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Reduction of CO₂ Emissions in Houses of Historic and Visual Importance

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Abstract: According to the ‘Climate Programme’ the municipality of Amsterdam has the ambition to reduce the CO₂ emissions within the city limits by 40% in the year 2025 compared to the year 1990. To realize this ambition substantial CO₂ savings have to be realized at the 375,000 current houses in the city. A special challenge is formed by the houses of historic and visual importance, as the implementation of standard energy saving measures may conflict with the ambition to protect their cultural and historic values. Nyenrode Business University was asked to study the possibilities for a successful combination of ambitions in both fields. This article shows an overview of suggestions that focus on the combination of technical and process orientated innovations which can contribute to the acceleration of the reduction of CO₂ emissions in houses of historic and visual importance. The article therefore addresses political and technical as well as financial and process related aspects in implementing energy saving measures in this category of buildings.

Keywords: CO₂ reduction; historic buildings; cultural values; scenic quality; balance between preservation and innovation

1. Introduction

Political concern in Europe about CO₂ emissions has led (besides other things) to taking measures for reducing emissions in the built environment. The Dutch government has set ambitious goals to reduce CO₂ emissions. Rules for the legally required energy performance state of new buildings are getting stricter year by year, in rule with the standards set by the European Union. However, it is clear that the goals cannot be reached, unless considerable effort is also made in regard to the existing building stock.

To address the Dutch goals of reducing CO₂ emissions in the existing building stock, a multi party approach is necessary, requiring cooperation between several parties such as owners (*i.e.*, housing associations), governmental bodies and tenants.

This can be illustrated by the case of the municipality of Amsterdam, which is looking for ways to reach its own stated goals of reducing CO₂ emissions, which are even more ambitious than the national goals. This reduction must partly be realized within the existing building stock in Amsterdam, which includes a lot of buildings that are protected because of their unique historical, cultural and/or architectural significance.

Part of Amsterdam's social housing stock, built between 1880 and 1940, is situated just outside the city centre. Most buildings in this area are not registered as national monuments but receive official protection because of their scenic quality. The municipality of Amsterdam wanted to research the potential of implementing CO₂ reducing measures in residential buildings owned by housing corporations in this part of the city and commissioned the Center for Sustainability of Nyenrode Business University to carry out a research project.

The Nyenrode researchers conclude, based on thorough research, that technically spoken CO₂ reduction is possible in buildings protected because of their historical, cultural and/or architectural values, while respecting these values. But for several reasons this potential for emission reduction is not being realized. In most cases this is not because of technical reasons, but because of policies, limited budgets and lack of knowledge. And a very important factor: proposed solutions in the past did not take into account (all) interests of all stakeholders involved.

As a case study Amsterdam, dealing with ambitions regarding both protection of the cultural heritage as well as CO₂ reduction, will be of interest to other cities of high profile historical character. When aiming to speed up CO₂ reduction in historic areas, it is necessary to focus on a merger of interests.

2. Conservation Concepts and Policies

The social and legal appreciation of architectural heritage as something worthy of protection is a relatively recent concept. Conservation concepts and policies are subject to continuous evolution over time. As stated by Jokilehto:

'Urban areas in their great variety are the product of on-going processes. As such, they necessarily reflect the intentions and needs emerging in the different periods as well as taking into account the existing situations, environmental, economic and socio-cultural. While the resulting fabric would reflect the diversity of human creative spirit, it would also

enclose a form of continuity that gives a particular identity to each area. Being considered *historic* would not be automatic, but rather the result of continuity in appreciation over time. Historic urban areas are thus areas of which the historicity has been recognized by the community concerned. This means that they are areas that would merit special care and even protection in order to monitor and control any changes that would undermine the recognized qualities [1]’.

From this perspective, architectural conservation does not just refer to technical aspects concerning protecting and restoring buildings, but also to issues of identification, policy and regulation, within specific contexts [2].

In the Netherlands, legislation protecting national cultural heritage exists since 1961 [3]. This Monument (or Historic Buildings) Act has since been revised several times; most recently in 2009. As a result of this Act around 62,500 buildings and archaeological sites are now listed as national monuments because of their national historical or architectural value. Furthermore 350 protected urban and village areas have been appointed because of their scenic quality. All of this concerns less than 1% of the total building stock [4]. The Monument Act also allows local governments to establish their own list of locally protected buildings.

Table 1. Listed buildings in the Netherlands (provincial listings are not included but have substantially lower numbers). Source: Rijksdienst voor het Cultureel Erfgoed, 2007 (in the 2007–2009 period around 1,500 buildings were added to listing in the national Monument Act, resulting in about 62,500 buildings listed as national monuments, as mentioned in the main text).

Province	Buildings listed by municipalities	Buildings listed nationally (Monument Act)
Groningen	595	2,550
Friesland	526	4,185
Drenthe	270	1,290
Overijssel	2,798	3,949
Flevoland	44	75
Gelderland	9,894	5,922
Utrecht	5,456	5,247
Noord-Holland	5,640	13,953
Zuid-Holland	7,771	9,013
Zeeland	603	3,642
Noord-Brabant	7,315	5,835
Limburg	1,880	5,376
TOTAL	42,792	61,037

Up to about 40 years ago, protection focussed mainly on preservation and restoration activities. Since then there has been a shift from a curative preservation policy towards a preventative one. Because of this, there has been more concern for maintenance and use. The Minister for OCW (Education, Culture and Science) has announced he is looking into a shift away from a conservational attitude towards Monuments towards a more developmental one, including transformation and finding

new uses for listed buildings (like redesignation as housing). Another shift is to be made from an object oriented view towards a more spatial and context oriented view on monuments [5,6].

Part of the Ministry OCW is the Rijksdienst voor Cultureel Erfgoed (State Service for Cultural Heritage). This State Service is responsible, with some other parties, for managing the Netherlands' heritage. Whenever historic, archaeological or cultural landscape values are at stake, the Rijksdienst voor Cultureel Erfgoed takes the lead in ensuring the conservation, statutory protection, conservation and investigation of the country's heritage. Local Dutch governments (especially municipalities) have specific responsibilities but are advised by the Rijksdienst.

Current views on preservation are reflected by the contents of the so called Vienna Memorandum on 'World Heritage and Contemporary Architecture—Managing the Historic Urban Landscape', which was the result of an international conference on this subject under the patronage of Unesco (2005, Vienna, Austria):

'Continuous changes in functional use, social structure, political context and economic development that manifest themselves in the form of structural interventions in the inherited historic urban landscape may be acknowledged as part of the city's tradition, and require a vision on the city as a whole with forward-looking action on the part of decision-makers, and a dialogue with the other actors and stakeholders involved [7]'.

3. Climate Policies and the Built Environment

Current policies, regulation and practice regarding listed buildings and other buildings to be considered of historic or cultural value, must be seen within a broad social, political and administrative context. Being part of the built environment, there are of course many other policies, regulation and practices applicable. In this paper we focus on the balance between the preservation of historic and cultural values and the governmental ambitions concerning the reduction of CO₂ emissions.

The Netherlands have ratified the Kyoto Protocol to the United Nations Framework Convention on Climate Change, aimed at combatting global warming, in 2002 [8]. The target agreed upon was an average reduction of greenhouse gas emissions of 5.2% from 1990 levels by the year 2012. The Netherlands committed itself to a reduction of 6%.

At a national level the Dutch government has committed to three things: saving 2% more energy per year, achieving an energy production that is 20% sustainable by 2020 and a reduction of greenhouse gas emissions of 30% from 1990 levels by the year 2020. The construction sector will have to approach new building projects in an innovative manner, and energy saving measures must also be implemented in existing buildings.

Reducing energy consumption and CO₂ emissions is also one of the main goals of the European Union (EU). Because 40% of the energy is being consumed in buildings [9], the building sector plays an important role in achieving EU policy objectives and can contribute to reaching the sometimes even higher targets of local energy efficiency policies. To promote the improvement of the energy efficiency of buildings the Energy Performance of Buildings Directive (EPBD) was implemented in EU countries in 2007–2008. According to article 7 of the EPBD ('... Member states shall ensure that, when buildings are constructed, sold or rented out, an energy performance certificate is made available to the owner or by the owner to the prospective buyer or tenant...') part of this new regulation is an

Energy Performance Certificate (energy label)—not only for new buildings, but for existing buildings also. Although the EPBD has a common base in all EU Member States, the various countries applied different certification requirements, embedded in national energy performance programs for residential dwellings as well as for utility buildings. Nevertheless, the diffusion and uptake of energy performance certificates still seems to be limited. In the study ‘Impact of Energy Certificates on energy savings in existing buildings in the Member States (EPBD art.7)’ it is estimated that the certification of existing buildings has started in only 65% of all EU Member States [10].

In the Netherlands the EPBD has been implemented since January 2008. This means that since January 2008, all transactions in the Dutch housing market need to be accompanied by an energy performance certificate. Social housing associations were obliged to have their complete building stock rated by January 2009. Exceptions are dwellings that have been constructed after 1999 and transactions in which the seller and buyer decide not to apply for an energy performance certificate. This weak legislation in combination with negative publicity seem to hinder the uptake by the Dutch market. According to the study ‘Energy Performance Certification in het Housing Market—Implementation and Valuation in the European Union’ in 2008 more than 100,000 dwellings were transacted in the Netherlands, of which a mere 20,000 had an energy performance certificate, which is approximately 17% of the transaction sample [11].

As in most EU countries monuments are exempt from the requirement in the Netherlands. Generally the EPBD seems to lead to concern for new buildings first (article 5), before the existing building stock is addressed (article 6). Article 6 EPBD just requires that the energy performance of buildings (>1,000 m²) undergoing major renovation is upgraded to meet minimum requirements ‘...in so far as this is technically, functionally and economically feasible.’ But how to define what is meant by ‘technically, functionally and economically feasible’ measures? Interpretations vary in the different EU member states, although there seems to be a shared understanding that historic buildings are a special case since interventions, and especially energy saving measures, could destroy their character. This common attitude is supported by the EPBD which lists buildings which may be made exempt from energy performance requirements as well as from certification (article 7). The list includes historic buildings, churches, temporary buildings et cetera and corresponds to exemptions to energy performance regulations already adopted in many EU member states. Not all EU countries exempt listed buildings. In the UK, for one, many of these buildings may not be exempted, although local governments can choose to do otherwise.

In the Netherlands, besides laws and regulations concerning the energy performance of buildings on a national level, several Conventions have been realized between the government and stakeholders, such as associations for the building sector, developers and housing associations. The federation of housing associations (Aedes), for example, committed itself in the Convention Energiebesparing Corporatiesector to save 20% on gas use (gas in the Netherlands is the main energy used for the heating of buildings) in the existing social housing stock between 2008 and 2018 [12].

4. Architectural Heritage in Amsterdam

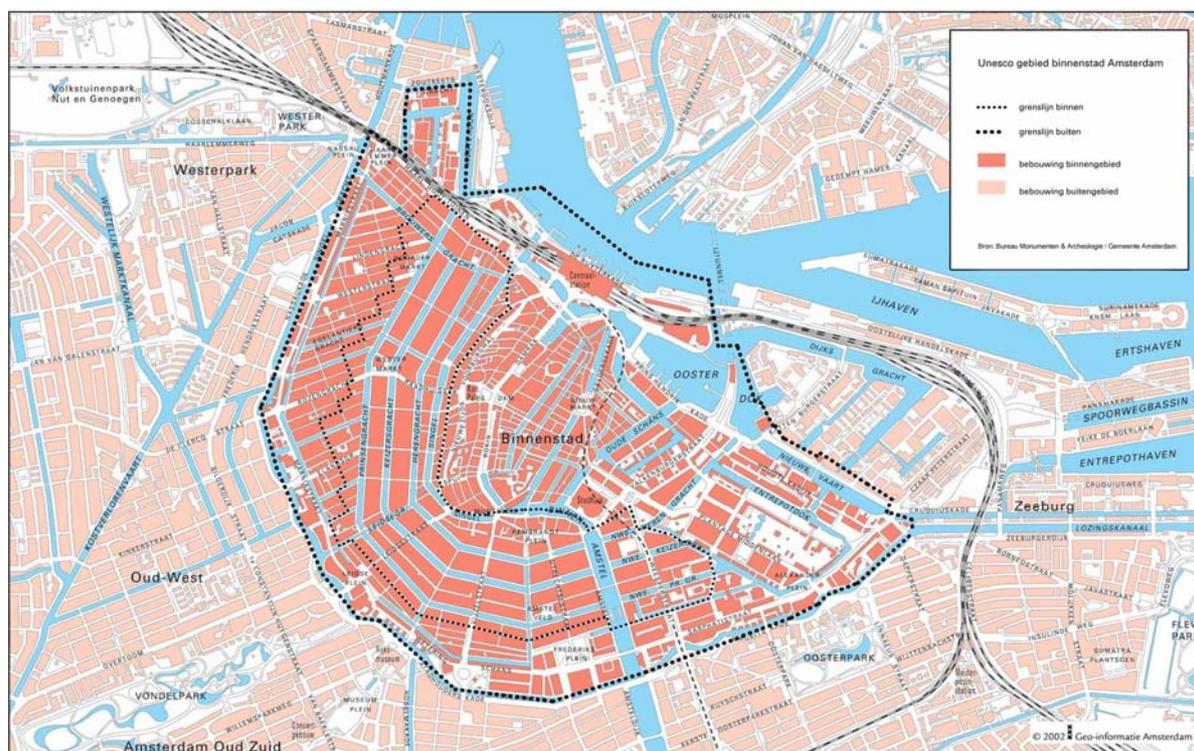
Tourists from all over the world visit the Netherlands every year. It is not just the cheese, the windmills and the tulips they come for. They also wish to see the canals and old city centres. Many tourists coming to the Dutch capital Amsterdam board canal boats and admire the old city centre. In fact, in 2007 over three million people took a round trip on the canals: two out of five were foreign visitors. Amsterdam's architecture is the most appreciated city feature among visitors (39%) [13]. The Amsterdam city centre therefore represents a touristic and thus an economic value.

Another perspective: the Dutch government nominated the seventeenth century part of the Amsterdam city centre for UNESCO's World Heritage List [14]. The World Heritage List includes properties which the World Heritage Committee considers as having outstanding universal value because of their cultural and natural heritage. This List was first realized following the 1972 World Heritage Convention [15].

There are many ways to assess the value of architectural heritage. In this article we do not focus on touristic appreciation. Instead, we look at the practice of dealing with values and ambitions in the built environment of Amsterdam. Even though our research did not concern the medieval till 17th century city centre itself, we were dealing with the immediate adjacent territory (literally and figuratively speaking).

Within the Amsterdam city limits (situated in the province Noord-Holland, see Table 1) stand more listed and other historic buildings than in any other Dutch city. The city centre has almost 8.000 listed buildings [16] and there are many in other parts of Amsterdam, too (on 1 January 2009 there were 8,865 in total in Amsterdam) [17].

Figure 1. Unesco area inner city Amsterdam. Source: Bureau Monumenten & Archeologie, Gemeente Amsterdam.

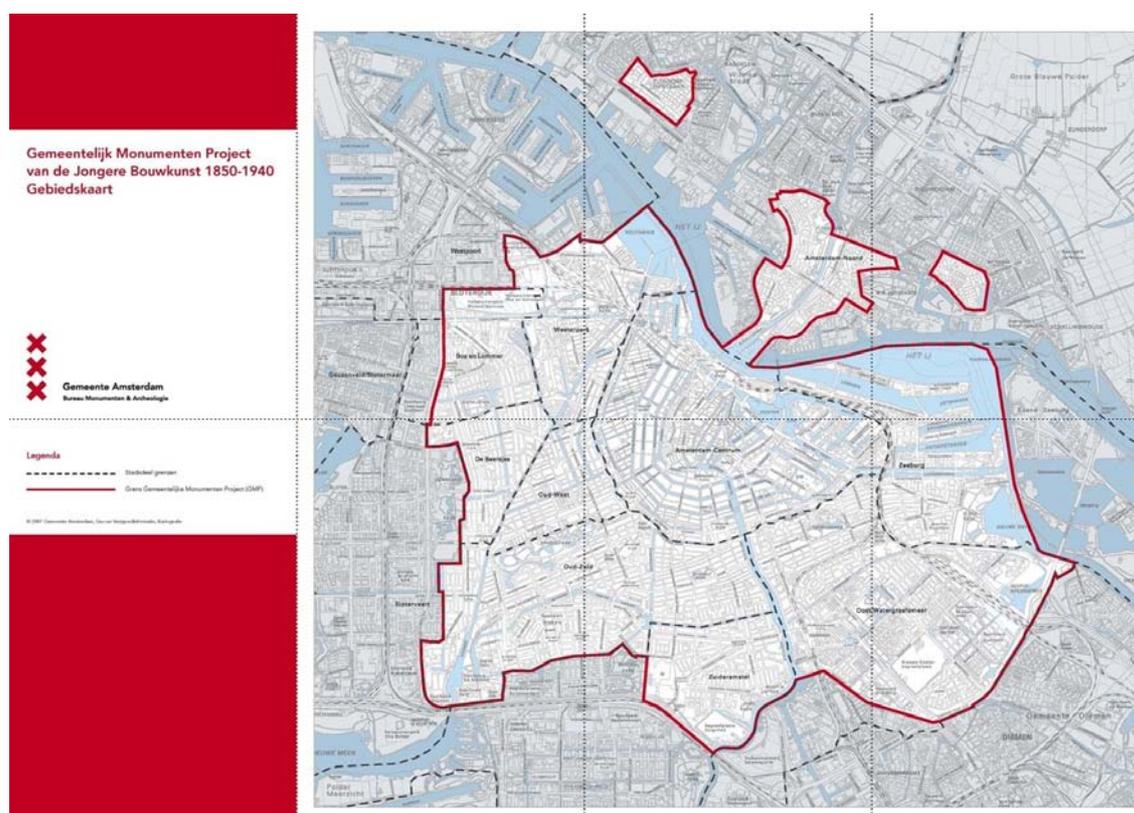


Furthermore, several city area's are protected because of their scenic quality. In 1999 the city centre was appointed as protected area by the Dutch government. This part of the city includes the 17th century canal area which has been nominated for UNESCO's international World Heritage List.

More recent parts of the city are also cherished. Such as the parts surrounding the city centre, that were originally built between 1880 and 1940 (the so called Nineteenth Century Ring and the '20-'40 Belt). They are also considered to have historic, characteristic and architectural value. To be able to protect the quality of the varied built environment, the municipality of Amsterdam has made a value assessment of all addresses in these area's and contributed values to each of these buildings, ranging from Grade 1 (listed buildings under either the Monument Act or by the municipality), Grade 2 (highly characteristic buildings with special urban or architectural value, built before 1940), Grade 3 (buildings built before 1940 with (relatively low) urban or architectural value) to Grade 4 (of no special significance) [18].

Owners with alteration plans for their buildings have to apply for permission. If the building is listed as a monument, extra permissions are required. For each Grade specific requirements are to be met. The Committee of Building Aesthetics and Monuments which consists of independent experts, advises the Municipality on these applications. The municipality of Amsterdam has instituted a Bureau for Building Aesthetics to support the Committee of Building Aesthetics and Monuments. Also the Bureau Monuments & Archeology supports and advises the municipality and her decentralised body of city districts.

Figure 2. In this part of Amsterdam the municipality has appointed municipal monuments, dated from 1850 till 1940. In this area also the '20-'40 Belt and 19th Century Ring are situated. Source: Bureau Monumenten & Archeologie, Gemeente Amsterdam.



5. Amsterdam Climate Policies and the Built Environment

Within the context of the international and national ambitions and requirements, the municipality of Amsterdam has set even higher goals. According to the 'Climate Programme' the municipality of Amsterdam has the ambition to reduce the CO₂ emissions within the city limits by 40% in the year 2025 compared to the year 1990. To realize these ambitions substantial CO₂ savings have to be realized at the 375,000 current houses in the city. In 2006 34% of Amsterdam CO₂ emissions were related to the building stock. Without taking measures, by 2025 this would be a calculated 36% [19].

To tackle this, the municipal Climate Bureau (Klimaatbureau) Amsterdam and the Amsterdam City Housing Department (Dienst Wonen) started by seeking cooperation with the Amsterdam housing associations. In the Netherlands, a large part of the housing stock is owned by housing associations, founded to supply so called social housing, affordable to low income groups. About 50% of the houses in Amsterdam is owned by housing associations [20].

As a consequence of Amsterdam's climate ambitions, the energy performance of monuments and buildings of historic and visual significance has to improve too. Because Amsterdam has a proportionally greater number of historic buildings than other Dutch cities plus high ambitions to reduce CO₂ emissions, there is a definite need to find a good balance between environmental ambitions, innovation and the preservation of cultural and historic values.

6. Merger of Interests

It was in this context that the Center for Sustainability of Nyenrode Business University was commissioned to carry out a research project for the city of Amsterdam in order to list the possibilities for CO₂ reduction in residential buildings owned by housing associations in the '20-'40 Belt and along the Nineteenth Century Ring.

This project was special since it involves two municipal departments that often have conflicting interests when it comes to sustainability: the Amsterdam Climate Bureau and the Bureau for Building Aesthetics. These Bureaus can be identified as expressions of policy trends of a definite different nature. The Bureau of Building Aesthetics is rooted in an old traditional administrative culture where as the Climate Bureau is the expression of a recent political trend and a result of urgency felt in the society as a whole. The research assignment itself was thus an expression of stakeholder cooperation. Fortunately, both parties involved felt an urgency to explore the possibilities for CO₂ reduction in this particular area of the city. The Amsterdam Climate Bureau assumed that measures to reduce CO₂ emissions would result in a loss of values. In their view, the Bureau of Building Aesthetics would therefore have to be willing to make compromises in order to fulfil the municipal ambitions. This research could also help implement policies and provide information to be used in communication with other stakeholders involved, especially the housing associations. The interest of the Dutch social housing associations is difficult to address since it is essentially multifarious: providing affordable housing, within set regulations, based on sound economics and reaching commonly set goals regarding sustainability and climate issues on the side (with an extra incentive: energy saving is in the interest of tenants as well).

In this Amsterdam case several sources of potential conflicts of interest can be detected. Firstly: in the Netherlands the practice of appreciating and protecting buildings because of their historic or

architectural value over the decades has gradually expanded to relatively young buildings, expanding the category of buildings that are not listed as monuments. This means that regulation affects more stakeholders and to a deeper extent. According to the Rijksdienst voor Erfgoed 5% of residential buildings in the Netherlands was built before 1900, 20% before 1940.

Secondly: concern about the environment and CO₂ reduction has led to both an increasing appeal to Corporate (Social) Responsibility as well as more stringent regulation for the building and housing sector. The houses concerned in this research are not exempt of EPBD regulations (because they are not listed as monuments) and are included in CO₂ reduction policies. But because of the status attributed by the municipality for these houses, standard reduction strategies are not easily applicable.

Thirdly: the houses in the Amsterdam areas concerned are well sought after. Viewed from an exploitation perspective, owners (housing associations) are faced with making decisions for either selling out to eager buyers or keeping (affordable) houses available for tenants. Because of housing regulation in the Netherlands, alterations and taking energy saving measures cannot always be compensated by raising the rent. As customary technical solutions will indeed often lead to a loss of cultural and historic values, customized solutions have to be realized. Customized solutions however are more expensive in most cases. For all stakeholders the variety of perspectives and interests can be experienced as a conflict of interests.

Dealing with this research assignment the researchers of Centre for Sustainability of Nyenrode Business University took an approach they had developed before, in which there is a focus on the merger of interests [21]. This approach is partly based on the Mutual Gains Approach as developed by Susskind *et al.* [22-26].

The first step to be taken was to redefine the situation. Instead of focussing on differences and possible conflicts of interest, they focussed on common interests and goals. By providing facts, assumptions and fears could be neutralized. By focussing on a merger of interests, clear starting points could be identified for shared action.

7. The Amsterdam Case—Residential Buildings in the '20-'40 Belt and the 19th Century Ring

As stated above, the Center for Sustainability of Nyenrode Business University was commissioned to carry out a research project for the city of Amsterdam in order to list the possibilities for CO₂ reduction in residential buildings owned by housing associations in the so called '20-'40 Belt and along the Nineteenth Century Ring; areas that were developed between 1880 and 1940.

Although the name of the '20-'40 Belt refers to the period 1920–1940 the area was realized in the period 1915–1940 and covers large parts of the southern area of the city, where since 1917 the famous 'Plan Zuid' by architect Berlage was realized. It was also the period of the 'Amsterdamse School' with famous architects such as De Klerk, Kramer, Van der Mey, Staal, Gratma and Wijdeveld. The 'Amsterdamse School' is characterized by monumental buildings, decorations, love for details and a deliberate choice of materials. Several housing associations built characteristic residential blocks for lower incomes in this period in the area. Regarding the whole city, especially between 1925–1940, most new dwellings in Amsterdam were built for the particular housing market. According to the Amsterdam Federation of Housing Associations (Federatie van de Amsterdamse Woningcorporaties) no more than about 30% of new dwellings in the period 1915–1945 were realized by housing

associations for low incomes. However, in many parts of the '20-'40 Belt and the 19th Century Ring we still find the characteristic residential blocks still owned by different housing associations. The period 1920–1940 was a time of economic recession in Amsterdam, as in cities all over the world. Therefore it is all the more remarkable that under these circumstances residential buildings were realized that are still favoured by many people in Amsterdam. Today the '20-'40 Belt and the 19th Century Ring belong to the favoured residential areas of the city.

The '20-'40 Belt and the 19th Century Ring consists of many buildings that are not listed as monuments, but have been appointed special status by the municipality of Amsterdam by categorizing them to be Grade 2 or 3 (see above). In this study these categories were specifically of interest.

For the study 7 renovation projects were selected for the technical assessment of buildings owned by different housings associations. Also interviews were conducted with stakeholders, identified as such by the Climate Bureau and the Bureau for Building Aesthetics. After this a hypothesis was made, which was tested in a workshop environment where 19 stakeholders took part.

Figure 3. Examples of houses studied for this research. Source: Bureau for Building Aesthetics, Lisl Edhoffer, Municipality of Amsterdam.



Figure 3. Cont.



Various stakeholders were involved in the cataloguing of possibilities for reducing CO₂ emissions on behalf of the municipality: housing associations, the Bureau for Building Aesthetics, the Climate Bureau, residents and architects. Furthermore, Amsterdam frequently employs the services of a supervisor, a kind of linking pin between the municipal executive, the associations and the architects who create the design for the restoration. Firstly, the researchers conducted interviews with all these parties to find out about their interests in the project. For example, their views on the importance of energy saving or CO₂ reduction, and any fears they might have.

As expected up front the interviewees mentioned different interests, depending on their point of view and knowledge. Where one of the interviewees stresses the importance of affordability of interventions and social consequences, another asks for more attention for practical problems. Remarkable is that all interviewees wish more insight into the real effects of energy saving measures. Also they all mentioned the wish for a good/better cooperation between different parties and for better

agreements. However, one of the most remarkable conclusions of the interviews was that indeed there is a wish for more innovative energy saving products and techniques, but there especially has to be more emphasis on the merger with other interests: examples are speeding up the progress of renovation work and user-friendliness of measures and work processes. It is expected by the interviewees that most stakeholders give priority to these other interests over increased energy saving. Although everyone has specific interests, it also became apparent that certain interests do not necessarily have to conflict and win-win-situations are certainly possible.

The interviews were followed by an assessment of the selection of seven renovation projects in this area [27]. During the assessment the applications for sustainable modification recently submitted to the municipality by several housing associations concerning blocks of houses, were considered. The researchers looked at the types of measures that had been applied for, such as double glazing, extra insulation, new heating and ventilation systems and solar energy. Which applications had been accepted by the municipality? Which ones were not and why? What was the resultant energy saving or reduction of CO₂ emissions, or what might have been achieved if additional measures were realized? Which modifications were not applied for, but could have been carried out with loss of visual quality? The calculations made during the assessment of the seven blocks concerned show that an amount of 70–80% energy saving could have been achieved and that 40–60% actually had been achieved.

The findings lead to the following hypothesis:

‘Technical solutions for the reduction of CO₂ emissions in historic buildings are already available and do not necessarily lead to a loss of cultural and historic values. The CO₂ reduction potential in historic buildings is not being reached, not so much because of technical limitations or because of preservation reasons, but because reduction measures have to be taken within a specific context of potentially conflicting interests and regulations. To be able to contribute significantly to the ambitious reduction goals Amsterdam has set, taking measures in the built environment has to be accelerated, including measures in historic buildings. In order to accelerate measures to reduce CO₂ emissions from historic buildings it is necessary to find new solutions based on a merger of interests’.

8. Results

After consultation with the Amsterdam Climate Bureau and the Bureau for Building Aesthetics the researchers grouped the results of the interviews and the Baseline Measurement in 5 topics:

1. Potentials for reductions CO₂ emissions
2. Consequences for the visual quality
3. Costs/affordability for the housing associations
4. Time
5. Attractiveness of the homes to tenants

Topic 1: Potentials for Reductions of CO₂ Emissions

The above mentioned calculations showed that improvement of the insulation values (façades, roofs, partly ground floor) in combination with new energy saving ventilation systems and new heating boilers in this type of buildings lead to a reduction of CO₂ emissions which varies from 40.6% to 61.5%. The average reductions result in 52.6%. If additional measures were realized in the construction (higher insulation values, insulating glass) the reduction could be improved to 60–65%. To reach higher ambitions in this type of buildings new installation concepts are necessary: more energy saving ventilation systems, thermal solar energy, photovoltaic cells, heat pumps, small local heat power plants... Smart combinations offer the possibility for a reduction of 70–80% of CO₂ emissions.

Topic 2: Consequences for the Visual Quality

Some of the measures that were realised in the 7 cases result in visible modifications in façades and roofs. Examples are extensions (partly with high insulation values), new balconies, the transformation of balconies into sun lounges, solar panels and/or photovoltaic cells on roofs or façades. The higher the ambition, the more important becomes the alignment between preservation and innovation. The use of active solar energy in the Dutch situation requires a south orientation. In the most favourable situation the rear is oriented to the south, so that visible measures on the streetside of the block are not necessary.

Topic 3: Costs / Affordability for the Housing Associations

In several cases the renovation of the housing block has lead to a reduction of the number of homes. Although the aggregation of different homes results in more surface area, the rental incomes for the housing association will decrease. The interviews and earlier research [28] showed that financing the renovation is an important stumbling block. Most relevant results of the interviews and the mentioned research:

- Dutch housing associations are interested in or pay attention to energy saving and the reduction of CO₂ emissions.
- According to the associations their main focus is not the creation of financial profits, but they are forced to limit the investments. In the Dutch situation the associations are not allowed to include the investment costs completely in the rental fees. In addition it is not possible to implement the increases of value in the accounting. Finally, the associations do not regard it to be desirable to raise the rental fee to compensate the investments as they also feel the social responsibility to offer homes that are affordable to low income people.
- Due to these circumstances the possibilities for housing associations to realize ambitious energy saving measures on a larger scale are reduced. With the exception of some ambitious pilots, only low ambitions are achieved in most cases, such as realizing double glazing or new heating boilers.
- As customary technical solutions will indeed often lead to a loss of cultural and historic values, customized solutions have to be realized. Customized solutions however, are in most cases

more expensive. This applies especially to Grade 2 and 3, the measures have to fulfil the requirements. Successful practices in Amsterdam are described in the publication 'Het Beste Verbeterboek' [29].

- The Dutch housing associations wish to gather more knowledge about the possibilities for energy saving. Some of them realize innovative pilots, e.g., by the production and supply of local sustainable energy in order to create new financial incomes. New forms of cooperation in the supply chain and cooperation between different associations (e.g., joint purchase of products and services) will possibly lead to a reduction of investment costs.

Topic 4: Time

Looking at the results of the Baseline Measurement, the first impression might be that buildings with historic and visual values can contribute to the municipality's ambition concerning CO₂ reduction without any problems. Unfortunately, looking at the practice other conclusions have to be made: according to the 'Jaarboek van de Amsterdamse Federaties van Woningbouwcorporaties' in 2007 1,389 so called 'high level renovations' were realized [30]. In 2008 an even smaller number of 703 high level renovations were realized in Amsterdam. 'High level renovations' are renovations with investment costs higher than €45,000 per home. The costs do not necessarily give an indication for the measures that are realized, but it can be stated that in renovation projects of this category of investments energy saving measures are part of the renovation. Housing associations own about 200,000 homes in Amsterdam, of course not all of them belong to the group of buildings with historic and visual values. For example there are also homes included that are built in the 1960s. The exact number of buildings with historic and visual values is not available, but the above mentioned numbers indicate that only a very small part of these homes has actually been renovated.

If the renovation process continues at the same speed as in the past years, it would take about 200 years to renovate all homes owned by housing associations. It should be noted that this is a very rough estimation: there are different residential buildings where single energy saving measures (like double glazing or new heating boilers) have been realized in the past years which do not appear in the statistics. However, it is obvious that there is a great need for acceleration, the implementation of energy saving measures in existing buildings is carried out too slowly compared to the high ambitions of the municipality concerning the reduction of CO₂ emissions.

Topic 5: Attractiveness of the Homes to Tenants

The assessments point out that in the seven cases several improvements for the tenants were realized. In addition it is one of the main interests of the tenants to avoid inconveniences during the renovation.

- The energy saving measures result in a lower energy bill for the tenants. Maybe a bigger surface area will lead to higher costs per home, but the costs per square meter will be lower than before. There is growing attention for the total costs for houses, including rent and energy costs. Expecting that the costs for energy delivery will rise in the future there will be even more attention for total costs.

- The homes in this type of building are small. By merging two homes, or by the realization of expansion on the ground floor or roof the surface area becomes bigger. These measures are also realized in the studied cases. In some projects new balconies were created for homes which had no individual outdoor space before the renovation.
- Buildings with historic and visual values offer less possibilities for interventions on the outside, especially the façades and the roofs. Interventions inside create more inconvenience for the tenants and reduce the possibilities for renovation while tenants stay in their homes. There is a great chance that the tenants have to move to other homes during the renovation.

The analyses above were used as input for a workshop with nineteen stakeholders, which was the next step in the research. These stakeholders included housing associations, representatives from various municipal bodies as well as from tenants organisations. All people present felt an urgency to address the climate issues and had a shared wish to realize energy savings in the studied building category. Discussions during the meeting pointed out that technical as well as process related innovations are inevitable. Only the combination of both kinds of innovation can lead to the necessary acceleration of the implementation of energy saving measures in this type of buildings. In today's practice customary measures (insulation, new glazing, new heating boiler, new ventilation system) are only realized in 'high level renovations' (see above) and the residents have to leave the dwelling during the renovation. One of the great problems for the acceleration is the fact that there are not enough dwellings available in Amsterdam for temporary residence. This problem could be tackled by shortening the renovation period. The shorter the renovation period, the quicker the residents can return to their home and the temporarily used dwelling can be given to other tenants. Another strategy to tackle the same problem is the implementation of energy saving measures while the residents stay in their home. As in this type of building measures have to be realized inside the buildings, this strategy asks for special technical and process related solutions. During the workshop different suggestions hereto were made.

Another problem, of course, are the high investment costs for the housing associations. Also it seems that despite good intentions, the implementation of energy saving measures is still hindered by rigid attitudes of involved parties. It is obvious that everyone has specific interests, but it also became apparent that certain interests do not necessarily have to conflict and win-win-situations are certainly possible.

As a result of the workshop 10 recommendations were formulated that will be given to the bench of Mayor and Aldermen of the municipality. Besides that the results of the research are currently used for the dialogue between the municipality and housing associations, aiming at agreements on the acceleration of the implementation of energy saving measures in buildings with historic, cultural and visual/scenic values, whether they are listed monuments or are protected in another way (see the above mentioned grades).

9. Conclusions

As the case study shows, technically spoken there are not many technical or juridical limitations to implement energy saving measures in buildings of historic and visual importance. But the implementation of these measures costs more time and money than in standard renovation projects. Also interventions in these buildings can result in more inconvenience for the residents. The main reasons energy savings measures in this type of buildings are not yet implemented on a larger scale are financial (limited budgets), and concern time, reluctance and organisational challenges. Research results also indicate that acceleration of CO₂ reduction measures is only possible with a combination of technical and process orientated innovations.

The Amsterdam experience described in this paper can be seen as an example for the situation in other Dutch cities. In other cities local governmental bodies and stakeholders too struggle to reconcile different perspectives, policies and interests concerning the built environment, and especially concerning monumental buildings and other buildings considered to have historic and architectural value. Using a mutual gains approach could contribute to resolve perceived conflicts of interests in these cases. The urgency felt by different stakeholders concerning politically and ecologically based issues such as CO₂ reduction ambitions can work to fuel cooperation. Cooperation is stimulated when there is a shift in focus away from emphasising perceived conflicting interests towards a focus on shared opinions.

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