Urban World Heritage Management and Climate Change Preparedness

Understanding the Effect of Amsterdam's Canal Ring District Heritage Site's Management on the City's Sustainability Development Plans

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Ricardo Ruiter Kanamori

4596552

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Marie-Therese van Thoor

Introduction

Every city needs to 'keep evolving in order to meet the needs of their current and future communities' (Bruin, Bennink, Veldpaus, & Pereira-Roders, 2013, p. 1). However, when discussing World Heritage Cities, as these authors state in their paper on the Canal District of Amsterdam, the challenge is finding solutions for development that can promote the cities sustainability while complying to the laws and regulations to protective the Outstanding Universal Values of site.

An exemplary case study that demonstrates the challenge of balancing development and conservation is the UNESCO's World Heritage Site of the Seventeenth Century Canal District of Amsterdam. Designed in the sixteenth century as a port city and built in the seventeenth century, it was the largest urban extension of its time and displayed a 'masterpiece of hydraulic engineering, town planning, and a rational programme of construction and bourgeois architecture' (UNESCO, n.d.b). With that, it was able to serve as an international commercial trade and intellectual exchange centre, establishing the model for the artificial port city for countries worldwide. Holding such a significant role in Dutch history, many buildings and structures within this historic urban landscape became enlisted as heritage, and thus protected by national and municipal heritage bureaus. That implies that legislations and policies have been implemented to ensure their conservation and proper management, making room for urban development in the city's Central Borough slim. Thereafter, in 2010, the Canal District of Amsterdam inside the Singelgracht was officially enlisted in UNESCO's World Heritage Site (WHS) list, accrediting it internationally as a project with Outstanding Universal Values.

While historic buildings continue to be valued, 'changing work patterns and lifestyles, higher occupancy densities, dwell times, and activities are leading to growing demands for increased comfort and convenience while at the same time we are exhorted to meet new environmental and energy-performance requirements' (Cassar, 2009, p. 8). Moreover, the urgency for improve the environmental sustainability is ever more demanding because of global warming. In 2016, The Netherlands along with the rest of the European union and 174 other states have signed the Paris Agreement, setting the ambitious goal to achieve climate neutrality by 2050. To carry out this goal, objectives such as to become natural gas-free by 2040, the major source of heat for houses in the country, have been set; objectives that require meticulous planning, substantial investments, and large-scale interventions. As a result, the need to understand how to balance between protection and conservation of the heritage site and environmentally sustainable development is very much present.

Works like the book *Managing Built Heritage: The Role of Cultural Values and Significance* by Stephen Bond and Derek Worthing provide a more philosophical framework for connecting the two topics for when development plans regarding heritage must be done. Following that line of work, this thesis will focus on the specific case study of Amsterdam's Canal Ring District by investigating the answer the question: to what extent does the conservation of UNESCO's WHS affect Amsterdam's sustainability development plans to achieve carbon neutrality by 2050 as signed in the Paris Agreement of 2016?

This thesis will start by explaining the background information necessary on the Seventeenth Century Canal District of Amsterdam's cultural significance to become a WHS. Then, Amsterdam's current management strategies towards conservation of the heritage site along with its sustainability development plans is investigated; consequently, exposing the discrepancy between the two ambitions in the case study. Later, though a literature-based research, a theoretical framework is created to assist in finding solutions for the conflicting aims of heritage preservation and environmental sustainability development. This is done using the Canal District of Amsterdam as the context for the discussion. Having the theoretical framework, this thesis concludes by providing practical recommendations to improve the energy efficiency of the district while maintaining the core values that make the site culturally significant.

Amsterdam's Canal District as a UNESCO World Heritage Site

To be able to discuss the topic of conservation and preservation versus sustainable development of a specific location or artifact, it is important to first understand thoroughly the reasons the Seventeenth Century Canal District of Amsterdam is valued in the first place. This section will thus give a background on the Canal District of Amsterdam and the UNESCO World Heritage Site's Outstanding Universal Values that are attributed to the site. As a consequence, the information in this section is predominantly retrieved from UNESCO's *Nomination Document 1349* and online dossier.

The UNESCO World Heritage's foremost objective is to preserve 'cultural and natural heritage around the world considered to be of outstanding value to humanity' (UNESCO, n.d.b). To enlist a heritage site, a country must nominate its monument for it to be approved by a committee of experts after careful evaluation. As such, the Netherlands nominated the entire Amsterdam's Seventeenth century Canal District, and it was accepted in 2010 to become a WHS under three of the ten criteria for Outstanding Universal Value. Namely: Criterion (i), (ii), and (iv). These criteria refer to firstly, 'to represent a masterpiece of human creative genius'; secondly, 'to exhibit an important interchange of human values, over a span of time or within a cultural area of the world, on developments in architecture or technology, monumental arts, town planning or landscape design'. Lastly, criterion iv states 'to be an outstanding example of a type of building, architectural or technological ensemble or landscape which illustrates (a) significant stage(s) in human history' (UNESCO, 2009, Chapter 3).

The large urban expansions were commissioned by merchants, investors, regents, and patricians who constituted the government of the city of Amsterdam during the seventeenth century. Based explicitly on the Vitruvian concepts of 'order and proportion (ordinatio), arrangement (dispositio), grace and proportion (eurythmia), symmetry (symmetria), decoration (décor) and distribution (distributio)' (UNESCO, 2009, p. 107) the design canal ring area was intended to exhibit practicality, usefulness, and beauty. However, this could not have been accomplished without exhibiting 'a masterpiece of human creative genius', consequently falling under criterion (i). As UNESCO (2009) explains in the

Nomination Document 1349 for the seventeenth century canal ring area of Amsterdam within the Singelgracht:

> Amsterdam was able to undertake such large urban expansions because of its advanced contemporary knowledge of surveying, civil engineering, hydraulic engineering and construction techniques. Its practice of town planning was based on mathematics, knowledge of architectural treatises, fortification theory, and thinking about the 'città ideale' (ideal city). (*UNESCO Nomination 1349,* p. 98)

Figure 1
Aerial view of seventeenth century canal ring area

Note. Photo by Rober de Jong

Even today, the historic urban landscape is still considered the epitome of the Dutch canal city. Its rational, functional, and geometrical pattern lines are still clearly visible as can be seen in Figure 1 thanks to the consistent maintenance and preservation done by the government even before its enlistment to the UNESCO WHS. As UNESCO (2009, p.104) explains in the nomination document, even after further societal, commercial, and town planning developments in the nineteenth century, the historic urban landscape of the seventeenth century canal district of Amsterdam remained mostly unaltered. From Figures 2 and 3, this identical, symmetrical pattern of the canals; the narrow radial connecting streets that follow alongside them; the positioning of the bridges which connect the residential blocks; and the vertical silhouettes of the strictly aligned façades adorned by the strict linear rows of trees are still as clearly visible today as they were in 1625.

Figure 2
Amsterdam's Canal District in 1625

Note. Background illustration by Balthazar Florisz.

Figure 3
Amsterdam's Canal District in 2020

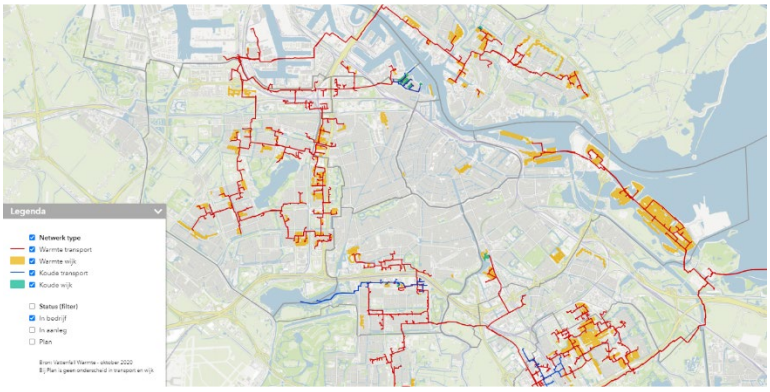
The second criterion (ii) is met in the eyes of UNESCO thanks to the Dutch Republic's world power during the seventeenth century where Amsterdam stood as a powerful and distinctive place within it. Together with the city's physical expansion, serving as a port city it also grew economically during the century. Moreover, with the 'freedom of establishment and declared tolerance and freedom of thought and religion rapidly attracted many new residents from various parts of Europe (the Southern Netherlands; Sephardic Jews from Portugal and Spain; Ashkenazi Jews from central and eastern Europe; French Huguenots)' (UNESCO, 2009, p. 100). This turned it into one of the greatest powers in Europe, after Rome and Paris. Included in this migration to Amsterdam were many artists, writers, scholars, cartographers, mapmakers, and publishers who helped expand the already dominant trade shipping spirit of the city into the fields of culture and interchange of human values (UNESCO, 2009, p. 102).

As stated previously, criterion (iv) refers to the property exemplifying a type of building, architectural or technological ensemble or landscape which was important in a stage of human history. The layout of the canal ring area of Amsterdam was not based on geography or the underlying landscape but built from the ground up based on mathematics and human ingenuity. This approach to large-scale town planning along with the 'Dutch' classicism of the houses became an example and influenced urban developments around the world, such as northern and eastern Europe and places were the VOC and WIC did commerce (UNESCO, 2009, p. 104). Following its character as a trades port for Europe, most of the buildings functioned as houses and warehouses, making them a prominent and distinctive face of the property. The warehouses are to the far extent integrated into the rows of canal houses. Today, however, most of the buildings do not function as warehouses but have transformed themselves to meet the societal developments of the nineteenth and twentieth century, serving now a variety of functions but predominantly hospitality and more housing.

Amsterdam's Current Management of the Canal District and Monuments towards a Sustainable Future

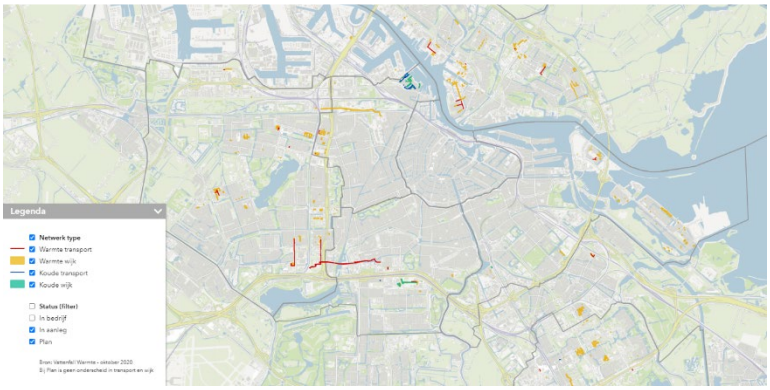
Despite its historic past, the municipality of Amsterdam still looks towards the future; trying to address the needs for sustainable developments and the needs for its residents in the twenty-first century. The government has set the goal to reduce CO2 emissions by at least 95% in 2050. In their ambition, they promise that 'the city will stop using natural gas before 2040 and within the next 10 years we will have only emission-free transport by road and water. In 2050, Amsterdam will be a circular city – everything we produce and consume will be reusable' (Gemeente Amsterdam, n.d., Policy: Sustainability and energy). While these goals seem promising, upon more detailed investigation the general outlines on how to reach them may come into conflict when dealing with the historic urban centre of Amsterdam. The challenge of compartmentalizing the two has to do with the conflicts between the aims between conservation and sustainability (Appendino, 2017, p.2). One of

Figure 4
In use city heating and cooling network – October 2020



Note. This map illustrates the current heating and cooling network in use in the historic centre of Amsterdam. There is hardly any infrastructure in the Seventeenth Century Canal District.

Figure 5
Expansion of Amsterdam's heating and cooling network – October 2020



Note. This map illustrates that there are currently no expansions being installed or in development in the historic centre of Amsterdam.

these difficulties, for example, is the use of renewable energies in historic contexts or improving the energy efficiency of ancient buildings.

In the *Amsterdam Climate Neutral Roadmap 2050* (2020, p.13), the main point of focus for the municipality to achieve climate neutrality is by transitioning their heat source from natural gas to more renewable sources. This can be done in several ways, but they state that that is most efficient through a city heating network. The challenge is how that can be done considering that housing, being private properties, equates to 52% of the natural gas consumption in the built environment; also, most of the buildings in the historic centre fall under protected cityscape laws and, specifically in the UNESCO WHS, have a monument classification with strict conservation guidelines. This problem is visible in Figures 4 and 5 which illustrate the current heating and cooling network (as of October 2020) and the future expansion of this network respectively on the map of Amsterdam. What can be seen is that the historic centre is currently not being satisfied with this solution and there are no plans yet to expand this network to heat and cool the heritage buildings of the Seventeenth Century Canal District.

Past emphasis in energy consumption focused on creating net-zero new buildings (Bond, S., & Worthing, D., 2016, p. 220). However, consisting of less than 1% of the total house market, the new buildings would not be enough; therefore, the attention expanded to making existing buildings more energy efficient. Since most of the buildings in the historic centre are now, at least partially, dedicated to housing, the municipality's current primary strategy is to provide guidance and supports in this transition (Gemeente Amsterdam, n.d., Duurzaamheid en monumenten; *Structuurvisie Amsterdam 2040, 2011, p. 148; Amsterdam Climate Neutral Roadmap 2050* , 2020, p. 18). While improving the energy

performance of buildings is possibly the least intrusive way to reduce CO2 emissions, it is still not being implemented in conservation areas at a large scale. The main concern with this method when applied to historical buildings is that badly considered energy improvements may damage the cultural significance of the asset. As a consequence, the buildings that are under protection because of their special architectural or historical merit may be exempted from complying to the minimum energy performance set by the Energy Performance in Buildings Directive of the European Union (Bond, S. et al., 2016, p. 220).

Leaving the historic city centre of Amsterdam untouched to preserve its architectural and historical merit may not be tolerated if the city will attempt to reach its climate goals. A key aspect for the survival of the historic centre is to fulfil the needs of the current and future residents and users, as they are crucial for maintaining the livelihood of the area and keeping it economically sustainable. Without addressing climate comfort and energy use in the historic centre, interest in the houses and commercial establishments might decrease as upkeeping costs will be higher than more energy efficient buildings. As Appendino (2017, p.9) points out in his study, a major factor for conserving a historic city as a dynamic and living organism is 'the integration of protection and sustainability aims, policies, actors and tools. The starting point is the realization that urban planning and urban conservation must work in tandem'.

Conservation versus Sustainable Development: Trade – Offs

A key challenge when discussing the topic of development versus conservation of cultural heritage is rooted in the intrinsic qualitative nature of the cultural sector. Culture, along with other forms of aesthetic evaluations present an impossible challenge of commensurability. A framework and criteria are required for evidence-based decision making. This means that culture must be measured and set across a scale, defining what is more culturally valuable or significant and what is less. Currently, 'measurement in the cultural sector has been based on the contribution the cultural sector can make to social and economic goals' (O'Brien, 2010, p.12), which correlates to criterion (ii) of the Outstanding Universal Values for which the Canal District of Amsterdam was proclaimed a WHS. In the case of Amsterdam, however, these contributions were from the seventeenth century; the social and economic landscape of Amsterdam has dramatically changed since then. What social and economic values do these monumental assets provide in the twenty-first century?

Simply trying to convert cultural value into monetary valuation is too limiting as O'Brien (2010, p.13) explains through the example of a museum. Museums bring non-market values to society, for example educational, architectural, or artistic; its significance to its society cannot be thus calculated purely through financial transactions. Therefore, the culture sector must create a framework to make cultural values commensurable with economic and environmental values.

By 2011, UNESCO understood the discrepancy between the goals of conservation and sustainable social and economic development, publishing on the 10th of November of that same year *The Recommendation on the Historic Urban Landscape*. This new approach aimed to help states manage their heritage sites in a more holistic way, moving beyond the

physical environment and focusing on preserving all the tangible and intangible qualities of the entire human environment. The key overarching concept from this approach is that 'the different approaches – heritage, economic, environmental and sociocultural – do not conflict; they are complementary, and their long-term success is dependent on them being linked together' (UNESCO, 2013, p.9). This is very similar to the conclusion of Appendino's (2017) study.

These publications and studies share the clear conclusion that a more holistic approach to conservation is be needed for historic urban landscapes. However, the approach Amsterdam has been taking for the conservation of the historic Canal District is still mostly following William Morris and John Ruskin's philosophy towards conservation; what must be protected is the original or authentic fabric of the structure. This is based on the notion that the physical artifact and its age represents the skill of the originator and therefore conveys the cultural worth. To be able to follow this principle, that implies hardly intervening with the original materials and structures, only apply minimal restorations if truly necessary. With the current policy of preserving the cityscape of the Canal District in Amsterdam, that applies most specifically to the façade of the old canal houses and warehouses. This archaeological perspective towards conservation is certainly appropriate in many buildings and situations but may propose difficulties when attempting to make the district more environmentally friendly.

Viollet-le-Duc, contrarily to Ruskin and Morris, expresses a different point of view towards how a heritage asset should be preserved. In his work *Restoration* (1854), he endorses restoration if thoughtful and thorough investigation of the building or site's original conceptualization has been done. As long as the original architect's ideation and style is respected, deeper interventions may be acceptable. This means that often the values embodied in the building is what needs to be respected in a restoration or refurbishment process. With this approach, it would allow for more flexibility to achieve the sustainability goals of today. Moreover, with regards to improving the climate crisis in a historic landscape, interventions geared towards energy efficiency may be seen, considering Viollet-le-Duc's perspective, as a continuation of the history of the heritage site.

The study *Built Heritage Conservation and Contemporary Urban Development: The Contribution of Architectural Practice to the Challenges of Modernisation* concludes that 'social and cultural changes in globalised economies demand a shift from the traditional object–based approach to a theoretically more open and inclusive value–based approach' (Plácido González Martínez, 2017, p.22); thus, heritage charters and documents must be reviewed and adapted for these contemporary societies. Through this value-based approach proposed in Martínez's paper, the three Universal Outstanding Values that allowed Amsterdam's Seventeenth Century Canal District to be enlisted as a WHS can be seen as the asset that must be preserved, not the fabric of the structure.

Transitioning between these two approaches would intrinsically require a second analysis on the heritage site and a re-evaluation of the elements that embodies and represents the values that contribute to the significance of the asset. Having this re-assessment, a classification of what is more or less culturally significant will be better understood. This would allow for some more room for discussion on trade-offs between some historic physical attributes and upgrading the energy performance of the building. As

Bond et al. (2016, p.220) explains, unless there is an identification and commensurability of the significance of each benefit between culture and sustainability, the opportunity to maximise energy improvement while retaining cultural value may never be realised.

Implementation of a Value-Based Conservation Approach in Amsterdam's Canal District for a Sustainable Future

As stated in the previous section, to adopt a value-based approach, a re-evaluation of the physical attributes that embody the Universal Outstanding Values must be done. When looking at the three criteria for which the Amsterdam's Canal District became a WHS, they mostly elaborate on the past accomplishments and what the area represented in the seventeenth and eighteenth centuries. The great value of the project is that it embodies a masterpiece of human ingenuity through the high level of hydraulic engineering and town planning. Under criterion (iv), a further detailed acknowledgement to the aesthetics of the buildings is presented. The variety of façades and gables in the Dutch single dwellings give the face of the heritage's rational construction programme and of the bourgeois architecture characteristic of the time; thus, creating a unique, yet homogeneous urban ensemble. The details of this homogeneity can be seen in Figure 6. These facades; along with the structure of the public spaces, with the narrow streets, rows of trees, and the structured canal system together with the historic bridges; can be considered the primary embodiments of the Universal Outstanding Values. Consequently, it may be argued that do indeed possess too much cultural significance to be altered and should thus be physically preserved in the way Morris and Ruskin outline. Proportionately, it may then be argued that

Figure 6
Homogenous Urban Ensemble - Amsterdam

Note. This image illustrates homogeneous form of the Canal District of Amsterdam despite the variety of façades and gables. The buildings tend to have similar height (illustrated in red) and width (illustrated in black). Also, when in front of a canal, a row of trees is often present (shown in green).

the interiors, among other factors, possess less cultural significance as compared to the attributes mentioned previously and may thus be subject to trade-offs with sustainability measures.

To improve the energy efficiency and subsequently the energy label of a house or building, the first measure to be taken before any mechanical energy-saving installations is to improve the thermal insulation of the building, as concluded in the study by Harrestrup and Svendsen (2014, p. 305). This reduces the amount of energy the building needs and often requires the least invasive interventions. As a result of the protected cityscape, the exterior of the buildings may not be touched, causing the insulations to be done solely in the interior of the buildings. This forces the thermal improvements to be done at a household level. In this regard, the government of Amsterdam provides guidance with a list of interventions an individual can do to their homes or establishments, which can be found under *Duurzaamheid en Monumenten* in the Gemeente Amsterdam's website. However, even if the alterations are done in the interior, each intervention in a building with monumental status must be given approval by the government; with consultations often being necessary as every house is in slightly different conditions. This makes upgrading the energy efficiency of the whole district more intricate and thus more expensive for the homeowner, diminishing the willingness for any intervention to take place.

For a building owner, restoration is filled with difficulties and ambiguity of which measures to implement, especially in a historic building. This uncertainty is a major reason energy renovation remains slow, as can be seen in Figure 7. To combat this problem, firstly, the government could loosen the permit regulations in the private sections of a building and other attributes that do not directly embody the Universal Outstanding Values of the WHS. Secondly, a public-private partnership can be founded that follows a service-oriented approach with a deeper awareness of the demands of the homeowners. A good example of this solution can be found in Copenhagen. This is done with a 'comprehensive digital one-stop-shop solution in partnership with key players in the construction value chain, including banks' (State of Green, 2018, p. 24). The goal of this partnership is to transform the complex and fragmented renovation process into a simple and more straightforward procedure for the homeowner. The company would have the knowledge necessary of all the most recent building policies and regulations and have direct access to the government for managing construction permits in heritage buildings, such as the ones found in the Canal District of Amsterdam. They would also be in direct contact with all parties necessary for the full realization of the energy renovation; being liable for contracting building constructors, material suppliers, and utility providers for example, which would give the investor a greater sense of security.

Figure 7
Energy Labels of Buildings in Amsterdam 2021

Note. While several of the buildings have been renovated and received an energy label of C or better, most of the buildings still have no energy-index registration.

The next step for improving the energy efficiency is by implementing energy-saving equipment for heat generation and electricity. This step, however, is often the most expensive for a single homeowner to afford and is why most people remain using a gas-powered boiler. Implementing machines such as a ground source heat pump or low temperature floor heating often have high initial costs. While the costs for these investments may return along the years through lower energy bills, that high initial price may be too drastic for some property owners to finance independently.

A viable solution is to provide subsidies or loans for residents in the historic, protected cityscape. For people currently living in the monument houses in the historic urban landscape of Amsterdam's Central Borough, it is in their hands to improve their residences as they please. However, this can be centrality managed. One of the most efficient methods for heating is through the use of a geothermal heat pump, which uses the year-round constant temperature of the ground as a heat exchanger. Implementing this requires excavations works which is firstly an extensive and expensive intervention and is, secondly, often not possible for people who do not live on the ground floor. The municipalities ambition of extending the heat network to connect the entire city is not necessary; smaller, more localized networks that connect multiple houses in a residential block for example using a centralized heat pump can prove to be more efficient logistically and with less waste of energy. In a study by Kopanos, Georgiadis, & Pistikopoulos (2013, p. 1522), they propose a 'residential-scale microgeneration through micro combined heat and power systems' and an interchange of electrical energy between the members of this microgrid. The study demonstrated that microgeneration energy supply networks, if properly implemented and managed through policies, presents significant efficiency benefits as opposed to boiler systems and standalone operations (Kopanos et al., 2013, p. 1534). Furthermore, allowing for the government to monitor and be liable for the

development of these micro systems would also allow them to ensure that the interventions will respect and preserve the cultural values the building blocks possess. When looking at criterion (iv) from the UNESCO Universal Outstanding Values, the masterplan exemplified a type of architectural or technological ensemble which illustrates a significant stage in human history. A significant stage in human history being lived in currently is the fight for reducing greenhouse gas emission and mitigating the effects of climate change, as evidenced by the signing of 194 states and the European Union to the Paris Agreement. Therefore, implementing micro-grids throughout the historic context of Amsterdam's historic city centre could then be considered as an illustration of the worldwide acceptance and strive towards a sustainable future. Similar to how Amsterdam served as a model of large-scale town planning for countries around the world until the nineteenth century, this new masterplan would also be an example on how sustainability and heritage conservation can come together.

These energy-saving equipment use electricity in place of gas, which is currently about 2.5 times more expensive as of 2020, with the price per mega joules (MJ) for electricity be €0,063 while gas is €0,023 (De Energieconsultant B.V., 2020). At this rate, it is not logical for individuals to invest in these types of equipment unless the costs are spread across the multiple residents of the building blocks. Also, with the innovations and investments in a renewable resource for the electric grid expanding greatly in the previous years and expected to grow further in the coming years (Centraal Bureau voor de Statistiek, 2019), this price decrease and become continuously cheaper. This is where self-energy generation becomes relevant, with the addition of solar panels to the roofs of the historic buildings. As can be seen from Figure 8, the rooftops of most buildings in the Canal District of Amsterdam as well as in the Old Centre are extremely suited for solar power generation.

Figure 8
Suitable Roofs for Energy Generation

Note. This map defines if the roof of a building is suitable for the implementation of solar panels by averaging the amount of solar radiation with the area and inclination of each roof. The scale goes from green to red, representing very suitable to not suitable, respectively.

Despite this appropriateness, most of the houses still do not have solar panels installed. That is again because the government or energy companies are relying on individuals to implement it in their own houses. Self-financing is the most conventional financing method for solar panel installations worldwide, where the owner acquires the asset with their own money. In this situation home- and building owners take full liability for the installation and maintenance costs of the solar system, which results in high upfront costs, consequently impeding the widespread adoption of PV rooftop installations (Tongsopit, Moungchareon, Aksornkij, & Potisat, 2016, p. 449). Also, similar to the problem of carrying out an intervention to place a heat pump, the roof is generally not the property of one single household but a conjunction of 2-3 residencies who share the same building.

For an easier and faster widespread solar panel adoption, a central organization should be responsible for their implementation, i.e., the municipality or an energy company. In the research from Tongsopit et al. (2016, p. 449), an effective business model is proposed. An energy company offers solar power as a service in exchange for renting the owners roof, where the company is the owner of the panels and take the responsibility of building and maintaining the asset. On one hand, the company increases profit by reducing infrastructure costs and inefficiencies in energy transportation. On the other hand, the customer receives benefits in the form of cheaper electricity, operation and maintenance services, and guaranteed performance. Furthermore, public financing may also promote the acceleration solar power use in the historic centre. With the provision of financial incentives such as low-interest loans or subsidies, investing in solar energy will become more affordable to the homeowner. This option, however, is bound to policy making and proper management of public capital.

Conclusion

The notion of sustainable development, that is to be able to meet the needs of the present without compromising the ability of future generations to meet their own, is the core principle for combating the ever more pressing climate change. With the Paris Agreement, the Netherlands signed that it would do its part to solve this issue and become energy neutral by 2050. However, when looking at a monument city such as Amsterdam, it becomes clear transforming a historic urban context to become fully environmentally sustainable is a major issue. The municipality of Amsterdam does show efforts to convert the city into a fully circular sustainable environment, developing general plans and strategies on how that can be done. However, through protection legislations to the cityscape and earning international accreditation through the UNESCO World Heritage List for its great historic, cultural, and architectural values, the margin for restoration within the historic Seventeenth Century Canal District becomes slim and slows the process down.

A key factor for the conservation of historic contexts is to accept that they are dynamic living organisms that should be integrated to the expanding and ever developing city. With regards to climate change, a starting point is to understand that sustainable urban planning and historic conservation must work together and can complement each other. Adapting towards sustainability must be considered a form of conservation and not as a

threat towards cultural values of heritage property. Moreover, improving the energy efficiency of the ancient buildings found in the historic site of Amsterdam will allow for its continuous use. As a consequence, the livelihood of the city centre is stimulated and the maintenance of the heritage buildings by the owners is promoted. This creates a positive feedback loop further increasing the longevity and value of the site.

When focusing on preserving the historic centre of Amsterdam as a World Heritage Site, this thesis proposes a value-based approach rather than the object-based currently being used. With this approach, the conservation organizations should focus on preserving the Outstanding Universal Values and essence of the place, and not strictly the original physique of the structure. This would require a second analysis on the heritage site; re-assessing what elements directly embodies the values that contribute to their cultural significance. With that, cultural significance can be better quantified and scaled, assisting with the creation of a holistic criteria making cultural, environmental, and economic benefits commensurable and trade-offs can be discussed, as suggested by UNESCO's *Recommendation on the Historic Urban Landscape*. Considering this, government building policies and permit regulations for transforming and restoring cultural heritage may be loosened, which would allow more freedom for new and innovative sustainable solutions to be formed.

Besides that, the national central government or municipality could also take more liability for the improvement in energy efficiency of historic buildings and implementation of sustainable sources of energy for these residential blocks. The only current measure being taken for developing the environmental sustainability Canal District of Amsterdam is to give guidance and expecting individuals to improve their properties through self-financing. However, by having a central organization, such as a through a public-private initiative, the city may not only eradicate the use of gas-powered heating but also ensure the appropriate preservation of the historic urban landscape.

While this thesis focused primarily on the challenges between conservation and sustainable development of the Seventeenth Century Canal District of Amsterdam, the recommendations and alternative solutions explored and discussed can be translated to other heritage sites around the world.

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Image sourcing

Image 1:

National Service for Archaeology, Cultural Landscape and Monuments (RACM). (n.d.). *Aerial view of Seventeenth-century canal ring area* [Photograph]. Retrieved from https://whc.unesco.org/en/documents/115081

Image 2:

Florisz, B. (n.d.). *Amsterdam's Canal District in 1625 - 010035000122* [Map]. Retrieved from http://archief.amsterdam/archief/10035/289

Image 3:

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Images 4, 5, 7, 8:

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Image 6:

Best of Amsterdam. (n.d.). *Homogenous Urban Ensemble - Amsterdam* [Photograph]. Retrieved from https://www.bestofamsterdam.com/canal-belt/#Picture_perfect_Canal_Belt