CONCLUDE

Informed Decision Making

White Paper

Strategies for design, procurement and operation of complex facilities to achieve a low carbon environment.

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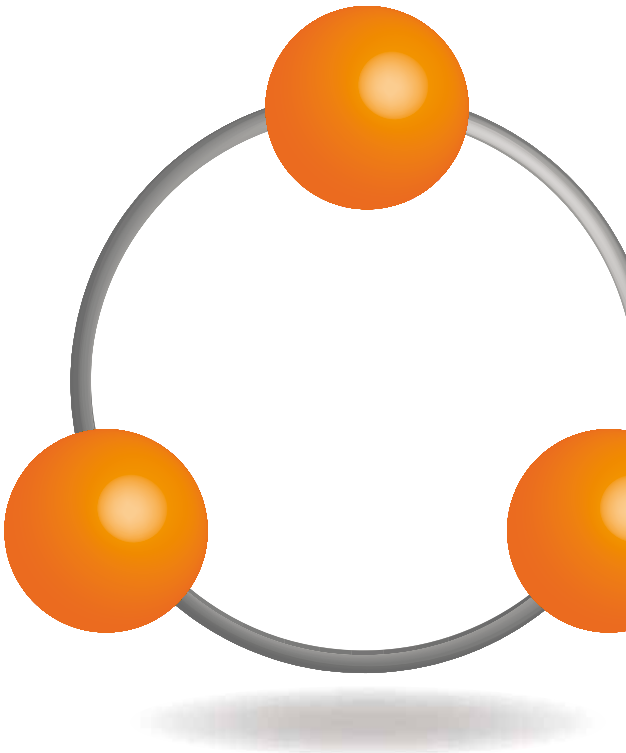
The Conclude Consultancy



Executive Summary

Achieving carbon reduction in the large scale built environment presents a unique set of challenges to all parties within the project team. The complex nature of the overall design process and shortages of quality information to inform decisions, coupled with competing objectives to control cost inevitably can compromise the carbon performance capability of the final product.

Even if the project team succeed in achieving a design capable of achieving energy performance targets, there is no guarantee that once in operation the building will consistently meet them. This is the fundamental challenge: how to optimise the design and operation of the facility to achieve the low carbon performance that is aspired to.

Until now an integrated process hasn't existed which enables a cohesive approach to effectively manage the end to end phases of design, procurement and operation – the critical steps to success.

The Conclude Consultancy Limited have developed such an integrated decision support process to enable an effective carbon reduction in the built environment.

Background

The agenda for low carbon performance is effectively enshrined within the Climate Change Act 2009. The Act requires a 34% reduction in carbon emissions by 2020. However by 2050 the Government intends to reduce carbon emissions by 80% compared to the 1990 baseline.

Challenges

In reflecting on these challenges, the Royal Academy of Engineers report, published in August 2010 titled: Engineering a low carbon environment, describes the challenges:

> *"The need for a radical overhaul in education and practice in the construction industry is urgent and undeniable. The changes necessary to achieve sustainable development in our built environment will be far reaching into areas of policy, finance, procurement practice and management.*
>
> *However, unless we equip the industry with the fundamental skills that will allow it to design, model and construct genuinely efficient buildings, then the transition to a low carbon economy simply will not happen."*

Until now, the main focus of the construction industry has been towards optimisation of asset specifications – essentially ensuring widespread use of new materials and technologies. Despite these best efforts, buildings consistently fail to achieve the design team's performance aspirations.

Why is this? What happens during the design, procurement and operational processes that causes such a divergence between the aspiration and actuality of performance?

This paper sets out to articulate some of the key challenges, and the strategies required to close this gap, and so deliver facilities that set new standards of carbon performance.

In 2007 the UK's National Audit Office (NAO) concluded:

> *"The government has set sustainability standards for the construction and refurbishment of buildings on the government estate, but these are not being met. Departments are failing to carry out environmental assessments and achieve the target ratings. In the sample of projects we examined, 80 per cent would not have attained the required standards."*

CABE, the Government's advisor on architecture, urban design and public space, also asserts that energy certificates show that a building's energy performance rarely matches the design aspirations. They conclude that post-occupancy monitoring and feedback is essential to understand how to improve this.

The NAO propose the following to address these challenges for the government estate which would be equally appropriate for other projects:

- Define the level of performance required on the government estate, and revise and promote the sustainability requirements in the Common Minimum Standards
- Develop outcome-based performance targets for individual buildings (for example in terms of energy and water use) which departments can include in specifications for construction and refurbishment projects
- Monitor and report on progress, including monitoring compliance at the project level, to help understand and hold departments to account for performance

In previous years the barriers to achieving a post-occupancy monitoring process have been perceived as largely insurmountable. However, with the need to achieve an aggressive carbon reduction strategy these barriers assume less significance. Far from being a "nice to have", Post-Occupancy Monitoring, what we prefer to refer to as "In-Use Management", is now deemed essential.

The recent report: Engineering a Low Carbon Built Environment – previously referred to, notes that a key issue that needs to be addressed is the design process:

> *"Construction clients are increasingly specifying performance standards for buildings, such as a target energy performance rating, a specific rating under the Building Research Establishment Environmental Assessment Method (BREEAM) or other international standard such as Leadership in Energy and Environmental Design (LEED).* ***However, the industry lacks sufficient information, guidance and mechanisms to design and construct buildings to achieve such targets.***

Consequently new ways of informing the client and the design team are required

in order that optimal design decisions can be made in driving towards low carbon performance.

The report: Low Carbon Construction – Emerging Findings. HM Government – Innovation and Growth Team published in March 2010 identifies principal barriers to progress towards Low Carbon design as

> *"The evidential gap between the design criteria of buildings in use and their performance on completion, and the invisibility of energy consumption."*

> *"A continuing preoccupation, on the part of many public and private clients with initial capital cost instead of appraising projects on a whole-life basis."*

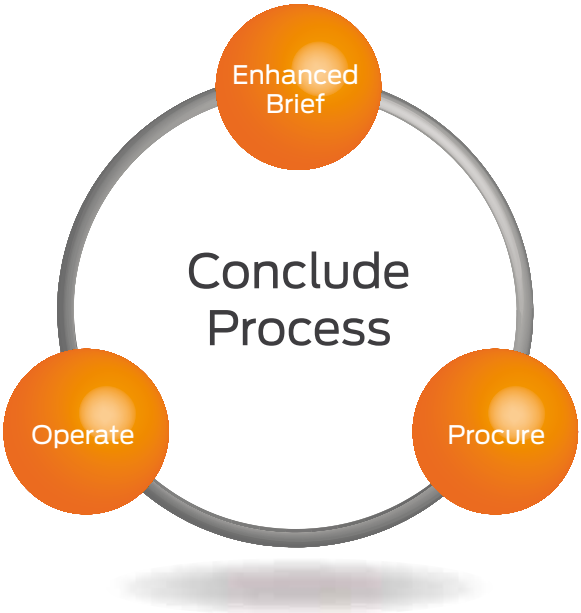
Conclusion

To succeed in achieving the objective requires an entirely new strategic approach to the decision-making processes governing the entire building life cycle from design, through procurement to the final operation of buildings.

The Conclude Consultancy, headed by Professor Matthew Bacon, has succeeded in defining a methodology and process to manage risk and achieve success. This is particularly relevant in complex buildings where the quality of highly critical interrelated decisions can quickly become jeopardised by an overwhelming level of complexity.

> *"The vision necessary to achieve clarity of decision making required in this complex field cannot be underestimated. This innovative strategy not only articulates a fundamental change to the way in which we should be engineering a low carbon environment, but most importantly it also sets out a means for achieving a pan-industry strategy. Professor Bacon's thought leadership will enable the whole industry to learn from the efforts of others."*
> ***Hywel Davies, Technical Director CIBSE***

The Conclude Process: Three Steps to Success



The Conclude Consultancy believes that to achieve challenging energy reduction targets (and by extension: low carbon targets) all discrepancies between the designed and actual performance have to be eliminated from the conventional design process. As a result our umbrella process informs three essential components of the project lifecycle.

- A radical new approach to facility briefing, leading to much improved design briefing decisions, where In-Use operational requirements are embedded in a new form of facility brief.
- Integrated procurement strategy for the final specification, manufacture and delivery of the facility. A holistic life cycle costing and a value model informs decisions focused on carbon emission performance and not simply construction cost.
- Implementation of an “In-Use Strategy”, where a new vision for monitoring and controls enables optimisation of carbon emission performance across the whole facility.

A doctoral thesis (Hopfe, 2009)[1] studied these challenges and identified the following need:

> *Decisions are often suboptimal because not all consequences are studied. The reasons can be insufficient knowledge of the consequences but also insufficient knowledge of the use of the object. This has a large consequence over time as the variations due to different building occupants; climate change, etc. are significant.*
>
> ***As a consequence we face uncertainty in climate, occupant behavior, building operation, increasing the complexity of the necessary tools and methods to support design decisions. It is therefore necessary to constantly face this complexity and improve our ability to predict the impact of changes, the consequences (e.g. risk) that may result. In doing so, the level of quality assurance of simulation results need to be increased.***

In facing this complexity the briefing process should aim to establish the objectives to be achieved as well as the means for achieving those objectives, not just within the design process, but within the In-use phase of the facility operation too.

In other words if there is explicit coordination between design and operation, then the risks of poor derived performance should be substantially reduced.

Step 1: Informed Design Decisions

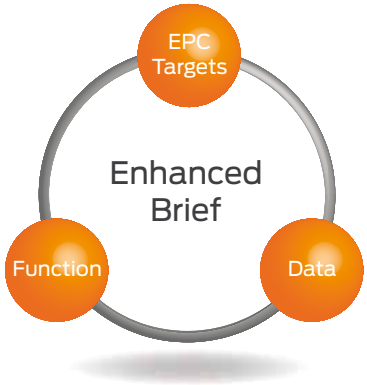
The requirement to achieve today's complex objectives starts with embracing a fundamental change to how the entire design briefing process is both informed and orchestrated.

Realistic Energy Performance Certificate (EPC) Targets

Unlike conventional building design considerations, the project team will become highly accountable for energy performance targets they set during the design process. Unlike other criteria, these targets will undoubtedly be referenced and measured against during the entire life-cycle of the building so it is essential the targets are held central to the design and construction strategy.

Not only does the quality of the design decisions made to achieve the energy performance target become highly transparent, but it is absolutely essential that the targets themselves are SMART (Specific, Measurable, Achievable, Repeatable and attainable within agreed Time constraints)

The Conclude Consultancy's Integrated Decision Support Process successfully integrates Carbon Targets throughout the entire brief.



[1] Thesis entitled: 'Uncertainty and sensitivity analysis in building performance simulation for decision support and design optimisation'

Performance Data

Until now design teams have pointed to an absence of specific Post Occupancy Monitoring ("In-Use") data from peer building performance and as a result there is considerable risk of substantial assumptions being made throughout the design process.

Scandinavia has a highly established track record in collecting In-Use data. The Conclude Consultancy has exclusive access to this specific reference data which successfully bridges this gap and permits "granular" performance benchmarking for major peer groups, such as hospitals, offices, and manufacturing facilities.

The Conclude Consultancy believes that the UK will significantly benefit from gathering its own local "In-Use" data, and the consultancy is currently formalising a major initiative to achieve this goal.

Function Analysis

The Conclude Consultancy has developed what it refers to as an "Integrated Decision Support" process which integrates the changes required into the project team's design, procurement and operational process.

Design objectives now need to take into account a far wider range of factors than previously considered which requires specific understanding of the building's functions and occupancy patterns. In the conventional process, design teams are obliged to make significant assumptions concerning the anticipated functioning of the facility. These assumptions lead to a basis of design that is often fundamentally flawed, an observation endorsed by the recent RAE Report previously referred to.

In responding to these challenges, The Conclude Consultancy has developed a new science called: "Occupancy Analytics"; built on proven studies in simulation technology. This innovative solution removes the myriad of assumptions and guess work from design processes which is highly relevant to all design teams wishing to take the step forward. The resultant "enhanced brief" is informed by data from the Occupancy Analytics that has been passed through Conclude's proprietary mathematical model.

Significant value is created by this approach, because the new science clearly demonstrates that significant reductions in both CAPEX and OPEX are possible. This is counter to conventional wisdom that suggests that increases in CAPEX are required to enable savings in OPEX. This is a false assertion and clearly demonstrates why a fundamental change in the design process is required.

Most significantly, the raw Occupancy Analytics data will be further used to inform a major research project resulting in the development of new design codes and standards for industry wide adoption.

Step 2: Integrated Procurement Strategy

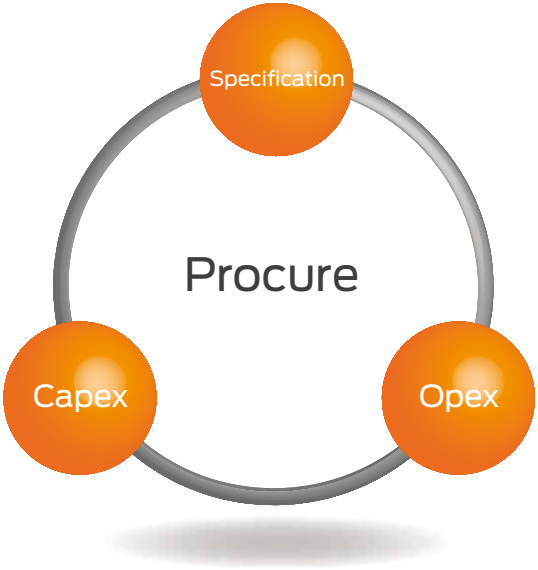
The high risk of procurement decisions leading to significant differences between the "design intent" and the "built reality" cannot be under-estimated. Management of an integrated procurement strategy is central to the building achieving the specified energy performance targets.

Cost accounting will always remain present in the procurement strategy but it is essential that the optimisation of lifetime Opex is not compromised by blunt objectives to reduce short term Capex. Gaining insight of the short term cause and long term effect between these conflicting drivers is essential.

To achieve effective procurement, project teams now need the support of a sophisticated control loop to ensure that the benefits of "value engineering" can be realised in the context of reducing long term energy costs.

The Conclude Consultancy's unique approach ensures the procurement strategy is integrated for complete transparency throughout the decision making process.

The result is that all key procurement decisions are informed by the impact each could have on the out-turn performance of the facility. It is here that The Conclude Consultancy's sophisticated decision support technology adds unique transparency, effectively cutting through the complexity that usually undermines the true objective.



Step 3: Implementation of Building Operation Standards

The conventional process to a hand-over between the delivered facility and the In-Use phase is through what are often referred to as "Operation and Maintenance Manuals", a process once described by CIBSE as "The Great Divide".

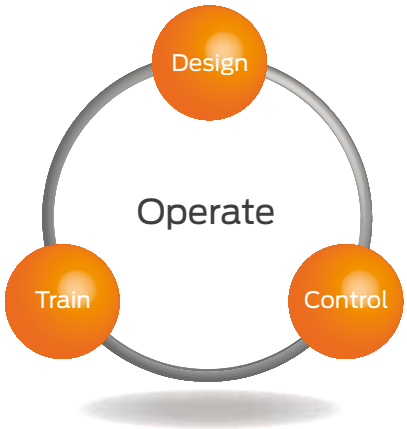
Today's sophisticated building systems are so specialised that highly complex commissioning configurations are the order of the day; the conventional O+M manual is wholly inadequate for the purpose of the on-going performance optimisation.

The Conclude Consultancy has confronted these challenges and in response has developed a radical new approach to facility management. Firstly, even the term "facility management" fails to adequately describe the level of new resources required. A new breed of specialists are needed which Conclude describe as "Facility Engineers" who are supported by an "integrated decision support system" that makes a truly optimised facility performance a reality.

The decision support system is founded in an integrated approach between simulation technologies, building automation systems and a whole new way of thinking about monitoring and controls. The Conclude Consultancy sustains the argument that in the absence of a holistic approach which considers a whole facility and a whole systems philosophy, the achievement of a carbon reduction strategy is simply unachievable.

Furthermore the operations team needs empowerment. For example, the data referenced during the design phase should clearly marry with the metrics used to control and operate the building.

The energy monitoring and control systems not only have to be fully integrated to provide real-time holistic management of energy consumption, but ideally all data from business systems should also be integrated. For example the clinical information systems used in hospitals provide a rich source of data that can be used to simulate facility functions, which in turn enable the building systems to be optimised.



Therefore: Conclude has the answer to complex decision making

This white paper is intended to provide an overview of the principle components used to inform your critical decision making processes. Behind these resides a fully integrated decision model which we tailor to your exact requirements

Our detailed methodology includes a number of work streams for the principal project groups. The Conclude Consultancy provides detailed project management enabling your team to harness the full benefit of the process throughout the entire project lifecycle.

If you would like to learn how The Conclude Consultancy can assist your next project please contact us for an exploratory meeting.

The Conclude Consultancy

Founded by Professor Matthew Bacon FRSA RIBA in 2010, Conclude has been appointed to manage leading substantial sustainability projects within the UK NHS. Within these his methodology has been thoroughly tested and proven.

The organisation draws on a wealth of experience from across Europe and the United States to form a team who have shaped best industry practice and government policy.