THE RESURGENCE OF NUCLEAR POWER IN THE U.S.

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In a recent article in *Real Estate Issues*,[1] the authors reviewed the likely impacts of deregulation in the electricity generating industry on real property tax assessments, tax revenues and budgets in local "host" communities (counties, cities, townships). In that context, the consensus view of the future of nuclear-fueled power generation was reported to be generally pessimistic. With some notable exceptions,[2] the "authorities" were forecasting a diminishing role for nuclear power because of increasing numbers of plant closings; limited prospects of license renewal for the remaining operating plants; and (above all) the inability of high-cost nuclear power stations (NPS) to compete effectively with existing coal-fired plants and new, highly efficient and environmentally "clean" combined-cycle natural gas-fired plants.

Since that article was written, a series of major market events, coupled with record-high levels of crude oil, natural gas, and refined petroleum prices, have combined to call for re-evaluation of the likely role of nuclear power in the U.S. economy for at least the first half of the 21st century. This manuscript addresses the significance of those events, and of developments in the markets for fossil fuels, for the likely future of nuclear power.

BACKGROUND TO THE ANALYSIS

The 1992 Comprehensive National Energy Policy Act mandated competition (most especially competitive pricing at the wholesale level) in the electricity generation segment of the U.S. electric utility industry.[3] Wholesale electricity price competition was intended to be achieved

through ownership and operation of generating facilities by non-regulated, non-utilities, which have emerged mostly as subsidiaries of regulated investor-owned utility companies (IOUs).

Beginning in 1997, several major states (e.g., California, Illinois, Michigan, New York), plus all the New England states, have sought to accelerate the transition to competitive pricing of wholesale electricity by requiring or "encouraging" their domestic IOUs to divest themselves of all generating capacity. In some states, there was serious debate over whether "non-utility" subsidiaries of domestic IOUs should be allowed to acquire or even bid for their parents' assets.

In a few other states (e.g., Pennsylvania), divestiture has not been required as part of the deregulation process. At the same time, real property tax assessment (and tax collection) has been transferred from the state to local "host" communities.

There have been over 60 auctions or negotiated sales involving more than 225 generating plants reported through August 2000. That process is confidently expected to continue at an even greater pace over at least the near-term future. For non-nuclear-fueled plants, reported sales prices have averaged 132 percent of book value. Nuclear-fueled plant sales prices have averaged well less than book value, however.

Sales prices per kilowatt of capacity (SPKW) for non-nuclear plants have generally increased from late 1997 through March 2000. For example, the sale of 4,276 megawatts (MW) of capacity in 21 plants in Maryland, New Jersey, and Pennsylvania by Sithe Energies, Inc., to Reliant Energy, was announced on February 22, 2000, as a $2.1 billion transfer at an average price of $491 per kilowatt (kW). Sithe acquired the same plants from GPU, Inc. on November 14, 1999, for an announced $1.62 billion. This represents an approximately 30 percent increase in price over a three-month period. These Sithe transactions reflect both increasing competition among a relatively small group of bidders (indicating an oligopsonistic market for generating capacity) and the emergence of a speculative sub-market for non-nuclear generating plants.

The same concentration of buyers is evident in the market for nuclear power stations (NPS). *Table 1* summarizes the characteristics of 10 reported sales agreements for 13 NPS, involving 16 generating "units," from June 1998 through August 2000.

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Except for the sale of a small fractional interest in the Seabrook Power Station in New Hampshire, the reported SPKW of rated generating capacity were quite low over the first 15 months of sales. Some of those transactions were negotiated contracts, rather than auctions. The latter have become the norm for non-nuclear power plant sales. Most of the reported purchases prior to December 1999 were made by AmerGen (a partnership of PECO and British Energy) or by PECO alone. More recently, effective competition has emerged from Entergy, Dominion Resources, Constellation Energy, and Duke Energy.

While some energy industry pundits confidently predicted the demise of nuclear power and the large-scale shutdowns of NPS throughout the U.S., and there have been some closings (e.g., Millstone 1, Zion, Maine Yankee, Connecticut Yankee, among others), *Table 1* shows growth in sales activity, competition, and prices per kW.

Some announced NPS sales are missing from *Table 1:* for example, at least one NPS was transferred when the entire utility company was absorbed in a merger; and details of some pending "sales" were not yet available when this manuscript was written.

Two announced negotiated "sales" (both to AmerGen) were successfully challenged as "not in the public interest" by state public utility regulatory staff, in New York and Vermont. The affected NPS are the Niagara Mohawk interests in Nine Mile Point Units 1 and 2, and Vermont Yankee. These challenges were based on the premise that the bids were not high enough, both in dollar amounts and in "benefits" to the ratepayers in the seller's franchise area. A new form of regulatory agency involvement appears to have emerged to foster the "deregulation" process.

Table 1

Trends in Sales Price per Kilowatt
U.S. Nuclear Power Stations
June 1998 - August 2000

Date Reported	Nuclear Power Station	Seller	Buyer	Capacity Purchased (MW)	Year License Expires	Reported Sales Price ($000,000)	Sales Price per Kilowatt
06/98	Seabrook	Eastern Utilities Assoc.	Bay Corp. Holdings	33.7 (2.9%)	2032	$3.2	$95
10/98 (12/99)	Three Mile Island 1	GPU, Inc.	AmerGen	786	2014	$23.0	$29
11/98	Pilgrim	Boston Edison	Entergy	670	2012	$13.0	$19
04/99	Clinton	Illinois Power	AmerGen	950	2027[a]	$20	$21
09/99 09/99 09/99	Peach Bottom 2&3 Salem 1 & 2 Hope Creek	{ Conectiv Energy	PECO/PSEG PSEG PSEG	328 (15%) 328 (14.8%) 52 (5%)	2013/2014 2016/2021 2026	{ $20	$28
10/99	Oyster Creek	GPU	AmerGen	619	2009	$10	$16
10/99	Vermont Yankee	Multiple	Entergy	540	2012	$23.5	$44
12/00 12/00	Nine Mile Point 1 Nine Mile Point 2	NYS E&G { Niagara Mohawk Rochester G&E	{ Constellation	615 941 (82%)	2008 2027	$273 { $677	$443 $719
03/00 03/00	Indian Point 3 Fitzpatrick	{ NY Power Authority	{ Entergy	980 825	2013 2014	{ $638	$353
08/00 08/00	Millstone Unit 2 Millstone Unit 3	{ Northeast Utilities	{Dominion Resources	870 1,075 (93.5%)	2015 2026	{ $1,195	$614

Source: *Utility Company 8-K's; Vermont Yankee; Power OnLine; Yahoo! Finance*

Notes: *(a) Not operating in 1999*

In earlier NPS transactions, SPKW was extremely low because of uncertainty over the likely cost and timing of decommissioning, responsibility and liability for contributions to the plant's decommissioning trust fund, and the likelihood of required on-site storage of spent fuel rods. More recently, some of that uncertainty has been removed by sellers topping off the trust fund as part of the sales transaction, and by a U.S. Court of Appeals decision discussed later in this manuscript.

The events that have occurred since the third quarter of 1999 have enhanced the relative attractiveness of investing in, owning, and operating NPS. The result has been active competition among a few NPS owner-operators. This has been especially noticeable for plants in the Northeastern U.S., where electricity rates are high, heavy user demand is concentrated in a relatively small transmission-distribution area, several NPS (mostly older, less efficient and unprofitable) have already been shut down, and price competition from oil-fired, coal-fired, and natural gas-fired generating plants is less aggressive than in other regions.

MARKET DEVELOPMENTS TOWARD SUSTAINING NUCLEAR POWER

1. *Treatment of Decommissioning Costs*

NRC requires each NPS owner-operator to set aside an annual sum in a Decommissioning Trust Fund. The amount required for each NPS is determined according to a formula established by NRC. In the past, Trust Funds into which only the annual amounts required by the formula have been paid, have been determined to be underfunded. Accordingly, buyers typically require sellers to "top off" the Trust Fund as a condition of purchasing a NPS. As a result, another element of uncertainty and perceived risk is greatly reduced, if not virtually eliminated.

While the level of anticipated decommissioning and on-site radioactive waste storage costs is still high and remains uncertain, responsibility for full funding of the transferred NPS Decommissioning Trust Fund has generally shifted back to the seller. With up-front or guaranteed "topping" of the fund required (and received) by purchasers, nominal "prices" have risen. Further, the process and technology for decommissioning have reportedly improved.

2. *On-Site Spent-Fuel Storage and Monitoring Costs*

In addition, the U.S. Court of Appeals for the District of Columbia ruled in early September 2000 that four specific NPS owner-operators have the right to sue the U.S. Department of Energy "for damages stemming from the DOE's failure to remove the fuel, starting in 1998, and transferring it to the Yucca Mountain facility in Nevada."[4]

A "permanent" storage site was mandated by Congress in the 1970s, to be available by 1998. Although several billion dollars were subsequently spent to create miles of deep underground vaults, at Yucca Mountain, and the internal train network to serve them, the facility has never been approved. It has not received any spent nuclear plant fuel.

The preliminary expectation of informed writers is that the Court of Appeals decision is applicable to all NPS sites at which spent fuel is being "temporarily" stored. Therefore, less burdensome storage and monitoring costs are forecast for the future.

3. *License Renewal or Extension*

Until March 2000, no NPS in the U.S. had had its operating license renewed by the Nuclear Regulatory Commission (NRC). Nevertheless, many observers and commentators during 1996-1998 assumed that such license renewal or extension would occur.[5] By December 1999, NRC reported that over two dozen license renewal-extension applications were in process.[6] This was nearly a decade before the actual expiration date of the earliest license. These early application requests indicated recognition of both the anticipated long application process before the final hearing, and the need to know well in advance whether plant shutdown would be required.

Table 2 shows that two license renewals were approved in March and May 2000. Each was for 20 years, effectively extending the license life of each NPS to 60 years. Three other formal applications were pending by September 2000.

Industry observers now forecast at least a dozen approvals from NRC by 2003.[7] Because of nuclear power's low operating costs, expectations of profitable operations (assuming lower capital amortization requirements) over an extended operating life can lead to substantial deferral of decommissioning activity and expenditures. This reduces their negative present value impact on potential buyers.

4. *Recovery of Stranded Costs*

In most states actively pursuing deregulation and wholesale price competition for electricity

Table 2

License Renewal Applications
U.S. Nuclear Power Stations

Owner	Power Station	Application Date	Status
Constellation	Calvert Cliffs	April 1998	Approved 03/23/00[1]
Duke Energy	Oconee	July 1998	Approved 05/23/00[2]
Entergy	Arkansas No. 1	February 2000	Pending
Georgia Power Co.	Edwin I. Hatch	March 2000	Pending
Florida P&L	Turkey Point 3 & 4	September 2000	Pending

Source: *Power OnLine: 2/4/00; Yahoo! Finance 9/14/00*

Notes: *(1) Unit 1: 20 years from 2014 to 2034*
Unit 2: 20 years from 2016 to 2036

(2) Unit 1: 20 years from 2013 to 2033
Units 2 & 3: 20 years from 2014 to 2034

generation,[8] the applicable state regulatory commissions (however labeled) have ruled that IOUs are entitled to recover most or all of their "prudently incurred" stranded costs on generating plant investments. "Stranded costs" are the portions of plant investments judged by those same state regulatory agencies as likely to be non-recoverable in a competitive wholesale price environment. In brief, "stranded costs" are the excess of Net Book Value (depreciated original cost) over current Market Value of generating plants, as determined by the state regulatory agency (or the courts, if necessary). NPS have particularly high "stranded costs."

The recovery of these "stranded costs," in nearly every state where a determination has been made, is achieved through a "temporary" surcharge (usually called a "transition fee"). This "transition fee" is typically added to all electricity bills within the IOU's franchise area for five - nine years. Whenever a generating plant (nuclear or non-nuclear) is sold by an IOU at a price above its Book Value, the "profit" is deducted from the total of "stranded costs" the IOU is permitted to recover. The practical effect of such "profits" is to shorten the duration of the "transition fee." Hence the interest of states to mandate or "encourage" divestiture of *non-nuclear* generating plants, in particular.

This process has reduced substantially the uncertainty surrounding the recovery of "stranded costs," as well as their amount, for any IOU.

5. *Increased Uncertainty Over Coal-Fired Generation*

While coal-fired electricity generation remains the second least costly method (after hydro), air quality standards enforcement and control pose a serious threat to the continued dominance of "king coal" usage in power plants. New coal plant construction has effectively disappeared, because environmental permits are virtually impossible to obtain.

Moreover, on March 3, 2000, the U.S. Court of Appeals in Washington, DC, upheld EPA's "State Implementation Plan" (SIP Call). This program requires power plants (and other industries) to comply with stringent nitrous oxide (NO_x) emission limits, beginning with the 2003 "ozone season." Although some Congressional opposition to the plan was reported on March 16, EPA's continued lawsuits against coal-fired power plants combine to add considerable uncertainty to the long-term future prospects for major dependence on coal plants in the U.S. power grid system. This offers additional competitive opportunities for continued NPS operations and profits.

6. *Increasing Cost of Natural Gas Plants and Fuel*

In the past few years, there has been almost total reliance in the U.S. on gas-fired combined-cycle turbines for new generating capacity.[9] This has had two foreseeable (and foreseen) results: the price of natural gas has increased (and is not expected to decline over the long run), and the cost of gas-fired generating plant construction has increased. While the average cost per kW of capacity over the 1998-99 period was $457,[10] the most recently reported projects have had much higher average costs. Despite economies of scale for larger plants, Duke Energy North America announced the sale of its majority interest in a nearly-completed 500 MW plant to Calpine Corporation on March 7, 2000, for $599 per kW. Only two years previously, the "going" construction cost was widely acknowledged to be $400 per kW.[11]

Since a major competitive advantage of gas-fired generation has been its relatively low capital cost (as compared to not only nuclear, but also coal, oil, and hydro), the trend of rising cost per kW of gas-fired capacity also enhances the relative competitiveness of nuclear power. This is especially the case when existing NPS can be acquired for markedly less than $400 per kW, and have lower fuel costs.[12]

7. *Emerging Economies of Scale for Nuclear Ownership*

It is widely acknowledged in the power industry that a critical mass of nuclear-fueled capacity is necessary in order to achieve sustained operating profitability over the next 15-20 years.[13] Indeed, Keuter notes that, "According to some analysts on Wall Street, companies must be willing to own a portfolio of 15,000 megawatts of nuclear generation to get the full benefits of being a large operator."[14] Such companies must therefore be well-funded and capable of operating a NPS "fleet" competently. Keuter notes further that, "The one common thread that runs through all high-performing plants is good employees."[15]

As a result, consolidation of ownership is evident, and is expected to continue, in the nuclear power industry. *Table 1* indicates that this is happening already. PECO is a major partner in AmerGen Energy, and has also announced plans to merge with Commonwealth Edison (the largest IOU owner-operator of NPS, with six active plants). Entergy Nuclear will operate Nine Mile Point 1 and 2, for Rochester Gas & Electric, in New York state, and has purchased the two New York Power Authority plants (and Vermont Yankee as well).

Historically, the valuation of NPS under the regulatory regime has been based on original cost less depreciation, as mandated by the Federal Energy Regulatory Commission (FERC). The result has reflected Net Book Value, which is an accounting concept. This procedure has also established the Rate Base of each IOU. The result has been that a hypothetical informed purchaser-investor would pay no more for a property than the present worth of the net income that could be earned from operating a NPS. In the regulatory environment, that led to virtual certainty that "Market Value" would closely approximate Net Book Value.

Dominion (Virginia Power) also bid for the NYPA NPS, and is purchasing Millstone 2 and 3. Duke Energy is another potential contender, according to industry analysts, as is Constellation. So far, that is the list of firms actively seeking to acquire and operate NPS in the U.S. "Competition" has become oligopsony in the market for power plants, and oligopoly in the sale of nuclear-generated power.

IMPACT ON NUCLEAR POWER STATION VALUATION METHODOLOGY

Valuation Under Regulation

Historically, the valuation of NPS under the regulatory regime has been based on original cost less depreciation, as mandated by the Federal Energy Regulatory Commission (FERC). The result has reflected Net Book Value, which is an accounting concept. This procedure has also established the Rate Base of each IOU. The result has been that a hypothetical informed purchaser-investor would pay no more for a property than the present worth of the net income that could be earned from operating a NPS. In the regulatory environment, that led to virtual certainty that "Market Value" would closely approximate Net Book Value.

In some states, notably New York, an alternative procedure was mandated by the Courts. It was ostensibly an application of Reproduction Cost New

universally estimated by *trending* Original Cost according to a construction cost index (developed for facilities that were no longer being constructed).[16] Even in New York state, however, the ultimate "answers" approximated Net Book Value.

Moreover, prior to the onset of deregulation, the real property of IOUs was most often valued for property tax purposes on a statewide basis (usually by a designated state agency). This is termed the Unitary Method of valuation. Since all of the operating assets of an IOU within a state were integrated under a single ownership, the combined total value of those assets was estimated. The values of properties within individual taxing jurisdictions were then allocated by the designated state agency in accordance with state legislation and/or regulations.

In New England, the Middle Atlantic states and some Mid-Western states, however, "situs valuation" was applied. In that system, all of the assets of an IOU within a particular taxing jurisdiction (the town in New England, or the county elsewhere) are assessed and taxed by that local jurisdiction. This meant that towns or counties that were host communities for electric power stations (especially NPS) reaped the fiscal benefits of having a large, high-cost taxpaying facility within their boundaries.

Impact of Deregulation

With deregulation, and more particularly following divestiture of generating facilities by IOUs, each power station, whether nuclear or non-nuclear, is effectively a stand-alone asset. The transmission lines and distribution lines over which the electricity flows continue to be owned and operated by whatever IOU or other entity has the local franchise for transmission and distribution. As noted earlier, the transmission and distribution functions within the electric power industry will continue to be closely regulated by both Federal (FERC) and State (e.g., PUC) agencies. In some states or groups of states, an Independent Service Organization (created under the 1992 Federal legislation) will act as traffic flow manager for transmission lines within that state or region.

For property valuation purposes, however, the notion of unitary valuation is being replaced gradually because of the increasing necessity to value each generating plant (NPS or non-nuclear) as a separate, free-standing asset.

METHODS OF VALUATION UNDER DEREGULATION

With the emergence of a market for generating plants, as summarized in *Table 1*, the opportunity to utilize variants of the standard Three Approaches to property valuation has emerged. Publicly reported sales of individual NPS (or groups) provide a basis for Comparative Sales Analysis. There is an active construction market for new generating capacity, virtually all of which consists of gas-fired turbines. These new facilities provide a basis for estimating Replacement Cost New, at least as far as nuclear generating capacity is concerned.

Finally, industry deregulation has led to competitive markets for wholesale electricity at the generating plant "gate." This can provide the basis for a version of the Income Capitalization Approach, even though generating plants (especially NPS) are typically not leased, nor is there market evidence that any speculative construction projects (non-nuclear) have been undertaken. (The reported sale of Duke Energy North America's 78.5 percent share in the non-nuclear Hidalgo Energy project to Calpine Corporation might be classified as such.)

The market information available to be applied in valuations using the Comparative Sales Approach, Replacement Cost Approach or Income Capitalization Approach is less than ideal. Therefore, only reasonably approximate figures can be produced. Nevertheless, certain market tendencies have emerged, as *Table 1* indicates.

1. *Comparative Sales Approach*

Table 1 does indicate that substantial market activity in sales of NPS has been reported through auctions and negotiated sales since mid-1998. The 10 transactions covered by *Table 1* include 16 units in 13 NPS. A combined total capacity of nearly 9,500 MW has been transferred. While this is only a small percentage of the total NPS generating capacity in the U.S., it is reasonably representative of the market areas in which divestiture has been mandated or "encouraged."

Most of the activity in sales transfers (and closings) of NPS has been concentrated in the Northeastern U.S. The region is characterized by high-priced electricity, large concentrations of electricity users within relatively short distances from generating plants, and a number of older NPS in single-plant operations.

It has already been noted that, generally speaking, *non-nuclear* generating plants have sold at nominal prices in excess of their book values. For those

IOUs with nuclear generating capacity, these "profits" have served as a basis to offset stranded costs. This has enabled the selling companies to write down NPS book values substantially, without reporting a "loss."

The nominal prices for NPS acquisition have been well below book value, but rising. Still, they have only recently exceeded 10 percent of book value. While the sort of competition being reported for NPS in New York State (the NIMO and NYPA sales) has resulted in increased nominal SPKW for nuclear facilities, the prices actually paid for the real property (and taxable tangible personal property as well) will likely remain a fraction of book value.

The actual transactions involving transfers of NPS are both complex and complicated. First, the prices commonly include nuclear fuel available on-site (or even contracted for). For example, the reported sales price paid by AmerGen to GPU for Three Mile Island Unit 1 was $100 million. Only $23 million was paid for the plant, however; the other $77 million was the price of the fuel on-site.

Another example of price inflation or "puffery" is the assertion by Entergy that it paid "the State of New York" $1.42 *billion* for the Indian Point 3 and James A. Fitzpatrick NPS owned by the New York Power Authority. The *present worth* of the payments offered for the real property and tangible personal property calculates to $398.2 million plus an additional $19.4 million, which would be "offset" by a reduction of $50 million "related to decommissioning."

These examples illustrate the caution with which reported sales prices must be treated and used. Whatever is reported most likely represents the upper limit to market price, and to market value as well. The necessary conclusion remains that the prices paid for NPS in the recent past, and those likely to be paid in the foreseeable future, are and will represent less than book value, with an upper limit in the range suggested by the NYPA and Northeast Utilities sales.

2. *Cost Approach*

The only type of power plant that has been constructed in any numbers recently (since 1997 at least) is a natural gas-fired turbine facility, typically in combined-cycle format. Moreover, no NPS has been started in the U.S. since 1973. This means that any truly market-based Cost Approach must start with an estimate of Replacement Cost New. Because of the different technologies involved in gas-fired turbines and NPS, the most meaningful basis for any sort of comparison is total generating capacity. This renders any Cost New figure less than "representative" from the outset. Nevertheless, because of the difficulties in developing "clean" sales prices for the real property (and sometimes tangible personal property), the Cost Approach is still widely advocated by many appraisers and most assessors.

In brief, no one of the three potentially applicable "approaches" to valuation is clearly superior to the others in every NPS valuation assignment. None alone is likely to reflect fully the detail or quality of market data that is required, or at least highly desirable. The important point that emerges is that an appraiser (or assessor) must spend the time and effort necessary to accumulate as much market information as possible, and interview as many knowledgeable market participants as time and resources permit.

With the recent renewals of NPS licenses by NRC shown in *Table 2*, and the announced backlog of planned applications from over 30 others, there is somewhat more variability associated with the estimate of Remaining Economic Life than was the case when it was regularly assumed that there would be *no* license renewal or extension. Another important consideration is that total operating expenses per kilowatt hour (kWH) produced at a gas-fired turbine plant are higher than they are at an NPS, and recently have been rising with increased natural gas prices. This means that some adjustment must be made for "negative obsolescence," when valuing the NPS using Replacement Cost New based on gas-fired turbines. Thus, there is greater uncertainty and less stability associated with application of the Cost Approach to the value of a NPS than was the case in the regulatory market environment. The Cost Approach is no longer necessarily the exclusive valuation method of choice.

3. *Income Capitalization Approach*

Because NPS facilities are independent, free-standing entities in a deregulated market environment, it is possible to estimate and forecast the

stream of both revenues and operating expenses directly associated with the production and sale of electricity at an individual facility. That electricity is the *product* that is generated and sold at the site. It therefore includes elements of business income as well as income to the real estate (and tangible personal property, if included in the valuation). Therefore, any application of Income Capitalization is likely to represent an overstatement of the Market Value of the real property of a NPS (and possibly personal property as well). Nevertheless, this method of valuation is being widely advocated by experts in the field.[17]

One of the important issues to resolve is the identification of the appropriate Capitalization Rate. This must reflect both the risk associated with the ownership and operation of a NPS, and the previously noted uncertainty (admittedly diminished since the Calvert Cliffs and Oconee renewals listed in *Table 2*) about the Remaining Economic Life of the facility. In the Income Capitalization Approach, the impact of anticipated (and required) future decommissioning costs and possible on-site radioactive waste storage costs must also be considered as a "residual" amount or negative reversion. This negative impact is tempered somewhat by the U.S. Court of Appeals decision about on-site spent-fuel storage costs, discussed earlier in this article. *(See Endnote 4.)*

4. *Summary of Valuation Methodology Issues*

In brief, no one of the three potentially applicable "approaches" to valuation is clearly superior to the others in every NPS valuation assignment. None alone is likely to reflect fully the detail or quality of market data that is required, or at least highly desirable. The important point that emerges is that an appraiser (or assessor) must spend the time and effort necessary to accumulate as much market information as possible, and interview as many knowledgeable market participants as time and resources permit. This will help to avoid the easy assumption that the Cost Approach alone will necessarily provide the "best" indicator of the value of the real property only, merely because both the Comparable Sales Approach and the Income Capitalization Approach incorporate elements of intangible business assets and their associated incomes or prices.

IMPLICATIONS FOR NUCLEAR POWER STATIONS AND THEIR VALUATION

Beginning no later than mid-1998, the fortunes and prospects for nuclear power (and hence NPS) in the U.S. have improved steadily from the depths of suspicion, fear, and stigma that characterized its market status following the Three Mile Island "incident" in 1979, through the Chernobyl meltdown in 1986, to the early days of deregulation (1992-1996). This dramatic shift has come about because of at least 10 market developments and events. The net result has been a reduction in uncertainty and perceived risks about the ownership and operation of NPS among enough operators and potential purchasers to create competitive bidding for NPS and rising market prices.

The important developments and events, not necessarily in chronological order, have been:

1. *Continuing Increased Demand for Electricity in Supply-Constrained Markets.* In some major market areas (e.g., California), little or no new generating capacity of any kind, and little or no new transmission capacity, has been built since the early 1990s. Whatever the reasons (which are many and varied) for this inactivity, the U.S. electricity system cannot tolerate the loss of nuclear generating capacity until a massive program of replacement is planned, executed and operational. No such program is reported to be under way. The U.S. needs as much of its nuclear generating capacity as can be reasonably retained.

2. *The Overall Quality of the Remaining U.S. Nuclear Generating Plants Has Improved.* Many of the least efficient NPS have been closed; a few have been transferred to more experienced, more efficient operators. The net result is an overall increase in average capacity factors, plus an overall decrease in generating expenses (including fuel and O&A).

3. *A Competitive Market for the Sale and Purchase of NPS Has Emerged.* Sales that have occurred since mid-1998 were anticipated earlier. Competitive bidding has emerged (see *Table 1*). In two instances (New York and Vermont), regulators have rejected proposed negotiated sales prices on the grounds that they were "not in the public interest." This translates to "Not High Enough." In both cases, higher prices were achieved, following mandated competitive bidding.

4. *Overall, Higher Prices per KWH Have Been Realized Since Competitive Bidding Took Over NPS Auction Sales. (See Table 1).* Many experts and students of the market have forecast even higher prices. One

major reason given is the diminution in uncertainty and perceived risk for potential purchaser operators that has been reported and inferred.

5. *The NPS Generating Industry Is An Emerging Oligopoly*, with some eight - 10 major, active participants. One-plant operators are being eliminated by the economic realities of the market. Multi-plant owner-operators have been able to take advantage of the economies of scale in managing the generating process.

6. *Increased Probability of License Renewal.* By 1997, applications for license renewal of NPS had been requested for over a dozen nuclear plants; by late 1999, that figure had doubled. From the mid-1990s, there was growing optimism that some license renewals would be generated, once NRC's criteria were known and understood.

   On March 23, 2000, the Calvert Cliffs NPS of Baltimore Gas & Electric (Constellation Enterprises) was granted a 20-year renewal until 2034 for Unit 1, and until 2036 for Unit 2. Then on May 23, 2000, Duke Energy's Oconee NPS received 20-year renewals for Unit 1 until 2033, and for Units 2 and 3 until 2034. These actions effectively reduced market uncertainty about license renewals for NPS generally, and enhanced the Market Value of not only those two NPS but of all similarly situated plants with comparable operating and safety histories.

7. *Stranded Cost Recovery.* The judicial determination in many states of the amount of both stranded costs and *recoverable* stranded costs, and the subsequent identification of both the amount and maximum duration of the "transition fee" surcharge, have further reduced uncertainty for large numbers of NPS operators about likely near-term revenues. This reduces perceived risk, and hence the risk rate applicable in the Income Capitalization Approach.

8. *Decommissioning Costs.* The owner-operator of an NPS which has been shut down or whose license has expired must decommission the plant in accordance with NRC regulations and requirements. Decommissioning is an exacting, time-consuming and very costly process. The further into the future it can be deferred, the lower the present worth of that cost is likely to be. Moreover, new technologies may well emerge in the interim, reducing the absolute cost of decommissioning.

   Decommissioning costs remain a real and major future liability, but the uncertainty and risk associated with them has been substantially reduced.

9. *On-Site Spent Fuel Storage and Monitoring Expenses.* As a consequence of the failure of DOE to find and develop a "permanent" storage site for spent nuclear fuel, NPS have been required to develop and maintain "temporary" on-site storage facilities, which add to overhead and administration expenses without any offsetting revenue or cost savings. In a recent decision cited earlier *(see Endnote 4)*, the U.S. Court of Appeals in the District of Columbia ruled that four IOUs with NPS have the right to sue the U.S. Government for that failure by DOE. Commentators opine that this decision most probably applies to all NPS. To that extent, there has been a further reduction in uncertainty and risk associated with long-term on-site spent-fuel storage and the expense it entails.

10. *Diminished Competitive Advantage of Generating Plants Using Fossil Fuel.* Increasing (and increasingly volatile) prices of heating or bunker oil, of natural gas, and of low-sulphur coal have worked to widen the spread of non-nuclear fuel costs and operating expenses, over those for NPS. The EPA State Implementation Plan noted earlier has placed the continued operation of many coal-fired generating plants in question, thereby enhancing the need for continued operation of existing NPS. Further, the nearly exclusive reliance on gas-fired combined-cycle turbine plants for construction of new generating capacity in the U.S. has exacerbated the increased demand for, and hence prices of, both natural gas and gas-fired generating turbines.

All of these market developments have enhanced the relative competitive position of nuclear-fueled power generation. As a result, longer remaining production and economic lives are being forecast for more NPS. The ultimate consequence is expected to be a further strengthening of their Market Value at levels closer to, but still below, the Book Values that would have applied under the regulatory regime. REI25

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NOTES

1. Kinnard, William N., Jr. and Gail L. Beron, "The Effect of Electricity Market Deregulation on Local Property Tax Assessments and Fiscal Stability," *Real Estate Issues*, Winter 1999/2000, pages 17-22.
2. See, for example, Burkhart, Lori A., "EIA Predicts Further Nuclear Growth," *Public Utilities Fortnightly*, January 15, 1997; Keuter, Dan, "The Nuclear Renaissance: Competitive Nuclear Energy, *Nuclear News*, August 1999; Price, Jeffrey P., "What's a Power Plant Worth?", *Public Utilities Fortnightly*, September 15, 1997; and Seiple, Christopher D., "A Nuclear Recovery," *Public Utilities Fortnightly*, May 15, 1999.
3. Kinnard, William N., Jr. and Gail L. Beron, *Impact of Electricity Price Competition on Assessment of Nuclear-Fueled Generating Plants*. Paper presented at 16th Annual Meeting of American Real Estate Society, Santa Barbara, CA, March 31, 2000, pages 1-2.
4. Murelio, April C., "Nukes Can Sue Government Over Disposal of Spent Fuel," *News & Analysis @ Power Online*, www.poweronline, September 7, 2000.
5. Green, Michael E., "Nuclear Power: Appraisal of Troubled Assets in a Competitive Market," *Journal of Property Tax Management*, Fall 1997.
6. Kinnard & Beron, op.cit., 2000. See also Nuclear Regulatory Commission, *Plant Applications for License Renewal*, September 18, 2000.
7. Keuter, op.cit.; Stolarski, op.cit.
8. Especially California, Michigan, Pennsylvania, New York and the New England states.
9. Kinnard & Beron, op.cit., 2000.
10. *Ibid.*
11. Kinnard, William N., Jr. and Gail L. Beron, *The Effects of Electricity Market Restructuring on the Assessable Value of Generating Facilities in Illinois*. Springfield, IL: Illinois Task Force on Property Assessment, December 1998.
12. See Table 1; Keuter, op.cit.; Kinnard & Beron, op.cit., 1998.
13. Keuter, op.cit.
14. *Ibid.*, p. 29.
15. *Ibid.*
16. No nuclear power station that was granted a construction permit by NRC after 1973 was completed or placed in operation. The last NPS competed and put into operation in the U.S. was the Watts Bar plant, a Tennessee Valley Authority project at Spring City, Tennessee. It came on line in 1996, 23 years after it was first proposed.
17. See, for example, Green, op.cit.; Hardin, C. James and Carl Hoemke, *Market Sales Analysis of Recent Electric Power Transactions and Valuation of Electric Power Plants*. Paper presented September 28, 1999 at the International Association of Assessing Officers Conference, Las Vegas, NV; Kinnard & Beron, 1999; McCabe, Gary L. and Steve Sutterfield, *Power Plant Valuation in a Deregulated Industry*. Paper presented September 29, 1999 at the International Association of Assessing Officers Conference, Las Vegas, NV.

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