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Executive Summary

Emissions from the buildings sector account for 21% of global GHG emissions. This paper aims to analyse the potential of global climate governance to promote the decarbonisation of this sector. The paper proceeds in four steps. First, the paper summarise existing knowledge on which barriers are impeding decarbonisation of the buildings sector as well as opportunities that may be leveraged. Second, the paper discusses how global governance may help with overcoming these barriers and mobilising potentials (“governance potential”). Third, the paper maps out the existing landscape of international institutions that are active in the buildings sector and discusses to what extent these institutions have already been able to exploit the governance potential identified in the preceding step. This discussion results in an identification of governance gaps and unexploited potential. Finally, the paper discusses options for filling the identified gaps and mobilising unexploited potential.

Global governance and cooperation in the buildings sector is generally difficult given its mostly localised supply chains, lack of exposure to international trade, and highly differentiated needs in relation to geography and climate. The paper nonetheless identifies a number of potential avenues for global climate governance, but this potential has been exploited only to a limited extent. The sector was not even mentioned in recent outcomes of institutions such as the G7 or the Major Economies Forum. While the challenge of providing climate-friendly cooling is governed with clear targets, rules and transparency mechanisms under the Kigali Amendment to the Montreal Protocol, regarding the buildings sector as a whole, there is no central institution, no strong government-backed signal on the need to decarbonise, and also is little rule-setting. The potential to provide transparency and accountability of countries’ actions also has been exploited only to a very low extent. Regarding means of implementation, while substantial resources seem to be provided, there is a lack of data on actual needs. IPCC and IEA consider that investments need to grow by a factor of 3-4 by 2030 to get onto a Paris-compatible trajectory.

Several already existing institutions could in theory help to close the governance gaps identified but in practice all have limitations, such as the diverging interests among the parties to the UNFCCC and the Paris Agreement and the need to achieve consensus. The best way forward may therefore be a coalition of ambitious countries and other others, such as a “Breakthrough” on the buildings sector, that draws on the strengths of existing institutions. To add value to the existing institutional landscape, such a “Breakthrough” should include an ambitious global target or roadmap as well ambitious individual targets and pledges to increase means of implementation for developing countries. The GlobalABC and the IEA could track implementation, as the IEA is already doing case with the existing Glasgow Breakthroughs. Successive COP presidencies could use the annual COP sessions as platform and occasion to demand demonstration of clear progress. In addition, if country members included their Breakthrough pledges in their NDCs, they would thereby be subject to the transparency mechanisms of the Paris Agreement.

However, the success of such as “Breakthrough” is far from assured given that so far several calls for building decarbonisation commitments by governments gained only a handful of signatories. A fallback option would be to strengthen the GlobalABC in terms of its membership and administrative capacity.

1 Introduction

As of 2019, global GHG emissions from buildings amounted to 12 Gt CO₂-eq, 21% of total global emissions. 57% of this total (6.8 GtCO₂-eq.) were indirect emissions from offsite generation of electricity and heat, 24% (2.9 GtCO₂-eq.) were direct emissions and 18% (2.2 GtCO₂ eq.) were emissions embodied in the cement and steel used in building. Final energy demand from buildings accounted for 31% of global final energy demand (128 EJ) and electricity demand from buildings for around 18% of global electricity demand (43 EJ) (Pathak et al., 2022). Thus, buildings and their construction are key for achieving the Paris Agreement. So far, however, energy demand in buildings has continually increased, driven by building floor growth in combination with improved energy access and living standards (IEA, 2021c).

International climate policy has traditionally to a large extent focused on elaborating adequate economy-wide emission targets. Even the Paris Agreement, where contributions are nationally determined, in Art. 4.4 encourages all countries to move to economy-wide targets over time. However, opportunities and barriers for decarbonisation differ strongly from sector to sector. Taking these differences into account would allow international governance to address each sector in the way it can be most effective (Oberthür et al., 2021; Victor et al., 2019).

Especially around the Copenhagen conference in 2009 there was already some discussion about the potential of sectoral approaches for global climate governance (see e.g. Barrett, 2010; Meckling & Chung, 2009; Sawa, 2010; Schmidt et al., 2008; Victor et al., 2019). However, much of this literature focused on the industrial sector, with little consideration of other sectors. Second, much of this literature focused either on negotiating sectoral emissions targets with emerging economies or organizing international technological cooperation and technology transfer along sectoral lines.

Third, the perspective on what actually the problem is and how it can be resolved has broadened over the last decade. Historically, as can be traced through the assessment reports by the Intergovernmental Panel on Climate Change (IPCC), discussions about international climate policy were to a large extent based on seeing climate change mitigation as a collective action problem where countries have an incentive to “free ride” on the efforts of others as most benefits of mitigation actions accrue globally rather than within the borders of those taking action. This perspective focuses on levels of GHG emissions and the enforcement capacity of international agreements to deal with free riding. Up to the fifth IPCC assessment report in 2014, the discussion of international cooperation therein (Stavins et al., 2014) focused on this perspective. Since then, a different perspective has developed that sees climate change mitigation as a transformation problem, where emission levels are the end result of a large number of transformative processes. This perspective focuses on analyzing the progress in individual transformations and on how international cooperation can stimulate them (Patt et al., 2022).

This article is based on the perspective of seeing climate change mitigation as a transformation problem and aims to contribute to the understanding of how global climate governance can contribute to the transformation of the buildings sector. It therefore takes a broader look at possible means of global governance that goes beyond emissions targets and technological cooperation, as outlined in section 2.2. In addition, it takes a broad approach to international institutions. In recent years, a plethora of new inter- and transnational governance initiatives have emerged to complement the climate regime under the UNFCCC as part of a “polycentric” global climate governance (Jordan et al., 2018). This article will seek to map the international institutions that seek to promote mitigation efforts in the buildings sector and analyse the extent to which this governance complex has harnessed the potential of global governance to advance sectoral emission reductions.

To this end, this article proceeds in four steps. First, it identifies key strategies and instruments for the decarbonisation of the buildings sector as well as challenges and barriers that impede the transformation of the sector. Second, it analyses how international institutions could *in theory* assist with overcoming these barriers and mobilising opportunities (“governance potential”: section 2.2). Third, section 2.3 assesses to what extent existing intergovernmental and transnational institutions that

have relevance for the decarbonisation of the buildings sector have so far *in practice* delivered on the identified governance potential. On this basis, section 3 discusses how global governance could be enhanced.

The analysis is based on the study of existing academic literature, grey literature, documents from international institutions and institutional websites. Interim results were presented at two expert workshops involving sectoral experts, policy makers, and academics. In addition, we conducted six expert interviews and a pre-final draft was reviewed by two external experts.

2 Assessment of existing sectoral governance landscape: gaps and potentials

2.1 Synthesis of main barriers and potentials to sectoral decarbonisation

This section provides the first step of the analysis by identifying the main barriers to decarbonisation of the buildings sector. The aim of this section is not to provide a comprehensive literature review, but to provide the basis for the subsequent steps of the analysis. The section therefore takes the most recent IPCC assessment report as key starting point, in particular the chapter on buildings (Cabeza et al., 2022), complemented by additional literature.

There are five main strategies for decarbonising the buildings sector. First, energy efficiency is the fundamental lever for decarbonisation, i.e. to enhance energy performance of buildings to reduce heating and cooling demand. On the one hand, all new buildings should have the highest possible energy performance. On the other hand, for existing buildings, energy renovation needs to be accelerated and go as deep as possible. Second, it is essential to shift from fossil-fuel-based and often low efficient to renewable-based and (super) efficient heating, cooling, and cooking. At the building level, heat pumps and super-efficient cooling appliance are among the key technological paths for the building sector to reach net zero emissions by 2050, in particular, for the residential and commercial buildings. Third, it is essential to ensure best available energy efficient appliances to be used, in particular, in developing countries where appliance ownership is expected to grow rapidly. Fourth, sufficiency measures avoid the demand of energy and materials and thus tackle the causes of GHG emissions from the building sector through, for example, limiting the growth of floor areas, adjusting room temperature for heating and cooling. Finally, Decarbonising buildings also calls for efficiently use building materials, minimizing embodied carbon of building materials, and closing material cycles (Bierwirth & Thomas, 2019; Cabeza et al., 2022; Carbon Trust et al., 2020; GlobalABC et al., 2020; GlobalABC, 2021; IEA, 2021b; Thomas et al., 2021; UNEP, 2021a).

In the following, we focus on the first two strategies. In particular reducing embodied carbon faces substantially different issues and actor landscapes.

Depending on implementation, mitigation action in the buildings sector can contribute positively to no less than 16 of the 17 Sustainable Development Goals (SDGs). Positive impacts are for example health and environmental benefits due to reduced local air pollution, poverty alleviation due to decreased energy expenditures, job creation, and reducing gender inequalities by reducing the need for collecting fuel wood (Cabeza et al., 2022).

Decarbonisation of the buildings sector is already on its way to some extent. In the last decade, building energy intensity has decreased. Yet, according to IEA, the decrease of building energy intensity needs to accelerate significantly in the next decade to be compatible with the objectives of the Paris Agreement (IEA, 2021c). For example, the energy renovation rate of the building stock is about 1% per year, compared to the 2.5% by 2030 envisaged in the IEA Net Zero Emission scenario. In addition, energy intensity reduction that resulted from renovation was less than 15%, which is far less than what is technically and often economically feasible (40%-80% reduction depending on the local climate and building features) (IEA, 2021a).

To accelerate the improvement of building energy performance, a number of challenges need to be addressed. A fundamental issue is the high number of relevant actors (constructors, building product producers, building managers, architects, engineers, owners, occupants, investors, trades people, equipment manufacturers, suppliers, architects, lenders, insurers, codes and standards setters, zoning officials, realtors and others), many of which have low degrees of capacity and knowledge about climate-friendly design options. Effective policies are therefore needed to align all of these actors towards decarbonisation (Höfele & Thomas, 2011; Oberthür et al., 2017).

2.1.1 Barriers to improving building energy performance

Currently, however, **political and institutional barriers** represent a key challenge for transformation. First, given the long lifetime of buildings and associated investment cycles, decarbonisation requires long-term commitment, which is not in line with the short-term election cycles in many countries (UNEP, 2020). Second, there is often an absence of clear policy signals and incentives for different actors on the value chain to be engaged and invest in building energy efficiency (IEA, 2021c). For example, it is challenging for many governments to develop an ambitious and comprehensive long-term roadmap to outline the building sector decarbonisation pathway (GlobalABC et al., 2020). Besides, in 2020, still about two-thirds of countries lacked mandatory building energy codes and more than two thirds of the buildings that are expected to be constructed between now and 2050 are expected to be constructed in countries that do not have any building energy codes (IEA, 2021a; UN Climate Change, 2021b). Where building codes exist, local authorities often lack the resources and technical capacity to enforce compliance (Cabeza et al. 2022). Third, governments are themselves owners of public buildings. Thus, they could make these buildings highly energy efficient and equipped with clean and efficient heating and cooling solutions and thus create demand for these options. However, governments often lack required technical knowledge to make informed decision and have limited financing to invest in these options (Herrando et al., 2022). On top of that, governments' public budgeting rules do not create incentives for specific authorities or departments to invest in energy efficiency as they may not be able to retain the monetary savings from energy efficient measures and resulting saving may also reduce their operational budget (Gynther, 2016).

In addition, there are key **economic and financial barriers**. Energy efficiency measures are often associated with higher upfront costs and longer payback time than conventional ones. In particular, depending on the building types and climate, deep energy retrofits can be costly (Ürge-Vorsatz et al., 2020). The cost barrier is for many buildings aggravated by split incentives, where the investors, who own the tenant-occupied buildings, do not financially benefit from their investment (Höfele & Thomas, 2011). On top of that, there is generally a lack of access to affordable finance to invest in building energy efficiency. Many households, companies and public entities are not able to finance high upfront costs from their own resources. Many are also not able to access affordable finance options due to informal and irregular income, high transaction costs and interest rates, taxes and down payment requirements. On the supply side, lenders are often inhibited by lack of liquid capital markets and lacking policy and governance frameworks (Climate Action Tracker, 2022). Capital providers (e.g. banks, institutional investors) often lack technical knowledge of building energy efficiency projects and assessment. For the latter, there is also an absence of supporting energy performance data (G20 EEFTG, 2017). They also perceive high lending and investment risk associated with these projects due to the lack of track records of lenders, low collateral asset value, a long project lifetime, and high performance risks. In addition, individual building projects are rather small and thus transaction costs of assessing each single project are high (ibid). Last but not least, governments, in particular, in developing economies, often lack funding to finance both policies for supporting implementation of energy efficiency investments and research and development activities as well as demonstration projects (RD&D), such as deep retrofits, net-zero carbon buildings, plus-energy buildings.

Another challenge that has impeded building energy efficiency is related to the supply-chain. On the one hand, transition to related products and services is costly for suppliers, in particular, considering the prevailing price competition with conventional options. On the other hand, suppliers are often uncertain about market demand of energy efficiency options (Höfele & Thomas, 2011). Furthermore, various suppliers lack required knowledge and skills about design and construction of high-energy-performance buildings (UNEP, 2020).

Availability and access to **information and knowledge** about building energy efficiency options and its cost-effectiveness is another factor that impedes consumers and investors from adopting decarbonisation options (Höfele & Thomas, 2011; Mata et al., 2021). Data on energy performance and cost savings after the implementation of measures is essential, but they are not always available or consistent (Criado-Perez et al., 2020).

Last but not least, **social and cultural factors** have a significant impact on adopting building decarbonisation options and building energy uses. In North America and Europe, in combination with information availability, consumers' attitudes and values were identified as one of the most important factors to improve the building envelope (Mata et al., 2021). Besides, building occupants' behavior can limit the GHG reduction potentials of building energy performance improvement, e.g. through increasing ownership and use of appliance (IEA, 2019), demand of more living space (Bierwirth & Thomas, 2015).

2.1.2 Barriers to decarbonising heating & cooling

In terms of **political and institutional barriers**, in most countries, installation of fossil-fuel heating in new buildings and replacement in existing buildings are still permitted (Lowe et al., 2022) and subsidies for fossil fuels and fossil boilers have significantly delayed transition towards renewable-based heating and cooling (IRENA et al., 2020). In Europe, millions of subsidies are still paid for new gas boilers (EEB, 2020). Second, clear heat and cooling decarbonization pathways are often missing (Gaur et al., 2021). Third, although more than 80 countries already have introduced minimum energy performance standards (MEPS) for air conditioners (ACs), MEPS vary significantly across the countries and are weakest or even absent in the regions where rapid growth of AC is expected (IEA, 2020).

In terms of **economic and financial barriers**, the higher upfront costs of heat pumps and super-efficient or renewable cooling compared to conventional alternatives have been one of the largest barriers for their adoption (Cohn & ESRAM, 2022; IEA, 2020). Besides, heat pumps work best in well-insulated buildings (Lowe et al., 2020) and high energy building performance is an essential strategy for net zero cooling (Carbon Trust et al., 2020)^{Fehler! Textmarke nicht definiert.}, which implies additional upfront investment of, e.g. deep energy renovation. The cost issue is further complicated by the split incentive, where tenants do not have control over their energy system and landlords who invest in the system switch hardly receive financial returns (Cohn & ESRAM, 2022; IEA, 2020; IRENA et al., 2020). On the other hand, depending on pricing mechanisms for electricity and fossil fuels, the operational costs for electrification can also be high (IRENA et al., 2020; Lowe et al., 2022). The fact that fossil boilers are often financially supported by governments as noted above further reduces the economic attractiveness of heat pumps. Besides, given the proper incentives, electric heating and cooling appliances could potentially provide flexibility services to the grid system, which could generate additional revenues and increase its cost-effectiveness. However, the power market design in many countries has impeded participation of small-scale consumers (IRENA et al., 2020; Lowe et al., 2020).

On the manufacturers' end, the costs for producing heat pumps and super-efficient cooling appliances are higher than conventional alternatives (Cohn & ESRAM, 2022; Park et al., 2021). Combined with market uncertainty, manufacturers may therefore lack of motivation to transition.

A key **technical barrier** preventing market penetration of decentralized heat pumps is the incumbent heating infrastructure, such as the gas grid, which is associated with significant sunk costs invested by gas utility companies (Lowe et al., 2022; Nadel, 2019). Besides, the performance of heat pumps is relatively low in extremely cold climates and in poorly insulated buildings (Gold, 2021). Other technical challenges include, e.g. suitability of renewable-based heating and cooling in certain buildings with limited roof space for solar thermal, historical/heritage buildings with planning limits, buildings with limited space which cannot contain hot water cylinder (IRENA et al., 2020), as well as maturity of specific technologies such as solar cooling (Sheldon et al., 2018). Furthermore, there is a lack of capacity and availability of qualified technicians, e.g. building managers, installers (e.g. IRENA, IEA, and REN21 2020; Cohn and ESRAM 2022; Carbon Trust et al. 2020). Beyond the building level, the increasing electrification of heating and cooling will significantly increase electricity demand and peak demand and thus create challenges on the grid system, in particular, the distribution grid (Love et al., 2017; Lowe et al., 2020).

Furthermore, lack of **information and awareness** about heat pumps and super-efficient cooling can impose a significant barrier for their adoption (Park et al., 2021; UNEP, 2021b). To make the investment decisions, consumers and investors need to know about how the best energy efficiency suits

their needs, installation and operation complexity, and cost effectiveness (IEA, 2020). In particular, although the improved technology nowadays enables heat pumps to operate well even in cold regions (Wei et al., 2020), previous low performance of heat pumps in these regions caused concern among consumers about their reliability.

2.2 Potential of global governance to address barriers and potentials

The building sector may be the least amenable to international cooperation, given its mostly localised supply chains, lack of exposure to international trade, and highly differentiated needs in relation to geography and climate (Victor et al., 2019). Nonetheless, global governance has various levers at its disposal which could be used to promote decarbonisation of the sector. Based on previous academic work on the functions and effects of global governance and its application to international climate policy (Kinley et al., 2021; Oberthür et al., 2021), we consider five key functions of global governance that international institutions can activate to address specific problems (such as climate change). Moreover, we follow Oberthür et al. (2021) in using the term “global governance” in a broad sense, including transboundary cooperation of various actors, which may include state and/or non-state actors and take place at varying geographical levels, from the regional to the global. “Global” is therefore not meant in the sense of requiring universal membership of an institution by (nearly) all countries. Relevant institutions may also consist of smaller subsets of countries or even be composed solely of non-state and sub-national actors.

The five functions are:

- › Guidance and signal: international institutions can signal the determination of members to pursue a particular course, such as decarbonisation. These signals derive from the principles and goals that underpin international institutions and can provide direction beyond the institution in question by giving businesses, investors, and other actors an indication of what policy paths countries are likely to take.
- › Rules and standards: International institutions cannot only provide desired direction, but also require their members to take certain actions to achieve mutually agreed-upon goals.
- › Transparency and accountability: international institutions can increase the transparency of actions taken by their members by collecting and analysing relevant data and identifying and addressing problems in the implementation of agreed rules/standards.
- › Means of implementation: International institutions can organise capacity building, technology transfer, and funding among members, including coordination efforts to effectively allocate and pool resources and clarify who should contribute how much.
- › Knowledge and learning: International institutions can create knowledge and platforms for individual and social learning. The goal is to create and disseminate scientific, economic, technical, and policy-related knowledge about understanding and/or possible solutions to the problem at hand.

Based on this conceptual framework, the following section considers how global governance might theoretically help to overcome the barriers outlined in the previous section. Again, the goal is not to provide a comprehensive review of the existing literature, but to lay a foundation for the empirical core of this article, the analysis of the currently existing governance complex. The mapping of options for international cooperation therefore began with a synthesis of the existing literature on global climate governance and buildings in the recent IPCC Assessment Report (Cabeza et al., 2022; Patt et al., 2022) and the 1.5°C Special Report (de Coninck et al., 2018).

2.2.1 Guidance and signal

Global governance could help overcome the current lack of political commitment, lack of clear and ambitious national policies and corresponding market uncertainty by providing a reference point for national and local policy as well as other actors (Dai, 2010; Obergassel et al., 2021). For example, in 2015 the district court in the Hague ruled that the climate policy of the Netherlands was too weak with reference to the findings of the IPCC and required the Dutch government to strengthen its emission targets (Saurer & Purnhagen, 2016). Since 2015, the objectives of the Paris Agreement have been a key reference point for “Fridays for Future” and other actors. From the observation of the authors, the mass protests by Fridays for Future were a key factor for the adoption of Germany’s first comprehensive climate legislation in 2019. Moreover, in 2021, Germany’s Constitutional Court ruled that this legislation was too weak and directly referenced the objectives of the Paris Agreement in its justification (Bundesverfassungsgericht, 2021).

While the objectives of the Paris Agreement apply to global temperatures and emissions, a reference point specifically for the buildings sector could for example be created by international adoption of energy efficiency / decarbonisation targets (e.g. stepwise by 2030, 2040, 2050), targets for phasing out fossil heating, and/or suitable building energy performance targets for building types by climate. For example, the “Building to COP coalition”, advocates that by 2030, 100% of new buildings must be net-zero carbon in operation and embodied carbon must be reduced by at least 40%, and by 2050, all new and existing assets must be net zero across the whole life cycle (Building to COP Website, 2022). If such targets were adopted internationally by governments, this would establish expectations regarding national policy and thus provide a basis and legitimacy for demands from domestic actors demanding more action (Dai, 2010).

2.2.2 Rules and standards

Governments could also agree on international rules to help overcome the lack of political commitment and ambitious national policies. The “Building to COP” coalition argues that all countries should “include full building decarbonisation targets, concrete policies and measures and related implementation mechanisms in their NDCs.” (Building to COP Website, 2022) A sectoral breakdown of NDCs would help to connect the NDCs to actual national policy, policy-makers and implementers (I. Geppert, personal communication, 25 July 2022; N. Steurer, personal communication, 3 June 2022). The “climate action pathway” on human settlements developed under the UNFCCC Marrakech Partnership suggests that all countries should have roadmaps for decarbonising the built environment by 2030 and all major emitting countries as well as cities and regions already by 2025. The “pathway” also suggests that all countries should have performance-based building energy codes in place by 2025 that require all new buildings to be net zero carbon and all retrofits to be net-zero carbon ready. Moreover, according to the “pathway” all countries should aim to achieve renovation rates of at least 3% by 2030 (UN Climate Change, 2021a). Governments could agree to turn these recommendations into a rule, mandating that all future NDCs must include a sectoral breakdown of targets and elaboration of policies and measures to achieve these targets (Obergassel et al., 2021).

Governments could also commit internationally to accelerated decarbonisation of their own, often substantial, building stock. In addition to the signalling value of such an undertaking, accelerated decarbonisation of public buildings could help to expand the market for energy efficient options and thereby address prevailing supplier uncertainty about market demand. In addition, the power of co-ordinated procurement could be brought to bear on heating and

cooling technologies. If relevant numbers of public and private buyers agreed to purchase only low-emission equipment, this would send a strong signal to the market (Victor et al., 2019). Another option to send a strong market signal is international agreement to fully phase out fossil heating by a certain date.

Governments could also coordinate to overcome the current lack of stringency in building energy codes, building rating systems and labels. While countries have varying needs relating to their climate and geography, they could coordinate on measurement methodologies regarding emission savings, actual building and component energy performance, and embodied emissions. In addition to national regulations, coordination on local standards among cities could also contribute to achieving earlier stabilisation of markets on high efficiency building designs (IPEEC Building Energy Efficiency Taskgroup, 2014; Victor et al., 2019). Similarly, it would be helpful if efficiency requirements, labels and associated test methods for traded goods such as heat pumps, air conditioners and building components were set internationally to help enlarge the market, avoid technical barriers to trade, and reduce design and compliance costs of manufacturers. Such international standards would also reduce the dumping of inefficient equipment in countries with no or lower efficiency requirements (Cabeza et al., 2022; IPEEC Building Energy Efficiency Taskgroup, 2014).

Governments could also coordinate on emission pricing and/or fossil fuel subsidy reform to help overcome economic barriers such as higher costs of high-efficiency and renewable energy options. A substantial body of literature recommends to ultimately create a single global emissions price (e.g. Keohane, Petsonk, and Hanafi 2017; van den Bergh et al. 2020). Other authors are sceptical about the practical and political feasibility of such an endeavour. As alternative they suggest to first create transparency on all governmental levies and subsidies related to high-emission and low-emission activities respectively. In the second step, countries should commit to gradually shift support from the former to the latter (e.g. Green 2017; Verbruggen 2011; Verbruggen and Brauers 2020; see also Obergassel, Lah, and Rudolph 2021).

To tackle not only the higher costs of climate friendly options but also the lacking access to finance, such an international agreement could include agreement to use at least part of the revenue from emission pricing for mitigation measures.

2.2.3 Transparency and accountability

To help to overcome lacking political commitment and insufficient policies, governments could agree that countries need to submit sectorally differentiated reports on national emissions, actions taken, and their impacts. On this basis, international review could identify implementation shortcomings and suggest remedies, or potentially also impose penalties (Gupta & van Asselt, 2019). In addition to the effects of government-to-government scrutiny, international transparency provisions and review processes also provide non-Party actors with information and political forums to appeal to public opinion and put pressure on governments to remedy insufficient policies (Dai, 2010). Activities of non-Party actors, as in the suggestions for coordination among cities in the preceding paragraph, should also include robust transparency provisions to help ensure implementation.

2.2.4 Means of implementation

Provision of financial, technological and capacity building support can help overcome a number of barriers. At its most basic it can help bolster the political commitment to tackle building sector decarbonisation in poor countries where otherwise more immediate development

needs would take precedence. Where political commitment already exists, international support can help overcome lack of resources and institutional capacity (Obergassel et al., 2021; Seto et al., 2014; WBCSD, 2010). For developing countries, building capacity for policy development, implementation and evaluation is especially important with respect to standard-setting institutes, testing laboratories, enforcement and compliance technicians and evaluation experts. In many countries there is a significant lack in data quality, availability, and methodologies for generating energy and emissions baselines and benchmarking, which international support can help remedy (Cabeza et al., 2022; IPEEC Building Energy Efficiency Taskgroup, 2014). International training, capacity building and awareness programmes can also help to raise awareness and enhance skills and expertise among the large number of actors involved in the buildings sector, from investors and architects to installers and owners (IPEEC Building Energy Efficiency Taskgroup, 2014; Oberthür et al., 2017).

Moreover, international co-operation could accelerate the development and demonstration of innovative low-emission heating and cooling technologies. In addition, electrification of the buildings sector is likely to require complementary energy technologies such as inter-seasonal storage, demand-side response, and smart meters and grids. Internationally co-ordinated development and demonstration of these technologies can play a key role (Victor et al., 2019).

International institutions can also provide financial support to governments and private investors to help overcome problems of access to finance, high upfront costs, long payback periods and (perceived) investment risks, such as grants and low-interest loans as well as risk-sharing instruments. In addition, international institutions can work with local financial institutions to address their lack of technical knowledge on building energy efficiency projects and assessment, and exaggerated risk perceptions.

International institutions could also support the harmonisation of building efficiency rating systems as a basis for investment ratings and decisions. Effective rating systems could highlight the monetary savings that can be gained from efficient buildings and thereby help overcome the barriers of higher upfront costs and longer payback periods (IPEEC Building Energy Efficiency Taskgroup, 2014).

2.2.5 Knowledge and learning

Finally, global governance could help to coordinate research, development and demonstration of high efficiency and more cost-effective building designs and achievable performance standards (Victor et al., 2019). Moreover, assessing building energy performance and its improvement is inherently difficult due to the relevance of other factors for energy use such as the weather and economic activity. International coordination could therefore help to develop and implement consistent metrics. International collaboration could also help to better understand the impact of policy measures that are in place (A. Hinge, personal communication, 8 June 2022).

Furthermore, policy and technical knowledge platforms and exchange formats can help overcome information and awareness problems by spreading knowledge on technological innovations and options for enabling policy, financing, and market frameworks. This should include a focus on key problematic policy areas such as public budgeting rules in relation to energy efficiency, instruments for removing split incentives, and power market design. For example, international collaboration can support the development of new and improvement of existing building codes by sharing technical knowledge and validated best practice on building code

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design, implementation, enforcement, and impact assessment (IPEEC Building Energy Efficiency Taskgroup, 2014; Oberthür et al., 2017; Victor et al., 2019). Detailed model regulations at regional level to account for regional differences would be particularly useful to help strengthen national policies (N. Steurer, personal communication, 3 June 2022).

International collaboration could also help to leverage the multiple benefits of energy efficiency by developing/improving and tracking metrics for assessing these benefits (IEA & IPEEC, 2015). International activities could also help to generate more political commitment by raising awareness of the multiple benefits among policy-makers. Finally, international programmes could support national education and awareness programmes to inform building professionals, owners and inhabitants of the multiple benefits and implementation options (IPEEC Building Energy Efficiency Taskgroup, 2014).

The below **Fehler! Verweisquelle konnte nicht gefunden werden.** summarises the results of the review conducted in this section. A more detailed overview relating the individual actions that may be taken to the individual enablers and barriers outlined in the previous section is provided in the annex.

Governance Function	Governance Options	Enablers/Barriers Addressed
Guidance and Signal	<ul style="list-style-type: none"> › Agree ambitious international targets for decarbonising buildings, phase-out of fossil heating, and/or energy efficiency to create pressure on governments and provide market signals 	<ul style="list-style-type: none"> › Lack of long-term political commitment by governments › Lack of clear and ambitious national policies › Uncertainty about market demand among actors in the supply chain
Rules and Standards	<ul style="list-style-type: none"> › Agree international requirements for sectoral emission targets in addition to national GHG targets in national short- and long-term strategies › Agree international commitments to decarbonise own building stock › Commitment to procure only high efficient/renewable heating and cooling equipment › Agree international fossil heating phase-out agreement › International coordination on emission pricing › International agreement on climate budget reform, including abolishment of fossil fuel subsidies, subsidies for fossil boilers, introduction emission pricing and reform of priorities and criteria for public investments › International coordination on building energy codes, rating systems and labels to harmonise measurement methodologies, cover all emissions and apply to actual performance 	<ul style="list-style-type: none"> › Lack of long-term political commitment by governments › Lack of clear and ambitious national policies › Higher upfront costs and longer payback periods for highly efficient buildings, heat pumps and super-efficient cooling › Potentially higher operating costs of electrification › Split incentives between landlords and users, builders and investors › Higher production costs of producing heat pumps and super-efficient cooling › Uncertainty about market demand among actors in the supply chain

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	<ul style="list-style-type: none"> › International coordination on product efficiency standards and associated test methods for traded goods › 	
Transparency and Accountability	<ul style="list-style-type: none"> › Require national reporting on measures taken and their impacts, in particular reporting on those measures where international coordination has been agreed › Require assessment of non-climate benefits › 	<ul style="list-style-type: none"> › Multiple benefits of efficiency and renewables in buildings › Lack of long-term political commitment by governments › Lack of clear and ambitious national policies including weak targets, lack of roadmaps, weak building codes, ongoing permission of fossil heating, subsidies for fossil fuels and fossil boilers, weak MEPS for air conditioning
Means of Implementation	<ul style="list-style-type: none"> › Provide resources for administrative, policy development, planning, implementation, evaluation and enforcement capacity of national and local governments as well as monitoring of policy impacts › Provide capacity building and financial support for assessing non-climate benefits › Provide financial support and risk-sharing for investments › Support establishment of building energy rating systems to properly calculate energy savings and payback › Capacity building for financial institutions 	<ul style="list-style-type: none"> › Multiple benefits of efficiency and renewables in buildings › Lack of long-term political commitment by governments › Lack of clear and ambitious national policies including weak targets, lack of roadmaps, weak building codes, ongoing permission of fossil heating, subsidies for fossil fuels and fossil boilers, weak MEPS for air conditioning › Lack of technical knowledge and finance among governments, investors etc. › Public budgeting rules disincentive efficiency › Higher upfront costs and longer payback periods for highly efficient buildings, heat pumps and super-efficient cooling › Potentially higher operating costs of electrification › Split incentives between landlords and users, builders and investors › Higher production costs of producing heat pumps and super-efficient cooling › Lack of technical knowledge and perceived lending and investment risks among capital providers › Small projects – high transaction costs for all involved › Lack of funding for RD&D, Low performance of heat pumps in very cold climates and inefficient buildings › maturity of specific technologies such as solar cooling › lack of capacity and availability of qualified technicians, e.g. building managers, installer › Grid challenges due to increasing electricity demand and peak demand › lack of information and awareness about heat pumps and super-efficient cooling among building owners, installers etc.

<p>Knowledge and Learning</p>	<ul style="list-style-type: none"> › Provide policy and technical knowledge platforms and exchange formats to help overcome information and awareness problems › Provide support for understanding the multiple benefits and impacts of decarbonising the building stock › Coordinated research, development and demonstration of technologies › 	<ul style="list-style-type: none"> › Multiple benefits of efficiency and renewables in buildings › Lack of long-term political commitment by governments › Lack of clear and ambitious national policies including weak targets, lack of roadmaps, weak building codes, ongoing permission of fossil heating, subsidies for fossil fuels and fossil boilers, weak MEPs for air conditioning › Lack of technical knowledge and finance among governments, investors etc. › Public budgeting rules disincentive efficiency › Split incentives between landlords and users, builders and investors › Lack of technical knowledge and perceived lending and investment risks among capital providers › Lack of funding for RD&D, Low performance of heat pumps in very cold climates and inefficient buildings › maturity of specific technologies such as solar cooling › lack of information and awareness about heat pumps and super-efficient cooling among building owners, installers etc. › Need to adapt power-market design to allow flexibility provision by heating and cooling
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TABLE 1: SYNTHESIS OF POTENTIAL FOR INTERNATIONAL COOPERATION AND GOVERNANCE

2.3 Sectoral governance landscape: remaining gaps and underexploited potential

2.3.1 Evidence Base

The following section analyses whether and to what extent the governance potentials identified in the previous section has so far been activated/exploited in practice. **Fehler! Verweisquelle konnte nicht gefunden werden.** To undertake this analysis, the authors developed a database of institutions that are relevant for the decarbonisation of the buildings sector. Following the approach laid out by Oberthür et al. (2021), we included institutions featuring in particular two characteristics:

- › institutions must aim to realise a common purpose, in this case decarbonisation of the buildings sector, and contribute to at least one of the five governance functions; and
- › institutions must have procedural rules for making and implementing decisions, including on substantive rules.

These criteria aim to delineate international governance institutions from international coalitions and lobby groups as well as ad hoc fora, platforms, projects, programmes and networks.

Applying these criteria, we first identified an initial list of potentially relevant institutions by reviewing the Global Climate Action Portal maintained by the UNFCCC Secretariat (UN Climate Change, 2022) and the “Future of Climate Cooperation” database maintained by the University of Oxford (Future of Climate Cooperation Website, 2022). The resulting list of institutions was subsequently complemented with further institutions identified through literature and expert review. To identify which institutions meet the inclusion criteria, we reviewed their governance statements. If such statements were not available from the existing databases, we retrieved them from the institutions’ own websites. The resulting list of institutions was reviewed by two external reviewers.

One may debate whether further institutions should be included, but based on the reviews we received we are confident that our database captures the large majority of institutions that are relevant for the decarbonisation of the buildings sector.

Discussing all the institutions we identified as relevant one by one would exceed the size limitation of a journal article. The following subsections therefore present a synthesis of major findings. An overview table of how each individual institution contributes to the individual governance functions is provided in the annex.

2.3.2 Overview

There is no formal international agreement dedicated to buildings (Patt et al., 2022). The International Renewable Energy Agency (IRENA) serves as central institution for the renewable energy supply side of buildings decarbonisation. For the cooling part of decarbonising buildings, the Kigali amendment to the Montreal Protocol mandates the phase-down of hydrofluorocarbons, which have so far been widely used in cooling appliances. However, there is no comparable international institution for enhancing building energy performance or overall building decarbonisation. Indeed, in some respects the international attention for energy efficiency in buildings has rather decreased instead of increased in recent years and much activity is short-term stop-and-go rather than long-term strategic (B. Lebot, personal communication, 30 May 2022). The IEA is usually the main reference on energy efficiency in buildings and beyond, but it mostly acts as think tank. Moreover, only OECD member states may join the IEA, but starting in 2015 the IEA has broadened its reach by giving non-OECD countries the opportunity to become association countries. There are currently 11 association countries including, for example, Brazil, China, India, Indonesia and South Africa (IEA, 2022b).

The closest approximation to an international energy efficiency agency was the International Partnership for Energy Efficiency Cooperation (IPEEC), which was founded at the 2009 G8 summit in L’Aquila and subsequently came to include 17 of the G20 countries as members. However, the funding of IPEEC was always limited and it was ultimately disbanded in 2019. IPEEC was intended to be replaced by a new Energy Efficiency Hub under the IEA but the transition has been difficult. At the time of its establishment, the Hub had lost India, Italy, Mexico, and South Africa as members (Voïta, 2021). Another example of discontinuation is the Major Economies Forum on Energy and Climate (MEF) which was originally established by the US Obama Administration. Its activities included an action agenda on improving energy efficiency in buildings through sharing of best practices and policies (A. Hinge, personal communication, 8 June 2022; U.S. Department of State, 2013). The MEF was also discontinued under the Trump administration. It was revived under the Biden administration but

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buildings did not feature on the agenda of its recent meetings. At the same time, the most recent MEF meeting pledged to mobilise US-\$ 90 billion in public investments in new technologies not yet commercially available under the “Clean Energy Technologies Demonstration Challenge” (The White House, 2022). So availability of resources or ambition does not seem to be a constraint, but it is focused on other sectors, in particular novel technologies (B. Lebot, personal communication, 30 May 2022).

One reason for the lack of political attention is probably the high degree of fragmentation of the sector. For example, as of 2010, while the top 10 automotive companies have a combined global market share of 70%, the 10 commercial real estate companies only had an 8% global market share (Nelson & Frankel, 2012). There are hence no large key emitters that could be addressed by policy. For civil society organisations, it is also easier to address large emitters rather than dispersed emission sources as in the buildings sector (I. Geppert, personal communication, 25 July 2022; B. Lebot, personal communication, 30 May 2022).

Nonetheless, while there is no clear fulcrum of activity, a number of UN organisations are active in the area, such as the United Nations Human Settlements Programme (UN Habitat) and UN Environment, which is hosting the secretariat of the Global Alliance Buildings and Construction (GABC), a coalition of 246 members, including 36 countries, private companies, civil society, intergovernmental and international organizations (GlobalABC Website, 2022c). The World Bank and other multilateral development banks overall have a large portfolio of programmes relating to buildings.

Furthermore, several city networks are active on climate change, including in the buildings sector, such as C40 Cities, the Global Covenant of Mayors for Climate and Energy, and ICLEI – Local Governments for Sustainability. Among businesses, for example the World Green Building Council is organising a network of national green building councils to support decarbonisation. The Efficient Cooling Initiative, the Cool Coalition and the Clean Cooling Collaborative aim to bring together governments, intergovernmental organizations, and the private sector to build high-level political leadership for climate-friendly cooling and facilitate collaboration among stakeholders. The Net Zero Asset Managers Initiative, the Net-Zero Asset Owner Alliance, and the Net-Zero Banking Alliance are UN-convened coalitions of private investors that have pledged to make their portfolios net-zero.

The UNFCCC has tried to orchestrate activities by non-state and sub-national actors by creating a registry and establishing the “Marrakech Partnership for Global Climate Action” (MPGCA). Two “High Level Climate Champions” co-ordinate this process. Human settlements are one of the thematic areas in this process. One outcome is the “Building to COP coalition”, a Joint initiative of C40, GlobalABC, WGBG and others in cooperation with the UN High Level Climate Champions and the COP26 Presidency (Building to COP Website, 2022).

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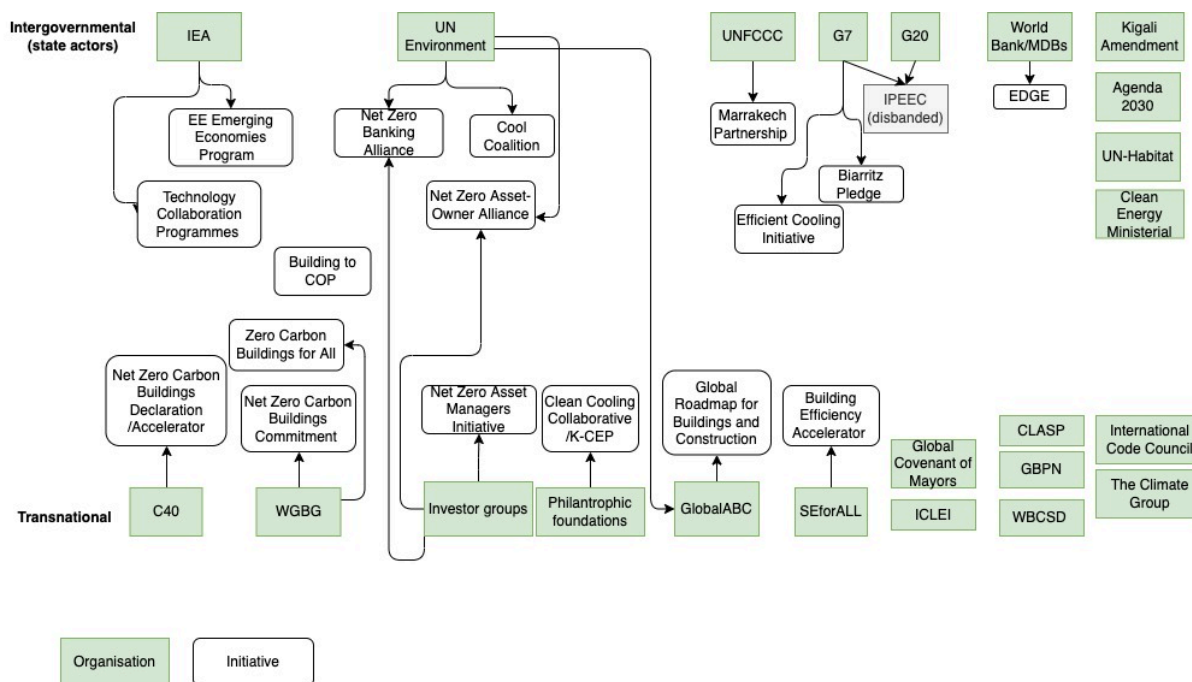


Figure 1: Overview of the governance landscape

Source: Authors

2.3.3 Guidance and signal

As noted above, the Kigali amendment mandates the phase-down of HFCs. A number of actors have coupled the need to improve energy efficiency to this mandate. For example, in the Biarritz Pledge for Fast Action on Efficient Cooling, the G7 countries pledged to undertake immediate actions to improve efficiency in the cooling sector while phasing down HFC refrigerants as per the Kigali Amendment (G7, 2019). Other institutions that are using the Kigali Amendment as platform to promote efficient cooling are the Efficient Cooling Initiative, the Cool Coalition and the Clean Cooling Collaborative.

However, apart from the particular aspect of HFCs, there are no internationally agreed global decarbonisation or building efficiency targets. Energy efficiency is generally included in the SDGs as target 7.3 that aims at “doubl(ing) the global rate of improvement in EE”, but there is no specific target for buildings. The New Urban Agenda (NUA) adopted at the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) in 2016 as guideline for urban development in the next 20 years includes a commitment to climate action but no quantified target.

Several calls for decarbonisation commitments have been instigated by various actors. Both the Buildings as Critical Climate Solution (BCCS) call and the Zero Carbon Buildings for All Initiative aim for halving emissions by 2030 and full decarbonisation by 2050, but each call gained only a handful of government signatories (respectively Chile, Jordan, Switzerland and Kenya, Turkey, United Arab Emirates, United Kingdom). The Global Call for Low Carbon, Energy Efficient, and Resilient buildings calls on countries to develop national strategies for buildings and construction in line with the Paris Agreement Goals and was signed by six countries (Argentina, France, Germany, Mexico, Morocco and Switzerland) (GlobalABC,

2022). The May 2022 meeting of G7 energy and climate ministers recognised the need to reach net-zero GHG emission by 2050 and pledged to “promote reaching zero carbon-ready/zero emission new buildings, ideally by 2030 or sooner” (G7 Germany, 2022a). However, this impetus was not taken up at the June 2022 G7 Leader’s summit, their communiqué did not include any mention of the buildings sector (G7 Germany, 2022b).

Among transnational institutions, 28 cities have signed the C40 Net Zero Carbon Buildings Declaration which has the objective that all new buildings operate at net zero carbon by 2030 and all buildings by 2050 (C40 Cities, 2022). The Net Zero Carbon Buildings Commitment organised by the World Green Building Council requires that by 2030 signatories achieve net-zero operating emissions of their existing buildings and net-zero lifecycle emissions for all new developments and major renovations. Signatories include 138 businesses and organisations, 28 cities and 6 federal states and regions (WorldGBC Website, 2022b). The GlobalABC has the objective to develop a zero-emission, efficient, and resilient buildings and construction sector. It has developed a Global Roadmap for Buildings and Construction to help set pathways to decarbonization of the buildings and construction sector by 2050 (GlobalABC et al., 2020). While the roadmap has not been officially endorsed by governments, the Global ABC comprises 246 members including 36 countries and therefore a relevant mass of actors. Finally, the UNFCCC High-Level Champions are maintaining the “Race to Zero” campaign, aiming to halve global emissions by 2030 and achieve net-zero emissions by 2050 at the latest. While “Race to Zero” is open to participants from all sectors, signatories include investors accounting for USD 1.2 trillion in real estate assets, construction companies, architects and engineers (Owen-Burge, 2021).

In summary, there is a legally binding international agreement to phase out the use of HFCs. A number of institutions are promoting targets to halve emissions by 2030, have all new buildings at net zero carbon by 2030, and achieve full decarbonisation by 2050. These objectives are gaining increasing support among non-Party actors but have so far gained only very limited government support. The potential to provide guidance and signal has therefore so far been exploited only to a very limited extent.

2.3.4 Rules and standards

The Kigali Amendment to the Montreal Protocol requires all countries to gradually phase down HFCs by more than 80 percent globally over the next 30 years and replace them with more environmentally friendly alternatives, with differentiated timelines for developed and developing countries (UN Treaty Collection, 2016). That apart, there is little firm rule-setting for buildings decarbonisation. There are currently no requirements that NDCs should have a sectoral breakdown. Nor is there intergovernmental coordination on specific policies and measures such as decarbonisation of public buildings or emission pricing. Regarding fossil fuel subsidies, the G20 in 2009 pledged to “phase out inefficient fossil fuel subsidies”. However, the pledge contains no definition or what constitutes an “inefficient fossil fuel subsidy” or “subsidies” in general, nor a clear timeline (G20, 2009). The IEA has found that G20 fossil fuel subsidies have remained unchanged in nominal terms, at USD 159.3 billion in 2020 compared to USD 161.8 billion in 2010 (OECD/IEA, 2021). COP26 in Glasgow also called on countries to phase out inefficient fossil fuel subsidies, it remains to be seen to what extent this call will be followed up on.

Several transnational institutions organise the adoption of commitments by their members. Under the C40 Net Zero Carbon Buildings Declaration, members pledge to enact regulations and/or planning policy to ensure new buildings operate at net zero carbon by 2030 and all buildings by 2050 (C40 Cities, 2022). The Net Zero Carbon Buildings Commitment organised by the World Green Building Council requires that by 2030 signatories achieve net-zero operating emissions of their existing buildings and net-zero lifecycle emissions for all new developments and major renovations. Signatories include 138 businesses and organisations, 28 cities and 6 federal states and regions (WorldGBC Website, 2022b).

Regarding the international pooling of purchasing power, during design, K-CEP funders initially envisaged that buyers' and/or sellers' clubs could be an effective means to expand the market share of highly efficient cooling technology. K-CEP explored several means of supporting formation of such clubs, but there was not sufficient interest or uptake, so this initiative was ultimately abandoned (Clean Cooling Collaborative, 2022).

There have been some efforts to harmonise building codes and develop model regulations. The Caribbean Community developed a Regional Energy Efficiency Building Code, which is currently being adopted by nations across the regions. Moreover, the non-state International Code Council developed an International Energy Conservation Code (IECC) and an International Green Construction Code (IgCC) already in 2000 and 2010 respectively and is working to broaden their uptake (UNEP, 2021a). There are also efforts to harmonise regulations on cooling appliances. Currently, regional air condition harmonization efforts are ongoing in Southeast Asia, Southern Africa, East Africa, West Africa, the Caribbean, and other regions (Park et al., 2021).

In summary, the Kigali Amendment requires the phase-out of harmful cooling substances, but otherwise there is hardly any firm rule-setting on buildings. While various institutions such as C40 and the World GBC collect building decarbonisation commitments from relevant actors, these are not legally binding and do not cover national governments. The steps which the G20 has taken on fossil subsidy reform are non-binding and implementation has been weak. There has been some movement towards coordinating building codes and standards for air conditioners, but efforts to organise buyers' or sellers' clubs for cooling technology were not successful.

2.3.5 Transparency and accountability

Parties to the Montreal Protocol need to annually report on production, imports and exports of controlled substances. Potential penalties for non-compliance include limitations on trade of products containing or produced with controlled substances.

Parties to the UNFCCC must regularly submit GHG emission inventories as well as reports on policies and measures they have implemented and their impact. However, the Paris Agreement requires Parties only to maintain NDCs and to implement policies to achieve them; it does not require Parties to actually achieve their NDCs. Correspondingly, there are no penalties for non-achievement. This was the only way to achieve any kind of agreement, most major emitters outside the EU would not have agreed to a Kyoto Protocol-style treaty with binding commitments and penalties (Bals, 2021; Obergassel et al., 2016).

In addition, the UNFCCC process has so far mostly focused on economy-wide emissions, the review process pays little attention to sectoral details. Recent literature also generally questions the capacity of the mechanisms established under the Paris Agreement, the Enhanced Transparency Framework (ETF), the compliance committee and the Global Stocktake (GST) to have an impact on Parties' actions (Pauw et al., 2018; Raiser et al., 2022; Weikmans et al., 2020). Most importantly, these mechanisms have neither the mandate to assess the adequacy of individual parties' NDCs nor the mandate to assess the adequacy of parties' policies and actions to achieve their NDCs. Moreover, the wide variety of NDCs complicates assessment in any case. In addition, opportunities for non-party stakeholders to participate in the transparency mechanisms are restricted, which limits their ability to use these mechanisms to generate public pressure. Finally, there are doubts as to whether Parties and the UNFCCC Secretariat have sufficient resources to adequately operate the ETF.

The G20 has established a peer-review process to monitor implementation of the pledge to phase out inefficient fossil fuel subsidies. However, this process is voluntary and since there is no common definition of what constitutes inefficient fossil fuel subsidies countries are free to come up with their own definitions. The process would therefore need to become mandatory and more stringent to be effective (Asmelash, 2017).

Among non-state actors, both the C40 Net Zero Carbon Buildings Declaration and the WorldGBC Net Zero Carbon Buildings Commitment include requirements of annual progress reports, the latter also includes verification of performance at individual building and portfolio level (C40 Cities, 2022; WorldGBC Website, 2022b). The Net Zero Asset Managers Initiative, the Net-Zero Asset Owner Alliance, and the Net-Zero Banking Alliance also require regular reporting on progress made. The respective guidelines have been developed under the aegis of UN institutions, in the former case the UNFCCC Race to Zero campaign and in the latter two cases the UNEP Finance Initiative (Net Zero Asset Managers Initiative, 2021; Net-Zero Asset Owner Alliance, 2021; Net-Zero Banking Alliance, 2022).

The actual robustness of these transparency mechanisms needs to be further assessed. C40 has produced a summary report on the extent to which actions have been delivered, are on track, have been delayed or not yet started (C40 Cities, 2022), but the web page dedicated to the Net Zero Carbon Buildings Declaration seems to have been taken offline. The WorldGBC Website includes a detailed page on how to report on Net Zero Carbon Buildings Commitment (WorldGBC Website, 2022a), but displays no information on reporting having been done. The Net Zero Asset Managers Initiative produced an initial target disclosure report in May 2022, that is, a report on which targets the individual members have set for themselves (Net Zero Asset Managers Initiative, 2022). The so far two progress reports by the Net Zero Asset Owner Alliance similarly focused on target-setting, target dates are 2025 and 2030 (UNEP FI Website, 2022). The Net-Zero Banking Alliance has so far not published progress reporting.

In summary, for countries, the potential to provide transparency and accountability has been exploited only to a very low extent. The Montreal Protocol has a robust transparency and compliance system. While the UNFCCC and the PA have the potential to provide for transparency of parties' actions in the buildings sector, this potential is not exploited as parties' performance is not discussed at sector level. More generally, NDC achievement is not mandatory and the PA's transparency mechanisms have several weaknesses. Institutions

that are addressing non-state and sub-national actors are requiring regular progress reports but the actual robustness of these transparency mechanisms needs to be further assessed.

2.3.6 Means of implementation

Multilateral development banks are increasingly supporting the development of green building products and services by financial institutions. As part of the Zero Carbon Buildings for All initiative, multilateral development banks and private finance institutions committed to mobilising USD 1 trillion in “Paris-compliant” building investments by 2030. Under the Net-Zero Asset Owner Alliance, the world’s largest pensions funds and insurers who are directing more than USD 2.4 trillion in investments committed to achieving carbon-neutral investment portfolios by 2050 (UN Climate Change, 2021b).

The MDBs are also undertaking substantial activities to promote capacity building. Moreover, the GlobalABC has supported the development of more than 30 national and sub-national building decarbonisation roadmaps (GlobalABC Website, 2022d). The IEA’s Energy Efficiency in Emerging Economies programme works with Brazil, China, India, Indonesia, Mexico and South Africa as well as other countries in Asia and Latin America to quantify and communicate the multiple benefits of energy efficiency, supports policy development in these countries, and offers series of thematic workshops and policy training (IEA, 2022c). The IEA is also organising a broad range of Technology Collaboration Programmes (TCPs) on energy efficiency, district heating and cooling including combined heat and power, energy storage, heat pumps, and solar heating and cooling to organise international collaborative RD&D as well as knowledge exchange, and to develop market and policy recommendations (IEA, 2022a);

Other institutions that undertake capacity building include for example, C40, ICLEI, the WorldGBC, the GBPN, and the Cool Coalition.

In terms of building ratings, the IFC developed the EDGE (Excellence in Design for Greater Efficiencies) certification system, which assesses savings in energy, water, and embodied energy in materials of specific building projects. Already at the planning stage users can use the EDGE software to estimate the additional cost of energy and resource efficient design options, and calculate pay-backs from operational savings as well GHG savings. Based on their performance buildings can receive a certification from accredited certifiers. The intention is to enable developers and banks to easily differentiate green buildings and thereby mobilise investment (EDGE Buildings, 2022). MDBs are also using the EDGE system for their own finance. For example, the Asian Development Bank cooperated with the IFC using the EDGE system for the construction and certification of 10,000 new homes in Ulaanbaatar/Mongolia (Asian Development Bank, 2019).

Following up on the adoption of the Kigali Amendment, cooling equipment has received particular attention. In addition to MDB programmes and the Montreal Protocol’s own financial mechanism, the Kigali Cooling Efficiency Program (K-CEP) united 17 foundations and individual donors that came together in September 2016 to announce a joint commitment of \$50 million to help developing countries transition to energy efficient, climate-friendly, affordable cooling solutions (Clean Cooling Collaborative, 2022). Moreover, in October 2021, the Green Climate Fund (GCF) approved a World Bank Cooling Facility with USD 157 million in

direct GCF financing, which is intended to leverage USD 722 million in World Bank co-financing (Sustainable Energy for All, 2022).

The question is to what extent the support that is being made available is sufficient to achieve the Paris objectives. The UNFCCC process has so far focused to a large extent on resource mobilisation in aggregate, for example follow-up on the pledge made by developed countries at COP15 in Copenhagen to mobilise USD 100 billion annually by 2020. Discussions have focused on whether the target is being met or not, what actually counts as climate finance, delays and conditionalities (Kinley et al., 2021). There is much less consideration of financing needs, both in the UNFCCC and in the academic literature (Patt et al., 2022). The UNFCCC Standing Committee on Finance (SCF) in 2021 for the first time produced a report on financing needs of developing countries in addition to its biennial assessment of climate finance flows. Both reports include consideration of needs and flows at sector level, but they note that there are strong data gaps (UNFCCC, 2021b, 2021a).

The latest IPCC assessment report similarly notes that there is a lack of peer-reviewed literature on investment gaps in the buildings sector. The IPCC cites IEA figures which estimate the incremental decarbonisation investment needs in the sector between 2026 and 2030 at USD 711 billion, including USD 509 billion for building energy efficiency and USD 202 billion for renewable heat for end-use and electrification in buildings. This would imply a growth of investments from their 2016-2020 levels by a factor of 3.6 and 4.5 respectively. The IPCC also notes that bottom-up literature reports significantly higher investment needs than the IEA, the actual investment gap is therefore likely to be even higher (Cabeza et al., 2022).

Moreover, public funding is currently often not provided for the long term but on an annual basis, which impedes long-term strategic planning (B. Lebot, personal communication, 30 May 2022; N. Steurer, personal communication, 3 June 2022).

In summary, while substantial resources are being provided, there is a lack of data on needs and actual flows. Estimates by the IEA suggest that investment levels need to triple or quadruple in order to achieve the Paris objectives

2.3.7 Knowledge and learning

Very many institutions are contributing to the creation and dissemination of knowledge and learning, for example:

- › Under the UNFCCC a Technical Examination Process (TEP) has collated and synthesised good practice policies for a variety of sectors, including low-emission housing and buildings (UNFCCC Website, 2022).
- › The G20 and the Major Economies Forum on Energy and Climate undertook activities to develop knowledge and promote implementation on a range of issues such as energy performance metrics, building codes and rating schemes, and best practice policies, for example in the framework of the G20's 2014 Energy Efficiency Action Plan (G20, 2014). These activities took place with support through IPEEC, in collaboration with the IEA and others. However, as noted above, IPEEC was disbanded and the follow-up in the IEA Energy Efficiency Hub is not yet clear.

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- › The GlobalABC tracks global progress on buildings decarbonisation in its annual Global Status Report for Buildings and Construction (Buildings-GSR), and its Building Climate Tracker. The GlobalABC also provides policy guidance and global and regional buildings and construction roadmaps outlining aspirational targets, timelines, and key actions for essential policies and technologies. including guidelines for countries to incorporate building sector in their NDC. The GlobalABC has also supported the development of 33 national roadmaps in close collaboration with the respective national governments.
- › United for Efficiency (U4E) is a public-private partnership led by UNEP, the Global Environment Facility (GEF), the United Nations Development Programme (UNDP), the International Copper Association (ICA), CLASP and the Natural Resources Defence Council (NRDC) with the support of other international partners. The U4E Global Map includes Country Savings Assessments showing the potential financial, environmental, energy, and societal benefits that are possible with a transition to energy-efficient lighting, refrigerators, room air conditioners, electric motors and distribution transformers. U4E has also developed Model Regulation Guidelines provide guidelines for setting MEPS and testing methods.

Further institutions that promote knowledge and learning include, among others. the UNEP Sustainable Buildings and Climate Initiative (SBCI), the Clean Energy Ministerial, the MDBs, C40, and the WBCSD. This governance function therefore seems to be well-developed.

2.3.8 In summary

Fehler! Verweisquelle konnte nicht gefunden werden. summarises the results of the above analysis. The table picks up on Table 1 in section 2.2 and summarises which options for international governance and cooperation as discussed in section 2.2 have been activated to some extent and which ones have not. The analysis has revealed that the governance supply differs by subject. The challenge of providing climate-friendly cooling is to large extent governed under the Montreal Protocol and its Kigali amendment. There is a clear requirement to phase down the use of HFCs, supported by a robust transparency and accountability mechanism and a financial mechanism. In addition, a number of institutions have been formed by governments and other actors to promote the HFC phase-out and at the same time promote energy efficiency of cooling equipment.

Guidance and Signal	Setting Rules	Transparency and Accountability	Means of Implementation	Knowledge and Learning
<ul style="list-style-type: none"> › Kigali Amendment requires phase-down of HFCs › Call for climate-friendly cooling in the G7 Biarritz pledge and by other actors › General SDG target on energy efficiency but 	<ul style="list-style-type: none"> › Kigali Amendment requires phase-down of HFCs › No international requirements for sectoral emission targets in national short- and long-term strategies › G20 pledge on fossil fuel subsidy reform but definition and implementation has been weak › Transnational decarbonisation 	<ul style="list-style-type: none"> › Robust sectoral emission inventories under UNFCCC › UNFCCC National Communications report on measures taken and their impacts › But no assessment of adequacy, no penalties for non- 	<ul style="list-style-type: none"> › Substantial provision of resources, but lack of data on investment needs. IPCC and IEA consider that investment needs to grow 3-4 times › Coordinated research, development and demonstration are undertaken 	<ul style="list-style-type: none"> › Policy and technical knowledge platforms and exchange formats do exist

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<p>not specifically for buildings</p> <ul style="list-style-type: none"> › Calls/commitments for halving emissions by 2030 and/or full decarbonisation by 2050 by some countries, C40 Cities, World GBC, GlobalABC, Race to Zero campaign › Roadmaps to decarbonisation by 2050 by GlobalABC and High-Level Champions 	<p>commitments organised by C40 Cities, World GBC, Race to Zero</p> <ul style="list-style-type: none"> › Model building codes by CARICOM and non-state International Code Council › Some regional harmonisation of standards for cooling appliances › No fossil heating phase-out agreement › No international coordination on public and private procurement of low-emission heating and cooling › No international coordination on emission pricing › 	<p>compliance, UNFCCC pays little attention to sector-specific developments</p> <ul style="list-style-type: none"> › No requirements to assess non-climate benefits › G20 process on fossil subsidy reform has weak transparency provisions › Robustness of transparency mechanisms of non-Party institutions is not yet clear 	<p>e.g. by IEA Technology Collaboration Programmes</p> <ul style="list-style-type: none"> › › EDGE certification system for savings of energy, water and embodied energy in materials 	
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TABLE 2: SYNTHESIS OF CURRENT GOVERNANCE LANDSCAPE

Regarding buildings more generally, there is substantial dynamism among sub-national and non-state actors. Increasing numbers of actors are signing up to commitments formulated by actors such as C40 cities, the WorldGBC and the Race to Zero campaign. These institutions are also making efforts to provide transparency on actual implementation but the actual robustness of their transparency mechanisms is not yet clear. Several of them have so far reported only on how members set their individual targets but not on implementation.

Regarding countries, however, the lack of stringent national policies is mirrored at the international level. There is a lack of a strong international signal on the need to decarbonise the buildings sector. Various attempts to make countries commit to decarbonisation of the buildings sector (the Buildings as Critical Climate Solution (BCCS) call, the Zero Carbon Buildings for All Initiative, and the Global Call for Low Carbon, Energy Efficient, and Resilient buildings) have so far had only very limited success, each call was signed only by a handful of countries.

There also is a lack of clear commitments by individual countries to decarbonise their buildings sectors. Ideally, there should be a national buildings decarbonisation roadmap in each country (I. Geppert, personal communication, 25 July 2022; N. Steurer, personal communication, 3 June 2022).

Correspondingly, there is a lack of transparency and accountability of countries' actions in the buildings sector. While the UNFCCC and the PA have the potential to provide for transparency of parties' actions in the buildings sector, this potential is not exploited as parties' performance is not discussed at sector level. More generally, NDC achievement is not mandatory and the PA's transparency mechanisms have several weaknesses.

Finally, there is a lack of finance and investment. While there are data gaps on needs and current flows, IPCC and IEA consider that investments need to grow by a factor of 3-4 by 2030 to achieve a Paris-compatible trajectory.

3 Options for enhancing global climate governance

This section will discuss how the governance gaps identified in the previous section could be closed. To this end, the section first introduces criteria for evaluating governance options. On this basis, the section first discusses generically which existing institutions have the potential to address the identified gaps. Second, the section discusses for each individual gap how it could be filled by existing institutions. Finally, the section discusses the potential of a new institution to address governance gaps.

3.1 Assessment Criteria

The following applies four criteria to analyse the potential of different institutional options, namely membership, institutional strength and capacity, legitimacy and authority, and political feasibility.

Membership refers to whether an institution includes actors as members that are needed to fill the governance gaps identified. As outlined in the previous section, there is substantial activity by sub-national and non-state actors, the main gaps identified relate to countries and international or inter-governmental bodies. Institutions to fill these gaps therefore either need to be intergovernmental or transnational with strong government membership. Buildings are a relevant emitting sector in each country and therefore ultimately all countries will need to take action. In the short run, however, collaboration could start with some frontrunner countries and grow over time. But it should include a relevant number of major emitting countries in order to have enough “critical mass”.

Institutional strength and capacity refer to whether an institution has the competence, capacity and expertise to address the identified governance gaps. The latest IPCC assessment report discusses institutional strengths in terms of regulative quality, mechanisms to enhance transparency and accountability, and administrative capacity (Patt et al., 2022). In other words, institutional strength therefore refers to whether an institution has the capacity to activate the governance functions introduced in section 2.2. Given the above gap analysis, filling the gaps identified requires institutions that have the capacity to give clear guidance and signals, define rules and standards, provide transparency and accountability, and mobilise means of implementation. In addition, administrative capacity includes financial and human resources, and the degree of institutionalization or presence of a permanent secretariat.

Legitimacy refers to the authority of an institution as perceived by other actors, both in terms of process (input legitimacy) and outcome (output legitimacy). This criterion is closely related to issues of membership and distribution of resources, especially in a North-South context.

Finally, political feasibility refers to whether there is a realistic political opportunity for institutional reform or the creation of a new institution. Regarding existing institutions, this includes compatibility with the institution's established goals and the prospects for agreement among its members. Regarding the potential for a new institution, this includes linkages to existing institutions and venues as potential starting points.

3.1.1 General potential of existing institutions

The following first discusses at a general level which of the institutions identified in section 2.2 has significant potential to make a significant contribution to addressing the gaps identified. As noted above, the discussion focuses on institutions that are intergovernmental or comprise strong government membership. Several of the institutions discussed in section 2.2 can arguably be excluded without detailed consideration

- › Agenda 2030 is a fixed document;
- › IRENA is focused on renewables;

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- › The Multilateral Development Banks by their mandates may address only means of implementation;
- › UN-Habitat as a UN-Programme has near-universal membership and correspondingly high legitimacy. However, while its mission includes environmental sustainability, the focus of its mandate is quality of life (UN-Habitat, 2022).

This leaves the UNFCCC/PA, the IEA, the G7/G20 and UNEP, in particular the GlobalABC that is hosted by UNEP. The following first discusses the general potential of these institutions and subsequently which steps they may take to address the gaps identified.

UNFCCC and Paris Agreement have near-universal membership and in consequence high legitimacy. In terms of institutional strength and capacity, they have legal competence to act on all five governance functions and there is a large Secretariat in place. The UNFCCC therefore in principle has the competence and strength to address all of the governance gaps identified. However, in terms of feasibility, its large membership also entails a broad variety of interests. Moreover, excepting some procedural matters, all decisions need to be taken by consensus.

The IEA's membership is limited to OECD countries but its association membership also includes 11 emerging economy countries^b. The key mission of the IEA is to provide analysis, data, and policy recommendations. It is widely seen as authoritative on energy issues and has strongly tried to promote energy efficiency as “first fuel” and to highlight its multiple benefits (Voïta, 2021). Given its mission it has no scope to create rules and standards or to mobilise finance, but it could play a key role in enhancing transparency and accountability. It is already tracking the development of the buildings sector at global level (IEA, 2021c) and is leading tracking of progress against the “Glasgow Breakthroughs” (IEA et al., 2022).

G7/G20 have limited membership and their legitimacy is often questioned, but in particular the G20 includes all large emitters. They have in the past taken relevant actions such as formation of IPEEC and the process on fossil subsidy reform. In terms of strength and capacity, the example of fossil fuel subsidy reform illustrates that they may in principle take action across all governance functions, including creation of rules and standards and providing transparency and accountability. However, in terms of practical feasibility, the example also shows that adopting stringent commitments and providing strict transparency has been difficult. Moreover, given the annually changing presidencies, continuity is a problem, issues go on and off the radar screen depending on the priorities of the presidencies. For example, the Australian 2014 G20 presidency prioritised energy efficiency, but it did not stay a priority in the following years (A. Hinge, personal communication, 8 June 2022). Finally, progress in the G20 will probably be difficult as long as the Ukraine war burdens relationships among its members, as shown by the failure of the G20 Joint Environment and Climate Ministers' Meeting in August 2022 to agree on a communiqué (Lamb & Budiman, 2022).

The GlobalABC has 246 members including 37 countries from the Americas, Europe, Africa and Asia and many other relevant actors from the sector. Member countries include many major emitters such as the Brazil, Canada, France, Germany, Japan, Mexico, Russia, the UK, and the USA. In addition, non-Party members come from further major emitting countries including Australia, China, India, Italy and South Africa. Furthermore, many large international organisations are members of the GlobalABC, including the IEA, IRENA, the IFC,

UNECE, UN-Habitat and UNEP (GlobalABC Website, 2022c). Moreover, since it is hosted by UNEP, the GlobalABC is seen as a “safe and neutral space” (N. Steurer, personal communication, 3 June 2022). Expertise is strong as the institution is dedicated to buildings but the mandate is limited. Existing work areas relate in particular to the governance functions guidance and signal, means of implementation, knowledge and learning. The common statement which members must subscribe to does not include a requirement to reduce own emissions (GlobalABC Website, 2022a). Finally, in terms of practical feasibility, staff capacity is very limited. Currently, four people work on buildings in UNEP’s Cities Unit (this includes staff and consultants), but only one of them works full-time for the GlobalABC (GlobalABC Website, 2022b; N. Steurer, personal communication, 3 June 2022).

3.1.2 Potential of existing institutions to address the gaps

Lack of a strong signal by countries on the need to decarbonise the buildings sector, e.g. in the form of a government-backed decarbonisation target and/or roadmap

The GlobalABC and the MPGCA have developed global roadmaps for the decarbonisation of the buildings sector by 2050. These so far have no official government backing, but in principle the UNFCCC could build on this work. There are at least two near-term opportunities. First, COP26 decided to establish a work programme to scale up mitigation ambition and implementation. The work programme is supposed to be adopted at COP27. If this work programme adopted a sectoral perspective, it could be used to develop government-backed targets and roadmaps at sector level (Evans, 2022). The second opportunity is the Global Stocktake. It could be used to collate and institutionalise existing knowledge and roadmaps on what achieving the Paris objectives would mean for each sector and what the current status is (Hermwille et al., 2019).

The G7 could in theory also send a strong signal on buildings decarbonisation. The 2022 G7 summit in Elmau adopted a number of sectoral targets, including commitment “to a highly decarbonised road sector by 2030” and a commitment to “achieving a fully or predominantly decarbonised power sector by 2035” (G7 Germany, 2022b). The G7 could therefore in theory also adopt a sectoral target for the buildings sector. However, as noted in the preceding section, the buildings sector does not feature at all in the Elmau communiqué. So currently there does not seem to be sufficient impetus on this matter in the G7.

Lack of commitment by countries to decarbonise their buildings sectors

Regarding rules and standards, in principle, the parties to the Paris Agreement could agree that NDCs and LTSs need to have a sectoral breakdown. Parties could also seek to organise co-ordination on specific sectoral rules and standards, such as emission pricing or aligned phase-out dates for fossil fuel subsidies, also as a means to respond to parties’ concerns around economic competitiveness and international equity (Kinley et al., 2021). COP26 made a step in this direction by calling on parties to rapidly scale up the deployment of clean power generation and energy efficiency measures and to phase down unabated coal power and to phase out of inefficient fossil fuel subsidies. However, the negotiations on this item were extremely contentious. It may therefore be politically difficult to achieve multilateral agreement on more detail (Oberghassel et al., 2022).

The G7 or the G20 might in theory agree on buildings-related commitments, but as noted above the G7 Elmau communiqué did not even mention the sector and the G20 is in a difficult situation due to the Ukraine war. The IEA and the Global ABC have no authority to create rules and standards.

Lack of transparency and accountability of countries' actions in the buildings sector

Regarding transparency and accountability, as outlined in the previous section, substantial strengthening of the PA's transparency provisions is generally required to enable them to actually have an impact. In addition, the transparency mechanisms should pay more attention to the sector level. However, the first review and potential update of modalities, procedures and guidelines for the enhanced transparency framework is due only in 2028 (UNFCCC, 2019, p. 2). Since negotiations on these provisions were hotly contested, it may not be possible to resume them in the near future. In this case, the new mitigation work program and the annual high-level ministerial meeting on pre-2030 targets and implementation could be used as complementary means to strengthen accountability. The work program and agenda for the high-level ministerial meeting should make clear that Parties are expected to demonstrate each year how they are raising ambition and implementation of their climate policies. In addition to NDCs, this should include a focus on sectoral commitments such as those made at COP26 (Obergassel et al., 2022).

The IEA and the GlobalABC are already tracking the development of the buildings sector at global level (IEA, 2021c) and the IEA is leading tracking of progress against the "Glasgow Breakthroughs" (Biol, 2021). Accordingly, the IEA could take a leading role to provide transparency on implementation of a buildings decarbonisation commitment if one was agreed e.g. by the G7/G20 or as a new "Breakthrough".

Lack of finance and investment

Regarding means of implementation, there is a lack of data on needs and actual flows at sector level. Donor countries should therefore invest resources to fill these data gaps in order to gain a more accurate picture. In addition, this gap should be addressed under the GST. Once financing needs and gaps have been identified more clearly, both the formal negotiations and individual funding initiatives could target identified gaps more clearly. In particular, the UNFCCC is currently in the process of negotiating a new long-term goal for climate finance, following up on the existing goal of 100bn USD annually from 2020. These negotiations would profit from including consideration of financing needs on a sector-by-sector basis. On this basis the COP could then call on donor countries and financial institutions to focus on filling identified financing gaps.

In Summary

In summary, several already existing institutions could in theory help to close the governance gaps identified in the previous section. [TABLE 3](#) summarises the above discussion. In practice, however, the near-term potential is probably limited. The UNFCCC has the mandate to act across all five governance functions, but the divergence of interests among its members has so far made it difficult to adopt strong decisions. The IEA has done much work to promote energy efficiency as "first fuel" and has strong competence to contribute to transparency, but has no mandate to create rules and standards. The G20 will probably be

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blocked by the Ukraine war for the foreseeable future and the most recent G7 leaders' communiqué did not include any mention of the buildings sector.

Gaps	Existing organisations/initiatives			
	UNFCCC/PA	IEA	G7/G20	GlobalABC
Lack of a strong international signal on the need to decarbonise the buildings sector	Use new mitigation work programme and GST, building on existing roadmaps	Is already emphasizing importance of sector, efficiency as "first fuel"	Adopt sectoral target similar to Elmau targets	Already prepared roadmap, needs stronger backing
Lack of clear commitments by individual countries to decarbonise their buildings sectors	Specify NDC guidance Co-ordinate specific rules and standards	No mandate	Adopt sectoral target similar to Elmau targets	No mandate
Correspondingly a lack of transparency and accountability of countries' actions	Strengthen transparency mechanisms generally and focus on sectors Annual ministerial roundtables as accountability checkpoint	Track progress of individual countries	Request IEA to track progress	Track progress of individual countries
Lack of finance and investment	Fill data gaps on needs and actual flows and call on countries and financial institutions to fill finance gaps	Fill data gaps on needs and actual flows	Organise commitments to fill finance gaps	

TABLE 3: OPTIONS FOR EXISTING INSTITUTIONS TO CLOSE GOVERNANCE GAPS

3.1.3 Potential for a New Institution

At the same time, while existing institutions have limitations, given that there already is a large number of institutions active in the area, there may be little point in creating a new one. Moreover, each of the existing institutions also has particular strengths. The best way forward may therefore be to enhance collaboration among these institutions to combine these strengths.

Since adopting strong commitments within the UNFCCC, G7 and G20 has been difficult, the lack of clear government commitments could potentially be promoted by a frontrunner alliance not subject to consensus requirements. At COP26, the UK presidency orchestrated the creation of several sectoral "breakthroughs" using the high visibility and legitimacy of the UNFCCC as platform. There was no "breakthrough" on the buildings sector in Glasgow, but France at the UNFCCC intersessional in June 2022 committed to championing the development of a buildings breakthrough with strong support from the GlobalABC and the "Building to COP" coalition (GlobalABC Website, 2022e).

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To add value, such a “Breakthrough” on buildings should define an ambitious global target or roadmap. As described in the previous sections, several institutions are promoting targets of having all new buildings zero-emission by 2030 and all buildings by 2050, this therefore seems a reasonable target for a “Breakthrough” to adopt.

In addition, all “Breakthrough” members should adopt ambitious individual targets for themselves. In addition, to enhance the degree of bindingness, enhance synergy with overall national policy and facilitate transparency, the COP or alternatively the COP presidency could call on countries to also include their “Breakthrough” pledges in their NDCs.

Regarding means of implementation, the commitments of developed country “Breakthrough” members should include commitments to scale up financial, technological and capacity building support to developing countries. There is a high number of existing institutions that can be used to channel resources, but the input of resources needs to be strongly increased in order to achieve a tripling/quadrupling of investments as indicated as necessary by IPCC and IEA.

In terms of transparency and accountability, the GlobalABC and the IEA could track implementation of such a Breakthrough, as the IEA is doing with the existing Glasgow Breakthroughs. In addition, successive COP presidencies could use the annual COP sessions as platform and occasion to demand demonstration of clear progress. Moreover, if countries that subscribe to the Breakthrough also include their Breakthrough pledges in their NDCs, implementation of these pledges would also be subject to the Paris Agreement’s transparency mechanisms.

TABLE 4 below summarises how existing institutions and a buildings “Breakthrough” could complement each other to enhance effectiveness. However, as discussed in section 2.3.3, so far all calls for building decarbonisation commitments by governments gained only a handful of signatories. It is therefore not at all a given that a buildings “Breakthrough” will indeed be successful. In this case, one fallback option would be to strengthen the GlobalABC. While it already has a relatively broad membership, it so far includes less than forty countries. Furthermore, its secretariat is currently very small, only one person works full-time for the GlobalABC. It should therefore be endowed with more resources to enhance its ability to achieve its objectives.

Gaps	Buildings “Breakthrough”	Existing organisations/initiatives		
		UNFCCC/PA	IEA	GlobalABC
Guidance and signal	Agree ambitious global target/road-map	Serve as platform to amplify Breakthrough		Existing roadmap as basis for Breakthrough target/roadmap
Rules and standards	Ambitious commitments by individual actors	Call on countries to include Breakthrough pledges in NDCs	No mandate	Existing roadmap as basis for Breakthrough pledges
Transparency and Accountability		Use annual ministerial roundtables as accountability checkpoint If pledges are included in NDCs, they will be subject to PA transparency mechanisms	Track collective and individual progress	Track collective and individual progress

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Means of implementation	Ambitious commitments by developed country members	Fill data gaps on needs and actual flows and call on countries and financial institutions to fill finance gaps	Fill data gaps on needs and actual flows		
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TABLE 4: POTENTIAL CONTRIBUTIONS AND SYNERGIES OF A NEW “BREAKTHROUGH” AND EXISTING INSTITUTIONS TO CLOSE GAPS

4 Conclusion: pathways towards enhanced sectoral governance

Buildings are one of the main emitting sectors but political attention to the need to decarbonise this sector has been low. Nationally, most countries lack strong mitigation policies and/or enforcement. Internationally, the sector was not even mentioned in recent outcomes of key institutions such as the G7 or the MEF.

Correspondingly, the potential of global governance has been exploited only to a limited extent, though with some variation. Very many institutions are active on the provision of knowledge and learning. The challenge of providing climate-friendly cooling is governed with clear targets, rules and transparency mechanisms under the Kigali Amendment to the Montreal Protocol. In addition, a large number of institutions are using implementation of the Kigali Amendment as platform to also promote energy efficiency of cooling equipment.

Regarding the buildings sector as a whole, however, there is no strong government-backed signal on the need to decarbonise; various calls for action were supported only by a handful of governments. There also is little rule-setting. There is no requirement for a sectoral breakdown of NDCs and LTSs. The steps which the G20 has taken on fossil subsidy reform are non-binding and implementation has been weak. There has been some movement towards coordinating standards for air conditioners, but efforts to organise buyers' or sellers' clubs for cooling technology were not successful.

Correspondingly, the potential to provide transparency and accountability of countries' actions has been exploited only to a very low extent. While the UNFCCC and the PA have the potential to provide for transparency of parties' actions in the buildings sector, this potential is not exploited as parties' performance is not discussed at sector level. More generally, NDC achievement is not mandatory and the PA's transparency mechanisms have several weaknesses.

Regarding means of implementation, while substantial resources seem to be provided, there is a lack of data on actual needs. IPCC and IEA consider that investments need to grow by a factor of 3-4 by 2030 to get onto a Paris-compatible trajectory.

Several already existing institutions could in theory help to close the governance gaps identified. In practice, however, the near-term potential is probably limited. The UNFCCC has the authority to act across all five governance functions, but the diverging interests of its broad membership and the need to achieve consensus have made it difficult to agree on strong decisions. The IEA has done much work to promote energy efficiency as "first fuel" and has strong competence to contribute to transparency, but has no mandate to create rules and standards. The G20 will probably be blocked by the Ukraine war for the foreseeable future and the G7 did not feature buildings in its most recent leaders' communiqué.

Finally, international coordination in the buildings sector is generally difficult given its mostly localised supply chains, lack of exposure to international trade, and highly differentiated needs in relation to geography and climate. The best way forward may therefore be a coalition of ambitious countries and other others, such as a "Breakthrough" on the buildings sector, that draws on the strengths of existing institutions. France and Morocco are currently leading efforts to launch one. To add value to the existing institutional landscape, such a "Breakthrough" should include an ambitious global target or roadmap as well ambitious individual targets and pledges to increase means of implementation for developing countries. The GlobalABC and the IEA could track implementation, as the IEA is already doing case with the existing Glasgow Breakthroughs. Successive COP presidencies could use the annual COP sessions as platform and occasion to demand demonstration of clear progress. In addition, if country members included their Breakthrough pledges in their NDCs, they would thereby be subject to the transparency mechanisms of the Paris Agreement.

However, the success of such as "Breakthrough" is far from assured given that so far all calls for building decarbonisation commitments by governments gained only a handful of signatories. A fallback option would be to strengthen the GlobalABC in terms of its membership and administrative capacity.

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Annex: Potential for International Cooperation and Governance

Opportunities/ Barriers	Guidance and Signal	Setting Rules	Transparency and Account- ability	Means of Im- plementation	Knowledge and Learning
Multiple bene- fits of effi- ciency and re- newables in buildings	>	>	> Require as- sessment of non-climate benefits	> Provide ca- pacity build- ing and fi- nancial sup- port for as- sessing non- climate ben- efits	> Improve metrics to assess multi- ple benefits > Provide knowledge platforms and ex- change for- mats on non- climate ben- efits > Support na- tional educa- tion and awareness programmes
Lack of long- term political commitment by govern- ments	> Agree in- terna- tional tar- gets for decarbon- ising buildings, phase-out of fossil heating, and/or energy ef- ficiency >	> Agree in- terna- tional re- quire- ments for sectoral emission targets in addition to national GHG tar- gets in na- tional short- and long-term strategies >	> Require na- tional re- porting on measures taken and their im- pacts, in particular reporting on those measures where inter- national co- ordination has been agreed >	> Provide fi- nancial sup- port and risk- sharing for countries with low ca- pacity	> Provide sup- port for un- derstanding the multiple benefits and impacts of decarbonis- ing the build- ing stock

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<p>Lack of clear and ambitious national policies including weak targets, lack of roadmaps, weak building codes, ongoing permission of fossil heating, subsidies for fossil fuels and fossil boilers, weak MEPs for air conditioning</p>	<ul style="list-style-type: none"> › Agree international targets for decarbonisation, phase-out of fossil heating and/or energy efficiency may help create pressure on national governments to implement policies › 	<ul style="list-style-type: none"> › Agree international requirements for sectoral targets in addition to national GHG targets in national short- and long-term strategies › Agree international commitments to decarbonise own building stock › International coordination on building energy codes, rating systems and labels to harmonise measurement methodologies, cover all emissions and apply to actual performance › International coordination on product efficiency standards and associated test methods for traded goods › Agree international fossil heating phase-out agreement 	<ul style="list-style-type: none"> › Require national reporting on measures taken and their impacts, in particular reporting on those measures where international coordination has been agreed › 	<ul style="list-style-type: none"> › Provide resources for administrative, policy development, planning, evaluation and enforcement capacity of national and local governments as well as monitoring of policy impacts › 	<ul style="list-style-type: none"> › Provide policy and technical knowledge platforms and exchange formats to help overcome information and awareness problems
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		<ul style="list-style-type: none"> › International coordination on public and private procurement of low-emission heating and cooling › International coordination on emission pricing › International agreement on climate budget reform, including abolishment of fossil fuel subsidies, subsidies for fossil boilers, introduction emission pricing and reform of priorities and criteria for public investments 			
Lack of technical knowledge and finance among governments, investors etc.	›	›	›	<ul style="list-style-type: none"> › Provide resources for administrative and planning capacity of national and local governments › Provide financial support and risk-sharing for investments 	<ul style="list-style-type: none"> › Provide policy and technical knowledge platforms and exchange formats to help overcome information and awareness problems

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Public budgeting rules disincentive efficiency	>	> International agreement to adapt budgeting rules to incentivise efficiency and renewables in public buildings; potentially as part of larger agreement on climate budget reform	>	> Provide resources for administrative and planning capacity of national and local governments >	> Provide policy and technical knowledge platforms and exchange formats to help overcome information and awareness problems
Higher upfront costs and longer payback periods for highly efficient buildings, heat pumps and super-efficient cooling Potentially higher operating costs of electrification	>	> International coordination on building energy codes and rating systems to harmonise measurement methodologies, cover all emissions and apply to actual performance >	>	> Provide financial support and risk-sharing for countries with low capacity > Support establishment of building energy rating systems to properly calculate energy savings and payback	> Provide knowledge platforms and exchange formats on building energy rating systems to properly calculate energy savings and payback >
Split incentives between landlords and users, builders and investors	>	> International coordination on building energy codes and rating systems to enforce high energy performance >	>	> Capacity building on policy instruments to overcome split incentives, e.g. through building codes or through including energy costs in basic rents	> Knowledge platforms to exchange on instruments to overcome split incentives
Need to adapt power-market design to allow flexibility provision by	>	>	>	>	> Knowledge sharing about power market design

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heating and cooling					
Higher production costs of producing heat pumps and super-efficient cooling	>	> International coordination on building codes and MEPS to enforce use of heat pumps and efficient technology	>	> Provide financial support to manufacturers to redesign products, re-tool manufacturing lines, to comply with HFC mitigation measures.	>
Lack of technical knowledge and perceived lending and investment risks among capital providers	>	>	>	> Capacity building for financial institutions > Provision of easy to use building/investment rating systems > Provision of financial support and risk-sharing instruments	> Policy and technical knowledge platforms and exchange formats to help overcome information and awareness problems
Small projects – high transaction costs for all involved	>	>	>	> Provision of financial support and risk-sharing instruments	>
Lack of funding for RD&D, Low performance of heat pumps in very cold climates and inefficient buildings maturity of specific technologies such as solar cooling	>	>	>	> Financial support and risk-sharing	> Coordinated research, development and demonstration >

Global Climate Governance for the Buildings Sector

Uncertainty about market demand among actors in the supply chain	> International targets for decarbonisation and/or energy efficiency to provide market signals	> International coordination on building codes and MEPS to provide market signals	>	>	>
Sunk costs of incumbent heating infrastructure	>	>	>	>	>
Limited suitability of renewable-based heating and cooling in certain building types	>	>	>	>	>
lack of capacity and availability of qualified technicians, e.g. building managers, installer	>	>	>	> International support for capacity-building	>
Grid challenges due to increasing electricity demand and peak demand	>	>	>	> Coordinated development and demonstration of technologies for energy storage, demand-side response, smart meters, smart grids	>
lack of information and awareness about heat pumps and super-efficient cooling among building owners, installers etc.	>	>	>	> International support for capacity-building	> Information campaigns, but probably no role for the international level?

Annex: Overview of institutions focusing on the building sector and their respective contributions to the governance functions

	Guidance and Signal	Rules and Standards	Transparency and Accountability	Means of Implementation	Knowledge and Learning
United Nations System					
United Nations Framework Convention on Climate Change (UNFCCC)	<p>Paris objective to hold increase in average global temperature well below 2°C, best efforts to stay below 1.5°C. Aim to achieve global peaking of GHG emissions as soon as possible, undertake rapid reductions thereafter, achieve a balance of emissions and removals by sinks in second half of the century</p> <p>Objective to make all financial flows compatible with the long-term objectives of the Paris Agreement</p> <p>“Race to zero campaign” aiming to halve global emissions by 2030 and achieve net-zero emissions by 2050 at the latest</p>	Requirements for Parties to maintain NDCs and implement actions to achieve the NDCs; invitation to Parties to submit long-term strategies	UNFCCC and Paris Agreement require Parties to provide transparency on national emissions, measures taken, and their impacts in the form of national emission inventories, national communications and international reviews	Commitments of industrialised countries to provide means of implementation. These are provided bilaterally and multilaterally, including through the UNFCCC financial mechanism (operated by the Global Environment Facility and the Green Climate Fund) and the technology mechanism (Climate Technology Centre and Network (CTNC)).	<p>Technical Examination Process (TEP) collated and synthesised good practice policies for a variety of sectors</p> <p>Global Stocktake to examine collective progress every five years</p> <p>MPGCCA developed sectoral ‘Climate Action Pathways’, which include visions for a 1.5-degree climate-resilient world as well as actions needed to achieve that future</p>
<p>Kigali Amendment to the Montreal Protocol</p> <p>129 countries, including China and India, have already ratified the Kigali amendment</p>	Phase down climate-polluting HFCs	Under the Amendment, all countries to gradually phase down HFCs by more than 80 percent over the next 30 years and replace them with more environmentally friendly alternatives.	<p>Parties need to annually report on production, imports and exports of controlled substances</p> <p>Potential penalties for non-compliance include limitations on trade of products containing or</p>	The Multilateral Fund for the Implementation of the Montreal Protocol assists developing countries in achieving compliance	•

			produced with controlled substances		
United Nations Agenda 2030 process	SDGs target 7.3 to double the global rate of improvement in EE, but no specific target for buildings		Global indicator framework established by UN, but countries may choose on which indicators to report High-Level Political Forum established to monitor progress on SDG implementation Countries may submit Voluntary National Reports (VNR) for discussion at the HLPF		•
UN Environment Programme Global Alliance for Buildings and Construction (Global ABC), launched at COP21 “With 215 members, including 34 countries, the GlobalABC is the leading global platform for governments, the private sector, civil society and intergovernmental and international organizations to increase action towards a zero-emission, efficient and resilient buildings and construction sector”	Goal to develop a zero-emission, efficient, and resilient buildings and construction sector Global Roadmap for Buildings and Construction to help set pathways to decarbonization of the buildings and construction sector by 2050 Stakeholder-driven regional roadmaps, based on Global Roadmap			<ul style="list-style-type: none"> develops policy guidance and global and regional buildings and construction roadmaps outlining aspirational targets, timelines, and key actions for essential policies and technologies provide guidelines for countries to incorporate building sector in NDC 	<ul style="list-style-type: none"> tracks progress in its annual Global Status Report for Buildings and Construction (Buildings-GSR), and its Building Climate Tracker, a new index to track progress in decarbonization in the sector. foster knowledge exchange through regional roundtables targeting policy makers awareness raising and outreach, Knowledge dissemination and exchange, Knowledge production and innovation, Policy planning and recommendations, Political and Technical dialogue
United Nations Environment Programme				tools and strategies (for example a 'Quick Scan Tool' to assess policies in the building sector and scenarios	<ul style="list-style-type: none"> providing a common platform to all buildings and construction stakeholders for

Sustainable Buildings and Climate Initiative (SBCI)				to improve the current situation) to better evaluate and implement sustainable building practices	addressing sustainability issues of global significance, especially climate change <ul style="list-style-type: none"> Establish globally acknowledged baselines based on the life cycle approach, with a first focus on energy efficiency and CO2 emissions Develop tools and strategies for achieving a wide acceptance and adoption of sustainable building practices throughout the world Promotes to key stakeholders the adoption of the above tools and strategies which will be evaluated through pilot projects
UN-Habitat	New Urban Agenda adopted at the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) in 2016 as guideline for urban development in next 20 years https://habitat3.org/the-new-urban-agenda/				<ul style="list-style-type: none">
Other International Institutions					
G20		Agreement to phase out “inefficient fossil fuel subsidies”	Peer reviews among G20 members on fossil fuel subsidies		G20 Energy Efficiency Action Plan to develop knowledge and promote implementation on issues such as energy performance metrics,

					building codes and rating schemes, and best practice policies
G7 Biarritz Pledge for Fast Action on Efficient Cooling	agree to undertake immediate actions to improve efficiency in the cooling sector while phasing down HFC refrigerants as per the Kigali Amendment	undertake ambitious measures to improve energy efficiency in the cooling sector while phasing out HCFC and phasing down HFC refrigerants, such as developing national cooling plans ..., using energy performance standards (MEPS) and labelling, and promoting use of good servicing practices; ...; To use the state's bulk purchasing power and relevant measures ...			
International Energy Agency (IEA)				E.g. the Energy Efficiency in Emerging Economies programme works with Brazil, China, India, Indonesia, Mexico and South Africa as well as other countries in Asia and Latin America to quantify and communicate the multiple benefits of energy efficiency, supports policy development in these countries, and offers series of thematic workshops and policy training	Tracking progress on emission reductions in buildings https://www.iea.org/topics/buildings Track cooling https://www.iea.org/reports/cooling Track cooling https://www.iea.org/reports/cooling Technology collaboration programmes (TCPs) on efficiency, heat pumps, solar heating and cooling to organise international collaborative RD&D as well as knowledge exchange, market and policy recommendations

<p>Clean Energy Ministerial (CEM) (global forum consisting of 24 countries and the European Commission; the IEA hosts its Secretariat)</p> <p>Super-efficient Equipment and Appliance Deployment (SEAD) Initiative is a voluntary collaboration among governments working to promote the manufacture, purchase, and use of energy-efficient appliances, lighting, and equipment worldwide.</p>	<p>Joint Statement in support of the Call to Action, to set countries on a trajectory to double the efficiency of key products (including AC) sold globally by 2030</p> <p>As of February 2022, 14 SEAD members have endorsed the Joint Statement</p> <p>¹</p>				<p>Knowledge products on the website</p> <p>SEAD Initiative has developed the Energy Performance Ladder framework, which brings together multiple policies under a single consistent set of performance thresholds</p>
<p>International Renewable Energy Agency (IRENA)</p>					<p>IRENA together with IEA and the Renewable Energy Policy Network for the 21st Century (REN21) published: Renewable Energy Policies in a Time of Transition: Heating and Cooling outlines the infrastructure and policies needed with transition pathways.</p> <p>https://irena.org/newsroom/pressreleases/2020/Nov/Urgent-Action-Needed-for-the-Energy-Transition-in-Heating-and-Cooling</p>
<p>Multilateral development banks</p>				<p>Multilateral development banks are increasingly supporting</p>	

¹ <https://superefficient.org/cop26-call-to-action>

				<p>financial institutions developing green building products and services. For example, just over the last year, the IFC has begun support for the following institutions: HDFC and Aavas Financiers Ltd (India); OCBC NISP (Indonesia); Commercial International Bank of Egypt; and Business Partners Ltd (South Africa).</p>	
<p>World Bank Energy Sector Management Assistance Program (ESMAP)</p> <p>The Efficient, Clean Cooling Initiative was established in 2019 thanks to an initial US\$3 million grant to ESMAP from the Clean Cooling Collaborative (formerly the Kigali Cooling Efficiency Program K-CEP)</p>	<p>collaboration with public, private, non-governmental, and philanthropic partners to help raise awareness around efficient, clean cooling opportunities in emerging markets.</p>			<p>help countries develop the necessary market infrastructure, financing mechanisms, and policies and regulations to deploy sustainable cooling at scale</p> <p>developing a Cooling Facility to channel concessional climate finance from the Green Climate Fund to co-finance IBRD- and IDA-financed operations</p>	<p>generates knowledge and facilitates knowledge exchanges to further expand the reach of the sustainable cooling agenda, and actively engages</p>
<p>ADB</p> <p>e.g. Disease Resilient and Energy-Efficient Centralized Air-Conditioning Systems</p>				<p>ADB aims to test and demonstrate innovative solutions that will improve energy efficiency, mitigate the risks of virus transmission, and ensure safe working conditions in public buildings by deploying efficient, clean, and smart CAC systems.</p>	

IFC TechEmerge Program				TechEmerge will match innovative companies from across the world with leading companies, energy service providers, and other organizations in emerging markets to pilot climate-smart, energy-efficient cooling technologies, products, and services and build commercial partnerships. https://www.techemerge.org/basic-page/sustainable-cooling	
City Networks					
C40 Cities Climate Leadership Group (C40) Municipal Building Efficiency Network				Support for municipal building efficiency activities	Knowledge products e.g.: How to finance the retrofit of municipal buildings. How to use reporting and disclosure to drive building energy efficiency. How to set energy efficiency standards for new buildings.
C40 Cities Climate Leadership Group (C40) Net Zero Carbon Buildings Declaration	pledge to enact regulations and/or planning policy to ensure new buildings operate at net zero carbon by 2030 and all buildings by 2050.	Pledge to establish a roadmap and develop a suite of supporting incentives and programmes.	Report annually on progress towards meeting targets, and evaluate the feasibility of reporting on emissions beyond operational carbon (such as refrigerants).		
C40 Clean Construction Action Coalition	Objective to halve emissions from the global built environment sector				Connecting existing efforts Facilitating dialogue Capacity-building and knowledge sharing Research and development

C40 Renewable Energy Declaration	Pathway related to cooling/heating: Maximising local renewable energy: Deploy clean energy systems for electricity, heating, cooling and cooking to achieve 50% of the assessed feasible potential within the city by 2030 and 100% by 2050.	Adopt a clear roadmap and strategy for our pathway objectives within two years of signing	publicly report every year on the progress made towards our goals.		
C40 Clean Energy Network				The Clean Energy Network supports cities in planning and implementing ambitious low carbon energy programmes for electricity, heating or cooling that will help them deliver net-zero carbon buildings and a renewable electricity supply by 2030. https://www.c40.org/networks/clean-energy-network/	
ICLEI - Local Governments for Sustainability (network of over 1,750 local and regional governments committed to sustainable urban development)	Overall objective to promote sustainable urban development			ICLEI does not directly fund or invest in local projects but provides technical consulting, training, and information services to build capacity, share knowledge, and support local governments	
Global Cool Cities Alliance (GCCA) supports strategies that increase the solar reflectance of urban surfaces such as roofs, walls, and roads as a cost-effective way to achieve				Build Tools for Implementers Promote Building Codes and Specifications, incorporating cool surfaces Supporting testing and rating infrastructure Facilitating training	Support replicate best practices, find expert partners, and share experiences with peers. Advance Research

significant cooling results.					
Businesses					
World Green Building Council, non-profit global network of national Green Building Councils	<p>advocates for halving emissions of the building and construction sector by 2030 and the total decarbonisation of the sector by 2050</p> <p>The Net Zero Carbon Buildings Commitment calls on the building and construction sector to take action to decarbonise the built environment, inspire others to take similar action, and to remove barriers to implementation. The Commitment requires that by 2030:</p> <p>Existing buildings reduce their energy consumption and eliminate emissions from energy and refrigerants removing fossil fuel use as fast as practicable (where applicable). Where necessary, compensate for residual emissions. New developments and major renovations are built to be highly efficient, powered by renewables, with a maximum reduction in embodied carbon and compensation of all residual upfront emissions.</p>	<p>The Net Zero Carbon Buildings Commitment Signatories must:</p> <ul style="list-style-type: none"> Evaluate the current energy demand and carbon emissions from buildings, and identify opportunities for reduction Establish a bespoke roadmap to reach net zero carbon municipal buildings Demonstrate further leadership through core business activities, as a catalyst for further action within their respective supply chains <p>Quality Assurance Guide for Green Building Rating Tools</p>	<p>The Net Zero Carbon Buildings Commitment Signatories must:</p> <ul style="list-style-type: none"> Report annually on progress towards meeting targets and verification of performance at individual building and portfolio level 	WorldGBC consists of regional councils and provides them with the tools and strategies to establish strong organisations and leadership positions in their countries.	<p>Provision of knowledge and learning</p> <p>e.g. good practices of the world's most cutting edge sustainable buildings.</p> <p>Decarbonizing construction: Guidance for investors and developers to reduce embodied carbon</p>

	<p>https://www.worldgbc.org/thecommitment has more than 140 signatories from industry, regions, cities and building councils</p>				
<p>Zero Carbon Buildings for All, co-ordinated by World GBC,</p>		<p>National and local leaders, to develop and implement policies to drive decarbonization of all new buildings by 2030 and all existing buildings by 2050</p>		<p>Financial and industry partners, to provide expert input and commit \$1 trillion of market action by 2030. Financial institution supporters include African Development Bank, International Finance Corporation, Investment Fund for Developing Countries (Denmark), European Bank for Reconstruction and Development, European Investment Bank, and others. https://www.worldgbc.org/news-media/zero-carbon-buildings-all-initiative-launched-un-climate-action-summit</p>	
<p>World Business Council for Sustainable Development</p>		<ul style="list-style-type: none"> 1. Ambition to reach Net Zero GHG emissions no later than 2050 and have a science-informed plan to achieve it, (natural Climate Solutions and other carbon removal solutions) Report progress annually in standard, 	<p>Report progress annually</p>		<p>brings together leading companies in the built environment to develop pathways for a fully decarbonized and circular built environment We help share knowledge and develop guidance and tools</p>

		<p>external communication of the company;</p> <ul style="list-style-type: none"> 2. Set ambitious, science-informed, short and mid-term environmental goals that contribute to nature / biodiversity recovery by 2050. 			<p>developed the Building System Carbon Framework. The Framework is an assessment tool representing the carbon emissions in the buildings and construction system. It helps companies understand where emissions occur all along the value chain and how they can work together to reduce them through a whole life-cycle approach.</p>
<p>The Climate Group EP100</p> <p>EP100 is a global initiative led by the international non-profit Climate Group, bringing together over 120 energy smart businesses committed to measuring and reporting on energy efficiency improvements.</p>	<p>Through the EP100 Cooling Challenge, EP100 members commit to identifying ways of cooling their operations as efficiently as possible – optimizing the contribution of efficient, clean cooling in meeting their energy productivity goals.</p>				
<p>Net Zero Asset Managers Initiative, a group of 128 institutional investors collectively representing \$43 trillion in assets under management</p>	<p>pledge to reach net zero carbon emissions by 2050</p>	<p>Specifically, my organisation commitment to:</p> <p>Set an interim target for the proportion of assets to be managed in line with the attainment of net zero emissions by 2050 or sooner</p> <p>Review interim target at least every five years, with a view to ratcheting up the proportion of AUM covered</p>	<p>Publish TCFD disclosures, including a climate action plan, annually, and submit them to the Investor Agenda via its partner organisations for review to ensure the approach applied is based on a robust methodology, consistent with the UN Race to Zero criteria, and action is being taken in</p>		

		<p>until 100% of assets are included</p> <p>Work in partnership with asset owner clients on decarbonisation goals, consistent with an ambition to reach net zero emissions by 2050 or sooner across all assets under management ('AUM')</p>	<p>line with the commitments made here</p>		
<p>Paris Aligned Investment Initiative (PAII)</p> <p>established in May 2019 by the Institutional Investors Group on Climate Change (IIGCC) to provide a member-led forum to explore how investors can align portfolios to the goals of the Paris Agreement</p>					<p>The Net Zero Investment Framework is a blueprint enabling investors to decarbonise investment portfolios and increase investment in climate solutions, in a way that is consistent with and contributes to a 1.5°C net zero emissions future.</p>
<p>UN-convened Net-Zero Asset Owner Alliance a group of 43 of the world's largest investors that have committed to reducing carbon emissions in their portfolio – worth \$6.6 trillion in AUM – to net-zero by 2050.</p>	<p>committed i) to transitioning their investment portfolios to net-zero GHG emissions by 2050 consistent with a maximum temperature rise of 1.5°C above pre-industrial levels</p>	<p>The Protocol explicitly sets out how individual members will set a target, achievable in the next five years.</p>	<p>setting and reporting on 5-year interim targets, including targets for company engagement.</p>		
<p>Net-Zero Banking Alliance Industry-led, UN-convened</p> <p>https://www.unepfi.org/net-zero-banking/commitment/</p>	<p>Within 18 months of joining, set 2030 targets (or sooner) and a 2050 target, with intermediary targets to be set every 5 years from 2030 onwards.</p>		<p>Within 12 months of setting the targets, banks shall publish, at a minimum, a high level transition plan providing an overview of the categories of actions expected to be</p>		<p>Guidelines for Climate Target Setting for Banks</p>

			undertaken to meet the targets and an approximate timeline		
other networks or Initiatives					
GBPN Global Buildings Performance Network				We commence with a policy planning (Plan) with our methodologies adapted to fit local contexts. Coalitions are formed to facilitate collaboration between policy influencers and to develop/endorse policy plan. Technical Assistance by local experts is arranged to support policy adoption (Adopt) and implementation (Do).	experience and insights generated through policy implementation programs is captured and shared via global evidence base
Science Based Targets initiative (SBTi) The SBTi is a partnership between CDP, the United Nations Global Compact, World Resources Institute (WRI) and the World Wide Fund for Nature (WWF). The Science Based Targets initiative (SBTi) drives ambitious climate action in the private sector by enabling companies to set science-based emissions reduction targets.	Construction sector acts on science-based targets More than 200 companies from the sector have committed to the Science Based Targets initiative (SBTi) to reduce their emissions in line with climate science.			SBTi launched a project in 2018 to develop target setting methods, target validation criteria and recommendations, a target setting tool, and a guidance for financial institutions to align their lending and investment portfolios with the ambitions of the Paris Agreement To date, more than 70 financial institutions have publicly committed to set emissions reduction targets through the SBTi.	
Building to COP coalition Joint initiative of C40, Global ABC, WBGC etc. In cooperation with UN High Level Climate Champions	By 2030, 100% of new buildings must be net-zero carbon in operation and embodied carbon must be reduced by at least 40%, and by 2050, all new and existing	Suggestion that all countries include full building decarbonisation targets, concrete policies and measures and related implementation mechanisms in their NDCs.			

COP26 Presidency	assets must be net zero across the whole life cycle.				
<p>The Efficient Cooling Initiative brings together governments, intergovernmental organizations, and the private sector</p> <p>It is a part of the Climate and Clean Air Coalition.</p> <p>Secretariat is hosted by the United Nations Environment Programme (UNEP).</p>	<p>The aim is to enhance energy efficiency in the cooling sector while countries implement the phase-down of HFC refrigerants under the Montreal Protocol.</p> <p>High-level events, e.g. high-level ministerial roundtable, to raise awareness on the need to improve energy efficiency, on efficient alternatives and technologies and market transformation,</p>				<p>disseminating best practices and lessons learned and increasing communication between important actors</p> <p>Showcasing alternative refrigerants and technologies</p> <p>Organizing a series of events focused on identifying financial frameworks to support improvements in energy efficiency in the cooling sector</p>
<p>Cool Coalition</p> <p>120+ partners through an official membership including countries, cities, private sector, finance and civil society</p>	<p>Race to zero: 14 cooling suppliers have joined the Race to Zero, representing 28% of the residential AC market. They are ready to supply solutions aligned with their customers' net-zero commitments</p> <p>During design, K-CEP funders hypothesized that buyers' and/or sellers' clubs could be an effective mechanism for expanding the market share of high efficiency cooling technology. While K-CEP explored several</p>			<p>develop methodologies, templates and tools for National Cooling Action Plans development, support country development, training and implementation.</p> <p>convening work between DFIs to provide guidance to countries, and link support for NCAP development to implementation readiness and broader climate finance²</p>	<p>Building an active learning community</p> <p>creating new knowledge, tools, trainings and high-level advocacy. increase knowledge and awareness by collecting case studies and best practices of nature-based cooling, Renewable Energy Cooling</p> <p>Collecting cooling publications published since 2015 into a database</p>

² Global-Cooling-Collaboration-SEforALL

	means of supporting formation of such clubs, there was not sufficient interest or uptake, so funds originally allocated for this were redirected to more promising work.				
<p>Clean Cooling Collaborative</p> <p>a collaboration among 18 foundations with a secretariat assembled by and housed within the ClimateWorks Foundation</p> <p>Originally started as Kigali Cooling Efficiency Program (K-CEP)</p> <p>In 2021, re-named to Clean Cooling Collaborative</p>	Aim to help developing countries transition to energy efficient, climate-friendly, affordable cooling solutions	<p>e.g. Testing program to verify the accuracy of energy efficiency and refrigerant certifications for ACs</p> <p>Supporting global efforts to improve standards and labeling for efficient cooling³</p>		<p>joint commitment of \$52 million to help developing countries transition to energy efficient, climate-friendly, affordable cooling solutions.</p> <p>Objective to mobilize over \$600 million in finance for cooling</p> <p>Support the proposal, adoption, or implementation of cooling appliance standards and labeling programs around the world</p> <p>K-CEP 25 cooling policies, standards, or programs have been proposed, adopted, and implemented in 15 countries</p> <p>K-CEP:10 countries that applied to the NDC Support Facility have added new cooling commitments to their 2020/21 enhanced NDCs</p>	K-CEP knowledge products and briefs
SEforALL-led initiative to drive investment and policy action on access to cooling in				Support to governments and development partners to mobilize finance and expand	In September 2017, SEforALL convened a Global Panel on Access to Cooling to identify challenges and

³ K-CEP-Phase-I-Impact-Report

<p>support of SDGs⁴.</p>				<p>access to cooling with policy and technical assistance⁵</p>	<p>opportunities. The Global Panel is made up of leaders in business, philanthropy, policy and academia who work together to guide the work of the Cooling for All Secretariat, hosted at SEforALL.</p> <p>Knowledge and data, including the Chilling Prospects series Events and webinars, in partnership with the Cool Coalition⁶</p>
<p>U4E is a public-private partnership led by UNEP, the Global Environment Facility (GEF), the United Nations Development Programme (UNDP), the International Copper Association (ICA), CLASP and the Natural Resources Defense Council (NRDC) with the support of other international partners.</p> <p>https://united4efficiency.org/</p> <p>it is a part of SEforALL Accelerator. In 2014, Sustainable Energy for All</p>				<p>Support countries to advance policies, strategies and actions for the phase-out of inefficient air conditioners and refrigerators.</p> <p>AIR CONDITIONERS Technical documents recommending adoption of common evaluation method of air conditioners by ASEAN Member States; Update ASEAN Regional Policy Roadmap on Air Conditioners; Update National Policy Roadmap on Promotion of Higher Efficiency Room Air</p>	<p>Develop U4E Model Regulation Guidelines for energy-efficient and climate-friendly air conditioners⁷</p> <p>U4E Global Map includes Country Savings Assessments showing the potential financial, environmental, energy, and societal benefits that are possible with a transition to energy-efficient lighting, refrigerators, room air conditioners, electric motors and distribution transformers.</p>

⁴ <https://www.iisd.org/articles/global-governance-sustainable-energy>

⁵ Global-Cooling-Collaboration-SEforALL

⁶ Global-Cooling-Collaboration-SEforALL

⁷ Ensuring the climate benefits of the Montreal Protocol- Global governance architecture for cooling efficiency and alternative refrigerants

<p>(SEforALL) launched the Global Energy Efficiency Accelerator Platform to help realize this objective. The SEforALL Appliances and Equipment Accelerator is committed to transforming these markets towards energy-efficient products.</p> <p>https://www.seforall.org/partners/appliances-and-equipment-accelerator-u4e</p>				<p>Conditioners of ASEAN Member States; Provide technical recommendations on adoption of harmonized evaluation standards https://united4efficiency.org/country-regional-activities/asean/</p> <p>ECOWAS Refrigerators and Air Conditioners initiative (ECOFRIDGES) Develop Financial Mechanisms to promote efficient, climate-friendly refrigerators and air conditioners, with eligibility criteria adapted from U4E's Model Regulation Guidelines https://united4efficiency.org/country-regional-activities/ghana-senegal/ https://united4efficiency.org/ecofridges-closes-deals-with-four-commercial-banks-in-ghana-to-offer-green-on-wage-financing-go/</p>	<p>knowledge products on the website</p>
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PARTICIPANTS



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