Nuclear Power Plant Extended Life and Power Upate Environmental Benefits

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**AREVA NP ACTIVITIES**

- **Products and Engineering**
  Electrical and Mechanical systems, spare parts, design and program engineering

- **Large Projects**
  Management and execution of nuclear reactor New Build projects

- **Installed Base**
  Maintenance, engineering services for existing nuclear fleets and fleets under construction

- **Fuel**
  Development, design, licensing and fabrication of fuel assemblies and core components for PWR, BWR reactors, and research reactors. Development of enhanced accident tolerant fuel.

- **Components**
  Design and manufacture of heavy components for nuclear islands

- **Instrumentation & Control (I&C)**
  Design and fabrication of safety I&C systems for the nuclear steam supply system
Why is it so Important to Extend Nuclear Power Plant Life and Increase Capacity?

- The world runs on energy, which is mostly provided by fossil fuels (coal, oil and gas).
- Burning fossil fuels release billions of tons of carbon dioxide every year into the atmosphere.
- Energy conservation is essential but conservation alone cannot significantly alter the adverse environmental impacts from burning fossil fuels.
- Renewable energy will also play a role in reducing greenhouse gases: however, renewable energy is cyclical and currently cannot provide base load capacity.

For the foreseeable future, nuclear energy is a proven technology that can offer the carbon free power generation needed to achieve EPA carbon reduction goals.
Most Economical Method to Increase Nuclear Capacity – Power Uprates

**Measurement Uncertainty Recapture Power Uprates**
- Achieved by implementing enhanced techniques for calculating reactor power. More precise measurements (e.g., Main feedwater flow) reduce uncertainty in the power level, which is used to determine safety margin under postulated accident conditions.

**Stretch Power Uprates**
- Stretch power uprates are typically up to seven percent and are within the design capacity of the plant.
- Stretch power uprates usually involve changes to instrumentation setpoints but do not involve major plant modifications.

**Extended Power Uprates**
- Require modifications to major balance-of-plant equipment such as the high pressure turbines, Feedwater and condensate pumps and motors, main generators, and transformers. Have been approved for increases as high as 20 percent.

Proven Methods and Process Delivers Predictable Results
**Nuclear Plant Power Uprate Results:**

- The NRC has approved 154 NPP uprates, resulting in a gain of approximately 22,900 MWt (megawatts thermal) or 7,000 MWe (megawatts electric).
- Net affect – significant reduction of CO2 production if power uprate capacity was not implemented in the US.

Collectively, these uprates have added generating capacity equivalent to about seven new NPPs.
Most Economical Method to Preserve the Existing Nuclear Capacity – Life Extension

- Nuclear power plants in the United States are initially licensed to operate for 40 years.
- NRC rule allows licensees to apply for extensions of up to 20 years after the initial 40-year term.
  - Process ensures that the current licensing basis will maintain an acceptable level of safety for the period of extended operation.
  - Process ensures that important systems, structures and components will continue to perform their intended function during the 20-year period of extended operation.

Must demonstrate ability to manage aging issues effectively during the renewal time period, thus ensuring equipment safety and functionality.
License Renewal Methodology

- Submit application to the NRC that addresses the technical aspects of plant aging and describes the ways those effects will be managed.
  - Includes evaluation of the potential impact on the environment.
  - The NRC reviews the application and verifies its evaluation through inspections.

- Implement programs to ensure that plant components and systems continue to perform their function beyond 40 years
  - Must identify, monitor and manage the effects of long-term operations.

- Implement additional inspections and aging-management activities
  - Verify acceptable performance for the NPP systems, structures and components.
  - Aging-management activities continue for as long as the plant operates.

License Renewal has already avoided a substantial retirement of nuclear power plant capacity and will continue to do so in the coming decades.
License Renewal Results

- More than 75 commercial nuclear reactors have had their licenses renewed, and 38 reactors have been producing electricity for more than 40 years.
  - To date, Extended License NPPs have delivered approximately 2.8x10^6 GWhr net generation
  - The total projected net generation from the current fleet is approximately 15.1x10^6 GWhr over the 20 year license extension period.

![Diagram](License Renewal Capacity Preservation.png)

Cumulative Net Generation (GWhr)
Annual Net Generation (GWhr)

Note: Ages have been rounded up to the end of the year. For the most recent information, go to the Dataset Index Web page at [http://www.nrc.gov/reading-rm/dms-collectors/datasets/index/](http://www.nrc.gov/reading-rm/dms-collectors/datasets/index/)
Environmental Benefits from NPP Uprates and Life Extension

- NPPs do not emit pollutants identified in the Clean Air Act: ozone, carbon dioxide, sulfur dioxide, nitrogen oxide, particulate matter, and lead.
- NPPs provide a carbon-free energy source, which accounts for over 60 percent of the nation’s zero-carbon energy production and displacing an estimated 600 million tons of carbon per year.
- Preservation of Green Space by eliminating the need for new plants to compensate for reduced NPP output.
- NPPs provide a stable base load of energy which serve to stabilize the grid during extreme weather events to prevent blackouts.

Although some NPPs have closed due to economic reasons, recent legislation passed in New York and Illinois demonstrate the public support for clean energy and for the value of a large base-load plant.