

Case studies on NZEB: Dutch experience with schools

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ACKNOWLEDGEMENTS

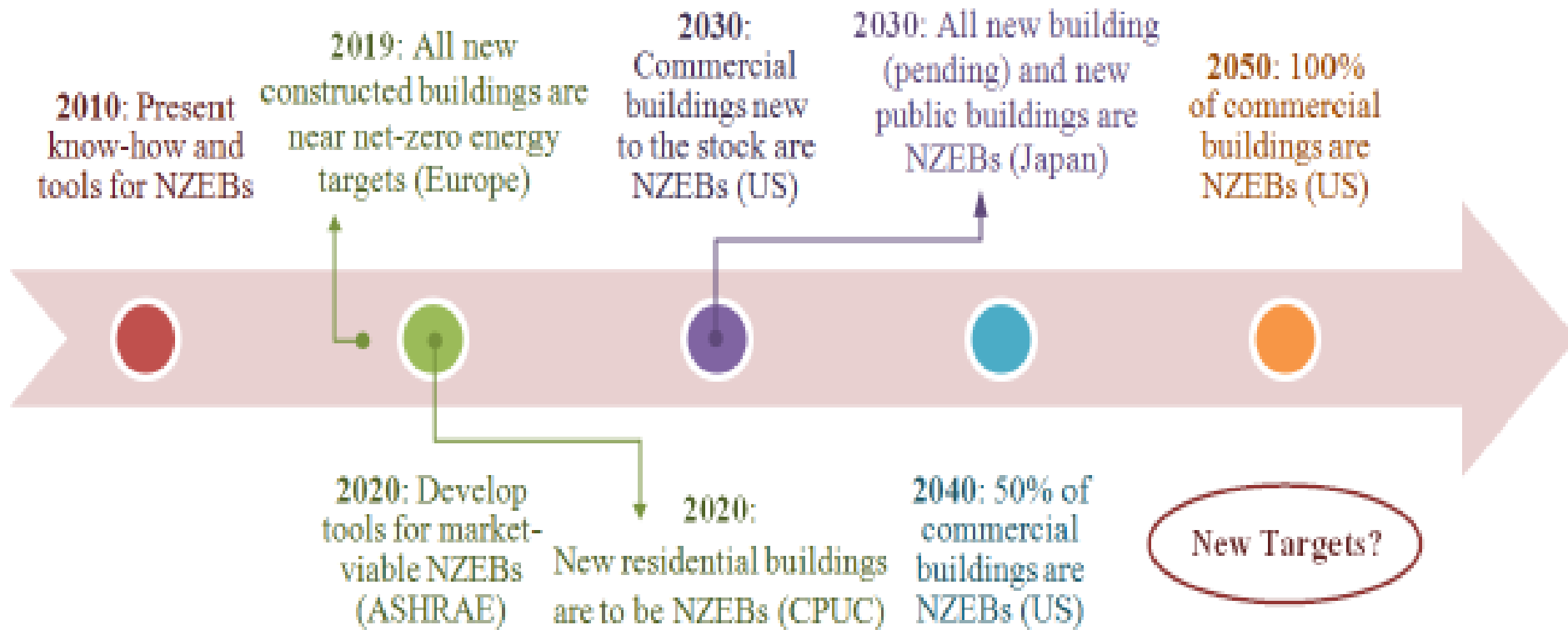
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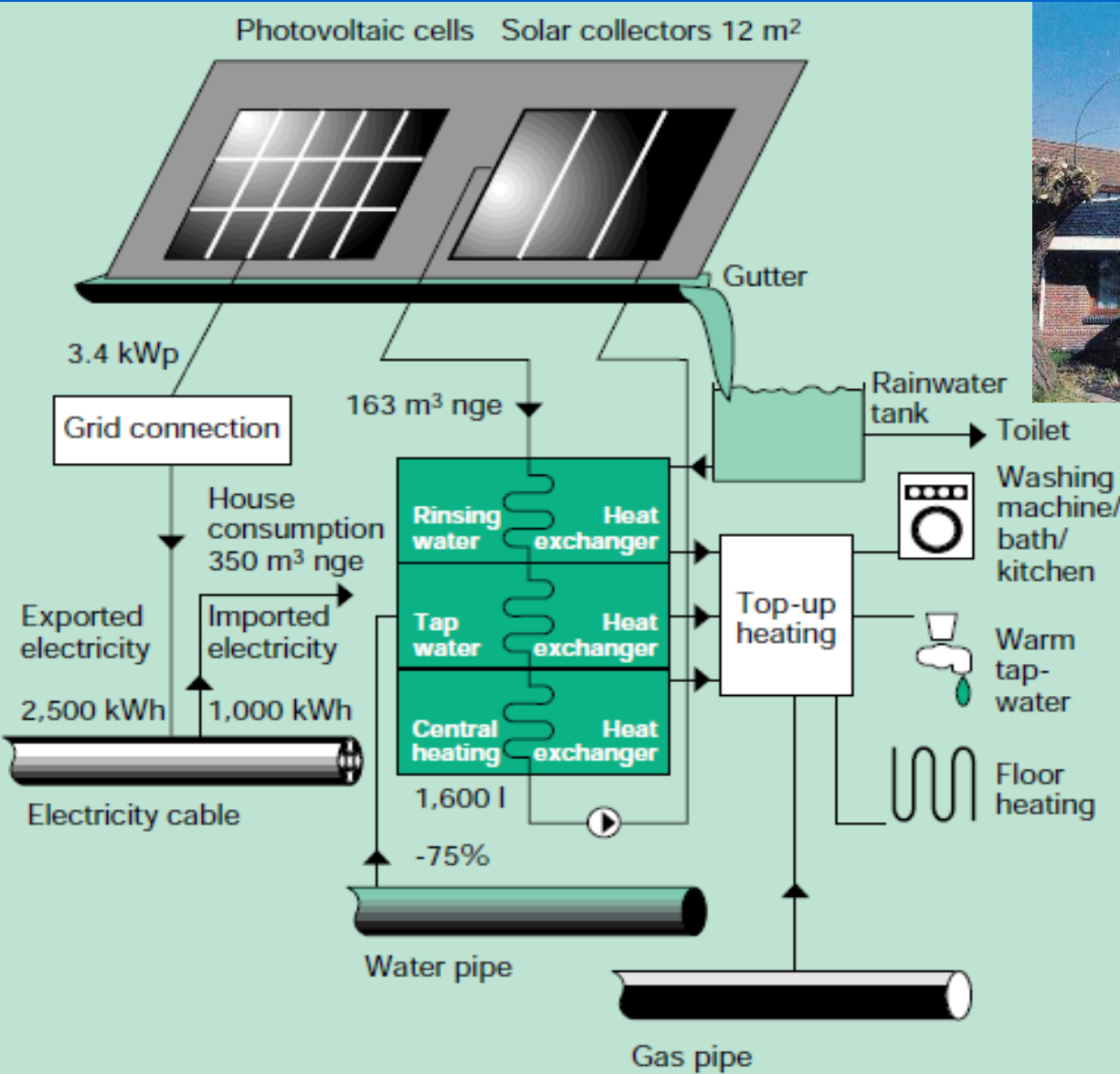
Technische Universiteit
Eindhoven
University of Technology

Where innovation starts

Summary of some of the major targets for NZEBs around the world [Kilkis 2010]



Schematic of the photovoltaic and active (thermal) solar heating systems and .Zero-energy house



School F2: from 19 kWh/m²y to a Netto energy building in 2002!





Heating around 4000m³ gas ~
16.000 kWh covered by
participation in a wind turbine
park



Electricity consumption around
14.650 kWh supplied by 145 m²
PV-panels on the roof



Results measurement Dutch passive houses

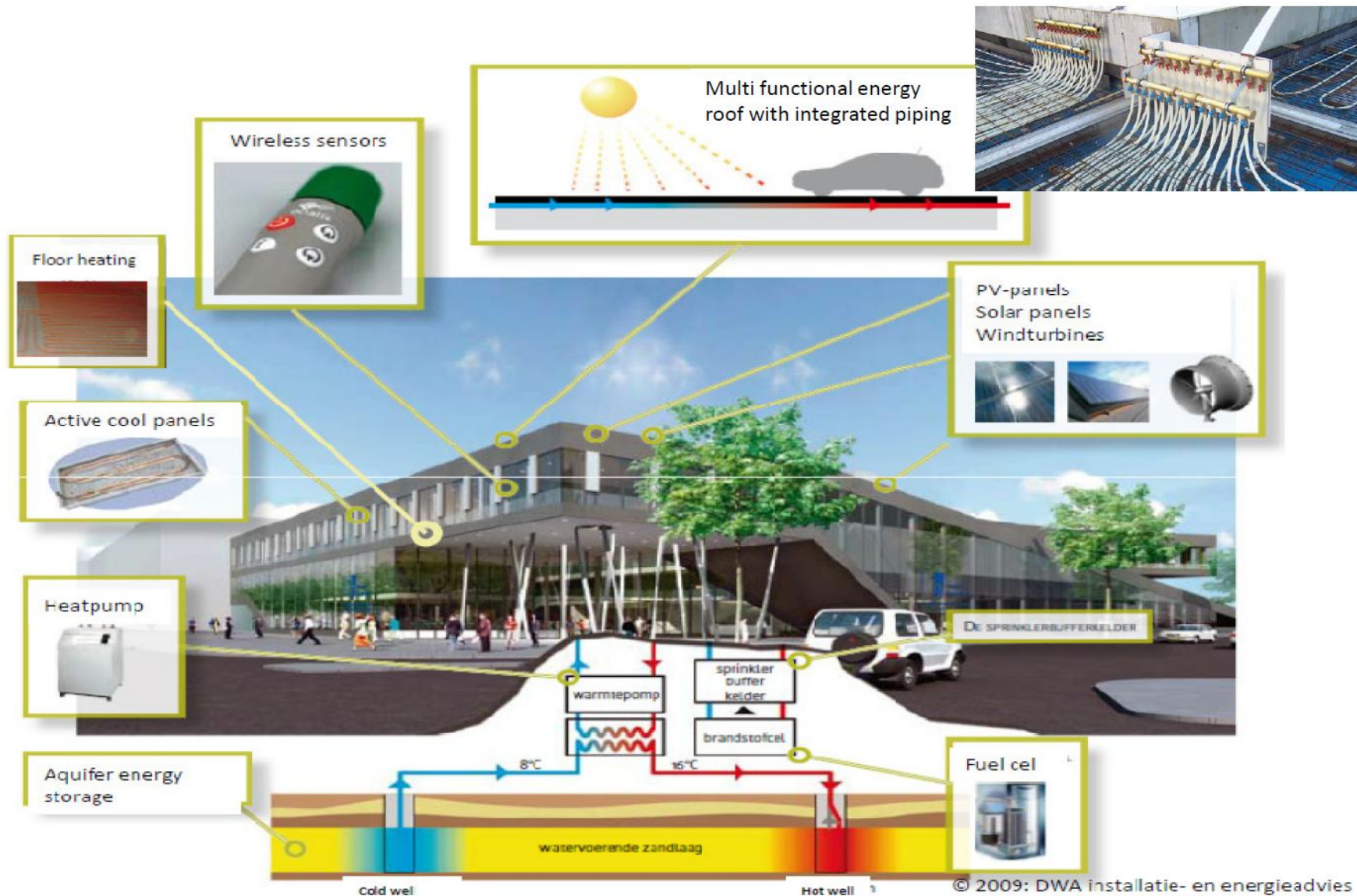
	Case 1	Case 2	Case 3	Case 4
				
Town	Slidrecht	Dalem	Duiven	Roosendaal
Type of house	Terraced house	Villa	Villa	Terraced house
Year of completion	2004	2000	2004	2008
Bedroom 1 [2 persons]*	800	750	950	600
Bedroom 2*	800	700	1650	600

*Average night time level CO2 [ppm]

University for applied science the Hague Delft



Total energy concepts of University of applied technology The Hague Delft [DWA 2009]



Christian Huygens College Eindhoven with energy roof



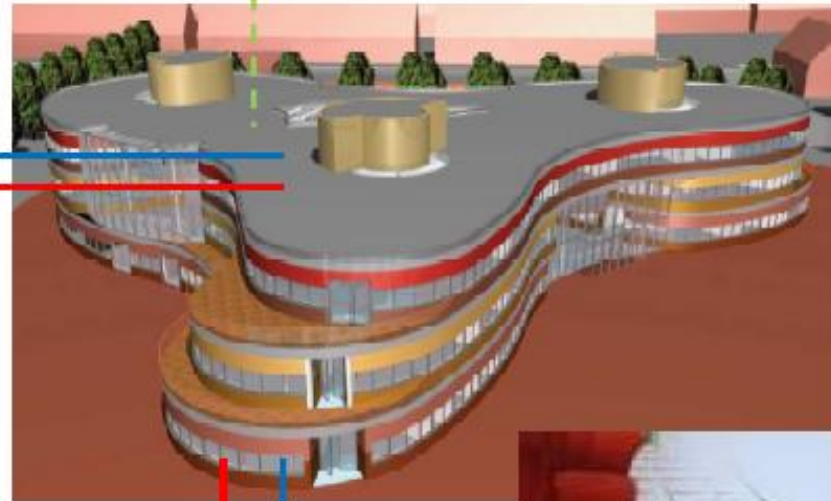
Renewable heat and cold Christiaan Huygens College



PV-cells

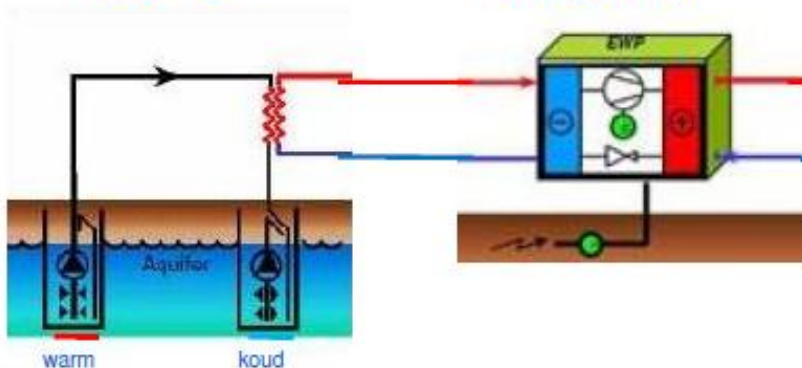


Energy roof



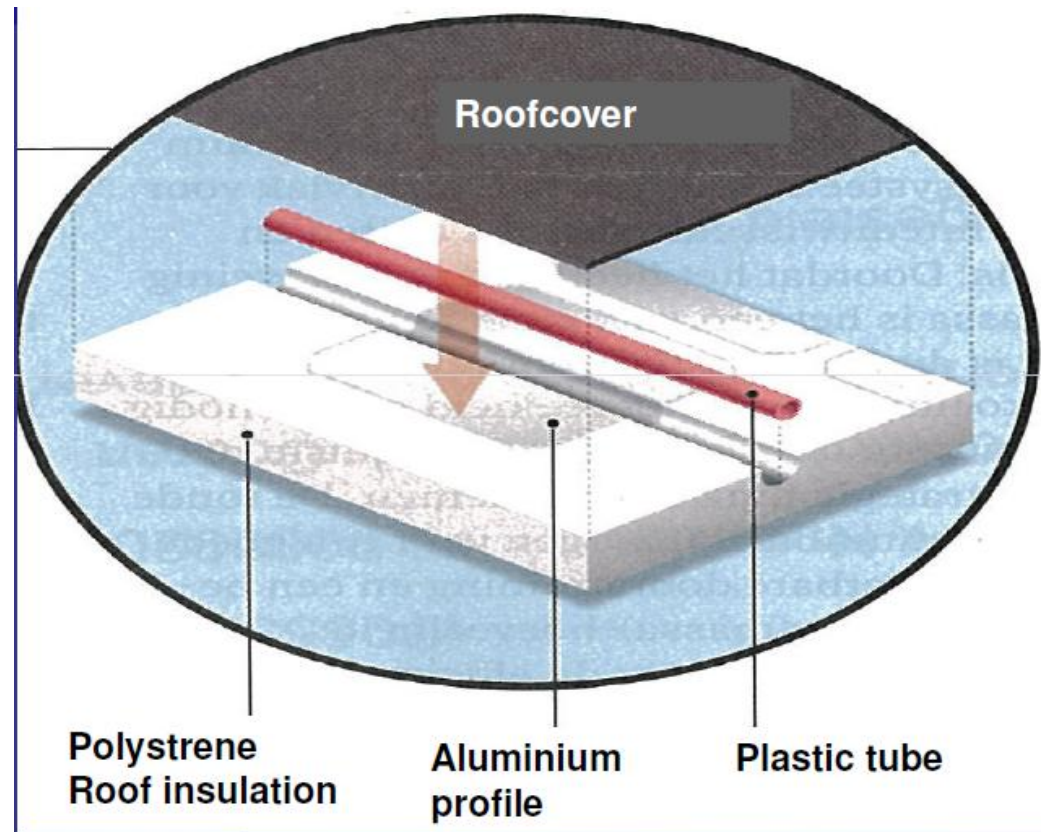
Source

Heatpump



Low temperature heating
High temperature cooling
: floor

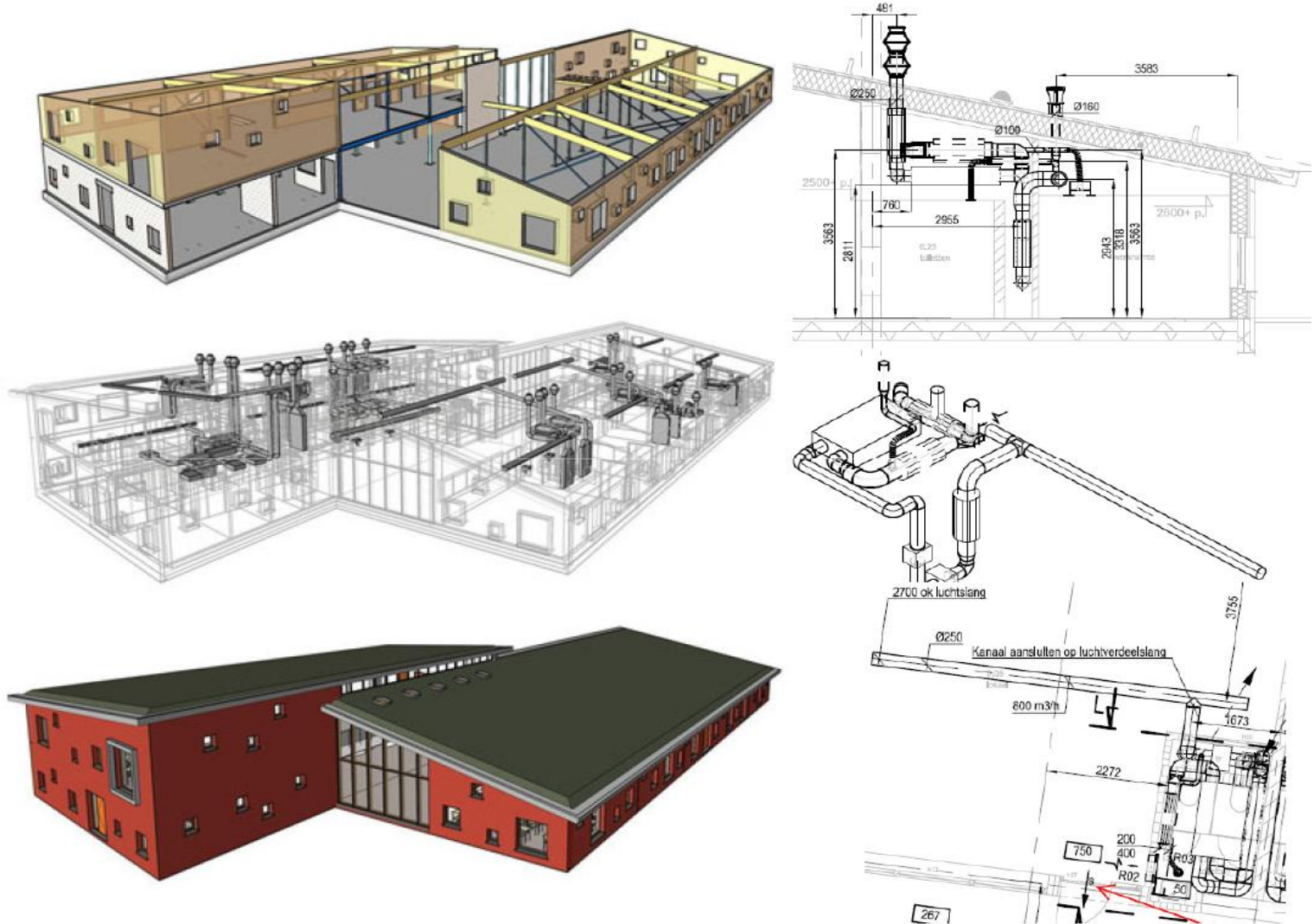
Energy roof construction



Building when nearly completed



The Veldhuizerschool Ede



Overview Dutch UKP NESK school projects

	Project	Location	Year	Special features of project	PV m ²
	Baken Poort	Almere, 6800 m ²	2013	Energy neutral high level insulation, low temperature heating, HR ventilation, HP, aquifer	3000
	Hart van Oijen	Lith, 2447 m ²	2012	Energy neutral by applying a biogas-CHP, low temperature heating, HP, aquifer	150
	VMBO Huygens College & De Polsstok	Heerhugowaard 4257 m ²	2012	Energy neutral based on applying Passive house-concept, R=10 insulation, HR ventilation, HP, aquifer, solar boiler.	2000
	SO/VSO OdyZee	Goes, 2458m ²	2011	Energy neutral based on applying Passive house-concept, R=10 insulation, HP, solar boiler, low temperature heating.	499
	MFC Brede School	Kollumerland, 1787 m ²	2012	Energy neutral by applying a combination of sustainable energy technologies, R=6 insulation, HP, floor heating/cooling	1190
	Klimaatneutraal DSK-II	Haarlem, 2735 m ²	2012	Energy neutral, uses the heat of a computer server room for heating and hot water, HP, aquifer	1000
	Het Klaverblad	Amsterdam ,3177 m ²	2012	Energy neutral by applying PV-panels which are installed by the local energy distribution company without extra costs for the school, connected to district heating	1000

Conclusions

NZEB are already nearly possible now!

Architects in particular should apply appropriate design process in order to effectively initiate NZEB design.

It should be understood that in order to achieve a sustainable future the current design practice should be changed to Zero Energy Building design especially for schools.

Thank you for your attention
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