Sustainable Sustainability

(Vedvarende holdbarhed)

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Link to Vadstrup, Søren: *Vedvarende holdbarhed. Bæredygtighed og cirkulær økonomi for bygninger*. 2018.
https://www.bevardithus.dk/wp-content/uploads/06-vedvarende-holdbarhed-3-2018.pdf

Resume

The results of the Research Project (Vedvarende Holdbarhed), carried out in 2015 – 2018, by Søren Vadstrup, but still continuing, has shown, that buildings built before approx. 1960 – must be maintained and renovated with completely different materials than buildings built after approx. 1960. Namely the classic building materials, building constructions and craft methods. In this way, they can achieve a (largely) unlimited and continuous durability and lifespan – called sustainable sustainability (Vedvarende Holdbarhed).

- A *sustainable building* is therefore first and foremost a building *that has lasted* a long time - or that will last a long time - actually indefinitely - if it is continuously maintained and energy improved with the classic materials and methods.
- A new building today, which calls itself for *sustainable*, must be able to prove through explicit research and practice, that its outer and inner materials and structures can *last for at least 200 years*.
- This is due to, that that the classic building materials and building structures, because of their simple and low-tech manufacturing, long lifetimes, as well as simple maintenance and long maintenance intervals, are more sustainable than most corresponding modern materials and elements developed after 1960-70.

Maintenance with unsuitable materials is therefore a far greater threat to our building culture – and sustainable development - than the degradation from weather and wind or rot and insects.

It is therefore extreme crucial for a *sustainable* development of the Earth, that buildings which are older than 1960, i.e. that today they are approx. 60 - 260 years old or more, will be kept in continuing use, maintained and restored with the classical building materials – and avoiding new, modern materials.

This strategy for a sustainable development will also 'lock' CO^2 through keeping the existing materials in the buildings, minimize waste and the use of the limited natural resources as clay, sand, water, limestone etc.

Clay cladding of half-timbering on hazel cane

Background

If the Earth is to survive, humanity must stop the extraction of limited natural resources, stop the emission of CO2 and stop the production of waste. Transferred to *buildings*, this means that we must stop the extraction, production and transport of a large number of building materials, we must heat the houses with CO2-neutral energy and we must stop the demolition of existing, usable older buildings.

The most important feature of a sustainable building in the future will therefore be that it can be *demonstrated* to stand, maintained and used for at least 100-200 years. In addition, it must not 'cost' the demolition of an existing building.

A building today, that can be *demonstrated* to stand, maintained and used for at least 100-200 years is, for example, a building that has *already* lasted for 100-200 years - which is why it provable can be maintained and used for 100-200 years *more*.

The biggest problem here is the choice of materials, methods and constructions for the maintenance. The research project shows, that if you consequently maintain and restore 100-200-year-old buildings with the same materials, methods and constructions, that they were originally built with, then the building can achieve what we have dubbed ‘sustainable sustainability’ - which means that it can be maintained and used for an unlimited number of years, in the future.

Half-timbered house in Denmark, built around 1750 of oak, elm and pine, with unburnt clay in the outer walls and partitions, as well as a thatched roof. The windows and doors were replaced in connection with a major rebuild in 1785. They are therefore around 230 years old, but absolutely sound and good, like the rest of the house.

*If this house is maintained with air lime wash, linseed oil paint, wood tar and new wood in the same quality as before 1960, it can last at least **250 more years**. However, the thatched roof must be replaced every 60 years. But if the house is maintained with cement, plastic paint, coal tar and poison-impregnated wood, it rots and **decays within 15-20 years.***

Maintenance with unsuitable materials is therefore a far greater threat to this house, and financially burdensome for the owner, than degradation from weather and wind or rot and pests. You will hardly find any construction in the kingdom that is more sustainable or 'circular' than this house.

Research

We must first understand here that older buildings are thought and built very differently, from the start, than virtually all other 'consumer goods' we surround ourselves with. For example, computers, mobile phones, cars, bicycles, clothes, furniture, double glazing, pressure-impregnated wood, plasterboard and reinforced concrete etc. Older buildings are originally built to last for at least 200 years or more.

The research project has worked with:

1. New knowledge about and new views on sustainability and circular economy for buildings - with unlimited durability. Including materials and methods to achieve this.
2. A new systematic method for feasibility studies, called 'analysis and assessment' of buildings before restoration and transformations.
3. A set of simple, understandable principles for the same restoration and transformation. – with unlimited or long-lasting durability.
4. Materials and methods for energy improvement of existing buildings, with long lasting durability - without compromising the building's conservation values.
5. Good solutions for improving the indoor climate conditions in older buildings.

Today we have about 1.3 million buildings in Denmark, built in a period of 800-years, from the burnt brick was introduced in this country around 1160 - to about 1960. These buildings are today from approx. 800 years to approx. 60 years old.

In total, they represent a register of just about 50 building materials, as for the individual building often only about 25 different materials have been used. These are materials that are part of constructions that have so far been shown to last for 150 to 800 years.

Very, very few of these 60-800-year-old buildings which stands to this day - are about to collapse. Virtually nothing can prevent them from lasting at least 200 more years. I allow myself to call this: Unlimited durability or *sustainable sustainability*, as the word 'sustainable' also means 'long lasting'.

Sustainable sustainability
What characterizes a building with sustainable durability is therefore:

- That it has already rounded the 60 – 200 years, some up to 800 years
- That it can be maintained with the same about 25 materials with which it is built, in further 150 – 200 years. Individual parts such as the roofing material or parts of the outer walls, through a partial replacement, other parts through a knowledgeable restoration.
- That existing buildings with long lasting durability can change its use without the big problems, because both the constructions and the interior are extremely flexible.

We must therefore introduce a new definition of the concept of 'sustainability' in relation to buildings. Namely a building that:

1. Has lasted a very long time - at least 60 - 260 years - and can then be reused on site by being maintained, refurbished and rebuilt with care and with the classic materials and methods, so the durability continues at least as long, i.e. at least 200 years.
2. Built to last a very long time because it consists of materials and constructions with a very long - at least 200 years * - service life and durability, and with a simple and environmentally friendly maintenance. (* thatched roofs and chimneys excepted).
3. Has a low energy consumption - based on simple and natural solutions, with a very long service life, i.e. at least 200 years - e.g. by being sensibly isolated in critical places. It must be emphasized that it is not the building itself that has the greatest influence on the energy consumption in this. It has the concrete use and behavior of the residents.

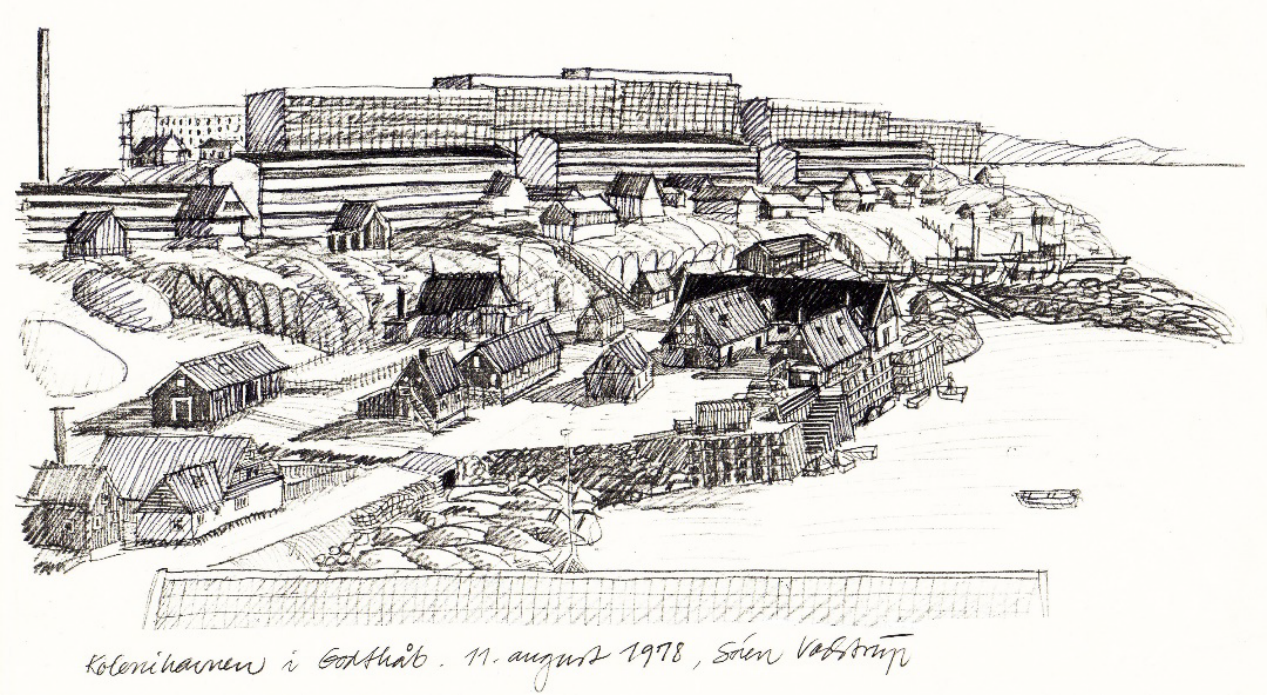
Older buildings' real lifetimes

For people who work with new construction today, the question of the real lifetimes of the houses and materials is, according to them, extremely difficult to answer. You can basically say nothing about this, apart from the building product warranty of 5 years (!) But for us who work with the preservation of older buildings, this question is extremely easy to answer. We have all the lifetimes we could want, 1:1, right in front of us.

We can provisionally concretely prove from practice 1:1 that
- Bricks can last for 800 years
- Roof constructions in timber for 600 years
- Roof tiles for 300 years
- Windows of heartwood for 400 years, panes 400 years
- Hand forged wrought iron 400 years
- Half-timbering 300-400 years
- Seaweed (eel grass) roof for 300 years
- Cast iron for 250 years
- Exterior board cladding for 250 years
- Exterior plaster 150 years
- Linseed oil paint 150 years
- Shingle roof 150 years

In other words, we can state that older buildings built with the classic building materials, constructions and craftsmanship methods have an almost unlimited durability. Thatched roofs and chimneys excepted. They only last 60-80 years.

Similarly, reinforced concrete walls can last for 100 years, aerated concrete walls last for 50-60 years, cement roof tiles for 50-60 years, eternity plate roofs for 40-50 years, thermal windows made of wood, plastic and wood-aluminum for 40-50 years, double-glazed window panes for 18-20 years and glued wood for 10-15 years. These materials and elements must therefore be completely avoided. They are not sustainable = durable for a very long time.



It is now not always that the energy frenzy extends beyond the oldest buildings. The first row of concrete apartment blocks in Nuuk in Greenland, built in the 1970s, was demolished in 2010, after only 40 years, in favor of better insulated and less energy-consuming concrete blocks. The old wooden and stone buildings in the foreground, from 1728 to the 1950s, are still standing. Drawing: Søren Vadstrup.

60 – 60 – 60

The research project has then dealt with what today's problems in relation to the preservation of older buildings, including a sustainable development for these, consist of. We have called this problem complex 60-60-60, because the number 60 is included in three important findings and results:

Buildings built before 1960 require different materials and methods than newer buildings
However, where things go completely wrong is that we now know that buildings built before 1960-70 require different materials, constructions and craft methods for maintenance, repair and refurbishment - as well as energy improvement - than buildings built after 1960-70. And thus completely different materials than most craftsmen and construction consultants today have learned and are used to using.

This applies to materials, constructions and craft methods such as:
• Masonry, lime and mortar for brick houses and masonry work
• Exterior wood cladding – wood quality, wood treatment, painting and carpentry and joinery work
• Painting and surface treatment of external iron, wood, masonry and plaster as well as painting/masonry
• Repair and energy improvement of wooden windows
• Energy improvement with materials and methods that do not degrade the houses technically or architecturally.

Here, studies and very long-term experience clearly show that the classic materials and methods perform best in virtually all areas when we talk about the maintenance and renovation of older buildings, and that the modern materials and methods such as KC mortar, plastic paint and rubber sealants, plastic vapor barrier etc. very often result in technical and aesthetic deterioration of older buildings. We can also state that experiences from e.g. Sweden, Norway, England and the Netherlands show exactly the same

How long does a powerful red lime color like this last before it needs to be retreated? Most people would say one year. But this building, Ewaldsgade 5 in Copenhagen, built in 1853 by N.S. Nebelong, and listed in 1978, I myself was involved in the lime washing of in 1987. And here 36 years later, the building has not been lime washed since. It is not 'unlimited durability' yet, but it helps a lot when the work is done according to new research.

60-80% of all activities in the construction industry take place on existing buildings
This generally does not happen with the good will of the construction industry, but because a majority of the population - i.e. the customers – quite clearly prefer to live and work in older buildings and urban environments, which have considerably more charm and soul than new ones. The percentage is therefore increasing, while new construction is correspondingly decreasing in percentage.

But it requires special knowledge and ability to preserve and reuse older buildings on site, which many architects, craftsmen and engineers unfortunately do not have. Among other things, buildings that were built

before 1960 requires to be maintained, repaired and rebuilt with the same kind of materials with which they were originally built, the so-called classic building materials - which are generally completely different from the modern materials that new buildings are built with today. This is proven through explicit research and practice.

60-80% of all older houses are maintained and repaired with incorrect materials

The research project therefore unequivocally shows that 60-80% of all houses in today's Denmark, which were built before 1960-70, are maintained, repaired, repaired, 'renovated' and energy improved far too violently - with the use of modern and inappropriate materials, constructions and craft methods. This has caused and still causes very serious and in some cases irreparable damage to older buildings, costing the owners very large and completely unnecessary sums of money.

- Partly in direct costs for the incorrectly performed work
- Partly for the damage to the buildings that occurs as a result of inappropriate materials and methods
- Partly in the form of a lower selling price for the house itself, because it has deteriorated technically and architecturally
- In addition to the sale prices of the other houses in the neighborhood falling when they are located together with older buildings that have been maintained and renovated with materials and methods that do not suit the historical, technical and architectural character and quality of the buildings

It is not because both authorities and knowledge centers within the field of building conservation have not disseminated lots of available, and even coordinated, information materials in Denmark on how and with what materials older houses should be renovated. There are just a lot of people around who are not updated and do not want to be updated with the latest knowledge either.

In other words, the vast majority of the damage that occurs to buildings built before 1960-70 is due to the use of incorrect and unsuitable materials for maintenance and repair – not the degradation from weather and wind, rain, snow and frost.

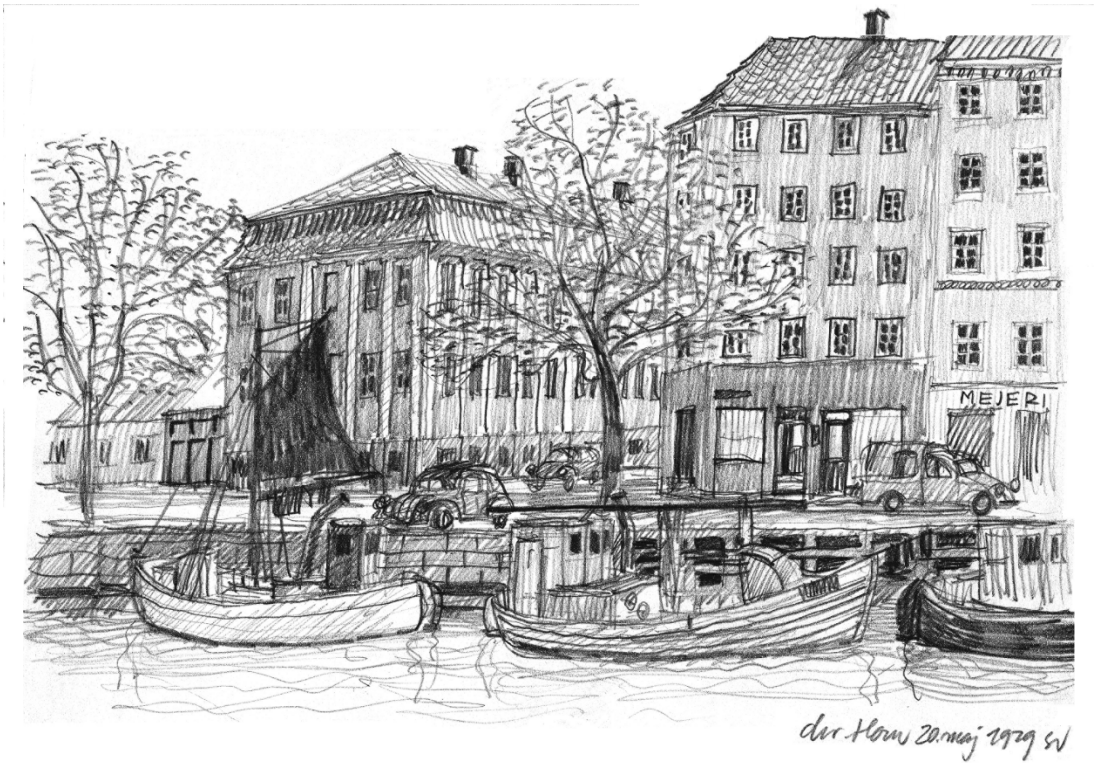
This lack of knowledge about older houses costs the house owners and builders a lot of unnecessary money, and it also damages the buildings themselves. Violent renovations and incorrect materials therefore 'burden' older buildings far more, financially and technically, than the ordinary degradation from weather and wind. And this lack of knowledge about the materials of older buildings also means that many older buildings are demolished, for economic or even sustainability reasons.

30-40 years ago, these 300-year-old baroque houses in Svendborg were in danger of being demolished to make way for cars and wider roads. Today, the biggest danger for these houses is the use of incorrect materials for maintenance, primarily plastic paint and coal tar - as well as destructive insulation with mineral wool and plastic vapor barriers.

Analysis and Assessment of buildings, urban areas, squares, etc.

During the research project we have developed a new, simple and operative method, which can help the house owners, craftsmen and architects to see the historical, technical and architectural potential of older buildings - before they are renovated or restored.

This method, called the 'Analysis and Assessment Method', can also be used to create an architectural and preservation overview of architectural wholes, entire cities, urban areas, ports, squares and urban spaces as well as villages and buildings in the open country. Therefore, it can also be used as a tool for fitting in new construction and new elements in older urban areas and as a tool for the ongoing maintenance and restoration of existing buildings. The method has also been used to engage local homeowners and residents in a fine old and conservation-worthy building environment, to maintain and refurbish their older buildings in a more qualified way. So that the overall building environment has been 'lifted' and improved - historically, technical and architectural.



The old 'Renaissance borough' Christianshavn in Copenhagen contains a fantastically attractive residential environment today. In other parts of Copenhagen has this socalled 'slum' been demolished in the 1970'ies.

The process itself follows a fixed methodology, which also forms the skeleton for the REPORT that comes out of the study:

1: Identification
An initial, very brief, overall identification (address, owner, architect, use(s), etc.), as well as a brief and general description of the building and its surroundings, or the town, settlement, square or village and its surroundings.

2: Analysis
A historical, technical and architectural analysis of the building, development or urban space - in the same order as mentioned. The historical analysis has a special focus on the building history of the house, its cultural history and the overall, intangible background for the appearance of the house today. For settlements, squares and villages, the analysis is further expanded with the functional and social conditions.

2.1: Historical analysis
2.1.1 Building historical and antiquarian analysis
Historical on-site registrations of the original parts of the house or building and historical development, supplemented by old photos, older building drawings and new, current measurements and reconstruction drawings.
2.1.2 Cultural historical analysis
Registration of traces of the original purpose of the house or building - and later uses
Personnel history. Furthermore, wear and patina,
2.1.3 Intangible assets
Registration of the type of building or settlement, its economic and social background, its architectural and constructive idea, philosophy and identity, as well as other sensory and atmosphere-creating values.

2.2 Technical analysis
2.2.1 Technical condition
Registration of the constructive and building technical condition of the house, possibly supplemented with
2.2.2 Moisture problems and indoor climate conditions

2.2.3 Energy and sustainability impacts.

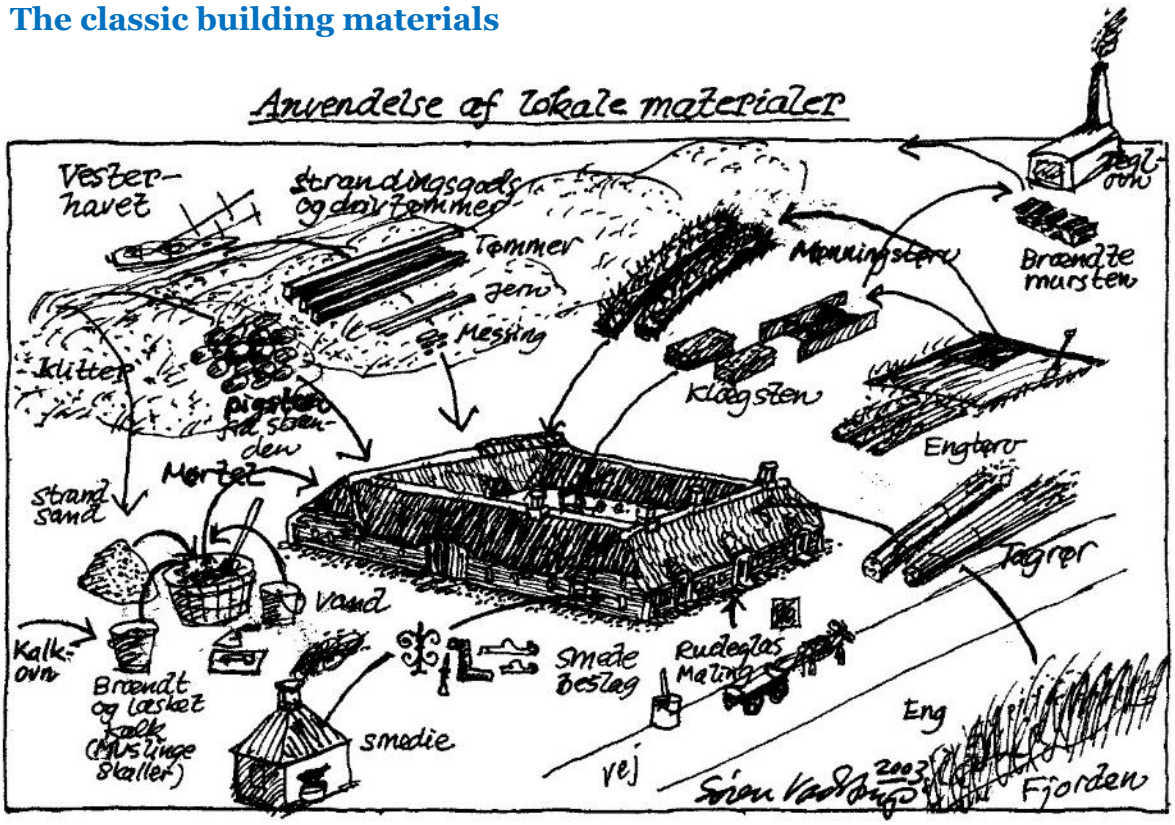
2.3 Architectural analysis
2.3.1 The body of the building,
The facade expression, Facade details, Facade colours, Windows and doors
2.3.2 The interiors of the house,
interior design and function. Including, if possible, previous colors and surfaces.
2.3.3 The surroundings of the house
and architectural adaptation to the landscape or the built environment/the whole.

3: Assessment
This consists of a conclusive statement of the basic conservation values of the building, development or site, as well as, not least, the particularly site-specific aspects of the building, development or urban space. The main conservation values can be supplemented with the designation of the elements that particularly support the conservation values and their vulnerability to changes. Including also the special constructions, construction techniques or functional conditions.

4: Recommendations
As a conclusion, the value statement results in a division into:
1. Inalienable structures and building parts that should be preserved, maintained and repaired (restoration)
2. Unsightly structures, rooms and building parts that can be removed (subtraction)
3. Removed or replaced structures, rooms and building parts that can be reconstructed (reconstruction)
4. Structures, rooms and building parts that can be remodeled and transformed (transformation)
5. New structures, rooms and building parts that can be added (addition)

5: Goals and principles for all interventions
It is not least important that all interventions in older buildings are guided by some simple, very operative and experience-based principles:
1. All interventions, small or large, must be based on a methodical analysis and value statement
2. Preserve as much as possible of the original materials, elements and structures.
3. New materials and elements must respect and harmonize with the existing ones
4. Use the classic building materials, constructions and craft methods that suit the house.
5. Preserve or recreate the architectural integrity of the building – both overall, in detail and for the surroundings.

The classic building materials



The West Jutland 'klitgård' probably belongs to the most adapted building type in Denmark, as far as the use of local materials is concerned. Located on the isthmus between the Vesterhavet and Ringkøbing Fjord, one could obtain from the sea side stranded goods, timber, iron and brass, seashells and beach sand for mortar and spikes. From the fjord side, they got clay stones (adope) for the courtyard's protected outer walls, reed for the thatched roof and meadow peat for the top protection of the roof. The dark red hard-burnt bricks were fired by the bricklayers in small local ovens, and so was the slaked lime. Small local forges produced fittings. Only the window panes and the cast iron stoves had to be transported from the city.

After 1960 the number of building materials and products explodes to the many thousands we know today. In this connection, we are used to believing that everything new that is created and developed, is always better than the old. Why else would you make them and bet money on them? Practical experience over the past 10-20 years, however, shows that for older buildings, i.e. buildings older than 1960, many of the new materials do more harm than good - purely in terms of construction techniques and also aesthetically and architecturally. Firstly, they are too hard, too strong and too dense, so in most cases they work very poorly together with the old materials, which quickly results in damage and the need for maintenance or direct replacement. Secondly, they are often, in contrast to the classic building materials, totally untested – i.e. for at least 100-150 years.

I am ignoring here kitchens, bathrooms, electrical installations and plumbing installations, etc., where the 'old' materials are hardly legal today.

But in relation to the use of the classic building materials, constructions and craft methods, there are many completely wrong opinions and perceptions in the construction industry, among the house owners, in the hardware stores and even among many craftsmen. However, there are more and more craftsmen who know about and can work qualifiedly with the classic building materials - so that the use of these does not become more expensive than others.

We very often have to face 5 assertions on old, traditional buildings, building materials, building-constructions and elements, for instance wooden windows, roof materials, surface treatments, etc., compared to new, modern materials and elements.

The new building materials/elements are claimed to be:

1 Technical better and long lasting, thanks to modern industrial development and research.
2 Better fitted to modern standards, such as insolation ability, weathering etc.
3 Cheaper and easier to use and maintain
4 More environmentally friendly
5 Much cheaper to change old elements to new and modern, than it is to repair the old materials or constructions.

Our research shows that these 5 "beliefs" are misleading and wrong. In fact, the opposite is true

Door from the 1770'ies has been painted 20 times – but clearly still durable for at least another 250 years. Then we are up to approx. 500 years, which can be called unlimited/continuously durable. Unless it is painted with plastic paint.

Conclusion

The research project has shown,

- that buildings built before approx. 1960 – must be maintained and renovated with completely different materials than buildings built after approx. 1960. Namely the classic building materials, building constructions and craft methods. In this way, they can achieve a (largely) unlimited and continuous durability and lifespan – called *sustainable sustainability*.

- that buildings older than 1960 do not have to be maintained as much as buildings younger than 1960 and brand new houses. The maintenance must also be done in a more preventive and systematic way. Most people do far too much, wrongly and too expensively.

- that a sustainable building is first and foremost a building that has lasted a long time - or that will last a long time - actually indefinitely - if it is continuously maintained and energy improved with the classic materials and methods.

- that the classic materials and crafts methods are also the most appropriate, in purely economic terms, for buildings that are older than approx. 1960, i.a. due to their very high durability.

- that the classic building materials and building structures, by virtue of their simple and low-tech manufacturing, long lifetimes, as well as simple maintenance and long maintenance intervals, are also more sustainable than most corresponding modern materials and elements developed after 1960-70.

So therefore, buildings that are older than 1960, i.e. that today they are approx. 60 - 260 years old or more, are by definition *sustainable*, i.a. because empirically they can live and last for at least as long yet. We have approx. 1.3 mil. of these buildings in Denmark, which constitute a large and invaluable resource for a sustainable future, as they can be recycled on site, and entail a minimal consumption of non-renewable natural resources - and the amount of waste and of toxic substances that to be deposited is also minimal.

The countries, cities and companies that can specialize in restoring existing older buildings so that 90-100% of their materials can be reused on site, with an extremely small consumption of new materials, energy and waste - constitute sustainable development of the future.

The bulldozer' is ready. In a short time, this building from the 1950s will be demolished. Its only faults are that it is located on a very attractive site next to Lake Furesøen and then that it is too small and too un-prestigious. Only the boulders are set aside for recycling -

Sources

Vadstrup, Søren: *Vedvarende holdbarhed. Bæredygtighed og cirkulær økonomi for bygninger*. 2018.https://www.bevardithus.dk/wp-content/uploads/06-vedvarende-holdbarhed-3-2018.pdf
in this (in English) by Søren Vadstrup:
5.3 Rehabilitation of a Half-Timbered Houses with Clay Fillings in Denmark (page 96 – 100)
5.4 Sustainable energy improvement of old buildings (page 101 – 109)

The old windows can, properly repaired, last for another 100-150 years. This can rightly be called genuine recycling, circular economy and sustainability – indeed the whole 'strip', while a replacement with new windows does not deserve these predicates.