Exhibit____(ERP-6)

BEFORE THE
STATE OF NEW YORK
PUBLIC SERVICE COMMISSION

In the Matter of

Application of Rochester Gas and Electric Corporation
For a Certificate of Environmental Compatibility
and Public Need under Article VII of the Public Service Law for
the Rochester Area Reliability Project

Case 11-T-0534

March 21, 2014

Exhibit____, Engineering Panel (ERP)-6

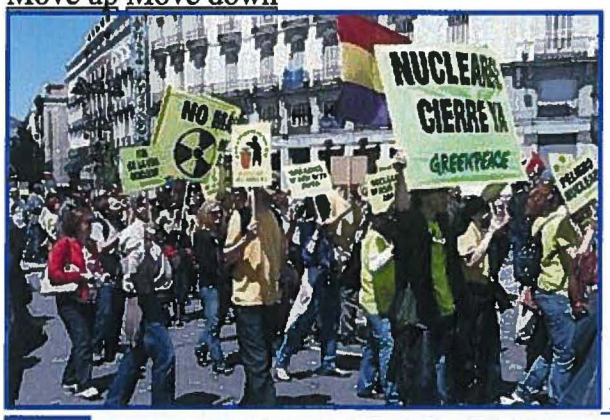
Forbes

Jeff McMahon, Contributor
I cover green technology, energy and the environment from Chicago.

TECH | 11/07/2013 @ 9:25AM | 17,520 views

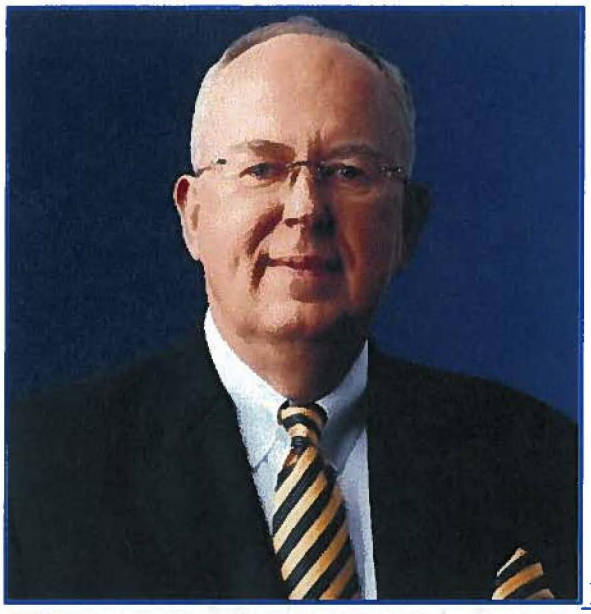
6 Nuclear Plants That Could Be Next To Shut Down

Move up Move down



New-Build Nuclear Is Dead: Morningstar

Jeff McMahon Contributor



Exelon's 'Nuclear Guy': No New Nukes 

Jeff McMahon Contributor

How Fracking Killed Nuclear Power 

Jeff McMahon Contributor

Nuclear isn't dead, according to Morningstar analysts, but cheap natural gas has shuttered some plants and left others at risk.

[*The Morningstar analysts do believe one aspect of nuclear power is dead: new-built nuclear in the West. Read about it here.*]

Davis Besse Nuclear Power Station near Toledo, Ohio (Photo credit: Wikipedia)

"In the last year, U.S. utilities have closed or announced plans to close five nuclear reactors in addition to the canceled development plans," according to Morningstar's *Utilities Observer* report for November, "leading to speculation that prolonged low gas prices could drive more plant closures given the high maintenance capital investment requirements."

"Despite slimmer margins for nuclear operators in a low natural-gas price environment, we think this speculation is unwarranted outside of some select situations."

But what are those select situations?

Below is a list of operating nuclear plants that Morningstar analysts believe are most exposed to the possibility of closure. The list does not include disabled plants, like Fort Calhoun in Nebraska, that are offline and may never reopen. And it does not include plants already scheduled for closure, like Exelon's Oyster Creek plant in New Jersey.

1. Indian Point: Less than 50 miles north of Manhattan, the reactors at Entergy's Indian Point Energy Center face a tough political fight for relicensing. One license has expired, and that reactor is operating under an allowance from the Nuclear Regulatory Commission. Another license is due to expire in 2015. New York Gov. Andrew Cuomo opposes relicensing. Outgoing New York Mayor Michael Bloomberg has defended the plant, based on the impact closure could have on New Yorkers' electric bills. Mayor-elect Bill DeBlasio has called for a gradual decommissioning as alternative power sources come online, which isn't how the process works. Ultimately, the decision rests not with local officials, but with the NRC.

2. Ginna Nuclear Generating Station: On the south shore of Lake Ontario near Rochester, NY, Ginna is a single-reactor plant that faces fresh competition from wind turbines, falling power prices, and, like Indian Point, a political climate hostile to nuclear reactors. "Upstate New York off-peak power prices have fallen to $32 per megawatt hour as of mid-2013 from $55/MWh in 2008," according to Morningstar. Ginna is owned jointly by Exelon and Électricité de France.

3. James A. Fitzpatrick Nuclear Power Plant: Another plant on the south shore of Lake Ontario in New York, FitzPatrick faces the same challenges as Ginna, but it's also an older boiling-water reactor that may need upgrades. "Fitzpatrick's operating license expires in 2034, but its revenue-sharing agreement with the New York Power Authority expires in December 2014, and unfavorable contract renewal negotiations could lead Entergy to shut the plant."

4. Three Mile Island: Most of the shale gas boom in America is happening in the Marcellus region of Western Pennsylvania, according to the Energy

Information Agency, which means Exelon's infamous Three Mile Island plant now has to compete with an abundance of gas never before seen in its lifetime. Several large, high-efficiency gas power plants are planned for the region.

5. Davis Besse Nuclear Power Station: FirstEnergy's plant near Toledo is not far from the Marcellus Shale formation and all that cheap natural ga. After Indian Point, it's the next power plant up for license renewal— in 2017. "We expect strong opposition from some parties," says Morningstar. "It has a tarnished reputation after an extended outage in 2002-04 due to corrosion in the reactor vessel head and several smaller issues since then."

6. Pilgrim Nuclear Generating Station: Entergy's Pilgrim plant in Plymouth, Mass., just survived a contentious license renewal process and was granted a new lease on life through 2032. But it may not survive the energy economy in which it now must compete. "Entergy is not obligated to operate it for that long and could exit if power prices sink much further," Morningstar says. The old boiling water reactor is more expensive to operate than newer designs.

Reactors recently closed or scheduled for closure:

- Vermont Yankee, Vermont
- San Onofre, California
- Kewaunee, Wisconsin
- Crystal River, Florida
- Oyster Creek, New Jersey

Most existing nuclear plants will survive because they provide power without producing carbon emissions, Morningstar says, because coal will suffer with greenhouse gas regulations, and because power prices should recover from their current trough. But most of all, because of nuclear's low variable cost (about $12/mwhr, compared to $24 for the most efficient gas plants).

"No emissions, coal closures, and improving power prices are certainly favorable aspects of nuclear stations but the low variable cost is far and away the primary reason that most are not at risk of closure despite a difficult market environment," said analyst Mark Barnett.

Follow Jeff McMahon on Facebook, Google Plus, Twitter, or email him here.

syracuse.com

Central New York nuclear plants struggle to avoid financial meltdown

2013-09-29-tsk-FitzPatrick.JPG
James A. FitzPatrick Nuclear Power Plant in Scriba, Oswego County, is a "challenged facility" that faces potential financial losses in the years to come, industry analysts say. *(Courtest of Entergy Corp.)*

Tim Knauss | tknauss@syracuse.com By **Tim Knauss | tknauss@syracuse.com**
Email the author | Follow on Twitter
on September 29, 2013 at 2:00 AM, updated October 03, 2013 at 4:39 PM

SCRIBA, N.Y. - As recently as four years ago, nuclear power companies were planning to spend billions of dollars to build a new reactor in Oswego County, alongside three existing nuclear plants.

Then the bottom fell out. Natural gas-burning power plants that benefit from a glut of cheap gas produced by hydrofracking cut wholesale electricity prices in half.

Now the outlook for nuclear power plants is so bleak that Wall Street analysts say one or more Upstate nuclear plants could go out of business if conditions don't change.

Two Upstate nukes in particular - the James A. FitzPatrick Nuclear Power Plant in Oswego County and the R.E. Ginna Nuclear Power Plant in nearby Wayne County - are high on the watch list of plants that industry experts say are at risk of closing for economic reasons.

Oswego County's other two reactors, Nine Mile Point Units 1 and 2, are in a stronger financial position, analysts say. But the Upstate electric market remains one of the harshest in the country for nuclear plants, raising the stakes each time a plant is faced with a prolonged outage or an expensive repair.

Nuclear critics and industry supporters finally agree on something: Nuclear power, the bedrock of Oswego County's economy and the biggest source of electricity in Central New York, faces a financial crisis.

These are "very challenging times," said Bill Mohl, president of **Entergy Wholesale Commodities**, which owns FitzPatrick and five other nuclear plants. "We're working very hard to work through this . . . and do everything we can to maintain these units and try to see if we can improve the financial results."

"We should expect more early (plant) retirements," nuclear critic Mark Cooper, senior fellow at the**Institute for Energy and the Environment** at Vermont Law School, wrote in a July report. "Rising costs of an aging fleet and the availability of lower cost alternatives are likely to persist over the next couple of decades."

Across the country, four nukes have shut down this year -- the first plant retirements in 15 years -- and a fifth announced it will close next year.

Analysts at UBS Securities LLC project financial losses for FitzPatrick nuclear plant in years to come.
Sue Santola | ssantola@syracuse.com

Three of those plants closed rather than make expensive, do-or-die repairs. But the other two - Kewaunee in Wisconsin and Vermont Yankee in Vermont - were high-performing units that simply could not make enough money to continue operating, said Richard Myers, vice president for policy development at the **Nuclear Energy Institute**, an industry trade group.

"There is absolutely nothing wrong with these plants," Myers said this week in a conference call with reporters. "There is something seriously wrong, in our view, with the markets in which they are generating."

UBS Securities LLC, a Wall Street firm that follows the nuclear industry, issued a report in January that identified Upstate New York as the second most difficult market for nuclear plants, after the Midwest. UBS predicted FitzPatrick and Ginna would begin to operate at a loss soon, if they haven't already, and said the plants will lose money at least through 2016.

A "challenged facility"

Entergy Corp., which owns FitzPatrick, and **Exelon Corp.**, which owns Ginna, both say they have "no current plans" to close the plants. But high-ranking officials from both companies acknowledge that FitzPatrick and Ginna are at risk.

"Fitz is a challenged facility," Mohl, of Entergy, said in a telephone interview Wednesday. "It's a marginal unit. It's a unit that we are watching very closely - marginal meaning that in some years it may make money, and in other years it may not."

FitzPatrick is Oswego County's fifth-largest private sector employer and one of its biggest taxpayers.

Entergy officials said FitzPatrick will lay off about 35 workers by the end of the year, 5 percent of the 650-person payroll. Mohl said Entergy will strive to become more efficient but will not be able to cut its way to profitability. "It's not the single answer to the issue," he said.

Mohl and other nuclear leaders are urging regulators to reform wholesale markets to put more emphasis on payments for "capacity," which reward generators for being available on a round-the-clock basis. That would benefit nuclear plants, which aim to run at full power 24 hours a day.

The two reactors at Nine Mile Point Nuclear Station in Scriba are generally regarded as less vulnerable than FitzPatrick and Ginna, because paired reactors can save money by sharing personnel and other costs.

Nine Mile Point's two units employ 1,000 workers and generate up to 1,900 megawatts. Barring other factors, Nine Mile Point can produce roughly 45 percent more power per employee than FitzPatrick, which has 650 employees and produces up to 850 megawatts.

NY officials concerned

In Oswego County, the announcement last month that Vermont Yankee would close sent chills down some spines. Like FitzPatrick, Vermont Yankee is owned by Entergy. Like FitzPatrick, which opened in 1975, the Vermont plant is an aging, stand-alone facility operating as a merchant plant. It opened in 1972. It's 25 percent smaller than FitzPatrick but similar in many other respects.

The FitzPatrick nuclear plant paid $12.3 million in school property taxes last year to the Mexico district in Oswego County, 51 percent of the school district's total tax levy and 24 percent of the total budget.
Jim Commentucci | The Post-Standard

Mohl was clear: The only reason Vermont Yankee will close is because it can't make money.

That prompted both New York state Assemblyman Will Barclay and state Sen. Patty Ritchie to call Entergy officials for a status update on FitzPatrick. Both said they have been assured there are no immediate plans to shutter the plant. Instead, Entergy officials say they are planning to refuel FitzPatrick a year from now.

But refueling is no guarantee of longevity. Vermont Yankee was refueled in April, four months before the company announced it would close at the end of its fuel cycle, in October 2014.

Barclay and Ritchie said they will fight for any changes that could help the local nuke plants. "The last thing we want to happen is for those three plants in Oswego to shut their doors," Ritchie said.

The three nuclear plants in Scriba account for 30 percent of Oswego County's tax base, County Administrator Phil Church said. FitzPatrick pays roughly $18 million a year in property taxes. Nine Mile Point makes nearly $24 million a year in payments in lieu of taxes.

>Big power, little pay

Central New Yorkers consume less than 9 percent of the state's total electricity, but the three nuclear plants in Scriba produced 14 percent of the electricity generated in New York last year, according to the **New York Independent System Operator**. Ginna's output increases that to 17 percent. The four plants produced nearly 24,000 gigawatt-hours, enough to supply 2.8 million average homes.

Despite that output, the nuclear plants are struggling with record low electric prices. In New York, nuclear facilities operate as "merchant" plants selling power in a competitive wholesale market rather than supplying utility ratepayers at government-regulated rates.

Natural gas costs half what it cost five years ago, thanks to a plentiful supply uncorked by **hydrofracking** in the Marcellus Shale, energy analysts say. Because natural gas is used by quick-start, quick-stop generating plants that respond to short-term price signals, natural gas plants tend to play a dominant role setting wholesale electric prices.

There is also a glut of electricity Upstate, where there are plenty of generating plants but not much economic growth and limited transmission capacity to lucrative Downstate markets. As a result, payments to generators in Central New York are extra low. Over the past summer, Central New York wholesale prices were 20 percent to 48 percent lower than prices on Long Island.

Entergy Corp., the owner of FitzPatrick nuclear plant, spends about $350,000 a year on charitable giving in Oswego County, including its sponsorship of the annual Harborfest fireworks show, according to Bill Mohl, president Entergy Wholesale Commodities.
Lauren Long | llong@syracuse.com

Myers, of the Nuclear Energy Institute, said the wholesale market discourages big, long-term capital investments that nuclear power requires. It also fails to reward nuclear plants for being on almost all the time, or for producing no air emissions, he said.

Five new nuclear reactors are under construction in Georgia, South Carolina and Tennessee, but each is being built in an area where the owners can recover their costs through regulated utility rates.

In competitive markets, the greatest risk falls on the smallest, oldest, single-unit nuclear plants, like FitzPatrick and Ginna. The risk intensifies when a plant faces costly improvements.

Like other nuclear plants, FitzPatrick in the next few years must make significant upgrades required by federal regulators in response to the tsunami-induced nuclear disaster in 2011 at Fukushima, Japan. Mohl estimated the cost of Fukushima upgrades at roughly $50 million for FitzPatrick.

The facility also is under pressure to replace its condenser tubes, which have leaked 16 times in the past three years, forcing the reactor to reduce power to make repairs. FitzPatrick had so many unplanned power changes during 2012, some because of condenser leaks, that it was placed under heightened oversight earlier this year by the Nuclear Regulatory Commission.

Mohl said Entergy is considering replacing the condenser tubes during the next refueling outage, which is scheduled for roughly a year from now. No final decision has been made, he said.

Asked how much it would cost, Mohl declined to be specific. "It's a substantial investment," he said.

Will politics play a role?

Ginna, a small, stand-alone reactor 60 miles west of Oswego, has yet to face the full force of a competitive market. When regulated utility Rochester Gas & Electric sold the plant 10 years ago to Constellation Energy

Nuclear Group, the utility contracted to buy 90 percent of the output at what turned out to be an above-market price, $44 per megawatt-hour. That contract expires in June 2014.

Exelon Corp., the nation's largest nuclear company with 22 reactors, acquired the Ginna and Nine Mile Point nukes last year when it took over Constellation. In a July 31 conference call with stock analysts, Exelon CEO Christopher Crane identified Ginna and another nuke plant in Illinois as weak links in the portfolio.

He implied that Ginna's future may depend on state regulatory changes to improve the financial picture for nuclear plants.

"So, there's nothing on the chopping block right now," Crane said. "It is constant work to look at cost. It's constant work to look at regulatory structure, and if it does not improve we'll be talking more about those facilities."

The fragile finances of nuclear power have provided new ammunition to anti-nuclear groups. In March, prior to the announcement of Vermont Yankee's shutdown, a coalition of four groups**petitioned the NRC** to suspend Entergy's license to operate FitzPatrick and Vermont Yankee arguing that the plants produce insufficient revenue to maintain and operate the reactors safely. Entergy has not yet responded to the petition.

Although economics are at the heart of Upstate nuclear problems, many observers expect politics to play a part in the resolution. As UBS analysts wrote in January: "Given the substantial tax base and employment supported by nuclear plants, as well as the material increases in . . . power prices resulting from a retirement, we see real potential for regulatory and political intervention to save plants, particularly in Illinois and New York."

*Contact Tim Knauss at**tknauss@syracuse.com** or 315-470-3023 or on Twitter @TimKnauss.*

syracuse.com

Another analyst cites financial risks at FitzPatrick and Ginna nuclear plants

Fitzpatrick plant.JPG
FitzPatrick nuclear plant in Scriba, Oswego County, made Morningstar Inc.'s list of five plants that are "most exposed" to the possibility of closing for financial reasons. *(Courtesy of Nuclear Regulatory Commission)*

Tim Knauss | tknauss@syracuse.com By **Tim Knauss | tknauss@syracuse.com**
Email the author | Follow on Twitter

on November 11, 2013 at 3:54 PM, updated November 11, 2013 at 4:26 PM

SYRACUSE, N.Y. - Two Upstate nuclear plants with **challenging finances** - FitzPatrick in Oswego County and Ginna in Wayne County - have made it onto another analyst's list of nukes that are at risk of closing.

Morningstar Inc., an independent investment research firm, includes FitzPatrick and Ginna on its list of five nuclear plants that are "most exposed" to the possibility of shutting down.

In the November issue of Morningstar's Utilities Observer newsletter, analysts write that most U.S. nuclear power plants are financially secure despite falling power prices. But there are several "select situations" where plant owners might decide to shut down a plant prematurely, they say.

Besides FitzPatrick and Ginna, the report names Three Mile Island 1 in Pennsylvania, Davis Besse in Ohio and Pilgrim 1 in Massachusetts.

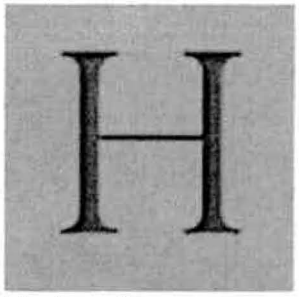
Several reports this year by Wall Street analysts and others have pointed to faltering finances at FitzPatrick and Ginna, both of which are small, old, stand-alone plants operating in a region where low natural gas prices have depressed the wholesale price of electricity. Some analysts have questioned whether the plants can make money under current circumstances.

Officials at Entergy Corp., which owns FitzPatrick, have said they are evaluating the plant's future but have no current plans to close it. Exelon Corp., owner of Ginna, has made similar comments about its plant.

Morningstar said FitzPatrick's age, which might necessitate costly maintenance and repairs, will be a factor in its survival. Morningstar noted that Ginna is Exelon's "least profitable" plant.

*Contact Tim Knauss at**tknauss@syracuse.com** or 315-470-3023 or on Twitter @TimKnauss.*

Seeking Alpha



Horizon Investments
Long only, value
Profile| Send Message| (123)

Exelon Corp.: Difficult Time Ahead

Nov. 29, 2013 3:59 AM ET | About: EXC by: Horizon Investments

The U.S. utility sector offers low risk, stable earnings and a high dividend yield, which is why it has remained a popular choice for income-seeking investors. However, lately, the sector has been facing several headwinds because of depressed gas and power prices, and soft electric demand growth. Exelon Corp. (EXC) has significant exposure to merchant power assets, and earnings of the business are negatively affected by weak power prices. The company's management has been proactive in taking measures to support its earnings and

navigate through the prevalent tough times, but weak gas and power prices continue to take their toll on the stock price. Because of weak forward power prices, I am downgrading EXC from 'buy' to 'hold', and believe that gas and power prices remain key drivers in the future.

Nuclear Plant Shutdown

Difficult power market conditions have had a negative impact on the company's earnings. The company's management, during the recent EEI conference, indicated that in the prevailing weak power market conditions, it will evaluate its cost structure and possibly opt for the shutdown of some of its existing nuclear plants. As the management is evaluating gas and power market weakness and plant economies, it may opt to shut down one or more of its nuclear assets. I believe it is highly likely that EXC will announce to shut down one or more of its nuclear assets, as difficult conditions persist in upcoming months. Among the options available with the company to choose which nuclear plant to shut down, I believe Quad City, Clinton and Ginna seem to be on top of the list. Quad City and Clinton are among the plants that have been unprofitable in recent times, which is why they have high probability of closure in response to tough power market conditions. The possible shutdown of any of the unprofitable plants will help the company support its earnings, as its costs will decrease and help navigate through difficult power market conditions.

Maintaining Investment Grade Credit Rating

In the ongoing difficult conditions for power markets, EXC is committed to maintaining its investment grade credit rating. Maintaining the investment grade credit rating seems to be among the top priorities for the company; EXC announced a dividend cut of 41% earlier this year. Now the company has been aiming to reduce its debt in order to maintain the investment grade credit rating. EXC plans to retire $615 million of ExGen debt in 2014 using proceeds from the recent Continental Wind LLC project issuance and using internally generated cash flows. It is important for the company to maintain its investment grade credit rating, as this will help the business participate in commercial business opportunities, improve cost efficiency and provide reliable access to the capital market, reduce collateral requirements and increase business financial flexibility. The following table shows the credit ratings assigned to EXC by different credit rating agencies.

	Moody's	**S&P**	**Fitch**
Credit Rating	Baa2	BBB-	BBB+

During the recent EEI conference, EXC introduced credit metric target ranges under both market and stress conditions to stay intact with its investment grade credit rating. Following are the credit metric targets introduced by EXC:

- FFO/Debt > 30% in base case and 27% in stress case
- RCF/Debt > 20%
- Positive Moody's Free Cash Flow

Margin Weakness

As discussed earlier, a continuous weakness in gas and power prices has been having a negative impact on the margins and stock price. Recently, the company introduced its total gross margin guidance of $7.4 billion for 2016, as compared to $7.6 billion for 2015. The management expects $2-$4 of upside in the competitive power markets/forward power prices moving in 2014 and 2015, which I believe is an optimistic projection by the company. I recommend investors keep an eye on a recovery in forward power prices, which remain a key performance driver for EXC in the future. The following table shows the total gross margin guidance from 2013 to 2016.

	2013	**2014**	**2015**	**2016**
Total Gross	$7.95 billion	$7.65 billion	$7.6 billion	$7.4 billion

Margin

Source: EEI Conference Presentation Slides

Final Words
The company's financial performance has been negatively affected by challenging power market conditions; however, I believe the management remains proactive in responding to prevailing conditions. To lower its cost curve and support its future earnings, EXC might announce to shutdown one or more of its nuclear plants. Also, maintenance of the investment grade credit rating will boost investor confidence and improve financial flexibility for EXC. However, difficult power market conditions will have a negative impact on EXC's future revenues and earnings; therefore, I am downgrading the stock rating from 'buy' to 'hold.'

Source: Exelon Corp.: Difficult Time Ahead

Symbol	Price	% Chg	Remove
[ ]	-	-	
[ ]	-	-	
[ ]	-	-	
[ ]	-	-	
[ ]	-	-	
[ ]	-	-	
[ ]	-	-	
[ ]	-	-	
[ ]	-	-	
[ ]	-	-	

Symbol	Alerts	Price Chg	% Chg

Report: Over Three Dozen U.S. Nuclear Reactors At Risk Of Early Retirement, 12 Face Greatest Shutdown Pressure

In Wake of San Onofre, Crystal River & Kewaunee Shutdowns, Cooper Outlines Next Nuclear Reactors Under the Greatest Pressure to Close Down; Reactors in AL CA, CT, FL, IL, IA, KS, MD, MA, MI, MN, MO, NE, NH, NJ, NY, OH, PA, SC, TN, TX, VT, and WI on "At Risk" List.

WASHINGTON, July 17, 2013 /PRNewswire-USNewswire/ -- The tough times the U.S. nuclear power industry faces today are only going to get worse. In the wake of nine major nuclear reactor closures or uprate cancellations in recent months, a review of the remaining U.S. fleet reveals that 38 reactors in 23 states are at risk of early retirement, with 12 facing the greatest risk of being shutdown, according to a major new analysis by Mark Cooper, senior fellow for economic analysis, Institute for Energy and the Environment, Vermont Law School.

Cooper is the author of several reports on nuclear power, including *"Policy Challenges of Nuclear Reactor Construction, Cost Escalation and Crowding Out Alternatives"* (2009).

Available online at http://216.30.191.148/atriskreactors.html and titled, *"Renaissance in Reverse: Competition Pushes Aging U.S. Nuclear Reactors to the Brink of Economic Abandonment,"* the new Cooper report looks beyond the recent shutdown of four reactors – San Onofre (2 reactors) in California, Kewaunee in Wisconsin, and Crystal River in Florida – and the death of five large planned "uprate" expansion projects – Prairie Island in Minnesota, LaSalle (2 reactors) in Illinois, and Limerick (2 reactors) in Pennsylvania. Using 11 risk factors -- including competition from lower-cost energy sources, falling demand, safety retrofit expenses, costly repairs, and rising operating costs – identified in three different Wall Street analysis reports from Moody's, UBS, and Credit Suisse, the Cooper report finds:

- 38 reactors in 23 states exhibited four or more of the 11 risk factors. The 23 states with at-risk nuclear reactors are: Alabama (Browns Ferry); California (Diablo Canyon); Connecticut (Millstone); Florida (Turkey Point); Illinois (Clinton, Dresden, LaSalle, and Quad Cities); Iowa (Duane Arnold); Kansas (Wolf Creek); Maryland (Calvert Cliff); Massachusetts (Pilgrim); Michigan (Cook, Fermi, and Palisades); Minnesota (Monticello and Prairie Island); Missouri (Callaway); Nebraska (Cooper and Ft. Calhoun); New Hampshire (Seabrook); New Jersey (Hope Creek and Oyster Creek); New York (Fitzpatrick, Ginna, Indian Point, and Nine Mile Point); Ohio (Davis-Besse and

Perry); Pennsylvania (Limerick, Susquehanna, and Three Mile Island); South Carolina (Robinson); Tennessee (Sequoyah); Texas (Comanche Peak and South Texas); Vermont (Vt. Yankee); and Wisconsin (Point Beach).

- Of the overall at-risk group, 12 reactors (in alphabetical order) were found to be at greatest risk of early retirement: Clinton (selling into a tough market); Davis-Besse (large number of risk factors); Fitzpatrick (high cost but offset by high market clearing price); Ft. Calhoun (outage, poor performance); Ginna (single unit with negative margin, existing contract); Indian Point (license extension, state opposition); Millstone (tax issues); Nine Mile Point (site size saves it, existing contract); Oyster Creek (already set to retire early); Palisades (repair impending, local opposition) Pilgrim (large number of risk factors, local opposition); and Vt. Yankee (tax issue and state opposition).

Commenting on the report, Mark Cooper said: **"Recent developments have sent what are truly shock waves through the industry and Wall Street. The spate of early retirements and decisions to forego uprates magnify the importance of the fact that the 'nuclear renaissance' has failed to produce a new fleet of reactors in the U.S. With little chance that the cost of new reactors will become competitive with low carbon alternatives in the time frame relevant for old reactor retirement decisions, we need to start preparing now for more early retirements or the threats of such retirements. By explaining the underlying economic causes of the growing wave of early retirements, the policymakers will be better equipped to make economically rational responses."**

Peter A. Bradford, adjunct professor at the Vermont Law School, a former member of the U.S. Nuclear Regulatory Commission (NRC), and a former utility commission chair in New York and Maine, said: **"No U.S. nuclear plant has ever closed because it reached the end of its licensed life. Instead, cost challenges to their continued profitability has usually been the cause of shutdowns. Dr. Cooper's new work shows this to be a widespread and an enduring problem, one that further undermines nuclear power's claim to being a promising bulwark in a serious climate policy."**

With a large number of reactors poised on the razor's edge of economic abandonment, the chances are high that any one of a number of the key factors – significant repair costs, retrofits to improve safety, stiff competition from lower-cost energy alternatives, rising costs of operation – will push the owners to retire the reactors early for economic reasons. As Cooper points out, the same factors call into question the economic efficacy of license extensions and reactor uprates.

The Cooper paper also shows:

- The economic situation for nuclear has always been bad and is unlikely to change. The poor performance of nuclear reactors that is resulting in early retirements today has existed throughout the history of the commercial nuclear sector in the U.S. The problems are endemic to the technology and the sector. The that the key underlying economic factors -- rising costs of an aging fleet and the availability of lower cost alternatives – are likely to persist over the next couple of decades, which is the relevant time frame for making decisions about the fate of aging reactors.
- It is not only old, broken reactors that are at risk of retirement. As old reactors become more expensive to operate, they may become uneconomic to keep online in the current market conditions. Indeed, the first reactor retired in 2013 (Kewaunee) was online and had just had its license extended for 20 years, but its owners concluded it could not compete and would yield losses in the electricity market of the next two decades, so they chose to decommission it.
- The industry continues to have great difficulty executing major capital improvements and repairs. Crystal River and San Onofre were abandoned after repairs went very badly. The experience with major uprates since 2009 exhibits exactly the same problems that have plagued nuclear construction projects throughout the history of the commercial sector -- abandonments, cancellation and large cost overruns.
- Things have gotten so bad in the aging nuclear fleet in the U.S. that Wall Street analysts are now issuing reports with titles such as the following: *"Nuclear... the Middle Age Dilemma? Facing Declining Performance, Higher Costs and Inevitable Mortality."* (Credit Suisse); *"Some Merchant Nuclear Reactors Could Face Early Retirement: UBS"*; and *"Low Gas Prices and Weak Demand are Masking US Nuclear Plant Reliability Issues"* (Moody's).

SOURCE Mark Cooper, Vermont Law School