Technological Progress and Stranded Costs in the Electric Industry

by

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I. INTRODUCTION

The case for and against stranded cost recovery in the electric industry has received the attention of many scholars. Nonetheless, a fundamental confusion persists. This confusion results from a less than careful characterization of the nature and causes of the stranded costs that are emerging in the move to competition.

Stranded costs in the electric industry are not primarily the result of poor management or imprudent investment. Indeed, if they were, there would be little case for stranded cost recovery because the courts and regulatory authorities have repeatedly denied such claims for indemnification. Moreover, stranded costs are not caused by a change in the structure of regulation. Opening the generation market to competition should not in and of itself cause generation assets to decline in value. The effect of competition is to cause assets to be priced at their true opportunity cost. While it is the case that a move to competition would be politically

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2 In the long run. There may be some short-run capacity effects as a result of the Wellisz (1963) and Averch and Johnson (1962) effect.
unlikely were it to result in higher prices and therefore higher asset values, it is still true that the change in the regulatory regime is not creating the problem. It only heightens sensitivity to the issue.

If not managerial failings or regulatory caprice, then what is causing stranded costs? Plain and simple, improvements in the operating efficiencies of generators have caused the true opportunity cost of electricity production to decline precipitously. Fundamentally stranded costs are the result of technological progress. The dramatic drop in the cost of power has caused a substantial portion of the capital stock of the electric power industry to become technologically obsolete, and it has caused almost all generating assets to be worth less. The thing that has made the opportunity cost of electricity fall off the table is new technology.³

Because of this, it is wrong to argue that a shift in the regulatory regime from rate regulation to competition is a fickle change of heart that breaks a societal bond and throws the mud of stranded costs in the face of faithful utilities. The dramatic change in the opportunity cost of electricity has to be reckoned with whether it is in the context of traditional rate regulation or in the context of a competitively restructured industry. Electric generation plant has been reduced in value due to obsolescence caused by technological progress, aptly called creative destruction. On this basis, the application traditional rate-making rules would imply that recovery of stranded costs should be denied and prices reduced, and this is true whether or not regulators choose to adopt a more competitive market allocation system.⁴

The point of this paper is to review the legal doctrine that most appropriately applies to the stranded cost debate and to develop the two empirical points that speak most importantly on the issue. The legal precedent shows the court’s defense of the process of creative destruction over the claims of affected asset owners. The empirical points are (1) stranded costs in the electric industry are the result of technological progress and (2) allowing such creative destruction to unfold has had no negative side effects in the past. We start with the first empirical point.

II. TECHNOLOGICAL ADVANCES IN ELECTRICITY GENERATION

Gas turbines have developed in a way that bears a family resemblance to advances in other high-tech industries in the last several decades. The improvements in turbines have been dramatic and rapid, and portend to continue into the future.

Gas turbines generators from the 1960s and 1970s were used for peaking purposes. These units had thermal efficiencies that were approximately equivalent to conventional-steam base-load units of the same vintage. The value of this vintage of turbines was found in their load following capabilities and in the fact that they had relatively low capital cost. Thermal efficiency measures the rate at which an electric generator can turn fuel into electricity. Higher efficiency ratings mean that less fuel is required to produce electricity, which means the cost of producing electricity is lower.⁵ Another measure of generator efficiency is heat rate. Heat rate is the ratio of the btu

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³ The technological advance is in the generation efficiencies of natural gas turbines. No doubt, part of the low cost of new generation is due to the price of natural gas, but gas cost is not the driving force. Even the low gas prices that exist today do not make old gas-fired conventional steam generators particularly attractive. A discussion of generator efficiencies is given in the next section.

⁴ In a somewhat ironic twist, it is arguable that utilities are using restructuring like Br’er Rabbit’s briar patch. That is, utilities claim that if regulators force competition on them, stranded costs must be recovered in process.

⁵ The thermal efficiency percentage is derived by dividing the heat content of 1 kilowatthour of electricity (3,412 Btu per kilowatthour) by the Btu content of the fuel used to produce 1 kilowatthour. A related measure that is
content of generator fuel to the kwh output of the unit. Thermal efficiencies of conventional steam generators are around 33 percent, which is the same as a heat rate of around 10,500.

Thermal efficiencies of gas turbines have increased dramatically over the last three decades. In the latter part of the 1970s thermal efficiencies jumped from around 30 percent to 34 percent. Then in the period from 1980-1990, the efficiencies jumped again to around 37 percent. Yet another increase has occurred and is just now being marketed. The newest turbines have efficiencies of 40 percent.

A major advance in thermal efficiency came when the exhaust gas of gas turbines was recycled to produce more electricity. These are called combined cycle units. In a combined cycle unit, the exhaust heat of one or more jet engines is used to produce steam which then drives another generator. As a rule, harnessing the exhaust heat of the turbine increases electricity output by 50 percent, which means that the thermal efficiencies of combined cycle units are 50 to 55 percent when the turbine itself has an efficiency of 34 to 37 percent. The very newest technology attains efficiencies of 60 percent in combined cycle applications.

Table 1 shows comparisons of heat rates between conventional steam generation, principally coal fired boilers, and combined cycle units installed by utilities over the years 1980 through 1995. These data are taken from Form 860 collected and distributed by DOE. The 1995 data were the last to report heat rates. The units covered in Table 1 only include generators of 100 MW and larger. The data show that there were substantially more conventional steam units installed in the 1980s than combined cycle. The average heat rates are 10,418 for these conventional steam generators compared to 11,660 for the combined cycle units installed during the same period. By the 1990s, there were more combined cycle units being installed and the heat rates on these units were better on average than the conventional steam units.

<table>
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<th>Installation Date</th>
<th>units</th>
<th>mean</th>
<th>std. dev.</th>
<th>min</th>
<th>max</th>
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<tr>
<td>1980s</td>
<td>151</td>
<td>10418</td>
<td>1349</td>
<td>9088</td>
<td>20000</td>
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<tr>
<td>1990s</td>
<td>13</td>
<td>10568</td>
<td>1568</td>
<td>8914</td>
<td>14168</td>
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<tr>
<td>Combined Cycle</td>
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<tr>
<td>1980s</td>
<td>18</td>
<td>11660</td>
<td>1933</td>
<td>8700</td>
<td>15349</td>
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<td>9071</td>
<td>2067</td>
<td>4568</td>
<td>12645</td>
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</tbody>
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Table 1 shows that the combined cycle units installed in the 1990s were on average 10 percent more efficient than the conventional steam units, and the best combined cycle unit was approximately twice as efficient as the best conventional steam plant. Also notice that there was no significant improvement in heat rates for conventional steam units from the 1980s to the 1990s.

\[ \text{Heat rate} = \frac{\text{Btu content of fuel burned}}{\text{kwh of electricity generated}} \]

Also widely used is heat rate. Heat rate is computed by dividing the total Btu content of fuel burned for electricity generation by the resulting net kilowatthour generation.

These numbers come from the General Electric power generation internet home page and from discussions with GE engineers.

The numbers reported in Table 1 are empirical heat rates so there is variation based on capacity utilization. That is, these data are the ratio of the Btu of actual fuel burned to the kwh of electricity generated.
while there were marked increases in turbine efficiencies. For reference, a heat rate of 4568 is the equivalent to a 55 percent thermal efficiency, while a heat rate of 8914 equals 37 percent thermal efficiency.

Thermal efficiencies in newest combined cycle units are twice those of most conventional steam units. This means that the fuel cost of generating electricity is cut in half. Couple this with the fact that turbines are much less expensive to construct. Overall, combined cycle technology has cut the cost of generation in half over the last fifteen years and promises to continue to drive cost down. This technological progress makes older generation assets obsolete. Simply enough, this is the cause of stranded costs.

III. THE COURT’S DEFENSE OF TECHNOLOGICAL PROGRESS

Policy makers must decide if utilities will be allowed to recover the cost of obsolete assets. They must also decide if the regulatory structure of the industry will be changed. However, the two decisions are completely separable. Indeed, policy makers acting in the public interest can best assess stranded cost recovery solely from the perspective of the traditional rate-making process.

The primary intent of rate regulation is to deliver prices that reflect the true cost of providing service while allowing the recovery of this cost. In order to induce investors to provide service under these conditions, the regulator must set rates so that expected returns to utility investments are attractive relative to other opportunities. Otherwise insufficient investment will occur. Hence, the rates allowed by the commission are designed to yield what is called a “fair” rate of return to qualified investments made by the utility. Nevertheless, rate of return regulation under this principle does not guarantee the allowed rate of return. Nor can it indemnify the utility against all events in a risky world.

As new technologies replace old ways of doing business, competitive firms are forced to adapt or yield to new competitors. In unregulated markets, this is the creative destruction that drives economic progress. In the regulated sector, however, price controls limit the ability of competition to drive new technologies into the market place. The question that must be addressed is: Should regulators force new technology on the industry against the wishes of the regulated firms and with the consequent devaluation of their existing assets?

A legal history has emerged that provides insight into the notion of a regulatory contract, and the degree to which utilities can expect to be protected from changing circumstances. Judicial treatment of regulated industries leans in favor of creative destruction and against stranded cost recovery. In situations such as we are now experiencing in the electric industry, the court has taken the view that public policy should promote overall social welfare even if it imposes economic losses on some parties.

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8 Also, competitive construction of merchant plant generators has significantly reduced construction cost overruns.

9 For instance, regulation has not precluded utility bankruptcy. For a review of the bankruptcies in the electric industry, see Maloney, McCormick, and Sauer (1996).
A. Three Pillars of the Law

The first and most significant ruling of this sort came in the landmark decision of the Charles River Bridge case. In the decision, the court chose to adopt a strict construction of the charter granted to the proprietors of the Charles River Bridge. Even though competition vitiated the proprietors’ right to collect tolls as authorized in the charter, the charter did not specifically grant an exclusive right. The court ruled that strictly construed the state was under no obligation to protect the income flow to the owners of the bridge.

In doing so, the court reflected on the fact that by allowing competition that drove the asset value of the charter holders to zero, the overall social welfare was improved. In such a case and in the absence of a specific contract that sheltered the bridge against competition, the court said that such protection of asset values should not be presumed because the greater good was served by the new investment. In the sense that new, competitive investment threatened to drive the value of the old asset to zero, the Charles River Bridge case is nearly identical to the case of stranded costs in the electric industry.

The story of the Charles River Bridge is as follows: The Proprietors of Charles River Bridge petitioned the Massachusetts state legislature to build and operate a toll bridge between Charlestown and Boston over the Charles River. In 1785 the legislature granted a forty-year (later extended to 70 years) franchise during which tolls could be collected. However, in 1828 the legislature issued another charter for a bridge that would directly compete with the Charles River Bridge. The new Warren Bridge could collect tolls only until the costs of construction and a five-percent margin were recouped; thereafter, passage would be free. Because the two bridges provided the same service, free passage on the Warren Bridge made the franchise for the Charles River Bridge worthless. Proprietors of the Charles River Bridge sued the state, claiming an uncompensated taking had occurred.

The case worked its way through the judiciary and was finally decided by the U.S. Supreme Court in 1837. The claim by Proprietors of Charles River Bridge was rejected because exclusive privilege was not expressly stated in the original charter:

The object and end of government is to promote the happiness and prosperity of the community by which it is established, and it can never be assumed that the government intended to diminish its power of accomplishing that for which it was created; and in a country like ours, … new channels of communication are daily found necessary both for travel, trade, and are essential to the comfort, convenience, and prosperity of the people. A state ought never be presumed to surrender this power because, … the whole community has an interest in preserving it undiminished; and when a corporation alleges that a State has surrendered, for seventy years, its power of improvement and public accommodation in a great and important line of travel, … the community have a right to insist that its abandonment ought not be presumed, in a case in which the deliberate purpose of the state to abandon it does not appear.

Thus, without explicit contractual language, the state of Massachusetts was under no obligation of contract to ensure the exclusivity of the charter for the Charles River Bridge.

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10 Charles River Bridge (Proprietors of) v. Proprietors of Warren Bridge, 36 U.S. 420 (1837). Charles River Bridge was the cornerstone of the Supreme Court’s so-called “strict construction” revolution. An insightful history of the case can be found in Kutler (1971).

11 The case was heard by the U.S. Supreme Court in 1831 but no decision was reached.

12 Charles River Bridge, p. 548.
The decision clearly demonstrated that in the court’s view government granted franchises unless they are explicitly stated to be exclusive do not protect regulated companies, especially when improvement of the economic well-being of the community is at stake. At the time, this decision was key to the development of the railroad industry in the United States. Canal and bridge owners were threatening to stop expansion of the railway system because it reduced the value of their assets. The Charles River Bridge case, which allowed that “charters only grant exclusive privileges when stated directly in the charter, and that exclusivity is not valid if it prevents improvements and increases in public welfare,” put an end to such claims and ensured the rapid growth of the railroad network in the United States.\(^{13}\)

The application of this precedent to the electricity industry is striking. In electricity, technological progress and investment in new generation assets threatens to reduce the income flows to the old capital just as the Warren Bridge threatened the income flow to the Charles River Bridge. Also, in the broad array of hearings, rulemakings, and adjudication that are said to comprise the “regulatory compact” in electricity, there is no specific cause of action or promise for stranded cost recovery just as there was no explicit exclusive charter for the Charles River Bridge.

The Charles River Bridge precedent was upheld and extended in the case of Market Street Railway.\(^{14}\) Here the court specifically addressed the issue of technological change within a regulated industry. Market Street Railway operated a streetcar franchise in San Francisco. Market Street Railway was an ailing company in an industry full of similarly situated firms. The whole streetcar business was past its zenith. In 1919, the Secretaries of Commerce and Labor reported to the President that a considerable percentage of urban street railways were in receivership. The industry as a whole was nearly bankrupt.\(^{15}\) Shortly thereafter, a presidential commission reported that only joint changes by municipalities and operating companies could save the industry.

From 1912 to 1921, Market Street Railway operated streetcars in the City of San Francisco in competition with city owned lines. It appears that both charged 5¢ per ride. In 1921, the parent company, United Railroad, went bankrupt. The bondholders took control of the operating company, Market Street Railway. In 1937, Market Street petitioned the Railroad Commission of California to raise its rates to 7¢, and this went into effect in 1939. However, the fare increase failed to increase revenues. At the outbreak of the war, revenues did increase. However, the commission decided that this was a temporary event and that Market Street’s fare should be cut to 6¢. The 6¢ fare was based, in part, on the commission’s determination that the value of Market Street’s assets was $7.95 million, based on an offer by Market Street to sell the lines to the City of San Francisco. After the case began, Market Street did sell out to the city for $7.5 million. However, the book value of Market Street’s assets in 1942 was $42 million.

Market Street sued the commission for cutting its fare and claimed, among other things that the Hope\(^{16}\) case required the commission to set rates that would indemnify the historical cost of assets. However, the court disagreed:

…[It] may safely be generalized that the due process clause has never been held by this Court to require a commission to fix rates on the … historical valuation of a property whose history and current

\(^{13}\) Harrison (1997), p. 35.
\(^{15}\) Id., p. 566, note 18.
financial statements showed the value to no longer exist ... even if once prudently made[...] ... [Due process] has not and cannot be applied to insure values or to restore values that have been lost by the operation of economic forces.\textsuperscript{17}

The court’s opinion in \textit{Market Street} was forceful and succinct. It brings into focus the important interaction between technological change and regulatory policy. In the street car business, technological progress in transportation made streetcars less and less valuable. People chose other modes of transportation and as a result, the market value of street car assets declined. The court ruled decisively that rate regulation should not and, indeed, could not, given the situation that faced Market Street Railway, rescue obsolete assets.\textsuperscript{18}

Proponents of stranded cost recovery in the electric utility industry argue that the \textit{Market Street} case has little significance for the current debate because the source of unrecoverable assets in the electricity industry is regulatory change rather than a technological transformation of the industry.\textsuperscript{19} It is true that integration of the electric power grid has created an industry that allows for competition. However, as we argue above, it is technological progress in generation that has caused the value of existing generation facilities to decline in value. Regulatory change has not caused stranded costs; it has merely highlighted them. Even when analyzed from the perspective of regulatory rate making, the fact is that technological change has created a situation where electricity prices should be lowered whether by rate making or managed competition. The court’s decision in \textit{Market Street} says that this can be done even if it imposes significant losses on the asset values of utilities.

More recent legal precedent continues to hold that stranded cost recovery is not guaranteed when economic forces move against the interests of the regulated firm. In \textit{Duquesne Light}, the Supreme Court looked more specifically at the circumstances under which a utility may be allowed to recover its capital costs.\textsuperscript{20} In 1967, a group of Pennsylvania utilities agreed to the joint construction of a series of seven nuclear power plants. In 1980, when four of the plants were canceled, Duquesne Light Co. sought to amortize the costs of the four plants. That same year, the Pennsylvania legislature passed legislation that excluded from the rate base any construction costs for generation prior to the time those generators were brought into public service. That is, an investment must be used and useful if it is to be included in the rate base. Because the four plants were cancelled and would not be put into public service, Duquesne sued when the legislation excluded the plants from the rate base.

The Supreme Court held that the state was within its rights by excluding the four plants from the rate base and that states have “broad limits” when crafting rules for cost recovery. Moreover, the court specifically determined that the disallowed cost recovery “did not take appellant’s property in violation of the Fifth Amendment.”\textsuperscript{21} According to the court, “‘all that is protected against, in a constitutional sense, is that the rate fixed by the commission be higher than a confiscatory level.’”\textsuperscript{22}

\textsuperscript{17} \textit{Market Street}, p. 567.
\textsuperscript{18} Interestingly, the case itself was fought over the escrowed one cent fare reduction. The fare was never actually reduced from 7¢ to 6¢. A lower court had stayed the rate decrease under the condition that it be rebated to consumers if Market Street lost its appeal. In the mean time, Market Street sold out to the city.
\textsuperscript{19} In particular, Sidak and Spulber.
\textsuperscript{21} \textit{Id.}, p. 299.
In Duquesne, the Supreme Court also suggested a test, albeit a weak one, to address the question of what was to be considered confiscatory. Here, too, the court’s logic implies that there should be no expectation of recovery in the relationship between the utility and its regulators. The court reviewed the problems that it faced when it issued the landmark decision in Hope (1944) and abandoned the rule of Smyth v. Ames. The earlier decision had held that fair value was the only constitutionally acceptable method of fixing rates. However, as noted by Justice Brandeis in an intervening case, the fair value rule is potentially circular when applied to regulated utilities: The market value of assets are determined by the cash flows that they generate, but cash flows in a regulatory setting are determined by rates based on the value of capital. Ultimately because of this circularity, the court in Hope broadened the discretion available to regulators in determining the value of assets to be used in the rate setting process. In Duquesne the court reaffirmed Hope:

"[I]t is not theory but the impact of the rate order which counts. If the total effect of the rate order cannot be said to be unreasonable, judicial inquiry .. is at an end."24

But even in doing so, the court pointed out that not all of the difficulties are resolved. There is no universal way to split the baby:

This language, of course, does not dispense with all of the constitutional difficulties when a utility raises a claim that the rate which it is permitted to charge is so low as to be confiscatory: whether a particular rate is “unjust” or “unreasonable” will depend to some extent on what is a fair rate of return given the risks under a particular rate-setting system.25

Duquesne provides an important benchmark for evaluating any regulatory contract. In addition to stating that cost recovery is not guaranteed, the precedent goes further by stating that even “prudent investments” approved by the state utility commission have no guarantee of recovery. Utility commissions conduct prudency reviews to ensure that utility investments are in the public interest. Many proponents of stranded cost recovery assert that when a utility commission deems an investment prudent, the investment is assumed to be an integral part of the obligation to serve, and therefore any outlays should be recoverable. However, in Duquesne, the court reiterates that regulation is forward looking even if the accounting practices are based on historical cost. Investments, even prudent ones, that become un-used and un-useful are not guaranteed indemnification. When looking at overall effect of rates on returns to equity, as long as equity is not arbitrarily eliminated, a policy denying stranded cost recovery is constitutional.

In fact, the court flatly rejected the idea that the prudent investment rule should be adopted as a constitutional standard. It said that such a move would be a retreat from 45 years of law. Moreover, the court pointed out that the “designation of a single theory of ratemaking as a constitutional requirement would unnecessarily foreclose alternatives which could benefit both consumers and investors” (p. 316), and in a footnote to this said, “For example, ...[t]he emergent market for wholesale electric energy could provide a readily available objective basis for determining the value of utility assets.” Indeed, in Duquesne in 1989, the court precisely

24 Duquesne, p. 310, quoting Hope.
25 Id.
26 Notably, Sidak and Spulber.
TECHNOLOGICAL PROGRESS

anticipates the situation in which we find ourselves today and remarks that it is to be considered a benefit to all parties.

B. Application to the Current Condition

In Duquesne, the court warns against “arbitrarily” changing the rules of the game back and forth between historical and reproduction cost methods of accounting. This is an admonition against regulators acting capriciously, not that they should stand as a stonewall oblivious to technological advances. Regulators cannot ignore the march of technology or the burgeoning competitive market for electricity. As the legal history makes clear, regulators have a duty to balance the demands of consumers with those of the regulated industry to establish a fair price. If new ways of doing business emerge that can significantly reduce the price of electricity, regulators must acknowledge such changes when determining regulatory policy. The courts have made clear that in the absence of specific language addressing the recovery of capital outlays, there is no contractual obligation on the part of state utility commissions to provide for guaranteed capital recovery to regulated utilities. Historical costs need not be paid for resources that have lost their economic value. In determining a fair price, regulators should continue their effort to mimic market outcomes, including the cost reductions entailed by new technologies.

The rule adopted by the court is consistent with good economics. A market economy is built on the profits and losses that result from the shifting sands of market forces. Changes that impose losses on one group almost by definition bestow gains on others. When the gains undeniably outweigh the losses and when there is no explicit contractual abrogation or property right confiscation, letting market forces operate maximizes wealth and welfare in the long run and ensures economic prosperity.

There is no better example of this than the case of stock and bond holders of electric industry securities. There is little doubt that competition will cause the value of these assets to decline. However, the loss in value that occurs in these assets will be more than made up by gains in other securities. Electricity deregulation will bestow net positive benefits to the economy in the form of net consumer and producer surplus and increased income and employment.\footnote{See Maloney, McCormick, and Sauer (1996) for estimates of these effects.} The net benefits from electricity deregulation will cause the overall stock and bond markets to increase in value. Hence, a fully diversified investor will gain from electricity deregulation even though the electric industry portion of the diversified portfolio will decline in value.

The ultimate empirical question concerning stranded cost recovery is whether the benefits to society from denying it are unquestionably larger than the losses imposed on capital owners in the industry. Kahn (1988) makes this point lucidly. In analyzing the issue of the appropriateness of reproduction-cost versus historical-cost rate regulation, which is really the heart of stranded cost recovery, he notes that the choice of accounting method is not nearly so legalistic or theoretically academic. It is one that is basically pragmatic. If service of acceptable quality in any regulated industry is to continue, investors must be given a fair shot at recovering their investment.\footnote{Kahn (1988), p. 34-41. The standard method of rate regulation uses historical cost accounting. In Smyth v. Ames, after a good bit of legal jousting the court held that reproduction cost was the appropriate benchmark for rate regulation. This position was reversed in Hope, where the court said that regulators could use whatever standard they wished. The test of “just and reasonable” should be judged on the outcome of whether the utility could operate successfully. As a consequence of Hope, most commissions adopted historical cost accounting because it is a simpler approach.}
Investors are not going to put money in if there is no chance of getting it back. This poses the fundamental question of stranded cost recovery: Is it likely that denying stranded cost recovery will stifle capital investment in the electric industry or any other industry to the detriment of overall economic prosperity?  

IV. ECONOMIC PROGRESS AND THE REGULATORY COMPACT

One thing that seems apparent when we examine the evidence from the electric as well as other industries, is that in a market economy, entrepreneurs are willing to accept the risk of technological obsolescence. Time and again we see firms investing large sums in products and technology with the almost certain expectation that these devices will become obsolete before they wear out. Technological progress threatens the value of capital assets. Technological progress lowers the cash flows that can be derived from the operation of existing capital thus making it obsolete. Financial markets take this into account when the capital is first put into place. When the expectation becomes eventuality, the market moves on.

There are two cases to which we can look for systematic empirical evidence on this point. The first is the case of non-utility generation assets in the electric industry itself. The other is the case of obsolescence, deregulation, and capital spending in the telecommunications industry.

A. Non-Utility Electric Generators

Right now there is a substantial portion of electric generation capacity that is owned by non-utilities. This segment of the industry is the fastest growing part. It is also the case that this segment of the industry is itself writing off a good deal of obsolete capital. In the 1980s, non-utility generators invested heavily in capital that, just like utility generation, is now proving to be obsolete. Non-utility generators have no forum from which to argue for stranded cost recovery. Their obsolete equipment is merely written off. In spite of the fact that they are not shielded from the losses imposed by technological progress, this segment of the industry is thriving.

Let’s review the facts concerning non-utility electric generation. In 1978, Congress passed the Public Utilities Regulatory Policies Act (PURPA) in response to the energy crisis of the early 1970s. The legislation was designed to encourage energy efficiency and increased reliability through the industrial cogeneration of electricity.

Arguably, the deterioration of the natural monopoly conditions in the electric power industry, coupled with the general policy trends since 1978 for deregulation, would have eventually raised the question of introducing competition in the electric power industry. However,
PURPA amplified and accelerated this policy option. The legislation made two points abundantly clear to both the industry and policy makers. First, alternative sources of electrical generation could arise without any loss in overall economic efficiency. The fact that cogenerators and other non-utility generators can provide electricity efficiently and at rates which are competitive with electric utilities was clearly proven by PURPA. Second, the transmission provisions of PURPA showed that electricity could be moved between utilities without any significant loss in reliability. These two trends are directly responsible for the continued expansion of competitive opportunities in the electric power industry.

Historically, the industrial (non-utility) supply of electricity made a significant contribution to the country’s total generating capacity. In 1900, over 59 percent of total U.S. generating capacity was located at industrial sites. However, by 1978, industrial electricity capacity had fallen to a low of 2.7 percent of total generating capacity. It is now around 10 percent, in large part thanks to the provisions in PURPA.

One of the earliest problems associated with PURPA implementation at the state level was avoided cost determinations. These cost methodologies had a direct impact on the level of the buyback rate for cogenerated power, and as a result, the level of cogeneration which was brought on-line in any given state. Clearly, the more “generous” the avoided cost methodology, the greater the incentive for cogenerated power. These generous methodologies led to a dual incentive for industrial firms considering cogeneration: (1) an energy efficiency incentive and (2) a profit incentive. As a result, a significant amount of cogenerated power came on line during the years following the passage of PURPA.

Following the passage of PURPA, FERC initiated a number of rule-making proceedings implementing the conditions and specifics which would guide state implementation of the new law. These implementation rules, particularly those specifying the definition of “avoided costs,” were challenged in court in the years following the passage of PURPA. These legal battles created an aura of uncertainty for industrial firms considering taking advantage of the new provisions of the legislation. Some of these uncertainties were removed in the early 1980s by two important Supreme Court decisions. In 1982, the U.S. Supreme Court upheld the constitutionality of PURPA, and in the following year, the high court went further in eliminating industry uncertainty by reversing a lower court ruling which upheld FERC’s avoided cost definition for establishing cogenerated power buy-back rates.

Over the years a significant amount of attention has been given to the extreme examples of generous purchased-power policies and the lucrative cogeneration projects which sprang from these policies. However, investment in these non-utility generating facilities does not come without risk. Despite the best made plans, non-utility generating projects can and do fail. Reasons for these failures include:

- failure to complete the appropriate permitting (siting, environmental);

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32 A number of studies have examined the incentive structure for firms contemplating cogeneration. The first descriptive and theoretic analysis was presented by Joskow (1982). Later empirical examinations were presented by Joskow and Jones (1983), Joskow (1984), Fox-Penner (1990a, 1990b) and Rose and McDonald (1991). The Fox-Penner and Rose and McDonald analyses explore the dual incentive and generally support the role that buy back rates have played on cogeneration capacity and generation decisions.
- inability to secure financing;
- changes in technology;
- unanticipated changes in qualifying-facility contract terms, conditions, and enforcement;
- failure to finalize contracts on fuel supply; steam supply, fuel transportation;
- difficulty in meeting contract terms with purchasing utility.  

Of the non-utility generation that has come on line since 1978, a significant percentage has been retired or mothballed. This is shown in Table 2. Based on surveys of non-utility generation, there has been 50,666 MW of non-utility generation installed from 1978 through 1994. Of this over 5 percent is shut down. While this number is not overwhelming, it does represent investment in electricity generation that is not subject to stranded cost recovery. Even more striking is the fact that 10 percent of the investment made in the 1980s has been retired, and 17 percent of the investment in the first half of the 1980s. This investment was made during the most uncertain period of the interpretation PURPA legislation and arguably was predicated on the expectation of much more favorable buyback rates than actually materialized. In spite of the fact that these investments are not subject to indemnification by government fiat, the amount of investment in non-utility generation appears to be growing.

The amount of non-utility capacity that has been installed over the years can be calculated from Table 2 by adding together the amount has been shutdown and that is still operating. Figure 1 weights non-utility capacity additions by total generation investment. Figure 1 also shows the percentage of non-utility generation installed in each year that has been shutdown. The date that the capacity was retired is not known. The graph displays the wave of obsolescence following a rising tide of investment. The amount of non-utility generation capacity that has been installed over that last several years is impressive on its own, it is impressive relative to the amount of utility generation that is being installed, and it is impressive relative to the amount of prior capacity that is being written off by the forces of competition acting on the non-utility generation sector of the industry.

The conclusion is that changes in governmental policy as well as advances in technology have occurred and caused some non-utility investments in generation to be abandoned. These investments are not subject to stranded cost recovery. In spite of the fact that investors must worry that the wave of obsolescence may crash down upon them, there has been no diminution in investment in new capacity.

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Table 2: Comparison of Shutdown to Operating Non-Utility Generation

<table>
<thead>
<tr>
<th>Commercial Operation Date</th>
<th>Shutdown Capacity (MW)</th>
<th>Operating Capacity (MW)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pre PURPA*</td>
<td>1902</td>
<td>4197</td>
</tr>
<tr>
<td>Unknown*</td>
<td>279</td>
<td>3429</td>
</tr>
<tr>
<td>Post PURPA*</td>
<td>13</td>
<td>0</td>
</tr>
<tr>
<td>1978</td>
<td>0</td>
<td>265</td>
</tr>
<tr>
<td>1979</td>
<td>0</td>
<td>410</td>
</tr>
<tr>
<td>1980</td>
<td>226</td>
<td>447</td>
</tr>
<tr>
<td>1981</td>
<td>43</td>
<td>193</td>
</tr>
<tr>
<td>1982</td>
<td>167</td>
<td>1231</td>
</tr>
<tr>
<td>1983</td>
<td>348</td>
<td>953</td>
</tr>
<tr>
<td>1984</td>
<td>329</td>
<td>2666</td>
</tr>
<tr>
<td>1985</td>
<td>285</td>
<td>3327</td>
</tr>
<tr>
<td>1986</td>
<td>464</td>
<td>2568</td>
</tr>
<tr>
<td>1987</td>
<td>174</td>
<td>4013</td>
</tr>
<tr>
<td>1988</td>
<td>200</td>
<td>4021</td>
</tr>
<tr>
<td>1989</td>
<td>218</td>
<td>3865</td>
</tr>
<tr>
<td>1990</td>
<td>202</td>
<td>5511</td>
</tr>
<tr>
<td>1991</td>
<td>40</td>
<td>4715</td>
</tr>
<tr>
<td>1992</td>
<td>33</td>
<td>4749</td>
</tr>
<tr>
<td>1993</td>
<td>52</td>
<td>3138</td>
</tr>
<tr>
<td>1994</td>
<td>2</td>
<td>5798</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>4978</strong></td>
<td><strong>55,495</strong></td>
</tr>
</tbody>
</table>

* Exact date of initial commercial operation unknown.
Source: Dismukes & Maloney (1999). Data are the combination of surveys of the Edison Electric Institute and Utility Data Institute.

Figure 1: Non-Utility Electric Generation Capacity Adjustments
B. Deregulation of Long Distance

The deregulation of the long distance telecommunications industry offers a virtual laboratory experiment from which to assay the effects of denying stranded cost recovery. The telecommunications industry has been rate regulated for a very long time, and this regulation came about because of the explicit request of the regulated firm, AT&T. Moreover, competition was introduced into the industry without stranded cost recovery and in a way that foretold of further deregulation in the areas that were not immediately subjected to competition. All told, if stranded cost recovery were a necessary ingredient for successful policy change, the telecommunications industry should be in shambles.

The summary facts are that for fifty years, the Bell system enjoyed a regulated monopoly in which it charged rates based on the embedded, historical cost of capital. It also engaged in a deliberate attempt to cross subsidize certain classes of customers. Beginning in the early 1960s and continuing through the divestiture in 1984, Bell was forced by regulators to deal with increasing competition in its most profitable lines of business. This competition was driven by technological progress that significantly altered the cost structure in the industry. Competition inflicted significant stranded costs on AT&T with little or no discussion of indemnification. The question that we pose is, What was the effect of this change in the regulatory regime on the well-being of telecommunication consumers?

As has been detailed by other researchers, the price of long distance service has fallen substantially as competition has made greater and greater in-roads into the industry. The continued decline in this price gives us some assurance that restructuring of telecommunications was not just of transitory benefit to consumers. However, the empirical, positive-economics dimension of the claim for stranded cost recovery is that the abrogation of the social compact will cause investors to withdraw financial capital from the restructured part of the industry as well as other parts of the industry that remain regulated. Capital spending by the firms operating in the telecommunications industry can be used to examine this proposition.

Capital spending in real terms increased an average of 3.5 percent over the years 1956 through 1983, the year before the AT&T breakup. Since 1983 capital spending by all firms in the industry has increased by 2.5 percent (through 1996). Rather than capital flight from either the deregulated or regulated sectors of the industry, there has been a continuous capital infusion.

Figure 2 shows capital spending in the telecommunications industry from 1977 through 1996. The industry is comprised of the Bell companies, which combines AT&T with the Regional Bell Operating Companies after the divestiture, as well as a break down of the other components of the industry. There are the four major Bell competitors (MCI, Sprint, GTE, and Alltel), other phone companies like Continental Telephone, cellular providers, and equipment manufacturers. The series depicted in the graph are (ordered from highest to lowest on the left side): Total telecomm; Bell companies; GTE, et al.; other phone companies; equipment manufacturers; and cellular companies.

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35 This section is taken from Maloney (1998).
36 See Crandall and Ellig.
The picture painted by these figures by no means depicts an industry starved for capital. In real terms, capital expenditures for the industry as a whole increased continuously during the 1960s, the time of the first recognition that competition was a significant possibility. Since 1970, capital spending has generally increased in real terms albeit the path has been less smooth. Clearly, there has not been a flight of capital from the industry.

In the 1970s and 1980s there were two episodes where capital expenditures declined. One was during the recession of the mid-1970s. The other was during the early 1980s. It is arguable that the decline in capital spending during the early 1980s was a result of the divestiture by AT&T of its regional operating companies. Capital spending by the other phone companies did not decline during this period as it did during the mid-1970s.

Since the AT&T breakup, there has been a modest decline in capital spending by the combined Bell companies. However, this has been offset by an increase in capital spending by other telecommunications firms. In 1977, Bell accounted for more than two-thirds of the capital spending in the industry. By 1996, AT&T and the combined Bell companies made around on-half of the capital purchases. Partly this is due to the fact that there has been a substantial amount of corporate reorganization in the industry. Cellular technologies have grown dramatically. Capital spending in the cellular part of the industry was essential non-existent in 1977, whereas it was 8 percent in 1996. Moreover, AT&T spun off Lucent Technologies in 1995 which itself accounted for 2 percent of industry capital expenditures in 1995. It is also interesting to note that capital spending by other phone companies surged fairly strongly in the period just following the AT&T breakup.

The undeniable conclusion is that in spite of a restructuring of dramatic proportions, the telecommunications industry has evidenced no debilitating effects. Technological progress
continues at a strong pace and with it capital spending. Restructuring has caused the face of the industry to change, but not for the worse from the perspective of the consumer.

VI. CONCLUSION

The arguments presented in this paper are built on the simple premise that stranded costs in the electric industry are a result of engineering advances in generation technology. Continuing and rapid improvements in the efficiencies of electric generators have made a substantial portion of the existing capital stock of the electric industry obsolete. Similar events have occurred in other industries.

Because stranded costs are the result of technological progress, it does not make sense to blame them on competition. Moreover, if we examine the case for stranded cost recovery in the traditional rate-regulation methodology, both legal and economic justification for indemnification of obsolete assets is lacking. Case law addressing precisely this issue starting with the Charles River Bridge decision and following through Market Street Railway and Duquesne all concludes that when assets no longer reflect true economic value, there is no requirement that regulators set rates that recover their book value. Indeed, the court has been especially sensitive to the fact that regulation that insulates markets from technological progress retards economic prosperity. This case law is consistent with good economics. The true avoidable cost of production should be the standard by which regulated rates are determined for this very reason.

Because stranded costs are a technological phenomenon, the decision to alter the process by which the electric industry is regulated should not become confused with the question of stranded cost recovery. Most policy analysts agree that managed competition in the supply of generation services with continued rate regulation of the transmission and distribution system is the best way to oversee the electric industry. Allowing competition in the generation segment of the electric industry merely reflects a change in the relative costs and benefits of alternative regulatory techniques.

Should policy makers choose to use open-access competition as the vehicle by which obsolete generation assets are marked to their market value, it is not a land-snatch or a violation of the regulatory compact. In particular, it does not imply that financial markets will view future government-sanctioned markets with increased risk. On the basis of economic efficiency, financial markets should always account for the risk of technological obsolescence when evaluating projects. There is ample evidence to suggest that financial markets are keenly aware of this risk and accept it willingly. To the extent that regulation encourages this aspect of efficient risk bearing, it improves economic efficiency rather than destroying it.

References


