Duke Energy Nuclear Programs Update for the South Carolina Nuclear Advisory Council

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Agenda

- Nuclear Fleet Performance Overview
- Subsequent License Renewal Process
- Subsequent License Renewal Industry Status
- Duke Energy Subsequent License Renewal Status
Duke Energy owns 100% of all units except the Catawba units.
Nuclear Fleet – Key Performance Indicators

Safety
- Personal
- Radiological
- Nuclear (Scrams)

Reliability
- Capacity Factor
- Online Reliability Loss Factor

Efficiency
- Total Operating Cost

2016 Duke Energy nuclear fleet industry ranking = 1 of 8
2017 Duke Energy nuclear fleet industry ranking = 1 of 8
Duke Energy goal = Best fleet in the industry
2016 and 2017 Generation Highlights

2016
- Fleet record annual capacity factor of 95.72 percent
- Catawba Nuclear Station completed small uprate on Unit 1 (additional 20 MWe)
- Oconee completed its shortest ever refueling outage in the spring (23 days) only to be surpassed in the fall (22 days)

2017
- Fleet annual capacity factor of 95.64 percent, second best only to 2016
  - 19th year of fleet capacity factor greater than 90 percent
  - Exceeded U.S. industry average for past 25 years
- Brunswick station completed a record dual-unit continuous run of 357 days
- Harris Nuclear Plant set a 12-month generation record of producing more than 8 billion kWh
- Three of the refueling outages in 2017 ended continuous runs –
  - Brunswick Unit 2 – record 711 days
  - McGuire Unit 1 - record 523 days
  - Oconee Unit 2 – 716 days, a new fleet record
- Catawba Nuclear Station set an annual generation record of producing more than 19 billion kWh
- Robinson Nuclear Plant has worked 957 days without a recordable injury (through May 17, 2018)
Duke Energy Nuclear Outreach

- Employees involved in community outreach
  - School supply drives
  - Food drives
  - Blood drives
  - Holiday gift drives

- Active involvement in North American Young Generation in Nuclear (NAYGN)
  - Wrote *Marie’s Electric Adventure*, a book explaining nuclear energy to elementary school children
  - Won a Nuclear Energy Institute Top Innovative Practice (TIP) Award
Industry Subsequent License Renewal Regulatory Background


- The Nuclear Regulatory Commission (NRC) Commissioners decided to leave 10 CFR 54 intact for SLR.

- The NRC Commissioners stated the NRC staff should continue to update license renewal guidance, as needed.
  - NUREG-2191 – Generic Aging Lessons Learned for Subsequent License Renewal (GALL-SLR) Report
Subsequent License Renewal Regulatory Process
Research to better understand technical issues associated with the long-term, safe operation of nuclear power plants:

- The Department of Energy (DOE)
- Electric Power Research Institute (EPRI)
- Nuclear industry

This research has shown nuclear plants can be safely operated during a second license renewal period.

- Nuclear plants continue to operate safely through
  - Continuous upgrade and replacement of parts and systems
  - Rigorous NRC oversight
  - Learnings from research and operating experience
Industry Subsequent License Renewal Submittal Status

- Subsequent License Renewal Application submittal to date:
  - NextEra – Turkey Point, January 2018

- Future submittals announced:
  - Exelon – Peach Bottom, July 2018
  - Dominion – Surry, December 2018
    North Anna, 2020
Life Extension as Strategic Bridge for Nuclear Power

Most plants in the U.S. have already received extensions of their original 40-year licenses to 60 years, and the oldest units will reach their 60-year limit in the early 2030s.

License renewal of the U.S. nuclear fleet to 80 years can sustain 100 gigawatts of carbon-free electricity generation for two decades, providing a bridge to the next generation of nuclear reactors.

Without life extension from 60 to 80 years, the fleet’s available capacity will drop significantly between 2032 and 2050.

Beginning in the 2020s, new light water reactors, small modular reactors, and other next-generation nuclear reactors are deployed. Their installed capacity increases as existing reactors approach the end of their 60-year lives.

Sources: U.S. Energy Information Administration (capacity data); U.S. Nuclear Regulatory Commission (license expiration)
Duke Energy Nuclear Fleet Licenses

Duke Energy Nuclear Plant License Expirations

<table>
<thead>
<tr>
<th>Station</th>
<th>Capacity (MW)</th>
<th>Units</th>
<th>Commercial Operation</th>
<th>License Expiration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oconee</td>
<td>2,554</td>
<td>3 PWR</td>
<td>1973</td>
<td>2033, 2034</td>
</tr>
<tr>
<td>Catawba</td>
<td>2,290</td>
<td>2 PWR</td>
<td>1985</td>
<td>2043</td>
</tr>
<tr>
<td>McGuire</td>
<td>2,316</td>
<td>2 PWR</td>
<td>1981</td>
<td>2041, 2043</td>
</tr>
<tr>
<td>Brunswick</td>
<td>1,870</td>
<td>2 BWR</td>
<td>1975</td>
<td>2034, 2036</td>
</tr>
<tr>
<td>Harris</td>
<td>928</td>
<td>1 PWR</td>
<td>1987</td>
<td>2046</td>
</tr>
<tr>
<td>Robinson</td>
<td>741</td>
<td>1 PWR</td>
<td>1971</td>
<td>2030</td>
</tr>
<tr>
<td>Crystal River</td>
<td></td>
<td></td>
<td></td>
<td>Retirement announced 2013</td>
</tr>
</tbody>
</table>

Total 10,699 11

1 - Does not include non-Duke Energy portion of co-owned plants

For Information Purposes Only
Duke Energy Commitment to the Environment

- Duke Energy is committed to a low-carbon future, as outlined in 2017 Climate Report to Shareholders:
  - Current plan to achieve 40 percent CO2 emission reduction by 2030 compared to 2010 levels
  - Duke Energy’s contribution to a global “two-degree policy” calls for a 72 percent reduction in CO2 emissions by 2050 compared to 2010 levels, referred to as Pro Rata Reductions
- In 2017, operation of our nuclear fleet avoided the release of about 82 million metric tons of CO2, as much CO2 as is released from more than 17 million passenger cars.
- Our nuclear fleet plays an important role in our company’s efforts to lower carbon emissions. One pathway to 2050:
Duke Energy Commitment to Customers and Communities

Customers

- In the Carolinas, nuclear power
  - Provides more than 50 percent of our customers’ electricity
  - Is a critical component in our generation portfolio
  - Has served Carolinas customers well for more than 45 years
  - Contributes to fuel diversity, which is important for our customers now and in the future

Communities

- Our nuclear fleet remains a driver for economic success
  - Provides good jobs – 6,300 Duke Energy employees plus additional contract workers during refueling outages
  - Provides partnership opportunities in the communities where our plants are located
  - Provides significant tax bases - more than $322 million in property and payroll taxes in 2017
    - S.C. nuclear payroll = $94 million
    - S.C. nuclear property = $44 million
Duke Energy Subsequent License Renewal

- Team evaluating Subsequent License Renewal for the nuclear fleet
  - Evaluating the technical basis for operation beyond 60 years
  - Leading and participating in industry working groups
  - Participating in Nuclear Regulatory Commission public meetings
  - Interfacing with lead Subsequent License Renewal applicants
    - Benchmarks
    - Peer Reviews of Subsequent License Renewal Applications
  - Performing economic analyses

- We believe all of our nuclear plants are good candidates for Subsequent License Renewal.

- Pursuing Subsequent License Renewal will provide the opportunity to operate the plants up to 80 years if it makes economic sense and provides benefits for our customers.
Questions ?
SLR Environmental Process

Source: U.S. NRC