A Better Path to Minnesota's Energy Future

BACKGROUND: Modern civilization is built on harnessing energy. Human lifespans, numbers, and quality of life have risen dramatically based upon access to affordable and abundant energy, whether in the form of fuels or more recently electricity.

As quality of life increases, people have paid increasing attention to the costs as well as the benefits of generating power. Only a few decades ago, over 4000 people were killed in London by a temperature inversion that trapped pollution around the city for 5 days—helping jumpstart the drive to reduce pollution while keeping energy affordable and abundant.

Now we expect energy not only to be affordable and abundant, but clean.

Dramatic strides have already been made to clean up our energy use, and new technologies promise a quantum leap. Yet those same technologies, if not properly implemented, threaten the affordability and abundance that still form the basis for modern life.

Prices for cleaner technologies have plummeted, but the current regulatory environment is designed to promote the market status quo where government supported monopolies dominate the electrical supply. Reasonable changes to current policies could unleash much faster development of new technologies that will speed the transition to cleaner technologies without threatening the abundance and affordability of energy.

The transformation has the potential to do for energy what the breakup of Ma Bell did for telecommunications. But as with telecom, the pace of change will remain glacial until market forces that promote innovation are unleashed.

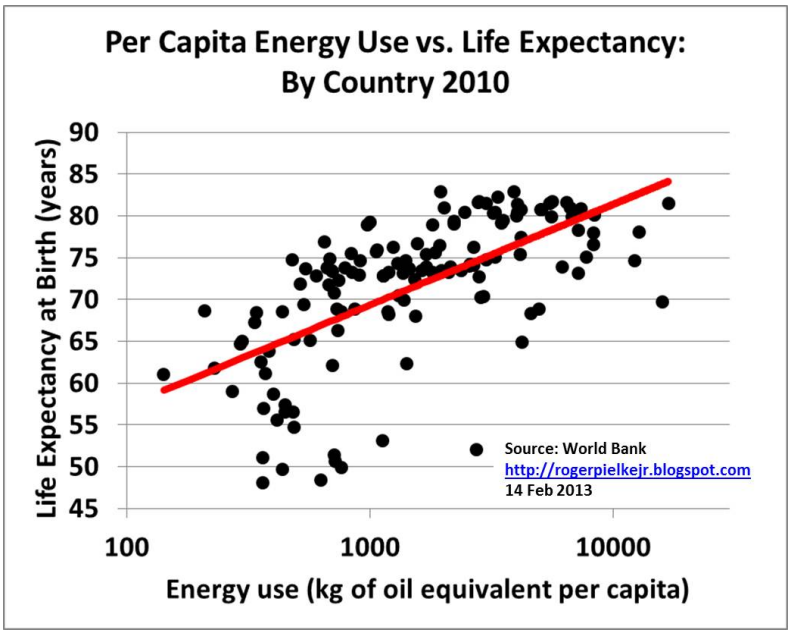
HISTORY: For over two centuries technological innovation has been the single most important driving force in human affairs. Human population, lifespans, and quality of life have all risen to heights that would have been unimaginable even a few decades ago, no less a few centuries. At the root of almost all these technological innovations has been the availability and affordability of fuels and electricity.

Not since the Neolithic revolution—the introduction of agriculture and the beginning of civilization as we understand it—has human life changed so dramatically. Before agriculture the total human population on earth numbered around 4 million persons—about the size of Los Angeles—but over the next 10,000 years world population shot up to nearly a billion people at the beginning of the 19th Century. It now stands at over 7 billion, and even with slowing growth rates associated with increased wealth, will reach 10 billion in the foreseeable future.

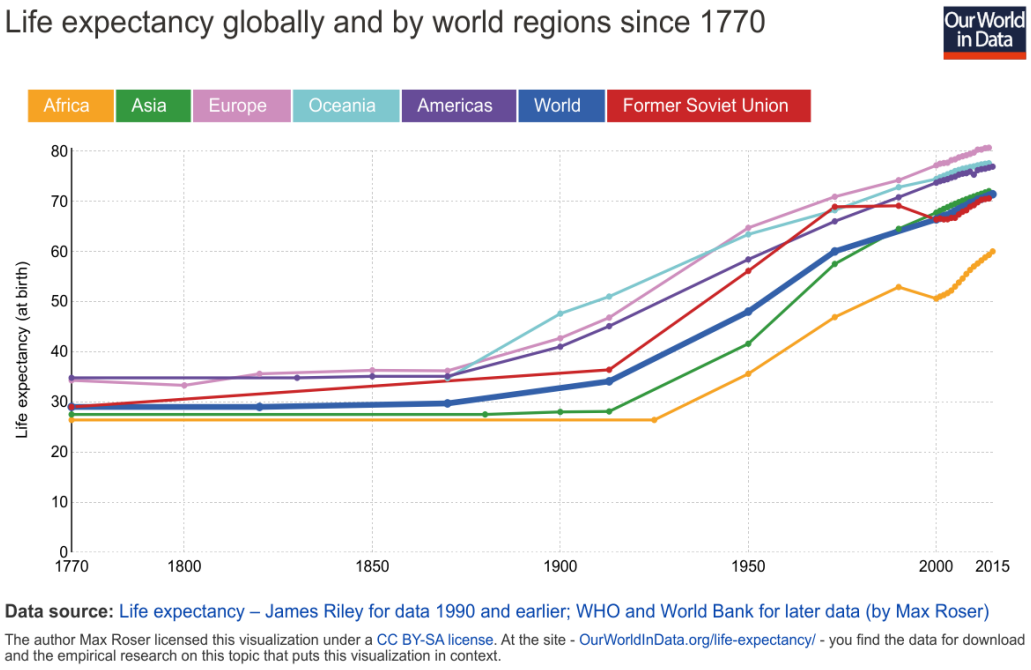
As much as population increased due to agricultural surplus, life itself remained remarkably similar for most people for most of that time. Life for the average person in 1800 AD was not dramatically different than it would have been in 1800 BCE. The basic technologies most people used were the same, and the most common form of power came from muscle.

Yet since the beginning of the 19th Century, everything has changed for nearly everybody. And what has driven that change more than anything else is the harnessing of non-muscle powered energy to do work of almost any nature. It can be argued that the differential rate of industrialization was one of the major reasons that slavery was outlawed in the industrialized North prior to the agricultural South. **The technological revolution that began in the late 18th century was as much as anything an energy revolution, which drove important social revolutions.**

Coal, steam, and the mastery of chemical energies changed everything. Human beings today live longer, healthier, and more prosperous lives than was imaginable at any point in history prior to the industrial revolution.



Abundant and affordable energy was and remains the catalyst for increasing human wellbeing. Lifespans, literacy and education levels, mobility, nutrition, and health are all highly correlated with economic development, which depends upon easy access to energy.



For the past two centuries fossil fuels have been the energy source of choice, because they have been abundant and generally affordable.

Fossil fuels are highly concentrated stores of energy, making them extremely attractive for use in both transportation and electrical generation. And despite concerns about access and occasional supply disruptions, they remain relatively inexpensive and abundant.

As such, fossil fuels have been the dominant form of energy storage and use for two centuries. Until recently, nothing save nuclear energy could touch them in terms of usefulness, and few forms of energy could compete in terms of cost and convenience.

Yet fossil fuels have their downsides. Their geographic distribution is uneven, their extraction and transportation present environmental dangers, and their use is becoming increasingly expensive as our tolerance for pollution rightly declines. Concerns about carbon emissions—overblown or not, depending upon to whom one listens—have become a driving political force.

In short, we are reaching the point of diminishing returns. Incremental increases in energy use no longer directly correlate with human well-being in the industrialized world, while at the same time environmental damage caused by fossil fuel use diminishes well-being as much or more than the benefits. Incremental increases in human well being from increased energy consumption have leveled off in industrialized countries, and energy efficiency permits substantial increases in quality of life without corresponding increases in energy consumption.

This simple fact can be seen in China's rapid industrialization, which has relied on dirty coal technologies. The pollution has become so severe that China's energy policies are being revised

to rely on cleaner technologies to avoid the harm caused by pollution, indicating that a tipping point has been reached in even partially industrialized countries. China, a country obsessed with economic growth, is now turning to nuclear and renewables as a means to improve quality of life.

THE TRANSFORMATION IS AT HAND

Without fossil fuels, modern civilization would not exist. In all likelihood the apocalypse repeatedly forecast by Malthus and the modern "limits to growth" theorists would have long ago arrived. There would be fewer human beings living shorter and poorer lives.

Despite the arguments made by some, simply abandoning fossil fuels is not an option in the near term for obvious reasons: the costs of doing so would outweigh the benefits. Yet over the next 50 years we will see a dramatic shift in energy use; in fact we are already seeing that transformation take place. Increasingly, industrialized nations are convinced that the short-term benefits of relying primarily on fossil fuels will not clearly outweigh potential future environmental and health harms.

But it is clearly time to replace fossil fuels with cleaner options as we can, and as part of that transformation it is time to reconsider our reliance on large, centrally controlled regulated utilities as the primary means to deliver power to industry and our homes.

A century ago government policies were put in place to speed the electrification of the United States (in much the same way that the creation of a telecom monopoly sped the telephone's ubiquity). A grand bargain was struck: in exchange for the rapid spread of near universal service, utilities were given near monopoly status and a guaranteed rate of return on their investment. This grand bargain for the most part worked, putting in place a system that achieved its goals. But, as with the telecom monopoly, it has largely achieved its goals and is outdated.

The current electrical grid is built around centralized energy generation, mostly one-way distribution technology, and mostly exclusive service zones for utilities that discourage competition and especially innovation. The arrangement encourages stability, but also stagnation.

As policy makers look toward the future, they are caught in a bind. On the one hand many of them see the need to spur the transition to newer technologies to continue maximizing well being for citizens, but on the other the policy levers within the current system are generally limited to command and control of a sclerotic and entrenched semi-government system.

Hence the reliance on mandates and subsidies, which are relatively crude mechanisms which often result in painful political disputes and slow and spotty innovation. They are also unnecessarily politically divisive.

Innovations can be spurred by massive government pressure and money, but almost never as well as within dynamic markets within which many profit-maximizing actors rely on constant innovation to acquire and retain customers. We often speak of "moonshots" and "Manhattan Projects," but we know of them precisely because they are so rare and have definitive end-points. We landed on the moon, and then moved on, even scrapping the technology to do so. Once the Manhattan Project reached its goal, it was disbanded and replaced with more standard engineering projects.

Neither is a model for how innovation tends to work, or for that matter how large government programs work.

The Space Shuttle and military procurement are better examples of massive government projects. Big, one-off projects like this are invariably more expensive and less capable than promised, with almost no benefits of iterative improvement. What has driven technology forward has been the rapid commercialization and even privatization of space, pushing the private sector well ahead of government projects in everything but pure science. In the aerospace industry as a whole, innovation is driven by mostly commercial imperatives.

Until recently, the same model has hampered investments in the next generation of cleaner energy technologies. Government subsidies and mandates have clearly spurred the deployment of greener technologies, yet the pace of innovation has been artificially slow. It has not been until the past few years—when entrepreneurs and larger corporations began to see a real, non-political market for their products that innovation has suddenly taken off. There is real money to be made, and business people want to win the race to get a piece.

NEXT GENERATION TECHNOLOGY

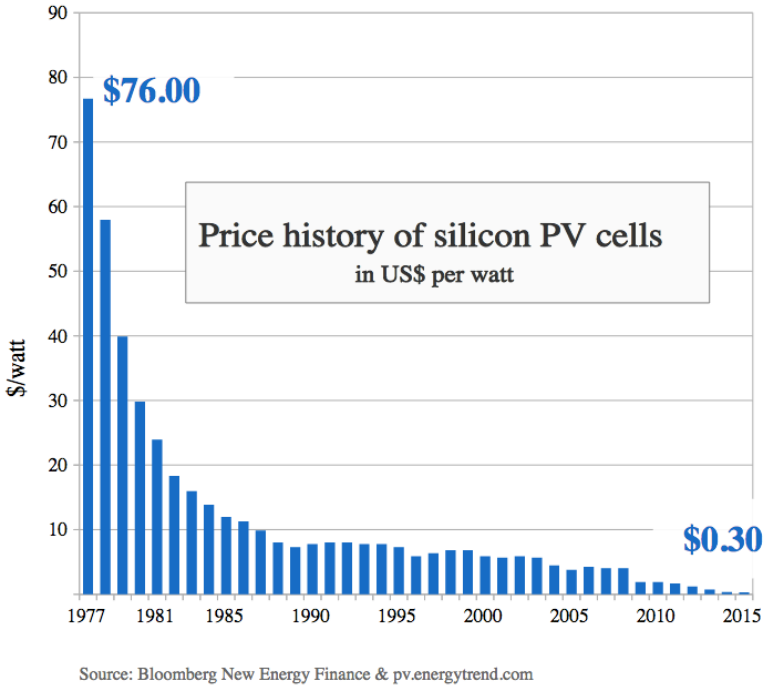
Prices for wind power generation are already competitive with coal, and while there is a lot of dispute about how precisely to compare costs and benefits of various types of electrical generation, one fact is indisputable: states that rely on wind for a substantial fraction of their power generation have electricity prices that are competitive with or cheaper than states that don't. At the very least, wind generation does not drive up electricity prices, and indisputably reduces external costs that come from pollution. Wind is no panacea, as it requires backup generation capacity, but that is largely true of all parts of our integrated grid.

Wind power fits relatively neatly into the current utility business model: large-scale generation throwing power off onto the grid. A freer market with third-party ownership, greater ability to upgrade to newer technologies, and more competition would help spur wind development; but wind will continue to be developed with or without much regulatory reform, because the incentives within the current system align properly to encourage its use.

The same cannot be said of solar technology, and that is a good thing.

Solar power promises to be the most disruptive technology since the spread of the cell phone. It can be deployed at almost any scale, by utilities, by individual businesses, by collectives, and by individual consumers.

Prices are dropping at a computer-like pace, and efficiencies are steadily improving. While still relatively expensive by grid standards, it is already directly competitive with conventional power in some regions, and promises to be so soon everywhere—with or without government subsidies.



Source: Bloomberg New Energy Finance & pv.energytrend.com

And, unlike large-scale projects, iterative improvements in the technology move rapidly into deployment as companies race to capture slices of the market by providing unique or superior value.

If the last century could be compared to the mainframe computer market of the 1950's to 1980's, solar power could be said to be the personal computer of power generation—a technology that improves at a stunning pace with falling prices, and that promises to disrupt a dominant model.

Personal computers have not replaced large centralized computer platforms, which still form a backbone of computer services, but they have fundamentally transformed the relationship of consumers to computing. Mainframes now provide essential behind the scenes services to the myriad distributed devices in the hands of consumers. Large power plants on a grid will continue to serve as the "mainframes" of the power network, but a larger and larger share of

the generation will take place in a distributed system of microgrids and even privately owned generation.

That is what solar power promises to do with energy production, provided that policy makers allow it.

USING BOTH FEET WHILE DRIVING

On the face of it, policy makers have been generally friendly to the spread of renewable energy and solar power in particular. Renewable energy mandates, subsidies, and net metering policies helped spur early deployment of these technologies, while causing some modest consternation to incumbent utilities.

In a sense you could say these policies have been like hitting the gas pedal for renewable energy.

But that is only half the equation. No matter how hard you hit the accelerator, the brake pedal has the power to slow the car. And government regulations, utility slow walking, and a focus on maintaining the grid in largely the same configuration is a brake on the spread of new technologies, especially solar power.

Minnesota is a perfect example of this phenomenon. Policymakers—from legislators to the Governor—are prominent proponents of renewable energy. Our state has some of the most stringent mandates in the country, and the Governor's office is now pushing for a dramatic increase in renewable requirements.

In a sense, policy makers have put the pedal to the metal—while ignoring the important left foot, which still rests on the brake.

Evidence of this fact is very clear: over 70% of large corporations have renewable energy goals, but most of the action in meeting these goals is taking place in states other than Minnesota. Minnesota-based corporations such as Target are rolling out programs to install solar panels on their large real estate holdings (flat roofs are a prime location), but they are bypassing Minnesota for states with friendlier regulatory environments.

Power purchase agreements are becoming common—agreements between private parties to build renewable generation facilities for the purpose of selling the power to businesses. Yet Minnesota has been left out of this energy revolution due to legal and regulatory ambiguities.

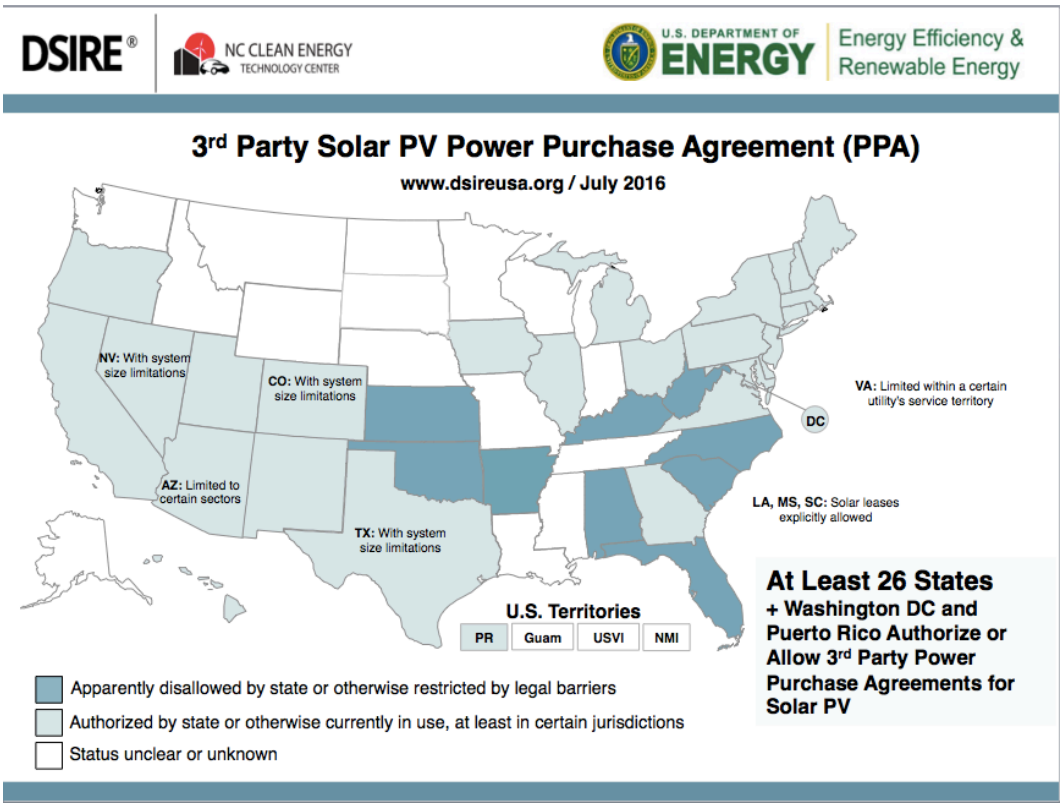
Minnesota's outdated regulatory environment creates a significant, even stifling regulatory risk. Ambiguity in what is and is not allowed, and on what may or may not be a good long-term strategy, is a significant brake on the development of energy innovation in the state. Corporations have a deep commitment to transitioning to renewable energy as long as it is cost-effective.

Minnesota is well placed to lead the energy transformation, as we were with the emerging boom in computers. But as with computers, our early lead is at risk because all the focus is on "mainframe" solutions in an emerging "PC" world.

A recent study placed Minnesota as one of the top 5 states with the potential to dramatically expand corporate access to renewable energy—to meet a demand that already exists in the marketplace. But an outdated regulatory environment is holding back corporate ownership of renewable energy assets.

Relatively simple (in terms of policy, not politics) changes to or clarification of regulations would dramatically change the landscape for the deployment of corporate-owned solar and wind assets, and speed the coming transformation from a centralized and monopolized utility model of electric generation and distribution.

OPENING UP THE ENERGY MARKET



The best way to speed the inevitable transformation in energy production is to unleash the potential of private actors to invest in next generation energy. The outdated model of centralized generation by monopoly utilities can and should be displaced by a growing acceptance of privately owned and operated generation, and power distribution through a growing web of microgrids.

The biggest barrier to this future is not technological. The technology is here, and getting more accessible and cheaper. Private corporations are generating their own power already in many places, and solar gardens are springing up around Minnesota and the nation. Yet here in Minnesota even solar gardens have artificial size limits placed upon their generation capacity, inhibiting their reaching their true potential.

Two major obstacles still stand in the way of rapid deployment of a distributed energy future: financing and regulation. In fact, financing is a problem in Minnesota largely due to regulation, so it could be argued that with the reform of regulation the financing problem will largely evaporate.

Homeowners are free to install panels on their roofs for their own use, but the legalities get murky at larger scales. Once a project reaches the scale of being able to power more than a few customers, utilities can argue that their regional monopoly is put at risk.

Compelling legal arguments suggest that the utilities are on shaky legal ground in making this argument, but challenging the utilities has the potential to be financially risky. Other states have clarified this issue, and are more fertile ground for investment.

UNTYING THE REGULATORY KNOT

The fastest and most economical way to speed the transition from an outdated centralized, fossil fuel-reliant energy grid is to open up the marketplace to competition.

We must remove the barriers to entry for alternative suppliers who can offer new services, build microgrids, provide rate guarantees, and/or any number of other market advantages to gain customers. Competition at all levels of power generation and distribution, will speed the transformation to a 21st Century power grid.

Smaller and more nimble service providers have the potential to dramatically alter the marketplace without necessarily disrupting the benefits we enjoy from the current system. Customers could be offered choices, neighborhoods and regions could enjoy the benefits of local and microgrids, all while driving down the costs associated with the deployment of new energy technologies.

The solar market is still relatively small, but even at this modest scale price is dropping while efficiency is increasing. A large scale increase in solar deployment would drive cost down even further and faster.

SOLUTIONS FOR MINNESOTA

- **DEFINE WHAT CONSTITUTES A UTILITY**

One of the biggest barriers to large-scale investment in innovative energy projects is the regulatory ambiguity regarding what constitutes a utility. Third party ownership of electric generation is currently legal at a small scale (<25 persons served), but as projects increase in size the legal status becomes murky.

Policy makers in Minnesota should explicity define utilities as those companies which currently have that status, and exempt from that definition new entrants into the marketplace who offer services that are an alternative to what is available currently.

Utilities exist to provide essential services. New entrants into the marketplace will not replace the current utilities, but exist beside them as an addition or alternative. There are a number of examples we have seen elsewhere in the economy, such as security companies, which supplement the police and exist beside them. The police provide a baseline service, while individuals may choose to supplement.

- **ENCOURAGE DISTRIBUTED GENERATION**
  The electric grid is not going to disappear, as it performs an essential service. But as useful as it is, reliance on a massive grid system largely freezes in place an aging and outdated system of generation and distribution of electricity.

  New technologies allow for the development of smaller, even "micro"grids, which exist in tandem with the larger grid. While usually connected to the larger grid, these microgrids allow for the deployment of newer technologies and enhanced reliability.

  Microgrids are similarly hampered by regulatory ambiguity, and in Minnesota we are basically limited to demonstration projects under the watchful eye of the utilities themselves.

  Allowing alternative ownership of microgrids would speed their development immensely, while driving down the cost of each successive project.

- **LOOSEN REGULATIONS WHICH RESTRICT THIRD PARTY OWNERSHIP**
  Third party ownership is the key to the rapid deployment of newer technologies. One of the biggest barriers to the spread of innovative technologies, even when they prove cheaper and better than current technology, is the large up front investment necessary to deploy it.

  Investors are eager to step into the breach and build out, but current laws and regulations discourage them from doing so in Minnesota. Many customers would be happy to have a third party build power generation on their property and then sell them electricity at a guaranteed rate, but current law and regulations make that a potentially risky business strategy.

In the coming years solar plus storage will continue to have large up front costs, but pay dividends over the longer run. Encouraging third party financing and especially ownership would dramatically speed the deployment of newer technologies.

- **ALTER "CERTIFICATE OF NEED" REQUIREMENTS FOR NEW TECHNOLOGY PROJECTS**
- The certificate of need process exists to prevent regulated utilities from building projects for the purpose of capturing a rate of return on otherwise superfluous projects. Since it is manifestly in the public interest to speed the deployment of next generation energy technology, it makes little sense to impose barriers to their deployment by requiring certificates of need for interconnection or other related work on these projects.

- **STANDARDIZE INTERCONNECTION**
  International standards for interconnections between renewable energy projects and the grid exist, but Minnesota does not require adherence to them. That unduly complicates every new project, treating them as if they were custom rather than standardized. Simply adhering to already established international standards would reduce cost and complexity, and speed the deployment of new technologies.

- **REFORM RATE STRUCTURE**
  New technologies require new ways of measuring costs. Under a monopoly utility structure, electric rates reflect a variety of costs including maintenance, transmission, fuel, construction, and connections. In an environment with multiple providers, microgrids, and constantly improving technologies it's time to rethink how consumers are charged for services as well as power.

- **END FEE ABUSE**
  Utilities correctly argue that new technologies have created the potential for cross-subsidies between customers who rely on the grid for backup power and those who solely purchase power from the utility. Their current solution, charging fees to customers who install solar, is being implemented in an arbitrary fashion, resulting in high fees, which serve to unnecessarily discourage adoption of new technologies. The better solution is rate structure reform that unbundles the costs of service provision from power generation, making the costs more transparent.