

"Déjà vu All Over Again?"
Nuclear Power in Future Electric Rate Cases

Law Seminars International

Managing the Modern Rate Case

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Agenda

- Overview
- Past rate case treatment of nuclear power
- Why nuclear power today?
- Key economic and regulatory issues that will affect future utility rate cases

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Overview

Today's electric industry landscape

- Wholesale energy markets competitive in many -- but not all -- regions
  - FERC market-based rate applications determine ability of wholesale generators to sell competitively
- Continued industry "restructuring"
  - New environmental mandates
  - Re-regulation of utilities pondered to address weaknesses of retail competition
  - Markets for ancillary services developing – but complex
- New approaches to local utility regulation needed in the face of increased fossil fuel prices and price volatility
  - Recognition of the value of hedging
  - Development of competitive procurement approaches for utility load responsibility
- Natural gas may no longer be "fuel of choice"
  - Rapid increase and volatility of natural gas prices
  - Clean coal technologies under development
  - What will the future bring?

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The nuclear power landscape

- The nuclear industry
  - Aging nuclear fleet
  - Consolidation of nuclear plant owner-operators
  - Critical policy issues (siting, permanent waste storage) unresolved
  - Five years ago, when natural gas prices were low, marginal prospects for domestic nuclear power industry
- Recent market changes have renewed prospects for nuclear power
  - Rapid increases in fossil fuel prices and price volatility
  - Concerns over fossil fuel supplies – both natural gas and crude oil
  - Increasing concern over greenhouse gas emissions – limiting coal-fired power plant development
  - Development of third and fourth generation reactor designs
  - Increased federal involvement to spur new investment by reducing financial risk

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Nuclear power – key issues

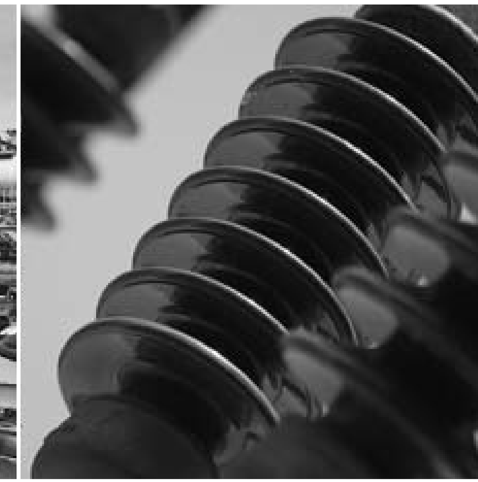
- Reducing and allocating construction/operating risk are crucial issues
  - Reduce long licensing/construction lead-times
    - Treatment of “construction work in progress” (CWIP) costs
  - Widespread utility development and ownership unlikely
    - Development by consortiums and existing multiple plant operators who can exploit economies of scope
  - Financial risk will affect utilities’ overall cost of capital and capital structure

In approaching new nuclear investments, regulators and investors will be highly risk averse

Nuclear power – implications for utility rate cases

- For nuclear investments to be viable, utilities must avoid past rate case problems
  - Prudence challenges arising from severe cost overruns
  - After-the-fact determinations of used-and-usefulness
- State and federal environmental initiatives will influence role, relative cost, and acceptance of nuclear power
  - NRC expedited licensing process, developed in 1992
  - State-level siting certification still required
    - Rules vary by state
- Investors will want as much certainty as possible in the rate case process
  - Requires a comprehensive level of economic understanding that assesses key risks





Past Rate Case Treatment of Nuclear Power

What happened to the U.S. nuclear industry?

- Industry succumbed to a mix of bad economics, bad regulation, and politics
  - One-off designs – essentially custom built plants – eliminated benefits from standardized design
  - Designers failed to realize that there might be a limit on economies of scale: plants became so big that design complexity began to increase per-unit cost
  - Design changes imposed during plant construction led to construction delays and higher capital costs
  - Deregulation of natural gas and oil prices led to significant declines in price, reducing the perceived economic advantages of nuclear power
    - In the 1990s, existence of a “gas bubble” – huge new supplies and very low prices – had generation developers focused almost exclusively on gas-fired generation
  - Lack of permanent waste storage facility
  - Nuclear power became a political symbol, rather than an energy source

Regulatory uncertainty contributed to the demise of the nuclear industry

What happened to the U.S. nuclear industry (cont.)?

- Nuclear power plants built by vertically integrated utilities
  - "Delusions of grandeur" – failure to assess financial risks adequately
- Investment prudence and used-and-usefulness decisions affected the industry
  - Prudence evaluates investments based on what is reasonably known at the time a decision is made
  - Used-and-usefulness is more "after-the-fact" – did an investment decision result in a plant that was actually used to produce electricity?
  - In some cases, regulators imposed de facto "clairvoyance" standards
    - Decisions superseded by outcomes

Some regulators/legislators introduced "economic" used-and-usefulness – was an operating plant providing energy at or below market cost?

What happened to the U.S. nuclear industry (cont.)?

- Regulatory/financial risks became too much for utility investors
  - Size of nuclear plant investments drove some utilities into bankruptcy
  - Fear of nuclear plant accidents after Three-Mile Island
  - Environmental and public opposition to on-site waste storage
  - Decommissioning cost risk – what would it cost and who would pay?
- Popular opposition to nuclear power resulted in legislative bans on new nuclear plants in some states
  - Legislative restrictions of on-site waste storage also enacted

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Why nuclear power today?

Poised for a resurgence

- Rapid increases in fossil-fuel prices and price volatility
  - Recognition of importance of fuel diversity
- Environmental requirements
  - Anticipated federal regulations on greenhouse gas emissions
  - Individual state actions on greenhouse gases – e.g., Regional Greenhouse Gas Initiative
  - Continued environmental opposition to siting coal plants – but clean-coal technology is under development/testing
- Growing need for baseload generation and capacity – cannot be met with renewable energy alone
- Industry consortia working on siting, certification of new plants
  - Goal: construction and operating license (COL) issued by NRC under streamlined certification rules developed in 1992

Limited fossil fuel alternatives and increasing electric demand favor nuclear power

Nuclear generation technology advances

- Generation III+ plants (under development since 1990)
  - Goal: commercial deployment by 2010
    - Passive safety, more economical
    - BWR, PWR, and gas-cooled plants
  - NuStart consortium has selected two sites for COL
    - Grand Gulf, owned by Entergy – GE Economic Simplified Boiling Water (ESBWR) design
    - Bellafonte, owned by TVA – Westinghouse AP1000 (PWR, granted design certification in January 2006)
- Generation IV plants (under development since 1999)
  - Goal: commercial deployment by 2030
    - More economical
    - Produce minimal waste
    - Westinghouse - Intl. Reaction Innovative Secure (IRIS): small (100 – 300 MW), PWR. Modular design, everything integrated within containment vessel.

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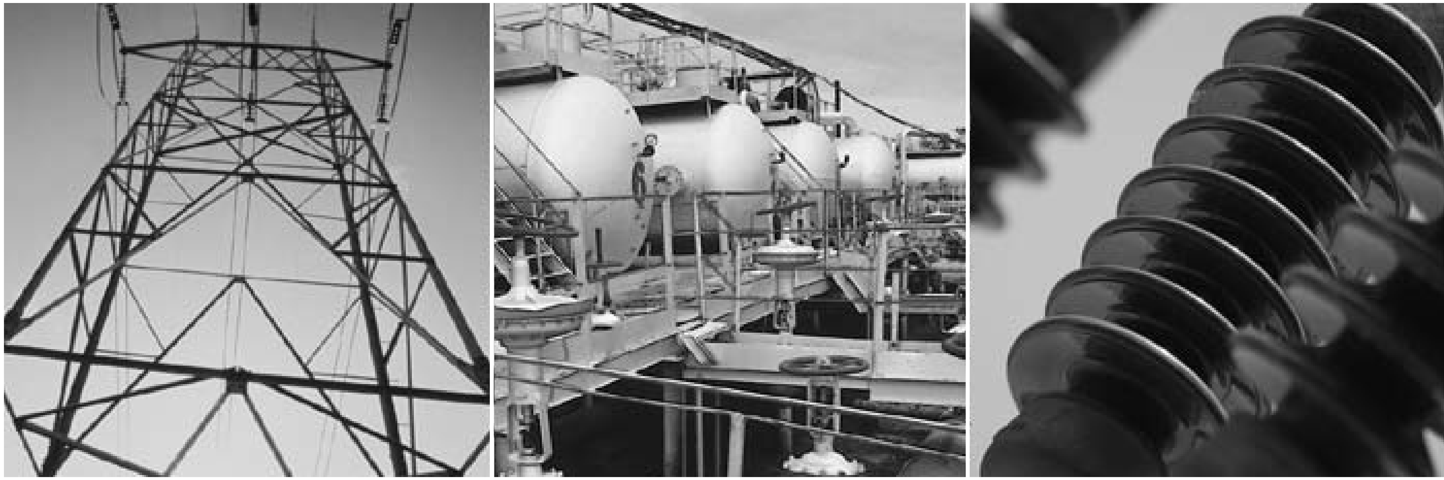

Key economic and regulatory issues that will affect future utility rate cases

Assessing the economics of new nuclear power plants in utility rate cases

- Two key issues will affect treatment in future utility rate cases
  - Who will build, own, and operate new nuclear plants?
  - How will prudence of either direct investment or signing PPAs be determined?
- Both issues involve assessing financial and business risks
  - New nuclear development will require long-term commitments
  - What is overall magnitude of risk?
    - How does that risk compare to risks of other generation alternatives?
  - How is risk distributed among developers, shareholders, and ratepayers?
- Utilities will need to provide risk-averse regulators and investors “proof” that the risk of nuclear power investments will be worth the benefit

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Examining the risks – construction/ownership/operation

- Construction cost/risk financial hurdles – hence consortium approach that avoids "bet the company" investments
- Long-term PPA hurdles – competitiveness, debt-equivalency issues
  - Evaluating costs and benefits of price hedges vs. resource diversity over time
  - Treatment of long-term PPA costs by regulators over time (regulatory certainty)
  - Impact of existing federal subsidies – uncertainty of continuation
- Price-Anderson Act liability limits
- Decommissioning cost risk
- Competing fossil fuel technologies and prices
  - Gas prices at historic highs – spurring new exploration
    - Despite high price, gas-fired generation has low capital cost and quick start-up, which can complement development of renewable technology
  - Clean-coal technologies beginning to be demonstrated

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Examining the risks – the regulatory process

- State regulatory approval process – politics, rate risks to consumers
  - Regulators want utilities and investors to bear all of the risk
  - Utilities, investors want commitment or long-term PPAs in order to proceed with development
- Effect on utility's capital structure and financial risk profile
  - Will nuclear plant ownership lead to higher cost of capital because of perceived financial risks?
  - Will it lead to lower cost of capital by reducing environmental risk exposure?
  - How will long-term PPA be viewed by ratings agencies? (debt equivalency)
- Regulatory uncertainty must be minimized

To avoid repeating past mistakes, establish clear regulatory guidelines

Determine economic viability by objectively quantifying risks

- Really just cost-benefit analysis under uncertainty
  - Traditional utility planning tools unsophisticated, did not address risk
  - Nuclear power development involves complex risks – some of which are non-market risks (e.g. terrorism)
  - Need to compare nuclear and alternatives on a level playing field
- Allow for regulatory buy-in by demonstrating impacts of specific risks of concern to regulators
  - Identify risks that really matter … and those that don't
  - Evaluate strategies that can hedge key risks

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The (pre) rate-case approach

- Do this before committing to investment – avoid rate case "surprises"
- Use sophisticated economic decision analysis tools to directly address price volatility and other risks when evaluating either direct investment or PPAs
  - More accurate approach to establishing prudence, used-and-usefulness
  - Provides quantitative assessment of "value-at-risk" for utility management
  - Can address <u>and value</u> non-market risks
- Provide estimates of value of new nuclear development compared with value of alternatives (overall probability distributions)
  - All generation investments have some risk
  - Need to evaluate risks and accurately compare alternatives

Economic valuation under uncertainty

- Use economic modeling process to estimate probability distributions of net present value for different investments
  - Sole focus on expected values ignores crucial information about investment risk
- Requires we identify risk drivers
  - Costs of alternative technologies
  - Fossil fuel price volatility
  - Availability risk

  Market risks

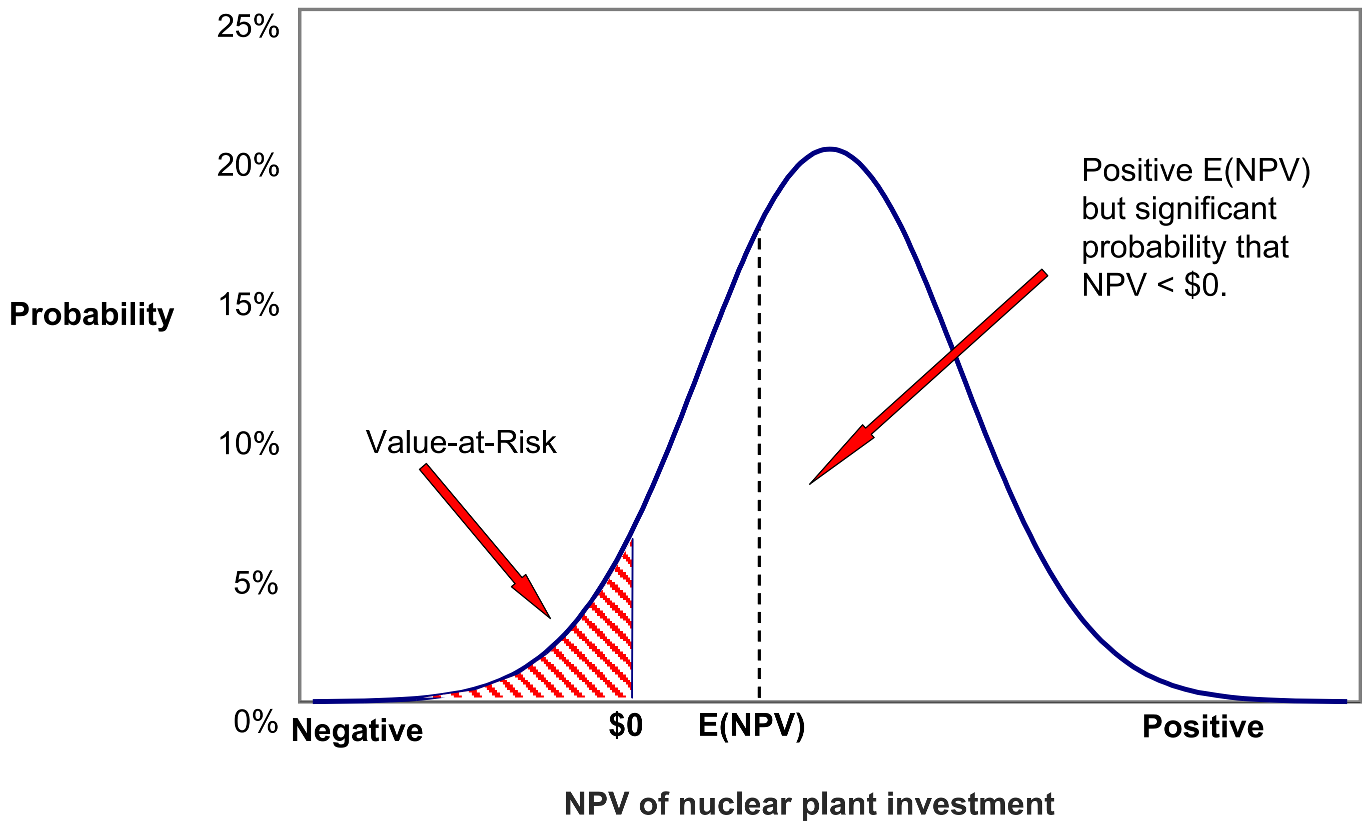
  - Level of government subsidies
  - Relicensing risk
  - Waste storage
  - Terrorism risk

  Non-market risks

Key: provide regulators with a complete view of costs and benefits, including the impacts of specific risks

Economic valuation under uncertainty (cont.)

- Just looking at expected value leaves out crucial information
  - Consider likelihood that investment will have negative NPV, even though expected NPV is positive



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Economic valuation under uncertainty (cont.)

- Uncertainties can reveal benefits, as well as costs
  - Focus is usually on downside risk – but upside is critical, too
  - Fossil fuel price volatility
    - Benefits renewable, nuclear technologies
  - Greenhouse gas legislation
    - Downside risk for coal-plant owners
    - Upside risk for renewable, nuclear
- Evaluating lead times can demonstrate positive value
  - Market volatility often raises a question: abandon or stay the course?
  - NPV analysis typically cannot address this issue
  - Can evaluate “option value” associated with “off-ramps”
    - Development can include key milestones where investment can be re-evaluated
    - Called “real-options” analysis
  - Long-lead times and volatility increase real option value

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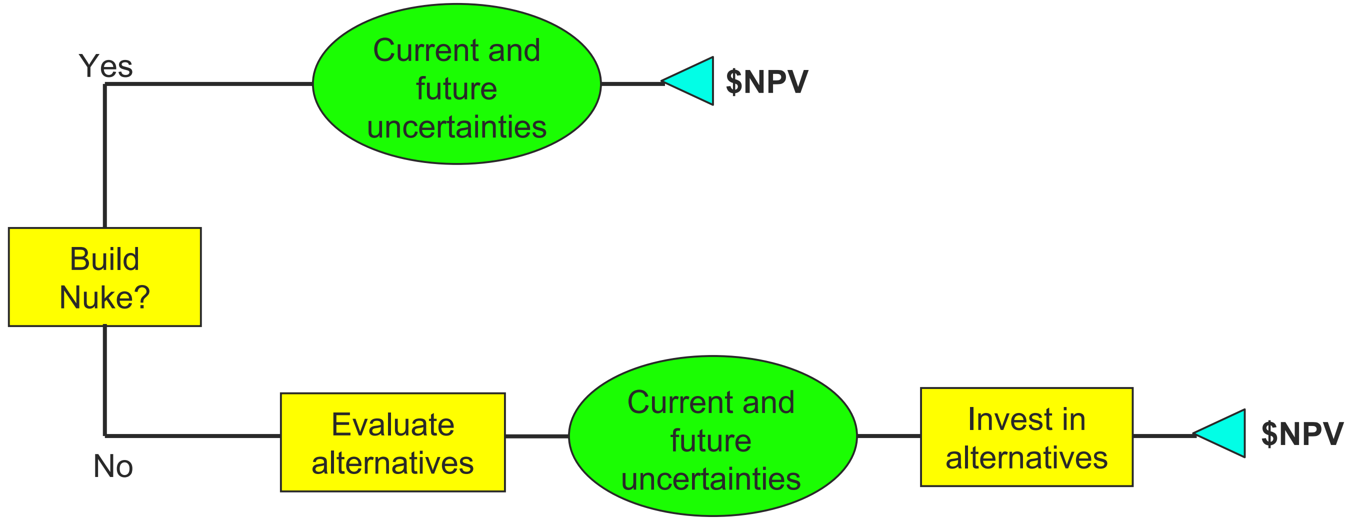
Structure of a typical, no-option analysis



This analysis can evaluate uncertainties, but presents only a “build or no” decision. No investment options

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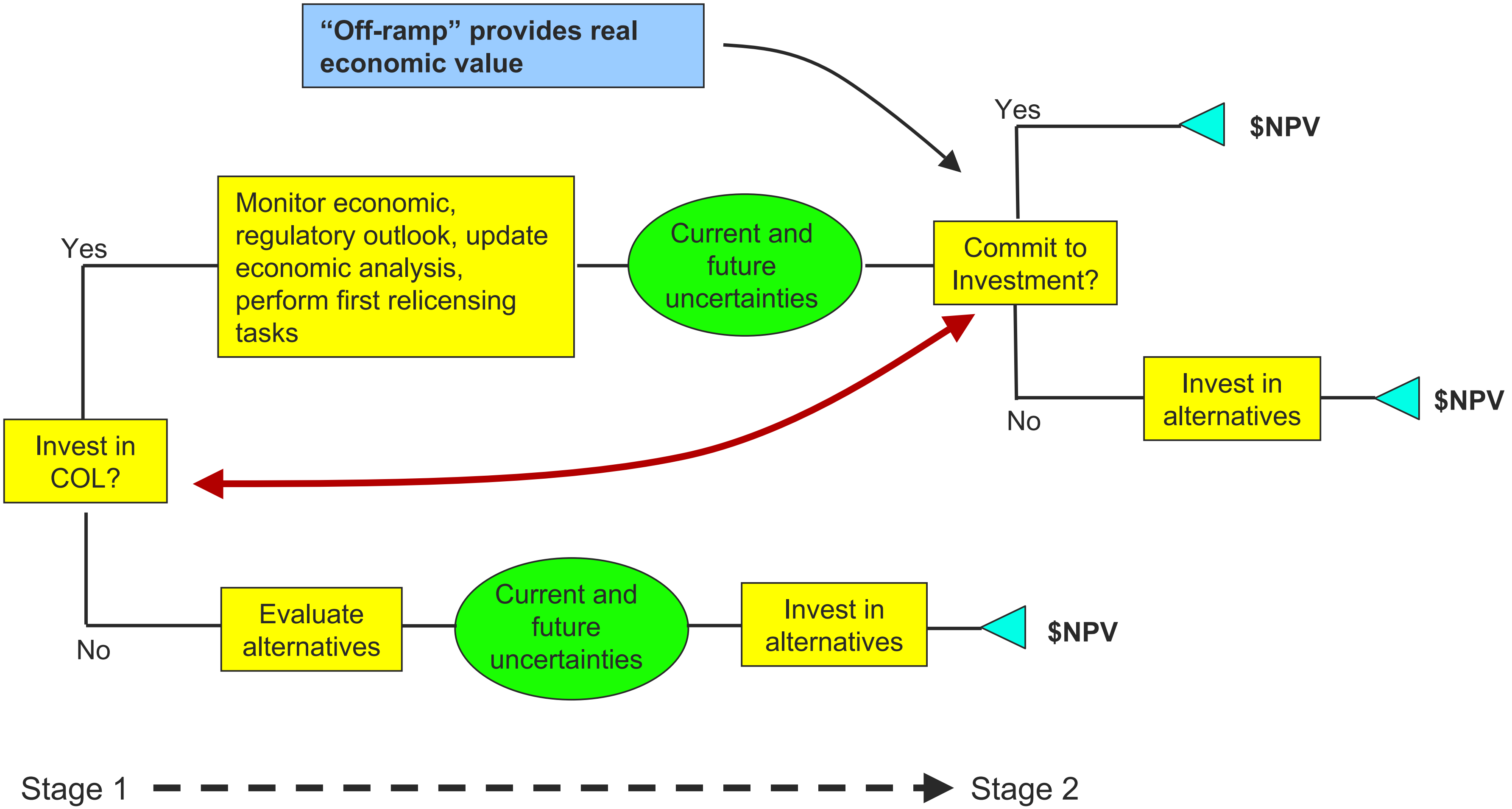
Structure of a probabilistic, real-options analysis



The reduction in expected cost between a "no-option" analysis and one with staged investment can be a significant fraction of total investment cost

Environmental considerations

- Accounting for environmental benefits
  - Nuclear provides greater emissions reductions than non-baseload renewables (e.g. wind) since no back-up required
  - Modify renewable portfolio standards requirements to value avoided emissions
  - Economic analysis can directly determine expected benefits associated with avoided emissions resulting from
    - Existing environmental regulations (Clean Air Act)
    - Potential impacts of future environmental regulations (GHG restrictions)
- Utilities spending billions of dollars today in SO2, NOx emissions control equipment for coal-fired plants
  - Still doesn't address greenhouse gases (experimental technologies)
  - Investment at a <u>single</u> coal plant can exceed $1 billion (and reduces plant operating efficiency)
    - Need to evaluate relative risks, demonstrate to regulators

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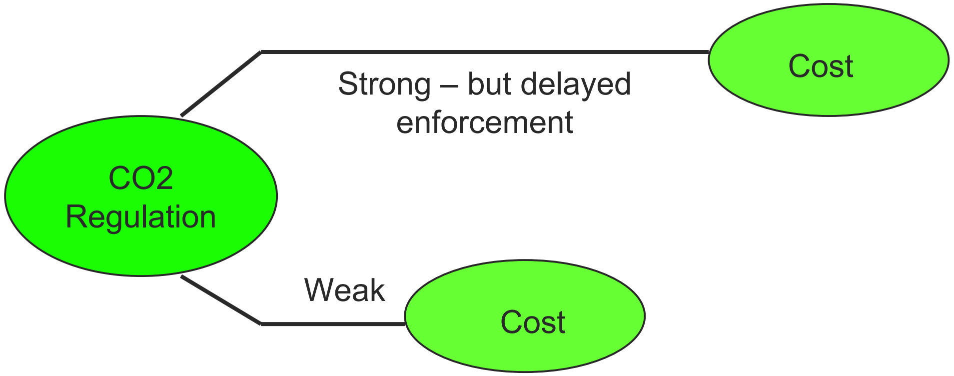
Evaluating environment risk – one framework

- One way to look at greenhouse gas regulation – break into two uncertainties
  - Timing of regulation
  - Severity (hence cost)



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Relicensing of existing nuclear plants

- New nuclear plants will need to compete with existing ones
  - Aging fleet, but costs depreciated
  - Hurdles to relicensing existing plants
    - Safety concerns (e.g., containment vessel embrittlement)
    - Maintenance cost uncertainties
      - Probability of high-cost or life-ending equipment failures
  - Utilities that decide to relicense, and seek rate recovery of relicensing costs need to evaluate economics similarly

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Unresolved issues: perfection is the enemy of the good

- Permanent waste storage
  - Still no permanent waste site – Yucca Mountain remains controversial
    - Judicial requirements to ensure safety for 100,000+ years
    - Ability to assess safety in that time frame impossible
  - On-site storage is an alternative
  - Regulatory/political “shakedowns” can increase overall costs of nuclear options
    - Introduces regulatory uncertainty
  - Evaluating uncertainty of (say) greenhouse gas impacts over 100,000 years impossible
    - Assume technology can develop workable solutions in the (relative) near term
  - Not building new nuclear does not “solve” the waste storage problem

Unresolved issues: perfection is the enemy of the good (cont.)

- Terrorism risk
  - Low-probability, high cost event
  - Liability issue
  - Rate case “success” requires economic evaluation of risk
- There are statistical approaches to model and value this type of risk directly
  - Can’t rely on expected values
    - Similar to expected cost of a large asteroid impact. Probability is so low that expected cost tiny.
      - But, if it happens, the damage is catastrophic
  - Can use “extreme value” analysis to estimate cost and explain to regulators

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Conclusions

- Circumstances favor new investment in nuclear power
  - Environmental concerns
  - Fossil fuel supply and price concerns
  - Safer, lower-cost technologies
- Risks
  - Streamlined NRC COL regulations, but state-level siting regulations time-consuming
  - Regulatory uncertainty
  - Lack of permanent waste storage facility
    - Continued debate over Yucca Mountain
  - Clean-coal technology may prove less costly
    - Opposition to coal plants likely to be lower as a result

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Conclusions (cont.)

- Key rate case issues, assuming new plants built
  - Ensure prudence is well-established before the fact, using more sophisticated economic tools that address risks comprehensively
    - After-the-fact “gotcha” regulation is costly and increases financial risk for all development
    - Get regulators involved up-front – and use sophisticated models to evaluate their specific concerns
  - Evaluate financial/supply risks associated with long-lead time construction
    - What will the world look like at completion?
    - Include development off-ramps (real-options) to reduce adverse impacts
  - Evaluate financial risks to utilities
    - Will nuclear power ownership be viewed as increasing financial risk, leading to higher cost of capital?
    - Will it lower financial risk because of reduced exposure to future environmental regulations?

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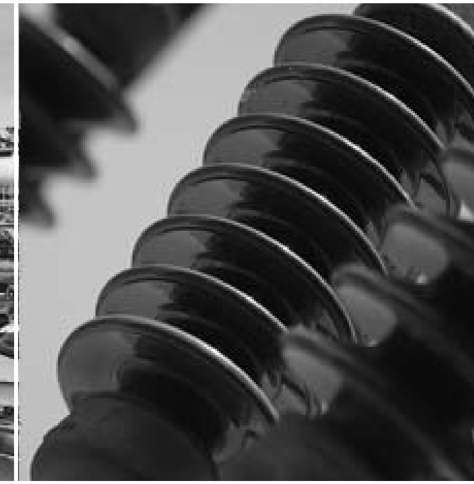

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Collin Cain, M.Sc., is a Manager with Bates White, LLC. Mr. Cain has more than 10 years experience in electricity and environmental economics. He assists clients in developing investment, divestiture and risk management strategies. Mr. Cain's expertise includes power plant valuation, forensic analysis in litigation support, and prudence evaluation. Mr. Cain also assists clients in developing regulatory strategies, and has provided expert testimony in both regulatory and private legal proceedings.

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