Paradox of Thrift

Economic barriers complicate T&D modernization.

By James M. Seibert

Industry interest in transmission and distribution (T&D) network modernization and the ubiquitous smart grid seemingly couldn't be higher. The infrastructure security challenge that developed in the wake of September 11th, 2001 and the August 2003 blackout elevated the modernization topic, and it has more recently become a white-hot industry need that has been supercharged by the *American Recovery and Reinvestment Act* of 2009.

While enthusiastic equipment vendors and zealous environmentalists push for the comfort of mandated modernization requirements, more thoughtful industry stakeholders are seeking to develop a technically and economically rational approach to modernize the T&D network. The core of this challenge lies in making modernization a financially attractive investment and it has two essential ingredients. First, investment resources must be available through consumer rates to provide utilities with the capability to invest in T&D modernization. Second, future rates (and ratemaking policies) need to embody the economic relativities of new, rapidly changing (and thus obsolescing) technologies that are replacing the industry's technically stable assets. In both of these areas, challenging the industry's conservative investment and depreciation practices likely will be necessary to make widespread, economically rational T&D modernization occur.

T&D Replacement

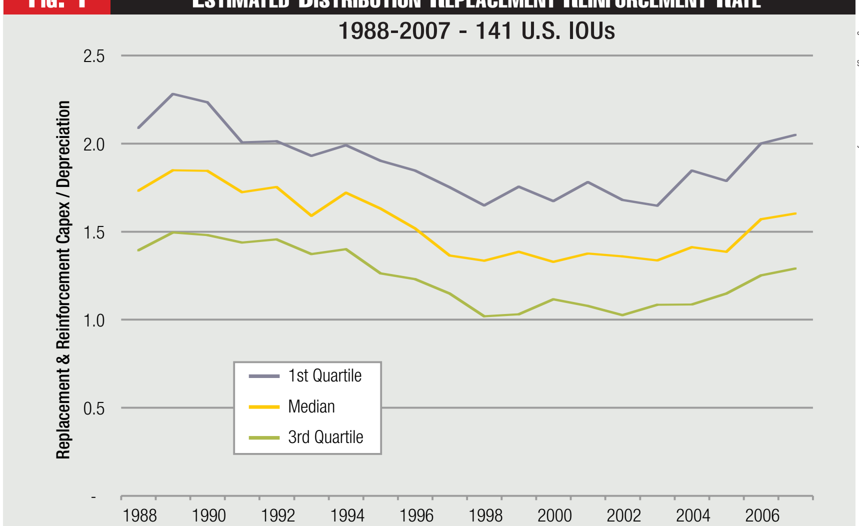
T&D network modernization is fundamentally an investment decision; more specifically, network modernization is better characterized as a reinvestment decision. This refurbishment of the T&D network doesn't add new customers, incremental load, or additional revenue to the electric system. Ironically, many of the positive elements of modernization investments will, in fact, reduce energy sales though conservation and efficiency.

Thus, predicting the likely pace of the industry's (or any individual utility's) T&D network-modernization efforts begins with an understanding of how the utilities make such reinvestment decisions. With the exception of those jurisdictions that simply mandate network modernization, the reinvestment decisions made by most utilities will follow logical and economically-rational patterns (*see Figure 1*).

Conceptually, T&D investments can be characterized in two ways: first, investments related to new business; and second, the balance of T&D investments related to reliability needs, equipment replacement and reinforcement requirements, and mandated investments such as relocation of system assets. Traditional ratemaking is designed to make new business investment neutral to the existing customer base [through contribution-in-aid-of-construction (CIAC) policies]. The balance of system investment must be economically justified either through existing rates, potential operating cost savings, incremental energy sales, or through planned rate increases.

Although GAAP and FERC accounting practices don't strictly characterize investments from this new business versus replacement perspective (indeed, investments are characterized by the nature of the assets themselves, not their rationale), these investment reasons are very much a part of the typical T&D investment planning processes and decision criteria. »

Fig. 1 Estimated Distribution Replacement-Reinforcement Rate



Source: Chicago Energy Associates LLC Analysis of FERC Form 1 Data

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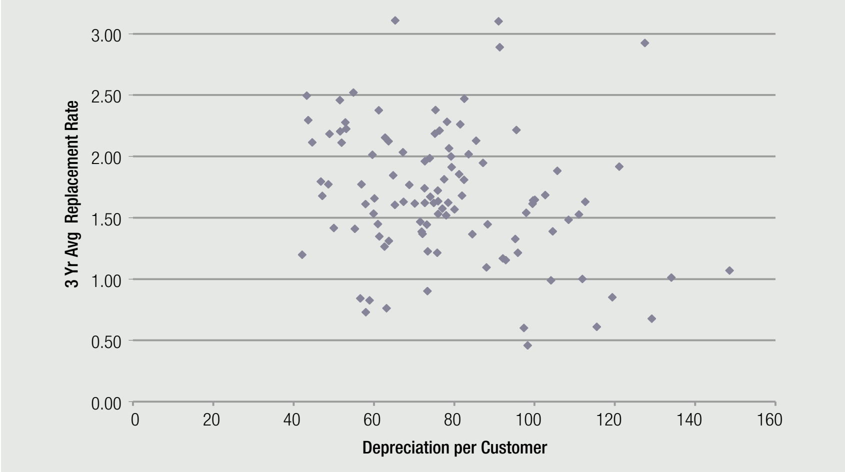
Fig. 2 — Distribution Replacement Rate vs. Depreciation per Customer



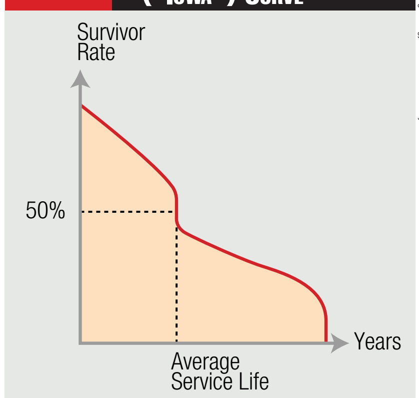
Source: Chicago Energy Associates LLC Analysis of FERC Form 1 Data

Fig. 3 — Reinvestment Rates

Depreciation Per Customer	Repair-Reinforce/ Depreciation
Lowest Quartile	1.79
2nd Quartile	1.70
3rd Quartile	1.79
Highest Quartile	1.47

Source: Chicago Energy Associates LLC Analysis of FERC Form 1 Data

Fig. 4 — Illustrative Survivor ("Iowa") Curve



Source: Chicago Energy Associates LLC Analysis of FERC Form 1 Data

The level of any utility's reinvestment activity can be estimated by examining its total investment but excluding the predominately new business-related investments in meters, services, and customer installations. Figure 1 presents a 20-year industry-wide analysis of the estimated electric distribution system reinvestment levels (relative to depreciation) for 141 investor-owned electric utilities. The relationship to depreciation is an important one: a reinvestment level greater than one (*i.e.*, reinvestment / depreciation > 1.0) suggests that a utility eventually will raise rates (presuming no change in per-customer usage of existing customers) to economically recover the investment. Reinvestment levels less than one suggest a utility is substantially disinvesting in the network. In short, they are sweating the assets.

Note that reinvestment levels for all elements of the industry (first quartile, median and third quartile) declined throughout the 1988 to 1998 era (*see Figure* 1). Regulatory uncertainty in this era resulting from transition-to-completion initiatives and rate freezes from merger activities led many utilities to invest more into unregulated assets and less into traditional T&D infrastructure. Industry reinvestment levels later were relatively flat and at historically low levels during the 1998 to 2003 era. During this time, investments were focused on back-to-basics strategies in the wake of the Enron and California debacles. Interestingly, the lowest (fourth) quartile of the industry was at or below a 1.0 rate in the early 2000s; in effect, utilities in this lowest quartile were disinvesting in their systems.

Since 2003, total reinvestment rates have risen industry-wide. This is consistent with the increasing rate-case activities in many jurisdictions. This has multiple causes—the rising cost of materials, the increasing attention to reliability investment, and the industry's nascent modernization investments.

> Utilities reinvest at the level of capital resources available in rates, not necessarily at the level of system needs.

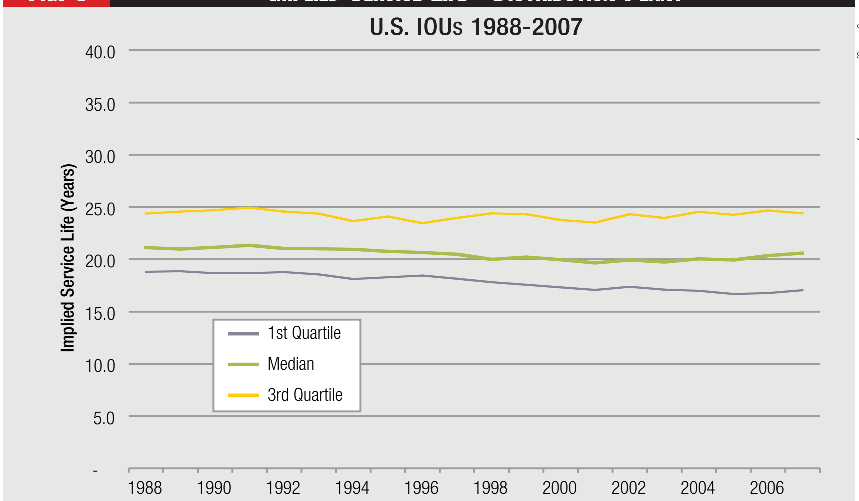
How Much to Reinvest?

This introduction will raise logical questions from experienced industry observers. Are replacement rates relatively high (*i.e.*, reinvestment/depreciation ≥1) or relatively low (say, less than 1) simply because the depreciation levels are inversely high or low?

Figure 2 presents a wide sample of the three-year average distribution replacement rates (replacement and reinforcement CAPEX/depreciation) for over 100 U.S. electric utilities. The scatter diagram shows that replacement rates are relatively uncorrelated to the level of depreciation (as measured by annual depreciation expense per customer). Figure 3 summarizes the data in Figure 2 and highlights this point further. It shows that the average reinvestment rate (as measured by the reinvestment/depreciation) is substantially identical for lowest, second, and third quartiles for utilities when they are categorized by depreciation per customer. The implication of this figure is fundamental but vital for corporate and regulatory policy makers—utilities reinvest at the level of capital resources available in their rates, not necessarily at the level of their system needs.

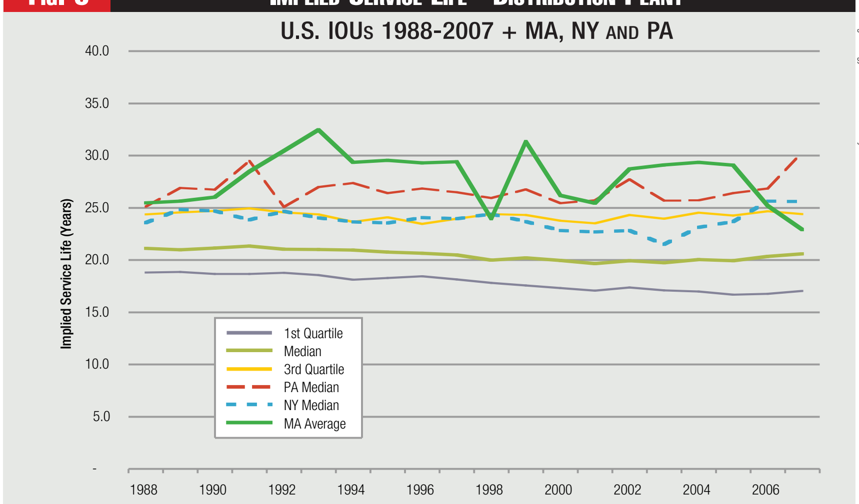
Although this may seem to be an obvious outcome, its documentation is an essential foundation and its »

FIG. 5 **IMPLIED SERVICE LIFE - DISTRIBUTION PLANT**



Source: Chicago Energy Associates LLC Analysis of FERC Form 1 Data

FIG. 6 **IMPLIED SERVICE LIFE - DISTRIBUTION PLANT**



Source: Chicago Energy Associates LLC Analysis of FERC Form 1 Data

implications are vivid. Rational electric utilities reinvest only at the level of the capital resources available to them in their rates. The amount of depreciation embedded in rates, and thus available to fund vital infrastructure reinvestment, should therefore be a topic of great concern for utility executives and regulators alike.

Depreciation Resources

Understanding the level of depreciation in rates is central to determining the economic resources available to modernize the T&D network. The starting point is to recall that depreciation in a regulated utility doesn't strictly follow normal accounting principles (*e.g.*, simple-fixed-life, straight-line depreciation). Rather, regulatory depreciation practices in many jurisdictions have been (appropriately) designed to encourage utilities to realize the maximum practical technical and economic life out of any asset in the following way:

> **Future ratemaking policies need to embody the economic relativities of new, rapidly changing technologies.**

Depreciation rates are set periodically by defining the average service life (ASL) of each major asset class. The ASL is defined as the point where 50 percent of the assets of each type have survived (*see Figure 4*). The ASL for all assets is periodically reevaluated at intervals that vary by jurisdiction. These methodologies follow the "Iowa" approach that dates from the 1930s.[1]

A key implication of this approach is that if a utility removes a specific asset from service before its ASL, it loses the remaining depreciation. This under-recovery theoretically is rectified by that portion of the asset class that survives longer than the class average.

Fortunately, overall the industry's depreciation practices haven't necessarily led to bias of extending the service lives of assets. The long-run trends of the industry's implied ASLs estimated from depreciation rates of distribution plant has been substantially flat (perhaps slightly declining) over a very long time period (*see Figure 5*). This stability of the implied service lives of distribution plant is consistent with the historically stable technologies, stable regulation, and the long-lived nature of these assets.

Although the overall industry trends suggest relative stability of the implied ASLs (and thus stability of depreciation rates), a closer examination of individual companies and jurisdictions reveals some critical challenges for some key jurisdictions and individual utilities. For example, Figure 6 highlights the overall industry trends with an overlay of the average implied service lives for distribution assets in the States of New York, Pennsylvania, and Massachusetts. For example, the ASLs of Pennsylvania utilities are systematically much longer than industry averages and indeed are getting relatively worse. These findings affirm those of other observers;[2] these results also are similar for New York as they have been consistently at third and fourth quartile. »

Fig. 7 **Sample of Implied Service Lives (in Years)**

	FERC Account	Account Description	Tampa Electric	PG&E	Potomac Edison	Pub. Svc. Oklahoma	Madison Gas & Elec	Metropolitan Edison	Georgia Power
Distribution	350	Land / Rights	43.5	84.7				67.1	
Distribution	352	Structures	43.5	47.6	35.5	65.8		44.1	71.9
Distribution	353	Station Eq.	40.0	47.2	73.5	64.5		55.2	51.0
Distribution	354	Towers & Fixtures	41.7	54.6	48.1	51.5		76.9	78.7
Distribution	355	Poles, Towers	22.7	33.2	64.7	35.7		68.0	36.6
Distribution	356	Ovhd Conductor	27.0	42.2	39.7	47.4		80.0	52.4
Distribution	357	Undg Conduit	58.8	81.3	49.5				58.8
Distribution	358	Undg Conductor	41.7	74.6	39.2	39.1			52.6
Distribution	359	Roads / Trails	45.5	73.5				43.3	70.4
Transmission	361	Structures	41.7	43.3	33.8		36.0	67.1	68.5
Transmission	362	Station Eq.	40.0	34.7	51.3	62.1	40.0	68.0	34.6
Transmission	364	Poles, Towers	21.3	22.6	42.0	29.2	24.0	72.5	38.0
Transmission	365	Ovhd Conductor	30.3	22.5	36.2	33.0	30.0	58.5	34.1
Transmission	366	Undg Conduit	50.0	45.2	40.0	45.5	50.0	54.3	53.2
Transmission	367	Undg Conductor	31.3	28.6	22.2	64.9	35.6	34.2	30.9
Transmission	368	Line Xformers	23.8	29.4	28.2	26.6	30.9	45.7	36.4
Transmission	369	Services	31.3	29.0	33.7	36.1	36.4	51.0	39.2
Transmission	370	Meters	15.9	30.6	34.5	25.4	20.0	23.1	29.9
Transmission	373	Street Light	19.2		21.2	12.7	19.6	43.1	21.8

Source: Chicago Energy Associates LLC Analysis of FERC Form 1 Data

The high and frequently rising ASLs are related to low and declining depreciation rates. These low depreciation rates result in a relatively low level of depreciation embedded in current rates. These low levels of depreciation can result in a highly negative self-reinforcing pattern: Low depreciation rates result in low levels of reinvestment, which extend service lives, and further reduce depreciation rates.

The original causes of these trends are multifaceted: Some of the utilities struggled with low investment levels in earlier periods (for example, from nuclear-related crises) and others struggled under onerous rate caps that resulted from merger agreements or deregulation initiatives. At this point, they represent an onerous financial barrier to modernization without a clear expectation of significant future rate increases and periods of lower return between rate cases.

Future Depreciation Rates

While historic depreciation rates play a critical role in determining the investment resources that are available to fund any utility's modernization initiatives, future depreciation rates will play an even more significant role in the pace of reinvestment and the economic return of the total modernization program. The reason for this prominent role lies in the fundamental technical attributes of modernization and other smart-grid investments.

For the past half-century, the electric utility industry has been characterized by very long-lived, mature, and technically stable assets that are evidenced by very steady ASLs (*see Figure 5*). This stability exists in substantially all classes of T&D assets. What's new and different about many smart-grid and modernization investments is that they may not economically fit into the industry's prevailing depreciation patterns. For example, existing metering methods are mostly based on mature electro-mechanical technologies that in today's regulatory and tax framework have an average service life of twenty years or longer (*see Figure 7*).

In contrast to these historic patterns, the latest modernization and AMI investments are based on advanced electronic technologies used in conjunction with automating software. Such technologies in other venues have a practical life of five to 10 years and occasionally shorter. These substantially shorter real or engineering lives in the context of the much longer regulatory and tax lives pose a genuine economic barrier to investment.

The industry's solution to this problem lies in the proven path followed by the telecommunications industry and especially in its rapidly changing cellular segment. Like today's electric industry, for more than a decade the telecommunications industry has faced rapidly changing (and thus obsolescing) technologies. The result has been to progressively challenge and increase depreciation rates (*i.e.*, reduce service lives) in numerous jurisdictions and across the affected asset classes.

Signs of progress are emerging in the electricity industry, albeit slowly. The *Emergency Economic Stabilization Act of 2008* was signed into law in October 2008 and it called for specific provisions for investments related to smart grid. Although it is relatively narrow and proscriptive in scope, it reduced the service life of AMI-related investments from 20 years to 10 years for tax purposes. A bolder initiative is needed to include substantially all T&D modernization investments. More important, state regulatory agencies need to follow this initial lead and make parallel changes in T&D asset service lives for rate-making purposes.

Accelerating Depreciation

Utility investments and rate-making trends have clear implications for electric utility executives and regulatory policy makers. Absent mandates, the level of T&D modernization investment will be linked closely to the capital resources available to utilities through depreciation in rates. Utilities and regulators alike need a full understanding of these factors in relation to their modernization needs.

Selected companies and some entire jurisdictions suffer from having very high ASLs of their T&D assets and thus very low depreciation rates. These utilities will be exceptionally challenged in their effort to modernize their systems.

Regulators and utilities likely will need to increase depreciation rates to create both a funding and a recovery mechanism, and also for modernization, especially in problematic jurisdictions and companies. Accelerated depreciation rates have been proven time and again as an effective means to encourage rapid and targeted investment.

Regulators and utilities alike need to acknowledge their roles in creating the current challenge of low depreciation rates that exist in some jurisdictions and companies, and that these conditions have evolved over years and even decades through rate caps, merger settlements, and ineffective deregulation.

ENDNOTES:

1. *Life Characteristics of Physical Property*, Winfrey and Kurtz, Bulletin 103, June 17, 1931
2. Fitzpatrick, Terrance J., "Revisiting the Keystone State," *Public Utilities Fortnightly*, July 2008, p. 34.