



Stanford eCorner

Following Your Startup Vision [Entire Talk]

Brent Constantz, *Calera*

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Calera founder Brent Constantz is an innovator who believes that successful entrepreneurs are the ones who follow through on their original vision. Drawing upon his deep background as a successful serial entrepreneur, Constantz shares his entrepreneurial experiences and discusses many of the competitive and strategic issues facing his current ventures.



Transcript

Today we have a really remarkable speaker. We have Brent Constantz, who is an amazing inventor-entrepreneur. His specialty is something we've never had discussed here before. He is a specialist in cement and has over 60 patents related to cement. Now you might think that this isn't particularly interesting but it is absolutely fascinating. In fact, he has started several companies in all different areas related to cement, including now the newest company related to water desalinization, medical cement for bones in the operating room, and most recently Calera, where they look at carbon sequestration in cement. He is going to tell us all sorts of stories and insights about being an inventor and an entrepreneur and I can't wait. Without further adieu, Brent. Thanks, Tina. Usually, when I give a talk I have technical slides and I'm talking about one company or one project I'm working on.

This is a real treat for me. Tina asked me, "You know, instead of showing us all the science, why don't you describe your entrepreneurial experiences that you've had because that would mean the most to the students here?" Well, the different experiences I've been through, what I'm going to do is go through my last four companies that I founded and was a CEO of and talk about a lot of similarities and some of the entrepreneurial strategies that I took and what worked and some of the implications of that. The first thing that came to mind, Tina, when you said, "Just talk about your experiences," I thought about a famous local musician, Carlos Santana. When they asked Carlos, "Hey, Carlos, what is the coolest thing about being Carlos Santana?" he said, "Inevitably, when we go out to dinner, a couple will come to us and say, 'We conceived one of our children to Samba Pa Ti,'" which is one of his songs. How inspiring it is. So, if you ask me, "What is the most inspiring thing or the coolest thing about being a serial entrepreneur," it's starting companies is like kicking off an avalanche. You can sit back and watch and the people that join you, your employees, the whole audience, get actually more excited about it than you ever were and see things and take it to new directions. And if you've ever skied powder and jumped off a cornice, some of those avalanches don't go anywhere and they fizzle out. Some of them just take off and they're out of control. And these companies are really like building a fire.

Some smolder out. Some get going. Some are out of control. That's really what happens when you found a company. You come up with an idea and people seize that idea, investors, employees, competitors. The whole world catches that idea and they take it. And the coolest thing is watching that happen and where all that goes. I wanted to start really back here at Stanford in 1986. I was starting my first company and I was a fresh PhD. I linked up with a guy in the B-school, who thought it was a good idea what I was doing and helped me out and introduced me to a professor named Pitch Johnson and his class wrote my first business plan.

And they wrote the best business plan. I wish we had followed it but we didn't follow it. But it's an incredible plan. At that time I was 27. I was just trying to raise some seed money. And it was very hard to raise seed money. My PhD was in geology.

My subject area is called biomineralization. By the way, if you want to hear about my science, I'm a consulting professor here and I teach it in the spring. It's cross-listed in GES and in mechanical engineering and the medical school.

The biomineralization is the most esoteric-geeky subject probably on the planet and most people don't really pay much attention to it. But what I had done at the time is decided I really wanted to do something really important. And I became aware at the time of the problems with health care. And I learned that the largest health care expenditure was fixing bone fractures. I would have thought it was heart disease, maybe. When you have a heart attack, you die and you're off the books. When you have a hip fracture, that's when the spending starts. I was just talking to Tom. We had a meeting that his brother helps put on down in Pebble Beach, called the Medical Device CEO Summit. And I was the only CEO invited to it for 10 year in a row.

One year we had Tommy Thompson down there. And he told us that health care expenditure is about a fifth of the GDP. And with diabetes, it's going to go up to about a quarter. But the biggest part of that is actually hip fractures in postmenopausal women. It's the biggest dollar figure. So, I thought about that and I had ideas about generating skeleton on my own, when I was working in the French Polynesia in the Tuamotu Archipelago. I had seen corals grow at incredible rates. My PhD thesis was on how they do that and I was able to actually make their skeletons grow in test tubes. And I thought, "Geez! If I could do that in the operating room, that would be phenomenal." And so, I founded Norian, my first company. I got Pitch Johnson's class to do my business plan.

And I went out to raise seed capital. The first person I talked to is Jeff Pfeiffer, who is still a professor here in the business school. And Jeff invested in my company. There was another professor named David Teece, who is now up at the Hoff school at Berkeley, who invested. At that time, Sun Microsystems was really young and Scott McNealy and Vinod Khosla and those guys were pretty young. So, I used to go out with them and they would pay for my beers and burgers, which at the time was a significant amount of money then. I really appreciated that. I couldn't get Vinod to invest because he had just joined Kleiner Perkins and they had some other investment. But he got his Buddy Scott to invest in us. Scott McNealy became the CEO and I guess chairman at Sun, so my other seed round investor.

And Scott told me a bunch of stories. I want to relate one story that Scott and Vinod would always say, the way they found Bill Joy for Sun Microsystems. They went and interviewed dozens and dozens of people. And every time they interviewed somebody, they would say, "Who would say, 'Who is the best person in the field you know in that area?'" and they would go interview that person and then they keep going. And then, finally someone said "Bill Joy", who was a professor at Berkeley, who had written UNIX at that time. And Andy, the grad student they founded it with, said, "Oh, I know Bill." And they used that strategy. I've used that strategy consistently. Always absolutely try to find the very best person in the world. And as I talked about some of the companies, you'll see some of the management that I have been able to recruit has just been insane, the people who have come and joined me. Something that I have been able to do that I think helped me came from my unique educational experience.

When you studied biomineralization, you have to know biology and crystallography and geology. So, they're two disparate fields. It would be like politics and economics or something like that. It's sort of like speaking two languages. Once you speak two, speaking in the third is easier and then the fourth and the fifth and all that. To be able to be cross-disciplinary and talk across fields is extremely important because you bring the ignorance from outside the field and ignorance is bliss. You don't see that it's not a problem. So, I went out to the first orthopedic surgeons and said, "Hey, why are you guys pinning these fractures together? Screws don't even hold. It causes pain. They don't work.

The patients in the hospital die of deep vein thrombosis. Why don't you just do something to get them up and walking? Let's just cement the fracture." That was sort of an insane concept. When we went in to the FDA and talked to them, they didn't even know whether I was talking about a drug or a device. But had I been trained in orthopedic surgery or even knew anything about it, I never would have thought, "Well, let's cement the fractures instead of pinning them together." The Norian experience allowed me to go out, raise capital, get a company going. It was an interesting time that maybe some of the students can relate to. I just finished my PhD. I was doing a postdoc at the US Geologic Survey over here on Middlefield. And I had just been given a Fulbright to go to the Weizmann to work on my area. And I was going to take a professorship at Caltech. The founder of my field was going to be at the Weizmann with me to train me before I went back to Caltech to start my academic career.

I was in the middle of starting a company. And to my parents' disappointment, all my professors' disappointment, they said, "You're crazy to go start a company." My wife supported me and I got started and got it going. So, it's not always easy to start a company. It was very hard to get the money together to get that going. But we ended up raising about \$56 million in venture capital and probably another \$30 million in other grants and corporate deals and things like that. I think one of the lessons learned from the Norian experience is anytime you go out and do something new and you're addressing the largest healthcare expenditure in the United States, there's a lot of incumbents. There are people that are on that gravy train already that you're disrupting. So, if you go to a large orthopedic company and tell them, "Well, you know, the \$4 billion worth of hip implants you're selling, we got a better way to do it and less pain and suffering, it's going to cost less, it's going to be better for everybody," when you tell an orthopedic surgeon who after medical school did their internships and spent seven years of

residency learning how to put those hip implants in, we're not going to need you guys. It's really hard to get things adopted. What was really interesting at that time, even though the biggest fracture I was trying to address was the hip fracture and everyone has heard the story that a grandmother fell down, went to the hospital, she didn't come home because she died of pneumonia in the hospital or something.

That's because these fractures are so tough. The other one I really wanted to get was the vertebral fracture. Especially in Asia, you'll see older, postmenopausal women like this. These are lumbar vertebral fractures, which had never been treated before except with calcium and vitamin D pain pills and go home. And then, they would go see the endocrinologist. At that time, my venture board said, "No one treats that. You have to go into an existing field and compete with those big hip companies." I said, "Yeah, there's 550,000 of these vertebral compression fractures in the spine every year, little ladies going through pain. It's terrible. Why don't we work on that?" We ended up not working on it and another company was spun off from Norian at that time, called Kyphon. Kyphon had a hard road.

It took them almost two decades to do it. But they were sold to Medtronic for \$3.9 billion just a couple of years ago because they stuck to the plan, the original mission, the original idea. Now, Norian is part of Synthes, which has the world's largest market share in the fracture market, and that product is in every operating room in the world that does orthopedic surgery. It's helping out a lot of people. But it's really interesting. I see this with all my companies. You have the big initial vision. And in almost every case, that's the right vision. And as you go along, especially investors who want to see something very tangible very soon will find easier ways to monetize your inventions and really not get it to the full extent of where you would like to take it. So, it's interesting, in coming up with a big idea, I think if you're going to go forward with it, which you really want to do, just make sure you're building that company, which is one reason, and I'll go forward to this later, that I think Vinod Khosla and I get along, because Vinod is a big-thinking guy.

He has built billion-dollar companies and he tells his management team, "Are you building a \$100-million company or a \$1-billion company?" A lot of people will be happy to build a \$100-million company but he has gone out to build billion-dollar companies. With the last company, Calera, the vision was really to build a trillion-dollar company, in that case. But if you're building a trillion-dollar company, then you're doing everything differently from the very beginning. You're not going off on little side markets or small opportunities. You're sticking to your gun and focusing on the big idea as you go forward. Well, Norian got into clinical trials. We had a 225 pacing and prospective randomized trial. We went to the FDA. We had international subsidiaries started in '87. This would be sort of '95.

We were approved in many foreign countries, treating patients and having really, really good results. What we found at that time was that we could go out with this new technology. What we really had to do is train the customers and train them with a whole new paradigm. And it wasn't just a product. We learned about the concept of really going out and selling the whole product to the customers, going to the operating room. We developed the concept of a new standard of care so that people get to think about things completely differently. So, we went all the way back to when the person showed up at the emergency room. So, it wasn't just another box on the shelf in the operating room. But it was a whole new standard of care from the beginning to the end, the economics and everything. Stanford was very incremental, I mean important, there as well.

Amy Ladd, Amy and I, I guess I can say this, we're the same age. She looks about six years younger but she's the chief of orthopedics of hand surgery at Stanford. We grew up together and we treated all these cases and Stuart Goodman and a number of the surgeons here. We did studies and we published in the New England Journal of Medicine, Orthopedics and all the best journals. I think we had over 200 peer-review journal articles. That's how we really sold this idea and this concept. It included economics. It included a lot of other things. In doing so, I learned another important lesson. And I'm learning it over and over again in anything I do.

When you come up with crazy ideas, you have to gain credibility no matter how good the crazy idea is. And so, what I have always done is assemble fantastic advisory boards. In Norian, I had an advisory board with the president of the American Academy of Surgery, the president of Orthopedic Research Society, the most famous endocrinologist on the planet, people like that who could back up everything we're doing, work with us. Some of them would come in-house and work with us for a long period of time. The other thing, and this would probably be the most valuable thing I learned in all these experiences, is I learned how to craft an operating plan for a company. And this is a plan that's put together by the company with not just a classic mission but objectives, goals that have lives of three or four years. And under each goal, there'll be milestones with date and an action that we would accomplish every quarter. And every quarter I take most of the company off-site and we'd make a new quarterly operating plan. And then, we'd stop planning and go do it. It has been, in all my companies, incredibly effective in terms of accomplishing things and moving things fast and having everyone bought into it and assign accountability to everybody.

An operating plan ended up being a very important thing. Norian teed up their S1 in 1996. When a company gears up to go public, especially in the days that we have now with Sarbanes-Oxley, you can't be a startup anymore. You're going to be living in a completely different world. Everything about a company changes when you try and take it to public. Norian ended up

getting acquired. Something that happens when you tee up a public offering is you're ripe for acquisition. When you have a lot of cash in the bank and you've got a great company, that happens. That's when I came over here to Stanford. I had another thing happening at that time.

My oldest son was diagnosed with cancer. It was a good time for me to be here on campus because he was at Lucile Packard. And I was here for six months or so. I got together with the heart surgeons, Tom Fogarty, whom some of you might know. He is a vascular surgeon here, remember the Fogarty catheter; Paul Yock, who invented the rapid exchange catheter. And they within a few days and a lot of the other people in the community, we put a company together because they were having issues with another really big problem in cardiovascular medicine, which was the calcification, the mineral growth, on heart valves and arteries. You probably heard of calcified arteries. Most of the amputations every year, people's legs, for example, are from calcified arteries that they can't revascularize. It didn't take long to come up with the big idea. And the big idea was, "Well, let's do what the bone itself does or specialized cells in bones that dissolve through it." The mineral that forms in bone actually is very similar to bone mineral.

And so, we devised with the leaders in the field some of the most sophisticated catheters probably ever designed with incredible plumbing to go into a total occlusion of the femoral artery, calcified aortic valves. We had an open-heart procedure. When the heart was stopped, we could decalcify the aortic valve. We even had a beating-heart approach. So, while the heart was beating, we could decalcify the aortic valve. That company just got funded right away. We were off and running. It really grew very quickly into quite a company. We had heart-lung machines in the lab, where we would bring in hearts and decalcify them and do the whole procedure and get it going. It got acquired very quickly.

Now, what happened with my son during that time is he was declared cancer-free. Then, the cancer came back and it was clear he was going to die. He died in, I think, June of 2000. Johnson & Johnson ended up buying the company and making it part of Cordis. That's when I really had a one big inspiration. When it was clear he wasn't going to live, one of the things I wanted him to do is to go diving on a coral reef. We did a lot of things before he died and that was one of the things. I realized at that time it's not just my son who is not going to see a coral reef, it's all our children. Like most of you in the audience, your children are never going to see a coral reef. The coral reefs are changing today.

I have trouble finding coral reefs worth diving on today compared to my experience diving all over the world, using submarines and all that. That's how fast the climate is changing today. And it's not just the esthetic value of seeing a coral reef. It's actual implications for what we were doing in our life. At that point, I was really in my career a medical guy. But I knew at that time that I had a strong inspiration to do something environmentally. I was approached by a number of the employees from my first company who really didn't like working for a billion-dollar company. They said, "Come on, man. You've got another company. Let's go do it." It turned out I thought up some chemistry that was better than the first company cement.

And so, one of the things I did is we got the band back together. I got one of the old buildings we had been in, took our old offices. It was sort of a stunning experience. We got together in August. By Christmas, let's see, it was 2002 by that point, we had our formulation. By New Year's, we had done animal surgeries and put this cement in animals. And by Valentine's Day, we had made an FDA application with our data. By Memorial Day, we had FDA approval. And by the Fourth of July, the FDA had come in and inspected our manufacturing facility and were shipping products to hospitals, less than a year, which is a record for any kind of medical product. Interestingly, with that company, prior to the first two companies which had been venture capital-funded, when you take venture capital money in Silicon Valley, you need to understand that the game is all set up for the venture capitalists, not for the entrepreneurs because if you're a lawyer and you have a law firm here, you might see that entrepreneur three or four times at the most in your life.

But you're going to see that venture capitalist every week. And so, all the documents are written for venture capitalists. And I thought, "Gee! You know, I played that game twice. I don't want to play it again." So, my third company, actually it wasn't even a C corporation. It was what we call an LLC. Everybody remembers. We funded ourselves, got checks from the famous orthopedic surgeons. And we're selling products and we're profitable with no outside investment, no professional investors very soon. It was an enjoyable experience. The main thing about it was there was only one person on the board now with me and we always got along.

There was never any controversy. It's a sad thing but the board of directors debilitate companies. It's not intended but the reality of the situation is if you have a board meeting every month, your management team is going to spend a day or two just preparing for the board meeting. And then, they spend a day or two just recovering from the board meeting. And typically, most venture capitalists are on more than one board. And even though you send out the board package days ahead of time, FedEx and all that, they show up at the board meeting, opening the board package. They make a lot of shoot from the hip decisions. And then, at the next board meeting they ask you why did you make that decision. And so, it literally takes about 20% of the management team's time. What I learned in that one company is by not having a board and by actually being able to be fast and operate quickly, you've just gained 20% of your time.

And you've lowered everyone's stress level a lot and you're allowed to pursue your original vision. And that's what we are able to do there. It was successful. I have made more money off that company than the other two combined. I still am. It's all over the world. It's in operating rooms. It's a better product than the first product and they are competing. So, if there's no competition, generate your own. But that was a great company.

It was acquired. I ran it under the new company as CEO until I came back over here to Stanford. And at that point, I was going to retire for sure. I still had this aching desire to do something on the environment. Through interactions with the Woods Institute, I learned that the production of cement was the third largest source of anthropogenic CO₂. So, the first is tail pipes, right, from cars mainly, from maritime industry and airlines. Second is the production of electrical power by burning fossil fuels, mainly burning coal. And the third is the production of Portland cement, which is the cementing component of concrete. And one thing about concrete, it's one of the largest markets, if not the largest market, depending how you count it. It's in the trillions of dollars.

Half of all building materials are concrete. Concrete is the most traded material other than water in the whole world. When the concrete stops flowing, the whole economy stops. It happened here in Northern California in 1978. Everything shut down. If you look at the 28-billion or so tons that humans put into the atmosphere of CO₂ every year, about three billion of those tons come from the production of Portland cement. It's interesting that it seemed quite easy to me to just produce a different type of cement that wouldn't produce CO₂. And that really didn't take long for me to come up with that and file the patents because I had already made lots of different types of cement. I got hold of my old buddy, Vinod Khosla. I heard he was working in the cleantech's basement, putting a company together quickly without a business plan.

So, Calera, which has raised somewhere near \$200 million, has never been a business plan. What I would like to say about business plans is, number 1, the only people that read them are your competitors. Number 2, they are the only thing that is never going to happen. It's like when I play golf, I tell my partners, "If you want to be safe, go stand near the flag because I'm never going to hit it there." But Calera is an exciting company which has a bouquet of opportunities that can really impact the world at this time. We set off and we had a lab of about eight ladies. I say that because I was the only male employee for some reason. We're making cement within about six months. Vinod was over there one day and we noticed that our limiting raw material was carbon dioxide. So, I asked Vinod, "Where can I get some carbon dioxide?" I was involved with deep-sea coral projects with Rob Dunbar here and looking at the ocean over the last 10,000 years and all that. But I just wasn't aware that people were really interested and actively sequestering CO₂.

I thought immediately, "Gee! You know, if you did this, you could make cleaning up the environment a prosperous activity." It wouldn't be a task or a negative thing that no one is going to want to do or governments have to force people to do. It's something people would do because they are going to make money doing it. If you could take CO₂ as a raw material and make stuff out of it, well, then you wouldn't have to go mine a bunch of limestone and put it in kilns and create CO₂. So, it would be a two-fer if you were to avoid the CO₂ going to the atmosphere but also displace the CO₂ that would have been created by making Portland cement. To this day, it's one of the interesting strategic aspects of Calera. It goes back to some of the earlier discussions about "Do you do your founding vision? Do you look at other opportunities that come up?" Today there is no price on carbon, not in the United States. We're the only country in the world that doesn't have a price on carbon. But even if we did have a price on carbon, what if it was \$10 a ton? I mean, we can sell a ton of cement for \$100 a ton. And for every ton of CO₂ that we capture, we can make two tons of cement. So, the economics, the prosperous thing that will induce the Chinese and the Indians to do this, actually works very well based on a profitable product.

Now, I'm in favor of carbon legislation. I'm very glad AB32 stuck up and we're going to get that because of the way California goes, the way the world goes with regard to carbon legislation. But the fact is, the fundamental economics of thinking about climate change don't make any sense to me. Professor Socolow in Princeton says we have to mitigate about seven billion tons of CO₂ a year. And he has seven wedges, renewables, energy efficiency. How are we going to do that? We're not anywhere close to doing that. But of the 28 billion tons of CO₂ we're putting to the atmosphere, we're thinking we want to mitigate seven billion tons. Remember, three billions tons can be mitigated just by replacing Portland cement with one of my cements. So, that's half the wedge. But the way we're thinking about it, and this really came through in Copenhagen, where it was the rich world holding their wallet and the developing world asking to be paid not to pollute.

Chinese, they need about \$100 a ton not to pollute. Say we need to mitigate 10 billion tons, 10 billion times \$100 is \$1 trillion. So, you can talk to and blow in your face let's pay the Chinese not to pollute. But it doesn't matter. There is not \$1 trillion a year to pay the Chinese not to pollute. We would have to borrow the money from them then pay them. And they don't even have that much to loan us. So, the fundamental concept of cap and trade just doesn't work. But the concept of being able to induce people economically to create a green economy by creating prosperous activities that also make a clean environment is huge. There is other fantastic aspects to what Calera is doing.

When you make concrete, about 20% of the concrete is cement. The other 80% is what we call aggregate and aggregate is rock. Here in Northern California, we get about 60% of our aggregate from British Columbia. It's barged down because there

are not enough quarries here. It has to be mined. It's actually limestone. It is very similar to the Calera cement. It self. It's a carbonate. It contains carbon.

Most of the carbon on the planet is not in the atmosphere. It's not in the oceans. It's in the lithosphere in the form of limestone, like 99% of all the carbon on the planet is sitting in limestone on the planet. The way you make Portland cement is you calcine limestone, which releases that CO₂. But Calera also has the potential to go beyond that three billion tons by replacing Portland cement and taking some of the nine billion tons that coal-fired power plants put in in doing that to preventing an enormous amount of mining, which whether you realize it or not, how much coal do you think is mined every year? About five billion tons. It is almost all shaft mining. How much rock do you think is mined every year? About 40 billion tons. Yeah, that's seven times as much. It's all open-pit mining. It's environmentally destructive and unsustainable.

So, it's a very, very interesting part of everything that's going on. But as I worked through this, I have also learned how challenging climate change is going to be. I mean, the big idea that Calera can do the whole thing is there. The technology is going to have to be developed and it's worth sticking to it. But the company has to decide, do we take some of the near-term opportunities, work in countries where there is a price on carbon, for example, and just do carbon mitigation or just make cement, make money doing that? There's a lot of interesting strategic questions that Calera has in front of it today. But no matter how you look at it, the challenge for our grandchildren is phenomenal. Half of India is under the age of 14 and coal is their source of electricity. China is building more wind power than anybody but coal is their source of electricity. Here in the United States, it's 51% of our electricity. If we want full-blown with all the renewables we could, it might be 49% in 20 years.

So, our future, whether we want it or not, involves coal. And that means there is going to be a lot of CO₂. Part of the thinking today is we better start looking at adaptation, not that we've lost the battle, not that we shouldn't keep trying. Hopefully, Calera is extraordinarily successful. But we really need to look at adaptation instead of paying the Chinese to build windmills in Western China that aren't connected to anything because they're getting clean development mechanisms to do that. They're just spinning and delivering electricity to nobody. Maybe we should be building seawalls in Bangladesh before millions of people are displaced. With Calera especially, I've had an opportunity to meet a lot of interesting people. We had Colin Powell, Tony Blair, Hank Paulson, Bill Gates, a lot of interesting folks. And something everyone realizes is the daunting size of climate change and the political implications of what could happen.

If you look at the Hindu Kush in Himalaya glaciers, eight of the rivers flowing out feed a third of the world's population their water. And whether you believe in climate change or not, those glaciers are going. The Chinese are having to decide right now between hydro power and drinking water today. It's not going the other way. It's not a seasonal fluctuation. If you think about what are the main things that our grandchildren are going to have to deal with, with regard to adaptation, what are they? Well, sea level rise, I can imagine that. In Bangladesh it's hard to imagine. That will be devastating. But most of the world I can imagine that, dealing with that. The biggest thing is probably going to be drought.

Mark Twain said, "People pay money for whiskey but they go to war over water." So, I have become extremely interested in water. We had a project in Australia, one of the dirtiest coal-fired power plants funded by the state of Victoria, where we will be producing fresh water to the site, 110 kilometers inland that has been in drought for over a decade. From the brine water we take out to combine with the flue gas. We have become more and more interested even locally. Calera has their plant down on Monterey Bay here at Moss Landing. And we have a permit to pump about 60 million gallons of sea water a day into our demo plant down there. And really, a lot of my background is oceanography. I used to deep dive and take submarines down and collect corals and all that. I know that the deepest submarine canyon in the whole world comes right in at Moss Landing, right, where the Monterey Bay Aquarium Research Institute is. It has the clearest, freshest deep water close into shore anywhere in the world.

And one problem we have here in California is we need about a million acre feet of water, just about a million gallons a day. We have been unable to permit a lot of coastal desalination plants because of the concern of taking organisms from the top of the ocean. We're in a tough spot. But the being an oceanographer, I know that if you go down to the depth where only 1% of the light at the surface exists. There is no chlorophyll because there is no photosynthesis going on. And then, there is not much life, not much of a food chain. So, we have this unbelievable opportunity, I'm pursuing right now to go out deep into the canyon, Monterey Canyon, onto a site I've been operating for a few years now with 200 acres of infrastructure and permits and pipes out into the canyon and provide hopefully initially 10,000 acre feet of water to Monterey County and Santa Cruz in a local project, which for me is really a blast because I have only worked on international products that have gone everywhere. And to do something locally has been really fun for me. I'm really excited about the work we're doing. The water we are going to produce is going to have a much lower carbon footprint than any other form of desalinating water because we're starting with very pure water.

And it doesn't have the other problems that ground water has, like chromium VI and other things like that. So, that has been an exciting project that I've gotten going. I could say a lot but I have exceeded my 40 minutes so I better cut it off. Great. Well, we have time now for questions from the audience. But as we normally do, we're going to ask Heidi Boysen to ask the first

question on behalf of the spirit of entrepreneurship class. Great. Thank you very much. That's fantastic. One of the students who takes the class remotely, who is probably watching right now, fielded a question online.

And so, we picked a question too launch for you. We talk a lot about entrepreneurship and company formation and all that. An this student was really curious about the fact that you said with Calera, in one month you brought 40 people on board. I think it was Calera. Now, we're thinking that maybe it was the company before that, given what you just described. But he wondered how in the world did you bring 40 people on board at once and how did you build the culture around bringing that many people. Yeah. Well, that happened at Calera for sure a few months in a row. I mean, you have to understand that Calera is just about three years old and it has already got quite a management team. But we have always really just gone back to that earlier principle that I told you about, just kill ourselves to get the very, very best people you can get.

You need management that can sell snow to Eskimos. You got to have people drinking the Kool-Aid. So, if you identify someone who you want, this sounds kind of mean but I think with Vinod, it's almost the challenge to me. I mean, Vinod is, "I bet you can't recruit that person." But we have been able to recruit anybody. Great. So, why don't we have questions from others in the audience? Who has got a question? Yes? Over here. Speak really loud. All right. So, when for example entrepreneurs, let's say, have an idea that they want to bring your product to market, most of the time, from what I have read and what I've heard, they think about "I want to make a lot off money off this, do you say, "I want to change the world," for example, and "I have this really great idea. I've got a really great solution to this problem which is unmet right now." But in the practical sense, once they start to sort of see the venture capitalist's side and the money capital side, they sort of say, "Is this feasible? Is it financially responsible to create this product?" So, at what point do you look at the financial implications of the product that you've made to change the world that now might now be financially responsible? Well, there is the real world and then there's Silicon Valley.

I think with my third company I learned a lot about just building a business with your own money and not setting your goals too high. If I noticed one common fault in everything I have done, it's that I have set my goals too high, which is great, if you want to go build that trillion-dollar company. But it's a lot easier to fail. I think choosing something that you know is doable, that you can go out and get accomplished without having to raise an enormous amount of capital and tell a fantastic story is a good way to go as well. I remember with Norian, the first company, they said, "Well, you know, it's going to take you \$50 million and five years to go through prospective randomized multi-centered trials in orthopedic surgery." But you know what? There is more of root canals than there are hip fractures. And we could make \$15 off each root canal. And we could get FDA approval for that in 90 days. So, let's become a root canal company. So, we wasted about a year and a bunch of money to do periodontal defects and that's a total waste of time. Dentists pay for things with their credit cards.

It wasn't what you want to do. So, it's this constant tension. It's true to really get these guys managing these big funds, to invest in something, you better have just a big story with a fantastic return on investment. And that's really different than the way most people start businesses. In Monterey, we are forming a joint powers authority with the local water districts floating in municipal bond to fund the building of \$100 million de-sal plant, working with local banks. It's a completely different story. I think it's possible for entrepreneurs to work outside of this Silicon Valley environment. Don't hire a Silicon Valley lawyer. As soon as you hire a Silicon Valley lawyer, your company is set up for venture investment. That's the road you're going.

I'm not saying, don't. I'm just saying that's the direction you're going to go. Cool. OK? Great. Right over here. You talked about your ability to recruit people and recruit top talent. And then, you also talked about your displeasure or kind of frustration with having a board of directors. But would you say that having a board of directors is also pretty helpful in attracting top talent and I was wondering kind of your thoughts were not to have a board and if you're faced with a disadvantage there? I haven't had that experience. Sometimes, you can use a board member to help recruit people. Especially if you're weak at recruiting people, then the board could recruit the whole team around you.

That might be a strategy. But generally, when I identify somebody that I want to bring in, I'll screen them through my entire management and let them do their homework on us. And then, when we have decided who we are going to hire, then we'll give them the opportunity to meet members of the board of directors. I think a board can be valuable but a board can also be disastrous, depending how it works. I guess the point is, when the company puts up risk factors, the technology won't work, we'll run out of money, the management won't get along, all the things that can kill a company. Unfortunately, one of the top three or four things is always we'll have board instability and that will kill the company. Great. Right over here? Yeah. You talked about how you didn't figure out that carbon dioxide could be sequestered into the layer on and you were developing Portland cement. But you also talked about how the first inspiration for you to go that route was to try to find a green resolution to the problem.

Right. So, did you have a plan before that or did you just happen upon this? Well, you see, just replacing Portland cement without sequestering CO₂ from some other source, just not using Portland cement and using something else that didn't produce CO₂ would reduce the annual anthropogenic CO₂ by three billion tons, if you never sequestered a single molecule of CO₂. So, the initial inspiration was just to replace Portland cement. Great, OK. I actually want go ask about a question about carbon trading. I was reading an article. And it actually listed carbon as a commodity in the market. And there's a billion-dollar

trade going on. Now your technology plans to take, I mean, it's actually taking over the carbon... Where do you see the market and it's affect to your technology? I mean people trading real dollars on that.

Yeah. I mean, it's amazing. The biggest supporters of Kyoto and also the treaties we're trying to get are actually British Petroleum because they actually saw they were going to make more money trading carbon than exploring and selling oil. And so, it's incredible. There is already carbon markets operating all over the world. The one in Europe really doesn't necessarily encourage anybody to stop polluting. There is a lot of ways around it. It grows out of the legal theory that polluters should clean up their mess. The Clean Air Act grew out of that. And the Clean Air Act has been the most successful environmental legislation that I know of.

And it works extremely well for, say, SO₂. But SO₂ is in the parts per million. And so, you can pay people not to put SO₂ into the atmosphere. The problem is, there is so much CO₂ and there is so few alternatives that there's just not enough money to pay people to do that. One of the things the US government is looking at and other governments is actually separating CO₂ from flue gas. Doing that would take about a third of the power of a coal plant just to separate it and then paying companies like Haliburton to transport it and paying other companies to inject it into the ground and other companies to monitor it for decades so that it won't leak out like what happened in that lake in Africa and killed the whole village, thousands of people in a few minutes, as a viable approach. And there's \$3 billion of stimulus money that are being spent on that. It could never, under the best scenario, sequester more than a few hundred million tons a year for a few decades. It wouldn't have any effect on our grandchildren's lives or anything. So, yeah.

I mean, the manipulation of those financial markets is almost unbelievable. And it really, in my opinion, isn't going to do anything for our grandchildren. Great, OK. Are you worried about competition with Calera? I hope there is competition. I mean, people tell me, "The Chinese are going to rip off Calera," and I say, "Great. More power to them." That would be the best thing for the world. First of all, there's plenty of CO₂. I learned by selling cement in China that you're not going to make any money in China anyway. I gave a lecture to a group of Chinese executives from a province south of Shanghai recently. They have already sort of started adopting the Calera process because it's so publicly known.

If you go to Calera's website, Calera has over 200 patent applications that are published. There is nothing secret about Calera. I really think that Calera is bigger than Calera Corporation, which is a Delaware corporation that has been incorporated and funded. I think the concept, like I said, originally about an avalanche, it's already out there. I was at the Cop16 Conference. People all over the world are aware that you can convert flue gas into carbonates then transform them into aggregate and rock. There is a lot of trick in it. But I am convinced that the only place to put the CO₂, if we really want to mitigate CO₂, is in the built environment on the surface of the Earth where it's stable and it ain't going to go anywhere and also bring the criteria of pollutants and the other things. It's in my opinion the most sensible, really only place to put it. And we have got the technology now.

But I'm already aware of other technologies being developed. From the various parts of the Calera process, they could be fit into it to make it even better. Super. Over there. Your idea sounds truly great. And I think your company is really on track to change the world. It almost borders on the fact that it's too good to believe that you can have the cake and eat it as well. When I was doing research online, there's a lot of critics that say that your process is not really grounded on factual information and that you can't give evidence. So, how do you respond to criticisms that say that your process is not scaleable as well as it might not actually work? How do you respond to that? First of all, I'd say it's funny because I've been in the medical field. When you're in medicine, everyone is like, "I hope you do it, man."

I hope you make the world a better place." What I learned in the climate community, there is a lot of politics, there is a lot of academic people trying to get funding. Even the Gates Foundation, Bill Gates has money in Calera. The advisers to the Gates Foundation, one of whom had started a blog about Calera, had said a lot of things. And these are people that didn't have any basic skills in crystallography or making cement and really had no basis to make these claims. But part of the reason was they're operating in a different paradigm. The paradigm they're operating in is, "Let's separate the CO₂ and inject it into the ground and then get paid by some government subsidy to do that." That's not the paradigm Calera is operating in. The paradigm Calera is operating in is, "Let's make cleaning up the environment a prosperous activity that is profitable and not based on whether it's feasible to scale on having a price on carbon but based on whether it's feasible to scale economically on will they buy the cement." Frankly, what's going to happen as the price of carbon comes on, is the price of Portland cement is going to increase because for every ton of cement they sell, they're going to have to pay whatever that price is for the ton of CO₂ they put out. So, the price of cement is going to increase. The price of Calera cement is going to decrease half as much because it's half the ton of CO₂ per ton of Calera cement. And so, it's only going to help Calera as the price of carbon comes on.

But we're just not operating in the cap and trade paradigm when we do the economics of our plans. But also, Calera is three years old. It's incredible the amount of progress Calera has made in three years. And if I think where they are going to be in a year, two years or three years, a lot of the challenging problems will be even more interesting. But I think in funding this

recent \$45 million matching funds grant that was publicly announced from the Department of Energy to Calera, I think the DOE was really looking at all the alternatives and how economically scaleable they'll be. Great. We'll take one more question. Right back there, yeah. Speak really loud. So, you talk about how the big vision is important to maintain the initial vision for a company.

It sound like Calera's initial vision has to do with selling cement that is not Portland cement and it's taking away CO2 from the environment. With what you're doing with water now, is that under Calera and does that fit in? No, it's just a new venture. The fact that we're doing it at Moss Landing, which is where the other Calera plant is, we're just right next door to each other. But I do think it can be expanded beyond the Monterey Bay, maybe Marin County down the coast. It's really all over the world. There is a company called Water Standards that takes large ships out on the ocean and they put a straw down deep in the ocean to avoid the life at the top. In that way, they're able to desalinate the way we're proposing on ship board and then bringing the ship to shore, pump the water on-board. But my one comment about that is, Vinod always tells me the companies that have their founders usually do better. And my wife pointed out there is an article in the San Jose Mercury over the weekend. It pointed out how clearly companies with their founders are always more successful.

And I think it's because someone needs to keep the vision. Great. On that note, I hope you join me in thanking Brent Constantz.