initiative.

**Marvin Odum:** The Low Carbon Fuel Standard -- so we'll always be in that conversation about maximum ways to improve it. But we've supported the program and the goals of the program.

**Greg Dalton:** Natural gas is one fuel that a lot of people look to as a possible -- it's talked about as a bridge to the future for a low carbon future. Shell, I believe, is now more of a gas company than an oil company. So let's talk about natural gas and this new energy mix in the future.

**Marvin Odum:** Yeah. I mean everybody in this room, I know, is perfectly aware of what's happened, particularly on this continent over the last half a decade or so, where there's just a tremendous amount of natural gas resources that, you know, as I think you've heard in some of these previous presentations, is really changing the energy landscape in total.

Now, the impact of that if -- we've talking about CO2 and a price on carbon. The impact on that, there has actually been a reduction in CO2 emissions across the U.S. And primarily, that's because more natural gas has gone in to power generation and more coal has been backed out. And I will tell you that the single -- you know, if my perspective as a company and advocating for what we've been talking about is to reduce carbon emissions, probably the single most impactful thing that we can do

over the next decade and a half to two decades is to drive natural gas in and drive coal out because of its affordability, because of the difference in CO2 emissions, because all the technology is there.

And at the same time, we can work on things like carbon capture and storage, which we're now doing at full scale in Canada to see if we can then match that technology up with natural gas by power generation over time to move that even closer to a zero emission source of energy.

**Greg Dalton:** And Shell got out of the coal business, was in the coal business at one point, and you're fortunate, you've been going from coal to oil and now to natural gas. So you've been lightening your carbon footprint. But the premise there about natural gas being better than coal is based on some math that isn't quite clear yet. And you're working on clearing that math, but it's based on whether how that gas is produced. It may be worse than coal or equal to coal depending on how it's done.

**Marvin Odum:** Yeah, I think this is the prime -- one of the primary challenges that I hear around natural gas development right now. And some people would call it fugitive emissions. So it's methane leaking into the air from the development of natural gas, either in the drilling process or in the fracture-treating process or in the straight production of that natural gas. And you see predictions all the way across math from, you know, relatively low emissions to emissions such they would make it about equivalent to coal, thus removing the benefits.

So what we decided to do, and I know Fred Krupp has been here before. We said, "Well, we need to get out of the business of speculating on what it is and we need to get into the business of understanding the science behind it." And so we joined up together with several companies and I think we're actually nine companies now including Chevron here in the state, and we've invited EDF and the University of Texas and some other academic organizations to actually go to our facilities and test each stage of this development and actually measure the methane emissions associated with that. And that study should be coming out in the next two months, some time I think in May or June, it should be available to the public.

**Greg Dalton:** If there's something like a thousand companies that frack for natural gas in the country and that may measure the way Shell does it or the big companies, but there's lots of Jed Clampetts out there that are poking holes and mining natural gas. And no one's looking over their shoulder to see how they're doing it.

**Marvin Odum:** Well, yeah. So this is another place where I again I don't apologize for being direct. And that is, you know, there's a goal in working with groups like Fred Krupp and EDF and there's a goal behind us putting out our operating principles for how to develop shale gas and oil onshore the right way. And that is we want to develop a standard for the industry and we want that standard to be adopted into regulations. And we want every company operating in the space to be held to those regulations

**Greg Dalton:** Okay. In that -- with that, right now, fracking is regulated at the states. So that means, I don't know, 30 something states adopting those rules, government is much slower than technology and industry right now. Government is playing catch-up. There's already fracking going on. If there's leaking or water contamination going on, it's happening now and the regulators don't have the resources or the knowledge or maybe they don't want to get around to doing that. How do you deal with that tension, with all that --

**Marvin Odum:** Well, I think you have to view it as a, you know, like everything that we could -- anything that we could talk about. We're going through a period of transition. So I think the important thing to do is get the scientific data and then act accordingly.



So what I expect these fugitive emissions that will fall directly into what I would call a set of best practices, on how to develop these type resources. So that's going to be a critical element of what I think will emerge as something that should show up in state-level regulation. Now, we already see states that are doing that, right? There's states that have these what I would call the critical elements of that already in place, and there are others that are moving in that direction. And I think it's better -- my personal opinion is it's better to help push those states along than to try to wait for this, you know, grand federal versus states' rights discussion which could go on for another 20 years. So let's work with the states who have the primacy now and let's help them get to the right way.

**Greg Dalton:** So does that mean that Shell is going to sell -- Shell is going to send people into the statehouse in Texas or Wyoming or South Dakota and say, "We've developed these principles; these ought to become regulations." And your friends at the bar are not going to be happy. They'll all be, you know -- that's, "Why are you doing that? It's going to cost me money. I don't want to do that." There's some tension there between -- I mean are you really going to go and have the legislators or the regulators adopt these principles?

**Marvin Odum:** So there's absolute tension there, and that's exactly what we do. So, I mean that is exactly what we do. The reason we put these principles together, which for clarity address the mechanical integrity of the well because that's the real concern when it comes to developing these resources. It deals with air emissions issues and reducing fugitive emissions with protecting water sources and recycling water wherever possible. It deals with minimizing the footprint of this activity and the fifth principle is around how do you work with communities where this kind of development can have a significant impact on increasing populations, on overloading schools, on overloading roads -- so all of those are important.

So not only do we put them together, and I think there's now something like 59 or 60 elements that sit behind those five principles, but we are taking them to the states. Now, we've also been very clear publicly which ones of these we think apply to all of our operations worldwide. So as you go into our website and you look at the details underneath these principles, it will say worldwide.

Which means if I'm drilling a well in a province in China or I'm drilling a well in Argentina or I'm doing it in the Marcellus in Pennsylvania, it's done the same way.

**Greg Dalton:** And I want to pick up on water because water is projected -- there's projected to be less water in the future as snow packs decline. Waterless fracking, is that a possibility? At what point do you decide to recycle all the water from fracking that involves fewer trucks into neighborhoods and out? A lot of the truck traffic which people object to is water in and out.

**Marvin Odum:** Yeah.

**Greg Dalton:** So -- let's talk about water recycling and water efficiency with fracking.

**Marvin Odum:** So it's a-- I'm -- again, I'm convinced it's a mindset, right? So I try to pick the most controversial areas. So the Marcellus is a fairly controversial area for shale development, a lot of it happening, but I mean there's a lot of debate back and forth in the Marcellus. We've been there for four years or so now, and we already recycled probably 99 percent of the water in our operations and -- our operations are expanding as we speak.

**Greg Dalton:** Is that more expensive or cheaper to recycle water?

**Marvin Odum:** It's more expensive on the front end, and -- but then when you think about, you

know, a large development that will take place over a 10 to 20-year time period, if you have that mindset going in and you build the loop systems to where you can capture and store and then reuse water, it's cheaper in the long run, but you have to have that perspective to put the investment in upfront.

**Greg Dalton:** And that is a mindset mentality because a lot of Wall Street these days, I hear a lot about companies who want to do things a certain way, but they get whacked by the Street because they spend more money upfront.

**Marvin Odum:** Yeah.

**Greg Dalton:** And that -- because of quarterly earnings, then don't spend this money today when you can, you know, spend some more tomorrow.

**Marvin Odum:** Yeah. And so we deal with that but I think we strike that balance about right. I want to take you back to CCS because I like carbon capture and storage. So I'd like Cho's example of the power plant you can double the cost of putting carbon capture and storage. So we have investors of course in the company.

We're involved in the oil sands development, another controversial area in Canada, and this is where we're putting in a carbon capture and storage project which has a price tag of over a billion dollars. Now, there's no return on that billion dollars. Now, part of that price tag is being picked up by both provincial and the federal government in Canada, and the rest we're providing. But I think our shareholders understand, just like they understand this concept of how we charge ourselves \$40 a ton. They understand that the world is changing and, you know, some of the questions that are given the investors are not "why are you wasting your money on this?" The questions might actually come in the form of "well, I'm worried you might be investing in something that's going to be a stranded asset in a changing world, and how are you preparing for that changing world?" So I think investors are savvy enough to understand what we're doing here.

**Greg Dalton:** And carbon capture and sequestration has been very hard. The federal government has put billions of dollars into it. No one internationally has really cracked it at industrial scale at a reasonable cost. Is that the concern with carbon capture by the investors is like, "ugh, this is going to be a white elephant" up there?

**Marvin Odum:** Well, I think generally the way we're doing it, which is, you know, picking several projects around the globe to go after and demonstrate, I feel like we have strong support from our investors. But the goal is to find a way to lower the cost of that technology. Well, the technology works. There's nothing magic about capturing CO<sub>2</sub>, compressing it, putting it in a pipeline and putting it deep underground. That's all stuff we know how to do right now.

The trick is doing it at scale, and at scale is where you learn how to then reduce the cost over time. Because there is something that could be very important to it over the next 30, 40 years.

**Greg Dalton:** There's some concern about that carbon dioxide leaking in the future. And is that something that is a company risk or is that a social risk up in Canada that if, you know, you put it down in the ground but CO<sub>2</sub> leaks up into a neighborhood or somewhere...

**Marvin Odum:** Yeah --

**Greg Dalton:** Or maybe you're doing it away from residential areas, but where's the risk for future problems with that CO<sub>2</sub>?

**Marvin Odum:** Yeah, it's one of the conversations we had worked through with the government of Canada, is where is that going to sit over time? But there's a way to work through that both contractually and from a regulatory standpoint, and that will be a shared responsibility in this case. But the more important aspect is not necessarily where the liability sits but what's the engineering that goes into making sure that that never happens? And so, it is a matter of both putting our experts on it to design it. It's a matter of bringing in third party experts who have no vested interest in what's happening there, you know, to put their seal of approval on it. And so we've done that quite extensively and to the satisfaction of the Canadian government.

**Greg Dalton:** If you're just joining us on the radio, our guest today at Climate One is Marvin Odum, president of Shell Oil Company. I'm Greg Dalton. We're talking about food and energy and water. Let's talk about another nexus here. Corn and water, food and water. There's often a tension there. Shell is not a big player in corn ethanol in the United States. Why?

**Marvin Odum:** Well, because I'm not really sure it makes sense, to be a little bit too frank about it. The --

**Greg Dalton:** Well, everyone says that unless they are a corn farmer --

**Marvin Odum:** Yeah -- no, exactly. So I understand it from a farmer's perspective. So, you know, from my perspective, what would be the driver for us is looking for a transportation fuel that has a lower carbon intensity than oil and gas. And corn ethanol for us doesn't fit that bill. Now, you know, but we understand transportation fuels and we spend a lot of time in that space. We work directly with our customers. And so we scanned the world and said biofuels may actually one of the technologies at our fingertips to help replace and lower -- replace some and lower the carbon intensity of the transportation fuel sector. And what we came up was biofuels, yes, but in Brazil, made from sugarcane where irrigation is not required to produce it. (0:33:57)

And we end up with something like a 70 percent reduction in CO2 intensity by the time you get and use it as a fuel.

**Greg Dalton:** So it's water-efficient and it's not competing with food?

**Marvin Odum:** That's right. And it doesn't require, you know, the deforestation of additional land and so forth. And so again, we scoured the world and said "Where is the right place to do this?" We're now one of the largest single entities producing biofuels, and it still struggles to get out of the country because the country is basically consuming everything that we're producing.

**Greg Dalton:** And so you look at some of the tension over corn ethanol and it -- hog farmers and others saying this darn ethanol mandates are driving up the cost of their feed and therefore our food. You think there's -- well, how do you do that sitting on the sidelines as you are?

**Marvin Odum:** Well, I think we just -- I rely on the facts, you know. So I rely on the facts, meaning what is the competition with fuel food and let's be clear about that, what is the CO2 intensity and let's be clear about that. And effectively that's a policy decision in terms of -- and by policy decision, I mean a government decision on making those tradeoffs. That's not our industry or my company's decision to do that.

**Greg Dalton:** Are biofuels going to be a bigger part of the transportation power source in the future?

**Marvin Odum:** Yeah, I think they will. But I think biofuels are a great example of where this requires a suite of solutions and not one individual solution. So biofuels are not going to be the

panacea of the transportation fuels, but they will fill a portion of that sector and in very important ways. But you'll see the different parts of the world, different geographies, different climates will have different solutions that make sense in that space. We talked a little bit about natural gas. I think the concept which has been around forever and there's probably natural gas vehicles that run in San Francisco, of course, and maybe some buses and others.

**Greg Dalton:** We have taxis that run on natural gas. Fleets.

**Marvin Odum:** Taxis.

**Greg Dalton:** Yeah.

**Marvin Odum:** But I think this whole concept of taking this vast amount of natural gas that the U.S. now has and driving that into the transportation sector.

And what I'm interested in and what we're interested as a company or where we're putting our money is into liquefied natural gas going into heavy transportation. So 18-wheel trucks, rail, marine vessels all around this country -- there is a what I would call a significant advantage from almost any way you look at it from that perspective. So I can imagine there's people in the room that say, "Yeah, but this all depends on developing shale gas the right way." So let's say we take these principles and we develop it the right way.

Then we're talking about significantly lower emissions. And by that, I mean also from a particulate standpoint, you know, the smog you see in the air, virtually none of that coming from LNG as a fuel.

And you do see -- so you get the environmental benefits of that and it can happen at a significantly lower cost than what the world pays for diesel today because of the pricing in North America.

**Greg Dalton:** If you're just joining us, our guest today at Climate One is Marvin Odum, President of Shell Oil Company. I'm Greg Dalton.

The Arctic is another area that's been in the news lately. Shell had some troubles up there. How's that going for you? [Laughter]

**Marvin Odum:** Well, I really -- I really appreciate you raising that. [Laughter] It was a challenging year, I'll say. A couple of thoughts on the Arctic and where I think we're headed with this. And you have to step back a little bit and look at it from a global perspective and then you come and look at it from a U.S. government perspective and then I'll come back to the company. But there is a -- and both in our scenarios and just in understanding of where energy is going globally, I think there's a pretty clear understanding that fossil fuels will be required for quite some time, still. Oil resources will be required for quite some time still. If you look at where the reserves are likely remaining across the globe, probably 25 percent of those are in the Arctic regions.

So you know, whether or not the world chooses to do it is a question...

**Greg Dalton:** Which is actually to say --

**Marvin Odum:** [Crosstalk] It's probably there is a significant fact.

**Greg Dalton:** And they're more accessible in a warming world now that the Arctic melt is --

**Marvin Odum:** Yeah.

**Greg Dalton:** Yeah, there's no more ice up there, right.

**Marvin Odum:** Now, that's right. I mean it's -- so the answer to that, yes. That what I was going to say is, you know, we had an experience this past year in the Arctic where there was actually more ice than there had been in the last 10 years, but that doesn't change the phenomenon you're talking about because there is more melting. There is more space. But it still can vary quite a bit from year to year. So we had a very, very short season this year, but the trend is correct, that there's less ice. And that will make this kind of activity easier, unquestionably.

I think from a U.S. government perspective, there's a strategic element in saying, you know, we want to understand at least the quantity of resources that are there as part of our decision-making on what to do with it. And they have worked with us. It's been a long and arduous path in a lot of ways, but they've worked with us on what is the right way, what are the elements that will be required to explore and find out what those resources actually are. And that's the phase we're in right now. So we were out -- you know, we worked five years with the federal government on the permitting and designing of systems to do that. We started that in 2012. We had some fairly public mishaps, you know, the most significant of those which was the grounding, meaning up onto the shoreline of the drilling rig, which didn't have anything to do with drilling operations by the way.

This is when we had left the north slope and it had come down to the southern portion of Alaska and we're towing the rig to Seattle, and lost it in a storm and then it ran aground in Southern Alaska, the Kodiak Island in that area, in South Alaska. But still, you know, very public and for me actually an embarrassing event. I hate to see something like that happen. But there are some real learnings that come out of that from a marine transportation perspective.

And we've worked now with the government on what needs to be done different before we go back and continue drilling.

**Greg Dalton:** When the Alaska pipeline was built, there was -- some people thought that the industry is sort of overconfident about its engineering abilities and the pipeline was harder and expensive than initially thought. Is it possible that drilling in the Arctic is harder and more complex than you anticipated?

**Marvin Odum:** So I never take it lightly is I think the most important thing that I can say to that question. But it's not something that we haven't done before. So there's been, you know -- off the north slope of Alaska, you have the Beauford Sea and Chukchi Sea. There's been about 30 wells drill in the Beauford to this point in history, and we've drilled a number of those. There's been five wells that have been drilled in the Chukchi and we drilled four of those five. So it's not an unknown quantity from that perspective.

Now that, in no way is that an excuse for, you know, losing a drilling rig in the storm and having it run aground. That's a separate issue that we have to address and put some other marine transit elements in place to make sure that there's no chance of that happening again. So we don't take it lightly, but we do know how to do this, actually, to drill these wells. There's one aspect that, again, I don't think this will be new for anybody in the room, but one aspect of drilling in particular in an area that's as remote as offshore Alaska, and that is that you take everything with you when you go.

And it's the biggest concern about the Arctic is you're too far away from response capability and so forth, which I completely agree with. But the only then reasonable response to that is you take everything with you based on a design with the government in this case of a worst case scenario and that you're able to respond on the spot with the assets that are already in place. And that's the way this is put together. So I think somebody told me that when this element is in operation offshore, it's something like the ninth largest navy in the world.

I mean it is quite a substantial number of assets.

**Greg Dalton:** The Natural Resources Defense Council, the Sierra Club, a lot of environmentalists are hitting you pretty hard on this one. Is there any middle ground or does this -- is it just they want no drilling up there, period? Or is there something -- accommodations, environmental protections, more safeguards, more response capabilities, something that they want from you that you could do?

**Marvin Odum:** Well, I think it's a mix. So there are groups that -- where the answer is absolutely no and there is no amount of fix or barriers or redundancies that will make that okay.

**Greg Dalton:** Zero is the only answer?

**Marvin Odum:** Zero is the only answer.

**Greg Dalton:** Uh-huh.

**Marvin Odum:** And I think there are a number of groups in that play. And there are clearly a number of groups that we found that we're working with on what I tend to call this "how do you do it the right way," how do we make sure we put the right protections in place.

**Greg Dalton:** There's another area of the hydrocarbon equation right now, which is the idea of unburnable carbon. And HSBC, the large British bank, came out with a report saying that if the world is serious about keeping greenhouse gas emissions or warming below 2 degree Centigrade, which the international community has said that's the level of -- the highest safe level of warming, if the world is serious about that, some of the hydrocarbon reserves on the books of fossil fuel companies will be unburnable and, you mentioned, earlier stranded assets. Is there any concern among your investors that some of the assets that prop up the price of Shell and other energy companies, maybe unburnable in a really hot world?

**Marvin Odum:** You know, I mean I think that's what I mentioned earlier, this concept of stranded assets and that's something on an investor's mind. I can tell you it's been on our mind a long time before it hit investors' consciousness, because that's exactly the world we live in. I mean it -- we're investing at a level of about \$30 to \$35 billion a year in new projects.

Most of these projects will last in the order of 10 to 20 to 30 years. And so we have to take a perspective that says where is the world going over the next 30 or even 40 years in some cases, and we absolutely think of it in that context. It's one of the ways that we use the scenarios that we have in Shell. And, one of the things I really like about the scenarios is Cho and his team, they develop them independent of the management of the company. So these are, you know -- this is a real thought group that sits out there on its own and brings the scenarios into us as a leadership group and a management team so that we can test our own thinking, which sometimes can be a little bit conventional against this kind of forward look in terms of where the world is going.

And it results in asking ourselves these types of questions. So we make our investments with these in mind.

**Greg Dalton:** So what are the scenarios at which, you know, the world gets serious or something, you know, Hurricane Sandy or multiple Sandys in the world says, "Look, we got to get real serious about carbon fast." Then what are the paths for Shell? How do you adapt to a world in that situation? How will that affect the company?

**Marvin Odum:** Well, I think there -- so there may be elements that move fast but I think you have to talk fast in terms of the energy system...

**Greg Dalton:** Well, energy is -- yeah.

**Marvin Odum:** -- and it is an amazingly complex and enormous system that doesn't change overnight. So, as much as anybody may wish for the energy system to change overnight, it will not do it and it can't do it. It's just physically impossible.

You know, I joke about this sometimes, but the name of company is Shell Oil Company, in the U.S. But you know, we produce more natural gas now as a company globally than we do oil. And that didn't happen by accident, right? This is because this is in our thinking of where is the world going, what is the preferred fuel. And we can clearly see a universe here where natural gas is going to be preferred over oil. It doesn't mean oil usage is going to go away. It doesn't mean we're not still going to produce oil and play in part of that market, but you can now visually and tangibly see the transition in the company to more natural gas.

At the same time, we're thinking through, you know, what will be breakthrough technology. You know, what is it that comes -- most of the people in this company will be focused on delivering the pieces of the business they need to deliver tomorrow or next month and by the end of the year. But at the leadership level of this company, we have to be thinking what happens in 2025, what happens in 2050. Cho now has taken the scenarios to 2100. That actually matters to us, you know, where does solar fit into that, where do other renewables fit into that. And we factor that into our thinking and in our investments.

**Greg Dalton:** And we should clarify that Marvin Odum is president of the Shell Oil Company. He's referring to Cho Khong, who's the chief strategist at Shell Oil. I'm Greg Dalton.

So, Shell is moving consciously toward a lower carbon posture or portfolio in natural gas more so than oil. The tar sands in Canada is one perhaps exception to that. That oil there is anywhere between 6 to 17 percent more carbon-intensive, dirtier than conventional fuel. So how does that affect your move toward lower carbon fuels, that you have one -- the biggest processors of tar sands up there in Alberta, Canada.

**Marvin Odum:** We are. So we make about a quarter of a million barrels a day of that crude. And so we came later to the game in terms of oil sands development in Canada. So we're more to that 6 to 7 percent range. So if you think about the average crude across this continent, our oil sands operations are on the 6 to 7 percent more CO<sub>2</sub>-intensive.

So first of all, it's just important to understand that's the difference. It's not twice as intensive or so. And so it's 6 or 7 percent more -- and it's a continually moving position. It's why I mentioned that carbon capture and storage project that we're putting and associated with oil sands development in Canada is to capture some of those CO<sub>2</sub> emissions and store them underground. So I have some numbers for you that I find interesting; maybe you will. (0:48:04)

We'll start with what the EPA I think put out about a year ago. It was a list of the top 100 CO<sub>2</sub> emitters in the country. It's focused on the U.S., the top 100 in the country. I think the vast majority of those were coal-fired power plants, and the top 10, nine or ten is individual facilities emitted over 20 million tons per annum -- million tons of carbon per annum, per year. Now, are -- we're a large oil sand operator; 250,000 barrels a day; the entire system emits about 5 million tons per annum. That entire, enormous operation, thousands and thousands of people, that's what it emits.

Now, there's carbon capture and storage project that we're putting in place. Of that 5.3 million tons per annum, we'll capture a million tons per annum and store it permanently underground. So I think this -- you know, we're dealing in a space where if the goal was reduce CO<sub>2</sub> emissions, the facts

really do matter, that that liquid resource to fuel transportation and so forth is still important and will be important for some time to come. And those numbers matter when it comes to really bringing down CO2 emissions across the country and across the world.

**Greg Dalton:** So you're saying that technology exists at a price? So what's the price per ton to store that carbon? Do you know?

**Marvin Odum:** Well, it's a lot right now. So the -- you know, we charge ourselves notionally \$40 a ton inside the company. I think the cost for carbon capture and storage right now is certainly over \$100 a ton. And it varies depending on where you are in the world, but it also points to the fact that if we're in a world that doesn't have renewable answers yet that can replace fossil fuels, carbon capture and storage, particularly in the scenario that you just mentioned, which is a real need to move fast around reducing carbon emissions, carbon capture and storage could be very, very important to us.

So the key is finding a way now to use that existing technology and bring that cost down from over \$100 a ton to something that's more manageable to economies around the world. That's what we're trying to do.

**Greg Dalton:** So it sounds like a hedge to me, that you spend a lot of money, you spend \$100 on something that there's no price on it now, but you better be prepared in case something happens, this is money -- it sounds like insurance or a hedge. Is that --

**Marvin Odum:** Well, I don't know where this happened in my career, but somewhere in the last 20 years, you know, the light bulb went on and said, "All of this has to be a suite of solutions." Now, there is no individual solution that's a panacea to the energy issue and the environmental issues associated with it across the world. It will take a very large suite of opportunities to have the impact we're looking to have.

**Greg Dalton:** Another large resource pool is the Monterey shale here in California. It's been looked at -- eyed by the oil companies for a very long time, decades. And now we're hearing more about it could have potentially half the oil of the north slope of Alaska. Will it be developed? Are you -- what's your view on the Monterey shale, which is this unconventional deposit in California that's potentially huge?

**Marvin Odum:** Yeah, I think there's a -- you know, a comment I'd make more broadly about shale development, you know, whether it's across the U.S. or across the world, because we're working in a number of countries around the world on this resource, is that there's still a lot to be learned. Now, what's been learned and I think is pretty clear to us now is that the natural, the shale gas, natural gas coming from shales across the country, there's been enough drilling and enough development to know that that's real. And when you hear people say there's a hundred years' supply of gas, that's real. It really is out there.

On the oil side, the developments are a little newer. So you hear about the Bakken in the Dakotas, you hear about the Eagle Ford in Texas, you hear about the Monterey shale, but those are much earlier in their development. And what I'll tell you is there's a lot of variability in Mother Nature here in terms of how producible it is, the quantities that will be produced, whether or not it's economic.

So if you're an oil producer, there's a lot of reason to be optimistic. If you're a state looking to boost the economy, there's a lot of reasons to be optimistic about the resources there, but it's far from a given still. And I'll put the Monterey shale in that category.



**Greg Dalton:** So it may remain an opportunity for the future a long time.

**Marvin Odum:** There's oil there. The question is can you economically develop that and how pervasive is it. That's still an open question.

**Greg Dalton:** Another question in California is whether oil extraction ought to be taxed. California is the only state that doesn't have an extraction or severance tax. Alaska taxes oil extraction at 12 percent, Louisiana at 12 percent, Texas and Wyoming around 5 or 6 percent. There's some interest in California in putting a tax on that. Would you for or against that?

[Laughter]

**Marvin Odum:** I'm against that, you know. [Laughter]

**Greg Dalton:** Do you --

**Marvin Odum:** I mean how do you, you know -- obviously there's some predictable statements from you tonight. I mean it -- what I would -- do I --

**Greg Dalton:** What's the different --

**Marvin Odum:** Do I look and say, "I think you should just take more money from these operations just because?" No. Now, at the same time you heard me say "I think there ought to be a price on carbon," which in some respects is the same thing, right? It's taking money from the production of these resources that would otherwise go to the company. But the thing I like about a price on carbon, the reason why you hear myself and us push very hard on the cap and trade system is one of the things that worries me most is the money going to the result that we're searching to get. So, straight tax is -- I'm not looking to increase the taxes on the business. If you put a carbon price out there, we pay more money to make up for that price on carbon, and that money that's paid goes directly to reducing carbon from the -- carbon emissions, whether through research and development or through physical reduction of carbon emissions, then that's okay.

But just putting a price on carbon and having -- it would go generally into the tax fund and being spent on whatever, I'm actually just not okay with that.

**Greg Dalton:** So California has cap and trade, so don't do a severance tax, but it's cap and trade addressing the issue? Okay.

**Marvin Odum:** And I think the reason why it's debated is because there is a link between the amount of taxes and the level of activity. There's just the straight economic calculation on this that will be part of that. And there's a calculation to be made on what is the right level of tax that gets that balance right between revenues directly from the resource being developed and revenues that come from the economic activity that stimulates through the jobs both direct and indirect.

**Greg Dalton:** Well, Alaska and Texas have severance taxes, and last I checked, there's a lot of drilling going on those states. It's not stopping that activity in those states. Are you saying --

**Marvin Odum:** But -- what I am saying is when we get to -- it depends on the whole of the economic equation. But I'll tell you right now, across the country where natural gas prices have been relatively low, they're up a little bit over \$4 now, but they've been down in the \$2 and \$3 range. When you're talking about those kind of prices for an energy source, then this kind of numbers on tax matter. And that is where we ship our money both in the country and around the world, that number does matter.

**Greg Dalton:** If you're just joining us on the radio, our guest today at Climate One is Marvin Odum, president of Shell Oil Company. I'm Greg Dalton. One local question. San Francisco Board of Supervisors recently voted to divest their pension system from oil companies, a number of universities and states are -- universities and cities are considering that. Is that on your radar at all? Is it something that is of significance? Has any of investors mentioned that? Is that just a liberal left coast thing?

**Marvin Odum:** No. It's far from that, and I think everybody here probably recognizes it. This isn't the only part of the world that's thinking about these kinds of issues.

As a matter of fact, on the -- last week, I was in London. We have an event that we call our -- it's our Socially Responsible Investors' Event where, you know, I don't know how much of the investment in the company was represented in that room but I wouldn't be surprised if it was 30 percent or more. And these are specialists in these firms and other representatives from pension funds and other places that are interested in the socially responsible side of this business. And we have day-long conversations about everything from oil sands to the Arctic to what we want to do with CO2 to where we are with the CO2 reduction target -- the full suite. So yes, they're very interested in this space, and I think they look for companies that are progressive in this space.

So the investment community is going through a transition as well, I would say. There are plenty of investors out there that are interested in what this quarter's results are and what are the next quarter results. But I do see a shift much more into the SRI space as we call it.

**Greg Dalton:** Socially responsible investing. We're going to invite your participation and put a microphone out here to join in the conversation. Again, if you're on this side of the house, please go out through those doors. The line starts with our producer, Jane Ann, right there. And then we invite you to join us with one one part brief comment or question and I'm here to help you on that if you need some help. And then while we're forming that line, we're talking with Marvin Odum at Climate One.

Steve Coll wrote a book called "Private Empire," about ExxonMobil. And he wrote -- the Pulitzer Prize-winning author said that "The one thing that made ExxonMobil anxious about their business model was a breakthrough in battery technology -- car battery technology." So I drive an electric car. Some people in the audience do. Does that make you a little anxious? The idea that if there was sudden blossoming or breakthrough in electric vehicles, that could be challenge to liquid transportation fuels?

**Marvin Odum:** You know, I think there's a misconception of -- I can't speak for companies broadly. I can really only speak for my own.

I think there's a misconception when a lot of people look at Shell and say, you know, "These guys are really about defending the business that they're in." And I will tell you that when we sit in our executive committee meetings and we talk about strategies of the company and where we're going, it's about how is the world changing and where is going to be the right place to be positioned in that changing world. And that goes to the questions about how long are you staying in certain resources, how much R&D money you put into the investment to the development of technologies. But also means that you connect yourself with the brightest minds in these areas, whether that's through universities or venture capitalists or otherwise, and you keep very close tabs on how development is happening. So we never remove the concept of a true breakthrough overnight, you know, breakthrough in technology. But we're also pretty realistic about the approach in terms of the likelihood of that happening. And if that does happen, you know, how quickly could we make an implementation take place? And again, all these investments are done in that context.

**Greg Dalton:** I heard Peter Voser, Chairman of Shell speak last year in Silicon Valley about the innovators' dilemma and how large companies often don't develop the innovations that they -- they do kind of protect what made them successful. And -- but so, let's --

**Marvin Odum:** So if I could at it --

**Greg Dalton:** Sure.

**Marvin Odum:** I think it's a point, again, about the Shell Scenarios that are developed is that's an easy trap to get stuck in that conventional thinking. Very easy. And I will tell you, if you get a chance to grab these scenarios and read through them, I think you'll see a real demonstration of how it's that thought process that pulls you out of that conventional thinking.

So when you challenge me around breakthrough technologies, whether it's battery or it's something else, that's actually the conversation we're having.

**Greg Dalton:** Right. Let's have our first audience question at Climate One. Welcome.

**Charles Reed:** Hi. Charles Reed, Lawrence Livermore Lab.

I'm wondering if you could speak a little bit about geo-engineering, because it seems that it's almost the opposite of carbon emissions in that you can get a small number of states or non-state actors having a large effect on a very complicated system that we don't understand. And when you bring in the cost of carbon, there might be financial motivations to do geo-engineering and have carbon credits. So could you speak to -- your thoughts on that?

**Greg Dalton:** And please define briefly what geo-engineering, how you understand the [Crosstalk] -

**Marvin Odum:** Well, I'll give you mine. But don't leave because I'm going to give you my interpretation of what -- yeah, but Lawrence Livermore is an example of a group that we work with. So, we work on specific projects with the lab. But I think geo-engineering, if you mean other ways to reduce carbon content in the atmosphere other than just reducing emissions from power plants and so forth, there is a way to draw carbon from the atmosphere and --

**Greg Dalton:** Or deflect heat back?

**Marvin Odum:** Or deflect heat, you know, so whether it's large-scale, you know, mirrors that push heat back to space or -- so conceptually, yes, but to be perfectly frank, we depend on people like you to think about that at Lawrence Livermore and other places. And it's why you see some of our funding going back into those areas. Because we recognize that's not our strength. But we recognize there are research institutions that very much do that, and as a core expertise. So we rely on you.

**Greg Dalton:** Let's have our next audience question here at Climate One for Marvin Odum, president of Shell Oil Company. Hi. Welcome.

**Dave Massen:** Good evening. Dave Massen. Citizens' Climate Lobby. I appreciate your focus on a price on carbon, and understand that you still save for cap and trade to get there. In Washington nowadays, most of the talk seems to be about a carbon tax, and I wonder what your views actually are about that option, which would still be market-based.

Maybe more predictable than cap and trade, still possible to predict the emissions' reduction results,

and maybe more possible to get Republican support. It's made revenue-neutral, the government doesn't keep any money, it's returned to citizens, and we may be able to get bipartisan support? What would be your view with that?

**Marvin Odum:** Now, I appreciate the question. And the response is pretty pragmatic, meaning we have a case for why we think cap and trade is best, but what we recognize is that's not our decision. So we advocate for that, but we also don't think there's only one answer to this question. So the idea of a carbon tax particularly the way you describe it, market-based, you know, outcome performance based, it would be sort of the next in line if you would to a cap and trade system. And my expectation is that's precisely what we'll see in some parts of the world.

**Greg Dalton:** Let's have our next question for Marvin Odum. Welcome to Climate One.

**Female Participant:** Thank you. We heard a lot about sequestration, which is a good word in your world and a nasty word in the rest of our worlds, especially if you want to fly. Have you been thinking about or are you considering doing some research in possibly besides or instead of sequestering carbon emissions? Recycling them in some way?

**Marvin Odum:** So we do. I mean with some of the, I guess the most obvious ways, and this is very internal to the industry, but what we have done, you know this is kind of interesting to think about. Back in the 70s and 80s, we used to actually find reservoirs, particularly in the area of Colorado and New Mexico that actually were almost pure CO<sub>2</sub> in the ground. We used to produce this CO<sub>2</sub>, pipe it to West Texas to put it into oil fields. Because when you mix that CO<sub>2</sub> with oil, it becomes much more miscible. It flows much easier through the reservoir and your recoveries go way up.

So now, one of the concepts is in that CO<sub>2</sub>, that when you stop that project, that CO<sub>2</sub> stays in the reservoir, a lot of it is recycled over time as you're producing the oil. So, one of the most simple concepts within the industry is use more CO<sub>2</sub>, captured it, not from -- now don't produce it from the ground but actually capture from emissions that would otherwise go into the air, and use it for this type of process and increase recovery efficiency with a lower footprint and all the other benefits to come along with it.

So we do think about other ways to use it. We worked with the technology for a while around how to take carbon and actually formulated basically into a cement mix so that it becomes, you know, so I can see -- tell it by the nods a lot of people heard about this -- become permanently in that state than it can actually be used as building materials and so forth. So we do -- we look for those breakthroughs as well.

**Greg Dalton:** Calera is a company not far from here that's doing that. Let's have our next audience question. Welcome.

**Peter Gesela:** Hi. My name is Peter Gesela. I understand you're on one of the boards at Harvard University. And my question has to do with scenarios at more effectively educating the general public about the complexities of these energy issues and energy efficiency. Are you open to looking at new scenarios that could more effectively challenge the general public to consider various strategies toward more energy efficiency in their communities?

**Greg Dalton:** Shell Scenarios in every school?

**Marvin Odum:** [Laughter] Yeah. So, I mean the answer is yes. I -- you know, it's one of the forever puzzles for me is when I get -- you know, I get a lot of feedback in this job. And usually, the [Laughter] and you've been very kind tonight, so thank you. That feedback is very often, you know,

"You need to do more as a company. You need to do more as an industry to educate people on some of the breadth and complexity of these issues so that we can get on with real solutions."

So I -- you know, I'm here tonight. I talk about this as much as I can find time to do it, and I haven't found that magic bullet yet for how to be more effective in that communication. But I do see the interest rising. I do see us able to use, you know, to work with MIT and with Harvard and a number of other organizations, NGOs and others, to help put that complex picture in a more consumable fashion. But I'm open to ideas. So, maybe we'll get a chance to talk afterwards. I'm open to ideas.

**Greg Dalton:** Let's have our next question for Marvin Odum. Welcome.

**Male Participant:** Thank you for being here and talking to us. You seem much more sincere than I expected and [Laughter] I'm almost convinced, but there still is niggling doubt that you're giving us a really skillful PR line. [Laughter]

**Marvin Odum:** Yeah. Those that know me well know better. [Laughter] I'm not that skillful.

**Male Participant:** So I'd like to hear the answer to your question kind of in relation to that. You spoke of the advantages of the open market in relation to cap and trade getting the result with the least cost to the economy. How do you feel about subsidies to oil companies which many people feel skew the market?

**Marvin Odum:** Okay. Thanks. Yeah. [Applause] I don't think anything I'm going to say now is going to surprise you. But I would challenge you to get to know me better to make up your mind about the sincerity point because I'm confident we'd end up in the right place on that topic. But in terms of subsidies, I think the most dramatic difference between the way you asked the question and the way I'll answer it is I don't call them subsidies, right? I call it a tax structure. And I'll give you an example.

There's -- one of the things that's typically called a tax subsidy to the oil and gas industry from a number of folks in Congress is the manufacturer's tax, a tax relief. So if you're a manufacturer in the U.S., you get a tax break of a certain percentage because you're manufacturing in the U.S. and I think the rate, the discount you get something in the order of nine percent. If you're in the industry, you know, whether it's Starbucks or a carpet manufacturer or a chemicals manufacturer, this is the rate that you get. And the oil and gas industry gets six percent. So that was -- that part of the tax code was already adjusted down specific for this industry.

So my point is this not that you'll ever agree that the tax structure that exists for this industry is where it should be, and I understand that you probably don't. But I think the characterization of calling these as special subsidies that go just to the oil and gas industry is the wrong terminology. It's just a tax code, it's just where we are. And now, there's still an open question as to whether or not we should change that tax code. And that's a policy decision as well, but it's not a free ride for the oil and gas companies.

**Greg Dalton:** But doesn't the depletion allowance have some special things for oil and gas that are not available for other industries? The Oil Depletion Allowance?

**Marvin Odum:** Well, to the degree that you're discovering a finite resource and producing that resource over time, yeah, because it's unique in that perspective and there's probably some unique tax code elements to that approach. But conceptually, I would say no.

**Greg Dalton:** So it wouldn't apply to solar because solar is infinite, not depletable, yeah.

**Marvin Odum:** And we don't know what -- I mean I don't even know what the -- so here's one of the things I worry about. Tremendous benefits of driving natural gas into transportation, from an environmental perspective, particularly the heavy transportation that I was talking about earlier.

If you think about marine and what ships burn and how they get around, there's a -- the emissions profile is not something you'd be very happy with. Those ships can run on liquefied natural gas. We now have the technology to produce liquefied natural gas in various regional points because we've really lowered the cost of doing that at smaller scale. And we can supply those ships going up and down the Mississippi River and the Great Lakes and so forth.

What I don't know is a company -- so this is part of the uncertainty I face as -- that's not a traditional use for natural gas. I have no idea what the tax structure around that's going to be. Is there going to be, you know, heavy fuel taxes layered on top of that that I'm not anticipating now? Should that slow down my investments or should I go ahead anyway? Yeah, these are some of the uncertainties that we deal with in the tax code where when you hear people say clarity would help things happen faster, that again, that's just one example.

**Greg Dalton:** We have about seven minutes left. Let's try to get as many questions as we can here for Marvin Odum. Welcome.

**Simon Mui:** Marvin, I appreciate your comments today. I'm Simon Mui with the Natural Resources Defense Council, one of the groups that has been engaging with you on some of these issues. I was interested in hearing Shell's position on AB32, particularly in support of California's Clean Energy Law including cap and trade. So that was refreshing. But at the same time, we're very acutely aware that the oil industry group Shell is part of, the Western States Petroleum Association, has, in our view, been fighting the program in the legislature tooth and nail as well as in the governor's office. So I wanted to ask you what do you see as Shell's responsibility to ensuring that the oil industry group is actually supporting implementation of California's Clean Energy Law and not just fighting it?

**Marvin Odum:** Yeah. No, thank you. It's another question that I get quite a bit. It usually comes in the context of API, you know.

**Greg Dalton:** The American Petroleum Institute?

**Marvin Odum:** American Petroleum Institute, which is a trade organization that sits primarily in Washington but has global reach.

We take a very simple perspective here, which is there's a lot of things that happen in the industry where we agree with our sort of fellow companies if you will in the industry and there's a lot of places where we don't agree. But principally, you know, once we get to a disagreement -- for example, Shell was a significant part of U.S. CAP when we were working on a cap and trade system. That clearly was not an API or probably a trade agency in California, WHISPA, position, but we took that position very publicly and very strongly. So we always try to make it very clear we are as a company and where we stand. But we'd much rather work these issues also from the inside in our industry rather than every time we disagree, we say "Well, that's it for this group; we're walking away," which I think is absolutely the wrong way to do it. So we sit at the table at API just like we do at WHISPA and a number of other places around the world, and we will fight for those things we support and we will heartily debate those things we disagree with.

And ultimately, those trade agencies take a position which may or may not reflect our company's position on that particular issue. But I do think you'll find us to be transparent about where we are

as a company.

**Greg Dalton:** Let's have our next audience question for Marvin. Okay. Let's have our next question. Welcome.

**David Leggett:** I'm David Leggett. I'm a civil engineer. Getting back to the question about public relations, I hear a lot of TV advertisements mainly saying "We support renewable energy." And it sounds great, but what I would like to hear is specifics. What is your revenue -- percent of revenue today from oil and natural gas and renewables and what will it be in 20 years and how can you relate that to how that affects emissions?

**Marvin Odum:** Yeah.

**David Leggett:** Specifically, with real numbers and to say "this is where we're heading."

**Greg Dalton:** Okay. Thank you -- thank you for that.

**Marvin Odum:** No, it's a great question. And I do think I completely understand where the challenge is coming from. So again, a very frank answer which is the percentage of both our investment and our revenue that comes from I think that the way you characterize renewable resources is very, very small. And I'm crystal-clear about that.

**Greg Dalton:** Less than one percent?

**Marvin Odum:** I don't know -- actually, I don't know exactly what -- we're just small. So I have a wind business. I have a gigawatt wind business. I keep it. It's not growing. It's fairly stagnant, but I keep it because it's a well-run, okay business. Not a good business but it's an okay -- from a financial standpoint. But we went into the wind business to understand what it was really all about and to understand the potential of it, how quickly it might grow and so forth.

So again, I get back to where Shell is as a company today, where our technical skills are. And the challenge in front of us is how do we reduce CO2 emissions. I just pick that as the environmental challenge. Then the most important thing I can do as a company is produce more natural gas, is to look for ways to provide an alternative fuel for transportation, which is the hardest nut to crack in this whole deal. And to look for ways to otherwise reduce carbon emissions. So I just told you we're over 50 percent natural gas now and that's been a long-term trend that we've been pushing towards. We're investing in biofuels in Brazil because after scanning the world, that was the place where it made the most sense. Now we're one of the largest single biofuels producers in the world. But I also told you that's not even enough to produce enough where it gets out of the country. I think it's something like 2 billion liters a year that we produce, but it almost all gets consumed in Brazil, but that was the right biofuels to work.

And then, we're putting huge investments in the -- for example, the carbon capture and storage project that I talked about. Because that is core to our skills. It directly impacts business and likely is going to continue to happen over the future decades.

And that's how we can have a big impact. Now, I could take that money and build more wind farms and other things, and I do lots of research and development around advanced biofuels and other forms of energy. But for real CO2 reductions, the three things I mentioned are the biggest impact I can have over the next one to two or maybe even more decades.

**Greg Dalton:** We're at the end here. I just want to ask a last question. 2012 was a remarkable year. It was the hottest year on record. Hurricane Sandy closed the New York Stock Exchange for

two days, 13-foot storm surge in New York, epic droughts in Texas and across the country. How urgent is climate change and how do you think it will affect you and your family going forward?

**Marvin Odum:** Well, I think my sense has transitioned I'd say primarily over the last decade. So I'll answer this question personally, to the sincerity point. I think it's urgent. I think action needs to happen. I think -- yeah, I find myself at times in a very difficult position because, you know, it does get actually a little -- you know, the idea of "We don't trust you. We think you're doing all the wrong things and so forth," does get a little tiresome. At the same time, I'd take great strength in knowing as a company we're actually working very hard to do the right things and to open up some paths for reduced CO2 emissions across the globe.

So I'm proud of what we do as a company. But I think action is urgent. I think we have to fix this link if you will between business and government and society, which feels completely broken, but I have a strong recognition that we can't move forward -- it's not a single company or even a single industry moving forward and fixing this problem -- if those three aren't working together, we can't get there. And I'll point to the gentleman from NRDC as an example. We've done some great work with NRDC and we disagree on a lot of things as well.

But those relationships are critically important. And the final point I'll make is you just can't give up because it is that important. It does have to happen. And I do think we'll get to a point where this is all more clear and it starts to happen in a much faster pace. And we're just trying to prepare things in the meantime.

**Greg Dalton:** Do you think they will require something worse than Sandy to be -- a worse crisis that will provoke that action?

**Marvin Odum:** You know, I can only answer again -- I feel I like I can only answer that question from a personal perspective, which is I look at the world and how it reacts to those kinds of things, and clearly that speaks to some people. But I don't think that the world sees isolated climate events or weather events as the ultimate signal for climate change. So that's part of it, I think.

**Greg Dalton:** You don't think that's enough?

**Marvin Odum:** I don't think that's the biggest issue. I think the biggest issue in terms of -- I like the way Cho described it in terms of getting the bottom up and meeting the top down, is there's a tremendous number of urgent issues in the world and there's a lot of those urgent issues that, you know, come up tomorrow and the next day. And thinking in terms of a climate system and what needs to happen, it's just very, very hard for the general public to do.

**Greg Dalton:** We have to end it there. Our thanks to Marvin Odum, president of Shell Oil Company, and Cho Khong, chief strategist at Shell, for joining us today. Thank you for joining us on the radio on Climate One. I'm Greg Dalton. Thanks for coming.

[Applause]

[END]