

The Social and Economic Impacts of Nuclear Power Plant Closures

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About the Institute

MISSION

To provide the communities that host nuclear power plants with the knowledge and tools they need to shape their post-nuclear futures.

INHC Program Areas				
Education	Research	Networks	Consulting	Public Policy
Raising awareness of key issues for local, regional, professional, and public	Analyzing impacts, initiatives, and best practices	Connecting communities to local, regional, and national allies	Providing tailored research and planning work to individual communities	Developing and securing public policy on key issues



Overview

- Part I – Jonathan Cooper: Fundamentals, based on
 - Economic & Policy Research
 - UMass Nuclear Closure course curriculum
- Part II – Jen Stromsten: Conditions & Recommendations, based on
 - Case Studies
 - Working with Host Communities

Part I

- Fundamentals of Nuclear Plant Closure
 - A. TIMELINE
 - B. CHARACTERISTICS
 - C. IMPACTS

Closure Timeline: 1989 – Present

Shoreham				Crystal River				
Rancho Seco				Kewaunee			Oyster Creek	
Fort St. Vrain	Trojan	Big Rock Point		San Onofre	Fort Calhoun	Pilgrim Station	Diablo Canyon	
1989	1992	1997		2013	2016	2019	2025	

FIRST WAVE

1991
Yankee Rowe

1996
Connecticut Yankee
Maine Yankee

1998
Zion

SECOND WAVE

2014
Vermont Yankee

2018
Palisades

2020/21
Indian Point

Wave One: 1989 – 1998

Ownership

Public utilities

Dismantlement

DECON – Immediate

Factors

Market deregulation

Operational issues

Public opposition

Operation

10 Reactors, 209 years



In the Trough: 1999 – 2012

Deregulation

1999: Pilgrim Station sold

Security Upgrades

2002: Sec B.5.b rules

Fukushima

2012: Natural disaster rules

Shale Gas

2011: Gas reserves double

Table 2.2: Changes in Production Costs by Energy Industry, 2008 and 2012

	Fuel Costs			O&M Costs			TOTAL COSTS		
	2008	2012	Change	2008	2012	Change	2008	2012	Change
Gas Turbines	64.23	30.45	-52.6%	6.49	5.22	-19.6%	70.72	35.67	-49.6%
Fossil Fuel Steam	28.43	24.17	-15.0%	7.31	7.72	5.6%	35.74	31.89	-10.8%
Nuclear	5.29	7.08	33.8%	16.09	18.4	14.4%	21.38	25.48	19.2%

Source: US EIA Electric Power Annual 2012, Table 8.4

Wave Two: 2013 – Present

Ownership

Investor-owned

Dismantlement

SAFSTOR – Deferred

Factors

Market competition

Reactor lifespan

Regulatory upgrades

Operation

12 Reactors, 464 years



About Plant Closure: Impacts

**A major socioeconomic event
with far-reaching impacts**

Household income: Hundreds of jobs with high wages and benefits

Civic contributions: Revenue for general funds, office budgets, and local nonprofits

Economic activity: Workforce and plant spending at local businesses

Land use: Significant portions of undeveloped, stigmatized land

About Plant Closure: Challenges

**A major socioeconomic event
with challenging characteristics**

Location: out of the way

Workforce: major out-migration

Cleanup: decades to complete

Assistance: no source of aid

Spent Fuel: broken policy

Characterizing Closure

Output

Location

Workforce

Cleanup

Assistance

Spent Fuel

- How is nuclear plant closure different from
 - Other power plants?
 - Manufacturing plants?
 - Other industry plants?
- Six Factors affecting
 - Redevelopment
 - Public support
 - Outside interest

Characterizing Closure

Output

Location

Workforce

Cleanup

Assistance

Spent Fuel

- Nuclear power in 2011
 - 0.006 percent of all US generators
 - 37 percent of industry workforce
 - 42 percent of industry wages
- **IMPLICATIONS**
 - Significant plant valuation
 - Creates sizable tax contribution
 - Potential source of conflict between host community and plant
 - Big numbers grab attention at closure

Characterizing Closure

Output

Location

Workforce

Cleanup

Assistance

Spent Fuel

- Out of sight, out of mind
 - Distant from highways and other infrastructure
 - Often found in rural communities
 - Substantial zone of exclusion
- IMPLICATIONS
 - Limited access diminishes site reuse potential
 - Rural communities have limited demographic and political influence
 - Enhances focus on site reuse as a power plant

Characterizing Closure

Output

Location

Workforce

Cleanup

Assistance

Spent Fuel

- Out of sight, out of mind (usually)
 - Distant from highways and other infrastructure
 - Often found in rural communities
 - Substantial zone of exclusion
- IMPLICATIONS
 - Limited access diminishes site reuse potential
 - Rural communities have limited demographic and political influence
 - Enhances focus on site reuse as a power plant



Characterizing Closure

Output

Location

Workforce

Cleanup

Assistance

Spent Fuel

- Large, well-trained, well-compensated
 - Average nuclear plant employs 950 people
 - Average non-nuclear plant employs 70 people
 - Enjoys wages and benefits well above community averages
- **IMPLICATIONS**
 - Substantial wage expenditures stay in-region
 - Workforce is a major contributor to local economy
 - Supports health care, food, financial, and real estate services

Characterizing Closure

Output

Location

Workforce

Cleanup

Assistance

Spent Fuel

- Lacking clarity, sowing confusion
 - 1980 estimate: decom = 10% of construction costs
 - 2014 VY estimate: \$1.24 billion
 - 1972 VY construction cost (\$217 million) adjusted to 2015 dollars: \$1.237 billion
 - Decommissioning standards vary by state and agency
- IMPLICATIONS
 - Public mistrusts decommissioning, overlooks closure
 - NRC focuses on decommissioning, overlooks closure
 - Higher standards = higher costs = more SAFSTOR

Characterizing Closure

Output

Location

Workforce

Cleanup

Assistance

Spent Fuel

- Who should we call?
 - NRC focuses on decommissioning only
 - Workforce retraining programs not attuned to nuclear industry
 - Federal agencies do not claim responsibility
- IMPLICATIONS
 - Overwhelmed local officials
 - No guidance for state, local, and plant officials to base conversations on
 - Impacts last longer-term

Characterizing Closure

Output

Location

Workforce

Cleanup

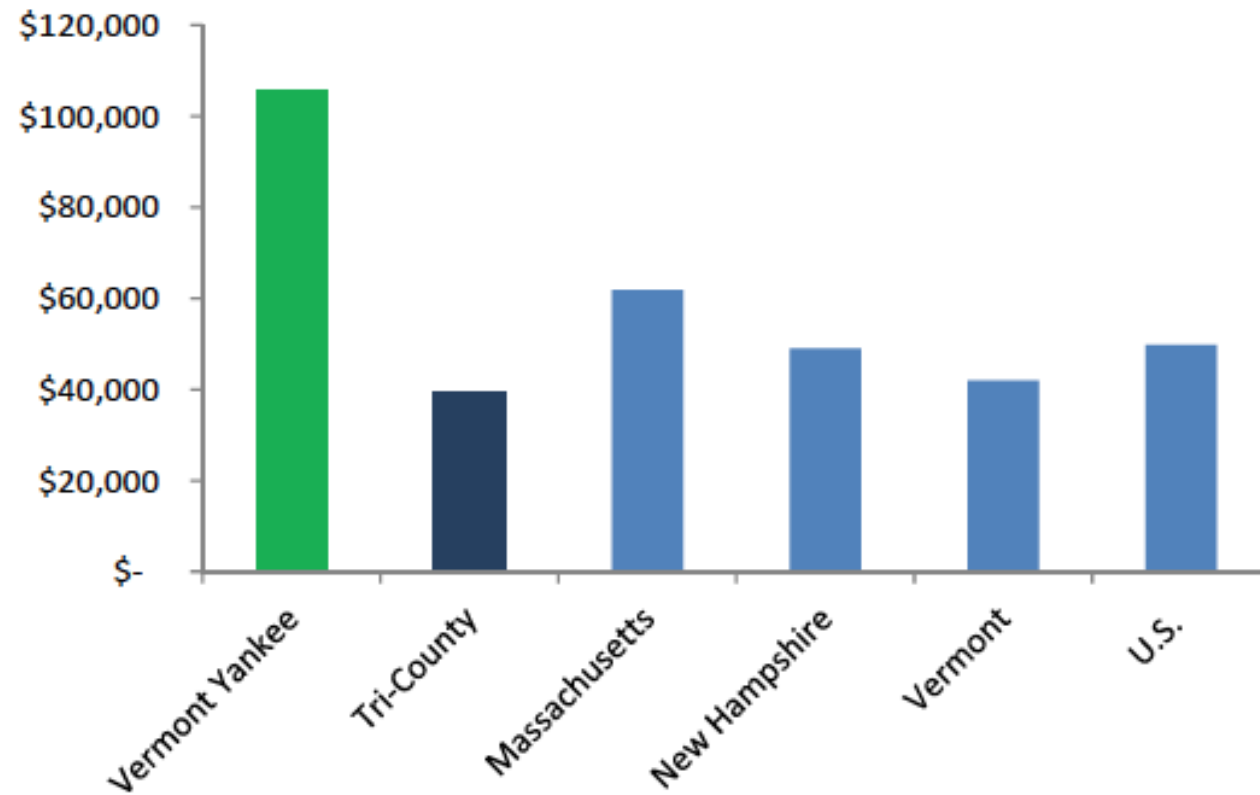
Assistance

Spent Fuel

- There's nothing else like it
 - No resolution in sight
 - Policy failure for several decades
 - Lives longer than decommissioning
- IMPLICATIONS
 - Creates tense holding pattern
 - “We want to go out of business, but we can't.”
 - Poses exceptional challenges for site reuse

Workforce Impacts

Figure 6. Average Wage Per Employee, Vermont Yankee Compared to Region, States, and U.S.



Municipal Impacts

Table 4.7: State & Local Payments

Plymouth PILOT	\$10,000,000		
MA Sales Tax	\$3,750,000		
MEMA	\$2,600,000		
EPZ Towns	\$686,000	\$245,000	Plymouth
		\$186,000	Marshfield
		\$85,000	Kingston
		\$85,000	Carver
		\$85,000	Duxbury
Non-EPZ Towns	\$314,000	\$114,000	Bridgewater
		\$100,000	Taunton
		\$100,000	Braintree
Total	\$17,350,000		

Sources: Municipal interviews (2014); Author's calculations.

Table 4.12: Estimated Property Tax Payments by Pilgrim Station Employees, 2015

Town	Workers	Region	Median Home	Employee Real Estate Value	Mill Rate	Annual Payment
Plymouth	190	OCPC	\$307,733	\$58.47 million	15.54	\$908,580
Sandwich	40	Cape Cod	\$349,500	\$13.98 million	14.82	\$207,200
Kingston	32	OCPC	\$329,512	\$10.54 million	16.94	\$178,624
Carver	33	SRPEDD	\$259,100	\$8.55 million	17.01	\$145,431
Duxbury	13	OCPC	\$609,200	\$7.92 million	15.60	\$123,552
Marshfield	24	MAPC SSC	\$386,700	\$9.28 million	13.29	\$123,336
Bourne	25	Cape Cod	\$388,779	\$9.72 million	10.07	\$97,875
Barnstable	19	Cape Cod	\$457,349	\$8.69 million	9.30	\$80,807
Middleboro	15	SRPEDD	\$261,500	\$3.92 million	15.78	\$61,890
Weymouth	15	MAPC SSC	\$302,016	\$4.53 million	12.90	\$58,440

Source: Massachusetts Department of Revenue; Author's calculations

Part II

- Communities and Closure – Overview on how it's going
 - A. BIG CONCEPTS
 - B. CURRENT DEFAULTS
 - C. BEST PRACTICES
 - D. BREAKING NEWS
 - E. BIG GOALS

Part II A – BIG CONCEPTS

- **We look at closure from the community perspective.** *From the ground up, not energy and financial market centered.*
- **The U.S. has effectively no policy relating to closure.** *The NRC closes power plants by running its regulatory script in reverse (un-making the souffle).*
 - *No recognition from U.S. Govt that NRC host communities are an interest group (DOE hosts are)*
 - *Some inclusion in DOE Consent Based Siting Study, but not in final recommendations issued this year.*
 - *Neither the NRC nor DOE nor state govts take a proactive stance on economic recovery, and most drivers are cleanup based.*
 - *Economically driven reuse like Griefswald, is unlikely as site restoration standards based geared to recreational use*
- **U.S. Energy Policy creates a complex mix.** *De-regulated markets, mix of public + merchant utilities, little top-down planning.*
 - *Market-driven volatility (cheap natural gas today)*
 - *Context & Ownership-driven dynamics*
 - *Ongoing litigation =uncertainty (fuel, DTFs)*
 - *Emissions regulation?*
- **Right Now: A major potential shift >> Performance-Based cleanup + Consent-Based Spent Fuel storage solutions (DOE)**

Part II B – CURRENT DEFAULTS

- **No data on Impacts:** *Permanent loss \$0.5-1.5 billion annually from regional economy, no study or recovery plan required.*
- **No leadership on economic:** *Infighting, distraction, low capacity at local / regional level = weak outcomes.*
- **No collaboration:** *Towns vs neighbors, county and state. Scrambling to stabilize tax base. Different areas and scales of public interest become adversarial groups, both within economic needs and with economic pitted against environmental.*
- **No mitigation:** *All this with no dedicated resources directed into economic recovery, except to layoffs.**
- **No long term, regional scale actions:** *Complete economic transition and recovery is not in the discussion.*
- **No off-site focus:** *It's hard to look away, despite site limitations (access, size, infrastructure).*
- **No scenario-driven site reuse and redevelopment:** *Default conversation is 'how clean', not 'what's next'.*

Part II C – BEST PRACTICES

- **DATA** - Detailed impact analysis, used to plan *long term economic development response geared to complete socioeconomic recovery.*
- **SCALE** – Embrace region-wide response *in total impacted area, focus on off-site pre-closure and near term mitigation of economic losses.*
- **DIY** - Build organizational capacity to operate long term, including redevelopment and planning authority at regional scale, politically resilient, focused on full recovery.
- **Proactive collaboration to sustain awareness, plan long term, solve**
 - Find \$ mitigation resources
 - Be ready for unexpected opportunities
 - Stay awake, things keep changing
site reuse as U.S. shifts to performance-based cleanup, market pressure to force spent-fuel storage solution, and climate change – affecting economics of energy markets.
 - Act like help is not on the way

Part II D – BREAKING NEWS

EMERGING MODELS

SPENT FUEL STORAGE

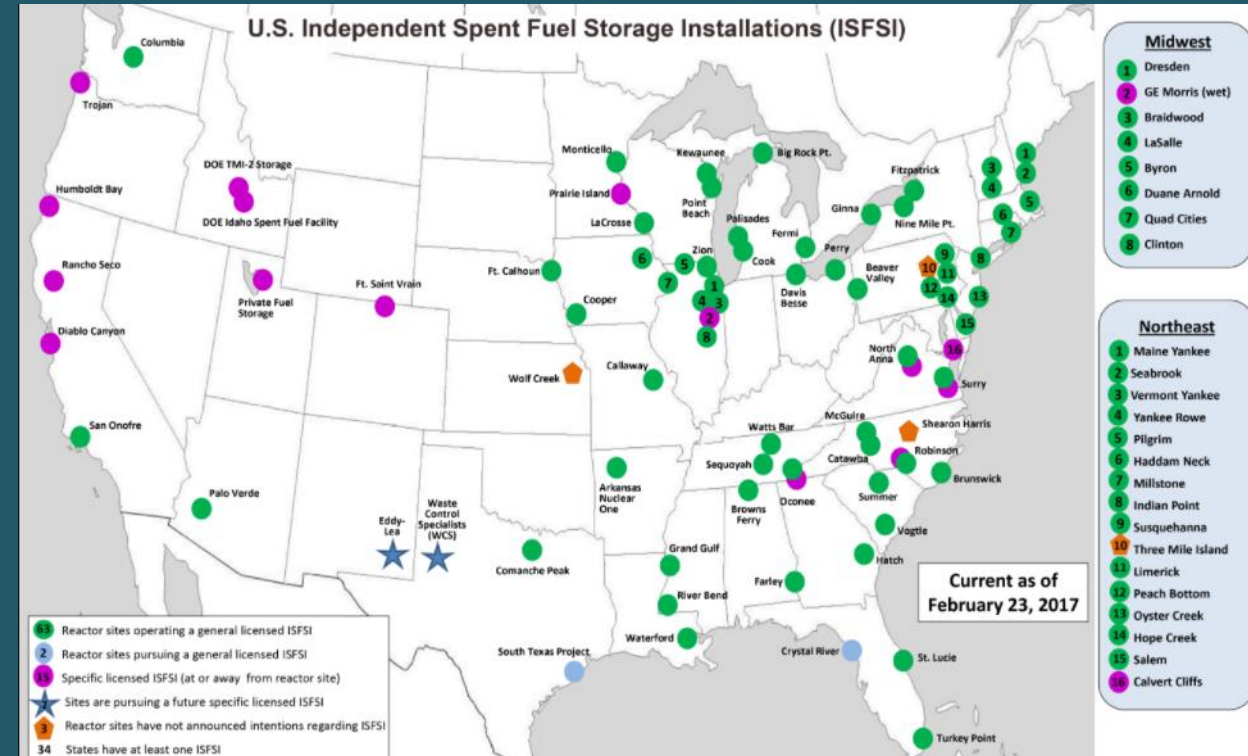
(DOE Consent-Based Siting Report 2017)

PERFORMANCE-BASED CLEANUP AND BUSINESS

(Northstar Vermont Yankee Pending Sale)

WILL IMPACT:

- **RECOVERY PLANNING** We used to recommend ignoring siting in economic planning with SAFSTOR
- **\$ & TIMING** Performance based may speed up cleanup - reduce economic benefit of decom activities but partial release of site possible and...
- **SITE REUSE** Consent-based siting of spent fuel = removal. If it happens may speed up total site release.



NRC.gov “U.S. Independent Spent Fuel Storage Installations”

Westinghouse Files for Bankruptcy, in Blow to Nuclear Power

By DIANE CARDWELL and JONATHAN SOBLE

The New York Times March 29, 2017



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A Westinghouse project in Waynesboro, Georgia, remains unfinished, its future in doubt after the bankruptcy filing.

Reuters

Part II E – BIG GOALS

- **All of the 60+ U.S. Host Communities become an identified constituency** with appropriate supports, advocacy, framework and resources for long term prep, plan & mitigation (DOE ECA model).
- **100% economic recovery goal for host regions with adequate long term resources,** planning and regulatory framework to support complete transition (BRAC model).
- **Site restoration and reuse that is scenario-driven guided by real community input.** May result in anything from deeper cleanup to industrial reuse (brownfields model).
- **Complete Life Cycle Planning for energy generation sites and their host communities,** including social and environmental, as well as MW generated and economic impacts.

Regarding proposed sale of plant and full license transfer
from Entergy to Northstar (and partners including Arriva)
to enact performance-based cleanup



Questions Welcome