Whole Life Costing

Preliminary Report on

- Available Tools and Guidance
- Barriers to Implementing WLC
- Income Streams
- Future Forecasting of Energy Prices

June 2011
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What is the SCI-Network?
The SCI-Network is a network of European cities and other public authorities working together to find new, innovative and sustainable solutions for their public construction projects.

Together with other expert organisations, the participating public authorities hope to:

- Identify the most sustainable construction solutions for their needs available on the market in Europe
- Make sure their construction procurement practices and procedures are set up to best encourage new, innovative solutions

This report forms part of the first round of outputs from the Working Groups which have been established within the network. Further information on the Working Groups and their outputs, is available at:

www.sci-network.eu

For further information on the content of this report, or to submit your responses to the questions highlighted, please contact:

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Further discussion of this report and related topics will take place on the online Forum:

http://procurementforum.viadesk.com
Introduction

Whole life costing (WLC) is the methodology for systematic economic consideration of all whole-life costs and benefits over a period of analysis, as defined in the agreed scope. The components of WLC, including Life Cycle Costing (LCC), are summarised in the cost breakdown diagram below.

![Cost breakdown structure from ISO 15686: Part 5](image)

WLC provides a method of justifying more sustainable approaches to construction as it enables the economic consideration of benefits such as reduced energy consumption over the operation of a building to be factored into a public authority’s investment decisions. In this context WLC can also be a key enabler for the adoption of new and innovative sustainable construction products and techniques which may hold higher up-front costs, but offer cost efficiencies for public authorities in the medium to long term.

This report examines a number of aspects of WLC relevant to increasing innovation in sustainable construction projects. The areas of focus have been chosen based on the interests expressed by participants in the Working Group, representing a range of local and regional authorities from different parts of Europe. The specific topics covered in this report are:

- What WLC tools are available to public authorities?
- What are the barriers to WLC and how can they be overcome?
- How are income streams being factored into WLC decision making?
- How are public authorities forecasting future energy and utility prices as part of their WLC decisions?
For each topic, initial research findings are presented, drawing upon a range of published sources. **Specific questions** have been highlighted, to which responses are invited from participants in the group and other interested parties.

The purpose of these questions is to stimulate further discussion of the problems and solutions identified, drawing upon the experiences and perspectives of group participants. This will lead to further recommendations and the documentation of successful and unsuccessful approaches in detailed case studies.

This workstream does not intend to duplicate previous work, rather to build upon it by helping public bodies make informed choices on the use of the tools, and exploring specific components of WLC approaches relevant to encouraging innovation.
1. Whole Life Costing In Member States

1.1 Whole Life and Life Cycle costs

Whole Life Costing (WLC) is an economic evaluation technique that concerns the assessment of the total cost of an asset over its operating life, including initial capital costs, maintenance costs, operating costs and the cost or benefit of the eventual disposal of the asset at the end of its life. WLC is a decision making tool, a management tool, and a maintenance guide. It is a decision making tool in the sense that it can be used to select among alternative projects, designs, or building components. It is a management tool in the sense that it can be used to estimate the costs that will incur during a building’s life. It is a maintenance guide in the sense that it can be used to forecast the maintenance and operating tasks that will incur at each year of a building’s life.

The primary use of WLC is in the effective choice between a number of competing project alternatives and it can be applied at any stage of a construction project, namely:

- Business Justification
- Procurement Strategy
- Concept Approval
- Design Approval
- Investment Decision
- Readiness for Service
- Benefits/Cost Evaluation

The strongest opportunity to use WLC is during early design stages. This is primarily because at this stage most, if not all, options are open to consideration. Over the course of the project the authority's ability to influence cost decreases. It has been estimated that 80-90% percent of the cost of running, maintaining and repairing a building is determined at the design stage.

1.2 Available WLC Tools

WLC is not a new concept and there is a substantial body of research, tools and guidance already available for public authorities. These range from Strategic Frameworks on WLC, to tools focused on calculating overall construction costs, to tools designed to address components within buildings.

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Available tools have been produced by both the public and private sectors, and for the public sector by national, regional and local organisations. This has created a myriad of tools which can ironically make it difficult for authorities to identify which is the right tool for their projects. As the tools are not consistently branded there can be confusion between Whole Life costing, Life Cycle costing, Whole Life Value and Life Cycle Analysis.

To help public authorities find and utilise the right WLC tools for their project(s) this workstream has produced an initial catalogue of available tools. This provides not only links to available resources, but also an overview of each tool’s functions and applicability to different types of project. As new tools are constantly being launched, and existing tools refined, it is our intention to periodically update the catalogue over the life of the SCI-Network. For reference purposes the workstream has adopted a simple taxonomy to classify the tools based upon their application:

1. **WLC Frameworks** - tools which provide authorities with overarching principles and guidance to set a corporate approach to WLC. Within these frameworks one or a combination of different WLC tools can be applied. An example of a WLC Framework is *ISO 15686-5:2008*. Published in 2008, this forms part of the International Standards Organisation wider standard on *Buildings and Constructed Assets*. The standard, which has an accompanying guidance document, sets out a standard cost breakdown model and methodologies for applying it to different stages of the project and procurement life cycle.

2. **Total Building WLC** - tools which allow an authority to calculate the WLC of an overall building, including design, build and operate. An example of a Total Building tool is LC Profit. On 1 September 1998, Statsbygg, Norway’s Directorate of Public Construction and Property, instituted a requirement for annual cost calculations for all projects in the pre-design phase. To facilitate the costing calculations, the Directorate developed a costing model. The model is structured around the Norwegian Standard NS 3454, *(Life cycle cost for construction - principles and structure)* and is divided into various subject areas. The software allows public authorities to calculate the level of rent needed to cover costs during a given rental period.

As management, operation and maintenance (MOM) costs comprise 35-50% of the total annual costs of Statsbygg’s buildings, they have a significant impact on rents. As a result, calculating correct MOM costs is as important as calculating correct investment costs. This model uses real interest rates in its calculations. The tool supports the comparison of capital costs and annual administration, operation and maintenance costs using basic accountancy calculations to determine a building’s total annual (life cycle) cost. The tool may be used for all types of projects: new construction, renovations or additions. It can be used at the design stage (pre-procurement stage) and once the building has been constructed. Although it may be used in all phases of construction, it is best suited to a detailed analysis of life cycle cost factors.
3. **Building Component WLC** - tools which are either not designed to, or sophisticated enough, to assess WLC of complete buildings or refurbishments, but can provide useful financial assessments of different component or system options, for example the choice of heating or lighting system. An example of this type of tool is Whole Life costing (+CO₂). Developed by Forum for the Future in partnership with Fife Council, Scotland the tool is intended for procurement professionals at the evaluation stage of the procurement process. It is most appropriate for assessing WLC and CO₂ emissions of any product or service that consumes electricity, gas, oil, vehicle fuel or water - meaning that it can also be used for non-construction projects.

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**Iceland: Centre for Icelandic Studies, Reykjavik**

The objective of the project was to analyse the Life Cycle Cost (LCC) of the Centre for Icelandic Studies (CIS) in Reykjavik, Iceland, which was in the design process.

Alternatives were analysed for three aspects within the building:

- Insulation of cladding surfaces, including exterior walls, roof, doors and windows
- Design of a skylight above the reading room
- Construction of a roof over an indoor garden

The LCC analysis, – undertaken in the summer of 2010, utilised Statsbygg's LC profit tool. The building was examined as a whole with respect to architecture, costs of construction and operation, energy use, indoor climate and acoustics.

The life cycle analysis determined that the proposed design options only had a limited impact in reducing the energy (9%), maintenance (1%) and renewal (3%) costs. Therefore they had no influence on the overall costs of the building because of how little the factors weigh in the total cost of the building.

Following the trial analysis, the Government Construction Contracting Agency decided to use the LLC analysis for all future major construction projects.
1.3 Barriers to Implementing Whole Life Costing

Despite the clear business benefits of WLC and the large number of tools and guidance documents available, the application of WLC remains limited in a number of Member States. In some application is limited to large PPP projects and is mostly undertaken at the early stages of procurement.\(^6\) Our research highlighted a considerable amount of academic research activity underway, however relatively few available examples of public authorities applying WLC on actual projects and collating in-use performance data.

To explore the reasons behind this contradiction further, a literature review was undertaken to understand common barriers to implementing WLC in public authorities. This was supplemented with input from public authorities either involved in the SCI-Network, or with experience of implementing WLC. The barriers we identified can be broken down into three broad groupings:

**Barriers to Whole Life Costing**

![Diagram showing the intersection of political, data, and capability barriers]

A summary of identified barriers along with and initial thoughts on how they can be overcome is provided below:

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<table>
<thead>
<tr>
<th>Type</th>
<th>Barrier</th>
<th>Potential Solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Political</td>
<td>The capital budget of construction is separated from the operating budget and public authorities may be restricted in their ability to transfer funds between capital and revenue budgets. Financial regulation and standards are often set by national government, and therefore public authorities do not always have the ability to change their application at a project level. A potential future activity for the SCI-Network would be to identify which Member States offer flexibility in capital/revenue budgets and any benefits this has brought to construction projects. This information could assist in dialogue with Member States for stimulating financial governance frameworks which encourage innovation in public procurement. Often one authority, or department within an authority will accept the lowest initial cost and then hand over the building to others to maintain.</td>
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7 For a commentary on this point see Costing the Future: Securing Value for Money the Sustainable Procurement, Westminster Sustainable Business Forum, 2008
9 The SCI network’s Environmental Assessment Methodologies workstream is looking at end user involvement in construction procurement and innovation.
## Political

<table>
<thead>
<tr>
<th>The fact that the public authorities are reluctant to invest in the more expensive options when there is a lack of solid technical data to guarantee any future savings.</th>
<th>Better quality case studies demonstrating the outcome of whole life costing at both point of award and operational performance.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Apply appropriate commercial and legal models to de-risk new and innovative solutions from suppliers.</td>
</tr>
<tr>
<td></td>
<td>Publically available data from post-occupancy assessments demonstrating that savings identified through whole life costing are actually realised by public authorities.</td>
</tr>
<tr>
<td></td>
<td>Apply consistent methodology to cost the impacts of future energy/utility/carbon prices in investment decisions.</td>
</tr>
</tbody>
</table>

## Data

<table>
<thead>
<tr>
<th>The need to forecast over a long period of time multiple factors such as future operating and maintenance costs, and discount and inflation rates.</th>
<th>Application of risk modelling and sensitivity analysis techniques.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Section 3 provides further discussion on the issue of forecasting energy and utility prices.</td>
</tr>
<tr>
<td>Availability and quality of data upon which to base WLC calculations. Currently, the availability of LCC data is rather limited. One of the main reasons for this is the lack of any frameworks or mechanisms for collecting and storing the data.</td>
<td>As part of the Intelligent Energy Europe programme, a project on simplifying data access and storage possibilities for LCC has produced guidance in this area.</td>
</tr>
<tr>
<td>The complexity of the WLC exercise requires a significant amount of manual input, especially at the detailed design stage.</td>
<td></td>
</tr>
<tr>
<td>In addition to selecting the most appropriate methodology/tool to use, the officer will have to collect and assess a wide variety of data on cost estimates of components and systems and manage complex interrelations between different types of costs.</td>
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</tbody>
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10 These issues are being considered by the SCI-Network through the New Technical Solutions and Financing & Contracting workstreams.


12 Cliff, M., and Bourke, K. (1999), Study on whole life costing, BRE Report 387, CRC

13 Further information on this project is available at: [http://ieea.era.hu/ieea/page/Page.jsp?op=project_detail&prid=1627](http://ieea.era.hu/ieea/page/Page.jsp?op=project_detail&prid=1627)
The European Commission has previously developed a Development of a Promotional Campaign for Life Cycle Costing. This campaign included a series of training materials for public procurers which would be used to increase their capability on LCC.

Questions to be discussed:

- Has your public authority incorporated WLC within a construction project?

- What challenges did you face when trying to implement a WLC approach to a construction project?

- How did you overcome these challenges?

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14 The final report from this project can be viewed at: [http://ec.europa.eu/enterprise/sectors/construction/files/compet/life_cycle_costing/100119_development_of_a_promotional_campaign_en.pdf](http://ec.europa.eu/enterprise/sectors/construction/files/compet/life_cycle_costing/100119_development_of_a_promotional_campaign_en.pdf)
2. The Use of Income Streams in WLC Decisions

Referring to the Cost Breakdown Structure set out in Section 1, should form a part of an authority’s overall WLC calculations. To explore how income streams relating to innovative sustainable solutions are being considered by public authorities a research study was commissioned by the Working Group. This section sets out the summary findings from the study.

2.1 Feed-in Tariffs

Feed-in tariff schemes involve the payment of subsidies to the owners of renewable energy installations in order to encourage the use of renewable energy technologies and accelerate developments in those technologies that reduce their manufacturing costs. These payments are made by electricity distributors, who are in turn financed by the government. The tariff rates paid to installation owners are dependent upon the technology type installed and the amount of electricity generated by an installation. Generally, feed-in tariff schemes offer a guaranteed purchase of electricity from renewable energy installations over long term contracts, (typically 15-25 years). These tariffs are designed to guarantee a healthy rate of return for investors by contributing an extra income stream to projects. The mechanism is generally designed so that rates paid to new installations decline over time to reflect declines in capital costs of technologies, thereby maintaining a consistent rate of return to investors for all technology types.

Feed-in tariff schemes have proved very popular in recent years. According to a 2009 report by the REN21 group, at that time there were cumulatively 63 countries/states/provinces with active feed-in tariff policies.

FIT Case Study - Spain: Madrid-2 La Vaguada PV Installation

The Spanish feed-in tariff scheme was implemented in 1994, and is well established. It has led to substantial numbers of renewable energy installations across the country, especially using solar photovoltaic (PV) panels.

An example of the scheme in operation is the large retrofit PV installation, installed at the “Madrid-2 La Vaguada” Commercial and Leisure Centre in Madrid during 2007. The system comprised three systems integrated into roof areas of a retail complex, totalling 100.4 kW of peak capacity (kWp). Finances for the project are summarised in the table below:

15 For further details of this project refer to the PV database website at http://www.pvdatabase.org/projects_view_detailsmore.php?ID=299
As can be seen from this case study, the contribution of additional income generated by the feed-in tariff scheme leads to a very significant reduction in the payback time for the project from over 25 years to 10 and a half years.

**Summary**

Feed-in tariffs are a popular mechanism for encouraging the uptake of renewable technologies for building retrofits as well as new installations. Many installations which receive funding by this mechanism would be otherwise financially unviable. However, the system relies on the confidence of investors, which can be damaged should a government decide to make significant changes to its scheme, as has been seen in Spain and more recently in the UK, where in March 2011 the Coalition Government announced a decrease in the subsidy by up to 70%.

### 2.2 The White Certificate Scheme in Italy

The Italian tradable white certificate scheme is an energy-efficiency trading scheme established in 2005 which aims to reduce energy use at the end user level. All Italian electricity and gas suppliers supplying at least 100,000 customers are required to reduce their customers’ emissions through improved energy-efficiency measures or pay penalty payments. Project types eligible to receive certificates include retrofitting of heating and lighting systems and switching to renewable fuel sources among others.

Each certificate is equivalent to one tonne of oil equivalent (TOE) worth energy saved by an installation, which is equivalent to 11,667 kWh or the annual savings typically from 1-2 average Italian households.

Once issued, white certificates can be traded between parties in a market regulated by the Italian Authority for Electricity and Gas (AEEG). Those suppliers whose customers do not achieve the targeted level of energy efficiency savings can still meet their obligations for energy saving, by buying certificates from other suppliers who have over-fulfilled their obligations and have surplus certificates to sell. Electricity distributors can therefore achieve their stated efficiency level, at the lowest cost.

To date, the white certificates mechanism has been very successful at reducing energy use in Italy. By
2010, it is estimated that over the scheme’s first five years it had saved 6.7 million tonnes of oil equivalent and avoided 18 million tonnes of carbon emissions. The average price for certificates has slowly been rising from around €60 at the beginning of 2008 to around €90 at the beginning of 2010. The scheme has recently been extended until 2012.

This example examines how white certificates can be used in the retrofitting of lighting for both indoor and outdoor applications:

- **Indoor lighting**: Replacing filament wire bulbs with compact neon lights with internal power supply.
- **Outdoor lighting**: Replacing mercury vapour bulbs with high pressure sodium vapour bulbs.

<table>
<thead>
<tr>
<th>Specification</th>
<th>Indoor lighting</th>
<th>Outdoor lighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual energy saving (TOE)</td>
<td>0.0146 TOE</td>
<td>0.0450 TOE</td>
</tr>
<tr>
<td>Annual energy saving (kWh)</td>
<td>66.37 kWh</td>
<td>204.58 kWh</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Project finances</th>
<th>Indoor lighting</th>
<th>Outdoor lighting</th>
</tr>
</thead>
<tbody>
<tr>
<td>Additional installed capital cost</td>
<td>€8.00</td>
<td>€51.96</td>
</tr>
<tr>
<td>Additional annual maintenance &amp; administration cost</td>
<td>€1.14</td>
<td>€2.47</td>
</tr>
<tr>
<td>Value of annual energy saving</td>
<td>€7.96</td>
<td>€24.55</td>
</tr>
<tr>
<td>Value of annual white certificate</td>
<td>€1.11</td>
<td>€15.15</td>
</tr>
</tbody>
</table>

The basic financial flows associated with the project are as follows:

- There is an initial capital investment to be recovered through financial returns.
- The primary financial returns are reduced energy costs and the value of the white certificates.
- Some of these reduced costs are offset through the increased operating costs and administrative costs associated with being in the programme.
- These costs are shown on a per unit basis, although the minimum project size for registration in the white certificates scheme is energy savings of 25 TOE, equal to 1,712 indoor lighting installations and 554 outdoor lighting installations.

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16 The cash-flows and financial returns are based only on the additional cost to install and maintain the energy efficient bulbs vs. the less efficient bulb. This assumes that the original, less efficient bulb needs to be replaced and the installer now has the choice of installing either another less efficient bulb or an energy efficient bulb.
The contribution of additional income generated by the white certificate scheme leads to a reduction in payback time for both projects. However, the amount of reduction is dependent upon the size and expense of the project, with the more expensive outdoor lighting project gaining an eleven month reduction, while the cheaper indoor lighting project only gained a two month reduction.

<table>
<thead>
<tr>
<th>White certificate status</th>
<th>Payback</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Indoor lighting</td>
</tr>
<tr>
<td>W/o white certificate</td>
<td>1 year, 2 months</td>
</tr>
<tr>
<td>With white certificate</td>
<td>1 year</td>
</tr>
</tbody>
</table>

**Summary**
This case study has shown that the Italian white certificate scheme can provide a useful additional income stream for some building retrofit projects, which can help to reduce the payback times for such projects. However, this will depend upon the scale of a project undertaken and the type of technology used. One potential drawback of this mechanism is that since it is a market-based system, uncertainties in the trading price of white certificates can occur with market liquidity; therefore a good estimate of the income stream for a particular project provided by this mechanism may be difficult to calculate, depending on liquidity in the white certificate market.

**Questions to be discussed:**
- Have you utilised income opportunities in your WLC calculation?
- If so, what were the impacts on overall cost and the payback time?
3 Forecasting Future Energy and Utility Costs in Whole Life Costing

Building on sections 1 and 2 of this report, in WLC calculations public authorities are faced with the challenge of undertaking long term forecasting of metrics including energy and utilities. In some member states authorities are also starting to consider the long term cost implications of water and carbon.

The working group commissioned research to identify any dedicated costing models for energy and water use in construction projects. At the time of writing this report no such models had been identified, suggesting that although authorities are factoring energy and other utility costs into their WLC calculations there is not a standard approach to determining what costs should be used.

This section considers how the market place currently predicts, takes into account and manages energy and utility costs. Secondly, how the tools and data currently available could be used in a WLC exercise to determine the benefits of adopting more innovative and sustainable designs and/or technologies and products.

3.1 Forecasting of Market Prices

Transportation, storage, seasonality and settlement issues are crucial to the working of energy markets and, as a result, traditional financial models must be customised to give useful results. These models are essential to traders and portfolio managers, who make crucial decisions based on the outputs from these models. There are a range of models used today in energy finance - from the most basic to the cutting edge.\(^{17}\) These may be Stochastic models\(^{18}\) which can be made more sophisticated by taking into account the volatility of the market by modelling asset jumps. Such models are used to produce pricing models for energy derivatives and to produce derivative market structures.

In the UK, the Department for Business Innovation and Skills (BIS) reports on forecasted changes in the market prices for utilities.\(^{19}\) A BIS report contains the rationale behind future fossil fuel price assumptions, which are then used to produce scenarios. These are currently updated on an annual basis by the UK’s Department of Energy and Climate Change (DECC)\(^{20}\) where the scenarios now are:

- Scenario 1 - Low global energy demand;
- Scenario 2 - Timely investment and moderate demand;
- Scenario 3 - High demand and producers’ market power;
- Scenario 4 - High demand, significant supply constraints.

Predictions for gas prices can be seen graphically below:

\(^{19}\) See ‘Communication on BERR fossil fuel price assumptions – updated to present the latest fossil fuel price assumptions following the January 2008 Call for Evidence’, BIS (Formerly Department for Business Enterprise and Regulatory Reform) which outlines the UK government’s assumptions for fossil fuel prices in its CO2 emissions projections modelling.
The fossil fuel price assumptions inform government analysis of different policy options which affect the demand and supply for energy. They provide a sensitivity tool to analyse how different policies will vary depending on fossil fuel price assumptions.

Another example is the Prospective Outlook on Long-term Energy Systems (POLES) which is a world simulation model for the energy sector. It was conceived on the basis of research issues related to global energy supply and climate change and the long-term impact of energy policies. POLES can model changes in sectoral value added and shifts of activity between sectors. However, POLES is not a macroeconomic model in the sense that it uses the gross domestic product as an input and includes no feedback on it that could result from the evolution of the energy system: for example carbon pricing, falling oil production and its effect on transport and mobility, or growth induced by technological innovation (such as the IT boom of the 1990s).

By utilising such models produced at a national or European level public authorities can factor best and worst case cost scenarios into their WLC calculations.

3.2 The Operating Energy Costs of Buildings

The operational energy costs of a building can be estimated, during the design stage, by the use of an asset rating. These are considered the most important costs in terms of energy and water because they are higher than that due to embodied energy and energy/water use on-site. Although, with increasingly sophisticated low energy designs embodied energy is becoming slightly more significant with respect to new build. An example of such an asset rating is an Energy Performance Certificate, as produced in the UK.

Once you have the asset rating and the lifetime of the building, you can estimate the operational energy use over the lifetime and by using the data from the strategic cost models (summarised in section 1), predict the lifetime energy cost of that building. This data could then be inputted into more sophisticated financial appraisal methods using discounting and Net Present Values (NPVs). The purpose of these is to determine the cost-effectiveness of upgrading the design, carrying out refurbishment and the implementation of any improvement measures using more efficient technologies and products. In doing this authorities should always be aware of other factors contributing the fiscal case including reduced maintenance and improved productivity of the occupants.21 This information can then be used as part of a whole life costing and cost management exercise in procuring the building.22

21 The Carbon Trust, based in the UK, has an extensive free downloadable library (www.carbontrust.co.uk/publications/pages/home.aspx) covering the full range of Energy Efficiency Best Practice
However, to ensure any savings are achieved one needs to measure and manage the energy use once the building is in operation and this can be achieved by the use of metering and the production of operational ratings. An operational rating indicates the carbon dioxide emissions that result from the energy a building consumes over a period of 12 months, as recorded by gas, electricity and other meters, and benchmarks them against buildings of similar use. Such a rating is a Display Energy Certificate (DEC) which is required in the UK by all larger public buildings.

To understand and manage the energy use in a building both ratings – operational and asset ratings - are required as they show different aspects of a building’s total energy performance. An asset rating models the theoretical, as designed, energy efficiency of a particular building, based on the performance potential of the building itself (the fabric) and its services (such as heating, ventilation and lighting), compared to a benchmark.

To truly understand the energy used, and carbon emitted from a building, a building needs both ratings. The asset rating is a measure of building quality and the higher the rating the worse the building is and the greater the opportunity to reduce carbon emissions and improve the building itself. However, the asset rating provides no information about how the building operates. Two offices with the same asset rating, could have very different operational ratings – the lower rating is a building used well by the occupant. The second is a building, used badly, where behavioural, end-user focused measures are the best option for carbon reduction.

Questions to be discussed:

- How does your authority account for future energy pricing in WLC decisions?