February 28, 2014

Robert Hingtgen
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VIA: Robert.hingtgen@sdcounty.ca.gov

RE: Comments on Soitec Solar Development Program Environmental Impact Report: 3800 12-010; Tierra Del Sol, 3300 12-010 (MUP), 3600 12-005 (REZ), 3921 77-046-01 (AP); Rugged Solar, 3300 12-007 (MUP); Environmental LOG NO.: 3910 120005(ER) & Request of re-circulation of a revised DEIR

Dear Mr. Hingtgen:

It is my pleasure to submit the attached comments on the Soitec Solar Development Program at the request of Ms. Donna Tisdale on behalf of The Protect Our Communities Foundation, and Backcountry Against Dumps. These comments include an update on our previous report, *Critical transformative issues in electricity: Negating the need for remote industrial wind and solar projects.* You can find a more extensive treatment of these issues on electricity technology and policy in my 55-page technical and policy Report on electricity, *Getting Smarter About the Smart Grid, that is incorporated here by reference.* A copy can be downloaded at <http://www.gettingsmarterabouthesmartgrid.org>.

Tim Schoechle

—

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<u>RE:</u> Comments on Soitec Solar Development Program Environmental Impact Report: 3800 12-010; Tierra Del Sol, 3300 12-010 (MUP), 3600 12-005 (REZ), 3921 77-046-01 (AP); Rugged Solar, 3300 12-007 (MUP); Environmental LOG NO.: 3910 120005(ER) & Request of re-circulation of a revised DEIR

From Timothy Schoechle, PhD
on behalf of The Protect Our Communities Foundation and Backcountry Against Dumps

Executive Summary

The following report conveys updated comments on the inappropriateness, and lack of need for utility-scale generation projects, and are provided now with specific regard to the Soitec Solar Development Program.

Background

In February of 2013, we provided 4-pages of comments in a report titled *Critical transformative issues in electricity: Negating the need for remote industrial wind and solar projects.* These comments challenged the presumed need for large remote wind/solar generation projects and identified the emergence of distributed generation, commonly called distributed energy resources (DER), and microgrid alternatives to centralized utility-scale generation/transmission projects. In particular, our report pointed out the benefits of trends toward decentralization, localization, and a new emphasis on premises-based systems. A copy of our 2013 report is annexed to this present report (Annex B).

What's new in the last year?

Current events have validated and exemplified the points made in our comments last year.[1] Over the past year, a number of dramatic technical and business changes have begun or advanced relative to the utility industry. Several of these changes are particularly relevant to proposed utility-scale solar projects justified as needed to serve the San Diego area. Our updated comments below will focus on both state-wide issues in general and on the proposed Soitec Solar Development Program in particular.

Summary of Recommendation

We recommend the "No Project Alternative"—that the project not be permitted, and that public resources be directed to more promising and less damaging alternatives. Such would include distributed rooftop solar, solar gardens, and other forms of distributed energy resources (DER). All of the objectives of the California Environmental Quality Act (CEQA) could be better achieved without the Soitec or similar projects. The goal of creating utility-scale solar energy in-basin is misguided and has been overtaken by events. The Soitec project will not improve electricity reliability for the San Diego region as well as the alternatives that we suggest. Given the rapidly changing technological and institutional picture today, we do not believe that these alternatives need to be reconsidered.

[1] For a more detailed discussion of such changes, see "The High Road to the True Smart Grid—[update on] *Getting Smarter About the Smart Grid*", presentation at Commonwealth Club of California, San Francisco. January 28 (Schoechle, 2014)

Update on 2013 comments in regard to Soitec Solar Development Project

What's new?

Several important developments have occurred over the past year that have significantly changed the strategic picture for electricity. The cost of photovoltaic panels (PV) and rooftop solar generation has dramatically dropped to the point that the utility industry is finding itself facing economic crisis. The ascendency of distributed energy resources in general, and rooftop solar in particular, has presented an existential challenge to the 130-year old investor owned utility (IOU) business model, according to the industry's own internal experts—the Edison Electric Institute. Large-scale solar projects are becoming even more inappropriate, facing increasing costs and declining economies of scale. Such projects are largely propelled by financial interests and by utilities searching for ways of using renewables to continue their dependency on profits from return-on-capital assets and from commodity sale of electricity, both guaranteed by regulators.[2] We propose that encouraging rooftop solar and community-based solar gardens offers a far better path for the residents, ratepayers, and taxpayers of the San Diego region. The following describes some of the key relevant new developments in electricity and relates them to the Soitec Solar Development Project.

1. Dropping costs of distributed PV (DER—distributed energy resources)

The example of Germany

Germany exemplifies the leading edge of the dramatic changes in the utility industry worldwide. Through its policy of *Energiewende—revolution away from carbon and nuclear and toward renewable and sustainable energy*, over the past few years Germany has reached nearly a quarter of its overall electricity generation from renewable sources, and is at approximately 20% solar—over half from individual rooftops. This was accomplished in large part by a system of feed-in tariffs that gave priority to localized and largely user-owned renewable generation. As a result, the incumbent investor owned utilities are facing a financial crisis and are planning radical shifts in their business approaches (Chazan, 2014). RWE has opted to pull out of electricity generation and morph into a service utility, while E.ON has opted to leave the German market and shift its activities to Turkey (Chazan and Vasagar, 2014). The German success contributed to the Chinese move into PV production that has fed the trend to declining PV prices. Japan may soon follow suit.

US solar market entry by competitive independent power producers

The compelling opportunities for distributed rooftop solar have been identified by independent power producers (IPPs) who are beginning to challenge the regulated IOUs in their own territories. Specifically, NRG, PJM, and Solar City are moving into the rooftop PV market. (Chernova, 2013). This situation was characterized by Jim Rogers, recent Chairman and CEO of Duke Energy Corporation quoted in the *Wall Street Journal*, "It is obviously a potential threat to us over the long term," (Martin and Malik, 2013). Recent FERC Chairman Jon Wellinghoff was quoted in an interview by *Greentech Media* on the topic.

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[2] California utilities earn the bulk of their profits through a set rate of return on investments in distribution and transmission infrastructure. On transmission assets, SDG&E earns an authorized 11.3 percent rate of return on its investors' equity, set by the Federal Energy Regulatory Commission.

> "Solar is growing so fast it is going to overtake everything," Wellinghoff told GTM last week in a sideline conversation at the National Clean Energy Summit in Las Vegas.
>
> If a single drop of water on the pitcher's mound at Dodger Stadium is doubled every minute, Wellinghoff said, a person chained to the highest seat would be in danger of drowning in an hour. "That's what is happening in solar. It could double every two years," he said. (Trabish, 2013).

2. New advanced UL/IEEE 1547.8 smart inverters and technical standards

In the past, one of the limitations of high solar penetration has been intermittency. A conventional solution has been to install natural gas peaking plants to compensate for the intermittency. However, a better solution has emerged in the form of a new generation of smart inverters that enable and facilitate premises-localized grid balancing and stabilization (St John, 2013). The technical standard for premises solar inverters, IEEE 1547, is being upgraded to provide additional features. IEEE 1547.8 improves safety and stability of grid disconnect functions. Other features already offered and now being standardized include VAR control[3], low voltage ride-through, grid frequency stabilization, and power factor compensation. Combined with even a small amount of premises storage (battery), power support/surge assist can be provided with dramatic effects. [4] These inverter features obviate the need to provide such functions in the distribution grid. They also change the basic nature of premises demand response strategies. UL began certifying IEEE 1547-compliant inverters in late 2013.

A recently issued 73-page study by the Rocky Mountain Institute (Bronski, et al., 2014), *The Economics of grid defection: When and where distributed solar generation plus storage competes with traditional utility service*, provides a detailed analysis of the potential economic impact of combining rooftop solar PV, advanced inverter/chargers, and battery storage, as described above. A summary of the RMI study is provided by Colthorpe (2014). This RMI study shows the risk of obsolescence and stranding that may soon face utility-scale generation and transmission projects.

3. Big Gen/Trans projects unneeded

Since its inception, the electricity industry has been based on large economies of scale and on large capital investment. This dependency was due to the nature of the technology of the time (*i.e.*, steam/coal, hydro, high-voltage transformers, transmission lines). Because of the high capital requirements, the industry's history was entwined with banking and finance, beginning with Edison and his backer, J.P. Morgan.[5]

> From the beginning the electricity industry was characterized by the need for enormous investment in generation and transmission infrastructure in the form of large centralized structures depending on major economies of scale. No industry was more capital intensive—three dollars of investment being required for every dollar of revenue. (Schoechle, 2013, p. 1)

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[3] VAR means "volt-ampere reactive"—a measure of the electrical energy (capacitive or inductive power) that is needed to energize the portions of the power system, depending on types of loads.

[4] See video presentation by inverter designer Heart Akerson at a conference of OSIsoft (Heart, 2013). A synopsis of the presentation is provided here as Annex A.

[5] A detailed historical account is provided in *Power Struggle: The Hundred-Year War over Electricity*, (Rudolph and Ridley, 1987) and a review of the book is provided by Schoechle (2013).

Recently, this historical situation has changed radically. Renewable generation, especially solar PV, and distributed grid technologies are just as efficient at either small or large scale. In reality, due to information technology and a smart grid, distributed systems can actually be more efficient than centralized systems.[6] Also, the financing of such systems does not need to rely on large capital projects, but rather can utilize more conventional small-scale or user-based financing and investment mechanisms, as with homebuilding, road construction, home appliances, *etc*.

Solar energy is an inherently diverse, distributed resource. There is nothing to be gained by trying to force it into the centralized capital-intensive paradigm of coal and nuclear baseload generation. Concentrating solar power (CSP) projects represent an attempt to hammer a "square peg into a round hole." The sun shines everywhere.[7] Mirrors in the desert or complex tracking CPV arrays, like Soitec, make little sense, especially when they also require big transmission. In this time of rapid change, investments in large-scale generation projects face the real possibility of becoming stranded.

Disruptive Challenges to the industry

In January of 2013, the Edison Electric Institute (EEI) released a brief, but extremely important report titled *Disruptive Challenges: Financial Implications and Strategic Responses to a Changing Retail Electric Business* (Kind, 2013). The report offered the electricity industry a "heads-up" that their basic business model was threatened and recommended that they rethink it.

> The financial risks created by disruptive challenges include declining utility revenues, increasing costs, and lower profitability potential, particularly over the long-term. As DER and DSM programs continue to capture "market share," for example, utility revenues will be reduced. Adding the higher costs to integrate DER, increasing subsidies for DSM and direct metering of DER will result in the potential for a squeeze on profitability and, thus, credit metrics. While the regulatory process is expected to allow for recovery of lost revenues in future rate cases, tariff structures in most states call for non-DER customers to pay for (or absorb) lost revenues. As DER penetration increases, this is a cost-recovery structure that will lead to political pressure to undo these cross subsidies and may result in utility stranded cost exposure
>
> ...While [this] paper does not propose new business models for the industry to pursue to address disruptive challenges in order to protect investors and retain access to capital, it does highlight several of the expectations and objectives of investors, which may lead to business model transformation alternatives. (p. 1).

It took many months for this news to have effect, but in late 2013, some major IOUs began to react. However, rather than adapting their business model, they began pushing back against net metering tariffs in California, Colorado, Arizona, and several other states. The futility of such a short-term temporary fix became evident when the Arizona Corporation Commission agreed with the utilities, but imposed only a nominal fee of 70 cents per kilowatt of installed solar, which would equate to about $5 per month in a typical household. As reported in *IEEE Spectrum*, "…that is but a tenth of what the power industry had advocated, spending millions of dollars to lobby the Arizona regulators and influence public opinion…" (Sweet, 2013). The

[6] The "smart grid" can be defined as using information technology (computers and communication) to make the grid more reliable, efficient, balanced, and renewable.

[7] The success of solar PV in Germany belies any need to locate solar PV in especially sunny locations. No part of Germany is as sunny as any part of the United States.

"political pressure" that the EEI report warned of may be only just beginning, and the public will likely be joined by IPPs gaining interest in solar PV markets. A timely sequel to the EEI report is provided by the new detailed RMI study (Bronski, et al., 2014) of the actual economics of the looming "disruption".

4. Implications for the Soitec Solar Development Program

Ivanpah

The Ivanpah Project, a new $2.2 billion 377 megawatt CSP facility in the Mojave Desert, was built by BrightSource Energy and others with the help of a $1.6 billion federal loan guarantee. The project situated on federal desert land near the Nevada border and adjacent to the Mojave National Preserve. The project has gained national attention for its impact on desert habitat, interference with wildlife, killing of birds, and garish appearance—and it has become the "poster child" for how *not* to do solar energy. As reported in the Wall Street Journal,

> Utility-scale solar plants have come under fire for their costs–Ivanpah costs about four times as much as a conventional natural gas-fired plant but will produce far less electricity—and also for the amount of land they require (Sweet, 2014, p. 2).

Ivanpah is only one of the latest examples of huge utility capital projects propelled by political influence and "greenwashing."

Soitec

Though just under half the capacity of Ivanpah, Soitec is planned to be a complex of four sites in residential areas of Boulevard, in rural San Diego County, using dual-axis tracking solar CPV panels. It is planned to occupy 1500 acres of land between the pristine Anza-Borrego Desert State Park (a unique national treasure) and the Mexico border. Following is a summary points of the shortcomings of the proposed Soitec approach *vs*. adding rooftop PV in San Diego:

- Unproven technology depending on complex electro-mechanical systems vulnerable to the desert environment
- Lack of economy of scale
- Geographical clustering of PV decreases grid stability (vulnerability to intermittency, extreme weather and wildfire events)
- Unneeded power
- CSP's inappropriate and unnecessary focus on efficiency
- Waste of scarce groundwater resources
- Excessive cost to ratepayers and taxpayers ($469 million for 2 of Soitec's 4 Boulevard projects: Rugged Solar and Tierra Del Sol Solar)[8]
- Environmental degradation
- Requirement for new transmission facilities
- Transmission loss of 7–14 %

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[8] See Soitec Solar's Fact Sheet for Tierra Del Sol & Rugged Solar CPV Solar Projects in Boulevard, California

- Requirement for infrastructure construction, support facilities, roads, *etc.*
- Financial risk and potential cost of removal
- Unintended consequences

5 Benefits to San Diego County and its people

In 2007, a major 158-page report was produced by E-Tech International, with the support of the San Diego Foundation's Environment Program, titled *San Diego Smart Energy 2020: The 21st Century Alternative.* This massive study showed in great detail how the San Diego region could realize a new energy future with a "…cleaner and more secure energy supply for generations to come."

> San Diego Smart Energy 2020 paves the way for a shift from reliance on fossil fuels and imported power to an array of local solutions that include energy efficiency measures with emphasis on high efficiency air conditioning systems; common-sense weatherization and conservation; the proven technology of solar photovoltaic (PV) panels, for large commercial use as well as on homes; small, highly efficient natural gas-fired power plants that generate both power and heating/cooling; adoption of smart grid procedures that improve the efficiency of the grid by monitoring and controlling the flow of electricity on a continuous basis; and the widespread institution of green building design principles (Powers, 2007, p.1).

Subsequent events and developments have fully validated this report. The market and technological developments have borne out the report's facts and the figures, as well as its vision. We believe that it is now time to implement this vision.

San Diego's unused rooftop space is adequate and available

According to Bill Powers, author of the aforementioned report, interviewed in July of 2013, "San Diego County urban and suburban developed areas have about 7,000 MW of rooftop and parking lot solar capacity. So far about 150 MW of this capacity has been developed, about 2%." He adds that only about half to two-thirds of the full 7,000 MW solar potential would need to be developed in order to meet all of the City of San Diego's electricity needs.[9]

Guiding principle of situating energy production

Some may ask, why not build large-scale renewable projects that could be located on existing structures, parking lots and ruined or non-ecologically important brown fields[10] near existing transmission facilities? The answer is that our preference should be for smaller-scale distributed renewables located at or near the point-of-use, and on fostering the markets for such technologies and products. Every dollar sucked up by a large utility-scale project is a dollar that will not be invested in rooftop solar, clean inverters, small hydro, small wind, and battery storage and other mass market technologies that result in long-term community-based jobs and manufacturing. The big projects tend to be one-time deals that primarily feed short-term construction jobs for outsiders, as well as provide rewards for bondholders, investors, land speculators, and utility's ratebase return-on-capital assets.

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[9] http://www.sandiegolovesgreen.com/bill-powers-compares-rooftop-solar-and-the-sunrise-powerlink/

[10] USEPA re-powering America's lands: http://www.epa.gov/oswercpa/

Jobs and economic growth/opportunity in San Diego County

A recent report from The Solar Foundation showed that "employment in California's solar energy sector grew by 8 percent in 2013 under robust regulatory and tax incentives, with even more aggressive hiring forecast this year…" (Lee, 2014). This report also identified 3,500 additional solar positions in the state during the 12 months ending in November 2013. The report showed the distribution of solar jobs in five U.S. Congressional districts of the San Diego area, showing nearly 3,000 solar jobs. It showed that last year solar installation workers represented 55% of all workers in the solar field, followed by manufacturing (22%), sales and distribution (12%), and project development (5%); and the average solar installation worker earned an average of $24.26 an hour (63 cents above the national average). A map produced for that San Diego Union Tribune article showed the most solar jobs were reported in Congressman Issa's mostly urban 49th district, that hugs the coast.

The multiplier effect

More and better local jobs are one of the benefits of electric power localization (Brookings, 2011). This benefit is shown by the 3.5 x multiplier effect of keeping the money in a community. A 2004 U.S. General Accounting Office study (GAO, 2004) showed that local ownership can generate significantly higher impacts for a county. For example, a single 40MW wind project built in Pipestone County, Minnesota, would generate about $650,000 in new income for the county annually. In contrast, that same 40MWs locally owned, would generate about $3.3 million annually in the same county. The GAO evaluation looked at three counties in Iowa and two in Minnesota. For these five counties, local ownership provided 2.5 times more jobs and 3.7 times more total local area dollar impact. There are additional environmental benefits and technology development economic benefits to the local area.

The EIR looses sight of its own purpose

The EIR rejects the "Distributed Generation Policy" option, stating on page 4.0-4

> While this alternative, including rooftop solar, would result in a significant net reduction in project impacts as compared with the Proposed Project, it is outside of the control of, and could not be implemented by, the project applicant.
>
> This alternative would not meet Objective 2 since it would not create utility scale solar energy facilities. Nor would this alternative meet Objective 1 of assisting in achieving the state's RPS and GHG reduction objectives of obtaining 33% of electricity from renewable resources by 2020. Although this alternative would result in increased generation of renewable energy sources, at present, most rooftop solar is ineligible to contribute towards the RPS.

The opinion expressed above is narrow, short-sighted, bureaucratic, and it "throws the baby out with the bathwater." The San Diego County Planning Commissioners and Board of Supervisors have an obligation to look out for the greater good of the people of San Diego County and that purpose must prevail.

The fact that the option is outside the control of the applicant is irrelevant. They can invest their money elsewhere. Objective 2 (creating utility-scale solar) is not an end in itself, but rather intended to serve a greater purpose that is now better served differently. The RPS also in not an end in itself, but rather it is an accounting issue that is likely to change. Again, as with Objective 2, the basic purpose of the RPS is to increase the percentage of renewable energy, and it is important to not loose sight of that purpose.

6 Conclusion

Guiding principles

We offer the following summary of guiding principles that should be used in evaluating the present and any future electricity generation projects:

- Produce power as close as possible to where it will be used
- The utility should manage the wires and poles
- Let the customers generate the power wherever possible

Recommendations

We offer the following general recommendations.

- Avoid spending and locking in ratepayer money, for 25 years, on obsolete technology
- Avoid crowding out investment in appropriate technology
- Take opportunity for more long-term jobs and economic development in San Diego
- Take opportunity for sustainable San Diego
- Take opportunity for improved grid reliability and security through localized distributed renewable resources

We offer the following specific recommendations.

- Reconsider the EIR "Distributed Generation Policy" in *Project Alternatives*
- Do not allow the Soitec Solar Development Program to proceed

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Annex A— Synopsis of Heart Akerson's OSIsoft presentation

Synopsis of Heart Akerson's OSIsoft presentation

The global utility industry in recent years has seen significant build-out of customer-owned distributed generation (DG) in their electric network. This unreliable and non-dispatchable generation is primarily in the form of small, rooftop PV solar arrays. The consequence is that many utilities are struggling with crew safety, localized grid stability, and generation dispatch due to high density solar on distribution circuits. Grid companies have already identified the impact of intermittency issues with high density solar and have also identified need for smart inverters but, they have only realized a small subset of what could be gained by integrating distributed Smart Inverters with Integrated Storage (SIIS) technology.

Coupled with local demand response, SIIS enables ultra-fast autonomous response times, eliminating the need for complex central command-and-control DMS. SIIS has further advantages of reduced environmental impact, sustainable operations, and economic advantages over utility large scale solar and storage. This paper will discuss the various operating concerns facing utilities and explain how SIIS integrated with PI situational awareness addresses these issues. Among the issues addressed are: DG variability, voltage fluctuation, high current management, frequency excursion control, VAR control, and spinning reserve generation mitigation.

About the Speaker:

Heart Ackerson has 40 years experience in solar inverter and distributed generation technology innovation. Heart has been an early pioneer in the evolution of inverters. He holds several patents on inverter and smart inverter design and a degree in Physics from the Virginia Polytechnic Institute.

Annex B—2013 Report

February 25, 2013

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Mark Wardlaw, Director
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RE: *Large scale rural wind and solar not needed*

Dear Ms. Jacob and Mr. Wardlaw,

It is my pleasure to submit the attached comments, *Critical transformative issues in electricity: Negating the need for remote industrial wind and solar projects*, at the request of Ms. Donna Tisdale. You can find a more extensive treatment of these issues on electricity technology and policy in my 55-page technical and policy Report on electricity, *Getting Smarter About the Smart Grid.* A copy can be downloaded at <http://www.gettingsmarterabouthesmartgrid.org>.

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Critical transformative issues in electricity:
Negating the need for remote industrial wind and solar projects

The electricity system is approaching a transition point in its 120-year history. Technological, environmental, political, and economic forces are converging to create a "perfect storm" that is likely to fundamentally re-shape our electricity system. Among such technological forces are the development of alternative renewable clean energy sources and advances in communication and control technologies. These, together with economic and political forces, are disrupting the utility business and regulatory models that have dominated for well over a century. The following is a brief synopsis of some of the key issues and the forces at play.

1. Presumed need for large remote wind/solar generation projects

There is great public interest in cleaner energy and incorporating more renewable and sustainable energy sources into the electricity grid. It is often assumed that wind and solar projects can and should be developed along the same centralized large-scale model that has characterized conventional baseload generating plants (*e.g.*, coal, nuclear, hydro, *etc.*) and their transmission systems. It is also frequently assumed that it is necessary for such plants be situated for maximum efficiency in particularly windy or sunny locations, often distant from urban centers that need the power. "Efficiency" is a principle justification for selecting and promoting large-scale remote sites and for construction of transmission facilities. In the western states, these sites are often on or near public lands, and it assumed that electricity generation would constitute utilization of public lands for a "public good." However, all of these assumptions are based on fallacies.

Wind and solar technologies do not have the economies of scale that characterize conventional generation (*e.g.*, coal, nuclear, large-scale hydro, *etc.*). In other words, they are just as efficient at small-scale as they are at large-scale—and thus bigger is not better. Additionally, generating power as close as possible to where it will be used makes sense because it avoids the transmission losses, the vulnerability, the capital costs, and the adverse environmental and socioeconomic costs of massive construction projects, including those in rural areas. Wind and solar are inherently distributed sources of energy and attempting to fit them into the centralized mold or mindset is not efficient or effective. It is obviously true that some regions have more sun than others, but it does not follow that generation should best be located there. Solar photovoltaic (PV) generation has been advancing so rapidly and widely that geographic solar flux advantages are becoming a relatively minor consideration. Germany has become a world leader in solar PV with over 1.2 million plants distributed all over the country, mostly (85%) on individual rooftops, with a capacity of about 28 GW (20-70% of the entire load)—while Germany gets less sunshine than anywhere in the United States.

In reality, the unstated rationale for these large capital projects has less to do with energy than it has to do with garnering guaranteed rates-of-return on capital assets and with financing fees and commissions. The current centralized business and financial model of the investor-owned utility (IOU) industry is based largely on regulated monopoly rate structures and on guaranteed rates of return on capital assets generally in excess of 10%. Perversely, a large solar farm off in a distant desert would make far more money for industry, bankers, and investors than would solar panels on individual rooftops.

Wind and solar development on remote sites and on public lands not only brings an array of problems but increased externalized public costs. Some of these include construction of roads, transmission lines, and communication towers on otherwise undeveloped and sometimes pristine landscapes—or converting productive farmland and rural communities to unnecessary industrial use. They result in traffic and equipment, such as massive inverters, substations, and power lines that unintentionally radiate electrical noise and electromagnetic fields with unknown effects on both people and wildlife. The transmission corridors create maintenance traffic and interrupt wildlife habitats and migration patterns, as well as scarring the landscape and diminishing human habitats and scenic value. They also create a hazard to indigenous wildlife and native plant species, resulting in unknown long-term deleterious effects on the overall ecosystem. Such projects might be worth considering if there were some economic or other merit to such a centralized large-scale energy development strategy—but the entire technological and economic model of electricity generation, distribution, and use has changed rendering this centralized approach obsolete and inappropriate.

2. Adverse impacts of smart meters/networks

In recent years the notion of the "smart grid" has emerged—the use of communication and information technology to improve reliability and efficiency, and more recently, to balance supply and demand on the electricity grid and facilitate the integration of more renewable energy. With government stimulus money to be spent, the utility industry and its suppliers saw the opportunity to piggy-back on the media hype and public enthusiasm to take the "low hanging fruit"—using much of this money (approximately $2 billion) on so-called "smart meters" based on shrewd promotion and misrepresentations about how the meters would enable the purposes of the smart grid.

In reality, the smart meters do no such thing, but rather they simply enable utility companies to cut their labor costs and streamline their back-office billing operations. The new meters and meter networks do essentially nothing to manage energy, balance supply and demand, or integrate renewables. At the same time, the smart meters introduced a new set of risks, including increased costs, rates, and financial risks, personal privacy risks, and potential health risks. As a result of the mass smart meter deployments, public belief in the potential of the smart grid has been seriously eroded. Additionally, the needed funding that could otherwise have been used to fulfill the true promise of the smart grid has been diverted and wasted. An example of a fruitful and implementable alternative path to the smart grid is the emergence of *distributed energy resources* and *microgrids* that do not depend on centralized utility control.

3. Emergence of distributed energy resources (DER) and microgrid alternatives

Communication and information technology together with improved feasibility of distributed generation has enabled an entirely new decentralized grid architecture. Such generation includes renewable generation (*e.g.*, wind, solar, small-scale hydro, fuel cells, combined heat and power, *etc.*), economical natural gas turbine peaking or back-up generation, and storage devices or facilities. At the same time, an array of new products and technologies for local premise-based control of electricity use, generation, and storage are being developed and introduced. These technologies are feasible in a small-scale distributed context and allow migration of electricity users away from large centralized grid structures to distributed, localized community-based microgrid structures. Such migration and localization improve grid security and reduce vulnerability to accidental or deliberate disruption of electricity—as has been experienced recently with persistent widespread outages during severe weather events. Distributed generation can also help reduce grid instability due to sudden losses of significant energy loads when large centralized remote projects unexpectedly go off-line.[11]

4. Decentralization, localization, and a new emphasis on premises-based systems

New technologies and products that are appropriate for small site-based installation are rapidly emerging. Such technologies and products include 1) premises communication gateways, 2) energy management systems, 3) smart appliances, 4) smart inverters, 5) premises storage including plug-in electric vehicles (PEVs), 6) advanced, efficient premises power and high speed data cabling systems, and 7) distributed energy management control protocols such as advanced demand response (DR) and "transactional energy" (TE).

One important element mentioned above—the premises gateway—provides both communication with external networks and a premises firewall that protects consumer data security and privacy. This premises gateway replaces the smart meter networks and serves to limit the ability of utilities to monitor consumer's personal lives. Such a gateway is now mandated for metering systems in Germany and other European countries.

Another important element is the smart inverter, a new genre of the inverters used to convert DC from solar PV panels to AC for local use or for feed-in to the grid. Additionally, advanced inverters can also 1) use PV (or other DC sources including batteries) to provide AC power; 2) provide a DC power bus for local use; 3) clean up high frequency electrical noise from compact florescent lamps (CFLs) and switching power supplies; 4) provide power factor compensation and premises power conditioning; and 5) manage electrical loads and sources in cooperation with premises gateways and energy management systems. Such inverters also can protect and enhance consumer privacy by effectively filtering/blocking the load signatures that smart meters could otherwise discern from aggregate premises power demand.

5. Conclusion

Rather than continuing on an unsustainable path attempting to prop-up a failing and unsustainable system, it is time for regulators, local and state leaders, ratepayers, taxpayers, and utilities to recognize and embrace the fundamental changes taking place in the economy of electricity. A renewed interest in community-based initiatives, such as municipalization and community choice aggregation (CCA) alternatives, suggests a growing recognition that localization and DER—generating and managing electricity closer to the end user—are among the best ways to access and accelerate affordable renewable energy and stimulate related local business and employment. We are now offered an opportunity to reshape our electricity system in a way that will bring clean, sustainable, and abundant energy as well as new innovation, products, and jobs—all without sacrificing our environment, our public lands, our wildlife, our rural landscape, and our quality of life.

[11] An example of such an event is the September 2011 cascading grid collapse that affected 5 million people in Southern California, Western Arizona and Northern Baja. The US military, Department of Energy, Department of Homeland Security, and others are recognizing the benefits of distributed generation in reducing vulnerability to deliberate or accidental interruption, and to improving the resilience of electrical infrastructure. This position has been vigorously advocated by former CIA Director James Woolsey.

6. Credentials

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Dr. Schoechle is an international consultant in computer and communications engineering and in technical standards development. He presently serves as Secretary of ISO/IEC SC25 Working Group 1, the international standards committee for *Home Electronic System* and is a technical co-editor of several new international standards related to the smart grid. He also serves as Secretariat of ISO/IEC SC32 *Data Management and Interchange*, and he currently participates in a range of national and international standards bodies related to smart grid technology and policy issues.

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Dr. Schoechle's November 2012 55-page technical and policy Report on electricity, *Getting Smarter About the Smart Grid*, can be downloaded at <http://www.gettingsmarteraboutthesmartgrid.org>.