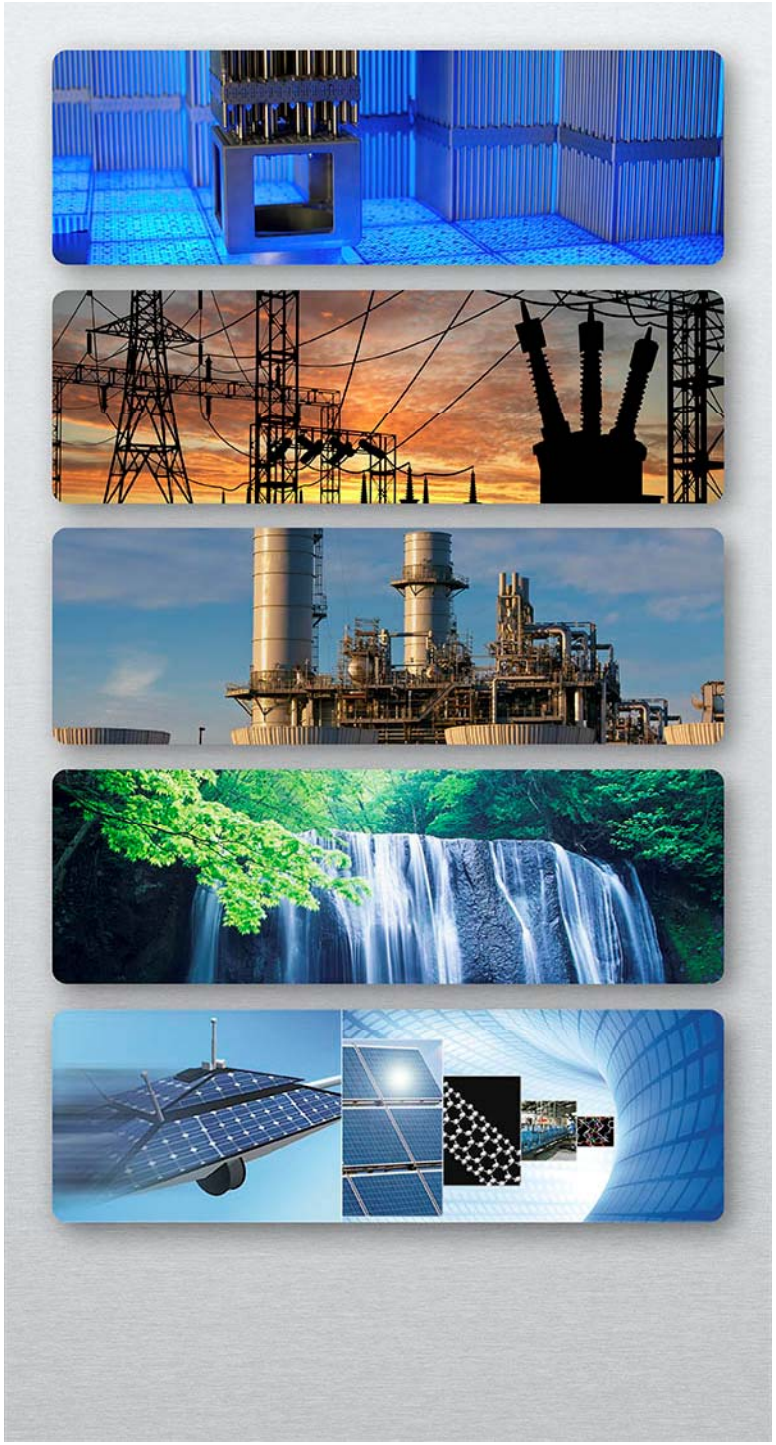


ELECTRIC POWER RESEARCH INSTITUTE

Integrated Life Cycle Management
(ILCM)

Charles A. Mengers
Senior Project Manager

2011 Second Utility Workshop on U.S. Nuclear Plant Life Extension and Deployment
February 24, 2011

Subject

What will it cost to safely and reliably operate a nuclear plant beyond the original and extended license period?

Background

- Industry initiated
- Standardized data and evaluation process
- Identification SSC refurbishment / replacement
  - Above baseline modifications
  - T+5 to end of operations
  - Outcomes determined to minimize cost and maximize reliability
- Forecast and Collaborate
- EPRI
  - Integrated Life Cycle Management (ILCM)
  - Long Term Operation (LTO)

Vision

The Integrated Life Cycle Management (ILCM) project will:

- Provide a standard methodology to support effective decision-making for the long-term management of selected station assets.
- Provide technology to provide a sound basis for continued operation of the current nuclear plants at high performance levels through 2030 and beyond.

Approach

Technical lens:

- Identify major plant equipment (SSC) that drive cost (high cost – high consequence)
- Understand SSC behavior due to aging
- Determine probability of failure over time to end of plant life
- Roll up into plant level asset
- Develop evaluation process for optimizing long range strategy optimum scenario for long range plan

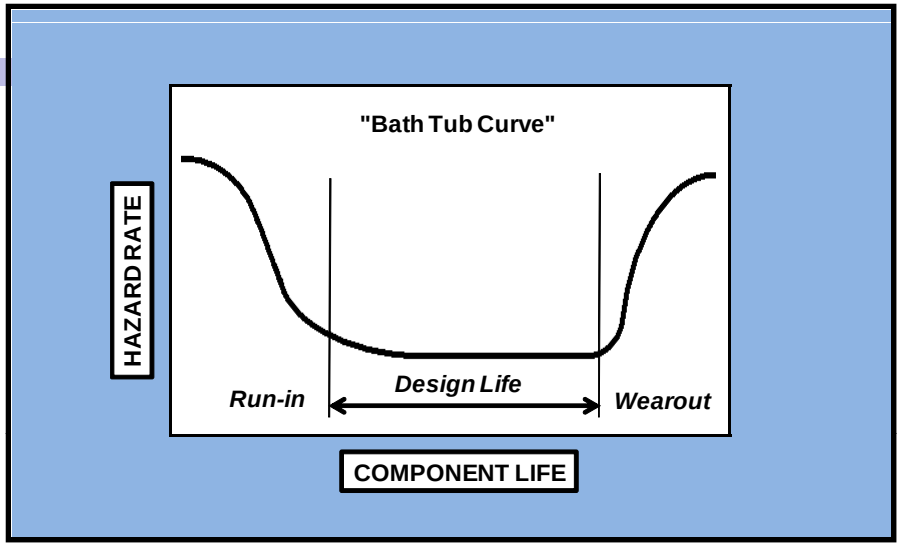
Basic Principles

1. Build on existing methods and tools – we are not starting from scratch.
2. Utilize a fundamental understanding of how degradation occurs.
3. Compared against OE from operating nuclear plants.
4. Failure curves will be plant-specific.
5. Benchmarked against pilot plants.

Concept of the Methodology

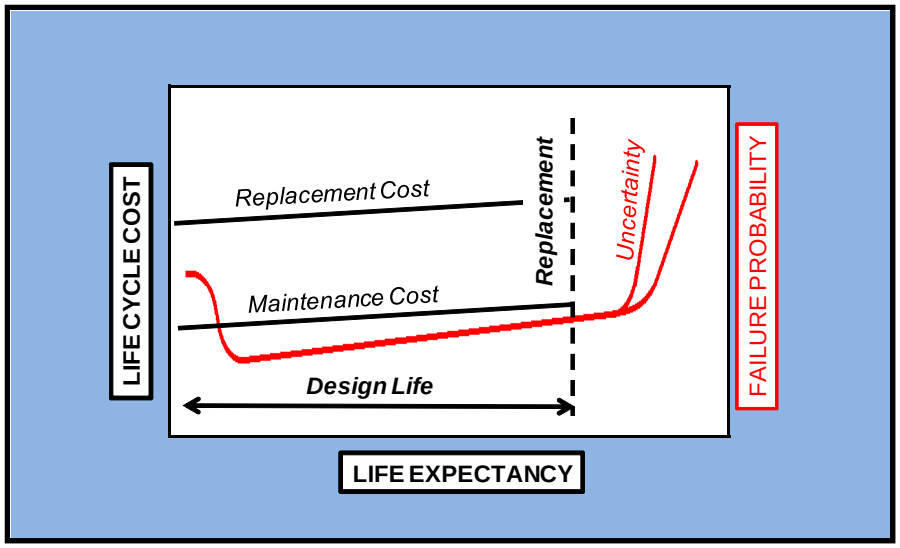
Component Aging Model

Component Aging Models are developed for selected equipment and structures



Component Cost Model

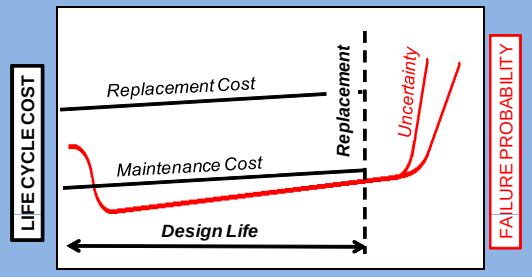
Component Cost Models are developed – considering replacement costs, maintenance costs, and consequences of failure.



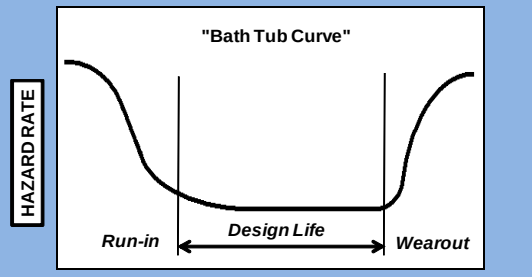
EPRI ELECTRIC POWER RESEARCH INSTITUTE

Integrated Life Cycle Cost

Component Cost Model - LCM

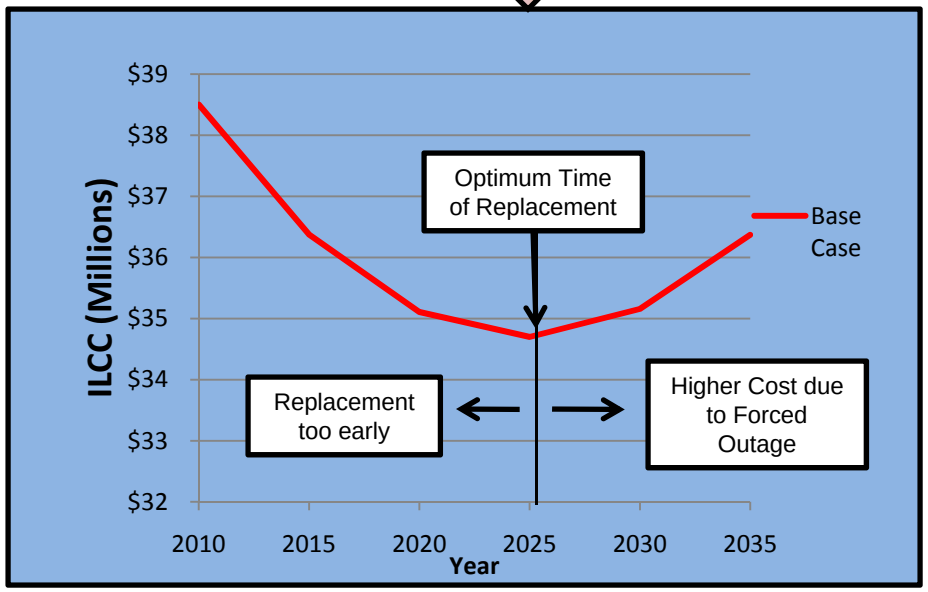


Component Aging Model



Integrated Life Cycle Cost (ILCC)

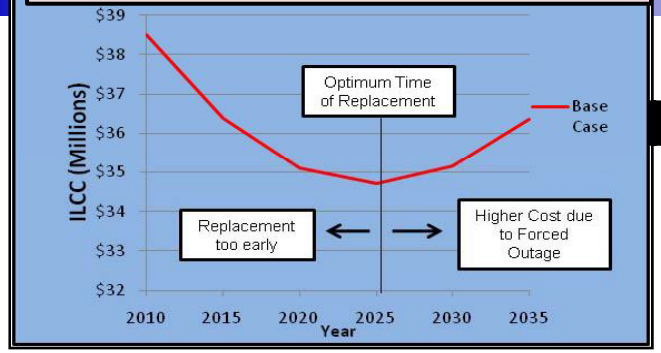
ILCC component models - Integrate the probability of failure from the aging model with costs and consequences to determine optimum replacement times



EPRI ELECTRIC POWER RESEARCH INSTITUTE

Apply across Plant or Fleet

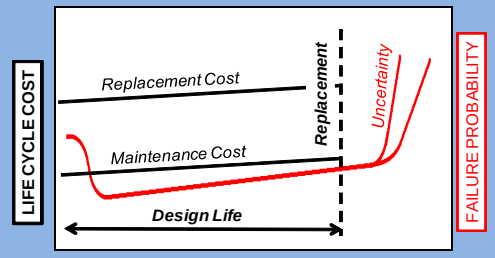
Integrated Life Cycle Cost (ILCC)



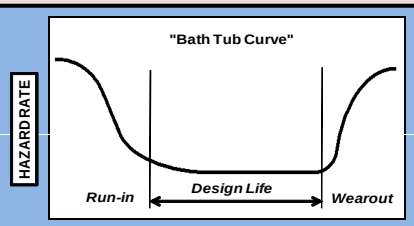
Integrated Life Cycle Management (ILCM)

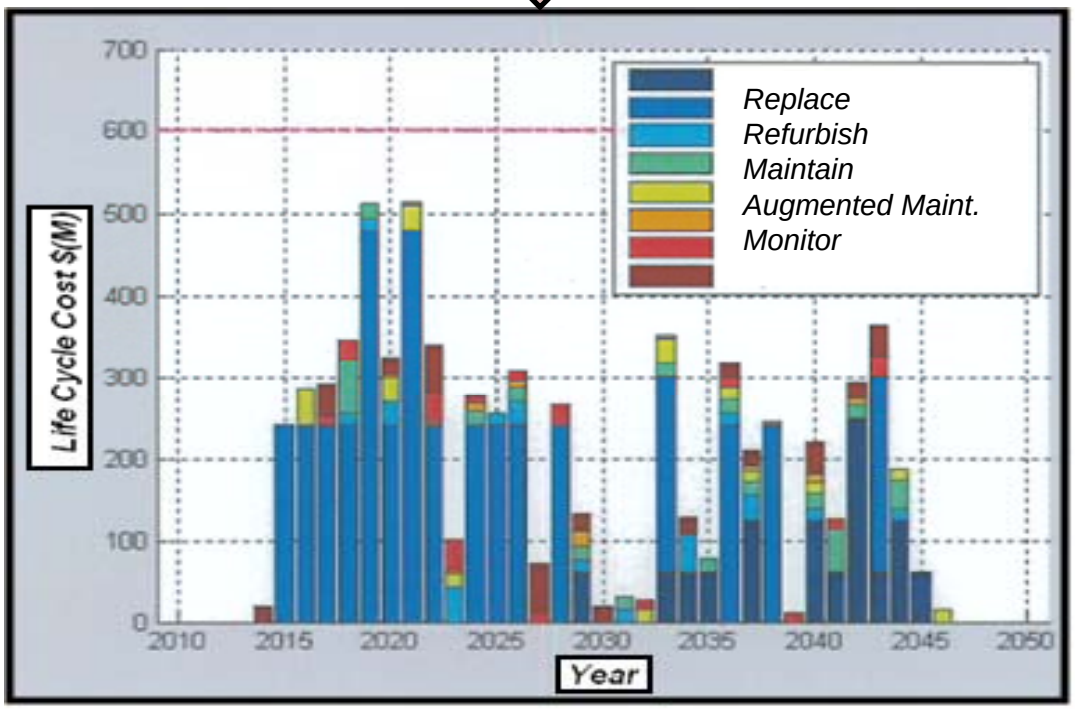
Integrate individual component and structure replacement strategies for plant or fleet wide assessment

Component Cost Model - LCM



Component Aging Model





EPRI ELECTRIC POWER RESEARCH INSTITUTE

Two Phased Approach

Phase 1:

- Develop methods for determining long-term likelihood of failure curves.
- Apply to selected structures and components.

Phase 2:

- Collaboration with EDF
- Assess existing optimization methods
- Refine models to provide desired results.
- Perform pilot
- Move to deployment

Project Deliverables

1. Methods and data to calculate failure probability.
2. Industry data base for long-term component and structure aging.
3. Methodology to calculate optimum replacement time.
4. Pilot results.
5. EPRI Technical Report.

Success

- Reliability data
  - Method proven for in scope SSCs (High Cost/High Consequence)
  - Simplified template for medium cost/medium consequence SSCs
- ILCM Database
  - Database structured, defined, tested and working
- ILCM/EDF model reconciled, changed, tested, and working
- EPRI Guideline
- User accepted and incorporated into their decision-making process

Together…Shaping the Future of Electricity