Creating Climate Wealth

https://www.climateone.org/audio/creating-climate-wealth
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Greg Dalton: I'm Greg Dalton and today on Climate One we're talking about generating wealth in the clean energy economy. California is leading the trend away from fossil fuels that are destabilizing the weather and hitting corporate profitability. Several entrepreneurs have become billionaires are creating new power in auto companies and many more are trying to follow. History shows that new wealth is creative when economy is moved from one form of energy to another: wood to coal, coal to oil and now fossil to renewable. Boosters say the transition away from dirty fuel is the biggest business opportunity of the century. Over the next hour, we will discuss the promise and the perils of empowering America's economy in a new way. Joining our live audience at the Commonwealth Club in San Francisco, we're pleased to have with us two entrepreneurs, Brad Mattson, CEO of Siva Power and author of the Solar Phoenix: How America Can Rise From The Ashes of Solyndra to World Leadership in Solar 2.0. and Jigar Shah, he's the founder of SunEdison, one of the country's largest solar companies and author of Creating Climate Wealth: Unlocking the Impact Economy. Please welcome them to Climate One.

[Applause]

Greg Dalton: Welcome both. Jigar Shah, when you were 16 years old, you read a book that changed your life. Tell us that story.

Jigar Shah: Well, unfortunately, I forgot what the book was called, but it was one of those books that you were sold door to door by the Southwestern company, when college students sold the books through their backpacks. And I think my dad bought it when I was maybe 10, but I just couldn't be bothered to read the 14th book that he would buy from these folks. So I read it when I was 16. And what was interesting is it was a book on electricity and it just, every two pages was here's how coal power worked, here's how wind power worked, here's how nuclear power worked, here's how solar power worked. And what struck me was that every technology got two pages.

So in my mind all of them were equal, right? So coal was equal, the solar was equal, the wind was equal, the nuclear was equal, the gas. And so I didn't know any better that coal was the dominant form of energy back then and solar was really small. And after reading it, I thought, well, you know, the solar thing actually does seem to make a whole lot of sense, there's a lot of sunlight. And I think that that's, as I progressed in my career, something that I found when you talk to five-year-olds or six-year-olds and you ask them where electricity comes from, they always say the sun and the wind. They never say it came from you know digging up the ground in Wyoming.

[Laughter]

Greg Dalton: And you had an idea later on to start a solar company which turned into SunEdison, but you worked at BP first and how did that give you credibility in the energy industry?

Jigar Shah: Well, I mean I don't know that it give me credibility but they had a solar energy division. In 1999, 2000, BP was the largest manufacturer of solar panels in the world and I went to go work for them but it was still part of BP. And the thing that struck me was we had this I remember this knowledge management initiative within BP when I was there and so they tried to

connect us all through, there was some private LinkedIn. And so I talked to people that were in the Northern slopes of Alaska or talked to people in Azerbaijan and other places of BP and they were all universally pro-solar, all of them, right? And so I think this notion that we're on two sides, and these guys hate us, and these guys love us is completely false. In general, I think, that's one of the big lessons I got out of BP was that people in general are actually for this resource efficiency revolution. And the second thing I got out of BP was that, I mean, look, people used to take my phone calls because it was like, well, I'm calling from BP solar they were like, okay, I'll give you five minutes, you and I would think I was 26 years old or something. And so reputation matters and that really came from the fact that BP sort of was a large company, good work at the time John Browne was CEO.

And they hadn't missed a quarterly earnings call, et cetera. And so I think some of these basic business practices, I do think are lacking in some of the social entrepreneurship courses that people take. It really does matter that you're steeped in the proper training in capitalism.

Greg Dalton: Brad Mattson, you started in a semi-conductor industry, tell us how you got to energy and where you are right now.

Brad Mattson: Yeah. That's right. I'm about 30 years in the semi-industry so I'm relativity new. Jigar is actually better in the industry. I came in new from the side. And the side was really interesting. After doing two companies in semi-conductors I retired for a while and I was working with social entrepreneurs. And what I found whether you're in Africa or India or in the jungles of Nicaragua, if you want to enrich lives, you want to like reduce poverty, energy is at the base of it. So I was doing small like solar lanterns in Africa. Mini-grid biomass power plants in remote villages in India or hybrid wind, solar panel, power installations in the jungles in Nicaragua. So energy became really key and when I was working with all these social entrepreneurs, I fell in love with solar. I mean, it was -- and it might have been because it's a semi-conductor device.

[Laughter]

It really does go back, it's a diode. Do you know that a lot of people believe that in fact people in solar would like to say, we're not semi-conductors, but it is a semi-conductor device. So actually my 30 years of work and study wasn't completely wasted in my second career. I mean, I could latch on to everything I learned and a lot of it did kind of transfer over in terms of what you could do in solar. But I did that for several years and there are some really notable companies in the energy space in developing countries we're developed in. But I ended up wanting to see if they can get the scale, a little bit like Jigar saying that, how do you bring this to scale. And so I made a mistake or wasn't exciting thing going into venture capital.

So I spent a few years in venture capital trying to figure out how to bring these technologies to scale and I focused 100% on solar at that point. I really made -- my transition point in my career was technology school and I worked in technology for 30 years, but it was really technology for technology's sake. And a lot of my customers were either in Japan or South Korea or Germany. These were really successful countries and successful companies already, but I really wanted to see technology benefit humanity in a more direct way and I saw solar as a way to really do that. It's not just technology for technology's sake but it can have a profound positive impact.

Greg Dalton: So you're talking about social entrepreneurs, people who create companies, they want to change the world through a company rather than a nonprofit. But Jigar Shah it sounds like, do you think that some of them are not well-suited or in fact your book is a big part about the reason solar has been successful. It's not the social entrepreneurs or social investors, it's hard-nosed

capitalists looking for a return, that's why it's been so successful, not sort of the do-gooders.

Jigar Shah: Yeah, and the do-gooders are valuable. I mean I was in the board of Green Peace for six years and so I'd see the huge value that they all play. But I think that when you think about making change at scale whether we're talking about climate change, whether we're talking about the empowerment of women or providing energy access to the 1.3 billion people in the world that don't have it or clean drinking water, everything has a trillion dollar price tag associated with it, right? I mean, if you want to decarbonize our grid, it's a trillion dollars. If you want to provide energy access to the poor in all these countries around the world, it's a trillion dollars. And so how do you raise a trillion dollars, right? You start with a million and then you start or maybe in a hundred thousand then you get to a million then you get to ten million then you get to hundred million and each pathway you're actually proving to a larger source of capital that you deserve the right to use their capital, right? And I think that that requires some respect for the system.

And look I'm just like everyone else after 2008, think that capitalism probably should be improved a little bit. But when you think about, the trajectory that SunEdison took, there was one other competitor that started at the same time that we did. And that competitor took money from San Diego football players to provide financing for solar power purchase agreements for San Diego City schools. And we decided to take $60 million from Goldman Sachs. Their cost of capital is about 6% or 7%; ours was 17% after tax, right? But at the time at which we went through Goldman Sachs, after that process was over, Wells Fargo was banging a path to our door, so was MetLife and MassMutual and others and saying, well if you got through that rigorous process, then you can get through our process, right? But if you got through San Diego football players, we don't know that your stuff actually works. We don't even know if they read the documents, right? I mean, before they made the investment. So it's just one of those things where I think social entrepreneurs feel so empowered by some foundation giving them a program related investment for three million bucks, at 3% interest, but that doesn't really actually force them into the rigor necessary to get to the next stage, get to the next stage. So, I mean, we're on track now. I mean, the solar industry is all ready to play roughly a trillion dollars and we're on track to doing another trillion between now and 2019.

Greg Dalton: What you seem to be saying is business first, social cost second. You can't get those two mixed up, otherwise you're not going to be a successful?

Jigar Shah: Yeah, I wouldn't make it linear. I actually don't think that you can solve the world's problems without a trillion dollars, right? I mean, I just don't. And so whether you're trying to apply drinking water to a village that I was born in India or whether you're talking about whatever it is like the empowerment of women, right? I mean, the empowerment of women around the world is generally energy-related because many women around the world, are spending five, six, eight hours a day compensating for the lack of energy whether they're walking to get water, whether they're walking to collect firewood. All these other things.

And so giving them basic things like solar lanterns or solar home systems or water pumps or all these things are not zero cost, you know. And so I think that no one's going to give you a trillion dollars unless they believe that you're going to be a good steward of that money and that you're going to give them a solid rate of return on a risk adjusted basis based on the promises that you've made. So I don't think it's linear. I think that to make social progress at scale, you have to be good at business.

Greg Dalton: And let's talk about where some people can make good investments now. If you want to be an investor in the clean energy economy, there are a number of publicly traded companies, there's Tesla, SunPower, et cetera, there are some $5 billion companies out there that seem pretty

good. Brad Mattson, where should the investor who'd want to get on the clean economy, where should they be looking?

Brad Mattson: Boy, that's a tough one. Once it's exciting and people start to get in, if they can kind of plow in and over invest and so you can be coming in too late. If you come in too early, there's risk so it's a little bit tricky. But I'd say, generally, what happens is, we switched over from the technology and I think this is the key part of Jigar's book as well, we're past the technology driving points. So a lot of like startups that look at new technologies for renewable energy, aren't so important as the deployment side and so not all the deployment problems have been solved. I mean, you look at SolarCity, a classic example of doing residential, but there's a huge market in the commercial area that's still kind of untapped. And so when they solve, let's say the new business model, the parallel to the residential one that SolarCity has for commercial, because it's a problem between who owns the facility and who's leasing the facility, the ownership. But if you solve that business problem, it's a huge opportunity. There's another SolarCity or SunEdison out there that's worth $6 billion if you solve that problem. So these new business models need to come into play, you need to be looking out for those. They'll be on the deployment side in markets that have yet been tapped because of huge untapped markets.

Greg Dalton: But a lot of people who've invested in solar, if you invested in solar in the 80s or 90s, you would have got burned. Now that maybe different --

Brad Mattson: I'd argue with that a little bit. It depends on when you get in, all things go in cycle.

Greg Dalton: Sure. It depends on when you get in or when you get out but --

Brad Mattson: The Walton family made a lot of money in First Solar.

Greg Dalton: And solar has been a good place to lose money --

Brad Mattson: That's true.

Jigar Shah: Well, I think it's important to define what we're talking about here. And so since 2003 we've invested roughly a trillion dollars into clean energy solutions as a world. The vast majority of that money went into project finance right? So Wells Fargo invested in solar projects on Walmart's rooftops or Costco or Macy's or Whole Foods or Target, et cetera. None of those have lost money that I know of, not from institutions. So Goldman Sachs didn't lose any money on their fund, Wells Fargo, MetLife, Mass Mutual, none of those guys lost a dollar and in fact they've all been performing assets.

Greg Dalton: Well, the big boys make money, it's the little guys who lose the money, right?

Jigar Shah: No, but even the little guys that invested in solar for the church that's in their community, didn't lose money. They are still getting a check whether the financial crisis happened or not, the electricity company is still billing you every month for the power that you're using. And so for those guys who financed solar for their own homes or for their churches or for their schools or for the community centers or things, they're still getting a check in the mail every month for the electricity that was provided to them. Now, for the folks who invested in new companies whether they were manufacturing companies or whether they're development companies, et cetera, hopefully you know the risks that you're taking on those companies. I mean, those companies depending on what stage of the company you're investing in, are risky investments. That's what venture capital is, right? And so if you lose your money on that well then you should know better to figure out what

risk you're taking. But for a lot of the folks that I target in general, what they're looking at is as baby boomers they remember the Fidelity Magellan Fund, right? Everybody was supposed to be in the Fidelity Magellan Fund.

Greg Dalton: Peter Lynch was god.

Jigar Shah: And stock market was supposed to go up by an average of 10% a year and they did and all that stuff. But then 1999 happened and the 2000 Bubble Burst and since 1999, the returns in the stock market have not been that great. And so now you're sitting there between the ages of 55 and 70 and you're a baby boomer and you're saying what should I do. And a lot of those guys are saying Prudential is offering me 3% return in my annuity account for the rest of my life which now that I've worked my butt off for 35, 40 years and I've got $2 million in my bank account, making 3% on that to live off of for the rest of my days is not what I planned on. The returns in our space regularly are between 7% and 10% returns and a lot of folks are looking at that. They are saying I'm going to invest in my community, I'm going to invest in people that I know and I trust and help them reduce our electricity prices while making a solid rate of return for myself.

Greg Dalton: One place where people do that, I don't know if you call them social entrepreneurs or not but Solar Mosaic, a couple of--

Jigar Shah: That's true.

Greg Dalton: --former activists, Dan Rosen, Billy Parish who created Solar Mosaic, which kind of democratized, tried to bring crowdsourcing, crowdfunding to solar. People can fund as particular project and get better than a bank return, 4 percent --

Jigar Shah: They're making six on my portfolio in solar mosaic.

Greg Dalton: Okay. Full disclosure, I've also put some money there, but wonder whether there's unknown risk like what if the school, you know, am I fully aware of that risk in there? I'm not so sure but at 4%, 6% isn't free there's some risk underneath there.

Jigar Shah: Well, there's always risk, but I think that you can make a portfolio. So like my portfolio with Solar Mosaic, I've got, you know, I just was testing it out so I have like $1,000 with them, but I have a $100 in ten projects, right? So if one those projects has a problem, the other nine, hopefully, you should be doing okay. And, you know, at SunEdison they had a quarterly conference call, I think three quarters ago where Ahmad said on the conference call that we've underwritten 1,200 solar projects, and SunEdison was started in 2003, and not a single one of them has failed, not one, right? And so, you know, if done properly, these solar projects can be underwritten properly and you shouldn't be, you know, on a portfolio basis ever losing money.

Greg Dalton: Are these things threatening to utilities? Do they see this is as competition, are they gonna try to corrupt this or stab it in the heart at some point, Brat Mattson?

Brad Mattson: Well, of course that's already happening. So there's legislation going on several states. The big debate now is focusing around net metering and you see wins and lose in there for the most part, solar is doing a great job.

Greg Dalton: And net metering is where people can -- explain net metering?

Brad Mattson: So net metering really is, if you have a solar power plant on your home, basically,

the power you pump into the grid, you get compensated for the same rate that you charge, so you just -- the meter runs backward so to speak. And what basically the argument for the utilities is, okay, that's fine, if we give you energy, you give us energy back at the same price, but when you know the sun isn't shining, you're then using our services for free. You know, and therefore this backup battery which the grid acts as for them is not being compensated. So there's an argument about what is the appropriate compensation for the service, the utility companies provide if you're kind of an independent home owner with your own power plant. How do you compensate them? And I think that's a valid discussion.

Greg Dalton: It is. And so 'cause if you have solar on your roof, you generate electricity in the day, you sell it to the electricity, you basically buy it back at night at night, you're not paying for that service and sort of holding on to that electricity from when you generate it and when you need it. My home was had a net surplus, $150 last year, we have an electric car. So we made a donation to Pacific Gas and Electric of $150. Jigar Shah, should people be allowed to keep that money?

Jigar Shah: Well, I think--

Greg Dalton: If they're a net supplier or --

Jigar Shah: Yeah.

Greg Dalton: -- pay some fee, reasonable fee for using the grid.

Jigar Shah: I think it's important particularly for this audience trying to understand how we got here. So from 1960 to 2000, the electric utility industry raised rates by about 0.6% per year on an annual basis, right? So that's half the rate of inflation roughly. Did a really good job at what they did. In the late 90s, Howard Wenger, who's, you know, an employee at SunPower, one of the senior executives, and Tom Starrs got together and 'cause the utility wanted to experiment with solar and said, you know what, we've got to do all the stuff and the utility said, you know, our meters are from the 1960s. And so they really aren't gonna be able to do what you want them to do. We can't put two different meters, meter them separately, bill you separately.

And so let's come up with this concept called net metering because the meters actually do have the capability of running backwards and would just save us a whole lot of trouble if you did. So this is the utilities, basically agreeing that this would just be so much easier than putting in $1,500 worth of new equipment having us upgrade our billing system to be able to handle all this data. You know, let's just let it run backwards, right? Now, that we're so successful, you know, they are saying, that was an unfair subsidy, we can't believe that you guys snookered us into doing that. Well, look, I mean, you know, I think decisions that we made 20 years ago can be revisited.

There are lot of folks revisiting how that should work and obviously we're at ground zero in places like PG and E or in Hawaii where there's so much solar happening, that the utilities are absolutely in the throes of having to figure out what's gonna happen to their 100-year old business model and should it be upgraded. But the good thing is that there's a lot of common sense, dispassionate people, doing government research showing that we're not actually taking down the grid. That we're not actually destroying reliable power. All of the unfounded claim is that they make are actually unfounded.

And that there is a reasonable pathway by which we can figure this out. Maybe there's a little bit of a -- and Greentech Media I think came up with something where they said maybe there should just be a minimum bill. You can't go to zero that you should put in solar, such that you're still paying 20

bucks a month to utility and that seem to actually the math seemed to work out when they did the analysis.

Greg Dalton: Fair enough. Would you buy stock at a utility company now knowing that some of them face death spirals or competition from their customers?

Jigar Shah: No. I would short them and I would short them quickly. Yeah absolutely. Look, I mean I think the electric utility industry is just like the buggy whip industry, right? I mean when you go from one technology to the next, then I think the electric utility industry will be with us for many, many more decades. But I think their companies are gonna be worth a lot less in the future than they are now because they'll be providing less services. There are companies like ours that are providing a part of those services as well, and we're gonna be compensated for part of that, and they're gonna be compensated for the services that they are left to provide.

Greg Dalton: If you're just joining us, our guests today at Climate One are Brad Mattson, CEO of Siva Power and Jigar Shah, co-founder of SunEdison. I'm Greg Dalton. How realistic is it that people can be off the grid with new storage technology, microgrids, that sort of things. So if utilities are trying to block progress, can people just go around utilities and say, I'm gonna have solar, battery in my garage, drive my car over some plate that then charges electric car. Jigar Shah, is that realistic?

Jigar Shah: Yeah. I mean, look, I think we've had off-grid homes since 1970s.

Greg Dalton: But those are--

Jigar Shah: Right? And so--

Greg Dalton: --those are hippies in the hills. I'm talking about—

[Laughter]

Jigar Shah: Well, you know they were trying to hide the marijuana that they were growing --

[Laughter]

Greg Dalton: Okay.

Jigar Shah: -- from the DEA, but I think look, I think -- I mean that's really how Real Goods, I think, stayed in business during the '80s. But, you know, I think we're in a situation now where there is tyranny. And where there is tyranny, there needs to be solutions to that tyranny. So, in Hawaii, electricity rates have gone in Oahu from about 14, 15 cents a kilowatt hour just six years ago or seven years ago to over 30 cents a kilowatt hour now. You can imagine, if your wages have been going up at the same rate that those electricity bills are really starting to hurt your family's budget. So when someone knocks on your door and says, I can save you money using solar power, you're very open to that conversation. Now when the utility company says, no, we've done enough solar. You're the, you know, 500th person who've asked us, we've already approved 499, but we're not gonna approve you, that seems capricious. And so, you could imagine, you're getting pissed at the utility company for doing that and saying screw-off, I'm gonna put a battery system in and I'm just gonna go off-grid. And you're seeing grid defections are way up in places like Hawaii, there way-up another places, are they logical? Absolutely not.

I mean the electric utility company does a fantastic job of this balancing work, but, you know, consumers are emotional. And if you pissed them off, you're absolutely going to, you know, decide to go off-grid. And today in Hawaii it's completely cost effective to go off-grid. Now, it's more cost effective for the utility to say in exchange for this fee we'll interconnect you, but if they're just saying no, which is what they're doing right now, you could imagine people just getting pissed.

Greg Dalton: And SolarCity, one of the biggest solar companies promises to have projects offering soon where basically you have Tesla batteries in your garage, you could have this sort of bundled storage generation program. When people are thinking about going solar today, should they consider leasing or buying 80% of the market is leasing. Brad Mattson, would you lease or buy? First of all do you have solar?

Brad Mattson: Not yet. I'm actually waiting to get our own solar panels from my company.

Greg Dalton: I was gonna say that. Solar CEO and no solar on your house, okay but--

Brad Mattson: We're in the process of building the panels. The --

Greg Dalton: Lease or buy?

Brad Mattson: I think that it's gonna be a transition. Today the prices are coming on, you know it's always this question, lease or buy even if buying a car, you know, or copier for your office. You've always had these two options. It has made sense in the past, absolutely the leasing model that Jigar kind of developed and promoted and commercialized. It's very powerful and it's a result of a vast expansion of solar in United States. The costs are coming down so fast at some point in time. It's like going down, you know, you can buy a system at Home Depot and then you just, do-it-yourselfers may come in. So I think they will see shifting business models. Right now, leasing is smart for most people, but if you have $10,000, what were you gonna buy a car with, you might put that $10,000 into a solar power plant. So I think we're gonna see a lot, even SolarCity is going to, you know, loans, you know. So basically, you could lease or you could do a loan. So I think we'll see both business models develop here and that you're gonna probably see growth of a loan model.

Greg Dalton: Because it's complicated Jigar Shah, it's more complicated than buying a car because you have this projection rates, and think about kilowatt per hour, people don't really understand what they're buying. It's pretty darn complicated, right?

Jigar Shah: Well, I don't know. I mean, you know, if you talk to homeowners in California, who are trying to figure out how they get charged by PG&E, that's really complicated.

[Laughter]

Jigar Shah: I mean--

Greg Dalton: Who understands their bill, yeah.

Jigar Shah: You know, the first 300 kilowatt hours, you're gonna get charge of this, the next 300, this much, any of a fixed charge. Oh and by the way, for this hydroelectric vehicle, we're only gonna let you charge during these hours of the day. I mean, look, I think solar is super simple, right? I mean, we're gonna charge you this flat cost per kilowatt hour. Here's the GE bubble meter that we're gonna use to actually monitor how many we're doing. Look, the leasing system made a whole lot of sense and it's the reason why we're here today, because consumers didn't wanna take the risk

of the solar panel's not working, right? They wanted us to take that risk and they wanted to be billed every month based on how much we produced. And that's how Sunrun and SolarCity and all these folks got started. Now, today, I think there are number of people who like the fact that the government has stepped in and actually helped to create standardized contracts. So there's no usurious terms in there. 70 or 80% of the entire solar industry now uses the same exact contract. And so people are feeling comfortable with taking the performance risk on solar. Once you're comfortable taking the performance risk on solar, you should do loans. And loans are way, way cheaper than leases. And we all know that. But it made sense to pay for the lease if you were skeptical as to whether you were actually gonna save that money or not. It gave you a peace of mind, which was worth the extra premium that you're paying.

Greg Dalton: One of the bellwethers I've noticed in solar is hearing advertisements on AM radio during San Francisco Giants games. They are clearly marketing solar to Joe Sixpack you know, on AM radio which is a new thing it didn't happen long ago. It's also happening, Jigar Shah, in red states. So tell us about the solar adaption around the country because a lot of people, it's not just sort of a Berkeley-Boston kind of thing anymore.

Jigar Shah: Yeah. So when I was working at BP we did the very first mass market, marketing program for solar in 2003 and we had this great tagline, it said, "Money doesn't grow on trees, it falls from the sky." And we were going crazy, we just sold a ton of solar and it was fantastic. And we did this study afterwards just to see who our customers were etc. The vast majority of our customers identified themselves as Republican. And the vast majority of customers said that they were doing it because they wanted to give the utility the middle finger, right? And so, you can imagine that it hasn't changed much since 2003. There's a lot of people out there who value their independence, I mean, we're Americans. And so they value their independence and they like having some control over their destiny which solar allows them to do. And then now that you've got Hurricane Sandy and you've got power disruptions at an all-time high, et cetera in United States, people are saying I want a better power quality too because I'm a business person that stays at home. And if I'm out of internet and I'm out of electricity, I can't make money. And so, I actually want to have backup power and these kinds of things and diesel and natural gas, generators are very expensive. So that's one demographic which is sort of the green Tea Party. The second demographic is, of course, environmentalist and people who care about climate change and folks who actually want to do the right thing while saving money. But there's a third demographic which I think people overlook which is a lot of people on fixed income. And so like in Idaho for instance they try to roll back net metering last year. And Public Service Commission had a hearing and I think there's only 120 people on Idaho who have net metering. And they all came and the vast majority there were over the age of 60. And the reason they had done it was because their solar security isn't being indexed to what they believe is there inflation.

And so, they really wanted to limit how much Idaho powers cost increases affect them and the same thing is true in Arizona. So you've got a lot of AARP members now involved. So AARP is now inserting themselves in the process in Connecticut, inserting their process in Wisconsin and other places. So I think we have an extraordinary coalition of people on our side and we even have a lot of folks on communities of color and other disadvantaged communities who were saying, look, this is a way for us to actually save money as well. And so they are jumping in at the same time that the electric utility companies are using them as a pawn to say, oh this is why net metering sucks because you're hurting poor people. It's the same people who actually are stepping up saying, we want access to advanced technologies and we wanna be able to control our destiny.

Greg Dalton: Jigar Shah is founder of SunEdison. Brad Mattson, you're looking to, perhaps, build a solar factory in the United States. What States are more receptive, more progressive when it

comes to welcoming solar industries, clean energy industries in general in United States?

Brad Mattson: It changes a little bit over time because, as you know the famous Solyndra kind of blew up and if you have in your state one of those examples then the legislation -- the people pull back their horns but, you know, New York is classic, you know, aggressive right now in terms of not only doing a research institution in Albany but also promoting -- they're trying to get a new solar factory there as well. So there are some States that are really aggressive in solar. Mississippi did quite a bit of work to try to bring solar manufacturing there, Oregon was also. So it goes State by State, but the changes over time based on what their experience is.

Greg Dalton: We've been talking a lot about clean energy; let's talk about the other side. Jigar Shah, we need to move away from dirty fuels because of climate change. You mentioned that utilities are gonna be worth less in the future and have a different role, what about fossil fuel companies, oil and coal companies?

Jigar Shah: Well, I think it's -- I think we should take those two separately. So today, the largest coal company in the world is Peabody Coal and SunEdison's stock price is higher than Peabody Coal. So we're worth more than Peabody Coal. So I'm very proud of that. The coal industry is now in decline and I think headed into much farther decline such that in the last auction in the Powder River Basin for free land that basically the Department of Interior gives to these coals companies free which is shocking to me, no one bid.

Greg Dalton: But coal demand is going up in India and China and other places. It may be going down in the United States but coals market share globally is --

Jigar Shah: Well not as of this quarter. So, as of this quarter coal demand in China actually went down for the first time in 25 years and China has pledged that they are gonna have peak coal so they're not gonna burn any more than a certain number of tons that they have already subscribed. And China's doing it for purely selfish reasons. The price that Australia, Mozambique, Indonesia is charging China for their coal is so expensive that China is saying solar and wind and energy efficiency and even nuclear is a lot cheaper than coal. And so, you know, I don't think China is an enlightened climate change advocate, but I do think that, you know, we have now hit a price point where it's much cheaper. In India, you have the same thing. Where India, yes they do a lot of coal, but in India the quality of their local coal is so poor, that they have to import coal. The rupee devalued from around 44 rupees to the dollar to over 60 rupees to the dollar a year ago primarily because of their import cost for fuel, right? I mean and so, you know, the new prime minister is saying, look we've gotta get off of imported oil and imported coal and we got to figure out how to use more domestic sources. And solar and wind are two of the things he's already publicly announced he's gonna be pushing in a big way.

So I think that folks who are enlightened are doing this for purely selfish economic reasons. I'm not sure that they're doing it for, you know, reasons of the planet. But, you know, one of the things that I think as an opportunity which is disappointing to me right now, but I think we'll get to is, you know the State of California really, as much as they've stepped up, hasn't stepped up, right? I mean, when you think about Japan and Germany and where they are, it's time for the governor of California to say, we're gonna be a 100% renewable energy by X date and I think we can.

Greg Dalton: And Mark Jacobson at Stanford has a plan for doing that and other people are working on that. So you think that the technologies there, it just needs some –

Jigar Shah: Yeah.

Greg Dalton: -- government leadership?

Jigar Shah: I think NREL, the National Renewable Energy Laboratory, which is part of Department of Energy has said that the technology's there, Rocky Mountain Institute, Google has done their own study and is obviously putting a billion and a half dollars of their money behind investing in renewables. There's the International Energy Agency that's done a study. It's not just Mark Jacobson, I mean there's many, many people who've done the study that said, not only is it actually completely technically possible and the Germans and others have proven that it's technically possible. There's no rolling blackouts in Germany. But these new studies have actually said that it's cheaper to actually go to micro-grids and go to local power and go to these places than the business as usual case of replacing old stuff with the same old stuff that we put in 30 or 40 or 50 years ago. And the shocking thing about it is it's the only way that we have to restore blue-collar work. I mean, that's the thing, is that when you look at the date out of the financial crisis, the people who've never been given a job back are blue-collar workers. Those are the folks going back to work in McDonalds at, you know, 40 years old and making minimum wage. And those are the folks who have the skills and the training that had been already given in the homebuilder industry or other industries where they were gainfully employed before the financial crisis that we can actually put back to work. The solar industry is now, you know, hiring between 2 and 3,000 people a month because of our growth rate and we could be hiring way more people if the State of California and the other would actually listen with their own experts and actually go all in, just one last rant, right now.

[Laughter]

Jigar Shah: You know, what Mike Peevey at the Public Service Commission and Commissioner Florio are doing a boondoggle deal with Sempra to do a 650 megawatt gas plant. Why in this day and age would the State of California allow a 650 million dollar, actually sorry, 650 megawatt gas plant which is gonna cost $2 billion, the most expensive gas plant that I have ever seen. Why would they possibly approve this boondoggle when we all know -- uniformly there's not a single person who is disputing this -- that that plant will be uneconomic within 10 years.

Greg Dalton: Because often it's thought that gas fired, which can turn up and down quickly like your stove, is necessary to firm up into intermittent power, solar, wind, which is -- you know, the sun shines in the day, wind blows at night, that that's necessary backup for --

Jigar Shah: And it can't do that actually. That the fascinated things, I don't know those of you just to get slightly esoteric, there's this thing that people talk about called the duck curve, right? So that if we do a lot more solar that around 4:30 to 6:00 at night when solar is coming down, there's a big gap, right? And what they found was natural gas can't fill that gap. Why? Because gas turbines take about 45 minutes to an hour to warm up, right? And so for the first 45 minutes, it's only running the gas turbine but not the combine cycle part of it which would allow it to meet the EPA Regulations on Emissions. So what are they doing instead? They're building 1300 megawatts in the State of California of storage. They're not using gas plants to actually meet the intermittency of solar and wind. They're actually embarking on 1300 megawatts of storage. So the State of California basically is saying we're doing the right on this side but we got to pay people off on this side just to get their buy in which is absolutely ridiculous. Why would you continue to actually, like spend rate payer dollars on something that makes no sense.

Greg Dalton: Back on Germany. Germany paid a handsome price for the solar adoption that they have, Spain also, and some people were concerned about the cost of renewable energy, the impact

on low and middle-income people. Germany paid dearly to get the solar adoption they did. Even German voters and consumers had pushed back and they dialed it back after they got to a certain point. So --

Jigar Shah: Yeah.

Greg Dalton: -- isn't there a legitimate concerned about going to a 100% renewables in California has a price tag that may be painful for some people.

Jigar Shah: Yes. In 2006, 2007, when I was helping to write the California solar initiative documents, we deliberately back-end loaded the solar in California so we didn't have the same issues that Germany had. And we've actually put solar in at roughly like 80 to 90% less premium cost than Germany did. But the U.S. has decided to do those things in healthcare. The U.S. pays for the world's healthcare and people thank us for it, right? So we spend way more in healthcare than the Germans do. They spend way more on electricity 'cause they want to be the owner of all this innovation in electricity and they have got extraordinary companies there that are now selling their goods and services here in United States and in China and other places. And so, different countries choose to invest their dollars different ways, but today the cost of solar and wind are so much lower than they were in '06, '07, '08, '09 when Germany and Spain were ramping that it's time for us to ramp because six years later, this stuff is really cost effective.

Greg Dalton: Brad Mattson, can California get to a 100% renewable power at a cost that consumers can afford?

Brad Mattson: I do not know the answer to that question, so Jigar's probably studied that more than I have. But I think that we don't have to have a goal of a 100% in my personal opinion, but we're like, you know, across the nation like less than 1%. So we can grow nationally 30 times where we are today without getting into this controversy. So me, I prefer to like this that we don't need to argue about that. We can grow, you know, 30 times from where we are today and I think by the time we see that growth rate, some of the storage technologies being invested in now that will solve these problems will be in place. So we really don't have to worry about too much solar or too much wind on the grid ever in the United States, as far as I'm concerned. So the issue of how far we go, I think we need policies that put in place to drive us to those levels, but arguing whether we end up at a 100%, 80% or 50% renewables, it has to be way over 30, I think. But with the exact number, I think technology is gonna help determine what that exact number is and it's the technology being developed now. So we don't have all the answers.

Greg Dalton: And one of the key issues is China has been accused of dumping solar panels. They put in a lot more money than the United States did. There's a trade dispute, there's now tariffs on Chinese panels coming to the United States. Jigar Shah, is that the right thing, to penalize China for their success in creating in low-cost solar panels?
Jigar Shah: Well, I mean I view it as -- we're penalizing U.S. policy from Jimmy Carter, right? I mean we have systematically, since the late 70s, decided that we wanted China to manufacture our stuff, right? I mean, whether it's the iPhone or whether it's the computers that I buy or whether it's solar panels. We love working with China and we have built our entire supply chains in China such that if you try to build solar in United States right now, it's hard because the U.S government really hasn't put together the program necessary to support manufacturers to be, you know, competitive with world leaders. And so, my challenge with the Chinese tariff case was that the US government on one side, you know, manipulated by a German guy at the head of SolarWorld, basically was taxing US solar panels at the tune of around 20% and on the other side not providing clear guidance to the U.S. manufacturing industry on how they might actually compete with Chinese manufacturing. And

so we were being damned on both sides. We're not getting a lot of local U.S. manufacturing and we're paying 20% more for solar panels which seems to make no sense whatsoever except in this crazy world that we live in.

Greg Dalton: Brad Mattson.

Brad Mattson: Well, I think sometimes we have to live in a crazy world. It doesn't get solved overnight. So this is where I would disagree a little bit. Essentially, if you ask if they should be penalized the answer would be yes. There's no doubt I don't think anyone argues they were dumping. They put in twice the capacity of the solar panels that the world needed and when they had that glut, they just said oh we'll sell them at marginal cost, even below marginal cost, even below marginal cost, you know, so that was clearly dumping. And so, we, you know, we have rules against that. If it was a U.S. company dumping, I mean that's why we had antitrust laws. You can't have one company, just try to take over the whole market and use predatory pricing in order get a large market share. But look where we are today, China has 80 to 90 percent of the world's market solar panels. So it's happened. So should something be done? Absolutely, I think something should be done. Now the fact that it hasn't helped yet U.S. manufacturing, I would agree with Jigar on this one. We haven't done the counterpoint to that which is, if we are serious we wanna have manufacturing in United States then why isn't the government doing work to support that because actually, in a lot of ways the government works against it. My kind of bottom line on this is we have dependency on the foreign energy already, or dependency on foreign oil. Why would you trade that for dependency on Chinese solar panels? We look at the amount of foreign oil it's less than half that we're bringing in. If we were fully dependent on energy, solar panels from China it'd be closer to 80 or 90% that would be controlled by one group. And I think that would be insane. So, yeah, we should keep – if there's unfair trade practices, we should keep the penalties in place that try to stop that, but at the same time we have to do something to spur manufacturing in United States because this a strategic technology. It's something -- if we wanna pick a manufacturing industry to do something about, this is one of them. I was around when we did it semiconductors, you know, where we said, well, Japan is gonna own the semiconductor industry and this is an enabling technology for not only the economy but for our military and we cannot afford to have this strategic technology be controlled by the foreign entity like that. This is as important or more important and I don't know why we have woken up to that fact.

Greg Dalton: Brad Mattson, the CEO of Siva Power and author of the Solar Phoenix we're also joined today at Climate One by Jigar Shah, the founder SunEdison and author of Creating Climate Wealth: Unlocking the Impact Economy. I'm Greg Dalton. We haven't talked about water. I wanna talk about water briefly. Not often, a sector of the economy Jigar Shah, that's thought about a great place to invest, it doesn't attract lots of entrepreneurs, lots of capital. Will we ever see a water billionaire? I mean water's -- we're in a huge drought here in California. This is the area where innovation can happen to help this drought and what's coming ahead with climate change.

Jigar Shah: Yeah. I think we will. I mean the reason you don't have a water billionaire is not because the innovation don't exist, it's because we don't price water. I mean 50% of the water draws out of the ground, not water consumption, that's sort of a different thing. But water draws are done for a fossil fuel plants or nuclear plant, so for cooling towers. Now, a lot of that water gets put back into the system after it serves its purpose for cooling, but that's 50% of water draws. And a lot of those plants don't pay what you and I pay for the water that we do at our homes. If they were paying that then coal and nuclear would be completely uneconomic, they couldn't afford to pay for the water that they're drawing out of the reservoirs. So now that San Diego is building an enormous desalinization plant, there's a real cost associated with that. So now, the entrepreneurs in water actually have a price to compare against. It's like, well you know, water's not free, water costs this

much, right? And desalinization plants use a lot of energy. So there's energy cost embedded in there, there's the concrete and the other things you have to pay for that, etc., and so now you actually have a price to compare. So now you have a price to compare, the water entrepreneurs actually have the ability to go to public officials and others and say, my technology that you've been sort of, you know, not respecting for the past15 to 25 years now has a price to compare against and I can show you that saving people water through energy efficiency or water efficiency is worth this much to you and so I would like for you to support me on that.

And I think that that is something that's coming and you see that first in the agriculture community with a lot of drip irrigation technologies and others which having used for God knows how many decades in Israel but hasn't come here and they're now coming here because we have real water issues here. And then next we'll go into apartment buildings on the places where we haven't been metering and monitoring water and getting people to meter and monitor water so we actually can tell when our toilets running or something else is happening so we can actually solve those issues and, so I think that's coming. But it requires a price signal to the entrepreneurs and that's finally coming.

Greg Dalton: Richard Branson is a billionaire, very well-known; the Virgin Group was involved with you at The Carbon War Room. And a book recently by Naomi Klein says that he promised over $3 billion over a decade to develop cleaner fuels and he only paid out $300 million. Has Richard Branson kept his promise on putting $3 billion into clean fuels?

Jigar Shah: Well, I'm not gonna speak for Richard because I think he has enough publicity that he could speak for himself but I do think that when you look at the biofuel space broadly --

Greg Dalton: Which is what he was talking about biofuels partly for his Virgin airplanes and --

Jigar Shah: Yeah. One of the things that I would say is, I mean as somebody who's worked a lot in the non-profit side to the carbon war on biofuels -- it's an extraordinarily complicated mess. And it's very difficult to see how an entrepreneur gets comfortable with that space. You know, when you think about what Solazyme and others are doing, the way that they are making money is they're not offsetting fuels, they're offsetting chemicals, specialty chemicals, they're offsetting olive oil, they are offsetting all sorts of markets that are far more rational than the fuel markets and so EPA currently, so POET just came out with their cellulosic plant that just came online.

And EPA still has over 20 additional pathways that they have to approve before an entrepreneur can test it. They've been sitting on them for a long time not because they're against cellulosic ethanol but because they're understaffed. And so when you think about getting into the biofuel space it's really hard to see how you actually legally get through the process without becoming a billionaire first and then coming in afterwards to see, you know, how you wanna do this, which is what, you know, Elon Musk did I think with Tesla.

Greg Dalton: Right. I've even talked to people from the US Navy and even the US Navy doesn't have enough money to put into a billion dollar bio refinery that they're comfortable with its big dollars and big challenges. We're talking about climate wealth at Climate One, let's have our audience question. Welcome.

Male Participant: Thank you. Two questions, the first one is I remember when I was driving across the deserts in southern California, there were acres of solar panels erected there. I believe ARCO did it, I know friends that have since purchased those solar panels which means it was destroyed. Why was it destroyed, why did it fail and what's that story, and the second one isn't the

entire solar panel system reliant upon cheap labor in the country with less worker protections, health conditions and unionization and such? So aren't we really exploiting poor countries in order to make our solar system more? Thank you.

Brad Mattson: Interesting comment on exploiting cheap labor. I think to some degree the current state of the art that would be true. What China did was when they really made a decision to get into solar with both feet they said we have to expand fast. And what they took was this older technology literally, you know, 10, 20-year old technology and they took the existing factory and they just said let's build a thousand of them. And they didn't really look at next generation tools or advanced manufacturing technique so they really used a lot of low cost labor. I really believe that that's gonna fundamentally change, it's already changing. What the Chinese are finding themselves is that they have less quality control that way. They're moving to more automated systems as a cost reduction move, in fact, as they move to automated systems. In terms of the plan I put together to put manufacturing in United States, the way you do that is with really high speed 100 percent automated tools which really doesn't have a low cost, you know, cheap labor. In fact what you want is technicians and engineers. And those systems with the factory, when you put them in the factory, they become half the cost of manufacturing in China. So you can with fully automated tools basically have lower cost than you can if you manufacture with labor, even cheap labor in China.

Greg Dalton: Jigar Shah, know anything about the ARCO stories, solar plants that are decommissioned?

Jigar Shah: Yeah, so, you know, the ARCO -- ARCO solar was basically, you know, a throwback to when the oil industry owned the solar industry, when Exxon and BP and others were all investors in Solarex and other companies, Ameco and, you know, they all had the same vision which is that if you just made solar an order of magnitude larger than it is today, it would get an order of magnitude cheaper than it is today. And so at the time, we are producing hundreds of kilowatts of solar per year. And so ARCO said if we build a five megawatt facility in the middle of the dessert, then this thing is really just gonna be awesome.

And it was thin film technology and, you know, nothing wrong with thin film technology it's actually, you know, quite good today. But back then it wasn't as stable as it is today. And so ARCO put all of these solar panels in the desert and what they found was they were getting uneven degradation right out of the gate. And so the solar industry, general speaking the way that it was built back then and even now a lot of it is built this way, you have 13 panels in a string. And if any one of those panels is failing, it takes down the entire string. And so you saw a lot of that going on with ARCO's system and so then they just, you know, decided to go declare bankruptcy and then sold it for parts and a lot of folks bought it for camping equipment and that kind of stuff and everyone got a panel. I think I even have a panel somewhere in the garage so. It's a great story though it's exactly what Siemens did in the late '90s -- sorry, the late '80s to get to the next age which is the plant that SolarWorld bought out of Camarillo. So it's, you know, it's a story of the solar industry.

Greg Dalton: Were talking about climate wealth at Climate One with Brad Mattson and Jigar Shah. Let's have our next question. Welcome.

Male Participant: I agree we're having a bit of an energy revolution and an employment boom but it's happening in natural gas and it's happening in North Dakota and Wyoming. If you look at some of the future plans of Hawaii and Puerto Rico, they're not looking all for solar as their deliverance but they're looking at the facilities to take liquid natural gas and they see that allows them to continue burning stuff in their turbines. How scared should we be or what is the real threat of cheap global natural gas coming from United -- exported from the U.S. of wherever else it's cheap

curtailing solar or renewables in other potential places?

Greg Dalton: Jigar Shah, the real boom, the real energy boom is natural gas.

Jigar Shah: Well this goes back to the trillion dollar conversation that we started with in the beginning, right? The reason why natural gas boomed the way it did was not necessarily just because the opportunity, but all of the capital structures, all of the trust relationships, all those pieces were already in place. So the time at which, you know, Anadarko and Chesapeake and others wanted to raise 20, 30, 50 billon dollars they knew who to go to, who actually to, you know, to hit up for that money and to get there. We're finally putting those relationships in play. So that's why we're now at a place where we can actually grow to where I said that we could grow to in 2016.

I think separately on the natural gas side, now again we should talk differently about electricity than we talk about, you know, transportation fuels, right. On the electricity side, I think it's quite clear to everybody that I talk to that natural gas and coal like, you know, cross over somewhere in the $3 and 60, 70 cents a million BTU range and so that natural gas is up to $4.20, $4.30 a million BTU, coal is cheaper than natural gas again. So I don't believe that natural gas is this, you know, threat to solar and wind. I think solar and wind is doing just fine and we've done fine that way. Now, if you want to go Hawaii and export nations like, you know, Costa Rica or other places that are thinking about the LNG stuff from the Hillary Clinton tour. You know, a lot of those guys have to spend a billion to a billion and a half dollars to actually build an LNG terminal. That's not cheap. So, someone's gonna have to pay for that. So, they're gonna add it to the cost of your natural gas bill probably to pay for it and when you look at the delivered cost of cooling natural gas, let's say natural gas is 4, 4.25 per million BTU here in the U.S. To get it to Hawaii will probably cost at least $9 a million BTU there and that's low. It might actually be closer to 10.

At $10 a million BTU, I mean we're way more cost effective that $10 a million BTU gas even in the solar hot water side, you know, even just to provide people with solar hot water is a lot cheaper than $10 gas and so I'm not overly concerned about the natural gas revolution. I actually think it's a good thing because I think that we're going to finally put the death nail into the coal industry which I think is fantastic and hopefully we'll actually get far more uptake of natural into the diesel and part of the transportation infrastructure to sort of reduce oil's grip on the hedge money there but I'm bullish about renewable energy and where it's going.

Greg Dalton: Last question. Welcome.

Male Participant: My question is really related to climate change. It's already there. We seem to be running out of time, so the conversation is very much focused on replacing high carbon by low carbon or even zero carbon hopefully and obviously that will have a tremendous impact, also creates new jobs, new business opportunities but it's just part of the solution. So, in terms of transportation, in terms of building green villages, building green cities, both on the retail side and on the wholesale side, what are the two gentlemen's viewpoints on the entire portfolio of activities required to de-risk climate change and to prevent, not only financial disaster, human disaster, but also prevent ecojustice disaster in terms -- because we all know that poor are affected disproportionately high by climate change.

Jigar Shah: So I mean I think that's one of the reasons I wrote my book. You know, I think that when you think about solar and wind it's been extraordinary how far we've come, but solar and wind aren't going to solve climate change. There's over, you know, 20 sectors that we have to do

something in; from agriculture to timber and deforestation, to industrial, energy use and so -- but the good news is that McKenzie, the International Energy Agency and others which is what I highlighted in the book actually have highlighted exactly which technologies we can deploy that have been around for 10 or 15 years that we haven't deployed at scale and part of what I'm doing in the private sector work I'm doing now is that I'm taking the lessons that we learned on financing solar and wind and figuring out how to finance wood pellet stoves, how to finance water efficiency technologies, how to finance all of these other stuff that also, you know, pays for itself and, you know, I think when you look at the data from IEA or McKenzie they show that if you just did the stuff that pays for itself at a 10 to 15% rate of return then you actually stave off some of the worst impacts of climate change and meet the interim goals that we have 2020 and in 2030 and then I'm hopeful that we have new technologies available to us to do what we need to do between 2030 and 2050.

Greg Dalton: Brad Mattson.

Brad Mattson: I think the technologies are clearly there and they're even economical, so I think this is a travesty that we don't solve this problem faster. This is one area where, you know, Jigar and I we're working in industry to make things happen and you push it as fast as you can but there are entrenched forces, huge entrenched forces, with a lot of senate votes. You know, this is an area where, you know, one thing the government does need to do is put a plan out there. I mean, if you start -- first thing is let's have a policy, let's have a plan that makes sense. If you don't start with that it's an umbrella that helps it. If you don't start with that it stops -- it slows down investment. We push as hard as we can and we open up avenues, we open up doors but where there's an umbrella policy that everyone's clear that we're going in this direction things just fall into line and we can accelerate this pace of deployment faster. Just look at Germany, it's a living example, laboratory of when the government gives the right kind of policy, put them in place, people fall in line and they move, and they move aggressively. So, you know, they got up to high penetrations, 20 to 30% penetration of renewable energy and we're in the small percentage of that. We can do it and we can do it quickly. So we're really -- this is where leadership would help a lot from our government to create that umbrella where investors feel confident in investing in these technologies that are economical and solve the problem.

Greg Dalton: We have to end it there. Brad Mattson is CEO of Siva Power and author of the The Solar Phoenix: How America Can Rise from the Ashes of Solyndra to World Leadership in Solar 2.0 and Jigar Shah, Founder of SunEdison and author of Creating Climate Wealth: Unlocking the Impact Economy. You can listen to a podcast of this and other Climate One programs in the iTunes store. I'm Greg Dalton, thanks for coming today and thanks for listening.

[Applause]

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