Circular Letter No.: 2024.216

Issue Date: 30 August 2024

Application: BEAM Plus NB Version 2.0

Effective Date: 3 March 2025

Major Amendments and Enhancement of Submission Template for IDCM 4, 5, 11 to 14 and EU P1 to 8 under BEAM Plus NB Version 2.0

1. The Technical Circular hereby announces the major amendments to the existing standards and the revision of Excel Templates and e-Forms on iBEAM for credits IDCM 4, 5, 11 to 14 and EU P1 to 8 under BEAM Plus New Buildings Version 2.0.

2. The requirements given in Sections 1.3, 2.1, 2.2, 2.3, 5.P, 5.1, 5.2, 5.3, 9.2 and 9.3 of the BEAM Plus NB Version 2.0 Manual (2023 Edition) are hereby updated with the enclosures in **Annex A** of this Technical Circular Letter respectively:

    a. Pages Annex A-1 to A-8 provide a summary of the major amendments made to the existing standards;

    b. Pages Annex A-9 to A-15 shall replace all contents in

        i. Section 1.3 Summary of Credits on IDCM 4, IDCM 5, IDCM 11 to IDCM 14 specified in Pages 10 and 13 of the Manual respectively; and

        ii. Section 1.3 Summary of Credits on EU P1 to EU 8 specified in Pages 26 to 31 of the Manual;

    c. Pages Annex A-16 to A-112 shall replace all contents in

        i. Sections 2.1 to 2.3 on IDCM 4, IDCM 5, IDCM 11 to IDCM 14 specified in Pages 62 to 68 and 99 to 111 of the Manual respectively;

        ii. Sections 5.P to 5.3 on Energy Use (EU) Category specified in Pages 249 to 300 of the Manual; and

        iii. Sections 9.2 and 9.3 on Appendix 9.2 - EU 2 Path 1 (Performance Approach) and Appendix 9.3 - EU 2 Path 2 (Prescriptive Approach) specified in Pages 399 to 423 of the Manual respectively.

3. To facilitate a smooth migration, a grace period from **30 August 2024 to 2 March 2025** (the "Grace Period") with the following arrangements will be implemented:

    a. Projects that commence PA submission during the Grace Period will be allowed to opt for assessment using previous assessment criteria or voluntarily comply with this Technical Circular Letter.

    b. Projects that commence PA submission after the Grace Period (i.e. on or after 3 March 2025) shall adopt the updated assessment criteria for assessment submission.

4. Approved PA projects: For projects that have already completed PA and have certain assessment approach approved, the Applicant may opt to adopt the same assessment criteria for FA or voluntarily comply with this Technical Circular Letter. For the avoidance of doubt, the Applicant shall provide PA evidence (e.g., extract of the PA report, documents submitted for assessment in PA, etc.) in subsequent assessments to support the intention of using the same assessment methodology as in PA.

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Ir Victor Cheung
Chairperson of Standards Sub-committee

Summary of Major Amendments

Major Amendment Number : 1
Date of Issue : 30 August 2024

Below is the list of amendments made to the manual:

Credit	Section	Amendment
IDCM 5	Credit Requirement	1. Parts (c) and (d) have been combined for assessment and converted to additional credits of parts (a) and (b).
IDCM 5	Assessment	1. The assessment criteria for the changes in Project's CxA under part (a) have been clarified. 2. Part (c) has been renamed as "Commissioning Review" and the assessment criteria have been clarified.
IDCM 5	Submittals	1. The supporting document "IDCM_05_01" has been removed. 2. The supporting document "IDCM_05_06" has been updated following the revision of assessment criteria for part (c).
IDCM 13	Assessment	1. The assessment criteria have been clarified that the demonstration of provision of the monitoring equipment for energy monitoring and/ or performance auditing is not required under the objective of this credit.
IDCM 13	Submittals	1. The requirement of supporting document "IDCM_13_01" has been clarified. 2. The supporting document "IDCM_13_02" has been removed to align with IDCM 14. 3. The requirement of supporting document "IDCM_13_03" has been updated to align with IDCM 14.
IDCM 14	Submittals	1. The requirement of supporting document "IDCM_14_01" has been clarified.
EU P1	Credit Requirement	1. The phrases "latest edition of BEC"/ "latest BEC" have been revised to "applicable edition of BEC". 2. A remark has been added to clarify that the applicable edition of BEC for a particular project shall be referred to the latest Circular Letter issued by BSL. 3. The definitions of "BEC Governing Buildings" and "Non-BEC Governing Buildings" have been clarified. 4. The credit requirements have been aligned with the assessment criteria.

Credit	Section	Amendment
EU P1	Assessment	1. The phrases “latest edition of BEC”/ “latest BEC” have been revised to “applicable edition of BEC”. 2. The phrases “air-conditioning equipment”/ “air-conditioning system” have been revised to “air-conditioning installation”. 3. The phrase “indoor lighting system” has been revised to “lighting installation”. 4. The table of cooling seasonal performance factor (CSPF), F_{csp} for the benchmarking criteria of the room air-conditioners has been included for reference. 5. The assessment criteria of lighting installation for different space conditions and residential buildings have been clarified. 6. The content has been revised to clarify the assessment criteria and align among “BEC Governing Buildings” and “Non-BEC Governing Buildings” under EU P1 and EU 2 Prescriptive Path - Active System Performance Improvement (“2.1 Air-conditioning Installation” and “2.2 Lighting Installation”). 7. The assessment criteria for “Projects that consist of both BEC Governing Buildings and Non-BEC Governing Buildings” have been clarified.
EU P1	Submittals	1. The summary tables required under “EU_P1_01” have been refined such that each table covers both “BEC Governing Buildings” and “Non-BEC Governing Buildings”, and to substantiate the compliance for both EU P1 and EU 2 Prescriptive Path - Active System (AC and Lighting). 2. The submittal requirements have been clarified and elaborated.
EU 1	Extent of Application	1. The exceptions in the extent of application have been removed.
EU 1	Credits Attainable	1. Revised to 6 + 1 additional BONUS
EU 1	Credit Requirement	**Option 1: Prescriptive Path** 1. 1 additional BONUS credit for incorporating all of the above listed passive design strategies has been added to Option 1: Prescriptive Path. **Option 2: Performance Path** 2. The credit requirement for “1. Built Form and Orientation” has been revised to “1 credit for reducing building envelope load of a designed building from a hypothetic building with a different built form and/ or at least 22.5° difference in orientation with justification by simulation”.

Credit	Section	Amendment
EU 1	Assessment	**Option 1: Prescriptive Path** *3. Vegetated Building Envelope* 1. Clauses 3.1 and 3.2 have been revised to clarify the assessment criteria. 2. The term “façade” has been replaced by “external wall” for the consistency within the credit. 3. The requirement of “demonstration of reduction in U-value” has been removed. **Option 2: Performance Path** *1. Built Form and Orientation* 4. The assessment criteria under clause 1.1 have been revised to include the requirement on “built form”. 5. The requirement of hypothetic building has been clarified. *2. Optimum Spatial Planning* 6. The term “façade” has been replaced by “external wall” for the consistency within the credit, as well as the consistency with “1. Optimum Spatial Planning” under “Option 1: Prescriptive Path”. *4. Vegetated Building Envelope* 7. The term “façade” has been replaced by “external wall” for the consistency within the credit. *5. Space Layout for Natural Ventilation* 8. Clause 5.5 has been revised to clarify the eligibility of this credit. *6. Space Layout for Daylight* 9. The assessment criteria for typical floors under clause 6.2.5 have been updated from “lowest, topmost, and middle levels” to “lowest levels”.
EU 1	Submittals	1. The supporting document “EU_01_02” has been removed.
EU 2	Extent of Application	1. The exceptions in the extent of application have been removed.
EU 2	Credits Attainable	1. Revised to 10 + 8 additional BONUS.

Credit	Section	Amendment
EU 2	Credit Requirement	**Option 2: Prescriptive Path** 1. A total of 8 additional BONUS credits have been added for prescriptive path compliance. *1.1. Building Envelope* 2. The benchmarking criteria have been updated and the requirements for 2022 edition RTTV have been included. 3. 3 additional BONUS credits have been added. *1.2. Natural Ventilation* 4. The benchmarking criteria have been updated. 5. 2 additional BONUS credits have been added. *2.1. Air-conditioning Installation* 6. The requirement for "N/A" has been removed. 7. 1 additional BONUS credit has been added for 25% performance improvement. *2.2. Lighting Installation* 8. 1 additional BONUS credit has been added for 30% performance improvement. *2.3. Lift and Escalator Installation* 9. The requirement for "N/A" has been removed. 10. The requirement for 1 credit has been revised to 10% performance improvement. 11. 1 additional BONUS credit has been added for 15% performance improvement.

Credit	Section	Amendment
EU 2	Assessment	**Option 1: Performance Path** 1. The phrases “renewable energy”/ “renewable energy generation” have been revised to “renewable energy application” for consistency throughout the Manual. 2. The phrase “Building Energy Report” has been revised to “Building Energy Performance Assessment Report” for consistency throughout the Manual. 3. The content of the “Building Energy Performance Assessment Report” has been revised to include Peak Electricity Demand reduction for EU Option 1 (Performance Path) for a collaborative report to substantiate the compliance of both EU 2 Option 1 (Performance Path) and EU 3 Option 1 (Performance Path). 4. The detailed requirements of the supporting documents for “Building Energy Performance Assessment Report” have been relocated from the “Submittal” section to the “Assessment” section. **Option 2: Prescriptive Path** 5. The phrase “summary report” has been revised to “Prescriptive Approach Summary Report” for consistency throughout the Manual. *1. Passive Building Design Enhancement* 6. The assessment criteria have been clarified and revised according to the revised credit requirement. *2. Active System Design Improvement* 7. The phrase “air-conditioning equipment” has been revised to “air-conditioning installation”. 8. The phrase “lighting system” has been revised to “lighting installation”. 9. The content has been revised to clarify the assessment criteria and align among “BEC Governing Buildings” and “Non-BEC Governing Buildings” under EU P1 and EU 2 Prescriptive Path - Active System Performance Improvement (“2.1 Air-conditioning Installation” and “2.2 Lighting Installation”). 10. The assessment criteria for “2.3. Lift and Escalator Installation” have been clarified and revised according to the revised credit requirement. 11. The requirement of non-applicability for lift and escalator installation has been removed. 12. The detailed requirements of the supporting documents for the “Prescriptive Approach Summary Report” have been relocated from the “Submittal” section to the “Assessment” section.

Credit	Section	Amendment
EU 2	Submittals	1. The summary tables required under “EU_02(Path1)_00” and “EU_02(Path2)_00” have been refined. 2. The supporting documents “EU_02(Path1)_04” and “EU_02(Path2)_03” have been streamlined. 3. A remark has been added to clarify that the summary tables EU_P1&02(Path2)_Appendix B3-B4 need not to be resubmitted if they have already been submitted in EU P1.
EU 3	Credits Attainable	1. Revised to 3 + 1 additional BONUS.
EU 3	Credit Requirement	**Option 2: Based on EU 2 Prescriptive Path** 1. The benchmarking criteria have been updated and 1 additional BONUS credit has been added for prescriptive path compliance.
EU 3	Assessment	**Option 1: Based on EU 2 Performance Path** 1. The requirements for the “Building Peak Electricity Demand Report” have been replaced by the “Building Energy Performance Assessment Report”, which is a collaborative report to substantiate the compliance of both EU 2 Option 1 (Performance Path) and EU 3 Option 1 (Performance Path). **Option 2: Based on EU 2 Prescriptive Path** 2. The requirement for “EU 3 achievement summary report” has been removed.
EU 3	Submittals	1. The supporting documents “EU_03(Path1)_01“ to “EU_03(Path1)_04” and “EU_03(Path2)_01” to “EU_03(Path2)_03” have been removed. 2. A remark has been added to clarify that the submittals need not to be resubmitted if they have already been submitted in EU 2.
EU 4	Extent of Application	1. The Extent of Application under EU 4b has been revised to “Non-residential buildings/ portions with tenanted areas”

Credit	Section	Amendment
EU 4	Assessment	**(a) Fundamental Metering and Monitoring** *1. Metering Coverage* 1. The requirements have been refined. 2. The energy monitoring provision has been clarified that it shall cover energy consumption (in kWh) or electricity demand (in kW) of the equipment. 3. The requirements for plumbing & drainage system have been clarified. 4. The requirements of drawings have been clarified and stated in clause 1.5. **(b) Metering for Tenanted Area** 5. The requirements of drawings have been clarified. 6. The monitoring provision has been clarified that it shall be capable to record electricity consumption (in kWh) or electricity demand (in kW) of the equipment. 7. The paragraphs have been rearranged to clarify the assessment criteria.
EU 4	Submittals	**(a) Fundamental Metering and Monitoring** 1. The requirements for the supporting documents have been clarified and streamlined. 2. The supporting documents "EU_04a_08" and "EU_04a_09" have been added. **(b) Metering for Tenanted Area** 3. The requirements for the supporting documents have been clarified and streamlined. 4. The "Contractually Binding Lease Document" has been clarified for Compliance Path 2 only.
EU 5	Assessment	**(a) Solar Energy Feasibility Study** 1. Notes have been added to clarify the supporting documents for feasibility study. 2. The requirements for economic study/ calculation of payback period for PV system have been removed. **(b) On-site Renewable Energy Application** 3. The phrase "annual energy generated by on-site renewable energy systems" has been revised to "Annual Energy Yielded from Renewable Energy Applications on Site". 4. The requirements on "Annual Energy Yielded from Renewable Energy Applications on Site" and "Annual Energy Use" have been clarified. 5. The requirements for biofuel application have been clarified.
EU 5	Submittals	**(b) On-site Renewable Energy Application** 1. The supporting document for biofuel application has been clarified.

Credit	Section	Amendment
EU 6	Extent of Application	1. The extent of application for EU 6b has been revised to “All buildings using variable refrigerant flow (VRF) units, window or split-type air conditioners as major source of air conditioning and installed by the project owner.”
EU 6	Assessment	**(a) Compliance with Manufacturer’s Recommendation** 1. The requirements on “For Projects providing AC platform but AC unit is not installed” have been streamlined. 2. The assessment criteria for Projects providing AC platform but without design provision of air-conditioning units have been clarified.
EU 6	Submittals	**(a) Compliance with Manufacturer’s Recommendation** 1. The submittal requirements on “EU_06a_03” for commitment of the credit compliance have been clarified. 2. The supporting document “EU_06a_04” for AC units installed by tenants has been removed. 3. The submittal requirements for “Projects providing AC platform, but AC unit is not installed” have been clarified.
EU 7	Extent of Application	1. The extent of application has been elaborated.
EU 7	Assessment	1. The credit applicability has been clarified.
EU 8	Extent of Application	1. The extent of application has been elaborated.
EU 8	Assessment	1. The credit applicability has been clarified. 2. The name of appliances has been aligned according to the current EMSD Energy Efficiency Labelling Scheme.
EU 8	Submittals	1. The supporting documents “EU_08_02” and “EU_08_03” have been revised to align with WU 3.
-	Appendix 9.2	1. The phrases “latest edition of BEC”/ “latest BEC” have been revised to “applicable edition of BEC”. 2. The requirements for projects adopting 2022 edition RTTV have been included in baseline case of “Building Envelope”. 3. The baseline case requirement of lighting installation for space not exceeding 70W has been clarified. 4. The requirements for lift regenerative braking control have been included in baseline case of “Lift and Escalator System”. 5. The requirements on HVAC system have been refined. 6. The phrase “Ventilation System” has been revised to “Carpark Ventilation System”. 7. Table-App 4 Default Operation Schedule for Calculation has been revised.

1.3 Summary of Credits

	Section	Credit Requirement	Extent of Application	Credit
2	**Integrated Design and Construction Management (IDCM)**			
IDCM 4	Life Cycle Costing	1 credit for conducting life cycle costing for active systems.	All buildings	1
IDCM 5	Commissioning	2 credits for the appointment of Commissioning Authority (CxA) as described in part (a) and providing a Commissioning Plan as described in part (b). 2 additional credits for conducting a Commissioning Review as described in part (c) and providing Commissioning Reports as described in part (d).	All buildings	4
IDCM 11	Building Management Manuals	1 credit for providing a fully documented Operations and Maintenance Manual and Energy Management Manual.	All buildings	1
IDCM 12	Operator Training plus Chemical Storage and Mixing Room	1 credit for providing training for operations and maintenance staff to the minimum specified; and demonstrating that adequate maintenance facilities are provided for chemical storage and mixing.	All buildings	1
IDCM 13	Digital Facility Management Interface	1 BONUS credit for providing a digital interface in addition to the project design metering provision for future facility management team to review the building operation performance.	Non-residential buildings/ portions or common areas of residential buildings/ portions	1 BONUS
IDCM 14	Occupant Engagement Platform	1 BONUS credit for providing a digital platform to engage building occupants.	Non-residential buildings	1 BONUS

	Section	Credit Requirement	Extent of Application	Credit
5	**Energy Use (EU)**			**31 + 18 BONUS**
EU P1	Minimum Energy Performance	Demonstrate performance improvement against the applicable edition of Building Energy Code (BEC). For Prescribed Buildings under Buildings Energy Efficiency Ordinance (BEC Governing Buildings): Referring to the applicable edition of BEC, demonstrate that performance improvement is achieved for the project in both of the following building services systems: 1. Improve 2% of code specified minimum coefficient of performance (COP) for air-conditioning equipment and/ or minimum cooling seasonal performance factor (CSPF) for room air-conditioner; and 2. Reduce 3% of code specified maximum allowable lighting power density for lighting installation. For Buildings where Buildings Energy Efficiency Ordinance does NOT apply (Non-BEC Governing Buildings): All Non-BEC governing building are required to demonstrate their compliance with the applicable edition of BEC in both of the following building services systems: 1. Code specified minimum coefficient of performance (COP) for air-conditioning equipment and/ or minimum cooling seasonal performance factor (CSPF) for room air-conditioner; and 2. Code specified maximum allowable lighting power density for lighting installation. For Projects that consist of both BEC Governing Buildings and Non-BEC Governing Buildings: Each building within the Project must adhere to the respective requirements based on its governing status.	All buildings	Required

	Section	Credit Requirement	Extent of Application	Credit
EU 1	Low Carbon Passive Design	Passive designs that can reduce building HVAC load, facilitate natural ventilation, and maximise daylight will be rewarded in this credit under either Prescriptive Path or Performance Path. Option 1: Prescriptive Path (1-4 Credits + 1 additional BONUS) 4 credits for incorporating any 4 of the passive design strategies listed below, 1 credit for each strategy: 1. Optimum Spatial Planning 2. External Overhangs 3. Vegetated Building Envelope 4. Cross Ventilation Provision (Normally Occupied Space) 5. Cross Ventilation Provision (Not Normally Occupied Space) 6. Daylight Provision 1 additional BONUS credit for incorporating ALL the above listed passive design strategies. Option 2: Performance Path (1-6 Credits) HVAC Load Reduction 1. Built Form and Orientation 1 credit for reducing building envelope load of a designed building from a hypothetic building with a different built form and/ or at least 22.5° difference in orientation with justification by simulation. 2. Optimum Spatial Planning 1 credit for demonstrating consideration of optimum spatial planning to enhance energy conservation with justification by simulation. 3. External Shading Devices 1 credit for the provision of fixed or movable external shading devices, in the form of vertical or horizontal sun shading feature with justification by simulation.	All buildings	6 + 1 additional BONUS

	Section	Credit Requirement	Extent of Application	Credit
		4. Vegetated Building Envelope 1 credit for the provision of vegetated building envelope with justification by calculation. <u>Natural Ventilation</u> 5. Space Layout for Natural Ventilation 1 credit for demonstrating that project space (both normally occupied space and not normally occupied space) is designed to facilitate the utilisation of natural ventilation with justification by simulation. <u>Daylight</u> 6. Space Layout for Daylight Penetration 1 credit for demonstrating that the space is well-lit by daylight and reduce occupants' dependency on artificial lighting with justification by simulation method.		
EU 2	Reduction of CO_2 Emissions	<u>Option 1 – Performance Path (1-10 Credits + 5 additional BONUS)</u> Demonstrate a percentage of reduction on annual CO_2 emission of the proposed building performance compared with the baseline case performance. 1 to 10 credits for annual CO_2 emission reduction from 1% to 19% for project adopting BEC 2018 as benchmarking criteria; or 2 to 10 credits for annual CO_2 emission reduction from 1% to 17% for project adopting BEC 2021 as benchmarking criteria. 1 to 5 additional BONUS credits for annual CO_2 emission reduction from 21% to 29% for project adopting BEC 2018 as benchmarking criteria, or from 19% to 27% for project adopting BEC 2021 as benchmarking criteria. <u>Option 2 – Prescriptive Path (1-7 Credits + 8 additional BONUS)</u> 1 to 7 credits plus 8 additional BONUS credits for demonstrating a prescriptive compliance in below listed item.	All buildings	10 + 8 additional BONUS

	Section	Credit Requirement	Extent of Application	Credit
		1. Passive Building Design Enhancement Residential buildings and non-residential buildings should follow different requirements. For buildings consist of both residential and non-residential portions, demonstrate the compliance for the corresponding requirements for residential and non-residential portions respectively as listed below. 1.1. Building Envelope 1.2. Natural Ventilation 2. Active Building Design Improvement Demonstrate further performance improvement as compared with the applicable edition of the Building Energy Codes (BEC). 2.1. Air-conditioning Installation 2.2. Lighting Installation 2.3. Lift and Escalator Installation		
EU 3	Peak Electricity Demand Reduction	Option 1 - Based on EU 2 Performance Path (1-3 Credits) 1 to 3 credits for reducing the peak electricity demand by 5% to 15%. Option 2 - Based on EU 2 Prescriptive Path (1-2 Credits + 1 additional BONUS) 1 credit when 4 credits are achieved in EU 2 (Prescriptive Path); 2 credits when 4 credits plus 2 additional BONUS credits are achieved in EU 2 (Prescriptive Path); or 2 credits plus 1 additional BONUS credit when 5 credits plus 4 additional BONUS credits are achieved in EU 2 (Prescriptive Path).	All buildings	3 + 1 additional BONUS
EU 4	Metering and Monitoring	(a) Fundamental Metering and Monitoring 1 credit for providing energy monitoring system for equipment and systems in spaces. 1 BONUS credit for providing performance auditing monitoring system for equipment and systems in spaces.	Part (a): All non-residential buildings/ portions or common areas of residential buildings/ portions Part (b): Non-	1 + 2 BONUS

	Section	Credit Requirement	Extent of Application	Credit
		(b) Metering for Tenanted Area 1 BONUS credit for allowing monitoring provision of tenants' energy consumption.	residential buildings/ portions with tenant areas	
EU 5	Renewable and Alternative Energy Systems	(a) Solar Energy Feasibility Study 1 credit for evaluating the building roof's potential in harnessing solar energy. (b) On-site Renewable Energy Application 1 to 5 credits plus 5 additional BONUS credits for using on-site renewable energy systems to offset annual building energy consumption from 0.2% to 2%.	All buildings	6 + 5 additional BONUS
EU 6	Air-Conditioning Units	(a) Compliance with Manufacturer's Recommendation 1 credit for complying with manufacturer's recommended installation positions for optimal heat rejection. (b) Performance Verification 1 credit for demonstrating the operating temperatures of all variable refrigerant flow (VRF) units, window type, split-type or packaged type air-conditioning units do not exceed manufacturer's recommendation for the specified COP in the manufacturer's technical specifications via computational simulation techniques.	Part (a): All buildings using variable refrigerant flow (VRF) units, window or split-type air conditioners as major source of air conditioning Part (b): All buildings using variable refrigerant flow (VRF) units, window or split-type air conditioners as major source of air conditioning and installed by the project owner	2

	Section	Credit Requirement	Extent of Application	Credit
EU 7	Clothes Drying Facilities	(a) Provision of Clothes Drying Facilities 1 credit for providing clothes drying facilities for all residential units under suitable location conditions. (b) Demonstration of Effectiveness 1 BONUS credit for demonstrating the effectiveness of clothes drying facilities via computational analysis.	Residential buildings, exclusively for those specified under "Assessment"	1 + 1 BONUS
EU 8	Energy Efficient Appliances	1 credit when 60% of total rated power of appliances are certified energy efficient products. 2 credits when 80% of total rated power of appliances are certified energy efficient products.	Residential buildings and hotel, exclusively for those specified under "Assessment"	2

2 Integrated Design and Construction Management

2.1 Integrated Design Process

IDCM 4 Life Cycle Costing

Extent of Application All buildings

Objective Encourage the use of life cycle costing to facilitate investigation of potential design options, specifications, operation and maintenance.

Credits Attainable 1

Credit Requirement 1 credit for conducting life cycle costing for active systems.

Assessment

1. Conduct life cycle costing analysis with design options for each of the below active system, if present in the project construction scope:
   1.1. Hot water system;
   1.2. Interior lighting system; and
   1.3. Air-conditioning system.
2. The life cycle costing exercise can be non-discounted and should include the following costs:
   2.1. Acquisition (supply and installation costs);
   2.2. Operation (utilities); and
   2.3. Maintenance (replacements, planned maintenance and management costs).

   While developing design options, the applicant should consider different configurations and specifications, for example, initial costs, number of equipment units involved, equipment efficiency and lifespan, etc.
3. Indicate cost of each design option of active system over 20, 30, 40 and 50 years and highlight which design option will have the lowest life cycle cost at the 50th year.
4. Prepare a life cycle costing report including all the assumptions made and the results of life cycle costing.
5. Substantiate the costs with catalogues, suppliers' recommendations or quotation. Cost approximations suggested by Quantitative Surveyor are also accepted. No professional life cycle costing software is required for this study.
6. Note that the costing exercise imposes no obligation for implementation but encourages consideration of the costs of systems throughout their life cycle.
7. The Life Cycle Costing Report should include at least the below items with a minimum of 8 A4 pages:
   7.1. Executive summary;
   7.2. Project description with construction scope;
   7.3. System options to be considered;

7.4. Life cycle costing and analysis; and

7.5. Conclusion.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
IDCM_04_00	BEAM Plus NB submission template for IDCM 4	✓	✓	✓
IDCM_04_01	Life Cycle Costing Report	✓	✓	✓

Remarks

(a) Additional Information

ISO 15686-5:2008 Buildings & constructed assets – Service-life planning – Part 5: Life-cycle costing

(b) Related Credit

None

2 Integrated Design and Construction Management

2.1 Integrated Design Process

IDCM 5 Commissioning

Extent of Application All buildings

Objective Ensure the building systems perform as design specified and buildings operate as design intended.

Credits Attainable 4

Credit Requirement 2 credits for the appointment of Commissioning Authority (CxA) as described in part (a) and providing a Commissioning Plan as described in part (b).

2 additional credits for conducting a Commissioning Review as described in part (c) and providing Commissioning Reports as described in part (d).

Assessment

(a) Engage Commissioning Authority (CxA)

1. Identify a Chartered Engineer, Registered Professional Engineer, Member of HKIE (under the discipline of building services, mechanical, electrical, energy or environmental), ASHRAE BCxP as the CxA.

2. The CxA should have the proper experience and credentials including adequate expertise in the commissioning of electrical and mechanical systems, equipment and components to develop and implement effective commissioning.

3. The CxA should have direct experience with at least two similar projects and must have been involved before the start of schematic design stage to countercheck that the systems will meet the design intents.

4. The CxA must not be responsible for any aspect of the project design, construction or installation of any building services installations of the project.

5. The CxA must not be an employee of the design firm.

6. The CxA must not be an employee of, or contracted through, a contractor or construction manager dealing with construction contracts. For design and build projects, the owner should directly employ the CxA.

7. The CxA may be a qualified employee or consultant of the owner.

8. The CxA shall be responsible for the following:

   8.1. Report all conditions and findings immediately and directly to the Client;

   8.2. Review and approve commissioning specifications;

   8.3. Develop a commissioning plan;

   8.4. Facilitate and ultimately oversee the commissioning process for all systems to be commissioned; and

   8.5. Document whether systems, equipment and components are functioning in accordance with the design intent and in accordance with the construction documents.

9. There can only be one CxA responsible for the testing and commissioning works for each project. If there are changes in CxA during the design and construction timeline, the Applicant should make reasonable effort in ensuring that there is a seamless transfer of testing and commissioning tasks between the old and the new CxA and to ensure that the new CxA confirms that the project complies with all testing and commissioning requirements.

   The new CxA shall fulfil the requirements as stipulated in Clause 1 to 8, except the involvement before the start of schematic design stage.

   Organisation Chart of the project team showing the involvement of the new CxA's with a brief description of the commissioning tasks; as well as CV of the new CxA to demonstrate the adequate expertise shall be submitted for review.

(b) Develop Commissioning Plan

1. Establish a preliminary Commissioning Plan by the CxA to outline the scope of commissioning and systems to be tested.

2. Project roles and responsibilities, the commissioning team's project directory, and schedule of commissioning activities should all be included in the commissioning plan.

3. The Commissioning Plan is a living document that is updated throughout the life of the project and will become the basis for the final commissioning report.

4. The Commissioning Plan should include the following contents:
   - 4.1. Goals and objectives;
   - 4.2. General project information;
   - 4.3. Systems to be commissioned;
   - 4.4. Description of the commissioning team, including team members, roles and responsibility;
   - 4.5. Description of the commissioning team's communication protocol, coordination, meetings and management;
   - 4.6. Development of functional test procedures for the following applicable system(s):
     - 4.6.1. HVAC&R system and associated controls;
     - 4.6.2. Electrical System, including light and daylighting controls;
     - 4.6.3. Plumbing and Drainage System;
     - 4.6.4. Lift and escalator system;
     - 4.6.5. Domestic hot water system (including swimming pool if heating is provided); and
     - 4.6.6. Renewable energy system;
   - 4.7. Verification of system performance;
   - 4.8. Reporting deficiencies and the resolution process; and
   - 4.9. Acceptance of the building systems.

(c) Commissioning Review

1. The CxA shall conduct commissioning reviews and confirm the following:

   1.1. Commissioning requirements of the building systems have been included in the design and incorporated into the construction documents, method statement and Testing and Commissioning (T&C) checklist; and

   1.2. Commissioning specifications have been provided to inform the contractors and/ or sub-contractors of their roles and responsibilities throughout the commissioning process.

2. A confirmation letter with endorsement from CxA shall be provided to confirm commissioning reviews have been conducted.

(d) Commissioning Report

1. After all commissioning tasks except seasonally deferred commissioning have been completed, the Commissioning Report(s) with all the approved checklists and endorsement from CxA shall be provided.

2. The Commissioning Report should include the following contents:

   2.1. Executive summary of commissioning process and results, system deficiencies identified and resolutions, outstanding issues identified.

   2.2. List of participants and their respective roles;

   2.3. Brief building description;

   2.4. Commissioning process scope;

   2.5. Installation verification checklist;

   2.6. List of systems commissioned;

   2.7. Equipment documentation;

   2.8. Functional performance tests including date and time of test, individuals present during testing, visual inspection observations, sensor checks, device checks, operating mode tests and results;

   2.9. List of outstanding commissioning issues and any testing that is scheduled on a later date; and

   2.10. All outstanding deficiencies identified during or as a result of commissioning activities should be listed and highlighted.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
IDCM_05_00	BEAM Plus NB submission template for IDCM 5	✓	✓	✓
For IDCM 5a & 5b, please provide the following:		**PA**	**CA**	**FA/ RFA**
IDCM_05_01	**/**	**/**	**/**	**/**
IDCM_05_02	Organisation Chart of the project team showing CxA's involvement with a brief description of the commissioning tasks	✓	✓	✓
IDCM_05_03	CV of CxA to demonstrate adequate expertise of the CxA	✓	✓	✓
IDCM_05_04	Commissioning Plan meeting the requirements in part (b) items 4.1 to 4.9 of the assessment criteria with endorsement by CxA	✓	✓	✓
IDCM_05_08	Undertaking letter from the Project's CxA confirming his/ her involvement before the start of schematic design stage, duties and responsibilities for the testing & commissioning process	✓	✓	✓
For IDCM 5c & 5d, please provide the following:		**PA**	**CA**	**FA/ RFA**
IDCM_05_05	Commissioning Specifications • detailing the commissioning requirements for each system and equipment; and • on the provision of commissioning report meeting the requirements in part (d) items 2.1 to 2.10 of the assessment criteria	✓	-	-
IDCM_05_06	Confirmation letter from the Project's CxA confirming commissioning reviews have been conducted in accordance with part (c) of the assessment criteria	-	-	✓
IDCM_05_07	Endorsed Commissioning Report by CxA to demonstrate all commissioning tasks fulfilling part (d) of the assessment criteria	-	-	✓

Remarks

(a) Additional Information

Chartered Institution of Building Services Engineers (CIBSE) – CIBSE Commissioning Code A: Air distribution systems.

Chartered Institution of Building Services Engineers (CIBSE) – CIBSE Commissioning Code W: Water distribution systems.

Chartered Institution of Building Services Engineers (CIBSE) – CIBSE Commissioning Code C: Automatic controls.

Building Services Research and Information Association (BSRIA) – Commissioning Air Systems. Application procedures for buildings (AG 3/89.3).

American Society of Heating, Air-conditioning, and Refrigerating Engineers (ASHRAE) – Standard and Guidelines on Commissioning Essentials.

Architectural Services Department (ArchSD) – Testing and Commissioning Procedure. [ONLINE]. Available at: https://www.archsd.gov.hk/en/publications-publicity/testing-commissioning-procedure.html [Accessed Jun 2024].

(b) Related Credit

None

2 Integrated Design and Construction Management

2.2 Green Construction Practices

IDCM 11 Building Management Manuals

Extent of Application All buildings

Objective Encourage the provision of a fully documented operations and maintenance manual to enable building operators to implement the design intent and a fully documented energy management manual containing instructions that enables systems to operate at a high level of energy efficiency.

Credits Attainable 1

Credit Requirement 1 credit for providing a fully documented Operations and Maintenance Manual and Energy Management Manual.

Assessment

1. Operations and Maintenance Manual (O&M Manual)

1.1. The O&M Manual shall include all of the following:

1.1.1. The design intent;

1.1.2. The basis of design; and

1.1.3. Full sequences of operation for all equipment and systems, including HVAC&R system and associated controls; electrical system including light and daylighting controls; plumbing and drainage system; lift and escalator system; domestic hot water system (including swimming pool if heating is provided), and renewable energy system, where applicable; all of which must meet the legal requirements and industry wide standards.

1.2. The description of the design intent shall include all of the following:

1.2.1. Space temperature and humidity criteria;

1.2.2. Levels operator and/ or occupant control over HVAC systems;

1.2.3. Ventilation requirements and related indoor air quality criteria;

1.2.4. Performance criteria related to energy efficiency;

1.2.5. Environmental responsiveness of the facility; and

1.2.6. Commissioning criteria.

1.3. The basis of design shall include all of the following:

1.3.1. Details of occupancy;

1.3.2. Space activity and any process requirements;

1.3.3. Applicable regulations, codes, and standards;

1.3.4. Design assumptions;

1.3.5. Performance standards and benchmarks; and

1.3.6. Control system appropriate for the skill of the operations and maintenance staff.

1.4. The O&M Manual must include for each piece of equipment and each system:

1.4.1. The name and contact information of the manufacturer or vendor and installing contractor;

1.4.2. Submittal data; and

1.4.3. Operations and maintenance instructions with the models and features for the subject site clearly marked.

1.5. The O&M Manual shall include only data for equipment that is actually installed, and include the following:

1.5.1. Instructions for installation, maintenance, replacement, start-up;

1.5.2. Special maintenance requirements and sources for replacement parts/ equipment;

1.5.3. Parts list and details of any special tooling requirements;

1.5.4. Performance data; and

1.5.5. Warranty information.

1.6. The O&M Manual shall include an as-built documentation package for controls covering all of the following:

1.6.1. Control drawings and schematics;

1.6.2. Normal operation;

1.6.3. Shutdown;

1.6.4. Unoccupied operation;

1.6.5. Seasonal changeover;

1.6.6. Manual operation;

1.6.7. Controls set-up and programming;

1.6.8. Troubleshooting;

1.6.9. Alarms; and

1.6.10. Final sequences of operation.

1.7. The O&M Manual shall be approved by the client's representative and/ or MEP consultant confirming that the manual has been finalised and accepted. Supporting documents such as approval records with the manual attached or endorsed manual shall be provided.

2. Energy Management Manual (EMM)

2.1. The EMM for all energy-related systems shall include the following:

2.1.1. Descriptions of the final design intent and basis of design, including brief descriptions of each system;

2.1.2. Final sequences of operations for all equipment;

2.1.3. Procedures for seasonal start-up and shutdown, manual and restart operation;

2.1.4. As-built control drawings;

2.1.5. For all energy-saving features and strategies, rationale description, operating instructions, and caveats about their function and maintenance relative to energy use;

2.1.6. Recommendations and brief method for appropriate accounting of energy use of the whole building;

2.1.7. Specifications of re-calibration frequency of sensors and actuators by type and use;

2.1.8. Recommendations for continuous commissioning or recommended frequency for re-commissioning by equipment type, with reference to tests conducted during initial commissioning;

2.1.9. Recommendations regarding seasonal operational issues affecting energy use;

2.1.10. List of all user-adjustable set points and reset schedules, with a discussion of the purpose of each and the range of reasonable adjustments with energy implications;

2.1.11. Schedules of frequency of reviewing the various set points and reset schedules to ensure that they are still near optimum;

2.1.12. List of time-of-day schedules and a frequency of reviewing them for relevancy and efficiency;

2.1.13. Guidelines for establishing and tracking benchmarks for building energy use and primary plant equipment efficiencies;

2.1.14. Guidelines for ensuring that future renovations and equipment upgrades will not result in decreased energy efficiency and will maintain the design intent;

2.1.15. List of diagnostic tools, with a description of their use, that will assist facility staff of the building in operating equipment more efficiently;

2.1.16. A copy of the commissioning report; and

2.1.17. Index of all commissioning documents with notation of their location.

2.2. The EMM shall be approved by the client's representative and/ or MEP consultant confirming that the manual has been finalised and accepted. Supporting documents such as approval records with the manual attached or endorsed manual shall be provided.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
IDCM_11_00	BEAM Plus NB submission template for IDCM 11	✓	✓	✓
IDCM_11_01	Owner's requirements/ specification on provision of O&M Manual for all applicable equipment and systems	✓	-	-
IDCM_11_02	Operations and Maintenance Manual adequately cover the major energy consuming building services systems and equipment where the manual includes the details given in the assessment criteria; and Supporting documents such as approval records with the manual attached or endorsed manual	-	-	✓
IDCM_11_03	Owner's requirements/ specification on the provision of Energy Management Manual for all energy-related systems	✓	-	-
IDCM_11_04	A dedicated Energy Management Manual meeting the requirements as stipulated in the assessment criteria; and Supporting documents such as approval records with the manual attached or endorsed manual	-	-	✓

Remarks

(a) Additional Information

American Society of Heating, Air-conditioning, and Refrigerating Engineers (ASHRAE) – ASHRAE Guideline 4-2008: Preparation of Operating and Maintenance Documentation for Building Systems.

Building Services Research and Information Association (BSRIA) – Operating and Maintenance Manuals for Building Services Installations (AG 1/87).

(b) Related Credit

None

2 Integrated Design and Construction Management

2.2 Green Construction Practices

IDCM 12 Operator Training plus Chemical Storage and Mixing Room

Extent of Application All buildings

Objective Encourage the provision of training for operations and maintenance staff to the minimum specified and demonstrate adequate maintenance facilities are provided for chemical storage and mixing.

Credits Attainable 1

Credit Requirement 1 credit for providing training for operations and maintenance staff to the minimum specified; and demonstrating that adequate maintenance facilities are provided for chemical storage and mixing.

Assessment

(a) Operator Training

1. The training should be carried out for the appointed Facilities Management Team or client representatives.

2. The training materials may cover the recommended items listed below:

   2.1. General purpose of each building system including basic theory of operation, capabilities and limitations, and modes of control and sequences of operation;

   2.2. Review of control drawings and schematics;

   2.3. Procedures for start-up, shutdown, seasonal changeover, normal operation, unoccupied operation and manual operation;

   2.4. Controls set-up and programming;

   2.5. Troubleshooting;

   2.6. Alarms;

   2.7. Interactions with other systems;

   2.8. Operational monitoring and record keeping requirements, and the use of data for analysing system performance;

   2.9. Adjustments and optimising methods for energy conservation;

   2.10. Any relevant health and safety issues;

   2.11. Inspection, service, and maintenance requirements for each system, including any need for specialised services;

   2.12. Sources for replacement parts/ equipment; and

   2.13. Any tenant interaction issues.

3. The demonstration portion of the training materials may include the following:

   3.1. Typical operation examples of each system;

   3.2. Start-up and shutdown procedures;

   3.3. Operation under all specified modes of control and sequences of operation;

   3.4. Procedures under emergency or abnormal conditions; and

3.5. Procedures for effective operational monitoring.

4. Verify that the training of the building's operations and maintenance staff was undertaken for all commissioned systems and major equipment, using the operations and maintenance manual, and the energy management manual as the basis for the training.

5. A permanent room for training is not necessary. Evidence of carrying out operator training (e.g. record of attendance) is required.

(b) Chemical Storage and Mixing Room

1. A chemical storage area and/ or a chemical mixing area should be provided for the project development, for the purpose of housekeeping and/ or mixing of chemical products that create odour during their mixing processes. Chemical products include HVAC and cleaning relates (e.g. refrigerants, cleansing chemicals) for all building's future operations and maintenance items and equipment.

2. The following table sets out the buildings required to provide chemical storage and/or chemical mixing provision;

Parts of the building	Type of A/C System	Requires Chemical Storage Area	Requires Chemical Mixing Area
Domestic[1, 2]	Window-type units	×	×
	Split-Type/ VRF system without fresh air provisions	×	×
	Split-Type/ VRF system with fresh air provisions (including DX-PAU and fresh air processing units)	×	×
Non-Domestic[3]	HVAC plant[4] installed within the assessment boundary	✓	✓
	District cooling system or chiller plant installed outside of the assessment boundary	✓	×
	Split-Type/ VRF system without fresh air provisions	✓	×
	Split-Type/ VRF system with fresh air provisions (including DX-PAU and fresh air processing units)	✓	×

Note:

[1] Domestic refers to the part of a composite building that is constructed or intended for habitation. This may include residential flats and dormitories.

[2] The requirement on chemical storage area and chemical mixing area is exempted for the domestic parts of the building given that the habitant will be responsible for the operations and maintenance of their personal domestic space.

[3] Non-domestic refers to the part of a composite building that is constructed or intended for use otherwise than for habitation. This may include clubhouses, offices, hotel rooms, shopping arcade, cinema, common entrance.

[4] HVAC plant refers to HVAC related plant for cooling and/ or heating generation (e.g. chiller plant, heat pump plant, cooling tower plant, etc.)

3. No size requirement for the chemical storage area and/ or chemical mixing area.

4. Submit details in the form of drawings and a report with ventilation calculation [1] to demonstrate the compliance of the following functional requirements of chemical storage and/ or mixing provision where applicable:

   4.1. For chemical storage area

   A lockable room for cleansing services (e.g. janitor room, cleaner's store) or a lockable cabinet within an operations and maintenance facility [2, 3]

   4.2. For chemical mixing area

   An area within an operations and maintenance facility equipped with the following building services installation:

   a) Separate outside venting or exhaust route to centralised exhaust riser with non-return damper at the branched duct for the designated room; and maintain negative pressure with respect to adjacent spaces when the doors to the room are closed;

   b) Water supply point for mixing and diluting concentrated products; and

   c) Drainage point for the appropriate disposal of liquid waste products.

5. Co-location of chemical storage area and chemical mixing area in a single operation and maintenance facility is acceptable so long if all functional requirement has been fulfilled.

1 Ventilation calculation is only required for chemical mixing area serving by both exhaust air and fresh air equipment.

2 Operations and maintenance (O&M) facility refers to an indoor area having the function compatible to workshop, store room, chiller plant room or A/C plant room. Locations such as RS&MRC; refuse room; toilet; pipe duct; and plant rooms for electrical/ ELV/ fire services are not appropriate for chemical storage.

3 For project developments which only require to provide chemical storage areas and without the O&M facility mentioned in footnote 2, the Applicant can propose other O&M facility such as plant rooms for plumbing and drainage system, maintenance office, etc.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
IDCM_12_00	BEAM Plus NB submission template for IDCM 12	✓	✓	✓
For (a) Operator Training, please provide the following:		**PA**	**CA**	**FA/ RFA**
IDCM_12_01	Owner's requirements/ specification on the provision of training materials and records of operator training	✓	-	-
IDCM_12_02	Copies of training materials (e.g. presentation materials, training manual, operations and maintenance manual, energy management manual etc.) which may cover the recommended items listed in the assessment criteria	-	-	✓
IDCM_12_03	Evidence of operator training (e.g. sample record of attendance) verifying that training of the building's operations and maintenance staff was undertaken for all commissioned systems and major equipment, using the operations and maintenance manual, and the energy management manual as the basis for the training	-	-	✓
For (b) Chemical Storage and Mixing Room, please provide the following:		**PA**	**CA**	**FA/ RFA**
IDCM_12_04	Plumbing and drainage drawing(s) to show the required water supply point and drainage point are provided in the chemical mixing area (if applicable)	✓	✓	✓
IDCM_12_05	MVAC drawing(s) and calculation demonstrating that the designated room with chemical mixing area is equipped with the required ventilation provisions (if applicable)	✓	✓	✓
IDCM_12_06	Architectural drawing(s) to show the chemical storage area indicating the location of the lockable room/ lockable cabinet and/ or chemical mixing area (if applicable)	✓	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credit

None

2 Integrated Design and Construction Management

2.3 Smart Design and Technologies

IDCM 13 Digital Facility Management Interface

Extent of Application Non-residential buildings/ portions or common areas of residential buildings/ portions

Objective Encourage provision of digital interfaces to enable future facility management teams to review the building operation performance.

Credits Attainable 1 BONUS

Credit Requirement 1 BONUS credit for providing a digital interface in addition to the project design metering provision for future facility management team to review the building operation performance.

Assessment Develop and implement a digital interface for future facility management team to review data collected by the electricity metering system installed in the building. The assessment focuses on the interface provision for providing vision regarding operation characteristics. This is for future implementation of first class (Cat I) energy management opportunities (EMOs), with reference to the Code of Practice for Building Energy Audit [1]. Metering system design and hardware quality is not assessed in this credit.

The interface should be a provisional media, providing the information below for the future facility management team to review the building operation. The format and media used for the interface is not restricted provided the credit objectives are achieved by meeting the requirements below:

1. Providing charts and summaries for **hourly** data collected. **Minimum** data required should refer to below table.

Table IDCM13-1:

System (if applicable)	Datapoint for Performance Auditing
Outdoor Condition	• Air Temperature (°C) • Humidity (RH) (%) • Daylight (Lux)
Building	• Total Energy Use Intensity (kWh/m^2) [Daily, Monthly & Annual] • Total HVAC Energy Use Intensity (kWh/m^2) [Daily, Monthly & Annual] • Total Lighting Energy Use Intensity (kWh/m^2) [Daily, Monthly & Annual]

1 Electrical and Mechanical Services Department (EMSD) – Code of Practice for Building Energy Audit

HVAC System	Each Equipment in HVAC (Water Side) - Chillers - Heat pumps - Pumps - Heat Rejection	• Electricity (kW or kWh) • Operation Hour • Supply & Return Water Temperature (°C) • Water Flow Rate (m^3/s)
	Each Equipment in HVAC (Water Side) - Absorption Chiller - Boiler	• Fuel (kW or kWh) • Operation Hour • Supply & Return Water Temperature (°C) • Water Flow Rate (m^3/s)
	Each Equipment in HVAC (Air Side) - Primary Air/ Air Handling Unit Fans - Return Air Fans - Free Cooling Fans	• Electricity (kW or kWh) • Operation Hour • Each Service Zone's Temperature (°C) • Supply & Return Air Temperature (°C) • Air Flow Rate (m^3/s)
	VRV and Unitary System	• Electricity (kW or kWh)
	Ventilation System - Carpark Ventilation - Toilet Ventilation (≥ 2.5kW each)	• Electricity (kW or kWh) • Operation Hour • CO/ NO_x Concentration Level (if applicable for carpark ventilation)
Lift and Escalator System	Each Lift and Escalator	• Electricity (kW or kWh)

2. Keeping inventories and records of the identified systems, including manuals, technical brochures indicating their configurations and characteristics.

3. Enabling a trend of total building electricity use reporting for the last 12 months.

4. Enabling a trend of total electricity costs reporting for the last 12 months.

5. As-built drawing and system schematic that shows the layouts of energy consuming equipment and systems, and drawings showing the layout of the building.

6. Providing Operations and Maintenance programmes that include the timing of major alterations, additions or replacements for the building.

Achievement of EU 4 is not required as the basic requirement in assessing this credit. The demonstration of the provision of the monitoring equipment for energy monitoring and/ or performance auditing is not required under the objective of this credit.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
IDCM_13_00	BEAM Plus NB submission template for IDCM 13	✓	✓	✓
IDCM_13_01	Technical specifications of the digital interface showing that it is capable of providing the information as prescribed in items 1 to 6 of the assessment criteria	✓	-	-
IDCM_13_02	/	/	/	/
IDCM_13_03	Operation Manual or other evidence (e.g. approved contractor's submission with technical information) showing that the digital interface is capable of providing the information as prescribed in items 1 to 6 of the assessment criteria	-	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credit

This credit may act as a platform gathering and processing the data collected in EU 4 Metering and Monitoring.

In conjunction with IDCM 3c Design Consideration for Operation and Maintenance, it is recommended to consult the facility management team while specifying the document management system.

2 Integrated Design and Construction Management

2.3 Smart Design and Technologies

IDCM 14 Occupant Engagement Platform

Extent of Application Non-residential buildings

Objective Encourage the provision of digital platforms to connect building occupants and the building status to drive behaviour change.

Credits Attainable 1 BONUS

Credit Requirement 1 BONUS credit for providing a digital platform to engage building occupants.

Assessment

1. Develop a digital platform for future occupants to understand the building status. The platform shall contain information to be reviewed by the respective occupant only. The digital platform should contain data referenced to EU 4 part (a) requirement and provide the following information:
   - 1.1. Description of green measures implemented in the building;
   - 1.2. Energy consumption in the occupants' respective leased spaces;
   - 1.3. Recommendations to conserve energy use in the building; and
   - 1.4. Healthy lifestyle tips.
2. The digital platform should be in a form of one of the following:
   - 2.1. Digital displays in at least one common area(s) accessible by all occupants;
   - 2.2. Mobile applications accessible by all occupants; or
   - 2.3. Web-based applications accessible by all occupants.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
IDCM_14_00	BEAM Plus NB submission template for IDCM 14	✓	✓	✓
IDCM_14_01	Technical specifications of the digital platform showing that it can provide the information as prescribed in the assessment criteria	✓	-	-
IDCM_14_02	Operation Manual or other evidence (e.g. approved contractor's submission with technical information) showing that the digital platform can provide the information as prescribed in the assessment criteria	-	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credit

This credit may act as a platform to present the data collected in EU 4 - Metering and Monitoring in a simple way for occupants to understand the building status.

1 Energy Use (EU)

5.P Prerequisite
5.1 Energy Use Reduction and Control
5.2 Renewable and Alternative Energy Generation
5.3 Energy Efficient Equipment

Introduction

Electricity generation accounts for around 60% of the total CO_2 emissions from energy use in Hong Kong. Buildings account for 90% of our electricity consumption. Ensuring buildings are designed for good energy performance is a key factor to the conservation of energy.

Power stations operate under licenses issued by the Director of Environmental Protection Department, requiring operators to employ the best practicable means to control the emissions to acceptable levels. However, there is a growth in demand which leads to an increasing power generation, transmission and distribution capacity, because of the use of air- conditioning where the buildings are responsible for much of the peak load in summer. Demand side management can reduce the rate of expansion of supply-side capacity.

5.P Prerequisite

EU P1 Minimum Energy Performance

Background

BEAM provides incentives to achieve energy performance better than the minimum requirements of building energy codes. Therefore, compliance with the up-to-date Building Energy Codes (BEC) is the mandatory requirement governing the energy performance of building services installations. This is taken as the energy performance prerequisite for BEAM certification.

5.1 Energy Use Reduction and Control

EU 1 Low Carbon Passive Design
EU 2 Reduction of CO_2 Emissions
EU 3 Peak Electricity Demand Reduction
EU 4 Metering and Monitoring

Background

The estimation of annual energy use and maximum electricity demand take into account the design improvements to the building envelope and the efficiency of building services systems including air-conditioning, lighting systems, electrical installations and equipment, etc. It shall cover all the aspects of energy use in buildings. BEAM Plus gives credit to additional measures that address further improvement in the building energy efficiency. Passive building design allows buildings to respond to the local climate and reduce the reliance on active means to satisfy human comfort, and therefore reduces energy consumption and the associated carbon dioxide emissions. This is particularly important for residential building and BEAM Plus has developed an alternative path to assess passive elements for residential buildings.

Through effective planning and architectural design, it is possible to improve building energy efficiency. As such, this section also assesses various strategies including building orientation, layout plan and external shading devices, etc.

Both **Prescriptive Path** and **Performance Path** are developed for EU 1, EU 2 and EU 3. Applicants can apply either path to suit the project's specific characteristics and externalities.

5.2 Renewable and Alternative Energy Generation

EU 5 Renewable and Alternative Energy Systems

Background

If energy consumption continues to increase at existing levels, projected carbon dioxide emissions generated by the year 2030 are expected to grow by more than 50% from the level in 2005. Effective use of renewable energy will reduce Hong Kong's reliance on fossil fuels and also our greenhouse gas emissions arising from the use of fossil fuels.

Although the large-scale application of renewable energy in buildings does not exist in Hong Kong, its wider use should be promoted in the interest of sustainable development. BEAM Plus credits award those meaningful installations that provide environmental benefits. The criteria for assessment have been set with reference to the percentage of the energy use in the assessed building that will be replaced by renewable sources. Furthermore, no distinction will be made on the selected means such as solar hot water systems, building integrated photovoltaic panels or wind turbines, etc. for substituting electricity or fuel by renewable energy. Hence, different or a combination of systems and equipment may be incorporated into a building.

5.3 Energy Efficient Equipment

EU 6 Air-Conditioning Units
EU 7 Clothes Drying Facilities
EU 8 Energy Efficient Appliances

Background

BEAM Plus gives credit to the designs that enhance the performance of equipment such as air-conditioning units. Likewise, the provisions of facilities/ equipment that improve energy performance are also encouraged. Provision of clothes drying facilities is a good practice for the unique high- rise and high-density urban context of Hong Kong. With the introduction of the Energy Efficiency Labelling Scheme by EMSD, it becomes easier for the developers to select energy efficient appliances in the market.

5 Energy Use **5.P Prerequisite**

EU P1 Minimum Energy Performance

Extent of Application All buildings

Objective To establish the minimum level of energy performance for the building services systems.

Credits Attainable Prerequisite

Credit Requirement Demonstrate performance improvement against the applicable edition of Building Energy Code (BEC).

For Prescribed Buildings under Buildings Energy Efficiency Ordinance (BEC Governing Buildings):

Referring to the **applicable** edition of BEC [1], demonstrate that performance improvement is achieved for the project in **both** of the following building services systems**:**

1. Improve 2% of code specified minimum coefficient of performance (COP) for air-conditioning equipment and/or minimum cooling seasonal performance factor (CSPF) for room air-conditioner; and
2. Reduce 3% of code specified maximum allowable lighting power density for lighting installation.

For Buildings where Buildings Energy Efficiency Ordinance does NOT apply (Non-BEC Governing Buildings):

All Non-BEC governing buildings are required to demonstrate their **compliance** with the **applicable** edition of BEC in both of the following building services systems:

1. Code specified minimum coefficient of performance (COP) for air-conditioning equipment and/or minimum cooling seasonal performance factor (CSPF) for room air-conditioner; and
2. Code specified maximum allowable lighting power density for lighting installation.

For Projects that consist of both BEC Governing Buildings and Non-BEC Governing Buildings:

Each building within the Project must adhere to the respective requirements based on its governing status.

** The applicable edition of BEC for a particular project shall be determined in accordance with the latest Circular Letter issued by BEAM Society Limited.*

1 Electrical and Mechanical Services Department (EMSD) – Code of Practice for Energy Efficiency of Building Services Installation [ONLINE]. Available at: https://www.emsd.gov.hk/beeo/en/mibec_beeo_codtechguidelines.html [Accessed Jun 2024].

Assessment

For Prescribed Buildings under Buildings Energy Efficiency Ordinance (BEC Governing Buildings):

1. **Air-conditioning Installation**

1.1. Provide a summary table of Energy Performance for Air-conditioning Installation to demonstrate the 2% performance improvement for EACH air-conditioning equipment and EACH room air-conditioner.

1.2. For EACH air-conditioning equipment, the COP improvement shall be compared against the corresponding minimum COP at cooling and/ or heating mode(s) at full load (and at the 75% of full load for chiller deploying variable speed drive) at specific standard rating condition specified under Section 6.12 of the applicable edition of BEC [1].

1.3. For EACH room air-conditioner (i.e. single package window type and wall mounted split type), the performance improvement should be compared against the applicable edition of the Code of Practice on Energy Labelling of Products ("the CoP"), under Mandatory Energy Efficiency Labelling Scheme (MEELS), Energy Efficiency (Labelling of Products) Ordinance (Cap. 598). The applicable edition of the CoP for a particular project shall refer to the latest Circular Letter issued by BEAM Society Limited.

1.4. The equipment efficiency of room air-conditioner equivalent to the Energy Efficiency Grade 2, under Mandatory Energy Efficiency Labelling Scheme (MEELS), Energy Efficiency (Labelling of Products) Ordinance (Cap. 598), using cooling seasonal performance factor (CSPF), Fcsp, shall be used as the basis for the comparison.

The benchmarking criteria for the room air-conditioners in the below table shall be adopted.

Type of air-conditioners	**CSPF, F_{csp} (2018 CoP)**	**CSPF, F_{csp} (2020/ 2023/ 2024 CoP)**
Single Package Type (Categories 1 - 2)	2.8	3.5
Split Type (Categories 3 - 4)	3.5	

1.5. Projects using district cooling system only, or projects without any air-conditioning installation or projects without any newly installed air-conditioning system, are not assessed under these criteria.

2. **Lighting Installation**

2.1. Provide a summary table of Energy Performance for Lighting Installation to demonstrate the 3% performance improvement of electrical power consumed by the lighting installation in whole building by area-weighted method compared against the applicable edition of BEC.

2.2. The lighting power density (LPD) for various types of spaces in baseline case should follow Section 5.4 of the applicable edition of BEC.

Area-weighted method:

Design Case:

$$\left(\frac{\sum[\text{LPD(Area A)} \times \text{Area A} + \text{LPD(Area B)} \times \text{Area B} + ...]}{\sum[\text{Area A} + \text{Area B} + ...]}\right)$$

Baseline Case:

$$\left(\frac{\sum[\text{BEC LPD(Area A)} \times \text{Area A} + \text{BEC LPD(Area B)} \times \text{Area B} + ...]}{\sum[\text{Area A} + \text{Area B} + ...]}\right)$$

$$\text{Lighting power reduction percentage} = \left(1 - \frac{\text{Design case}}{\text{Baseline Case}}\right) \times 100\%$$

2.3. For spaces where the total electrical power consumed by the lighting installations is less than 70W, an energy neutral approach shall be adopted, such that the LPD in the baseline case shall be the same as that in the design case.

2.4. For spaces where a lighting system neither exists nor is specified in a space (e.g. tenant area with lighting provision for occupation permit (OP) inspection only), the LPD in the design case shall be the same as that in the baseline case. unless a legally binding agreement is provided to substantiate the designed LPD.

2.5. For spaces that are NOT governed by the BEEO or without a suitable listed space type from the BEC, the LPD in the baseline case shall be the same as that in the design case.

2.6. Exclude those lighting installations as specified in Section 5.1.2 of the applicable edition of TG-BEC [2] in the calculation.

2.7. For residential buildings that are governed by BEEO, the LPD within a dwelling unit is excluded from the calculation.

For Buildings where Buildings Energy Efficiency Ordinance does NOT apply (Non-BEC Governing Buildings):

3. **Air-conditioning Installation**

3.1. Provide a summary table of Energy Performance for Air-conditioning Installation to demonstrate the performance compliance in percentage (%) for EACH air-conditioning equipment and EACH room air-conditioner.

3.2. The assessment criteria shall follow to Clause 1.2 to 1.5.

4. **Lighting Installation**

4.1. Provide a summary table of Energy Performance for Lighting Installation to demonstrate the performance compliance in percentage (%) of electrical power consumed by the lighting installation in whole building by area-weighted method compared against the applicable edition of BEC.

4.2. The assessment criteria shall follow to Clause 2.2 to 2.6.

2 Electrical and Mechanical Services Department (EMSD) – Technical Guidelines on Code of Practice for Energy Efficiency of Building Services Installation [ONLINE]. Available at: https://www.emsd.gov.hk/beeo/en/mibec_beeo_codtechguidelines.html [Accessed Jun 2024].

4.3. For residential buildings that are NOT governed by BEEO, the LPD within a dwelling unit in the baseline case shall be equal to the below:

- Bedroom: 13 W/m²
- Living Room/ Dining Room: 15 W/m²
- Kitchen: 13 W/m²
- Bathroom: 13W/m²

The LPD in the design case of the dwelling unit shall be the same as that in the baseline case, unless there is a completed lighting design within the dwelling unit, or a legally binding agreement is provided to substantiate the designed LPD.

For Projects that consist of both BEC Governing Buildings and Non-BEC Governing Buildings:

Each building within the project must adhere to the respective requirements based on its governing status.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
EU_P1_00	BEAM Plus NB submission template for EU P1	✓	✓	✓
EU_P1_01	Summary of Energy Performance for Air-conditioning Installation [EU_P1&02(Path2)_Appendix B3]; [and/ or] Summary of Energy Performance for Lighting Installation [EU_P1&02(Path2)_Appendix B4]	✓	✓	✓
EU_P1_02	Equipment schedule of Air-conditioning Installation highlighting the key performance data (e.g. rated capacity, rated COP at full load and 75% load (for VSD equipment), CSPF, etc.); and MVAC air-side and water-side (if applicable) schematic drawings	✓	✓	✓
EU_P1_03	Air-conditioning equipment specifications and/ or lighting specifications, highlighting the requirement on performance improvement/ compliance	✓	-	-

EU_P1_04	Technical data (e.g. catalogue) of air-conditioning equipment highlighting the key performance data (e.g. rated capacity, rated COP at full load and 75% load (for VSD equipment), CSPF, etc.); [and/ or] Lighting schedule with luminaire showing the key design information (e.g. installation location, type of light fitting, quantity, input wattage, control gear loss, etc.)	-	✓	✓
EU_P1_05	MVAC layout drawings [and/ or] Lighting layout drawings	-	✓	✓
EU_P1_06	/	/	/	/

Remarks

(a) Additional Information

Electrical and Mechanical Services Department (EMSD) – Code of Practice on Energy Labelling of Products [ONLINE]. Available at: https://www.emsd.gov.hk/energylabel/en/cop.html. [Accessed Jun 2024].

(b) Related Credit

None

5 Energy Use **5.1 Energy Use Reduction and Control**

EU 1 Low Carbon Passive Design

Extent of Application All buildings

Objective Passive building design allows buildings to respond to the local climate; reducing the reliance on active means to meet human comfort. This in turn reduces energy consumption and its associated carbon dioxide emissions.

Credits Attainable 6 + 1 additional BONUS

Credit Requirement Passive designs that can reduce building HVAC load, facilitate natural ventilation, and maximise daylight will be rewarded in this credit under **either** Prescriptive Path **or** Performance Path.

Option 1: Prescriptive Path (1-4 Credits + 1 additional BONUS)

4 credits for incorporating any 4 of the passive design strategies listed below, 1 credit for each strategy:

1. Optimum Spatial Planning
2. External Overhangs
3. Vegetated Building Envelope
4. Cross Ventilation Provision (Normally Occupied Space)
5. Cross Ventilation Provision (Not Normally Occupied Space)
6. Daylighting Provision

1 additional BONUS credit for incorporating ALL the above listed passive design strategies.

Option 2: Performance Path (1-6 Credits)

HVAC Load Reduction

1. Built Form and Orientation

1 credit for reducing building envelope load of a designed building from a hypothetic building with a different built form and/ or at least 22.5° difference in orientation with justification by simulation.

2. Optimum Spatial Planning

1 credit for demonstrating consideration of optimum spatial planning to enhance energy conservation with justification by simulation.

3. External Shading Devices

1 credit for the provision of fixed or movable horizontal/ vertical external shading devices, in the form of vertical or horizontal sun shading feature with justification by simulation.

4. Vegetated Building Envelope

1 credit for the provision of vegetated building envelope with justification by calculation.

Natural Ventilation

5. Space Layout for Natural Ventilation

1 credit for demonstrating that project space (both normally occupied space and not normally occupied space) is designed to facilitate the utilisation of natural ventilation with justification by simulation.

Daylight

6. Space Layout for Daylight Penetration

1 credit for demonstrating that the space is well-lit by daylight and reduce occupants' dependency on artificial lighting with justification by simulation method.

Assessment

Option 1: Prescriptive Path

Prepare a Passive Building Design Report with calculations, building elevations and drawings to demonstrate the compliance of each selected strategy.

1. Optimum Spatial Planning

Demonstrate the space planning complying with the following requirements:

1.1. For Non-open Planned Design

Demonstrate at least 20% of external wall of the building to be occupied by non-conditioned space for buildings where the developer/ owner has direct influence over the interior fit-out work for 50% or more of the identified non-conditioned occupied space.

1.2. For Open Planned Design

Demonstrate at least 5% of external wall of the building to be occupied by non-conditioned space for buildings where developer/ owner has direct influence over the interior fit-out work for less than 50% of the identified non-conditioned occupied space.

To document this strategy, for non-open planned and open-planned designs, the Passive Building Design Report should include the following information:

a) Building floor layout with indication on complied area;

b) Measurement of the perimeter length of the typical floor layout;

c) Measurement of the non-conditioned space external wall length;

d) Calculation of non-conditioned space external wall area; and

e) Summary table showing the percentage calculation.

2. External Overhangs

Demonstrate fixed or movable overhangs provided for project complying with the following requirement:

2.1. Incorporate external overhangs with depth that are >0.3 of window height on south orientated façade.

To document this strategy, the Passive Building Design Report should include the following information:

a) Façade design drawings with highlighted external overhangs; and

b) Drawings demonstrating that the depth of external overhangs from façade zone is >0.3 of window height.

3. Vegetated Building Envelope

Demonstrate greenery are provided for project envelope:

3.1. Demonstrate that the area of vegetation is at least 50% of the roof area of conditioned spaces. Roof of non-conditioned areas (e.g. mechanical plant rooms) does not count into the total roof area; OR

3.2. Demonstrate that the area of vegetation is at least 5% of the external wall area of conditioned spaces. External wall of non-conditioned spaces (e.g. mechanical plant rooms) does not count into the total external wall area.

3.3. Only permanent plantation is considered as vegetation area.

To document this strategy, the Passive Building Design Report should include the following information:

a) Drawings with highlighted indications that substantiate the area of vegetation on the roof area (or external wall area);

b) Drawings with highlighted indications that substantiate the roof area of conditioned space (or the external wall area of conditioned space);

c) Calculation for demonstrating the percentage of compliance; and

d) Maintenance contract or undertaking statement from Project Owner committing that landscape maintenance personnel/ company will be employed for the maintenance of building envelope vegetation.

4. Cross Ventilation Provision (Normally Occupied Space)

Demonstrate each normally occupied space in project is cross ventilated:

4.1. Provide cross ventilation for each normally occupied space of the building with reference to the cross-ventilation requirement stipulated in the latest edition of the Guidelines on Design and Construction Requirements for Energy Efficiency of Residential Buildings [1] (For 2014 edition, refer to Part 3.2 Cross Ventilation Requirement) (for residential buildings/ portions) OR ASHRAE Standard 62.1-2016 Section 6.4.2 [2] (for non-residential buildings/ portions).

To document this strategy, the Passive Building Design Report should include the following information:

a) Drawings of typical floors (or typical spaces design sections) showing the openable windows location and the cross-ventilation path;

b) Drawings illustrating natural ventilation; and

c) Calculation for demonstrating the compliance of minimum openable window area to floor area.

5. Cross Ventilation Provision (Not Normally Occupied Space)

5.1. Provide cross ventilation for each not normally occupied space (e.g. corridor, lobby) of the building with reference to the cross-ventilation requirement stipulated on ASHRAE Standard 62.1-2016 Section 6.4.2.

1 Buildings Department – PNAP APP-156 – Design and Construction Requirements for Energy Efficiency of Residential Buildings; Guideline on Design and Construction Requirements for Energy Efficiency of Residential Buildings 2014.

2 American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) – ANSI/ASHRAE Standard 62.1-2016 Ventilation for Acceptable Indoor Air Quality

To document this strategy, the Passive Building Design Report should include the following information:

a) Drawings of typical floors (or typical spaces design sections) showing the opening location and the cross-ventilation path;

b) Drawings illustrating natural ventilation assessment; and

c) Calculation for demonstrating the compliance of minimum openable area to space area.

6. Daylighting Provision

Demonstrate each normally occupied space is daylit:

6.1. Provide window for each normally occupied space with each window height > 50% of the corresponding normally occupied space depth.

To document this strategy, the Passive Building Design Report should include the following information:

a) Drawings of typical floors sections (or typical spaces design sections);

b) Drawings highlighting the height of windows;

c) Drawings highlighting the depth of normally occupied space; and

d) Calculation for demonstrating the percentage of compliance.

Option 2: Performance Path

Prepare a Passive Building Design Report to demonstrate the achievement of each selected passive design strategy with numerical supporting.

1. Built Form and Orientation

1.1. Conduct a building total energy analysis to demonstrate that the designed building has incorporated a better built form and/ or orientation. For built form, evaluation is carried out by demonstrating that a better built form is adopted for the designed building, comparing with a hypothetic building in a different built form. For orientation, evaluation is carried out by rotating the designed building to demonstrate a better orientation design is adopted. The selected baseline condition (hypothetic building) should be at least 22.5° different from the designed building in orientation. The hypothetic building should be a practical one, which should conform to the statutory requirements such as Building Ordinance and Town Planning Ordinance, that within the project site boundary after changing the built form and/ or rotation. A Passive Building Design Report should be provided to document the analysis and result.

To document this strategy, a Passive Building Design Report should include the following information:

a) A summary of simulation result;

b) Baseline case (hypothetic building) energy consumption;

c) Design case (designed building) energy consumption;

d) Demonstration (e.g. design drawings, perspective views from simulation models) of the orientation angle difference and/ or the difference in built forms between baseline case and design case;

e) Hourly data (i.e. 8,760 hours) of building energy consumption for both the baseline case and the design case; and

f) Input and output reports generated by the simulation software.

The simulation program used for energy modelling should meet the following criteria. Compliance review for below criteria is required only if the simulation software is not listed on Table 9.6 of applicable edition of Technical Guidelines on Code of Practice for Energy Efficiency of Building Services Installation.

a) Capable to perform hourly simulation (8,760 hours per year);

b) Capable to provide hourly variations in occupancy, lighting power, miscellaneous equipment power, thermostat setpoints, and HVAC system operation;

c) Capable to model 10 or more thermal zones;

d) Capable to model and simulate the thermal behaviour of a building and the interaction of its building fabric, air-conditioning, lighting and other relevant energy consuming equipment and systems;

e) Capable to perform design load calculations to determine the required air-conditioning equipment capacities and air and water flow rates for both the design case and baseline case building;

f) Capable to model part-load performance curves for mechanical equipment;

g) Capable to model capacity and efficiency correction curves for mechanical heating and cooling equipment; and

h) Capable to model air-side economisers with integrated control.

2. Optimum Spatial Planning

2.1. Demonstrate at least 20% of irradiation of building external wall is taken up by the external wall of non-conditioned space.

To document this strategy, the Passive Building Design Report should include the following information:

a) Annual solar irradiation on each building elevation;

b) Table summarising external wall area of non-conditioned space on each orientation of building elevation;

c) Calculation for demonstrating the design case compliance in irradiation gain reduction; and

$$\frac{\sum \text{Irradiation from External Wall of Non-conditioned Space}}{\text{Overall External Wall Irradiation}} \geq 20\%$$

d) Input and output reports generated by the simulation software.

3. External Shading Devices

3.1. Demonstrate the provision of fixed or movable horizontal/ vertical external shading devices in reducing direct solar irradiation entering the building interior. Any architectural features that shade the building surfaces from direct sunlight are considered as shading devices.

3.2. Conduct an external solar irradiation simulation to demonstrate that the annual solar irradiation on the façade is at least 2% lower than the baseline (hypothetic) case without a shading device.

To document this strategy, the Passive Building Design Report should include the following information:

a) Simulation result of solar irradiation on each building elevation for both design case and hypothetic case; and

b) Drawings illustrating the solar shading design; and

c) Input and output reports generated by the simulation software.

4. Vegetated Building Envelope

4.1. Demonstrate that the U-value of roof area of conditioned spaces is reduced 50% by vegetation. Roof of non-conditioned areas (e.g. mechanical plant rooms) does not count into the total roof area; OR

4.2. Demonstrate that the U-value of external wall is reduced 5% by vegetation. External wall of non-conditioned spaces (e.g. mechanical plant rooms) does not count into the total external wall area.

4.3. Only permanent plantation is considered as vegetation area.

To document this strategy, the Passive Building Design Report should include the following information:

a) Drawings with highlighted indications that substantiate the area of vegetation on the roof area (or external wall area);

b) Drawings with highlighted indications that substantiate the roof area of conditioned space (or the external wall area of conditioned space);

c) Calculation for demonstrating the percentage of compliance;

d) Technical information that substantiates the U-value of roof materials (or external wall materials); and

e) Maintenance contract or undertaking statement from Project Owner committing that landscape maintenance personnel/ company will be employed for the maintenance of building envelope vegetation.

5. Space Layout for Natural Ventilation

5.1. Demonstrate that at least 50% of openings and openable areas in each normally occupied space has an average incoming/outgoing velocity of 0.2 m/s.

5.2. Demonstrate that at least 20% of normally occupied space, in terms of floor area, has achieved a wind velocity of 0.2 m/s at 1.2m level above the finished floor.

5.3. A CFD simulation should be conducted in accordance with the AVA methodology and assessment area of the simulation model outlined in Technical Circular No.1/06 [3] to obtain the external wind pressures at the centre of the opening area. Another model that simulates the indoor flow pattern 1.2m level above the finished floor shall also be conducted using the external wind pressures computed by previous CFD model.

5.4. For buildings with 3 stories above grade or more, at least 3 typical stories (covering high, middle and low levels of buildings) with similar interior layout should be selected and studied for each multi-storey building within the site boundary. For buildings with less than 3 stories and/ or without typical floors design, the simulation should cover all floors.

5.5. For a normally occupied space in a building with site environmental problems identified by authorities (e.g. poor air quality, poor acoustic condition), providing openable windows for the identified normally occupied space is not practical. This credit is not eligible for project with 100% normally occupied space identified as non-practical for providing openable windows.

3 Housing, Planning and Lands Bureau (HPLB) and Environment, Transport and Works Bureau (ETWB) – Technical Circular No. 1/06 [ONLINE]. Available at: https://www.devb.gov.hk/filemanager/en/content_679/hplb-etwb-tc-01-06.pdf. [Accessed Jun 2024].

To document this strategy, the Passive Building Design Report should include the following information:

a) The derived incoming/ outgoing velocity at the opening under 1 out of the 3 most prevailing wind directions in summer; and

b) Calculation of the Area-Weighted Average Wind Velocity (AAWV) for the complied space; and

c) Input data, picture of the 3D model and simulation assumptions.

6. Space Layout for Daylight

6.1. Demonstrate that at least 25% of the total floor area of the normally occupied spaces achieves spatial Daylight Autonomy$_{300/25\%}$ ($sDA_{300/25\%}$). In other words, at least 25% of the total floor area of the normally occupied spaces can receive at least 300 lux of sunlight for at least 25% of operating hours each year.

6.2. Compliance with the assessment criteria by demonstrating through daylight simulation satisfying the below requirements:

6.2.1. Normally occupied spaces shall be assessed (including normally occupied spaces without window);

6.2.2. Internal doors within a unit are assumed to be fully opened;

6.2.3. Calculation grids shall be no more than 0.6m^2;

6.2.4. Assessment plane shall be placed at 0.8m above F.F.L. horizontally;

6.2.5. Assessment area shall cover typical floor(s) at the lowest level(s) of each building within the site boundary. All normally occupied spaces shall be assessed if the project building without typical floors design;

6.2.6. Annual sky file referencing a local climate file, such as an EnergyPlus weather format data file (*.epw), shall be used for sky model;

6.2.7. The assessment shall cover hours between 8a.m. to 6p.m. local clock time, for a full calendar year, from January 1 to December 31;

6.2.8. Overall external reflectance of an average of 0.2 for building (include the project development) and 0.2 for ground;

6.2.9. Internal wall, floor, ceiling reflectance can make reference to Table A1.12 in CIBSE Lighting Guide LG 10: Daylighting - A Guide for Designers (2014) [4]. If the finishes in the space is not completed, use the following default surface reflectance: 0.8 for ceiling, 0.2 for floors, and 0.5 for walls. The entire floor plate, except for the core is assumed to be normally occupied space;

6.2.10. Surrounding buildings and terrain shall be included in the model based on the GIS information from Lands Department;

6.2.11. The surrounding building and large structures should be included in the simulation model. The surrounding area should be at least 2H (H being the building height (m) of the tallest building on the project site) or 200m away from the project site boundary, whichever is larger. The building geometry can be simplified as blocks; and

4 Chartered Institute of Building Services Engineers (CIBSE) – Lighting Guide LG 10: Daylighting - A Guide for Designers (2014)

6.2.12. The terrain area shall be in a size of at least, 10H (H being the building height (m) of the tallest building on the project site) or 1000m × 1000m, whichever is larger, with the project placed in the centre. Where smaller terrain area is desired, the Applicant should propose a terrain area with justification and the terrain area should be surrounded by a wall with a height same as the average height of the surrounding buildings.

To document this strategy, the Passive Building Design Report should include the following information:

a) The industrial guidance/ publications for arriving the adopted design criteria for the project;

b) Software validation report; (if the simulation software is not on the list in Annex 4 of PNAP APP-130)

c) Simulation results of the spaces which have fulfilled the daylight illuminance requirements;

d) Calculation for demonstrating the percentage of compliance; and

e) Input and output reports generated by the simulation software.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
EU_01_00	BEAM Plus NB submission template for EU 1	✓	✓	✓
EU_01_01	Passive Building Design Report	✓	✓	✓
EU_01_02	/	/	/	/

Remarks

(a) Additional Information

None

(b) Related Credit

None

5 Energy Use **5.1 Energy Use Reduction and Control**

EU 2 Reduction of CO_2 Emissions

Extent of Application All buildings

Objective Reduce the consumption of non-renewable energy and the associated carbon dioxide (CO_2) emissions to the atmosphere.

Credits Attainable 10 + 8 additional BONUS

Credit Requirement

Option 1: Performance Path (1-10 Credits + 5 additional BONUS)

Demonstrate a percentage of reduction in annual CO_2 emission of the proposed building performance compared with the baseline case performance.

1 to 10 credits plus 5 additional BONUS credits for annual CO_2 emission reduction by the following saving percentages:

Credit(s)	Percentage of reduction of annual CO_2 emission / %	
	Adopting BEC 2018 as benchmarking criteria	Adopting BEC 2021 as benchmarking criteria
1	1%	
2	3%	1%
3	5%	3%
4	7%	5%
5	9%	7%
6	11%	9%
7	13%	11%
8	15%	13%
9	17%	15%
10	19%	17%
10 + 1B	21%	19%
10 + 2B	23%	21%
10 + 3B	25%	23%
10 + 4B	27%	25%
10 + 5B	29%	27%

Option 2: Prescriptive Path (1-7 Credits + 8 additional BONUS)

1 to 7 credits plus 8 additional BONUS credits for demonstrating a prescriptive compliance in below listed items.

1. **Passive Building Design Enhancement**

   Residential buildings and non-residential buildings should follow different requirements. For buildings consist of both residential and non-residential portions, demonstrate the compliance for the corresponding requirements for residential and non-residential portions respectively as listed below.

   1.1. **Building Envelope**

   Demonstrate the performance improvement in building envelope of the applicable building portions with reference to the statutory requirements on OTTV [1] / RTTV [2].

1 Buildings Department – PNAP APP-67 – Energy Efficiency of Buildings, Building (Energy Efficiency) Regulation; Code of Practice for Overall Thermal Transfer Value in Buildings 1995.

2 Buildings Department – PNAP APP-156 - Design and Construction Requirements for Energy Efficiency of Residential Buildings; Guideline on Design and Construction Requirements for Energy Efficiency of Residential Buildings 2014

<table>
<tr><th rowspan="2">Credit</th><th colspan="2">Performance Improvement</th></tr>
<tr><th>Adopting 2014 edition RTTV & 2019 edition OTTV as benchmarking criteria</th><th>Adopting 2022 edition RTTV & 2019 edition OTTV as benchmarking criteria</th></tr>
<tr><td rowspan="4">0.5</td><td colspan="2">a) Residential Buildings/ Portions</td></tr>
<tr><td>• $RTTV_{wall}$ Reduced by 5%</td><td>• $RTTV_{wall}$ Reduced by 1%</td></tr>
<tr><td colspan="2">b) Non-residential Buildings/ Portions & Residents' Recreational Facilities (RRF)</td></tr>
<tr><td colspan="2">• $OTTV_{tower}$ Reduced by 5%
• $OTTV_{podium}$ Reduced by 20%</td></tr>
<tr><td rowspan="4">1</td><td colspan="2">a) Residential Buildings/ Portions</td></tr>
<tr><td>• $RTTV_{wall}$ Reduced by 10%
• $RTTV_{roof}$ Reduced by 20%</td><td>• $RTTV_{wall}$ Reduced by 3%
• $RTTV_{roof}$ Reduced by 10%</td></tr>
<tr><td colspan="2">b) Non-residential Buildings/ Portions & Residents' Recreational Facilities (RRF)</td></tr>
<tr><td colspan="2">• $OTTV_{tower}$ Reduced by 10%
• $OTTV_{podium}$ Reduced by 40%</td></tr>
<tr><td rowspan="4">1 + 1 additional BONUS</td><td colspan="2">a) Residential Buildings/ Portions</td></tr>
<tr><td>• $RTTV_{wall}$ Reduced by 15%
• $RTTV_{roof}$ Reduced by 20%</td><td>• $RTTV_{wall}$ Reduced by 5%
• $RTTV_{roof}$ Reduced by 10%</td></tr>
<tr><td colspan="2">b) Non-residential Buildings/ Portions & Residents' Recreational Facilities (RRF)</td></tr>
<tr><td colspan="2">• $OTTV_{tower}$ Reduced by 10%
• $OTTV_{podium}$ Reduced by 40%</td></tr>
<tr><td rowspan="4">1 + 2 additional BONUS</td><td colspan="2">a) Residential Buildings/ Portions</td></tr>
<tr><td>• $RTTV_{wall}$ Reduced by 15%
• $RTTV_{roof}$ Reduced by 30%</td><td>• $RTTV_{wall}$ Reduced by 5%
• $RTTV_{roof}$ Reduced by 20%</td></tr>
<tr><td colspan="2">b) Non-residential Buildings/ Portions & Residents' Recreational Facilities (RRF)</td></tr>
<tr><td colspan="2">• $OTTV_{tower}$ Reduced by 10%
• $OTTV_{podium}$ Reduced by 40%</td></tr>
</table>

For exemplary performance, 1 additional BONUS credit for demonstrating:

(i) the compliance of "1 + 2 additional BONUS"; and

(ii) $RTTV_{roof}$ is reduced by 50% (for Projects adopting 2014 edition RTTV requirement) or 40% (for Projects adopting 2022 edition RTTV requirement).

1.2. **Natural Ventilation**

Demonstrate the performance improvement in natural ventilation provision for normally occupied spaces of the applicable building portions.

Credit	Performance Improvement
1	a) Residential Buildings/ Portions 20% of normally occupied space (habitable space) satisfy the ventilation requirements
2	a) Residential Buildings/ Portions 40% of normally occupied space (habitable space) satisfy the ventilation requirements
2 + 1 additional BONUS	a) Residential Buildings/ Portions 40% of normally occupied space (habitable space) satisfy the ventilation requirements b) Non-residential Buildings/ Portions & Residents' Recreational Facilities (RRF) i. For normally occupied spaces that utilise natural ventilation with direct openings to outdoors, the net free unobstructed area of the opening shall be not less than 5.2% of the net occupied floor area. ii. For normally occupied spaces that utilise natural ventilation without direct openings to outdoors, and is ventilated through adjoining room, the net free unobstructed area of the opening shall be not less than 8% of the net occupied floor area of the normally occupied space or not less than 2.3m².
2 + 2 additional BONUS	a) Residential Buildings/ Portions 40% of normally occupied space (habitable space) satisfy the ventilation requirements b) Non-residential Buildings/ Portions & Residents' Recreational Facilities (RRF) i. For normally occupied spaces that utilise natural ventilation with direct openings to outdoors, the net free unobstructed area of the opening shall be not less than 6.0% of the net occupied floor area. ii. For normally occupied spaces that utilise natural ventilation without direct openings to outdoors, and is ventilated through adjoining room, the net free unobstructed area of the opening shall be not less than 8% of the net occupied floor area of the normally occupied space or not less than 2.3m².

2. **Active System Design Improvement**

Demonstrate further performance improvement as compared with the applicable edition of the Building Energy Codes (BEC) [3].

2.1. **Air-conditioning Installation**

Demonstrate the performance improvement in percentage (%) of code specified minimum coefficient of performance (COP) for EACH air-conditioning equipment and/or minimum cooling seasonal performance factor (CSPF) for EACH room air-conditioner:

Credit	Performance Improvement
1	3%
2	6%
2 + 1 additional BONUS	25%

2.2. **Lighting Installation**

Demonstrate the performance improvement in percentage (%) of electrical power consumed by the lighting installation in whole building by area-weighted method:

Credit	Performance Improvement
0.5	5%
1	10%
1 + 1 additional BONUS	30%

2.3. **Lift and Escalator Installation**

Demonstrate the performance improvement in percentage (%) of code specified maximum allowable electrical power consumed by lift and escalator installation:

Credit	Performance Improvement
1	5%
1 + 1 additional BONUS	10%

The electrical power reduction achieved through lift regenerative braking and/ or automatic speed reduction mode of escalator can be included in the performance improvement calculation.

Regenerative braking should be provided for **ALL** lifts; and/ or switching device, that can set the escalator under automatic speed reduction mode, should be provided for **ALL** escalators within a project in order to account for the reduction in the calculation.

3 Electrical and Mechanical Services Department (EMSD) – Code of Practice for Energy Efficiency of Building Services Installation (BEC) [ONLINE]. Available at: https://www.emsd.gov.hk/beeo/en/mibec_beeo_codtechguidelines.html. [Accessed Jun 2024].

Assessment

Option 1: Performance Path

Whole building energy simulation should be carried out in a prescribed methodology as listed below in order to quantify the potential savings due to energy saving measures and improvements over the relevant baseline model.

Simulation Software

Simulation program used for energy modelling should meet the following criteria:

1. Tested with industry standard methods: ANSI/ASHRAE Standard 140-2017 or equivalent.
2. Capable to perform hourly analysis (i.e. 8,760 hours per year);
3. Provide hourly variations in occupancy, lighting power, miscellaneous equipment power, thermostat setpoints, and HVAC system operation;
4. Capable to model 10 or more thermal zones;
5. Capable to simulate the thermal behaviour of a building and the interaction of its building fabric, air-conditioning, interior lighting and other relevant energy consuming equipment and systems;
6. Capable to perform design load calculations to determine the required air-conditioning equipment capacities and air and water flow rates for both the proposed building and baseline building;
7. Capable to model part-load performance curves for mechanical equipment;
8. Capable to model capacity and efficiency correction curves for mechanical heating and cooling equipment; and
9. Capable to model air-side economisers with integrated control.

Baseline and Proposed Model Set-up

Develop the corresponding baseline building performance according to modelling set up guideline in Appendix 9.2 for different building types.

Exceptional Calculation Methods (ECM)

When no simulation program can adequately model a design, materials or device, an ECM can be used to demonstrate above-standard performance. Its adoption is subject to the justification (submitted by the Applicant) of its underlying principles, quantitative & qualitative techniques, assumptions, etc. in detail.

For any claim of non-regulated load saving or strategies that lead to a difference between proposed and baseline model it is required to submit a narrative and provide ECM calculation.

ECM is allowed to create a representation of that element. If the methodology of approximation has not been previously published in any technical circular or FAQ, it is the responsibility of the applicant to submit a narrative explanation describing the simulation methodology and providing the calculations for the energy savings if necessary.

On-site Renewable Energy Application

On-site renewable energy application is included in the proposed case calculation to further reduce the whole building CO_2 emission. By providing annual energy generation estimation details in the proposed case, the percentage reduction of CO_2 emission is accounted by the percentage of reduction from baseline CO_2 emission.

Equivalent Carbon Dioxide Emissions

Electricity: 0.7kg CO_2 per kWh electricity consumed [4]

Town gas: 3.141 kg CO_2 per unit of town gas consumed

(1 unit of town gas = 48 mega-joules consumed)

Building Energy Performance Assessment Report

Prepare a Building Energy Performance Assessment Report to demonstrate the compliance. If EU 3 Option 1 (Performance Path) is attempted, a collaborative report should be provided to substantiate the compliance of both EU 2 Option 1 (Performance Path) and EU 3 Option 1 (Performance Path).

The report should include the following contents:

1. Executive summary
    1.1. Energy saving measures summary
    1.2. CO_2 emission and energy consumption reduction as compared with baseline ; and
    1.3. Peak Electricity Demand reduction as compared with baseline
    (If EU 3 Option 1 is attempted).
2. Introduction
    2.1. Methodology of energy performance assessment, including the details of the energy simulation software and ECM (if any) used; and
    2.2. Project information.
3. Description of energy saving measures
4. Modelling Parameters
    4.1. Operating schedule; and
    4.2. Input parameters summary table with reference.
5. Results and discussion
    5.1. Summarise the CO_2 emission reduction in percentage (%);
    5.2. Provide baseline and proposed case energy breakdown diagrams;
    5.3. Calculation of Peak Electricity Demand reduction in percentage (%) *(If EU 3 Option 1 is attempted)*; and
    5.4. Peak Electricity Demand breakdown diagrams for baseline and proposed cases *(If EU 3 Option 1 is attempted)*.
6. Conclusions
    6.1. Conclude the major reasons for achieving CO_2 emission reduction.

4 Environmental Protection Department (EPD) – Guidelines to Account for and Report on Greenhouse Gas Emissions and Removals for Buildings (Commercial, Residential or Institutional Purposes) in Hong Kong, 2010 [ONLINE]. Available at: https://www.climateready.gov.hk/files/pdf/Guidelines_English_2010.pdf [Accessed Jun 2024].

The report shall include the supporting documents for input, based on project development status, including:

1. OTTV/ RTTV calculation sheet based on the requirements of Buildings Department for baseline and proposed case;
2. Indoor design criteria from project team highlighting indoor thermal condition, occupancy density, fresh air flow rate requirement, internal load, equipment load and ventilation rate;
3. System and equipment specifications; schedules; and technical data (e.g. catalogues):
    3.1. All air-conditioning equipment highlighting COP, cooling/ heating capacity, input power, flow rate, etc., as well as energy recovery appliance highlighting efficiency;
    3.2. All lift and escalator highlighting capacity, motor power and energy saving control system;
    3.3. All water heater (if applicable) highlighting installed power;
    3.4. All ventilation fans highlighting input power and flow rate;
    3.5. All lighting fixtures highlighting designed space-specified LPD and/or input lighting power; and
    3.6. Other systems (e.g. renewable energy applications) highlighting the key energy performance parameters;
4. Pre-input calculation for modelling (if any), including but not limited to:
    4.1. Simplified Fan Power input; and
    4.2. Lighting Power Density;
5. Exceptional Calculation;
6. Schematics drawings for building services systems; and
7. Layout plans for building services systems (optional for PA).

The report should be endorsed by a Locally Qualified Professional who has at least 8-year of relevant experience in building energy modelling. The Locally Qualified Professional shall attain at least one of the following local professional qualifications:

- Member of The Hong Kong Institution of Engineers (MHKIE);
- Member of Hong Kong Institute of Qualified Environmental Professionals Limited (MHKIQEP);
- Registered Energy Assessor (REA), under the Buildings Energy Efficiency Ordinance (Cap. 610); and
- Registered Professional Engineer (R.P.E.), under the Engineers Registration Ordinance (Cap. 409).

The accepted disciplines of the above local professional qualifications include Building Services, Mechanical, Electrical, Energy and Environmental.

CV of the Locally Qualified Professional shall be provided to demonstrate that the Locally Qualified Professional holds the required local professional qualification(s) and with the relevant experience.

Option 2: Prescriptive Path

Prepare a Prescriptive Approach Summary Report to demonstrate the compliance of each applicable category below:

1. Passive Building Design Enhancement

1.1. **Building Envelope**

a) Residential Buildings/ Portions

Provide calculation sheets for **$RTTV_{wall}$** and/ or **$RTTV_{roof}$** to demonstrate the performance improvement in building envelope with reference to the statutory requirement.

b) Non-residential Buildings/ Portions & Residents' Recreational Facilities (RRF)

Provide calculation sheets for **$OTTV_{tower}$** and/ or **$OTTV_{podium}$** to demonstrate the performance improvement in building envelope with reference to the statutory requirement.

1.2. **Natural Ventilation**

a) Residential Buildings/ Portions

1. Demonstrate not less than 20% or 40% of the normally occupied space (habitable space) area satisfies with the natural ventilation requirements detailed in Appendix 9.3. The provided guidance in Appendix 9.3 can only be applied to a single residential floor. Layout of a multi-floor unit should be reviewed per each floor.
2. If a flat is designed without internal partition between normally occupied space (habitable space) and other spaces, the compliance must be demonstrated by a typical layout with partition to represent the intended design for occupancy or habitation.
3. Provide descriptions, mark-up on the normally occupied space (habitable space) drawing such as layout plan, elevation drawing and summary tables of total area with natural ventilation requirements complied according to the detailed credit requirement stated in Appendix 9.3.

b) Non-residential Buildings/ Portions & Residents' Recreational Facilities (RRF)

1. Demonstrate the provision of sufficient permanent openings for natural ventilation with the performance improvement as compared with ASHRAE Standard 62.1-2016 Section 6.4.2 [5]:
    i. For normally occupied spaces that utilise natural ventilation with direct openings to outdoors, the spaces or portions of spaces to be naturally ventilated shall be permanently open to operable wall openings directly to the outdoors. The net free unobstructed area of the opening shall be not less than 5.2% or 6.0% of the net occupied floor area.
    ii. For normally occupied spaces that utilise natural ventilation without direct openings to outdoors, and is ventilated through adjoining room, the opening between rooms shall be permanently unobstructed (Door between rooms is deemed as permanently unobstructed opening). The net free unobstructed area of the opening shall be not less than 8% of the net occupied floor area of the normally occupied space or not less than 2.3m².

5 American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) – ANSI/ASHRAE Standard 62.1-2016 – Ventilation for Acceptable Indoor Air Quality

2. Provide mark-up on drawing such as layout plan and elevation drawing to illustrate the dimensions/ area of the permanent openings on building envelope and interior zone, as well as the net occupied floor area of the normally occupied space.
3. Provide calculation to demonstrate the compliance of the openings area or the percentage of the openings area to the net occupied floor area.

2. Active System Design Improvement

2.1. **Air-conditioning Installation**

2.1.1. Provide a summary table of Energy Performance for Air-conditioning Installation to demonstrate the performance improvement in percentage (%) for EACH air-conditioning equipment and EACH room air-conditioner.

2.1.2. The assessment criteria shall refer to Clause 1.2 to 1.5 under EU P1.

2.2. **Lighting Installation**

2.2.1. Provide a summary table of Energy Performance for Lighting Installation to demonstrate the performance improvement in percentage (%) of electrical power consumed by the lighting installation in whole building by area-weighted method compared against the applicable edition of BEC.

2.2.2. The assessment criteria shall refer to Clause 2.2 to 2.6 under EU P1.

2.2.3. For residential buildings that are governed by BEEO, the LPD within a dwelling unit is excluded from the calculation.

2.2.4. For residential buildings that are NOT governed by BEEO, the LPD within a dwelling unit in the baseline case shall be equal to the below:

- Bedroom: 13 W/m²
- Living Room/ Dining Room: 15 W/m²
- Kitchen: 13 W/m²
- Bathroom: 13W/m²

The LPD in the design case of the dwelling unit shall be the same as that in the baseline case, unless there is a completed lighting design within the dwelling unit, or a legally binding agreement is provided to substantiate the designed LPD.

2.3. **Lift and Escalator Installation**

2.3.1. Provide a summary table of Energy Performance for Lift and Escalator Installation to demonstrate the performance improvement in percentage (%) of electrical power for whole building lift and escalator installation.

2.3.2. The maximum allowable electrical power for lift and escalator installation shall be referred to Section 8 of the applicable edition of BEC.

2.3.3. The electrical power reduction achieved through lift regenerative braking (i.e. the amount of electrical power obtained when lifts travel downwards with heavy load or travel upwards with light load) and/ or automatic speed reduction mode of escalator (i.e. the amount of electrical power reduced under automatic speed reduction mode when the traffic demand is low) can be included in the performance improvement calculation.

Regenerative braking should be provided for **ALL** lifts; and/ or switching device, that can set the escalator under automatic speed reduction mode, should be provided for **ALL** escalators within a project in order to account for the reduction in the calculation.

The report shall include the supporting documents for calculation, based on project development status, including:

1. RTTV/ OTTV calculation sheet based on the requirements of Buildings Department and the corresponding improvement;
2. Floor layout plan showing all normally occupied spaces (habitable spaces); elevation drawings highlighting the locations of openable windows; schedules of usable floor area; schedule of openable window size; and summary table of usable floor area illustrating compliance with the detailed requirements stated in Appendix 9.2 (for Residential Buildings);
3. Floor layout plan showing the occupied floor spaces; elevation and section drawings highlighting all permanent openings on envelope and interior zone; schedule of net occupied floor areas; schedule of net free unobstructed area of permanent openings of each occupied space; and summary tables of net occupied floor areas complying with the credit requirements (for Non-residential Building/ Portion and/ or Residents' Recreational Facilities);
4. MVAC air-side and water-side (if applicable) schematic drawings; and MVAC layout drawings (optional for PA) showing all air-conditioning equipment;
5. Air-conditioning equipment specifications highlighting the requirement on performance improvement; equipment schedules and technical data (e.g. catalogues) highlighting the key performance data (e.g. rated capacity, rated COP at full load and 75% load (for VSD equipment), CSPF, etc.)
6. Lighting specifications highlighting the requirement on performance improvement; and lighting schedule with luminaire showing the key design information (e.g. installation location, type of light fitting, quantity, input wattage, control gear loss, etc.);
7. Lighting layout drawings (optional for PA);
8. Lift and escalator location markup on layout drawings;
9. Lift and escalator specifications highlighting the requirement on performance improvement; equipment schedules; and technical data (e.g. catalogues) showing the key design information (e.g. equipment type, rated load, rated speed, rated power etc.); and
10. Substantiation for electrical power reduction from lift regenerative braking/ automatic speed reduction mode of escalator (e.g. technical specifications; calculation along with assumptions made; technical data (e.g. catalogues); and functional performance test result/ declaration letter from manufacturer for electrical power reduction from lift regenerative braking/ automatic speed reduction mode of escalator) (if applicable).

The report should be endorsed by a Locally Qualified Professional who has at least 5-year of relevant experience in green building services system design. The Locally Qualified Professional shall attain at least one of the following local professional qualifications:

- Member of The Hong Kong Institution of Engineers (MHKIE);
- Member of Hong Kong Institute of Qualified Environmental Professionals Limited (MHKIQEP);
- Registered Energy Assessor (REA), under the Buildings Energy Efficiency Ordinance (Cap. 610); and
- Registered Professional Engineer (R.P.E.), under the Engineers Registration Ordinance (Cap. 409).

The accepted disciplines of the above local professional qualifications include Building Services, Mechanical, Electrical, Energy and Environmental.

CV of the Locally Qualified Professional shall be provided to demonstrate that the Locally Qualified Professional holds the required local professional qualification(s) and with the relevant experience.

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below*.		**PA**	**CA**	**FA/ RFA**
Option 1: Performance Path				
EU_02(Path1)_00	BEAM Plus NB submission template for EU 2 Path 1 with Input Summary and Output Result Summary [EU_02&03(Path1)_Appendix A1 – A8]	✓	✓	✓
EU_02(Path1)_01	Endorsed Building Energy Performance Assessment Report	✓	✓	✓
EU_02(Path1)_02	CV of the professional as prescribed in the assessment criteria	✓	✓	✓
EU_02(Path1)_03	Input and Output Simulation report which is generated from simulation software	✓	✓	✓
EU_02(Path1)_04	Supporting documents for input, based on project development status, as stipulated in the assessment criteria	✓	✓	✓
Option 2: Prescriptive Path				
EU_02(Path2)_00	BEAM Plus NB submission template for EU 2 Path 2 with Compliance Summary Tables [EU_02(Path2)_Appendix B1, B2, B5]; and [EU_P1&02(Path2)_Appendix B3-B4]*	✓	✓	✓
EU_02(Path2)_01	Endorsed Prescriptive Approach Summary Report	✓	✓	✓
EU_02(Path2)_02	CV of the professional as prescribed in the assessment criteria	✓	✓	✓
EU_02(Path2)_03	Supporting documents for report calculation, based on project development status, as stipulated in the assessment criteria	✓	✓	✓
*The supporting documents EU_P1&02(Path2)_Appendix B3-B4 shall be the same as those submitted under EU P1. The Applicant need not resubmit the same materials in EU 2 if they have already been submitted in EU P1				

Remarks

(a) Additional Information

None

(b) Related Credit

None

5 Energy Use **5.1 Energy Use Reduction and Control**

EU 3 Peak Electricity Demand Reduction

Extent of Application All buildings

Objective Encourage energy conservation and methods to reduce peak electricity demand.

Credits Attainable 3 + 1 additional BONUS

Credit Requirement

Option 1: Based on EU 2 Performance Path (1-3 Credits)

1 to 3 credits for peak electricity demand reduction by the following saving percentage:

Credit	Percentage of reduction of peak electricity demand / %
1	5%
2	10%
3	15%

Option 2: Based on EU 2 Prescriptive Path (1-2 Credits + 1 additional BONUS)

Credits can be achieved when the following credit points are achieved in EU 2 Option 2 (Prescriptive Path):

Credit	Credit points achieved in EU 2 Option 2 (Prescriptive Path)
1	4 credits
2	4 credits + 2 additional BONUS
2 + 1 additional BONUS	5 credits + 4 additional BONUS

Assessment

Option 1: Based on EU 2 Performance Path:

Use the same whole building energy analysis of baseline and proposed case buildings in EU 2 Option 1 (Performance Path).

A collaborative Building Energy Performance Assessment Report should be provided under EU 2 to substantiate the compliance of both EU 2 Option 1 (Performance Path) and EU 3 Option 1 (Performance Path). The contents and requirements of the report and supporting documents should follow EU 2 Option 1 (Performance Path) of this Manual.

The peak electricity demand reduction in percentage (%) can be calculated as follows:

$$\left(1-\frac{\text{Proposed case peak electricity demand (kW)}}{\text{Baseline case peak electricity demand (kW)}}\right)\times 100\%$$

The peak electricity demand in the baseline case and that in the proposed case do not require to be occurred in the same month.

In order to encourage the use of renewable energy application(s), offsetting the peak electricity demand of assessed building (proposed case) by the electricity generated from renewable energy application(s) is allowed. The Applicant is opted to choose the electricity generated at any hour by the renewable energy application (s) to offset the peak electricity demand of the assessed building (proposed case). Calculation/ simulation result of the hourly electricity generation with due account of the diurnal and seasonal variations shall be provided for the substantiation of the peak electricity demand reduction in proposed case.

Option 2: Based on EU 2 Prescriptive Path:

Demonstrate a minimum 4-credit achievement in EU 2 Option 2 (Prescriptive Path).

The compliance shall be demonstrated under EU 2 Option 2 (Prescriptive Path).

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
Option 1: Based on EU 2 Performance Path*				
EU_03(Path1)_00	BEAM Plus NB submission template for EU 3 Path 1	✓	✓	✓
EU_03(Path1)_01	/	/	/	/
EU_03(Path1)_02	/	/	/	/
EU_03(Path1)_03	/	/	/	/
EU_03(Path1)_04	/	/	/	/
Option 2: Based on EU 2 Prescriptive Path*				
EU_03(Path2)_00	BEAM Plus NB submission template for EU 3 Path 2	✓	✓	✓
EU_03(Path2)_01	/	/	/	/
EU_03(Path2)_02	/	/	/	/
EU_03(Path2)_03	/	/	/	/
* The supporting documents for "Option 1: Based on EU 2 Performance Path" and "Option 2: Based on EU 2 Prescriptive Path" shall be the same as the submittal requirements under EU 2. The Applicant need not resubmit the same materials in EU 3 if they have already been submitted in EU 2.				

Remarks

(a) Additional Information

None

(b) Related Credit

EU 2 Reduction of CO_2 Emissions

5 Energy Use **5.1 Energy Use Reduction and Control**

EU 4 Metering and Monitoring

Extent of Application

EU 4a: Non-residential buildings/ portions or common areas of residential buildings/ portions

EU 4b: Non-residential buildings/ portions with tenanted areas

Objective

Enable building operators to measure, monitor and develop measures to improve the performance of the building's engineering systems.

Credits Attainable

1 + 2 BONUS

Credit Requirement

(a) Fundamental Metering and Monitoring

1 credit for providing **energy** monitoring system for equipment and systems in spaces.

1 BONUS credit for providing **performance auditing** monitoring system for equipment and systems in spaces.

(b) Metering for Tenanted Area

1 BONUS credit for allowing monitoring provision of tenants' energy consumption.

Assessment

(a) Fundamental Metering and Monitoring

1. **Metering Coverage**

1.1. Energy monitoring provision covers energy consumption (in kWh) or electricity demand (in kW) of the equipment.

1.2. Performance auditing monitoring provision covers the system capacity ratings and operating characteristics.

1.3. For common areas of residential buildings/ portions, provide monitoring provision for future facility management to review occasionally the end-use consumption.

1.4. For non-residential buildings/ portions, with reference to latest edition of EMSD Code of Practice for Building Energy Audit [1], provide the monitoring system for the installations in landlord's-controlled area, where present in the project. Terminal unit is not in the assessment scope.

Requirements of monitoring coverage are summarised as below:

Table EU4-1:

System (if applicable)	Energy Monitoring	Performance Auditing Monitoring
Outdoor Condition	• N/A	• Air Temperature (°C) • Humidity (RH) (%) • Daylight (Lux)

1 Electrical and Mechanical Services Department (EMSD) – Code of Practice for Building Energy Audit (EAC) [ONLINE]. Available at: https://www.emsd.gov.hk/beeo/en/mibec_beeo_codtechguidelines.html. [Accessed Jun 2024].

HVAC System	Each Equipment in HVAC (Water Side) - Chillers - Heat pumps - Pumps - Heat Rejection	• Electricity (kW or kWh)	• Supply & Return Water Temperature (°C) • Water Flow Rate (m^3/s) • Water Pressure (Pa) • Capacity Rating
	Each Equipment in HVAC (Water Side) - Absorption Chiller - Boiler	• Fuel (kW or kWh)	• Supply & Return Water Temperature (°C) • Water Flow Rate (m^3/s) • Water Pressure (Pa) • Capacity Rating
	Each Equipment in HVAC (Air Side) - Primary Air/ Air Handling Unit Fans - Return Air Fans - Free Cooling Fans	• Electricity (kW or kWh)	• Supply & Return Air Temperature (°C) • Air Flow Rate (m^3/s) • Air Pressure (Pa)
	VRV and Unitary System	• Electricity (kW or kWh)	• N/A
	Ventilation System - Carpark Ventilation - Toilet Ventilation (≥2.5kW each)	• Electricity (kW or kWh)	• CO/ NO_x Concentration Level (if applicable for carpark ventilation) • Air Flow Rate (m^3/s) (Jet Fan is excluded) • Air Pressure Head (m) (Jet Fan is excluded)
Lighting System	Lighting and receptacle system	• Electricity (kW or kWh)	• N/A
Plumbing and Drainage System	Each set of pumps (duty pump(s) and standby pump(s)) in Plumbing and Drainage	• Electricity (kW or kWh)	• N/A

Lift and Escalator System	Each Lift and Escalator*	• Electricity (kW or kWh)	• N/A
		1 Credit	**1 BONUS credit**
* A separate single meter monitoring the entire lift/ escalator system is acceptable, provided that the monitoring system can provide individual reading of each lift and escalator.			

1.5. Drawings shall be submitted to demonstrate the provision of the monitoring equipment for energy monitoring and/ or performance auditing. The drawings can be electrical schematic drawings, MCB details, chiller plant control diagram, data/ BMS point schedules, etc. The provision of the monitoring equipment shall be clearly indicated with the reference ID highlighted or annotated for substantiation.

2. **Monitoring Provision Requirement (Datapoints, Sensors or Meters)**

2.1. Electricity metering should comply with BS EN [2] accuracy class 1 or equivalent.

2.2. Sensors for performance sub-metering should meet the minimum accuracy requirements in ASHRAE Standard 114 [3] or equivalent.

3. **Interval and Recording**

3.1. Monitoring record should be at intervals of one hour or less and capable to record the item as required.

3.2. For common areas of residential buildings/ portions, all data recorded by the sub-metering system and monitoring system should be collected monthly and be kept for at least 36 months.

3.3. For non-residential buildings/ portions, all data recorded by the sub-metering system and monitoring system should be transferred to a Building Management System (BMS) or other data collection system. The BMS or other data collection system should have sufficient capacity to store for at least 36 months.

(b) Metering for Tenanted Area

Demonstrate compliance by selecting one of the following paths for <u>all</u> tenanted area:

<u>Compliance Path 1: Landlord to install monitoring provision</u>

In all tenanted areas, allows separate monitoring of electricity use by:

1. HVAC system;
2. Lighting; and
3. Small power.

2 British Standard BS EN 62053-11:2003. Electricity Metering Equipment (A.C.). Particular Requirements. Electromechanical Meters for Active Energy (Classes 0.5, 1 and 2).

3 American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) – ASHRAE Standard 114-1986: Energy Management Control Systems Instrumentation, American Society of Heating, Refrigerating and Air-conditioning Engineers, Inc., USA. 1987.

All data recorded should be transferred to a Building Management System (BMS) or other forms of data collection facilities. The BMS or data collection facilities should have sufficient capacity to store for at least 36 months.

Drawings shall be submitted to demonstrate the provision of the monitoring equipment for energy monitoring and/ or performance auditing. The drawings can be electrical schematic drawings, MCB details, chiller plant control diagram, data/ BMS point schedules, etc. The provision of the monitoring equipment shall be clearly indicated with the reference ID highlighted or annotated for substantiation.

OR

Compliance Path 2: Tenants to install monitoring provision

Provide a contractually binding lease document signed by both the project owner and the tenants which explicitly state the requirements of obtaining electricity usage data from the tenant's meters. The tenant's meters should separately monitor HVAC system, lighting and small power.

A contractually binding lease document, with reference to HKGBC Green Tenancy Driver [4], is required to establish to ensure data could be shared between project owner and tenants, which explicitly state:

1. The aim of improving the environmental performance of the building thereof the cost reduction and indoor quality;
2. The requirements of obtaining electricity usage data from the tenant;
3. Data and relevant information to be shared between Landlord and Tenants are to be kept confidential unless for the purpose of management of the building;
4. Landlord and Tenant are agreed to work collaboratively in setting up a Green Tenancy Committee (GTC); and
5. Responsibility of the GTC at minimum:
    a) Sharing the building operation data;
    b) Review the environmental performance of the premises;
    c) Setting up a Green Office Tenancy Plan with annual sustainability targets; and
    d) Review the target and progress periodically.

For both paths, the monitoring provision should provide record at intervals of one hour or less and capable to record electricity consumption (in kWh) or electricity demand (in kW).

4 HKGBC – Green Tenancy Driver for Office Buildings [ONLINE]. Available at: https://www.hkgbc.org.hk/eng/engagement/guidebooks/green-tenancy-driver/index.jsp. [Accessed April 2021].

Submittals

(a) Fundamental Metering and Monitoring

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
EU_04a_00	BEAM Plus NB submission template for EU 4a	✓	✓	✓
For EU 4a (Normal Credit), please provide the following:		**PA**	**CA**	**FA/ RFA**
EU_04a_01	Drawing(s) as prescribed in part (a) Clause 1.5 to demonstrate the metering and monitoring provisions for energy monitoring	✓	✓	✓
EU_04a_08	Summary of Energy Monitoring [EU_04a_Appendix A]	✓	✓	✓
For EU 4a (Bonus Credit), please provide the following:		**PA**	**CA**	**FA/ RFA**
EU_04a_02	Drawing(s) as prescribed in part (a) Clause 1.5 to demonstrate the metering and monitoring provisions for performance auditing	✓	✓	✓
EU_04a_06	Operation Manual of the Monitoring System	-	✓	✓
EU_04a_09	Summary of Performance Auditing Monitoring [EU_04a_Appendix B]	✓	✓	✓
For EU 4a (both Normal Credit & Bonus Credit), please provide the following:		**PA**	**CA**	**FA/ RFA**
EU_04a_03	Technical specifications of i. metering and monitoring equipment & ii. data collection facilities (e.g. BMS) (for non-residential buildings/ portions only) [or] Technical data (e.g. catalogues) of i. metering and monitoring equipment & ii. data collection facilities (e.g. BMS) (for non-residential buildings/ portions only)	✓ -	- ✓	- ✓
EU_04a_04	/	/	/	/
EU_04a_05	/	/	/	/
EU_04a_07	/	/	/	/

(b) Metering for Tenanted Area

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
EU_04b_00	BEAM Plus NB submission template for EU 4b	✓	✓	✓
For Compliance Path 1, please submit the following:		**PA**	**CA**	**FA/ RFA**
EU_04b_01	Drawing(s) as prescribed in part (b) Compliance Path 1 for the metering and monitoring provisions for separate monitoring of electricity use in tenanted areas	✓	✓	✓
EU_04b_02	Technical specifications of all metering and monitoring equipment [or] Technical data (e.g. catalogues) of all metering and monitoring equipment	✓ -	- ✓	- ✓
EU_04b_03	Technical specifications of data collection facilities, e.g. BMS [or] Technical data (e.g. catalogues) of data collection facilities (e.g. BMS)	✓ -	- ✓	- ✓
EU_04b_04	/	/	/	/
EU_04b_05	Operation Manual of the Monitoring System	-	✓	✓
For Compliance Path 2, please submit the following:		**PA**	**CA**	**FA/ RFA**
EU_04b_06	Undertaking letter from the project owner committing that a contractually binding lease document will be established	✓	-	-
EU_04b_07	Contractually binding lease document	-	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credit

IDCM 13 Digital Facility Management Interface

IDCM 14 Occupant Engagement Platform

While this credit assesses the electricity consumption metering and monitoring system in the building, IDCM 13 and IDCM 14 encourages processing the data collected to useful information for facility managers' and occupants' use.

5 Energy Use **5.2 Renewable and Alternative Energy Generation**

EU 5 Renewable and Alternative Energy Systems

Extent of Application All buildings

Objective Encourage the wider application of renewable energy sources in buildings.

Credits Attainable 6 + 5 additional BONUS

Credit Requirement

(a) Solar Energy Feasibility Study

1 credit for evaluating the building roof's potential for harnessing solar energy.

(b) On-site Renewable Energy Application

1 to 5 credits plus 5 additional BONUS credits for using on-site renewable energy applications to offset annual building energy consumption [1].

Credit	Percentage of annual building energy consumption
1	0.2%
2	0.4%
3	0.6%
4	0.8%
5	1%
5+1B	1.2%
5+2B	1.4%
5+3B	1.6%
5+4B	1.8%
5+5B	2%

Assessment

(a) Solar Energy Feasibility Study

Conduct a feasibility study to evaluate the potential of standalone and building-integrated installation in harnessing solar energy including photovoltaic and solar water heating and provide a Solar Energy Feasibility Study Report. The report should include the following contents in around 10 A4 pages which should suffice for the purpose (however, the 10 A4 pages is not a straight limit):

1 The energy consumptions of the building services systems controlled or influenced by the applicant (e.g. MVAC, lighting, lift & escalator, plumbing & drainage, service hot water system, etc.) shall be accounted. Areas to be considered shall include those under the landlord's control such as entrance lobby, lift lobbies, corridors, staircases, shopping arcade, clubhouse, car park, plant rooms, public toilets, etc.

1. Consideration of PV, BIPV or solar thermal potential installation

    1.1. Number of potential surfaces;

    1.2. Potential surfaces area;

    1.3. Height variation between roofs;

    1.4. Potential shading from the surroundings including trees and adjacent buildings;

    1.5. Potential shading from on-site building services equipment; and

    1.6. Other (proposed).

    (Note:
    Supporting documents such as layout plan showing the locations and numbers of the proposed PV panels shall be provided to substantiate the feasibility study.)

2. Technical generation potential of solar energy

    2.1. Expected solar peak capacity;

    2.2. Expected annual yield; and

    2.3. Project building energy use intensity (Default value could be used if EU 2 – Option 1 (Performance Path) is not attempted) and the estimated percentage of reduction.

    (Note:
    Supporting documents such as technical data (e.g. catalogues) showing the rated capacity of each PV panel shall be provided to substantiate the feasibility study.

    The efficiency and loss of the proposed PV system shall be included and clearly stated with any assumption made in the study. Supporting documents are not required.)

3. Conclusions

    3.1. Conclude whether the harnessing of solar energy is feasible for the project.

4. Roll-out plan (if concluded to be feasible)

    4.1. Propose access and safety measures if solar energy is to be harnessed; and

    4.2. Propose recommendations to refine the roof design to maximise the usable roof space for M&E equipment.

The Solar Energy Feasibility Study Report should be endorsed by a Locally Qualified Professional who has at least 3 years of relevant experience in renewable energy. The Locally Qualified Professional shall attain at least one of the following local professional qualifications:

- Member of The Hong Kong Institution of Engineers (MHKIE);
- Member of Hong Kong Institute of Qualified Environmental Professionals Limited (MHKIQEP);
- Registered Energy Assessor (REA), under the Buildings Energy Efficiency Ordinance (Cap. 610); and
- Registered Professional Engineer (R.P.E.), under the Engineers Registration Ordinance (Cap. 409).

The accepted disciplines of the above local professional qualifications include Building Services, Mechanical, Electrical, Energy and Environmental.

CV of the Locally Qualified Professional shall be provided to demonstrate that the Locally Qualified Professional holds the required local professional qualification(s) and with the relevant experience.

Note that the feasibility study imposes no obligation for implementation but encourages consideration of solar energy harnessing.

(b) On-site Renewable Energy Application

Calculate the percentage of annual building energy consumption [2] obtained from all renewable energy applications on site with reference to the annual energy use of the proposed case building calculated in EU 2 Reduction of CO_2 Emissions.

$$\frac{\text{Annual Energy Yielded from Renewable Energy Applications on Site(kWh)}}{\text{Annual Energy Use (kWh)}}$$

1. The calculation of annual energy yielded from each renewable energy application should take into account of the following factors:
    1.1. Diurnal and seasonal variations in the external environmental conditions; and
    1.2. Energy loss by the renewable energy systems (e.g. inverter loss of solar PV system, system efficiency loss, etc.) should be discounted from the systems output
2. The amounts of annual energy use should be derived from the proposed case as calculated in EU 2 Option 1 (Performance Path). The tenant's electrical loads, which are not controlled or influenced by the Applicant, should be excluded from the annual energy use.
3. For renewable energy applications that generate energy from renewable sources (e.g. solar PV system, wind power system), the energy generated should be counted into the "Annual Energy Yielded from Renewable Energy Applications on Site" in the above equation. If energy is required on site to convert renewable energy sources to fuel or electricity (e.g. conversion of biomass to biofuel), such energy should be counted into the "Annual Energy Use" in the above equation.
4. For building systems that obtain energy from renewable sources to provide services (e.g. pre-heating water by solar panel for hot water system, replacing normal electricity by the energy produced from a biofuel generator), which will otherwise use fuel or electricity to produce those services, the equivalent amount of energy to produce those services (e.g. the amount of energy for water heating without the application of solar hot water system; the amount of normal electricity use for the connected load without using biofuel generator) should be counted into the "Annual Energy Use" in the above equation.
5. Examples of renewable energy applications accepted in this credit include:
    5.1. Solar photovoltaic (PV) System
    5.2. Solar water heating system
    5.3. Wind power system
    5.4. Bio-gas heating/ electricity generation
    5.5. Biofuel (on-site/ off-site generation)

2 The energy consumptions of the building services systems controlled or influenced by the Applicant (e.g. MVAC, lighting, lift & escalator, plumbing & drainage, service hot water system, etc.) shall be accounted. Areas to be considered shall include those under the landlord's control such as entrance lobby, lift lobbies, corridors, staircases, shopping arcade, clubhouse, car park, plant rooms, public toilets, etc.

6. While the biofuel generator applied on-site to replace normal electricity use, the biofuel from renewable energy sources can either be produced on-site or purchased from off-site suppliers. The amount of annual renewable energy attributed to the biofuel system should be limited to the connected load of the system. To support this, the Applicant is required to submit documentation evidence, such as electrical schematic diagrams, to demonstrate the connected load of the biofuel system. This documentation will help ensure accurate calculation and assessment of the renewable energy contribution.

7. If EU 2 Option 1 (Performance Path) is not attempted or EU 2 Option 2 (Prescriptive Path) is adopted, the annual energy use of the Project building could be estimated based on the reference figure in Table EU5-1 [3].

Table EU5-1

#	Building Type	Total Energy use kWh/m^2	Controlled by Applicant
1	Office	222	40%
2	Enclosed and strip malls	268	50%
3	Retail shop	180	50%
4	Educational	166	100%
5	Other	334	100%

8. The calculation of percentage of annual building energy consumption [4] obtained from all renewable energy applications, including the calculation of annual energy yielded from each renewable energy application, shall be endorsed by a Locally Qualified Professional who has at least 3 years of relevant experience in renewable energy. The Locally Qualified Professional shall attain at least one of the following local professional qualifications:

   - Member of The Hong Kong Institution of Engineers (MHKIE);
   - Member of Hong Kong Institute of Qualified Environmental Professionals Limited (MHKIQEP);
   - Registered Energy Assessor (REA), under the Buildings Energy Efficiency Ordinance (Cap. 610); and
   - Registered Professional Engineer (R.P.E.), under the Engineers Registration Ordinance (Cap. 409).

   The accepted disciplines of the above local professional qualifications include Building Services, Mechanical, Electrical, Energy and Environmental.

   CV of the Locally Qualified Professional shall be provided to demonstrate that the Locally Qualified Professional holds the required local professional qualification(s) and with the relevant experience.

3 Commercial Buildings Energy Consumption Survey (CBECS) Building Energy Intensity Data.

4 The energy consumptions of the building services systems controlled or influenced by the Applicant (e.g. MVAC, lighting, lift & escalator, plumbing & drainage, service hot water system, etc.) shall be accounted. Areas to be considered shall include those under the landlord's control such as entrance lobby, lift lobbies, corridors, staircases, shopping arcade, clubhouse, car park, plant rooms, public toilets, etc.

Submittals

(a) Solar Energy Feasibility Study

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
EU_05a_00	BEAM Plus NB submission template for EU 5a	✓	✓	✓
EU_05a_01	Endorsed Solar Energy Feasibility Study Report demonstrating compliance with part (a) items 1 to 4 of the assessment criteria	✓	✓	✓
EU_05a_02	CV of the professional as prescribed in the assessment criteria	✓	✓	✓

(b) On-site Renewable Energy Application

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
EU_05b_00	BEAM Plus NB submission template for EU 5b	✓	✓	✓
EU_05b_01	Technical specifications of on-site renewable energy application [or] Technical data (e.g. catalogues) of on-site renewable energy application	✓ -	- ✓	- ✓
EU_05b_02	Drawings (e.g. elevation and/ or layout plan) highlighting the location of each on-site renewable energy application	✓	✓	✓
EU_05b_03	Schematic diagram of each on-site renewable energy application For the application of biofuel generator, documentation evidence (e.g. electrical schematic diagrams) to demonstrate the connected load of the biofuel system	✓	✓	✓
EU_05b_04	Endorsed Calculation of annual yield of each on-site renewable energy application and assumptions	✓	✓	✓
EU_05b_05	Endorsed Calculation of percentage of annual building energy consumption obtained from on-site renewable energy applications	✓	✓	✓
EU_05b_06	CV of the professional as prescribed in the assessment criteria	✓	✓	✓

Remarks

(a) Additional Information

Electrical and Mechanical Services Department (EMSD) – HK RE Net [ONLINE]. Available at: https://re.emsd.gov.hk/english/index.html [Accessed Jun 2024].

Electrical and Mechanical Services Department (EMSD) – Energy Land [ONLINE]. Available at: http://www.energyland.emsd.gov.hk/en/energy/energy_use/application.html [Accessed Jun 2024].

Electrical and Mechanical Services Department (EMSD) – New & Renewable Energy [ONLINE]. Available at: http://www.emsd.gov.hk/en/energy_efficiency/new_renewable_energy [Accessed Jun 2024].

Environment Branch, Environment and Ecology Bureau (EEB) – New Scheme of Control Agreement (SCA) with Hongkong Electric Co. Ltd. and HK Electric Investments Ltd. (1 January 2019 to 31 December 2033) [ONLINE]. Available at: https://www.eeb.gov.hk/sites/default/files/en/node66/new_HKE_SCA_eng.pdf [Accessed Jun 2024].

Environment Branch, Environment and Ecology Bureau (EEB) – New Scheme of Control Agreement (SCA) with CLP Power Hong Kong Ltd. and Castle Peak Power Company Ltd. (1 October 2018 to 31 December 2033) [ONLINE]. Available at: https://www.eeb.gov.hk/sites/default/files/en/node66/new_CLP_SCA_eng.pdf [Accessed Jun 2024].

(b) Related Credit

EU 1 Low Carbon Passive Design

EU 2 Reduction of CO_2 Emissions

BEAM Plus appreciates comprehensive energy saving measures. Thorough consideration of passive design, active design and renewable energy will help buildings achieve significant reduction in energy consumption.

5 Energy Use **5.3 Energy Efficient Equipment**

EU 6 Air-Conditioning Units

Extent of Application

EU 6a: All buildings using variable refrigerant flow (VRF) units, window or split-type air conditioners as major source of air conditioning

EU 6b: All buildings using variable refrigerant flow (VRF) units, window or split-type air conditioners as major source of air conditioning and installed by the project owner

Objective

To ensure that the installation of air-conditioning units is able to provide near optimum performance.

Credits Attainable

2

Credit Requirement

(a) Compliance with Manufacturer's Recommendation

1 credit for complying with manufacturer's recommended installation positions for optimal heat rejection.

(b) Performance Verification

1 credit for demonstrating the operating temperatures of all variable refrigerant flow (VRF) units, window type, split-type or packaged type air-conditioning units do not exceed manufacturer's recommendation for the specified COP in the manufacturer's technical specifications via computational simulation techniques.

Assessment

(a) Compliance with Manufacturer's Recommendation

1. **For Projects installing AC unit**

   Demonstrate that the locations for the installation of air-conditioning units, including variable refrigerant flow (VRF) units, window type and split type, are capable to fulfil manufacturer's recommended installation requirements on

   i. Optimal heat rejection (not maintenance access space provision) for the air-conditioning units. At minimum, the following separation criteria shall be met:

      a) Separation from wall;

      b) Separation with other units; and

      c) Separation from wall at air-intake side.

   ii. Refrigerant equivalent pipe-length of manufacturer's requirement for the specified COP in the manufacturer's technical specifications.

2. **For Projects providing AC platform but AC unit is not installed**

   Demonstrate that the air-conditioning platforms for the installation of air-conditioning units, including variable refrigerant flow (VRF) units, window type and split type, by future users are capable to fulfil the recommended installation requirements from at least one representing manufacturer on

   i. Optimal heat rejection (not maintenance access space requirement). At minimum, the following separation criteria shall

be met:

a) Separation from wall;

b) Separation with other units; and

c) Separation from wall at air-intake side.

ii. Refrigerant equivalent pipe-length for the specified COP in the manufacturers' technical specifications.

(b) Performance Verification

Demonstrate, using Computational Fluid Dynamics (CFD), that all air-conditioning units do not exceed the manufacturer's recommended operative temperature.

For outdoor installations, make the following assumptions:

1. All wall surfaces are flat and air-tight;
2. Outdoor dry bulb temperature of 35°C;
3. No external wind effect; air is driven purely by buoyancy effect;
4. The effect of solar radiation is negligible; and
5. Air-conditioning units operate at full rated capacity.

Prepare a Performance Verification Report including the following contents:

1. Objectives;
2. Building layout;
3. Information of air-conditioner installations including brand, model, dimension, cooling capacity (kW) and installed locations;
4. Modelling methodology;
5. Modelling assumptions;
6. Screen shots of all input parameters;
7. Results, including temperature of all air-conditioning units; and
8. Conclusion.

The Performance Verification Report should be endorsed by a Locally Qualified Professional with at least 3 years of relevant experience in CFD simulation. The Locally Qualified Professional shall attain at least one of the following local professional qualifications:

- Member of The Hong Kong Institution of Engineers (MHKIE);
- Member of Hong Kong Institute of Qualified Environmental Professionals Limited (MHKIQEP);
- Registered Energy Assessor (REA), under the Buildings Energy Efficiency Ordinance (Cap. 610); and
- Registered Professional Engineer (R.P.E.), under the Engineers Registration Ordinance (Cap. 409).

The accepted disciplines of the above local professional qualifications include Building Services, Mechanical, Electrical, Energy and Environmental.

CV of the Locally Qualified Professional shall be provided to demonstrate that the Locally Qualified Professional holds the required local professional qualification(s) and with the relevant experience.

Submittals

(a) Compliance with Manufacturer's Recommendation

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
EU_06a_00	BEAM Plus NB submission template for EU 6a	✓	✓	✓
For <u>Projects installing AC unit</u>, please provide the following:		**PA**	**CA**	**FA/ RFA**
EU_06a_01	Equipment schedules of VRF units, window and/ or split-type air-conditioners	✓	✓	✓
EU_06a_02	Drawings (e.g. schematic diagrams) showing the type(s) and locations of VRF units, window and/ or split-type air-conditioners	✓	✓	✓
EU_06a_03	Supporting documents (e.g. Declaration Letter from the Project Owner/ Developer, Tender Specification, etc.) to demonstrate the commitment that the 3 separation criteria and refrigerant equivalent pipe length can be met	✓	-	-
EU_06a_04	/	/	/	/
EU_06a_05	Drawings (e.g. scaled layout plans and/ or elevation drawings) with highlighted indications to illustrate that the 3 separation criteria, and refrigerant equivalent pipe length requirements can be met	✓	✓	✓
EU_06a_06	Representing Technical Data (e.g. catalogue) of VRF units, window and/or split-type air-conditioners [or] Technical Data (e.g. catalogue) of VRF units, window and/or split-type air-conditioners	✓	✓	✓
EU_06a_07	Representing Manufacturer's Installation Details showing the 3 separation criteria and refrigerant equivalent pipe-length [or] Manufacturer's Installation Details showing the 3 separation criteria and refrigerant equivalent pipe-length	✓	✓	✓

For <u>Projects providing AC platform but AC unit is not installed</u>, please provide the following:		PA	CA	FA/ RFA
EU_06a_08	Drawings (e.g. typical installation details drawings) with highlighted indications to illustrate that the 3 separation criteria and refrigerant equivalent pipe length requirements can be met	✓	✓	✓
EU_06a_09	Representing Technical Data (e.g. catalogue) of VRF units, window and/or split-type air-conditioners	✓	✓	✓
EU_06a_10	Representing Manufacturer's Installation Details showing the 3 separation criteria and refrigerant equivalent pipe-length	✓	✓	✓

(b) Performance Verification

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		PA	CA	FA/ RFA
EU_06b_00	BEAM Plus NB submission template for EU 6b	✓	✓	✓
EU_06b_01	Endorsed Performance Verification Report	✓	✓	✓
EU_06b_02	CV of the professional as prescribed in the assessment criteria	✓	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credit

None

5 Energy Use **5.3 Energy Efficient Equipment**

EU 7 Clothes Drying Facilities

Extent of Application Residential buildings, exclusively for those specified under "Assessment"

Objective Encourage wider use of natural means in lieu of gas or electricity for clothes drying purposes.

Credits Attainable 1 + 1 BONUS

Credit Requirement

(a) Provision of Clothes Drying Facilities

1 credit for providing clothes drying facilities for all residential units under suitable location conditions.

(b) Demonstration of Effectiveness

1 BONUS credit for demonstrating the effectiveness of clothes drying facilities via computational analysis.

Assessment This credit applies exclusively to residential units within private/ public housing developments and government quarters.

(a) Provision of Clothes Drying Facilities

Fulfill below requirements on the suitable location conditions of the clothes drying facilities for each dwelling unit:

1. The clothes drying facilities are protected from water droplets and debris falling from higher levels; and
2. At re-entrant location, the clothes drying facilities are required to be:
   i. 0.5m horizontal distance away from air-conditioning units; and
   ii. 1.5m horizontal distance away from kitchen exhausts

   to mitigate the potential nuisances by smoke, fumes and pollutants emitted from water heaters, cooking exhausts, discharges from air-conditioning units.

If the provision is portable clothes drying rack, supporting documents (e.g. Declaration Letter from the Project Owner/ Developer, Tender Specification, etc.) shall be submitted to demonstrate the commitment of the provision.

(b) Demonstration of Effectiveness

Prepare a computational analysis report with the following contents:

1. Description of the surrounding environment;
2. Building orientation;
3. Locations of the clothes drying facilities;
4. Methodology of study, including but not limited to the software tools used, assumptions, calculation methods and screenshots of input parameters; and
5. Demonstration of the clothes drying facilities effectiveness by meeting one of the below requirements.

5.1. **Sunlight**

1 Hour, with 5-minute reporting interval, of direct solar exposure in winter solstice (冬至日)

5.2. **Wind**

Minimum wind velocity of 0.5m/s under winter prevailing wind with the highest wind frequency should be used.

The Computational Analysis Report should be endorsed by a Locally Qualified Professional with 3 years of relevant experience in computational simulation. The Locally Qualified Professional shall attain at least one of the following local professional qualifications:

- Member of The Hong Kong Institution of Engineers (MHKIE);
- Member of Hong Kong Institute of Qualified Environmental Professionals Limited (MHKIQEP);
- Registered Energy Assessor (REA), under the Buildings Energy Efficiency Ordinance (Cap. 610); and
- Registered Professional Engineer (R.P.E.), under the Engineers Registration Ordinance (Cap. 409).

The accepted disciplines of the above local professional qualifications include Building Services, Mechanical, Electrical, Energy and Environmental.

CV of the Locally Qualified Professional shall be provided to demonstrate that the Locally Qualified Professional holds the required local professional qualification(s) and with the relevant experience.

Submittals

(a) Provision of Clothes Drying Facilities

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
EU_07a_00	BEAM Plus NB submission template for EU 7a	✓	✓	✓
EU_07a_01	Layout plans with indications of the locations of the clothes drying facilities For re-entrant locations, the locations with respect to air conditioning units and kitchen vents shall also be indicated to demonstrate the compliance	✓	✓	✓
EU_07a_02	Drawings (e.g. elevation/ section drawings) with indications to demonstrate the falling protections for the clothes drying facilities	✓	✓	✓

EU_07a_03	Supporting documents (e.g. Declaration Letter from the Project Owner/ Developer, Tender Specification, etc.) to demonstrate the commitment of the provision (substantiation for portable clothes drying racks only)	✓	✓	✓
EU_07a_04	/	/	/	/

(b) Demonstration of Effectiveness

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
EU_07b_00	BEAM Plus NB submission template for EU 7b	✓	✓	✓
EU_07b_01	CV of the professional as prescribed in the assessment criteria	✓	✓	✓
EU_07b_02	Endorsed Computational Analysis Report	✓	✓	✓

Remarks

(a) Additional Information

None

(b) Related Credit

None

5 Energy Use 5.3 Energy Efficient Equipment

EU 8 Energy Efficient Appliances

Extent of Application

Residential buildings and hotel, exclusively for those specified under "Assessment"

Objective

Encourage the wider use of energy efficient appliances.

Credits Attainable

2

Credit Requirement

1 credit when 60% of total rated power of appliances are certified energy efficient products.

2 credits when 80% of total rated power of appliances are certified energy efficient products.

Assessment

This credit applies exclusively to private/ public housing developments, government quarters, dormitories, hostels, and hotel developments.

This credit assesses only the appliances provided by the developer.

The appliances covered in this credit include the following items covered by the EMSD Energy Efficiency Labelling Scheme. In other words, only appliances which are governed by the EMSD Energy Efficiency Labelling Scheme will be included in the denominator for percentage calculation.

1. Refrigerating Appliances
2. Washing Machines
3. Dehumidifiers
4. Electric Clothes Dryers
5. Storage Type Electric Water Heaters
6. Televisions
7. Electric Rice-Cookers
8. Electronic Ballasts
9. Induction Cookers
10. Microwave Ovens
11. Photocopiers
12. Fax Machines
13. Multifunction Devices
14. Printers
15. LCD Monitors
16. Computers
17. Hot/ Cold Bottled Water Dispensers
18. Gas Instantaneous Water Heaters
19. Gas Cookers

Provide a schedule of all appliances including the location, quantity, model and the rated power.

The appliances should achieve Grade 1 under the Mandatory Energy Efficiency Labelling Scheme (MEELS) [1] or Grade 1 (for appliance types with 'Grading type' Energy Label)/ "Recognition Type" Energy Label under the Voluntary Energy Efficiency Labelling Scheme (VEELS) [2].

Submittals

Supporting Documents *Please provide softcopies with filename prefix as indicated on the leftmost column below.*		**PA**	**CA**	**FA/ RFA**
EU_08_00	BEAM Plus NB submission template for EU 8	✓	✓	✓
EU_08_01	Schedule of All Appliances Provided by the Developer [EU_08_Appendix A]	✓	✓	✓
EU_08_02	Contract specification or catalogue together with information of EMSD Energy Efficiency Label (e.g. a copy of the EMSD Energy Efficiency Label or an extracted page of the register of MEELS/ VEELS products from EMSD's website with highlighted indication)	✓	-	-
EU_08_03	Technical data (e.g. catalogue) or sales brochure showing the as-installed appliances model(s) together with information of EMSD Energy Efficiency Label (e.g. a copy of the EMSD Energy Efficiency Label or an extracted page of the register of MEELS/ VEELS products from EMSD's website with highlighted indication)	-	✓	✓
EU_08_04	/	/	/	/

Remarks

(a) Additional Information

None

(b) Related Credit

None

1 Electrical and Mechanical Services Department (EMSD) – Mandatory Energy Efficiency Labelling Scheme [ONLINE]. Available at: https://www.emsd.gov.hk/en/energy_efficiency/mandatory_energy_efficiency_labelling_scheme/index.html. [Accessed Jun 2024].

2 Electrical and Mechanical Services Department (EMSD) – Voluntary Energy Efficiency Labelling Scheme [ONLINE]. Available at: https://www.emsd.gov.hk/en/energy_efficiency/voluntary_energy_efficiency_labelling_scheme/index.html. [Accessed Jun 2024]

9 Appendices

9.2 EU 2 Path 1 (Performance Approach)

Whole Building Energy Simulation is required for Path 1 compliance. Both the baseline building model and the proposed building model must cover all building energy components listed in this appendix. The simulation models for calculating the baseline and proposed case building should be developed in accordance with the modelling methodology and the requirements per building category in the following Table-App 1 - 4.

Energy Modelling Methodology

The simulations for the proposed model and baseline model must be calculated using:

(i) the same software

(ii) the same weather data

(iii) the same operating schedules; unless justification is provided through Exceptional Calculation Method (ECM). Otherwise, default operation schedule in Table-App 4 shall be used.

(iv) the same occupancy density

(v) the same building design in terms of shape

(vi) the same outdoor and indoor design conditions, and

(vii) the same internal illuminance levels (lux) for space lightings

(viii) the same **thermal block** based on similar internal load densities, occupancy, lighting, thermal and space temperature schedules, and in combination with the following guidelines:

- Separate thermal blocks should be assumed for interior and perimeter spaces. Interior spaces should be those located greater than 5m from an exterior wall. Perimeter spaces should be those located within 5m of an exterior wall.
- Separate thermal blocks should be assumed for spaces adjacent to glazed exterior walls; a separate zone should be provided for each orientation, except that orientations that differ by less than 45 degrees may be considered to be the same orientation. Each zone should include all floor area that is 5m or less from a glazed perimeter wall, except that floor area within 5m of glazed perimeter walls having more than one orientation should be divided proportionately between zones.
- Separate thermal blocks should be assumed for spaces having floors that are in contact with the ground or exposed to ambient conditions from zones that do not share these features.
- Separate thermal blocks should be assumed for spaces having exterior ceiling or roof assemblies from zones that do not share these features.

Exceptional Calculation Method (ECM)

When no simulation program can adequately model a design, materials or device, an ECM can be used to demonstrate above-standard performance. Its adoption is subject to justification (submitted by the Applicant) of its underlying principles, quantitative & qualitative techniques, assumptions, etc. in details.

Any claim of non-regulated load saving or strategies that lead to a difference between proposed and baseline model is required to submit a narrative and provide with ECM calculation.

ECM is allowed to create a representation of that element. If the methodology of approximation has not been previously published in any technical circular or FAQ, it is the responsibility of the applicant to submit a narrative explanation describing the calculation methodology and providing the results for energy savings if necessary.

Documentation includes the minimum:

(i) Description of software limitation;

(ii) Scope of application;

(iii) Description of calculation methodology, theoretical and empirical information to support the accuracy of the method; and

(iv) Demonstrate result and corresponding saving.

Necessary software being used in calculation other than that used for building energy assessment shall provide corresponding verification.

Table-App 1 Modeling Requirements for Calculating Proposed and Baseline Building Performance

Baseline Case	Proposed Case
Building Envelope	
a. Orientation: The baseline case shall be generated by simulating the building with its actual orientation and again after rotating the entire building 90, 180, and 270 degrees, then averaging the results. - **Exception**: for multiple buildings project applicant could consider not implement this clause. Under this condition benefits from orientation shall be demonstrated through ECM. b. External Shading: No shading projections shall be modelled; No manual window shading devices shall be modelled. c. Infiltration[1]: - Operable window: 1L/s/m^2, pressure at 75Pa accordance with NFRC 400 or ASTM E283 - Curtain wall and glazed shop front: 0.3L/s/m^2, pressure at 75Pa accordance with NFRC 400 or ASTM E283	a. All components of the building envelope in the proposed case shall be modelled as shown on design documents (or as-built for existing building envelopes)
Residential Building & Residents' Recreational Facilities (RRF)	
a. Above grade Wall & Roof: Create baseline opaque thermal properties for assessed building that just meet the regulatory requirement [2] For projects adopting 2014 edition RTTV & 2019 edition OTTV as benchmarking criteria: - $RTTV_{wall}$: 14W/m^2; - $RTTV_{roof:}$: 4W/m^2, AND if applicable - $OTTV_{RRF, tower}$: 21W/m^2; - $OTTV_{RRF, podium}$: 50W/m^2 For projects adopting 2022 edition RTTV & 2019 edition OTTV as benchmarking criteria: - $RTTV_{wall}$: 12.5W/m^2; - $RTTV_{roof:}$: 3.5W/m^2, AND if applicable - $OTTV_{RRF, tower}$: 21W/m^2; - $OTTV_{RRF, podium}$: 50W/m^2	a. All components of the building envelope in the proposed case shall be modelled as shown on design documents (or as-built for existing building envelopes). This included: • Building geometry and window design • Albedo of the envelope • Thermal properties for the external walls, roof, floors, and fenestrations (vertical fenestration and skylight) • SC and VLT for fenestrations b. No manual fenestration shading devices such as blinds or shades shall be modelled. Automatically controlled fenestration shades or blinds might be modelled with creditable documentation provided. c. Permanent shading devices such as fins, overhangs and light shelves may be modeled.

1 American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) – ANSI/ASHRAE/IES Standard 90.1-2016 – Energy Standard for Buildings Except Low-Rise Residential Buildings.

2 Buildings Department – PNAP APP-156 – Design and Construction Requirements for Energy Efficiency of Residential Buildings; Guideline on Design and Construction Requirements for Energy Efficiency of Residential Buildings 2014.

Baseline Case	Proposed Case
b. Below grade Walls: Modelled identically with the proposed case. c. The baseline shall be developed from the proposed building envelope design for the above target with below steps: - Step 1: No shading projections shall be modelled; - Step 2: No manual window shading devices shall be modelled; - Step 3: Exclude roof insulation; - Step 4: Adjust the window-to-wall area ratio (WWR) to achieve the targeted RTTV/ OTTV value; - Step 5: If RTTV/ OTTV targeted value cannot be achieved under 80% WWR, relax the glazing SC value. The final SC value shall not be greater than 0.65. d. If there is existing building envelope, the model shall reflect the existing conditions prior to any revision that are part of the scope of work being evaluated.	
Commercial Buildings, Hotel Building & All Other Building Types	
a. Above grade Walls & Roof: Create a baseline that just meet the regulatory requirement [3] - $OTTV_{tower}$: 21W/m^2; - $OTTV_{podium}$: 50W/m^2 b. Below grade Walls: modelled identically with the proposed case. c. The baseline shall be developed from the proposed building envelope design for the above target with below steps: - Step 1: Exclude any external shading device; - Step 2: Exclude roof insulation; - Step 3: Adjust the window-to-wall area ratio (WWR) to achieve the targeted OTTV value; - Step 4: If OTTV targeted value cannot be achieved under 80% WWR, relax the glazing SC value. The final SC value shall not be greater than 0.65. d. Existing building envelopes shall reflect the existing conditions prior to any revision that are part of the scope of work being evaluated.	a. All components of the building envelope in the proposed case shall be modelled as shown on design documents (or as-built for existing building envelopes). This included: • Building geometry and window design • Albedo of the envelope • Thermal properties for the external walls, roof, floors and fenestrations (vertical fenestration and skylight) • SC and VLT for fenestrations b. No manual fenestration shading devices such as blinds or shades shall be modelled. Automatically controlled fenestration shades or blinds might be modelled with creditable documentation provided. c. Permanent shading devices such as fins, overhangs and light shelves may be modelled.

3 Buildings Department – PNAP APP-67 – Energy Efficiency of Buildings, Building (Energy Efficiency) Regulation; Code of Practice for Overall Thermal Transfer Value in Buildings 1995.

<table>
<tr><th>Baseline Case</th><th>Proposed Case</th></tr>
<tr><td colspan="2">Interior General Lighting System</td></tr>
<tr><td colspan="2">Lighting provides a substantially uniform level of illumination through an area. General lighting shall not include decorative lighting or lighting that provides a dissimilar level of illumination to serve a specialised application or feature within such area. All installed lighting shall be modelled in each thermal block.
1. Lighting Power shall be determined in space-by-space method with same categorization as the proposed design.
2. Lighting system power shall include all lighting system components shown or provided for on the plans for background lighting. Lighting system that solely use for emergency purpose is not in scope.
3. Lighting power shall include all power used by the luminaires, including lamps, ballasts, transformers, and control devices.
4. Any independently operating lighting systems in a space that are capable of being controlled to prevent simultaneous user operation, the installed interior lighting power shall be based solely on the lighting system with the highest wattage.
5. Lighting equipment that is additional to general lighting requirement for a space and is controlled by an independent control device is not included.
6. Lighting that is integral to equipment or instrumentation and is installed by its manufacturer is not included in this assessment methodology.
7. For spaces where the total electrical power consumed by the lighting installations is less than 70W, baseline case shall be modelled identically with the proposed case in the space.
8. Lighting installations in clauses 5.1.2 of applicable edition of BEC TG [4] are excluded.
9. Automatic lighting control shall be modelled in the baseline case in accordance with table 5.4 and clauses 5.6 of applicable edition of BEC [5]. Residential dwelling units are excluded from this requirement.
Exceptions: emergency lighting that is automatically off during normal building operation; lighting that is specially designated as required by a health or life safety statute, ordinance, or regulation.</td></tr>
<tr><td colspan="2">Residential Building</td></tr>
<tr><td>a. The lighting power density within the dwelling unit shall be set equal to the below:
• Bedroom: 13 W/m^2
• Living Room/ Dining Room: 15 W/m^2
• Kitchen: 13 W/m^2
• Bathroom: 13W/m^2
* For any other space type in the building, please refer to Table 5.4 maximum allowable Lighting Power Density (LPD) of applicable edition of BEC.
b. Lighting Control shall be included to reflect the mandatory control requirements in applicable edition of BEC for spaces other than dwelling units in a building.</td><td>a. Dwelling Unit where a complete lighting system designed (or installed) shall be consistent with design documents (or actual equipment used).
b. Dwelling Unit where a lighting system neither exists nor is specified in a space, lighting power shall be modelled identically with the baseline case, unless a legally binding agreement is provided for the future users.
c. For other spaces where a complete lighting system designed (or installed) shall be consistent with design documents (or actual equipment used).
d. For other spaces where a lighting system neither exists nor is specified in a space, lighting power shall be modelled identically with the baseline case.</td></tr>
</table>

4 Electrical and Mechanical Services Department (EMSD) – Technical Guidelines on Code of Practice for Energy Efficiency of Building Services Installation [ONLINE]. Available at: https://www.emsd.gov.hk/beeo/en/mibec_beeo_codtechguidelines.html [Accessed Jun 2024].

5 Electrical and Mechanical Services Department (EMSD) – Code of Practice for Energy Efficiency of Building Services Installation [ONLINE]. Available at: https://www.emsd.gov.hk/beeo/en/mibec_beeo_codtechguidelines.html [Accessed Jun 2024].

Baseline Case	Proposed Case
c. Daylight responsive control shall be modelled for the space (other than dwelling units) with fenestration area exceeding 5m^2 and with lighting electrical consumption at 150W and above. The control should be able to shut off orreduce the lighting zone's lighting power automatically to 50% or less in response to the available daylight. d. Automatic lighting control (occupancy sensor) for space (other than dwelling unit) with lighting electrical consumption at 150W and above. The control should be able to shut off or reduce the general lighting power by at least 50% automatically of the lighting zone being controlled.	e. For automatic lighting controls in addition to those mandatory requirements in applicable edition of BEC, Exceptional Calculation Method (ECM) is required to justify the modification of lighting schedules uses for the proposed case. Credible technical documentation for the modification shall be provided.
Commercial Buildings, Hotels and Other Building Types	
a. Lighting power shall be modelled with reference to the maximum allowable LPD in Table 5.4 of applicable edition of BEC . b. For space that that cannot be determined from the Table 5.4 of applicable edition of BEC , LPD could be advised by professional, and justification shall be provided for advanced approval. c. Daylight responsive control shall be modelled for the space with fenestration area exceeding 5m^2 and with lighting electrical consumption at 150W and above. The control should be able to shut off or reduce the lighting zone's lighting power automatically to 50% or less in response to the available daylight. d. Automatic lighting control (occupancy sensor) for space with lighting electrical consumption at 150W and above. The control should be able to shut off or reduce the general lighting power by at least 50% automatically of the lighting zone being controlled.	a. For spaces where a complete lighting system designed (or installed) shall be consistent with design documents (or actual equipment used). b. For spaces where a lighting system neither exists nor is specified in a space, lighting power shall be modelled identically with the baseline case, unless a legally binding document for future use is provided to justify the input. c. For automatic lighting controls in addition to those mandatory requirements in applicable edition of BEC, ECM is required to justify the modification of lighting schedules uses for the proposed case. Credible technical documentation for the modification shall be provided.

Baseline Case	Proposed Case
Receptacle and Other Loads	
Energy for receptacle and other loads (unregulated load) [a] shall be modelled with respect to building type. These loads shall be input as per design information to reflect the expected energy consumption. Justification shall be provided by the applicant through ECM. If no information could be provided, default power density shall be used for the below space type: • Office: 25W/m^2 • Retail: 15W/m^2 • Chinese Restaurant: 20W per person [b] • Western Restaurant: 20W per person [b] • Coffee shop/ Bar/ Lounge: 10W/m^2 • Canteen/ Food Plaza: 20W per person [b] • Grocery Store: 27W/m^2 • Residential Unit, Habitable Area in Hostel/ Dormitory: 0.25W/m^2 • Hotel Guest Room: 900W/room • Classroom/ Lecture theatre: 10W/m^2 • Data Centre (Data Hall): 900W/m^2 Notes: [a] The load resulting from the consumption or release of energy consumed in support of a manufacturing, industrial or commercial process other than conditioning spaces and maintaining comfort and amenities for the occupants of the building (i.e. process load) could be excluded from the energy assessment. The applicant shall provide supporting information and justification (e.g. calculation) for the portion of energy load being accounted in/ discounted from the energy assessment. [b] 10W per person for sensible heat and 10W per person for latent heat.	
a. Receptacle and other loads shall be estimated based on the building type or space type category and shall be assumed to be identical in the proposed and baseline case, unless a narrative and calculation by ECM is provided.	a. Receptacle and other loads shall be input as design information with supporting through ECM; if no information could be provided, default value shall be used. b. Both baseline and proposed case shall be modelled identically, including power, schedule and control. c. If both cases are not identical, submission of a narrative and calculation by ECM is required for justification.
Miscellaneous	
Miscellaneous energy uses are defined as those that may be treated separately since they have little or no interaction with the conditioned thermal blocks or the HVAC systems that serve them. • Exterior Lighting System • Service Hot Water System • Lift & Escalator System • Irrigation, Plumbing and Drainage, Fire Services	

Baseline Case	Proposed Case
Exterior Lighting System	
a. Where exterior lighting system has been specified (or installed) in the proposed case, the system shall be modelled identically with the proposed case. b. Where no exterior lighting has been specified in proposed case, no exterior lighting shall be modelled.	a. When exterior lighting system has been specified (or installed) in the proposed case, the system shall be modelled consistent with design documents (or actual system information). b. Where no exterior lighting has been specified in proposed case, no exterior lighting shall be modelled.
Service Hot Water System For a combination of equipment and auxiliary devices (e.g. controls, accessories, interconnecting means and terminal elements) by which energy is transformed so it heats up water for domestic or commercial purpose other than space heating and process requirements.	
a. Where service hot-water system has been specified (or installed) in the proposed case, the system shall be sized identical to the proposed case, where energy source shall be electrical heater. Efficiency of the water heater shall be 80%. b. Where no service hot water system has been specified but the building will have service hot-water loads, a service water system using electrical heater shall be used. Efficiency of the water heater shall be 80%. c. For buildings that will have no service hot-water loads, no service hot-water heating shall be modelled. d. Service hot-water energy consumption shall be calculated explicitly based upon the volume of service hot water required and the entering makeup water and the leaving service hot-water temperatures. Leaving temperature shall be based upon the end-use requirements in proposed case. e. Service water loads and usage shall be the same for both the baseline case and the proposed case.	a. Where a service hot-water system has been specified (or installed) in the proposed case, the system shall be modelled consistent with design documents (or actual system information). b. Where no service hot water system has been specified but the building will have service hot water loads, a service water system shall be modelled identical to the baseline case. c. For building that will have no service hot-water loads, no service hot-water heating shall be modelled.
Lift and Escalator System	
a. With reference to proposed design equipment rank, input by identifying each corresponding maximum allowable electrical power according to Section 8.4 in applicable edition of BEC. b. Lift regenerative braking control shall be modelled in the baseline case in accordance with clauses 8.5.5 of applicable edition of BEC.	a. Where lift and escalator system has been specified (or installed), the system shall be modelled consistent with design documents (or actual system information). b. For controls in addition to those mandatory requirements in applicable edition of BEC, ECM is required to justify the modification of lift schedules uses for the proposed case. Credible technical documentation for the modification shall be provided.
Irrigation, Plumbing and Drainage, Fire Services	
a. No system to be modelled.	a. No system to be modelled.

<table>
<tr><th>Baseline Case</th><th>Proposed Case</th></tr>
<tr><td colspan="2">On-site Renewable Energy Application</td></tr>
<tr><td>a. No renewable energy application to be modelled.</td><td>a. Where a renewable energy application has been specified (or installed) in the proposed case, the system shall be modelled consistent with design documents (or actual system information).</td></tr>
<tr><td colspan="2">HVAC System</td></tr>
<tr><td colspan="2">1. General
- Outdoor condition to be used for both baseline and proposed case sizing shall reference to Table 6.4 of applicable edition of BEC.
- Indoor condition(s) to be used for both baseline and proposed case shall be identical. Justification shall be provided else value in Table 6.4 of applicable edition of BEC shall be used.
2. The HVAC system(s) in baseline building design shall be of the type and description specified in Table-App 2 “Baseline HVAC System Setting Summary”.
3. Equipment Efficiencies
All HVAC equipment in the baseline case shall be modelled at the minimum efficiency levels, both part load and full load, in accordance with Table 6.12a (Part 1) and Table 6.12b of applicable edition of BEC .
All HVAC equipment in the proposed case shall be modelled consistent with design documents (or actual installed equipment information).
In both baseline and proposed case, for package type system the descriptor shall be broken down into its components so that supply fan energy can be modelled separately.
4. Equipment Capacities
The equipment capacities for the baseline case shall be based on sizing run and shall be oversized by 15% for cooling.
5. Minimum outdoor air ventilation rate shall be modelled identical in both baseline and proposed case.</td></tr>
<tr><td colspan="2">Residential Building</td></tr>
<tr><td>(i) Public housing:
a. Space: residential unit, common area and recreational facilities area (e.g. communal area) should be modelled with unitary air-conditioner – non-split type unit.
b. Space: kitchen and toilet should be modelled with mechanical ventilation only. Mechanical fans should be 1.1W/L/s of exhaust air flow rate.
* Calculation method refers to Section 6.7.6.1 in applicable edition of BEC.</td><td>(i) Public housing:
a. Space where complete HVAC system has been designed (or installed), the model shall be consistent with design documents (or actual system type used).
b. Space where no HVAC system has been designed (or installed) but AC platform is designed for future provision, the HVAC system should be identical to the system modelled in baseline (unitary air-conditioner – non-split type unit).
c. Space where no HVAC system has been designed (or installed) and no AC platform is designed for future provision, no HVAC system has to be modelled for both baseline and proposed cases.</td></tr>
</table>

Baseline Case	Proposed Case
(ii) Private housing: a. Space: residential flat, common area and recreational facilities area (e.g. club house) should be modelled with unitary air-conditioner – split type unit. b. Space: kitchen and toilet should be modelled with mechanical ventilation only. Mechanical fans should be 1.1W/L/s of exhaust air flow rate. * Calculation method refers to Section 6.7.6.1 in applicable edition of BEC.	(ii) Private housing: a. Space where complete HVAC system has been designed (or installed), the model shall be consistent with design documents (or actual system type used). b. Space where no HVAC system has been designed (or installed) but AC platform is designed for future provision, the HVAC system should be identical to the system modelled in baseline (unitary air-conditioner – split type unit). c. Space where no HVAC system has been designed (or installed) and no AC platform is designed for future provision, no HVAC system has to be modelled for both baseline and proposed cases.
Commercial, Hotels, Educational and Other Building Types	
(iii) Commercial, hotels, educational and other buildings with air-conditioned floor area < 14,000m^2. a. Conditioned space should be modelled with unitary air-conditioner – split type unit. b. Non-conditioned space should be modelled with mechanical ventilation only, Mechanical fans should be 1.1W/L/s of exhaust air flow rate. * Calculation method refers to Section 6.7.6.1 in applicable edition of BEC.	(iii) Commercial, hotels, educational and other buildings with air-conditioned floor area < 14,000m^2. a. Space where complete HVAC system has been designed (or installed), the model shall be consistent with design documents (or actual system type used). b. Space where no HVAC system has been designed (or installed) but AC platform is designed for future provision, the HVAC system should be identical to the system modelled in baseline (unitary air-conditioner – split type unit). c. Space where no HVAC system has been designed (or installed) and no AC platform is designed for future provision, no HVAC system has to be modelled for both baseline and proposed cases.

Baseline Case	Proposed Case
(iv) Commercial, hotels, educational and other buildings with air-conditioned floor area ≥ 14,000m^2. a. Conditioned space should be modelled with VAV system with reheat. b. Supply fan system shall be 2.1W/L/s. * Calculation method based on description stated in Section 6.7.3 and 6.7.5 in applicable edition of BEC. c. Non-conditioned space should be modelled with mechanical ventilation only, Mechanical fans should be 1.1W/L/s of exhaust air flow rate. * Calculation method refers to Section 6.7.6.1 in applicable edition of BEC. d. Chiller configuration shall meet the specific requirements in Table-App 3.	(iv) Commercial, hotels, educational and other buildings with air-conditioned floor area ≥ 14,000m^2. a. Space where complete HVAC system has been designed (or installed), the model shall be consistent with design documents (or actual system type used). b. Space where no HVAC system has been designed (or installed) but AC platform is designed for future provision, the HVAC system should be identical to the system modelled in baseline (Chiller, VAV system with reheat). c. Space where no HVAC system has been designed (or installed) and no AC platform is designed for future provision, no HVAC system has to be modelled for both baseline and proposed cases.
District Cooling System (If Applicable)	
a. Set-up a virtual main plant based on building cooling load: **< 2000kW:** 2 water cooled centrifugal chillers with same capacity **2000≤ cooling load< 9000kW:** no chiller larger than 1000kW & all sized equally **≥ 9000kW**: no chiller larger than 3000kW & all sized equally b. Performance of individual components refer to Table 6.12b of applicable edition of BEC. c. Virtual primary variable pumping system shall be included.	a. Based on actual efficiency performance; or b. If project team cannot obtain actual performance data for main plant, it is permissible to use the following default average performance values: DCS cooling plant – COP of 4.4 for total cooling plant average efficiency (including cooling towers and primary pumps) c. Seasonal thermal distribution losses – including minor leaks and condensate losses (but not pumping energy, which must be accounted for separately where it applies): chilled water district cooling: 5%.
Carpark Ventilation System	
Carpark ventilation (if applicable) shall be operated with staging of fans, provide down to 50% less of the design capacity. * Calculation method based on description stated in Section 6.10.7 in applicable edition of BEC.	Carpark ventilation shall be consistent with design documents (or actual system installed).

Table-App 2 Baseline HVAC System Setting Summary

	Residential		Commercial, Hotels, Educational and Other Building Types		Any Building Types that used District Cooling System (DCS)
	Public Housing	Private Housing	Air-conditioned Floor Area < 14,000m^2	Air-conditioned Floor Area ≥ 14,000m^2	
Cooling Generation	Unitary air-conditioner – non-split type	Unitary air-conditioner – split type	Unitary air-conditioner – split type	Chiller	District Chiller Plants
Heating Generation	Unitary air-conditioner – non-split type	Unitary air-conditioner – split type	Unitary air-conditioner – split type	Electric Resistance	Electric Resistance
Performance of Individual Components Guideline	Table 6.12a (Part 1) in applicable edition of BEC	Table 6.12a (Part 1) in applicable edition of BEC	Table 6.12a (Part 1) in applicable edition of BEC	Table 6.12b in applicable edition of BEC	Table 6.12b in applicable edition of BEC
Terminal Type	N/A	N/A	N/A	VAV with reheat	VAV with reheat
Heat Rejection	Air-cooled	Air-cooled	Air-cooled	Water-cooled*	Water-cooled

* For Projects not under Fresh Water Cooling Towers (FWCT) Scheme or when there is a strong supporting evidence to prove inappropriate of such baseline (e.g. hygiene requirement in hospitals), air-cooled chiller is allowed in baseline setting.

Table-App 3 - Baseline Chiller Configuration

Buildings with Air-conditioned Floor Area	**Number and Type of Chiller(s)**
< 20,000m^2	2 water-cooled screw chillers sized equally
≥ 20,000m^2	2 water-cooled centrifugal chillers minimum with chillers added so that no chiller larger than 2,800kW, all sized equally
All types	Primary/ secondary systems with variable speed drives on secondary pumping loop

Table-App 4 Default Operation Schedule for Calculation [6]

Assembly Occupancy

Hour of Day (Time)		Schedule for Occupancy			Schedule for Lighting System			Schedule for HVAC System			Schedule for Service Hot Water System			Schedule for Elevator (Lift & Escalator System)			Schedule for Receptacle Load		
		Percentage of Maximum Load			Percentage of Maximum Load						Percentage of Maximum Load			Percentage of Maximum Load			Percentage of Maximum Load		
		Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1	(12am - 1am)	0	0	0	5	5	5	Off	Off	Off	0	0	0	0	0	0	5	5	5
2	(1am - 2am)	0	0	0	5	5	5	Off	Off	Off	0	0	0	0	0	0	5	5	5
3	(2am - 3am)	0	0	0	5	5	5	Off	Off	Off	0	0	0	0	0	0	5	5	5
4	(3am - 4am)	0	0	0	5	5	5	Off	Off	Off	0	0	0	0	0	0	5	5	5
5	(4am - 5am)	0	0	0	5	5	5	Off	Off	Off	0	0	0	0	0	0	5	5	5
6	(5am - 6am)	0	0	0	5	5	5	On	Off	Off	0	0	0	0	0	0	5	5	5
7	(6am - 7am)	0	0	0	35	5	5	On	On	On	0	0	0	0	0	0	40	5	5
8	(7am - 8am)	0	0	0	35	30	30	On	On	On	0	0	0	0	0	0	40	30	30
9	(8am - 9am)	20	20	10	35	30	30	On	On	On	0	0	0	0	0	0	40	30	30
10	(9am - 10am)	20	20	10	65	40	30	On	On	On	5	5	5	0	0	0	75	50	30
11	(10am - 11am)	20	20	10	65	40	30	On	On	On	5	5	5	0	0	0	75	50	30
12	(11am - 12nn)	80	60	10	65	40	30	On	On	On	35	20	10	0	0	0	75	50	30
13	(12nn - 1pm)	80	60	10	65	40	55	On	On	On	5	0	0	0	0	0	75	50	65
14	(1pm - 2pm)	80	60	70	65	40	55	On	On	On	5	0	0	0	0	0	75	50	65
15	(2pm - 3pm)	80	60	70	65	40	55	On	On	On	5	0	0	0	0	0	75	50	65
16	(3pm - 4pm)	80	60	70	65	40	55	On	On	On	5	0	0	0	0	0	75	50	65
17	(4pm - 5pm)	80	60	70	65	40	55	On	On	On	5	0	0	0	0	0	75	50	65
18	(5pm - 6pm)	80	60	70	65	40	55	On	On	On	0	0	0	0	0	0	75	50	65
19	(6pm - 7pm)	20	60	70	65	40	55	On	On	On	0	0	0	0	0	0	75	50	65
20	(7pm - 8pm)	20	60	70	65	40	55	On	On	On	0	65	65	0	0	0	75	50	65
21	(8pm - 9pm)	20	60	70	65	40	55	On	On	On	0	30	30	0	0	0	75	50	65
22	(9pm - 10pm)	20	80	70	65	40	55	On	On	On	0	0	0	0	0	0	75	50	65
23	(10pm - 1pm)	10	10	20	25	40	5	On	On	On	0	0	0	0	0	0	25	50	5
24	(11pm - 12am)	0	0	0	5	5	5	Off	Off	Off	0	0	0	0	0	0	5	5	5
Total Hours/ Day		7.10	7.50	7.00	10.10	6.60	7.45	18.00	17.00	17.00	0.70	1.25	1.15	0.00	0.00	0.00	11.55	8.00	8.45
Total Hours/ Week		50.00			64.55			124.00			5.90			0.00			74.20		
Total Hours/ Year		2,607.14			3,365.82			6,465.71			307.64			0.00			3,869.00		

Wk = Weekday

1. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques, except they have been changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in space.

6 Washington State Building Code Council – 2021 Washington State Energy Code - Commercial Provisions - Appendix B Default Internal Load Values and Schedules - B103 Default Schedules [ONLINE]. Available at: https://sbcc.wa.gov/sites/default/files/2024-01/2021_WSEC_C_2ndEd_012824.pdf [Accessed Jun 2024].

Office Occupancy

Hour of Day (Time)		Schedule for Occupancy			Schedule for Lighting System			Schedule for HVAC System			Schedule for Service Hot Water System			Schedule for Elevator (Lift & Escalator System)			Schedule for Receptacle Load		
		Percentage of Maximum Load			Percentage of Maximum Load						Percentage of Maximum Load			Percentage of Maximum Load			Percentage of Maximum Load		
		Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1	(12am - 1am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0	5	5	5
2	(1am - 2am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0	5	5	5
3	(2am - 3am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0	5	5	5
4	(3am - 4am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0	5	5	5
5	(4am - 5am)	0	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0	5	5	5
6	(5am - 6am)	0	0	0	10	5	5	Off	Off	Off	8	8	7	0	0	0	10	5	5
7	(6am - 7am)	10	10	5	10	10	5	On	On	Off	7	7	4	0	0	0	10	10	5
8	(7am - 8am)	20	10	5	30	10	5	On	On	Off	19	11	4	35	16	0	30	10	5
9	(8am - 9am)	95	30	5	65	30	5	On	On	Off	35	15	4	69	14	0	90	30	5
10	(9am - 10am)	95	30	5	65	30	5	On	On	Off	38	21	4	43	21	0	90	30	5
11	(10am - 11am)	95	30	5	65	30	5	On	On	Off	39	19	4	37	18	0	90	30	5
12	(11am - 12nn)	95	30	5	65	30	5	On	On	Off	47	23	6	43	25	0	90	30	5
13	(12nn - 1pm)	50	10	5	55	15	5	On	On	Off	57	20	6	58	21	0	80	15	5
14	(1pm - 2pm)	95	10	5	65	15	5	On	On	Off	54	19	9	48	13	0	90	15	5
15	(2pm - 3pm)	95	10	5	65	15	5	On	On	Off	34	15	6	37	8	0	90	15	5
16	(3pm - 4pm)	95	10	5	65	15	5	On	On	Off	33	12	4	37	4	0	90	15	5
17	(4pm - 5pm)	95	10	5	65	15	5	On	On	Off	44	14	4	46	5	0	90	15	5
18	(5pm - 6pm)	30	5	5	35	5	5	On	On	Off	26	7	4	62	6	0	50	5	5
19	(6pm - 7pm)	10	5	0	30	5	5	On	Off	Off	21	7	4	20	0	0	30	5	5
20	(7pm - 8pm)	10	0	0	30	5	5	On	Off	Off	15	7	4	12	0	0	30	5	5
21	(8pm - 9pm)	10	0	0	20	5	5	On	Off	Off	17	7	4	4	0	0	20	5	5
22	(9pm - 10pm)	10	0	0	20	5	5	On	Off	Off	8	9	7	4	0	0	20	5	5
23	(10pm - 1pm)	5	0	0	10	5	5	Off	Off	Off	5	5	4	0	0	0	10	5	5
24	(11pm - 12am)	5	0	0	5	5	5	Off	Off	Off	5	5	4	0	0	0	5	5	5
Total Hours/ Day		9.20	2.00	0.60	8.00	2.80	1.20	16.00	12.00	0.00	5.37	2.56	1.13	5.55	1.51	0.00	10.40	2.80	1.20
Total Hours/ Week		48.60			44.00			92.00			30.54			29.26			56.00		
Total Hours/ Year		2,534.14			2,294.29			4,797.14			1,592.44			1,526.70			2,920.00		

Wk = Weekday

1. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques, except they have been changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in space.

Hotel Building Occupancy

Hour of Day (Time)		Schedule for Occupancy			Schedule for Lighting System			Schedule for HVAC System			Schedule for Service Hot Water System			Schedule for Elevator (Lift & Escalator System)			Schedule for Receptacle Load		
		Percentage of Maximum Load			Percentage of Maximum Load						Percentage of Maximum Load			Percentage of Maximum Load			Percentage of Maximum Load		
		Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1	(12am - 1am)	90	90	70	20	20	30	On	On	On	20	20	25	40	44	55	20	20	30
2	(1am - 2am)	90	90	70	15	20	30	On	On	On	15	15	20	33	35	55	15	20	30
3	(2am - 3am)	90	90	70	10	10	20	On	On	On	15	15	20	33	35	43	10	10	20
4	(3am - 4am)	90	90	70	10	10	20	On	On	On	15	15	20	33	35	43	10	10	20
5	(4am - 5am)	90	90	70	10	10	20	On	On	On	20	20	20	33	35	43	10	10	20
6	(5am - 6am)	90	90	70	20	10	20	On	On	On	25	25	30	33	35	43	20	10	20
7	(6am - 7am)	70	70	70	40	30	30	On	On	On	50	40	50	42	40	52	40	30	30
8	(7am - 8am)	40	50	70	50	30	40	On	On	On	60	50	50	42	32	52	50	30	40
9	(8am - 9am)	40	50	50	40	40	40	On	On	On	55	50	50	52	45	65	40	40	40
10	(9am - 10am)	20	30	50	40	40	30	On	On	On	45	50	55	52	45	65	40	40	30
11	(10am - 11am)	20	30	50	25	30	30	On	On	On	40	45	50	40	42	53	25	30	30
12	(11am - 12nn)	20	30	30	25	25	30	On	On	On	45	50	50	51	60	60	25	25	30
13	(12nn - 1pm)	20	30	30	25	25	30	On	On	On	40	50	40	51	65	53	25	25	30
14	(1pm - 2pm)	20	30	20	25	25	20	On	On	On	35	45	40	51	65	51	25	25	20
15	(2pm - 3pm)	20	30	20	25	25	20	On	On	On	30	40	30	51	65	50	25	25	20
16	(3pm - 4pm)	30	30	20	25	25	20	On	On	On	30	40	30	51	65	44	25	25	20
17	(4pm - 5pm)	50	30	30	25	25	20	On	On	On	30	35	30	63	65	64	25	25	20
18	(5pm - 6pm)	50	50	40	25	25	20	On	On	On	40	40	40	80	75	62	25	25	20
19	(6pm - 7pm)	50	60	40	60	60	50	On	On	On	55	55	50	86	80	65	60	60	50
20	(7pm - 8pm)	70	60	60	80	70	70	On	On	On	60	55	50	70	80	63	80	70	70
21	(8pm - 9pm)	70	60	60	90	70	80	On	On	On	50	50	40	70	75	63	90	70	80
22	(9pm - 10pm)	80	70	80	80	70	60	On	On	On	55	55	50	70	75	63	80	70	60
23	(10pm - 1pm)	90	70	80	60	60	50	On	On	On	45	40	40	45	55	40	60	60	50
24	(11pm - 12am)	90	70	80	30	30	30	On	On	On	25	30	20	45	55	40	30	30	30
Total Hours/ Day		13.9	13.9	13.0	8.6	7.9	8.1	24.0	24.0	24.0	9.0	9.3	9.0	12.2	13.0	12.9	8.6	7.9	8.1
Total Hours/ Week		96.40			58.70			168.00			63.30			86.75			58.70		
Total Hours/ Year		5,026.57			3,060.79			8,760.00			3,300.64			4,523.39			3,060.79		

Wk = Weekday

1. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques, except they have been changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in space.

Residential Occupancy

Hour of Day (Time)		Schedule for Occupancy			Schedule for Lighting System			Schedule for HVAC System			Schedule for Service Hot Water System			Schedule for Elevator (Lift & Escalator System)			Schedule for Receptacle Load		
		Percentage of Maximum Load			Percentage of Maximum Load						Percentage of Maximum Load			Percentage of Maximum Load			Percentage of Maximum Load		
		Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1	(12am - 1am)	100	100	100	7	7	7	On	On	On	8	8	8	5	5	5	7	7	7
2	(1am - 2am)	100	100	100	7	7	7	On	On	On	4	4	4	5	5	5	7	7	7
3	(2am - 3am)	100	100	100	7	7	7	On	On	On	1	1	1	5	5	5	7	7	7
4	(3am - 4am)	100	100	100	7	7	7	On	On	On	1	1	1	5	5	5	7	7	7
5	(4am - 5am)	100	100	100	19	19	19	On	On	On	4	4	4	10	10	10	19	19	19
6	(5am - 6am)	100	100	100	39	39	39	On	On	On	27	27	27	20	20	20	39	39	39
7	(6am - 7am)	100	100	100	44	44	44	On	On	On	94	94	94	40	40	40	44	44	44
8	(7am - 8am)	85	85	85	39	39	39	On	On	On	100	100	100	50	50	50	39	39	39
9	(8am - 9am)	39	39	39	17	17	17	On	On	On	96	96	96	50	50	50	17	17	17
10	(9am - 10am)	25	25	25	12	12	12	On	On	On	84	84	84	35	35	35	12	12	12
11	(10am - 11am)	25	25	25	12	12	12	On	On	On	76	76	76	15	15	15	12	12	12
12	(11am - 12nn)	25	25	25	12	12	12	On	On	On	61	61	61	15	15	15	12	12	12
13	(12nn - 1pm)	25	25	25	12	12	12	On	On	On	53	53	53	15	15	15	12	12	12
14	(1pm - 2pm)	25	25	25	12	12	12	On	On	On	47	47	47	15	15	15	12	12	12
15	(2pm - 3pm)	25	25	25	12	12	12	On	On	On	41	41	41	15	15	15	12	12	12
16	(3pm - 4pm)	25	25	25	21	21	21	On	On	On	47	47	47	15	15	15	21	21	21
17	(4pm - 5pm)	30	30	30	44	44	44	On	On	On	55	55	55	35	35	35	44	44	44
18	(5pm - 6pm)	52	52	52	62	62	62	On	On	On	73	73	73	50	50	50	62	62	62
19	(6pm - 7pm)	87	87	87	83	83	83	On	On	On	86	86	86	50	50	50	83	83	83
20	(7pm - 8pm)	87	87	87	99	99	99	On	On	On	82	82	82	40	40	40	99	99	99
21	(8pm - 9pm)	87	87	87	100	100	100	On	On	On	75	75	75	40	40	40	100	100	100
22	(9pm - 10pm)	100	100	100	69	69	69	On	On	On	61	61	61	30	30	30	69	69	69
23	(10pm - 1pm)	100	100	100	38	38	38	On	On	On	53	53	53	20	20	20	38	38	38
24	(11pm - 12am)	100	100	100	16	16	16	On	On	On	29	29	29	10	10	10	16	16	16
Total Hours/ Day		16.4	16.4	16.4	7.9	7.9	7.9	24.0	24.0	24.0	11.6	11.6	11.6	5.9	5.9	5.9	7.9	7.9	7.9
Total Hours/ Week		114.94			55.30			168.00			81.06			41.30			55.30		
Total Hours/ Year		5,993.30			2,883.50			8,760.00			4,226.70			2,153.50			2,883.50		

Wk = Weekday

Schedule is referenced to U.S. Department of Energy Commercial Reference Building Models of the National Building Stock NREL/TP-5500-46861 February 2011 – Table B-6 Midrise Apartment Hourly Operation Schedules [7].

7 U.S. Department of Energy, Office of Energy Efficiency & Renewable Energy – U.S. Department of Energy Commercial Reference Building Models of the National Building Stock [ONLINE]. Available at: https://www.nrel.gov/docs/fy11osti/46861.pdf. [Accessed Jun 2024].

Parking Garage Occupancy

Hour of Day (Time)		Schedule for Occupancy			Schedule for Lighting System			Schedule for HVAC System			Schedule for Service Hot Water System			Schedule for Elevator (Lift & Escalator System)			Schedule for Receptacle Load		
		Percentage of Maximum Load			Percentage of Maximum Load						Percentage of Maximum Load			Percentage of Maximum Load			Percentage of Maximum Load		
		Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1	(12am - 1am)	NA			50	50	50	Based on likely use			NA			Included with other occupancies			100	100	100
2	(1am - 2am)				50	50	50										100	100	100
3	(2am - 3am)				50	50	50										100	100	100
4	(3am - 4am)				50	50	50										100	100	100
5	(4am - 5am)				50	50	50										100	100	100
6	(5am - 6am)				50	50	50										100	100	100
7	(6am - 7am)				100	100	50										100	100	100
8	(7am - 8am)				100	100	50										100	100	100
9	(8am - 9am)				100	100	50										100	100	100
10	(9am - 10am)				100	100	50										100	100	100
11	(10am - 11am)				100	100	50										100	100	100
12	(11am - 12nn)				100	100	50										100	100	100
13	(12nn - 1pm)				100	100	50										100	100	100
14	(1pm - 2pm)				100	100	50										100	100	100
15	(2pm - 3pm)				100	100	50										100	100	100
16	(3pm - 4pm)				100	100	50										100	100	100
17	(4pm - 5pm)				100	100	50										100	100	100
18	(5pm - 6pm)				100	50	50										100	100	100
19	(6pm - 7pm)				100	50	50										100	100	100
20	(7pm - 8pm)				100	50	50										100	100	100
21	(8pm - 9pm)				100	50	50										100	100	100
22	(9pm - 10pm)				100	50	50										100	100	100
23	(10pm - 1pm)				50	50	50										100	100	100
24	(11pm - 12am)				50	50	50										100	100	100
Total Hours/ Day		-	-	-	20.0	17.5	12.0	-	-	-	-	-	-	-	-	-	24.0	24.0	24.0
Total Hours/ Week		-			129.50			-			-			-			168.00		
Total Hours/ Year		-			6,752.50			-			-			-			8,760.00		

Wk = Weekday

1. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques, except they have been changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in space. For parking garage lighting, the schedule has been revised to accompany the office schedule: the lighting in the parking garage is set to be on at 100% for all hours when the building occupancy is 10% or greater, but reduced to 50% for all hours when the building occupancy is less than 10%. For other uses, it is acceptable to modify the parking garage schedule to parallel that use.

Restaurant Occupancy

Hour of Day (Time)		Schedule for Occupancy			Schedule for Lighting System			Schedule for HVAC System			Schedule for Service Hot Water System			Schedule for Elevator (Lift & Escalator System)			Schedule for Receptacle Load		
		Percentage of Maximum Load			Percentage of Maximum Load						Percentage of Maximum Load			Percentage of Maximum Load			Percentage of Maximum Load		
		Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1	(12am - 1am)	15	30	20	15	20	20	On	On	On	20	20	25	0	0	0	15	20	20
2	(1am - 2am)	15	25	20	15	15	15	On	On	On	15	15	20	0	0	0	15	15	15
3	(2am - 3am)	5	5	5	15	15	15	On	On	On	15	15	20	0	0	0	15	15	15
4	(3am - 4am)	0	0	0	15	15	15	Off	Off	Off	0	0	0	0	0	0	15	15	15
5	(4am - 5am)	0	0	0	15	15	15	Off	Off	Off	0	0	0	0	0	0	15	15	15
6	(5am - 6am)	0	0	0	20	15	15	Off	Off	Off	0	0	0	0	0	0	20	15	15
7	(6am - 7am)	0	0	0	35	30	30	Off	Off	Off	0	0	0	0	0	0	40	30	30
8	(7am - 8am)	5	0	0	35	30	30	On	Off	Off	60	0	0	0	0	0	40	30	30
9	(8am - 9am)	5	0	0	55	55	45	On	Off	Off	55	0	0	0	0	0	60	60	50
10	(9am - 10am)	5	5	0	55	55	45	On	On	Off	45	50	0	0	0	0	60	60	50
11	(10am - 11am)	20	20	10	85	75	65	On	On	On	40	45	50	0	0	0	90	80	70
12	(11am - 12nn)	50	45	20	85	75	65	On	On	On	45	50	50	0	0	0	90	80	70
13	(12nn - 1pm)	80	50	25	85	75	65	On	On	On	40	50	40	0	0	0	90	80	70
14	(1pm - 2pm)	70	50	25	85	75	65	On	On	On	35	45	40	0	0	0	90	80	70
15	(2pm - 3pm)	40	35	15	85	75	65	On	On	On	30	40	30	0	0	0	90	80	70
16	(3pm - 4pm)	20	30	20	85	75	65	On	On	On	30	40	30	0	0	0	90	80	70
17	(4pm - 5pm)	25	30	25	85	75	55	On	On	On	30	35	30	0	0	0	90	80	60
18	(5pm - 6pm)	50	30	35	85	85	55	On	On	On	40	40	40	0	0	0	90	90	60
19	(6pm - 7pm)	80	70	55	85	85	55	On	On	On	55	55	50	0	0	0	90	90	60
20	(7pm - 8pm)	80	90	65	85	85	55	On	On	On	60	55	50	0	0	0	90	90	60
21	(8pm - 9pm)	80	70	70	85	85	55	On	On	On	50	50	40	0	0	0	90	90	60
22	(9pm - 10pm)	50	65	35	85	85	55	On	On	On	55	55	50	0	0	0	90	90	60
23	(10pm - 1pm)	35	55	20	45	45	45	On	On	On	45	40	40	0	0	0	50	50	50
24	(11pm - 12am)	20	35	20	30	30	30	On	On	On	25	30	20	0	0	0	30	30	30
Total Hours/ Day		7.50	7.40	4.85	13.70	12.90	10.40	20.00	18.00	17.00	7.90	7.30	6.25	0.00	0.00	0.00	14.55	13.65	11.15
Total Hours/ Week		49.75			91.80			135.00			53.05			0.00			97.55		
Total Hours/ Year		2,594.11			4,786.71			7,039.29			2,766.18			0.00			5,086.54		

Wk = Weekday

1. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques, except they have been changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in space.

Retail Occupancy

Hour of Day (Time)		Schedule for Occupancy			Schedule for Lighting System			Schedule for HVAC System			Schedule for Service Hot Water System			Schedule for Elevator (Lift & Escalator System)			Schedule for Receptacle Load		
		Percentage of Maximum Load			Percentage of Maximum Load						Percentage of Maximum Load			Percentage of Maximum Load			Percentage of Maximum Load		
		Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1	(12am - 1am)	0	0	0	5	5	5	Off	Off	Off	4	11	7	0	0	0	5	5	5
2	(1am - 2am)	0	0	0	5	5	5	Off	Off	Off	5	10	7	0	0	0	5	5	5
3	(2am - 3am)	0	0	0	5	5	5	Off	Off	Off	5	8	7	0	0	0	5	5	5
4	(3am - 4am)	0	0	0	5	5	5	Off	Off	Off	4	6	6	0	0	0	5	5	5
5	(4am - 5am)	0	0	0	5	5	5	Off	Off	Off	4	6	6	0	0	0	5	5	5
6	(5am - 6am)	0	0	0	5	5	5	Off	Off	Off	4	6	6	0	0	0	5	5	5
7	(6am - 7am)	0	0	0	5	5	5	On	On	Off	4	7	7	0	0	0	5	5	5
8	(7am - 8am)	10	10	0	20	10	5	On	On	Off	15	20	10	12	9	0	20	10	5
9	(8am - 9am)	20	20	0	50	30	10	On	On	On	23	24	12	22	21	0	50	30	10
10	(9am - 10am)	50	50	10	85	55	10	On	On	On	32	27	14	64	56	11	90	60	10
11	(10am - 11am)	50	60	20	85	85	40	On	On	On	41	42	29	74	66	13	90	90	40
12	(11am - 12nn)	70	80	20	85	85	40	On	On	On	57	54	31	68	68	35	90	90	40
13	(12nn - 1pm)	70	80	40	85	85	55	On	On	On	62	59	36	68	68	37	90	90	60
14	(1pm - 2pm)	70	80	40	85	85	55	On	On	On	61	60	36	71	69	37	90	90	60
15	(2pm - 3pm)	70	80	40	85	85	55	On	On	On	50	49	34	72	70	39	90	90	60
16	(3pm - 4pm)	80	80	40	85	85	55	On	On	On	45	48	35	72	69	41	90	90	60
17	(4pm - 5pm)	70	80	40	85	85	55	On	On	On	46	47	37	73	66	38	90	90	60
18	(5pm - 6pm)	50	60	20	85	85	40	On	On	Off	47	46	34	68	58	34	90	90	40
19	(6pm - 7pm)	50	20	10	55	50	20	On	On	Off	42	44	25	68	47	3	60	50	20
20	(7pm - 8pm)	30	20	0	55	30	5	On	On	Off	34	36	27	58	43	0	60	30	5
21	(8pm - 9pm)	30	20	0	50	30	5	On	On	Off	33	29	21	54	43	0	50	30	5
22	(9pm - 10pm)	0	10	0	20	10	5	Off	On	Off	23	22	16	0	8	0	20	10	5
23	(10pm - 1pm)	0	0	0	5	5	5	Off	Off	Off	13	16	10	0	0	0	5	5	5
24	(11pm - 12am)	0	0	0	5	5	5	Off	Off	Off	8	13	6	0	0	0	5	5	5
Total Hours/ Day		7.20	7.50	2.80	10.60	9.40	5.00	15.00	16.00	9.00	6.62	6.90	4.59	8.44	7.61	2.88	11.15	9.85	5.25
Total Hours/ Week		46.30			67.40			100.00			44.59			52.69			70.85		
Total Hours/ Year		2,414.21			3,514.43			5,214.29			2,325.05			2,747.41			3,694.32		

Wk = Weekday

1. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques, except they have been changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in space.

School Occupancy

Hour of Day (Time)		Schedule for Occupancy			Schedule for Lighting System			Schedule for HVAC System			Schedule for Service Hot Water System			Schedule for Elevator (Lift & Escalator System)			Schedule for Receptacle Load		
		Percentage of Maximum Load			Percentage of Maximum Load						Percentage of Maximum Load			Percentage of Maximum Load			Percentage of Maximum Load		
		Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun	Wk	Sat	Sun
1	(12am - 1am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0	5	5	5
2	(1am - 2am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0	5	5	5
3	(2am - 3am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0	5	5	5
4	(3am - 4am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0	5	5	5
5	(4am - 5am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0	5	5	5
6	(5am - 6am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0	5	5	5
7	(6am - 7am)	0	0	0	5	5	5	Off	Off	Off	5	3	3	0	0	0	5	5	5
8	(7am - 8am)	5	0	0	30	5	5	On	Off	Off	10	3	3	0	0	0	30	5	5
9	(8am - 9am)	75	10	0	60	15	5	On	On	Off	34	3	5	30	0	0	85	15	5
10	(9am - 10am)	90	10	0	65	15	5	On	On	Off	60	5	5	30	0	0	95	15	5
11	(10am - 11am)	90	10	0	65	15	5	On	On	Off	63	5	5	30	0	0	95	15	5
12	(11am - 12nn)	80	10	0	65	15	5	On	On	Off	72	5	5	30	0	0	95	15	5
13	(12nn - 1pm)	80	10	0	55	15	5	On	On	Off	79	5	5	30	0	0	80	15	5
14	(1pm - 2pm)	80	0	0	55	5	5	On	Off	Off	83	3	5	30	0	0	80	5	5
15	(2pm - 3pm)	80	0	0	55	5	5	On	Off	Off	61	3	3	30	0	0	80	5	5
16	(3pm - 4pm)	45	0	0	50	5	5	On	Off	Off	65	3	3	15	0	0	70	5	5
17	(4pm - 5pm)	15	0	0	35	5	5	On	Off	Off	10	3	3	0	0	0	50	5	5
18	(5pm - 6pm)	5	0	0	35	5	5	On	Off	Off	10	3	3	0	0	0	50	5	5
19	(6pm - 7pm)	15	0	0	35	5	5	On	Off	Off	19	3	3	0	0	0	35	5	5
20	(7pm - 8pm)	20	0	0	35	5	5	On	Off	Off	25	3	3	0	0	0	35	5	5
21	(8pm - 9pm)	20	0	0	35	5	5	On	Off	Off	22	3	3	0	0	0	35	5	5
22	(9pm - 10pm)	10	0	0	30	5	5	On	Off	Off	22	3	3	0	0	0	30	5	5
23	(10pm - 1pm)	0	0	0	5	5	5	Off	Off	Off	12	3	3	0	0	0	5	5	5
24	(11pm - 12am)	0	0	0	5	5	5	Off	Off	Off	9	3	3	0	0	0	5	5	5
Total Hours/ Day		7.1	0.5	0.0	7.5	1.7	1.2	15.0	5.0	0.0	6.9	0.8	0.8	2.3	0.0	0.0	9.9	1.7	1.2
Total Hours/ Week		36.00			40.40			80.00			36.19			11.25			52.40		
Total Hours/ Year		1,877.14			2,106.57			4,171.43			1,887.05			586.61			2,732.29		

Wk = Weekday

1. Elevator schedules, except for restaurants, are from the U.S. Department of Energy Standard Evaluation Techniques, except they have been changed to 0% when occupancy is 0%. These values may be used only if actual schedules are not known.
2. Lighting profiles are modified to reflect the requirement for occupancy sensors in space.

9 Appendices

9.3 EU 2 Path 2 (Prescriptive Approach)

When outdoor conditions are suitable, natural ventilation, as opposed to mechanical cooling, can be used to remove heat gains and pollutants from buildings. This reduces energy consumption.

The wind availability at a window is determined by site massing and neighbourhood massing which are addressed elsewhere in this guidance. It is not the intention of this credit to assess the natural ventilation potential in a specific wind environment, simply to give designers a tool to optimise window design and spatial to achieve good natural ventilation.

Acoustic windows calculation should be accounted with reference to PNAP APP-130 (2/2015) Section 6.

Cross Ventilation Requirements

Units can be considered to have good cross ventilation when the air flow path between façade openings is relatively unobstructed.

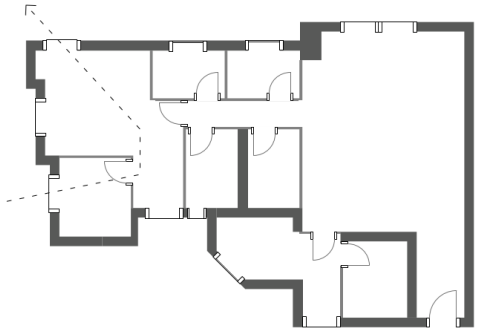
Design should demonstrate cross ventilation enhancement consideration by below design principle:

Openable windows can be located in different habitable areas, e.g. living room and bedroom or on differently orientated façades of the same habitable area.

The cross ventilation path between openings should be one turn only, from the middle of one window to another; (Figure 1 & 3)

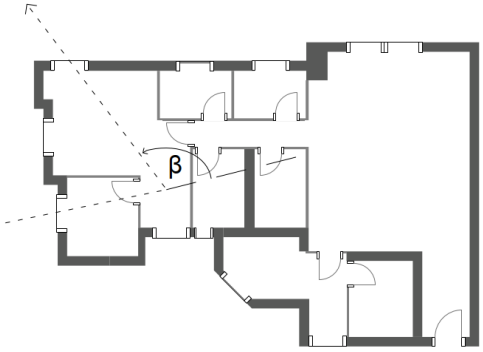
The angle of turn for the cross ventilation path at the joint of the two lines should not be greater than 90°; (Figure 2 & 3)

Cross ventilation path should not be more than 12m in length for each habitable area. (Figure 3)



✖ No More Than One Turn Is Allowed

Figure 1 Cross Ventilation Path between Openings



✖ Angle of Turn, β, Should Not Be Greater Than 90°

Figure 2 Angle of Turn for the Cross Ventilation Path at the Joint of the Two Lines

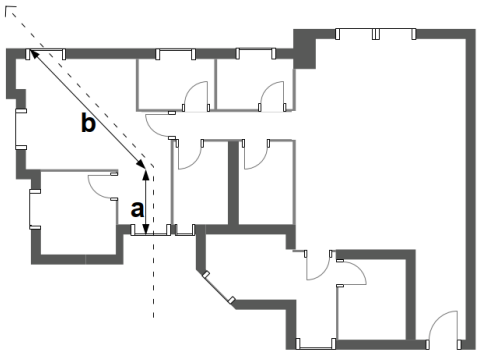


Figure 3 Cross Ventilation Path for Each Habitable Area

In each habitable area, total physical openings area (i.e. not aerodynamic free area) should be double of that of the statutory requirement (i.e.1/8 of openable window area to usable floor area);

When considering a single room, the openable window size located at each wall should be at least 1/16 of the usable floor area;

To ensure cross ventilation can affect the majority of the habitable space, it is required to have the windows a reasonable distance apart. To assess this, draw the smallest box possible that covers the habitable area and divide into equal halves through the longest side. The windows shall lie in different halves of the habitable area. (Figure 4)

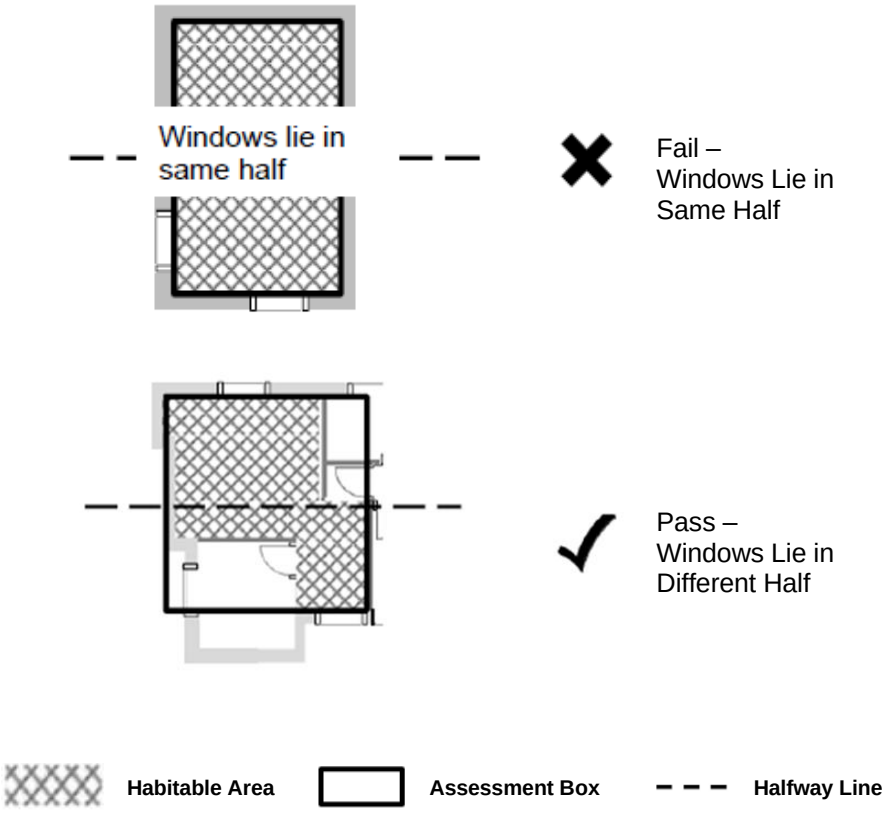


Figure 4 Allowable Locations of Windows in a Zone

For Windows Located within Re-entrants

Concave areas of buildings with width greater than 4.5m will typically have similar flow characteristics to the free-stream. Hence, for the purpose of ventilation, a re-entrant begins when a concaved area has width less than 4.5m. This can be defined graphically by a plane of 4.5m wide (referred to as the External Plane, (ExP), extending from infinity towards a concave area: the re-entrant begins where such a plane can no longer pass through.

A secondary opening located in the re-entrant may still achieve satisfactory cross-ventilation performance provided that the re-entrant is sufficiently wide and the window is located relatively close to the beginning of the re- entrant. Such an acceptable window can be defined by connecting a plane of 2.3m width and 4.5m length (referred to as Secondary Window Plane, (SWP) to ExP. Windows that can be reached by SWP are considered acceptable secondary windows.

For the purpose of this assessment, the effective area of an apartment can be extended by the concept of a “notional” area. Such a notional area can be defined by connecting a Notional Plane (NP) of 1.5m width from SWP to a secondary window. The conditions for demonstrating cross ventilation explained above now cover NOT only the actual residential unit, but also the notional area together, i.e. the ventilation path is measured from the primary window to the SWP, See Figure 5.

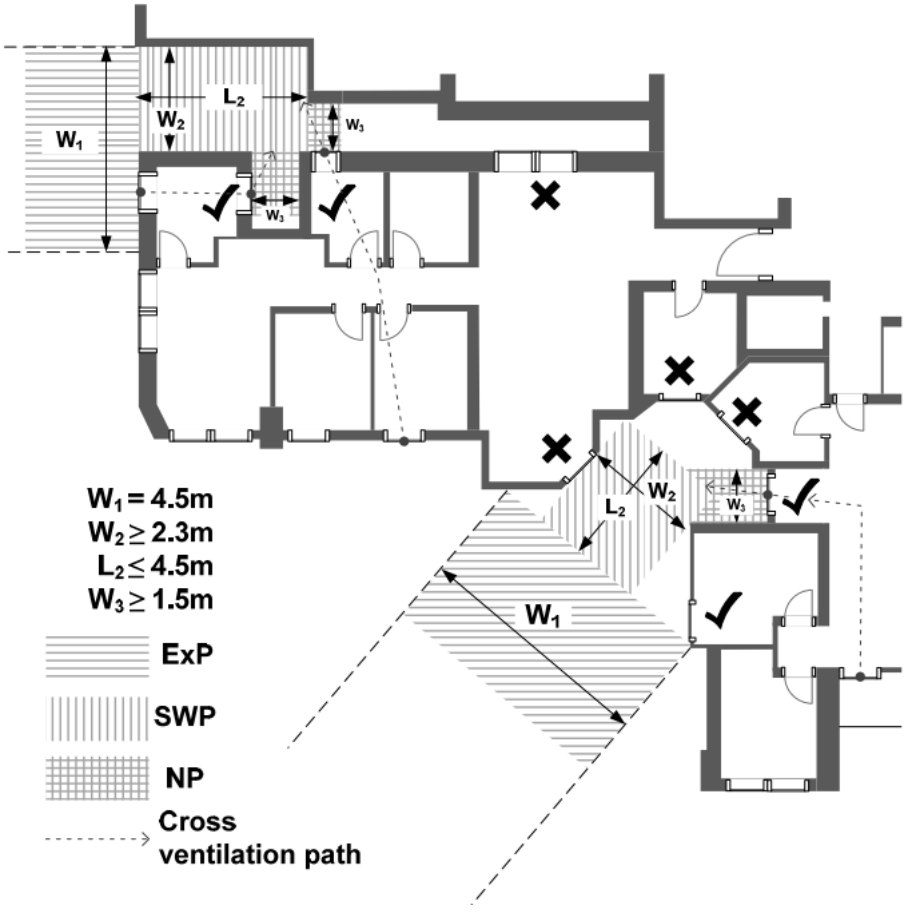


Figure 5 Allowable Locations of Windows in Re-entrants

Single Side Ventilation Requirements

Units can be considered to have good single sided ventilation when the ventilated space is sufficiently small to allow for air exchanges resulting from turbulent fluctuations in the wind which induce pressure differentials across openings or stack effects. The following criteria set out guidelines to achieve single side ventilation requirements.

The window will ventilate up to 4.5m from opening area, the area under question shall be contained within this zone. (Figure 6)

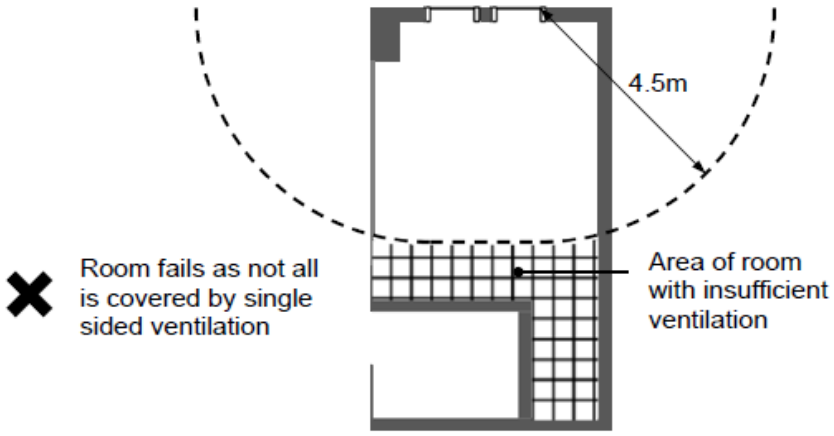


Figure 6 Room Ventilation Zone

At least two separated openable window panes should be located at same wall or different walls for single sided ventilation; and

The total physical openings area (i.e. not aerodynamic free area) in each habitable area shall be at least 1/5 openable window of the usable floor area.

