

NREL Realty Primer

Director Arvizu Wants a Conversation

⚡ Dan Arvizu leans on a test bed of new photovoltaic shingles, asphalt shingle replacements, at NREL in Golden, Colo. Each shingle produces 17 watts.

Gets Time for

By Martin Rosenberg

Time With Utility Execs

» Early this year, President Bush declared in his State of the Union annual address that we are oil addicts and must turn to technology to end our addiction and preserve the environment. Shortly thereafter, he journeyed to Golden, Colo., to the Department of Energy's National Renewable Energy Laboratory, to underscore his commitment to dramatic change in energy policy.

Dan Arvizu, who has completed one year as NREL director, has a pivotal – and difficult – role to play in execution of that mission. Outside observers, such as Antonia Herzog, staff scientist with the Natural Resources Defense Council, point out that NREL's budget over the decades has been a political yo-yo: "That poor lab is particularly affected by the political winds," she said. Indeed, around the time of the president's visit, there was an embarrassing layoff and speedy rehiring of workers.

With all of the challenges, Arvizu, 55, embraces his job. He has been around cutting-edge technology most of his career, serving most recently as senior vice president and chief technology officer of CH2M Hill Companies, headquartered in Denver.

EnergyBiz recently spent time with Arvizu in his office to discuss the challenges and opportunities confronting NREL and the energy sector. His comments, edited for length and style, follow. »



Photo courtesy of NREL



Photo by Jack Dempsey

NREL INDUSTRY PARTNERS

WIND

- General Electric Wind Energy
- Clipper Windpower Technology
- Northern Power Systems
- Southwest Windpower
- Genesis Partners
- AWS Truewind
- Global Energy Concepts
- General Electric Global Research
- Massachusetts Institute of Technology

PHOTOVOLTAIC

- Energy Conversion Devices
- Energy Photovoltaics
- First Solar
- Florid Solar Energy Center
- Global Solar Energy
- International Solar Electric Technologies
- ITN Energy Systems
- NanoSolar
- Shell Solar Industries
- United Solar Ovonix
- BP Solar International
- Evergreen Solar
- Dow Corning
- GE Energy
- SunPower
- Xantrex Technology
- Spectrolab
- Amonix
- JX Crystals
- Concentrating Technologies

President Bush with Dan Arvizu at NREL on Feb. 21.

energybiz: NREL has been through many ups and downs since President Jimmy Carter launched it in the late 1970s.

ARVIZU: It was oil embargo time; it was the first real concerted national effort that said, "Gosh, we're vulnerable." This laboratory was set up primarily for the purpose of moving technology into the marketplace rather quickly. Some would argue we haven't seen nearly as much progress in the area as we might have otherwise expected, and I agree.

energybiz: Were the right bets put down — the right investments made?

ARVIZU: What we didn't fully appreciate was that energy markets are moving targets. An attempt at utility deregulation was made in the late 1980s, creating a whole lot of dynamics in the energy infrastructure that we didn't anticipate, as we were trying to figure out how energy research and development fit into that marketplace.

energybiz: Let's talk about wind generation, which is becoming widespread. Could NREL have made that happen faster?

ARVIZU: The technology, when first implemented, was 10 times more costly in a lifecycle cost basis than it is today. That was primarily due to the fact that the R&D was sponsored by the government in partnership with the industry.

energybiz: Do you see further dramatic cuts in the cost of wind energy in the next decade?

ARVIZU: Not so much, and I wouldn't call it dramatic. There will be incremental cost improvements just because of the nature of technology development. The government programs are very much focused on opening up the low-wind speed regime for the same level of penetration we have in high-wind regimes. The next big area of market opportunity is offshore.

energybiz: Are you currently working in the offshore area?

ARVIZU: We are just starting. We recently signed an agreement with GE.

energybiz: What is the major hurdle offshore? Is it getting the power transported or building large structures that can stand in oceans?

ARVIZU: You get a much better wind profile offshore than you get onshore. As a result, large wind turbine rotors and larger power generation per unit is possible. So, discussions are taking place to have 5-megawatt turbines out there that have rotors with diameters larger than 100 meters. Then, it's necessary to get that power from those wind turbines onshore, setting up new opportunities for R&D.

energybiz: What offshore wind generation potential have you seen?

ARVIZU: It is certainly in the tens of gigawatts. Focusing only on the New England area, some of the studies I have seen show a potential of 9 gigawatts to 10 gigawatts — just in that one region.

energybiz: How long until these new-generation wind generators gets established?

ARVIZU: A decade. It will be four years to a prototype, and then it takes a while to get them all up. The Europeans are already looking at them offshore and in fairly big sizes.

energybiz: Do you think this would ever get us to wind being 10 percent to 15 percent of our total generation?

ARVIZU: That is certainly possible.

energybiz: What about solar power? Where have we made our mistakes, and why are photovoltaics not coming along as fast as wind?

ARVIZU: In high-value markets, photovoltaics are currently available, and they are very cost effective. They have been for the last decade. We haven't seen photovoltaics move into the marketplace as quickly as a lot of people had hoped. Internationally, it is a big market pushing \$10 billion dollars a year.

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Photo courtesy of NREL

⚡ **Dan Arvizu rests on an advanced design wind turbine blade designed by NREL.**

News Flash>>

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EUROPE GETS RENEWABLE

Europe's 20 largest utilities plan to double their capacity to generate renewable power in the next five years, according to *Emerging Energy Research*.

They plan to spend 15 billion euros, or about \$18.6 billion, bringing the continent's total large scale renewable generation investment to \$62 billion by 2011, according to the company, with offices in Cambridge, Mass. and Barcelona.

The biggest market is in Germany. The second biggest is in Japan. The third biggest, believe it or not, is in California, primarily because Germany, Japan and California have put in place some fairly significant incentives that are public-policy driven.

energybiz: Are we behind the Japanese and Germans?

ARVIZU: It is U.S. technology being put into the market place internationally. The German public policy is a very aggressive subsidy that, if broken down into its components, is nothing more than a German jobs program. The incentives they put in place a few years ago were the equivalent of almost 60 cents per kilowatt hour.

energybiz: And Japan?

ARVIZU: The Japanese have subsidized their markets dramatically.

energybiz: Are we behind?

ARVIZU: In terms of production, absolutely. Japan has the two largest producers of photovoltaics in the world. One is Sharp and the other is Kyocera.

energybiz: Do we plan to import this technology, because we are not nurturing the industry sufficiently?

ARVIZU: That certainly is a distinct possibility.

energybiz: What is needed to speed deployment in the United States?

ARVIZU: Photovoltaics is still quite a bit more costly than conventional energy. It is best used in shaving

I HAVE SEEN A SIGNIFICANT CHANGE IN THE WAY THIS LABORATORY IS VIEWED AS A RESULT OF THE PRESIDENT'S VISIT ...

the peak power requirements of a particular region or particular location. It requires that you have time-of-day pricing and two-way metering.

energybiz: Is it your job to shape national philosophy and policy towards renewable energy, or are you an administrator who must cope with the realities as they come your way?

ARVIZU: Clearly, what is necessary is a dedicated, national commitment to really pursuing renewable energy and energy-efficiency technologies.

energybiz: Do you think you have that in the Bush Administration today?

ARVIZU: It hasn't changed administration to administration for a long time. Democratic and Republican administrations in the past did not put the kind of commitment to this arena that, if had they, would have created much greater progress today than ever before.

energybiz: But now energy security has become national security. Do you think now is the time to strike a new initiative?

ARVIZU: It is absolutely the right time. The reasons the president came here to promote the priorities around this area were very much driven by national security. I have seen a significant change in the way this laboratory is viewed as a result of the president's visit, both within the Department of Energy and externally. The president's budget for the 2007 fiscal year provides for a dramatic increase relative to other technologies and relative to other priorities within the department.

energybiz: What is the percentage increase?

ARVIZU: The expectation is 22 percent.

energybiz: Do you see any low-hanging fruit that you think you can bring out fairly fast?

ARVIZU: In the bio-fuels area, absolutely. The whole initiative around cellulosic ethanol is huge. The goals we have are to generate roughly one-third of our transportation fuels from cellulosic ethanol over the course of the next decade. By 2012, we hope to get the cost of ethanol down to \$1.07 a gallon — which would be equivalent to about \$1.42 per gallon of gasoline.

energybiz: So it will be viable with gas over \$1.42 a gallon?

ARVIZU: That's right. There is enough cellulosic ethanol biomass — without affecting our food production — to provide almost one-third of what we presently use in our transportation fleet.



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Getting Smart About Renewables

By Corey N. Hessen

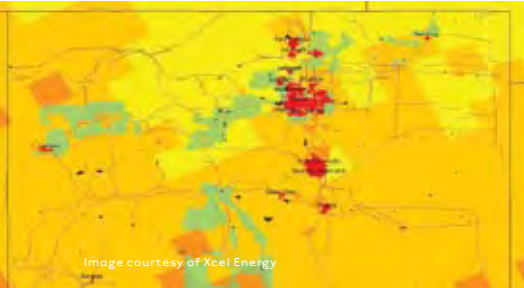


Image courtesy of Xcel Energy

▲ **NREL's software map provides Xcel Energy with useful data for deciding where to site solar projects.**

When his phone rang last April, little did Xcel Energy utility innovations director Dennis Stephens know he would be fielding an inquiry that would benefit not only his company, but potentially the utility industry as well.

On the line was Ben Kroposki of the National Renewable Energy Laboratory. NREL had satellite imagery and reams of data about solar intensity, wind speed, biomass and other renewable-energy resources. Could Stephens find a use for it?

The inquiry eventually led to a pioneering agreement between Xcel Energy and NREL. It called for software development to evaluate siting options for both off-grid and grid-connected commercial rooftop photovoltaic systems in Colorado. It also moved the company closer to meeting that state's voter-mandated, renewable energy requirement.

Xcel's GIS data — company facilities, load and consumption — was overlaid with NREL's data for solar resources, land ownership, land-use and satellite images.

"NREL's satellite imagery has the capability to zoom in right down to individual sites where our feeders are located," Stephens said. "It can then measure physical data such as light intensity, light duration and shadows." All of this information helped Xcel answer some important questions, such as where are the best PV sites in Colorado? How will solar installations affect its system? How much power could they potentially produce? Can solar power help meet peak demand?

"This project helps us predict when peak solar power will be available and how it works when there is peak demand" Stephens said.

And while solar applications are the company's primary focus now, the partnership is beginning to look at other potential benefits.

"We are providing NREL with feeder information, load profiles and projected load growth," Stephens said. "By studying feeders that are highly loaded in low-growth areas, we will be able to determine if the use of PV systems could delay replacement of electric facilities and related costs. We also will be able to study the broader applications of PV systems and their impact on transmission and energy-supply capacity requirements."

Corey N. Hessen is Xcel Energy executive director of IT strategy and customer operations.

I AM VERY BULLISH ABOUT THE OPPORTUNITY IN FRONT OF RENEWABLE ENERGY ...

energybiz: How well-briefed would you say utility executives today are on the work that you are doing?

ARVIZU: There is a growing interest on the part of utilities. Utilities tend to be quite conservative. They have many different dynamics and factors in trying to maintain profitability. Many utility executives want to know what will be the carbon policy of this country. They are concerned about the volatility of the price of natural gas. Clean coal is one answer, as is sustainable nuclear power. Maybe, there is a renewable or energy-efficiency option they might choose.

energybiz: How does renewable energy fit in?

ARVIZU: What isn't necessarily in the forefront of their thinking is how to accommodate renewable energy and energy efficiency. How do you extract the value of those technologies in this construct of big power plants and big wires? There must be a distributed nature to the future energy infrastructure. That is the part where the bridge needs to be built.

energybiz: What will the utility of tomorrow look like?

ARVIZU: It will be a mix of big power plants and big wires and smaller power plants and generation that's even more distributed than micro-grids. You could create sustainable businesses around them that fit into a very different future energy mix than the one we have today.

energybiz: Do you think utility executives should be paying attention to what you are nurturing here, in terms of emerging technologies?

ARVIZU: Yes, of course. The opportunity here is closer to a market reality than many utility executives realize. It is incumbent upon us to articulate what the business case looks like. As Wayne Gretzky likes to say, we skate to where the puck is going to be rather than where it is today.

energybiz: Are you optimistic?

ARVIZU: I am very bullish about the opportunity in front of renewable energy and energy efficiency technologies. You can do a lot more with renewable energy if you think about the future infrastructure differently than you think about today's infrastructure. ☺

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