G20 Global Smart Cities Alliance

WORLD ECONOMIC FORUM

MODEL POLICY

Adaptive Reuse of Assets

Contents

This policy is considered foundational to the G20 Global Smart Cities Alliance policy roadmap.

Background

Cities play a key role in advancing sustainability and net-zero goals. They currently account for 70% of global CO_2 emissions, primarily from fossil fuels used in industrial processes, motorized transportation systems and infrastructure constructed with carbon-intensive materials.[1] Despite some positive effects observed during the COVID-19 pandemic, the gap between the trajectory and decarbonization target for the buildings and construction sector is widening, and it appears unlikely to achieve net zero by 2050.

Achieving urban decarbonization and limiting global warming to below 1.5°C requires shared responsibility, the rapid implementation of best practices and multistakeholder collaboration. To make advancements, the World Economic Forum and partners are driving key climate initiatives with global leaders stressing that traditional "business-as-usual" approaches are no longer viable. Charting progress requires transformation across the public and private sectors and industries, including real estate.

In 2021, the Forum's Real Estate Industry community released a framework outlining a vision for the future of real estate, centred on liveability, sustainability, resilience and affordability.[2] To support this vision, the green building principles were introduced to drive decarbonization across real estate portfolios.[3] Efforts like the Davos Baukultur Alliance are committed to advancing high-quality design and planning, focusing on urban resilience, circularity and social value.

At the same time, the G20 Global Smart Cities Alliance helps cities tackle urgent challenges by bringing forth best practices through multi-stakeholder engagement. The Alliance's model policies on adaptive reuse of assets and the whole life carbon assessment mandate intersects these initiatives and helps to catalyse further progress globally. These initiatives are being advanced locally through tailored workshops, campaigns and dialogues to accelerate the net-zero transition.

Adaptive reuse involves repurposing existing buildings or structures for new uses to extend the asset's lifespan. By engaging in adaptive reuse projects (ARPs) instead of demolition and new construction, cities can realize benefits such as reduced embodied and operational carbon, economic stimulation, increased housing supply, job creation, community revitalization, and the preservation of cultural and architectural heritage.

ARPs vary in scale and scope, depending on the level of renovation and changes needed. Project types can range from operational efficiency upgrades to building code compliance and structural improvements that support new uses while extending the building's lifespan. Effective ARPs can offer a range of environmental, community and economic benefits:

Environmental benefits

Reusing built assets helps preserve resources from the initial construction and reduces embodied carbon – the emissions from raw material extraction, manufacturing, construction, maintenance, demolition, transport, waste and end-of-life impacts. By reducing the need for new materials, energy and water, ARPs can conserve resources and improve local air quality by diverting demolition waste from landfills. They also promote mixed-use commercial and residential spaces, placing residents, jobs and services closer together. Overall, adapting existing buildings rather than demolishing them can significantly reduce the environmental footprint of the building sector.

Community benefits

ARPs offer a range of community advantages and societal benefits. They can preserve cultural and architectural heritage by extending the life of buildings with historic or cultural significance. They can also help revitalize neighbourhoods by adding housing and increasing mixed-use to retain or create a renewed sense of place. Additionally, the activation of vacant or dilapidated spaces can increase public safety. ARPs can repurpose ageing and low-quality building stock into strong, durable community assets that improve surrounding quality of life and community well-being.

Economic benefits

Adaptive reuse can boost local economies and contribute to regional productivity and competitiveness by attracting investment and creating workforce

development opportunities, including temporary and permanent jobs. Adaptive reuse also has the potential to increase the market value of underutilized and converted assets, increasing property values and property tax revenues. These additional revenues benefit local governments, improving public services such as schools, emergency services, public transportation, parks, infrastructure maintenance and affordable housing.

An increase in the market value of an existing asset also provides an economic incentive to property owners and investors, providing gains through increased demand and higher returns. However, this can potentially be a community risk requiring careful measures and management to prevent exclusion and unintended community impacts.

How to use this model policy

This model policy can encourage adaptive reuse in cities to reduce the carbon footprint of their built environments, provide benefits to communities and boost local economies. The objective is to provide practical support to cities and stakeholders to achieve sustainability goals. It can offer city stakeholders a baseline for implementing a city policy, or ordinance that facilitates the retention and conversion of existing, underutilized, and/or historically significant built assets through adaptive reuse.

The private sector can use this policy to shape adaptive reuse ordinances in their cities. They can provide resources, knowledge and expertise to help shape policies to ensure real-world impacts, providing crucial perspectives as to how a policy may influence actual development outcomes. They may also use this policy as a practitioner's resource and reference tool, given that the policy contains numerous use cases and practical tools for adaptive reuse projects.

The model policy layout has four principles, each divided into sub-principles with supporting examples that list best practices and use cases. These examples are often cross-cutting and can support more than one principle. Several levers, enablers and incentives are highlighted in this policy to make adaptive reuse feasible for building owners, developers and planners, and to counter the potential challenges of adaptive reuse. These are also supported by potential risks that need to be considered and mitigated to capture the positive benefits of ARPs.

It is recommended to review the list of definitions at the end of this policy in interpreting and contextualizing the principles. This model policy should be considered in conjunction with the Whole Life Carbon Assessment Mandate Model Policy,[4] Adoption Playbook[5], the Practitioners Guide,[6] Nine Solutions for Greener Buildings and Communities, Green Buildings Principles[7], and the C40 Cities Clean Construction Policy Explorer and the Whole Life Carbon Buildings Playbook.

Model policy development

These guidelines were co-created by the Task Force on Sustainability and Smart Cities led by the G20 Global Smart Cities Alliance at the World Economic Forum in collaboration with C40 Cities and Infosys Ltd.

The model policy content is informed by various tried and practical existing policies by cities. The content was further informed by expert interviews and went through a review process. Model policy wording is derived from various existing policies, guidelines and best practices from around the world including:

Vancouver, Canada – Vancouver Vacancy Tax No. 115674 and the Embodied Carbon Guidelines[8]

Canada – Standard on Embodied Carbon in Construction[9]

London, England – The London Plan[10]

Finland – Procurement Requirements for Low-Carbon Buildings[11]

Milan, Italy – Milan Art. 40[12]

Los Angeles, California, USA – Los Angeles Adaptive Reuse Ordinance[13] (revised draft pending formal adoption)

Kirkland, Washington, USA – High-Performance Building Standards[14]

Boulder, Colorado, USA – Ordinance 8366[15]

New South Wales, Australia – Decarbonising Infrastructure Delivery Policy[16]

New Zealand – Building Performance Code Updates[17]

Denmark – National Strategy for Sustainable Construction and Building Regulations 20181[8]

The collection, analysis and additional work in this document aims to be a foundational guide for cities to build upon. The examples and use cases listed in the tables are not an exhaustive list and were selected through interviews and a landscape review conducted in 2024. Task force members do not endorse these examples; instead, they are showing samples and contextualized cases.

The task force members recommend that policy-makers and their communities adapt this model policy to their local and regional context and needs. Members also recognize that one size does not fit all, and that other local government-level policies and guidelines on this topic are likely to emerge over time from other regions of the world. While this model policy is foundational today, best practices evolve and update over time. Finally, a thorough determination of emerging practices from developing and emerging countries is needed.

Guiding principles

This section introduces the four guiding principles of the model policy for adaptive reuse of assets.

Principle 1

Cities are recommended to prioritize existing built assets, which are vacant, underutilized, or stranded[19] over new construction.

To further adapt and contextualize this principle, Box 1 shows several examples of how "vacant, underutilized, or stranded" built assets have been interpreted and applied in three cities.

BOX 1 **Extracted definitions from existing policies as a sample for prioritized assets**

1. Vancouver Vacancy Tax By-Law No. 115674[20]
    a. "Vacant" – Unoccupied for more than six months.
2. Milan Art. 40 bis Provisions relating to critically disused buildings[21]
    a. "Stranded" – Buildings that have been abandoned for more than one year, which are determined to be a danger to public safety, health, or inconvenience to decorum and quality urban life or create the presence of asbestos or other chemical dangers.
3. Los Angeles Adaptive Reuse Ordinance (revision pending formal adoption)[22]
    a. Existing buildings constructed in accordance with building and zoning codes in effect at the time they were built, for which at least 15 years have elapsed since the date of permitted and completed construction.
    b. Any parking structure or parking area within an existing building constructed in accordance with building and zoning codes in effect at the time they were built, for which at least five years have elapsed since the date of permitted and completed construction.

Principle 2

Adaptive reuse of existing assets should serve as a benefit to the community.

2.1 ARPs should have a fair and equitable consultation process that engages direct and indirect stakeholders, such as building owners, developers and community members, to have a voice in the conversion of use.

a. A fair and equitable process is defined as the practice of centring relevant stakeholders and communities, particularly marginalized groups in the policy-making, urban governance process, and policy enablers for the ARP.

2.2 Local planning departments should ensure ARPs use qualitative and/or community-based assessments (See Box 2 for examples).

2.3 Renovations, if needed, should prioritize retention of heritage value and long-term durability of existing fabric to avoid maladaptation. Heritage buildings or sites with historic and cultural value must preserve the integrity of the asset in accordance with local laws.

2.4 Adaptive reuse projects should be assessed and retrofitted to address the needs of persons with disabilities in accordance with local codes and standards, or the 2021 International Building Code (IBC) Chapter 11 Accessibility serving as a minimum threshold towards inclusive design (See Box 4: 6b).

BOX 2 Examples of community assessments

1. **Global Future Cities SDG Project** Assessment Tool[23]

This framework is designed to evaluate and guide urban development projects in alignment with the United Nations' Sustainable Development Goals (SDGs). It is developed to assist cities in addressing challenges (such as rapid urbanization, climate change and social inequality) to foster inclusive, resilient and environmentally sustainable cities worldwide.

a. **Assessing potential project impacts:** Aiming to assess project impacts across economic, social and environmental dimensions, the online SDG tool helps uncover strengths and weaknesses of an urban project, make improvements over time and monitor progress towards contribution to the SDGs.

b. **Practical information and recommendations:** The framework offers insights and recommendations to ensure that urban projects contribute positively to sustainable development.

2. **Australian Urban Research Infrastructure Network** (AURIN)[24]

AURIN empowers communities and informs policy-making by providing a comprehensive understanding of land use and urban challenges. AURIN provides accessibility, transparency and robust data analysis capabilities that make it a valuable resource for assessing community benefits and shaping policies that promote equity and sustainability in the built environment.

a. **Empower communities:** AURIN can be used to engage community members in decision-making by providing them with data and visualization tools on demographics, health, housing and more, which enables a more holistic approach to urban planning beyond environmental justice.

b. **Inform policy-making**: By integrating AURIN data into planning processes, policy-makers are better informed in urban planning, infrastructure development and social policy.

3. **Canadian Environmental Sustainability Indicators** (CESI)[25]

CESI empowers communities and informs policy-making by providing publicly accessible data on various environmental indicators. This allows communities to understand and engage with environmental data prepared collaboratively across the Canadian federal, provincial and territorial government departments.

a. **Empower communities:** CESI can be used to track Canada's performance on key environmental issues while also explaining how communities influence, as well as are influenced by the results.

b. **Inform policy-making:** The indicators are built on strict methodology and high quality. These are regularly available data from survey and monitoring networks. Social and economic drivers and information are provided on how the indicator results are influenced by consumers, business and governments.

BOX 2 **Examples of community assessments** (continued)

4. **US EPA Health Impact Assessment** (HIA)[26]

The US EPA's Health Impact Assessment (HIA) tool is a resource for evaluating the potential health effects of proposed policies, programmes and projects.

a. **Health determinants:** By systematically considering a wide range of health determinants, the tool helps decision-makers identify and address potential health impacts, ensuring that public health considerations are integrated into the planning and decision-making process.

b. **Evidence-based recommendations:** The tool promotes healthier communities by providing evidence-based recommendations to enhance positive health outcomes and mitigate adverse effects, thereby fostering well-being and equity in urban and rural development initiatives.

BOX 3 **Examples of community benefit case studies**

1. Circular Cleveland: Cleveland neighbourhood process[27]

Cleveland, Ohio, is transitioning from a linear to a circular economy in a collaborative effort between the Cleveland Neighborhood Process and the City of Cleveland. They have defined circular economy as a comprehensive and sustainable approach to providing community-wide benefits by designing waste and pollution out of our economic system, keeping products and materials in use as long as possible, protecting and regenerating natural systems, and creating new jobs.

The 30-month Circular Cleveland initiative with community workshops has awarded organizations grants to lead initiatives such as recycling and composting programmes, repurposing fabric and furniture, and leading workshops on repairing broken-down vehicles. Until July 2024, 14 groups and organizations were awarded funds for various activities including keeping products and materials in use. The effort hopes to advance better environmental and health outcomes for residents.

2. San Antonio: Community benefits of a circular economy[28]

San Antonio, Texas, is shifting from a traditional linear economy (make, use, dispose) to a circular economy model that prioritizes recycling and reuse of materials. The circular economy is defined here as where materials are recycled and reused will allow the city to recover and leverage existing assets to meet its stated economic, equity, sustainability, waste diversion and housing goals.

The adoption of a deconstruction ordinance, requiring the salvaging of materials from demolished buildings, is a key part of this effort. This change is expected to bring numerous benefits to residents and businesses, including increased employment opportunities. For instance, reuse and refurbishment activities create significantly more jobs per ton of waste (300 jobs per 10,000 tons) compared to traditional waste disposal methods (1-6 jobs per 10,000 tons).

3. London, UK: Battersea Power Station[29]

The adaptive reuse of the Battersea Power Station is a central feature of the broader redevelopment project in London, which has transformed a former industrial site into a mixed-use development while preserving its architectural and cultural heritage. This approach involves repurposing the historic power station, which was decommissioned in 1983, into a mixed-use development. The key aspects of this adaptive reuse include the preservation of historic architecture, modernizing current use for a mix of housing and commercial spaces, and providing social spaces for the community, such as a cultural hub to house community gatherings as well as indoor and outdoor spaces that are accessible to the public in the form of public galleries and parks and open space. Other aspects with benefits to the community include improved connectivity from the project to other areas through transportation links and bike and pedestrian networks, as well as greater energy efficiency and use of sustainable materials.

BOX 3 **Examples of community benefit case studies** (continued)

The adaptive reuse of the Battersea Power Station was made possible through a public-private partnership that has spurred economic development in the surrounding area and attracted investment, tourism and new businesses. This has contributed to the regeneration of a previously underutilized part of London and bolstered the local economy through the creation of nearly 4,000 jobs during the construction of the project and an estimated 20,000 jobs once fully operational, 4,000 new homes, 600 of which will be affordable, and the diversion of waste to landfill through sustainable construction practices and reuse and recycling programmes.

Principle 3

In projects where additional construction is necessary to convert the existing asset to another use, ARPs must use existing structural elements and low-carbon materials to the maximum extent and adhere to local accessibility regulations.

3.1 The asset shall maintain an established minimum percentage[30] of the combined existing building's primary structural elements (e.g. foundations; columns, beams, walls and floors; and lateral elements) and existing building enclosure (e.g. roof, framing, wall framing and exterior finishes)[31] (See Box 4: 1a).

3.2 A minimum percentage of materials and equipment (e.g. carpeting, doors, lighting fixtures) are to be salvaged and retained[32] instead of demolished and sent to waste. Those materials not able to be salvaged or retained should follow best practices for deconstruction and/or recycling (See Box 4: 4b, 4c).

3.3 If new materials are needed, ARPs should prioritize the use of low-carbon or reused construction materials. A minimum percentage of low-carbon materials is recommended as policy to qualify the ARP for further incentives[33] (See Box 4: 2a, 4c).

a. Building materials used should avoid products that will be hazardous to health and the environment. (See Box 4: 2e, 2f).

3.4 If alterations or additions to an existing built asset are needed, the alteration or additions should strive for maximum energy efficiency possible (See Box 4: 5a).

3.5 ARPs should include a deconstruction and material diversion plan[34] for the building's eventual retirement (See Box 4: 3a).

BOX 4 **Examples of ARPS – standards and practises**

1. **Salvaged materials and equipment**

    a. CALGreen part 11, title 24: Codifies that at least 45% of the combined existing building's primary structure and enclosure is reused.[35]

    b. The London Plan: Chapter 9 on Sustainable Instructure, Policy SI 7 and SI 8, provides a strategy for resource conservation, waste reduction, increase in material reuse and recycling to manage London's waste more sustainability.[36]

2. **Low-carbon construction materials**

    a. Recommendations from the Finish Ministry of the Environment: This is a Finnish environmental guide where procurement criteria for low-carbon buildings have a minimum of 10% of the weight of construction materials as either renewable or recycled.[37]

    b. Standard on Embodied Carbon in Construction: This is a Canadian standard that sets minimum requirements for the procurement of design and construction services to disclose and reduce embodied carbon.[38]

    c. Decarbonising Infrastructure Delivery Policy: This is an Australian policy that provides guidance for managing upfront carbon.[39]

    d. Guide To Building Reuse for Climate Action: The American Institute of Architects provides a guide to low-carbon construction materials and methods.[40]

    e. The Red List - International Living Future Institute: The Living Building Challenge from the International Living Future Institute hosts a list of chemicals representing the "worst in class" building substances that pose serious risk to human health and the environment.[41]

    f. Green Policy Science Institute Six Classes: The aim of this policy is to reduce the use of harmful chemicals in consumer and other products, focusing on entire classes or concerning groups of chemicals, rather than phasing out problematic chemicals one at a time.[42]

    g. Amsterdam Circular Economy Strategy: The aim of this policy is to create a sustaining circular economy for the city of Amsterdam. The strategy contains more than 70 action items (e.g. reducing raw materials) to achieve a more sustainable city.[43]

3. **Deconstruction ordinances**

    a. Boulder Colorado, USA Ordinance 8366: This is related to commercial and residential deconstruction.[44]

4. **Construction standards**

    a. ISO 14001:2015: This is an environmental management standard (rather than system) that encourages and implements waste diversion practices.[45]

    b. LEEDv5 ID+C – Reuse Interiors and Reduce Embodied Carbon | U.S. Green Building Council: LEED V5 suggests 65% as "exemplary" for a project, although this percentage may not be feasible in many cases, depending on the condition of existing materials and equipment.[46]

    c. Living Building Challenge: This is a set of standards aimed to dramatically raise the bar of building construction standards.[47]

BOX 4 **Examples of ARPS – standards and practises** (continued)

5. **Energy efficiency standards**

   a. Building Code Update 2021: Updated New Zealand code to increase energy efficiency across all buildings. The code uses metrics such as minimum insulation levels and clear compliance pathways.[48]

   b. Denmark Building Regulations 2018: Danish building codes that focus on annual energy consumption and targets as well as overall building performance. BR18 also includes voluntary energy class for renovation of buildings to encourage building owners to perform more thorough energy renovations.[49]

6. **Accessibility standards and certifications**

   a. Certification for Professionals in Accessible Built Environments (CPABE): This is an international certification encouraged to obtain for those participating in accessibility audits.[50]

   b. 2021 International Building Code (IBC) | ICC Digital Codes: Appendix E of the International Building Code contains minimum accessibility requirements to be considered in building systems.[51]

Principle 4

ARPs are recommended to complete a whole life carbon assessment (WLCA) prior to starting the conversion of the asset and at intervals throughout the design and construction process. The priority is to minimize embodied and operational carbon over the building's lifespan with transparency and complete measurement of a building's full emissions.

4.1 ARPs should assess at least one of the following:

1. The emissions associated with renovation and operation of the asset (i.e. greenhouse gas (GHG) emissions and global warming potential as a metric of GHG emissions) resulting from the components added to a building as part of the ARP, as well as the demolition of components removed, their transport, installation and associated site work across the life of the building using a WLCA (See Box 5: 2 for reference guides and standards on WLCA).

2. If an official WLCA cannot be completed, the emissions associated with the renovation and operation of the asset of the ARP should be clearly assessed using context-appropriate tools (such as those in Box 5).

a. To encourage reuse, reused materials and components shall be excluded from the embodied carbon assessment for all building life cycle stages (A-C)[52] as established by EN15978:2011[53] (See Box 4: 3b). Since these materials have already undergone stages A-C in a previous building's life cycle, they can be excluded from the ARP's associated emission counting.

4.2 ARPs should improve energy efficiency and reduce operational carbon emissions (See Box 4: 5a).

BOX 5 Examples of economic and environmental cost and benefit assessments

1. **Embodied and operational estimation tools**

    a. The Carbon-Avoided Retrofit Estimator (CARE),[54] Early Phase Integrated Carbon (EPIC),[55] BEAM[56] and SlipStream:[57] These can enable fast estimates of the reduction in carbon emissions from the reuse of a structure and other building components.

2. **Whole life carbon assessment standards**

    a. RICS WLCA,[58] ASHRAE/ICC Standard 240P:[59] These standards can support with assessing and evaluating the amount of carbon emitted throughout the life cycle of a constructed asset.

3. **Building LCA tools for use in completing whole life carbon assessments**

    a. One Click LCA,[60] Athena Impact Estimator[61] and TallyLCA:[62] These must be used in conjunction with an energy modelling tool (or similar) to evaluate operational carbon.

4. **Carbon assessment policies**

    a. G20 Global Smart Cities Alliance's Model Policy[63] on Whole Life Carbon Assessment: This baseline policy can help city officials draft legislation requiring whole life carbon assessments for major developments in the built environment.

    b. Embodied carbon guidelines v1 (vancouver.ca):[64] These are technical guidelines on modelling embodied carbon emissions. It demonstrates compliance with requirements in the Vancouver Building By-Laws that require designers to calculate, limit and later reduce embodied carbon in new Part 3 (>600 sqm) buildings.

    c. CALGreen part 11, title 24 (1 July 2024 amendment):[65] This amendment is a measure to demonstrate 10% lower embodied carbon emission than a baseline project, applicable to nonresidential commercial buildings over 100,000 square feet and school buildings over 50,000 square feet, requiring compliance with one of three pathways: (1) reuse at least 45% of the existing building's structure and exterior, (2) complete a whole life carbon assessment (WLCA), or (3) document materials emissions through environmental product declarations. See section 5.409.2.

    d. Denmark's National Strategy for Sustainable Construction:[66] LCAs are a mandatory requirement after applying for a building permit. Transport, energy and water consumption on the construction site as well as the amount of construction waste are also required to be measured, registered and documented. The policy also mandates operation and maintenance plans.

Stakeholder engagement

Even though a city may have the financial resources and capabilities to develop ARPs, city governments should actively engage with the private sector to shape their adaptive reuse policy and establish appropriate provisions to stimulate adaptive reuse instead of conducting new construction.

The design and architecture community, as one example, is important to engage in the early stages of the policy formulation process to help adapt this model policy to local spatial and zoning challenges. The development community can provide insights as to the right mixture of incentives needed that could offset costs to make ARPs more feasible.

Engaging a broader range of stakeholders and communities is crucial for developing transparent, inclusive and effective policies. Incorporating place-based approaches that account for future generations and climate impacts ensures that policies reflect diverse needs and perspectives, leading to more equitable and sustainable outcomes. It also fosters a sense of ownership and accountability among residents and industry. This can enhance the legitimacy and acceptance of policies and uncover valuable insights and innovative solutions that policy-makers might initially overlook.

By involving civil society and the relevant private sector actors, governments can build trust, improve compliance, and ultimately create policies that are more responsive to the real-world challenges and aspirations of their constituents.

Risks to communities

Adaptive reuse and redevelopment, while beneficial in many ways, can also pose several risks to communities. It is the intention of this model policy, through the included policy principles, to ensure maximum environmental, social and economic benefits. However, the authors and contributors of this model policy would be remiss not to identify and make policy leaders aware of potential risks to help avoid any unintended consequences.

Potential risks to communities can include:

– Redevelopment can lead to increased property values and rents, making it unaffordable for existing residents and businesses, leading to possible gentrification and displacement.

– Redevelopment can attract higher-income residents and businesses, potentially widening economic disparities within the community, and placing strain on existing infrastructure.

– While adaptive reuse often aims to preserve historic buildings, the focus on modernization and profitability can sometimes lead to the erosion of cultural heritage.

Avoiding these risks requires careful planning, community engagement and equitable development practices to ensure that adaptive reuse benefits all community members while preserving their heritage and environment.

Policy incentives

For the policy to be effective in fostering adaptive reuse, it should include a mixture of incentive types. Incentive-based policies increase the feasibility of adaptive reuse and decrease the financial and regulatory barriers that developers, property owners and communities often face with ARPs. These incentives often come from government entities, but can also involve partnerships with non-profits and private sector organizations.

Incentive types and strategies can include:

- **Tax credits in the form of historic preservation tax credits or state and local tax incentives:** In many countries, developers can receive tax credits for the rehabilitation of historic buildings. Some municipalities offer additional tax credits or abatements for adaptive reuse projects, particularly those that preserve historic structures or contribute to urban revitalization.

- **Grants reserved for adaptive reuse purposes or economic development:** Grants can come from government agencies, non-profit organizations, or foundations tailored to cover the rehabilitation costs of projects that involve the preservation and adaptive reuse of historic buildings or built assets that contribute to economic development, particularly in underserved or revitalizing areas. These incentives are designed to spur job creation, attract businesses and improve the local economy. There may also be environmental grants aimed at incorporating sustainable practices, such as energy efficiency upgrades or the use of green materials.

- **Low-interest loans and green financing:** This could include revolving loan funds specifically for adaptive reuse purposes such as the rehabilitation of older buildings as well as greener finance products that offer favourable financing terms for sustainable and/or energy-efficient practices with positive environmental impact.

- **Subsidies and fee waivers:** City governments may waive or reduce development and permit fees, also known as impact or infrastructure fees, which can significantly reduce the upfront costs of ARPs. In cases where environmental remediation may be necessary, government programmes may provide subsidies.

- **Zoning and regulatory incentives:** These may include zoning variances or zoning exceptions that allow developers to bypass certain restrictions that typically apply to new construction, for example, increased density, reduced parking requirements, or mixed-use developments. Other regulatory incentives could include expedited permitting and flexible building codes related to fire safety, accessibility and energy efficiency, making it easier to adapt existing buildings and structures for new uses.

- **Public-private partnerships:** Shared financing or joint ventures through public-private partnerships have the potential to derisk the investment in ARPs and provide benefits for public and private actors. Through this model, the public sector may contribute financially (through infrastructure improvements as one example) to complement the private investment in the redevelopment of an existing asset.

This model policy can be leveraged with these tools to aid in the development of ARPs. The following use cases provide examples of how these tools are being applied in cities and communities worldwide to promote sustainable development, preserve historic buildings and revitalize neighbourhoods while reducing the environmental impact associated with new construction.

BOX 7 **Examples of policy incentive use cases**

Financial incentives

- AHCC 467M[67]
  A New York City policy to exempt from real estate property taxation, other than assessments for local improvements, any building that is converted into residential (subject to affordability requirements) from a non-residential use (excluding hotels or other class B multiple dwellings). The exemption period varies from 25 to 35 years depending on the year of construction commencement.

- United States Federal Historic Preservation Tax Incentives[68]
  These federal tax credits enable buildings listed in the National Register of Historic Places or those certified as contributing to the significance of a "registered historic district" to qualify for a 20% tax credit of the cost of rehabilitation of the building. The policy is meant to uphold the integrity of historic buildings (not structures) to enable ongoing business-related use.

- Melbourne Heritage Restoration Fund[69]
  The Melbourne Heritage Restoration Fund provides financial assistance to owners of heritage buildings to help cover the costs of conservation and adaptive reuse. The fund offers grants and low-interest loans for approved conservation works on heritage properties. As a result, the fund has supported numerous projects, including the adaptive reuse of the former Royal Mail Hotel into apartments and commercial spaces, preserving historical architecture while accommodating modern uses.

- Dublin's Living City Initiative[70]
  This Living City Initiative aims to revitalize the historic city centre of Dublin and other Irish cities through the adaptive reuse of older buildings. The initiative provides tax relief for qualifying expenditures incurred on the refurbishment and conversion of residential and commercial properties within designated areas. This facilitates the transformation of old, underutilized buildings into vibrant residential and mixed-use spaces, promoting urban renewal and economic activity.

- Chicago's Class L Property Tax Incentive[71]
  This programme targets landmark buildings in need of significant rehabilitation. It offers a substantial reduction in property taxes for a 12-year period: a 10% assessment level for the first 10 years, 15% in the 11th year and 20% in the 12th year. As a result, numerous historic buildings, such as the Chicago Motor Club Building and the Old Dearborn Bank Building, have been successfully redeveloped under this incentive.

- Historic England's Heritage at Risk Grants[72]
  The City of London offers grants to support the repair and adaptive reuse of historic buildings at risk of decay or demolition, particularly for necessary repairs and conversions, as well as expert advice and assistance in navigating planning regulations. Numerous projects, such as the transformation of the historic Battersea Power Station into a mixed-use development, have benefited from these grants, preserving iconic structures and adapting them for modern needs.

- California Assembly Bill 1695[73]
  The bill opens adaptive reuse projects to existing funding sources administered by the Department of Housing and Community Development. Any notice of funding availability issued by the department for an affordable multifamily housing loan programme shall state that the adaptive reuse of property for affordable housing purposes is an eligible activity.

- Post-Secondary Institution Incentive Programme[74]
  The provincial government of Alberta in Canada commits to pay the lease costs for a minimum 20-year lease term on behalf of a participating post-secondary institution that commits to locate in Calgary's downtown for a minimum of 20 years. The City of Calgary will provide CAD$50 per square foot as a grant to a private property owner who agrees to undertake an office-to-post-secondary institution conversion and enter a 20-year lease with the institution.

BOX 7 **Examples of policy incentive use cases** (continued)

Zoning reforms

- California Assembly Bill 2011[75]
  AB 2011 is intended to permit residential development on sites currently zoned and designated for commercial or retail uses. AB2011 allows a ministerial approval process that is exempt from the California Environmental Quality Act (CEQA), for multifamily housing development on sites within a zone where office, retail, or parking are the principal use and requires a percentage of affordable units.

- New York City: Office Adaptive Reuse Task Force[76]
  Local Law 43 established a task force to create the 2023 Office Adaptive Reuse Study, which recommends allowing most office buildings constructed in 1990 or before to be converted to housing. Today, office buildings outside the financial district typically need to be built before December 1961 to access the most flexible reuse regulations. By moving the eligibility date to 1990, the city could provide new homes for as many as 40,000 New Yorkers in the next 10 years.

- Flexible Zoning in Central London[77]
  To encourage the adaptive reuse of buildings, particularly in response to the changing demands for office and residential spaces, London has implemented flexible zoning policies in areas like the Central Activities Zone (CAZ). The Greater London Authority allows for changes of use between offices, retail, and residential without requiring full planning permission, provided certain conditions are met. This has facilitated the conversion of many older office buildings into residential apartments, helping to address housing shortages while preserving the historic character of central London.

- Strategic Development Incentive (SDI) Scheme and Singapore's Green Plan 2030[78]
  Singapore has a robust conservation programme that encourages the adaptive reuse of heritage buildings through relaxed zoning and regulatory frameworks. The Urban Redevelopment Authority (URA) offers incentives such as development charge waivers, flexibility in building use, and expedited planning approvals for projects involving the adaptive reuse of conserved buildings. The scheme works in tandem with Singapore's Green Plan 2030 and is intended to encourage the redevelopment of older buildings in strategic areas into innovative developments. It provides a framework to evaluate and guide proposals that deviate from existing planning parameters but have a positive and transformational impact on the surrounding environment that will help rejuvenate the area.

Technology enablers

Cities adopting this model policy can consider technology and related tools as an enabler, where appropriate and relevant, to register, monitor and implement ARPs. The growth and disruptive nature of technology provide opportunities to create digital models of existing structures to visualize assets, determine precision dimensions and analyse information to support accurate planning, design and management of ARPs.

Digital technology can support measurement and quantification and potentially provide insights for smarter decision-making, maximizing the value of ARPs. The use of technology can be considered across various ARP phases – pre-design and advocacy, design, building, operations and end-of-life. For example:

- **Augmented reality and virtual reality (AR/VR) technology** can help community members and project stakeholders visualize the end result of ARPs, particularly in the context of historically significant assets with perceived cultural significance.

- **Performing building modelling computer-aided design (CAD) and parametric simulation** can enable site relevance, code compliance and resource use forecasting.

- **Building information modelling (BIM)** can be considered by architects and engineers to assess conditions, analyse structural integrity, and identify potential challenges and opportunities for reuse. This can facilitate accurate planning and design, reducing errors and unexpected costs during the renovation process. BIM can also support design for modular, prefab, or unitized buildings, enabling faster construction with low-carbon and circular materials. A combination of physical manufacturing and digital control systems can be integrated with BIM and use artificial intelligence (machine learning) automation to increase efficiency in offsite or factory-built components.

- **Smart building technology such as meters, sensors and analytics** can be integrated to track and adjust real-time performance. This can ensure resources are used to scale with the design intent and send useful information to building owners, occupants and operators.

- **Emerging artificial intelligence (machine learning) methods**, including predictive analytics, can identify patterns and trends, leading to optimized operations and maintenance strategies. However, the use of artificial intelligence in operations needs an incredible amount of energy to power artificial intelligence data centres. Building performance monitoring and the addition of on-site energy generation and storage are also good strategies to reduce energy costs and emissions.

- **Technology can enable the gathering and analysing of data**. Data for building material reuse for recycling and repurposing is essential for decarbonization. Developing decentralized yet integrated digital supply chains to track and trace materials and products end-to-end, with the goal of delivering them at the lowest cost, when and where they are needed.

The World Economic Forum's Task Force on Digital Transformation[79] released a toolkit[80] in 2022, which can help identify appropriate digital solutions for buildings. While the context of this toolkit is within the office experience, finding the right technology guide[81] in particular provides a set of useful questions for assessing and supporting technology decisions.

BOX 8 Technology use cases

Calgary, Canada[82]

Through the architecture firm Gensler, a proprietary algorithm was created to assess the conversion suitability for office buildings. The algorithm significantly reduced the time it would take to complete on-site building evaluations. The algorithm enabled Calgary to separate adaptable assets and assets at the end of their useful life. This further helped the city decide which sites to target for demolition or adaptation incentives. The resulting analysis of 6 million square feet of downtown vacant office space helped the city establish a CAD$75 per square foot incentive programme and a change in zoning rules to incentivize conversions by the private sector. The analysis also showed that roughly 25-30% of existing class C buildings were physically suitable to be converted.

Hong Kong SAR[83]

Tai Kwun, the Centre for Heritage and Arts, the city's former Central Police Station compound, was transformed into a new art and culture centre. Computer-aided design (CAD) and building information modelling (BIM) were used extensively to test interior, exterior and structural design elements for safety.

The use of 100% recycled aluminium as a material created a distinctive expression against the collection of masonry blocks. After lab-testing materials samples, it was determined they could safely reuse existing slabs with historic wire reinforcement to avoid extensive recasting of floor slabs. To overcome historical conservation constraints, while meeting modern fire-safety codes, fast-response sprinkler heads and computational fluid dynamics (CFD) modelling were used to programme the activation time of the sprinkler heads.

Technology risks

Technology can offer promising solutions and be a supportive tool for adaptive reuse. However, it is crucial to consider the potential drawbacks of technology in maximizing their benefits for ARPs and communities.

Some potential risks can include:

- The cost of implementing advanced systems like smart sensors and building management tools can create significant barriers to entry, particularly for smaller developers or projects with limited budgets. This may lead to a digital divide in adaptive reuse projects, where only well-funded initiatives can benefit from technological advancements.

- Lack of appropriate technological governance structures and processes can increase privacy and cybersecurity risks, impacting occupant experience and trust, as well as increase mitigation and recovery costs.

- There is the risk of rapid technological obsolescence, requiring frequent upgrades and potentially undermining the long-term sustainability goals of adaptive reuse projects. In addition, technologies that are in vendor lock-ins may limit agility over time.

- The complexity of integrated systems may increase maintenance costs and introduce additional points of failure, potentially offsetting the intended efficiency gains.

- Technologies also have a carbon footprint. Understanding the GHG emissions and environmental footprint of technology itself is key for achieving the net-zero goals of APRs.

- Introduction of technology in ARPs can increase the value of property, presenting affordability and other community-related risks and challenges.

Proper assessment of technological products and services is necessary to identify the right solution that can sustainably maximize benefits and minimize risks. This must be combined with adopting ethical and responsible technology governance practices. The G20 Global Smart Cities Alliance has published several model policies on technology governance[84] based on tried and tested approaches globally, which can serve as a baseline guide. The World Economic Forum continues to advance the responsible use of technology across technology domains.

Definitions

Adaptive reuse:
The process of repurposing buildings for new uses from their intended use. Adaptive reuse extends the lifespan of a building reducing its environmental impact and preserving architectural heritage and cultural significance.

Building information modelling (BIM):
A digital representation of a building's physical and functional characteristics used as a resource for facility information and making reliable decisions during its lifecycle.

Built assets:
Constructed assets related to buildings and infrastructure.

Circular economy:
An economic system based on the reuse and regeneration of materials or products, especially as a means of continuing production sustainably.

Community benefit:
Advantages to the health (i.e. air quality), safety and prosperity of a community (workforce development, community/cultural centres, increased housing opportunities).

Cultural heritage/historic building information models (HBIMs):
A specialized form of BIM that focuses on documenting and preserving the historical and cultural significance of existing buildings.

Deconstruction:
The systematic disassembly of a structure to maximize the salvage of materials for reuse over salvaging materials for recycling, energy recovery, or sending the materials to the landfill. (City of Portland (OR) City Code 17.106.020).

Embodied carbon:
Emissions related to the extraction of raw materials, their manufacturing, assembly during construction, any maintenance or replacements, the disassembly and demolition, and any associated transport, waste and end-of-life impacts.

Historically significant buildings:
A building or structure that has been designated as a historical resource or part of a historic district, at the national or sub-national level, including but not limited to listing in the National Register of Historic Places, UNESCO World Heritage, or International Council on Monuments and Sites (ICOMOS).

Material reuse:
Installation of a previously used material or product that requires limited to no processing for reinstallation and use on a different project. This category of materials does not refer to recycled content in manufactured materials/products. Some level of processing (e.g. resawing salvaged lumber) would still be considered a minimally processed salvaged and reused material.

Operational carbon:
Emissions associated with the energy used to operate a building.

Retrofit:
Renovation of the components and systems of existing buildings and homes to be more energy efficient, decrease energy demand and become more resilient, safe and adapted to local needs.

Salvage:
The deliberate reclamation of reusable materials from the disassembly, deconstruction, or demolition of buildings or structures.

Whole life carbon:
Whole life carbon (also known as whole body carbon and whole building carbon) refers to both the operational and embodied carbon emissions associated with a building throughout its entire life cycle. It quantifies the total carbon footprint, considering both direct emissions during use and indirect emissions from materials and construction processes.

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About the G20 Global Smart Cities Alliance

The World Economic Forum, the International Organization for Public-Private Cooperation, serves as the secretariat for the G20 Global Smart Cities Alliance. Established in 2019 through the G20 presidency, the alliance brings together business leaders, innovators and experts with city networks to accelerate the adoption of cutting-edge solutions for pressing urban challenges. The alliance's global network has produced more than a dozen model policies, practitioner guides and case studies to support cities as they advance climate resilience and sustainability, transparent and innovative governance, and safety and accessibility goals. The alliance also helps advance the adoption of these policies to drive on-the-ground impact.

More information about the alliance can be found at: https://globalsmartcitiesalliance.org.

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