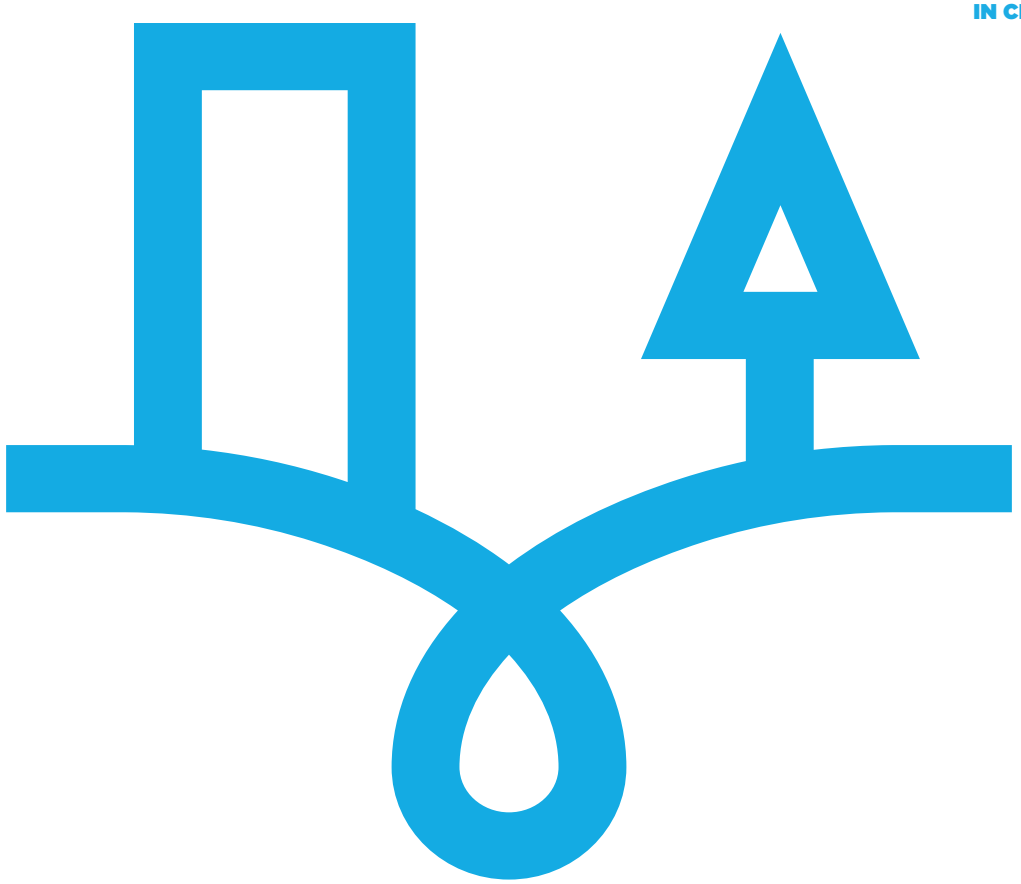
CIRCULAR ECONOMY IN CITIES



OPERATING AND MAINTAINING BUILDINGS FOR MAXIMUM, REGENERATIVE PERFORMANCE

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Reducing energy and water consumption in buildings is important in order to improve the use of resources, and to reduce operating costs and improve affordability. Predictive and timely maintenance prevents disrepair and keeps materials and components in use. For new building stock, taking appropriate actions in the design phase can ensure that buildings are energy- and water-efficient, but for all buildings (and particularly existing buildings which in many places account for a significant part of the urban building stock), ensuring good operational and maintenance practices is key. This can be significantly enabled through new business models (in which maintenance is incentivised), and smart, digital technologies.

CASE FOR CHANGE

30% of global energy consumption and **28%** of the world's energy-related CO_2 emissions are linked to the use of buildings[1]

Up to **21%** of water use in Europe happens in buildings[2]

Around **10%** of EU households struggle to pay their energy bills[3]

9/10 existing buildings in the EU will still be in use in 2050[4]

"In Italy between 2014 and 2015, the cost of ordinary and extraordinary maintenance works was around EUR 117 billion, while the construction sector was worth EUR 169 billion. Safeguarding existing stock was therefore equal to 70% of the building sector's entire turnover."

Antonio Disi, energy-efficiency expert, the Italian National Agency for New Technologies (ENEA) (2018)

EXAMPLES OF CIRCULAR ECONOMY OPPORTUNITIES

Using smart technology to run buildings effectively

Smart meters and connected devices can be applied in new and old buildings to optimise performance, reducing average energy and water use. Sensors can monitor the building's condition and predict maintenance needs, and prolong the building's lifespan.[5]

Using product-as-a-service models for building fit-outs

Building users can purchase building fit-out items, such as lighting, air conditioning, and carpeting, through new business models (known as performance-based or product-as-a-service business models). In these business models, users pay for the use of the products rather than the products themselves. The product-as-a-service provider retains ownership of the product and therefore also often the responsibility for the maintenance, upgrade, and take-back of the product, which incentivises improved performance, reduced operational costs, and places greater value on the maintenance and reuse of the product and components. The service provider is financially incentivised to provide solutions that are either or both reusable and durable, and energy- and resource-efficient.

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Repurposing buildings for alternative uses

To be kept in use, non-modular buildings can be adapted and reconfigured to serve a new purpose. For example, redundant commercial and public buildings can be converted into new and more adaptable spaces including housing, makerspaces, and office space. (See *Buildings: Designing)*

Refurbishing[6] buildings to run more efficiently

Refurbishing the existing building stock (which can include the opportunities above) can improve how efficiently buildings are used and operated. Refurbishing is generally less resource intensive than replacing old buildings with new ones and is therefore especially important in established cities where urbanisation has peaked and most of the building stock has already been built.[7]

RELEVANT CASE EXAMPLES

Procuring light as a service

Philips' 'pay per lux' solution provides lighting as a service to Amsterdam's Schiphol Airport on a performance contract basis. The system is designed to be cost- and resource-efficient. For example, Philips has developed specially designed light fixtures that are easier to service and maintain, making them last 75% longer than conventional alternatives. In addition, by using LED electricity, use can be reduced by up to 50%. The service operates through a collaboration between the Schiphol Group, the energy service provider Cofely, and Philips. This multi-party arrangement also enables the real-time management of the service, helping to ensure it is as reliable and effective as possible.[8]

Repurposing surplus retail space into community hubs and business incubators

Due to changes in the retail banking sector a range of Barclays' bank branches closed. This led Barclays to trial a new business support and incubator scheme in their place. Partnering with 3Space (a building management company), several empty branches were repurposed into co-working, event, and makerspaces, supporting community engagement and the growth of local start-ups. A 2,000 sq ft branch in Oxford, UK, became home to 48 start-ups and social organisations, with over 600 visitors and 29 events a month including maker meet-ups, coding classes, conferences, training sessions, innovation/technology education for the community, cultural events, and art exhibitions.[9]

Collaborative refurbishing project of municipal buildings, paid with energy savings

In 2008, Middelfart Municipality refurbished its publicly owned building stock consisting of 97 buildings (or 180,000 m^2). The project investment was DKK 44 million, and with 21% in annual energy savings generated (which exceeded the initial guaranteed savings), this investment was repaid in 10–11 years. By partnering with the energy service company (ESCO) Schneider Electric, the project was financed through a cost-neutral energy performance contract, in which the achieved energy savings covered the project investments.[10]

EXAMPLES OF WHAT URBAN POLICYMAKERS CAN DO

Asset management of existing buildings owned by the city is an important lever to ensure the efficient use of buildings. Asset managers can also inform **public procurement** to ensure maintenance work is conducted most cost effectively – for example by pooling tenders for lighting, fit-outs or refurbishment to achieve economies of scale and cost reductions. Through **legislation and regulation** some city governments can also ensure that the entire urban building stock fulfills certain energy- and resource-efficiency standards.

To explore further see **Policy Levers**

EXAMPLES OF LINKS TO OTHER SYSTEMS AND PHASES

Buildings: Designing Building design will have a significant impact on the operational efficiency of buildings and how easy they are to maintain or adapt.

Buildings: Making The use of 'buildings as a material bank' can also support the maintenance of buildings by giving owners greater awareness of the building's material content and age.

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EXAMPLES OF BENEFITS

ECONOMIC PRODUCTIVITY

Generating positive return on investment

Investing in extensive energy-efficient renovation gives a good return: EUR 1 invested by the government in renovations can return up to EUR 5 back to public finances within one year.[11]

Increasing GDP

A 2012 study showed that EUR 1 billion of energy-efficiency investments, had a positive impact on GDP of EUR 0.88–1.06 billion.[12]

Increasing productivity

Improving building insulation can lead to improved thermal comfort, and therefore reap productivity benefits. A study estimates that every EUR 1 invested in insulation, results in EUR 0.78 benefit in a reduction of days missed. Productivity improvements due to better air quality can reach 8–11%.[13]

JOBS, SKILLS, AND INNOVATION

Creating jobs, skills development and increasing competitiveness

Meeting a 40% energy savings target by 2030 in the EU could create 1–2 million local, direct jobs (especially in SMEs) as well as upskilling opportunities, while improving competitiveness and innovation in the construction and energy service industries.[14]

HEALTH AND ENVIRONMENT

Reducing GHG emissions

Meeting a 40% energy saving target in existing buildings in Europe by 2030 would reduce the sector's GHG emissions by 62.9% in the residential sector and by 73% in the non-residential sector. By 2050, deep renovation of the building stock could reduce the sector's GHG emissions by 90% compared to 1990 levels.[15]

COMMUNITY AND SOCIAL PROSPERITY

Reducing energy poverty

Improving the energy performance of buildings addresses a root cause of energy poverty. Increasing homes' energy-efficiency guarantees permanent energy savings and leads to lower energy bills for residents.[16]

RESOURCE USE

Reducing energy consumption through refurbishment

Through simple refurbishment solutions, it is possible to reduce energy consumption by 20–30% in existing buildings.[17] Deep refurbishment can cut building-related energy consumption in Europe up to 80%, saving the EU over 30% of its total energy use (equivalent of 4 billion barrels annually).[18]

Saving energy through smart technology

Current smart technologies have the potential of lowering the energy consumption of buildings by 10% globally.[19]

Reducing maintenance costs and extending building life

Predictive maintenance and analytics can currently save up to 20% annually on maintenance and energy costs, while increasing the projected lifetime of the building.[20]

Reducing water consumption

A smart meter system helps the IBM factory in Burlington to cut water use by 29% or USD 0.72 million annually.[21]

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ENDNOTES

1 UN Environment, *Global status report 2017: towards a zero-emission, efficient, and resilient buildings and construction sector* (2017) p. 14; International Resource Panel, *The weight of cities* (2018)

2 BIO Intelligence Service, *Water performance of buildings* (2012) p. 9

3 European Parliament, *Boosting building renovation: what potential and value for Europe?* (2016) p. 53

4 Renovate Europe, *Multiple benefits of renovating*, renovate-europe.eu

5 Arup, *The circular economy in the built environment* (2016) p. 36; Arup, *Smart city opportunities for London* (2016)

6 Refurbishing here used synonymously with renovation, deep renovation, and retrofit

7 European Parliament, *Boosting building renovation: what potential and value for Europe?* (2016) p. 22

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16 Renovate Europe, *Multiple benefits of renovating*, renovate-europe.eu

17 Ellen MacArthur Foundation, SUN, and McKinsey Center for Business and Environment, *Growth Within: a circular economy vision for a competitive Europe* (2015) p. 85

18 European Parliament, *Boosting building renovation: what potential and value for Europe?* (2016) pp. 21, 51, Renovate Europe, *Multiple benefits of renovating,* renovate-europe.eu

19 UN Environment, *Global status report 2017: towards a zero-emission, efficient, and resilient buildings and construction sector* (2017) p. 10

20 Schneider Electric, *Predictive maintenance strategy for building operations: a better approach* (2014) p. 4

21 Ellen MacArthur Foundation, *The circular economy opportunity for urban and industrial innovation in China* (2018) p. 50

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