REALpac
Real Property Association of Canada
Association des biens immobiliers du Canada

REALpac Energy Benchmarking Program

Data Normalization Technical Bulletin

May 2015

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Publication Data

This REALpac Energy Benchmarking Program Data Normalization Technical Bulletin was released as of May 13th, 2015.

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1. Introduction

The REALpac Energy Benchmarking Methodology (v3.01) was revised in May 2012 to better reflect industry demand for comparative metrics and more refined reductions/savings determinations. REALpac made enhancements to the weather normalization approach, which allowed owners/operators to compare their energy intensity from the current year to the base year by taking into account degree-day weather differences in the location of the building. As a result, there were two energy intensity metrics added that allowed for separate comparisons – one for comparing an individual building to the base year in the building's original location and one for comparing an individual building to the to the base year in the base city.

Through ongoing review and during the development of the Water Normalization Methodology, it was noted that the year-over year normalization calculations (comparing an individual building to the base year in the building's original location) were not generating results as expected. Further investigation uncovered a variable needing revision. This technical bulletin will describe the revisions made and the impact to building energy use metrics, both the Weather Normalized Building Energy Use to Base Year 2009 metric and the final Location Normalized Building Energy Use to Toronto, metric (Fully Normalized Building Energy Use).

2. Revisions to the Weather Normalization Approach

Weather normalization, or weather "correction", is a mathematically based adjustment of the data which, in theory, factors out variations in outside air temperature thus enabling a like-for-like comparison of energy consumption in buildings that are located in different places and that experience different weather conditions.

2.1. Objective

The Energy Normalization Database now incorporates a revised normalization of the ekWh/ft^2/year value for weather variations within the same location but compared to the base year 2009. The following sections describe the revised assumptions made and procedures used to normalize energy consumption relative to a base year and the adjustments this causes to the final normalization for weather at different city centers across Canada.

2.2. Weather Data and Requirements

The requirements for inputs have not changed from the original Methodology or from the most recent version (3.01). Weather data for the normalization procedure encompasses one full year (January 1 to December 31) and is collected from 16 major city centers across Canada, collectively representing all of the largest markets in commercial real estate.

As in past versions of the Methodology, the Database formulas have already incorporated the necessary degree-day ratios between each site and Toronto and between each year within a location.

2.3. Normalization Calculations

2.3.1. Actual Building Energy Use (current year)

This metric has not changed and will be calculated in the same manner as described in previous versions of the Methodology.

2.3.2. Building Characteristic Normalized Building Energy Use (current year)

This metric has not changed and will be calculated in the same manner as described in previous versions of the Methodology.

2.3.3. Weather Normalized Building Energy Use to Base Year 2009

This metric was previously calculated by using the 2009 base year as a "model" year for weather. The model weather was compared to actual weather in each location and the adjustments of the model to the current year were applied to the current year energy use proportionately (adjustments made forward).

It was noted that the more accurate approach would be to take the current year weather and compare to the model year. Then corresponding adjustments would be applied to the appropriate amount of current year energy to effectively "adjust back" to the base year.

This revision has been implemented and is seen to impact the directionality (adjust forward vs. adjust backwards) of calculations. Variability in changes to final metrics are discussed below.

2.3.4. Location Normalized Building Energy Use to Toronto, ON (Fully Normalized Building Energy Use)

This metric has not changed and will be calculated in the same manner as described in previous versions of the Methodology.

The final metric reported for fully normalized building energy use intensity in the Database will be different from those previously reported as the calculations in this step build upon the results from the previous step, which have changed. The measure "Location Normalized Building Energy Use to Toronto, ON" still provides a metric for the user to apply for national benchmarking across all locations and compared to the base year 2009 and now more accurately reflects comparisons to the base year.

3. Impacts and Next Steps

REALpac performed comparative testing for all buildings in the Database to determine the significance of the changes to the final normalized metrics.

All buildings for all years of data were compared in the impact analysis. Overall, the average difference between the previous "Location Normalized Building Energy Use to Toronto, ON" metric and the current "Location Normalized Building Energy Use to Toronto, ON" is +3.9% across all cities and years. There is an average absolute difference in the mean of the whole dataset of +1.1 ekWh/ft^2/yr moving the average normalized metric from 27.0 ekWh/ft^2/yr to 28.1 ekWh/ft^2/yr.

In the 2010 dataset, the average difference between previous and current normalized metrics is +7.3% (range +47.9% to -7.3%) across all cities. The average absolute difference in the mean of the 2010 dataset is +2.3 ekWh/ft^2/yr moving the average annual normalized metric from 27.8 ekWh/ft^2/yr to 30.0 ekWh/ft^2/yr.

In the 2011 dataset, the average difference between previous and current normalized metrics is +1.4% (range +16.5% to -7.3%) across all cities. The average absolute difference in the mean of the 2011 dataset is +0.5 ekWh/ft^2/yr moving the average annual normalized metric from 27.7 ekWh/ft^2/yr to 28.2 ekWh/ft^2/yr.

In the 2012 dataset, the average difference between previous and current normalized metrics is +7.7% (range +27.8% to -6.7%) across all cities. The average absolute difference in the mean of the 2012 dataset is +2.0 ekWh/ft^2/yr moving the average annual normalized metric from 25.0 ekWh/ft^2/yr to 26.9 ekWh/ft^2/yr.

In the 2013 dataset, the average difference between previous and current normalized metrics is +2.6% (range +39.7% to -6.7%) across all cities. The average absolute difference in the mean of the 2013 dataset is +0.7 ekWh/ft^2/yr moving the average normalized metric from 25.5 ekWh/ft^2/yr to 26.2 ekWh/ft^2/yr.

As the normalization approach is based on the weather occurring at different locations and in different years, it would follow that buildings in different locations will see varying impacts to their metrics. It is also true that these buildings will be impacted differently in different years as the weather fluctuates over time.

The REALpac Energy Benchmarking Technical Committee has convened to discuss the above described adjustments to the weather normalization calculation and has agreed that this approach is more accurate for users moving forward. This revised approach will be incorporated into the 2015 Energy Benchmarking Survey and Methodology (new version to be released summer 2015) and will be integrated into the Energy Normalization Database calculations when the 2015 Survey opens May 2015. Thus, all buildings entered with 2014 data and will be normalized using the adjustments described. At the same time as the 2015 Survey is launched, REALpac will revise the previously entered data (2009 thru 2013) to be in alignment with the new calculations thus permitting more accurate and meaningful year-over-year comparisons of building energy use performance.

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