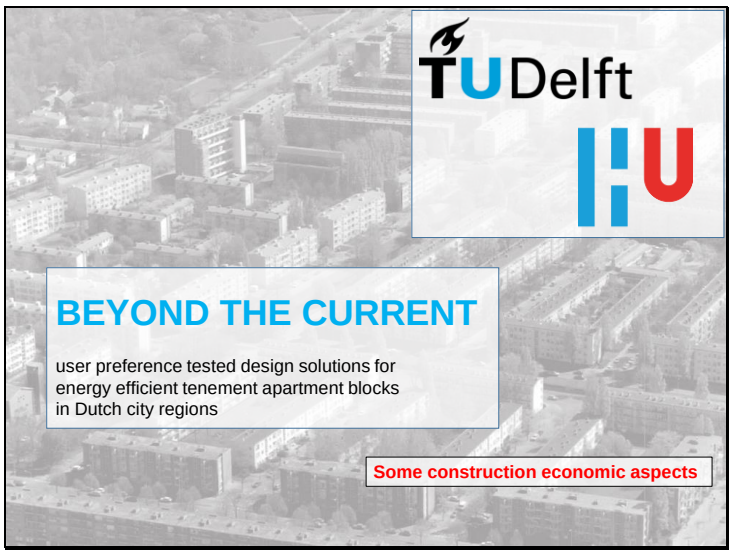
Introduction Tim de Jonge:
Construction economist with own consultancy.
Clients are: architects, housing associations, municipalities, school boards

Member of NVBK.

President of Bouwprojecteconomie-corporation
12 consultancies that work together on EcoQuaestor
calculation model and database
for construction costs and environmental impact of buildings.
Next month training 90 consultants of the Central Government Real Estate Agency.

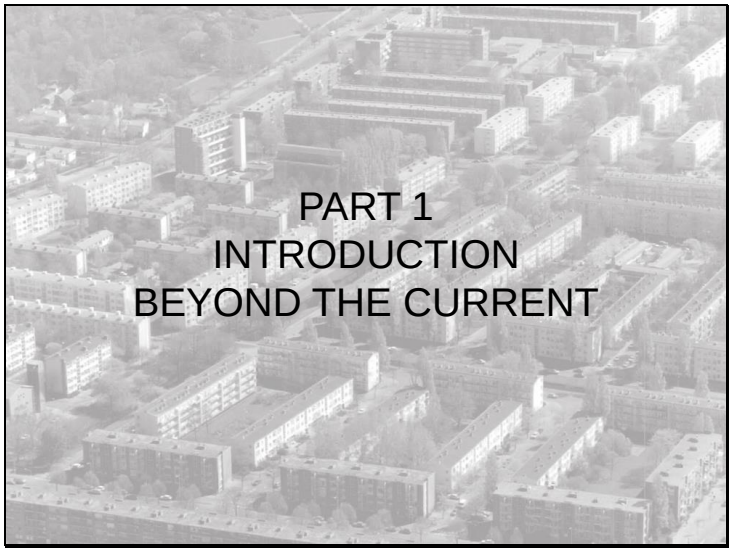
None of this will feature in my presentation.

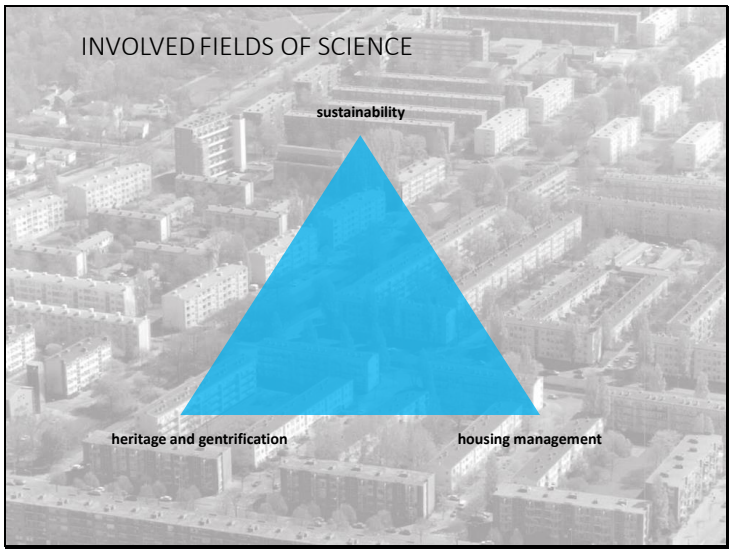


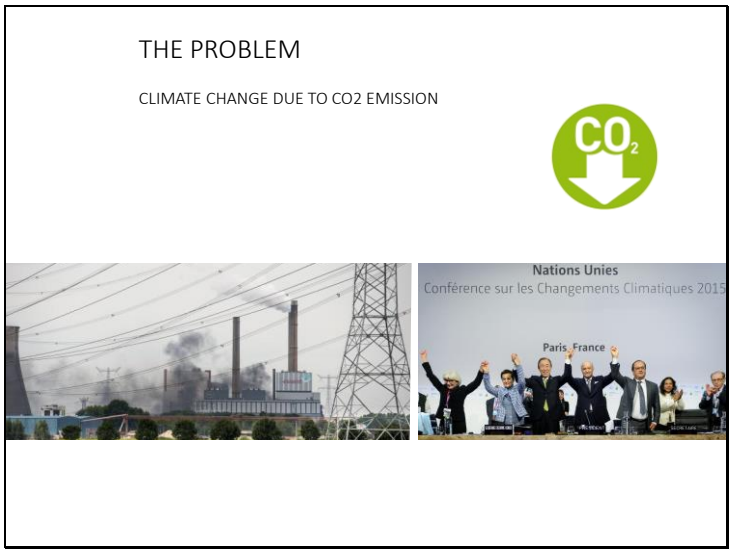
A year ago I was asked to join a research team of
Delft University of Technology and
Utrecht University of applied sciences,

Dealing with a research on energy efficient renovation of tenement apartment blocks.
The main focus in this research is to test tenants preferences to various design solutions.

But I will present to you some construction economic aspects.







The research finds its place of course within the context of the climate change issue.

THE PROBLEM: EXISTING DUTCH HOUSING STOCK

Problems of existing Dutch houses
- to big energy demand
- to much CO2 emission
- not much use renewable energy
- the Dutch are addicted to cheap fossil gas

MULTI DISCIPLINARY RESEARCH TEAM

TUD
Management in the Built Environment
Ir. Sabira El Messlaki

Architectural Engineering + Technology
Dr.ir. Thaleia Konstantinou

Architectural Engineering + Technology
Dr.ir. Leo Oorschot

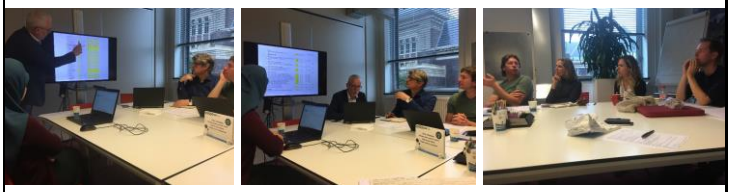
UU
Dr.ir. Tim de Jonge

Delft University of Technology: Architecture and Built Environment
Chair: Housing Management
Prof. dr.ir. Vincent Gruis — dr. Clarine van Oel

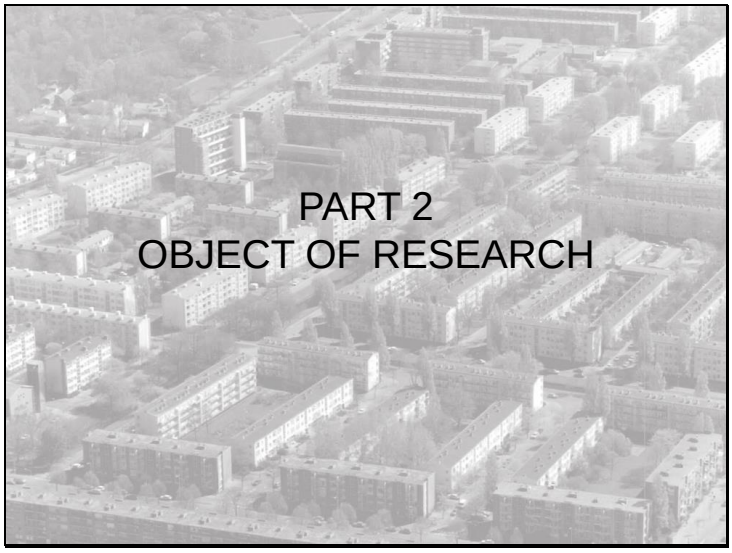
Chair: Architectural Engineering
Prof. ir. Thijs Asselbergs — ir. Tjalling Homans

Chair: Heritage & Design
Prof. Ir. Wessel de Jonge — ir. Lidwine Spoorm

Utrecht University of applied Sciences
Prof. Jan Willem Kroon



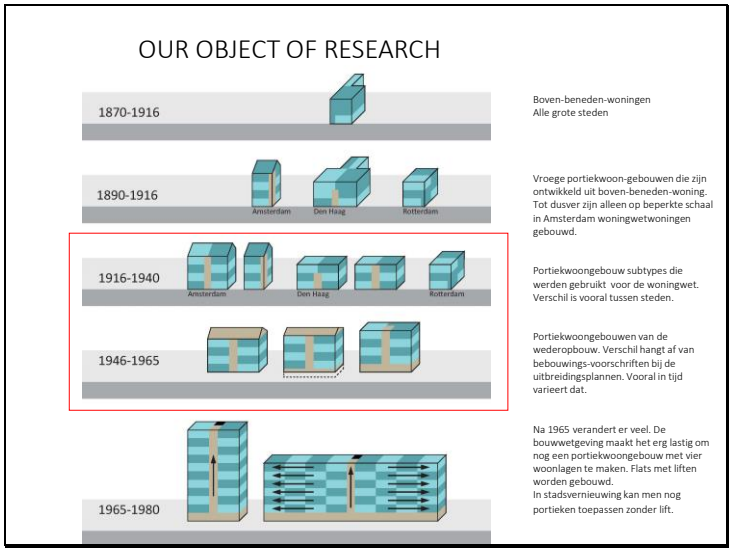
Sabira El Messlaki – housing management, tenants preferences
Thaleia Konstantinou – construction physics, energy
Leo Oorschot – architecture, heritage
Tim de Jonge – construction costs, life cycle



The research is aimed at 3 – 5 storey tenement apartment blocks;
Constructed between WI and WII, and in the first 20 years after WII;
Owned by housing associations, so social housing (for income-groups up to 32.000 / year)

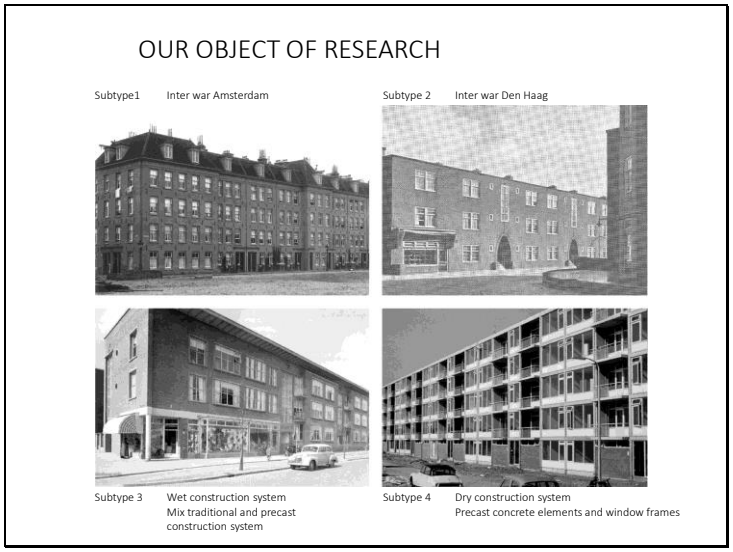
About half a million of these apartments, located in the larger cities in NL.

A characteristic building block consists of 4 to 8 units;
Each unit contains 4 to 8 apartments around a share staircase;
The are usually no lifts.
The building blocks are always part of a coherent urban ensemble.



At the start of the research
a classification of apartment buildings
categorized by:
- period of construction,
- main organization principles of their lay-out.

The research is aimed at these construction periods.



In this housing stock, we have distinguished 4 sub-types:
2 sub-types in the inter bellum era
2 sub-types in the post second world-war reconstruction-era.

DESIGN CASE 1

CAMERA OBSCURA UTRECHT - SUBTYPE DRY CONSTRUCTION SYSTEM

Plaats	Utrecht, Overvecht
Adres	Camera Obscuradreef
Stedenbouw	wijkgedachte, bouwstempel, oorspronkelijk Wissing
Architect:	Gemeente Utrecht & VAM
Gebouwobject	314 appartementen in 6 bouwstroken
Bouwjaar	1964-1965
Bouwwijze	droog prefab bouwsysteem VAM
Eigenaar	Mitros

According to these apartment-types, we have selected 4 projects,
mainly based on what was available at the housing associations in our stakeholders group.

Utrecht – reconstruction era.

DESIGN CASE 2

SURINAMEPLEIN DE BAARSJES AMSTERDAM - SUBTYPE INTER WAR

Plaats	Amsterdam, De Baarsjes
Adres	Surinameplein 26-38, Curaçaostraat 4-40, Hoofdweg 1– 9
Stedenbouw	De Gordel ’20 - ’40 / AUP , Van Eesteren & Van Lohuizen
Architect	Posthumus Meyjes & Van der Linden
Gebouw object	80 appartementen in een bouwblok
Bouwjaar	1936
Bouwwijze	traditioneel (Haagse architectonische karakteristieken zoals open portiek)
Eigenaar	Eigen Haard

(According to these apartment-types, we have selected 4 projects,
mainly based on what was available at the housing associations in our stakeholders group.)

Amsterdam – inter bellum

DESIGN CASE 3

VECHTSTRAAT AMSTELZUID AMSTERDAM - SUBTYPE INTER WAR

Plaats	Amsterdam, Zuid
Adres	Vechtstraat 62-84, Lekstraat 48-52
Stedenbouw	De Gordel '20 - '40, Berlage
Architect	Zietsma
Gebouwobject	59 appartementen in een bouwblok
Bouwjaar	1924
Bouwwijze	traditioneel (Haagse architectonische karakteristieken zoals plat dak)
Eigenaar	De Alliantie

(According to these apartment-types, we have selected 4 projects,
mainly based on what was available at the housing associations in our stakeholders group.)

Amsterdam - interbellum

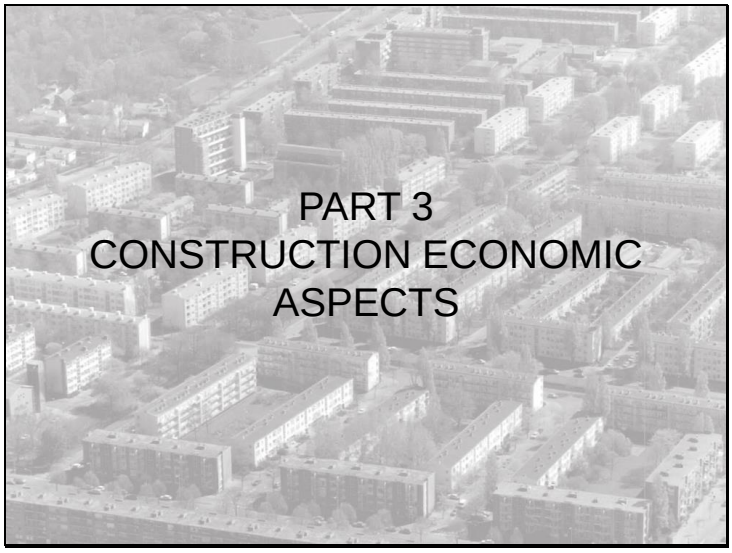
DESIGN CASE 4

MARIAHOEVE DEN HAAG - SUBTYPE WET CONSTRUCTION SYSTEM

Plaats	Den Haag Mariahoeve
Stedenbouw	Wederopbouw ensemble, midden periode, Van der Sluijs
Architecten	Fels & Kroon
Gebouwobject	264 appartementen in verschillende bouwstroken
Adres	Robijnhorst 4-276 / 3-127 & Diamanthorst 1-179
Bouwjaar	1959-1960
Bouwwijze	mix traditioneel - bouwsysteem (Korrelbeton)
Eigenaar	Haag Wonen

(According to these apartment-types, we have selected 4 projects,
mainly based on what was available at the housing associations in our stakeholders group.)

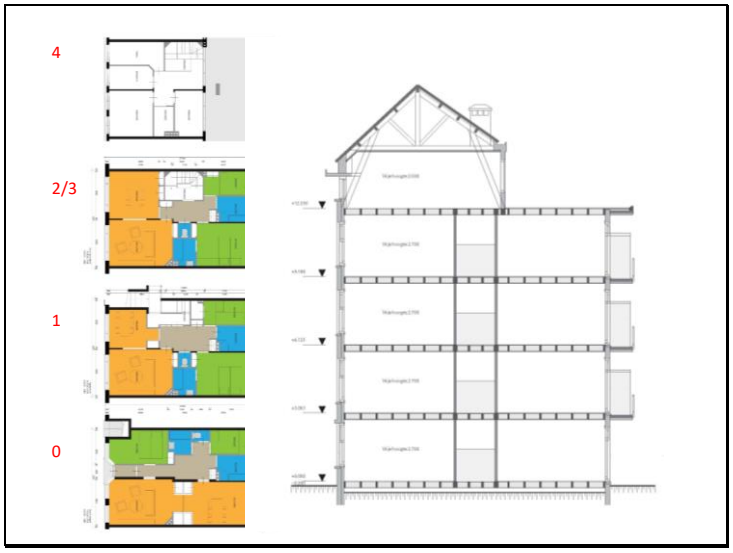
The Hague – reconstruction era.



The main object of the research is
to find design solutions that are preferred by tenants.

For our profession however,
the focus of this presentation is on: construction economic aspects.

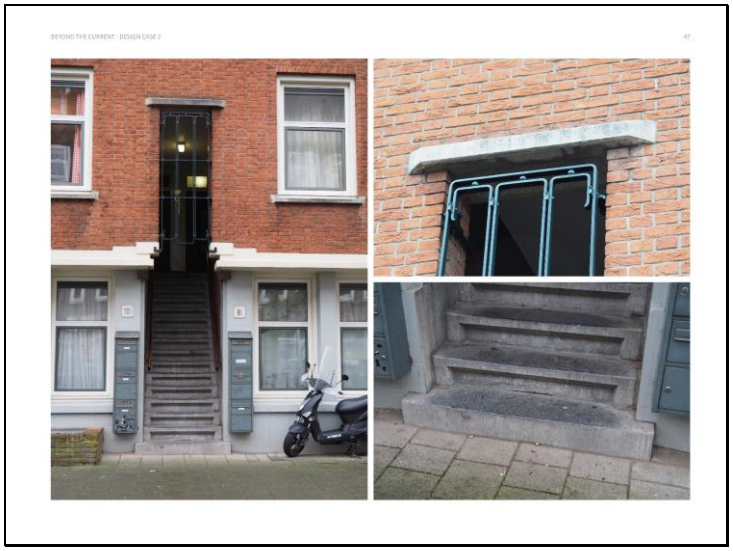
The example for my explication is this Amsterdam building complex.



It is a 5 storey building
4 apartments on top of each other
And a shared attic, where every apartment has a kind of storage-room.

Ground floor apartment is accessible directly from the street.
Upstairs' apartments can be reached by an outside, stone made staircase (see next sheet)

Apartments on the 2nd and 3rd floor are further accessed by internal staircases.

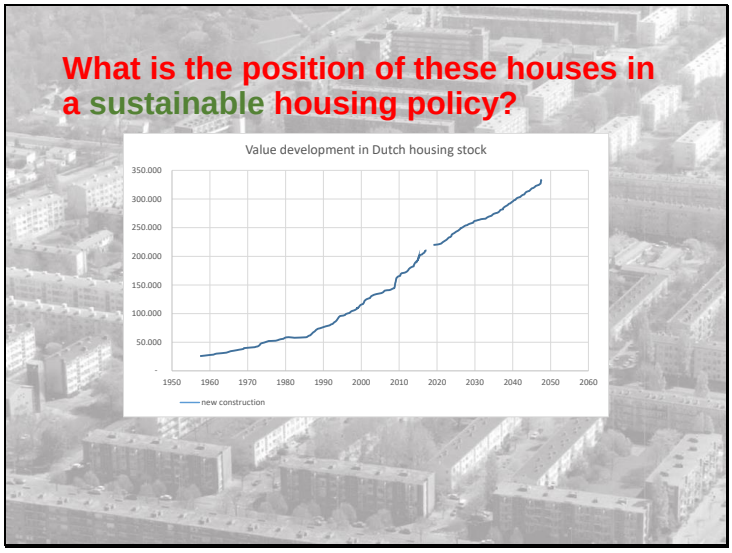


... can be reached by an outside, stone made staircase (back to previous sheet).

Apartments on the 2nd and 3rd floor are further accessed by internal staircases.

Here again the building block, with the stone made, open staircases.

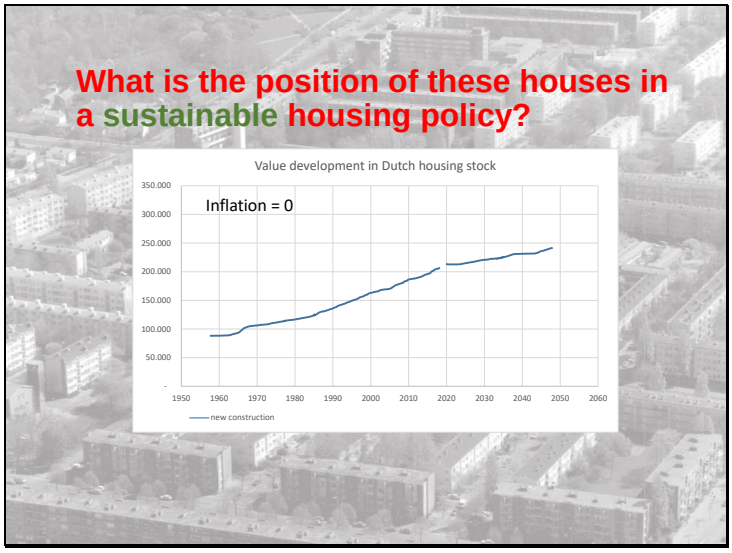
And the back side of the building, renovated apparently in the 1980s.
In good weather it looks quite friendly!



So: What is the position of these apartments in a SUSTAINABLE housing policy?

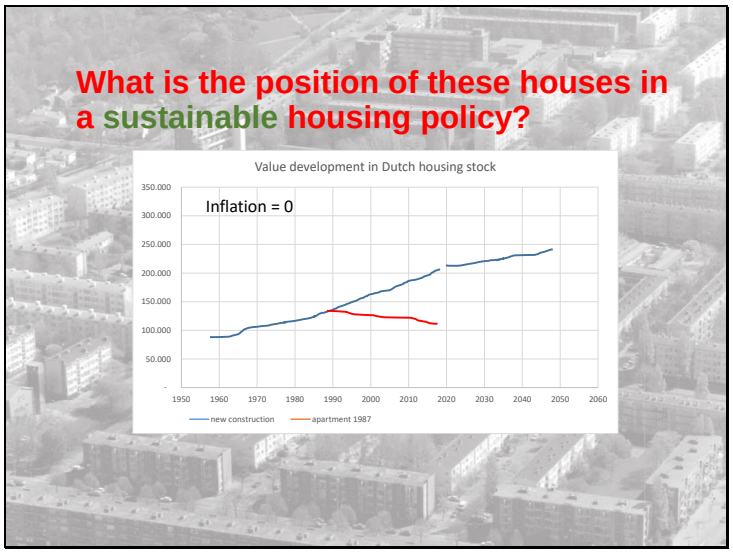
Here you see the value development of new-construction in Dutch housing.
So the value of a typical new constructed apartment in the subsequent years
in the second half of the 20th century up until now,
and the expected development of that value in years to come.

I want to point out that value is not the same as costs.
The value is what one would be prepared to pay for the ready product, in this case the newly-built apartment.
The costs that should be covered by this value would apparently be:
- capital construction costs
- associated capital construction costs
- ground costs.



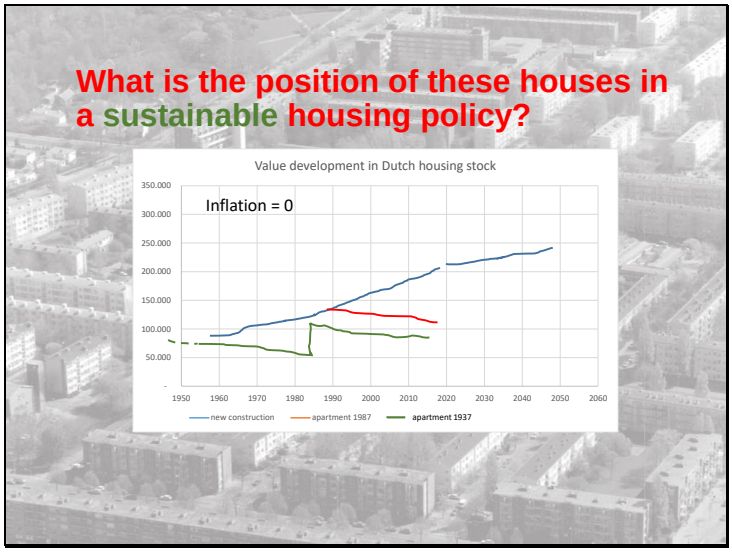
If we correct this graph for inflation, it looks like this.

The real growth of value is of course related to better performances of new buildings compared to older ones.
For instance, new apartments will have better equipment like bathrooms, kitchens, electricity systems.
Better functioning windows and doors as to locks and fasteners, double or triple glazing.
Better thermal and sound insulation.
Better water systems, ventilation services, heating.



If we look at the value of a 30 years old apartment,
and the development of that value in time, it wood look like this.

As you see, the value rather diminishes;
that is partly due to wear and tear,
but mainly because the appreciation for an older building, will decrease
when the performance of the newer buildings set the standard a little higher.

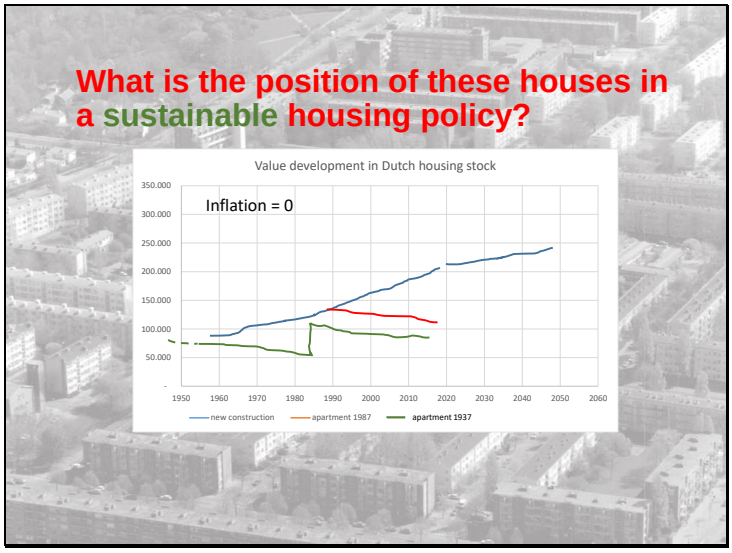


In the research, however, we are looking into an apartment from the inter bellum era.
The value of such an apartment could be expected to develop like this.

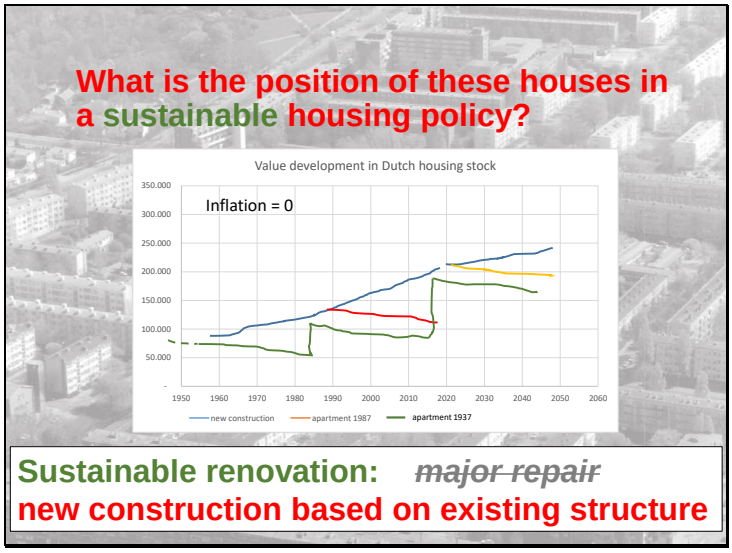
In the middle you see the effect of a 1980s' renovation.

In 2017 you see a rather big gap between the value of the inter bellum apartment and a newly-built apartment.
However, in practice all inter bellum apartments in the larger cities in NL are very much in demand.
Partly because of a moderate rent, but also because they are still nice dwellings in interesting neighbourhoods.

Let's remember for a moment the problems that are at the basis of our research.



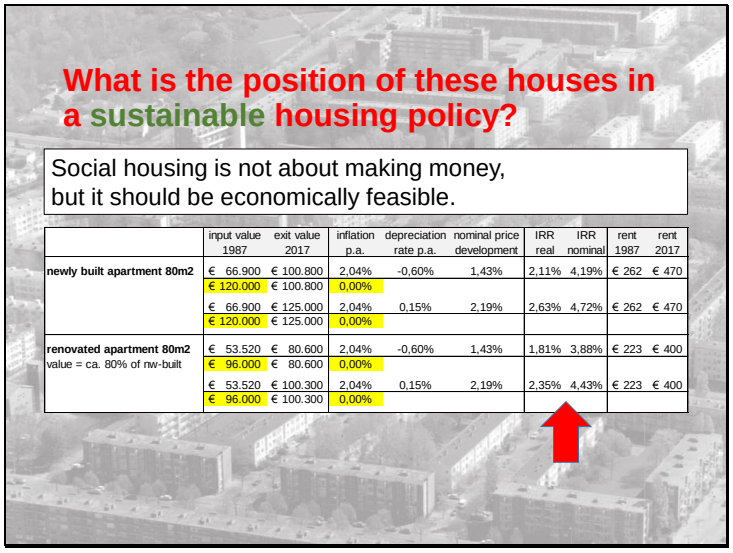
In the housing stock, at least until the 1990's, the quality of houses add to this problem.
So improvements should be made to all these buildings in order to achieve the goals of the Paris treaty on climate change..



That implicates rather big investments,
while the required improvements can only be realised,
if the apartments undergo major renovations.

In fact - in order to get the right mind set for this operation - we should state:
sustainable renovation should not be seen as "major repair",
but rather as "new construction based on existing structure".

(Of course in the future the diminishing of the value will inevitably continue.)



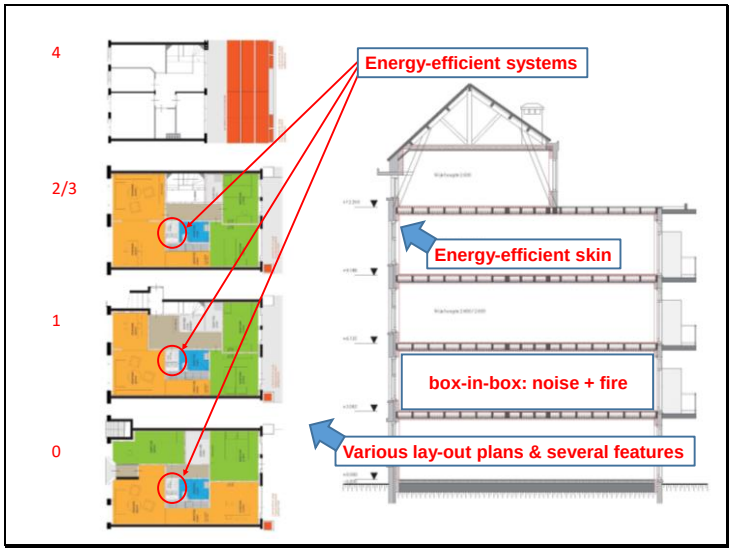
	input value 1987	exit value 2017	inflation p.a.	depreciation rate p.a.	nominal price development	IRR real	IRR nominal	rent 1987	rent 2017
newly built apartment 80m2	€ 66.900	€ 100.800	2,04%	-0,60%	1,43%	2,11%	4,19%	€ 262	€ 470
	€ 120.000	€ 100.800	0,00%						
	€ 66.900	€ 125.000	2,04%	0,15%	2,19%	2,63%	4,72%	€ 262	€ 470
	€ 120.000	€ 125.000	0,00%						
renovated apartment 80m2	€ 53.520	€ 80.600	2,04%	-0,60%	1,43%	1,81%	3,88%	€ 223	€ 400
value = ca. 80% of nw-built	€ 96.000	€ 80.600	0,00%						
	€ 53.520	€ 100.300	2,04%	0,15%	2,19%	2,35%	4,43%	€ 223	€ 400
	€ 96.000	€ 100.300	0,00%						

Social housing is not about making money,
but it should be economically feasible for housing associations.

So a certain return has to be made.
Here you see, what the return would have been on investments on apartment,
if rents would have been on the 2017 level (with rents following inflation).
In reality, rents have been lower,
that is starting with lower rents and increasing more than inflation, have led to the 2017 level.

Associations did not go bankrupt, so the appearing IRR should be enough for social investments in housing.

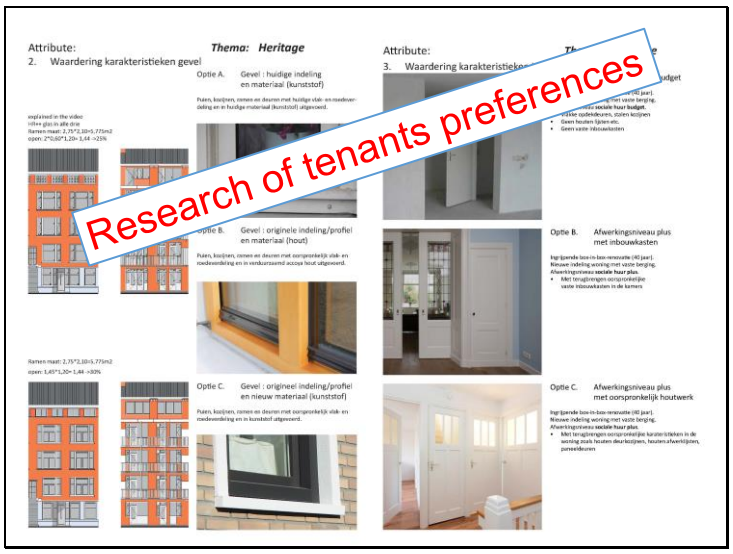
Back to the apartments block and the design in our research.



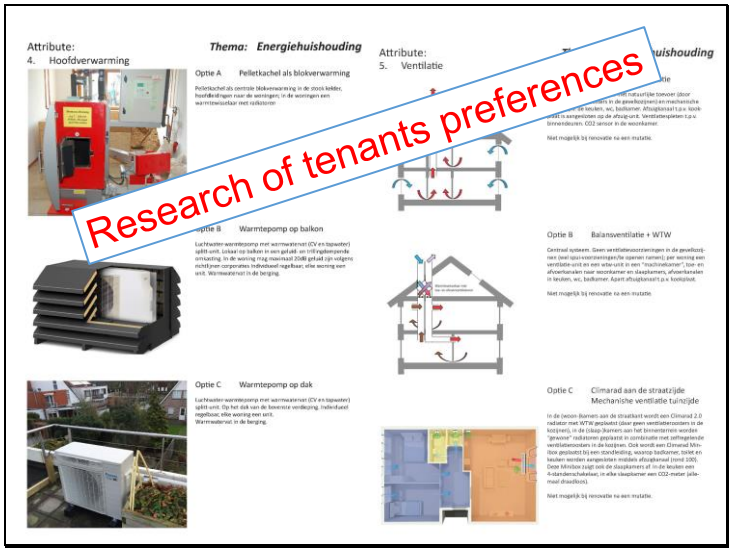
In order to deal with noise and fire protection a so-called box-in-box renovation plan has been designed.

With various lay-out plans and several features, to be researched for tenants preferences.

Measures to create an energy-efficient skin (external walls and roof) were selected.
And energy-efficient systems were selected, and since these systems ask for extra room, the extra room was incorporated in the design.



The features have been researched for preferences, but I cannot go into that right now.



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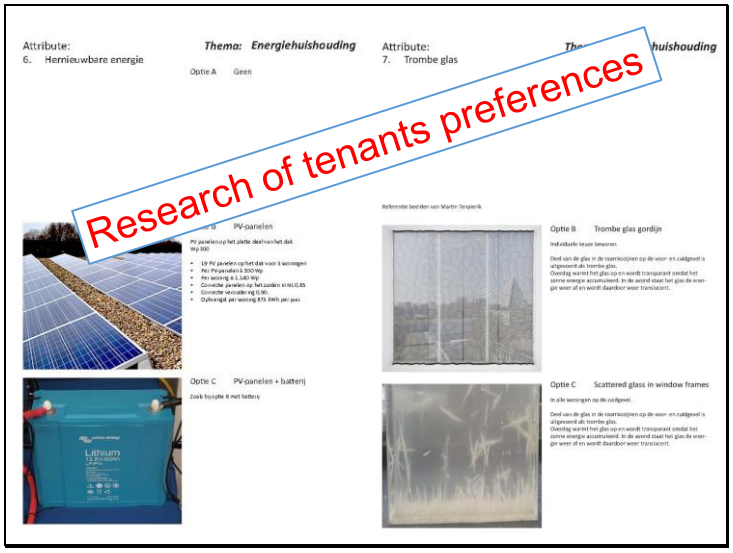

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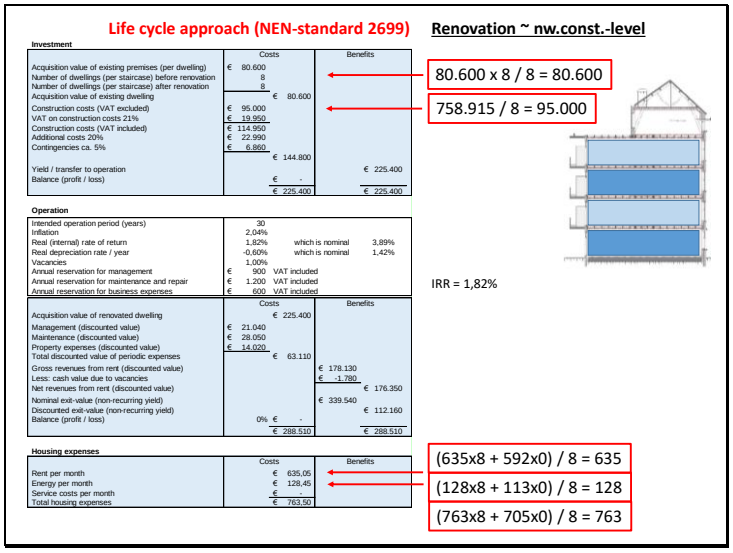


So: Is this approach indeed economically feasible?
We researched that on the basis of de life cycle scheme of NEN-standard 2699.

This scheme is divided in 3 sections:
Section 1 Investment – from the viewpoint of the project developer.
Section 2 Operation – from the viewpoint of the landlord, i.e. the housing association.
Section 3 Housing expenses – from the viewpoint of the end user, the tenant.

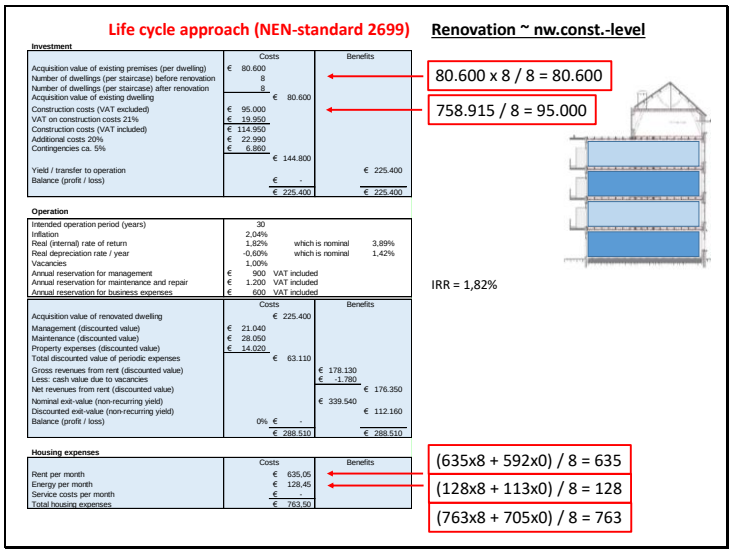
When we start with assessing the values of the investment and the housing expenses.
We can next see under which conditions a balanced operation is possible.
The IRR should be around 2%, as we have seen previously.

We will start with a renovation that brings the apartments on a new-construction level.
No lifts, however. And moreover no energy-efficiency measures.

We start with 4 apartments on top of each-other, that is 8 apartments in a staircase-unit.
After renovation we have again 8 apartments (with approximately new-built qualities).

The investment exists of:
acquisition value x 8/8
construction costs of renovation
associated costs.

The investment is transferred to the operation; we will come to that later on.



Now for the housing expenses.
In NL the rent for social housing is assessed to be socially acceptable if it does not exceed € 635 for a two-and-more persons household,
or € 592 for a single person household.
Households with income less than € 32.000, will be subsidised according to their actual income.

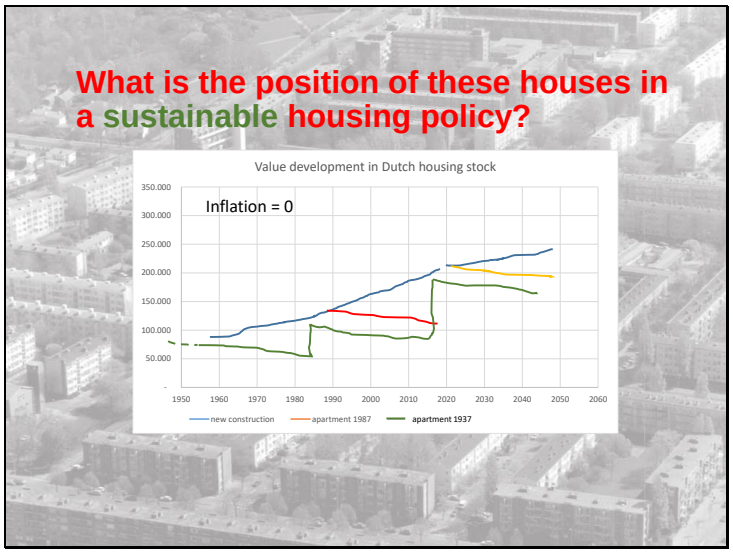
Based on statistics by Energie Centraal (Energy Centre)
we assessed the average energy-bill of the same households.

Rent and energy-costs together are the housing expenses.

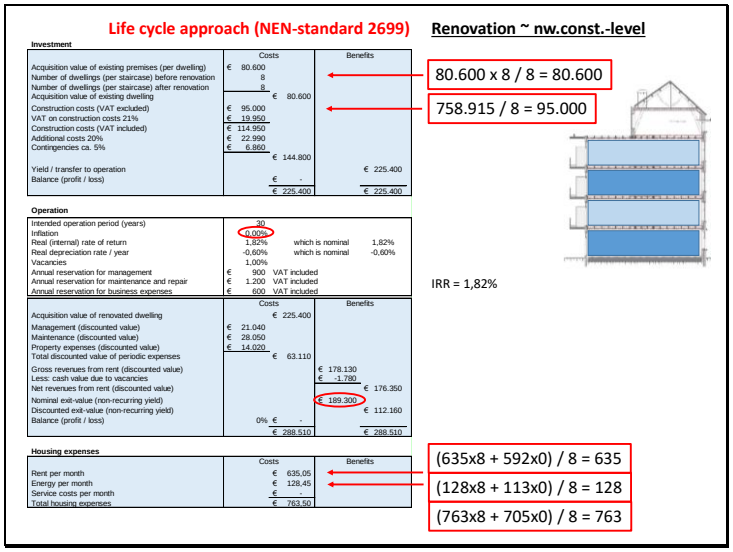
So, on the one hand we have the investment costs for the renovated apartment,
and on the other we have the rent, which can serve as a benefit for the landlord.

We bring the values of both items (cash-flows, if you want)
to the operation-section of the life cycle scheme.
We have to translate them into present values (I won't bore you with the technicalities.)

We put also some other operating costs.
And finally, we have the exit-value of the property after 30 years ...

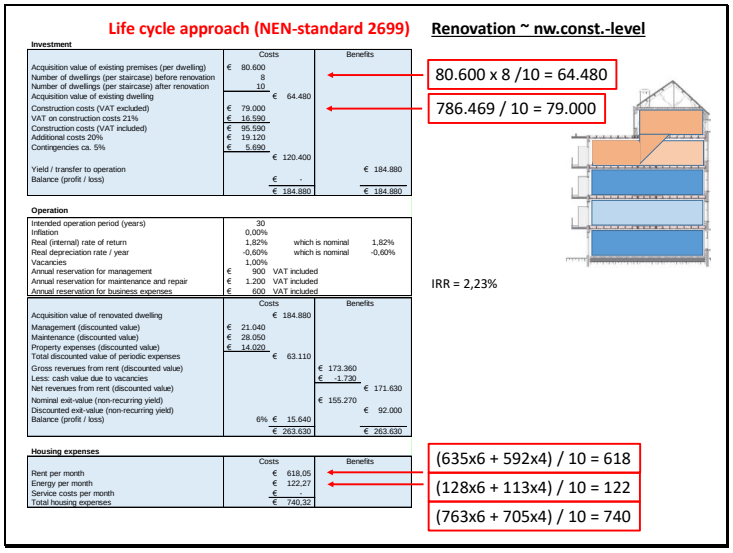


... Remember this!

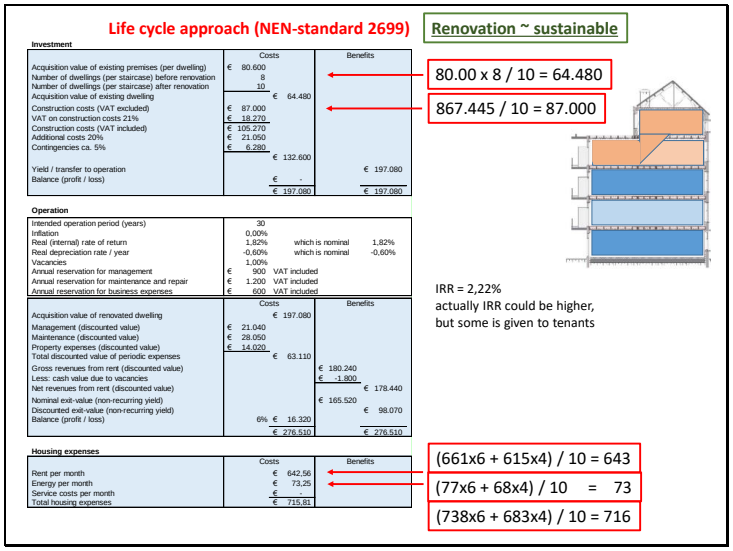


Now, if we correct the whole thing for inflation, you can see that the exit-value is less than the input-value.

The IRR is 1,82%; that is on the bottom side of the feasibility.



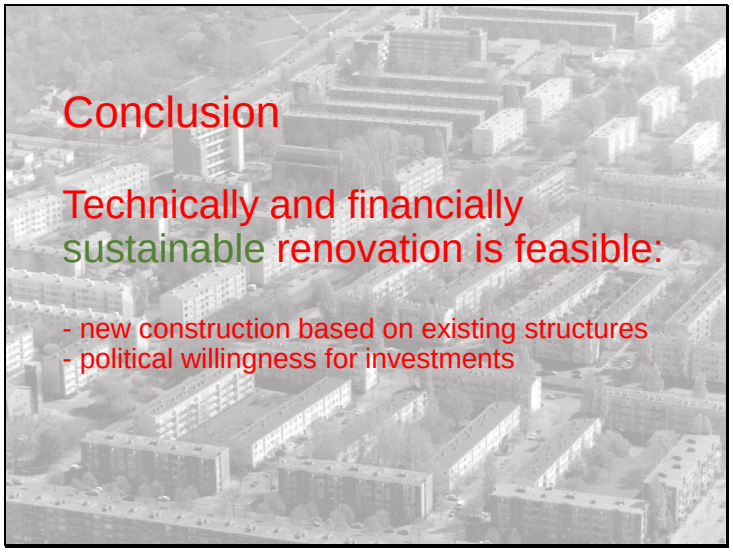
What we can do, is make more apartments in the building block.
Investment costs and housing expenses will change.
But the effect is, that the IRR moves to the safer end of the spread.



Finally, we add the extra measures, to make it a sustainable renovation in terms of energy efficiency and CO2-reduction.

This can yield the same IRR, if the profit of the reduction of energy-costs is split 50/50 between the tenant and the housing association.

Of course an extra investment has to be made.


Conclusion
Technically and financially
sustainable renovation is feasible:
- new construction based on existing structures
- political willingness for investments