Venture Capital Is Fueling Clean Tech

Early stage venture capital increasingly is a key source of finance for clean tech and clean energy, says Andrew Chung, a partner at Khosla Ventures, a venture capital firm that focuses on both areas. In this interview with Knowledge@Wharton, he discusses how clean tech is set to grow quickly over the next decade, the challenge of government subsidies and how solar technologies are reaching cost parity with oil, along with other topics. "We exist on an electricity generation infrastructure and a transportation fuel infrastructure that's been around for 50 years…. Some of the newer folks in venture capital are really trying to … reinvent and change that and redefine the paradigm."

Knowledge@Wharton: We're meeting today with Andrew Chung, who is a partner with Khosla Adventures, a venture capital company that invests in clean tech and information technology. Thanks for joining us at Knowledge@Wharton today.

Andrew Chung: Thanks very much for having me.

Knowledge@Wharton: Tell us what clean tech is.

Chung: I think I have a pretty broad definition of clean tech. I think it's any technology or service that enables the delivery of scarce resources in a renewable or sustainable in a more efficient way than what's out there currently. So it can include things like solar, biofuel, wind energy storage, energy efficiency smart grid, but then also, new techniques for farming or agriculture, water purification and a whole range of a whole range of other types of technologies that enable the delivery of those types of resources.

Knowledge@Wharton: So a big chunk of it is oriented toward energy, but there are other facets to it.

Chung: Correct.

Knowledge@Wharton: Right now about 20% of venture capital funding is going into clean tech, which is a pretty big number.

Chung: Yes, it wasn't always like that.

Knowledge@Wharton: It was only 3% percent just five or six years ago. So that's growing rapidly. At the same time, the renewable energy's global capacity is still only 2%, but yet, during the last year, half of all the new energy-generating capacity added globally was from renewable energy, which is pretty remarkable. So on the one hand, it's still a very small part of pie. On the

other hand, it was a big part of last year in growth. What's that look like going forward? How will those numbers develop?

Chung: I think the problem at hand is a massive one. It's how do you deliver scarce resources, whether it's energy, food, electricity, water -- to five billion plus people in the developing world, so that they can have the types of lives that 500 million people in the developed world have. And that's a massive problem, right? So right now, with only 2% of the overall energy equation coming from renewables, there's massive headroom for us to expand that number over time. And I think that the early numbers around the capacity growing mostly from these renewable sources, are a good sign, but it's a signal that we still have a long way to go. So that 16% or 20% of venture investing going into renewables could still potentially have room to grow.

Knowledge@Wharton: And is venture capital the main driving force to the growth in renewables?

Chung: I think it's one of multiple sources. So, if you're talking, for example, the growth of wind capacity, which has been going up by tens of gigawatts every year for several years now, a lot of that is driven by later-stage financing sources, like project finance, different sources of debt from governments outside of governments. And so, that is less driven by venture capital. I think where venture capital is really the key player is around the early stages of innovation. How do we identify and develop the technologies that are going to have the transformative effects five to 10 years from now to really take that 2% number and explode that into a 20% or beyond. So, solar has seen a lot of venture capital investment, biofuel has seen a lot of venture capital investment, a lot of the more recent energy efficiency companies have seen a lot of venture investment. Those are more around being able to create the types of technologies that really can expand the percentage share of renewables and more efficient use of the energy that we already have today.

Knowledge@Wharton: So in the venture capital world and in the clean tech sector, I understand there's a phrase that's called "the valley of death." And what it refers to is a lot of these renewable companies and start-ups are getting funding from venture capital, they get a leg up, they show some good results, and they reach a certain level of success. But in order to commercialize an idea or get to the next level, they need a lot more capital than venture capital sources can provide $100 million or more. And it turns out that in the U.S., there's a gap in that funding. But around the world that's not the case. In Europe, in China, in many other areas of Asia, governments are filling that gap. They're providing a lot of subsidies, which would seem to put the U.S. at something of a disadvantage. How could the U.S. fill that gap, through government or otherwise? And what's the future look like for that valley-of-death problem?

Chung: If you look at the number of dollars that the Chinese government has pledged towards sustainable technologies -- green tech -- and so far, it looks something on the order of$80 billion for each of the next 10 years, that is probably more than double of what the U.S. government put into clean tech last year and more recently.

And with some of the recent hubbub around the press around whether they're doing the right things, it could potentially change, as well. So China has clearly put a strong commitment behind investing in these types of technologies. Other parts of the world have, as well. And I think in the U.S. we really need to make sure that that type of support continues, otherwise, I think we could fall behind. The valley of death that you referred to earlier is definitely an issue that venture capitalists will keep an eye on, because for a lot of these types of technologies, while there are some on the energy efficiency side and software side and so forth, they can be scaled up very capitally efficiently, like some of the other IT-related companies might be able to scale up.

But then there are others that will require plant building. You have to build manufacturing. You have to spend several hundred million to build a biofuel plant or a solar plant, and that is not too different from the old semi-conductor plants from before – they are all in the same vein. So in order to raise that type of capital, there are a lot of companies that, if their technology has not gotten to the point where financiers are willing to take a bet, it can become a very difficult situation for them to raise that next slug of capital.

One of the things that we've done at Khosla Ventures and I've done in some of my investments prior has been to look at capital flexible companies, where you're not dependent on raising $100 or $200 million yourself every time to build up a plant manufacturing capability. So for example, some of our biofuel companies have partnered up with companies like Shell, Chevron, some of these large monolithic conglomerates that need to have renewable sources of fuel, to leverage their balance sheet and leverage their capital capability in order to build plants…. Again, the point was not for them to necessarily build up their own manufacturing capability, but leverage capital from the outside, like the state of Mississippi and other sources in order to build up their manufacturing capabilities. So across the board, the order of the day is to try to get to a nominal level of production with as little capital as possible, and be very capital efficient in getting there and then leverage other folks' capital in order to get to the 100 megawatts or 100 million gallons per year of plant capacity. So it's about the creativity necessary to get there.

Knowledge@Wharton: So you mentioned the state of Mississippi there -- so that's some government money, some state money in that case and presumably, some federal money for some of these projects. Everyone's pretty aware of some of the recent high profile failures that we've had recently. There are two or three solar firms that failed towards the end of the summer of 2011. Is that just the inevitable weeding out process and should people not be overreacting to these things? Or what's your view?

Chung: I think so. Many of the folks in the venture industry would say that for a number of years, some of the challenges associated with these companies and their failures has been generally talked about and understood from an inside baseball standpoint. From a broader public view, perhaps not. I think it is the inevitable weeding out process of a broad range of companies where some of them are just not going to work. And unfortunately, in the Solyndra case, it was such a high-profile incident because of some of the key political figures who were involved and just the sheer size of the dollars that went into that project. It's unfortunate for the industry. But

does that mean that companies in the clean tech area aren't able to generate significant returns and so forth? That's not the case. Khosla Ventures -- just over the past 12 months -- we've had three public offering and three biofuel companies … that have generated over a billion of profits for the firm. So it is possible if you pick in the right areas and pick enough of them that some of them will come out as winners. But as a matter of practice in the venture capital business, you invest in 10 companies, there are going to be some that aren't going to make it.

Knowledge@Wharton: It also seems that as the projects get bigger. Maybe 10 ten years ago we were building a renewable project that might power a couple hot water heaters and now we're talking about maybe 50,000 houses. So the projects are bigger, they're not all going to succeed, and the failures are going to be bigger failures in terms of dollars.

Chung: Right. What we're talking about it really reinventing society's infrastructure, right? We're existing on an electricity generation infrastructure and a transportation fuel infrastructure that's been around for 50 years. And what some of the newer folks in venture capital are really trying to do is reinvent and change that and redefine the paradigm. So it's going to take some time and there's going to be some failures along the way. But out of the failures, hopefully, will come some successes that will radically change the landscape for energy infrastructure.

Knowledge@Wharton: Tell us a little more about the companies that your firm has been investing in -- you mentioned a few briefly back there that sound pretty interesting. Some of the successes and some of the new ventures that you're embarking on.

Chung: Sure. Well, there's a broad range of companies in the Khosla Ventures portfolio, about 60 or 70 companies on the clean tech side, another 50 or 60 on the information technology side. And those companies span a very broad range of the various clean tech sectors. It's exciting for me to be involved with so many of these companies because they really touch every aspect of being able to solve that problem that I mentioned earlier, which is how do you bring these scarce resources and renewable resources to the five billion developing country folks and move them into the realm of developing country, right? And so, we have investments in LED lighting, including a company called Soraa, which has developed a new type of LED lighting source that's significantly cheaper and higher performance than the existing LED technology that's out there. So they have a great shot when they get into production of being able to displace the incandescence and the fluorescent light bulbs out there, in terms of cost and performance. We have companies that are in the biofuel space that I mentioned earlier that have leveraged advanced techniques in synthetic biology to create microorganisms that convert sugars into a whole range or fuel and chemical alternatives at very compelling, economic rates of production. We have a company that I mentioned in the solar space, Stion, which is developing the highest efficiency thin film materials in order to dramatically lower the installed cost of production for solar manufacturing and PV material.

Knowledge@Wharton: One interesting measure -- there is always cost per kilowatt hour and how that compares to a conventional generating plant. And we always hear about how solar is

getting closer and closer (though it depends on oil prices) in the cost of production per kilowatt her hour. So the thin films that you're talking about -- just give us some sense of scale of what kind of a difference that could make.

Chung: So the key thing there is the traditional way of making solar modules, the kind that you would have had on your solar calculator, back in high school. That is made with a type of material that's called crystal and syllacine and it's a very age-old method -- for the past 35 years, they've been making it with a very complicated and costly process and, over time, they've been able to reduce the costs of significantly.

The way of making thin films is intrinsically a cheaper production process -- fewer steps, cheaper materials and a shorter process, as well. So the way of actually making this material and manufacturing it is going to be cheaper than crystal and syllacine in the traditional methods. The problem in the past has been that these thin films are usually much lower efficiency than the crystal and syllacine alternative. And so, even though you can make the panel cheaper, you need more of the panels in order to get the same amount of power put on your rooftop or in a larger solar farm installation. And so, what our company has been able to do is to create a type of material and innovate on that material's design so that you can get efficiencies that are approaching, if not exceeding that of crystal and syllacine. So you get the best of both worlds. You get the lower manufacturing cost because it's thin film and then you also are able to put fewer of them on the roof tops and so, that your overall installed cost ends up being the best in the industry.

Knowledge@Wharton: Is that project soon to be commercialized?

Chung: They're manufacturing product today and they're building a plant in Mississippi right now, yes.

Knowledge@Wharton: That brings me back to this other problem with this. Historically, there's been this cyclical rise and fall of oil prices and when the price is up, renewables look very attractive and a lot of money rushes in and invests in them. Prices fall and it seems that a lot of those projects and companies wither away because they can't be as competitive. But I get the sense that things have changed. There's peak oil, for example, which may eliminate those days when prices really go back down significantly compared to today's prices. And also, an increasing concern about climate change, which gives people another incentive to invest in these renewables. What's your view on that and what do you see going forward?

Chung: I think there's a couple of different things that will contribute to a perfect storm going forward. For the first time in many of these industries' histories, you're reaching a cost performance level that is getting close, if not reaching parody with traditional sources of energy of whatnot. So solar, again, you're getting close to that magic dollar per watt number that folks have been talking out for years. In the battery industry, you're getting close to a cost per kilowatt per hour that can be very competitive. In other sectors like biofuels and wind and so forth, again,

we're at cost parody in certain regions of the world already and in some cases, we're getting very close.

So if you look at this energy crisis versus what we had 30 years ago, it's no comparison just because the cost levels are just fundamentally orders of magnitude different from where they were before. So I think we're just close enough that if you take the other elements of the equation -- which is that there is still a lot of technology head room for these technologies to improve -- they're going to continue dropping the costs over time, and you have a lot more social, corporate and government imperative around making these things happen, whether it's the corporates that are investing dollars into supporting renewable and sustainable technologies, making themselves lead certified and actually investing in these technologies, to the governments around the world, including China and the U.S., who are trying to put money into helping building manufacturing capacity out there.

Renewable portfolio standards, renewable fuel standards, other things that are contributing to moving customers towards making the easier decision to use these renewable sources. When you factor all those types of things in, you know, from the economics to the technology head room to all of the government, social and corporate imperative around this, I feel like there is still an absolute opportunity over the next five to 10 years for that 2 % of renewables penetration to grow significantly. And we're probably in the second inning of an extra inning game when it comes to clean tech and sustainability.

Knowledge@Wharton: So let's say 10 years from now, what percentage of energy generation propensity will renewables take up?

Chung: Well, at Khosla Ventures we always talk about how forecasting tends to be very difficult and often meaningless. And you know, one of the jokes that we have around the office is you know, the projections on wind capacity development -- you mentioned that there was a lot of wind capacity that came online. You know, some of the authorities in wind changed their predictions five times over the last five years and it's gone up tenfold from where they thought it was going to be back in 2005. So it's hard for me to make a forecast. But if you force me to make a number, I'd say probably closer to 10% to 15%.

Knowledge@Wharton: And are you erring on the side of being conservative also?

Chung: We tend to be very optimistic.

Knowledge@Wharton: Thanks very much for joining us.

Chung: Great, thanks so much.