# Risk Identification and the Quantification of Sustainability Comprehensive Financial Cost Benefit Analysis that Includes Environmental and Social Costs - 11553

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## ABSTRACT

As discussed in this paper a triple bottom line methodology and sophisticated financial modeling tool, DELTA™ has been developed that can account for external sustainability factors. The tool can be used to assist in the selection of the "optimum" project both from the traditional internal financial perspective, and from the wider external societal and environmental perspective to improved environmental and social performance. This process and tool represents the latest thinking in sustainability, and allows a complete representation of all of the project's issues and concerns (engineering, safety, risk, environmental, social and community issues) to be included and compared in a common unit – money.

## INTRODUCTION

The inclusion of sustainability into projects is typically a requirement but difficult to correctly account for. The Department of Defense (DOD) is one of the largest users of energy in the US. 2009 Executive Order (EO) 13514, "Federal Leadership in Environmental, Energy, and Economic Performance," requires the DOD to "develop, implement and annually update a plan that prioritizes actions based on a positive return on investment for the American taxpayer and to meet energy, water, and waste reduction targets". In 2010, the DOD Strategic Sustainability Performance Plan was released presenting goals for energy conservation/reduction and reduced reliance on fossil fuels. The sub goals provide specific management objectives to ensure the continued availability of resources critical to mission accomplishment, focus DOD to serve as a leader in reducing greenhouse gas (GHG) emissions, emphasize minimizing waste and pollution and stress continuously improving mission accomplishment through management practices built on sustainability and community. To accomplish these goals and to make effective decisions specific advanced methodologies and tools need to be employed in addition to adherence to traditional forms of sustainability in building design/construction such as Leadership in Energy & Environmental Design (LEED) certification and Multi Criteria Analysis (MCA). LEED was developed in 1993 by the US Green Building Council and is an internationally recognized points-based green building certification system, providing third-party verification that a building or community was designed and built using strategies intended to improve performance in specific metrics such as energy savings, water efficiency, $CO_2$ emissions reduction, improved indoor environmental quality, and stewardship of resources and sensitivity to their impacts (USGBC, 2010). LEED is intended to provide building owners and operators a concise framework for identifying and implementing practical and measurable green building design, construction, operations and maintenance solutions but can not examining tradeoffs between different development and construction processes to improve net sustainability. The disadvantage to MCA analysis is that the process is inherently subjective and so risk identification and preferences in sustainability solutions can differ from decision maker to decision maker.

Advanced processes need to be able to objectively account for environmental and social considerations to "optimize" decision making and to profitably incorporate sustainability into decision making. The advantage to objectively including societal and environmental costs and benefits into the decision making process are:

- Improved risk identification, quantification and management;
- Improved internal and external Stakeholder communication; and
- Improved adherence to DOD and other governmental sustainability goals and project success.

### Delivering Profitable and Sustainable Projects

In the 21st Century, sustainability matters in project delivery. Environmental and social issues, more than ever before, have the ability to affect the bottom line of governments, corporations and projects globally. Getting the sustainability issues right on a

project mean faster approvals, fewer approval conditions, better community relationships, a positive public image, improved efficiency at all levels, and a more profitable operation over the long term. Getting the sustainability issues wrong can lead to significant costs, negative public relations, and adverse effects on project viability. On a day-to-day level, sub-optimal sustainability increases costs, erodes profits and locks businesses into sub-optimal choices over the long term.

Profitable sustainability delivery helps clients identify and implement solutions which maximize profit *and* sustainability over the asset life cycle to:

- Build in operational resilience;
- Increase efficiency;
- Reduce energy and water consumption;
- Reduce emissions and create cleaner operations;
- Manage environmental and social risks;
- Improve environmental outcomes;
- Engage stakeholders;
- Accelerate approvals; and
- Improve long term profits.

The methodology that WorleyParsons has developed through our corporate EcoNomics™ initiative improves the overall environmental, social and financial sustainability of projects over the asset life cycle in two main ways (each is discussed in more detail below):

1. **Assessment**: By fully quantifying environmental, social and financial issues in monetary terms (dollars), to identify optimal business decisions which optimize project performance over the full life cycle.

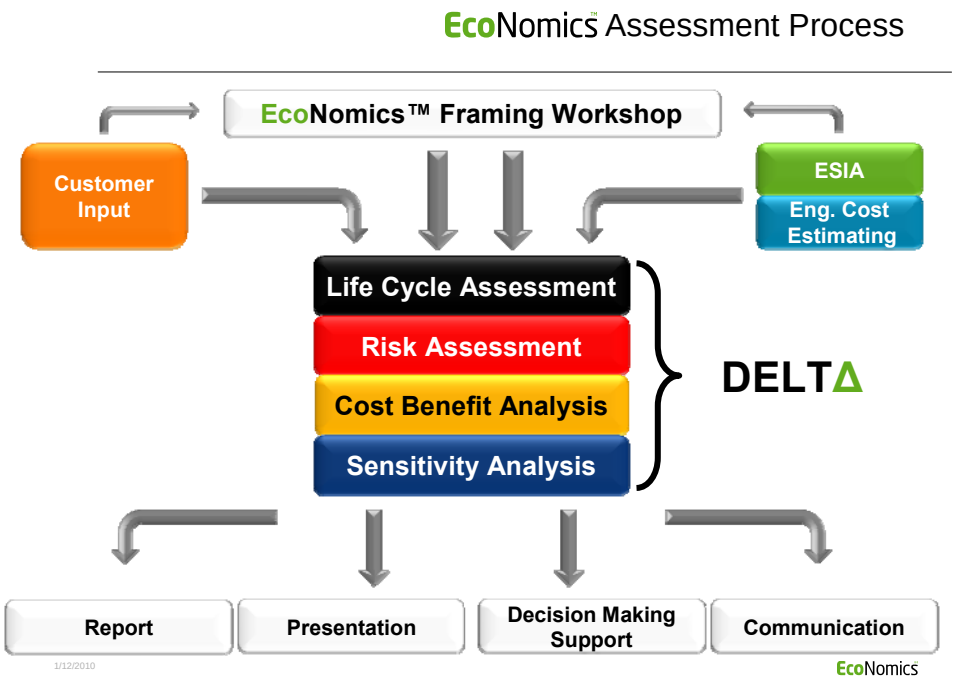
2. **Delivery:** By fully embedding sustainability-related capabilities and expertise within our project design and delivery teams from the outset, to ensure that projects meet or exceed the customer's sustainability and business performance objectives.

## Triple Bottom Line Financial Assessment

The methodology developed by WorleyParsons allows for a quantitative decision analysis that can balance impacts and benefits along the bottom line by providing quantification in monetary terms of the economic sustainability of a course of action or options. By explicitly placing dollar values on assets which are not normally included in a financial net-present value (NPV) calculation, such as water, carbon (GHGs), ecology, community amenity, and blight, the effect of these issues on project decisions-making can be assed in monetary terms, on a like-for-like basis. The analysis can also include varying trajectories of real cost changes in commodities like energy, water, and carbon, among others. This way, if a project or option is economic (NVP positive when all issues are included), it is by definition sustainable. Uneconomic options are not sustainable because society does not receive overall benefit to justify the costs involved.

Additionally, by conducting an assessment using DELTA™ a full monetized understanding of risk to and from the project and the impact of various project options or alternatives on those risks, development of risk-mitigation options can be developed. DELTA™ has been developed by WorleyParsons over the last 3 years to incorporate the sustainability into project option cost benefit analysis. The tool includes life cycle assessment, risk assessment and externality monetization components to arrive a NPV calculation for various viable technology, project or strategy alternatives (Hardisty, PE and Ozdemiroglu, E. 2005) (Hardisty, PE 2010).

As shown below, the assessment follows a rigorous standardized procedure, starting with a framing workshop, and culminating in analysis using the EcoNomics DELTA™ toolset, a sophisticated calibrated economic modeling tool which incorporates all of the private financial and social and environmental external costs and benefits, and allows examination of the effects of range of possible future trajectories for all sensitive parameters. The tool can be used to assist in the selection of the "optimum" project or strategy both from the traditional internal financial perspective, and from the wider external societal and environmental perspective. In this way, clients can gain a better understand and efficiently optimize their operations in the context of the environment and society in addition to their obligations of profitable operation. By conducting a risk cost benefit assessment using the DELTA™ tool the true overall environmental, social and financial costs and benefits of the project can be revealed and compared to a range of practical alternatives. Uncertainty about the future becomes a decision-making strength, allowing identification of options which are robustly economically superior over a wider range of possible future conditions and elimination of those which are clearly uneconomic.




This methodology allows for explicit trade-offs made in capital and operating planning to be identified over the life cycle of the project. For example to assist in the identification of the most economic renewable power generation option for a specific site commercial concerns must be balanced against a series of environmental (water quality, noise, air quality, GHG emissions) and social (blight, health and safety and community relations) issues.

The advantage of this methodology over other cost benefit approaches are that sustainability is built into the process in an objective and non subjective way and that the results of the analysis can therefore have greater stakeholder (community and regulatory) acceptance.

## Case Example Assessment Projects

**Project: Cost Benefit Analysis (CBA) of Tritiated Groundwater Remediation**
**Client: Atomic Weapons Establishment (AWE)**

WorleyParsons was commissioned to undertake a remediation feasibility study and strategic CBA of potential remedial options for tritiated groundwater for the AWE in Aldermaston, Reading, UK. This work involved assessing the feasibility of numerous potential options for the remediation of tritium contaminated

groundwater. Once feasible options had been selected a cost benefit analysis was undertaken to assess the most economic remedial option. This assessment was undertaken in accordance with the Environment Agency's guidance on CBA, authored by WorleyParsons. The CBA considers the costs and benefits to all stakeholders, i.e. the problem holder, regulators, society and any other relevant parties.

This is achieved by considering all potential costs and benefits, both internal (problem holder) and external (society and other stakeholders). The result is an assessment of the most economic remedial solution, that with the highest net benefit. The outcome was the optimal economic solution; in this case, limited hotspot removal and continued monitoring rather than the implementation of groundwater remediation as advocated by the regulators.

**Project: Radioactive Landfill Management Options Cost Benefit Analysis (CBA)**
**Client: United Kingdom Atomic Energy Authority (UKAEA)**

WorleyParsons undertook a CBA of a former landfill area at a nuclear facility operated by UKAEA at Dounreay, Caithness, Scotland. The landfill in question contained radioactive waste and Asbestos Containing Materials (ACMs) deposited in the 1960s and 1970s, the presence of which was in contravention of the waste management license granted to the site in 1992. In response to the Scottish Environmental Protection Agency's consideration of this contravention, and the potential need for remediation of the site, the CBA considered the costs and benefits associated with undertaking numerous different remedial options based on source pathway and receptor management that included interceptor wells and pump and treat systems. Results of the analysis suggested the most economic solution was pathway management through synthetic liner installation and hot spot removal, followed by continued monitoring.

**Project: Remediation Option Assessment**
**Client: Confidential Client**

In 2008, an assessment was performed for a global hydrocarbons client to provide an assessment of methods of soil and groundwater remediation at a large urban manufactured gas plant located adjacent to a river and a public drinking water supply well field. Options considered included natural attenuation, soil remediation, soil and unconfined groundwater remediation, and the installation of a pump and treat well in the regional aquifer. CAPEX and OPEX costs were studied over the full life cycle together with the following monetized externalities; blight, total economic value of water, community asset value, and ecological and other natural resource elements. The assessment provided the client with an understanding of quantified risk and the total economic benefit involved in from various options for site remediation and redevelopment over the life cycle of the project. The optimum method of remediation that was more costly than had been proposed by the land owner to provide greater protection from the risk of wider contaminant impact. Thus, the remediation measure was selected and approved by the local regulator that was selected and net benefit to society was maximized.

## CONCLUSIONS

The cost benefit risk assessment risk methodology and DELTA™ financial modeling tool developed by WorleyParsons represents the latest thinking in sustainability, and allows a complete representation of all of the project's issues and concerns (engineering, safety, risk, environmental, social and community issues) to be included and compared in a common unit – money. The assessment represents a significant step forward in the

ability to choose the most sustainable and profitable strategies, projects and project designs. In essence, the methodology is an enhancement to any project, driven by the customers' sustainability objectives, selected and justified based on sound economic analysis which quantifies sustainability outcomes in financial terms.

## REFERENCES

Hardisty, PE and Ozdemiroglu, E (2005). The Economics of Groundwater Remediation and Protection. CRC Press, NY

Hardisty, PE (2010). Environmental and Economic Sustainability. CRC Press, NY.

USGBC, 2010. USGBC Web Page at: http://www.usgbc.org/DisplayPage.aspx?CategoryID=19