



EcoMotion – Sustainability Solutions

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White Paper: The Wireless Future of Energy

An Essay by Ted Flanigan

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This brief essay is based on a talk that I gave in Santa Monica on May 19th at the City's Climate Fest celebration at Saint Monica's Church and Community Center. I was on a panel with a Southern California Edison official, Annette Tran, who spoke of SCE's plans for a clean energy future while electrifying transportation, and Ted Bardacke, the newly minted Executive Director of the Clean Power Alliance of Southern California, who gave an update on the local community choice aggregation. My job was to present the role of distributed energy resources in our energy future... to try to stretch some participants' minds a bit!

Introduction

No wires? No wires!

Close your eyes. Imagine a future without the transmission lines that desecrate the purest landscapes. Transmission corridors will now be for hiking, biking, walking, birds... Imagine a future without the electrical distribution lines that clutter our views. Imagine no more big, ugly power plants along our coastlines and rivers. These will be gone... repurposed perhaps as new-age energy and healing centers, industrial-age vortexes.

Is this totally far-out? Perhaps. But let's look no further than the phones in our pockets. Our grandparents could never imagine cell phones, or that land-lines would be a thing of the past, reserved only for junk calls. "Telephone poles" are now really power poles, also carrying cable and internet services... and less and less phone lines. Because with phones... wires are mostly gone, the rest on the way out. No wires.

Now let's shift back from telecommunications... back to power. How many of you use electric toothbrushes? They are recharged using inductive charging... not metal on metal, but power

being transmitted through non-conducting plastics. Korean electric bus systems are being developed whereby an electric bus swoops into a station where an umbrella drops down from above, and without a physical connection, recharges the bus. Zap! Experts are also working on EV charging using inductive charging, so what your EV is charged at your parking spot, automatically, kinda' like charging your laptop at Starbucks that have the new, energized tables.

Those are short-distance, wireless solutions. How do we move power longer distances? Microwaves are an option, so is use of hydrogen as an energy carrier in pipelines... and so is use of lasers coupled with photovoltaic receptors. This technology has been used to power electric planes, with power lasered from ground to plane. No wires.

Many of you have heard about California's new solar mandate. It calls for homes to be essentially net zero electric. But they will still be grid connected. I envision a future where communities become their own microgrids, carbon-free; where some homes and rooftops over-generate to power their neighbors – they'll be net positive -- perhaps all tied up using block-chain accounting. Communities can be autonomous, sometimes independent, and at other times will contribute power into the grid as a socially responsible action, and for profit.

For cities and other population centers, distributed energy resources (DERs) may not cut it. The first line of attack is for community-owned solar, wind and other renewable energy systems. Then we'll need centralized renewable power generation... be it offshore wind, or solar farms in the desert. For these sources, I imagine using renewables to power electrolysis to split water and to create hydrogen that can be piped into cities and other population centers. Furthermore, hydrogen can be stored -- wiping away the duck curve -- and providing unparalleled levels of electricity resilience.

These are visions, possibilities. Other visions are also possible. One thing that we all can be quite sure about, is that the future of energy will be very different than we know it today. The pace of innovation is fast, its momentum unstoppable. Our energy future will be 100% disrupted! Just as Uber has transformed taxi services; just as AIRBNB has transformed hotels; just as cell services dominate telephone use; just as Amazon has transformed shopping... the energy future will be completely different. It will be 100% renewably powered. Totally clean.

Distributed Generation

Buckminster Fuller taught many of us a key lesson: that every region of the nation has abundant renewable energy: The Northeast and the Northwest have their rivers and their forests, for hydroelectricity and biomass. The Midwest has its wind. The Southwest is blessed with sunshine. Every region has enough renewable energy to power its society.

Here in Southern California the vision of no wires is easy to imagine. Homes and businesses here can generate enough power to sustain their operations. Now energy storage, in the form of batteries, provides another potent tool to offset conventional utility power. And with solar + storage, plus controls, homes are just a step away from cutting the cord... and becoming energy

independent. Right now, solar is highly cost effective. Storage is too in many instances. Soon it will be cost effective to island. No more wires.

Distributed energy resources have many benefits:

- They can be highly cost effective. All the work that EcoMotion does for schools, cities, and corporations with efficiency, solar, and storage is cost-effective. Our clients want win-win-wins only... energy, economic and environmental savings.
- For building owners, solar allows for new, rooftop profit centers. Roofs can be leased; solar systems can turn unused space into cash.
- Distributed energy resources support local economies, providing jobs in energy efficiency in our communities, installing solar and storage systems, providing ongoing maintenance.
- Distributed energy resources avoid the transmission and distribution losses inherent in the macrogrid. T&D losses are typically 5 – 10% of total centralized generation, a big and hidden tax on conventional power resources.
- Distributed energy resources are clean and do not contribute to climate change by releasing greenhouse gases. They're carbon free!
- Distributed energy resources have fixed prices, providing hedges against future utility rate escalation.
- Finally, no more wires....

The Santa Rita Story

I told the Santa Rita story in Santa Monica next, how EcoMotion was hired to provide energy resiliency on six school campuses in Monterey County... and to do so at no cost to the Santa Rita Union School District (SRUSD).

The story was fresh. Just earlier that week we presided over a ribbon-cutting for the systems in the land of Steinbeck. It was the culmination of a 2.5-year development period: Six microgrids... carbon-free, fully financed, and with no money down.

Thanks to EcoMotion's consulting services, we installed enough solar on each campus to provide for 100% of each campus's power bill. By switching to the Pacific Gas & Electric A6 rate (a "solar friendly" rate that has been discontinued), EcoMotion saved the District enough money to invest in batteries... and lots of them! By feathering together solar and storage for any given school day, calculated probabilities of complete resilience were developed. A winter

day with little sun would be harder to energize than a bright sunny day. To account of the perfect storm – all kids have arrived, the grid goes down, and it's raining – we installed sophisticated wireless controls on all HVAC units.

So now when the “macro grid” fails – which could be a function of earthquake, fires, drought, flooding, or sabotage – SRUSD's schools will be powered. They will “island,” shut off from the utility, and will be operating independently as “microgrids.” And they can operate in a carbon-free mode indefinitely. In fact, we're working now with the Red Cross to establish these sites as PERCs – Powered Emergency Response Centers – that can be operated by the Red Cross in the event of a prolonged outage.

Most of the time, the microgrids at Santa Rita will serve as insurance policies. Just like a roof that's only used when it rains, the microgrids will only be used when the power goes down. But this is just part of the story. Batteries have “stacks” of values. There are potential revenue streams that stem from having considerable energy storage onsite. Unused battery capacity can be sold to PG&E during its peak periods. (By noon if there is no outage, half of the capacity can be sold.) In the future, the batteries at SRUSD may well be used to provide “ancillary services” to the California power grid and its Independent System Operator.

SRUSD Superintendent Shelly Morr is thrilled, as is her entire staff, and the students and their families. This school district has come of age in terms of energy. It is the future. And it is not far from being energy independent. It could make the decision to be self-sufficient. We're that close. No wires.

Being the Future

I wrapped my brief talk with a discussion of what I have done in my own home, and what I plan to do next. I want to be a model. My goal is to be totally independent, to wipe out our carbon footprint, and to do so cost effectively! If it doesn't pencil, it is a faulted model for scaling.

Terry and I live in a 1924 home in Glendale. When we bought it eight years ago, it was completely outdated with avocado-colored appliances, miniature closets, knob and tube wiring, no air conditioning, etc. We spent three months to bring it up to standard... all with super-efficient appliances – HVAC, lights, many new windows etc. We put 30 inches of insulation in the attic and buried our upstairs cooling ducts in drifts of white fluff. Lots of energy efficiency. Our AIRBNB has an on-demand water heater; we put a SolaTube in our stairwell.

The next big step was solar. We installed 8 kW, enough to 100% power our home, our AIRBNB, and now my electric vehicle. By the way, the solar cost \$24,000, I got an \$8,000 federal tax credit and a \$9,000 incentive from our local utility. We experienced a net cost of \$7,000 with savings of well over \$1,000 a year. Our payback is in the six-year range, shorter if you factor in the avoided fuel and maintenance savings from the EV!

I promised that I would not get an electric car until I generated enough solar power to drive it. And now I do, so I leased a Chevy Bolt and love it. I started the day today with 344 miles of range. My typical commute is 20.2 miles a day, requiring only 3 kWh. On a typical sunny day in summer, we generate 45 kWh with solar... building up lots of credit for air conditioning, winter and overcast days.

Next steps:

- First, more solar. Terry wants an EV too! And we are figuring on needed more electricity to cover increased electrification.
- Second is the electrification. Short of having handy source of piped-in hydrogen, it's time to wipe our natural gas use. The Viking stove must go, our home's domestic water heater that I just replaced needs to go, as do our two furnaces. That's going to cost a lot. The heaters will be swapped out electric heat pumps that cool and heat, all with our own distributed solar.
- Next is storage and on this we're still working: What is the objective? To save money? To become resilient? To island? The latter, but this will not be cost effective. Right now, Glendale Water and Power's residential rates are flat, there is no time of use differential in prices that would allow for savings through energy arbitrage. We pay no demand charges that could be avoided with storage systems' discharges. Storage's value in my home will be resilience. Unlike nearly every solar system in California – dependent on the grid's AC power to invert DC to AC at every installation -- my solar system will work in a utility outage once I've added storage and controls.
- Sizing is the issue that still stymies me: How much storage do I need to have on site? Hours, days, weeks? The best storage is seasonal, but that's expensive and hard to store onsite. We'll have to develop our own probability matrix to determine the optimal size for us. But I am comforted, slightly, because the Bolt stores 60 kWh. Could I use it for supplemental power during a prolonged outage, or if we are having a big party? Could I plug my car into my house... Vehicle to Grid-style. Actually, my car and others will need to be equipped with bi-directional inverters to do so, and that's coming!

At this point – after more solar for another EV and for all-electric appliances, after storage, managing the V2G capability – we could very well disconnect from the grid. We are the future, saving the Earth, saving money. No wires. But that is not our intention: We'd rather be connected and part of the solution. Let's be prosumers. Let's be net positive... providing excess solar power to our neighbors and back to the grid. Rather than islanding and demonstrating fierce energy independence, we like the idea of our own solution being a catalyst and part of our community's solution. This is the future of energy.