

California's Energy Innovations Beyond Power Road

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Twenty-five years ago, when I first began reporting about California's energy and electric utility industry, a revolution of innovation was taking place. Long structured as a business based on government-sanctioned territorial monopolies, the stodgy and stagnant power marketplace was slowly being pried open by advocates of competition.

This was first experienced via the federal deregulation of markets for natural gas. Driven by air quality concerns in smoggy Los Angeles and propelled by lawmakers' desire for "energy independence" from costly Middle East petroleum sources, cleaner burning natural gas was beginning to displace dirty oil as the fuel of choice for power generation in the state. New companies sprang up to tap the gas wells and previously closed pipelines were forced open as "common carriers" for anyone willing to pay the toll.

Soon, the clamor for more open markets rattled the golden cages of the electric utility monopolists as well.

I was part of a small band of energy journalists – Peter Asmus, the main author of this book was another – who specialized in covering a similarly small band of "independent power producers" that were taking advantage of the provisions of a 1979 federal law called the Public Utility Regulatory Policies Act (PURPA) to sell electric energy to utilities.

These IPPs promoted a new generation of gas-fired combustion turbines that far outstripped the existing utility plant in terms of efficiency of production and cleanliness of emissions output. And, increasingly, they were bringing into the market "alternative" resources that utilities had long held could never work: solar collectors, wind turbines, geothermal power and small-scale hydroelectric facilities. Under federal parlance, these generators were also called "qualifying facilities" (QFs), defined by the language of PURPA.

The rules of this marketplace, as devised by state regulatory agencies whose main clients had always been the utilities, were arcane and the barriers to entry many. The utilities complained that they were being forced into these QF power-purchase contracts against their will, at prices that far exceeded their own built-in costs. The reality was that the IPPs and QFs had to meet rather strict standards for selling energy at an "avoided cost" rate – equal to or better than the cost the utility would incur to build its next needed generation resource, or even expand or modernize its existing fleet.

New, large, gas-fired turbines with favorable economic profiles compared to, say, a costly and risky investment in a nuclear power project, managed to establish footholds in several states. California was the place where lawmakers and regulators allowed IPPs and alternative QFs to thrive (relatively, as it was never a simple matter to win a contract, license a site, secure financing and bring a new project into operation), and by the early 1990s, there were hundreds of these new projects in the works or already operating.

My forum for documenting this evolving energy marketplace was a weekly newsletter I started in 1989 called *California Energy Markets* – staffed not by professional industry analysts with a built-in bias against change, but by independent journalists who served as outside observers to these intriguing new developments.

Some of my crew --admittedly, proudly -- came from the ranks of activists who had protested against utility rate hikes or marched against nuclear power construction. Others were engineers or legal professionals who found in journalism a more fulfilling, if not financially rewarding, calling than in corporate jobs.

Mostly, though, we were young, dedicated reporters who just happened to find the whole energy business in transition a fascinating field of inquiry.

Asmus, who was living in Sacramento at the time, became our field correspondent at the state Capitol and eye witness to the pains and tribulations of the local municipal utility that was about to conduct a mercy killing on its failing Rancho Seco nuclear power plant.

While considered specialists – certainly compared to our colleagues at newspapers and other mainstream media, who had to argue with ignorant or skeptical editors over adding utility reporting to their other business-news beats – we were still learning how this industry had come to be and struggling to understand how it was changing before our eyes. That meant we found ourselves spending long hours in regulatory hearings and public forums, poring over filings, contracts and obscure documents in claustrophobic libraries, and attending as many industry-oriented conferences as possible where we could ask hard questions of utility executives, regulators and other decision-makers who would rather we didn't exist.

Achieving such understanding usually involved piecing together small bits of information from disparate sources into a larger context that sometimes gelled into a useful insight.

That's how I developed the idea for "Power Road."

Reading through dozens of site-license applications and power-sales contracts, I discovered a trend. Many of the new IPPs and QFs were being located on or near California's Highway 58 – a 350-mile stretch of two-lane asphalt running eastward from near San Luis Obispo out past Barstow and into the Mojave Desert. There the road splits into Interstate-15 heading to Las Vegas and I-40 going eastward through Arizona along the path of old Route 66.

All of the newest technologies for electricity generation were represented on Power Road and appeared to be breaking down the traditional industry lines: Oil giant ARCO had built a field of solar photovoltaic collectors in the Carrizo Plains; gas-fired cogenerators by the dozens were reviving the dormant oil drilling industry in Bakersfield or providing inexpensive steam for the Central Valley's huge agriculture and food processing business; wind turbines dotted the hills of the Tehachapi Mountains; rows and rows of

solar power collectors of an innovative “rotating trough” design were being installed at Kramer Junction and Daggett. There was even an experimental synthetic fuel processing plant being developed by Texaco that turned black coal into a liquid synfuel, which boasted of being “the world’s cleanest coal power plant.”

A little bit off the main road, one could find several of the more-traditional utility facilities – river-run hydroelectric stations that dated back to the beginning of the 20th century, fossil-fueled generators built in the 1950s, and a hub of transmission substations at Midway that tied together the state’s network of high-voltage power lines and anchored the entire Western electricity grid from British Columbia to New Mexico.

This region was also the terminal point for a half-dozen natural gas pipelines being built to transport the new “fuel of choice” from producing basins throughout the Southwest.

Extending the lines a bit further west of Highway 58 brought the controversial Diablo Canyon nuclear plant into the Power Road construct, and a northern jaunt from Mojave led to the Coso geothermal fields being developed at a U.S. Navy weapons testing site at China Lake near Ridgecrest.

A Route 66 for energy is how I described Power Road.

There were certainly other locations in California where wind, solar, geothermal, cogeneration and other technologies were being installed – but no place where they all came together to illustrate how the deconstruction of monopoly energy markets could spur technological innovations along many fronts.

Flash forward a decade or two and Power Road still appears a remarkably viable concept. No longer “alternative” tech, the cogen, wind and geothermal power plants have proven themselves through day-after-day operations as mainstream resources and long-term investments.

Some technology experiments failed, of course they would; the ARCO solar fields have long gone fallow, and the Texaco syn-fuel plant never proved viable. It still stands like a ghost town of steel towers and unfulfilled dreams.

But in the sense that “everything old is new again,” there has been a revival of interest in coal-to-liquid technologies, and just recently other hopeful solar power developers have inked contracts to sell power to Pacific Gas & Electric from a proposed facility on the Carrizo Plains.

Sometimes, the original IPP/QF company went bankrupt, as at the Luz desert solar collector sites, and new owners or financial investors took over. Through it all, the solar troughs kept collecting sunlight and generating electrons. Now, another generation of concentrated solar troughs is updating the Luz designs, building on past foundations with somewhat better financial models.

Market restructuring a decade ago forced the divestiture of some of the utility power plants to non-utility companies, while a great many of the independent plants changed hands for a variety of other reasons. Hundreds of wind turbines were retired and replaced with better designs.

Still, the major features of Power Road remain intact (including Diablo Canyon), and some are now recognized as the “future” of the industry. Tehachapi Pass is slated for a major expansion of wind energy to meet California’s low-carbon, high-renewables content laws. This requires a multi-billion dollar investment in new transmission lines and substations along Power Road. These transmission hubs and gas pipelines are also the conduits for an entire financial and energy-trading marketplace that didn’t exist 20 years ago.

There is a renewed interest in the solar trough collectors at Daggett and a metastasizing of technology innovations derived from facilities all along this route to other parts of the state, nation and world.

The New Power Road

However, if the identifying characteristic of Power Road was as a physical location where innovation could be seen and explored in multiple variations, the future of energy markets may well be more diffuse and less geographically defined.

The vestiges of utility territorial monopolies remain, to be sure, and may have been permanently cemented by the catastrophic failure of California’s experiment in electric restructuring in 2000-01. But innovation cannot be contained or confined.

In the 1970s, the need for cleaner air and a push for energy independence – along with an influx of talented entrepreneurs eager to break down traditional barriers and find new solutions to old problems – set the stage for the innovations that I found along Power Road. Concurrent innovations in energy efficiency, building codes and appliance standards that have been part and parcel of California’s energy business and regulatory policies for decades (well documented in other sections of this book) are now being recognized as essential strategies throughout the world.

Now, containing greenhouse gas emissions has become the single filter through which all of California’s energy and environmental policies flow. The passage in 2006 of landmark legislation, AB 1890, will dictate utility resource procurement, land use, and investment patterns for decades to come. It will determine what new technologies are allowed to enter the market, and it is already causing developers and utilities outside the state to rethink their plans to build conventional coal plants.

As other regions – and maybe even the federal government – come to terms with the global warming issue and play catch up with California’s leadership, we could see profound changes in how we produce and use electricity.

We've long talked about decentralized or "distributed" generation that reduces the need for building big power plants and stringing transmission lines to reach remote locations where wind, solar, geothermal and other resources lie. We're not there yet, and probably won't be for several more years, but California's innovators continue to work on and improve fuel cells, roof-top solar and wind generators. Just two houses down the street from where I live, one can see in action a brand new, innovative wind turbine design that someday could be as ubiquitous as plasma TVs or laptop computers.

Even the utilities are finally realizing ways to employ innovations in energy distribution – as long as regulators allow them into rate base – and "smart grid" advances, interactive energy management, automated meters and other new tools are moving into the mainstream in millions of homes and business locations.

An influx of new money and ideas into the energy sector has the potential to completely change the rules of the game for investors, producers and consumers. I can easily imagine how a breakthrough in battery technologies meant to improve cell phones and laptops could translate into improvements in electric automobiles and maybe even energy storage – the plug-in car is not a science fiction concept but a working prototype.

There are entrepreneurs who readily see how ethanol will give way to bio-diesel, and that the same cellulosic feedstock being developed for transportation fuels could also be cracked, manipulated or genetically engineered into a whole range of products that will alleviate our petroleum dependence.

These are people who (as in the computer industry) simply will not accept old ways of thinking or be deterred by the kinds of barriers that utilities and regulators tried to put in the way of the old IPPs/QFs.

In fact, I've met several new "clean tech" executives who began their careers as California independent power producers, but who now are trying to train algae to consume carbon emissions, for example, or apply the biochemical principles of deep-sea photosynthesis to achieve much higher levels of production efficiency for rooftop solar cells.

As I said earlier, innovation cannot be contained.

But the most positive aspect, I think, is that we're seeing a new level of interest in energy and the environment among college students and those even younger. Where five years ago, universities were closing down their electrical engineering programs for lack of interest, there is demonstrable a move back into the sciences that can be applied to understanding and solving the climate-change dilemma --and energy will be a major part of that.

Somewhat like a previous generation whose imagination was captured by ecology, alternative energy and a desire to change the world, this new blood represents the future.

They will be involved for the long haul, and they are the real drivers of whatever energy market we will create.

California's New Power Road is where we'll be test-driving the future.

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Arthur O'Donnell, after more than 25 years as an independent energy journalist, has recently become the Executive Director of the Center for Resource Solutions, a San Francisco-based nonprofit with a global impact on energy policy and renewable power markets. He is author of several books, including "Soul of the Grid: A Cultural Biography of the California Independent System Operator" and "The Guilty Environmentalist." He can be reached via www.energyoverseer.com.