The Social and Economic Impacts of Nuclear Power Plant Closures

Jonathan Cooper & Jen Stromsten
Institute for Nuclear Host Communities

Presentation to the American Nuclear Society Northeastern Section
Framingham, MA – October 18, 2017
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.

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

Ownership
- Public utilities

Dismantlement
- DECON – Immediate

Factors
- Market deregulation
- Operational issues
- Public opposition

Operation
- 10 Rectors, 209 years
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

<table>
<thead>
<tr>
<th></th>
<th>Fuel Costs</th>
<th></th>
<th></th>
<th></th>
<th>O&amp;M Costs</th>
<th></th>
<th></th>
<th></th>
<th>TOTAL COSTS</th>
<th></th>
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</thead>
<tbody>
<tr>
<td>Gas Turbines</td>
<td>64.23</td>
<td>30.45</td>
<td>-52.6%</td>
<td></td>
<td>6.49</td>
<td>5.22</td>
<td>-19.6%</td>
<td></td>
<td>70.72</td>
<td>35.67</td>
</tr>
<tr>
<td>Fossil Fuel Steam</td>
<td>28.43</td>
<td>24.17</td>
<td>-15.0%</td>
<td></td>
<td>7.31</td>
<td>7.72</td>
<td>5.6%</td>
<td></td>
<td>35.74</td>
<td>31.89</td>
</tr>
<tr>
<td>Nuclear</td>
<td>5.29</td>
<td>7.08</td>
<td>33.8%</td>
<td></td>
<td>16.09</td>
<td>18.4</td>
<td>14.4%</td>
<td></td>
<td>21.38</td>
<td>25.48</td>
</tr>
</tbody>
</table>

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

- 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

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

- 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
• 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
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

<table>
<thead>
<tr>
<th>Town</th>
<th>Amount</th>
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<tbody>
<tr>
<td>Plymouth PILOT</td>
<td>$10,000,000</td>
</tr>
<tr>
<td>MA Sales Tax</td>
<td>$3,750,000</td>
</tr>
<tr>
<td>MEMA</td>
<td>$2,600,000</td>
</tr>
<tr>
<td>EPZ Towns</td>
<td>$686,000</td>
</tr>
<tr>
<td>Non-EPZ Towns</td>
<td>$314,000</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>$17,350,000</strong></td>
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</table>

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

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

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

  - 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)
The Pilgrim Nuclear Power Station Study
A SOCIO-ECONOMIC ANALYSIS AND CLOSURE TRANSITION GUIDE BOOK

Jonathan G. Cooper
UNIVERSITY OF MASSACHUSETTS AMHERST | APRIL 2015
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
Vernon, Vermont - Home of Vermont Yankee Nuclear Power Plant
Public Hearings with Vermont Public Service Board (Utilities)
Regarding proposed sale of plant and full license transfer
from Entergy to Northstar to enact performance-based cleanup
partners including Areva and Burns & McDonnell

Part II D – HOT TOPIC
EMERGING MODELS

SPENT FUEL STORAGE
DOE Consent-Based Siting Report 2017 & A new attempt at legislative basis to compensate communities

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
Part II E – INHC 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.
Questions?
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