TGS v3

How does the typical MURB stack up?

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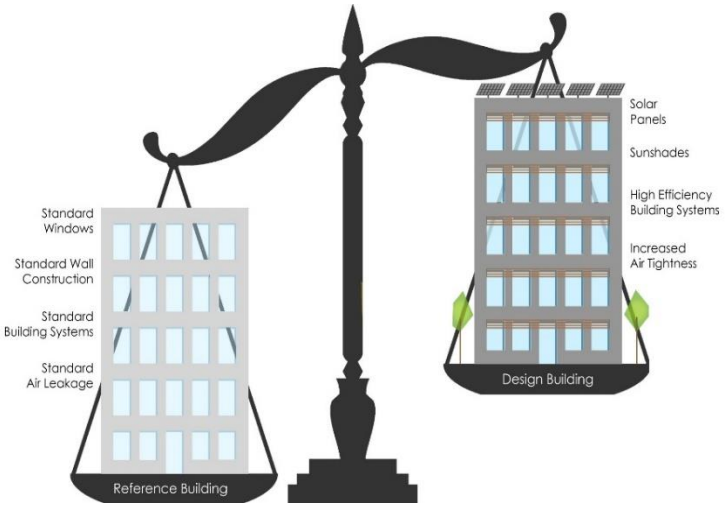
Late last year, City of Toronto council officially approved version 3 of the Toronto Green Standard (TGS). The new set of guidelines is quickly approaching its implementation date of May 1, 2018, and the news has many developers wondering what, if anything, they will need to change about their building designs in order to meet the new standard. Like its predecessor, all new developments going through the planning approval process will be required to comply with Tier 1 of version 3, and Tier 2 remains an optional incentive for developers.

With this new version comes many enhancements to the TGS, particularly to how the energy use of the building is evaluated. The current TGS version 2 uses a 'reference building' approach to demonstrate compliance, which compares the proposed building as designed to an imaginary 'reference' version of your building designed to minimum code requirements. As long as your design performs better than the reference, you achieve compliance. This has been the norm in the industry for many years, and follows the same approach used in the Ontario Building Code and LEED.

> ***Version 3** of the **TGS** proposes replacing the reference building approach by using **three new absolute targets;** Energy Use Intensity, Thermal Energy Demand Intensity, and Green House Gas Intensity.*

Version 3 of the TGS proposes replacing the current approach by using **three new *absolute* targets.** The intent of moving to absolute targets is to encourage all buildings to meet the same standards of performance regardless



of design. For example, building developers will now be able to easily compare their absolute energy use intensity to neighbouring building of the same type. In contrast, actual performance may vary dramatically between buildings when using the reference building approach. This is because the reference building has many of your design decisions, good or bad, built into it. For example, the reference building has the same orientation and layout, passive shading, and fuel type (if you use a low carbon HVAC system like a heat pump, chances are your reference building uses that same system). With a reference building approach there are many 'compliance neutral' design strategies like these. With absolute targets, everything is on the table.

The three new absolute metrics, with buildings required to meet the performance target of each one, are as follows:

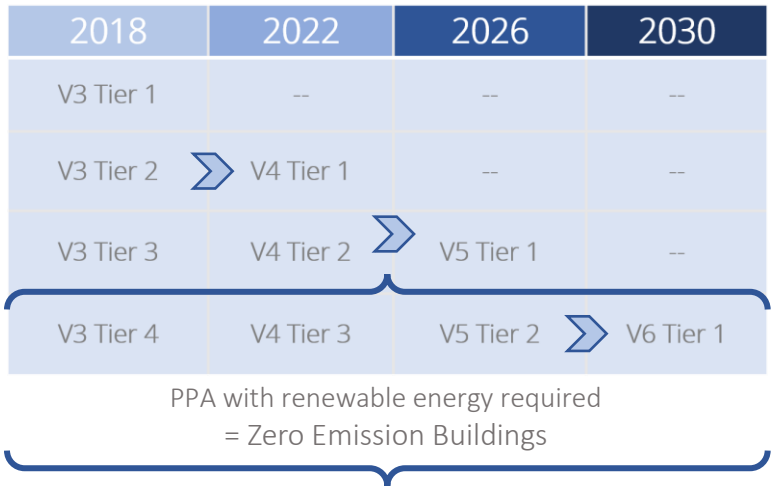
Energy Use Intensity – EUI – kwh/m^2: Annual building energy use, divided by the conditioned floor area. This is the classic, straightforward metric that many new and existing building standards, for example *EnergyStar Portfolio Manager,* use in some way.

Thermal Energy Demand Intensity – TEDI – kWh/m^2: Annual heating load, divided by the conditioned floor area. TEDI excludes the effects of mechanical efficiencies (e.g. condensing boilers) but does include passive systems such as in-suite heat recovery, solar gains, and internal gains. In general, TEDI will require builders to focus on the *real* performance of the passive building envelope, rather than relying on the active mechanical systems to achieve targets.

Green House Gas Intensity – GHGI – kgCO2e/m^2: Annual greenhouse gas emissions, divided by the conditioned floor area. Because of the relatively carbon free electricity grid, this metric favours the use of electricity over natural gas. As a result, we may see more heat pump and VRF building designs popping up in order to meet this metric. This means fuel switching is now on the table as a viable strategy for compliance.

The performance targets for these new metrics naturally depends on the Tier you are pursing, as well as the type of building you have. In other words, a condo building has a different target than a big box retail store.

Tier 1** targets will become progressively more stringent as we approach a **net zero** ready target in **2030.



Those familiar with the TGS understand that developments may wish to voluntarily pursue a higher level of certification, Tier 2, which entails more stringent energy efficiency and green development requirements in return for a development charge refund. Version 3 builds on this and introduces a new, voluntary Tier 3 and Tier 4. This is part of the City's path to net zero, with the idea that required Tier 1 targets will become progressively more stringent as we approach a net zero ready target in 2030, when the current Tier 4 will become Tier 1.

According to the *Zero Emissions Building Framework*, the following absolute targets can be expected for high rise MURBs:

Tier	EUI (kWh/m^2)	TEDI (kWh/m^2)	GHGI (kgCO2e/m^2)
TGS v2 Tier 1 (current Code)	190	77	26
TGS v3 Tier 1	170	70	20
TGS v3 Tier 2	135	50	15
TGS v3 Tier 3	100	30	10
TGS v3 Tier 4	75	15	5

Changes to Modeling

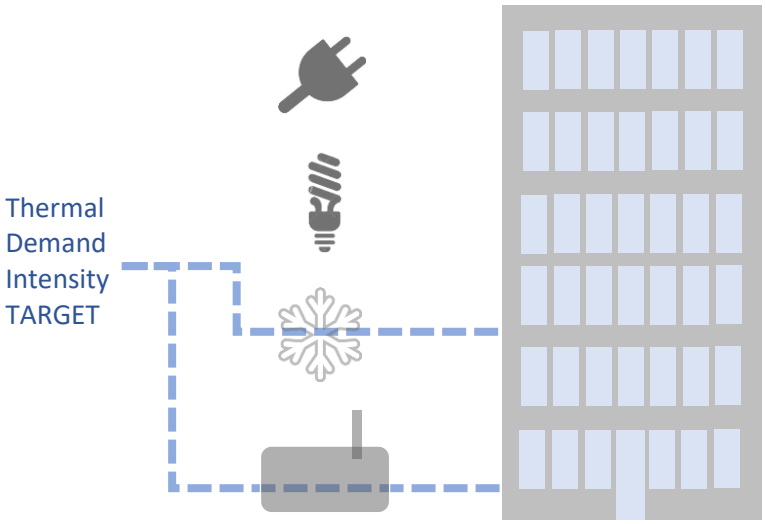
Aside from the new targets, TGS v3 also comes with new and improved energy modeling guidelines, presenting some specific challenges to how MURBs are typically built and designed in the GTA.

TGS Version 3 and the new energy modeling guidelines** will present significant challenges **to how MURBs are built in the GTA.

This first challenge relates to a requirement for a holistic accounting of thermal bridging through the building envelope. This involves accounting for thermal losses through slab edges, cantilevered balconies, parapets and window transitions, among others. Previous modeling guidelines have required this to an extent, albeit with many exceptions and allowances. This means the same walls built today may be required to model lower R values for TGS version 3, putting projects 'in the hole' as a starting point.

Condo projects may find this particularly challenging as cantilevered balconies are the norm. Coupled with high window-to-wall ratios and relatively poor performing spandrel wall construction, a typical condo may max out at an effective R-4 or R-5 wall – a significant reduction from the nominal R-20 that is likely installed.

A common approach to deal with a poor performing envelope has been to 'trade-off' with high efficiency mechanical systems. However, with the introduction of the **Thermal Demand Intensity** metric (which accounts primarily for the passive elements of the building) that approach is no longer an option. Moving forward we expect design teams will need to start seriously considering the thermal performance of their envelope, in particular limiting window-to-wall ratios and focusing on details to eliminate thermal bridges.



With TGS v3, *buildings will need to have* ***tight building envelopes with minimal thermal bridging*** *and a* ***low Window to Wall Ratio.***

The second challenge relates to outdoor air rates. Typical high rise design requires large air handling units to pressurize the corridor. These are installed to combat stack effect, and to limit smoke and smell migration from the suites and between floors. The bigger these units are, the more air they need to heat. In typical MURB design this is one of the largest sources of heating energy use. Following the current modeling approach, these outdoor air rates are matched in the reference building, making the issue more or less *compliance neutral.* In fact, some modeling protocols (including the current building Code language) specify that these increased outdoor air rates should be ignored and omitted altogether. With the new absolute metrics this is no longer the case: the higher these outdoor air rates, the harder it will be to meet the targets.

Heat recovery *will be essential to meet* ***Tier 1*** *requirements.*

Corridor pressurization sizing in MURBs is often referred to in terms of cfm / suite or cfm / door. A building with in suite ventilators (ERVs or HRVs) may spec a 30-50 cfm / door air handler. Coupled with the air rates of the in suite ventilator, this adds up to a building total of about 100-120 cfm / door. Buildings without in suite ERVs will specify similar amounts of air in the corridors. These buildings omit in suite ERVS/HRVs and rely on the central unit for all ventilation needs, typically without heat recovery, and deliver air to the suite via undercut doors. In both scenarios, this is significantly more than what the occupants require for an adequately ventilated unit. With the new absolute targets, there are likely *no scenarios* where a MURB will meet Tier 1 without some way to recover heat.

Steps may need to be taken to reduce these outdoor air flows, including using a VFD to schedule and reduce the central AHU flow rates, and attention to building detailing so less pressurization is needed such as compartmentalizing elevator shafts, which are a major source of stack effect and pressurization requirements.

In the suite, better controls on ERVs (e.g. CO2 sensors) can reduce outdoor air flows by more closely matching demand.

Challenges for MURBs

These changes have many high rise developers asking us where they will stand with the new TGS. Is there any possibility of meeting Tier 2 with their current design, or is this a far off dream as they struggle to meet Tier 1?

__Tier 1 is likely doable__ with modest upgrades to typical design. __Tier 2,__ however, will require __some adjustment.__

EQ has begun the process of analyzing the impact of the new modeling rules and the absolute targets on typical high rise projects. Initial results show that Tier 1 is likely doable with modest upgrades to typical design. Tier 2, however, will require some adjustment.

A few key **design strategies** to keep in mind for Tier 2 performance include:

Focus on better detailing around **thermal bridging**. With a full accounting of thermal bridges, these details become a weak point for the envelope in the model. Particular focus should be paid to concrete balconies, which should either be thermally broken or reduced in size and quantity.

Glazing performance requires an improvement, and soon going to triple pane glass will become the norm. The good news is that there are signs the industry is picking up on this, as triple pane glass pricing has begun to decrease as demand increases.

Glazing area also becomes more significant, particularity to meet the passive **Thermal Demand Intensity**. Projects considering Tier 2 should be targeting no more than a 40% window-to-wall ratio. Limit the size of the corridor air handler as much as possible. A common strategy is to add a VFD to the air handler supply fan, sizing a big enough unit for peak loads but allowing it to throttle back during periods of low activity.

Look to the top of the line **HVAC equipment** in terms of performance – including magnetic bearing chillers, high efficiency condensing boilers, variable speed drives and ECM motors, and high performing in-suite ERVs.

LED lighting throughout common areas is a must – particularly corridors, parking garages and stairwells

As with all buildings, there are always multiple ways to achieve these targets, and it is up to the design team to decide which way is most cost effective or beneficial to their clients (and energy modeling is a perfect tool to evaluate and contrast these options). In general, a renewed focus on passive design elements is recommended as a starting point, as these improvements hit all three metrics – energy, thermal demand and carbon intensity. Design teams can then focus on

__Meeting Tier 3 and 4__ will undoubtedly require heat pump (air or ground source) or VRF technology for space heating to meet Greenhouse Gas requirements

improving the efficiency of the active systems – HVAC and lighting. Ideally, improvements in the passive design elements have allowed these systems to be downsized, finding some cost savings and room to improve.

As buildings begin to move past Tier 2, conversations around fuel switching come to the forefront. Tier 3 and 4 will undoubtedly require heat pump (air or ground source) or VRF technology for space heating to meet their targets. At a certain point this will be the only way to meet the Greenhouse Gas requirements.

Some big challenges lie ahead for the Toronto high rises, and EQ is looking forward to working with the development community to meet them.