Estimating benchmarks of local market performance to establish Zero Carbon Trajectories.

Principle underpinning the Buildings Criteria under the Climate Bonds Standard

Zero Carbon Trajectories are used to align the Climate Bond Standard for Low Carbon Buildings with the imperatives of a 1.5°C future. The necessary trajectory for a given location is established by a linear path toward zero carbon in 2050 from a 2015 baseline, established from the 15th percentile of most carbon efficient buildings in the local market. The targets for any certified climate bond are then determined by the trajectory as it relates to the term of the bond and the location of the building covered. Different trajectories are set for different locations due to the differing energy needs in different locations.

A key limitation of this approach in practice

The scarcity of reliable operational performance data for buildings in many parts of the world has been a significant limitation to take up of the Criteria. Without this data, we have not been able to determine baselines and low carbon trajectories in most locations, and hence we cannot certify building portfolios in those locations.

Although issuers still have the option to use the proxy route to certification, not all issuers who have approached CBI for certification use those proxies so still cannot be certified. And in any case, a process of estimating market benchmarks, where the estimate is able to be produced with reasonable confidence, is preferable to adopting proxies that we have found can be challenging to relate to operational building performance.

A new way forward

A process has been developed to allow estimation of the baselines needed where data of sufficient quality cannot be sourced for that location.

We are now able to estimate market benchmarks with high confidence where the climate characteristics for that market are within the bounds of climate associated with our established city baselines. In essence, we can extrapolate from locations where we do have benchmark data, to locations where we don't – so long as the source and extrapolated locations share similar climate characteristics.

The method: The method for estimation relies upon strong correlations being observed between the established city baselines and three characteristics of climate that impact upon a buildings energy demands and resulting operational carbon footprint. The three characteristics used are high wet bulb temperatures, high dry bulb temperatures and low dry bulb temperatures. These influence latent cooling, sensible cooling and heating energy demands respectively. By determining the correlation between existing city baselines and each of these characteristics we are able to estimate baselines for new locations from knowledge of only the local weather characteristics and the underlying carbon intensity of the local fuel supply.

The data: Weather characteristics are derived from analysis of hourly annual weather data representative of a typical year for the target location. Such weather data is widely available and typically used by dynamic thermal modelling software for the purposes of predicting a buildings energy performance. Carbon intensity information is established from the best available local source. It is usual for this to be the same information that is required to be used for organisational greenhouse gas reporting in the location.

Confidence in the results: When estimating new benchmarks for similar economies and climates, i.e. offices in developed city markets within the bounds of climate covering the established benchmarks, this method is able to predict the market benchmark within an expected accuracy range of +/- 10%. The accuracy of the prediction reduces when the weather characteristics are outside the bounds of climates covered the established benchmarks.

A sense check of the results: The ability to produce estimates of this accuracy is initially surprising as the method does not require any knowledge of the age of building, density or other non-climate related characteristics that could impact a buildings energy performance. This is explained by the market baseline approach of the Climate Bond Standard for low carbon buildings. As the baseline is established for the whole of market, typically a city, the influence of any building specific aspects that might overtly influence performance outcomes is moderated by the diversity of built form in any given market. Additionally, as the baselines are representative of the 15th percentile of low carbon performance, they are identifying the best performers in the market, which are expected to be of a similar level of technical sophistication.

Expanding routes to certification under the Buildings Criteria

As noted above, we have high confidence in the results where the weather characteristics are inside the bounds of the climates covered by the established benchmarks. The accuracy of the prediction reduces when the weather characteristics are outside the bounds of climates covered the established benchmarks and accuracy deteriorates proportionally with climatic deviation. For this reason, it is proposed that this method of extrapolation is used only across similar climates, which are within 20% of the bounds of the established benchmarks.

Based on an initial analysis of climate characteristics, it is anticipated the baselines will be able to set with the highest confidence for the following cities from the World Major 150 largest cities by GDP:

Tokyo, Los Angeles, London, Paris, Mexico City, Buenos Aires, Seoul, Madrid, Detroit, Istanbul, Seattle, Beijing, San Diego, Barcelona, Denver, Rome, Milan, Pusan, Bogotá, Baltimore, St Louis, Johannesburg, Lisbon, Cleveland, Portland, Vienna, Vancouver, Cape Town, Pittsburgh, Tianjin, Dublin, Birmingham, Manchester, Berlin, Ankara, Lyon, Turin, Munich, Algiers, Naples, Curitiba, Leeds, East Rand, Medellin, Izmir, Auckland, Zurich, Amsterdam, Prague, Rotterdam, Brussels, Chengdu, Budapest, Xian, Casablanca, Taegu, Cologne, Pyongyang

The analysis shows that the following cities fall within a 20% climate bounds tolerance and are able to be estimated with reasonable tolerance:

Osaka/Kobe, Shanghai, Atlanta, Toronto, Guadalajara, Fukuoka, Athens, Porto Alegre, Warsaw, Hamburg, Shenyang, Copenhagen, Krakow

Further work

The baselines established from operation performance data is limited to temperate climates. To extend the Buildings Criteria for Low Carbon Buildings further there is a need to establish more baselines in tropical and cold climates. Only when enough baselines are established from primary data representative of these climate will correlations be able to established to estimate for more locations.

Placing this new route to certification in the hierarchy

As noted above, the benefits of using an operation performance measure for compliance with the low carbon building standard are significant. It provides confidence that the low carbon characteristics that underpin a climate bond are actually realised over the term of the bond. The use of estimated benchmarks to establish a low carbon trajectory is therefore considered and important contributor to bring operation targets to new markets. The role of such estimates in the hierarchy adopted by Climate Bonds for low carbon buildings is therefore:

1. 2050 Zero Carbon Trajectory established from a local market baseline
2. 2050 Zero Carbon Trajectory established from estimated/ extrapolated baseline
3. Unable to baseline market - operational performance rating proxy
4. Unable to baseline market - design performance rating proxy