

OUT OF THE BOX

The Future
of Global
Energy
Emerges

ILLUSTRATION BY JÜRGEN MANTZKE

The thousands of energy leaders who assembled in Washington in early March

sensed it. The Washington International Renewable Energy Conference was an event of global and historic proportions, a defining moment. Governments, entrepreneurs, corporate leaders, academics nongovernmental organizations — all came together with a shared vision of what the world's energy future should look like.

To capture the high energy of the conference, we circled back and interviewed one of its most stirring speakers, Vinod Khosla. We asked Greg Manuel, a State Department official helping to shape American global energy policy, and Michael Eckhart, the main organizer of WIREC, to reflect on its implications. And we invited two fascinating individuals we met, one a New Delhi businessman and the other a government official in Iceland, to contribute commentaries on emerging energy trends. A movement is being born, and it stirs the pages that follow.

WIREC

- ▶ 8600 delegates
- ▶ 250 speakers
- ▶ 246 exhibitors
- ▶ 150+ international delegations
- ▶ 119 countries represented
- ▶ India to host in 2010

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Expect the Unexpected

BY MARTIN ROSENBERG

Fresh from engineering school,

Vinod Khosla dreamed of setting up a soymilk production facility in India to help feed millions of Indians who lacked refrigeration. It failed, but Khosla did not. He went on to found Sun Microsystems in 1982 to build powerful workstation computers.

Four years ago, he formed Khosla Ventures to spur creation of entrepreneurial, innovative enterprises that promise to have a positive social impact. He was one of the anchor speakers at the Washington International Renewable Energy Conference in Washington, D.C. in March, where he observed that most predictions about the future of energy, such as oil price trends, tend to be wrong. To drill more deeply into his thinking about the global energy scene and the areas in which Khosla Ventures is placing its bets, we recently conducted several telephone interviews with Khosla. Highlights follow.

EnergyBiz At the Washington International Renewable Energy Conference you said that in energy, count on the unpredictable happening. Can you elaborate?

Khosla Every forecast the experts have out there is wrong, including the forecasts I make. In 1980, a study predicted there would be 900,000 cell phones in the United States by 2000. There were actually 109 million. Forecasts based on economists and econometrics are dead wrong, because they don't allow for innovation.

EnergyBiz So, what are some big strategic errors in energy thinking? Is global warming a problem?

Khosla The risk of global warming is much higher than the risk of your home burning down. If we buy home insurance, and most people do, we should be buying climate insurance. We need planet insurance, because the probability of a disaster is so much higher.

EnergyBiz Do you think coal will continue to generate half of our electricity?

Khosla Not likely.

EnergyBiz And oil?

Khosla Oil will have to chase biofuels down to \$35

a barrel over the next 25 years. I don't think coal-based fuels will be relevant in 20 years. Did you know that steel mill exhaust can be turned into 50 billion gallons of biofuels? Winter cover crops alone, with no additional land use, can replace 100 percent of our oil imports.

EnergyBiz These would be crops that grow in the winter when food is not grown and are then converted to biofuels?

Khosla Yes, without taking an acre of land out of food production. It could actually increase yields for food production during the summer because winter crops result in better soil ecology.

EnergyBiz What about the cost of emerging generation technologies?

Khosla Solar-thermal technology, risk adjusted, is starting to be competitive with integrated-gasification combined-cycle coal and natural gas-fired generation. Natural gas generation will be more expensive than enhanced geothermal in many areas. At six kilometers depth you could have very local geothermal power in many parts of the United States. You could put it right in Washington, D.C. to power the Capitol,

which is powered by a coal plant today. All the technology developed in deep oil well drilling works in this context.

EnergyBiz How can coal be best used?

Khosla Coal to natural gas is one area we have invested in. Coal to plastics is another great area.

EnergyBiz What kinds of research-and-development efforts are you supporting?

Khosla About a quarter of what we do is in fuels to replace oil, foreign oil. A quarter of what we do is the war on coal. Another quarter of what we do is efficiency related, from lighting to engines to better air conditioners, better compressors and motors. And the last quarter is related to materials, things like water, bio-plastics, new kinds of cement and new kinds of glass.

EnergyBiz What is the war on coal? Do you think we need to stop using coal the way we have for the past century?

Khosla Yes. Absolutely. I don't believe carbon sequestration is likely to be cost effective as envisioned today. I think we should try it, but I wouldn't put my money there because I don't buy the risk profile. It's too high.



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EnergyBiz Do you see generation as being decentralized?

Khosla No. Solar thermal plants will be centralized and large scale. Asura, part of Khosla Ventures' renewable portfolio, is building a 175-megawatt plant for Pacific

Gas & Electric. There will be some distributed generation but the bulk will be centralized.

EnergyBiz When will it be completed?

Khosla Faster than you could complete an IGCC coal plant even without sequestration. A couple of years for the first large-scale solar thermal project, probably by 2010.

EnergyBiz What are the cost comparisons?

Khosla It depends on how you account for risk and the cost of capital. If I could get the 5 percent interest rate the nuclear guys get from federal loan guarantees, I could produce power well below the cost of nuclear, coal and natural gas — well below 6 cents per kilowatt-hour in many areas.



Vinod Khosla
PHOTO COURTESY KHOSLA VENTURES

EnergyBiz You have mentioned the possible use of a new kind of cement to absorb carbon dioxide. How would that work?

Khosla I can't talk about it, but we are working on it. If it works, it would be cheaper than regular cement, so adoption's not an issue. It would be carbon-negative cement that would be cheaper than Portland cement.

EnergyBiz Do you think the electricity that we will need in our country for the next 20 years will be developed by utilities or venture capitalists such as yourself?

Khosla I think it will be developed by incumbent utilities in conjunction with venture capitalists. We're in touch with all the utilities.

EnergyBiz What two or three things would you like the next president and Congress to do on the energy front?

Khosla Adopt a national renewable portfolio standard. The

right way to do it is to require states to either have a renewable portfolio standard or have a feed-in tariff. If some states don't think they can have renewable power, they should opt for feed-in tariffs and accept all the renewable power they can get at, say, 10 cents a kilowatt-hour.

EnergyBiz Are you working on any wind ventures?

Khosla No. In wind, we are looking at wind storage more than anything else. That would make wind dispatchable power, a critical requirement for utilities.

EnergyBiz Any other things Congress can do besides enacting a national renewable portfolio standard?

Khosla Yes. Congress should put a minimum set of sustainability requirements on biofuels so abuses that will give biofuels a bad name don't happen. I'm a big fan of more restrictions on biofuels so they are sustainable. That can easily be done and we can still get to \$1 a gallon biofuel within three to five years. It will blow oil out of the water in terms of cost effectiveness.

EnergyBiz How long will it take to eliminate our reliance on imported oil?

Khosla Within three decades, easily.

EnergyBiz Are you talking to oil companies about this?

Khosla Yes.

EnergyBiz Do they get it? Do they understand the potential here?

Khosla Yes. Most do. They may not have the same view on how fast they can scale up. But, frankly, how fast it scales depends on policy.

EnergyBiz Do Americans understand the nature of the energy crisis and the possible solutions?

Khosla They do not.

EnergyBiz What are the central facts that the American public needs to know?

Khosla One, some of the renewable electricity can be cost competitive with our fossil fuels like coal, natural gas and oil. Two, biofuels can be done correctly, or they can be done poorly. For example, we ought to ban biofuels or any agricultural imports from countries that continue deforestation. And three, we need energy efficiency. We can double efficiency in lighting. We can double efficiency in car engines. We can double efficiency in pumps, air conditioners, compressors, the whole bit, and we ought to drive efficiency. We can cut the oil we need in half. That's not a difficult thing to do over 30 years.

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EnergyBiz Do you like plug-in hybrid vehicles?

Khosla I don't think plug-in hybrids make a lot of sense as climate change solutions. They're not economical. According to recent studies, they're among the most expensive ways to reduce carbon emissions. But they are attractive markets and we are investing in the area.

EnergyBiz On your Web site, it mentions that when you started out in your career, your dream was to develop a soymilk product for India. Is this energy field, now, your life's work?

Khosla I'm very passionate about it. Carbon emission is a worldwide problem. It's a global problem. In fact, it's the worst global problem we have. It is also a great economic opportunity.

EnergyBiz And the solution?

Khosla The best way to predict the future is to invent it. In the meantime, we have to count on predictable unpredictability. I am absolutely optimistic. Whether our ventures succeed or not doesn't matter. Somebody will succeed.

(GUEST OPINION)

The U.S. Seizes Leadership Role

Next-Generation Thinking for Next-Generation Energy

BY GREGORY MANUEL

New challenges require new

solutions. Decoupling economic growth from carbon emissions is no small challenge. It requires nothing less than reorienting the way we design our policies, build our businesses, and prioritize our research. In early March, the United States achieved an important milestone in meeting this challenge by hosting the world's largest gathering of public- and private-sector participants focused on the singular goal of scaling renewable

energy around the world.

The Washington International Renewable Energy Conference brought together more than 8,600 participants from government, industry, scientific, and NGO communities across 119 countries. This integrative and multidisciplinary approach represents the DNA of new energy solutions — in which the sheer breadth and complexity of issues require finance, energy, and environment ministers to comingle with financiers, private sector leaders, and entrepreneurs. To be sure, the exchange of lessons learned, case studies, and inspiring success stories informed many decision makers on how to implement their renewable energy strategies faster, better, and more cheaply. Importantly, however, these discussions uncovered a number of emerging global patterns around renewable energy development and deployment in which we each have a stake.

First among these is R&D acceleration and alignment. Participants discussed the importance of increasing and consolidating basic R&D efforts around key breakthrough technologies, such as portable and large-scale energy storage. Enhanced portable energy storage could help shift the transportation sector from liquid fuels to more efficient grid power. Likewise, large-scale energy storage would mitigate intermittency concerns for renewable energy and provide needed capacity to meet peak demand. Participants noted that global R&D efforts needed to be increased by an order of magnitude with more equitable burden sharing. Currently, the United States and Japan contribute more than 80 percent of global renewable energy R&D while representing 35 percent of global GDP.

Second, it was noted that regulatory consistency within and among countries and regions was critical to the diffusion of renewable energy technology. Harmonizing standards and codes around buildings, biofuels, and grid interconnectivity would contribute to a “build once — distribute everywhere” model, lowering costs and accelerating the adoption of renewable energy technology.

Third, participants noted that the places where renewable energy technology is being innovated, scaled-up, and distributed are often occurring in different geographies. An enzyme company in California, for example, might want to scale operations in Brazil at a fraction of the cost and time, but ultimately deploy in China or the United States where market demand for cellulosic biofuels will likely be strongest. This global renewable energy continuum of innovation, scale-up, and mass deployment is missed by many companies and investors who tend to be focused on a single country or region.

Fourth, participants discussed the unique financing needs of renewable energy — large sums of capital needed over longer time horizons with relatively high technology risk. It was noted that while venture capital may have the risk appetite, venture capitalists rarely have the balance sheet to scale emerging renewable energy technology, which often requires tens of millions of dollars to build commercial sized facilities. Private