DISRUPTING THE ELECTRON MONOPOLY

How Solar, Wind and Battery Storage Will Transform Our Energy Sector

'Disruption.' According to the Merriam-Webster dictionary, disruption is defined as "a break or interruption in the normal course or continuation of some activity, process, etc." We can all relate to the concept of disruption in our own lives – often accompanied by feelings of anxiety, concern and eventually, possible enlightenment and progress.

Similar turmoil surrounds technological disruption. Everyone older than 25 will recall how the advent of digital photography turned the world upside down for established companies like Kodak and Polaroid. These and other incumbents created the industry supplying the world with photographic film and film-loading cameras and the myriad film-processing and printing businesses. Virtually overnight, the transition to digital caused this well-established industry to restructure entirely. Most of the players disappeared, victims of inevitable technological progress.

An Industry Ripe for Change

According to two prominent thought leaders (along with a growing contingent of industry experts who study the global energy sector), what befell the world of film photography is destined to overrun our electrical production, transmission and distribution industry and the many legacy utilities that have operated as a virtual monopoly for over a century.

Tony Seba and Adam Dorr work at RethinkX, an independent think tank that studies technological disruption and the impacts such occurrences can have on our society. These savants have plenty to say on how solar energy, wind energy and energy storage can completely restructure our existing energy sector. The transition is already underway. Lower costs and environmental concerns are driving the transformation these experts claim can occur much faster and for far less cost than conventional thinking suggests.

Here's their argument – the combination of solar, wind and battery storage (SWB), consisting primarily of solar generation, can become a 100% replacement for the U.S. electrical grid by 2030. Further, SWB represents the least expensive option for building the future energy grid – estimated to cost less than $2 trillion, SWB is more affordable than an equivalent system employing natural gas or coal generation.

The SWB model proposed for the U.S. accounts for both sunny and windy regions in the southwest and New England locations offering much less of both. The SWB model works well everywhere, although energy storage may play a somewhat larger role in less sunny/windy regions.

Expect Resistance from Within

From a purely economic standpoint, to say nothing of the climate change imperative, little stands in the way of a successful roll-out of the SWB model. But this expectation won't stop incumbent utilities from resisting such a transition vigorously. After all, these "monopolies of electrons" face an existential threat – they risk becoming obsolete if they don't prepare for wholesale change and quickly.

Historically, technological disruptions rarely arise from the major players in the sector. It's the perimeter companies that are responsible for generating such developments. We should not expect power utilities that are presently enjoying their monopolies to lead the charge to a rapid clean energy transition. As society demands the shift, look to nontraditional businesses offering extremely low-cost energy to spur on competition, drive innovation and accelerate change. Consider the case of companies like Walmart, for example. Because the SWB model allows consumers and businesses the right to generate and store electricity, it may be feasible for Walmart, with its massive inventory of rooftop real estate capable of becoming solar energy generators, to offer its energy for free to attract more customers to its stores.

It's About Energy Generation

The SWB model suggested by Seba and Dorr consists of solar and wind generation capacity that considerably exceeds the peak power demand. It is not a system that replaces existing generation, transmission and distribution infrastructure on a one-to-one basis – SWB will look substantially different and emphasize electrical generation.


Photo courtesy Andreas Gucklhorn, Unsplash

The SWB model incorporates the concept of "Superpower," defined as the gain in additional energy production exponentially greater than the money spent developing the generation. Superpower refers to the non-linear return on investment that will compel societies to embrace technological disruption and exclusively deploy SWB at scale to rapidly transition away from conventional fossil fuel, nuclear and hydroelectric generation. California represents a region benefiting from Superpower, if only intermittently at this time. The same can be said of Germany. Both areas enjoy a surplus of extremely low-cost solar and wind-generated energy at times – virtually free and clean.

In seeking to uncover the lowest-cost and most practical SWB system to replace our existing electrical infrastructure, Seba and Dorr discovered something unexpected. The optimal balance between clean energy generation and storage favors an overabundance of production and much less storage than conventionally believed required. It is unnecessary to develop a month's worth of long-term energy storage for a 100% SWB replacement to function at its best.

Sidestepping the Transmission System Concern

One might think that adopting the SWB approach of overgeneration capacity would overwhelm the existing transmission and distribution network. Quite the opposite – the more energy generation SWB disperses throughout a region close to load centers, the less dependence there is on transmission infrastructure. A recent Australian study highlights that for heavy concentrations of SWB, the cost of transmitting and distributing the energy generated is less than 10% of the energy system's overall cost. Seba and Dorr conclude that adapting and building out transmission and distribution for the new SWB model will not functionally impair implementation.

Plenty of Room to Grow

The disruptive nature of SWB adoption is expected to create a new electrical infrastructure much larger in scope than today's. The scale of increase will allow plenty of room for continued development and growth. In support of this belief, one only has to reflect upon our earlier digital camera example – how many more digital cameras infiltrate society today than film cameras ever did?

The Domino Effect

Decarbonizing the energy sector arising from SWB disruption can affect significant energy users simultaneously – not just the electrical power sector but transportation, heavy industry and the means by which buildings are heated and cooled. Furthermore, the Seba-Dorr model predicts that incremental investments of 10% or more over and above the lowest cost version of SWB increase Superpower generation capacity by multiples, causing exponential returns in decarbonization.

Regions fueled by super-cheap and super-abundant SWB Superpower will become substantially more cost-competitive and attractive to economic development. Other areas will take note, adopt the same model and compete, creating a "race to the top" that will decarbonize everything. Nothing compels growth like cheap, perhaps even "free" energy.

Avoid Partial Measures

Seba and Dorr caution that SWB adoption is not a part-measure. Their vision embraces 100% conversion, not 80% or 90%. Anything less than a full switch to SWB will not allow energy costs to drop as far as possible and reduces all the direct and spin-off benefits SWB offers.

If Seba and Dorr have this right, there's only one path that makes the most sense as we advance, and it involves widespread change for traditional methods of energy development and use. As we all learned early on, ripping off a bandage is best done quickly.