

# Upgrading Programs

## The Westinghouse Solution

Nuclear power plant updatings are a timely and cost-effective way to provide incremental electric generation. Westinghouse has successfully implemented more than 150 plant updatings, providing more than 5000 MWe of additional power generation.

Westinghouse currently offers three types of updating programs:

1. Measurement uncertainty recapture (MUR) power update:  $X < 2\%$ 
  - *Taking advantage of improved power measurements to lower the power calorimetric uncertainty.*
2. Stretch power update (SPU):  $2\% \leq X \leq 7\%$ 
  - *Raising power to within the design capacity of the plant.*
3. Extended power update (EPU):  $X > 7\%$ 
  - *May require significant modifications to major balance-of-plant (BOP) equipment (e.g., high-pressure turbines, condensate pumps and motors, main generators and/or transformers).*

## Customer Benefits

An increase in the nuclear steam supply system not only garners additional revenue from increased power generation, but it also updates the design and licensing basis of a plant in many areas by utilizing enhanced analytical methods and upgrading equipment. An update can also provide cost savings and synergies with other Long Term Operation (LTO) asset management programs and can help fund future programs. An updating provides a cost-effective opportunity to assess and use design and analysis margin in a beneficial way.



## Update Program Description

The scope of work in an updating program generally covers five major areas: update decision process, project development and management, engineering analysis, regulatory approval and licensing, and implementation. Westinghouse has the experience and capability to provide support in each of these areas.

Westinghouse recommends a three-phase process for power updates, one that has resulted in a 100 percent success rate for achieving updatings at plants throughout the world.

The process is summarized in the illustration on the next page. Each phase is structured to develop specific information that will support decision-making and outline the basis for the update project. However, there is considerable flexibility in the way an updating is conducted. The program structure can be readily modified to accommodate an individual plant's needs.

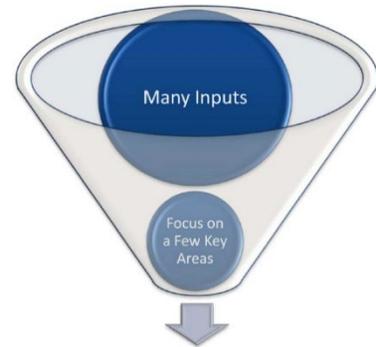
Systematic work planning optimizes the updating and also allows for integration with other LTO asset management programs such as equipment efficiency upgrades, license renewal and life extension and fuel cycle management.

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# Power Updatings

## Three-Phase Process:

1. Joint Expert Panel
  - Determine recommended target uprated power level
  - Identify limiting plant features and regulatory approval issues
  - Provide preliminary schedule and rough order of magnitude with uncertainty estimates
2. Feasibility Study
  - Using expert panel results, perform "scoping" calculations to better identify and understand selected pinch points
  - Recommend margin usage and trade-offs, fuel design, operating parameters and regulatory approach
  - Refine work scope and cost required to implement uprate
3. Technical Work Scope and Implementation
  - Perform uprate program and obtain regulatory approval to operate at uprated thermal power



This three-phase uprating process follows the concepts identified in NEI-08-10 and has resulted in a high success rate for achieving updatings at plants throughout the world

## Experience

- MURs completed
  - 51 American pressurized water reactors (PWRs)
  - 14 European PWRs
  - 2 Asian PWRs
- SPUs completed
  - 39 American PWRs
  - 4 European PWRs
  - 4 Asian PWRs
- EPU completed
  - 18 American PWRs
  - 12 European PWRs
  - 11 European BWRs

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