GM: 2021 FAQs

Section A: Timeline or Certification Process related

1. What are the updates/changes in GM: 2021 2nd edition that will be effective on 1 Jan 2024?

[Added on 6 Oct 2023]

The 2nd edition of GM: 2021 has been uploaded to Green Mark 2021 website.

Here is the summary of the key changes:

Section	Summary of Key Changes	
EE	1	Inclusion of EUI baseline (EE Pathway 1) for light industry for Warehouse/Logistic buildings
	2	VRV M&V requirement tweaked for aircon area <2000m2 served by VRV system
	3	Provided clarity that onsite RE used to meet EE requirement cannot be sold as REC to avoid double counting
	4	Inclusion of GM: 2021 In Operation for Existing RB
Cn	1	Inclusion of accounting of A5 Construction Phase embodied carbon emissions in the Reference value for all building typologies
	2	Tightened the Reference value of Residential Building typology from 1500kgCO2e/m^2 to 1300kgCO2e/m^2
	3	Double the score weightage from the range of 0.5pt - 1pt to 1.0pt - 2pts respectively based on the adoption of Low Carbon Concrete (minimum SGBP 2 ticks to SGBC 4 ticks or equivalent administered by local certification bodies) for Residential building typology.
Re	1	Updated list of water fittings to align with PUB's Water Efficiency Labelling Scheme (WELS)
	2	Additional explanations for clarity
Hw	1	Removal of 1.3c designated smoking points
	2	Score adjustment to 3.2a (i), 3.2a (ii), 3.3a (i) and 3.3b (i)
In	1	Tweaked criteria on "Digital Twin" to be included as an example in the Innovation section
	2	Tweaked the "Voluntary Disclosure of Building Energy Performance Data" criteria
	3	Added in new use cases such as Adaptive ACMV control system (water/air side), Community experience, E-notice board, etc
Mt	1	Architecture: Removal of prerequisite to use of salt-free mortar to address efflorescence issues (based on industry feedback that this was too costly and not easily available)
	2	Mechanical: Removal of cleaning eye with viewing panel for sanitary pipes (based on industry feedback that there were no longer suppliers in the market)

	3	Landscape: Revision to spacing of bib taps from 15 m radius to 20 m radius (based on industry feedback that this may be too stringent as a back-up irrigation system)

2. Can I request for extension of time as my building's validity of the previous certification is going to be expired?

[Updated on 28 Sep 2023]

Yes, projects can request for the extension of its previous Green Mark certificate with the following **conditions**:

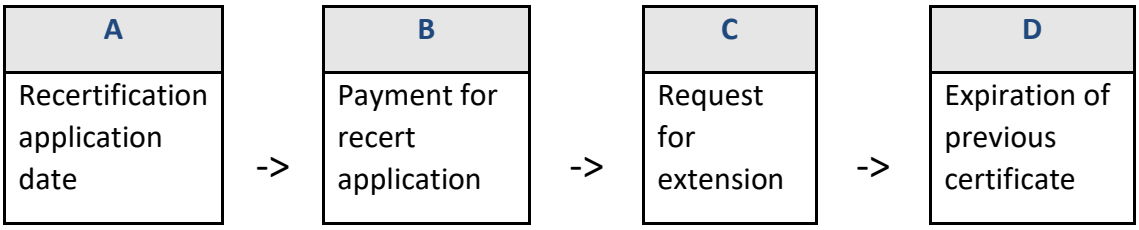

Diagram of the sequence of the process flow

1) Extension will be granted on a case-by-case basis after the project team submits a formal written request and is only applicable to projects going for recertification under GM:2021 In Operation. No extension will be given for projects undergoing full certification for GM: 2021.
2) The Green Mark re-cert application (A), payment (B) and request for extension (C) shall be made before the expiration date of the current certificate (D).
3) As a good practice, it is recommended to submit re-certification application six months before the expiry date of the current certificate.
4) Up to 24 months extension could be granted, during which the project team must complete airside retrofit/optimization and install permanent M&V for airside, with a condition to meet measured TSE of 0.78 kW/RT (or 0.2 kW/RT for airside efficiency if building is tapping chilled water from DCS) or better during the recert assessment.
5) This is only applicable to the transition period, from now till 30 March 2025 (refers to the endorsed GM submission date) for projects to meet airside requirements and is not perpetual.
6) At the end of EOT period, if the project cannot meet the conditions set in the EOT, such as the measured TSE of 0.78kW/RT (or 0.2 kW/RT for airside efficiency if building is tapping chilled water from DCS), no certificate will be awarded. BCA will issue no award, or project team may request for withdrawal but there will be no refund based on Green Mark Terms and Conditions.

For info, the Green Mark Incentive Scheme for Existing Buildings 2.0 ("GMIS-EB 2.0") will provide grant support to private building owners on their goals to attain higher energy performance. For more details, please refer to https://www1.bca.gov.sg/GMIS-EB 2.0.

3. Can you tell me more about the GM certification process under GM: 2021?

To start the certification process, the building owners or the Green Mark consultant need to apply via Green Mark online at https://www.bca.gov.sg/GreenMarkOnline.

Upon system acceptance of the application fee payable, a BCA Green Mark Assessor will be assigned to the project. Assessment will be conducted after the full submission of required supporting documents. After completion of the assessment, a Letter of Award (LOA) will be issued.

Upon the completion of the project, BCA may select the project for verification on site, if applicable.

4. For pilot projects, is Green Mark online application required as normal projects and does the GM application fee apply?

Yes, pilot projects are subject to the same Green Mark online application process and the application fees.

5. Could you define "legacy project"?

Legacy projects refer to all previously certified GM projects under previous GM criteria such as GMv4.1, GM NRB: 2015, GMENRB ver2.1, GMENRB ver.3, GM ENRB: 2017 etc. These projects can be re-certified under GM: 2021 In Operation if there are no major energy use change, such as change of chillers.

6. I have a mixed development with 60% of GFA for commercial, 10% GFA for Hotel and another 30% GFA for Residential, can I apply for one Green Mark Certification for the entire development, or must I apply for two certifications under GM: 2021?

GM: 2021 criteria replace GM: 2015 for NRB, GM: 2016 for RB and GM: 2017 for ENRB. It provides the flexibility to certify the mixed development under one single certification. For energy efficiency for NRB and RB, they must comply with the respective NRB and RB requirements. However, the developers have the choice to apply for two certifications as well.

7. We have a mixed development project with both Non-residential and Residential components within the same development. For GM assessment should we comply with the NRB criteria or RB criteria?

[Added on 7 Jul 2023]

For a mixed development with both Non-residential and Residential components, if Non-residential development's GFA is > 2000 sqm and the Residential development's GFA is also > 2000 sqm then the development would have to comply with both NRB criteria and RB criteria. In this case, the final GM score for the Sustainability sections should be prorated based on the GFA for the Non-residential and Residential components as some of the green features and common facilities could be shared within the development.

However, If the GFA of the Non-residential development or Residential development is less than 2000sqm, then criteria shall be based on the larger part of the building works.
For Mixed Developments where the developer wishes to target different GM Ratings for the Non-residential and Residential components within the same development, it is advised to do two separate GM applications - one for the Non-residential and other for the Residential development accordingly so that separate GM certificates reflecting the GM rating could be provided.

8. There are two phases with two BP submissions for our project with two TOPs. The phase-1 TOP and phase-2 TOP is 3 to 4 years apart. The development will be using one centralised chiller plant to serve 2 phases, can we opt for one GM submission?

If the gap between the two TOP is more than 3 years, it should be separated into two GM applications. The certification of non-residential building is only valid for 3 years from TOP date, and the verification should be completed within the validity of the certification.

Section B: EE requirement in GM: 2021 full certification

9. I am doing a major retrofitting project which comprises an extension of 2 new floors to the existing building, which EE standard in GM:2021 should I refer to?

EE standards in GM: 2021 have been standardised regardless of whether the building is a new or existing building. Please refer to the details on the EE section in GM: 2021.

Additional information: As the building comprises an extension of 2 new floors, you may also need to check on the legislation on Environmental Sustainability for Buildings.

10. What are the key differences between GM: 2021 and GM NRB: 2015, GM ENRB: 2017?

The table below shows a simple summary of the key differences:

GM NRB: 2015, GM ENRB: 2017	**GM: 2021**
Pre-requisites in all sections	Only EE as a pre-requisite
Energy efficiency is measured based on a point system and energy savings (for new development)	3 parallel performance-based pathways to energy efficiency compliance instead of a point system Energy efficiency has moved up in performance level required, about 5% for each tier compared with Green Mark 2015.
Qualification is based on a point system, with mandatory scoring in many sections	More focused criteria allowing projects to focus on key areas that have the most value and meaning to their projects through the modular sections
Some points can be scored for meeting industry norms and building code requirements	Many criteria based on industry norms are removed as they are considered BAU. New areas are developed, such as: • Design for Maintainability • Nature based solutions (within resilience section) • Whole-life carbon and refined embodied carbon calculation with reduction from baseline

	• Zero carbon transition plan for the building (how the project would be net zero carbon by 2030) • Resilience strategy for the building (based on TCFD scenario planning) • Enhanced Health and wellbeing criteria – building on GM 2015 and GM 2017 – so greater focus on active mobility (the interior layout and finish to encourage activity), areas of respite, space for outsourced workers • Digital Twins, data ethics, BIM to ISO 19650

Some areas under GM: 2021 are like those of GM NRB: 2015/GM ENRB: 2017 but with a higher standard:

- Sustainable construction (CUI, products, and fitout – including green lease)
- IAQ and IEQ
- Sustainable operations and procurement (from Existing Buildings)
- Water fittings
- Environmental Impact Assessment
- Acoustic performance
- Biophilic design/ access to nature
- Energy modelling approach (pathway 3 for demonstrating energy performance).

Lastly, for GM: 2021 full certification, the minimum rating is Gold^{PLUS}. Gold rating has been removed. However, Gold rating is still available under GM: 2021 In Operation for re-certification.

11. Should we calculate the value of TSE for VRF systems using the NEA formula or measure it through permanent M&V?

[Updated on 7 Jul 2023]

During the design stage, the TSE for VRF systems can be calculated using the NEA formula for CU efficiency plus air side efficiency. However, during the operation stage, it is recommended to measure the TSE through permanent M&V. When M&V is not required, catalogue data should be used to calculate TSE.

For VRF systems, M&V is required under these circumstances:

- For new developments or existing buildings (including multi-tenanted buildings) to be assessed under GM: 2021 full criteria, M&V for VRF systems is required if the VRF serving an aggregated aircon area greater than or equal to 2000m2 belongs to a single tenant or landlord.

- For existing buildings to be assessed under GM: 2021 In Operation, M&V for VRF systems is required if the VRF serving an aggregated aircon area greater than or equal to 2000m2 belongs to a single tenant or landlord and has undergone system replacement. The permanent M&V is not required if the existing VRF is not replaced at the time of the GM assessment.

12. My project is an office building with a small data centre. Which Energy Efficiency (EE) pathways are applicable for my project? Is there any requirement for the data centre energy efficiency?

There are three EE pathways in GM: 2021 - EUI, Fixed metrics and Energy Savings based on simulation. Please refer to more information below:

Pathway 1 – EUI: The energy consumption from Data Centre must be included. EUI is computed based on total building energy consumption.

Pathway 2 – Fixed metrics: This pathway is particularly suitable for mixed developments that include a data centre, as it assesses the energy efficiency of the cooling system instead of just energy consumption .

Pathway 3 – Energy Savings: Under this pathway, the data centre will be treated as plug load. However, no energy savings from data centre will be accounted for. If the data centre applies for GMDC certification (see details below), its energy consumption and M&E system will be excluded from the main building's assessment. Please refer to the Energy Modelling guideline here.

Scenarios:
a) if the IT capacity of the data centre ≥1MW, it is required to obtain GMDC certification with the same award rating as the main building.
b) If the IT capacity < 1MW, it is required to meet the PUE requirement stated in GMDC criteria based on the same rating as the main building, at 25%, 50% and 75% IT load respectively, or operational PUE requirement for existing data centre. In this case, it is optional to obtain GMDC certification and the data centre is treated as plug load in EM if there is no GMDC certification.

Please note that for any buildings targeting ZE/PE ratings, the total energy consumption from the building, including those from data centre, must be offset by renewable energy.

13. We have a central chiller plant to supply different buildings located in the University's campus, can this plant be treated as a DCS* plant?

[Updated on 25 Sep 2023]

Please refer to the definition of DCS in the main document. DCS* plants refer to corporations that have operational control of a business activity that involves the supply of chilled water for air-conditioning. Thus, if the cooling plant is under the same ownership and operational control as the cluster of buildings connecting to it, and the central chilled water plant is not required to comply with Energy Conservation Act (ECA) and Minimum Energy Efficiency Standards (MEES) as this does not fall under the category of a business activity that supplies chilled water for air-conditioning.

Please also note that to obtain Green Mark PE rating, the total renewable energy generation should be greater than its consumption.

14. What is the Energy Efficiency requirement for buildings with chilled water supplied by DCS*?

[Updated on 25 Sep 2023]

Pathway 1 – EUI. The energy consumption of the chilled water supplied by DCS is excluded from EUI. Refer to the table, Energy Use Intensity (EUI) – With District Cooling Supply. Also, projects must comply with its Airside efficiency requirement.

Pathway 2 – Fixed metrics. Energy efficiency of the DCS shall be excluded, project shall meet the Air side efficiency requirements in Fixed metrics.

Pathway 3 – Energy Savings. The same energy savings requirement in Pathway 3 applies to both building with in-building chilled water plant and buildings with chilled water supplied by DCS plant. Energy consumption of the chilled water supplied by DCS plant shall be excluded from the energy modelling. Also, projects must comply with its Airside efficiency requirement. Cooling load savings in GM NRB 2015 is not required in GM: 2021, refer to Energy Modelling guideline.

Please note that for buildings supplied with DCS aiming for Green Mark ZE/PE rating, the total energy consumption, including the purchased cooling energy, must be offset by renewable energy.

15. What is the Energy Efficiency requirement for HDB projects taking chilled water supplied by DCS*?

[Added on 7 Feb 2023]

For HDB projects taking DCS* supply where chilled water FCUs are provided by utility service provider, the project must comply with air side efficiency for the respective ratings such as 0.18kW/RT for Platinum rating. However, if homeowners choose not to

take DCS*, GM assessment will be based on current method which excludes the household aircon requirement for HDB projects.

16. In GM: 2021 SLE EE Fixed Matrix, what is the definition of non-ac space? Does it include the circulation and transit areas, or only occupied space? Could we have a list of applicable spaces in office and retail buildings for reference?

The spaces here take reference to URA's GFA guidelines, the percentage of non-air-conditioning spaces is the non-air-conditioned space (GFA definition) divided by the total GFA. If the space is counted as GFA as per URA's GFA guidelines, it will be included in the calculation. For example, carparks in the recent development are not counted as GFA, but staircases and corridors are counted, therefore the former will not be included in the calculation, but the latter will be included.

17. What happens if the standardised operation schedules used for EE Pathway 1 and 3 used in energy modelling differ from the actual operation schedule during the verification stage? For example, for commercial offices, some developments have longer operating hours, depending on the tenants' make-up.

For Pathway 1, the EUI calculated for new development: 1) shall be based on estimated operation hours (as close to actual as possible); 2) if the actual operation hours are not known, the fixed hours as indicated in Pathway 3 can be used.

For verification of Pathway 1, if occupancy is low, e.g., 20%, the measured consumption must be extrapolated to 80% occupancy to compute the EUI. In scenario 2) above, if the actual operation hours are used during the design stage, adjustment of operational hours is not required during the verification stage. If the standardised operational hours are used during the design stage, it should be adjusted to actual operational hours during the verification stage.

For Pathway 3, the operational hours used for EM is fixed (say 10hr). At stage 2 verification, if the actual operational hours are 15hr and the utility consumption is 1,000,000kwh, the value of $1{,}000{,}000 \times \frac{15\text{hr}}{10\text{hr}}$ can be calculated and the requirement is considered to be met if it is less than the proposed model consumption.

If the occupancy is low, e.g., only 30%, it needs to be extrapolated to at least 80% occupancy, see example below.

An example is provided:

A small office building	Results 1) based on EM proposed model for new buildings; or 2) based on projected data for existing building undergoing retrofit)	
Annual Total Building Energy Consumption: At 30% occupancy	115,489.3	kWh/year
GFA	2,584	m2
EUI	44.7	kWh/m2/year
TBEC Adjusted to 80% occupancy	=115,489.3÷0.3x 0.8 = 307971.4	kWh/year
EUI after adjustment	119.2	kWh/m2/year

With adjusted EUI of 119.2, the project can pass the verification requirement for Platinum rating.

18. In Energy Modelling, about the approach in sizing the reference (baseline) chillers, can the capacity of the reference chillers be auto sized by the software? Otherwise, if it is sized based on the peak plant load and adhering to the Clause 2.1a in the Energy Modelling Guideline, how do we determine the capacity of each chiller? Do we take the peak plant load and divide it by 800RT? For example, if peak cooling load is 1600RT, do we have to do 2x800RT? Or can we do 4x400RT?

[Added on 21 Mar 2023]

Reference chillers are not allowed to be auto sized. The reference chillers' total capacity equals to the peak load of the reference model. Sizing of air conditioning system shall refer to EM Guideline, section 2.1. Reference model of Peak building cooling load of 1,600 RT ≥ 500 RT shall be 2 numbers of 800 RT centrifugal chiller type. For example, if peak load is 810 tons, reference model will be 2 x 405 RT since 810 RT is more than 800 RT.

19. Energy Modelling for healthcare projects, AHUs or PAHUs are typically installed with heat recovery units to provide dehumidification in order to meet the required conditions for hospital. In this case, what is the reference/baseline COP to be used? We understand that Clause 2.10 in the Energy Modelling Guideline is applicable only to hot water generation.

[Added on 21 Mar 2023]

Reference model of Energy Recovery System shall refer to SS 553: 2016, section 12.1. Exhaust air of 2.5 m3/s or greater from conditioned space in a single location shall have energy recovery system with at least 60% recovery effectiveness. 60% recovery effectiveness means a change of enthalpy of the outdoor air supply equal to 60% of the

difference between the outdoor air and return air at design conditions when tested under AHRI standard 1060. This is covered in the EM Guideline, section 2.11.

20. Among the 3 pathways, there is a difference in terms of the minimum ACMV TSE required (i.e., Pathway 1&3 requires minimum of 0.8 kW/RT(New) 0.9kW/RT(EB), Pathway 2- 0.8kW/RT). What is the rationale for this?

Pathway 1 is purely outcome based (consumption reduction), so the performance requirements are more relaxed as a low EUI (with majority occupation) clearly means that the building is energy efficient. Pathway 2 is deemed to comply and so it uses conservative figures including AC TSE to ensure equivalent energy savings compared with other pathways. The TSE reflects the requirements for minimum standards for Periodic Energy Audits (PEA), a project will retain its certification if it meets the relevant requirements.

21. In GM: 2021 main document, it is mentioned that projects attempting EE Pathway 1 using EUI shall adopt the standardized schedules for computation if operational schedules of the building are unavailable at design stage. For projects attempting pathway 2 and 3, should the standardized schedules be applied as well?

The standardized schedules are applicable for pathway 1 and 3. For pathway 2, there is an established schedule which is mentioned in the technical guide.

22. Will the electrical consumption of EV charging stations installed in the development affect the compliance with requirements for SLEB or ZEB?

The electricity consumption of the EV charging points needs to be metered separately, and it will be excluded from the EUI calculations for the building. Hence, it will not affect pathway 1 - EUI.

23. Do retail buildings under GM: 2021 pathway 2 need to meet the lighting power budget requirement in all tenanted spaces or just those areas within the landlord's control?

[Updated on 3 Jul 2023]

For new retail buildings that choose to use pathway 2, they must comply with the lighting power budget (LPB) requirement in all tenanted spaces. The landlord must also impose a Green Lease before new tenants move in.

For existing malls, the landlord may impose a Green Lease upon lease renewal or the next interior retrofit. In addition to the Green Lease, the LPB of the lighting in the existing tenants' areas must comply with GM: 2021 requirements, including the replacement of

lighting at the time of the GM assessment. This can be achieved through commitments assessed under GM: 2021 full certification and must be verified before the expiry of the GM validity period.

24. For an existing building targeting GM Platinum SLE, can it go for pathway 3 – Energy savings via energy modelling, i.e., demonstrating 60% energy saving based on actual building's energy consumption BEFORE and AFTER the EE retrofits?

Yes, existing building projects **can** choose pathway3 - energy saving. However, they should not use before retrofit as baseline. Instead, they should build the reference model based on EM guideline and use the post retrofit data to compare to the reference model.

25. To get prepared for pandemic situation at a nursing home, where many occupants (elderly) are at higher risk, MERV 14 may be provided at the return air to FCU. MERV 14 adds friction loss, and there is difficulty to find FCU that can cater for friction loss from MERV14. As a result, a booster fan is added. Can the booster fan efficiency will be considered as MV category in term of EE efficiency pathway2?

MERV14 can be used for chilled water FCUs, but the booster fan must be included in the TSE calculation in pathway2 instead of being considered as MV category.
In addition, GM2021 Hw section does not recognize MERV14 for point scoring. It should be ePM1 =>75% or at least MERV14A.

26. I am going to submit GM for a new building, understand there is a cap of receptacle load when I do Energy Modelling to calculate energy saving. Can I apply the cap of receptacle load if I choose pathway 1 - EUI?

For any new buildings using Energy Modelling to calculate EUI under pathway1, **all** energy consumption within the building must be included without applying the cap of receptacle load; however, if the same project chooses to use EM to calculate energy saving under pathway3, cap for receptacle load is allowed. In short, to calculate EUI, all energy consumption on site including receptacle load, process load or production/manufacturing load must be counted.

27. How is the Green Mark "project boundary" defined? What does "on-site" mean for the purpose of meeting SLE/ZE/PE requirement?

[Added on 6 Nov 2024]

The GM project boundary is defined by the applicant/owner as follows:

- It is a continuous boundary in plan view; and
- It encompasses a building or group of buildings and the surrounding land area; and
- All included areas must be under the same ownership or control; and

- The boundary must not overlap with other GM projects.

"On-site" refers to the area within this GM project boundary. This includes:
- Energy produced by solar PVs within the boundary; and
- Energy used by building(s) within the boundary

28. For project that make use of on-site renewable energy to make up energy shortfall to comply with energy efficiency requirements in the fixed matrix, how do we determine the amount of energy that needs to be offset or how does the safety factor for on-site renewable work?

If a project cannot meet the system efficiency requirement, the energy delta due to that shortfall should be calculated and annualised. For example, if the TSE is 0.72kW/RT rather than 0.68kW/RT (requirement), then there would be an efficiency shortfall of 0.72-0.68=0.04kW/RT. This would be multiplied by the annual RThrs to get the kWh/yr. The calculated shortfall, say 1000kWh/yr, will be multiplied by the safety factor, e.g., 1000 × 1.1 for office buildings or 1000 × 1.5 for schools, etc. to obtain the onsite replacement yield needed.

29. Can I buy off-site renewable energy to meet SLE requirement?

No, the first 60% energy saving, up to SLE level, must be from on-site energy saving measures, or on-site renewable generated from PV owned by the building owners. After the buildings meet the first 60% energy saving, purchase of off-site renewable from locally generated sources to meet ZE requirement is allowed.

30. Can carbon credit in any form be used to meet the EE requirement for GM: 2021?

No, local Renewable Energy Certificate (REC) can only be used to meet requirements beyond SLE, meaning the first 60% energy savings must be achieved through EE and on-site RE. Beyond SLE, projects can use local REC to meet ZEB requirements. GM recognises carbon credit by awarding points in other sustainable sections, but it cannot be used to make up any shortfall of EE savings. In short, Green Mark 2021 seeks to: 1) energise the local RE marketplace and help reduce the BE emissions (local REC's) and 2) support the decarbonisation of the local economy and the BE sector through recognition of positive actions to offset carbon emissions.

31. For buildings with space cooling by Passive displacement with fresh and outdoor air cooling PAHU, is the total airside efficiency based on:

(a) PAHU power and load: i.e. PAHU power / PAHU cooling load OR

(b) Total Airside power and building load: i.e., Total PAHU + PDV electrical power / Total building cooling load

Answer is (b)

32. I have an existing building project first time applying for GM: 2021 certification, there is no major retrofit for air side, can I use 3rd party energy audit for air side efficiency?

No, 3rd party energy audit is not acceptable for GM: 2021 full certification. It is stated in GM: 2021 full certification technical guide page 13, footnote3. https://www1.bca.gov.sg/docs/default-source/docs-corp-buildsg/sustainability/20211206_energy-technical-guide_r1.pdf?sfvrsn=4bdbcb84_0

33. For Table 2A- Lighting power budget under GM: 2021 EE section, is there any consideration given to the cavity ratio of rooms, i.e., high volume?

[Updated on 6 Oct 2023]

Yes, LPB baseline can be adjusted based on the Room Cavity Ratio (RCR) stated in SS530. For example, spaces with high ceiling, the LPB baseline can be adjusted.

Here is an example, there is an irregular-shaped atrium, under Table 2A, SS530 LPB is 10W/m2:

LPB (W/m2)	Goldplus	Platinum	SLE	SS530 Ref
Auditorium	*5*	*4.5*	*3.5*	*10*

If the Height of the atrium = 8m, area = 840m2; the perimeter = 164m

So, RCR = 2.5 x 8 x 164/840 = 3.9

If the design lux for the atrium is 300lux, then the LPB based on SS530 RCR table will be adjusted to 14W/m2.

Hence, the LPB baseline will be adjusted to:

	Goldplus	Platinum	SLE	SS530
Atrium (original LPB)	6	5	4	10
Atrium (adjusted LPB based on RCR)	8.4	7	5.6	14

34. Under GM: 2021, only EE is a pre-requisite. Are there any mandatory sustainability requirements for projects that are not pursuing the Green Mark or SLE certification?

Yes, the only pre-requisite in GM: 2021 is EE. However, all projects must comply with other regulation requirements from BCA and other Government agencies, but these are not GM: 2021 requirement. There is a summary of regulatory requirements in the Annex

of GM: 2021 main document. Note that requirements change as agencies update their regulations, thus project teams are expected to stay abreast of development control, building plan and other statutory requirements.

35. Under Green Mark SLE RB, should the RETV be calculated with the latest ETTV coefficients?

For both RETV and ETTV, the coefficients used will be based on the prevailing Code on Envelope Thermal Performance for Buildings, as shown below. Please note the coefficients used for envelope heat transfer for RETV and ETTV are different.

SLE RBs are required to achieve RETV of 20 w/sqm or below

$$RTTV = 12.5(1-SKR)U_r + 4.8(SKR)U_s + 485(SKR)(CF)(SC)$$

$$ETTV = 12(1-WWR)U_w + 3.4(WWR)U_f + 211(WWR)(CF)(SC)$$

36. For private residential developments that are using Option 2: Simulation with ceiling fans for ventilation performance of dwelling units; can the ceiling fans be provided only for the five (5) typical units design layouts that were simulated using CFD analysis and not for all the dwelling units?

[Updated on 7 Jul 2023]

All units must be provided with the ceiling fans as the 5 typical unit design layouts represents only a sample size used for CFD analysis/simulation. As the entire development will be called a GM certified development, all units must be provided with the same passive and active EE measures by the developer, and homeowners will have the choice to opt out of ceiling fans if they wish to do so.

37. If a residential building is using ceiling fans to meet the ventilation performance requirement for dwelling units, is it mandatory to install the ceiling fans at the time of verification?

[Added on 6 Nov 2024]

The developer should provide home buyers with the service to install the ceiling fans. To avoid wastage, home buyers can have the option upfront to opt out the ceiling fan provided by the developer i.e. not install their ceiling fans provided by the developer. The percentage record of opt out rate should be declared during verification by the developers i.e. not install the ceiling fan provided by the developer.

Section C: GM: 2021 In Operation related

38. Can an existing building previously certified with lower GM ratings such as Certified or Gold be upgraded to higher GM ratings under GM: 2021 In Operation?

[Updated on 15 Nov 2024]

Yes, existing buildings with lower Green Mark (GM) ratings can be upgraded under GM: 2021 In Operation, provided they meet the operational energy efficiency requirements for the respective ratings. The eligible upgrades are as follows:

Previous Rating	**Eligible Upgrades Under GM: 2021 In Operation**
Certified/ Gold	SLE/ZE/PE
Gold^{PLUS}	Gold^{PLUS} SLE/ZE/PE
Platinum	Platinum SLE/ZE/PE

These changes will take effect for GM certificates issued on or after 1 January 2025.

39. My project was previously certified under GM ENRB ver3, and I am applying for re-certification under GM: 2021 In Operation, do I need to have permanent M&V for air side in order to submit TSE?

[Updated on 7 Jul 2023]

For projects certified under legacy criteria, air side efficiency can be done through third party energy audit if permanent M&V for air side was not a requirement during the previous certification. This is valid until the next major retrofit when the building will be subjected to the GM2021 full certification.

40. For a project that was previously certified Green Mark Platinum and is currently applying for re-certification, can the project be certified with the badges under GM: 2021 In Operation, if the operation performance meets the relevant criteria?

Yes, it is optional for previously certified projects to top up to get a badge or a few badges during re-certification under GM: 2021 In Operation, based on the building's performance.

41. For re-certification purposes, is there any circumstance in which the project must go through a full certification under GM: 2021 instead of GM: 2021 In Operation?

If there are any major changes in energy use, such as change of chillers or major retrofit, the project must be assessed under GM: 2021 full certification instead of GM: 2021 In Operation.

42. For existing building coming in for re-certification, should the EUI be based on the previous one year or the average of the past 3 years?

For existing building under GM: 2021 full certification under pathway 1 – EUI, the EUI should be based on the immediate prior year, provided the occupancy rate is at least 60%. Please exclude Circuit Breaker (CB) or COVID period with occupancy rate less than 60%. Past three years EUI data should also be provided for consistency check.

43. My building (a bus depot) is going for re-certification and will be assessed under GM: 2021 In Operation. Since a bus depot does not fall into any of the building types in EUI Pathway 1, we are opting for TSE in Pathway 2. What is the TSE required for this bus depot, which is also not in any of the building types in the Table for Pathway 2?

For buildings which are unable to be categorised under any of the building types in the Table for Pathway 2, you may consider the TSE for building types under "For other Non-Residential Buildings".

44. For GM: 2021 full certification pathway 2, it states any shortfall in EE performance can be made up with the use of onsite renewables, subject to the building typology multiplication factor. Would like to check whether this can be applied to GM 2021 In Operation?

[Added on 7 Jul 2023]

No, onsite PV generation is not allowed to offset the EE performance shortfall under GM: 2021 In Operation.
This brings another question, however, if building was certified under GM: 2021 previously and they did offset the TSE. E.g., 0.68 kW/RT (SLE) and the design TSE is 0.72 kW/RT, the shortfall was offset by onsite RE (say X kWh). When this building comes for recert under GM: 2021 In Operation, then the 0.72 kW/RT should be acceptable with the verification of the actual amount of PV annual generation of X kWh.

Section D: Other Sustainability Sections related

45. For private condominiums, if the main entrance door is a fire rated door, is there any contravention to the fire code if a gate is provided for the entrance door?

For residential buildings, the provision of grilles or gates for the main entrance is allowed provided:

- The gate swing does not obstruct public escape
- Units situated along a common corridor must allow a minimum clearance of 1 m from the gate to the wall when gates are opened perpendicularly.
- Gates must not obstruct or hit neighbouring apartments windows or doors
- The main door should be fire rated and complete with a self-closing device.

- This is true for HDB and private residential projects, as such, provided the unit design provides adequate space for the grilles/gates as above. The QP should consult SCDF as the fire code is a live document and subject to amendments.

46. Will the requirements on ventilation affect compliance with NEA's acoustics requirements?

Natural ventilation does not necessarily pose challenge to indoor noise level unless the development is sited in immediate proximity/facing noise sources. We encourage to design openings away from the noise sources and to consider acoustic parameters/treatments during the design stage to provide peaceful environment for the occupants without compromising on the minimum ventilation required for the dwelling unit.

47. I have an RB project certified based on RB2016 and received LOA in 2020, can I top up to get a Hw badge now?

The project must apply for GM: 2021 full certification or GM: 2021 In Operation in order to get any badge. Badges are only available for GM: 2021 family. Without GM: 2021 certification, there is no badge to be awarded alone. It is a top up for GM: 2021 certification.

48. What are the differences between GM: 2021 Hw badge and GM HW: 2018? How are both the certification co-related and/or different since they have some similar/overlapping requirements?

[Added on 7 Feb 2023]

Hw badge is one of the sustainable badges under GM: 2021 certification for the entire buildings. On the other hand, GM HW: 2018 is certification for the tenanted office spaces only, whose use and fit-out works are within the individual tenant's control.

49. Under CN1.1, is it feasible to do embodied carbon calculation before construction starts, since assessment is before construction?

[Added on 7 Feb 2023]

The Whole Life Carbon assessment adopts the BS EN 15978 framework which sets out the principles and calculation method for WLC of projects based on life-cycle assessment (LCA). It is imperative to plan and design for the use of use of low carbon materials and solutions right from the inception of the project, together with all stakeholders to achieve the greatest impact of a low carbon project.

50. Why are there two versions of the Building Embodied Carbon Calculator (BECC) on https://www.sgbc.sg/resources/eccalculator? Which one should I use?

[Updated on 6 Jul 2023]

Two versions are available to cater for different versions of Microsoft Office. Ver2016 is catered for companies that use Microsoft Office 2016 and older, while Ver2019 is catered for companies with Microsoft Office 2019 and after. Depending on which Microsoft Office your company is using, please use the right version such that the ECC functions as intended.

51. For existing building project to score CN1.2, does it mean with the commitment plan, when year 2030 comes, the project would need to achieve net-zero carbon emission operation? Or does it mean that when the year 2030 comes, the project should implement the committed strategies to reduce carbon emissions and eventually reach net-zero carbon emission operation down the road?

[Added on 7 Feb 2023]

This criterion is crafted with the intent for the building's project team and developer/building owner to work together and come up with a commitment plan and work towards the goal of operating the building at net zero carbon emissions by 2030.

By implementing the committed strategies as part of the plan, the building should reach Net Zero, that's the key outcome when we assess the plan. The exact strategies may vary due to changing market conditions and technologies, but the plan should be used as a base to guide building owners on how they can achieve net zero operational carbon by 2030.

52. For a new building development, what does the verification of the CN1.2 transition plan involve? Would like to confirm that the intent of the plan is to ensure that the developer have set strategies that are passed down to the MCST to ensure that targets are set to meet net zero by 2030. Hence, during verification stage, the project team does not need to provide any documentation/ readings to support the plan? If a plan has been set in place to meet the net zero carbon by 2030 for the development, this would suffice, and no publishing of data is required.

[Added on 7 Feb 2023]

Providing a plan is insufficient. Verification documentation is required to support and ensure that the plans set out towards zero operation carbon in 2030 is measured, monitored, and reduced. For residential project, the report should be sufficiently detailed to guide the building operator on the optimum pathway towards achieving net zero by 2030. This should provide guidance going beyond the first year, encompassing plans till 2030. During the point of verification, the project team needs to update their plan, based on actual metered reading, and ensure that the proposed plans remain relevant. We will also validate the disclosure component to ensure that the details have been updated. On the publishing of data, one way is for the data to be disclosed on the development's webpage/portal, where it should be publicly accessible and continuously monitored and updated.

53. Under CN 2.1 Sustainable Construction - (iv) Replacement of coarse and fine aggregates, why is the replacement amount for Washed Copper Slag (WCS) ⩽ 10%? How can this be scored?

[Added on 7 Feb 2023]

Washed Copper Slag (WCS) should comply with the requirements of SS289: Specification for Concrete, for non-structural elements in buildings and may be used to replace up to 10% by mass of sand in the production of structural grade concrete. Please refer to https://www1.bca.gov.sg/buildsg/sustainability/additional-programmes/sustainable-construction/sustainable-construction-publications - A Guide on the Use of Recycled Materials (pg. 10 – 15) for more information.

For scoring, 0.5 point will be awarded if the usage of WCS is more than 0.75% of the building's GFA and the replacement amount is less than or equals to 10% of fine aggregates used.

1 point will be awarded for replacement of both coarse and fine aggregates. Please refer to the GM2021 technical guide for more information.

54. In Cn2.2 Sustainable products and finishes, why cost ($) is used as one of the measurement units in GM2021? Is the installation fee and delivery fee to be included in the calculation for cost?

Based on industry's feedback, cost ($) is the available data in cost plan/Bill of quantities (BoQ) in any projects. Cost usually plays as a key deciding factor in the selection of sustainable products & finishes for a project.

The cost is solely based on the Bill of Quantities (BoQ) which typically encompasses the products, systems, installation, and delivery costs.

55. In Cn2.2 Sustainable products and finishes, is prorating of GM point allowed?

No pro-rating of points is allowed as Whole Lift Carbon section is developed to recognise exemplary performance; GM points are only accorded when the criteria are met.

56. For CN2.2 Sustainable Products & Finishes, I would like to clarify the 2 options for scoring under sustainable products and finishes – coverage by cost and area, for products – thermal break and warm edge solutions. Curtain wall typically comprises of several components such as glazing, framing, sealants, spacers etc. As such, I would like to know if we are able to consider thermally broken framing members & insulating glass with warm edge solutions (using SGBP 2 ticks and above) as a base category under architectural product?

Yes, it is acceptable for the applications on top of the curtain wall as long as the products are SGBP 2-ticks products. To recap, the key is still the total BoQ, the base shall include all items that used.

57. In Cn2.2 Sustainable products and finishes, when I am doing retrofitting work for my existing building and I only need to change three MEP systems and interior work, in this case, am I able to score for CN 2.2.1 and CN 2.2.2?

You can score full 3 points under Cn 2.2.2 if these three newly changed MEP systems are certified by approved local certification bodies. For interior work, you can score under CN3.2 Fit Out if they fulfil the requirements stated in the criteria.

58. If my client were to use paints to claim for CN3.2 Fit Out Products as it was used for exterior and interior façade painting, can the same paints be used to claim for HW1.2 Material Emissions for TVOC specs?

Paints (internal) which are SGBP 2 ticks or equivalent and fulfils ≥ 80% (by value or by area) of the fit-out materials used (construction and finishes) for common areas (i.e. non-tenanted spaces) or used (construction and finishes) for tenanted spaces/ dwelling units shall be conserved are eligible to be scored under CN.3.2.

Internal paints with SGBC 4 ticks are counted under HW1.2.

59. Under Innovation section, how many Environmental Product Declaration (EPD) products do we require to score and what is the extent of usage to score under this section?

[Updated on 6 Jul 2023]

General guidelines for scoring under the Innovation section:

- EPD of the product must be in accordance with EN 15804 and ISO 14025 standards
- Carbon emission factor from the product EPD to be used in to calculate the product's upfront carbon using the Building Embodied Carbon Calculator (BECC) / the Singapore Building Carbon Calculator or in the computation of Whole Life Carbon (WLC) (at least minimum WLC) using the list of recommended WLC software tools in the Carbon technical guide.
- Extent of usage will follow either CN2.2 Sustainable Products and finishes or CN3.2 Fit Out products, depending on product used.

60. Under Innovation section, "Recognise DfD", how are these assessed for point scoring e.g., are there any % threshold or prorated based on its impact/extent or it is as simple as whether the project has adopted it?

[Added on 7 Feb 2023]

Designing for deconstruction (DfD) requires architects/engineers/building designers at the design stage to incorporate deconstruction design strategies, e.g., estimate the types and quantities of materials needed, the relative ease or difficulty of salvage, and the relative value of the material after it is recovered.

For point scoring, documentation to showcase that architects/engineers/building designers have thoroughly evaluated the complete life cycle of the building and its environmental impacts to determine the best design approach that facilitate future changes and dismantlement (in part or whole) for recovery of systems, components and materials is required.

61. I have a mixed development project with 70% of GFA for commercial, 30% GFA for Residential under one Green Mark Certification for the entire development. Do I need to achieve 10pts for GM2021 NRB & 10pts for GM2021 RB within the Whole Life Carbon section to qualify for the Carbon badges (as the point scoring/criteria is different for NRB & RB)? What if I score 10pts for NRB however unable to score the min 10 pts for RB. Do I still qualify for the Carbon badge?

[Added on 7 Feb 2023]

For mixed development, we will prorate the points under the Whole Life Carbon section to assess the NRB part and RB part based on GFA apportionment and if the pro-rated points for both the NRB and RB portion achieve a minimum 10 points, the project is eligible to attain the Carbon badge.

62. Under RE1.1b, could you advise whether the 90% relevant water fittings including landscape water fittings?

No, landscape water fittings are not included.

63. Under RE1.2a Outdoor Thermal Comfort, is the site area applicable for UTCI simulation inclusive of accessible / non-accessible landscape, M&E area and occupiable areas such as outdoor gathering spaces?

[Added on 7 Jul 2023]

All areas within the site boundary including the non-accessible area are required to be included to the boundary for simulation. Points are awarded if the simulation achieves UTCI of ≤32°C for 100% of the applicable Outdoor Area (includes all accessible landscape and occupiable areas where people are more likely to have outdoor activities, excludes non-accessible areas to public such as maintenance paths).

64. Under RE1.2b UHI mitigation measures, can solar PV panels be considered in the site area coverage?

[Added on 7 Jul 2023]

Yes, solar PV panel areas are deemed to comply as a UHI mitigation measures.

65. RE2.3 Resilience Strategy: Would client be able to use Portfolio document such as MAS environmental Risk Assessment to claim points here?

No, whist the portfolio risk assessment helps, the strategy must be building specific, what are the risks to that building and what is the strategy for that building to reduce those

risks. GM is not about corporate or portfolio level strategy or commitment, we dive into the project, so how do the corporate strategies get implemented on that particular asset.

66. For RE3.2 Natural Climate Solutions under (i) - To clarify whether the reforestation/ marine aquatic ecosystem restoration programmes shall be in Singapore only or can it also be implemented overseas (e.g., Indonesia)?

[Added on 7 Feb 2023]

The ecosystem restoration programmes can also take place overseas. It needs to be with a credible organisation where the programme is verified by an independent third party. You may find some examples of ecosystem restoration initiatives listed on the UN Environment Programme website, https://www.decadeonrestoration.org/ as indicated in the technical guide. Documentary evidence include written documents such as contractual or official agreements, correspondences between building owner and organisation(s) involved in the restoration programme/project, implementation, and management plans, etc.

67. Can projects which incorporate PUB Active, Beautiful and Clean Waters (ABC Waters) design score GM points?

[Added on 7 Jul 2023]

Projects which incorporate PUB ABC Waters design concepts encourage sustainable storm water management while enhancing biodiversity and living environment. This are in line with the desired outcomes of Green Mark 2021 Resilience section of deploying climate mitigation and adaptation strategies and use of nature-based solutions. Thus, projects that are certified under PUB's ABC Waters certification can score Green Mark points under the 'Resilience – Innovation' section.

68. There are prerequisites in the Intelligence and Maintainability sections. Is compliance to these pre-requisites' compulsory for all projects?

[Added on 7 Feb 2023]

Besides achieving minimally 10 GM points, projects aiming for the Intelligence or Maintainability badge must comply with those prerequisites that are relevant to their projects. While the prerequisites are not compulsory for projects not aiming for the Intelligence or Maintainability badge, complying with them is highly encouraged.

69. Maintainability Section (NRB) 3.3.1b covers FCU mounted at heights. When would this requirement be applicable?

[Added on 8 Nov 2024]

This criterion applies to Fan Coil Units (FCUs) mounted at or above 4.5 metres from the finished floor level (FFL). The height is measured from the FFL to the bottom of the FCU. This requirement is also applicable to similar criteria in the ENRB (Existing Non-Residential Buildings) and RB (Residential Buildings) frameworks.

70. How are CCTV cameras assessed under Maintainability Section (NRB) 4.3.1 (provide access for CCTV cameras), given that Section 2.2.3 already covers access to all parts of ceilings and exposed slab soffits?

[Added on 8 Nov 2024]

The assessment of CCTV cameras is divided as follows:

1. Indoor CCTV cameras: Assessed under Section 2.2.3
2. Outdoor CCTV cameras: Assessed under Section 4.3.1 if mounted at or above 3 metres from the finished floor level (FFL)

The height for outdoor cameras is measured from the FFL to the bottom of the CCTV camera. This assessment approach also applies to similar criteria in the ENRB (Existing Non-Residential Buildings) and RB (Residential Buildings) frameworks.

Section E: Life Cycle Cost Analysis for Green Mark projects

71. What is the objective of conducting the Life Cycle Cost Analysis (LCCA) for BCA Green Mark projects?

The objective of LCCA is to determine the holistic cost of greening and identify the cost benefits of a BCA Green Mark Building over its lifecycle. LCCA helps projects to understand how the net positive savings achieved during the building operation over its life span outweigh the upfront investment cost.

72. What are the components considered in this LCCA?

The LCCA provides a holistic approach of GM cost over the building's lifecycle and takes into consideration the following:

- **Initial Capital Expenditure (Capex)** – this refers to the cost of investment
- **Operating Expenditure - Utilities (Opex)** – this refers to the utility consumption
- **Maintenance Cost –** this is projected using standard equipment life span commonly adopted in the industry, and the comprehensive maintenance rate.
- **Replacement Cost** during the building's lifecycle period – this shall include estimated cost of dismantling, removal from site, supply and installation of brand-new equipment at the end of their useful lifespan. The year of replacement varies according to the equipment and their economic life spans.
- **End-of-Life (Salvage) Value** – this refers to the estimated resale value of the green features (equipment/materials) at the end of its useful lifespan.
- **Escalation Rate** of 1.5% p.a. is applied to account for the anticipated annual change in percentage for price levels of the goods/materials and services.
- **Net Present Value (NPV) method** is used to determine the current value of all future cash flows generated by the project over the 30-years period. To account future cash flows for time value of money, the Study adopts a Discount rate of 5%.

73. How to calculate the Net Present Value Savings per GFA in the analysis?

The NPV savings calculated as follows:

NPV Savings = NPV of Baseline Building (lifecycle cost of a non-Green Mark building) – NPV of GM Building (lifecycle cost of a Green Mark rating building)

As the NPV savings (i.e., in terms of total absolute costs) vary from project to project depending on the size of the projects, the NPV savings are then divided by their respective project's Gross Floor Area (GFA) so that the data are normalised for comparison across the various Green Mark rated projects.

$$NPV\ Savings\ per\ GFA = \frac{NPV\ Savings}{GFA}$$

74. For air conditioning saving and payback calculation, should I just consider the equipment saving with same capacity?

No, it should take the reduction of the size of the air-conditioning equipment into account when you calculate the saving and the payback which may have been achieved due to a more efficient design thus reduction in cooling load when compared to the baseline design.