Deploying Clean Energy: Overcoming Regulatory Barriers

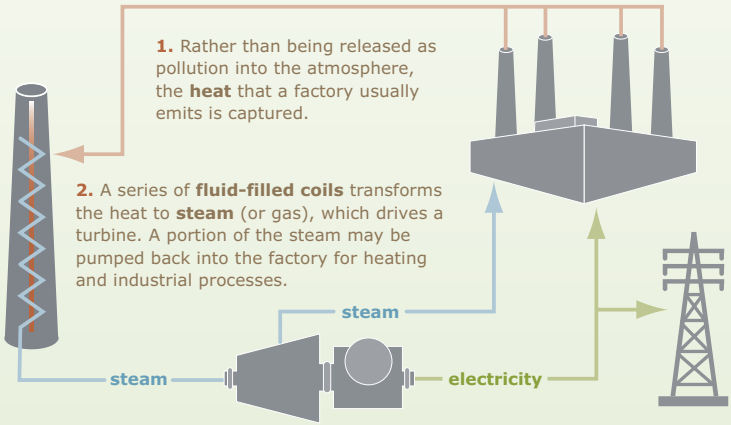
by Thomas R. Casten and Dick Munson

January 2009

RED
RecycledEnergy Development

WASTE HEAT RECOVERY

reduces pollution and energy costs by reusing otherwise wasted heat



3. Steam from the heat recovery boiler is pumped into a **turbine** which generates electricity used to power the plant. Excess power may be sent to the local grid to provide clean electricity for the outlying community.

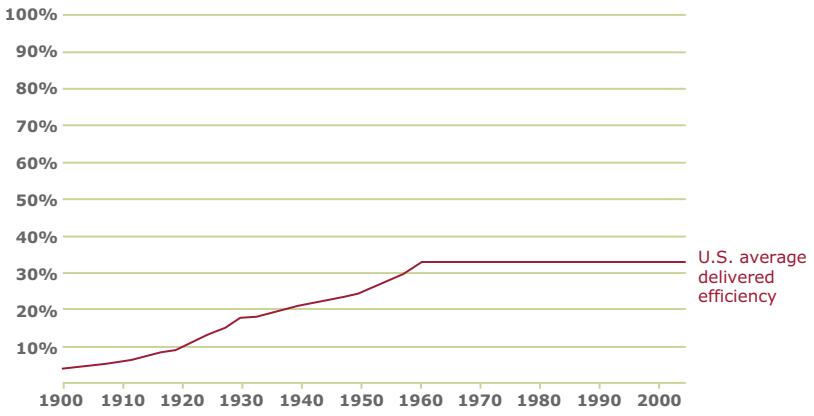
Many of the world's best brains are focused on reducing fossil fuel use to mitigate climate change. Strangely, little attention is paid to the source of the greatest inefficiency – the generation of heat and power, which accounts for 67% of carbon-dioxide emissions. Capturing and recycling the currently wasted energy could displace nearly 30 percent of U.S. fossil-fueled generation, slash U.S. CO_2 by 20 percent, and save $150 to $250 billion per year.

Such numbers sound too good to be true, largely because everyone assumes electric utilities and large manufacturers must be optimally generating their electricity and thermal energy. **That assumption, however, is totally flawed. In fact, current energy and environmental regulatory policies are barriers — barriers that block the deployment of clean and efficient generation.**

That these barriers exist is proven by the fact that the power industry has made no overall efficiency gain in the past five decades, since Dwight Eisenhower occupied the White House. Electricity generators burn three units of fuel to deliver just one unit of power, resulting in an efficiency rate of only 33 percent. Monopoly utility regulation had already stopped efficiency gains when Congress enacted the 1970 Clean Air Act, which ignores efficient generation as pollution control and inadvertently penalizes investments in efficiency.

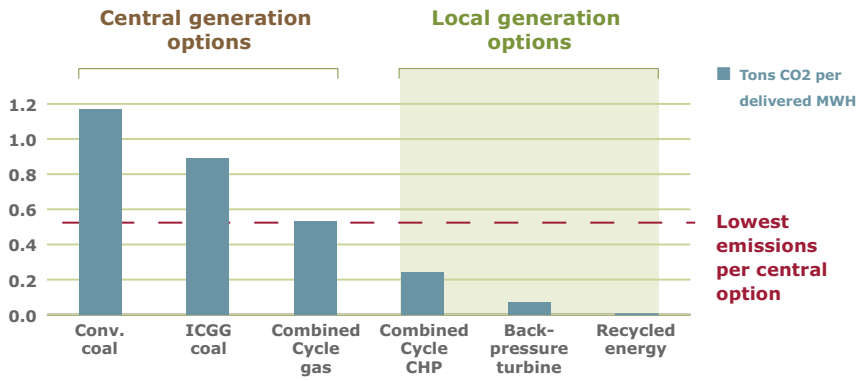
In fairness, global warming and problems with fossil fuel use were not on the radar screen when monopoly regulations were formulated or when the Clean Air Act first tackled air quality. But these

U.S. ELECTRIC EFFICIENCY, 1900-2005



CO_2 EMISSIONS PER DELIVERED MWH

By generation type



rules block efficiency and force society to pay to warm the planet. Since the needless release of carbon dioxide is threatening life as we know it on earth, these rules must be modernized.

The chart above shows that carbon emissions from central generation plants — those favored by regulation — are five to ten times higher than CO_2 from local generation plants.

Economic theory suggests that free markets drive continuous improvement and that entrepreneurs operate close to economic optimality, given current technology. This theory supports the notion that government can best reduce fossil fuel use by investing in research and development. However, the theory fails to fit the facts of the U.S. electricity industry. Despite incredible improvements in technology over the past five decades, average national electric generation efficiency remains frozen at 33 percent. Additionally the electric industry has been largely protected from market forces for over a century. Regulated utilities, long sheltered from competitive pressures, are in no way "economically optimal."

Consider how competitive markets work. Producers face constant threats of value destruction when entrepreneurs build more efficient capacity. Economist Joseph Schumpeter, describing the process "creative destruction," noted that competitors build new production facilities whenever they believe they can undercut the prices of existing producers. Free-market producers, facing constant threats of losing the value of their productive assets, must either continuously reduce costs and increase efficiency or lose market share. In Schumpeter's view, the freedom to build more efficient production facilities, even when existing capacity more than satisfies product

demand, creates more value than it destroys, allowing society to enjoy an improved standard of living.

Planned economies like the failed Soviet Union block Schumpeter's creative destruction in all sectors. Politburos and bureaucrats estimate the demand for each good or service and then prepare five-year "plans" that will supposedly produce sufficient goods to satisfy demand. Of course, no centrally planned economy has matched the economic performance of free markets.

The century-long protection of electric monopolies has imposed this inefficient central planning on electricity generation. Several regulatory agencies in recent years have worked to remove some barriers, and we've seen progress with the elimination of excessive interconnection requirements and the introduction of locational marginal pricing. Still, most rules have not been modernized to conform to current technology and fuel options. To achieve clean generation, regulations must be modernized to remove three types of barriers to efficient generation:

- **Outright Barriers** – policies that block or severely penalize non-utility generation.
- **Value Deniers** – policies that prevent local, cleaner generation from capturing the value it creates, whether built by the regulated utility or by independent power producers.
- **Playing Field Tilters** – policies that grant economic advantages to older and electric-only generators versus more efficient local units.

Outright Barriers

Outright barriers are surprisingly common.

- All 50 states still ban private electric wires that cross any public property. Lacking state or national mandates to purchase clean or more efficient energy at full value, such legal prohibitions allow distribution monopolies to kill on-site generation. Local energy developers, in fact, are forced to sell power to their competitor at a low price. Even the few states, such as Texas, that require monopoly distributors to move an independent's power still allow 'postage-stamp' rates that reflect the cost of transmitting electricity across the entire state even though the power actually moves to the nearest users.
- Roughly 15 states ban any non-utility entity from selling to an electricity consumer. An entrepreneur recycling waste energy from a steel smelter, for instance, is forbidden from

selling power to that smelter and is left with not building or accepting deeply discounted prices from the utility monopolies, even though the entrepreneur's electrons flow to the host without ever entering the utility's transmission and distribution system.

- State regulators typically approve rates for backup power based on the highly improbable assumption that all local generation will fail at precisely the moment of the distribution system's peak demand, thus requiring the monopoly utility to maintain 100 percent spare generating, transmission, and distribution capacity. In fact, the statistical probability that all three generators in a typical cogeneration plant will all fail at the exact system peak is about one in six million–infinitesimal. On the other hand, the odds that most of the local generation will be available when the grid needs power are 99.99 percent.

- Most state regulatory commissions allow utilities to demand needlessly expensive interconnection designs. The Federal Energy Regulatory Commission (FERC) and some states have attempted to standardize interconnection requirements, but utilities typically delay and over-specify standards as a way to discourage local generation. Most commissions are ill-equipped to debate the utilities' technical arguments.

Value Deniers

Value deniers prevent local clean generators from being compensated for the benefits they create.

- Electricity from distributed generation, regardless of who purchases the power, always flows to the nearest users and thus reduces demands on the existing transmission and distribution system. This reduces lines losses, benefiting all users. In fact, since line losses are proportional to the square of current flow, a little bit of local generation provides significant benefits. Yet local generators seldom, if ever, receive any value for reducing line losses or for enabling society to avoid investments in new transmission and distribution wires. PJM Interconnection and the New England ISO recently provided some locational value to local generation, but all other jurisdictions still deny this value to clean local generation.

    - Most state regulatory commissions ignore the savings that local generation creates by avoiding line losses and new investments in the grid, and underpay local generation relative to the value it creates.

- Recycling normally wasted energy to displace boiler fuel doubles the fuel's productivity and thus, all else being equal, halves the criteria pollutant and greenhouse-gas emissions per unit of useful output. However, current environmental regulations pay no attention to how much useful output a plant produces and thus give no benefit for efficiency. The Clean Air Act actually denies any credit for the boiler fuel saved by local generation. As described below, basing pollution regulation on energy outputs rather than fuel inputs would reward efficiency.

- Many climate change mitigation proposals, including the Warner-Lieberman Climate Security Act would give some CO_2 allowances to existing polluters but require all new generators, no matter how efficient, to purchase allowances for 100 percent of their emissions. A better approach would be for all allowances, to either new or old generators, to be based on the output of useful energy, thereby leveling the playing field and giving value for more efficient generation. The present approach prevents new generators from competing fairly with old generators.

- Local generation significantly lowers the requirement for redundant generation and transmission capacity because numerous smaller power plants are inherently more reliable than a single generator. Recent studies at Carnegie Mellon University show that a system of many distributed generators, having 3-percent to 5-percent redundancy, would provide the same system reliability as the current system of large central generators with 18-percent redundancy. Deploying 200 gigawatts of efficient local generation across the U.S. would eliminate the need to invest $50 billion in redundant generation and associated transmission and distribution wires. Yet regulatory commissions seldom, if ever, pay local generation anything for reducing system redundancy requirements.

- Distribution utilities install (and add to rate base) capacitance and inductance banks that passively control the distribution system's power factor variance. Typical contracts require local generators to maintain a specified power factor, which forces them to purchase oversized generators and accept some loss of electric output to correct grid power factor, but

they receive nothing for providing this public benefit. By contrast, large remote electric-only generators regularly sell power-factor-correction services to the grid. To level the playing field, distribution utilities should be required to also contract with local generators to purchase local power-factor-correction services.

Playing Field Tilters

Playing field tilters provide differential advantages to existing or new electric-only generation plants versus local units that recycle wasted energy.

- The regulatory system effectively provides financial guarantees for electric-only and inefficient central generation but makes more efficient local units absorb 100 percent of the financial risk. In fully regulated states, public service commissions agree to set (and re-set) electricity prices. Their actions provide profits to cover all utility investments in central generation and associated wires and transformers. Local generation plants receive no comparable financial guarantees, making their capital either more expensive or even impossible to obtain. States that have deregulated generation no longer provide such ratepayer guarantees, but it remains to be seen whether markets will build required new capacity with neither a rate guarantee nor a long-term contract. Society could level the playing field either by guaranteeing (or providing long-term contracts to) both central and local generation, or by giving no guarantees of return on investments to either approach.

- Current regulations also guarantee that all costs of interconnecting central generation to the transmission system go into the rate base and are thus paid by electricity users. In contrast, regulators make local generators pay for interconnection to the grid, even though the local facilities provide substantial net benefits to other electric users. A study done at the University of Massachusetts found that each new kilowatt of local generation capacity in Boston created net benefits – such as reducing line losses and the need for additional generation and transmission and distribution (T&D) lines –of $365 per year. Yet even after the study was introduced in rate proceedings, the Massachusetts commission allowed the Boston utility to charge local generators a standby rate of $135 per kilowatt. This $500 per kilowatt swing from the projected societal value to the rate charged the local generator keeps Boston “local generation free.”

- The Clean Air Act of 1970 placed all of the burden for cleaner air on new pollution sources, while "grandfathering" old plants and allowing them to continue emitting at historic levels. Given the progress in available control technology, a new local generation plant is only permitted if it reduces criteria pollutant emissions by a hundred fold, about 1 percent of the grandfathered emissions from old power plants. The Clean Air Act's crafters assumed the old facilities would wear out over time and cease operations, but the right to continue polluting has become so valuable that old power plants have gained virtual immortality. The age of the average coal plant has increased from ten years in 1970 to 36 years today. Anyone trying to develop a new generator must pay high costs to reduce criteria pollutants and then compete with the old dirty plants.

Policy Changes to Remove Barriers and Give Clean Energy a Chance

Several policy changes would, at no cost to governments, give clean energy a chance. The first step, however, is to change several conceptual approaches to the electric system, including:

- Seek and reward the lowest cost/cleanest approaches, without regard to whether they are new or old and whether they are central or located near an industrial or commercial host. Think about local plants as a benefit to the grid.
- Revisit regulatory rules in light of the need to increase efficiency and confront a rapidly changing climate.
- Restrict monopoly status to distribution of power, not generation. Complete the process of opening electric generation to competition by removing all of the biases in favor of monopolies and older or central plants.

Below are several specific proposals.

Output Allowance Emission Rules

End grandfathered permits and replace the Clean Air Act's methodology with output-based allowances for all emissions. Grant every generator of heat and/or electricity an annual allowance per unit of useful output for each of the four major pollutants – CO_2, NO_x, SO_2, and PM or particulate matter. Set the initial allowance values equal to the average emission of that pollutant in the prior year by all U.S. generators of electricity and by all generators of thermal

energy. Every generator would be required to obtain sufficient allowances each year to match actual emissions of all four pollutants. Relatively clean generators would earn added revenue from the sale of allowances, while relatively dirty generators would face added costs of purchasing allowances. Congress would schedule the emission allowances per unit of useful output to decline each year and automatically adjust for any load growth, guaranteeing declining total emissions. Initially, the average cost of heat and power would not increase, since all money paid by dirty plants for allowances would go to clean plants, thus encouraging deployment and operation of more clean generation. Markets would set prices for allowances of each pollutant.

Spurred by additional revenue from selling excess allowances, energy entrepreneurs will build cleaner plants and drive dirty units out of operation. As average emissions per unit of useful output fall, **the increased generation efficiency will cut fuel costs and produce net savings**.

This output-allowance methodology prevents politicians from picking technology favorites. It also assumes that the added costs to dirty generators is matched by added revenue to clean generation, which avoids increasing rates to industrial producers and threatening jobs. Output allowances motivate every generator to increase efficiency relative to fossil fuel use (in order to reduce CO_2 per unit of output) as well as to reduce criteria pollutant emissions. Output allowances, moreover, let markets make all technology decisions, leveling the playing field and rewarding clean generation.

This approach allows Congress to void grandfather rights and the Clean Air Act's New Source Review (NSR) provisions, but use output allowances to constantly drive pollution lower. The NSR provisions are an effective ban on investing in energy productivity at any existing thermal or electric generation plant.

Clean Energy Standard Offer Proposal

We propose a national Clean Energy Standard Offer Program (CESOP) that induces clean energy at a discount. Unlike state Renewable Portfolio Standards that only encourage certain clean technologies, CESOP would encourage deployment of all clean energy generation, including renewable resources. Eligible generation would include all generation that at least doubles

today's delivered fossil efficiency per unit of useful output. Specifically, CESOP would offer 20-year contracts for clean energy at a price equal to 85 percent of FERC's estimate for delivering electricity from the best new base-load, fossil-fueled, electric-only generation. By including time-of-use pricing in the offer, the CESOP also would induce clean generation that follows the demand for power instead of randomly encouraging off-peak generation. Clean energy based on recycling presently wasted energy can be significantly cheaper than power from any new fossil-fueled electric-only generation, and the public should receive some of the benefit. By offering long-term contracts, CESOP will allow entrepreneurs to obtain low-cost capital in the financial markets for clean energy projects that reduce pollution as well as the cost of power to the public. The program also will create added revenue streams to U.S. manufacturers from recycling their waste energy, thus making them more competitive in world markets.

FERC Actions to Induce Optimal Local Generation

The Federal Energy Regulatory Commission has the power to correct several barriers to local generation. Below is a short list of FERC actions that would level the playing field and induce the deployment of efficient and clean energy.

1. Set wholesale rates that compensate local generators for reducing line losses and curtailing the need for additional investment in T&D wires, substations, and capacitance and inductance equipment. Local generators deserve to obtain value for the benefits they provide.

2. Require RTOs/ISOs to calculate and compensate local generators for reducing the number of redundant generators and T&D. Wholesale rates need to reflect the benefits such distributed facilities bring to an RTO's overall reliability.

3. Require utilities to interconnect to all generation, regardless of size or location. These expenses should be added to that utility's rate base. Such rate base additions will be substantially less than the capital otherwise required for new T&D.

4. Grant a federal exemption to state laws that ban private wires to any local generation plant that FERC deems will ease T&D constraints. Allowing qualified local generators to install private wires that move power to nearby retail electric users is consistent with FERC's current regulation of natural gas transmission, which allows gas users to apply for a tap on an interstate gas pipeline and construct a private pipe crossing public streets. It's unlikely this policy change will spur the construction of new wires, but it will create an honest negotiation about the value of moving power across the street in an existing distribution wire.

Legalizing private wires would place an economic limit on the distribution utility's charges and thus allow the market to optimize choices of new generation and new wires.

5. Require transmission and distribution utilities to bid out all capacitance and inductance services, thus allowing local generators to supply power-factor correction and voltage stabilization in lieu of ratepayer-guaranteed investments in capacitance and inductance devices.

6. Require all RTO/ISO's to allow local generating plants to bid on spinning reserve, priced to the locational needs of the RTO/ISO, regardless of the generator's size.

7. Offer long-term power contracts, tied to heat rates but adjusted for fuel prices, to local generators that displace the need for new T&D. The current system, which has regulators approving and rate-basing all new T&D investment, forces ratepayers to amortize new transmission services. Instead, FERC should give the same long-term contract to efficient local generators that ease congestion.

Conclusions

The bad news is that the delivered electric efficiency is a pathetic 33 percent and has not improved since Eisenhower was in the White House – this inefficiency is exacerbating many of the economic problems facing the U.S. The good news is that proven technology could satisfy electric load growth with clean local generation that slashes fuel, capital, pollution, greenhouse gas emissions, and retail power costs. The second bit of good news is that governments can induce markets to achieve profitable reductions of fossil fuel and all emissions by simply modernizing the regulations and regulatory practices that block deployment of clean technology.

We have provided suggestions for two major federal initiatives and a series of regulatory actions that begin to level the playing field between inefficient central generation and efficient local generation. Such changes will reduce the cost and environmental impact of future power generation.

For further information please contact:

Thomas R. Casten
Chairman
tcasten@recycled-energy.com

Dick Munson
SVP Public Affairs
dmunson@recycled-energy.com