

## Betting on green

**Vinod Khosla** thinks most venture capitalists are being too cautious with their green investments. But is his own approach too risky?

“ENVIRONMENTALISTS are fiddling while Rome burns,” says Vinod Khosla, founder of Khosla Ventures, a Silicon Valley venture-capital firm. “They get in the way with silly stuff like asking people to walk more, drive less. That is an increment of 1-2% change. We need 1,000% change if billions of people in China and India are to enjoy a Western, energy-rich lifestyle.” Forget today’s green technologies like electric cars, wind turbines, solar cells and smart grids, in other words. None meets what Mr Khosla calls the “Chindia price”—the price at which people in China and India will buy them without a subsidy. “Everything’s a toy until it reaches that point,” he says.

Mr Khosla has a different plan to save the planet. He is investing over \$1 billion of his clients’ money in “black swans”—ideas with the potential for sudden jumps in technology that promise huge environmental benefits, easy scalability and rapid payback. The catch? Mr Khosla expects nine out of ten of his investments to fail.

“I am only interested in technologies that have a 90% chance of failure but, if they do succeed, would change the infrastructure of society in some radical way,” he says. Khosla Ventures’ portfolio reads like an eco-utopian wish-list: non-polluting nuclear reactors; diesel from microbes; carbon-negative cement; quantum batteries; and a system for extracting methane from coal while it is still underground.

“Any one of these things is improbable but, if you have enough shots on goal, then it’s very likely that something improbable will win,” he says. “Ten years ago, no analyst in the world would have predicted 650m cellphone subscribers in India but only 300m people with access to latrines and toilets. Even five years ago, no one would have predicted the way that Twitter took off. These are the black swan outliers.” Mr Khosla is keen to point out that he has caught a black swan before. In the mid-1990s, when working for Kleiner Perkins Caufield & Byers, a venture-capital firm, he invested \$3m in Juniper Networks, a company making telecoms gear based on internet standards.

“At the time, every major telecommunications company told us that they would never switch to internet systems,”

says Mr Khosla. Within just a few years, the internet boom had netted Kleiner Perkins a \$7 billion return on its Juniper investment. Now Mr Khosla is gambling that venture capital can work similar magic in the field of clean technology. His approach is that of a pragmatic businessman rather than an eco-warrior. “I don’t view climate change as a moral thing. I view it as a risk, no different from nuclear proliferation, terrorism or national defence,” he says. “Business is used to buying insurance, and this is insurance that it is imperative we buy.”

These high-tech insurance policies come in many flavours. Mr Khosla has invested in companies that promise ultra-efficient air conditioning using hypersonic vortices or desiccant chemicals. He is funding the commercialisation of low-power lighting, next-generation solar cells and super-strong building materials. But, like the environmentalists he scorns, Mr Khosla puts most of his energy into seeking alternatives to traditional fossil fuels.

“We remain primarily a gasoline-driven consumer economy,” he says. “I’m happy to see the price of oil going up, as it will incentivise us to replace fossil fuels.” Mr Khosla has invested in several biotechnology companies that aim to condense the multi-million-year process of creating oil from plant life into a matter of hours. Amyris, which was floated on the NASDAQ exchange last autumn, is using genetically engineered organisms to turn plant sugars into a precursor of diesel.

### Never tell me the odds

Another start-up, KiOR, is hoping to go one step further, converting cellulosic biomass (such as waste wood and leaves) into a crude oil replacement called Re-Crude. Fans of cellulosic biofuels hope that they can produce ethanol without competing with food crops for agricultural land. According to Mr Khosla, KiOR can produce Re-Crude in America today for less than \$90 a barrel. “Three years ago, I would have said that there was a 90% chance of KiOR failing. But these things aren’t predictable. Forecasting is based on assumptions, and technology changes those assumptions,” says Mr Khosla. “I never compute returns. If you start forecasting cash flows, you lose innovation, you lose instinct. You average yourself down to mediocrity.”

No one is likely to accuse Mr Khosla of that. At the age of 20 he launched a soya-milk company in his home city of Delhi, targeting the multitudes in India who did ▶▶

## "I don't view climate change as a moral thing. I view it as a risk, like nuclear proliferation or terrorism."

▶ not own a refrigerator. When it failed he moved to America to study biomedical engineering and business. In 1982 he co-founded Sun Microsystems, a maker of powerful workstation computers. After the company's initial public offering (IPO) in 1986, Mr Khosla left to become a venture capitalist. At Kleiner Perkins, Mr Khosla was involved in the early financing of Nexgen, an innovative chipmaker, and Excite, a search engine. He also had some high-profile flops, including Dynabook, a company that designed a tablet computer 20 years before the Apple iPad but proved unable to bring it to market.

"I've had many more failures than successes in my life," admits Mr Khosla. "My willingness to fail gives me the ability to succeed." His next move was characteristically unpredictable: he temporarily moved his family to India. "I wanted to see if I could have a social impact," he says. "I quickly realised that any non-profit activity I could do would be no more than a drop in the ocean. Most non-profit organisations are completely ineffective. That's when I decided that I needed to look for scalable solutions, which meant self-propagating solutions, which meant capitalist solutions. Proving the capitalist tool as a solution for poverty is high on my priority list."

Mr Khosla put several million dollars into SKS, a for-profit microfinance company. Although India's booming microfinance industry has since attracted criticism (and even government action) for its high interest rates and aggressive debt-collection practices, Mr Khosla is adamant that its benefits outweigh any ills. "Millions of people now have access to financial services," he says. "That's more social than any non-profit thing I could have done. And guess what? In the process, I made \$100m. You never know when something you're trying to be radical on will make you money."

If Mr Khosla is unapologetic about making money while helping some of the world's poorest people, he is equally outspoken when it comes to the environmental movement in the West. "Wind projects are a waste of time. And the reality is that electric cars today are coal-powered cars, because the USA and much of Europe have mostly coal-based electricity," he says. "Environmentalists use artificial rates of return, buried assumptions and 'what if' assumptions about behaviour changes. It's useless crap."

This sort of talk does not exactly endear Mr Khosla to environmentalists. "The

solution to our energy problems is almost the exact opposite of what Khosla says," declares Joseph Romm, who is the editor of *Climate Progress*, an influential climate blog, and a senior fellow at the Centre for American Progress Action Fund, a think-tank. "Technology breakthroughs are unlikely to be the answer. Accelerated deployment of existing technologies will get you down the cost curve much more rapidly than a breakthrough."

But Mr Khosla is standing behind his black swans. "We fool ourselves into thinking that if 5% of San Franciscans or rich Germans can afford a technology, then it's getting market traction. But only when an electric car can compete with a Tata Nano will you achieve scale, and that requires radical innovations in battery technology," he says, referring to the world's cheapest production car. Accordingly, Khosla Ventures is funding several energy-storage systems, including high-efficiency solid-state batteries that sidestep the safety problems with today's lithium-ion cells.

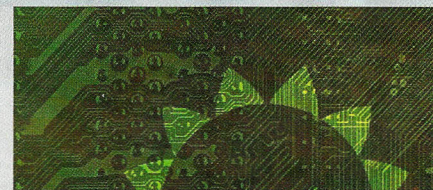
It's all about diversification, says Mr Khosla: "We'll try half a dozen batteries. If other people try 30 more, only one has to work to completely change society." Whether other investors will be prepared to take similar gambles on blue-sky technologies remains to be seen.

### Going it alone

Although Khosla Ventures' two funds are fully subscribed, and have invested about \$1.3 billion in over 40 companies, billions more dollars and many more start-ups will be needed to hatch a flock of black swans. Mr Khosla estimates that the amount of investment required to replace all the petrol consumed in America with renewable fuels will run into the hundreds of billions of dollars. But other high-tech venture capitalists seem to be steering clear of risky green investments.

"I would love to say that Vinod is starting a trend," says Steve Westly, another venture capitalist focusing on green technology. "But no. Not everybody has the courage to do that. Even here in Silicon Valley, people find it hard to understand that if you think big, you're going to have some failures." Mr Khosla thinks other investors will come round to his way of thinking eventually. "The climate will change as soon as we have a Netscape moment. When we have an IPO where people see they can make a billion dollars, everyone will start to invest."

But Marc Andreessen, the co-founder



of Netscape, whose IPO kicked off the internet boom, thinks Silicon Valley investors will prefer to stick to information technology. He has even promised that his latest venture-capital fund will avoid "clean, green, energy and electric cars". He argues that clean-tech is a very different field. "Moving from IT ventures to green technologies is nearly impossible, except for rare and extraordinary individuals like Vinod," he says. "He has put years into becoming a master of the field, but it's not the entire Valley deciding to move into clean-tech." Mr Khosla's mentor at Kleiner Perkins, John Doerr, has expressed concern over his own company's green investments and Peter Thiel, co-founder of PayPal and a partner at the Founders Fund, has said that clean-tech companies "for a variety of reasons don't work".

Facing both industry scepticism and the ire of environmentalists, Mr Khosla decided to engage Tony Blair, a former British prime minister, who joined Khosla Ventures last year as a senior adviser. The idea is that Mr Blair can provide a more diplomatic public face for the company, and he also brings global clout.

Mr Khosla, who clearly likes to see himself as a green iconoclast and financial maverick, is either very foolish or very clever. But at this point it is difficult to say which. "I try a lot of new things," he says. "It's fun to play the game and fun to play the odds—and long odds win a lot of fun." Mr Khosla's cold-blooded view of the economics of environmentalism has certainly ruffled some feathers. But if he turns out to be right, his quest for clean-tech black swans could be exactly what the planet needs. ■

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