



Ministry for the
Environment
Manatū Mō Te Taiao

Sustainable Government Buildings

**Beyond Design
A Best Practice Approach to
Building Commissioning, Completion
and Ongoing Operation**

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Executive Summary

This report has been prepared as part of the Govt³ programme. It provides advice to government ministries, departments and agencies on the better commissioning, completion and ongoing operation of the buildings they use. As the Government moves towards ensuring it is housed in more environmentally sustainable buildings, there will be a greater emphasis on achieving and maintaining environmental performance over their lease term or life. The gap needs to be closed between design expectations and real building performance. Better commissioning of new buildings and re-commissioning of existing buildings are excellent ways to achieve this.

Commissioning is a systematic process that ‘ensures through documented verification that all systems perform interactively according to the documented design intent and the owner’s operational needs’.¹ In short, it is a way to ensure buildings work as they are supposed to, and this becomes crucial when it comes to designing buildings that are environmentally sustainable. It is widely accepted that many buildings are not properly commissioned, and this is borne out by poorly performing buildings and complaints from their occupants. This report aims to identify a better approach to commissioning.

The basic idea is to extend the current process that is carried out immediately prior to handover by bringing it forward into the completion and review of the design, and extending into the first year of operation. Ideally, the building’s performance should also be regularly audited over its lease term or life, as its uses and demands change and equipment deteriorates. A process of “continuous commissioning” should therefore be adopted.

There are many potential benefits of proper commissioning of a building, including:

- improved quality assurance, documentation and co-ordination between design, construction and occupancy, leading to a better-quality product
- lower energy usage over the life of the building and a greater potential for meeting energy targets, particularly for sustainable buildings
- lower water usage over the life of the building and greater potential for meeting water targets, particularly for sustainable buildings
- improved indoor air quality, and reduced noise and draughts, with consequent increases in occupant comfort and satisfaction
- reduced operation and maintenance problems and costs over the life of the building (studies indicate an 8–15% saving in costs, ignoring soft benefits)
- fewer on-site changes and their associated costs
- fewer complaints or call-backs to the building owner, contractors and design consultants
- improved tenant satisfaction for a leased building
- a mechanism for proving compliance with the proposed changes to the New Zealand Building Code clause H1 amendments.

¹ Derived from participant comments at the US National Conference on Building Commissioning.

Of all the measures that can be taken to make a building more sustainable, better commissioning is perhaps the most influential. This is reflected in the value case for better commissioning, with simple paybacks in the order of three years and a 15-year net present value (NPV) equivalent to twice the initial investment.

Environmental ratings schemes such as the New Zealand Green Building Council's Green Star rating system also recognise the importance of commissioning by allocating up to six points for commissioning-related features. These points represent nearly 10% of the overall weighted score for a four-star building and 7% for a five-star building, so they represent a cost-effective way of achieving a good Green Star rating.

This Main Report is complemented by three appendices. Appendix A provides documentation for inclusion in procurement documents for leased government premises. This can easily be adapted if the buildings are government owned rather than leased. It also deals with larger and/or more complex building types and should therefore be fine-tuned for smaller, less complex buildings, although the principles of the process remain the same.

A post-occupancy environmental management plan template is provided in Appendix B to assist with setting up processes to achieve and maintain sustainable building performance over the term of a lease.

Finally, the report also touches on so called "green leases" or performance-based leases, which set out to capture real building performance in relation to design predictions. Further information on this is given in Appendix C.

1 Introduction

This report proposes a best practice approach to commissioning, completion and ongoing operation for environmentally sustainable government buildings. It is one thing to design sustainable buildings. It is another to obtain the predicted performance and benefits in practice without the follow-up that a best practice approach should provide.

For example, a 1994 US study of 60 commercial buildings found that:

- more than 50% had control problems
- 33% had sensors that were not operating properly
- 25% had energy management control systems, economisers and/or variable speed drives that did not run properly
- 40% had problems with heating, ventilation and air-conditioning equipment
- 15% were missing specified equipment.

A more recent US study of the commissioning of 224 buildings for a variety of locations and building types found an average of 28 significant deficiencies in new buildings, and an average of 11 significant deficiencies in existing buildings.

Although similar studies have not been carried out in New Zealand, there is no reason to expect that the situation here is any different, and if anything it could be worse given the market constraints in terms of cost and time. These deficiencies often remain as latent defects in the building, which continue to effect a building's performance over its life.

Better commissioning is a way of improving the outcomes and performance of sustainable building projects. Commissioning is generally only associated with the normal testing, adjusting and balancing of heating, ventilating and air-conditioning (hvac) systems. In reality it should encompass a much broader scope of activities and a more extensive range of services, including electrical, hydraulic, fire, security, communications and lifts.

The Chartered Institution of Building Services (CIBSE) defines commissioning as “the advancement of installations from the stage of static completion to full working order to specified requirements”. A fuller definition of a best practice approach to commissioning, as developed by participants and recorded in the proceedings of the first US National Conference on Building Commissioning, is as follows:

Commissioning is a systematic process, beginning in the design phase, lasting at least one year after construction, and including the preparation of operating staff. It ensures thorough documented verification that all systems perform interactively according to the documented design intent and the owner's operational needs.

Sustainable buildings by their very nature require a high level of performance, and the New Zealand Green Building Council's Green Star environmental rating scheme recognises the important part commissioning plays in achieving it. The management category of Green Star allocates up to six points for commissioning-related features, which could represent nearly 10% of the overall weighted score for a four-star building and 7% for a five-star building.

The proposed changes to the New Zealand Building Code (NZBC) and compliance documents include a number of new requirements on the design of HVAC systems. Although there is no specific requirement relating to commissioning, there will need to be proof of compliance that HVAC systems as “specified systems” perform to the standard. Commissioning could be used to confirm that design features comply as installed. It should be remembered, however, that the NZBC represents minimum standards, and that in this document we are concerned with best practice, which is a higher standard.

Proper commissioning has traditionally had a low profile and priority in the construction industry. However the new trend towards sustainable buildings is likely to place greater importance on better commissioning practices. As the Government is the most significant tenant of buildings in New Zealand, they have the ability to act as a catalyst for better practice in this area.

2 The Current Commissioning Process in New Zealand

As noted in the Introduction, there have been no specific studies of commissioning in New Zealand. However, a commissioning seminar organised by project managers Carson Group Ltd, in November 2004, highlighted the following issues with the current commissioning process.

2.1 The issues from a client's perspective

- Commissioning is under pressure at the end of a project and is often required to be compressed, and as a result is not done adequately.
- The commissioning timeframe, both during and after handover, is not usually well communicated.
- Timely issue of operation and maintenance (O&M) manuals is important to enable early familiarisation of systems and to identify potential defects during warranty periods.
- Adequate programme float or slack is needed so that when problems are identified during commissioning there is sufficient time to resolve them correctly.
- Performance of the entire system may change as a result of local commissioning. The complete system may need to be checked and re-commissioned to maintain optimum plant performance and efficiencies.
- Consideration needs to be given to undertaking commissioning re-checks after occupation to determine if a system requires further adjustment or refinements (e.g. an increase in occupancy in an area may require additional cooling and air-flow rebalance).
- Comprehensive test reports must be recorded in operating manuals.
- It is important that the design intent and accurate and comprehensive test results are documented and recorded. These are the client's reference points if faults or problems arise.
- O&M manuals need to focus on the operation, design intent and description of systems. (Seminar participants noted a tendency to "bulk up" manuals with suppliers' "glossies".)
- The process of checking the accuracy of "as-builts" should be reviewed. Currently, clients must rely on the contractor to produce these.

2.2 The issues from a consultant's perspective

- The builder's focus is on the static rather than dynamic status of services.
- Commissioning is the Cinderella activity and often fees have been spent, so time and input are restricted.
- A reduction in fee costs means a reduction in service, particularly in observation and site attendance.
- Often the design is not fully complete prior to construction due to design programme constraints, and this is difficult to resolve during construction.
- There is continual time pressure placed on the builder and subcontractor to achieve handover because of financial and contractual impacts triggered by practical completion. This is often mirrored by the developer, who is exposed to holding and financing costs prior to completion.
- Specification of zero defects improves commissioning expectations.
- You need a mix of building, systems and occupants to see how all three work together for commissioning to be completed.
- Often the state of physical building construction is not suitable for commissioning to commence.
- More effort is needed in pre-commissioning activities (e.g. cleaning of pipe work, duct work).
- Controls commissioning is done badly. Full point-to-point checks need to be done. Typically, building management systems (BMS) are only 80% commissioned, even at the end of the defects period.
- Budget pressures often mean design cut-backs and the removal of spare capacity / safety factors from the design.
- The quality and attitude of the builder's services co-ordinator can greatly affect the delivery and commissioning of the systems.
- There is often a lack of understanding by clients or users about the need for post-occupancy fine-tuning to be undertaken.
- In the UK it is common on large or complex projects to have a commissioning agent. Their role is to be proactive. They do a full design review prior to tender to ensure expectations match the documentation.

2.3 The issues from a contractor's perspective

- Time creates the greatest pressure on most construction projects, and with commissioning coming at the end of the construction programme this is traditionally what gets squeezed.
- A tendering market tends to drive pricing down, so you end up getting what you pay for both from a consultant perspective as well as from a construction perspective (i.e. low fees will mean less site attendance, and low construction costs mean basic systems and/or a low quality of materials and labour).
- Typically, builders are not involved with post-occupancy commissioning activities.
- The sophistication of systems can complicate the commissioning process.

2.4 The issues from a commissioning subcontractor's perspective

- The biggest issue is the builder. Often not enough time or consideration is allowed for commissioning activities as part of the construction programme. It is at the end of the construction period and is usually under pressure.
- There is only very rarely a commissioning programme interfaced with the construction programme. The builder is mainly focused on the static completion of building services.
- There is more focus on achieving handover (practical completion) than commissioning because of the financial and contractual implications triggered by practical completion.
- The consultants need to be heavily involved in the commissioning activities because they know the parameters of the design and the tolerances available.
- Poor installation is often only picked up during commissioning, which then creates further time pressure to get the faults rectified and re-commissioning completed.
- If zero defects completion and point-to-point BMS testing are specified, then they should be insisted upon because they are seldom implemented in practice, due to the onerous implications if practical completion is not given. Point- to point testing envisages each and every point of the BMS will be physically tested and commissioned.
- Rightly or wrongly, clients view commissioning management and the role of a commissioning agent as being part of a consultant's normal duties and are reluctant to pay twice for what is perceived to be a double-up activity.

2.5 Conclusions

The issues raised above suggest that a number of issues need to be addressed in the development of better commissioning of buildings.

- There is a need to reduce the confusion about or misunderstanding of the services design intent between the design team, the construction team and the building operator.
- Commissioning needs to be more proactively managed, with better planning, programming and resourcing.
- Controls commissioning is particularly troublesome. As a BMS supplier put it, “We sell dreams and install nightmares”.
- It needs to be contractually recognised that commissioning is a dynamic process that straddles the end of construction and the first year of operation, and this needs to be addressed in terms of sensible requirements for practical completion. Rather than pretending to finish commissioning by a premature physical completion date, the ongoing commissioning required needs to be planned, costed and resourced for continuation and completion after occupancy, without undue contractual or financial implications. This approach should be reflected in the Development Agreement between the tenant and developer/building owner
- Post-occupancy evaluation and fine-tuning are essential tools in completing the commissioning process, but this process is not always well understood: “By post occupancy evaluation, do you mean taking the photos for *Architecture New Zealand* and *Trends*?” (Architect)
- Commissioning, verification and O&M documentation standards need to be improved.
- Time and money, including professional fees, are inevitably squeezed when it comes to commissioning, and there needs to be greater allowance and back-end loading in both fees and builders costs: “Going back to site after completion eats into my profit margin, assuming there is one!” (Consulting Engineer)
- The requirement for better commissioning practices is not adequately covered in consultant appointments or construction documents, and is therefore seldom allowed for.

3 A Best Practice Approach to Commissioning

A best practice commissioning approach starts towards the end of the design phase, continues through the construction and handover phases, and is initially completed at the end of the first year of occupation or defects liability period. Ideally it should continue over the life of the building. A best practice commissioning approach integrates and enhances the traditionally separate functions of:

- design peer review and recording of design intent
- management of the commissioning process by a commissioning agent
- testing and commissioning verification by a commissioning agent
- O&M documentation, including a user guide
- staff training
- facilities and environmental management.

In this section we look at the part commissioning plays in the four main commissioning phases – design, construction, warranty and post-warranty. We then cover the extent of the commissioning process and conclude by briefly examining “green” leases.

3.1 Design phase

The developer or building owner should appoint a commissioning agent during the design stage to oversee the commissioning process. (The role of the commissioning agent is defined in the Appendix A of this report.) Early selection during the design phase allows the commissioning agent to play an advisory and review role.

The designer should provide a detailed *design intent* for the building in addition to the normal drawings and specifications. This can then be communicated consistently to the commissioning agent, construction team and building operators. The design should be reviewed for its ability to be commissioned, operated and maintained. This review would normally be carried out by the commissioning agent and, if available, by the facilities management staff.

3.2 Construction phase

During this phase the commissioning agent should provide a commissioning plan and programme. They should also visit the construction site periodically and note any conditions that might affect system performance or operation.

The testing and commissioning process should be carried out by the installing subcontractors to accepted codes (i.e. Chartered Institution of Building Services Engineers, Building Services Research and Information Association and American Society of heating, Refrigeration and Air Conditioning Engineers) and should verify the proper operation of equipment and systems according to the design intent, design drawings and specifications. Point-to-point or end-to-end testing of the BMS is highly recommended. If corrective measures are required, the commissioning agent should make sure they meet the design intent. Acceptable performance is reached when equipment or systems meet specified design parameters under full-load and part-load conditions during all modes of operation, as outlined in the commissioning plan.

A high standard of verification, completion, clearance of defects and documentation should be achieved prior to granting handover. After completing pre-handover commissioning, the commissioning agent should write a handover commissioning report, which includes all commissioning documentation, and submit it for review by the building owner and designers. Prior to handover, building operators should be trained in the operation and maintenance of equipment and systems. The commissioning agent should oversee the training sessions provided by the installing contractors, designers and manufacturers' representatives.

The commissioning agent also verifies that operation and maintenance manuals include a user guide and are complete and available for use during the training sessions.

3.3 First-year operational or warranty phase

Even though the project is considered complete, some fine-tuning commissioning tasks should continue throughout the typical one-year defects/warranty period. The commissioning agent should initially return on a monthly basis for the first three months, and then quarterly through the defects/warranty period to review system operation and liaise with facility staff to address any performance problems. It is also helpful after six months to carry out a post-occupancy evaluation survey of the building's occupants to identify any issues with the building, and this can inform the need for any further fine-tuning.

A monthly log of energy and water consumption should be kept and reconciled with the agreed performance targets. Any non-performance problems should be addressed as part of the system's fine-tuning and operational practices.

An environmental management plan (EMP) should be set up at the start of this period. A typical example is given in Appendix B.

3.4 Post-warranty phase/continuous commissioning

It is a good idea for the building owner to consider re-commissioning their facilities periodically to ensure that equipment performance levels continue to meet design intent. This means that in order to maintain a high level of performance, in a sense commissioning never ends. Operation and management staff should be encouraged to audit and partially re-commission selected building systems on a regular basis, perhaps every three years depending on building usage, changes to layout equipment complexity and operating experience.

3.5 Extent of commissioning and facilities management provisions

The extent of the commissioning process will obviously vary depending on the size and complexity of the project and the ownership structure, as indicated in Table 1.

Table 1: Extent of commissioning and facilities management provisions

Project size	Ownership	Peer review of design and recording of design intent	Independent commissioning agent	Design engineer or builder's services co-ordinator as commissioning agent	O&M manual, including user guide	Staff training	In-house facilities management and energy management	Contracted-out facilities management and energy management
2,000 m ² < 7,500 m ²	Owner occupied	Y	N	Y	Y	Y	N	Y
	Leased	Y	N	Y	Y	Y	N	Y
> 7,500 m ² < 10,000 m ²	Owner occupied	Y	Y	N	Y	Y	?	?
	Leased	Y	Y	N	Y	Y	?	?
> 10,000 m ²	Owner occupied	Y	Y	N	Y	Y	Y	N
	Leased	Y	Y	N	Y	Y	Y	N

3.6 Green or performance-based leases

For leased buildings, consideration should also be given to a performance-based or “green” lease, which identifies remedies if the environmental performance of a building is not met. Further information on green leases is given in the Appendix C.

An Australian Government Green Lease Template www.greenhouse.gov.au/government/pubs/d1glsversion20.doc is available as a basis if this approach is being considered. It should, however, be noted that New Zealand developers and building owners are currently hostile to these types of leases. A performance-based appointment of the commissioning agent is also a possibility, with a base fee and a performance bonus if the energy target is achieved within the first year.

4 Commissioning Resources

The commissioning process is a team effort involving all the traditional stakeholders in the construction process, plus a commissioning agent with the specialised knowledge and experience to help plan and direct the commissioning activities. The role of the commissioning agent could be provided by either the building services engineer, the contractor, or an independent company. Each option has its advantages and disadvantages, and these are covered below. The final decision will depend on the scale and complexity of a particular project.

4.1 Independent commissioning agent

An independent company under contract to the developer/building owner can play an objective role and ensure that the developer/building owner gets the building performance they expect. For large and/or complex projects, especially buildings with highly integrated and sophisticated systems, future savings from commissioning often outweigh the slightly higher costs of an additional contract for an independent commissioning agent.

Independent third-party commissioning providers also bring a fresh perspective to the project because they collaborate with the design team. By joining the project team during the design phase, the commissioning agent can suggest improvements and savings at the stage when changes can be made on paper rather than by costly on-site changes. This arrangement is required by Green Star NZ for one point.

4.2 Design engineer

A separate engineer from the building services consultants could be asked to take on the commissioning agent's role. This option has some advantages because the engineering consultants are already familiar with the project requirements and don't need to spend time getting up to speed. Managing the commissioning is not normally included in a design professional's basic fees, so the developer/building owner must pay the designer extra for this additional role. To manage the potential conflict of interest created by having the commissioning services managed by the building services consultants, all findings of the commissioning process should be directly reported to the developer/building owner. This arrangement is not recognised by Green Star NZ.

4.3 Builder's services co-ordinator

Although builder's services co-ordinators may have the knowledge and capability to programme, plan and supervise installation activities, they may not be skilled in design-related or system-testing and commissioning matters. In addition, some contend that it is difficult for builder's representatives to objectively assess their own work, especially since repairing deficiencies found through commissioning may increase their costs and delay completion. This arrangement is not recognised by Green Star NZ.

5 The Benefits and Costs of Better Commissioning

5.1 Benefits

The potential benefits of proper commissioning of a building include:

- improved quality assurance, documentation and co-ordination between design, construction and occupancy, leading to a better-quality product
- lower energy usage over the life of the building and greater potential for meeting energy targets, particularly for sustainable buildings
- lower water usage over the life of the building and greater potential for meeting water-use targets, particularly for sustainable buildings
- improved indoor air quality, and reduced noise and draughts, with consequent increases in occupant comfort and satisfaction
- reduced operation and maintenance problems and costs over the life of the building (studies indicate cost savings of 8–20%)
- fewer on-site variations and associated costs
- fewer complaints or call-backs to the building owner, contractors and design consultants
- improved tenant satisfaction for a leased building
- a mechanism for proving compliance with the proposed New Zealand Building Code Clause H1 amendments.

5.2 Costs

The cost of commissioning depends on a number of factors, including the building type, size and complexity, and whether it is a new building or an existing building. Typically, the cost of commissioning ranges from 0.5 to 1.0% of the total construction cost. For a new office building this might equate to \$9 to \$18/m². Better commissioning would be at the higher end of the scale. The cost of commissioning management is in the order of \$2 to \$3/m². The cost of re-commissioning an existing building is estimated at 25 to 30% of the cost of a new building, or \$2 to \$5/m².

The following section provides a more detailed economic analysis to present a value case for better commissioning.

6 The Value Case for Better Commissioning

Using a 10,000 m² air-conditioned office as an example, and making the following assumptions, a value case for better commissioning can be made.

6.1 Assumptions

Capital cost assumptions

Commissioning agent's cost	\$35,000
Additional point-to-point BMS testing	\$30,000
Additional design input into design intent and user guide	\$15,000
Additional design input into post-occupancy stage	\$15,000
Present value of re-commissioning at year 5	\$9,313
Present value of re-commissioning at year 10	\$5,783
Total	\$110,096

Operating and maintenance cost reduction assumptions

Annual operating and maintenance cost	\$270,000
Operating and maintenance cost saving (14% average)	\$37,800

Economic assumptions

Discount rate	10%
O&M inflation rate	3%

6.2 Economic analysis

Simple payback	15-year lease period net present value (NPV)	Internal rate of return (IRR)
2.9 years	236,273	33%

The 15-year net present value (NPV) is 2.1 times the initial capital cost premium and represents one of the best sustainable building investments that can be made. The above analysis ignores any potential savings due to reduced reworking/variations as a result of the design review and commissioning management process improvements.

Appendix A: Typical Procurement Documentation

1 Introduction

In this appendix the best practice approach described in the Main Report has been translated into documentation to assist in the normal range of procurement stages for a leased government office building. The extent of information provided on building commissioning, completion and ongoing operation builds into progressively more detailed documentation from one stage of the procurement process to the next. These stages generally run as follows.

1. Expression of interest or request for first-stage proposal – an open or limited request for proposals from the marketplace is made, based on a relatively limited statement of requirements and information, to be provided by the respondents.
2. Request for second-stage proposal – an outline building brief is issued to a short-listed group of respondents selected in response to the proposals provided by the first-stage respondents. At this stage the client's consultants may work collaboratively with each of the short-listed respondents to refine and optimise their design and commercial proposal.
3. Building performance specification – this is a contractually binding agreement with the preferred respondent following the second stage of the evaluation process. It will be used as the basis for construction of the leased premises for the ministry, department or agency (the client).

The respondents are typically either developers or building owners, with their associated team of professional advisors. The tenant is normally represented by their associated team of professional advisors.

The documentation can easily be adapted if the buildings are government-owned rather than leased. It can also be scaled down for smaller and less complex building types. However, the fundamental principles of the approach need to remain the same.

2 Expression of interest or request for first-stage proposal

At this stage of the procurement process high-level pro-forma project details and requirements are issued by the client to the marketplace for expressions of interest and requests for a first-stage proposal. Responses are normally assessed using a standardised evaluation template and a ranking and weighting evaluation tool, which might cover the main aspects such as:

- business needs
- building location
- size and configuration
- design specification
- high-level commercial terms

- development team approach
- experience and delivery risk.

The relative weighting of each aspect will be project-specific. It is recommended that the approach to commissioning, completion and ongoing operation should have a significant weighting of the potential scoring of both the ‘development team approach’ and the ‘experience and delivery risk’ sub-categories.

A typical question in the client’s expression of interest (EOI) or request for proposal (RFP) documentation to assess the market respondent’s approach towards commissioning at this stage could be:

The [ministry/department/agency] understands that the performance objectives of a “sustainable” or “green” building will only be achieved by a high standard of building commissioning. Describe your approach to the completion of the building, including:

- *design and documentation review*
- *base building and fit- out integration*
- *testing and commissioning*
- *operator/user training*
- *operating and maintenance documentation*
- *acceptance and handover*
- *post-occupancy fine-tuning, review and performance testing the mix of building systems and occupants*
- *facilities management and ongoing operation and maintenance*

The respondent’s attention is drawn to the Ministry for Environment’s document Best Practice Approach to Building Commissioning, Completion and Ongoing Operation in this respect.

3 Request for second-stage proposal

A request for a second-stage proposal normally follows short-listing of the stage 1 respondents. It generally includes a more detailed set of requirements, including an outline building brief. This will include an outline of the better commissioning, completion and ongoing operation approach.

At this stage the selected respondent’s proposals are generally refined in a collaborative process with the client’s advisors. Responses are normally finalised for assessment by the advisors using the response template provided as part of the outline building brief. Typical outline building brief details are included in Table 1.

Responses are similarly assessed using a standardised evaluation template and a ranking and weighting evaluation tool. Weightings should be similar to the request for first stage proposal.

Table 1: Outline building brief: building commissioning, completion and ongoing building operation

Ref	Defining aspect	Performance objective	NZGBC Green Star reference	Performance criterion or measure	Respondent's response
1.0	Design and documentation review and the appointment of a commissioning agent.		MAN 4	<p>The overall design shall be progressively reviewed by the tenant's representative at the 60%, 90% and 100% base building and fit-out stages.</p> <p>An independent commissioning agent shall be appointed by the developer / building owner to proactively manage and verify the commissioning process.</p> <p>The commissioning agent shall also review the services design for commissionability and maintainability at the 60%, 90% and 100% stages and shall submit a commissioning plan and programme for the building. The commissioning agent shall report progressively and concurrently to the developer / building owner and the tenant.</p> <p>At completion of the design and in addition to the normal design documentation, the services consultants shall summarise the design intent and performance requirements into a stand-alone document for the commissioning agent, the installing subcontractors and the building operators.</p>	
2.0	Testing and commissioning	Minimise energy use and maximise air quality by fully commissioning the building prior to occupation	MAN 2	<p>Commissioning of the building shall meet the requirements of the Ministry for the Environment's <i>Best Practice Approach to Building Commissioning, Completion and Ongoing Operation</i> and shall be in accordance with appropriate CIBSE/BSRIA codes, New Zealand standards and NZGBC Green Star management clauses.</p> <p>The commissioning agent shall manage and verify the commissioning process and report the results to the developer/building owner and tenant concurrently.</p> <p>The commissioning shall be properly allowed for and programmed from the outset. All the principal commissioning activities shall be completed prior to the tenant's soft fit-out.</p> <p>Final commissioning prior to occupation shall include a two-week continuous controlled run period and a concurrent overnight elevated bake-out period following soft fit-out of the office floors.</p>	
3.0	Clearance of defects			All significant building defects shall be cleared prior to the tenant's soft fit-out and shall not interfere with access to and completion of the soft fit-out works.	
4.0	Operator/user training			Structured training in the sustainable use of the building and its operation shall be provided to facilities management staff and nominated tenant staff representatives prior to handover.	

Ref	Defining aspect	Performance objective	NZGBC Green Star reference	Performance criterion or measure	Respondent's response
5.0	Operating and maintenance documentation		MAN 5	<p>Two bound copies of tailored operating and maintenance documentation shall be provided in hard copy and Word or PDF electronic format.</p> <p>Two copies of A1 and A3 as-built drawings shall be provided in hard copy and AutoCAD or PDF format.</p> <p>In addition to the above, the services consultant(s) shall provide two bound copies of a high-level, user-friendly building user guide in hard copy and Word or PDF electronic format. This shall include the basis of the design, load summaries, design narrative, design drawings and acceptance criteria.</p>	
6.0	Acceptance and handover for occupation by the tenant			<p>The building shall not be accepted for practical completion until the following deliverables are available:</p> <ul style="list-style-type: none"> • a report from the independent commissioning agent to verify the pre-handover commissioning process is complete, with the exception of post-occupancy fine tuning • proof that the commissioning of the building meets the requirements of Green Star MAN 2, MAN3, MAN 4 and MAN 5 • all necessary producer statements and certificates of compliance • a "complete for review" set of all as-built drawings • a "complete for review" set of all O&M manuals and a building user guide. • training of building operating staff has been completed. • a statement from all consultants that the contract works are in their opinion complete and acceptable for occupation • acceptance from the Insurance Council for fire services • final inspection report from the territorial authority, including their documentation requirements for the Code Compliance Certificate application • confirmation that the builder has lodged the Code Compliance Certificate application, and copies of the application have been passed to the developers/building owners for acceptance • provision of all written guarantees required to be obtained by the builder under the outline building brief. 	

Ref	Defining aspect	Performance objective	NZGBC Green Star reference	Performance criterion or measure	Respondent's response
7.0	Post-occupancy fine-tuning, review and performance testing the mix of building systems and occupants	Ongoing optimisation of all building systems	MAN 3	<p>An environmental management plan (EMP) shall be provided to structure the approach to the sustainable operation of the building.</p> <p>The building services are required to be fine-tuned initially on a monthly basis for the first three months and then on a quarterly basis during the first year of operation. Results and remedial actions shall be reported by the commissioning agent to the building owner and tenant concurrently. The tenant will maintain a log of any operational issues/faults to assist with this process.</p> <p>Monthly energy and water audits using the building's metering shall be carried out and reconciled with performance targets. Results and remedial actions shall be reported by the independent services commissioning agent to the building owner and tenant concurrently.</p> <p>The tenant will be carrying out an independent post-occupancy evaluation 6 months after occupation and shall make the results of this available to the building owner to identify any residual issues in terms of occupancy comfort and satisfaction.</p>	
8.0	Facilities management and ongoing operation and maintenance			<p>Maintenance contracts shall be let within three months of completion for ongoing preventive maintenance.</p> <p>Ongoing commissioning shall occur throughout the lease period as a result of the yearly energy and water audits and a three-yearly building audit. Any re-commissioning required as a result shall be carried out and the documentation updated. An audit of the building shall be carried out on a three-yearly basis by an independent consultant(s) who shall report to both the building owner and the tenant concurrently. This shall review the condition and performance of the building in relation to the requirements and performance measures of the building performance specification (BPS). The review shall also include all tenancies and any impact of any subsequent fitting out work since completion or the last audit. The need for any corrective actions such as partial re-commissioning to restore operational performance shall be identified.</p>	

4 Building performance specification (BPS)

The building performance specification is a binding contractual document between the developer/building (owner) and the tenant and defines the level of specification to be provided for the building.

4.1 Design intent and design review

4.1.1 Design intent

The design engineer should record the design intent for the building systems. This should include the:

- basis of design – design standards/codes and parameters such as internal/external/design temperatures and statistical basis, outdoor air rates or air-change rates, humidity, filtration level, occupancy densities and schedules, small power and lighting loadings, hot-water loadings and cold-water storage quantities, and fire hazard category
- load summary – including the cooling load, heating load, air handling and fan duties, pump duties, electric loads, hot-water loads, cold-water storage quantities and all allocated diversities and safety factors
- design narrative and fire report – a description of the design, including the system scope, system types, plant locations and control strategies, and also a fire report
- design drawings –plant system and control schematics, together with air and water diagrammatics with all flow rates shown for balancing purposes
- acceptance criteria – tolerances for acceptance of commissioning results.

4.1.2 Design review

The base building and hard fit-out design shall be reviewed by the client's advisor at the 50%, 90% and 100% design completion stages for compliance with the performance specification. At the 90% and 100% stages the design shall also be reviewed by the commissioning agent (and the facilities manager, if available), who may provide input on potential problems in terms of achieving commissionability, maintainability and energy efficiency.

The following high-level design checklist is provided to assist in this process.

Design checklist

- a. Has the commissioning agent been appointed?
- b. Has the design intent been recorded/issued?
- c. Can the systems be commissioned in accordance with the specification and CIBSE commissioning codes? Are there adequate regulation devices and test points?
- d. Can the installed services be adequately and safely maintained after handover? Is adequate access provided for all equipment?
- e. Has sufficient detailed design information been provided, especially in respect of controls, including strategies, set-points and system flow rates?
- f. Is the specification definitive in its coverage of the commissioning responsibilities, acceptance criteria and tolerances?
- g. Have all interfaces with other systems been identified and co-ordinated (electrical, fire alarms, etc)?

- h. Have interfaces with packaged plant and proprietary systems been identified and co-ordinated?
- i. Have air and water diagrammatics been provided to assist in air and water balancing?
- j. Are air or water velocities within an acceptable range?
- k. Has adequate sound attenuation been provided for all systems?
- l. Can the design be simplified while still achieving the performance criteria?
- m. Are there any value-added components that should be considered?

4.2 Commissioning management

4.2.1 Scope of works

An independent commissioning agent shall be appointed by the developer/building owner. The commissioning agent shall, with the builder's authority, direct the services subcontractors technically with the intention of achieving the objectives of the commissioning process as defined in the CIBSE codes and BSRIA application guides. The builder shall retain responsibility for the production of the overall construction programme, management and overall direction of the services subcontractors.

The commissioning agent shall undertake the following activities to enable the commissioning of the works:

- familiarisation and review of the engineering designs and agreeing testing facilities with the services design engineer and services subcontractors
- confirmation that the system has adequate provision to be fully commissioned and maintained
- preparation of a commissioning plan for the works
- preparation and monitoring of programmes for the testing activities, and producing sequential network programmes jointly with the builder and the services subcontractors
- co-ordination and technical supervision of the testing and commissioning process
- confirmation that draft operation and maintenance information is available for all equipment and systems to enable commissioning to commence
- monitoring and reporting of all tests, and collating records of same in accordance with the requirements given in the contract documents (note: confirmation of any certified data by the services subcontractors is required for selection of associated plant, e.g. confirmation of evaporator, strainer and coil hydraulic losses to enable confirmation of pump heads)
- checking that all control equipment is in accordance with the specification requirements and is located in correct position
- checking that the building management system (BMS) is in accordance with the specification, including the point-to-point checking
- verifying the pre-commissioning and setting-to-work activities by the services subcontractors
- verifying the correct operation and regulation of all systems

- verifying the correct operation of all systems under automatic control, including environmental services, fire and security services, hydraulic services, electrical services and lifts
- verifying the correct operation of the BMS, and the correct operation of systems when controlled by the BMS and/or fire alarm system
- identifying any variances in systems performance against the design data and agreeing the course of action with the services design engineer for resolving such variances
- verifying commissioning of the systems to conform to design values
- verifying compliance with the requirements of statutory authorities
- final reporting of the setting-to-work by the services subcontractors before practical completion
- collation and presentation of system and equipment testing and commissioning data into a comprehensive commissioning report
- input into the fine-tuning process during the first year of operation.

4.2.2 Commissioning management code

The following publications shall apply in conjunction with the commissioning agent's role:

- CIBSE Commissioning Code M – *Commissioning Management*
- BSRIA AGS/2002 – *Commissioning Management: How to Achieve a Fully Functioning Building*
- CSA TM/1 – *Standard Specification for Commissioning and Commissioning Management.*

4.2.3 Familiarisation and advisory duties

During the detailed design and working drawing period, the commissioning agent shall become familiar with the detailed design, prepare documentation, and advise on any features of the systems considered necessary to aid satisfactory commissioning and testing of the systems in accordance with the design intent and requirements.

The commissioning agent shall liaise with the relevant services subcontractors and draw up a sequential programme for setting-to-work, regulation and testing. These programmes shall be compiled to the satisfaction of, and with assistance from, the builder.

Duties during site installation

The commissioning agent shall, during the installation period, visually inspect the works to ensure that all commissioning devices are installed in accordance with the manufacturer's instructions and as detailed on the contract drawings.

The commissioning agent shall also during this period verify commissioning results and collate data in preparation for the editing of the testing and commissioning records.

Duties after site installation

After site installation the commissioning agent shall complete the compilation of the testing and commissioning documentation into a commissioning report for inclusion into the building user guide and operation and associated maintenance documentation.

During this time it is intended that the relevant services subcontractors will be making final adjustments to any item of plant and equipment and the operation of systems brought to design performance. This activity shall be allowed for in the commissioning agent's programmes.

4.2.4 Commissioning plan and programming

Commissioning plan

A commissioning plan shall be provided by the commissioning agent prior to tender. This should include the:

- scope or level of commissioning
- commissioning programme
- roles and responsibilities
- communication, reporting and management protocols
- documentation requirements of each team member
- detailed scope of monitoring and verification
- detailed scope of training
- deliverables by practical completion
- deliverables post-occupancy and during the defects/warranty period.

Programming the commissioning works

Programme set-up

The commissioning agent shall prepare and issue to the builder a comprehensive programme and supporting method statement for the commissioning and testing of the works.

Programme integration

The builder shall provide the construction programme information forming the basis of the commissioning programme. The builder shall be available for liaison and clarification of the construction programme during the programme set-up period.

Commissioning programme

The commissioning programme shall show key dates for activities, as outlined below, and critical milestone dates for integration in the construction programme as agreed with the builder. It shall also take into account any requirements for sectional completion and the need for any final commissioning or re-commissioning of any systems following the fitting-out works. The commissioning programme shall indicate for each of the relevant services contracts the information as listed below and integrate the information for all services, with due allowance being made for the interdependency of services:

- key dates for the availability and safe use of primary services (i.e. water, gas, electricity, refrigeration, heating)
- services subcontractors' static check certification
- services subcontractors' setting-to-work date (followed by the commissioning agent's inspection and builder's agreement to set to work)
- services subcontractors to regulate/adjust system
- commissioning agent to witness system and report
- integration of the commissioning of all the building services systems
- witnessing inspections and acceptance tests
- period for operational instruction to facilities management staff
- compilation of documentation.

The programme shall allow for a 14-day period prior to the intended practical completion date for the building for continuous running of the completed systems and bake-out period following the proving of each constituent section, during which time the commissioning agent shall, through the builder, organise the services subcontractors to demonstrate that all sections of the systems are capable, satisfactory and demonstrate simultaneous operation. The period shall be used to demonstrate the complete, fully commissioned installation to the developer/building owner and tenants' representatives.

Progress monitoring

The commissioning agent shall supply a copy of a monthly report and programme review, which will reflect the up-to-date situation of the commissioning works. Any delays emanating from any source shall be immediately brought to the attention of the builder. The review and reporting period subsequent to the start of final commissioning shall be on a weekly basis.

4.2.5 Testing

The commissioning agent shall certify that pre-commissioning checks on each of the installations have been carried out by the relevant subcontractor. This shall include, but not be limited to:

- all site testing complete and recorded
- all systems cleaned down internally and externally according to the contract documents
- all lubrication carried out
- all controls, starting sequences and safety devices working correctly
- all electrical switchgear operational and correct overloads fitted.

If the inspection carried out by the commissioning agent reveals that any of the contract requirements have not been met, the matter will be reported to the builder, who shall draw the default to the attention of the responsible subcontractor with instructions to rectify. When the default has been rectified the commissioning agent shall re-inspect and report.

Following confirmation of satisfactory reports from the commissioning agent, the builder shall issue an “agreement to set to work” for a system (or in appropriate cases, part of a system). Thereafter, the commissioning agent shall verify that the respective subcontractor has set to work all plant and systems prior to regulation and adjustment being undertaken.

Tests shall be carried out as the installations proceed by the relevant subcontractor. These will include but, not be limited to:

- hydraulic pressure testing of pipe-work systems
- air leakage testing of duct-work systems
- air and water testing of drainage (public health) systems
- inspection and testing of electrical installation
- testing of fire protection systems
- testing of the lifts
- testing of fire detection and alarm systems
- testing of emergency lighting
- further expansion required for other systems, as required.

The responsibility for verification of all site tests as carried out by the services subcontractors is vested with the commissioning agent. The acceptance of all site tests is vested with the builder and services design engineer.

The commissioning agent shall witness and report all site tests and thereafter collate records of these tests into the commissioning report.

4.2.6 Commissioning report

The commissioning agent shall be responsible for the compilation of a commissioning report for incorporation into the operation and maintenance manuals forming a record of the installation testing and commissioning procedures used and the results obtained. This shall be co-ordinated and given to the builder to issue for review to the developer/building owner and services engineer. This should include the:

- master index of all commissioning documents
- final design intent document
- commissioning results, including any agreed non-compliance with the design intent.

The commissioning agent shall be required to review the operation and maintenance documentation in draft form prior to its issue by the services subcontractors to the services engineers for acceptance.

4.2.7 Commissioning roles and responsibilities

Table 2 identifies the roles and responsibilities of the various parties in a best practice approach towards commissioning.

Table 2: Commissioning roles and responsibilities

Activity number	Activity description	Commissioning agent (CA)	Building services contractor (BSC)	Builder (B)	Design engineer (DE)
1	Review DE's design drawings and specifications for commissioning requirements.	Action and advise DE. Co-ordinate any comments from BSC and B.			Review comments and action as appropriate.
2	Review installation drawings and technical submissions from BSC for commissioning requirements.	Action and advise B and DE.	Prepare and submit for review. Action any comments as instructed by B.	Co-ordinate, supervise and direct/instruct as appropriate.	Review, comment and issue directives to B if applicable.
3	Review installations with respect to compliance with specifications and drawing intent for commissioning	Supervise inspection of installations and issue reports to B and DE.	Receive CA reports and action as necessary.	Co-ordinate, supervise and direct/instruct as appropriate	Review, comment and issue directives to B if applicable.
4	Produce detailed co-ordinated commissioning plan, including revisions and updating.	Procure information from BSC. Prepare programme, discuss with B and issue to all parties for comment.	Submit plans/ information and liaise with CA.	Review programme with regard to its impact on the construction process. Issue comments and approve.	Review, comment and accept.
5	Produce detailed commissioning method statements, including pre-commissioning, setting-to-work and interface tests.	Guide and assist in their production. Review and accept content. Liaise with B and DE.	Discuss format and content with CA. Produce method statements.	Receive, review and approve. Liaise with DE and CA.	Review, comment and accept.
6	Testing and pre-commissioning, including off-site works testing (as requested).	Procure procedures from BSC and suppliers for approval. Witness and validate tests and results.	Submit information and liaise with CA. Complete outstanding works schedules.	Review/comment and approve. Carry out spot checks.	Review, comment and accept. Carry out spot check as required.
7	Produce project-specific test sheets.	Prepare and issue pro forma sheets, including interface and performance tests.	Liaise with CA.	Receive, review and approve.	Review, comment and accept.
8	Monitor and report on commissioning progress.	Prepare spreadsheets to be used to monitor all progress. Issue and update at regular intervals.	Assist CA during monitoring process.	Receive and review reports and circulate. Monitor progress and manage any programme changes.	Review and comment.

Activity number	Activity description	Commissioning agent (CA)	Building services contractor (BSC)	Builder (B)	Design engineer (DE)
9	Progressive installation tests and pre-commission.	Monitor, witness and ensure accurate recording of all results, in accordance with method statements.	Implement testing. Prepare records and demonstrate.	Monitor progress. Carry out spot checks.	Review, comment and accept. Carry out spot checks as required.
10	Pipe-work system flushing, cleaning and dosing.	Monitor, witness and ensure accurate recording of all results, in accordance with method statements.	Implement activities, prepare records and issue analysis reports.	Monitor progress. Carry out spot checks.	Review, comment and accept. Carry out spot checks as required.
11	Setting-to-work of plant and systems, commissioning and performance testing in accordance with programme.	Direct BSC, giving guidance as necessary. Witness activities and ensure accurate recording of results.	Execute all planned activities. Demonstrate selected items to B/DE as directed.	Monitor progress. Witness as required.	Carry out spot checks and witness activities on a selective basis.
12	Prepare testing and commissioning reports, incorporating all plant and system test results.	Action and submit to B.	Liaise with B and supply all relevant documentation. Action adjustments to system performance as advised or instructed by B.	Monitor progress. Issue directives/instructions to BSC as appropriate.	Review, comment and accept. Issue directives to B as appropriate.
13	Prepare models for record documents/drawings and O&M manual format.	Monitor preparation, and comment on submissions via B.	Submit information and liaise with CA.	Monitor progress. Liaise with client. Issue directives to BSC, as appropriate.	Review, comment and accept.
14	Provide demonstrations to the relevant territorial authorities.	Manage and co-ordinate the demonstration of all life safety systems, as required, to the statutory authorities.	Execute all planned activities in conjunction with the B.	Monitor progress. Attend demonstrations.	Review, comment and attend demonstrations.
15	Prepare final record documents	Receive, collate and comment on submissions by BSC.	Submit record documents for approval and liaise with B. Update to suit comments.	Issue to client and co-ordinate all comments with BSC.	Review, comment and accept.
16	Client/end-user awareness and liaison	Co-ordinate activities and advise the client of all potential operational implications.	Liaise with CA and be responsive to the client/end-user's needs.	Liaise with the client/end-user.	Monitor status.
17	Client/end-user training programme.	Co-ordinate and manage BSC contractual obligations.	Liaise with CA. Co-ordinate the activities of specialist suppliers.	Monitor progress and participate. Liaise with client/end-user.	Review, comment and accept. Participate as required.
18	Post-occupancy fine-tuning/warranty period	Review operation with facilities management staff, initially on a monthly basis for the first three months and then quarterly.	Carry out post-handover fine-tuning, respond to any operational problems and attend to any required remedial works.	Assist in directing any BSC remedial work and attend to any building remedial work.	Respond to any design-related issues raised during the post-occupancy period and carry out warranty inspections.

Activity number	Activity description	Commissioning agent (CA)	Building services contractor (BSC)	Builder (B)	Design engineer (DE)
19	Post-occupancy warranty period energy/water-use monitoring	Review energy- and water-use trends with facilities management staff and refer issues to DE or BSC, as appropriate.	Attend to any remedial works requirements.	Assist in directing any BSC remedial works.	Attend to any remedial design action required.

4.3 Testing and commissioning

4.3.1 Scope

All works tests, pre-commissioning checks, setting-to-work, commissioning and performance testing of the works shall be carried out by the builder in accordance with the developer/building owner's design intent. The scope of work shall be generally as follows.

Air systems	CIBSE Commissioning Code A: Air Distribution Systems BSRIA AG3/89.2: The Commissioning of Air Systems in Buildings BSRIA TM1/88: Commissioning of HVAC Systems – Division of Responsibilities BSRIA AG1/91: Commissioning of VAV Systems in Buildings TR19: Guide to Good Practice 'Internal Cleanliness of Ventilation Systems'
Boilers	CIBSE Commissioning Code B: Boilers
Controls	CIBSE Commissioning Code C: Automatic Controls
Refrigeration	CIBSE Commissioning Code R: Refrigeration Systems
Water systems	CIBSE Commissioning Code W: Water Distribution Systems BSRIA AG8/91: Pre-commission Cleaning of Water Systems BSRIA AG20/95: Commissioning of Pipework Systems – Design Considerations BSRIA AG2/89.2: The Commissioning of Water Systems in Buildings CSA GN/1: White Water Balancing CSA GN/2: Automatic Balancing Devices CSA GN/3: Variable Volume Water Systems CSA GN/4: Bacteria Within Closed Circuit/Pipework Systems CSA TM/9: Water Treatment and the Commissioning Engineer
Plumbing and drainage	NZS/AS 3500
Fire detection and alarm systems	NZS4512
Automatic fire sprinkler systems	NZS 4541
Electrical installations	NZS/AS3000
Lighting	CIBSE Commissioning Code L: Lighting
Lifts	NZS/AS 1735
Smoke ventilation	AS 1668

4.3.2 Commissioning specialists

The services subcontractors shall engage experienced “hands-on” commissioning specialists to carry out all commissioning activities.

4.3.3 Continuous system operation run test

Upon satisfactory completion of the commissioning and performance testing, all systems shall be subjected to a period of continuous operation and bake-out. The minimum duration of the continuous operation period shall be two calendar weeks.

4.3.4 BMS testing

BMS testing shall include full point-to-point/end-to-end testing of all BMS points, and shall include documentary evidence for each point in the form of a checklist that each point has been tested in terms of wiring, address, span, calibration and software functionality.

4.4 Building user guide and as-built documentation

Provide a building user guide and associated operating and maintenance documentation in a consistent format for each system.

4.4.1 Building user guide

The building user guide should form an easily understood summary of the building and should be provided by the design team. The user guide should cover the following main points.

Energy and environmental strategy

Information on energy-efficient features and strategies, including an overview of the potential savings (stated for economic and environmental impact) shall be provided to building users and occupants.

Monitoring and targeting

Energy targets and benchmarks shall be provided for the building and tenancy as well as a metering and sub-metering strategy, with details on how to record and present meter readings.

Building services

A description of the basic functioning and operation of the following shall be provided, with simplified system diagrams and explanation of energy-saving features:

- ventilation
- heating system
- cooling system
- electrical systems
- lighting

- domestic hot water
- fire detection and protection systems
- lifts.

Transport facilities

Car-parking requirements, including details of the provision of cycling facilities, conditions of access and appropriate use, shall be provided. Also, if applicable, local public transport information, maps and timetables, and information on or links to alternative methods of transport to the workplace (e.g. carpooling) shall be provided.

Materials and waste policy

Information shall be provided on recycling, including what can be recycled, where the recycling storage areas are and schedules for waste/recycling removal. Include instructions on the proper use for less common practices such as composting.

Expansion/re-fit considerations

A list of environmental recommendations shall be provided for consideration, highlighting in particular the areas covered in the building users' guide, Green Star and the Green Building Australia's *Clean Up Your Office* guide (i.e. use of environmentally friendly materials, re-use of other materials, exhausts for printing/photocopying rooms, etc).

References and further information

Links to relevant information shall be provided, including websites, publications and organisations relating to energy and water conservation, efficient building operation, indoor air quality/sick building syndrome, environmentally friendly design features, etc.

4.4.2 Operation and maintenance manuals

Operation and maintenance manuals shall be of high quality and in a consistent format, and shall provide a detailed installation record, describe system operation and detail maintenance requirements.

4.4.3 As-built drawings

As-built drawings shall be provided, including: schematics, diagrammatics, general arrangement drawings, plant room drawings, schedules, controls schematics and wiring diagrams of control panels.

4.4.4 Electronic format of as-built documentation

The contractor shall provide all building user guides, maintenance documentation and as-built drawings in electronic CD format and hard copy format.

4.5 Instructing the employer's staff to operate systems and equipment

The contractor shall provide a structured programme of training and instruction to the building operating staff prior to completion to explain the purpose and function, operation and maintenance of the works.

4.6 Practical completion and handover

The building shall only be accepted for handover when the following have been delivered:

- proof that the commissioning of the building meets the requirements of Green Star MAN 2, MAN3, MAN 4 and MAN 5
- a report for the independent commissioning agent to verify the commissioning process is complete, with the exception of post-occupancy fine-tuning
- all necessary producer statements and certificates of compliance
- a “complete for review” set of all as-built drawings
- a “complete for review” set of all operations and maintenance manuals and a building user guide
- training of building operating staff has been completed
- a statement from all consultants that the contract works are in their opinion complete and acceptable for occupation
- acceptance from the Insurance Council for fire services
- a final inspection report from the territorial authority, including their documentation requirements for the Code Compliance Certificate application
- confirmation that the builder has lodged the Code Compliance Certificate application, and copies of the application have been passed to the developer's/building owner's project manager for acceptance
- all written guarantees required to be obtained by the builder under the outline building brief.

4.7 Post-occupancy

4.7.1 First year of operation and defects/warranty period

Any faults or defects that become apparent during the warranty period shall be promptly remedied by the builder/subcontractors.

The commissioning agent shall return initially on a monthly basis for the first three months and then quarterly through the defects/warranty period to review system operation and to liaise with facility staff to address any performance problems and faults.

A monthly log of energy and water consumption shall also be kept and reconciled with agreed performance targets. Any non-performance problems shall be addressed as part of the system's fine-tuning and operational practices.

4.7.2 Subsequent years of the lease term

A building management committee (BMC) shall be formed by representatives of the landlord and tenant. As part of their general remit for operating the building they shall be responsible for guiding its environmental performance. An environmental management plan (EMP) shall be drawn up to structure and assist with this activity.

Within three months from completion, a comprehensive maintenance programme shall be entered into for maintenance, service, repair and replacement to ensure that the building services, equipment and associated fixtures and fittings are maintained and kept in good operational order on a continuous basis and to an appropriate high standard.

An annual warrant of fitness shall be provided for specified systems, requiring a compliance schedule. The building owner shall ensure continued effective operation of those features and systems and shall sign and display an annual building warrant of fitness.

Energy and water usage shall be audited and reconciled with the agreed performance targets on an annual basis.

A full technical audit of the building shall be carried out on a three-yearly basis by an independent consultant(s) who shall report to both the building owner and the tenant concurrently. The audit shall review the condition and performance of the building in relation to the requirements and performance measures of the building performance specification (BPS). The review shall also include all tenancies and any impact of any subsequent fitting out work since completion or the last audit. The need for any corrective actions such as partial re-commissioning to restore operational performance shall be identified. Any failure to maintain energy and water usage performance or building performance standards shall be dealt with in accordance with the lease mechanisms.

Appendix B: Post-occupancy Environmental Management Plan

1 Introduction

1.1 Application and scope

This environmental management plan (EMP) applies to the [project name], owned by [*owner's name*] and leased by [name of government ministry, department or agency].

The EMP has been developed and agreed between the landlord and tenant and addresses energy efficiency, water efficiency, waste reduction and workplace travel planning associated with the building.

1.2 Purpose

The main purpose of the EMP is to assist the landlord and the tenant to meet their respective obligations under the as-built and in-use ratings of the Green Star NZ rating scheme. The primary objectives are to:

- achieve the required Green Star NZ rating and its associated environmental performance targets
- maintain the required rating and associated environmental performance targets over the term of the lease.

1.3 Principles

This EMP adopts the following four basic principles of effective environmental management.

- Information – This should include consumption data, end-use breakdowns and intensity indices which are essential to understanding how, where and why energy and water are used. Also the amount and waste is generated in the building and how its users travel to work.
- Knowledge – education of and awareness among the building operators and users is necessary to achieve improvements in operation, efficiency and behaviour.
- Action plan – the landlord and tenant must have an action plan of how to achieve and improve on the building's environmental performance, based on the information available.
- Commitment – the landlord, tenant and building's users must openly demonstrate a commitment to environmental management.

1.4 Briefing information

As part of the design process, the design intent has been recorded and a user guide has been provided. This supplies information on the design assumptions, standards, load assessments, building and system descriptions, and operating principles. The guide should be read and understood by the landlord and tenant representatives of the building management committee (BMC) in developing this EMP.

The design intent and building user guide documentation should be appended to this EMP.

2 Building base data, operating assumptions and environmental key performance indicators

Table 1: Building base data

Item	Description
Year built	
Last major refurbishment	
Roof and external cladding	
Insulation (roof and walls)	
Glazing and shading systems	
Levels – number of	
Basements levels – number of	
Gross building area (m ²)	
Total net lettable area (m ² NLA)	
Tenancy (m ² NLA)	
External landscaped area (m ²)	
Car parks (external) – number of	
Car parks (basement) – number of	
Non-office areas such as retail (m ² NLA) and main business activity (e.g. café)	

Table 2: Operating assumptions and key performance indicators

Item	Description
Operations – central services hours, days, weeks
Operations – tenancy hours, days, weeks
Personnel number of people in the tenancy (average per annum)
Energy-use target kwh/NLAm ² /year
Water-use target litres/NLAm ² /year
As-built Green Star NZ rating stars

3 Stakeholders

This Plan recognises that there are a number of stakeholders involved in achieving, maintaining and improving the environmental performance of the building. It addresses the need to understand the requirements of each, how they are best met, and the impact of their requirements not being satisfied.

Table 3 lists these stakeholders, defines their stake(s) or interest(s) in the building that impact on environmental performance, and the impacts they might have on achieving the required outcomes required (both positive and negative), plus appropriate responses.

Table 3: Stakeholders: their interests, impacts and required responses

Ref	Stakeholders	Objectives for or interest in environmental management	Likely impact on efficiency and/or usage levels	Response(s) required
1	Landlord	Future-proofing asset Tenant satisfaction Longer lease term Enhanced building rental and valuation	High	Ensure the building performance specification is delivered, any remedial works required are actioned, and the building is correctly commissioned, operated and maintained.
2	Tenant	Lower operating costs and environmental impacts Government commitments (Govt ^s) Improved user satisfaction and productivity	Medium	Ensure the hard and soft fit-out design and equipment do not compromise the base building environmental performance. Make sure occupants use the building as intended.
3	Occupants	Comfort, ease of use Amenity and user satisfaction	High	Encourage sustainable behaviours by occupants.
4	Facilities manager	Minimise operating costs Maintain building asset value Maximise tenant satisfaction	High	Operate and maintain the building correctly and efficiently.
5	Contractor(s)	Complete project on time, on budget and to required quality, with minimum call-backs	Low, provided they have done their job properly.	Ensure project is properly completed, tested and commissioned and defects are cleared.

Ref	Stakeholders	Objectives for or interest in environmental management	Likely impact on efficiency and/or usage levels	Response(s) required
6	Designers	Meet or exceed design intent predictions, in terms of environmental performance	High for first year only, provided they have done their job properly.	Communicate the design intent and sustainable use of the building and involvement in the first-year fine-tuning process.
7	Cleaning contractor	Daytime cleaning possibilities to reduce energy use Improvements to indoor air quality	Medium	Minimise the cleaning period and associated energy use. Adhere to waste management principles. Use environmentally friendly cleaning materials.
8	Electricity supplier	Use of electricity as an energy source Reductions in peak demand	Low	Ensure tariffs are competitive and encourage demand reduction.
9	Gas supplier	Use of gas as an energy source and reduction in peak demand.	Low	Ensure tariffs are competitive and encourage demand reduction.

4 Key actions and responsibilities

4.1 Key actions

Key actions required by the Environmental Management Plan (EMP) are summarised in Table 4.

Table 4: Schedule of key actions

Ref no.	Description	By	To	Due
1	Form building management committee and appoint environmental representatives	Landlord + tenant	Other party	Within 14 days of commencement date
2	Environmental management plan	Landlord + tenant	Building management committee (BMC)	Within three months of completion, then review every two years
3	Maintenance contracts	Landlord	Maintenance companies	Within three months of completion
4	Energy, water and waste data reports	Landlord + tenant	Other party	Within 14 days after each calendar month
5	Post-occupancy evaluation	Expert	BMC	Six months after completion and then three-yearly
6	EMP performance report	Landlord + tenant	Other party	Within three months of each anniversary of commencement date
7	Remedial plan	Either party	Other party	Within 15 working days of remedial notice
8	Green Star NZ accreditation rating	Expert	Landlord + tenant	12 months after completion
9	Triennial building audit	Expert	Landlord + tenant	Every three years

4.2 Building management committee responsibilities

A building management committee shall be established, with representatives from the landlord, tenant and facilities manager. During its first-year establishment phase, the committee shall be supported by representatives of the designers, contractor and commissioning agent.

Table 5: Responsibilities of the building management committee under the Environmental Management Plan (EMP)

Ref	Item and frequency
	Quarterly
1	Review energy use, water use and waste production.
2	Review the energy, water and waste reduction strategies good practice checklist – are there any outstanding issues?
3	Update progress on the implementation of agreed improvement strategies.
4	Provide notice of any upcoming change that may affect environmental performance (e.g. staff increases, after-hours usage or planned fit-out changes).
5	Contract review – are there any contracts coming up for review that impact on energy performance (e.g. cleaning, maintenance)?
6	Policy review – are any new policies being introduced that impact on environmental performance (e.g. work from home policy, travel, occupational health and safety (OH&S) etc)
	Annually
1	Compare energy, water and gas usage and waste generation and disposal with previous years. Is there any significant change? Did it meet improvement targets (if relevant)? Does usage trend up or down? Is this an issue?
2	Tariff review – is the current tariff still appropriate based on the previous year? Does it need to be renegotiated/adjusted?
3	Strategic planning – look at priorities to address in the future (e.g. in relation to amending policies and contracts, communications activities, set and revise consumption targets).
	Triennially
1	Conduct building three-yearly building audit. The audit shall be carried out by an independent consultant(s) who shall report to both the building owner and the tenant concurrently. This shall review the condition and performance of the building in relation to the requirements and performance measures of the building performance specification(BPS). The review shall also include all tenancies and any impact of any subsequent fitting out work since completion or the last audit. The need for any corrective actions such as partial re-commissioning to restore operational performance shall be identified.

4.3 Landlord’s responsibilities

The landlord’s responsibilities in achieving the required environmental outcomes are outlined in Table 6.

Table 6: Landlord’s responsibilities under the Environmental Management Plan (EMP)

Landlord management	Considerations for Building Management Committee	Information sources	Review frequency
Arrange for building operating staff to attend training prior to handover by contractor.	–	Programme from contractor and commissioning agent	–
Confirm receipt of all building documentation, including design intent, commissioning report, O&M manuals, as-built drawings, user guide and code compliance certification, and warranties.	–	Delivery by commissioning agent and builder	–
Appoint representative to building management committee (BMC).	–	–	–
Tender/appoint facilities management staff and maintenance/cleaning/waste management contractors.	Review	–	Review as required by contract duration
Based on advice from the BMC, review any non-performance against environmental performance targets, sanction any remedial works required by the landlord, and advise of any remedial works required by the tenant.	Review information and summarise required actions	Energy, water and waste and indoor environmental quality IEQ reporting	As required
Confirm clearance of defects at the end of the defects period and final payment of contractors.	Provide fault reports for action by builder	Advice from professional team and builder	–
Maintain indoor environmental quality.	Implement indoor environmental quality strategies	Specific indoor environmental quality strategies	From occupation
Arrange for warrant of fitness inspections and certification.	–	Expert inspections and certificates	Annually
Make annual inspections of tenant areas and advise owner of any areas of non-compliance.	Review for any environmental impacts	Inspection reports	Annually
Set-up sinking fund for plant and system upgrading and replacement.	–	–	–
Review triennial building audit and sanction any remedial actions required by the landlord.	Review report and summary required actions	Expert report	Three-yearly
Review and sanction significant tenant alterations and re-fits.	Review for any environmental impacts	Tenant fit-out proposals	As required

4.4 Tenant responsibilities

The tenant's responsibilities in achieving the required environmental outcomes are outlined in Table 7.

Table 7: Tenant responsibilities under the Environmental Management Plan (EMP)

Tenant management	Considerations for Building Management Committee	Information sources	Review frequency
Faults	<p>Monitor faults for likely issues that impact on environmental performance.</p> <p>Ensure that fault reports are reviewed, and faults actioned that effect environmental performance.</p> <p>Report lighting faults promptly.</p> <p>Monitor tenant fault report for heating, ventilation and air-conditioning HVAC (e.g. air temperature issues).</p>	<p>Tenant fault reports</p> <p>Maintenance reports</p> <p>Building owner fault reports</p>	<p>Quarterly or as required</p>
Staff levels	<p>Establish an acceptable range.</p> <p>Monitor staffing levels within the acceptable range.</p> <p>Note: the number of employees has a direct impact on energy use.</p>		<p>Commencement of lease within first three months</p> <p>As required</p> <p>As required</p>
Fit-out changes	<p>Consider the impact of fit-out changes on environmental performance.</p> <p>Note any impact on comfort levels as well.</p> <p>Includes partitions.</p> <p>Note the impact on HVAC.</p> <p>Building owner's approval is required for any hard fit-out changes.</p>	<p>Refer to fit-out design brief</p> <p>Mechanical engineer report</p> <p>Approve plans by building owner</p>	<p>As required</p> <p>As required</p> <p>As required</p>
Equipment	<p>Consider the impact of equipment numbers (e.g. computers, fridges).</p> <p>Give preference to energy-efficient equipment with energy-saving modes.</p> <p>Liaise with information technology administrator to ensure stand-by function and/or energy saving is enabled.</p> <p>Monitor information technology updates.</p> <p>Consider and review the impact of requests for bar fridges, drinks-vending machines, etc on energy performance.</p> <p>Note: the number of computers and appliances has a direct impact on energy use.</p>	<p>Liaise with IT administrator</p>	<p>As required and when purchasing</p>
Lighting	<p>Ensure that lighting system controls are functioning as designed.</p> <p>Review operating times.</p> <p>Are out-of-hours operations, including automatic switching overrides and sensor controls, working?</p>	<p>Check commissioning report</p> <p>Maintenance reports/ staff feedback</p> <p>Maintenance reports</p> <p>Review fault reports</p>	<p>Commencement of lease/before default period expires</p> <p>Quarterly</p> <p>Quarterly</p> <p>As required</p>
Controls	<p>Do not adjust unless labelled as okay to adjust. Submit request to facilities manager.</p>		

Tenant management	Considerations for Building Management Committee	Information sources	Review frequency
Non-authorized equipment	Unauthorized use of radiators, toasters, fans and other non-authorized appliances.	Inspect regularly Check 30-minute electricity data	Annually Quarterly
Vents	Do not obstruct vents.	Building inspection reports Maintenance reports	Annually Quarterly
Water	Implement water conservation strategies.	Water reduction strategies	Within six months of occupancy
Workplace travel	Implement a tenant workplace travel plan. Integrate with other tenants.	Land Transport New Zealand Workplace Travel Plan Co-ordinator's Guide	Within six months of occupancy
Waste	Implement waste minimisation strategies.	Specific waste reduction strategies	Within six months of occupancy

5 General environmental strategies

In order to achieve the required outcomes, the following strategies shall be adopted.

1. Implement training for key stakeholders and facilitate access to project information and feedback on performance.
2. Appoint landlord representative and the tenant representative to a building management committee (BMC) and require them to be environmental champions (i.e. openly demonstrate leadership of and commitment to environmental performance).
3. Develop an EMP with key strategies to achieve energy, water, waste and workplace travel-planning targets.
4. Measure and make all consumption, key performance indicators, cost and end-use data readily available to facility managers, operators and the building management committee.
5. Develop a communications strategy and awareness campaign, with regular reporting to tenants/occupants on building environmental performance. Identify unacceptable behaviours and work practices and define required behaviours, relevant barriers and incentives to achieve the required cultural, behavioural and system changes.
6. Assess any building and fit-out changes for their potential environmental impact.
7. Have formal mechanisms for gathering feedback from tenants and facilities management.
8. Adopt a process of continual improvement.

6 Specific energy-use reduction strategies

6.1 Strategies for reducing energy use

1. The building systems and plant operation, including all energy-saving strategies, shall be fine-tuned during the first year of operation.
2. The landlord shall undertake monthly energy meter readings and identify end uses and any trends in relation to targets.
3. The landlord shall establish procedures for energy efficiency and conservation.
4. The landlord and tenant shall initiate quarterly surveys of after-hours energy use of common areas and tenancy to identify lights, plant and equipment left on unnecessarily.
5. The landlord's maintenance and cleaning contracts shall include performance clauses encouraging contractors to help achieve the required performance target.
6. The landlord and tenant shall regularly review the operating schedules of the building systems and plant, and the need or otherwise for after-hours operation.
7. The landlord and tenant shall review the impact of cleaning on energy use and ensure there is no undue wastage of energy. Where practical, the landlord and tenant shall encourage daytime cleaning.
8. The landlord and tenant shall implement communications and education strategies for stakeholders.
9. The tenant shall enable energy saving/sleep routines for computer equipment.
10. The tenant shall select equipment and appliances on the basis of energy efficiency.
11. The landlord shall ensure the building operates in accordance with the design intent and building performance specification.
12. The landlord shall ensure regular maintenance and re-calibration of building services.
13. The landlord shall ensure regular cleaning of windows and blinds.
14. The landlord and tenant shall put up signs for users and cleaners to turn off lights after use.

6.2 Energy consumption targets

Energy use and carbon dioxide emissions key performance indicators in kWh/m²NLA/year and kg/m²NLA/year shall be used (see Table 8). Performance shall be determined and reported monthly by recording actual consumption in relation to targets. If it appears that the target energy consumption and carbon dioxide emission targets are not being achieved, then the landlord and tenant shall identify all reasonable measures needed to achieve the target. Where feasible, energy-saving measures shall be delivered in the time frame required to achieve the target.

Table 8: Target, actual and forecast monthly consumption for rating period

Month/ year	Target kWh/month (kg CO ₂ /month)				Actual and forecast kWh/month (kg CO ₂ /month)					
	Tenancy		Whole building/ central services		Total	Tenancy		Whole building/ central services		Total
	Electricity	Gas	Electricity	Gas		Electricity	Gas	Electricity	Gas	
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										
11										
12										
Year										

7 Specific water-use reduction strategies

7.1 Strategies for reducing water consumption

The landlord shall:

- undertake monthly water audits
- establish procedures for water efficiency and conservation
- establish mechanisms for the timely reporting and rectification of water leaks, and report performance annually
- sub-meter all major loads and/or end uses (more than 15% of the total), especially cooling towers and non-office uses
- monitor and analyse meter data on water time of use to identify inconsistencies
- require cleaners and security personnel to report leaking taps, urinals and toilets
- ensure the building operates in accordance with the design intent and building performance specification.

In addition:

- the landlord’s maintenance contracts shall include performance clauses encouraging subcontractors to help achieve the required performance target
- the landlord and tenant shall implement a communications and education strategy for stakeholders
- cleaning contracts shall specify relevant cleaning and maintenance procedures for specialist “green” products, such as waterless urinals, where used
- indoor planting is to be selected for low water use
- the landlord and tenant shall provide signs to encourage water-saving practice.

7.2 Water consumption targets

A water-use key performance indicator of kL/m²/year shall be used based on net lettable area (NLA). Performance shall be determined and reported monthly by recording actual consumption and NLA figures in relation to targets. If it appears that the target water index will not be achieved, then the landlord and tenant shall identify all reasonable measures needed to achieve the target. Where feasible, water-savings measures shall be delivered in the time frame required to achieve the target.

Table 9: Target, actual and forecast monthly consumption for rating period

Month/ year	Target kL/month			Actual and forecast kL/month		
	Tenancy	Whole building/ central services	Total	Tenancy	Whole building/ central services	Total
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
Year						

8 Specific waste reduction strategies

8.1 Strategies for reducing waste

1. After six months a waste audit shall be carried out and thereafter annually.
2. The landlord and tenant shall set targets and develop and follow effective waste management systems and procedures.
3. The landlord shall provide separate facilities to receive reusable, recyclable, compostable and landfill-type waste and ensure correct disposal by contractors. Secure document destruction contractors shall process waste to recycling, not landfill.
4. The tenant shall use its best endeavours to put in place recycling arrangements for office computers, fax machines, printers and photocopiers.
5. The landlord's waste services contracts shall include performance clauses encouraging subcontractors to help achieve the required performance target.
6. Landlord's and tenant's cleaning contracts shall specify compliance with waste management policies.
7. The tenant shall pre-sort its waste and use the correct waste receptacles.
8. The tenant shall adopt a green purchasing policy in relation to office paper and consumables: use paper with high (60% or more) post-consumer recycled content, and use re-manufactured/refilled toner cartridges for printers and photocopiers.
9. The tenant shall recycle copier and printer paper for the production of draft documents and encourage paperless office principles and double-sided printing as a default.
10. The landlord and the tenant shall establish mechanisms for the timely reporting of waste reduction measures and performance against targets.
11. Signage shall be provided by the tenant to remind staff to recycle and minimise wastage.
12. The landlord and tenant shall minimise waste during fit-out, alterations and major refurbishment works.

8.2 Waste reduction targets

Baseline waste production was determined as [X] tonnes per year for common areas and [Y] tonnes per year for the tenancy within six months of the commencement date as required. The BMC agreed a [insert target %] waste reduction target and the landlord and the tenant will use their best endeavours to achieve this target.

The waste reduction target and the sum of actual and remaining target waste production levels will be used to determine the average savings needed for each of the remaining months in the assessment period to achieve the target. If it appears that the target will not be met, then suitable reduction measures will be identified and delivered in a time frame required to achieve the target.

Table 10 summarises the common waste types and target production levels. The agreed waste stream sorting and disposal arrangements are [describe].

Table 10: Summary of site waste streams

Waste stream type	Quantity (tonnes per annum)
White paper	
Other paper	
Plastic	
Glass	
Metal	
Other inorganic	
Organic	
Total	

9 Specific indoor environmental quality strategies

The tenant shall undertake post-occupancy evaluation six months after completion, and shall provide a copy of the evaluation report to the landlord to assist in building fine-tuning.

The landlord shall carry out regular carbon dioxide monitoring using building management system (BMS) provisions.

The landlord shall test HVAC systems regularly for contaminants and carry out regular indoor air quality tests.

The landlord shall change filters in accordance with suppliers' recommendations (pressure drop) and replace with equivalent grades.

The landlord's maintenance contracts shall specify that all paints, sealants and adhesives are no or low-emission.

The landlord shall monitor and maintain indoor temperature at set summer and winter ranges.

The landlord's cleaning contracts shall specify the use of natural, solvent-free and hydrocarbon-free cleaning products. Cleaning equipment with high efficiency particulate arrestor (HEPA) filters shall be used and their shall be regular auditing of cleaning equipment.

The landlord shall clean lights periodically to remove dust build-up and replace lamps when maintained illuminance levels are not being met.

No herbicides, fungicides, insecticides or pesticides shall be used on indoor plants.

10 Specific hard and soft fit-out changes strategies

The tenant shall re-use existing furniture and modular partition systems, doors, ceilings and joinery wherever practical.

Where new furniture is required, the tenant shall select environmentally preferable products with certification as appropriate.

The tenant shall select water- and energy-efficient equipment and appliances.

The tenant shall continue to use low-emission paints, finishes and adhesives.

The tenant shall selectively replace carpet tiles and encourage recycling/re-manufacture of existing tiles.

The landlord and tenant shall ensure any associated HVAC, lighting, water and electrical changes associated with re-fitting are consistent with energy, water and indoor environmental quality Indoor Air Quality strategies and the original design intent.

The tenant shall ensure that any refitting is consistent with the waste management strategy.

11 Specific workplace travel planning initiatives

The tenant shall appoint a workplace travel plan co-ordinator and working group who shall.

1. Develop a scope and budget for travel plan development and maintenance.
2. Set objectives for each aspect of the travel plan, and develop improvement measures.
3. Obtain senior management support and commitment.
4. Carry out a staff travel survey to determine current travel patterns and behaviours. Take into account number of staff employed, number of visitors and number of deliveries.
5. Set targets and co-ordinate the plan with Govt³ initiatives.
6. Develop a package of site-specific measures promoting sustainable travel.
7. The travel plan shall cover:
 - information, training and advice
 - commuting
 - business travel
 - supplier travel
 - visitor travel
 - working arrangements.

8. The travel plan shall provide commuting initiatives such as:
 - car sharing
 - cycling and walking
 - preferential parking for car sharers and environmentally friendly vehicles
 - public transport season ticket loans
 - energy-efficient, small and more environmentally friendly vehicles
 - spaces and changing facilities for motorcycles, mopeds and cyclists.
9. The travel plan shall provide business travel initiatives such as:
 - video conferencing
 - telephone conferencing
 - offsetting carbon from official air travel
 - use of car hire and taxi companies that have high environmentally friendly vehicles.
10. The travel plan shall investigate ways to minimise the number of supplier visits in particular postal services and waste collections.
11. The travel plan shall provide visitor travel initiatives such as electronic and hard copy maps which identify public transport opportunities and publicise facilities available for disabled visitors.
12. The travel plan shall provide flexible working initiatives such as:
 - reducing travel during peak hours
 - job-splitting and sharing
 - compressed hours
 - home working.
13. Review and undertake annual surveys to measure progress against targets and review the travel plan and identify any new issues.
14. Develop a communications strategy to communicate annual achievements of travel planning. Initiatives might include an intranet and internal publicity.

12 Risk management

Both the landlord and the tenant face risks in meeting their obligations relating to the environmental key performance indicators and the associated Green Star NZ rating. These risks are acknowledged in Table 11 below, and the suitable mitigation measures should be developed as identified by this plan and the preceding design and construction management processes.

Table 11: Risk schedule

Risk description
Poor design practices
Poor contractor practices
Poor tenant work practices
Poor system commissioning
Poor facilities management practices
Increased occupancy levels
Increased working hours
Increased energy intensity of office equipment
Fit-out changes adversely impacting on original design
Small groups working outside business hours
Lack of champions in senior management of landlord and tenant
Maintenance contracts lack effective incentives

Appendix C: Green or Performance-based Leases

1 Introduction

Until recently the development of “green” buildings in New Zealand, particularly for commercial offices, has been ad hoc. Briefs were very vague, designs were unchallenged and a building’s performance has not been guaranteed in any shape or form. There has been an element of “green wash”.

The new generation of “green” commercial buildings for major government and corporate tenants are seeking to address these shortcomings by:

- providing outline building briefs and subsequent performance specifications with clearly defined and, wherever possible, measurable and sustainable objectives
- participating in a collaborative design and commercial leasing terms process to refine and apply the sustainable design objectives to a range of potential owners’ particular development propositions
- the use of measurement tools during the design process to test how sustainable an owner’s design is, including environmental ratings (e.g. Green Star NZ), energy-use modelling, water-use modelling and daylight modelling
- a higher standard of project delivery than has traditionally been accepted in terms of design, construction and commissioning/handover
- the use of a “green” or performance-based lease to clearly define lessor and lessee obligations in terms of meeting agreed environmental outcomes
- an element of continuous commissioning in the first year of operation to fine-tune the building and its systems to suit the building occupants and the sustainability objectives
- producing an environmental management plan or building user guide on the continued sustainable use of the building
- a triennial building audit.

A green or performance-based lease is similar in most respects to a standard lease for a conventional building, but also provides for the lessor and lessee to maintain and conform to the environmentally sustainable design² (ESD) aspects included in the building to minimise environmental impacts and to achieve agreed energy- and water-use outcomes, with associated reduced operating costs.

² Also known as ecologically sustainable development (ESD) in Australia.

Components of this type of lease normally include:

- the *agreement for lease* and the *lease*
- an *ESD schedule* – this will include the required ESD outcomes and the associated assumptions and requirements for meeting them, along with the requirement to make the lessee’s fit-out consistent with the ESD principles of the base building and an environmental management plan or user guide on the correct and sustainable use of the building.

Green or performance-based leases are starting to be developed overseas for sustainable commercial buildings. Probably the most prominent Australasian example of this type of lease is that developed for the 60L building in Melbourne. The Australian Federal Government has also issued a Green Lease Schedule Template, and is intending to procure all new lease arrangements on this basis. Performance-based contracts have been used for some years in the energy contracting area, where companies take over the energy supply to a client’s business and guarantee a minimum level of energy cost saving.

In New Zealand there is particular interest in these types of leases from government tenants due to the obligations of the Govt³ programme,³ which seeks to improve the environmental performance of government operations. These types of leases also support more collaborative property solutions by tending to favour long-term lease/total occupancy cost arrangements between the lessor and lessee rather than traditional short-term leases with net rentals and recoverable operating expenses.

2 Key features of green or performance-based leases

A green lease builds on the features of conventional leases but also includes commitments from both the building owner and the tenant. This type of lease will generally include a specific ESD schedule, which is generally structured as follows:

- ESD outcomes
- ESD outcome assumptions
- ESD outcome calculation
- lessor obligations relating to the ESD outcomes
- lessee obligations relating to the ESD outcomes
- co-operation required
- dispute resolution.

³ A programme run by the Ministry for the Environment that helps central government agencies to become more sustainable. It focuses on four key areas, including buildings, and seeks to improve energy, water and materials use, reduce waste and wastewater, improve occupancy health and wellbeing, and influence staff travel.

ESD outcomes

Setting measurable targets that can be transformed into achievable outcomes for environmental performance is extremely important to enable the lessor and lessee to measure their own and each other's performances. For example, the lease could specify the achievement of a certain environmental rating score and/or specific energy, water and waste outcomes over the life of the lease for both the lessor's base building and the lessee's fit-out. These should be evaluated every year for the entire term of the lease, and will require the co-operative efforts of both the lessor and lessee to maintain.

Lease terms to achieve these objectives could include any or all of the following:

- achievement of an agreed as-built environmental rating and score for the base building and fit-out (e.g. Green Star NZ)
- an obligation on the lessor to separately meter the energy and water consumption of each lessee and the building end uses for diagnostic purposes
- establishing a mechanism for the appointment of a qualified and independent consultant to monitor energy and water consumption, and to assess compliance with the ESD outcomes prescribed by the lease to ensure these are achieved
- prescribing a fair and reasonable calculation formula for failing to comply with the lease obligations or to achieve prescribed ESD outcomes. It is important that the parties assess and agree to a penalty that provides sufficient incentive for them to comply with the lease terms and achieve environmental outcomes and performance criteria prescribed by the lease. For example, the lease might require a reduction in the rent commensurate with the increased costs associated with the lessor's failure to achieve the ESD outcomes.

ESD outcome assumptions

Given the number of variables that could reasonably be used to predict a building's performance, it is important to have a clear basis on which to derive the ESD outcomes. This should:

- define the assumptions on which the ESD outcomes are based and identify variables that are beyond the scope of the outcomes (e.g. use of the building, loading of the building, climatic data)
- apportion obligations for meeting the ESD outcomes to both parties.

ESD outcomes calculation

For ESD outcomes to be acceptable and not merely regarded as a potential penalty, they must be equitable to both the lessor and the lessee. To achieve this they should:

- include a tolerance on the outcome given the accuracy of modelled versus real building performance
- make allowances or corrections for factors that will influence energy usage but are beyond the control of the lessor (e.g. non-average climatic effects or an increased intensity of use of the building)
- define a calculation basis for fair cost recovery if the ESD outcomes are not met.

Lessor's obligations in respect of ESD outcomes

The lessor will have obligations, which would include:

- meeting an agreed as-built environmental rating score for the base building
- meeting agreed performance targets, normally for energy and water usage under the building owner's control, including:
 - the energy used by heating, cooling, ventilation, common area lighting, pumping, lifts and hot water
 - the flushing water contribution
- ensuring that all fundamental building elements and systems are installed and operated with maximum efficiency, which may require certification by an engineer with relevant qualifications
- monitoring and, where necessary, adjusting air-conditioning levels to reduce energy use
- ensuring that an easily accessible and dedicated area for recyclable collection and storage of waste is set aside
- ensuring recyclable waste is actually being recycled
- providing bicycle storage and changing rooms.

ESD outcomes prescribed by a lease must be achievable. The lessor should be in a position to demonstrate to the lessee that the building can, under normal operating circumstances, achieve the proposed ESD outcomes provided the lessee conducts its operations in a particular manner.

3 Lessee obligations relating to ESD outcomes

In conventional commercial leases, fit-out is usually the responsibility of the lessee, although this should be integrated with the base building and subject to approval by the lessor. A lessor of a green building will wish to impose obligations on the lessee regarding the nature or type of materials used in the fit-out to achieve ESD goals, or require the lessee to comply with a fit-out policy annexed to the lease. In essence, the environmental standard of the fit-out should be consistent with that of the base building and the lessee would be required to meet an agreed as-built environmental rating for the building, including the fit-out.

Commercial properties typically have building rules, and for a green lease these would be extended to prescribe the lessee's ESD obligations. An environmental management plan or user guide would be prepared for the building, which the lessee would have to comply with. There would also be an obligation on the lessee for a proportion of the building's ESD energy outcome, including:

- on-floor small power equipment energy use
- on-floor-lighting energy use
- potable (drinkable) water use.

4 Co-operation required

Achieving the desired ESD outcomes will require the full co-operation of each party at every stage of the design and construction process, and during the lessee's occupation of the premises. The lessor and lessee need to review the achievement of the ESD outcomes at an agreed frequency, normally quarterly, via a building management committee (BMC) meeting. If required, they also need to review and agree on any potential remedial measures needed by either party to bring the outcomes back on track if they are not being achieved.

The lessor and lessee may need to appoint professionals to help achieve this co-operation.

5 Dispute resolution

A green lease should not only specifically define the responsibilities of the lessor and lessee, but ideally should include a dispute resolution mechanism in the event of a disagreement between the parties as to why a particular target or objective prescribed by the lease has not been achieved.

The manner and form of the dispute resolution mechanism is, as always, negotiated on a case-by-case basis. If, however, the lease includes a requirement for an annual independent audit, then the lease could include a requirement that the auditor's brief not only advise on the performance of the building, but also include:

- an explanation as to why the building is not achieving a prescribed target
- advice on who, in the auditor's opinion, is responsible for that non-performance.

Depending on what the parties agree to, the auditor's report may be binding on the parties or form the basis of triggering the dispute resolution mechanism.