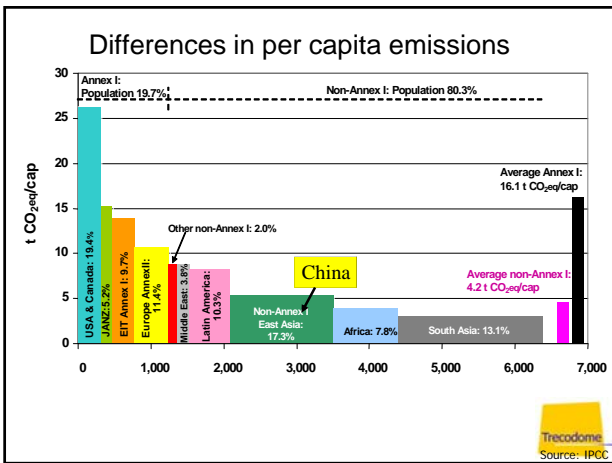
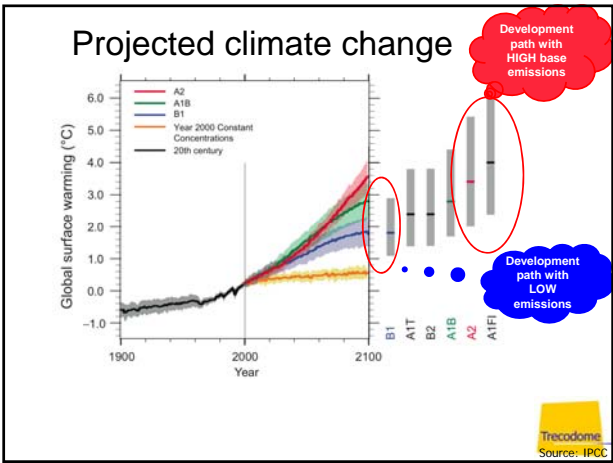
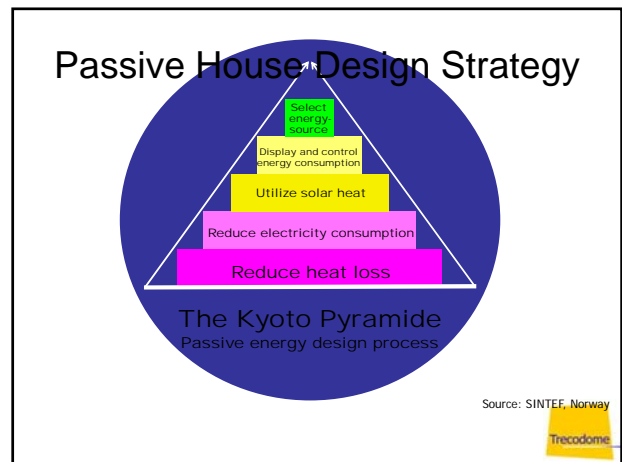
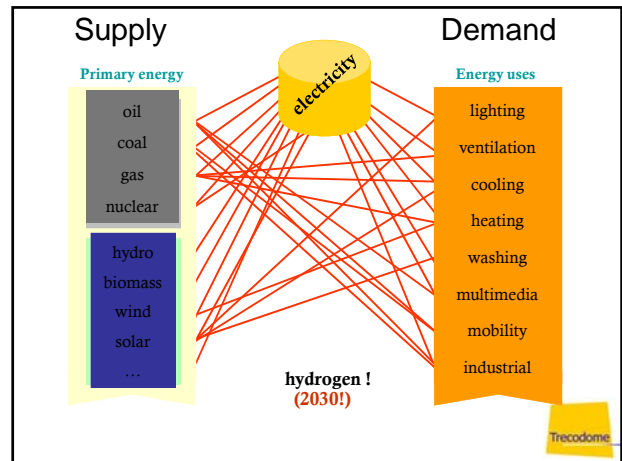
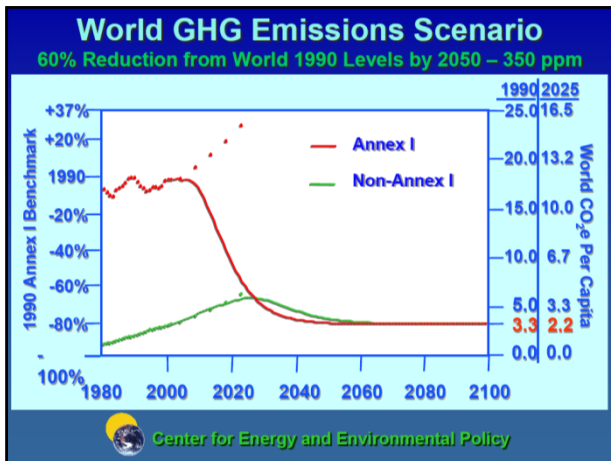




Low Energy Buildings in Europe

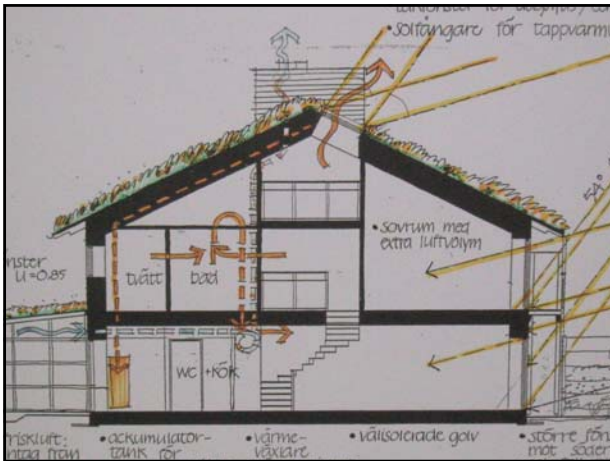
- the climate challenge
- what is low energy housing
- why passive housing
- passive housing in Europe
- vision for the future
- examples





- ### Where do we stand
- 200 kWh/m² - existing building stock
 - 100 kWh/m² – standard renovation
 - 50 kWh/m² – new homes
 - 25 kWh/m² – passive renovation
 - 15 kWh/m² – passive housing
- Trecodome





Quality criteria

- Heat demand less than **15 kWh/m²**
- Total energy less than **120 kWh/m²** in primary energy
- Passive House Certificate
- [Note: electricity has factor of over 2.5]



15 kWh/m²

Continuous insulation

- U values in range of **0.10 – 0.15 W/m²K**
- U glazing in range of **0.5 – 0.8 W/m²K**
- U window frames around **0.8 W/m²K**
- No thermal bridges
- No unwanted air leakage



15 kWh/m²

A breathing indoor environment

- Balanced ventilation **with heat recovery**
- Operable windows
- Summer night ventilation



Summer night ventilation

- Ventilation rate between 4 – 20 depending on climate and temperature difference
- Night ventilation allows building to cool during evenings and night



The two remaining energy uses in passive house require

Low energy domestic hot water system

- read as solar collector for DHW

Low energy electrical appliances

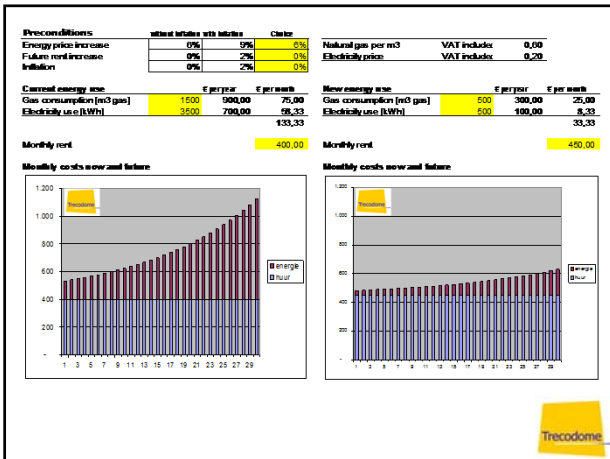
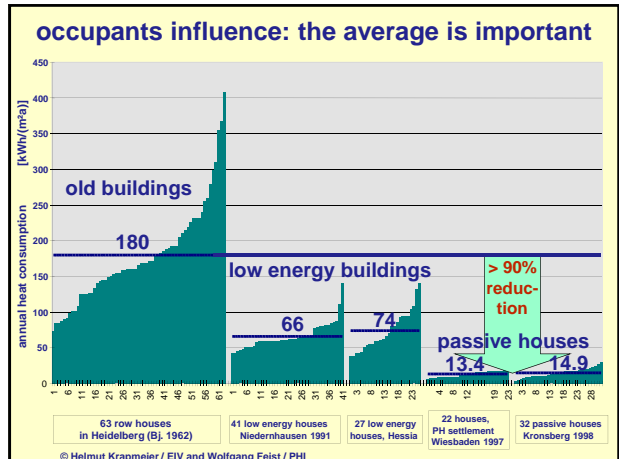
- devices with real on/off buttons
- No standby losses from digital tv box, cable modem, chargers, digital metering systems ...





Towards zero emission

- Passive House standard to achieve low energy demand
- On site renewable energy to cover a significant part of the energy balance
- Off site renewables help improve the overall performance of the electricity grid



Why should we do it

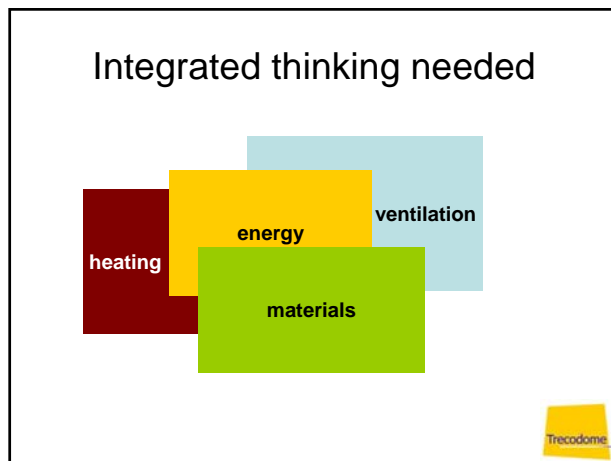
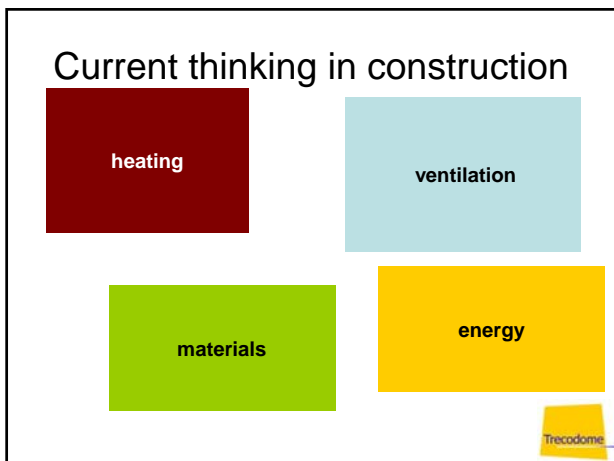
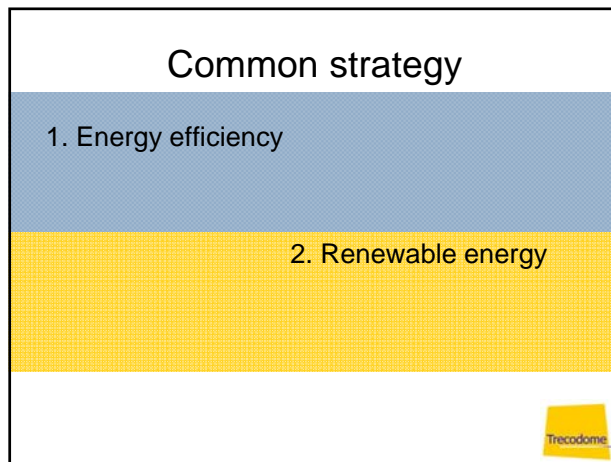
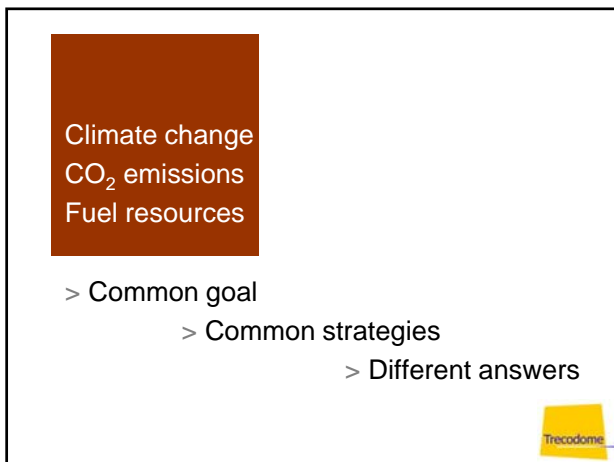
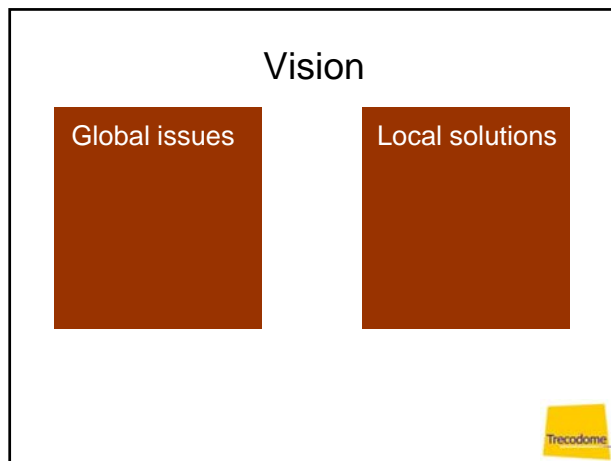
- Need for a robust standard, which may survive next 50 years
- New distributed energy generation does not come in large quantities
- Small energy demand can be met by high % renewable energy

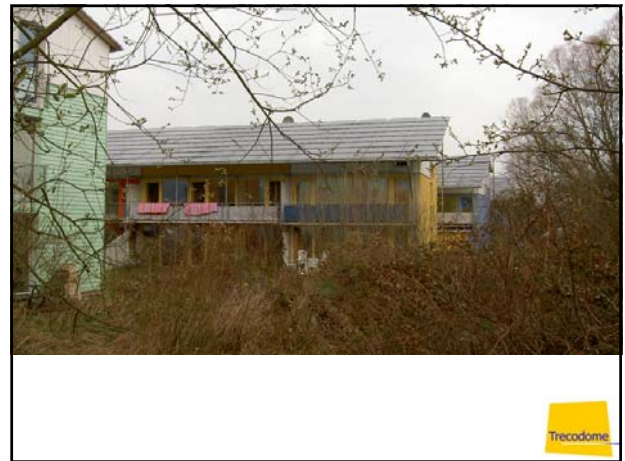
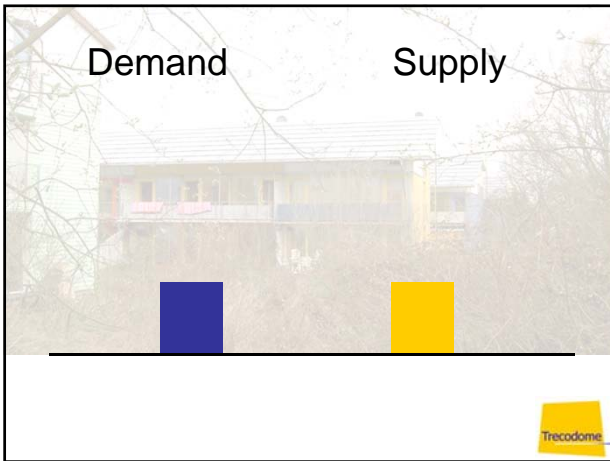
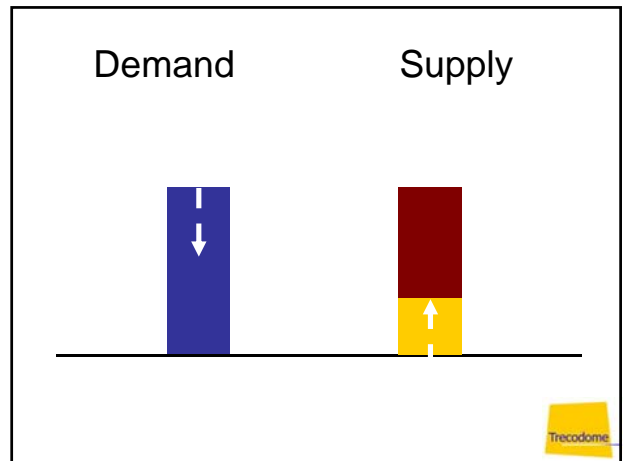
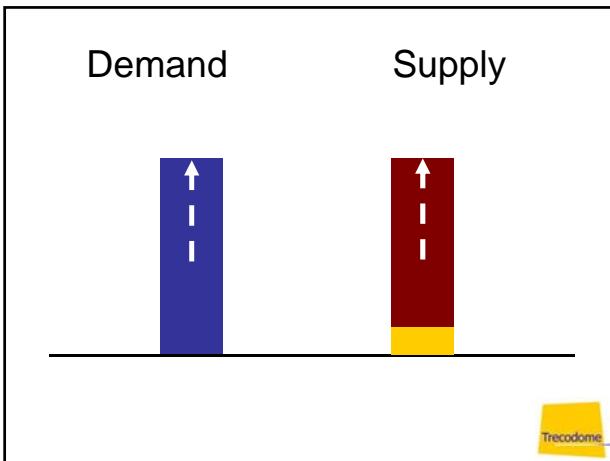


4. passive housing in Europe










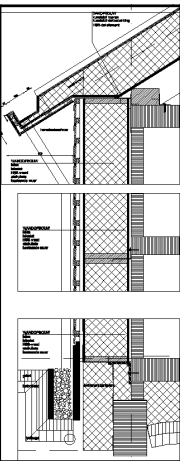
E2ReBuild
Kroeven – Rosendaal
facts + figures
Chiel Boonstra - Trecodome
general meeting Rosendaal 14 June 2011

The slide features a green vertical bar on the left. At the bottom left is the logo for the 7th EU Framework Programme. A small yellow Trecodome logo is in the bottom right corner.



U values

- Roof: 0,11 W/m²K
- Walls: 0,11 W/m²K
- U frame: 0,95 W/m²K
- U window: 0,5 W/m²K
- Floor: 0,2 W/m²K





PHPP calculations

- Passive House Certificate for mid terraced units

	$n_{50}=0,6$	$n_{50}=1,0$	
• Mid terrace	18	22	kWh/m2
• End terrace	25	29	kWh/m2

Monitored $n_{50} = 1,0 - 1,5$

Kroeven 505		before	after	saving
m2 floor area		120	120	
units		134	134	
total m2		16080	16080	
Space heating	[kWh]	12500	104	2500
Hot water	[kWh]	4000	33	2000
Cooking	[kWh]	500	4	500
Electricity	[kWh]	3500	29	3500

Passive renovation – 80%

Kroeven 505		before	after	saving
rent		500,00	565,00	(65,00)
Energy costs	price		per month	per month
gas [in m3]	0,67	1700	94,92	500
electricity [in kWh]	0,22	300	5,50	300
			100,42	33,42
				67,00

Monthly costs now and future - current energy use

Monthly costs now and future - future energy use

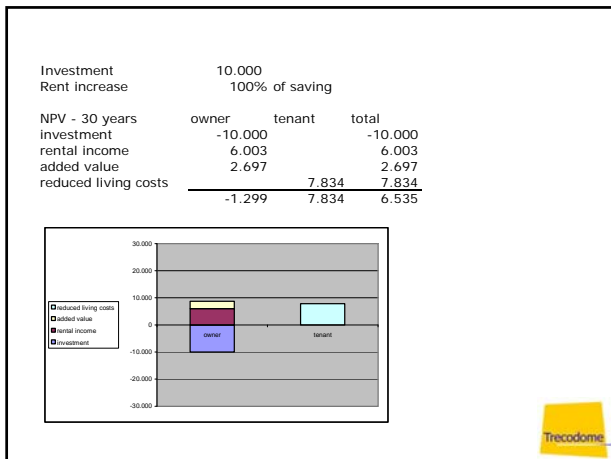
Investment	25.000		
Rent increase	100% of saving		
NPV - 30 years	owner	tenant	total
investment	-25.000		-25.000
rental income	15.992		15.992
added value	6.744		6.744
reduced living costs	-2.265	20.870	20.870
			18.605

Reference – 30%

Reference		before	after	saving
rent		500,00	525,00	(25,00)
Energy costs	price		per month	per month
gas [in m3]	0,67	1700	94,92	1250
electricity [in kWh]	0,22	300	5,50	300
			100,42	75,29
				25,13

Monthly costs now and future - current energy use

Monthly costs now and future - future energy use



Compact heating system

- Mechanical heat recovery
- Solar storage tank 150 liter
- Condensing gas boiler

- 5 m2 solar collector

At completion of the renovation works blowerdoor tests have been made resulting in an airtightness figure of 1.0 airchanges at 50 Pa.

Infrared imaging of the units did not result in any anomalies



Next generation

Example Groenewoud Tilburg, TBV Wonen

Innovations

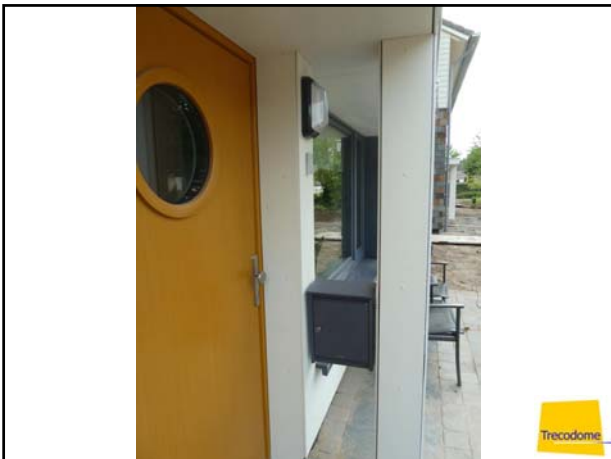
- Fresh air supply via external ducts, integrated in facade approach
- Filling the gaps between prefab elements and existing walls.

- Blowerdoortest: 0,7 airchanges at 50 Pa in end terrace





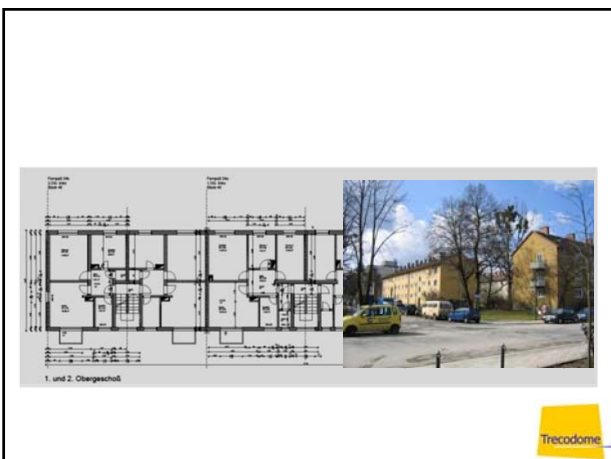
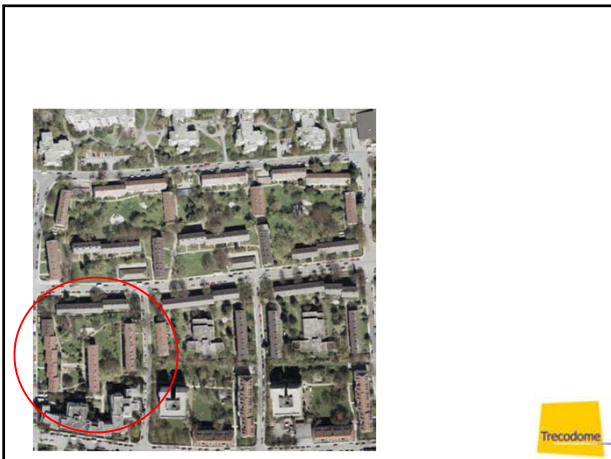




E2ReBuild

Munich Demo

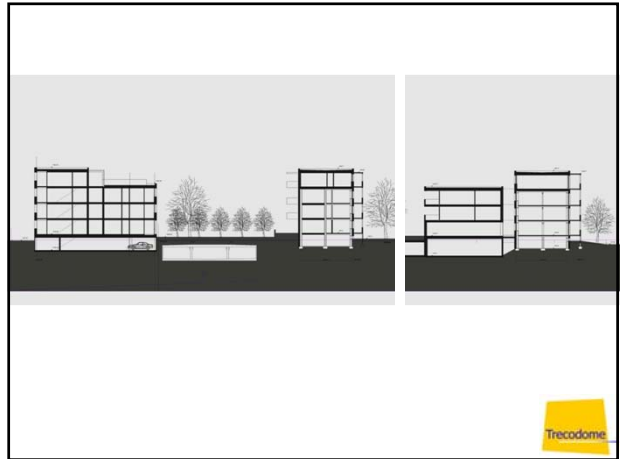
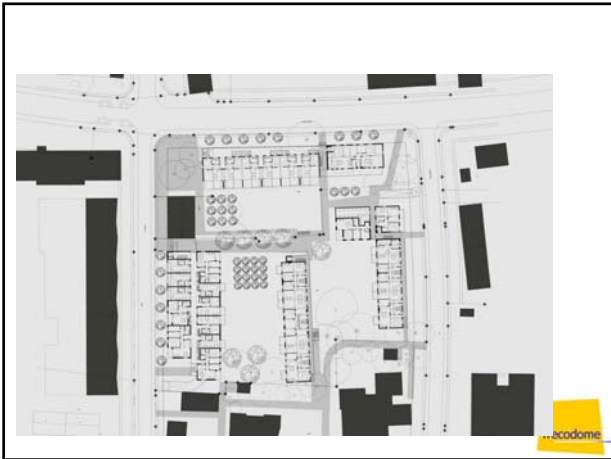
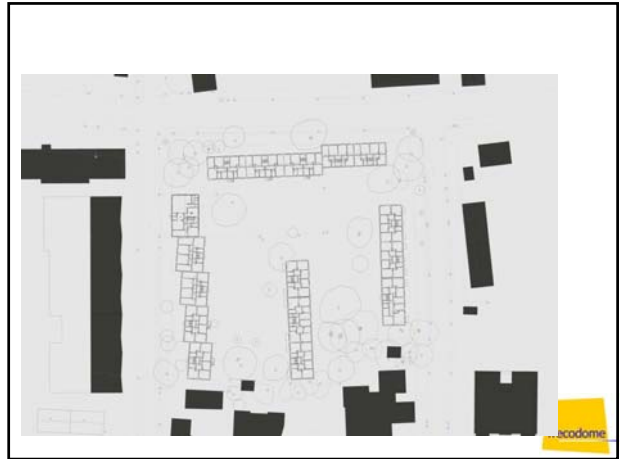
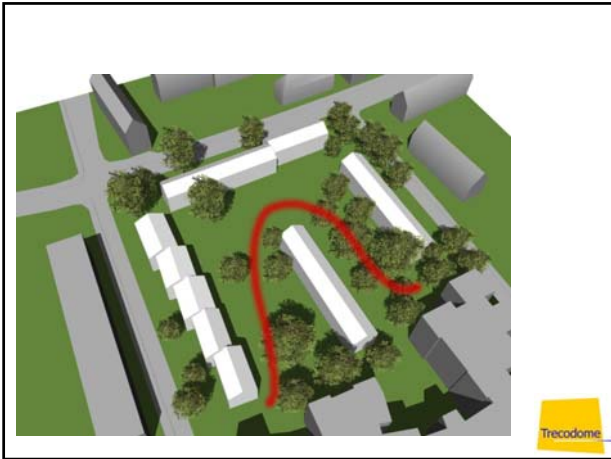
Residential block GWG München

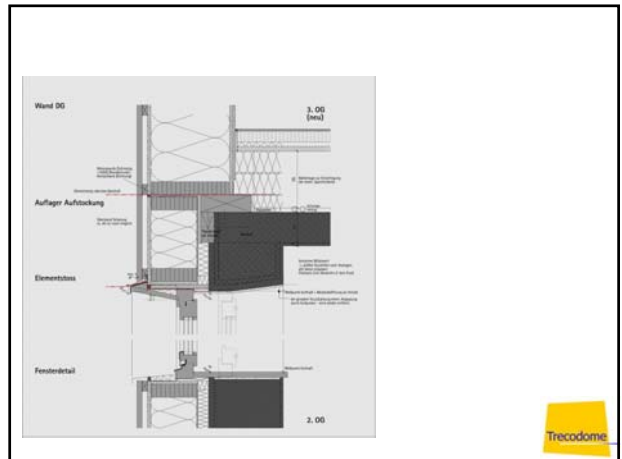
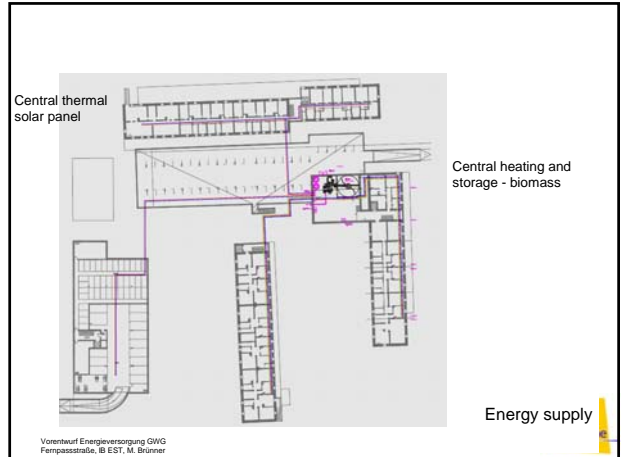
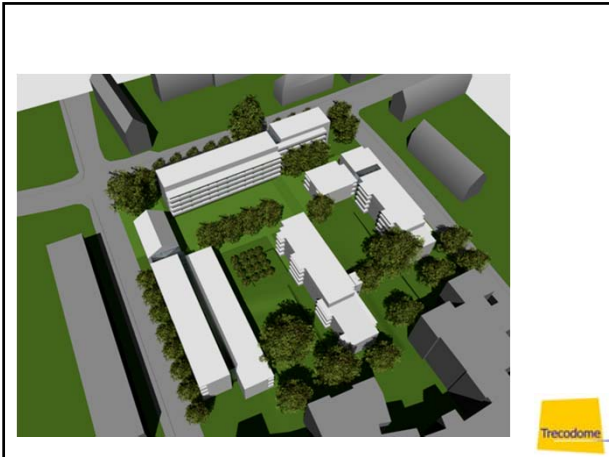


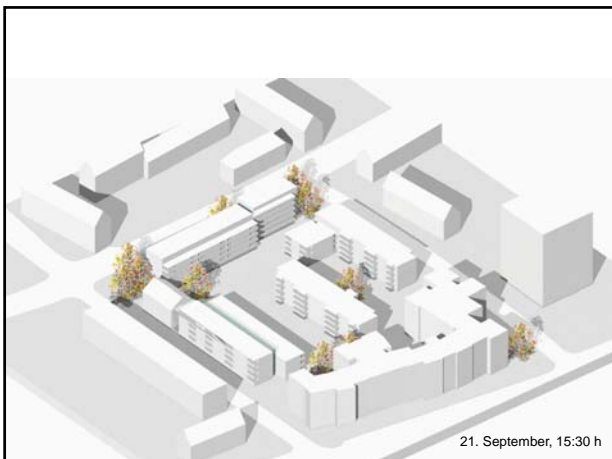
Deutsche Gebäudetypologie – Häufigkeit von Gebäudetypen unterschiedlichen Baualters

Gebäudetypen*	Wfl. in 1000 m²	Baualtersklassen										Summe	Anteil
		Jahre											
		1918	1919	1920	1921	1922	1923	1924	1925	1926	1927		
EFH	82.000	149.700	290.000	374.200	259.400	222.000	122.800	226.900	295.200	352.200	1.709.500	52%	
RH	14.500	21.400	21.800	25.900	41.400	25.700	22.900	22.900	22.900	22.900	267.000	8%	
MFH	22.000	136.600	127.000	149.000	122.000	91.200	128.200	124.700	124.700	124.700	1.055.000	31%	
GHM	25.200	111.000	111.000	111.000	111.000	111.000	111.000	111.000	111.000	111.000	1.111.000	33%	
NH	22.000	22.000	22.000	22.000	22.000	22.000	22.000	22.000	22.000	22.000	220.000	7%	
MFH NBL	14.200	14.200	14.200	14.200	14.200	14.200	14.200	14.200	14.200	14.200	142.000	4%	
GHM NBL	22.000	22.000	22.000	22.000	22.000	22.000	22.000	22.000	22.000	22.000	220.000	7%	
NH NBL	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	11.000	110.000	3%	
Wohnfläche in 1000 m²	113.477	304.200	346.374	364.355	505.822	326.454	222.267	405.266	443.266	129.126	3.133.118		
Wohnfläche in 1000 m²	1,1%	3,0%	3,2%	3,9%	5,2%	3,0%	2,1%	3,9%	4,3%	1,2%	38,7%		
Wohnfläche in 1000 m²	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	38,7%		

819.327.000 m² Wfl.
11.608.000 units







Passive Renovation – Rotterdam

First PassivHaus certified project in The Netherlands

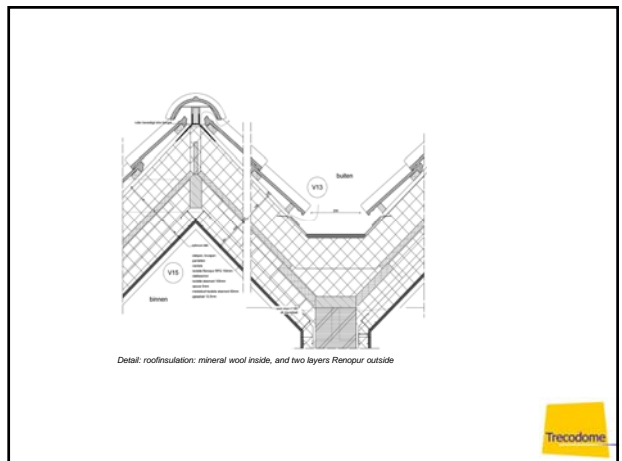
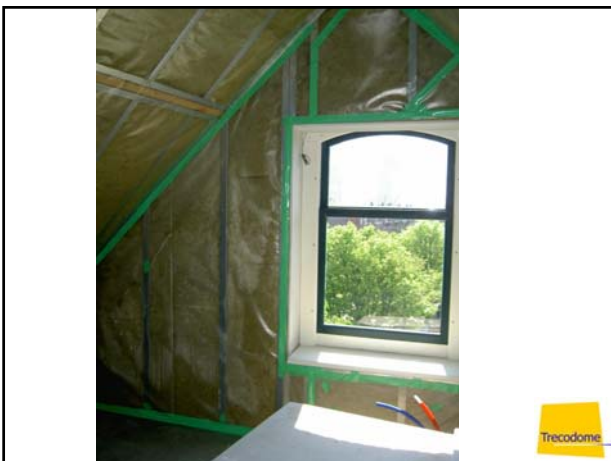
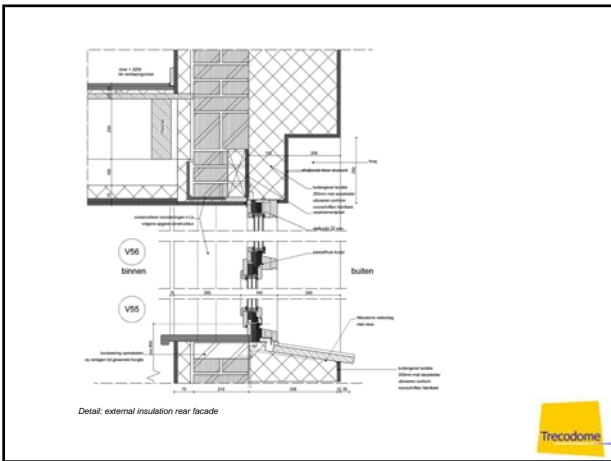
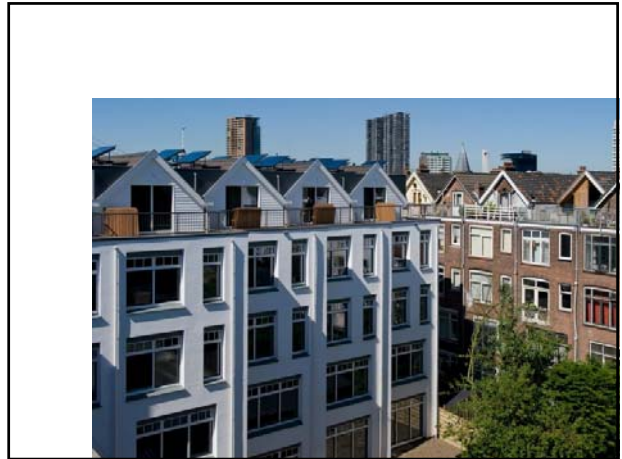
Trecodome

Before renovation

Built in 1900
typical architecture
'protected' status

Trecodome





Heating, ventilation, hot water

- Condensing gas boiler + radiators
- Heat recovery ventilation
- Solar thermal for hot water

Trecodome



Trecodome



PHPP calculations

- Before: 200+ kWh/m²
- Standard: 95 kWh/m² – 230 kWh/m²
- Passive: 25 kWh/m² – 126 kWh/m²

Trecodome

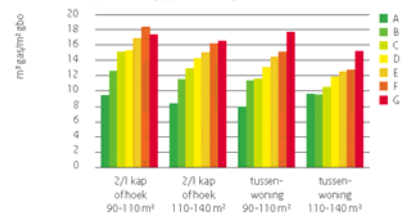
What were the passiv-costs ?

- Additional investment € 25,000 per flat
- Flats sold at market prices
- Increased value after one year: € 100,000

Trecodome

Typical NL energy figures

Figuur 7.1 Gemiddeld gasverbruik (m³) per m² gbo⁶ per woningtype en energielabel



Trecodome

Bron: VROM, november 2009

Trecodome

Monitored energy figures

- Before: 25,000 – 30,000 kWh gas
- Average NL 15,500 kWh gas
- Sleephelling 4,000 kWh gas

WERKELIJK GASVERBRUIK IN M³ PER JAAR

Sleephellingstraat - voor renovatie	3000	m ³ gas
gemiddelde woning Nederland	1550	m ³ gas
energielabel A woning	1164	m ³ gas
Sleephellingstraat - passiefrenovatie	402	m ³ gas

Energy costs

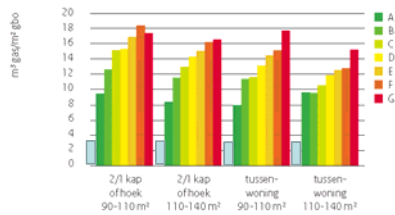
- € 10,00 per month for heating
- € 9,00 for domestic hot water

VARIABLE ENERGIEKOSTEN PER MAAND

bij een gasprijs van € 0,67 per m³ gas en elektriciteitsprijs van € 0,22 per kWh

woningtype vloeroppervlak	Sleephelling 133 m ²	boven 104 m ²	beneden 162 m ²	NL-gemiddeld 101 m ²
verwarming	€ 10,61	€ 7,82	€ 14,68	€ 64,21
warm tapwater	€ 9,05	€ 8,38	€ 9,77	€ 19,54

Figuur 7.1 Gemiddeld gasverbruik (m³) per m² gbo* per woningtype en energielabel



Trecodome

Bron: VROM, november 2009

Trecodome

- Need to consider future proof energy costs
- Need to address 'long-term' carbon targets
- Need to rethink the scale of EPC's

Trecodome

You don't have to pay for energy
you don't use

THANK YOU

www.trecodome.com

chiel.boonstra@trecodome.com