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U.S. government role in merchant nuclear?



Merchant nuclear projects, created by U.S. electricity industry reform, sell power into electricity markets. Two merchant nuclear projects closed early (and permanently) in 2013 due to financial losses and others may retire early because of losses. Should the U.S. government to take action to prevent the early and permanent retirement of merchant nuclear power plants?

The U.S. has more nuclear power plants than any other country. Unlike other countries with nuclear power, U.S. nuclear power plants are mostly owned by private companies. U.S. nuclear power plants were mostly built by regulated electric utilities.

Electricity industry restructuring in the U.S. transformed privately owned regulated nuclear power plants into merchant generators that sell power into electricity markets. These merchant generators had limited-term power contracts with original utility owners that provided financial stability to both parties. These power contracts expired at a time when wholesale electricity market prices are very low. The power contracts were not renewed, leaving merchant nuclear generators to sell power into electricity markets.

Energy policy decisions resulting in U.S. electricity industry reforms did not anticipate that this would mean the early and permanent closure of merchant nuclear power plants.

In 2013, the Kewaunee and Vermont Yankee nuclear power plants retired early (and permanently) because of losses in the electricity markets. These merchant nuclear units were well maintained, had good performance (e.g., capacity factors above 90%), and had NRC approval for 20-year operating license renewals. Neither plant was able to find a way to operate profitably.

Other merchant nuclear plants, including Ginna in New York and several Exelon units in Illinois, face similar economic pressure that may lead to early retirement.

The UK had a similar experience with merchant nuclear. Government-owned nuclear generator British Energy was privatized in 1996. British Energy operated as a merchant generator in the England & Wales electricity market and experienced financial losses for several years. To avoid the loss of nuclear generation, the UK government re-nationalized British Energy in 2005.

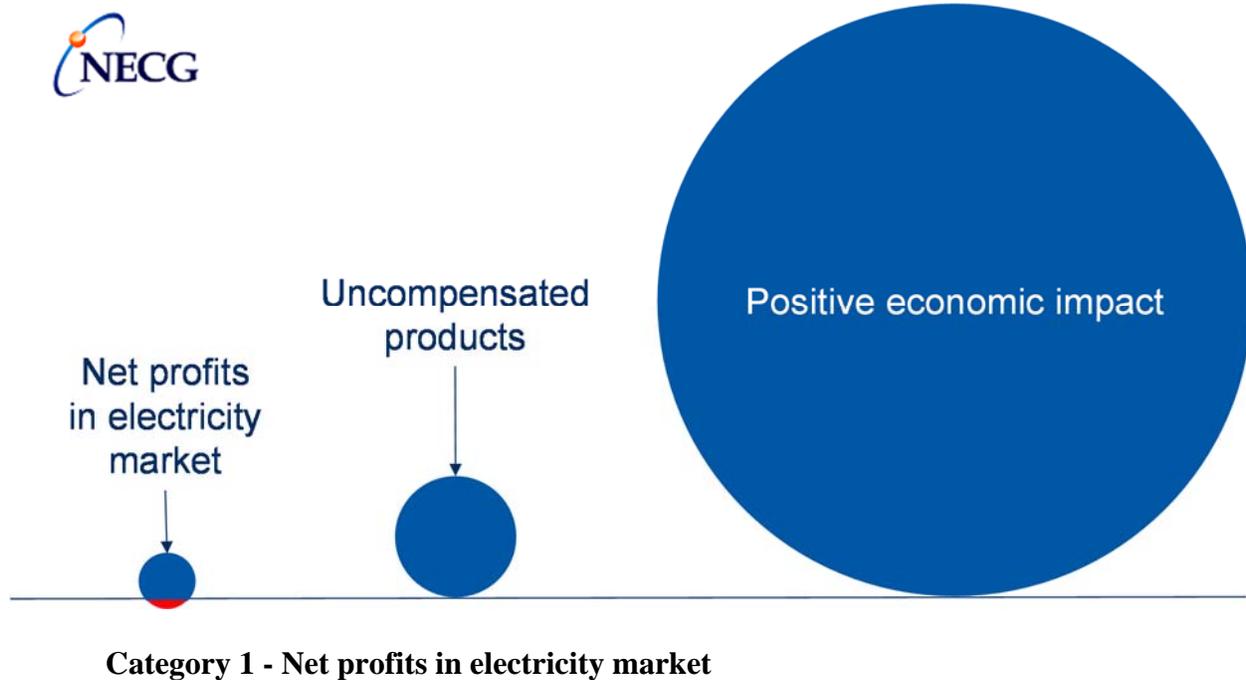
The merchant nuclear generator approach may not work, as explained in my earlier WNN editorial "[Can nuclear succeed in liberalized power markets?](#)"

U.S. merchant nuclear plants must subsist on low and uncertain electricity market revenues, while providing significant benefits, without compensation, to local communities, states, regional electricity markets, and to the country.

Nuclear value

Merchant nuclear project value has three categories, as shown in Figure 1 below. Merchant nuclear power plant owners subsist on the first value category, while providing other value categories without compensation.

Figure 1 – merchant nuclear value



The first category is the profit, if any, from selling power into an electricity market.

The costs of operating a nuclear power plant are largely fixed, so the profit of these plants is highly dependent¹ on electricity market prices. Low natural gas prices, programs to encourage renewable capacity, low electricity demand growth, flawed electricity market designs, and other factors have resulted in low electricity market prices and merchant nuclear plant losses.

The now-retired Kewaunee and Vermont Yankee nuclear power plants closed because of losses selling power into electricity markets, resulting in the loss of the other value categories.

Category 2 – Uncompensated products

The second category is the value of uncompensated nuclear electricity attributes.

Uncompensated nuclear electricity attributes include reliable/dispatchable capacity, zero-carbon and emission-free electricity, base load operation, long-term stable fuel costs, and electricity system reliability. These uncompensated outputs provide benefits to the regional electricity market in which the merchant nuclear plant is located and to the entire country.

Utility regulators in the traditional electricity industry structure (i.e., not in electricity markets) can and do reflect these nuclear electricity attributes in making resource planning decisions.

¹ This is different from a combustion-based generation technology, where a substantial portion of the total cost of power generated is the cost of fuel. Fuel costs can be avoided by operating less, an option that nuclear power plants do not have.



If merchant nuclear plants were compensated for nuclear electricity attributes that they now provide with no compensation, the financial viability of these plants would be enhanced.

Category 3 – Positive economic impact

The third category is positive economic impact.

A series of economic impact studies of merchant nuclear plants has been sponsored by NEI. These studies consistently show that a nuclear power plant provides hundreds of millions, if not billions, of dollars in direct and indirect economic benefits to local communities, regions, states and the entire country. These positive economic impacts provide NO benefit to a merchant nuclear power plant, but will be lost if a merchant nuclear plant retires early.

Utility regulators in the traditional electricity industry structure (i.e., not in electricity markets) can and do reflect positive economic impact of nuclear power in resource planning decisions.

Efforts to prevent the early retirement of merchant nuclear plants can be justified by the positive economic impacts that will be retained.

Why government action?

Several state legislatures and utility commissions in the U.S. have recognized that merchant nuclear projects provide benefits that are not compensated in the electricity market. These states are trying to prevent the early retirement of merchant nuclear plants, as discussed in [NECG Commentary #6](#). State action to keep merchant nuclear plants in operation is limited to local utility rates, even though the benefits of continued operation apply to the entire country.

There has been little action by the U.S. federal government to help threatened merchant nuclear projects, despite the national benefits that would be lost if these plants close.

The U.S. government spent hundreds of billions of dollars to save threatened automobile companies and financial institutions and provides several billion dollars in subsidies for renewable energy each year.

U.S. government support of renewable energy is justified by the failure of electricity markets to reflect the societal cost of fossil generation, including air pollution, greenhouse gas emissions, fuel cost/supply risks, and other factors. These market failures would also justify federal support for nuclear power.

The demonstrated failure of electricity markets to provide compensation to merchant nuclear power plants sufficient for continued operation, despite the significant benefits these merchant nuclear power plants provide, is another market failure that would justify government action.

Keeping existing merchant nuclear plants in operation will be easier, faster, and a lot cheaper than providing incentives for private companies to build new nuclear power plants to replace retired merchant nuclear plants.

The value provided by nuclear power is why nuclear power is moving ahead in government economies like China, where the government is both the owner and beneficiary of the value created by nuclear power. This value also explains why regulators in the non-market regions of the U.S. support new and existing nuclear power plants.

It is appropriate that the federal government take action to prevent the loss of regional and national benefits that will occur if (or when) more merchant nuclear plants retire early.

What could the federal government do?

The federal government could take several approaches. Federal government action may be the only way to prevent the early retirement of merchant nuclear generators.

Electricity market changes

Early retirement of merchant nuclear projects is an unintended consequence of electricity reform and electricity markets.

It may be possible to change electricity markets in ways that would more fully compensate merchant nuclear projects for the benefits they provide.

Electricity markets operate by treating electricity as a commodity, so that making changes to the electricity spot market to reflect non-commodity attributes of electricity may not be possible.

However, electricity markets have side markets (e.g., capacity auctions to help retail utilities meet the NERC capacity requirements or to help maintain system reliability) and side contracts with specific generators (e.g., reliability-must-run agreements).

Adapting the side market/side contract approach to help merchant nuclear is feasible. The PJM capacity mechanism are one example of a side market and the recent changes to the PJM capacity mechanism to reflect the value of capacity offered will provide some added benefit to merchant nuclear generators.

A requirement that electricity market operators enter into side contracts (maybe as the outcome of auctions) to keep nuclear generators in operation might be a more effective approach.

Carbon Tax

A federal carbon tax would raise the cost of fuel for all combustion-based generation technologies. Increased fuel cost would result in increases in bid prices in electricity markets and would result in higher electricity market spot prices.

If the carbon tax were large enough, the resulting increase in electricity market prices would allow merchant nuclear generators to operate profitably.



National Low Carbon Portfolio Standard

This would be a national requirement that all retail load-serving utilities in the U.S. include a certain percentage of low- or no-carbon generation, including new and existing nuclear power, in the electricity they buy and use.

This might look like the Low Carbon Portfolio Standard proposed in Illinois but applied to the entire country.

Merchant nuclear generators would get additional revenue from selling “nuclear energy credits” or “carbon-free electricity credits” to retail electricity companies, in much the same way that renewable generators sell renewable energy credits under state renewable portfolio requirements.

Production Tax Credits for existing nuclear

The U.S. already provides federal income tax credits to renewable generation and is committed to provide these credits to new nuclear power plants meeting the conditions in the Energy Policy Act of 2005.

It should be possible to implement a new federal production tax credit that applies to existing merchant nuclear power plants. The increased revenue from these tax credits would help threatened merchant nuclear power plants remain in operation.

Invest in merchant nuclear power plants

The U.S. government could buy or invest in threatened merchant nuclear power plants. This might be similar to the approach used in the federal rescue of financially threatened automobile manufacturers and financial institutions.

These government investments could be structured to minimize the need for a change of ownership or a change in nuclear operator. This would be similar to the UK government re-nationalization of British Energy in 2005.

When electricity market prices reach sustainable levels, the federal government investment in merchant nuclear power plants might be sold at a profit, similar to the profits the federal government made in automobile and financial institution investments.



Federal Power Contracts

A 2014 paper in The Electricity Journal, [Rescuing U.S. Merchant Nuclear Power](#), outlines the use of power contracts to keep merchant nuclear projects in operation.

These power contracts could be similar to the contracts proposed in Ohio by FirstEnergy for the Davis Besse nuclear power plant.² These financial contracts for differences (CfDs) would have a merchant nuclear project as one party and some federal entity (e.g., DOE) as the counterparty.

CfDs are well-known, widely used financial mechanisms that could be used to provide a certain and sufficient level of revenue to merchant nuclear power plants, regardless of the electricity market spot price. CfDs can be tailored to ensure that merchant nuclear power plants remain in operation but prevent windfall profits to the owners if (when) electricity market prices are sustainable.

Like the federal government investment approach, these power contracts would be profitable if electricity market prices reach sustainable levels.

Summary

U.S. electricity markets are failing to provide compensation to merchant nuclear power plants to support continued operation. The early retirement of these merchant nuclear power plants will mean the loss of the significant benefits to the country.

The U.S. government should take action to prevent merchant nuclear power plants from closing early and permanently. Keeping merchant nuclear power plants in operation will cost less than the incentives needed to convince private investors to build new nuclear power plants.

The difficulty in implementing any federal government action means that we need to get started now. Otherwise, we may lose more merchant nuclear power plants.

[I received much-appreciated comments on drafts of this commentary from several colleagues, including Robert Bryce, Edward Davis, Margaret Harding, Paul Murphy, Richard Myers, and Elise Zoli. Any errors are my sole responsibility.]

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² Public Utilities Commission of Ohio, Case No. 14-1297-EL-SSO.