Total Cost Assessment Method and Training Workshop

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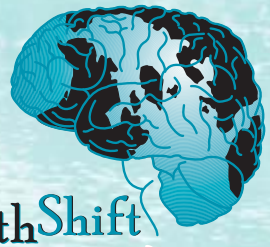
September, 2008

Agenda

8:30-8:45	Introductions
8:45-9:15	Total Cost Assessment—where it came from, what is it good for
9:15-10:00	Methodology—cost types, uncertainty, how you do it
10:00-10:10	Break

Hands on—our own workshop

10:10-10:25	Define Goal and Scope
10:25-11:10	Define Scenarios
11:10-11:20	Break
11:20-11:50	Define Costs
11:50-noon	Wrap-up



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Total Cost Assessment—where it came from

- Developed in 1991 by the Tellus Institute for the EPA and New Jersey Department of Environmental Protection
- Based on methods and programs developed by GE. "GE developed its new environmental project analysis method to better select and justify waste management investment decisions that are environmentally sound and should reduce long-term liabilities "
- Sequence of studies provided the theoretical background for Total Cost Assessment

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AIChE CWRT Project

- In 1997, AIChE Members wanted a sound TCA methodology
- Embarked on a two-part project.
- Part I: Survey of status and available methodologies world-wide
- Part II : Development of industry validated methodology
- Project Team
  - AD Little (Collab. & Researcher)
  - Bristol-Myers Squibb
  - DOE
  - Dow
  - Eastman Chemical
  - Eastman Kodak
  - Georgia Pacific
  - IPPC of Business Round Table
  - Merck
  - Monsanto
  - Owens Corning
  - Rohm and Haas
  - SmithKline Beecham (Lead)
  - Sylvatica (TCAce Dev.)

TCA: Who else is using it?

- Alternative energy companies
- Mining companies and institutes
- Heavy machinery manufacturers
- Multi-sector corporations
- Water and wastewater treatment engineering companies
- Municipal governments (e.g., British Columbia)

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TCA: What is it used for

- To determine the “real” ROI (NPV) of a decision
- May be a decision to use a more environmentally benign process
- May be a decision to implement a more robust health program
- Could also be used for other employee, supply chain, or customer benefits programs
- Typically used for multimillion dollar decisions due to the cost of convening the workshop.

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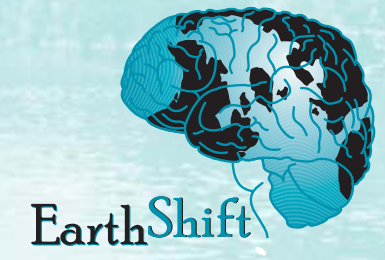
Five Cost Types Distinguished

- Type I: Direct
- Type II: Indirect
- Type III: Contingent Liability
- Type IV: Intangibles
- Type V: External



Cost Types

Cost Type	***Description***	***Examples***
I. Direct costs	Manufacturing site costs	Capital investment, operating, labor, materials, and waste disposal costs
II. Indirect costs	Corporate and manufacturing overhead	Reporting costs, regulatory costs, and monitoring costs
III. Future and contingent liability costs	Potential fines, penalties and future liabilities	Clean-up, personal injury, and property damage lawsuits; industrial accident costs.
IV. Intangible internal costs (Company-paid)	Difficult-to-measure but real costs borne by the company	Cost to maintain customer loyalty, worker morale, union relations, and community relations.
V. External costs (Not currently paid by the company)	Costs borne by society	Effect of operations on housing costs, degradation of habitat, effect of pollution on human health

Conventional (I & II) Costs

- Use the same I & II costs as traditional ROI
- Use same conventions for:
  - Investment: depreciation and salvage values
  - Discounting
  - Time horizons
  - Tax impacts in profitability analysis
- Include cost and price uncertainties
- Workshop sometimes uncovers uncounted type I and II costs

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Uncertain

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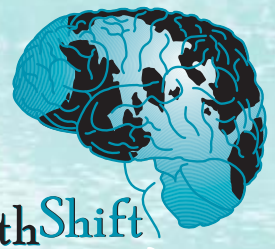
Why get into uncertainty?

"Never make predictions, especially about the future.“
Casey Stengel

Uncertainties are pervasive

- Prices
- Costs
- Sales
- Macro-economy
- Technological Change
- Decisions by competitors, governments, NGOs
- Accidents
- Lifetimes of investments
- Timing of events
- Impact effectiveness



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Approach to Uncertainty

- Take blinders off; acknowledge
- Ask subject experts what they know
- Brainstorm
- Model systematically
- Test for sensitivity
- Refine if necessary

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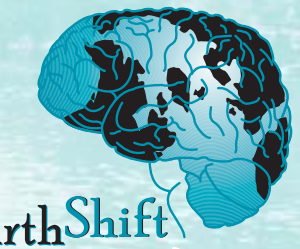
What is probability?

- "The probability of an event is the degree of belief that a person has that it will occur, given all the relevant information known to that person."

  Granger Morgan & Max Henrion, Uncertainty; A guide ot dealing with uncertainty in qualitative risk and policy analysis describing Personalist or Bayesian view of probability.



Total Cost Assessment—How do you do it?

- Step 1 – define goal and scope
- Step 2 – streamline the analysis
- Step 3 – identify potential risks
- Step 4 – conduct financial inventory
- Step 5 – conduct impact assessment
- Step 6 – feedback to decision-making loop

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Total Cost Assessment—How do you really do it?

- Step 1 – define goal and scope
- Step 2 – get buy-in for project and methodology
- Step 3 – convene workshop
- Step 4 – crunch results and identify pivot points; sensitivity analysis
- Step 5 – provide preliminary feedback to team
- Step 6 – team revises figures
- Step 7 – final report created, approved by team, circulated

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Goal and Scope Definition

- Define up front and get buy in (may require TCA training for participants)
- Determine whether or not externalities are important
- Some sticky points
  - How to handle site-specific costs in a corporate-wide decision

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Mechanics: "Workshop" Approach

- Convene workshop of key experts in the company
  - Often include
    - Operations
    - HR
    - Public Relations
    - Brand value
    - Environment, health, and/or safety personnel
    - Multiple sites, countries, and cultures represented
- The process works because these are the company experts.

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The Workshop

- 1-2 day on-site workshops work best.
- Focus on TCA
- Sources of costs, benefits, risks, and other data well documented.
- Where there is disagreement over a number, use the range between the highest and the lowest in the group.

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Options: Define Scenarios

- For each option or course of action, analyze possible impact from:
  - Future environmental regulations
  - Accidents, spills, equipment failures
  - Worker health/safety incidents
  - Public outrage
  - Non-compliance incidents
  - Interruption of supply chain
  - Shifts in market share
  - Actions/pressure from one or more stakeholders
- And many more “What if” analyses
  - Use check lists to help brainstorming process

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Scenarios: Define Costs and Benefits

- For each possible event:
  - What are the possible cost or benefit impacts?
    - Direct costs / benefits (Type III costs become Type I and II costs when the event occurs)
    - Costs that fall to the bottom line but are not easily identified
      - Customer loyalty
      - Employee attraction/retention/morale/productivity
      - Brand value
      - “License to operate” (local, state, federal)
    - Include timing, duration, magnitudes

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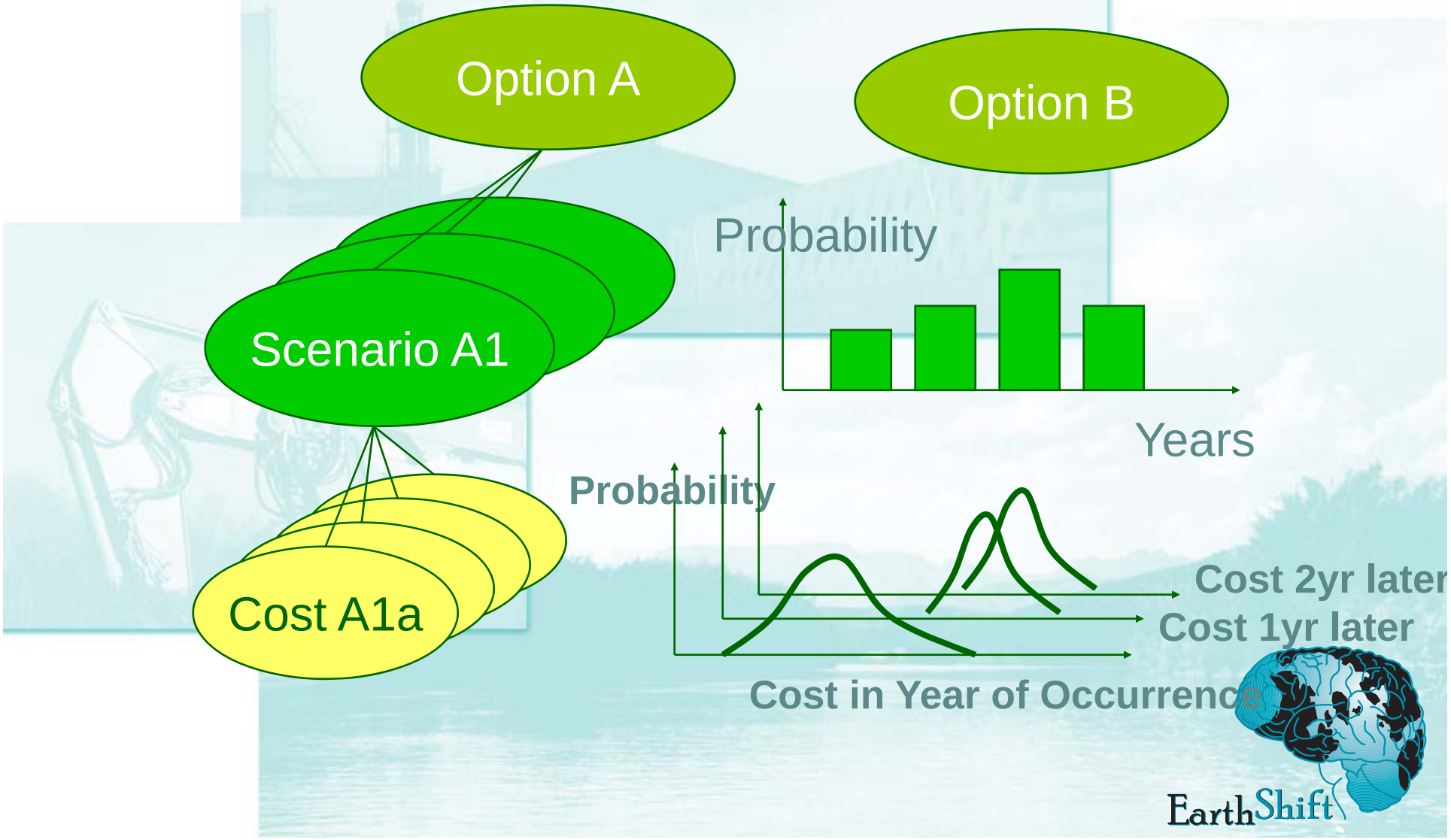
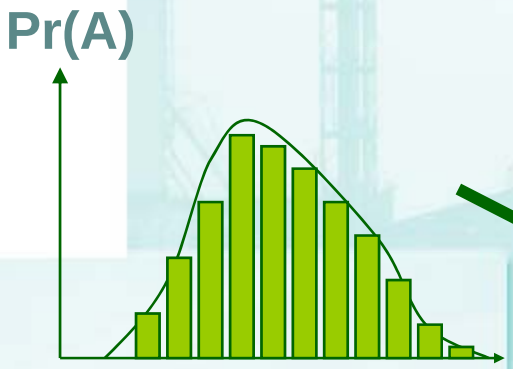
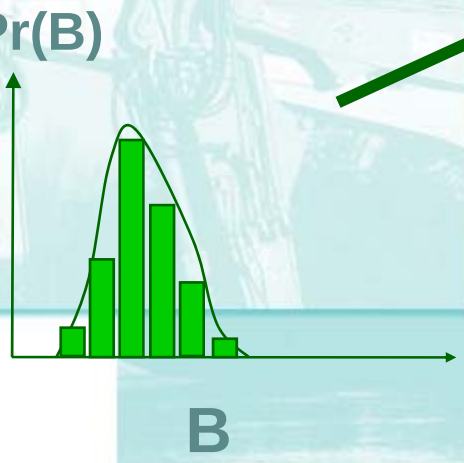
Scenario Analysis



Monte Carlo Analysis

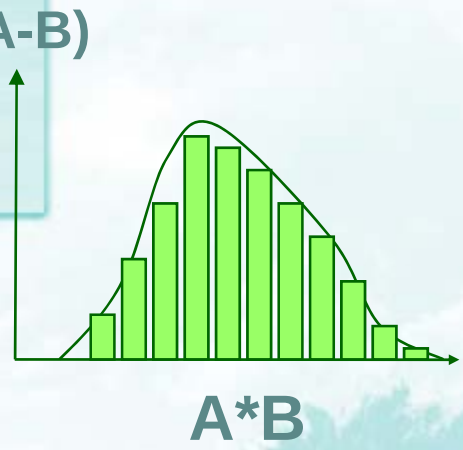




Structured sampling for A and B;

compute A-B each iteration;

create distribution for A-B



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Create a picture of the (uncertain) future

- Worst case and blue sky scenarios
- Most likely outcomes
- Probability of a positive NPV
- Breakeven point (at 95%, 75% or 50% probability)

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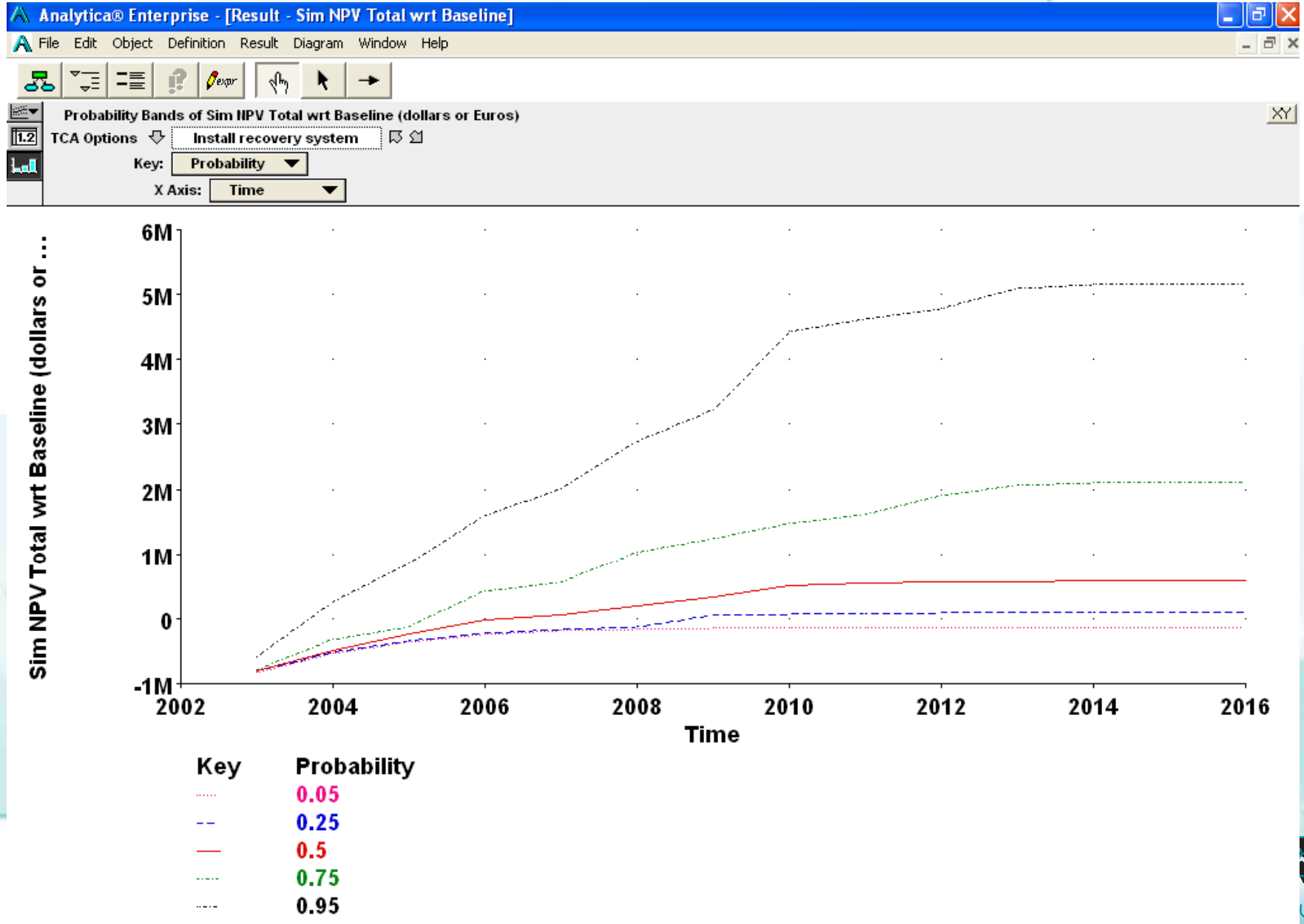
Analytica® Enterprise - [Result - Sim NPV Total wrt Baseline]
File Edit Object Definition Result Diagram Window Help
Probability Bands of Sim NPV Total wrt Baseline (dollars or Euros)
TCA Options
Install recovery system
Key:
Probability
X Axis:
Time
XY
Sim NPV Total wrt Baseline (dollars or ...
6M
5M
4M
3M
2M
1M
0
-1M
2002
2004
2006
2008
2010
2012
2014
2016
Time
Key
Probability
0.05
0.25
0.5
0.75
0.95

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Sensitivity Analysis

- Drop off scenarios that cause the greatest swing in results and recalculate
- Drop off scenarios with the most controversy
- Sensitivity may lead to a more robust option (more oversight, investment in small “insurance policies”)
- Sensitivity improves acceptance of the results

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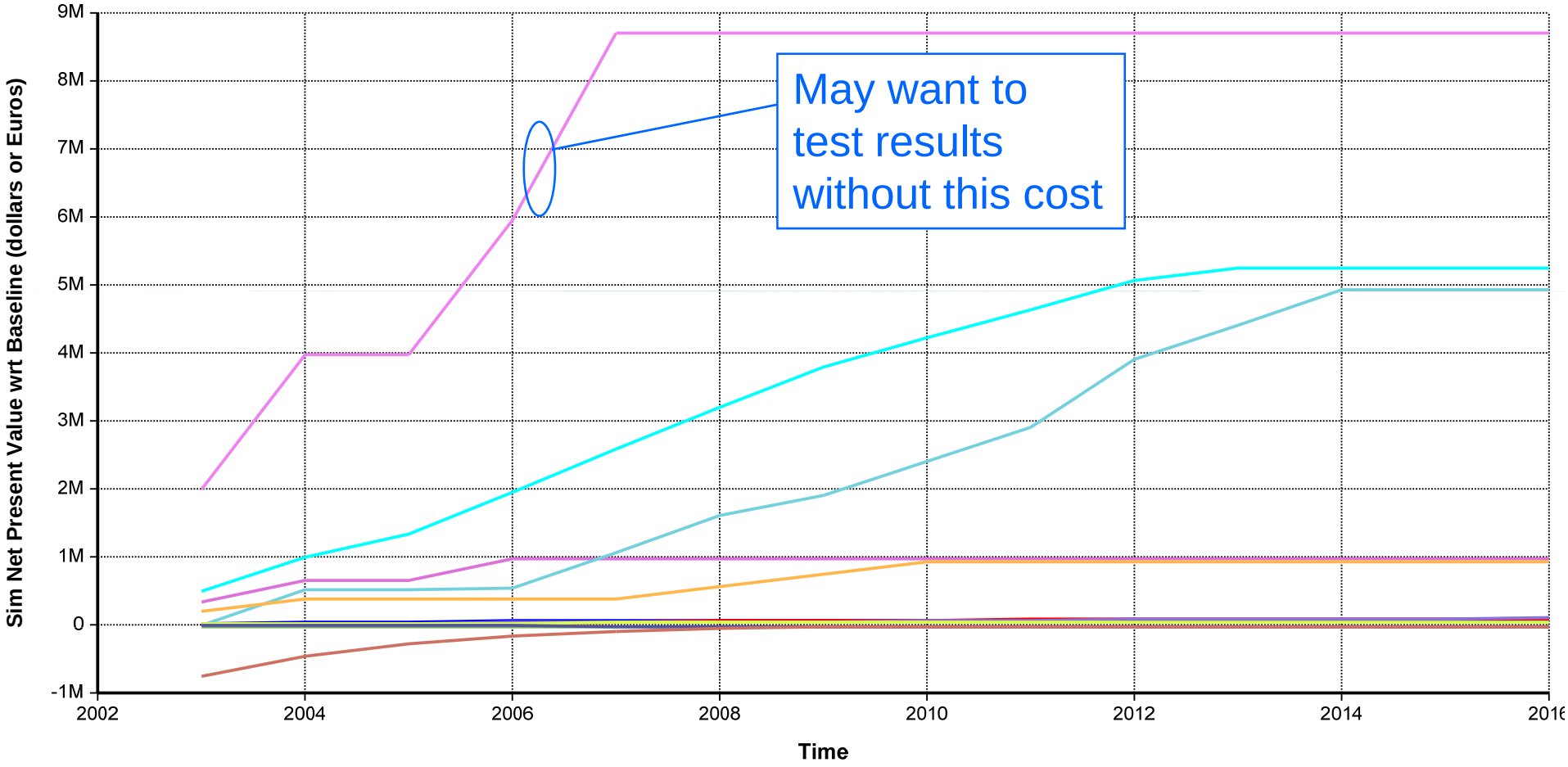
Maximum NPV by Cost



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TCA Workshop

- EcoShirts is a small, private t-shirt manufacturer in North Carolina. The company has made its name selling organic cotton t-shirts dyed using a patented“green” processes. In addition to selling green products, EcoShirts has been recognized for its sustainable business practices. The company buys locally whenever it can, uses only fair trade labor when it can’t, and has installed a solar array to generate some of the power for its factory and warehouse. Although EcoShirts cost more (about $3, as opposed to $1 for a conventional, screen printed shirt), the company has been experiencing significant growth.

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The Decision

- Should EcoShirts perform an LCA on their t-shirts?

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