2018

EconomisE

LIFE16 GIC/FI/000072

Bridge That Gap!

The Paris Agreement Compatible Emissions Reduction Pathway for the Finnish Real Estate

AUTHOR: KAARINA KOLLE
CONTRIBUTORS: KTI

Foreword by Liisa Rohweder

The recent publication of IPCC's 1.5 C report concluded what we already knew: the world is at a climate crossroads. We must urgently steer our collective efforts at transforming every emitting sector in the global economy. The clean energy transition spearheaded by wind and solar technologies is finally underway and gathering steam. But as the revolution of clean electricity unfolds, what does it mean for the heating sector? Unfortunately, a trickier clean energy conundrum remains to solve how to power Northern climates during the winter. This is why we need a laser sharp focus not only on renewable energy but also energy efficiency and energy savings. After all, in life cycle emissions, negawatts often trump megawatts.

The future low-carbon energy system can be described as the equivalent of a 'Swiss army knife' – we will need a palette of tools from renewable energy production to demand side reduction. However, it is widely recognized that one of the sharpest knives to cut the energy consumption is to steer our collective gaze on energy efficiency of buildings.

Therefore, the largest players of the Finnish real estate sector must step up to overcome this challenge. The Finnish institutional investors and real estate companies must go beyond the business-as-usual level of energy efficiency improvements that are often dictated by the existing legislation. First and foremost, we need to ask what is *adequate* in light of the pressing timeline dictated by the Paris Agreement.

In this study, conducted in cooperation with KTI Property Information Ltd, we want to redefine the contours of that conversation. The starting point must be climate science. Fortunately, many Finnish investors and companies are stepping up to the challenge and setting independent targets for their real estate investments and company operations. We greatly encourage the positive development. The challenge ahead of us will require us to tap into every possible intervention: international and internal policy, determined target-setting, CEO-level interest, and brick and mortar.

Let's ensure that we bridge that gap together.

Key findings

- The Finnish real estate must be completely decarbonized by 2035 (1.5 °C) or 2040 (2 °C).

- Currently, the median energy efficiency rating in commercial buildings is E and in residential buildings D. Less than 10% of professionally managed floor space reaches the highest energy ratings of A and B.

- With the business-as-usual rate, the energy consumption of commercial real estate is set to decline 30-35% by 2035-40.

- With the business-as-usual rate, the energy consumption of residential real estate is set to decline 20-25% in energy consumption by 2035-40.

- With the business-as-usual rate, the average energy consumption per building reaches a level of 140 kWh/m2 for both commercial and residential buildings at the 2035-40 cut-off point

- Applying the logic of 'Carbon Law', by 2030 Finnish buildings should not use more than 100 kWh/m2.

- Currently, only about 40 buildings consume less than 100 kWh/m2.

- Therefore, the figures suggest that the energy efficiency improvements in professionally managed buildings greatly lag the speed that is adequate to meet the Paris Agreement's targets. **Most of the Finnish buildings are therefore vulnerable to transition risk and need to be renovated.**

Introduction

In the coming decades, the entire existing global building stock would need to be retrofitted in order to have a chance of meeting the objective of limiting *global average temperature to well below 2 °C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5 °C* - as is dictated by the Paris Agreement. It is therefore essential to estimate the existing inconsistency between current action and the required level of ambition.

In late-2018, IPCC published the latest numbers lifting the veil on what the 1.5 °C carbon budget means concretely. By 2030, CO_2 emissions decline by about 45% - roughly following the logic of the 'Carbon Law' calling for halving of the emissions every decade. Moreover, the Finnish Climate Panel has also revealed the first estimation of the appropriate target for Finland indicating that most emitting sectors need to decarbonise around 2035 (and in 2040 in the 2 °C scenario) – depending on the level of carbon sinks and equity assumptions. All in all, the decarbonisation of the building sector is a Herculean task requiring action and greatly exceeds the regulatory minimum.

This report will explore in collaboration with KTI Property Information Ltd (later KTI) the gap that exists between the current emissions of professionally managed buildings and where the Finnish real estate sector needs to go in order to align with the Paris Agreement's temperature targets. The analysis presented in this report shows that the current emissions reduction trajectory drastically falls short in the professionally managed real estate - both in electricity and heat. The building sector lags far behind its technological potential and, consequently, it is evident the renovation speed/ rate of the existing building stock in Finland must accelerate.

Appropriate Level of Ambition: Paris Agreement Compatible Target for the Finnish Real Estate and "The Carbon Law"

There are several first attempts to model what the 1.5 °C target means in practice for the entire economy. Unfortunately, more sector specific estimations have not yet been fully established to take into account the more stringent end of the Paris Agreement's ambition level. Generally, the real estate sector is widely regarded as one of the sectors that must decarbonise earlier given the technical feasibility and cost-efficiency.

According to the new report *Global Warming of 1.5 °C,* the scientific community states with high confidence that "Pathways limiting global warming to 1.5 °C with no or limited overshoot would require rapid and far-reaching transitions in energy, land, urban and infrastructure (including transport and **buildings**), and industrial systems". By 2030, CO_2 emissions decline

by about 45 % from 2010 levels. Overall, the emissions need to reach net zero globally before 2050[1][2].

The IPCC's global figures for the emissions reductions are also close to a newly coined concept of « Carbon Law » that follows the logic of « Moore's Law » better known in computing. Moore's Law states that computer processors double in power about every two years. While it is neither a natural nor legal law, this simple rule of thumb or heuristic has been described as a "golden rule" which has held for 50 years and still drives disruptive innovation. An international team of researchers, led by Stockholm Resilience Centre, have proposed that the global economy needs to halve emissions every decade[3]. The paper notes that this offers a flexible way to think about reducing carbon emissions. It can be applied across borders and economic sectors, as well as both regional and global scales.

The Finnish Climate Panel's first estimates for the appropriate long-term strategy for the Finnish real estate sector have been published in June 2018[4]. Given that the sector-specific pathways aligned with the 1.5 °C carbon budget are not yet available for Finland the estimation must be rooted in proxies and generalist assumptions (as opposed to a detailed sector specific analysis that are provided by, inter alia, the International Energy Agency).

The Panel offers different scenarios depending on two major parameters: the level of carbon sinks and the underlying equity assumption. For the purpose of this analysis, WWF has chosen a carbon sink level of -20 Mt CO2-ekv/v as it reflects Finland's current forest management reference level[5][6].

Regarding the equity assumptions, WWF supports a level of historical responsibility that acknowledges the common but differentiated responsibilities and respective capabilities of countries' emissions reductions. Therefore, out of the available options laid out by the Panel, WWF chooses to support the historical responsibility, which cover the years 1990 – 2050. It is

---

[1] According to the World Metereological Organisation (WMO) « Net zero emissions are achieved when emissions of greenhouse gases to the atmosphere are balanced by anthropogenic removals. This requires at least the same amount of CO2 to be removed from the atmosphere as is emitted » Formally, in the words of the Paris Agreement, net zero emissions are "a balance between anthropogenic emissions by sources and removals by sinks of greenhouse gases in the second half of this century".

[2] Regarding the EU's climate ambition, WWF believes that the EU's new long term climate strategy should aim for the EU as a whole to reach zero net emissions domestically by 2040, recognising that individual Member States may wish to set an earlier or later date in their long term strategies.

[3] Rockström et al, 2017. A roadmap for rapid decarbonization. http://science.sciencemag.org/content/355/6331/1269

[4] Ilmastopaneeli, 2018. Ilmastopaneelin näkemykset pitkän aikavälin päästövähennystavoitteen asettamisessa huomioon otettavista seikoista. Access at http://www.ilmastopaneeli.fi/uploads/selvitykset_lausunnot/Ilmastopaneelin%20muistio_hyv%C3%A4ksytty_4.6.2018.pdf (in Finnish)

[5] Statistics Finland, 2018. National Inventory Report under the UNFCCC and the Kyoto Protocol https://www.stat.fi/static/media/uploads/tup/khkinv/fi-nir_eu_2016_2018-03-15.pdf

[6] Importantly, this number can drastically reduce if the Finnish government realises the planned forest harvesting levels. According to the impact assessment of the Energy and Climate Strategy, the sinks could be reduced to as little as -10 or – 13 Mt CO2-ekv in 2030. Source (page 78): https://tietokayttoon.fi/documents/10616/3866814/21_Energia-+ja+ilmastostrategian+vaikutusarviot+Yhteenvetoraportti/40df1f5f-c99c-47d1-a929-a4c825f71547?version=1.0

essential to highlight that the reference years do not consider the entire extent of Finland's industrial past and falls short of a comprehensive account on historical responsibility.

The Panel's analysis shows that if Finland inspires to reach the 1.5 °C target, it will require reaching carbon neutrality in 2028 and become carbon negative thereafter. The emitting sectors, applying to the real estate sector, need to decarbonise approximately in 2035 (see Figure 1). The 2 °C target requires Finland to become carbon neutral in 2032 and the emitting sectors to decarbonise by 2040 (see Figure 2).

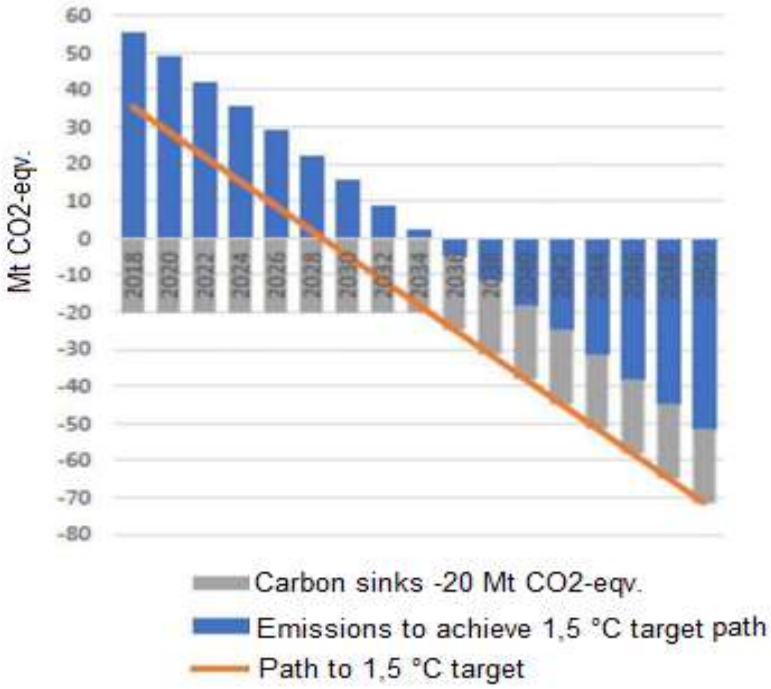

Figure 1. Historical reponsibility 1990 – 2050 with the 1.5 °C carbon budget.
Source: The Finnish Climate Panel, 2018.

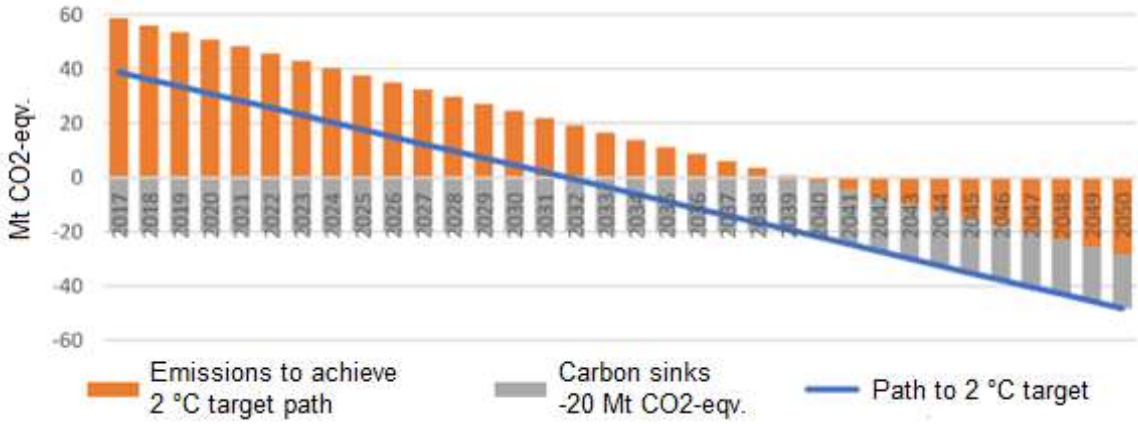

Figure 2. Historical responsibility 1990 – 2050 with the 2 °C carbon budget.
Source: The Finnish Climate Panel, 2018.

For future analysis, the level of ambition needs to be adjusted according to the most available data calibrated for the real estate sector and eliminate any potential double counting of carbon sinks. Analysis derived from global carbon budget models may already include some assumptions on carbon sinks, which may lead to any domestic analysis tilted towards a later decarbonisation date than is appropriate.

Some countries, including Germany, have already set specific roadmaps for different sectors that help to better define the desired ambition level. The German Energy Efficiency Strategy for Buildings[7] dictates that the non-residential buildings' final energy consumption should be set at 100 kWh/m2 (and 74 kWh/m2 for residential buildings) in 2050. In Finland, such energy-related target is not yet available.

Taking into consideration all the aspects above, the across-the-sectors numbers used in this report must be regarded as the floor rather than the ceiling.

Energy Efficiency Rating in Commercial and Residential Buildings: Results

To conduct the analysis, an extensive and commercially available database of KTI has been used. KTI's Finnish property index data covers approximately 40% of the institutionally owned commercial building stock in Finland. Importantly, it is the most comprehensive aggregated database available for the Finnish property market to date[8] and is therefore the best available proxy for the overall state of the Finnish real estate.

The energy data for each building has been obtained through annual reporting from about 45 real estate companies and investors with granular user data from various types of buildings (residential and commercial). The energy data covers some 2800 buildings reflecting a total of some 13.5 million m^2 with an aggregate total energy consumption of 2885 GWh (10.4 PJ), which translates to 0.52 million t. CO_2-ekv.

The energy related data consists of mainly residential buildings (78 % of assessed buildings) followed by office buildings (15 %), retail (4 %) and industrial property (4 %). The geographic focus has a strong emphasis on the Helsinki metropolitan area (42 %) with the other half of the data covering the rest of Finland (59 %).

Based on the data, **the median energy efficiency rating in commercial buildings is E and in residential buildings D.** The results are presented in figure 1 and the granular level break-out in table 1. The data shows that in both commercial and residential **buildings less than 10% of professionally managed floor space reaches the highest energy ratings of A and B**.

[7] Federal Ministry for Economic Affairs and Energy (BMWi), 2015. Energy Efficiency Strategy for Buildings. https://www.bmwi.de/Redaktion/EN/Publikationen/energy-efficiency-strategy-buildings.pdf?__blob=publicationFile&v=6

[8] KTI's database reflects actual valuations, returns, operative costs, rental data and additional KPI's from institutional, commercial and residential property holdings and portfolios with time series of data starting from the mid-1990s.

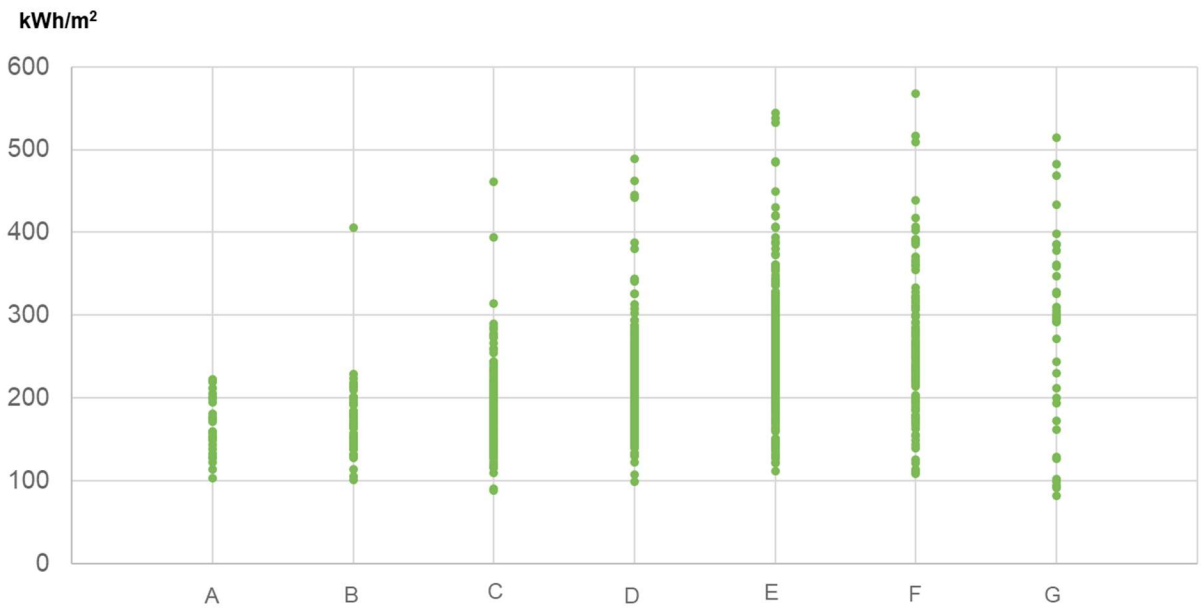

Figure 3. The energy efficiency rating and relative sizes of buildings in KTI's current database.

	Residential	Commercial
A	3 %	3 %
B	5 %	3 %
C	16 %	12 %
D	39 %	24 %
E	28 %	32 %
F	7 %	20 %
G	2 %	6 %

Table 1. The energy ratings distribution based on % of the floor space (m^2)

Gap Analysis: the Results

Historic data reflects an improvement in energy consumption levels for commercial real estate in Finland. Extrapolating the declining pathway from the data set, **energy consumption of commercial real estate would decline by 30-35% by 2035-40**. If the business-as-usual rate continues**, average energy use per building would reach a level of 140 kWh/m2**, assuming a linear continuation of the trend. The corresponding figures for **residential properties reflect a slightly less steep trajectory resulting in a 20-25% decline in energy consumption by 2035-40.**

This would leave the **average energy consumption at similar levels for both commercial and residential real estate as we reach the 2035-40 cut-off point.**

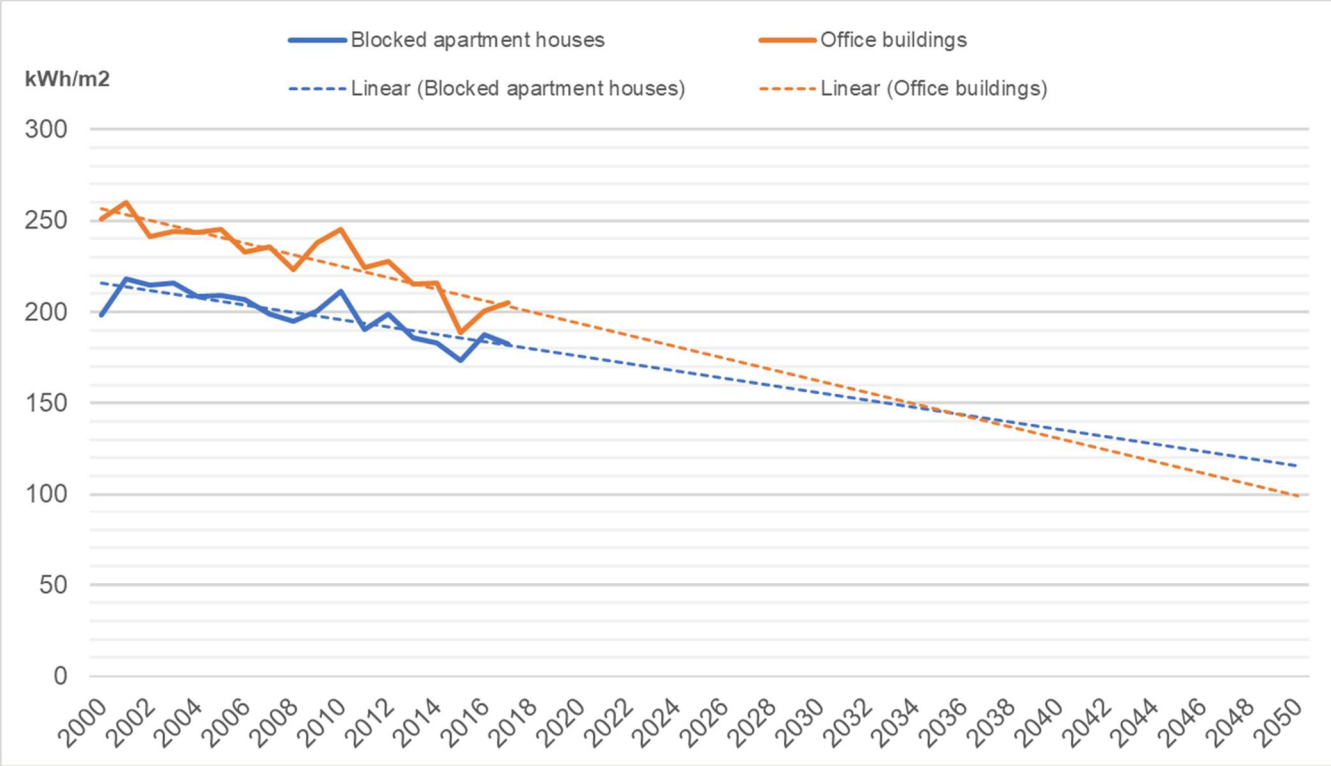

Figure 4. The business-as-usual energy reduction pathway in Finnish commercial and residential properties.

However, given that by 2035-40 the real estate sector should have already fully decarbonised, **the figures suggest that the level of energy efficiency improvements lags the desired speed.** This is not surprising given that the global trend shows how investments for sustainable buildings remain lacklustre.

While buildings' energy source at the utility level can reduce emissions by switching the fuel source, there are currently few fully carbon-free options for heating if the utility in question continues to generate heat and power primarily through burning. In Finland, about three-quarters of district heat production is based on combined heat and power (CHP) generation.

By 2035, no Finnish utility will no longer be permitted to use coal due to the coal ban introduced by the Finnish government entering into force in 2029. However, no phase out plans have so far been made for other high emission fuels such as peat and gas - both likely substitutes to coal. Furthermore, the emissions coming from bioenergy and pellets – another likely substitute fuel for the Finnish utilities - may not be fully accounted for in the land sector making them potentially a high carbon alternative.

It should therefore be assumed that the central instrument for deep emissions cuts in buildings need to be energy savings in the existing building stock – through deep renovation and similar activities. Another alternative remains localized low-carbon energy production, including the use of solar panels and heat pumps. However, given to data restrictions, the level of granularity relating to comprehensively analysing localised energy production falls outside the scope of this exercise.

Setting the energy consumption target for buildings: 100 kWh/m2 by 2030

If we apply the logic of 'Carbon Law', by 2030 the emissions should have halved every decade. The average energy consumption in 2017 was 195 kWh/m2 for residential buildings and 205 kWh/m2 for commercial buildings. If it assumed that the level of emissions at the utility level remain static and that we need to halve the emissions by 2030, the cut-off point for buildings can be set approximately at **100 kWh/M2. This is consequently the representational figure used in this report to indicate the appropriate level of ambition in 2030.**

Combining data from both electricity and heat, it is possible to plot each individual building in a graph showing which buildings are outside the Paris Agreement's required level of ambition using the 100 kWh/m^2 as the target level. Buildings in the red represent the section of the market that is facing a transition risk if the energy efficiency requirements for the existing building stock significantly tighten. In other words, **these buildings need to be renovated in the coming decade are thus vulnerable to transition risk.** (See figure 5.)

According to the analysis, **only about 40 buildings (covering the floor space of 300 000 m2 currently consume less than 100 kWh/m^2**. Residential buildings are particularly abundant in the climate-compatible quadrate.

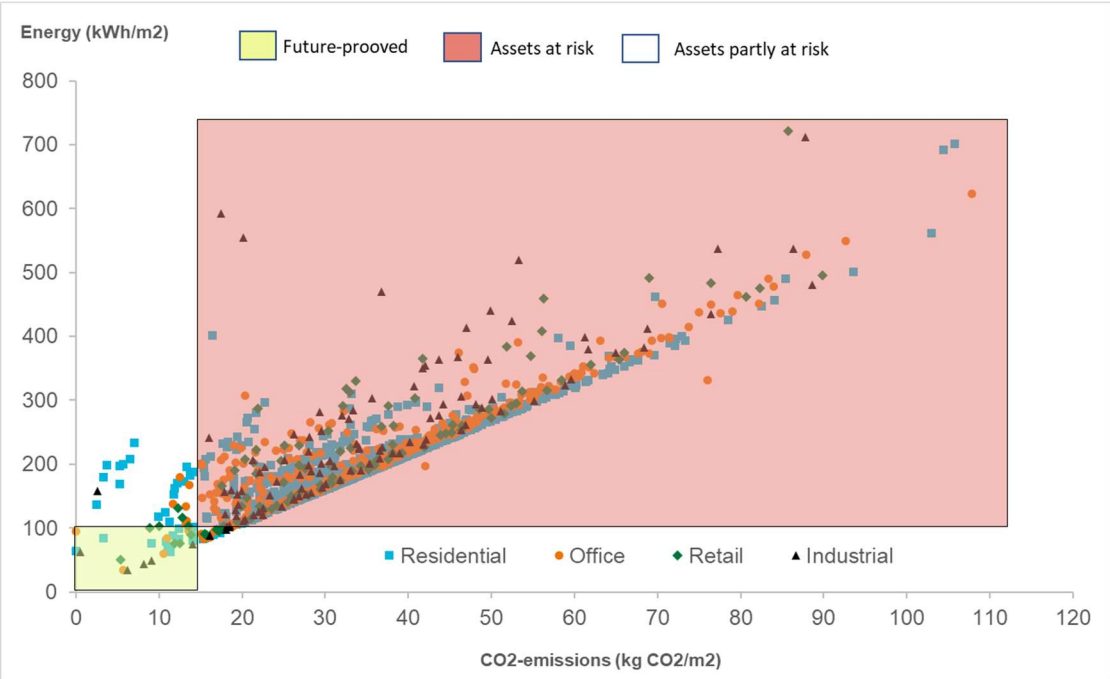

Figure 5. The gap analysis of the buildings that are aligned with the Paris Agreement (using a representational figure of 100 kWh/m^2 as the target)[9].

The emissions for each building have been calculated on the basis of Motiva's CO_2 emissions data[10].

[9] Electricity consumption data of commercial buildings partially includes also electricity usage by tenants in addition to electricity used by the building.

[10] Motiva, 2018. Electricity : 164 kg CO2/MWh. District heating for CHP: 188 kg CO2/MWh. The regional differences of energy mixes have been taken into account :

Next steps : WWF's recommendations

The buildings sector is characterized by very long-living infrastructure and immediate steps are hence important to avoid lock-in of inefficient carbon and energy-intensive buildings. Therefore, pronounced policy interventions are a prerequisite to achieve the global climate targets.

Recommendation: The Finnish Government

1. Establish adequately stringent Long Term Renovation Strategies in EPBD's (Art.2a) national transposition, which requires to develop strategies to reach a highly-energy efficient and decarbonised building stock in 2050 (with 2030 and 2040 indicative milestones).

   The strategy can draw on the German example of setting a specific kWh/m2 target for commercial and residential buildings, which adequately takes climate science into account.

2. Set a stringent minimum energy rating level, such as C or similar, for commercial and residential buildings. This would force the bulk of the buildings to be retrofitted.[11]

Recommendations: Institutional Investors

3. Develop climate policy and disclosure in accordance with Task Force on Climate-related Financial Disclosures (TCFD) recommendations. Institutional investors are encouraged to describe the resilience of the organisation's strategy, taking into consideration different climate-related scenarios, including a 2°C or lower scenario.[12]

4. Adopt a time-bound climate science-based target built on a forward-looking climate-scenario analysis. The Science Based Targets Initiative for Financial Institutions is an appropriate tool once finished (2020 onwards)

Recommendations: Companies

5. Develop climate policy and disclosure in accordance with Task Force on Climate-related Financial Disclosures (TCFD) recommendations. Organizations with more

https://www.motiva.fi/ratkaisut/energiankaytto_suomessa/co2-laskentaohje_energiankulutuksen_hiilidioksidipaastojen_laskentaan/co2-paastokertoimet

[11] Similar to the Netherlads where office building with energy label D or worse banned as from 2023 https://www.akd.nl/en/b/Pages/Office-building-with-energy-label-D-or-worse-banned-as-from-2023.aspx

[12] See also WWF's guide to asset owners: aligning investment portfolios with the Paris Agreement http://wwf.panda.org/?317790/climate2Dquide2Dto2Dasset2Downers

significant exposure to climate-related issues should consider disclosing key aspects of their scenario analysis – including the 2°C or lower scenario[13].

6. Adopt a time-bound climate science-based target built on a forward-looking climate-scenario analysis. We recommend the sectoral decarbonisation approach developed by Ecofys, i.e. to commit to the target-setting process of the Science Based Targets Initiative.

EconomisE

LIFE16 GIC/FI/000072

This publication reflects only the EconomisE project's view, and the EASME/ Commission is not responsible for any use that may be made of the information it contains.

** This report has been carried out with the financial contribution of the LIFE Programme of the European Union*

***KTI's data provide background and form a base for additional analysis by WWF. KTI has done its best in ensuring the completeness and accuracy of its data, but cannot accept any responsibility for potential losses caused by it.*

[13] https://www.fsb-tcfd.org/wp-content/uploads/2017/06/FINAL-2017-TCFD-Report-11052018.pdf