3encult

EFFICIENT ENERGY FOR EU CULTURAL HERITAGE

Recommendations

for Local Governments

Integrating energy efficient retrofit of historic buildings into urban sustainability

(D2.3 – Proposal of generic replicable factors for incorporation into the Aalborg Commitments (indicators and recommendations)

EUROPEAN COMMISSION

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1. Executive Summary

The efficient use of resources – here energy savings, energy efficient technologies and measures as well as the use of Renewable Energy Sources (RES) is needed for the energetic refurbishment of historic buildings. Local governments need to be involved in discussion of results, also in exploring the identification of generic replicable factors that can be proposed for **incorporation into a broader urban sustainability concept**.

Why is sustainability an issue? The built environment has a major impact on our lives, as we live and often work in buildings. They impact on our health and can put a strain on limited natural resources. Historic buildings are also closely inter-connected to the community´s identity and economy (e.g. maintaining and promoting historic city centers, monuments and tourist attractions).

Local governments are not only tasked with creating policies able to enhance their community's quality of life, but also owners of a large amount of historic buildings, for which they are directly responsible, both in terms of maintenance and usage.

The refurbishment of historic buildings to lower energy demand is necessary, possible and economically feasible. This guide addresses local governments, exploring how they can address energy efficient historic building renovation in a **comprehensive, strategic, integrated and effective approach** – outlining how to best utilize these buildings as vehicles for **sustainable development** at local community level.

Historic buildings have embedded potential for sustainability. They often use comparatively **low-energy and durable materials**, and historic neighborhoods are often characterized by density, short distances and mixed use, which make them a relatively efficient model of sustainable development. Furthermore, demolishing or replacing these buildings would require a major reinvestment of energy and resources.

The Aalborg Commitments on Sustainable European Cities provide a holistic framework for discussion and implementation of sustainable indicators and recommendations. Cultural heritage[1], although included, has not been addressed directly in the Commitments. 3ENCULT wishes to provide additional and replicable recommendations and strategies for the inclusion of historic buildings into sustainable urban planning, as well as for local climate and energy action plans.

This document outlines how a local government in Europe, as the owner of historic buildings and monuments, as the developer of local strategy and policy, and as administrator and regulator of its geographical area, can engage and use the local cultural heritage to move a step closer to achieving a sustainable community.

[1] **Cultural Heritage** is an expression of the ways of living developed by a community and passed on from generation to generation, including customs, practices, places, objects, artistic expression and values. Cultural Heritage is often expressed as either Intangible or Tangible Cultural Heritage. [*ICOMOS, International Cultural Tourism Charter. Principles and Guidelines for managing Tourism at Places of Cultural and Heritage Significance*. ICOMOS International Cultural Tourism Committee. 2002.]

2. Introduction

The **Aalborg Commitments** offer a framework for holistic action on urban sustainability. Organized into 10 themes, they are developed to allow decision-makers to adapt them to their own particular local conditions. The Commitments are designed to be tools to be used in the strategic target-setting process, to support in identifying where it is necessary to set goals and strategies, and they can then be further used to monitor the sustainability process.

3ENCULT will explore how these indicators can be brought forward to include cultural heritage. **Why address sustainability while discussing cultural heritage protection**?

Climate change is a reality; communities are facing the challenge of both mitigating its effect and adapting to a changing environment, through coherent and effective approaches. Sustainable development and green growth have been identified as global priorities.

It is understood that sustainable energy – energy conservation, energy efficiency and the transition to renewable energy – is at the heart of these issues. Cultural heritage not only has a great potential for emission reduction and energy savings, but is also suffers for climate change, and increasing extreme weather events.

Through exploring replicable indicators on how to best include cultural heritage within urban sustainability processes, 3ENCULT aims to inform local governments of the potential lying in cultural heritage, both from energy and from a societal point of view.

Many technical solutions and options are available for local governments intending to seek the optimal balance of cultural heritage and energy efficiency - from design to technology and materials. But it is not only about technical solutions. **Innovation needs to be informed, and embedded into a policy framework** and coherent processes, ensuring that it is able to consistently address needs at the local level. This is especially relevant given that historic buildings are a core tourist attraction in many European cities, impacting directly on society both economically and socially.

While **each building is unique and needs its own tailor-made solution**, through selecting from a range of existing possibilities it is possible to outline a series of **replicable principles** and recommendations on what to consider and how to make cultural heritage part of sustainability strategies at urban level.

The input comes from the **3ENCULT project** (**Efficient Energy for EU Cultural Heritage)**, a project implemented in the 7th Framework Programme (FP7) of the European Commission (EC). It bridges the gap between the conservation of historic buildings and dealing with climate protection. While this may seem like a contradiction in terms, it is clear that historic buildings have a higher chance of “survival” where energy efficiently retrofitted.

The 3ENCULT research activities are accompanied and stimulated by the involvement of eight **case studies** in different countries and climatic zones, from different historic eras. The results of these case studies and the process that lead to the retrofit are used in this guide to inform the recommendations and indicators proposed. Each proposed recommendation and indicators will be accompanied by a real case study in brief, to provide **practical examples and inspiration.**

2.1 Target group

Local leaders can trigger and intensify discussions, outline a clear direction and strategy for the community, to implemented and monitored by the local government when dealing with these topics.

To act as a driver for such strategies **local government representatives need to make informed decisions** – based on an understanding of what is possible and not possible. This is also the case for built heritage, historic buildings and monuments, as more complex building types to be addressed. Although they make up a small percentage of the total building stock in a city or town, their value goes far beyond their current use as monuments, office space or residences. These buildings are the heart and soul of our European cities. Visitors from around the globe flock to see and admire them. They add greatly to the local economy, purely by existing. Decisions about energy efficient retrofit can (and should) ideally be linked to the broader municipal strategy, e.g. the Urban Master Plan and the Sustainable Energy Action Plan (SEAP) or Climate Plan.

Energy efficiently retrofitting European cultural heritage provides local leaders with the opportunity for a wide spectrum of actions with a social, cultural but also economic impact at the local community level. This makes it an **interesting field of engagement for local governments as the leaders and administrators of their local community**. They have the mandate and interest to stimulate local sustainable development, making their communities liveable and supporting good quality of life for citizens and businesses alike (jobs, services, etc).

Why local governments? Local leaders:

- **shape local strategy and policy** (e.g. sustainable development, climate protection, job creation, ...);
- **deal with urban planning and updating the urban master plan**;
- **outline and enforce building regulations** (also protection and maintenance of monuments);
- **plan the sustainable energy transition in the community** (e.g. Sustainable Energy Action Plan);
- **can reduce energy demand in municipal buildings and switch to renewable energy**, e.g. green electricity; and
- **encourage the local community to engage in the sustainable energy transition** (stakeholder action).

Energy efficiency retrofit of heritage could become a quite beneficial selected action to implement into a **Sustainable Energy Action Plan**, as it would help facilitate reaching the 20-20-20 target (reduction of emissions, increase of renewables by 2020) while triggering a wide **social impact**. It is a great start for living up to this challenge.

2.2 Guide focus

This guide offers a **set of recommendations and indicators for local decision-makers** on the integration and advancement of sustainability criteria at urban level, and the role that

energy efficiency retrofit of cultural heritage can play in advancing the local sustainability agenda.

Using the 3ENCULT project results and the outputs of the discussion of a working group of municipal experts, the guide aims at providing inspiration and ideas, on how the nexus between a sustainable city and the conservation of its historic buildings can be addressed in an optmised and reciprocally beneficial approach.

Specifically aimed at local decision-makers who are not necessarily experts on sustainable energy, urban planning and buildings, this set of recommendations will help to inform local leaders involved in municipal decision-making processes relevant to the built environment, urban planning, the energy sector as well as tourism and sustainable economic development.

3 About Sustainability

What is sustainability? A **sustainable community** strives to **reduce its per capita use of natural resources** to a level that doesn´t endanger either local or global ecosystems, and at the same time, it **ensures that political, economic and social** systems guarantee a high **quality of life for everyone**.

Not only environmental factors, but also governance, society, and economy are directly included in the concept of a sustainable development[2] that aims at meeting the needs of today without compromising future generations' ability to meet their own needs in the future.

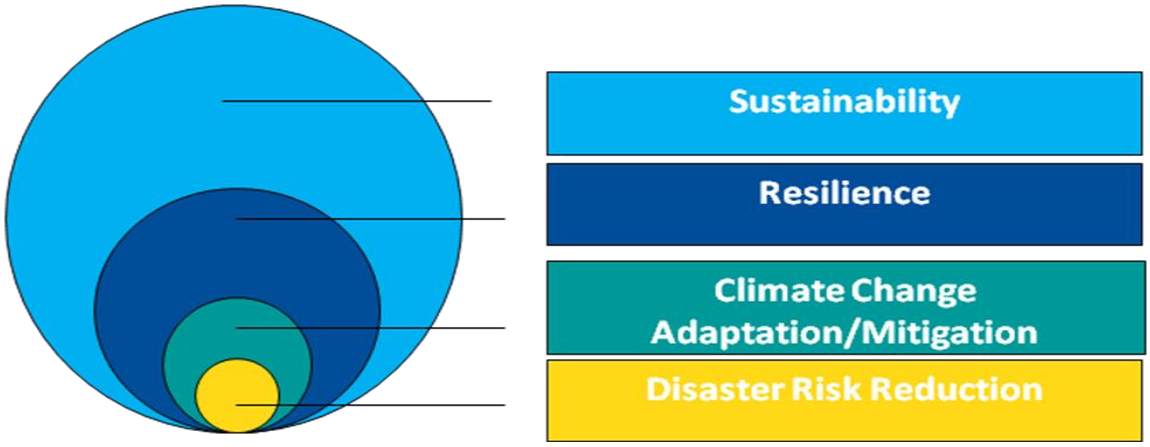


Figure 1: ICLEI's vision of urban sustainability

A sustainable city works to reduce environmental risk, implements policies and strategies both to mitigate and adapt to the effects of climate change and become resilient[3] to it. A sustainable city contributes positively, through its policies, not only to the decrease of environmental degradation, but also in alleviating poverty and inequality, adopting a long term approach that goes beyond simply tackling environmental issues (Figure 1).

To be effective in the long run, environmental measures need to take into account the involvement and role of all stakeholders represented, especially of the citizens, and they should be designed in such a way to advance the community's sustainable development in a number of areas including urban governance, infrastructure, finance, design, social and economic development, and environmental / resource management.

[2] "Development that meets the needs of the present without compromising the ability of future generations to meet their own needs", World Commission on Environment and Development's (the Brundtland Commission) report: Our Common Future (Oxford: Oxford University Press, 1987)

[3] For the European Environment Agency (EEA) a resilient city as an "urban ecosystem" that is dynamic: consuming, transforming and releasing materials and energy in an adaptive way and interacting with other ecosystems, tackling mitigation and adaptation efforts and addressing quality of life through better and greener urban planning

3.1 Why include sustainability criteria?

Effective mitigation and adaptation strategies, protection of environment and biodiversity, as well as the smart use of natural resources are closely linked with high and stable levels of quality of life, including economic growth and employment. The challenges of urban growth, climate change and sustainable development can best be tackled through local government policies.

Decisions concerning the built environment have a fundamental impact on these issues.

Re-use of existing built assets, reducing waste, water and energy consumption, respecting the local environment, community history, and biodiversity are vital to achieve the smart, sustainable city of the future.

Local governments can act in their role as regulator, and as real estate owner, andembrace sustainability through property and construction processes.

3.1.1 Urban growth

Increasingly, people are living in cities. For the first time in history, the majority of the world's population lives in urban areas, and this proportion continues to grow. **By 2030, 6 out of every 10 people will live in a city**, and by 2050, this proportion will increase to 7 out of 10 people (WHO).[4] To accommodate these extra 2 billion citizens, cities will have to transform their master plans, adapt their infrastructures and services, and decrease energy demand, while using cleaner and more affordable energy.

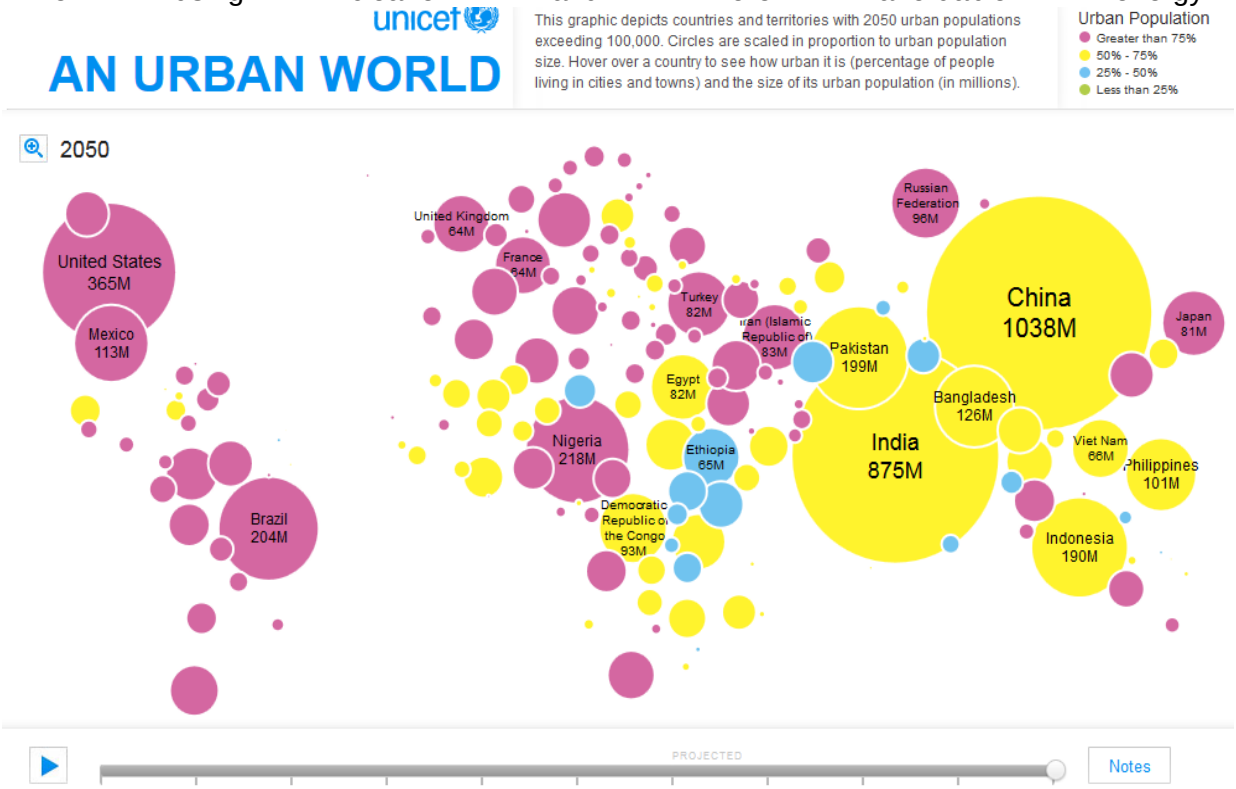


Figure 2: [An Urban World]

[4] http://www.who.int/gho/urban_health/situation_trends/urban_population_growth_text/en/

Buildings are **major energy consumers** in the urban context[5]. The energy demand of buildings in Europe is as high as 40% of the total energy demand, they also account for 12% of the global **potable water** use on global scale, and 40% of **solid waste** streams in developed countries[6].

As such buildings represent both a challenge when it comes to sustainable management of resources, as well as climate protection, and a valuable opportunity to improve sustainability in the urban context.

In Europe, historic buildings represent large part of the urban texture. Investing in energy efficiency has become increasingly urgent in order to respond to the steep growth curve of energy prices, and **energy security** is a main item in European agendas. European cities past can play a proactive role in their future.

Historic buildings provide a link to a community´s past and are the manifestation of an areas' culture. They represent social identity and a growing economic potential for the service sector. They are also an important facet constituting Europe's singularity and provide a source of strength, dynamism and creativity (Horizon 20202 challenge 6.3).

The adjustment of the older built heritage could reduce CO_2 emissions and energy costs between 42-46%. It needs to be kept in mind that retrofitting is undoubtedly more complex than a new realization, since the necessary measures imply a differentiation and an articulation of solutions sometimes complex and integrated with each other.

3.1.2 Climate change

Historic building protection and energy efficiency are becoming a more effective combination thanks to new technology and the advancements of research. Energy-saving oriented renovation can help to "adapt" the irreplaceable heritage of cities to a continuously changing world, and Councils have the possibility to take the lead in the developing strategies that allow communities to protect these cultural and economic assets.

The first step is through **commitment** at political level. Protecting historic buildings needs to become part of wider strategic planning in tackling **climate change[7] mitigation[8] and adaptation[9]**. Heritage protection should become part of the larger framework of the energy and climate strategy of the city.

While the Kyoto Protocol on global warming proposes, among other adopted commitments, to make new and existing buildings "more sustainable", by retrofitting them and improving their energy efficiency through the best cost to effectiveness ratio, it is important to underline

[5] Troi, A., Historic buildings and city centers – the potential impact of conservation compatible energy refurbishment on climate protection and living conditions, Proceedings of the International Conference Energy Management in Cultural Heritage, 6.-8.4.2011, Dubrovnik, 2011

[6] UNEP, Building Design and Construction: Forging Resource Efficiency and Sustainable Development, June 2013

[7] Climate change: a change in climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods (UNFCCC)

[8] Mitigation: an anthropogenic intervention to reduce the sources or enhance the sinks of greenhouse gases (IPCC).

[9] Adaptation: the adjustment in natural or human systems, in response to actual or expected climatic stimuli or their effects that moderate harm or exploit beneficial opportunities (IPCC).

that buildings, especially historic ones, need to be protected against the effects of climate change.

Historic buildings are being affected by changes in hydrological, chemical and biological processes. Historic building materials are often more porous than modern constructions, heightening their vulnerability. Any increase in soil moisture, for example, may result in greater salt mobilisation, which once crystallized, can damage decorated surfaces. Through climate change, timber and other organic building materials may be subject to increased biological infestation in altitudes and latitudes that may not have been previously affected. Flooding may damage building materials not designed to withstand prolonged immersion. Increases in storminess and wind gusts can lead to structural damage. Desertification, salt weathering and erosion are already threatening cultural heritage in desert areas.

Climate change may also result in social and cultural impacts, with communities changing the way they live, work, worship and socialise in buildings sites and landscapes, possibly migrating and abandoning their built heritage.

Sustainability at urban level has to address these impacts and include cultural heritage within a comprehensive strategy.

World Heritage sites can serve as laboratories where monitoring, mitigation and adaptation processes can be applied, tested and improved so as to ensure global benefits at the lowest possible cost.

4. Enhancing the Aalborg Commitments

In Europe, a variety of schemes and movements have been established to address sustainability at local level, with different focuses, including the Aalborg Charter, Aalborg Commitments, Covenant of Mayors, Green Capital Award, EU Reference Framework for Sustainable Cities. The various schemes and initiatives have different origins. However, they all strive to provide and facilitate an evaluation of sustainable urban development.

The Aalborg Process for Local Sustainability, with its Charter established in 1994 has been a precursor of this discussion and it remains a strong framework for the urban sustainability movement. The Charter still remains a reference for sustainability in cities as of today.

The Aalborg Charter

Approved by the participants to the first European Conference on Sustainable Cities & Towns in Aalborg, Denmark, the Aalborg Charter is an urban environment sustainability initiative inspired by the Rio Earth Summit's Local Agenda 21 plan, and it was developed to contribute to the European Union's Environmental Action Programme, 'Towards Sustainability'. The signatories of this Charter are individuals, municipalities - more than 3000 local authorities from more than 40 countries - NGOs, national and international organisations, and scientific bodies.

The Charter is comprised of a consensus declaration of European sustainable cities and towns towards sustainability (Part 1); of the set-up of the European Sustainable Cities & Towns Campaign (Part 2); and of a declaration of intent to engage in Local Agenda 21 processes (Part 3).

For more information: www.sustainablecities.eu

4.1 The Commitments

Providing a holistic framework for sustainability, the Aalborg Commitments encompass a list of qualitative objectives organized into 10 themes through a structured and ambitious approach.

Developed in 2004, they summarize the attempt of reaching a common understanding of local sustainability, and of how to embed it thorough across municipal sectors and activities[10].

The Commitments have been developed as tools for decision-makers to set their strategic targets; they provide flexible guidance that allows policy makers to adapt them to meet their community local conditions, for example in setting time limits for specific sustainability goals.

The Commitments can also be used to monitor the sustainability process at local level and to keep track of peer-exchanges within the network of the signatories. About seven hundred cities and towns have signed the Commitments (as of February 2014). That number is steadily increasing, with thirty-four new signatories in April 2013 alone, including also non-European members from Niger, Egypt, Tunisia, Morocco and Senegal.

[10] Aalborg commitments have been developed through discussion among organizations including: Association of Cities and Regions for Recycling (ACRR); Climate Alliance -Klima-Bündnis -Alianza del Climae.V; Council of European Municipalities & Regions (CEMR); Energie Cités; EUROCITIES; ICLEI Local Governments for Sustainability; Medcities; Union of Baltic Cities (UBC), and the World Health Organisation (WHO) - Healthy Cities.

4.2 Other Frameworks

The Aalborg Commitments have been the precursor of the debate on the development of a common framework for sustainability; nonetheless these are not the only monitoring scheme on sustainability. Many other frameworks are now bringing forward what the Aalborg process started, often focusing on specific topics (e.g. mitigation for the Covenant of Mayors).

Below a brief introduction to more relevant frameworks to enhance sustainability.

a. The Reference Framework for European Sustainable Cities (RFSC)

The Reference Framework for European Sustainable Cities (RFSC) is an online toolkit designed to help cities promote and enhance their work on integrated sustainable urban development. It is available to all European local authorities and offers practical support in integrating sustainability principles into local policies and actions. The RFSC is a check-list on sustainability, and it includes the possibility of attending training and exchanging both in person and online with peers across Europe.

A joint initiative of the Member States, the European Commission and European organizations of local governments, the RFSC gives a common space and language to the community of cities that are interested in learning from each other, while respecting the diversity of local priorities.

For more information: http://app.rfsc.eu/

b. The Leipzig Charter

Adopted by the EU Members States in 2007, the Leipzig Charter on Sustainable Cities represented a step towards an agenda for a European large cities policy.

The Charter recognizes the important social, cultural and economic role that cities play, addressing and highlighting the necessity of ‘integrated strategies and coordinated action’. The necessity of an integral approach imposes requirements on the institutional setting in which the (European) large cities policy is enacted. All levels of government – local, regional, national and European – have an interest in healthy cities and share the responsibility for the success of cities.

The document calls for a general framework in which urban policy can be enacted, including access to financing for local projects and peer exchanges of knowledge.

The Charter states that local national, local and regional governments must be involved in planning and developing integrated approaches for sustainability, as well as interested individual citizens and private organizations. The Leipzig Charter emphasizes repeatedly that the skills must be developed at local level by all the parties involved.

The Leipzig Charter calls for the engagement of urban policy in using the tool of integrated urban development and the related governance for its implementation and, to this end, establish any necessary framework at national, regional and local level through:

- dealing with deprived neighbourhoods;
- improving the public spaces;
- modernising infrastructure with a focus on saving energy;
- better education for young children and refresher training for workers;
- better and more efficient public transport in and between cities.

Specifically addressing public spaces and cultural heritage the Charter states: “the quality of public spaces, urban man-made landscapes and architecture and urban development play an important role in the living conditions of urban populations. As soft locational factors, they are important for attracting knowledge industry businesses, a qualified and creative workforce and for tourism. Therefore, the interaction of architecture, infrastructure planning and urban planning must be increased in order to create attractive, user-oriented public spaces and achieve a high standard in terms of the living environment, a “Baukultur”. Baukultur is to be understood in the broadest sense of the word, as the sum of all the cultural, economic, technological, social and ecological aspects influencing the quality and process of planning and construction. However, this approach should not be limited to public spaces. Such a “Baukultur” is needed for the city as a whole and its surroundings. Both cities and government must make their influence felt. This is particularly important for the preservation of architectural heritage. Historical buildings, public spaces and their urban and architectural value must be preserved.[11]„

For more information: http://app.rfsc.eu/userfiles/file/leipzig/leipzig-English.pdf

c. The Covenant of Mayors

After the adoption, in 2008, of the EU Climate and Energy Package 2020, the European Commission launched the Covenant of Mayors (CoM) initiative to endorse and support the efforts deployed by local authorities in the implementation of sustainable energy policies.

The CoM is a voluntary commitment and it represents a great example of multilevel governance that mobilizes local and regional actors around the fulfillment of EU objectives.

local authorities signing up for the CoM translate their political commitment into concrete measures and projects through preparing a Baseline Emission Inventory, and subsequently submitting a Sustainable Energy Action Plan (SEAP)[12], including planned measure to be implemented to achieve targets set by the local authority itself.

Although the focus of this initiative is climate mitigation, the actions planned and implemented by the signatories reflect also into job creation, healthier environment and quality of life and enhanced economic competitiveness and greater energy independence.

For more information: http://www.covenantofmayors.eu

[11] Leipzig Charter on Sustainable Cities, http://app.rfsc.eu/userfiles/file/leipzig/leipzig-English.pdf

[12] “A Sustainable Energy Action Plan (SEAP) is the key document in which the Covenant signatory outlines how it intends to reach its CO_2 reduction target by 2020. It defines the activities and measures set up to achieve the targets, together with time frames and assigned responsibilities”, www.covenantofmayors.eu

5. Proposal of generic replicable factors

5.1. Methodology used

After analysis, Aalborg **Commitments and actions relevant to cultural heritage have been identified** (See Annex I). Improved indicators have been drafted, and 3ENCULT has invited local and sub-national governments to contribute to the discussion on the development of more detailed recommendations and indicators to be integrated within the Aalborg Commitments, addressing this specific topic.

Municipal and local experts on buildings, urban planning and monument protection have been invited to debate the concept of sustainability in relation to cultural heritage through answering to a questionnaire (see Annex II), and specifically through proposing enhanced indicators to monitor sustainability in relation to cultural heritage buildings. Part of the proposed indicators has been integrated in these recommendations.

Ad hoc discussion has taken place in face-to-face meetings and during study tours and workshops organized within the project timeframe.

A discussion on the possibility of officially integrating the recommendations drafted in the text of the Aalborg Commitments, most likely as a non binding Annex[13], is still ongoing with the City of Aalborg, which is responsible for the management of the Aalborg process.

In the next sections a series of **recommendations and indicators** will be provided in relation to each analyzed commitment. The number of the commitments and of the actions presented below is not continuous, as the focus was posed only on the Commitments directly related to cultural heritage). A series of **practical examples** and case studies are featured, to give inspirations and practical advice to each action/ indicator proposed.

For the full list of Commitments please see Annex I.

Indicators are proposed not to be exhaustive, but to be discussed and improved continuously. Best practice examples serve to illustrate the recommendations and to provide inspiration, and do not wish to be considered exhaustive.

5.1.1 Commitment n. 3 – Natural Common Goods

"We are committed to fully assuming our responsibility to protect, to preserve, and to ensure equitable access to natural common goods."

Action 1 - reduce primary energy consumption, and increase the share of renewable energies.

Indicators:

Relevance	Indicator	Proposed improved indicator
High	• Increased share of electricity and heat from renewable or environmentally preferable energy sources	• Set ad hoc target for renewable energy use in historic buildings • Set ad hoc target for energy efficiency

[13] The Commitments have been signed by 693 cities and it would be very difficult to proceed with the adoption of a new commitment at this stage.

	(recommendation: to 12 % by 2010) • Doubling of the total share of cogeneration.	renovation of historic buildings • Promote usage of locally produced renewable energy and materials – reducing emissions from transport • Increase the share of recycled material – when compatible with the building • Monitor energy consumption in public buildings with historic value • Build awareness on energy efficient behavior for users of these buildings

Recommendations:

- The historic environment is a **common good** and it contributes to our sense of national, local and community identity and can support community cohesion through providing a sense of place. For this reason its **protection** is crucial to achieving sustainable development.

  At the same time **cultural heritage is a finite resource**, and it needs to be conserved to benefit everyone, through **equitable access** to it now and in the future.

  Local governments should work to **create added social and economic value** to the historic buildings they own – including them into broader strategies at local level.

- **Retrofitting and providing new life to historic buildings** reduces energy consumption and is inherently sustainable. Not only because of their embodied energy preserved, but also in consideration of the savings both in emissions and in energy that would cost **producing materials** for a new construction, and demolishing and **disposing of the existing materials**.

  Guidelines and inspirations on a range of possible technical solutions to adopt, on a case by case basis, to protect historic buildings while proceeding with an energy efficiency retrofit, have been developed by 3ENCULT.

  For more information: www.3encult.eu

- Ad hoc **targets** on both **energy efficiency and renewable energies** can be set on a case to case basis, keeping in mind that the protection of the building remains the ultimate goal of the action.

  Local authorities need to consult with experts, heritage protection authorities, and research institutions to ensure that the full potential of both protection and energy efficiency is exploited.

- Generally a **building that can be used is more appealing to investments**. A balance between conservation and new use needs to be discussed ad hoc. Flexibility and compromised might result in ensuring that the building will be maintained.

  Nonetheless, **revertible and not invasive solutions** are always to be preferred.

  Local authorities should consider that **reducing energy demand** is a sustainable approach that allows for positive results potentially without impacting severely on the building – e.g. through more efficient heating or plumbing systems, that use less and cleaner energy. This will also results in a **return of the investment** for the retrofit through the energy and heating bills.

- Where feasible connecting the buildings to **district heating and cooling systems**, or can use co-generation or other renewable energy sources. A sustainable option is also to **purchase locally produced renewable energy**.

The best practice:

Commitment n. 3 - action 1:

Peak District National Park Authority[14] - guidelines for building owners

The Peak District National Park Authority (UK) has developed a brief and effective guideline for owners and occupiers of historic buildings in the area.

The guideline clearly states how the priority shall be reducing the need for energy – as the most sustainable energy is the one not consumed. Reducing energy use and improving energy efficiency are much more cost-effective than retrofitting energy measures. They also have minimal impact on a building's character.

The document also provides some generic information on how to approach the retrofit of the buildings in the area, inviting owners to repair and draught-proof existing historic windows, to improve their thermal efficiency. Indicating how the character of historic buildings can easily be destroyed by inappropriate, modern windows. Such works are not always cost-effective.

It also provides some advice on more appropriate options for improving the thermal efficiency of historic windows including:

- Blinds or heavy curtains – fitting these almost halve the heat loss.
- Internal shutters – these reduce heat loss slightly more.
- Combining shutters and curtains, or curtains and secondary glazing – provides better insulation than a double-glazed unit.

The advised solutions take into account traditional ways of insulating or managing temperatures that are less invasive.

The guidelines also provide advice on sustainable use of materials, stating:"Sourcing materials and products from around the world contributes significantly to air pollution and environmental damage. Some modern materials require large amounts of energy to be used ('embodied energy') in their extraction, processing, manufacture and transportation."

It invites to use materials more sustainably by following these principles wherever possible:

- Repair rather than replace – less embodied energy, less waste.
- Use salvaged or recycled materials and products, including aggregates, where appropriate.
- Buy materials and products locally – reduce transport emissions.
- Minimise use of non-renewable resources.
- Avoid products whose manufacture, use or disposal causes harmful by-products.
- More detailed recommendations that can be replicated state:

[14] Peak District National Park Authority, Conserving your Historic Building, Sustainability and Historic Buildings: A guide for owners and occupiers

- Use plant- or water-based paints labeled with a low VOC rating (volatile organic compounds, harmful to health), rather than oil-based paints.
- Avoid plastics and upvc. Made from oil, a nonrenewable resource, these require large amounts of energy in production and emit toxins when incinerated (many European countries have restricted the use of upvc in buildings on environmental grounds).
- Wherever possible use local materials, such as stone, slate and tiles: imported stone and slate from other continents are often a poor visual match to our traditional materials.
- Specify timber from independently certified, well managed forests bearing the Forest Stewardship Council (FSC) logo.

For more information or to get inspired on how to address citizens and sensitize them to both cultural heritage protection and sustainability: "*Peak District National Park Authority, Conserving your Historic Building, Sustainability and Historic Buildings: A guide for owners and occupiers"*

Action 3 - ensure the mixed use of buildings and developments with a good balance of jobs, housing and services, giving priority to residential use in city centers.

The indicators:

Relevance	Indicator	Proposed improved indicator
Medium	• Deliver a plan for brownfield site utilization. • Reduced proportion of new building on greenfield sites.	• Raised awareness about social/economic benefits of retrofitting historic buildings (city of short distances, repopulation of historic urban centers...) • Improved and integrated transportation system to facilitate citizens living in centers as well as tourists visiting • Inclusive approach/ working groups/ stakeholders consultation set-up to discuss renewal of master plan

The recommendations:

- Although most places of heritage value are in use, often the relationship between use and heritage values can range from mutual support (in the normal situation of use justifying appropriate maintenance) to conflict.

  The **shared public and private interest in sustaining heritage** in use demands mutual co-operation and respect between owners or managers and regulators. The best use for heritage building is one that is both capable of sustaining the place and the values it represents, and avoids or minimizes harm to its values in its setting.

  The exchange between owners and policy makers is crucial to ensure adequate protection of the heritage buildings, as **informed owners** will be able to retrofit more adequately their historic buildings.

- Considering the need for **housing and infrastructure** expected over the coming decades, the building sector represents a critical component to achieving long-term sustainability objectives. Reductions in the cost of tenant-paid utilities facilitate social housing residents. Sustainable social housing also provides new employment and life opportunities for residents, through improved urban integration. Facing the current

challenges of **urban segregation** is crucial to truly contribute to **poverty eradication** and enhance the quality of life of the most vulnerable populations.

- Most historic centers have a **compact layout** with a mix of business, residential, retail and leisure uses which reduces the need for travel and it is inherently sustainable.

  Local authorities can use this to their advantage and through **integrated urban planning approaches**. They can reduce infrastructure needs and costs through linking transport, energy generation and urban planning. Especially in the field of transportation the potential for emission reduction and for economic and social improvement is particularly high, through simply facilitating more integrated and sustainable mobility within the city. This would give both access to people to better live their environment and to business, especially tourism, to be connected.

The best practice:

Commitment n.3 – action 3:

Lublin: back to the historic center

Lublin (Poland) has been working on the revitalization of the Old Town since 1995. The revitalization bases on the outlines of the "Strategy for the revitalization the Old Town" together with concept designs for public space improvement.

Lublin has approximately 345,000 inhabitants. Its picturesque old town with narrow cobbled streets and burgher houses is about 120 hectares in size. About12,000 people live in the historic city centre.

Through Lublin's revitalization plan:

- 80% of properties were subject to some kind of improvement (renovation/extensions of buildings, new houses);
- The basic infrastructure (water + sewage) introduced in 90% of the streets where previously missing;
- Improvement of 30% of street surfaces;
- Creation of app. 300 private local businesses;
- Clean-up and arrangement of recreation area, including main bicycle route of the city;
- improvement of public space, technical infrastructure, public safety and accessibility,
- supporting cultural activities to bring life to the Old Town and communicate the history and the cultural value,
- supporting tourist-oriented activities, ground floor business activities and cultural oriented businesses.

The revitalization scheme was developed jointly by the city and by the local business situated in the historic centre, through a participative consultation approach.

For more information: URBACT HerO

Action 4 - ensure appropriate conservation, renovation and use/re-use of our urban cultural heritage.

The indicators:

Relevance	Indicator	Proposed improved indicator

Very high	• Reduced number of buildings of communal and cultural value demolished per year • Increased proportion of disused buildings and urban spaces returned to active use.	• Set up a stakeholders consultation process for renovation of historic buildings • Monitor energy consumption in public heritage buildings • Raise awareness/ train staff working in public heritage buildings both on energy efficient behavior, with specific use on how to best interact with the specific building they work in – e.g. traditional solutions • Set up and awareness strategy within the departments of the local governments and for the public • Monitor population density in historic centers • Monitor business in historic centers

The recommendations:

- Cultural heritage embeds a series of values that go beyond the purely aesthetic considerations and that are worth of conservation. It can have **evidential value** - evidence about past human activity, **historical value** - events and aspects of life in the past; **aesthetic value** and **communal value** - the meanings of a place for the people who relate to it, or for whom it figures in their collective experience or memory.

  Communicating that significance to everyone concerned with a place, particularly those whose actions may affect it, is then essential if all are to act in awareness of its heritage values. This understanding should include policy makers, but also business and the citizens so to ensure cyclical renewal and repair.

  Explore within your local government what strategies are being used, for example by other departments, to communicate with both stakeholders and citizens and start an **awareness** strategy – e.g. within the **energy days** organized in your city.

- Every conservation decision should be based on the understanding that it will **impact** not only on the building but also on the **urban fabric**, and that it might influence the usage and the interaction with the building. Local governments should be aware of this and engage appropriate experts in drafting the best possible integrated strategy, which should include energy, climate, mobility, biodiversity aspects.

  3ENCULT has developed guidelines to support local governments in **integrating cultural heritage** in their **master plan**, as well as in their **climate and energy** policies and planning.

  To ensure a successful integration of these actions and the best possible benefit for the community, the guidelines suggest a 5 milestones approach to follow:

  - Assessment – where do you stand? Draw your baseline!
  - Target setting – what do you want to reach?
  - Planning – how do you plan on reaching these targets?
  - Implementation – what steps to take - including financing
  - Monitoring – evaluate, optimise and start to improve again!

To learn more, the 3ENCULT's "**Recommendations for Local Governments on Integrating energy efficient retrofit of historic buildings into policy and planning"** developed by ICLEI, are available at: www.3encult.eu.

- **Change in the historic environment is inevitable**. Natural processes, time and usage, and people's responses to social, economic and technological change, have an impact of the relationship with cultural heritage.

  It is crucial to consider the characteristics of the building, and what is needed to ensure its protection, and at the same time to assess the **best possible usage**, which will allow the community's interest into continuing appreciating and protecting its value.

  Explore traditional solutions: energy efficiency does not always come from the newest technologies – explore with conservators if historic techniques can be reapplied to the building (e.g.: cooling, shading)

- **Train the staff working in public historic building** to assume an **energy efficient behaviour** in the building and make them aware of how to use **traditional solutions** to this aim. Aware users are usually more understanding and keen to contribute.

- Use retrofitting of historic buildings to **repopulate** historic centres. This will contribute to sustainable use of the land, and reduction of the emissions through shorter distances and utilization of public transports, and it would result in a reduction of possible impacts due to **anthropogenic habitat fragmentation** of the area[15].
  Monitor the density of your historic centre, and the percentage of business. Urban planners and experts dealing with mobility need to be involvement in this process – good **mobility strategies** will support the revival of the historic centre and the economy in the area.

The best practice:

Commitment n.3 – action 4 (I):

3ENCULT new methodology for Environmental Impact Assessment

The Royal Danish Academy of Fine Arts has developed a new methodology based on Environmental Impact Assessment (EIA). The methodology is being applied to the eight case studies selected by the 3ENCULT project, representing a diverse, and comprehensive, mix of European built heritage (urban and rural, cold and warm climates, humid lowlands and dry mountain areas).

Environmental Impact Assessment (EIA) is an impact assessment tool that is aims at identifying and facilitating environmental potential risks and optimal solutions for integrating an infrastructure through a sustainable development framework.

EIA ensures that potential environmental impacts are addressed in the phase of planning. EA can be undertaken both for single and impacting projects, on the basis of Directive 85/337/EEC, 'Environmental Impact Assessment' – EIA Directive, or for public plans or programmes on the basis of Directive 2001/42/EC, 'Strategic Environmental Assessment' –

[15] http://ec.europa.eu/agriculture/publi/landscape/ch5.htm

SEA Directive. The common principle of both Directives is to ensure that plans, programmes and projects likely to have significant environmental impacts are subject to a detailed assessment, prior to their approval or implementation.

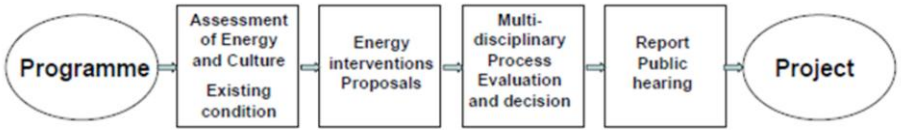
Consultation with the public is a key feature of environmental assessment procedures.

Projects such as development of infrastructures are strongly impacting, and they are developed within policy frameworks, planning strategies and programming procedures.

The use of SEA can improve the quality of such plans and programmes through aiming at a better environmental integration, which takes into account holistic and cross-sectoral approaches, steering plans and programmes towards sustainability objectives.

While SEA addresses strategies for future development with a high level of uncertainty, EIA addresses concrete measures.

The new 3ENCULT methodology goes beyond these considerations and it aims at providing **guidelines for identifying and better integrating cultural and energy indicators** within conservation works of built heritage. Through doing so, environmental, social and political decision-making is supported. This methodology has been developed as an instrument that identifies different stakeholders' perspectives as part of a process that includes energy and culture in environmental impact assessment. This process also involves public participation.



3. 3ENCULT Methodology flow chart

This methodology, developed on the basis of a survey conducted by 3ENCULT, wishes to identify and find a balance between the value of cultural heritage and energy efficiency. In doing so the methodology refers to European and international cultural charters and conventions, as well as to energy standards and directives. The identified indicators will be integrated in scenarios and setups for the democratic process, public hearings and decision-making. Scenarios will include passive and active energy retrofit solutions to be evaluated in a multidisciplinary decision forum, and will take into account local and even universal environmental impact assessment.

To learn more about the methodology visit www.3encult.eu

The methodology was applied in the Fæstningens Materialegård, the Material Court of the Fortress, in Copenhagen (Denmark), one of the case studies explored by 3ENCULT. Restored in 1994-96, the main building, Building I, was brought back to its original shape of 1756. The building, owned by Realdania byg A/S and the Cultural Authorities, has been refurbished and turned into office space. The restoration of the court is a pilot project, offering concrete results and a best practice example both of successful implementation of energy efficiency measures in an historic building, and of cultural heritage converted to new usage.

1. 3ENCULT study tour at Material Court of the Fortress

The energy retrofit of the listed "Old Material Court" in Copenhagen was aimed not only at the preservation of the building itself, but also at becoming a best practice on preservation

and CO_2 emission reduction for listed buildings across Denmark. Realdania byg A/S, a foundation owning a large number of historic buildings, worked closely together with the Danish Heritage Authority and experts from the different fields from the very beginning of the project.

The decision on the final solutions to be applied was developed through an iterative process: starting from a high number of potential solutions, following a series of analyses increasingly detailed, a poll more and more narrow of solutions have been shortlisted, up to reaching the optimal solutions for the building and the purpose of the retrofit – utilizing integrated Multidisciplinary Decision Process approach. **A multidisciplinary working group**, including professionals with great experience in building renovation contributed to the single tasks with their specific viewpoint. The group included:

- **Building owner** - impact on rental opportunities, operating and maintenance conditions
- **Heritage authority** - conservation viewpoint (also general evaluation of building typology)
- **Architects** - building history, conservation project, shape, appearance, functionality, interior design conditions
- **Structural engineer** - impact on existing construction, risk assessment (moisture)
- **Services engineer** - assessment of energy and indoor climate

Visit www.3encult.eu to learn more about this success story!

Commitment n.3 – action 4 (II):

Sustainable renovation in a housing area and national heritage asset in Torpa, Sweden

In Torpa, a multidisciplinary research analyses the complexity of decision making process for the renovation of an historical building stock, and assess the needs for involving a broad spectrum of stakeholders early in the process.

Torpa, built in 1940, is an early post-war housing area. Using stakeholder mapping and analysis, the local research team aim to visualize the different interests of the many stakeholders affected, including: antiquarians, architects, engineers, planners, property owners, researchers and a tenants' association.

A round-table discussions and workshops among the stakeholders has resulted in an inventory and pre-study for a planned renovation of Torpa. The study reveals that a broader stakeholder participation in early stages of renovation process will increase the understanding about the complexity of the process among the involved actors, and thus it will support a learning process able to strengthen not only the local cultural historical values but also the social values.

The research team tried to visualize the complex interactions and potential conflict areas between stakeholders within the renovation process. The perspective of the housing owner, the social perspective of the tenants, the technical perspectives, the environmental perspectives, cultural heritage and architectural qualities are among the different fields that the study covers.

The neutral platform for discussion provided, enabled direct exchange and discussion, while giving all stakeholders the opportunity to influence the process through providing input.

The housing stock in Torpa presents issues related to the building envelope (e.g. mould formation), which can result in health problems and at the same time energy efficiency related problems. The challenge is to find energy efficient solutions for the retrofit while

protecting the buildings, and at the same time, trying to guarantee a social stability threatened by the possibility of increased rents, as result of the renovation process.

The final decision concerning the renovation in Torpa will provide input for replicability for similar cases.

For more information: The Case of Torpa

Action 5 - apply requirements for sustainable design and construction and promote high quality architecture and building technologies.

The indicators:

Relevance	Indicator	Proposed improved indicator
Very high	• Have sustainability requirements included for construction and renovation in development plans. • Increased proportion of buildings with an energy consumption of less than 70 kWh/sqm (single-family-buildings) and less than 55 kWh/sqm (multi-family-buildings) (low-energy-standard). • Develop, adopt and implement a sustainable construction programme (guidelines, labeling, tax incentives etc.). • Decreased amount of construction and demolition waste.	• Have sustainability requirements included for renovation plans in historic buildings • Use sustainable materials – where compatible with building protection • Use locally produced material - where compatible with building protection • Set up consultation process with research and industry to find the optimal solution – traditional or innovative • Use sustainable solutions (e.g. natural ventilation and daylight) - where compatible with building protection • Set standards for user comfort

The recommendations:

- Once assessed the building, its value, and discussed the potential for intervention with the experts, **set a target for energy efficiency**. Displaying the results – e.g. an energy label could be useful to raise awareness of staff and visitors.

  Tests include: thermography, Ground Penetrating Radar testing, Blower Door Tests, Heat flow meter measurements; Hygrothermal monitoring with the use of wireless sensors (WSN); "Spot" measurements of expressive parameters of the Hygrothermal, visual and acoustic comfort; Psychrometric and lighting maps material compatibility. Discuss with the expert and involve them through the process.

- **Set guidelines for sustainable renovation**. Where compatible with the protection of the building, re-use sound materials derived from the place itself, repaired or altered - re-use of sound traditional materials recovered from alteration and demolition of other similar buildings, where feasible, can also contribute to sustainability.

  Furthermore, this will contribute to maintaining demand for new traditional and local materials that can stimulate both their continued or renewed production, and the **craft skills** to utilize, potentially creating **new jobs**.

- **Prefer sustainable techniques/ solutions** where feasible. Natural ventilation and day lighting for example improve the building occupants' health and well-being without the use of active technology. Consider the potential for:
  - Passive solutions (resulting from design and change in user behaviour)
  - Active energy solutions, meaning improving energy efficiency (technologies) and generating renewable energy for electricity, space and water heating or space cooling.
- **Look for the most sustainable materials,** in balance with cost-effectiveness**.** Discuss with experts, research and business and look of the optimal solution for the building.

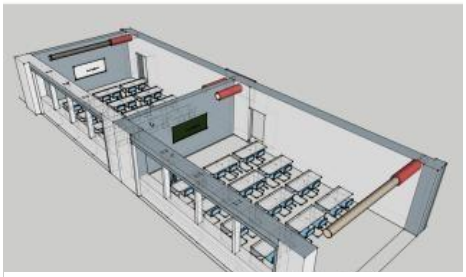
  Sustainability is also about economy, and integration. Take the opportunity to exchange with local research institutions and business, to proactively impact on education and economy in your local context. Furthermore, don't forget to look at the larger picture: energy saving means not only less emissions for your community but also less costs.
- **Power your building with local renewable energy**
- **Showcase your results**
- **Ensure user's comfort.** High quality architecture and innovative technologies should meet in historic buildings to make sure both protection of the building and enhancement of the user comfort. This is especially important if the building is a school or an office building where occupiers spend most of their day.
  For this purpose, monitoring is a particularly important measure. It can be used to monitor energy consumption, but also **temperature, humidity, light, and air quality**, all parameters essential to comfort.
  The **comfort of artworks** is also essential in order to guarantee their preservation for future generations.
  Local governments should consider **comfort of users** both as a **ultimate goal** and as a **trigger** for proceeding with energy efficiency retrofit of historic buildings.

The best practice:

Commitment n.3 – action 5 (I):

New ideas for retrofitting heritage school buildings: non-invasive ventilation system tested in masterpiece of early-modern architecture

In Innsbruck, at the Neue Mittelschule Hötting - a historic building and 3ENCULT pilot project - a new minimally invasive ventilation system for school buildings is being tested. The dual aim of this system is to preserve the architectural value of the building while guaranteeing scholars´ comfort.



5. 3NCULT - Neue Mittelschule Hötting´s classroom

When ventilation systems are integrated into historic buildings this requires minimal invasiveness (structurally) with maximum reversibility. For this purpose the principle of "active overflow", which is already used in refurbished dwellings, is an optimal energy efficient solution that can also be applied to school buildings. The idea is simple: fresh air is vented into the corridor and stair case, with fans actively pushing the air

from the corridor into the classrooms. Typically to optimize this approach, the ventilation system is linked to heat recovery and therefore needs ducts for air inlet and - exhaust to and from the rooms. Silencers are also needed to prevent noise.

Two 3ENCULT partners, the University of Innsbruck together with the company ATREA, are testing the first prototypes of active overflow elements with vans and silencers in one class room of the Hötting school. The prototypes aim for the obvious advantage - to avoid the need for ducts in the corridor or for the installation of a vertical shaft to provide fresh air.

The heat recovery system is instead placed on the roof and the fresh air is distributed via the open staircase and corridors through vertical ducts. Driven by a fan through a silencer the air is then distributed through textile ducts. The flow rate of the central unit is controlled by CO_2-sensor in the corridor and the fans in the classrooms are switched on according to a schedule one hour before the start of lessons. Motion control sensors switch off the fans after a delay of 15 minutes.

With a special focus on cultural heritage, this minimally invasive strategy is a big advantage to combine together preservation aspects and **user comfort** at the same time.

The technologies applied and the experience of the retrofit talking place in this school is setting a best practice that will potentially be **replicated** not only in schools in Austria but potentially across Europe.

To learn more visit www.3encult.eu!

Commitment n.3 – action 5 (II):

New jobs from an old profession – Strickbau in Appenzell (Switzerland)

As part of the 3ENCULT project case studies, researchers and experts are working together to make Strickbau wood log buildings more energy efficient whilst restoring them in line with conservation principles, and, at the mean time, actively working for creating a sustainable future for the Strickbau building technique, typical of the Swiss Appenzell region.

6. Strickbau in Appenzell

The challenge is to use modern and traditional features, and preserve historic architecture, to give these buildings new comfort standard and energy efficiency.

Developed during the 18th century, Strickbau features a highly recognisable architecture with even planking and wooden shingles on the facades. The traditional technique used conical beams able to dove-tail connections at the corners, meaning beams are fitted perfectly on top of each other. At the beginning of the 20th century, however, this technique was slowly abandoned and the knowledge was also lost.

The research of the 3ENCULT project aims to remedy this situation through an energy efficient retrofit of Strickbau without losing their historic character. The aim is to achieve airtightness in the house by adding new windows and finding solutions for moisture transport, including testing different techniques, such as vacuum-insulation- and wood-wool-panels, to identify the most suitable solution.

The efforts of retrofitting the Strickbau with modern, energy efficient, restoration methods, has triggered a recent revival and interest with some carpenters acquiring the traditional techniques used for these buildings in the past. Although it is estimated that it will take up top two generations to be able to restore fully this technique, a new "re-vamped" interest for craftsmanship is creating new skilled labor and job opportunities.

For more information visit: www.3encult.eu.

Commitment n.3 – action 5 (III):

A living lab for users´ comfort: Palazzina della Viola becomes an international hub for the University of Bologna

A fresh start for the XV century building of Palazzina della Viola in Bologna, Italy. The Palazzina, one of 3ENCULT's case studies, has been refurbished after 16 months of work.

7. **Inauguration Palazzina della Viola**

The building is now the headquarters of the University's Department of International Exchange – a working area for exchange and multiculturalism of about 1,300 m^2. The area hosts 40 employees who interact with around 5,000 international students and more than 2,000 exchange students annually. The Palazzina symbolises the continuous joint effort and the crucial collaboration between the City and the University.

Since the end of the refurbishment works in March 2012, an extended and innovative cloud sensing network was installed in the building. The system, developed by the DEIS Dept. of University of Bologna, consists of about 40 nodes, each equipped with a number of sensors. These nodes are distributed throughout the four levels of the building. The sensors continuously record energy and structural and environmental data, which is then stored in a database. The data is accessible in real-time through a website for data visualisation and downloading, creating a valuable data bank for further studies.

Light distribution maps, air temperature and relative humidity data have been obtained through a number of "movable" WSN nodes located on the first floor. These nodes are used to perform post-intervention diagnosis and facilitate greater analysis of employee behaviour and use of the building. This in-depth evaluation will help to find ways of improving the comfort and energy consumption of the Palazzina, a "living lab" for the University of Bologna.

For more information visit: www.3encult.eu.

5.1.2 Commitment n. 4 – Responsible Consumption and Lifestyle Choices

"We are committed to adopting and facilitating the prudent and efficient use of resources and to encouraging sustainable consumption and production."

Action 3 - avoid unnecessary energy consumption, and improve end-use energy efficiency.

The indicators:

Relevance	Indicator	Proposed improved indicator
High	• Decreased total primary energy use. • Reduced CO_2 emissions caused by energy consumption in municipal buildings and operations (recommendation: 30 % by 2005 and by 50 % by 2010, base year 1987)	• Regularly monitoring the release of GHG emissions in historic buildings to detect problem areas • Set target for improved energy efficiency in historic buildings • Include lifecycle cost analysis in retrofitting – need to be assessed with in mind protection of the building

The recommendations:

- The most sustainable way to increase energy efficiency is to avoid energy consumption as far as possible. Local governments should invest in **educating** both staff and occupants of buildings to use adequately the buildings ´features and to maintain a more energy-aware behavior.
- Purchasing environmentally sound appliances and materials can heavily contribute to the overall decrease of energy use. **Green public procurement** can be an efficient way to address sustainability when approaching a retrofit.

  Within the procurement process, local governments should aim to identify solutions that can satisfy the requirements of building protection, and at the same time, social economic and environmental sustainability. Key social, economic and environmental factors that should be addressed **during the lifecycle** - considering the whole life of a project **from inception through to design and construction, operation and finally re-use or disposal**.
- Tools for **Environmental assessment** are available and can support decision makers thorough the process. Local governments should not only consider direct impacts on the building but also investigate the **impacts in terms of transportation of the materials, as well as the re-usage/disposal of discarded materials**, as well as the energy for creating or renovating the replace material, keeping in mind that energy is not only translated in emissions but also in costs. Prefer transport by train instead of tire when possible, and as much as possible discarded materials.

  A long lasting, energy efficient, sustainable material/appliance might be more costly today but have a **relatively short pay-back time** while considering the additional costs for maintenance, disposal and replacement.
- Green public procurement can also be the key for exploring **innovative financing and contracting approaches** able to **support the retrofit of historic public buildings.** Read more at: Procurement of Innovation Platform

More information on what financial schemes can be used to retrofit public buildings in the 3ENCULT's "**Recommendations for Local Governments on Integrating energy efficient retrofit of historic buildings into policy and planning"** developed by ICLEI, and available at: www.3encult.eu.

- A team of experts, including procurers, can support local governments in identifying within the range of suitable options the best value whole-life – able not only to meet the business´ need but also in making informed decisions about the feasibility and nature of the project. This includes the impact the options (in delivering and operating the facility) will have on the stakeholders.
- **Innovative technical solutions** are being developed to be increasingly sustainable through environmentally sound materials and high energy performances. Local governments should refer to experts and researchers to better evaluate their options and purchase the materials/appliances that best suit the building, its protection, its usage and considerations on sustainability. Very often research can be found on the spot through local institutes of research and local universities.

  The most sustainable and energy efficient solutions could also be the employment of a **traditional material**, the re-set up of a traditional technique or system - local authorities should not forget that innovation can come from the past and it is not always the more expensive option.
- **Monitoring** represents a substantial precondition of any intervention, especially in considering historic buildings. Adequate **tests (blowdoor test, hygrothermal, etc.)** need to be carried out prior to planning the intervention and are crucial in order to define optimized solutions and strategies for both the preservation and the energy efficiency improvement of the building.

  Local governments need to consult experts both in the field of energy efficiency and monument protection in order to ensure informed retrofit strategies.

  Monitoring of the behavior of the building can inform, from one side the selection of adequate solutions, but also **support on the decision of the future usage** of the building, as well as supporting the process of **increasing the comfort** of both artworks and staff using the building. Monitoring is therefore needed thorough and even after the process. This will allow an understanding of the behavior of the building, also from an energetic point of view and will support a **better preservation** on the long term of both the **building fabric** and of the **indoor climate conditions**.

  Furthermore monitoring, in combination with informed user behavior, will allow to improve, and to positively impact on the **energy efficiency** of the overall building.
- Local governments are not only a user of innovation but can proactively contribute to the development of new sustainable technical solutions through **promoting** their use and collaborating with research institutions.

  Furthermore, local governments act as beacon in **inspiring** citizens into investing and deploying sustainable innovation. Through making the public aware of the quality of the intervention applied to a trademark historic building, local authorities can educate the public and trigger **interest and awareness** in the community.

Commitment n.4 – action 3 (I)

Sustainable Construction & Innovation through Procurement

During 2004 the Treasury Building (also known as GOGGS), a listed Edwardian building, was redeveloped to support the demands of a 21st century business, using sustainable public procurement.

When built, GOGGS was regarded as one of the most important new public buildings in London since Sir Charles Barry's Palace of Westminster, completed over half a century earlier, in 1852. Special mention was made of the towers and the Circular Court.

By working closely with English Heritage the project team was able to successfully develop a **good value for money** project that delivered essential improvements to the building fabric and the working environment for staff, **while respecting the historical and environmental aspects** of a significant London landmark.

In addition to its architectural importance, politically and historically GOGGS has acquired a symbolic status for the role it played during the Second World War. Partly because of the building's robust construction it was chosen as a suitable home for Churchill and his wartime Cabinet between 1940 and 1945. The D-Day Invasion of Normandy in June 1944 was planned in the Cabinet War Rooms (CWR) below the West Court.

As part of the 1 Horse Guards Road design, considerable additional space was made available for the extension of the CWR Museum, where exhibits explain the pivotal role of the building's occupants during the Second World War.

For more info: PPI Platform

To learn more about sustainable public procurement of innovation for construction, take a look at the work done by the SCI-Network (Sustainable construction and innovation through procurement) is an organization that seeks to connect European Public authorities with sustainable building procurement opportunities. The Network provides five working groups that assist in the procurement process, including:

- Environmental assessment tools
- Innovative technical solutions
- How to encourage innovation in construction procurement
- Life cycle/whole life costing
- Innovative financing and contracting approaches

The Network has produced two publications which aim to assist public authorities in their construction procurement:

A Guide on Procuring Innovative and Sustainable Construction Solutions has been produced by the project and is now available for download. The Guide contains a series of recommendations for good practice developed by a series of working groups within the network.

The Guide is available in English, Dutch, Finnish, German and Italian.

A collection of best practice "Snapshots" has also been produced to accompany the Guide, which provides concrete examples from across Europe to illustrate the recommendations given in the Guide.

More information at: http://www.sci-network.eu/

Commitment n.4 – action 3 (II)

Monitoring and control for energy savings, comfort and education: Industrial Engineering School of Bejar Salamanca

In the scope of the 3ENCULT project, a new concept of wireless sensors –ZigBee sensors – able to monitor the environment, processes and store the collected data so that other sensors can use them, transmitting the information through a wireless link. The sensors are placed into and engineering school where students experience monitoring of energy efficiency in cultural heritage directly.

This newly developed sensor has been used in one of the case studies of the 3ENCULT project, Industrial Engineering School of Bejar, in combination with a Building Management System allowing for improvement in the behavior of the building through saving energy, raising comfort conditions for an overall better indoor climate conditions. Through these improvements, the risk of damages to historical value of the building is minimized, and the comfort is exponentially improved.

In total 7 ZigBee sensors have been deployed together with a Building Management System which is collecting stable data from the School's lighting and HVAC systems.

The lighting system was previously working inefficiently, with poorly distributed luminaries activated manually. After the deployment of ZigBee sensors, luminaries are divided into zones according to the occupancy patterns, and the control is automated through light sensors. This way the best zone to be enlightened is identified automatically, and as result 50% of the lights can be kept off.

Another control system is deployed on the HVAC system of the school building. This system controls the temperature by operating according to pre-set temperature points. If the temperature goes over 25.5°C and the room is occupied, the fan coils are switched on in cooling mode, and if the temperature goes below 21.5°C, the fan coils are turned on in heating mode. All these information processed by a Building Management System which also takes into account the usage of the rooms in the building, in order to avoid the system working outside the established timeslots.

The required data can be collected by the wireless sensors without damaging the historical value of the building. This smart control system has improved both comfort level and energy behavior of the buildings.

Students are witnessing on a daily basis but the usage of these innovative technologies and beneficiaries of the comfort improvements. Additionally, their awareness on energy efficiency and protection of heritage has increased, through influencing their behavior as users of the building.

For more information: www.3encult.eu

5.1.3 Commitment n. 5 – Planning and Design

"We are committed to a strategic role for urban planning and design in addressing environmental, social, economic, health and cultural issues for the benefit of all."

Action 1 - re-use and regenerate derelict or disadvantaged areas.

The indicators:

Relevance	Indicator	Proposed improved indicator

High	• Reduce proportion of unfit residential and commercial buildings. • Increase in the number of services and infrastructure facilities within regeneration areas.	• Raise awareness on historic and energy value of historic buildings • Integrate historic building relevant aspects in urban planning approach (e.g. connection to district heating / cooling system) • Inform citizens of the project for regeneration • Ensure a balanced mix between social and private housing in reclaimed areas • Include community facilities in regenerated areas • Employ locally, to further benefit the economy of the area and create a sense of belonging • Minimise potential conflict between sustaining heritage values of a place and other important public interests by seeking the least harmful means of accommodating those interests

The recommendations:

- Sustainability involves optimally balancing seemingly conflicting needs across constraints in different areas (environment, economy, society, politics)

  From the **environmental** point of view, sustainability is concerned with protecting and conserving both biodiversity and the environment. This applies to buildings, by reducing energy consumption, waste, preventing pollution and using water – and other natural resources – as efficiently as possible. Due to the nature of historic building complying with environmental sustainability criteria is often challenging, as with cultural heritage the priority remains with the preservation of the building.

  From the **social** perspective, sustainability has a great potential when it comes to cultural heritage. It allows to identify the needs of individuals and considers their well-being in a wider scale, keeping into account the impact that retrofitted historic centers and buildings can have on the collectivity - from health and safety, through to boosting local economy, social inclusion and eradicating poverty.

  Economic sustainability criteria, focusing on economic growth are also particularly relevant to many heritage buildings, thanks to relevance that many of these buildings have on tourism and service industry.

  All of these factors need to be included while planning the regeneration of an urban area. The strategy developed needs to be coherent and to take into account the density of the area, the type of inhabitants, the mobility and the infrastructures present in the area.

- Historic centers are increasingly **depopulated** due to high costs both of living and of maintenance – including bills, which severely impacts on the standard of comfort. The **young** segment of the community cannot afford to live in these areas, and when it does, cannot afford to invest in the retrofit of the buildings. **Owners are often elderly** who from one side do not engage or cannot engage in renovations, and from the other belong to a segment of the population particularly **at risk**, from example of **fuel poverty**.

- Energy efficient solutions in historic buildings can be difficult to implement, and when the occupants are on low or fixed income, the **comfort** level has direct impact on their **health** and well being. Energy poverty directly affects tenants: cold homes are prone to mould and fungal growth form condensation dampness, which can cause respiratory problems – which result also in increased costs for the health-care system in many countries.

  Local authorities should act to ensure that historic properties with tenants at risk of fuel poverty are comfortable, affordable and suitable.

- The regeneration of a derelict area can not only bring positive effects on individuals but also contribute to creating a **favourable environment for business and investments**. This can result in better services, more jobs and in an increased integration among the inhabitants.

  For this purpose local governments should always consider the buildings that they decide to retrofit as part of an overarching and inclusive urban planning strategy – including green **spaces, better transport and mobility, cultural and social facilities able to foster sense of community around the historic buildings** being retrofitted.

  A useful exercise could also be to consider whether the building can continue or change its usage to host a facility able to meet the needs listed above.

- Cities have a role demonstrating positive impacts from sustainable building practices in schools, social housing and government buildings. By enacting sustainable building policies, **cities can foster change in consumption patterns** and educate their residents on the benefits of energy efficient and smart behaviour, and ensure the long-term performance and benefits of sustainable buildings.

The best practice:

Commitment n.5 – action 1 (I):

Energy Heritage– sustainable development against fuel poverty in Edinburgh

The project launched in 2017, in Edinburgh, aimed to producing best practices and guidance for replication on large scale of retrofitting of listed Georgian houses, situated within the Old town Conservation Area and Edinburgh UNESCO World Heritage Site. The reason behind the project was the result of a Fuel Poverty Map of the city, identifying in the historic center the part at highest risk.

Through the set up of a pilot case study, where measures were implemented, tested an monitored and through extensive discussion with a multidisciplinary team, effective solutions acceptable to planning and conservation bodies, as well as householders were developed.

The key issues taken into consideration were:

- impact on energy efficiency
- impact on aesthetics
- impact on fabric
- cost-benefits
- replicability
- innovation

Potential solutions were listed and discussed on a case by case basis, through a debate with the different experts and stakeholders. The main aspects addressed within the retrofit were

insulation, floors and windows. Lighting and heating were also addressed together with awareness raising among the householders. Systems chosen were mostly reversible, and originally existing internal wooden shutters were retrofitted or reinstalled.

Smart monitors were installed to address householders' energy efficiency awareness.

For more information: *Energy Heritage "A guide to improving energy efficiency in traditional historic homes", A Changeworks Initiative*

Commitment n.5 – Action 1 (II):

Valhalsgade, Copenhagen (Denmark): The Osram building – Preserving the soul of an historic building through addressing its future

The Osram building is a shining example to both Copenhagen and the rest of the world of the energy savings that can be achieved through sustainable retrofitting.

8. 3ENCULT study tour at the Osram building

The building, previously used for the manufacturing of light bulbs, has been renovated while retaining respect for the building's unique history. Throughout the renovation environmentally sound solutions have been used to enhance the structure.

The Haraldsgade neighbourhood was built from the end of the 1800s, and slightly over half of the area's buildings are from 1920-1939, mostly composed of industrial buildings. After industry became less significant in Denmark, much of the space in the old working-class neighbourhood lost its previous function.

In the new millennium, new demands have been made on the neighbourhood alongside changes in the makeup of the 9500 residents. People of 30 different nationalities live together in the neighborhood - largest groups are from Palestine, Turkey and Somalia. About 30% of the residents in the neighbourhood are ethnic minorities.

Early in the planning of the Haraldsgade neighbourhood Integrated Urban Renewal Scheme[16] - a five year plan funded by the City of Copenhagen and the Danish Ministry of the Interior and Social Affairs – it was decided that the Osram building would be renovated.

The five-year **urban renewal project** is holistic, and aimed to improve the district physically, culturally and socially. The scheme would have been in accordance with the needs of the local residents, including them in the discussion: residents were engaged in the preparation of the neighbourhood plan together. Residents also play a central role as representatives in the scheme's steering committee, which decided the projects to be financed.

THE BUILDING: The Danish architect Karl Wiedemann Petersen built the Osram building as the first construction in Copenhagen to be built with blasted concrete elements. The prefabricated elements were then assembled at the site, with the advantage that the building could be completed in a short time and regardless of the season. The blasted concrete, very

[16] http://www.covenant-capacity.eu/fileadmin/uploads/se/Events/osram_pr%C3%A6sentation_26062012.pdf

durable, also made it possible for the architect to express his creativity in designing the shape of the outer walls.

The building has been renovated while still retaining respect for the building's unique history, environmentally-sound solutions for local issues and a good interaction with the city's strategy for modernising the district heating network. This renovation work brought the Valhalsgade 4 to gain a frontrunner position during the 15th Conference of the Parties to the United Nations Framework on Climate Change (COP15).

Renovations have cut more than 60% of the building's energy consumption. This has been partly achieved through connecting the building to the modern district heating network (which was also being modernised at the time), and through installing a new and environmentally friendly heat pump.

One of the major themes in the culture house is daylight. New low-energy windows, skylight windows and glass walls help to make the house brighter. The glass also ensures optimal use of daylight, which saves not only electricity consumption on lighting, but also warms the building. A green yard has been created for residents of the area to use. The lights used are not the original appliances restored but modern LED lights: the aim with the renovation was not only to preserve the structure of the building but also its innovative soul, showing through the day the "pulse" of the dwelling and of its occupants.

Today the Osram Building fulfills various functions, including housing the offices of the Haraldsgade Integrated Urban Renewal Scheme. It is also a social and cultural gathering place for various activities, and an area of social importance. A gardening project takes place around the building. There, citizens originally from Copenhagen and belonging to minorities can meet, get to know each other while sharing a small garden that they cultivate together.

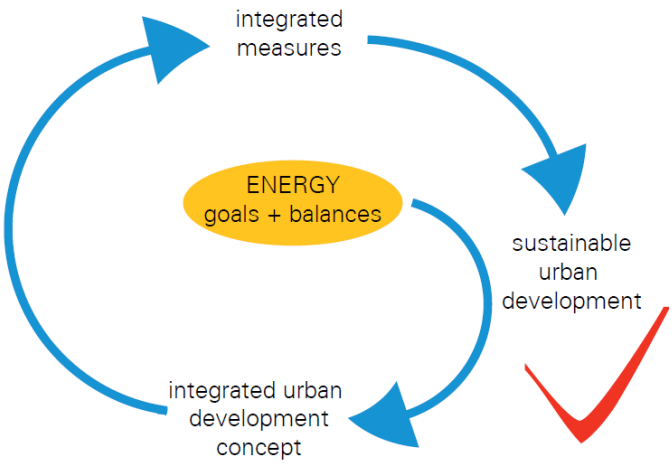
To learn more visit www.3encult.eu!

Commitment n.5 – Action 1 (III):

Integrated Quarter Assessment (IQA)

To effectively retrofit historic buildings it is important that measures are implemented in a coordinated way. Energy-efficiency measures work best in unison, while piecemeal measures may cause unnecessary complexity in the system. A new study has put forward a proposal for an integrated planning process and the description of two transparent and comprehensible methodologies for implementing it.

Integrated strategies are necessary that consider the city as a whole and will work with informal instruments. One central aspect of the proposed procedures is to examine and evaluate both built cultural heritage and energy efficiency, and to consider them in equal measure in an integrated planning process at urban level. Within the first paper, the Integrated Urban Development Concepts are methodically underpinned, with the energy goals of a municipality serving as the basis for the strategic planning.



Integrated measures as a motor of urban development

These concepts allow for an integration of communal planning by using city-wide strategic goals.

The Integrated Quarter Assessment tool strengthens the implementation of Integrated Urban Development Concepts within the local area and in the spatial integration of the strategic goals. In this tool the areas of urban structure, built heritage and energy supply infrastructure are equally considered within the context of sustainable urban development.

The IQA is an element for amending an integrated urban development concept or spatial strategx and combines the initial energy situation with urban qualities, and it serves as a tool for a cross-disciplinary planning of measures to improvethe energy efficiency in a quarter.

The IQA method is based on instruments of analysis in the field of urban development, monument conservation and energy supply infrastructure, and it addresses urban developmental goals, energy supply infrastructure and existing building stock on the basis of structural settlement typologies. The method assesses need for action within a quarter based on the experts 'consensus, through three phases:

- Inspection – Mapping and analysis of the initial situation in the quarter based on existing documents and a walk through the quarter.
- Assessment – Connecting the topics urban structure, built urban heritage and energy efficiency based on a few criteria for an assessment of the condition and the need for action.
- Recommendation – Presenting the synergies and conflicts of possible measures in a citywide context, and giving a recommendation with regard to an energy efficient urban restructuring.

The method presented here was developed at the Görlitz Centre of Expertise and published in the „Report on Integrated Planning Procedures for Low Emission Concepts in Urban Cultural Heritage Context".

To learn more visit www.3encult.eu!

5.1.4 Commitment n. 10 – Local to Global

"We are committed to assuming our global responsibility for peace, justice, equity, sustainable development and climate protection."

Action 1. develop and follow a strategic and integrated approach to mitigate climate change, and work towards a sustainable level of greenhouse gas emissions.

Action 3. raise awareness of the causes and probable impacts of climate change, and integrate preventive actions into our climate change policy.

Action 5. strengthen the international cooperation of towns and cities and develop local responses to global problems in partnership with local governments, communities and relevant stakeholders.

The indicators:

Relevance	Indicator	Proposed improved indicator

High	• Increased number of city partnerships for sustainability • Increased support to NGOs active in the field of international co-operation. • Improved support to local sustainable development by developed European towns to non-European less developed ones, particularly those of neighboring regions like the Mediterranean (Medcities).	• Include historic buildings into climate mitigation, adaptation and Sustainable Energy action Plans • Raise awareness about impact of climate change on historic centers • Number of actions taken to counter harmful effects of natural change, or to minimize the risk of disaster – monitoring time, proportion to the severity, and likelihood of identified consequences, and sustainability.

The recommendations:

- The historic environment is a shared good. Everyone should be able to benefit from it and to participate in sustaining it. To this aim, it should be managed through reasonable, transparent and consistent decisions, informed by consultation with all relevant stakeholders.

  Local Governments should consult citizens and community, business and industrial organizations to gather information and **build a consensus** on sustainable development strategies able to coherently include cultural heritage.

  This can include programmes for **participatory target-setting and stakeholders´ participation**, for example in discussing district regeneration; new technology and forms of digital democracy for example in re-discussing a master plan; and bridging the gap between research and policy-making and action and accountability and transparency in the decision-making process.

- Addressing cultural heritage is increasingly important to consider **climate change**. Experts can support local governments in understanding materials **vulnerability** (for example, in case of too much or little moisture), in monitoring the changes that these materials are suffering (e.g. for extreme weather events).

  They can use appropriate date to foresee the behavior of the building in reaction to climate change, and give input on how to limit and **prevent damages (**fail-safe methods and technologies for monitoring the impact of climate change).

- Socio-economic analysis, such as cost-benefit, is also crucial to the planning and implementation of integrated and sustainable policies and projects. **Assessing the economic losses** from climate change, both on the building itself, and on the society, can be valuable in order to plan appropriate investments and measures to implement.

  This can include **support to disaster management** (fire, drought, floods, avalanches, glacial lake outbursts, etc.) or effective **answers to stress factors** (e.g. pollution, sedimentation, etc.), but also understanding climate change **impacts on society** i.e. movement of peoples, displacement of communities, change in focus of local economy, and how they affect the **relation with cultural heritage.**

- All of these factors need to be reflected in the development and subsequent implementation of climate mitigation and adaptation plans.

  Cultural heritage can become a **flagship project**. Local governments can include selected cultural heritage in their **SEAPs** with the aim of improving the sustainability

of the building while protecting it, but also with the result of sensitizing local communities towards the issue while **reducing the energy bill**.

Resilience to both climate change and to increasing tourism needs to be increasingly considered. It responds from one side to the need of preserving cities from natural disasters, but it also gives the chance to **secure urban cultural – and economic - assets**, that millions of tourists come to visit every year.

- **Invest in safety**: train extensively workers working at the construction site on safety measures in order to limit injuries (i.e. best practice at Olympic Site in London).
- Networks of local authorities, partnerships and twinnings play a very important role in increasing the awareness in the field of sustainability.

  They facilitate **political commitment**, as first step within a local authority to engage. They give the opportunity to discuss within the municipality itself – they can **trigger discussion among the different departments and with the opposition party**.

  Cities can meet their **peers**, exchange and discuss replicable strategies, which can be implemented at local level through a **tailor-made approach**.

  Sharing best practices and skills contributes widely to the development of sustainability, creating better trained and more skilled staff – at relatively low cost. Techniques such as work-shadowing prove to be particularly effective in this regard.

  Workshops and training are also fundamental to build capacity on this topic, also through addressing stakeholders´ involvement and financing models.

The best practices:

Commitment n.10 –actions 1 &3

How resilient is your cultural heritage? Padua includes historic district into adaptation planning for the future of the city

In the past years Padua has become a frontrunner on climate mitigation. The city has signed the Covenant of Mayors in 2010 and has developed its Sustainable Energy Action Plan (SEAP) aiming to a reduction of a 20% reduction of the greenhouse gas emissions equivalent to 378.432 CO_2e. Now Padua investigates how to adapt to climate change and protect its cultural heritage.

9. Basilica del Santo, copyright: syder.ross / Foter.com

The impact of climate change on the city has been slowly increasing, and after the flood of the river Bacchiglione that has hit the neighbouring city of Vicenza in 2011 and following a record heat-wave during the same year, Padua has decided to proactively plan for an adaptation strategy to build on the mitigation actions already in place.

The **Adaptation Plan**, still in the "baseline assessment" phase, aims to include all the specificity of the territory including historic buildings. The very large historic center is home of one of the oldest university in the world, and of several heritage, historic and listed buildings such as the Scrovegni Chapel (with frescos by Giotto), the Basilica di Sant´ Antonio and of an ancient Botanic Garden that was added to the UNESCO World Heritage List in 1997.

In the years, excessive rainfalls have threatened the Scrovegni Chapel, whose crypt has been repeatedly flooded. Lack of integrated planning within the park in which the Chapel is located, allowed trees to be planted very closely to the building, which is now threatened by them during particularly windy days.

The city is now taking into consideration possible adaptation strategies, starting from an in-depth vulnerability study to assess how to better proceed with integrated actions. Among the foreseen actions the city is already considering: integrated approaches for green urban areas, improvement of already existing plans through the support of the civil protection office with a special focus on water and rainwater management.

A step-by-step process has led the city to explore integrated approaches for the citizens and for the environment where they live.

For more information contact: Comune di Padova, Settore Ambiente - Ufficio Agenda 21 c/o Informambiente - www.padovanet.it

Commitment n.10 – action 1,3 & 5

Bologna – Cultural heritage & Sustainable Urban Planning

The Municipality of Bologna is working on the retrofit of the Sala Urbana (also known as Coat of Arms Hall), located in the Municipal Arts Collection Museum of Palazzo d' Accursio. This retrofit has become a pilot for the city´s SEAP, which will also include retrofitting more selected historic buildings.

10**. Sala degli Stemmi, Palazzo D´Accursio**

The works follow a series of investigations, conducted in collaboration with the University of Bologna and the local 3ENCULT case study team, to assess the stability of the building and the level of indoor comfort.

This case study is particularly interesting and significant because of its museum function: the building does not only have to satisfy conservation and protection requirements for the collections contained, but also to guarantee health and comfort of the public and the personnel.

A delicate microclimatic balance has to be found for both people and objects hosted within this building. Structural safety has also to be guaranteed, as well as security, and fire safety.

Environmental comfort includes all the actions aimed at the protection of the building from external agents (e.g. micro-climate, pollution). Among the parameters that can affect environmental comfort there are: hygrometric and thermal conditions (temperature, humidity and ventilation) and lighting conditions, including UV, also chemical pollution, among others. These values have to be confronted with real condition to identify a compromise taking into consideration conservation, users 'needs and systems functions.

Structural safety includes stability of the building against natural events (snow, wind, earthquakes). To this aims it is crucial to verify the static capacity of the structure and if

needed to plan an improvement. To this aim, in Italy, is foreseen, a compulsory analysis of the seismic vulnerability of all buildings declared of so called “primary interest” (such as: libraries, schools, museums) in seismic areas (1 to 3 risk index).

Safety in the usage addresses all issues related to utilization of the building as well as safety of the collections hosted. Fire alarms, smoke detectors, motion sensors, security alarm and safety shutters and glass able to stop UV rays – damaging frescos. All these interventions need to be verified in advance for compatibility with structural and aesthetic criteria, and to be potentially revertible.

An important element to assess the internal microclimate is captured by temperature and relative humidity data. To gather this information extensive monitoring is required: it is crucial in order to detect fluctuations during different periods.

It is also crucial to evaluate the illumination: both sunlight and heat can cause damages. Non- destructive investigations and monitoring can provide indispensable information for the energy efficiency retrofit.

Among the non-distructive investigations conducted: thermography, Ground Penetrating Radar testing, Blower Door Tests, Heat flow meter measurements; Hygrothermal monitoring with the use of wireless sensors (WSN); "Spot" measurements of expressive parameters of the Hygrothermal, visual and acoustic comfort; Psychrometric and lighting maps.

The monitoring and analysis of energy consumption in the selected areas were followed by a series of dynamic energy simulations, to evaluate the effectiveness of different technical solution. This aided in selecting the best performing energy and environmental solutions. Three types of intervention were selected:

- the replacement of all fixtures with a selective double-glaze;
- the replacement of the terracotta-tiled wood roof with a ventilated roof, providing a package of wood fiber insulation;
- the renovation of the limestone plasters.

The process of investigation of the building required the collaboration among several expertise including: experts on building conservation, urban planners, experts on installation of systems, specialists on retrofitting and energy efficiency, on monitoring and non-destructive investigations, on data collection and scenario simulation (both static and dynamic), experts on conservation of art collections, among others.

The process of approval of the intervention required several steps of authorization:

- approval by the local government administration
- approval of the cost by the administration
- approval of the project by the National Heritage Protection Agency
- review of the project by the office for anti-seismic safety
- and re-approval by the local government administration

The retrofit has also become a pilot case within the GovernEE project, a complementary project funded by the Central Europe program, dealing with issues regarding, in particular, the governance in energy saving projects, as an example of technical-administrative management. The project also supported the cost of replacing the windows. All other operations are funded by the city of Bologna.

This retrofit has allowed the city of Bologna to delineate multiple scenarios for the Local Action Plan for increasing energy efficiency in municipal buildings, in collaboration with several departments of the municipality. The Plan foresees activities also on selected historic buildings.

The Local Action Plan (LAP) is aimed at reaching the target fixed while elaborating the Sustainable Energy Action Plan (SEAP), developed within the context of the Covenant of Mayors´ initiative targets: 20% reduction of energy consumption for thermal uses in whole municipal stock of buildings.

The Final Scenario involving 87 buildings foresees energy savings for 13,5 GWh/year, photovoltaic production of 775,5 MWh/y, costs of 16,6 million euros and payback of 14,1 years.

For more information visit: www.3encult.eu, www.governeeproject.eu and http://www.comune.bologna.it/paes.

6. Brief conclusions and final recommendations

Sustainability aims to provide integrated solutions for a better quality of life, for this and for future generations. It is based on the understanding that smart use of resources needs to be integrated not only with environmental protection but also with social, political and economic standards able to guarantee high quality of life.

The construction sector employs 111 million people globally (ILO, 2010). The retrofit, operation and maintenance of sustainable historic buildings can support additional high - quality, long-term jobs to ensure the proper performance of these buildings. In addition to delivering considerable gains in resource efficiency and a reduction in the life cycle costs of buildings, sustainability in this sector has several health and social benefits that promote the well-being of local communities.

Although solutions and **technologies** (traditional and innovative) need to be discussed on a case by case basis, many are the factors that can be replicated on a larger scale when discussing cultural heritage and sustainability.

- The protection of the building comes first, followed by the comfort of the users. A retrofit can have a direct social impact. It can improve **health of occupants**, in relation to energy poverty, and it can drive the **regeneration** of disadvantaged areas.
- A retrofitted building is more likely to be used, and a building used is more likely to be invested on, and kept “alive”. Discussing cultural heritage is particularly important to define the **optimal use** (traditional or new), to fully benefit from the quality of the building while respecting it.
- **Climate change** is a direct threat to cultural heritage. Historic buildings need to be consistently integrated in both mitigation and adaptation plans - from one side, to ensure their protection, and from the other, to fully exploit their potential for emissions reduction and energy efficiency.
- Using **REs for powering** the building and for its retrofit, carefully preferring sustainable and local materials, and **consulting all stakeholders** through the process, are few of the indicators that can be applied.
- Existing procurement rules also give an opportunity to embed sustainability in the retrofit, for example through following **green public procurement**, and analyzing the whole life cost of the buildings, the material replaced, and the new ones used.
- The maintenance and reuse of the historic fabric, in particular of historic buildings and the historic centre contributes to **the efficient handling of natural resources** through reducing the need/ consumption of new materials (e.g. for construction), reducing the use of land, facilitating “urban development with short distances” (historic urban areas are usually a compact urban structure and are located in the city centre or nearby), reducing the length of transport ways/ less commuting.
- An attractive and lively historic urban fabric can contribute not only to the quality of life of the community, but also **enhance local and regional economic competitiveness**, creating a better environment for businesses and tourist sector.

Making cultural heritage part of smart urban strategies is an efficient way to both protect the building, the history of the communities, through making cultural heritage a valuable contributor to local sustainability.

7. Annex I

Aalborg Commitments

(directly relevant to 3ENCULT project - highlighted in yellow):

1 GOVERNANCE

We are committed to energising our decision-making processes through increased participatory democracy.

We will therefore work to:

1. further develop a commonly shared long-term vision for a sustainable city or a town.

2. build participation and sustainable development capacity in the local community and municipal administration.

3. invite all sectors of local society to participate effectively in decision-making.

4. make our decisions open, accountable and transparent.

5. cooperate effectively and in partnership with adjoining municipalities, other cities and towns, and other spheres of government.

2 LOCAL MANAGEMENT TOWARDS SUSTAINABILITY

We are committed to implementing effective management cycles, from formulation through implementation to evaluation.

We will therefore work to:

1. strengthen Local Agenda 21 or other local sustainability processes and mainstream them into the heart of local government.

2. deliver integrated management towards sustainability, based on the precautionary principle and with regard to the forthcoming EU Thematic Strategy on the Urban Environment.

3. set targets and time schemes in the framework of the Aalborg Commitments and create and follow the Aalborg Commitments monitoring review.

4. ensure that sustainability issues are central to urban decision-making processes and that resource allocation is based on strong and broad sustainability criteria.

5. cooperate with the European Sustainable Cities & Towns Campaign and its networks to monitor and evaluate our progress towards meeting our sustainability targets.

3 NATURAL COMMON GOODS

We are committed to fully assuming our responsibility to protect, to preserve, and to ensure equitable access to natural common goods.

We will therefore work, throughout our community, to:

1. reduce primary energy consumption, and increase the share of renewable energies.
2. improve water quality, save water, and use water more efficiently.
3. promote and increase biodiversity, and extend and care for designated nature areas and green spaces.
4. improve soil quality, preserve ecologically productive land and promote sustainable agriculture and forestry.
5. improve air quality

4 RESPONSIBLE CONSUMPTION AND LIFESTYLE CHOICES

We are committed to adopting and facilitating the prudent and efficient use of resources and to encouraging sustainable consumption and production.

We will therefore work, throughout our community, to:

1. avoid and reduce waste, and increase re-use and recycling.
2. manage and treat waste in accordance with best practice standards.
3. avoid unnecessary energy consumption, and improve end-use energy efficiency.
4. undertake sustainable procurement.
5. actively promote sustainable production and consumption, in particular of eco-labelled, organic, ethical and fair trade products.

5 PLANNING AND DESIGN

We are committed to a strategic role for urban planning and design in addressing environmental, social, economic, health and cultural issues for the benefit of all.

We will therefore work to:

1. re-use and regenerate derelict or disadvantaged areas.

2. avoid urban sprawl by achieving appropriate urban densities and prioritising brownfield site over greenfield site development.

3. ensure the mixed use of buildings and developments with a good balance of jobs, housing and services, giving priority to residential use in city centres.

4. ensure appropriate conservation, renovation and use/re-use of our urban cultural heritage.

5. apply requirements for sustainable design and construction and promote high quality architecture and building technologies.

6 BETTER MOBILITY, LESS TRAFFIC!

We recognise the interdependence of transport, health and environment and are committed to strongly promoting sustainable mobility choices.

We will therefore work to:

1. reduce the necessity for private motorised transport and promote attractive alternatives accessible to all.
2. increase the share of journeys made by public transport, on foot and by bicycle.
3. encourage transition to low-emission vehicles.
4. develop an integrated and sustainable urban mobility plan.
5. reduce the impact of transport on the environment and public health.

7 VIBRANT AND SUSTAINABLE LOCAL ECONOMY

We are committed to creating and ensuring a vibrant local economy that gives access to employment without damaging the environment.

We will therefore work to:

1. adopt measures that stimulate and support local employment and business start-ups.
2. cooperate with local businesses to promote and implement good corporate practice.
3. develop and implement sustainability principles for the location of businesses.
4. encourage markets for high quality local and regional produce.
5. promote sustainable local tourism.

8 LOCAL ACTION FOR HEALTH

We are committed to protecting and promoting the health and wellbeing of our citizens.

We will therefore work to:

1. raise awareness and take action on the wider determinants of health, most of which lie outside the health sector.
2. promote city health development planning, which provides our cities with a means to build and maintain strategic partnerships for health.
3. reduce inequalities in health and address poverty, which will require regular reporting on progress towards reducing the gaps.
4. promote health impact assessment as a means for all sectors to focus their work on health and the quality of life.
5. mobilise urban planners to integrate health considerations in their planning strategies and initiatives.

9 SOCIAL EQUITY AND JUSTICE

We are committed to securing inclusive and supportive communities.

We will therefore work to:

1. develop and implement programmes to prevent and alleviate poverty.
2. ensure equitable access to public services, education, employment opportunities, training, information, and cultural activities.
3. foster social inclusion and gender equality.
4. improve community safety and security.
5. secure good quality and socially integrated housing and living conditions.

10 LOCAL TO GLOBAL

We are committed to assuming our global responsibility for peace, justice, equity, sustainable development and climate protection.

We will therefore work to:

1. develop and follow a strategic and integrated approach to mitigate climate change, and work towards a sustainable level of greenhouse gas emissions.
2. mainstream climate protection policy into our policies in the areas of energy, transport, procurement, waste, agriculture, and forestry.
3. raise awareness of the causes and probable impacts of climate change, and integrate preventive actions into our climate change policy.
4. reduce our impact on the global environment and promote the principle of environmental justice.
5. strengthen the international cooperation of towns and cities and develop local responses to global problems in partnership with local governments, communities and relevant stakeholders.

8. Annex II

Aalborg Commitments – Call for imput

Call for input: Proposals for the integration of energy efficiency retrofitting of historic buildings in urban sustainability concepts

The efficient use of resources – here energy savings, energy efficient technologies and measures as well as the use of RES is needed for the energetic refurbishment of historic buildings. Local governments need to be involved in discussion of results, also in exploring the identification of generic replicable factors that can be proposed for incorporation into a broader urban sustainability concept.

The Aalborg Commitments offer a framework for an holistic action on urban sustainability. Organized into 10 holistic themes, they are developed to allow decision-makers to adapt them in order to meet their own special local conditions. The Commitments are designed to be tools to be used in the strategic target-setting process, to support in identifying where it is necessary to set goals and strategies, and they can then be further used to monitor the sustainability process.

Starting from the existing Aalborg Commitments on Sustainable European Cities (indicators and recommendations), 3ENCULT wishes to explore recommendations and strategies for the inclusion of historic buildings into urban planning, local climate and energy action plans, through the identification of replicable indicators and strategies to be implemented a local level.

The Aalborg commitments with relevance to the 3ENCULT focus:

Aalborg Commitment	Action	Relevance	Indicator	Proposed improved indicator	Comments/Proposals	Challenges/ Replicability
3 NATURAL COMMON GOODS : **We are committed to**	1. reduce primary energy consumption, and	High	• Increased share of electricity and heat from renewable or environmentally	• **Target for renewable energy use in historic buildings** • **Target for energy**	•	•

fully assuming our responsibility to protect, to preserve, and to ensure equitable **access to natural common goods.**	increase the share of renewable energies.		preferable energy sources (recommendation: to 12 % by 2010) • Doubling of the total share of cogeneration.	**efficiency renovation of historic buildings** • **…**		
4 RESPONSIBLE CONSUMPTION AND LIFESTYLE CHOICES We are committed to adopting and facilitating the **prudent and efficient use of resources and to** **encouraging sustainable consumption and production.**	3. avoid unnecessary energy consumption, and improve end-use energy efficiency.	High	• Decreased total primary energy use. • Reduced CO2 emissions caused by energy consumption in municipal buildings and operations (recommendation: 30 % by 2005 and by 50 % by 2010, base year 1987)	• **Regularly monitoring the release of GHG emissions in historic buildings to detect problem areas** • **Target for improved energy efficiency in historic buildings** • **…**	•	•
5 PLANNING AND DESIGN **We are committed to a strategic role for urban planning and design in addressing environmental, social, economic, health and**	1. re-use and regenerate derelict or disadvantaged areas.	High	• Reduced proportion of unfit residential and commercial buildings. • Increase in the number of services and infrastructure facilities within regeneration areas.	• **Raise awareness on historic and energy value of historic buildings** • **Integrate historic building relevant aspects in urban planning approach (e.g. connection to district heating / cooling system)** • **…**	•	•

cultural issues for the benefit of all.	3. ensure the mixed use of buildings and developments with a good balance of jobs, housing and services, giving priority to residential use in city centres.	Medium	• Deliver a plan for brownfield site utilization. • Reduced proportion of new building on greenfield sites.			
	4. ensure appropriate conservation, renovation and use/re-use of our urban cultural heritage.	Very high	• Reduced number of buildings of communal and cultural value demolished per year. • Increased proportion of disused buildings and urban spaces returned to active use.			
	5. apply requirements for sustainable design and construction and promote high quality architecture and building technologies.	Very high	• Have sustainability requirements included for construction and renovation in development plans. • Increased proportion of buildings with an energy consumption of less than 70 kWh/sqm (single-family-buildings) and less than 55 kWh/sqm (multi-family-buildings) (low-energy-standard). • Develop, adopt and implement a sustainable			

			construction programme (guidelines, labelling, tax incentives etc.). • Decreased amount of construction and demolition waste.			
10 LOCAL TO GLOBAL **We are committed to assuming our global responsibility for peace, justice, equity, sustainable** **development and climate protection.**	1. develop and follow a strategic and integrated approach to mitigate climate change, and work towards a sustainable level of greenhouse gas emissions.	High				
	3. raise awareness of the causes and probable impacts of climate change, and integrate preventive actions into our climate change policy.	Medium				

	5. strengthen the international cooperation of towns and cities and develop local responses to global problems in partnership with local governments, communities and relevant stakeholders.	High	• increased number of city partnerships for sustainability • increased support to NGOs active in the field of international co-operation. • improved support to local sustainable development by developed European towns to non-European less developed ones, particularly those of neighboring regions like the Mediterranean (Medcities).			