

# “Sustainability” - Decision Support Tools for Asset Managers and Decision Makers

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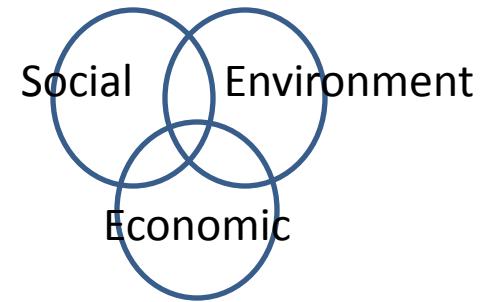
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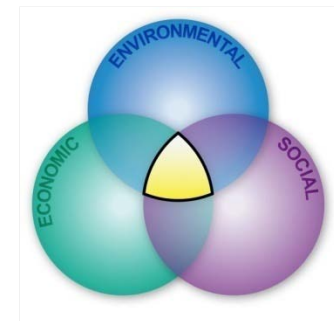


# Overview

- Why is this topic important?
- What are the basic tools for success?
- What are some of the advanced tools to learn?
- Scenario based applications?
- Resources
- Q&A



what	limitations
similar	best use



# Why should this topic matter to you?

Anonymous Quote:

*For leaders and managers – “The quality of your life and your work is directly related to the quality of your decisions.” So..... just how do you make your decisions?*

- ✓ Today's (asset and liability) managers and leaders have over 1,000 times more data and information at their disposal than managers in the 1970's
- ✓ How you approach the information will decide how your decisions support the DoD's Strategic Sustainability Performance Plan.....or not.

# Basic – LCCA (Life Cycle Cost Analysis)

Life-cycle cost analysis (LCCA) is a method for assessing the total cost of ownership. It takes into account all costs of acquiring, owning, and disposing of a building or building system or infrastructure or natural system.

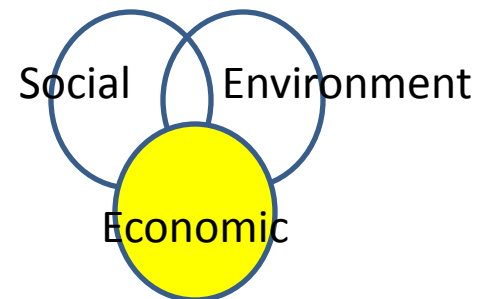
Alternatives analysis should always use:  
Same cost breakdown  
Same net present value computations  
Same period(s)  
Same parameters  
Same discounting rate and convention  
Same treatment of inflation

Similar tools: Lowest life-cycle cost (LCC) is the most straightforward and easy-to-interpret measure of economic evaluation.

Other similar tools include:

- Net Savings (or Net Benefits),
- Savings-to-Investment Ratio (or Savings Benefit-to-Cost Ratio),
- Internal Rate of Return, and Payback Period.

Decisions about built environment related investments typically involve a great deal of uncertainty about their costs and potential savings. Performing an LCCA greatly increases the likelihood of choosing a project that saves money in the long run.



# Basic – CBA (Cost Benefit Analysis)

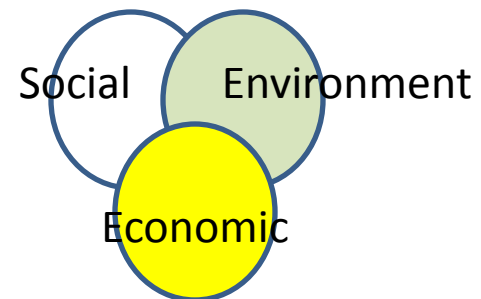
Frequently used in business planning and decision support processes. In its simplest form CBA uses monetized costs and benefits. More sophisticated uses includes the valuation of intangible costs and benefits. In essence the costs and benefits are weighed against each other.

Tool should only be used when one fully understands the rationale for its use  
How one defines in practical and equivalent terms the costs and the benefits  
Which costs and benefits are to be included (boundaries of the system)  
Which financial metrics are important to the decision

No universal or precise approach or method for this tool. Similar tools are:

- Benefit/cost
- Cost Benefit Assessment
- Return on Investment Analysis
- Financial justification
- Total cost of ownership

Decisions using CBA (or similar tools) attempt to predict financial and/or other business consequences of a decision – best used when the decision parameters are bounded and definable



# Basic – NEBA (Net Environmental Benefit Analysis)

Net environmental benefits are the gains in environmental services or other ecological properties attained by actions, minus the environmental injuries caused by those actions. A net environmental benefit analysis (NEBA) is a methodology for comparing and ranking the net environmental benefit associated with multiple management alternatives.

NEBA draws upon the knowledge domains of biology, environmental science, human health, risk assessment and ecological risk assessment. There are similar methods which include Natural Resources Damage Assessment and Ecological Characterization.

1. Irreversible 2. Reversible

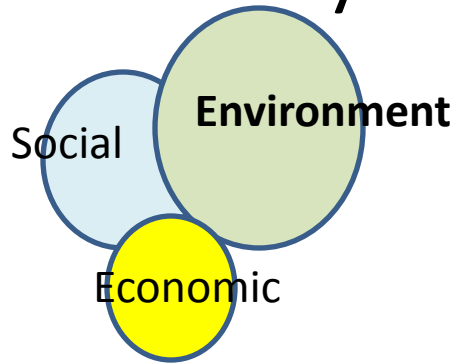
A. Severe	1A	2A
B. Trivial	1B	2B

Can be conducted for a variety of stressors and management options  
Is an iterative vs linear process and untimely  
Generally considered to be an hard method – as defined by both legal and government formal decision and rule making  
Doesn't easily monetize the value of the ecological services. Doesn't easily relate the human health risks to societal needs/issues.

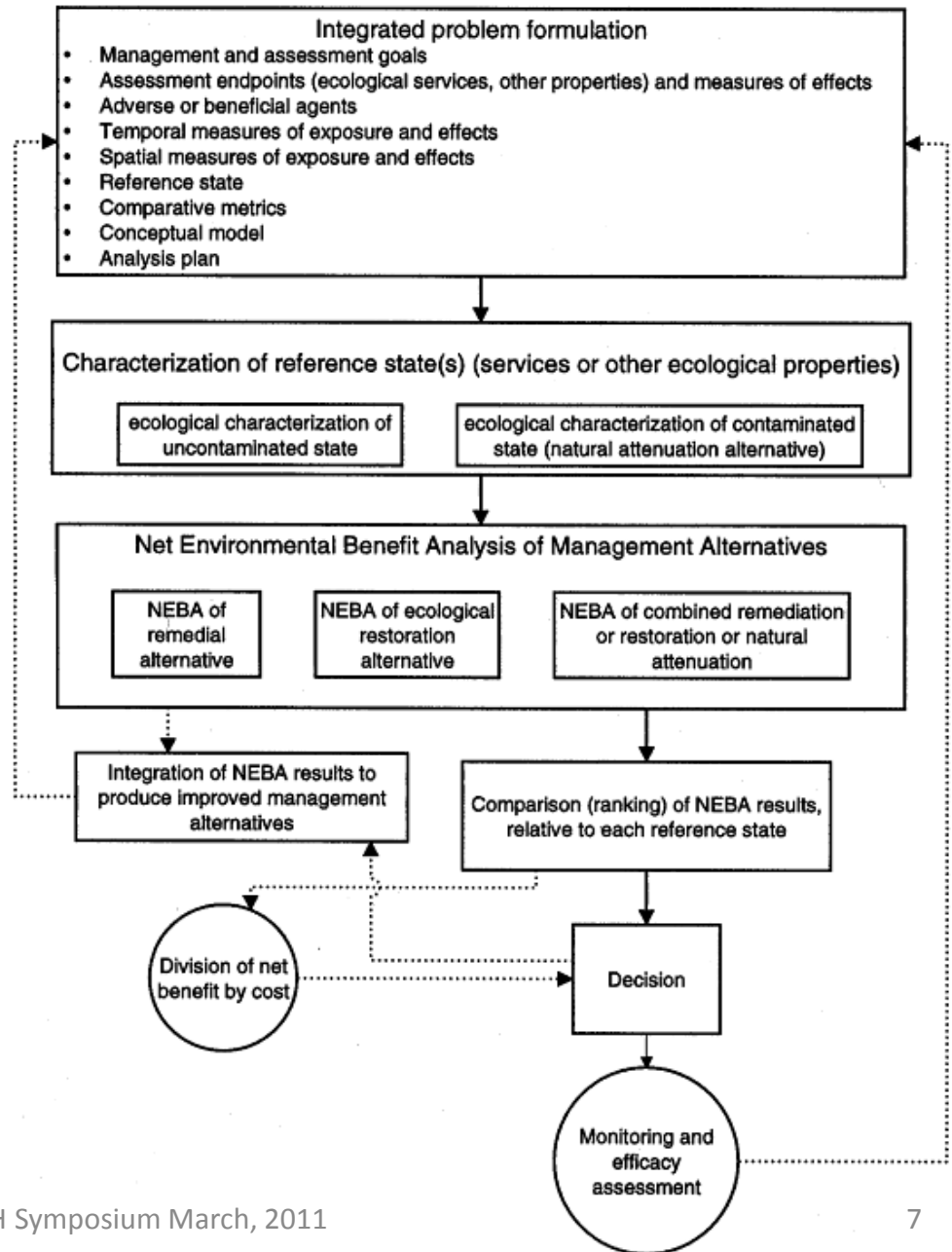
Appropriate participation by all stakeholders  
Participants must take the process seriously  
Evaluate the data or expert opinions objectively  
Apply the thresholds consistently  
Be objective when using the risk matrix  
Remember that you are dealing with levels of concern, not actual impacts

Best Uses – next slide

# NEBA supports some aspects of Sustainability



- Within the method the goals can be stated broadly
- Within the method the temporal measures should be broad
- The conceptual model may also be broad
- The alternatives to be compared can be distinguished with multi-attribute utility prioritization (MAU)



# Advanced – SAF (Sustainability Assessment Framework©)

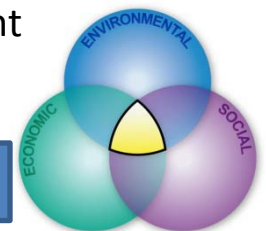
SAF is a proprietary data collection and information generating computational method which accounts for objective and subjective inputs. As a decision support tool the SAF helps create a more complete but complex understanding for subject matter experts. SAF uses 8 environmental, 4 economic and 4 social categories of information

SAF requires a SME with domain knowledge in the object of the assessment, and each of the main determinants. SAF is an decision support tool which can lead to the introduction of alternative selection bias and is less defensible in the face of definitive economic based analysis. An affinity for sustainability is assumed. SAF is a “snapshot” tool which does not address on-going operations

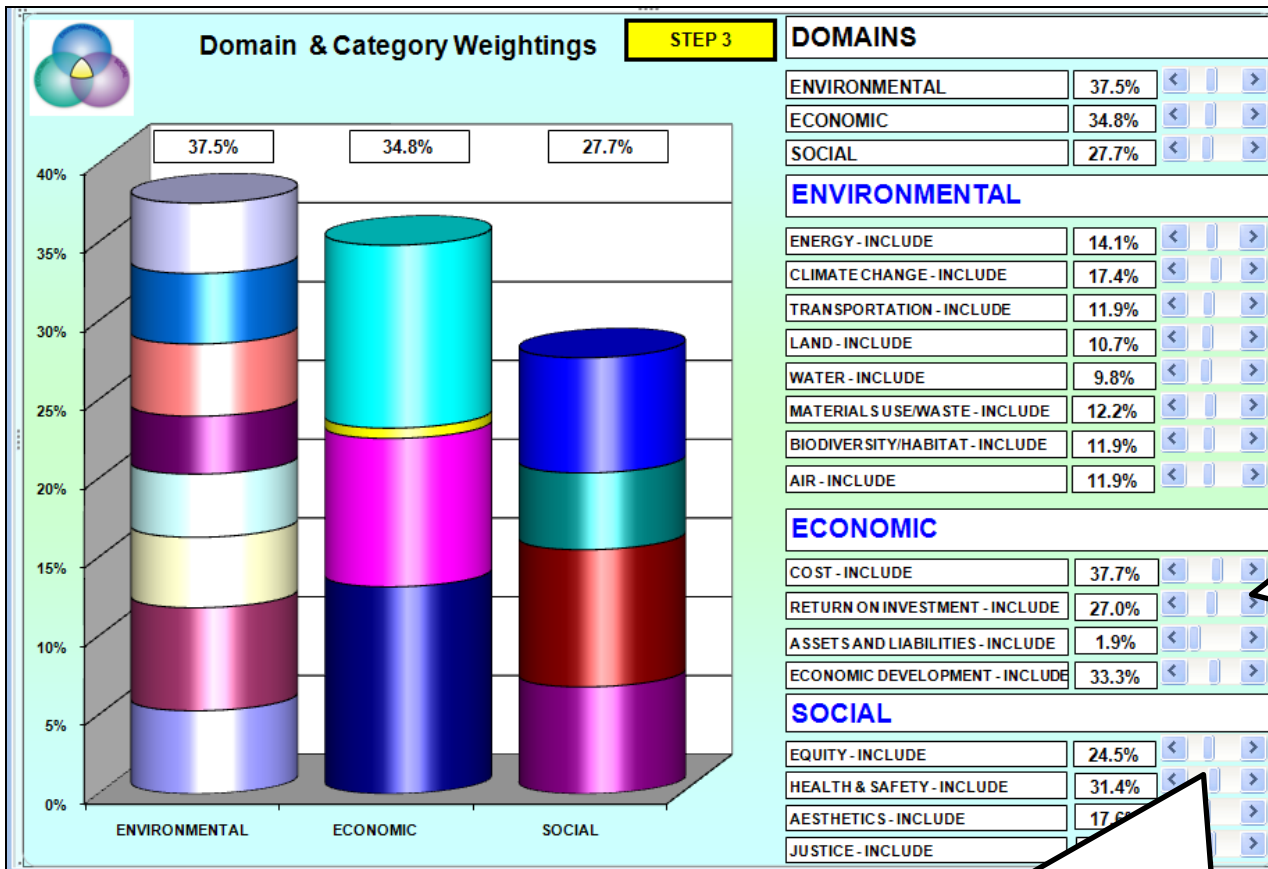
Other similar tools and methods include the USGBC’s criteria based scoring systems, GreenRoads™, Sustainable Sites Initiative (SSI is now part of LEED™). The integration of subjective and objective data can be approximated with mathematical modeling using “Fuzzy Math” – which uses custom set theory in relationship to qualified variables.

Energy	Cost	Equity
Climate Change	Return on	Health & Safety
Transportation	Investment	Aesthetics
Land	Assets and	Justice
Water	Liabilities	
Materials	Economic	
Use/Waste	Development	
Biodiversity/Habitat		
Air		

A Balanced Array



# SAF© continued



Within the three DOMAIN sliders the user is able to establish the relative weights of the selected DOMAINS. If a DOMAIN is not included the relative percentage will not display nor will other relative weights be affected by slider adjustments

Within the sliders for specific selected categories the user is able to establish the relative weights of the selected CATEGORIES within a DOMAIN by adjusting the slider bars which control the relative weights.

To increase the relative weight adjust the slider bar to the right, to decrease relative weight adjust the slider bar to the left

# Advanced – SI Port™

Sustainability Intelligence Portal “SI Port”© is an extensive information collection and modeling tool for highly complex decision making support requiring real time and long term data analysis and assessment. It was developed to assist cities and municipalities understand the inter-related impacts of the myriad of decisions made on a daily basis. It is a custom based DST application.

Similar advanced sustainability simulation and modeling software have been developed by Rocky Mountain Institute (RMI), Oakridge National Laboratory (ORNL) and the DOE’s NREL.

Other providers include:

- Aedas R&D (UK) – computational modeling and sustainability modeling
- ASA – Turku Business School Finland

The vast amount of information available requires the development of key performance indicators (KPIs)

The application is non-standard and must be developed for each use.

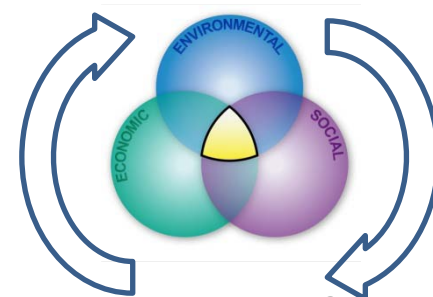
The water and energy nexus is a developing science and will change quickly

The carbon management future is uncertain.

The tool is too complex for project level application

SI Port is a community level modeling tool best used to support large scale on-going infrastructure and environmental asset management decision making for:

- GHG emissions
- Waste mgt
- Water
- Green products
- Economics
- Biodiversity





- Program Executive Dashboard
- Planning and Design
- Sustainability Indicators
  - Green House Gas
    - Travel Emissions
    - Material Embodied Emissions
    - Utility Use Emissions
    - Material Delivery Emissions
  - Waste Management
    - Waste Tracking
  - Water Footprint
    - W/WW
  - Ecology
    - Biodiversity
  - Social Impacts
    - Code of Conduct
    - Social Wellbeing
  - Economics
    - Economics
- Indicator Assessment Tool
- Carbon Offsets

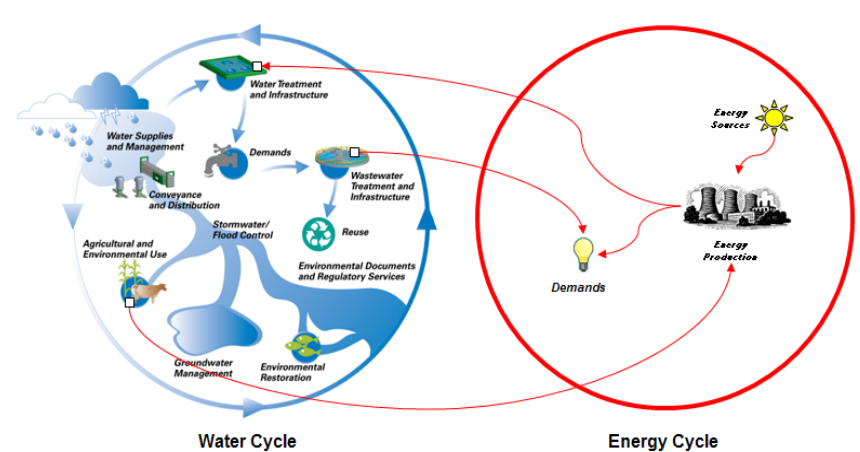
# SI Port™ (continued)

- ✓ Key performance Indicators drive the data collection and modeling
- ✓ Real time monitoring allows real time management decisions
- ✓ Carbon management focused



# Most Advanced – Voyage™

Voyage™ is an object oriented decision support tool. It allows the user to track various criteria and optimize multiple parameters simultaneously using linear or non-linear methods and to run “what-if” scenarios. It uses existing information, analyses, and models as information inputs. Voyage™ provides an operator-friendly interface to organize and analyze complex problems and sustainability issues and is valuable as a communication tool. It can aid in the communicating concepts and ideas through a simple graphical interface with animation capabilities.



Voyage™ was originally developed for modeling the total water cycle at a macro scale.

The Masdar System Integration Voyage™ Model has been developed to evaluate numerous alternative scenarios resulting from changes to:

- Project phasing
- Population projections
- Resource consumption rates

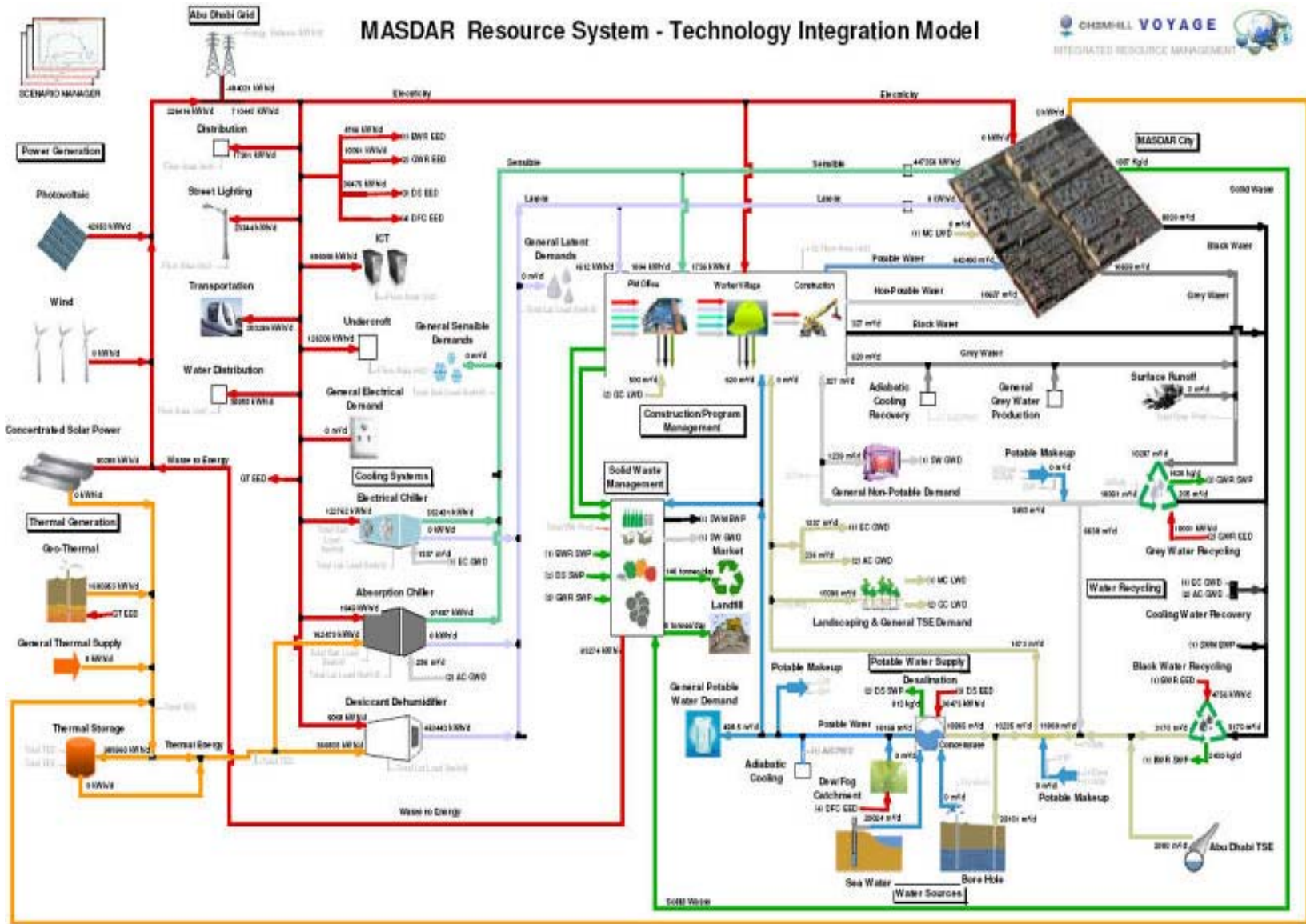
It is a one of kind and prototypical decision support system.

Best used to model:

- Energy consumption
- Energy generation
- Energy production
- Potable water consumption
- Non-potable water consumption
- Wastewater generation
- Treated water production

- Recycled water production
- Treated wastewater discharge
- Greenhouse gas generation
- Spatial footprint

# Voyage™ Conceptual Integration Model



# Scenarios Drive Tool Selection

- Project – program or portfolio decisions – scale matters. Temporal issues matter. What is the scale and timing of the decision at hand?
- Key performance indicators – if everything is important than nothing is important. What stands out or is likely to be the principal determinant?
- Complex or simple? All sustainability decisions tend to be complex – no one tool is best sometimes the best approach to decision making is to use multiple tools. Which tool(s) should I use?

# Resources

- <http://www.wbdg.org/resources/lcca.php>
- [http://www.mindtools.com/pages/article/newTED\\_08.htm](http://www.mindtools.com/pages/article/newTED_08.htm)
- <http://www.solutionmatrix.com/cost-benefit-analysis-definition.html>
- [http://www.esd.ornl.gov/programs/ecorisk/net\\_environmental.html](http://www.esd.ornl.gov/programs/ecorisk/net_environmental.html)
- <http://www.serdp.org/>
- [http://www.ch2m.com/corporate/services/sustainable\\_solutions/default.asp](http://www.ch2m.com/corporate/services/sustainable_solutions/default.asp)
- <http://aedasresearch.com/team/strand/advanced-modelling>
- [http://www.teollinenekologia.fi/pdf/Tk04/Luukkanen\\_241104.pdf](http://www.teollinenekologia.fi/pdf/Tk04/Luukkanen_241104.pdf)

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# Questions and Answers

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