



CONSTRUCTION & CLIMATE

Global public procurement factsheet



This factsheet provides an overview of the challenges and opportunities facing the construction sector in the context of global climate emergency. It summarises the innovative actions GLCN cities have taken to address those issues locally through public procurement.

Background

The global construction sector is currently booming, growing by over 6% an annum and expected to reach nearly US\$ 11 billion by 2023, [as research shows](#).

Whilst necessary to accommodate for housing, work, leisure and public services, the expansion of the building sector is associated with important challenges in a context of climate crisis and resource depletion. In particular:

★ **Buildings are resource-inefficient:** In the European Union alone, [it is estimated](#) that roughly 75% of buildings are resource-inefficient and this leads to a significant waste of energy, contributing to unnecessarily high running costs and an excessive carbon footprint. According to data, the construction and operation of buildings account for around 40% of resources use, 25% of water use and 40% of energy use worldwide ([IRP 2017](#)). [Estimates](#) show that renovating existing buildings could reduce total energy consumption by 5-6% and lower carbon dioxide emissions by about 5% (in the EU). Renovation regularly delivers a better environmental performance than a “demolish and rebuild” approach, in many cases at equivalent or lower costs. However, on average, only 1% of the national building stock is renovated each year, showing significant scope of improvement on that front. [Research](#) has however identified two strong barriers to the implementation of refurbishment projects: high upfront costs (whether actual or perceived) and insufficient skills in the construction industry. The challenge is to incentivise refurbishment of buildings to improve their energy performance and resilience to climate change, thereby avoiding new construction and reducing the material and energy demand for the sector.

→ #EnergyWaste → #EnergyEfficiency

→ #RetrofitBuildings

★ **GHG emissions and climate footprint:** Throughout their lifecycle (construction, operation, demolition etc.), buildings and infrastructure works account for over one third of greenhouse gas emissions globally ([UN 2017](#)). The **type and origin of materials** used in the construction of buildings and infrastructure have an extensive impact on its climate impact and environmental performance. Well-known challenges include the following:

- **Extraction and transport:** According to the European Commission ([COM \(2014\) 445](#)), in the EU, construction activities account for almost 50% of the demand for raw materials. Where no efforts are made to promote the use of local, recovered, recycled or low-impact materials, the carbon emissions embodied in the extraction and transport of construction materials are significant.
- **Insulation properties:** Material choices at the design stage also strongly impact the energy performance of buildings in use. Across the EU, nearly 35% of the buildings have a low (D or below) energy rating ([Rics Data Services 2020](#)), and this poor performance can partly be attributed to the use of materials without satisfactory insulation properties ([Yüksek 2015](#)).
- **Barriers to reuse:** The choice of design and construction materials impact not only the carbon footprint of buildings during construction and use, but also their end-of life environmental impact. Materials which are difficult to identify, repair or disassemble or which contain harmful substances will make buildings more challenging to refurbish. They will also increase the costs and difficulty of salvaging and recycling usable materials upon demolition. Choosing materials which

are easily maintained and can be dismantled for reuse or recycling is therefore key to increase resource efficiency in the construction sector ([European Environment Agency 2020](#)).

- **Urban Heat Islands:** The extensive use of traditional concrete and brick materials in construction also contributes to urban heat island effects ([Wonorahardjo et al. 2020](#)), an increasingly challenging issue in the context of global warming. This phenomenon is enhanced in cities with a large building footprint, where built up areas do not leave much room for green space. This effect can be mitigated by choosing reflective materials and integrating nature-based solutions, such as green roofs and facades or permeable pavements, into the built environment.

In addition, **layout, scaling, landscaping and internal design decisions** can all contribute to the environmental impact of a building in use. Oversized buildings leading to a wasteful use of land energy ([Bierwirth and Thomas 2019](#)), inefficient heating and cooling systems ([US Department of Energy 2015](#)) and facilities which promote a reliance on private transport vehicles all contribute to the adverse climate impact of buildings. Finally, design choices made for new buildings affect not only their carbon footprint, but also their vulnerability to climate change. Increased occurrences of extreme temperature and flooding pose a clear threat to the durability of buildings which are constructed without due regards to those risks ([Opach et al. 2020](#)).

→ #GHGemissions → #SustainableConstructionMaterials
→ #SustainableDesign → #LifeCycleCostingApproach

- **Vulnerability of the built environment:** As flooding and extreme temperatures become more common, buildings need to adapt to ensure they can perform their functions safely ([Stagrum et al. 2020](#)). The use of heavy machinery to transport material to-and-from and run operations on site also contribute to the environmental impact of construction. In London alone, a recent study showed that emissions from building site machinery accounted for up to 150,000 tons of CO₂ emissions per annum ([Bellona Foundation 2019](#)). Throughout extended construction periods, building site traffic and operations also regularly contribute to congestion in cities, noise pollution and poor local air quality. In addition, linear construction and demolition practices generate extensive amounts of waste. By weight, construction and demolition waste represents ca 25-30% of the waste produced annually in the European Union, whilst the USA generates ca 550 million tons of such waste in a typical year. The transport, landfilling or incineration of this waste are all associated with strong adverse environmental impacts. Discarding potentially re-usable materials also constitutes a missed

opportunity to reintroduce them in the economy, fuelling the need to extract new materials and contributing to the depletion of primary resources and increased emissions.

→ #Pollution → #ExtremeWeatherEvents → #Waste

- **Energy poverty:** In the European Union alone, between 50 and 125 million people are currently unable to benefit from proper indoor heating and cooling systems because of high energy costs ([BPIE 2014](#)). As many people across the world suffer from improper access to thermal comfort, it is key to ensure that the move towards better insulated and resource-efficient buildings benefits everyone.

→ #EnergyPoverty

- **COVID-19 recovery:** In the context of the global pandemic, thanks to its ability to create jobs, the construction sector can play an important role in the resilience of regional economic activities and, at the same time, can support the transition towards sustainability and digitalisation ([ILO 2021](#)). In the EU, the construction sector provides 18 million direct jobs and contributes to about 9% of the EU's GDP ([EU Commission](#)).

→ #Pandemic

The Power of Public Procurement

Through their role of commissioning construction and demolition works and owning and occupying buildings, city governments have an important part to play in improving the performance of the sector. In 2014, buildings owned or managed by public authorities made up more than 10% of the overall building stock in the EU, and public works contributed to around 40% of the construction turnover ([SMARTSPACES 2014](#)). By spending this money in an environmentally-aware and socially-conscious way, cities can drive the transition towards a more sustainable construction sector.

Public authorities around the world own, occupy and operate a significant number of buildings. Whilst no figures are available at a global scale, Germany alone is host to roughly 186,000 public buildings, and those offices, schools, hospitals, social housing blocks, etc. cost the country's public authorities €3.4 billion per annum in energy expenditures ([DENA](#)) and a significant carbon footprint is associated with these costs.

"Sustainable construction practices through public procurement can provide several benefits" says María Celeste Lemos of the Environmental Policy and Strategy Directorate of the Environmental Protection Agency, City of Buenos Aires. *"Among them are health and well-being, lowering emissions, economic savings, uptake of renewable energy solutions and optimized use of resources"*. [Learn more](#).

GLCN commitments on construction

GLCN cities are fully determined to use their purchasing power to deliver cleaner and healthier buildings. This is reflected in a list of targets that 5 of the network's cities have set for themselves on the topic:

Denver:

The city will achieve a 20% reduction in the energy used by the buildings it operates by 2020, from a 2011 baseline.

Helsinki:

- All new municipal buildings, where the design phase has started in 2020, will be at least 20% more energy efficient than the national baseline requires. Where feasible, PVs and ground source heat pumps will be installed as well.
- All new city's multi-storey apartment buildings designed in 2020 and onwards will belong in energy performance class A, which is 16 % more energy efficient than the national baseline requires. Solar PV systems will be installed to all new housing, and ground source heat pumps when feasible.
- By the end of 2025, all city of Helsinki's construction sites will be fossil free.
- By 2030, in addition to construction sites being fossil free, at least 50% of construction machinery and site transports will be powered by electricity, biogas or hydrogen.

Seoul:

- By 2020, all new city-owned buildings will be 'best in class' certified and achieve grade 1 energy efficiency.
- By 2020, all indoor lighting in public buildings will be replaced by energy-efficient LED lighting.

Oslo:

- By 2025, all construction machines and vehicles used on municipal construction sites will be zero-emission. Until then, machines and vehicles have to be run on fossil free diesel.
- The municipality of Oslo requires all private and public construction sites within the city's borders to be fossil free.
- In all municipal tenders, Oslo will use award criteria to promote zero emission machinery and vehicles on the building site.
- For new municipal construction works, the city will only commission public buildings which meet passive house standards.
- By 2020, the municipality will only be letting buildings that demonstrate low energy use performance. From 2020, it will only take leases on buildings meeting passive house standards.
- The city will continuously assess, develop and follow up measures to ensure safe and fair working conditions in all municipal building and construction contracts.

Rotterdam:

- By 2030, the amount of primary resources used under commissioned public works (including construction contracts) will be reduced by 50%.
- By 2030, the city will achieve a 40% reduction in the energy consumption of municipal buildings. By 2050, almost 100% of municipal buildings will be carbon neutral.
- By 2020, circularity principles will be integrated in 25% of the city's contracts (including construction). By 2030, 100% of contracts will include sustainability considerations.



Sustainable public procurement of construction in practice

As they strive to meet their targets, GLCN cities are finding innovative ways to use their procurement activities to deliver and operate more sustainable buildings. The below section showcases their activities, illustrating how sustainable public procurement practice can help address the environmental challenges associated with the transition towards greener buildings and infrastructure whilst promoting fair working practices in the construction sector.

The three following aspects of sustainable public procurement in construction are showcased:

1. Procuring the climate-friendly refurbishment of buildings
2. Procuring climate-friendly and resilient design
3. Procuring low-impact construction practices

Cities in action

Helsinki's life-cycle costing approach to make the business case for refurbishment

In 2019, the City of Helsinki demonstrated good practice in the preparation of a business case for the energy-efficient refurbishment of public housing. By procuring a study comparing the life-cycle environmental and cost performance of the refurbishment and adding wood structured storeys of city-owned affordable housing buildings with the impact of a 'demolish and rebuild' approach, it managed to obtain political buy-in for the refurbishment approach.

This case study illustrates the importance of preliminary research in informing green public procurement choices in the construction sector. Given the high capital costs and the complex environmental challenges created by construction activities, a robust comparison of cost and carbon impacts of a refurbishment versus new build approach is essential in supporting effective decision-making and the choice of the most appropriate solution.

More information on this case study can be found [here](#).

1. Procuring the energy- and resource-efficient renovation of existing buildings

The challenges

- #GHGemissions
- #EnergyWaste
- #EnergyEfficiency
- #RetrofitBuildings
- #LifeCycleCostingApproach
- #Pandemic

What can public procurement do?

Public authorities are well placed to lead the way towards the large-scale refurbishment of cities' old building stock. Using their procurement powers to commission energy refurbishments on their premises would lead to long-term savings on running costs supported by greater energy efficiency. Adopting a life-cycle costing approach in preparation of a procurement can help public procurers make the case for such intervention.

By contracting energy- and resource-efficient refurbishment of their building stock, city governments can additionally help the local construction market develop skills in this area. In turn this may help improve opportunities for other stakeholders to commission similar refurbishment works.

Cities in action

Denver's ambitious plan to increase the sustainability of public buildings

GLCN member Denver is a true leader in the procurement of climate-friendly refurbishment works in public buildings. In 2019, the city set for itself a target that 256 of its municipal buildings will be run exclusively on renewable energy by 2025. By delivering on this commitment, it will help the city to reduce its emissions by circa 62,000 tons of CO₂ and save US \$1 million per year in electricity costs.

As of 2019, the city achieved 18% of the target. The procurement of energy efficiency retrofits in existing buildings has been key in contributing to this performance.

More information on this case study can be found [here](#).

2. Procuring climate-friendly and resilient design

The challenges

- #GHGmissions → #SustainableConstructionMaterials
- #SustainableDesign → #Pollution
- #ExtremeWeatherEvents → #Waste
- #LifeCycleCostingApproach → #Pandemic

What can public procurement do?

As mentioned before, the choice of materials, as well as layouting, scaling and internal design choices are crucial when it comes to climate resilience. The challenge for Public Administrations is to commission buildings with sustainably-sourced materials that are designed with a lifecycle perspective to have a low-carbon impact and serve their function with resource-efficiency. When commissioning new buildings or infrastructure works public authorities have significant opportunities as construction clients to impact their design (See [FutureBuilt's published design criteria for circular buildings](#)). By applying sustainability criteria in the tender process, they can encourage a radical change in conventional design practices.

Examples of approaches they can adopt to promote a more sustainable design include:

- Asking contractors to use a **life-cycle costing** approach
- Encouraging designers to adopt **circular thinking** throughout the lifecycle of the building. (e.g. maximise the use of recycled construction materials, propose a flexible design allowing modification and repurpose over the building's lifetime, plan for eventual dismantlement of the building at the end of its life through the use of material passports that allow for a better identification and re-use of materials) ([EU Commission 2020](#)).
- Requiring the use of highly **sustainable materials**, with low embodied carbon and no harmful substances (e.g. environmental product declarations (EPDs) can certify the environmental performance of key construction products).
- Asking for **nature-based solutions** (see [EU Commission](#))/ **green spaces** to be included in the site proposals.
- Requiring designers to include features promoting the use of **sustainable transport** in the plans (cycle parking and showering facilities, safe and welcoming public space around the building).

- Requesting the achievement of a certain level of **energy performance** in use.
- Using sustainable building **certification schemes** (such as [BREEAM](#) or [LEED](#)) to ensure high sustainability performance is achieved comprehensively.

Cities in action

Using certifications to procure sustainable building design in Seoul

In 2001, the South Korean Government launched its own building sustainability certification scheme. The system helps to assess the climate and environmental performance of buildings according to nine indicators, including the carbon footprint of materials, energy efficiency, transport accessibility, green space quality and ratio, etc. (See [Korean Green Building Certification](#)).

Building on the familiarity of the market with this certification system, the City of Seoul decided to embrace it through all of its procurement activities. As of 2020, any new building over 3,000 m² built for public administrations in the city is required to acquire the highest certification grade in the energy efficiency category. ([Learn more](#)).

Through this standard approach, the city will help mainstream outstanding energy performance in the design of all public buildings, contributing to systemic change within the local building sector.



Cities in action

Promoting circular demolition in Helsinki

Helsinki is promoting circular demolition by piloting pre-demolition audits. The first pre-demolition audit was carried out in 2019 for a school and the aim was to test the new guidelines and the method published by the Finnish Ministry of the Environment. The purpose of the audit was to identify potential construction materials and building parts for reuse and recycling already during the demolition planning phase by using BIM (building information model) and identification on site. However, 93% of the demolition waste was recycled successfully, 63% of recycled concrete is not included in the recycling rate.

Based on the experiences gathered from the first pilot, three new pilots were launched to find out a more suitable level of contents for the pre-demolition audit. A lighter version of the audit will be carried out in two of the projects including BIM model and site visits as in the first pilot, but with a lower level of detail. In one of the pilots the identification is made simply by site visit and without the digital building model. The focus in these three pilots is to concentrate mainly on the construction materials and building parts with high end-use potential and make a concrete reuse action plan for them to ensure their reuse.

The ethics box

Making low-energy buildings for everyone: The City of Denver

Public authorities can leverage procurement to ensure that their efforts for energy-efficient buildings also help their most vulnerable community members. As a GLCN member, the city of Denver provides an example of good practice on this front. Since 2007, it has embarked on a journey to apply high sustainability standards to the construction of affordable housing units. For affordable housing projects funded or procured by the city, Denver requires that certain criteria regarding energy efficiency and access to sustainable transportation are met. This helps to both minimise the environmental impact of the new buildings and ensure that low-income residents can afford thermal comfort and green transportation.

More information on this case study can be found [here](#). See also: US Environmental Protection Agency (2011), [Energy Efficiency in Affordable Housing](#).

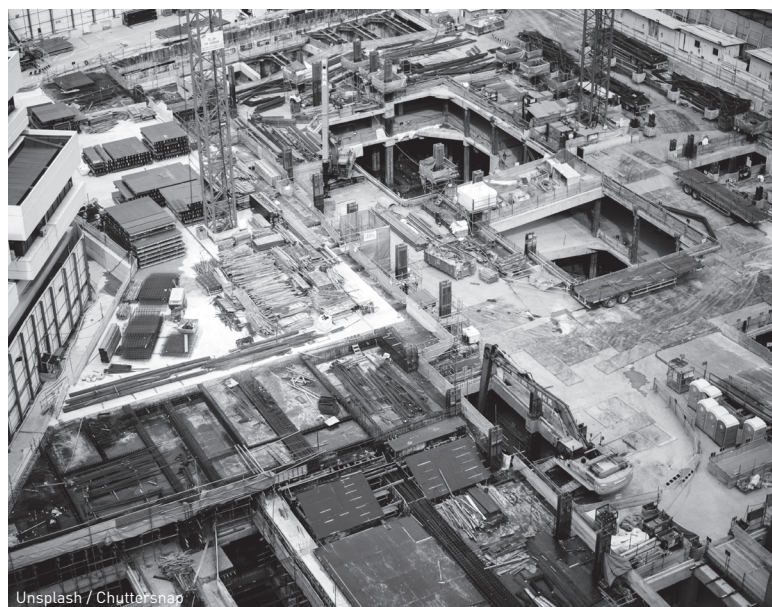
3. Procuring low-impact construction practices

The challenges

- #GHGemissions → #Pollution
- #ExtremeWeatherEvents → #Waste
- #LifeCycleCostingApproach → #Pandemic

What can public procurement do?

As public authorities commission building works, they have a significant scope to use their procurement powers to promote climate and environment-friendly construction practices. For example, when commissioning building works, procurers can encourage bidders to consider innovative ways to reduce the impact of the works. Off-site construction methods are a good example of an innovative construction practice which procuring authorities can encourage through tender criteria. Off-site building manufacturing methods often display a significantly lower environmental footprint than traditional construction techniques. [Studies](#) notably estimate that modular construction methods can reduce water and construction material use by 50%, decrease the waste of material on-site by up to 80% and reduce on-site construction times by up to 60%. Lower site traffic, raw material extraction requirements and waste handling needs can strongly contribute to reducing the carbon footprint of building sites, whilst also decreasing construction-related air pollution and noise. Promoting a low-emission approach to building sites, or the circular management of raw materials are additional ways in which public procurers can support a more responsible construction sector.



Cities in action

Procuring sustainable construction sites in Oslo

Among GLCN members, the City of Oslo provides an inspirational example when it comes to tackling the climate impact of construction practices.

Upon realising that construction machinery was responsible for nearly 30% of the total traffic emissions of the city, the local government entered a major consultation exercise with the construction industry towards identifying means to effectively lower the emissions.

The market engagement made it clear that technology could easily be developed so that clean alternatives replace high-emission construction vehicles. Starting in 2017, the city, as major developer and landowner, required the use of fossil-free construction machinery as a minimum criterion in all of its public procurement procedures.

Four kindergartens and two sports arenas have notably been constructed in line with this standard: on those construction sites, all diesel driven machinery and equipment were replaced with fossil-free alternatives. For more information, [click here](#).

An impressive achievement is the Olav Vs gate pilot, the first completely zero-emission site in the world, completed in 2020 by the City of Oslo. Here the construction site utilised mostly electrical machinery which in general operate similarly to the diesel machines, but are quieter and produce less on-site pollution ([learn more](#)). Oslo is aiming for zero-emission construction sites as standard for municipal works by 2025. This approach could bear significant potential for replication in other cities looking to use their procurement power to promote climate-friendly construction methods. [Learn more](#).

Cities in action

Procuring modular social housing in Budapest

In 2019, the GLCN member City of Budapest in collaboration with local housing associations and NGOs went out to procure a multi-story, prefabricated, modular social housing block. The building will accommodate 100 residents and offers different apartment sizes, reflecting the diverse housing needs of the prospective tenants. The modular construction method will contribute to significantly reduce the carbon footprint of the entire construction process. Cost savings resulting from off-site construction will also allow the city to invest more in the quality of the building, which will be carbon neutral, built according to circular economy principles, and include extensive communal green features.

More information on this case study can be found [here](#).

The ethics box

Ensuring fair working condition for construction workers in Oslo and Helsinki

The transition towards climate-friendly, circular construction practices in the public sector is essential to help address global environmental challenges. A truly sustainable procurement practice in the construction industry should however also take into account its social impacts.

With over 4.5 million construction workers worldwide estimated to be in forced labour ([Business and Human Rights Resource Centre 2019](#)), the sector is associated with significant violations of human rights.

As public authorities push for a transformation of the industry through green and circular public procurement practices, they have a unique opportunity to simultaneously help addressing the human rights abuses that exist in the sector.

GLCN city Oslo and Helsinki are leading by example in this area. In addition to environmental considerations, in Oslo all of the city's calls for tender in the construction sector include criteria requiring fair pay and working conditions for workers. Through such practice, public bodies can ensure that climate-friendly initiatives also hold contractors accountable and address social issues in the industry. In Helsinki, contracts seek to comply with the Act on Contractor's Obligations and Liability as well as the prevention of the grey economy.

Resources

EU Green Public Procurement Criteria for office buildings:

https://ec.europa.eu/environment/gpp/pdf/report_gpp_office_buildings.pdf

Report on zero-emission construction sites:

https://network.bellona.org/content/uploads/sites/3/2019/10/ZECS_Status2019.pdf

UK Green Building Council: Guide on tackling embodied carbon in building projects:

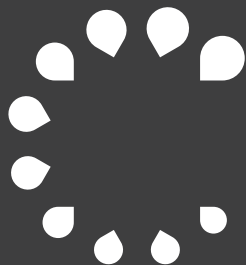
www.ukgbc.org/sites/default/files/Tackling%20embodied%20carbon%20in%20buildings.pdf

Circular Economy Principles for Building Design, European Commission 2020:

<https://ec.europa.eu/docsroom/documents/39984>

Big Buyers Initiative - Lessons Learned Report: Public Procurement of Zero-Emission Construction Sites:

https://sustainable-procurement.org/fileadmin/user_upload/Big_Buyers_Initiative/ZemCons/BBi-ZEMCONS-lessons-learned.pdf



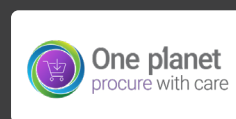
About the GLCN on Sustainable Procurement

The Global Lead City Network on Sustainable Procurement is a group of cities committed to drive a transition to sustainable consumption and production by implementing sustainable and innovation procurement. All participating cities are acting as ambassadors of sustainable procurement to lead to a resource efficient, low carbon and socially responsible society.

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