

URL: <https://stvp.stanford.edu/blog/videos/the-evolution-of-clean-tech-investing-entire-talk>

Amy Francetic is the founder and managing partner of Buoyant Ventures, a venture fund that invests in digital climate solutions. In this talk, delivered on the 50th anniversary of Earth Day and in the midst of the global COVID-19 pandemic, Francetic sheds light on the evolution of the clean tech market and shares why now, more than ever, is an opportune time to invest in clean energy and energy efficiency.



Transcript

- [Narrator] Who you are defines how you build.. - Hi, I'm Toby Corey and I'd like to welcome you to Entrepreneurial Thought Leaders Series presented by STVP, the entrepreneurship center in the School of Engineering and BASES, the Business Association of Stanford Entrepreneurial Studies.. Today, we're excited to welcome Amy Francetic.. Now, Amy is the Founder and managing general partner of Buoyant Ventures, a new venture fund in Chicago that aims to invest in digital climate solutions.. She previously founded and led Energize Ventures.. Her career spans over 20 years of high technology entrepreneurship, private equity, and research.. Amy also co-founded and served as the CEO of Technology Accelerator Clean Energy Trust and held roles of private equity firm, MBC Capital, and the Stanford Research Institute.. Early on her career, she was co-founder and CEO of a tech company that she sold to Lego systems, and she helped fundraise for mobile gaming company, Glu Mobile, on whose board she served until it went public on the NASDAQ.. Amy has a BA from Stanford University.. Welcome, Amy..

- Thank you, thanks Toby, thanks so much for having me.. It's such an honor to be here.. I wish I could take this class.. (Toby laughs) - Well, we're honored to have you now.. I'm gonna open up with, is it pure luck, the universe, or the Greek Earth goddess, Gaia, working your magic that you're here today, leading a climate crusade on Earth Day.. - Absolutely, 50th anniversary.. (cheering) - I know, huh? (Amy giggles) All right, well we got a lot to cover in such limited time, let's kick things off.. You started your career developing children's software, educational software then you sold a company to Lego, then over to a leading think tank, Stanford Research Institute, off to private equity, venture capital work, you founded a technology accelerator called Clean Energy Trust, then left to raise \$165 million venture fund in Energize Ventures.. You served on private nonprofit boards, now you started Buoyant Ventures where you're focusing on digital climate solutions.. I will say that's a really heavy polymath career trajectory..

Could you walk us and the students through that journey and share some of your insights and lessons learned 'cause it's fascinating.. - Well, thank you so much.. I feel like, when you recite it all, I feel really old, but I do feel like I still have so much to do.. So I think the key theme is entrepreneurship.. This Buoyant Ventures is my fourth startup, and I think it's been really great to take what I learned at Stanford and to try new things and take risks.. And a big part of, another theme that kind of, is a thread throughout my career is working alongside of engineers and scientists, and I guess, I always wish that I had become a scientist or become an engineer and instead, I'm a business person and so I try to do the best that I can to apply my business schools, skills, rather, to scientists and engineers to help them realize their dreams.. So that's a big part of what's driven me.. Throughout my career, I'm kind of a science junkie.. I love to read about it, I love to talk to the scientists, I love to think, try to understand how they think, and I'm also really struck by the potential of all these great ideas that are coming out of labs and universities and how can we bring capital to help these people tackle some of our most daunting challenges like climate change and I think that's, I have great respect for anyone who dedicates their life's work to that and I wanna help them be successful.. - Yeah, so one thing related to that, yes, is that you have been able to find and cultivate really great mentors throughout your career..

That was a huge topic at Stanford.. I've been teaching there for 10 years, how have mentors shaped your career, and like what have you done to really help find some people that have made a big difference in your life and your career? - Well, I think, I have to embarrass one of my very early mentors whose name is Kathy Schlein, who, she has a lot of Stanford folks in her family but she was a friend of mine, she was my boss actually early on in my career when I worked for Hasbro.. We're

making a line of kids' software and I remember very fondly that one of our first interviews, she was a runner, I was a runner at Stanford too, I walked onto the track team so I wasn't good enough to be recruited but I loved to run so much that I walked onto the track team and the only reason I really raced at all was because the gal who was an Olympic athlete in my races was injured, so that's why I was able to race on the Stanford track team while I was there, but Kathy was a runner too and we both ran 800s and she really drilled me in our first interview about what my times were, and so I think if they weren't respectable, she probably wouldn't have hired me.. But I think it's really important for women to find women mentors.. I think that's a really important thing.. Kathy was a great mentor of mine.. She really taught me to speak up for myself and she really set a great example about being authentic and being your authentic self and I think being fearless, that's a really, she worked alongside Steve Jobs, and so she had picked up a lot of great experiences working with him at Apple and try to bring that to us and relay some of those great learnings.. But I think also there's, it's great to have women mentors especially for young women starting out in the business world, but sometimes they, you have to also find great men mentors as well.. So I've had a number of those throughout my career and folks that helped me realize some of my goals and also maybe try to help avoid some of the pitfalls, pointed things out and were honest when I needed that honesty and showed some tough love, which is really important is to get, have real honest feedback from your mentors and your peers whenever possible.. And you really realize then how rare that is..

It's really rare to get someone who can really tell you.. When someone's told you no or they're sort of not letting you do something, you don't often get the feedback about why or how to do it better and so it's really valuable to work with people that can be honest with you and that builds a really terrific trust.. - Yeah, that's awesome, fantastic.. So tell us what led or inspired you to pursue clean energy because that's not the easiest industry to be in.. But what got you in that track? - Well, I was working in the high tech business for the first part of my career and had started out actually in video games, and then worked in the wireless business, and I had run to company that spun out of a think tank that Paul Allen funded.. The think tank was called Interval Research and the company was called Zowie, and that was one that I did also with Kathy.. She was helpful and was an advisor to that company and gave us a lot of support.. Anyway, so we, I moved to clean energy because there was a turning point in my life, like at a relatively young age, I actually got sick.. I had kind of a rare form of cancer, and had that, fortunately, had that treated and in the recovery of that, I just felt like I really wanted to do something with my life that was meaningful, that gave me more meaning, and that was going to leave the world in a better place than how it was, and I found so much great joy and comfort from being outdoors.. I get a lot, I mean, basically nature is like my religion, so that's a really important thing to me and I wanted to protect that and make sure that it was around and healthy for my kids and their grandkids..

So I thought let's just put the rest of my career into trying to do something to address climate change and so that's what I've done with the last few startups.. It started with Clean Energy Trust, and then energized and now Buoyant Ventures, and yeah, think we can do this.. I think we can turn this ship around.. I mean, I really, I just have been thinking a lot about climate change especially amidst the whole COVID crisis and really like what some of the leaders in Europe are doing where they're really trying to get the stimulus funding and the recovery funding that the EU is going to be deploying to invest in clean energy technologies and innovation because they don't wanna go backwards.. They don't want to be beholden to fossil fuels, they wanna move forward and they want to do more coming out of this crisis to make things better and solve some of these other big challenges that we have.. So that's what drove me is I wanted to, I just wanted to have more purpose in my work.. - Yeah, that's fantastic.. I worked at SolarCity and at Tesla, and it's definitely not for the faint of heart.. It's a space that just got a lot of lobbying interest and there's a lot of work to do.. The good news, I do think that, I think, sentiment is changing and I actually think COVID-19 is going to be a potential catalyst for that but we'll get more to that in a little bit..

I wanted to get a better understanding of, as you look at your investment theses for your new fund, looking at Digital climate solution, so what does a good investment look like in general terms? - Sure, sure, so digital climate solutions means technologies that are primarily software, some hardware, internet businesses, the general tech, digital technologies that have made up most of the venture segment over the last several years but applying them to industries that have the biggest climate risk associated with them and so those industries are energy, agriculture, transportation, and the built environment.. Those four industries are the major contributors to carbon emissions and so we wanna turn, use digital technologies to help businesses and some governments and communities address climate risk in their businesses and their communities and to do this in a way so that it can be scaled very, very quickly, right? So there's a lot of great technologies that other investors are working on, people like Bill Gates and Breakthrough Ventures that are trying to look at battery chemistry or fuel cells or fusion even, and the challenge with those technologies is that they take a long time to mature and they require a lot of capital and they're not necessarily built for a 10-year traditional venture fund.. So with Buoyant Ventures, we really wanted to use these very scalable technologies that require 10s of millions of dollars as opposed to hundreds of millions of dollars to scale, and that have also, these technologies have also matured quite a bit over the last five years.. So the value that they can bring to these businesses is more meaningful and is more impactful today than it was even five years ago.. So the data that a lot of these businesses are contending with the volume of data is overwhelming and trying to draw some kind of insights or competitive insights from the data is really, really challenging, so a lot of these young companies have created solutions that allow asset managers, business leaders, insurance companies to better understand and take signals from the market to make decisions that are gonna either help reduce the emissions in their business that will help them adapt to this new climate reality or can help them operate more efficiently and do more with less.. So that's just a broad sort of summary of our thesis.. I know I can go into specifics or give you a couple of specific example if you like.. - No, I think that was really helpful.. So green tech was really red hot area like 15 years ago.. I know, I think Kleiner and Draper Fisher, there was a lot of aggressive

money in that space..

Of course, I worked at SolarCity and Tesla, but I know it's been a really tough business to make money and deliver returns, but what's changed since then and why is the right time now? The landscape is different.. Heidi Roizen talked about that last week, so someone who had an evaluation, other folks that have had companies that were on fire are letting people go in mass quantities, right? So the world's entirely different place.. - Right.. - So, why now? We're at a really interesting time in history, right? - Well, okay, so first to go back to the transition, the 15-year transition that you said to sort of the last six years, right? So if you look back and you measure clean tech funds from, say, 2010 till now, they had terrible returns, right? So they were single digits or negative not even returning their base capital.. Since in the last six years, they've done so much better so the top quartile clean tech funds have been delivering, on average, according to Cambridge data, which is the data that I'm citing up in the mid-20s, so that's really good, that's a really good venture return, that's a three x net return for these funds.. The IT funds, the IT venture funds have done in the mid-'30s so they've been really great over the last six years, and you guys know all about that and some of the big funds in the valley that have been leading away there.. So what's changed, what's better now? So a few things have changed.. Number one, the core equipment and technology for renewable energy is much, much more cost competitive and is much, much cheaper than it was 10, 15 years ago.. So wind and solar are very, very inexpensive and some of the lowest cost energy you can build, new generation you can build today, they'd certainly be coal and nuclear in every market and even in some markets, be it natural gas.. So the core base technology has become very, very cost competitive..

Another thing that has changed is in the venture space is this addition, there's been a lot of new capital that's come in that is looking for venture fundable technology.. So, there are some very ambitious folks that are shooting high and maybe looking for 20-year returns like Breakthrough, but there's a lot of new funds that have been raised in the last four, five years and filling that gap that had existed before to help commercialize a lot of these technologies and they're getting very good at choosing companies that can scale in a venture timeframe in a 10-year timeframe.. And one of the things that's gotten worse is I think the political headwinds that we have in at least the United States, so you've got really great leadership happening globally, the rest of the world has woken up to the fact and accepts climate change and accepts the science, and then we've just, with this administration, we've had a lot of resistance.. So that has opened up some additional capital like folks is almost sort of maybe activated a part of the market that before wasn't activated because they wanna do something about it, so it's have helped to bring some new capital into the market, and a lot of that new capital is coming from family offices and foundations and others that have a really strong impact in ESG impact drive for their capital, so they're looking for not just financial returns, but some environmental, social, or governance benefits for their capital, so that's a big thing that has changed in the last few years and I think it's brought in some new sources of capital that have a really strong intention with their money, so that's at least where we've seen a lot of funds have been successful in raising from some of those folks.. - Yeah, I would agree and I think too, obviously, we're going through a very difficult social transformation right now but now seems like a really good time.. It's a very contrarian point of view to actually start this initiative.. Look at some of the great companies that have been during the dot-com bust, the housing crisis.. Who would have thought a guy like Elon Musk could transform the transportation industry, right? - [Amy] Right.. - What are your thoughts on timing? - I think the timing is especially good now because everybody has talked about how fraud evaluations were over the last few years and those are coming down.. I mean, you wanna be putting capital to work when you're at the bottom of the market..

So, this is a really good time for folks that have dry powder, even.. I think the other thing that's really happened in the space that is exciting that we hope will resume post-COVID is all of this, all of the promises and commitments from the super majors, but also all the institutional capital that is moving into the sector, right? So all the big banks have made commitments to address climate risk in their portfolios, endowments, the universities are getting a lot of pressure from the students to divest fossil fuels, so that's helping to bring more capital into the market.. And I think we'll see, we'll continue to see the momentum build again from those institutional investors.. I don't think we're gonna go backwards and they're suddenly gonna say, "Oh no, we wanna go back "to how we were investing before this." I think that that you're gonna see that the sustainable funds are going to outperform the traditional benchmarks and they're certainly gonna outperform any funds that have any kind of fossil exposure in them especially considering the price shocks that we're seeing in the oil and gas industry.. So I think you're gonna see definitely a good momentum returning to any of the folks that are investing with ESG top of mind, and I think we'll see some big institutional players will double down.. - Yeah, I agree with you.. So I think your fund is more series B? - Yeah, early stage, yeah.. We're early stage series A and B.. - Yeah, so for all those super talented smart folks that are thinking about becoming an entrepreneur and wanna do something about what I think is the greatest human existential threat around climate change, what advice would you give a big idea entrepreneur on how to raise capital? We all know the top three reasons ventures fail, one is they find out there's no need for their product, they don't have the product marketed, or two, just the wrong people involved, or three, they run out of capital.. But to think about how you're looking at the future, some of the opportunities here, what advice would you give a young entrepreneur that wants to do something in the climate change space..

- Well, first of all, I would say, I draw a lot of inspiration from college students.. Clean Energy Trust has, since its origination in 2009 has been funding student-led businesses with their capital, and they've had support from the Department of Energy as well as a number of corporate sponsors.. So, young people are gonna save us, but they have to save us.. We're counting on you all to save us.. But I think, one piece of advice is there's so many great support systems for young people starting companies, whether you're a student and you have support through a venture fund at your university, I know

Stanford has terrific support in Bryan Bartholomew's class and some other more accelerator type support systems there, the Y Combinator, and TechStars, I mean, that didn't, that's a relatively recent phenomena and they do a really, really great job of helping people hone their business ideas and investors like myself.. Like we definitely go to all those demo days.. We watch all of those pitches.. Clean Energy Trust funds those student companies and you've got a lot of young, early, early stage support for new ideas and I think that's really a great place to go learn from your peers, find mentors.. There actually is a TechStars sustainability initiative in Denver or Boulder that is also sponsored by the Nature Conservancy, so you now can find a TechStars type program specifically for climate and I've heard really terrific things and I've talked to the folks that run that and they do a really great job of helping people shape their businesses and get in front of mentors and help run those interviews like Steve Blank's questioning that he does for new business ideas, I think that they do a great job of giving exposure in helping people get in front of customers to hone their ideas.. So that's what I would say is get yourself into one of those programs, so you get all that support wrapped around you..

- Yeah, I would agree.. I think your timing is exceptional because I think, if you look at the evolution of software, and look where it was just 10 or 20 years ago, it was really hard to build software, and the tools and the frameworks that exist today, other new infrastructure companies like Plaid that comes out that allows you to plug into any sort of bank for an ACH pool, and you look at the distributed energy assets that are sitting out there today, so I think your timing is great that there's enough of inertia and raw material out there for the second half of the play that can really take this thing to the next level.. So, I love the space that you're in.. So, let's shift gears a little bit.. We're all dealing with a super significant pandemic.. We're seeing nothing like, I don't think anyone's ever seen in our lifetime, unemployment rate is skyrocketing.. I don't think we've ever seen an economic shutdown like we have, the health issues that that we're all facing.. How do you think COVID, what does it do to climate change? How do you see it playing out? - Well, there's definitely a connection.. I think that what we've seen is that some of the people that have suffered the worst and have died have been in areas with a lot of air pollution.. They may have had underlying asthmatic conditions, which is, again, very much a condition of living in highly polluted areas..

So when you have a respiratory disease, that's a very strong factor and when you've seen what happens when we shut down the economy around the world and you see how clear the air is and how clean the water is and all that, like, to me, that's a great opportunity that we just got a taste right before our eyes of how good it could be and we don't wanna have to shut down the economy to achieve that.. We want now human ingenuity to come up with solutions and technologies and policy that will help us achieve this but stimulating the economy.. And so I think again, like I said, what these 13 countries in the EU have called for an investment in the space.. And I think, recognizing the job potential of the space as well, the wind and solar and energy efficiency industries employ more people than the coal industry, three times as many people as the fossil fuel industry.. And a lot of these businesses are small businesses so you talk about the SolarCity and the Tesla roof.. I mean, all those installers pretty much now are out of business, right? they're there, while they're not working, let's just say that, it's not that they're out of business, they're not working so you can't go and really have that business continue if people won't, they're not considered essential and people won't let you into their home and you can't do energy efficiency retrofits or do these installations either.. So we need to get those folks back to work and they, more than half of the employees in the Clean Energy space are with small businesses and that's just the job creation engine of the country.. So I think we have to recognize that, I hope in a future stimulus package or recovery package that Clean Energy will get some support because there was a lot of progress that was made in 2008 under the Obama administration when they stipulated that those ARA funds, the American Recovery Act funds, had to go into Clean Energy, and really did stimulate the growth of the business and helped to bring the prices down in the energy that we have today and the equipment that produces the energy today.. So we need to get the industry back to work.. We need some support for these workers, and I think we have to, we just got a taste of what....

Actually the emissions reduction over the last quarter is about equivalent to what we would need to do to prevent a rise in temperature by 1.5 degrees.. So we've just seen how that can happen, but now we can't do it by shutting down the economy.. We have to do it with human innovation and policy changes.. - Yeah, I know, and you're so spot on.. I remember hearing some criticism from the conservative side of the house about federal tax credit.. That's actually been around for quite some time, going back to the '60s to spur housing development and that was, a matter of fact, that money ends up coming back into the treasury anyway.. So we were able to take like the cost of per watt basis from about \$8 a watt down to about \$3 or \$4 a watt because of the federal tax credit, and it allowed for massive job creation, great paying jobs versus being in a coal mine or working on an oil rig, or doing something that is so damaging to our economy and there really is, it's quite uncomfortable to sit here and look what's playing out.. I like you have a lot of hope.. I think Generation Z and Millennials are, they're wired differently and I think that you're gonna have this opportunity to unlock this incredible talent.. So, if you were, if I give you a magic wand, and I said, "What would be the one thing we could all do "to make the biggest impact around climate change, "what would that be?" - The one thing, maybe, eat less meat would be one of the worst things you could do, right? So, and it's not obvious but if it's an individual person, livestock and the ag sector is a major contributor to emission..

So if we ate, the resources that are necessary to feed the livestock that we eat are enormous, the amount of water that it takes is enormous.. So if we ate less meat, especially in the developing countries, we would have a potentially really positive effect on the emissions from the ag sector.. I think that would be a major benefit.. - Yeah, I would agree and that's such a massive contributor and it doesn't quite get that play.. My guess is that there are still really strong lobbyists in Washington.. - Absolutely, yeah, absolutely.. - (laughs) But I would say, so would agree with you, the second advice I would give is please get out and vote in November, people, especially young voters.. You're historically fickle and to an extent, you can make the difference this November.. So hopefully we get a lot of folks-- - Actually, we won't change anything if you don't vote, you know

what I mean? Like we have to, we have to get young people to vote and we know that climate change and sustainability is one of the number one issues for young people, so you have to make your voices heard, and that's, we really need you.. - Yeah, okay, we've got a whole bunch of questions coming in, I'm gonna pivot to that in a second but I had a couple last questions for you..

So we're gonna talk about a business and a lot of shop and big thinking stuff and where the thesis of your investment fund and where the world's going, so what do you do to reduce stress? - I run, I swim, I can't run as much as I used to, so I swim but I can't swim now because all the pools are closed.. So I get outside, I mean, that's my nirvana.. I get outside with my dogs and my husband and my girls and we just walk for miles and miles and run and get fresh air and honestly, that's our saving grace right now.. It's keeping us mentally sane and physically sane, although I know it will be months and months before I'll fit back into any of my pants, so it's helping but it's not making enough of a difference.. It's not contracting all of the cookies and baking that my girls are doing here at home.. So yes, so I have to go get a bunch of new pants to wear.. - Well, I'm curious to know because you and I have been somewhat similar careers.. It's a lot of pressure working for very high stakes companies and the demands are quite extraordinary and I'll admit my work-life balance historically has not been good, but you've worked with some very high pressure jobs, you've dealt with a life-threatening health issue, and you just seem really centered and so, what have you done throughout your career to work through, lots of stressful times and where you got to to today? Whatever stuff you're doing looks like it's working.. - Well, you're very kind and I don't, I mean, I think I don't really know if I have a great answer.. I wish I did, Toby, I wish I had advice..

I think, I feel a deep responsibility to try to make a difference, and I feel like people are counting on me and that means a lot and I function really well in a team, so I really like to be part of a team, and I take really seriously the success that we all have, that responsibility we have for success for each other, so that's the biggest thing that kind of drives me to do the right thing is to think about my team, to think about my family.. You haven't asked me what it's like to be a working mom.. I have two teenage daughters and definitely had times where I've missed out on things that they were doing to work but we talked a lot about why I was working and what I was doing and they were supportive of that goal, in that mission but I also tried to be in jobs where I had the flexibility so I could be there for the most important things when I needed to.. And that sometimes meant that you couldn't work for folks that weren't supportive of that, so I think that that's another key thing for women as they are in their careers is to really find those bosses that have a family and understand that they're gonna get better work and better loyalty and commitment out of their employees if they are flexible and allow you to also be a mom, and a wife, and a dad, and a husband, and to turn up for your kids, that's so important.. - Yeah, somewhat related to that.. Do you feel, if you look back again on your career, and I know some young students are just getting ready to start their career.. Did you get to where you got to where these things just stack on top of each other, or was there some nonlinear moments where some positions and some things just really catapulted you far faster than the linear step? - It was definitely nonlinear.. It was definitely nonlinear and actually one of the big debates I had with myself and some of my bosses and my peers was going back to business school.. So I have a BA from Stanford and I don't have a business degree, and when I was in my late 20s, I was in the very fortunate position to be running a company and I felt like I was learning so much running that company that I couldn't afford to take the time out to go back to business school like what I was learning, raising capital and running the business was more important than learning it in a classroom, but I highly think, I highly recommend people do that because I know people all of the MBAs that I've hired over the years have gotten so much out of that experience especially the relationships and friendships that they've built in business school has been so important.. But that was always a debate that I had was, should I be going back to business school or not? So I had a couple of opportunities early on where I got a lot of experience and that was all on the job and that's how I decided to learn and then I filled in the gaps in areas where I didn't know, like I didn't know much about accounting, so I took an accounting class..

Nowadays, you can do that too.. You can sort of supplement your education relatively easily by taking online classes, so I'm a big believer in that, and sort of learning what you can while you're working because you get to apply it right away, and that's the best way to learn it too is to put it to use the next day.. So yeah I think that, I forgot even what your first question was so, (laughs) hopefully, I didn't ramble too.. - No, I think it's important because, you sort of looking at this incredible career trajectory is like, wow, these things start to stack up and learn, learn, learn or whether.. I know my career, there were moments where it was super nonlinear where just like, what I learned was an explosion.. Other things were more kind of incremental and I was wondering if the same experience and to that add, you worked at a really interesting, had a career stop at Stanford Research Institute, which is incredibly secretive place and I was curious that that seemed to be a little bit different, I know-- - [Amy] Yeah.. - I'm curious to know what you learn there and what that was all about.. - I loved my time there, it was awesome.. I was actually working in the ventures and licensing group for Norman Winarsky, and he's credited with helping to identify what became Siri.. I actually worked for a period of time with Adam Shire on what, on the early, early early part of the research that became Siri there and my job was to be the business person to help either license, figure out the licensing of the SRI technology or to help raise capital for spin-outs, and they have very good successful track record of turning their research into viable businesses especially in the voice recognition area..

I'm also in cybersecurity so I worked a lot on cybersecurity there when I was with them.. And that was super fun because it was just like, I love to be in the labs, I love to sit alongside these scientists and these crazy smart people and then just dream about, well, what can we do with this? Where would it fit in the market? Who would buy it? How much would it have to cost? Like, what partners would we need? And that was my job was to think about the business part of it and we got to interface with a number of venture capitalists that were supporting that effort at SRI so they have put together this great advisory

panel of some of the top venture capitalists in the area to help review their technologies and to have opinions about that and that was super fun, but I love working with Norman.. I actually, the reason that I stopped working there was we moved back to the Midwest to raise.. Once I had both of my daughters, we really wanted to be closer to family, so we moved back from Menlo Park, we moved back to the North Shore of Chicago to raise our kids closer to my family, so that's what disrupted that.. Otherwise, I think I would have still been there working on that, I love, that was one of my favorite job experiences 'cause it was so intellectually stimulating.. - Yeah, it's a very fascinating place with amazing technologies are conceived and birthed there, so that seemed like it was a great stuff.. Okay, one last question, we had some really cool questions popping up in the Q&A but, lastly, so if you went back in time to your freshman year at Stanford, what would you do differently? - Well, I would think, let me talk about my Stanford experience in general.. One thing I would do differently that I regret is I never studied overseas, so I wish I had done that.. That's what I wished, one thing I wish I had done and we didn't have a lot of money.. I was on a big scholarship, I had to work throughout my Stanford career, I had a big loan, so I think that felt very luxurious to me and I didn't think I could afford to do that..

So I wish I had done that because everybody I know that did it had a great experience and I sort of, then said about after graduating trying to travel a lot because I missed having that experience as a student, but I do remember one thing, one piece of advice is I would give a little more forgiveness to myself that freshman year because it was, I came in, I was class valedictorian in high school.. I had straight A's, but I was not prepared for the intellectual rigor of some of the advanced math and science classes at Stanford and they just kicked my butt.. And I remember feeling I was so, I was just like so humbled, it was really.. (laughs) And I think it took me quarters to recover from that, like signing up for some of these classes, and I thought, "Oh my God, I don't belong here." I totally had that imposter syndrome.. I don't belong here, like what am I doing in these advanced math classes.. So I had to get sort of put into the right classes and that was really, it was like a huge confidence, shattered my confidence and I think, I wish I would forgive myself a little bit more for those experiences and maybe fumbling a little bit, freshman year figuring out where I belong to what classes and all that kind of stuff.. - Yeah, I love it, so look, I think, fate played a big role in you being here today on Earth Day.. I so applaud your work and effort and courage in what you're doing and I don't know if we hit 420 parts per million yet, I know we're 419 last time I checked, and we're clearly not on a sustainable path and I've looked at studies that show, within 100 years, so students, your kids are gonna be inheriting something quite extraordinary here.. It could reach \$2 trillion a year to deal with climate change.. That's not going to education, that's not going to infrastructure, that's not going to invest into the future paying for the past so it's not too late..

Thank you so much for everything that you're doing.. I think your fund's going to be phenomenally successful, and I think you've shared some amazing insights with our students today.. So we got a little bit of time, let's do some Q&A, and so they've got some good votes here, so the most voted up question is, broadly speaking, what does the success scenario look like for climate change technology and what is the end game and how different, and how is it different from today? - Well, let's see, let's talk about, wow, success.. What does success look like? So I think we kind of saw it a little bit, like I said, just the last the last month or so as we, how you can see the Himalayas from the cities in India, how clean the air is in LA and in China.. I think success is definitely keeping us under that threshold, the emissions threshold, and the temperature threshold.. I think more importantly, it is, we've caused a lot of damage even to the ecosystem and the biodiversity and I think that helps, a big success will be restoring that, and these habitats that a lot of the, we've encroached upon a lot of the habitats of all the animals and that's been a big cause of infectious diseases, right? So as we've encroached upon their natural habitats, we've seen more and more animal to human infectious diseases.. So I don't know that it's going backwards to what we had before, but I think it's like renewing the biodiversity, it's clean air and water.. And I think a big part of it from a, like you think about the energy sector, in particular, I think getting us to 100% clean energy is definitely doable, I think we can get there.. I think what we need is we need the political will to build transmission and to connect up all the renewable energy in the rural areas where it's very inexpensive to produce it and to deliver it to the load centers, but also to have some of the changes in the energy rules so that we can transmit that power over state lines.. I know you guys have a special situation there in California with figuring out how to import enough renewable energy, but also how to deal with your solar, you have so much solar and how much curtailing that will be, so how do you balance that on the grid..

So a lot of these are very, to me, those are very solvable problems.. And I think if we had the political will to get there and can change some of the rules and regulations so we can use all these technologies that exist and just put them to work and let them do their thing, then I think we can make really tremendous strides and I think we have it, Tesla and their amazing electric cars.. They basically helped to make the EV market, so we'll get back to that eventually, like EVs are gonna take a major hit from COVID, like just people's disposable income and people aren't gonna be buying as many cars.. But again, I think the internal combustion engine is not necessarily going as fast as a way of the coal plant but it's kind of on that trajectory, so I think that that will resume and we'll get there around the transportation sector in removing the emissions in that sector, so I think we can get there.. I think we just have to let all of the great inventions we already have, they have to be scaled, and we need support from the government to do that in a rulemaking and regulatory standpoint, and if we had a price on carbon and we could get the political will to do that, that would accelerate us in the really positive direction.. So, maybe we can get that with a new administration.. - Yeah, I mean I would agree 100%.. I remember back when Elon was very active at SolarCity while I was there, he was our chairman.. And I remember when kind of these green products first came into the marketplace, they were typically not as good and they cost more, and that was like an anathema to Elon, and if you think about it, they don't advertise an electric car, like he's completely transformed the driving experience.. It just happens to be electric, happens to be great for the environment..

I think that's the opportunity that's there.. How do we create extraordinary awesome products? Big thinking, big breakthrough opportunities that the market wants and needs, and the timing, it's so right and we're literally dealing with hundred-year-old technology, that's how old our electrical infrastructure is today.. And we've got kind of the first wave of renewables that has made its mark and are being deployed today, so the opportunities are just absolutely huge, but you're right, we need to elect the right folks that are not thinking about yesterday, are not thinking about 1950s policies, and are thinking about what's right going forward for humanity, the viability of our planet, and this November's gonna be really important so.. Okay, next question that was voted pretty high here.. How do you see travel impacting climate change in the future? There seem to be potentially two camps, the camp travel will decrease in line of COVID and the camp that travel will continue to steadily increase as access to transportation becomes more widespread across the world, and as global population increases, how will the travel problem be solved in the future as we work towards global sustainability? - I think that, well, certainly, travel is gonna be curtailed until we have a better handle on a vaccine, right? So that's really the, I think the big thing, and we won't even once we have a vaccine, we won't have it produced in enough volume to really vaccinate everybody that needs it, right? So inventing, it is one thing and then producing enough of it is another thing for sure.. I think that travel will resume.. I think that virtual is great.. I think it's absolutely helpful that we have all these amazing tools and when I think about digital technologies, I think about how Zoom scaled from 10 million users to 200 million in a quarter.. Like we have these tools that are gonna make it easier to communicate virtually so we won't have to meet as often in person.. But I do think that, I mean, we're such a....

I don't think we're gonna go backwards on a globalization, I really don't.. I think the effort to try to prevent that is futile.. I think that trying to keep people out of this country and trying to limit immigration and also trying to limit dependencies that we have on each other, the countries have on each other, I just don't think that that's worthwhile.. I think we have to embrace that and we have to be more prepared in the future when the next pandemic happens because it will happen, it's going to happen.. I mean, it's gonna happen again so we have to learn everything we can from this one to know how to get communication out and how to treat everyone more successfully, how to make sure our hospitals are better prepared and have all the equipment that they need to be more effective.. That's been such an issue is for them to have what they need to do their jobs.. They don't have what they need so I think we're gonna have to rebuild all the stockpiles.. And I think that, again, like the whole supply chain for medical equipment is completely global, so you can't, you really, I think we have to just embrace the fact that we are dependent upon each other and make sure that we have better systems for dealing with the next pandemic, but I do, I am hopeful that global travel will resume, and I think that from a carbon standpoint, that is big emitter and we do have ways we can address that.. In jet fuel, we have ways that we can address that certainly with electric vehicles.. And then, I was talking to Maersk the other day and the shipping industry is a huge, huge opportunity to address for emissions and looking at pulling carbon out of the shipping industry and the transportation industry, the logistics side of things..

Like you can do so much more with less fuel and there's a lot of great innovation that you can use to reduce the amount of fuel needed to transport these goods and Maersk is one of the leaders in that area.. They've got a commitment to net zero carbon by, I think, they're 2040, they're trying to get there by.. So that's incredible goal that they have because especially since the fuel for the shipping industry is so, so dirty, they have to do even more than others do than, say, the airlines do to try to address that.. But I think, again, we have the innovation, we know how to make biofuels, we know to help flight and to help the airline industry and we know that electric can do their part, electric vehicles, trucking, fleet, everything can be happening on the vehicle front.. So I think we'll get there and I think it will resume.. It'll take a long time and I know people are probably gonna be starved for getting back together in person, too.. I think, we won't do it as much but we're going to really do it for what's really, really important.. - Yeah, I agree.. Okay, we have one last question, let's see.. In your opinion, what, let's see, here we are..

In your opinion, what are some near future green alternatives to fossil excluding nuclear? - Okay, well, I think the alternatives to fossil.. I mean, we've got, wind and solar are super effective, right? So I think deploying that at scale and we've got a lot of rooftops that could still take solar on them and putting battery storage and pairing those with battery storage is really important, so we've seen that that can be very cost effective.. Tesla's been a leader in that for sure.. So I think deploying the technologies that we have at scale and then focusing on the transmission of that power, the transmission is really the difficult piece.. If we could transmit the clean power more easily to where it's needed, that would solve a lot of the problems that we have.. So you've got some really great thinkers there at Stanford that are thinking a lot about this problem and how you do this and I tend to agree with them.. Mark Jacobson and some of the others who aren't looking for us to depend upon nuclear power, and they're certainly planning for storage to be a big, big part of that solution, but even if we didn't get to 100%, if we got to 80%, we'd be in really, really good shape.. So I think if you still needed to use gas peaker plants in certain locations, if you still, if you've kept open the nuclear plants longer than they're supposed to be, which is basically the entire fleet that we have in the country is operating way beyond its useful life, but if you could safely keep them online for a little bit longer, I think you could get there with really, with more transmission and with more storage it's deployed at an even greater scale.. (upbeat electronic music)..