WHOLE LIFE COSTING ANALYSIS FOR SUSTAINABLE DESIGN

Abdullahi Ahmed (PhD)
Understanding whole life costing analysis

- Environmental challenges;
- What is whole life costing analysis all about?
- What is involved?
- How do I do it?
- How do I apply it to my projects?
Sustainability: The Challenge

Key Issue

■ Economic and social needs must be balanced with the capacity of the earth’s resources and ecosystems;

Challenge

■ The human community faces an array of choices about the quality of our lives and the state of the global environment. Our choices today will help Each of those choices will help to determine the condition of future generation;

■ Water needs to be managed sustainably;

■ We need to make the transition to renewable energy sources;
What is Whole Life Costing?

- Whole Life Costing is defined in the International Standard, ISO 15686 Part 5 as:
  “Economic assessment considering all agreed projected and relevant cash flows over a period of analysis expressed in monetary value. The projected costs are those needed to achieve defined levels of performance, including reliability, safety and availability”.
What is Life Cycle Costing?

- Life Cycle Costing is a sub-set of Whole Life Costing and it is a method of systematically doing economic evaluation; This can be defined as:

- Life Cycle Costing is “..Methodology for systematic economic evaluation of the life cycle costs over a period of analysis, as defined in the agreed scoping”.

- Life Cycle Costs are “..cost of an asset or its parts throughout its life cycle, while fulfilling the performance requirements”.
WLC/LCC

Whole Life Cost (WLC)

- Non Construction Costs
- Life Cycle Cost (LCC)
- Income

- Construction
- Operation
- Maintenance
- End of Life

Environment (including energy and utilities)
Economic and financial approaches to whole life costing
WLCA process – it’s an iterative process

BSRIA, (2008)
Features and Consequences

What Whole Life Costing does:

- Compares different technical solutions to the same problem
- Incorporates financial costs and benefits occurring over an extended period of time
- Allows for a flat rate of inflation
- Uses Net Present Values to reduce long-term cash flows to a single figure

What this means for you:

- The solutions being compared have to be functionally equivalent
- All costs and benefits have to be quantified in financial terms
- Assumptions have to be made about timescales and future inflation
- Be careful about precision of data and the use of the results
Why bother?

- It is Government policy, supported by OGC and Treasury guidance – particularly important for public sector

- Everyone is becoming more aware of the long-term effects of capital expenditure choices
  - Fluctuations in running costs can make for some nasty surprises
  - Business profit is largely driven from worker productivity
  - Estate costs are coming under the spotlight as a place to make savings

- Achieving best practice
  - BREEAM credits from carrying out WLC
  - Drive for “excellent” ratings on more and more buildings
  - Higher discount rates cause value to decay more rapidly
  - Sustainability credentials to attract talented staff and valued customers
Step 1: Define the problem

- Take time to understand the underlying issues
  - How do different stakeholders measure success?
  - What assumptions have been made within the project brief?

- Make sure the problem is stated in functional terms
  - What performance must all solutions deliver?
  - This is about defining what needs to be achieved, not specifying how it is done
Step 2
Model alternative solutions

- Identify a range of alternative solutions
  - Enough to explore the real choices
  - Not too many to overwhelm you – typically 3-5 is sufficient

- Check each solution satisfies just the performance requirements

- Collect data on timing and cost of all project components
  - Initial capital costs, periodic capital reinvestments
  - Regular running costs for energy and maintenance
  - End-of-life costs

- Use data to build one WLC model for each solution
Step 3
Calculate the WLC

- Calculate the effect of time
  - Costs and benefits in the future are less valuable than costs and benefits arising now

- Discount rate is either
  - Set by Treasury (3.5%)
  - Dictated by client
  - Suggested by project team

- Calculate the NPV for each line item – add them all up to give the overall whole life cost
Step 4
Refine the models

- Assess the nature of each time/cost estimate
- Focus on items with the least certainty
- Research more robust data
- Run “what-if” variations on least certain data to understand the responses from the suite of models
Step 5
Interpret the results

- One golden rule:
  
The preferred alternative is that which produces the lowest whole life cost

- Precision of input data helps decide whether the difference between two WLCs is significant
Applying whole life costing in a business environment

- Select one option from a range of alternatives, for one specific project or problem

- Understand which are the key financial influences for the viability of your project

- Make the case for increasing up-front investment to save running costs in the future
Limitations  (From Roebuck’s PHD Bradford University)

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<tr>
<th>Stakeholder</th>
<th>Limitations</th>
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<tr>
<td>Industry</td>
<td>1) Capital costs usually considered separately from running costs, normal practice to choose project with cheapest capital costs (Bull, 1993)</td>
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<td>2) It is often ambiguous as to who is responsible for funding operation and maintenance of an asset (Bull, 1993)</td>
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<td>3) Project design fees often calculated as percentage of total project cost, hence lack of motivation on the part of the designer/consultant to optimise costs (McGeorge, 1993)</td>
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<td>Client</td>
<td>1) No strong client requirement for WLCing and no marked long-term interest in the cost of ownership (Nicolini et al 2000)</td>
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<td>2) WLCs rarely monitored and there is no well established standard methodology for doing so (Nicolini, 2000)</td>
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<td>Designer/consultant</td>
<td>1) Uncertainty regarding future events, e.g. operational lifecycles, operation and maintenance costs, unplanned activities, discount and inflation rates (Ferry &amp; Flanagan, 1991)</td>
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<td>2) Difficulty in obtaining up-to-date costing information, may also be a lack of reliable historical data (Bull, 1993). Obtaining relevant data can be expensive (Ferry &amp; Flanagan, 1991)</td>
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<td>3) Might not be time to perform a detailed WLC analysis. However this can be reduced with the aid of computer-based models and decision support systems (e.g. Griffin, 1993; Lampe et al, 2005; Roebuck &amp; Ashley, 2006)</td>
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<td>4) Difficultly in dealing adequately with intangible (non-monetary) costs (Flanagan et al, 1989)</td>
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Practical Application

WHOLE LIFE VALUE

Key to achieving best whole life value:
1. Understand Value
2. Assessing Value
3. Putting a Cost to Value Propositions
4. Identify the Best Value Sustainable Solution – prior to commit to invest
5. Optimising Value over the Whole Asset Life Cycle (Post Occupancy Evaluations - POE)
Estimating the initial costs, operating, maintenance, energy and replacement costs is not always straightforward.

Estimating times of occurrence for replacing items of plant can be a challenge;

Make sure that all assumptions and sources of information are documented;

Be aware of the time and cost of carrying out the analysis itself!

Remember to include income from schemes such as FITS and RHI,
Learn more about whole life costing