The Worldwide CIBSE/ASHRAE
Gathering of the Building Services Industry

Building Sustainability, Value and Profit

A CIBSE/ASHRAE International Conference

The Edinburgh International Conference Centre

Edinburgh, Scotland
24 – 26 September 2003

Sustainability Un-definable Success in a Defined World

E. Mitchell Swann P.E.
Vice President

swann@mdcsystems.com

MDC Systems, Inc.
700 East Gate Drive
Mt. Laurel, NJ 08054
United States of America.
(01) 856.802.6928 ext. 19 (voice)
(01) 856.802.6929 (fax)

www.MDCSystems.com

Sustainability – Un-definable Success in a Defined World

Introduction

Sustainable\Green (S\G) design has been almost universally designated a desirable methodology and a 'value-added' concept which should be integral to today's responsible design process. To execute S/G design requires additional time and effort and sometimes special consultants and construction techniques; thus additional expense.

This results in a value add to the contract between the client and the 'service provider', whether the designer or the contractor. An addition to the value of the contract should be considered in conjunction with an increase in the value of the services provided or the product delivered. If the final service or product 'fails to deliver' the agreed upon value, the contact value should be expected to be adjusted accordingly.

This leads to the following questions:

- If sustainable design has an added value, what are the 'units' of sustainability that define this value such that it's 'worth' can be established, performance measured and contractual compliance determined?

- What are the interrelationships in the value chain between design, construction and operating methodology such that a comparison of delivered value versus promised value can be developed for the completed project?

To answer these questions we must define the framework of this analysis.

First, define 'value'? In the abstract, value is something, either tangible or intangible, which one party seeks to obtain from another. In legal terms, value is defined as:

> **value,** *n*. **1.** The monetary worth or price of something; the amount of goods, services or money that something will command in an exchange.[i]

The 'something' is most often tangible and the transaction is most often monetarily. Thus an item only has value if there is an exchange between parties. If one party receives an item without an exchange to the previous owner of the item, the item could be said to have no value. This would be the case of a demolition contractor 'keeping' the items removed from the project for reuse\resale with no compensation to the owner. Without an agreement between the parties prior to the contractor performing the work, the owner would not be permitted to deduct the value of the recovered items after the contractor has removed them due to a late discovery by the owner that the materials could be sold or reused.

Similarly, if a designer incorporated S/G design features into a project with no promise of performance or additional fees to the client, the owner would not be permitted to seek compensation under the contract should the S/G features not provide the level of 'value' expected by the owner.

The next question is what is a contract? A contract is defined as follows:

> **Contract**, *n.* **1**. An agreement between two or more parties creating obligations that are enforceable or otherwise recognizable at law; **4.** A promise or set of promises by a party to a transaction, enforceable or otherwise recognizable at law; the writing expressing that promise or set of promises.[ii]

Now comes the most difficult definition – what is sustainability? What is green design?

> "Sustainable development involves...meeting the needs of the present without compromising the ability of future generations to meet their own needs."[iii]

There are many groups working on the sustainability issue. ASHRAE focuses on the need to place such objectives in a lead position of our on-gong thinking:

> ***Sustainability –*** Humanity must ultimately convert to sustainable energy systems; rapid development of renewable resources is essential for this transition. However, nonrenewable energy resources will continue to be needed, and environmentally sound, further development of these resources is necessary.[iv]

Within current practice, sustainable design is considered an approach that has been outside of the normative design practice. Sustainable design is based upon the traditional design and construction practice, but goes beyond those normal and customary practices to include new techniques, technologies and materials. For that there is a cost premium, both in design and construction. The resulting product should be a more energy efficient building with a reduced resource demand and a healthier indoor environment.

There are three words above which must be looked at closely as it relates to a contract: 'more', 'reduced' and 'healthier'.

These are imprecise words and imprecision can lead to misunderstanding.

The use of the qualitative modifiers and suffixes, 'more', '-ed' and '-ier' imply that there is a range of performance available. Fundamentally, if there is a 'more' there must be a 'most' and a 'less'.

What then is ‘sustainable’ enough to distinguish a normal design from a sustainable design? How do you know you’ve arrived if you don’t know how far you’re going and what do you owe the driver for the trip?

MEASUREMENT OF SUCCESS

There are various standards for the design of energy efficient buildings. Many provide prescriptive approaches to system specification and/or design. These prescriptions can be used to set targets and the performance of a design can be measured against those targets.

The use of design standards plus some mutually agreed upon ‘improvement’ beyond these baselines can be used to establish an energy budget target for the project. These targets can be developed on a system basis or can be indicated as a ‘total building’ target. The first approach allows the owner to concentrate on specific areas or systems, but reduces the flexibility of the designer to consider the design holistically. The second approach gives the designer the latitude to look for an optimized blend of solutions, but also makes it possible to overweight the solutions in one area which may be problematic if external conditions change.

In addition to energy there is the issue of resource utilization. In many industrial process facilities there are significant process utility demands that can outweigh facility demands. Compressed air, process water, gases, steam and other utilities may add significantly to the overall site resource loads. Process chemistry choices can have an equal level of impact on liquid and gaseous emissions. Often the design firm is directly responsible for specifying the process equipment and refining and finalizing the process itself. It is possible to develop resource utilization targets similar to those for energy for ‘non-facility’ driven utilities. The challenge is that the targets will vary across projects and processes. Developing good targets will be much more dependent upon owner and equipment vendor input.

The measurement of sustainability performance should be done in the ‘units’ typically used to measure the items in question – energy, mass flow, weight, volumes. The use of monetary targets is not recommended since there may be shifts in pricing or markets due to factors beyond the control of any and all parties to the contract.

THE IMPACT OF THE OWNER ON ACHIEVING ‘SUSTAINABILITY’ (OR, ‘YOUR MILEAGE MAY VARY’)

Achieving ‘sustainability’ is not only dependent upon the quality of design and construction, but also on the commitment of the owner to operate the facility the way it was intended. The situation is analogous to that of a competitive race car. To field a winning entry requires the combined skills of the car designer\builder, the pit crew and the driver.

In a building project, the owner is the driver and he has ‘contracted’ with the other participants for a ‘victory’ in the ‘race’. The challenge in sustainable design is that the outcome of the race may take several years to determine. No amount of skill or craft by the builder or pit crew can overcome the impact of the driver’s technique on the outcome of the race. The same is true in facility operation.

Given the significant impact of how a facility is operated on its overall environmental impact, how should this impact be accounted for within the contract?

The inclusion of performance targets into the contract introduces a risk to the design and construction parties which they must take steps to mitigate. If the owner has a legal recourse within the contract to evaluate the building’s ‘performance’ relative to the targets, the design and construction parties must establish some guidelines or criteria for operation to verify proper usage. Such criteria can be developed during the design phase and included as a part of the contract for acceptance by the owner. During design development, various criteria must be developed, evaluated and refined to analyze the performance of the building in response to various design options.

Once optimized, the inputs, assumptions and criteria used can form the basis of the operating guidelines used to measure adherence to the design intent. This is not the traditional operating manual which provides component information on the various pieces of equipment in a building, but deals with the intended methods, modes and schedules of operation for the facility. It translates not only the ‘what did I say’ aspects of the design, but the ‘what did I mean’ aspects as well.

These operating guidelines can be presented to the owner for review, modifications and acceptance at the conclusion of design development and included with the Basis of Design or project specifications as a part of the contract. It might also be prudent at this time to develop maintenance guidelines for inclusion into the contract.

With the completion of the resource utilization models, operating and maintenance guidelines, it is possible to prepare a more accurate total project cost model, thus shifting the focus from first cost\simple payback to true life cycle costing - the heart of sustainability. This facilitates the evaluation of the real cost of the investment in sustainability and the return on that investment.

IMPLICATIONS TO THE CONTRACT

The addition of resource utilization targets to the contract requires a higher level of performance from the design professional. These heightened requirements equate to a transfer of risk from the owner to the designer. The transferred risk is that associated with the on-going operating cost and performance of the building. This transfer is done at a cost – in design fees due to the additional analysis and investigation required by the designer and in construction costs due to the use of better materials, new technologies and new techniques designed to achieve these targets.

Unlike the normal arrangement where the owner is the recipient of a design or building and the project is ‘done’, in the sustainable project, sustainability can only be measured over time. Because this time period occurs after the owner has taken beneficial use of the project, the owner in some ways could be said to be the final service provider to him or herself in satisfying the contract. This concept may have some interesting impacts to the process of contract formation and the negotiation of terms and conditions.

In order to establish ‘reasonable’ performance targets for a particular project, the prudent owner would want to have an idea of what is customary for such projects based on industry ‘norms’, project size, location and other contextual matters. The prudent owner would also want to have an idea of the cost of such a facility. If the owner has no such knowledge based on internal research or prior experience, it may benefit the owner to take one of the following paths:

- commission an investigatory project to research the ‘typical’, the ‘possible’ and the ‘probable’ and the associated costs of same, or

- execute the contract with design-construct team using a two step process. The first step would be to perform such an analysis, most probably on a ‘time and material’ or cost-plus contract basis and at the conclusion of design development, shift to a fixed fee or lump sum contract once the scope has been properly defined and the targets set and agreed upon.

This may be perceived as problematic in some process industries, but suitable performance targets can be set without unnecessarily restricting process technology options. This process may be seen as raising the cost of design, but that is one of the costs of the sustainability investment.

The Distribution of Liability in Multi-Party Contracts

Typically liability is apportioned between multiple parties in a contract based on their respective portions of the reward or the nature of their services relative to the nature of the liability. Within the sustainable project model the success of the project depends upon a reversal of roles over the life of the project. The design and construction teams have an obligation to provide a suitable facility to the owner and the owner has an obligation to operate the facility in a suitable fashion once it has been delivered. A failure on the part of either party would constitute a breach of the ‘contract’ and render one or more terms of same void. While the owner’s failure to live up to his or her obligations in operations would not necessarily open the door for the design or construction team to make a claim for damages under the contract, it could negate a claim by the owner that the facility did not meet the expected performance.

What happens if the owner makes some change to the operation as a result of business conditions, but the change is not of such a material nature that the new conditions could be said to be completely outside of the expectation or anticipation of the design team? What tools are available to evaluate this variation from the expected theme?

To the extent that the new conditions are able to be characterized as an 'extension' or variation upon the agreed upon operating scenario, the model may be adapted to show the anticipated performance at the new conditions. Differences between the predicted and actual performance can form the basis for evaluating the performance of the parties relative to the contract. Traditionally, collecting the data necessary to evaluate such scenarios has been time consuming and cost prohibitive, but advances in computerized control and monitoring systems has made such collection much simpler.

The effect of time on performance must be considered. All systems degrade in performance over time, even those with excellent maintenance programs. Looking back at the race car analogy, it is unreasonable to expect the horsepower output to be the same at the 100^{th} race as it was at the 10^{th} race.

WHAT'S THE POINT OF ALL OF THIS?

The benefits of sustainable design must be evaluated in multiple contexts. The typical pro argument is that it is good stewardship to be conscious and minimize our impact on the environment, but the benefits extend to more practical areas as well. Within highly developed regions, there are limits to what demand the existing infrastructure can support. Reducing the resource demand extends the life of that existing infrastructure. The typical con argument is that it is too expensive given the alternative solutions. However, the price of alternatives varies depending upon the market.

A simple analogy: if the increase in 'computing power' of PCs had been matched by a commensurate increase in electrical power required, it is probable that the proliferation of PCs in businesses by the limitations in electrical load-carrying capacity in many existing buildings. The incoming feeders and 'load-side' distribution infrastructure would be insufficient to handle the processing load, thus there would be a clear limit as to the 'amount' of computing capacity that could be carried by an existing building or on an existing utility grid. Would the increase in productivity attributed to the spread of computers overcome the costs associated with the overhaul of building and utility electrical systems (relocation and 'stranded investment' or infrastructure rebuilds)?

A parallel can be found in the sustainability issue. As economic 'density' increases in developed areas, there is an increasing need to maximize and optimize the net output of existing infrastructures. The cost impacts of total refurbishing or abandonment of existing infrastructures will make sustainable design a practical economic alternative.

Thus sustainability will have an impact on the 'cost of doing business' and the economic performance of a project. This economic impact will become the subject of contractual and legal debate.

SUMMARY AND CONCLUSIONS

Sustainable design is seen as a value-added approach. This value will likely increase as the demand on available resources increases. A natural result is the incorporation of sustainability into the 'custom and practice' and the tendency to evaluate sustainability contract performance in a manner consistent with 'custom and practice'. However, the subtle, yet significant differences in the execution, delivery and evaluation of sustainable projects will require new approaches to defining a successful project – and evaluating contract compliance.

In order to effectively evaluate the performance of parties in the delivery of a suitable, sustainable project, it is necessary to develop some new tools and methodologies. These include:

- develop 'targets' for 'sustainability' relative to the specific project and over a set time period.

- 'target' development should be done using 'reasonable' goals relative to projected costs and currently available technologies.

- performance goals should include criteria for on-going operations and maintenance to facilitate the 'best use' of the design.

- Performance evaluations must be conducted over time; such evaluations must take into account the effects of time on the performance of systems and equipment.

- The evaluation of the impact of operation relative to design relative to construction on the overall achievement of the sustainability targets will be critical to evaluating the long term performance.

The spread of sustainable and green design techniques and technologies will usher in a new era of cooperative team dynamics for designers, builders and owners alike. These new dynamics may initially strain our preconceived notions of what a good project is compared to a bad project, both technically and contractually, but this strain will ultimately lead to a positive outcome for all concerned and a higher level of quality in the built environment.

References

[i] Black's Law Dictionary – Abridged Seventh Edition, Bryan A. Garner, Editor in Chief, published by the West Group, St. Paul, MN, USA 2000

[ii] Black's Law Dictionary – Abridged Seventh Edition, Bryan A. Garner, Editor in Chief, published by the West Group, St. Paul, MN, USA 2000

[iii] Brundtland Report, Earth Summit, Rio de Janeiro, Brazil, 1992

[iv] ASHRAE Energy Position Document – Issued January 30, 2003.