Tracking Incremental Energy Efficiency Investments in Certified Green Buildings

A tracking methodological brief

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CLIMATE POLICY INITIATIVE

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ABOUT CLIMATE POLICY INITIATIVE

CPI is an analysis and advisory organization with deep expertise in finance and policy. Our mission is to help governments, businesses, and financial institutions drive economic growth while addressing climate change. CPI has six offices around the world in Brazil, India, Indonesia, Kenya, the United Kingdom, and the United States.

SECTOR
Energy Efficiency, Buildings & Infrastructure

REGION
Global

KEYWORDS
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EXECUTIVE SUMMARY

In 2019, the building sector accounted for the largest share of global energy consumption (35%) and energy-related CO2 emissions (38%) (UNEP, 2020). This significant contribution to global energy demand explains why large-scale energy efficiency measures in the building sector are central to most scenarios that target ambitious decarbonization. To achieve these targets, it is necessary to monitor energy efficiency investments in the building sector to assess if those investments are achieving efficiency at the required scale and pace.

Energy efficiency investments in new buildings and retrofits are incremental in nature as they lead to a decrease in energy use compared to a baseline situation. Therefore, energy efficiency investments in buildings per se correspond to the incremental investment made towards energy efficiency improvements only and not the total investment towards building and construction.

Because most energy efficiency investments in buildings are components within larger projects, they are difficult to extract from the overall cost of the project. Additionally, there is a lack of understanding of the extent to which energy efficiency investments are consistent with low-carbon pathways. Energy efficiency gains may lead to a certain reduction in greenhouse gas (GHG) emissions, but it is unclear whether such improvements are sufficient for a timeley net zero emissions pathway. Therefore, tracking energy efficiency investments in buildings is challenging, compounded by the absence of comprehensive asset-level data, as well as a lack of clear definitions, standards, and benchmarks for assessing the energy efficiency performance of buildings.

Given the inertia of the building stock, not addressing these issues is a high risk for creating significant further lock-in of inefficient and high-energy consumption patterns.

To understand how to accelerate investments in energy-efficient buildings, a systematic assessment of current investment flows is needed. This can help identify the challenges and entry points to scale investments, while also measuring year-to-year progress. Establishing a consistent and standardized methodology will help to avoid potenital greenwashing of investments made towards buildings that result in little to no energy efficiency gains. It can also help to build investor confidence in the market to ensure investments are made where they are actually needed.

This brief aims to address the energy efficiency data gap by proposing a methodology for estimating climate finance in energy efficiency in newly constructed green buildings and by adding a more granular view on the alignment of projects—and investments—with low-emission scenarios. To achieve these goals, we frame our approach around five dimensions, summarized in Table ES1. Together, these dimensions constitute a framework to conduct a more accurate tracking of energy efficiency investments in green buildings.

Central to this approach, we use a 'energy efficiency cost premium' method to measure energy efficiency investments in new buildings that received a green certification in 2019 and 2020. The energy efficiency cost premium is the incremental investment on energy efficiency improvement above a baseline of spending for conventional (less efficient) equipment or service. We also look at the energy performance of the stock of these newly certified green buildings to assess if existing certifications and schemes provide reliable benchmarks for decarbonization targets.

The work relies on a CPI-created global database of more than 16,000 green building certifications from 2019-2020, compiled by collecting and processing asset-level certificates that amount to over 214 million square meters of certified floor area, 96% of which were new constructions.[1] This is roughly 2% of the 5 billion square meters of new floorspace being added per year (IEA, 2021c).

Table ES1: CPI's approach to overcome existing barriers in tracking incremental energy efficiency investments in buildings

	Definition	Source data	Alignment	Measuring investment	Sources & instruments
Framing Questions	What is energy efficiency in buildings?	What asset-level[2] data is available?	What energy efficiency levels are required?	How to isolate energy efficiency investments?	Who is investing and how?
Barriers	1: Diffused scope	2: Asset complexity	3: Inadequate standards	4: Composite & incremental	5: Uncoordinated tracking efforts between actors involved
CPI approach	Define the scope Energy budget of operating phase only, measured by whole building energy intensity	Collect green certification data New constructions and building retrofits certified in 2019 and 2020	Assess certified assets' energy performance Energy efficiency gains achieved compared to baseline buildings	Estimate incremental investment In newly built buildings using energy efficiency share of green cost premium	Categorize financial flows Building typology and location as preliminary proxy

KEY FINDINGS

Energy efficiency investment in certified green buildings is a fraction of total investments in buildings.

- **For every USD 1 spent on energy efficiency gains, USD 19 was spent on conventional construction measures.** Estimated overall investments in the construction of new, green-certified buildings averaged USD 206 billion annually in 2019-2020 out of the USD 5.9 trillion in total investments in buildings construction and renovation.
- **Estimated incremental investments in energy efficiency in new certified green buildings averaged USD 10.5 billion in 2019-2020**, amounting to about 5% of the total investments in those buildings. This suggests that using the full capital cost of certified green buildings to measure energy efficiency finance results in overestimating investment levels.

1 Green certification schemes tracked include: LEED, BREEAM, DGNB, Effinergie, PassivHaus, PHIUS, CASBEE, Hong Kong Beam Plus, Edge, Miljöbyggnad.
2 Building level

Certified green buildings generally perform better than conventional buildings, but with great variability

- **Most certified buildings do not achieve a drastic energy use decrease compared to a business-as-usual scenario.** More than half of the certified floor area we tracked achieved less than a 30% incremental gain. Only a fourth of the certified surface reached over 40% efficiency gain. This variability can be partly attributed to diverging baseline contexts (e.g. countries that have more ambitious energy building codes), but also suggests that most green certificates are inconsistent indicators of the mitigation potential of investments in these buildings.

Better data and metrics are critical to measure alignment with Net-Zero pathways

- **A green certificate alone does not guarantee that an asset is aligned with a low-carbon trajectory.** This is because the energy performance standards that green certifications set out are usually not derived from low-carbon scenarios. As mentioned, certified assets usually perform better than conventional ones. However, certification schemes rarely reflect the construction and energy performance needs of local (national, regional, municipal) low-carbon strategies.

DATA GAPS AND LIMITATIONS

Due to several issues related to the availability, quality, and robustness of publicly available data from the public and private actors, the scope of this study is limited to assessing energy efficiency investments and energy performance of new construction that received a green certificate. These issues include:

- **Poor reporting on investment metrics:** Granular data for investment metrics—cost of construction, green cost premium, share of energy efficiency in the green cost premium, operational energy performance of the building, etc.—which is key to the application of the methodology are not reported by investors. These additional costs are often project-specific and vary based on the choice of technology, the knowledge and experience of the building developers and users, the climatic zone, the type and level of certification available in the country, and other factors. To overcome these challenges, this study relies on a set of assumptions based on extensive literature review.
- **Lack of accessible and consistent data on energy performance of certified green buildings:** Green building certification schemes use different energy performance metrics to assess the buildings they certify. Beyond scheme specificities, the lack of transparent access to both ex-ante estimates and ex-post measurements of certified buildings' energy performance at the asset-level prevents a thorough assessment of projects.
- **Difficulty in tracking a wider range of energy efficiency investments:** Given the data availability, this study focused on measuring financial flows towards energy efficiency gains in buildings that achieved a green certification. Yet, there are various ways in which energy efficiency gains can be achieved in buildings, for example, through provision of loans, funds, or credit lines for energy efficiency projects, expenditure on research and development, budgetary allocations for policies and regulations, implementation of

building codes and standards, etc. Additionally, the buildings which are energy efficient but have not acquired green building certifications are also excluded from the scope of this study as there is no comprehensive database to collect and track these types of investments in energy efficiency in buildings.

- **Lack of data on investments for retrofits:** Because green building certificates are primarily being delivered to new construction rather than to retrofitted buildings (only 4% of tracked certified floor area), the methodology for estimating investments towards retrofitting is not developed at this stage.
- **Lack of inclusion of lifecycle emissions:** Life cycle carbon emissions in the building sector can be divided into five stages: material preparation, construction and reformation, operation, demolition, and waste treatment and recycling (Gong and Song, 2015). Our study only accounts for the solutions that exist to lower the energy budget of the operating phase of buildings, during which at least 80% of the lifecycle energy is consumed (Prakash et. al, 2010). As the emissions from this phase reduce, the lifecycle emissions will take primary importance. However, currently, there is limited commitment from green building certifications to include mitigation of lifecycle emissions in the certification process.

OUR RECOMMENDATIONS

1. **There is a need for standardized reporting of energy efficiency investments and the energy performance of buildings.**

   More investors and businesses are committing to decarbonize their investment portfolios. However, there is an overall lack of transparency and accountability in the building sector in terms of investments towards energy efficiency and their impact. This contributes to the current lack of publicly available information on these crucial factors. A standardized reporting mechanism at the asset level will improve the consistency, comparability, and robustness of publicly available data. Such asset-level data will also have significant implications on improving the tracking of investments and energy performance of a building.

2. **Assets should be monitored on an ongoing basis,** benchmarked against tailored net zero scenarios, and set energy efficiency and decarbonization targets for the building. Energy efficiency investment is a moving target: what is considered energy efficient today may no longer be in the future. Transparency in regular monitoring and reporting will help ensure that targets are successfully implemented and help avoid the greenwashing of investments made towards buildings that have little or no potential to cut energy demand.

3. **Retrofitting at scale needs to be emphasized in developed economies while reassessing the need for constructing new buildings.**

   The majority of tracked green building certifications are acquired for new buildings in Western Europe and North America. Only 4% of the tracked certified floor area corresponded to retrofitted buildings. It is important to reorient the focus on certifying retrofits, instead of new construction in developed economies. Considering the large stock of existing buildings in these countries, it should also be assessed if there is a need for constructing new buildings at all. Certifying new buildings should be prioritized in emerging markets where the need for new construction is incomparable in order to leverage the massive low-carbon investment opportunity and avoid lock-in of decades of inefficient building stock.

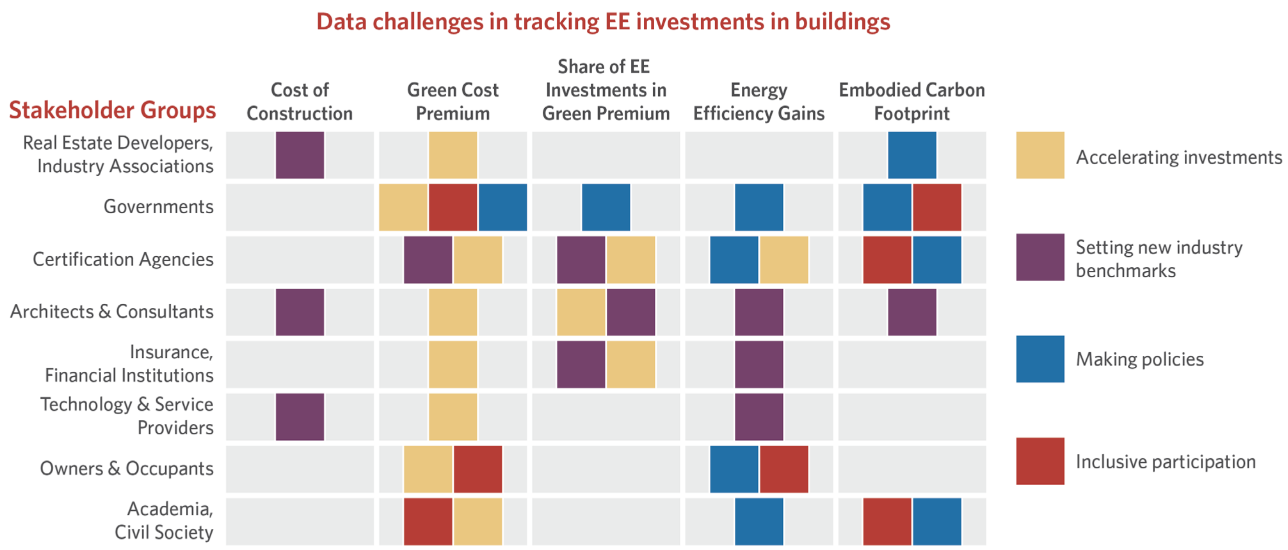
4. **The 'energy efficiency cost premium' methodology developed in this brief can serve as a guide to estimate energy efficiency investments in buildings.**

   Given the limitations of green certificates, other types of information and approaches are needed to guide investment. Public and private actors can apply the 'energy efficiency cost premium' method to measure incremental investments, and voluntarily disclose the premium deployed towards low-carbon assets in their decarbonization and transition plans. The location-specific asset-level primary data on investment metrics, such as cost of construction, green cost premium, and share of energy efficiency investment in green cost premium, are key to the application of this methodology. They can develop and use this primary data based on the local baselines for energy performance, aligned with the local decarbonization trajectories.

5. **Multi-stakeholder engagement is required to address key data gaps in estimating energy efficiency investments in buildings.**

   Various stakeholders on both the public and private side need to be engaged to address the key data gaps on estimating energy efficiency investments. Multi-stakeholder collaboration is crucial to overcome the barrier of uncoordinated and fragmented efforts from various actors in the construction industry and making the data available and accessible for everyone.

Figure ES1: Multi-stakeholder engagement for addressing key data gaps



Setting up new governance processes are often expensive and time consuming. Therefore, the umbrella of existing green building councils can be leveraged to faciliate the data collection and aggregation process on key investment metrics.

- **Architects, consultants, real estate developers, and other technology and service providers** can provide asset-level information on key investment metrics and energy efficiency gains to aggregators such as green building councils.
- **Certification agencies** can provide guidance on the methodologies for continually monitoring and evaluating projects after the issuance of certifications, which can help create more robust databases.
- **Insurance, investors, and other financial institutions** can assess their investments for key metrics and disclose the information in the public domain.
- **Governments** and its agencies can collect information on key investment metrics and publish statistcs on progress of their energy efficiency programs for buildings and other sustainable procurement initiatives.
- **Independent owners, occupants, academia, and civil society organizations** can participate more through surveys, interviews, and other data-collection efforts to provide data on the real-time energy performance of buildings as well as investment metrics.

CONTENTS

INTRODUCTION

In this decade, immediate and significant emission reductions are critical for reaching the Paris Agreement goals. In 2019, the building sector accounted for the largest share of global final energy consumption (35%) and energy-related CO2 emissions (38%) (UNEP, 2020). This significant contribution to global energy demand explains why extensive energy efficiency measures in the building sector are central to achieving decarbonization. **As per recent estimates, annual investment needs in buildings' energy efficiency and electrification sit between USD 0.4 and USD 1.1 trillion through 2050** (CPI, 2021). To achieve these targets, it is necessary to monitor energy efficiency investments in the buildings sector to assess if those investments are achieving energy efficiency gains at the required scale and pace.

Some estimates of the current level of aggregated energy efficiency investments in buildings exist through top-down approaches such as market sizing. For example, the International Energy Agency estimates suggest that energy efficiency investments in buildings increased by 11% to almost USD 180 billion in 2020 from over USD 160 billion in 2019 (IEA, 2021); 2021a). **Estimating the volume of energy efficiency investments in buildings through a bottom-up approach is challenging due to the absence of comprehensive asset-level data, as well as a lack of clear definitions, standards, and benchmarks for assessing the energy efficiency performance of buildings**. However, in a bottom-up approach, the factual information on energy efficiency gains and impact of investments is gathered from the buildings where the investment was made. This can help investors accurately report on the impact of the capital deployed using information from the real asset where the investment was made to evaluate the climate alignment of their investment portfolios.

To understand how to accelerate investments in energy efficient buildings, a systematic assessment of current levels of investments is needed. This can help to identify the challenges and entry points to scale investments, while also measuring progress. A better tracking of energy efficiency investments in buildings will help improve transparency and accountability in the investment decisions made towards climate-related activities. Establishing a consistent and standardized methodology can avoid greenwashing of investments made towards buildings that have little or no potential to improve energy efficiency. It can also help to build investor confidence in the market to ensure investments are made where they are actually needed.

Currently, investors heavily rely on green building certifications to define buildings as sustainable, energy efficient, and low carbon, but are these certificates reliable benchmarks? Assessing the energy efficiency performance of these certified green buildings will inform asset owners on the quality of their investments and allow them to set ambitious targets that will turn their investments into climate finance.

What are Green Building Certifications?

Green building certifications are granted to buildings that reach a certain level of performance against a set of environment- and energy-related criteria. Most green certifications are voluntary schemes and are delivered by independent organizations. Both national and international schemes exist.

Buildings that are granted a green certification usually outperform baseline buildings in terms of energy consumption, water usage, and renewable power generation, as certification standards tend to be higher than those of national building codes. Most schemes offer multiple levels of certifications or using rating systems (e.g. Bronze/Silver/Gold/Platinum or 1/2/3 stars).

The level of performance required and the environmental dimensions assessed vary largely from one certification provider to the other. A growing number of green certifications are available, with increasingly tailored certificates and options: building type, new construction, existing building refurbishment, preferred environmental aspect.

To identify the challenges, we framed an approach around five questions, summarized in Table 1, which together constitute the base to our comprehensive tracking of energy efficiency investments.

Table 1: Framing the tracking of investment on energy efficiency in buildings

	Definition	Source data	Alignment	Measuring investment	Sources & instruments
Framing Questions	What is energy efficiency in buildings?	What asset-level data is available?	What energy efficiency levels are required?	How to isolate energy efficiency investments?	Who is investing and how?

By addressing these questions, we intend to contribute to an improved methodology for estimating climate finance in energy efficiency in new certified green buildings, as well as adding a more granular view on the alignment of projects—and investments—with net zero scenarios. We propose an 'energy efficiency cost premium' method to measure incremental investment on energy efficiency in buildings that received a green certification in 2019 and 2020. The green cost premium of a green building refers to the incremental investment brought by adopting green building technology different from the benchmark conventional building in order to realize the green function of buildings. Using this methodology, we estimate the annual average of incremental investments in energy efficiency in new green buildings in 2019-2020. We also look at the energy performance of the stock of these certified green buildings to see if the existing certifications and schemes provide a reliable benchmark for decarbonization targets.

This work relies on a global database of green building certifications, which CPI compiled by collecting and processing more than 16,000 asset-level certificates. Granular data for investment metrics, such as the cost of construction, green cost premium, share of energy efficiency in the green cost premium, and operational energy performance of the building, which is key to the application of the methodology, is not available in the public domain. In the absence of this data, we used assumptions based on extensive literature review of scientific papers and industry reports.

The purpose of this brief is not to provide global and comprehensive estimates, but rather to investigate available options for an effective bottom-up assessment of energy efficiency investments in buildings.

This brief has five parts:

1. We first identify the barriers relevant to each of the framing questions.
2. Next, we outline our approach to overcome the difficulties specific to tracking energy efficiency investments in buildings.
3. In the third chapter, we discuss the primary findings related to our estimation of financial flows and the energy performance of the buildings.
4. Subsequently, we discuss the data gaps that have been addressed in this brief and what further analysis is needed to expand the scope and refine the methodology.
5. We conclude with a set of recommendations for multistakeholder engagement and best reporting practices for investors and asset owners.

1. BARRIERS TO TRACKING ENERGY EFFICIENCY INVESTMENTS IN BUILDINGS

Investments in energy efficiency are rarely captured in climate finance tracking exercises because of the many obstacles that prevent their clear identification. In this section, we describe what makes it so complex to rigorously track finance for energy efficiency in buildings.

Table 2: Barriers to tracking energy efficiency in buildings

	Definition	Source data	Alignment	Measuring investment	Sources & instruments
Framing Questions	What is energy efficiency in buildings?	What asset-level data is available?	What energy efficiency levels are required?	How to isolate energy efficiency investments?	Who is investing and how?
Barriers	1: Diffused scope	2: Asset complexity	3: Inadequate standards	4: Composite & incremental	5: Uncoordinated tracking efforts between actors involved

BARRIER 1: ENERGY EFFICIENCY IN BUILDINGS IS HARD TO DELIMITATE

Energy efficiency is a simple concept which could be summarized as "[...] using less energy to perform the same task" (EESI, 2021). Energy is the quantification of a state change over time in any given system (speed, temperature, shape, etc.) and is everywhere in our very energy-intensive economy. It is precisely the omnipresence of energy – and hence of energy efficiency – that makes it difficult to single out and delimitate energy efficiency-specific activities. Historically, energy-related investment in climate change mitigation solutions have often been over simplistically divided into two categories: renewable energies on the supply side, and energy efficiency on the demand side (buildings, industry, transport).

As a result, diverging metrics and activity scopes are being used to measure the magnitude of energy efficiency in the economy – especially in the building sector. Indeed, some restrain energy efficiency in buildings to improvements of the overall energy performance of building assets (CBI, 2020), while others include purchases of efficient standalone equipment and goods (e.g., efficient heat pumps or LEDs) using market sizing approaches (IEA, 2021a).

Moreover, buildings go through three successive phases from a lifecycle perspective, each demanding energy and potentially subject to efficiency measures (Prakash et al., 2010). First, the building manufacturing: the energy required for the extraction and manufacturing of the materials it will be built out of, and the construction of the asset. Second, the operating phase: the energy demand from the asset over the course of its life. Third, the demolition phase: the energy required to demolish the asset and recycle some of its materials. Therefore, energy efficiency in buildings can refer to a broad scope of activities.

BARRIER 2: BUILDINGS ARE COMPLEX ASSETS

Collecting building-level data on energy efficiency at the global scale is particularly difficult. Indeed, most buildings are unique. They do not have a set size or shape, they are not all made out of the same materials, they evolve over time, and they make use of most available energy sources to function (electricity, biomass, fuel, gas, solar, etc.) – often multiple at once. Their emissions can be direct (on-site combustion) or indirect (use of electricity). Buildings also perform differently depending on the climate they are in, occupant behaviors, and their purpose (residential, restaurant, hotel, hospital, etc.). As a result, buildings usually do not fall into simplistic categories. Most of the features above are hard to accurately measure at a granular level, although they play central roles in a building's energy performance. Until recently, there have been limited initiatives to collect and aggregate bottom-up energy efficiency data directly from assets at a large scale. [1]

BARRIER 3: ENERGY EFFICIENCY STANDARDS ARE NOT UP TO THE MARK

Energy efficiency is incremental by nature as it is a decrease in energy use compared to a baseline situation. If the investment purpose is to replace an existing product, energy efficiency is relatively easy to conceptualize (e.g., replacing an incandescent light bulb with a LED). If instead the investment purpose is not to replace, but to create, a new asset (a new construction for instance), energy efficiency becomes relative to a hypothetical baseline. However, these baselines, are subject to change over time. In other words, energy efficiency investments are a moving target as what is today considered energy efficient may no longer be in the future.

A greater investment in more energy-efficient products and services may lead to a reduction in a building's energy use. However, what the minimum energy demand reduction should be for a building to be compatible with a low-carbon scenario (e.g., 1.5°C or 2°C of warming) remains largely overlooked. In other words, some energy efficiency gain can be insufficient to bring an asset energy use down to satisfactory levels.

Given the inertia of the building stock, there is a high risk of creating a further lock-in of inefficient and high energy consumption patterns. Investing in a building that ends up performing just above average is not only a missed opportunity to further reduce energy demand, it can also prevent longer-term sharp energy cuts. By failing to assess this aspect, most existing methods to determine the compatibility of energy efficiency investments are inconsistent or incomplete.

1 For example, GRESB, CRREM, EPCs in Europe.

BARRIER 4: THE ATTRIBUTION OF COMPOSITE AND INCREMENTAL INVESTMENTS IS CHALLENGING

The attribution of financial flows is also not straightforward. Energy efficiency investments are often components within larger projects (CPI, 2019), such as the installation of more efficient lighting or heating systems during building constructions. As a result, they are difficult to extract from the overall cost of the project. This can lead to poorly categorizing the whole project cost as an energy efficiency investment or simply missing the energy efficiency investment component.

Secondly, since energy efficiency is incremental, measuring incremental financial flows requires to collect information on both baseline and energy-efficient technologies and services. This raises further data challenges and methodological issues if the cost of an energy-efficient product is not greater than the baseline.

BARRIER 5: UNCOORDINATED TRACKING EFFORTS BETWEEN ACTORS INVOLVED

The dense and disparate global building stock is largely held by private actors, many of whom are individuals, making energy efficiency investments scattered and uncoordinated. Data CPI had access to in previous climate finance tracking exercises[2] principally came from public actors—MDBs and DFIs—that report explicitly on loans to improve energy efficiency and isolate the specific component in the overall expenditure. This type of tracking is not representative of broader existing practices and **private actors have little incentive to report data** in the absence of mandatory reporting requirements.

2 GLCF 2021

2. THE APPROACH

The following section underpins how we overcame the difficulties specific to tracking energy efficiency investments in buildings. This is a step-by-step approach, built to reconcile existing definitions, new data availability, and methodological constraints. Further details on the assumptions and literature are available in Annex 1.

Table 3: CPI's approach to overcome existing barriers in tracking incremental energy efficiency investments in buildings

	Definition	Source data	Alignment	Measuring investment	Sources & instruments
Framing Questions	What is energy efficiency in buildings?	What asset-level[3] data is available?	What energy efficiency levels are required?	How to isolate energy efficiency investments?	Who is investing and how?
Barriers	1: Diffused scope	2: Asset complexity	3: Inadequate standards	4: Composite & incremental	5: Uncoordinated tracking efforts between actors involved
CPI Approach	Define the scope Energy budget of operating phase only, measured by whole building energy intensity	Collect green certification data New constructions and building retrofits certified in 2019 and 2020	Assess certified assets' energy performance Energy efficiency gains achieved compared to baseline buildings	Estimate incremental investment In newly built buildings using energy efficiency share of green cost premium	Categorize financial flows Building typology and location as preliminary proxy

STEP 1: DEFINE THE SCOPE

Defining the scope of our study requires looking at which phase of a building lifetime this study should be restrained to, the metrics we are going to use to monitor improvements in energy efficiency, and the technologies that can enable it.

Our study only accounts for the solutions that exist to lower the energy budget of the operating phase of buildings, during which at least 80% of the lifecycle energy is consumed (Prakash et. al, 2010). These solutions can be implemented during the construction of the building or once it is in operation.

Increasing the energy performance of a building during its operating phase can be achieved through a combination of structural, technological, and usage solutions. **Our study covers the structural and technological solutions that cut end-use consumption for space heating and cooling, water heating, cooking, lighting, and to some extent electrical appliances.** [more details here]

3 Building level

STEP 2: COLLECT GREEN CERTIFICATION DATA

We have collected green certification data of over 16,000 buildings in 99 countries [more details here]. In 2020, only one in three countries had a mandatory building energy code (IEA, 2021b). In this context, buildings that receive a green certification – green buildings - constituted the most promising sample to extract detailed information on energy efficiency investments in low-carbon assets. This is why:

1. **Performance strategy.** The best energy performance levels can only be achieved if a clear energy target is set for the entire building. Stacked and uncoordinated actions to improve the energy efficiency of building components and equipment do not allow for top tier energy performances (Ademe, 2021). Buildings that apply for a green certification deploy a set of coordinated energy efficiency measures to reach a certain energy performance level. In other words, in green buildings, efficient equipment and materials are purchased as part of a comprehensive low energy consumption strategy which reduces the risks of loopholes such as thermal bridges. Only then can efficient appliances and materials fulfill their efficiency potential. This is the reason why this brief does not focus on market sizing approaches to measure investments in efficient goods (heat pumps or triple glazed windows sales, etc.).
2. **Asset-level.** Retrieving information from green building certifications supports development of granular data sets by aggregating the list of buildings that received green certificates. This approach enables collection of building-specific information on energy performance, aligned with the energy intensity metric decision described above.
3. **Action only.** By selecting certificates granted to new constructions and refurbishments only, certificates that do not correspond to actual construction or retrofit work in buildings, like the certification of existing assets, are excluded. In this brief, buildings that received a certification in 2019 and 2020 were selected. However, the certification year can differ from the year the construction or retrofit work took place.

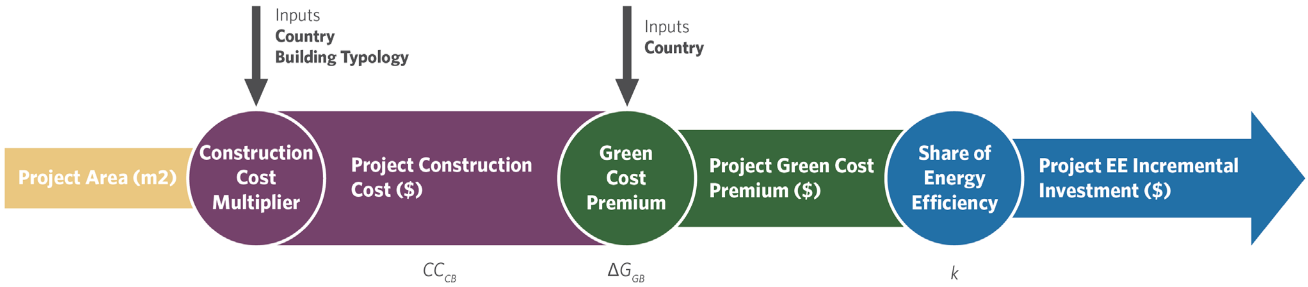
STEP 3: ASSESS CERTIFIED BUILDINGS' ENERGY PERFORMANCE

Next, the energy performance of certified green buildings is assessed and benchmarked to understand the energy savings potential of assets. [more details here]

STEP 4: ESTIMATE INCREMENTAL INVESTMENT

To measure investments in energy efficiency in certified green buildings, CPI uses a metric of 'energy efficiency cost premium (Figure 1).' This methodology should be applied using the data available at the asset level based on local conditions. In the absence of asset-level data, we relied on a set of assumptions to estimate the energy efficiency investments at asset and aggregate level.

Figure 1: Methodology of calculating incremental energy efficiency investment in green certified buildings



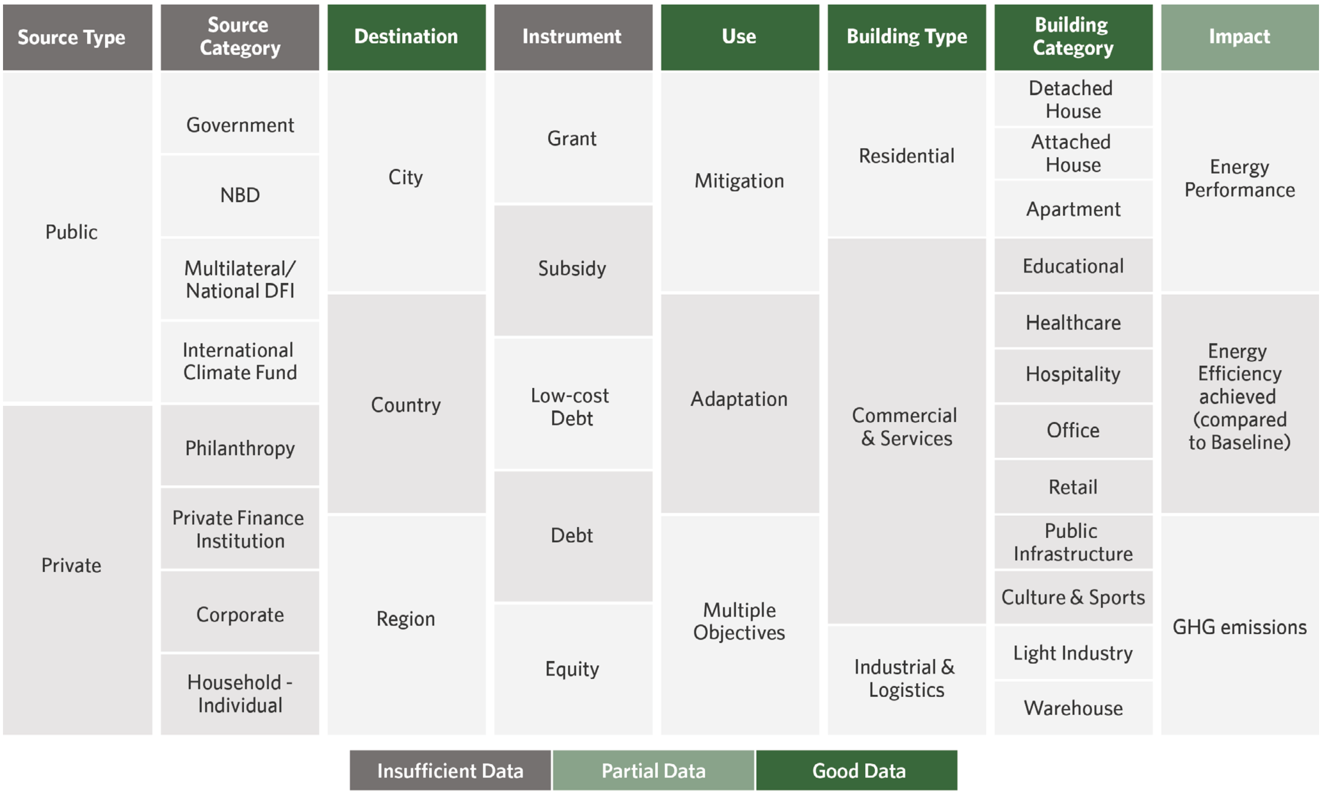
Given the incremental nature of energy efficiency gain, we derive the incremental investment of energy efficiency i.e. energy efficiency cost premium, from the total building construction cost using step by step approach (Figure 1):

- First we collect data on the total cost of building construction (project construction cost CC_{CB}). In the absence of primary data, we estimated the cost using market data on average construction cost per meter square.
- Then, we derive the additional cost incurred to make the building greener. The green cost premium of a green building (ΔG_{GB}) refers to the incremental investment brought by adopting green building technology different from the benchmark conventional building in order to realize the green function of buildings.
- Third, we estimate the share of incremental energy efficiency from the cost of green cost premium (*k*). Although energy efficiency improvements are major components of greening buildings, not all costs of greening buildings are related to energy efficiency, it may include other non-energy efficiency related improvements such as water efficiency, protecting occupant health, etc. [more details here]

STEP 5: CATEGORIZE FINANCIAL FLOWS

CPI aims to be as precise as possible in building and depicting a comprehensive analysis of financial flows. This analysis aims to capture: a) what actor sourced the investment, b) what financial instrument was used, c) where the actor is based, d) the recipient of the flows and their location, and e) how the project is categorized in terms of use and sector.

Figure 2: CPI tracking framework applied to energy efficiency in buildings



The use of asset-level data from green building datasets answers some of the questions framed above, such as the location of the project and the typology of the building. Asset-level data also support the measurement of some impact metrics (which is beyond the level of detail CPI assesses in our Global Landscape of Climate Finance series[4]). High-level precision corresponds to the enhanced need for refined and tailored indicators in the building sector, where a particularly meticulous screening of projects is required.

Certification data provides little to no information on the project owners and the financial details of how projects were funded. While some data providers further investigate these aspects[5], their coverage is for now too limited to build assumptions for a brief with a global scope. The typology of the project (e.g., a hospital in France or a commercial office in India) only provides hints of who the project developers or and investors could be.

The methodology described in this section allows us to estimate incremental energy efficiency investments in new certified green buildings, harnessing the robustness of asset-level data while facing limitations in coverage and information availability on projects' financial arrangements.

4 https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2021/
5 Observatoire BBC: http://www.observatoirebbc.org/

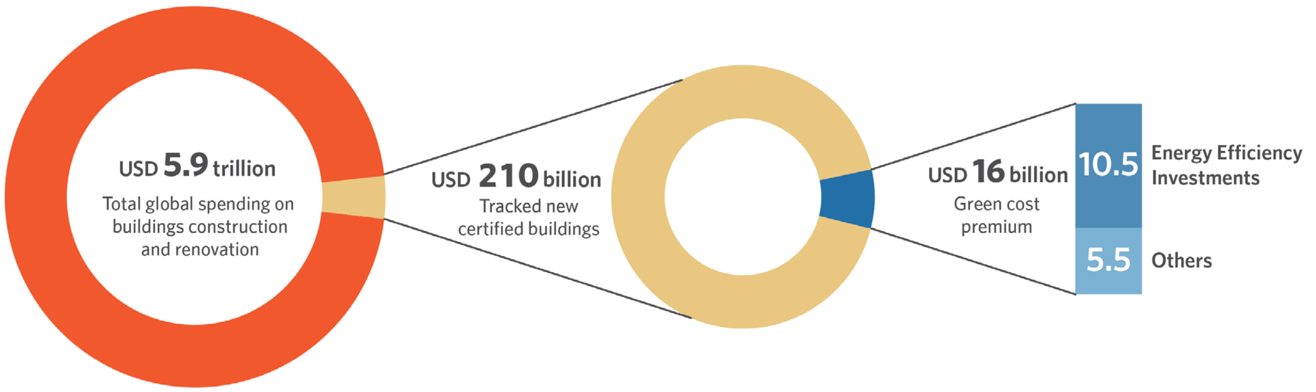
3. KEY FINDINGS

ENERGY EFFICIENCY INVESTMENT IN CERTIFIED GREEN BUILDINGS IS A FRACTION OF TOTAL INVESTMENTS IN BUILDINGS

For every USD 1 spent on energy efficiency gains, USD 19 was spent on conventional construction measures.

Globally, an annual average of USD 5.9 trillion was invested in construction of buildings in 2019 and 2020 (UNEP, 2020). **The average estimated incremental investments in energy efficiency in new certified green buildings in 2019-2020 was around USD 10.5 billion**[6]**.** This was roughly 5% of the total cost of construction for the tracked green buildings in that period.

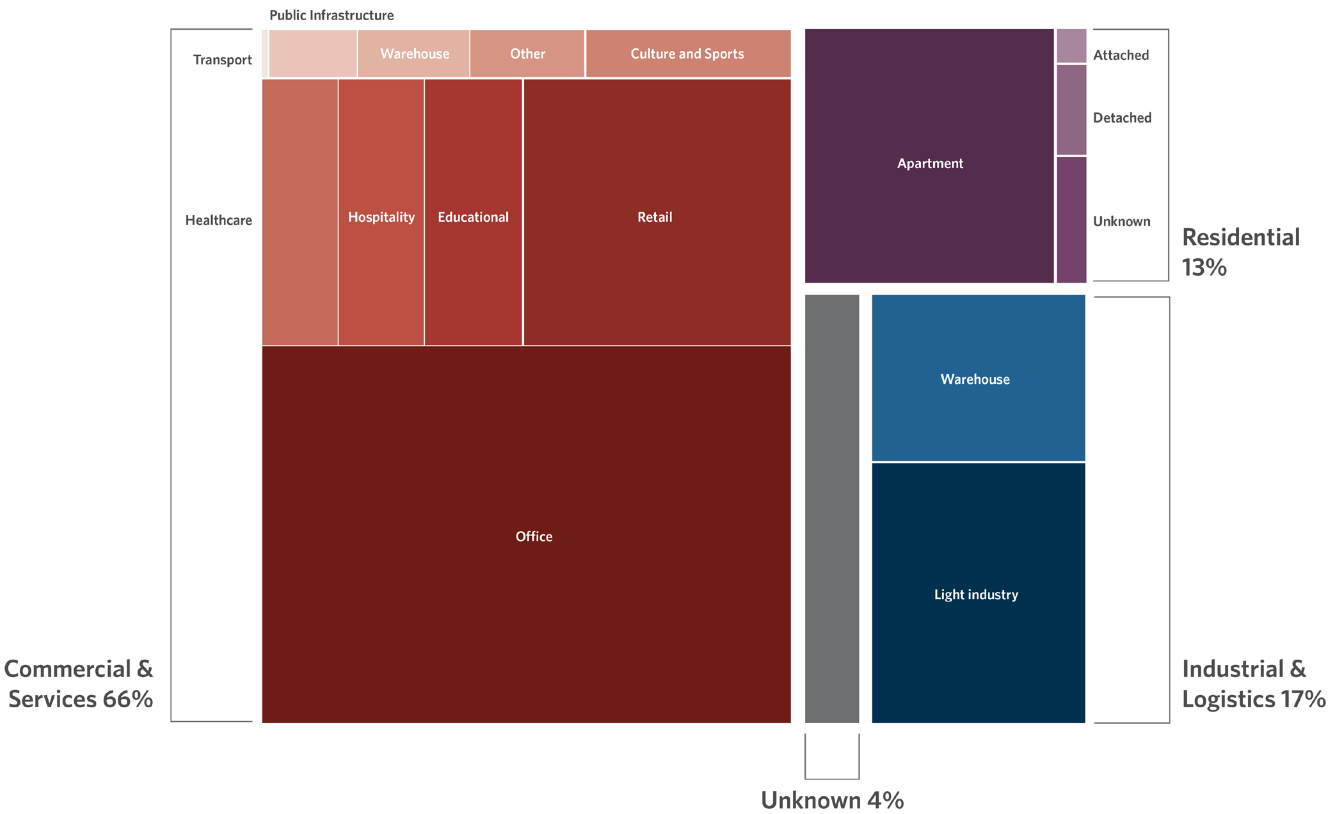
Figure 3: Building construction and energy efficiency investments in 2019/2020



Commercial buildings represent two-thirds of the new construction certificates tracked (Figure 4, in total area), **with offices accounting for the majority of commercial space. In the residential sector, large apartment building projects are predominant.** Indeed, green certificates best suit large real estate developers that seek profitability through longer term return on investment (through energy savings and rent premiums) and can afford the upfront costs of the certification. This phenomenon overlooks smaller scale projects, which are where the needs for energy efficiency investment is the greatest.

6 Based on the assumptions for green cost premiums and share of investments on energy efficiency

Figure 4: Tracked green certificates delivered to new constructions by building type (weighted by floor area)



Energy efficiency investments are predominantly concentrated in three regions that together account for 95% of the total certified floor area and 97% of financial flows: Europe (USD 4.3 bn), North America (USD 3.0 bn), and Asia (USD 2.6 bn).

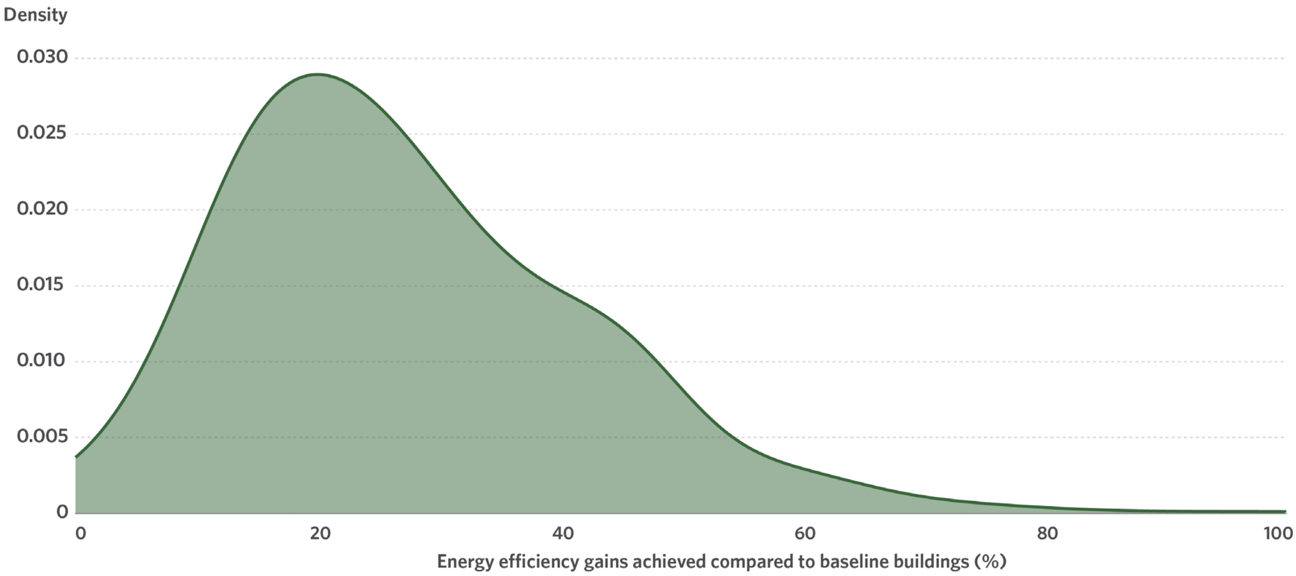
Table 4: Regional breakdown of certified floor area and incremental energy efficiency investments in new constructions

Regions	Certified floor area (millions of sqm)	Incremental EE investments (2019/2020) (USD billion)
Europe	92.4	4.31
North America	49.7	3.01
Asia	54.4	2.62
South America	7.1	0.29
Australia and New Zealand	0.8	0.05
Africa	0.6	0.02
Others & Unknown	1.4	0.03
Grand Total	**206.3**	**10.28**

CERTIFIED GREEN BUILDINGS GENERALLY PERFORM BETTER THAN CONVENTIONAL BUILDINGS, BUT WITH GREAT VARIABILITY

As mentioned in Section 2, many schemes disclose enough data and information on their rating system to either retrieve or estimate the energy performance of individual buildings[7]. Figure 5 displays the distribution of energy efficiency[8] that these new constructions achieved compared to their respective baselines, weighted by floor area.

Figure 5: Distribution plot of the energy efficiency gains achieved by certified new constructions[9]



Quite strikingly, most of the certified buildings do not achieve a drastic energy use decrease compared to a business-as-usual situation, and most green certificates are inconsistent indicators of energy performance. Therefore, alone, they fail to provide reliable benchmarks that financial actors could use to align their portfolios with ambitious decarbonization targets.

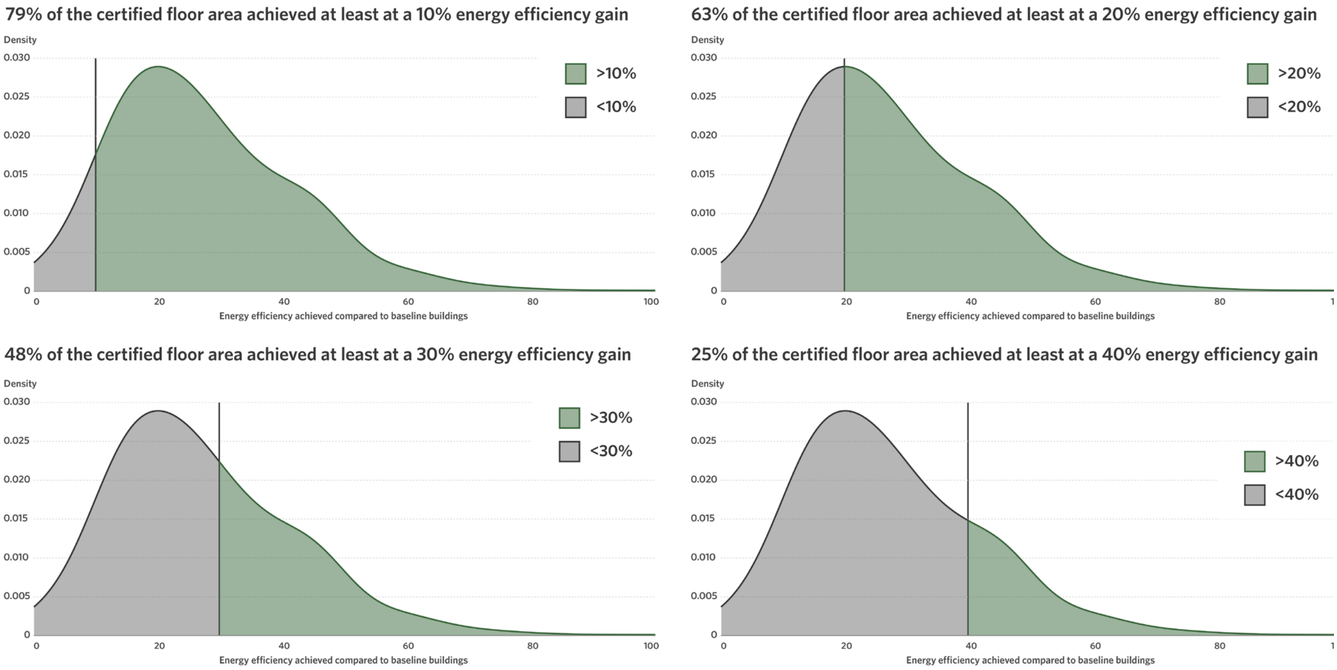
More than half of green certificates do not even achieve a 30% energy efficiency gain (Figure 6). Only a fourth of the certified surface reached over 40% efficiency gain. This variability can partly be attributed to diverging baseline contexts (e.g., countries that have more ambitious energy building codes), but also suggests that most green certificates are inconsistent indicators of the mitigation potential of investments in these buildings. Our findings also suggest a limited correlation between the energy efficiency gain of buildings and the certification level reached by projects (e.g., Bronze/Silver/Gold/Platinum). Indeed, in certification schemes that evaluate multiple factors simultaneously (water use, comfort, etc.), the energy performance rating of the projects can be diluted in.

7 More details in Annex.

8 Available data only allows to access ex-ante estimates of buildings' energy performance. This metrics often differs from on-site measurements of the actual energy use in the buildings, which is subject to multiple additional factors (behaviors, climatic fluctuations, etc.).

9 A density graph smoothens the distribution of data. The area below the curve is equal to 1.

Figure 6: Using some landmark arbitrary energy efficiency gain thresholds to discriminate investments



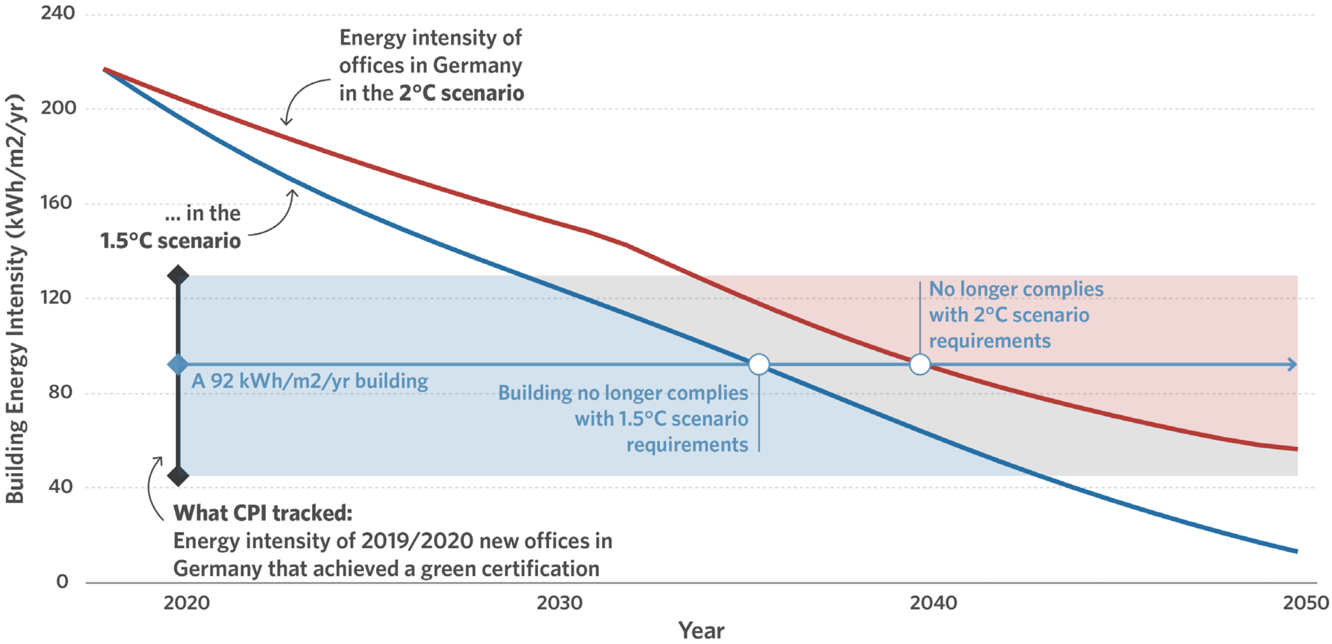
BETTER DATA AND METRICS ARE CRITICAL TO MEASURE ALIGNMENT WITH NET ZERO PATHWAYS

To assess the alignment of projects – and investments – with low-emission scenarios more comprehensively, the energy intensity of buildings must be benchmarked against clear targets. Some organizations, such as CRREM (Carbon Risk Real Estate Monitor), developed country-specific and building-type specific energy intensity scenarios. These scenarios are the first step in analyzing dynamically the compatibility of projects. Indeed, alignment implies that an asset is compatible with the needs to decarbonize a sector over time, ideally throughout the asset lifespan (CPI, 2020).[10]

Figure 7 is an example of how decarbonization scenarios can be used to assess the alignment of projects, using CRREM scenarios for office buildings in Germany. The blue line shows the energy intensity required from the stock of German offices as a whole in a +1.5°C degree of warming scenario. The red line shows the same energy intensity required in a +2°C scenario. These energy intensity pathways are derived from GHG emissions scenarios, which rely on ambitious shifts to low-carbon energy sources on top of the energy demand cuts discussed in this brief.

10 Alignment methodology brief.

Figure 7: Case study - CRREM scenarios



In parallel, we isolated 2019 and 2020 new constructions with green certificates that matched the building typology of interest – offices in Germany. The black vertical ribbon represents their range of energy intensity values. Typically, a building with a 92 kWh/m2/year energy intensity, which is within the range tracked, performs far better than the average German office building. It is contributing to the decrease of the average energy intensity of this stock of buildings. However, if no further energy efficiency work is conducted to improve its performance, there will come a time when the building is outperformed by the energy intensity targets in either CRREM scenario. It stops being a contributor and becomes a straggler. In the +1.5°C scenario, that shift occurs from 2036 onwards. In that sense, the building is not aligned with the requirements of a +1.5°C scenario. **When certifying new constructions, any proposed 'net zero' alignment label needs to be carefully defined to avoid the risk of greenwashing, and should only be attributed to projects that have anticipated 2050 GHG targets and their underlying energy intensity requirements - with minimal extra energy efficiency work required along the way.**

Techniques to assess, categorize, and measure investment flows are increasingly sophisticated and data intensive. The ability to make such methods operational and scalable relies on the availability and quality of data produced and reported. Monitoring assets' energy and GHG emissions performance on an ongoing basis informs GHG scenarios on progress achieved and streamline the currently difficult but yet crucial back and forth between assets and updated targets.

4. DATA GAPS AND LIMITATIONS

The methodology set out in this brief – summarized in Table 5 – requires a specific set of data variables, some of which CPI was able to collect or estimate. However, some gaps persist, and in many ways hinder the breadth and quality of the findings of this brief. More data is required make estimates more robust and to extend their coverage. From improving the use of asset-specific targets and energy efficiency cost premium, to expending the scope to embodied energy budgets and building retrofits.

Table 5: CPI's approach to overcome existing barriers in tracking energy efficiency investments in buildings

	Definition	Source data	Alignment	Measuring investment	Sources & instruments
Framing Questions	What is energy efficiency in buildings?	What asset-level data is available?	What energy efficiency levels are required?	How to isolate energy efficiency investments?	Who is investing and how?
Barriers	1: Diffused scope	2: Asset complexity	3: Inadequate standards	4: Composite & incremental	5: Uncoordinated tracking efforts between actors involved
CPI approach	**Define the scope** Energy budget of operating phase only, measured by whole building energy intensity	**Collect green certification data** New constructions and building retrofits certified in 2019 and 2020	**Assess certified assets' energy performance** Energy efficiency gains achieved compared to baseline buildings	**Estimate incremental investment** In newly built buildings using energy efficiency share of green cost premium	**Categorize financial flows** Building typology and location as preliminary proxy
Data gaps and limitations	Difficulty in tracking wider range of energy efficiency investments in buildings	Certified green buildings only capture a fraction of low-carbon buildings; Inconsistent and partial reporting practices from certifiers	Lack of accessible and consistent data on energy performance and lifecycle footprint	Poor reporting on investment metrics	Lack of data on investors and projects developers

Poor reporting on investment metrics: Granular data for this additional cost incurred for providing greener and more energy efficient alternatives in new buildings and obtaining the green building rating are not reported by the investors. These additional costs are often specific to the choice of technology based on the location, building type, end use, and knowledge of the building developers and users. Therefore, the knowledge on the key investment metrics such as green cost premiums and the share of energy efficiency investments in green cost premium is still vague and scattered.

Lack of accessible and consistent data on energy performance of certified green buildings: Green building certification schemes use different energy performance metrics to assess the buildings they certify. Beyond scheme specificities, the lack of transparent access to these measurements and estimates at the asset-level prevents a thorough assessment of projects. With increasingly ambitious standards[11] and open data initiatives,[12] national building codes and Energy Performance Certificates (EPC) could otherwise soon make green certifications obsolete.

Difficulty in tracking wider range of energy efficiency investments in buildings: Given data availability, the scope of this study was limited to measuring financial flows towards energy efficiency gains in buildings that achieved a green certification. However, there are various other ways in which energy efficiency gains can be made in the buildings and construction sector, for example through provision of loans, funds, or credit lines for energy efficiency projects, expenditure on research and development, budgetary allocations for policies and regulations, and implementation of building codes and standards. Additionally, the buildings which are energy efficient but have not acquired green building certifications are also excluded from the scope of this study as there is no comprehensive database to collect and track these types of investments in energy efficiency in buildings.

Lack of data on investments on retrofits: Almost all (96%) of tracked floor area that received a green certification corresponded to new constructions while only 4% corresponded to retrofit works. Therefore, the methodology for estimating investments towards retrofitting is not developed at this stage.

Lack of consideration to lifecycle emissions: Recently, the World Green Building Council announced its commitment towards net zero buildings and construction in terms of lifecycle emissions (WorldGBC, 2021). About 80% of the energy consumption of buildings occurs at the operation and maintenance stage (Ramesh et al., 2010). However, as the emissions from this stage decrease due to the uptake of renewable energy and energy efficiency measures, the relative importance of the emissions from the building and construction phase will continue to increase. There is a need for comprehensive information on the investments made towards improving the energy consumption in the construction process through the use of efficient materials, vehicles, equipment, processes, products, etc. Currently, these energy efficiency measures are not covered by any of the green building rating systems.

11 https://www.ecologie.gouv.fr/reglementation-environnementale-re2020
12 https://epc.opendatacommunities.org/

5. RECOMMENDATIONS

There is a need for standardized reporting of energy investments and performance of green buildings.

More investors and businesses are committing to decarbonize their investment portfolios. However, there is an overall lack of transparency and accountability in the buildings sector in terms of investments towards energy efficiency and their impact.

Tracking energy efficiency investments in buildings should focus on the factual information on energy efficiency gains gathered from the buildings where the investment is made. A standardized, publicly available reporting mechanism at the asset level will impact the consistency, comparability, and robustness of data. Such data will have significant implications on improving the tracking of investments and energy performance of in the building sector and provide a decision-making tool for investors.

Assets should be monitored on an ongoing basis. Energy efficiency investment is a moving target: what is considered energy efficient today may no longer be in the future. Our findings suggest that the current practice of green certification issuance only focuses on the energy performance at the time of the building completion. Assets' energy performance needs to be monitored by the owners or users of the asset on an ongoing basis, benchmarked against tailored net zero scenarios and energy efficiency targets for the building. Transparency in regular monitoring and reporting will help ensure that targets are successfully implemented and help avoid the greenwashing of investments made towards buildings that have little or no potential to cut energy demand

Retrofitting should be emphasized, and new building construction should be more thoroughly assessed in developed economies.

The majority of tracked green building certifications are acquired for new buildings in Western Europe and North America, while only 4% of the tracked certified floor area corresponded to retrofitted buildings. Our findings suggest that green certificates do not guarantee that assets are aligned with the low-carbon trajectories at the country-level over time. For example, the reduction in emissions intensity of the stock of new, certified office buildings in Germany in 2019-2020 does not align with the requirements under the +1.5°C degree of warming scenario in Germany developed under the CRREM scenarios.

As per the revised Energy Performance of Buildings Directive (EU) 2018/844, EU member states are required to identify high-energy consuming building stock and provide refurbishment or retrofitting. Therefore, to meet these targets, green building certification agencies need to reorient their focus towards certifying existing buildings for retrofits.

Providing certifications for retrofitting is a complex challenge. Many aspects need to be assessed simultaneously, such as energy performance assessments, upgraded design requirements, cost-benefit analysis, and use of smart technology and new materials. Therefore, robust methodological research and a shift in perspective are required to build tailored solutions for retrofitting buildings in developed economies. The European construction market is growing at a slow rate of 1-2% since 2015, whereas renovations are enjoying a steady growth (Dukhno, 2019). Under such conditions, it should be assessed if a new building needs to be constructed at all in developed markets.

On the other hand, in emerging markets, there is a USD 25 trillion low-carbon investment opportunity in new green buildings by 2030 (IFC, 2017). In India, for example, 70% of buildings needed by 2030 are yet to be constructed (IFC Edge, 2018). Certifying new buildings in emerging markets needs to be prioritized before these markets 'lock in' decades of inefficient building stock.

The 'energy efficiency cost premiums' methodology developed in this brief can serve as a guide for public and private financial institutions to estimate additional energy efficiency investments in buildings.

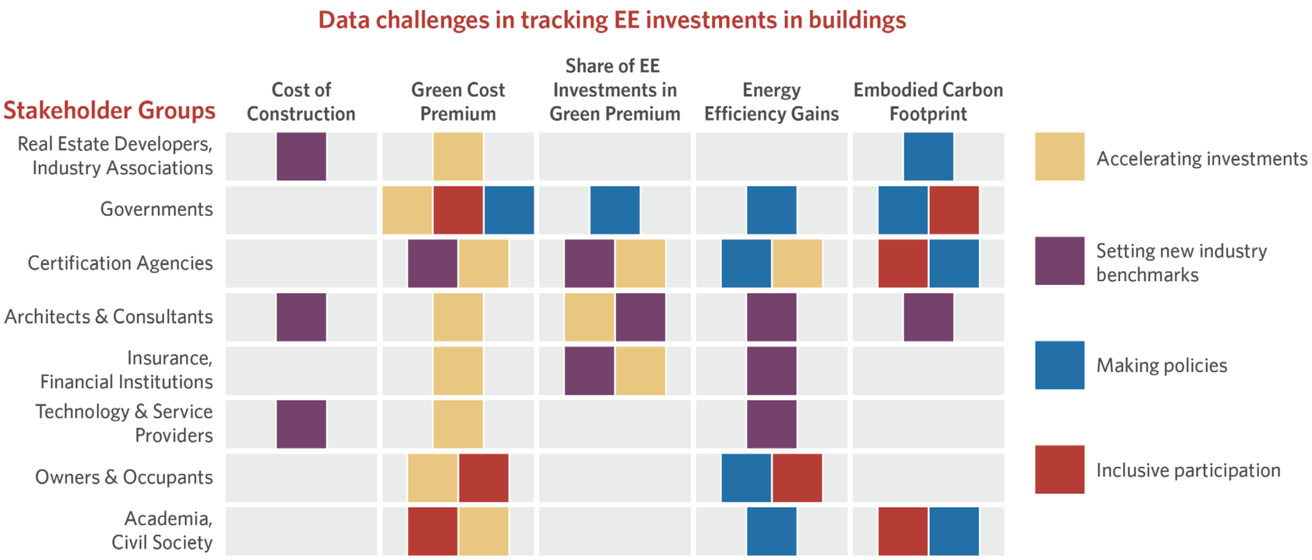
Given the limitations of green certificates, other types of information and approaches are needed to guide investment. Public and private actors can apply the 'energy efficiency cost premium' method to estimate incremental investments, and voluntarily disclose the premium deployed towards low-carbon assets in their decarbonization and transition plans. The location-specific primary data on investment metrics, such as cost of construction, green cost premium, and share of energy efficiency investment in green cost premium, are key to the application of this methodology. They can develop and use this primary data based on the local baselines for energy performance, aligned with the local decarbonization trajectories.

For example, the guidance provided by the Taskforce on Climate-related Financial Disclosures (TCFD) in October 2021 for private financial institutions suggests that the capital expenditure towards low-carbon technologies, assets, or products supporting decarbonization plans can be reported as a response towards climate-related risks and opportunities (TCFD, 2021). The 'energy efficiency cost premium' method developed in this study can empower private investors and financial institutions to estimate share of the incremental investments on energy efficiency in the total capital expenditure on low-carbon buildings. Disclosing this information will also help in filling the persistent data gap in the tracking energy efficiency investments by the private sector.

Multi-stakeholder engagement is required for robust methodology development and data gathering.

This study has built a model to estimate the energy efficiency investments in certified green buildings. However, the application of the model to the dataset is based on broad assumptions made at the country or regional level. In the absence of mandatory reporting frameworks for investments in green buildings, there is little to no incentive to disclose detailed energy efficiency investment metrics. This data is key to the estimation of incremental investments in energy efficiency in green buildings.

Figure 8: Multi-stakeholder engagement for addressing key data gaps



Multi-stakeholder collaboration is crucial to overcome the barrier of uncoordinated and fragmented efforts from various actors in the construction industry and making the data available and accessible for everyone. Setting up new governance processes are often expensive and time consuming. Therefore, the umbrella of existing green building councils can be leveraged to facilitate the data collection and aggregation process on key investment metrics.

Green Building Councils are independent, non-profit organizations made up of businesses and other organizations working in the building and construction industry. Being members of the World Green Building Council, they have shared interests and encounter similar challenges and opportunities. Enabling them to gather accurate and consistent data can help achieve results faster and more effectively.

The green building councils can engage various stakeholders in both the public and private sector to address the key investment metrics on energy efficiency investments as shown in Figure 8. This can help to accelerate investment, form a basis for evidence-based policy making, and set new industry benchmarks for net zero and climate-aligned built environment.

Participation from stakeholders in a bottom-up approach will ensure that the transition is inclusive and just.

- Architects, consultants, real estate developers, and other technology and service providers can provide asset-level information on investment metrics and energy efficiency gains to aggregators such as the green building councils..
- Certification agencies can provide methodologies to monitor and evaluate projects after the issuance of certifications, which can help create more robust databases.
- Insurance, investors, and other financial institutions can assess their investments for key investment metrics on energy efficiency and disclose the information in the public domain.
- Governments and its agencies can collect information on key investment metrics on energy efficiency and publish statistics on progress of their energy efficiency programs for buildings and other sustainable procurement initiatives.
- Independent owners, occupants, academia, and civil society organizations can participate more through surveys, interviews, and other data collection efforts to provide data on the real-time energy performance of buildings as well as investment metrics.

ANNEX 1 : MORE DETAILS ON THE APPROACH

STEP 1: DEFINE THE SCOPE

[Back to main report]

The structural and technological solutions covered under the study include:

- Efficient thermal envelope (wall insulation, glazing, etc.), optimized building orientation and exposition (natural lighting, shadowing)
- Heating, Ventilation and Air-Conditioning (HVAC): Efficient boilers, heating and cooling systems (not limited to RE). Recovery of buildings' waste heat.
- Lighting and Appliances: Efficient lighting, efficient appliances, electric load reduction.

STEP 2: COLLECT GREEN CERTIFICATION DATA

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Green buildings data were collected from multiple green certifiers that have different geographic energy performance and building type scope ambitions, as summarized in Table 3.

Table A1: Tracked certificates delivered in 2019/2020 to newly built and retrofitted buildings

Certification Schemes	Number of Certified Projects Tracked	Certified Floor Area Tracked (million sqm)	Scheme Geo. Focus	Asset-level Energy Performance data
LEED	10,414	110.3	Global (USA-based)	Yes
BREEAM	3,888	75.2*	Global (UK-based)	No
DGNB	321	8.4*	Europe + China & Thailand (Germany based)	Yes
Miljöbyggnad	450	6.0	Sweden	Yes
HK Beam Plus	150	5.3	Hong Kong	No
Effinergie	910	4.6*	France	Yes
CASBEE	137	2.5	Japan	No
Edge	103	2.0	Developing Countries	Yes
PassivHaus	252	0.3	Global	Yes
PHIUS	80	0.1	USA	Yes
TOTAL	**16,705**	**214.7**	NA	NA

*estimated

STEP 3: ASSESS CERTIFIED BUILDINGS' ENERGY PERFORMANCE

[Back to main report]

To measure certified projects ' energy performance, CPI uses a set of metric shared by multiple green building certifications : the project final energy consumption per square-meter and a baseline final energy consumption per square meter, which is a standard that reflects how a conventional building with similar features (e.g. an office in Germany) performs.

Variants to this simple energy intensity metric exist, such as primary energy demand intensity, which accounts for the energy losses along the energy transformation supply chain (e.g. the amount of unconverted energy necessary to produce and provide a building with 1kWh of electricity). Or even more sophisticated ones, such as Passivhaus's Primary Energy Renewable (PER), that projects the building energy performance potential in a 100% renewable energy universe (PassiPedia, 2021). These other measures were not utilized, as they introduce further data limitation constraints.

The energy efficiency gain reflects how much better than a baseline building the project is performing. It is calculated as follows:

$$EE = \frac{(EI_B - EI_P)}{EI_B}$$

Where:

EE, is the energy efficiency gain achieved by the project;

EI_B, is the energy intensity performance of the relevant baseline building, in kWh/m^2 /year;

EI_P, is the energy intensity performance of the project that is assessed, in kWh/m^2 /year;

However, these metrics are not always directly and easily retrievable at the project level. When not accessible upfront, EIP is (in order of preference) 1) derived from the project energy grade or alternative metric[13], 2) estimated if the certification scheme provides partial project-level data, 3) derived from the overall certification level achieved (e.g. bronze, silver, gold, etc.) or building grade using the underlying energy threshold requirements, or 4) left blank if no reliable ground for assumption is found. If instead the relevant EIB is not directly provided by in certification data, CPI uses ASHRAE Standard 90.1[14] and IECC energy models[15], depending on the building profile[16].

'LEED:BD+C' CERTIFICATION, AN EXAMPLE OF HOW WE ESTIMATED ENERGY EFFICIENCY GAINS

The LEED: BD+C certification is a good example of the various techniques we had to use to estimate the energy performance of projects.

13 Alternative energy performance metrics include source/primary energy consumption per square-meter.
14 https://www.govinfo.gov/content/pkg/FR-2011-10-19/pdf/2011-27057.pdf
15 https://www.energycodes.gov/prototype-building-models
16 Local baselines remain the preferred option as buildings' energy performances vary substantially depending on context-specific factors (country, climate zone, ...).

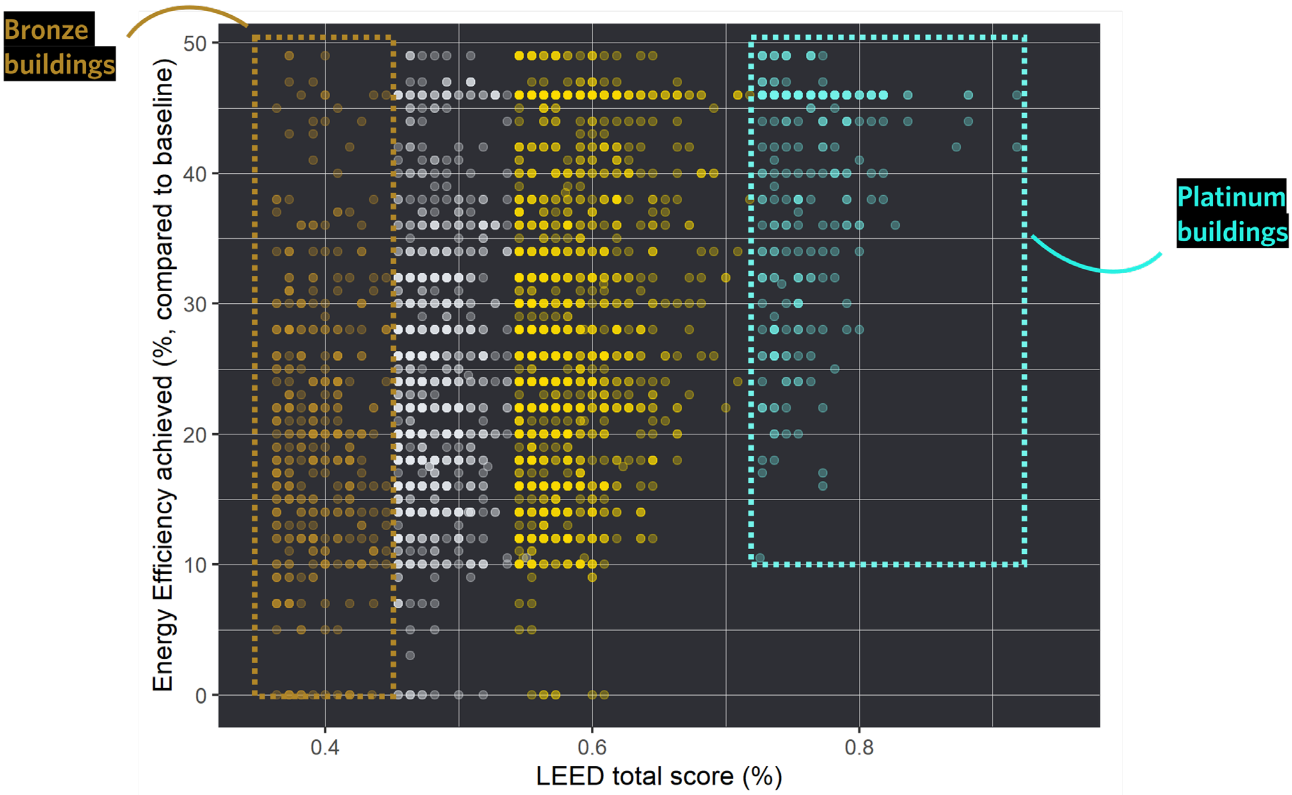
Projects that received that certification in 2019 and 2020 came with the following challenges:

- Not all certified projects disclosed their detailed certification scorecards (energy performance-specific score, beyond the overall bronze, silver, gold, platinum one).
- Not all certified projects used the same certification versions and standards (LEED v3, v4, v4.1, or some building type-specific certification schemes, such as LEED: schools or LEED: hospitality). The rating system from one version to another varies, so do the energy performance requirements.

To tackle these challenges, we used a 3-step approach:

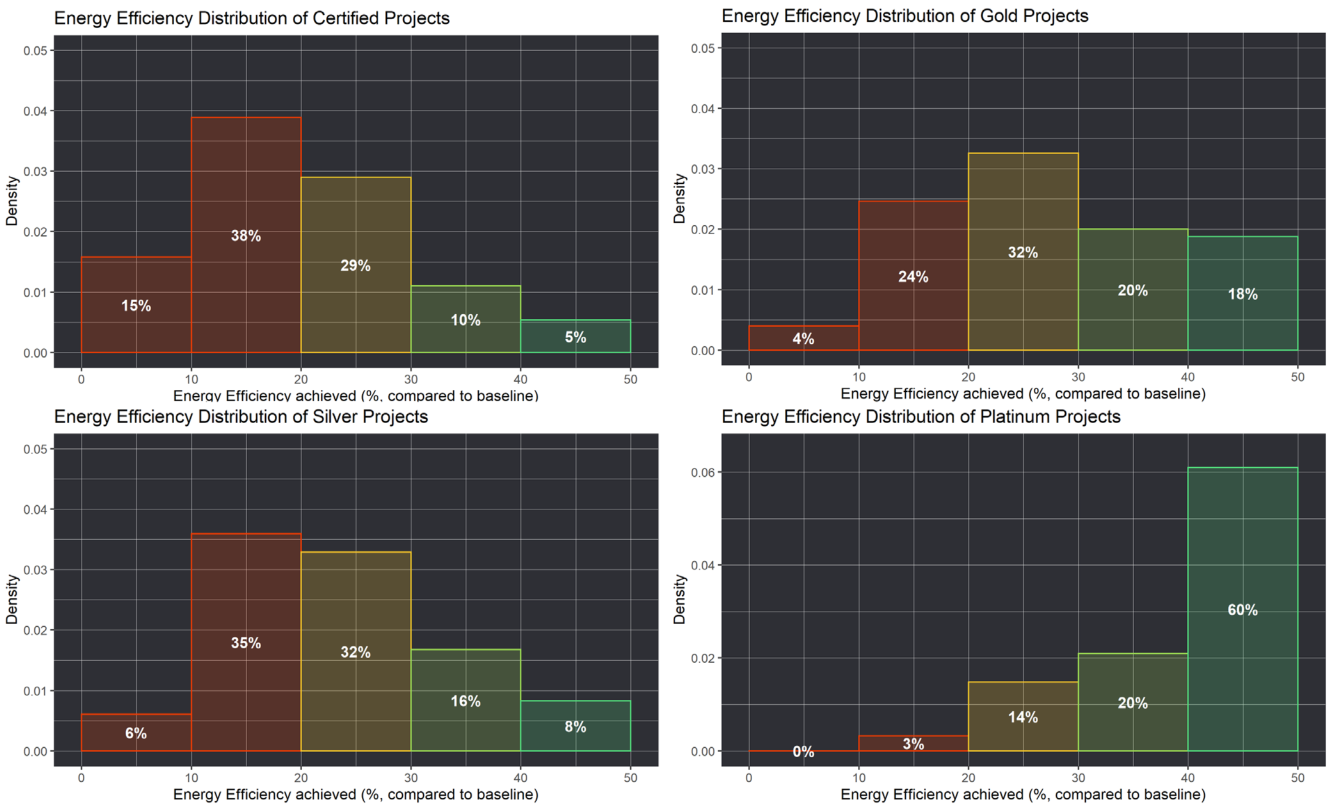
1. Map and understand the energy rating systems of all of the certification versions for which we collected data. For each version, we assessed a) how energy performance was rated (i.e. how to convert back LEED points into energy efficiency gains), and b) what baseline building performance were used.
2. Extract from our data base the projects for which we had detailed data (2877 projects) to understand what correlation exist between the energy efficiency gains achieved by projects and the overall certification score, which is the only metric available for all projects.

Figure A1. Energy efficiency gains achieved by certified LEED: BD+C projects against their total LEED score (% of available points scored)



3. Apply the following distribution of energy efficiency gains to projects with no data, by certification level.

Figure A2. Histograms of energy efficiency gains achieved by certified LEED: BD+C by certification level (Certified/Bronze, Silver, Gold, Platinum)



In other words, projects with no data were divided into 5 sub-projects with different energy efficiency gain levels, depending on their certification level, the floor area was used to weight these sub-projects.

STEP 4: ESTIMATE INCREMENTAL INVESTMENT

[Back to main report]

The incremental cost for the purpose of energy efficiency gains in a green building can be calculated by using a following formula:

$$\Delta EE_{GB} = CC_{CB} \times \Delta G_{GB} \times k$$

Where ΔEE_{GB} represents the energy efficiency cost premium i.e. the incremental cost of energy efficiency gains in a green building per square meter; CC_{CB} represents the cost of construction of a conventional building per square meter, ΔG represents the green cost premium of a green building of the same type, located in the same geography and climate zone and k represents a share of green cost premium spent on energy efficiency specific investments (e.g. the energy efficient solution).[17] In the absence of asset level data, we used a set of assumptions to demonstrate the methodology.

17 Relying on green cost premiums means that investments are only accounted for if the energy-efficient solution is more expensive than the baseline one. This approach is aligned with CPI's principle of conservativeness to prevent over-reporting of financial flows, and limit the scope to additional investments.

To estimate the **cost of construction of conventional buildings** (CC_{CB}), we used the findings of the International Construction Market Survey (ICMS) 2019 and 2021 prepared by Turner & Townsend, an independent professional real estate services company. This survey is the largest and most in-depth survey globally, providing construction data and charts the average construction costs per square meter for multiple asset classes across several sectors in 90 markets. For the countries where cost of construction was not available through the survey, we have assumed it be equal to that in the neighboring countries, if available. For all other countries and asset classes, regional averages of construction cost per square meter are used.

There is a wide range available for estimated **green cost premium** in the literature (Kats, 2010; Dwaikat and Ali, 2016; Russ et al., 2018; Hu and Skibniewski, 2021). The studies are spread across different geographies, climate zones, property types, certification types, level of certification, and time periods. After an extensive literature review, results suggest that 90% of all green cost premiums fall between 0- 12% of the cost of the building. For the purpose of this study, we have assumed an average green cost premium of 7% for the developed countries and 12% for emerging economies, for all levels and types of green building certification (WorldGBC, 2013).[18]

Out of the total green cost premium, it is assumed that a significant share is spent on energy saving improvements in a model building (k). This is based on the rationale that the life cycle cost of the building is positive only when there is rent or sales premium attached to it which is dependent on the buyer experiencing cost savings on energy utility bills. This encourages the developer to maximize spending on energy efficiency (WorldGBC, 2013).

For example, a study by (Gabay et al, 2014) built a cost-benefit model based on the Israeli voluntary Green Building Standard and focused on office buildings of different sizes and standards. They estimated that out of the 4.3–11.6% extra costs of a green building, 75–96% were spent on energy saving improvements in Israel. A study in China based on 276 green buildings concluded that incremental cost for energy saving made the largest proportion (65%) of the total green building incremental cost (Ge, J. et al., 2018). However, this level of granular data is unavailable for all types of buildings, types and levels of green building certification levels in all countries. Therefore, we base our assumption that 65% of green cost premium is spent on energy efficiency gains by selecting the best available study on incremental cost of energy efficiency.

Almost all (96%) of tracked floor area that received a green certification corresponded to new constructions while only 4% corresponded to retrofit works. Therefore, the methodology for estimating investments towards retrofitting was not developed in this brief.

18 The differential in green cost premium is because of the differences in baseline. The baseline of a conventional building is highly dependent on the progressiveness of the national or local building regulations for that particular location. We assume that the developed countries have environmental certification systems in place which may have an influence on improved baselines for code-compliant buildings, consequently narrowing the gap between the cost of a conventional building and a green building. Developing countries have less emphasis on the green agenda embedded into their building regulations might find that the cost premiums are higher.

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