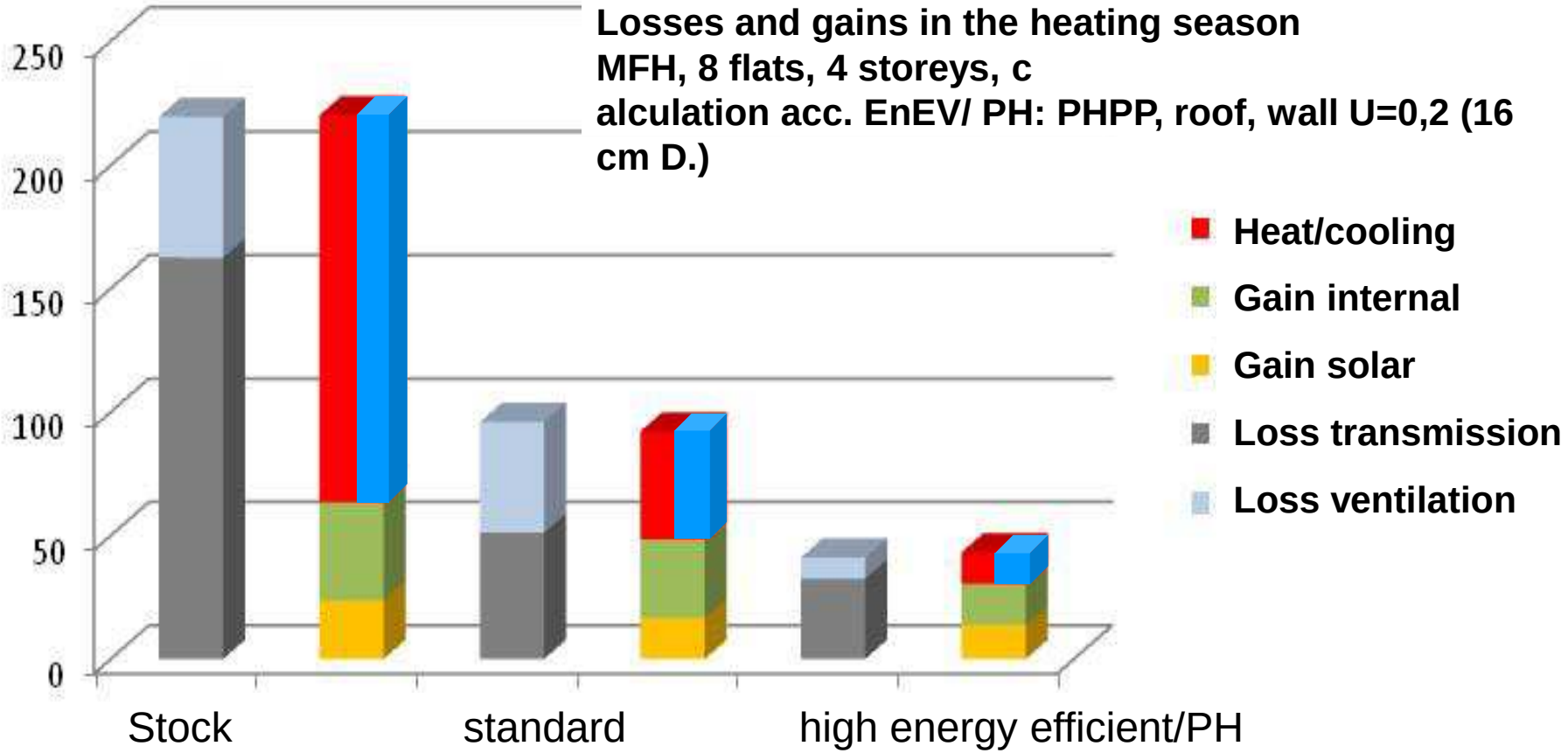
Simplify Your Building
Cities Adopt Passivhaus

High Energy Efficient Buildings - Myths and Fallacies you have to deal with till now
Argue With Fun, It's a Pleasure to Plan and Be in a Passivhaus

- The technology is complicated, and intensive training of planners and users is necessary, cause of the possibility to be heated with a hairdryer . . .
- Ventilation systems are injurious to health, need space, make noise, cost a lot to maintain if you don't have an expert on Passivhaus . . .
- Passivhaus quality (!) is like buying a Mercedes Benz: prestige, comfortable, ecological and expensive ? . . .
- PH buildings are ugly: the requirements restricts the freedom of the architect as an artist . . .
- The windows have to remain closed all the time during the short heating season of 4 month in an PH, cause . . .?
- You only need summer solar protection for a Passivhaus because PH-insulation keeps too much of the summer heat outside . . .
- Some Passivhauses need 50% more energy than predicted, that's two times fuel for the car . . . .

Simple but Only One Chance till 2050!
Heat/Cooling Net Energy Accounting

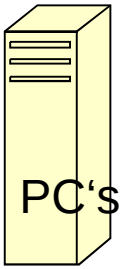
Do it right and best for the future (35 years!)
Reduction loss 50% more results in reduction net energy to ¼!
Therefore every cm more insulation counts (optimum EU ~ 20 – 25 cm)!



Heating Ssystems for Comfort, Need for "I'm cold“, Experience – Relations – Complex Systems Need?

or

or



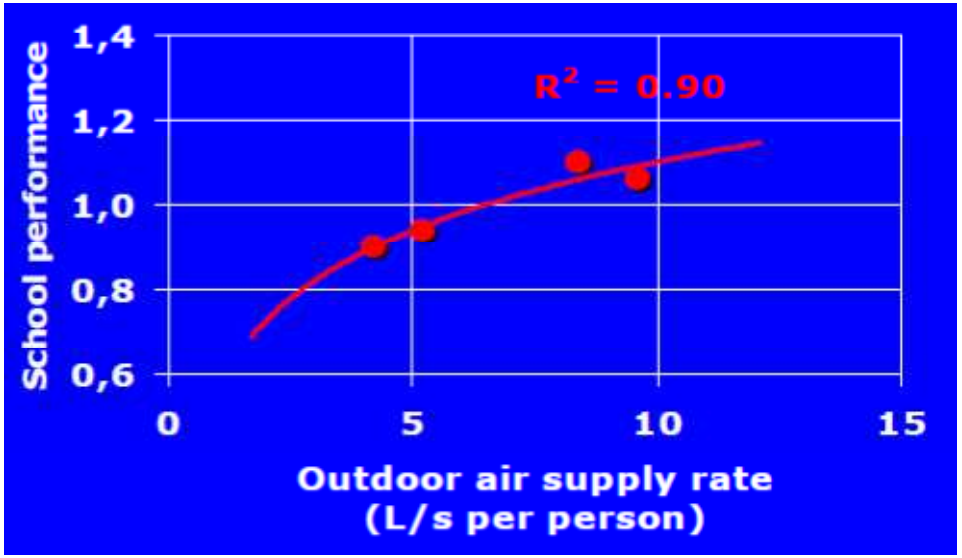
and

house	**stock**	**standard new**	**PH**	**plusenergy**
	200 W/m²	**50 W/m²**	**10 W/m²**	**10 W/m²**
150 m²:	**20 kW**	**5-10 kW**	**1,5-3 KW**	**1,5-3 kW**

Key - Indicators Building Market, Owners Demand

- Price
- . . .
- Lower operating costs
- Right thing to do for the next 35 – 50 years till the next refurbishment . . . .
- Corporate Social Responsibility commitment
- Green building policies
- Branding/publik relations (LEED, BREEM not enough?!)

- Much better comfort
- Much better (+20%) working/ learning performance?
- for nearly the same price?!



Source: Professor Dr. Ing. Bjarne W. Olesen International Centre for Indoor Environment and Energy

Short Backround
Comfort with energy efficient PassiveHouse components
http://www.passiv.de/komponentendatenbank/en-EN

- Temperature behind double glasing (-20° C, 20° C, U_g 1,3): 13,2° C
- Temperature behind triple glasing (-20° C, 20° C, U_g 0,6): 16,9° C
- Summer heat gain through normal wall (40° C, 20° C, U_{aw} 0,4): 8 W/m²
- Summer heat gain through PH wall (40° C, 20° C, U_{aw} 0,13): 2,5 W/m²
- Air quality with efficient ventilation system like:
  heat/cold recovery > 80%, SFP < 0,45 Wh/m³ (< 1600 Ws/m³)
  power consumption < 20 kWh/aP

40% < humidity < 60%, CO_2 < 1500 ppm

- Less maintenance cause of strong, certified components
- Saving a lot of energy costs

Simple Messages!
What Does a Highly Energy Efficient Building Need?
No Complex Building Concept!

- Reduce influence from out- and inside on room conditions, PH is simpler and gets better economy with better adopted construction
- More insulation from 5 to 30 cm (wall-roof, 0,032 W/mK) depend on climate
- typical triple glazing windows (U_w 0,8 instead of 1,3 W/m^{2}K), not more than necessary for lighting, much heat/cold storage mass
- Mechanical basic ventilation (20 m^3/h per person, only frech air)
- Vent heat recovery > 75% and efficiency (SFP 1-2 acc. EN 13779 ~ 0,45 Wh/m^3), relation of electricity for recovery to heat/cold 1:10, Moisture and odor removal only with exhaust air,
- Airtight construction (as standard, but more careful execution)
- Fewer, smaller simply technical systems, substantially (x 1/5) smaller heating and cooling system (10W/m^2)
- Control is simplified (thermostatic valve, time control, more is often not efficient) with much better user acceptance, heating/cooling costs negligible

Building Bronze Age 1400 BC, Isolation Steinheile, hill near Langenselbold, Main-Kinzig-Kreis, Germany

Bronze Age, reconstructed double wall with grass filling (~ 0,2 m) and daub.

U_{AW} ~ 0,5 W/m²K,

UK standard 19 . .: $U_{AW} \leq ?$

UK standard 20 . .: $U_{AW} \leq ?$

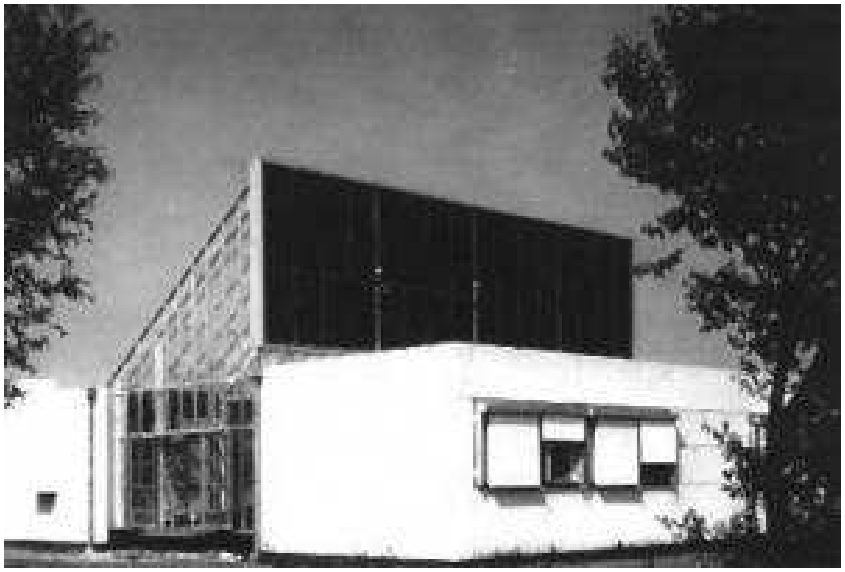
Windows: $U_W \leq ?$

Source: Dr. H.-O. Schmitt, Staeves, Irene, u.a. in "Ein Energiesparhaus vor 3500 Jahren“

Fram, First PassiveHouse-ship in 1883, DTH Zero - Energy house in 1973

The walls are covered with tarred felt, it follows cork filling, then a wainscoting of fir wood, then again a thick layer of felt, then air-tight linoleum, and finally again a wainscot. The ceiling ... they have all in all, a thickness of about 40 cm. The window through which the cold could very easily penetrate, was protected by **three panes** and in other ways. (Here) is a warm, cozy place to stay.

Fridtjof Nansen



Korsgaard et al 1978 DTH-Nul-Energihus; Technical University of Denmark, 1978

Source: http://passipedia.de/grundlagen/anmerkungen_zur_geschichte

The Frankfurt Way To the PH Decision

- Autumn 2000: Architectural contest for the new primary school and kindergarten in the Riedberg development area with the requirement „a Passivhaus building is desired“.
- Autumn 2001:Passivhaus alternative is pursued further.
- Spring 2002: Initial proposals for a Passivhaus option of the city of Frankfurt should have PH-standard
- Febr. 2003: After intensive discussions about the costs and technology, the final decision to implement new buildings to Passivhaus quality was made for all schools and Kindergardens
- September 2003: Start of construction of the PH primary school Riedberg
- 1.November 2004: The first PH primary school is opened
- Sept. 2007: All buildings should be PH-Standard
- Since 2010/11 first Energyplus buldings under construction and finished
- City of Frankfurt PH-buildings 2015: 74 new (nd), 8 refurb. (nd), 20 plan+const. (nd), www.energiemanagement.stadt-frankfurt.de

First PH-school : Mölln Sixth-form College 2002/3

Erweiterung der Realschule Mölln im Passivhaus-Standard

Architektonische und technische Umsetzung - erste Betriebserfahrungen

Dipl.-Ing. Markus Kaupert
petersen pörksen partner
Kanalstraße 52, 23552 Lübeck
Tel.: 0451 / 79968-0
Fax: 0451 / 79968-99
E-Mail: info@ppp-architekten.de
www.ppp-architekten.de

Dipl.-Ing. Sören Vollert
*KA*plus - Ingenieurbüro Vollert
Marienthaler Str. 17, 24340 Eckernförde
Tel.: 04351 / 735-188
Fax: 04351 / 735-386
E-Mail: info@kaplus.de
www.kaplus.de

Erweiterungsbau und Bestandsgebäude der A.-Paul-Weber Realschule in Mölln

Second PH - School Waldshut Energy - Saving School 2003 Labarotories

Volker Weiß und Dr. Wilhelm Stahl
Stahl, Büro für SonnenEnergie
Bertoldstr. 45, 79098 Freiburg
T: 0761 / 38909-30, F: 0761 / 38909-39
www.stahl-sonnenenergie.de

Ansicht der Justus-Liebig-Schule in Waldshut, Bauzustand November 2002

A School to Passivhaus Quality, Expectations, Experiences Heating, Simple and Good Arguments

- In a PH school the heat from 25 pupils and a teacher is enough (1.5 kW), to keep the classroom comfortable warm during the whole year , especially with heat recovery. Therefore the main purpose of the heating system is to stop the school getting too cold over weekends and holidays.
- Therefore the heating works best with small radiators, not using the ventilation. In schools the capital costs are about the same whichever way you do it. For comfort and easy control we decided to use one small radiator on an internal wall of a classroom.
- No space loss by heating element under the window, which saves construction costs
- Control is simplified. The only reason you need individual room control is for comfort: the heating costs are already negligible
- A PH school is good-natured. Even if the heating system fails for a few days, the pupils can keep the classroom temperature above 20°C

The Frankfurt Way To the PH Decision

Bericht des Magistrats vom 06.06.2003, B 461

Betreff:
Neue Kindertagesstätten und Schulen in Passivbauweise bauen
Vorgang:
Beschl. d. Stv.-V. vom 27.02.2003, § 4892
- NR 866 GRÜNE -

27.02.2003 city-parliament of Frankfurt:

The small additional costs attest that kindergardens and schools should be built to Passivhaus quality

Derzeit wird die Grundschule mit Kindertagesstätte am Riedberg in Passivhausbauweise geplant. Daher liegen hier relativ genaue Daten für die Mehrkosten und die Wirtschaftlichkeit im Vergleich zum herkömmlichen Standard vor. Die Mehrkosten für das Passivhauskonzept dieses Projektes (einschließlich der Lüftungsanlage mit Wärmerückgewinnung) betragen 4,2 Prozent der Baukosten für die Basisvariante nach Energiesparverordnung beziehungsweise 3,6 Prozent der Baukosten für die verbesserte Variante (Unterschreitung der Energiesparverordnung um 45 Prozent). Da bei diesem Projekt zusätzlich Fördermittel in Höhe von 190.000,-- Euro gewährt wurden, kann hier eine Amortisation der Passivhaus-Variante nach heutigen Energiekosten nach 38,6 Jahren erreicht werden. Es ist jedoch damit zu rechnen, dass durch Verteuerung von Energie in den nächsten Jahren sich diese Phase erheblich verkürzen wird.

Inzwischen wird allgemein anerkannt, dass in deutschen Schulneubauten ohne maschinelle Grundlüftung die CO2 Belastung der Raumluft am Ende der Unterrichtsstunden vor allem im Winter nicht mehr tolerierbar ist. Die Außenluft in Innenstädten weist zwischen 300 und 600 ppm CO2 auf, am Ende der Unterrichtsstunden werden in neu errichteten Klassenräumen regelmäßig über 1.500ppm CO2 festgestellt. Daher wird davon ausgegangen, dass in Zukunft eine natürliche oder maschinelle Grundlüftung bei dem geforderten Dichtigkeitsstandard

First Passivhaus - School with Kindergarden Frankfurt – Riedberg 2004

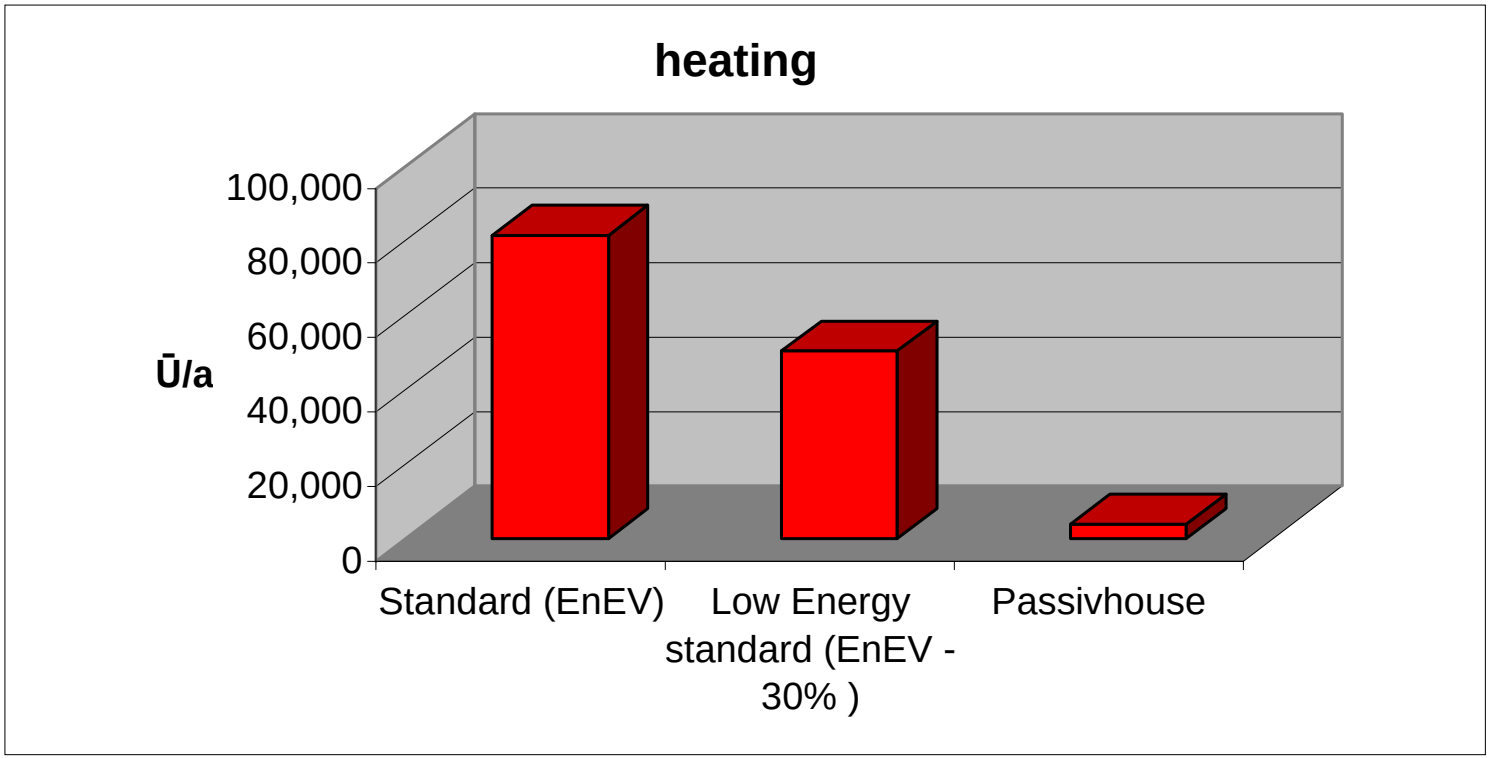
From SW

Additional Investment Result for PH - Quality, Compilled for a (Low Energy) Grant for the Riedberg Primary School, No Real Additional Costs

Component	nett	design 18%	tax	Comments
footing	43.900	7.900	8.300	insulation
facade	124.800	22.500	23.600	2160 m^2, insulation and structure
windows, glazing	137.000	24.700	25.900	1780 m^2, PH-glazing, 75-100€/m^2
suspended ceiling	47.700	8.600	9.000	2560 m^2
roof	148.500	26.700	28.000	3600 m^2 , insulation
ventilation, heating	156.700	28.200	29.600	3 extra ventilation plants, but less heating and central building control
Total	**658.600**	**118.600**	**124.400**	**approx. 900.000 €**
Part				5.3 % of 16.7 million €

(First architectural Design: 25 mio €)

Heating Costs For Primary School at Preungesheim



reduced energy-costs over lifetime = amount to pay more for PH-quality:

$$value_{Standard\ (kWh/m2a)} \times value_{PH(15kWh/m2a)} \times GFA_{(m2)} \times energyprice_{(€/kWh),\ Ø40a!)} \times lifetime$$

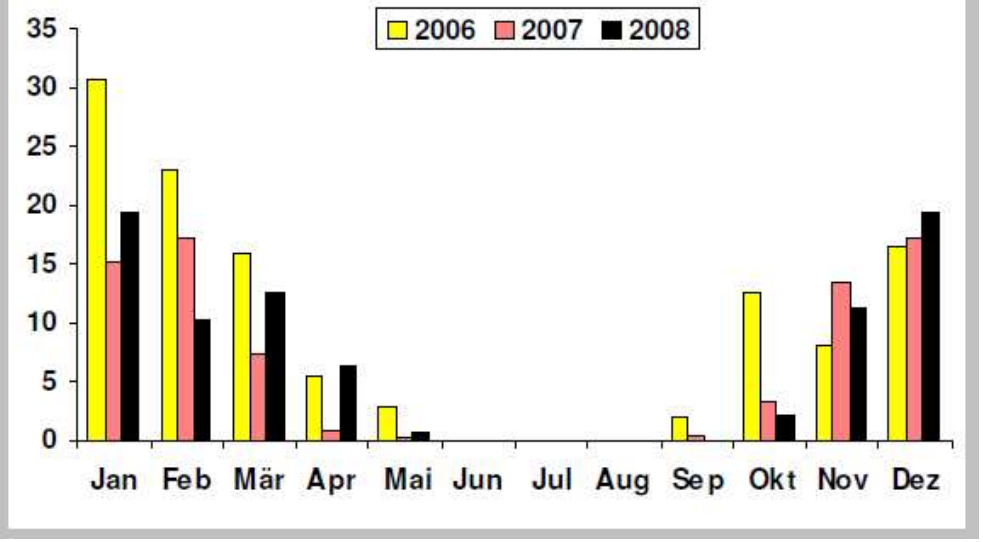
Riedberg Primary School, Results

- **Consumption for heating school and kindergarten, conditioned floor area 5540 m² 2008: 14,9 kWh/m²**

Zählwerk	H7 - ET
EVU und Zählernummer	SF 128857
Verbrauchsart	Wärme
Verbrauchsbereich	Sch.+Kita
Multiplikator und Einheit	x 1 MWh

Zählerwechsel			
Einbaudatum	01.11.2004	Nummer des Vorgängerzählers	0
Ausbaudatum		Nummer des Nachfolgerzählers	
Bemerkung			

Monat	Ablesung	Zählerstand	Verbrauch
	02.01.2008	324,62	MWh
Januar	01.02.2008	343,354	19
Februar	01.03.2008	353,888	10
März	01.04.2008	366,43	13
April	01.05.2008	372,823	6
Mai	01.06.2008	373,492	1
Juni	01.07.2008	373,51	0
Juli	01.08.2008	373,522	0
August	01.09.2008	373,532	0
September	01.10.2008	373,546	0
Oktober	01.11.2008	375,77	2
November	01.12.2008	387,129	11
Dezember	01.01.2009	406,584	19
Jahr 2008			82



Primary School Riedberg, Ffm, Results II

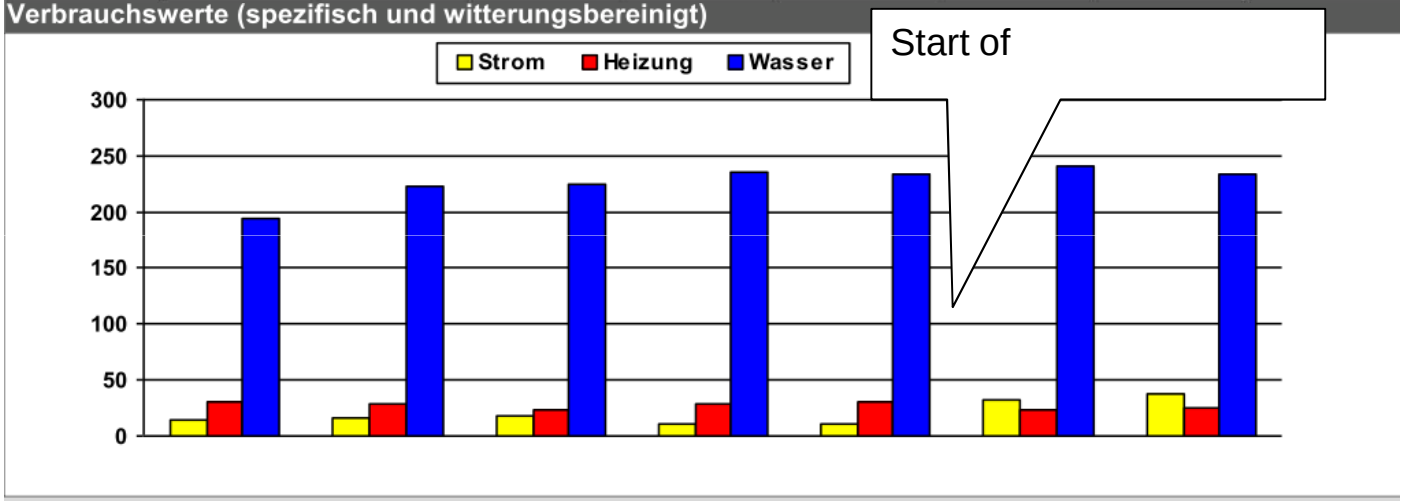
Verbrauchswerte und Kosten aus EVU-Rechnungen

Gebäude	Grundschule Riedberg und KT		Bauherrenamt	40.4	Dez 4
Straße, Nr.	Zur Kalbacher Höhe	15	Stadtbezirk	650	OBZ 12
Nutzung	Grundschulen		Bauwerkzuordnung		4110

Nettogrundfläche (beheizt)

	2007	2008	2009	2010	2011	2012	2013	
NGF (beh.)	7.670	7.670	7.670	7.670	7.670	7.670	7.670	m²

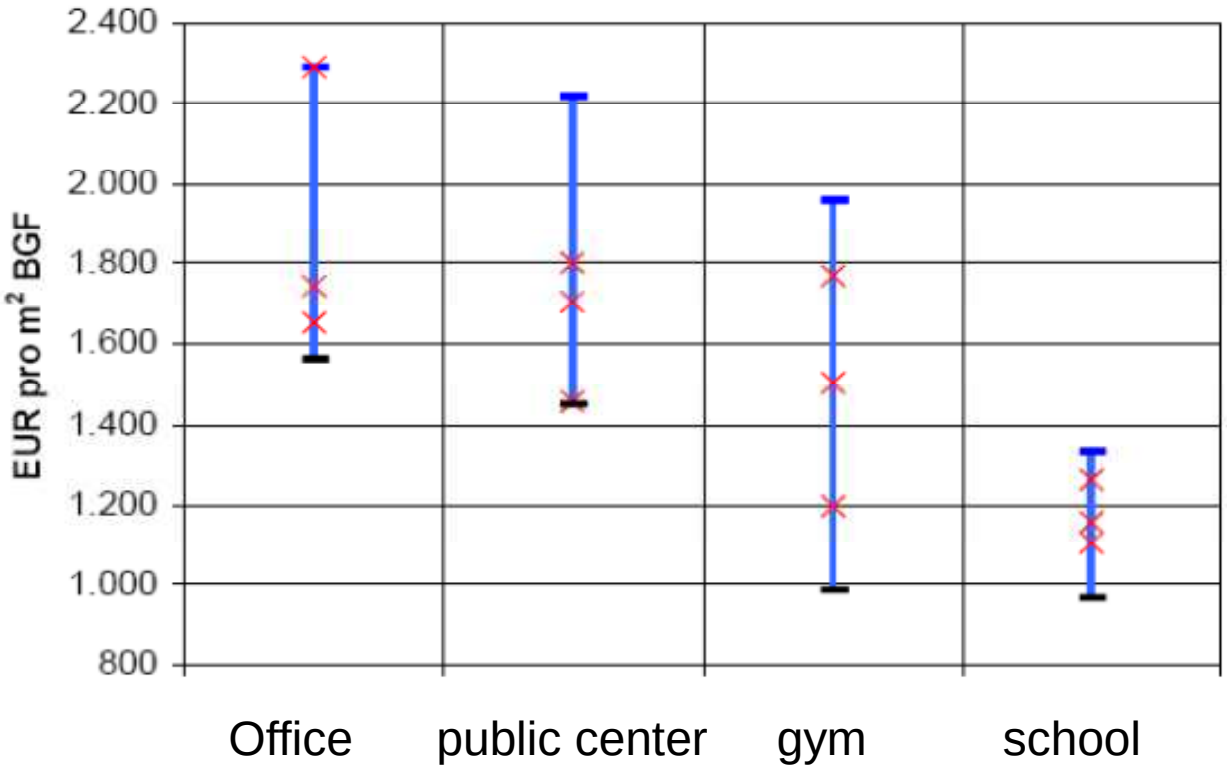
Verbrauchswerte (spezifisch und witterungsbereinigt)



	2007	2008	2009	2010	2011	2012	2013	
Strom	15	17	17	10	10	32	38	kWh/m²a
Heizung	31	28	23	28	30	23	26	kWh/m²a
Wasser	195	223	226	235	234	240	233	l/m²a
Strom	22.129	25.855	26.789	19.488	18.982	56.106	72.302	€/a
Heizung	9.423	7.747	6.429	10.331	8.780	7.067	9.725	€/a
Wasser	5.678	6.496	6.566	6.850	6.851	5.214	5.625	€/a
Summe	37.230	40.098	39.784	36.669	34.613	68.387	87.652	€/a

Red: heating+ ww

Range of Specific Capital Costs for Different Architectural Designs for the Same Building Task In €/M² in Relation to High Energy Efficient Additional Costs (Evaluation Of Competitions, Ebök 2004)



Relation:Additional investment for PH . .

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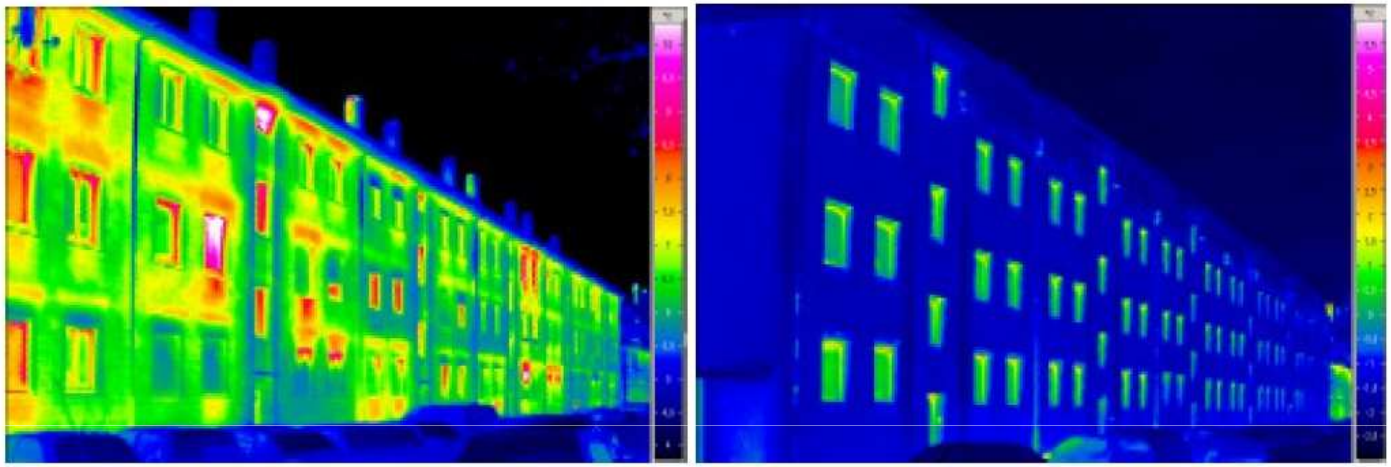
Montessori Primary and Secondary School in Aufkirchen (Munich) 2004

www.architekten24.de/projekt/montessorischule-aufkirchen

Every Journey Begins with a First Step, Redevelopment Tevestr. Frankfurt to Passivhaus Standard in 2005



Passivhaus-Institut

The Frankfurt Way To the PH Decision

FNP vom 01.02.2005

CDU: Passivhäuser sollen Standard werden

Frankfurt. Jochem Heumann, pla- Schule im Passivhausstandard ge-

2005: Frankfurt residential building company (ABG) „overwhelming success in selling PH residential buildings“
CDU: Passivhaus should be standard

durch diese Bauweise deutlich. „Passivhäuser stellen die richtige Antwort auf die steigenden Energiekosten dar“, erläuterte Heumann, Die im Regelfall höheren Baukosten für diesen Haustyp könnten durch günstige Kredite der Kreditanstalt für Wiederaufbau und durch die eingesparten Heizkosten ausgeglichen werden. Im Stadtteil Riedberg wird zur Zeit die Wilhelm-Busch-

dass Passivhäuser bei intelligenter Planung zu gleichen Investitionskosten wie herkömmliche Neubauten errichtet werden könnten. Die CDU-Fraktion hat den Magistrat in seiner Eigenschaft als Gesellschafter städtischer Wohnungsbaugesellschaften aufgefordert, beim Neubau und Sanierungen von Wohnungen grundsätzlich den Passivhausstandard zu berücksichtigen. (tre)

The Frankfurt Way To the PH Decision

Leitlinien zum wirtschaftlichen Bauen 2006

2006 city government decide:

New city buildings should be built according to the guidelines for economic construction

That means not only PH standard, but also economic, sustainable buildings

Awards for the city of Frankfurt for building according to the Frankfurt

„guidelines for economic buildings“:

EU-Greenlight Award 2006, Greenbuilding award, a.s.o.

www.stadt-frankfurt.de/energiemanagement/english/english.htm

A.

a)

Wirtschaftlichkeitsberechnung zu erstellen. Es ist zu beachten,

Frankfurt Guidelines for economic Buildings

Content: guidelines for economic buildings

www.stadt-frankfurt.de/energiemanagement/english/english.htm

Total Cost Calculation for the City of Frankfurt

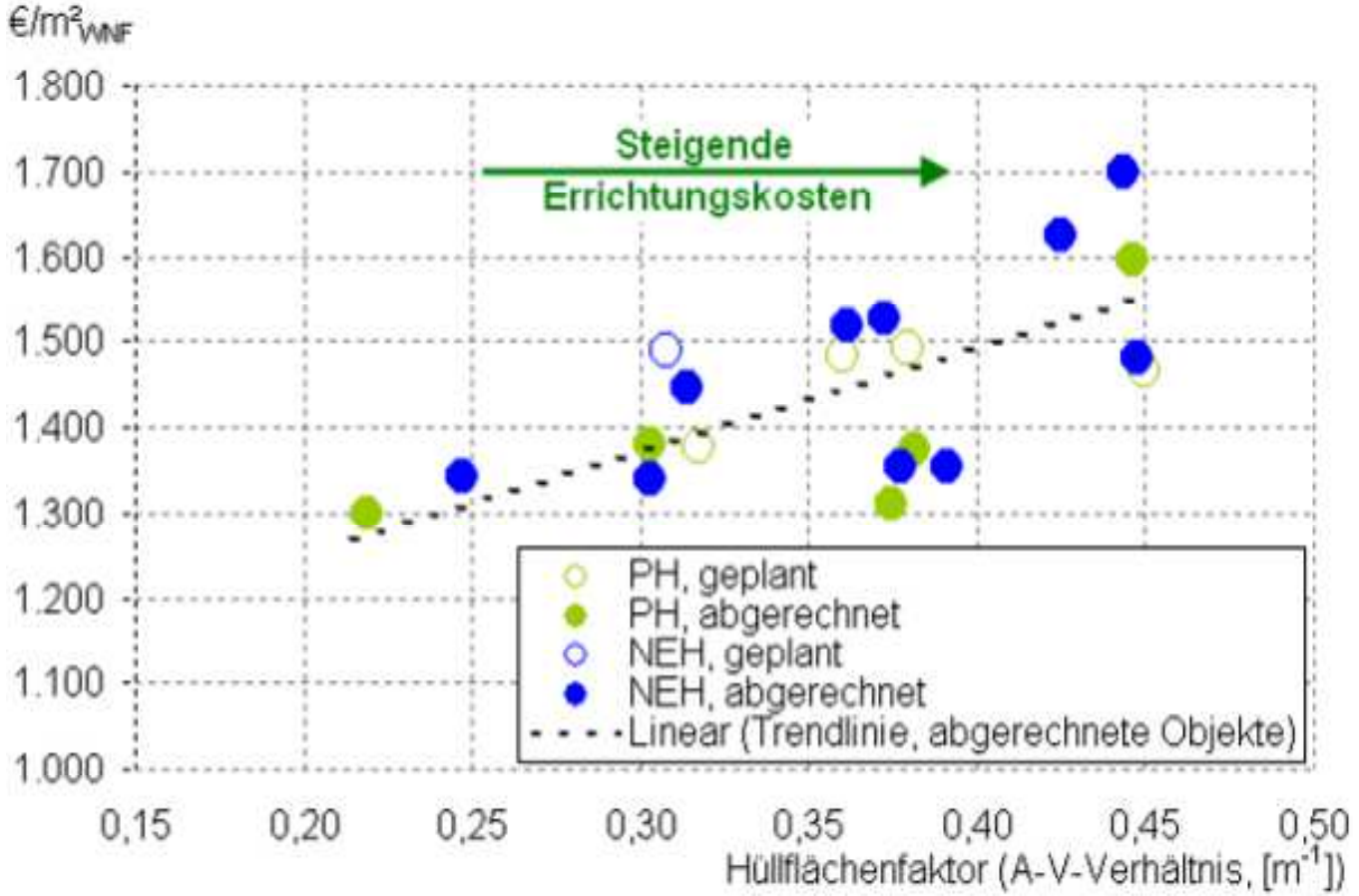
www.energiemanagement.stadt-frankfurt.de/Englisch/Englisch.htmenergiemanagement/pro.htm

1. Life cycle costs

Konzeption und Gestaltung: Hochbauamt der Stadt Frankfurt, Abteilung Energiemanagement

A.	**General data**							
A1	name of building	Preungesheim Ost				A2 Unterab.		
A3	type	Grundschule, KT, JH, TH				A4 Str.-Nr.		
A5	road					A6 Haus-Nr.		
A7	period	40	a	A8	Währung	€		
A9	interest	3,5%		A10	Annuitätsfaktor	0,05		
A11	rise in price all/energy	5%	3%	A12	Mittelwertfaktor Energie/A	2,55	1,70	
B.	**different solutions**	**Bezeichnung**						
B0	**Standard**	**EnEV**						
B1	**Standard - 30%**	**EnEV - 30%**						
B2	**PH**	**PH**						
B3								
B4								
C.	**values**	**Standard**	**Standard - 30%**	**PH**	**0**	**0**		
C1	Gross floor area (GFA)	6.723	6.723	6.723	6.723	6.723	m²	
C2	persons	550	550	550	550	550	P	
C3	demand of heat	172	104	17			kWh/m²a	
C4	value boiler	96%	96%	91%			%	
C5	power consumption	14	13	13			kWh/m²a	
C6	CO2-emission	47	32	11			kg/m²a	
C7	water supply	3,87	3,87	3,87			m³/P a	
D.	**cost of capital**	**Standard**	**Standard - 30%**	**PH**	**0**	**0**		
D1	Invest (DIN 276)	19.671.071	20.109.911	21.846.895			€	
D2	promotion						€	
D3	own capital	19.671.071	20.109.911	21.846.895	0	0	€	
D4	**capital cost**	**921.143**	**941.692**	**1.023.031**	**0**	**0**	€/a	
D5	**spez. capital cost**	**137**	**140**	**152**	**0**	**0**	€/m²a	
E.	**running costs**	**Standard**	**Standard - 30%**	**PH**	**0**	**0**		
E1	Cleaning and labor	81.477	81.477	81.477			€/a	
E2	maintenance	203.053	207.036	223.423			€/a	
E3	heating	84.007	52.900	5.349	0	0	€/a	
E4	power consumption	27.030	24.460	24.800			€/a	
E5	water supply	8.246	8.246	8.246			€/a	
E6	admin and insurance						€/a	
E7	**running costs today**	**403.812**	**374.118**	**343.293**	**0**	**0**	€/a	
E8	**average running cots**	**780.552**	**701.422**	**608.843**			€/a	
E9	**spez. running costs**	**116**	**104**	**91**	**0**	**0**	€/m²a	
F.	**environment pollution c**	**Standard**	**Standard - 30%**	**PH**	**0**	**0**		
F1	CO2-emission (50 €/to)	15.802	10.717	7.099	0	0	€/a	
F2	water (1 €/m³)	2.130	2.130	2.130	0	0	€/a	
F3	**env. pollution costs**	**17.933**	**12.847**	**9.229**	**0**	**0**	€/a	
F4	**spez. Pollution costs**	**3**	**2**	**1**	**0**	**0**	€/m²a	
G.	**total lifecycle costs**	**Standard**	**Standard - 30%**	**PH**	**0**	**0**		
G1	**total lifecycle costs**	**1.719.627**	**1.655.962**	**1.641.103**	**0**	**0**	€/a	
G2	**spez. life cycle costs**	**256**	**246**	**244**	**0**	**0**	€/m²a	

Compactness and Building Costs, Comparing Normal Low-energy (NEH) and Passivhauses, Quality and their Assurance Pays - Efficient is Cheaper!



Univ. Prof. Arch. DI Dr. Martin Treberspurg, DI Roman Smutny, DI Roman Grünner ANALYSE DER BENUTZER-ZUFRIEDENHEIT UND ENERGIEPERFORMANCE ausgewählter Wiener Passivhaus-Wohnhausanlagen, Reader 14. Internat. PH-Tagung Dresden 2010

The Frankfurt Way To the PH Decision

STADT FRANKFURT AM MAIN

STADTVERORDNETEN - VERSAMMLUNG

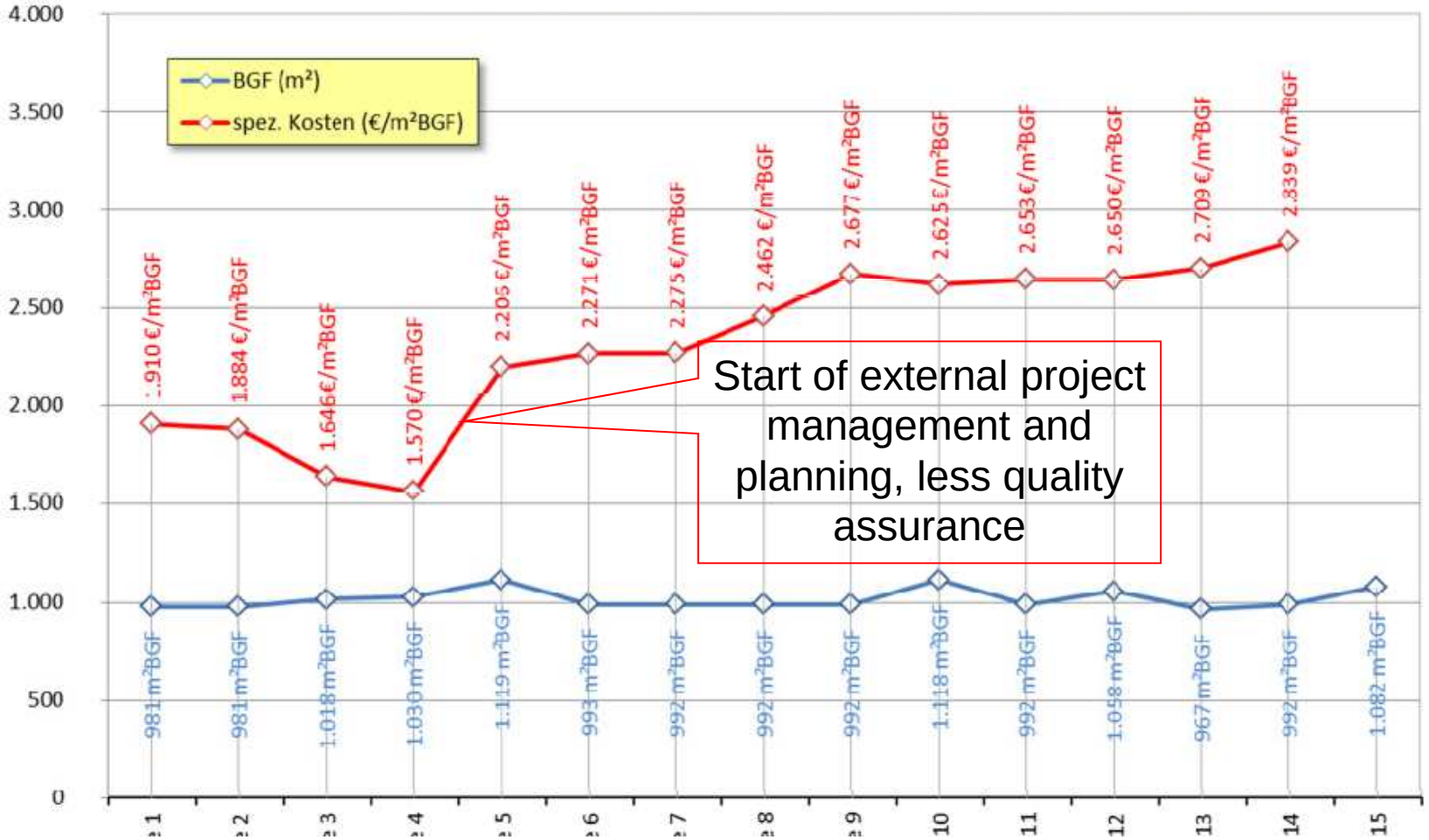
XVI. Wahlperiode

Sept. 2007, City parliament of Frankfurt, PH-decision

The municipal administration has to ensure that all new buildings for the municipal administration, urban institutions and corporations and all buildings in the Framework of PPP for the city of Frankfurt will be built and designed accordingly the PH-standard.
If a design fails to meet this standard, this has to be justified
For renovations PH-standard is the aim. To fail this aim has to be justified also.
Where the municipality sells land, there has to be a contractual agreement that any new construction satisfies the PH-standard
a.s.o

Influence Of Project Management, Tender Time And Lack Of Quality Assurance On Spec. Invest (for PassiveHouse Gym)

Cost group 300 + 400, €/m² total floor area



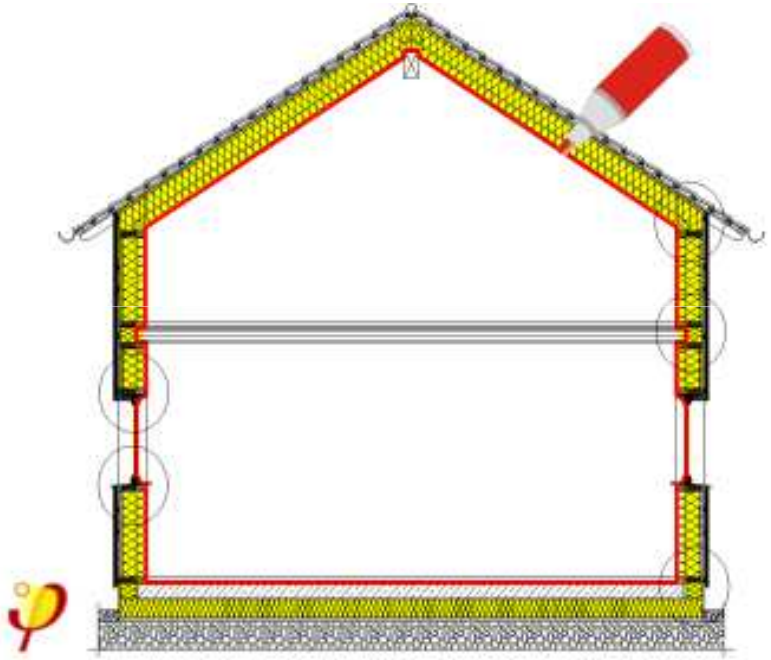
Components , what Additional Invest? German Window Market

Offer in german building stores 2008/2010:
“Get triple glazing for the price of double”

Window market 2013:	Ug > 1,1	0%;
Germany	1,1 < Ug < 0,8:	45%,
	Ug < 0,8:	55%

VFF: Mehr Energie sparen mit neuen Fenstern

Isolation, 10 cm More, Not Expensive, Good Comfort!



Maße in mm	Stärke in mm	Art-Nr.	Pack	entspr./ m²	(Pal.-Abn.) Pack	(Pal.-Abn.) entspr./m²
4.400 x 1.200	140	*8761644*	**44.45** (5,28 m²)	8.42	**39.95**	(18 Pack) 7.57
3.900 x 1.200	160	*8761645*	**44.65** (4,68 m²)	9.54	**39.95**	(18 Pack) 8.54
3.500 x 1.200	180	*8761646*	**45.15** (4,20 m²)	10.75	**39.95**	(18 Pack) 9.51
3.100 x 1.200	200	*8761641*	**43.95** (3,72 m²)	11.81	**39.75**	(18 Pack) 10.69
2.800 x 1.200	220	*8761642*	**44.25** (3,36 m²)	13.17	**39.95**	(18 Pack) 11.89
2.600 x 1.200	240	*8761643*	**44.95** (3,12 m²)	14.41	**39.95**	(18 Pack) 12.80

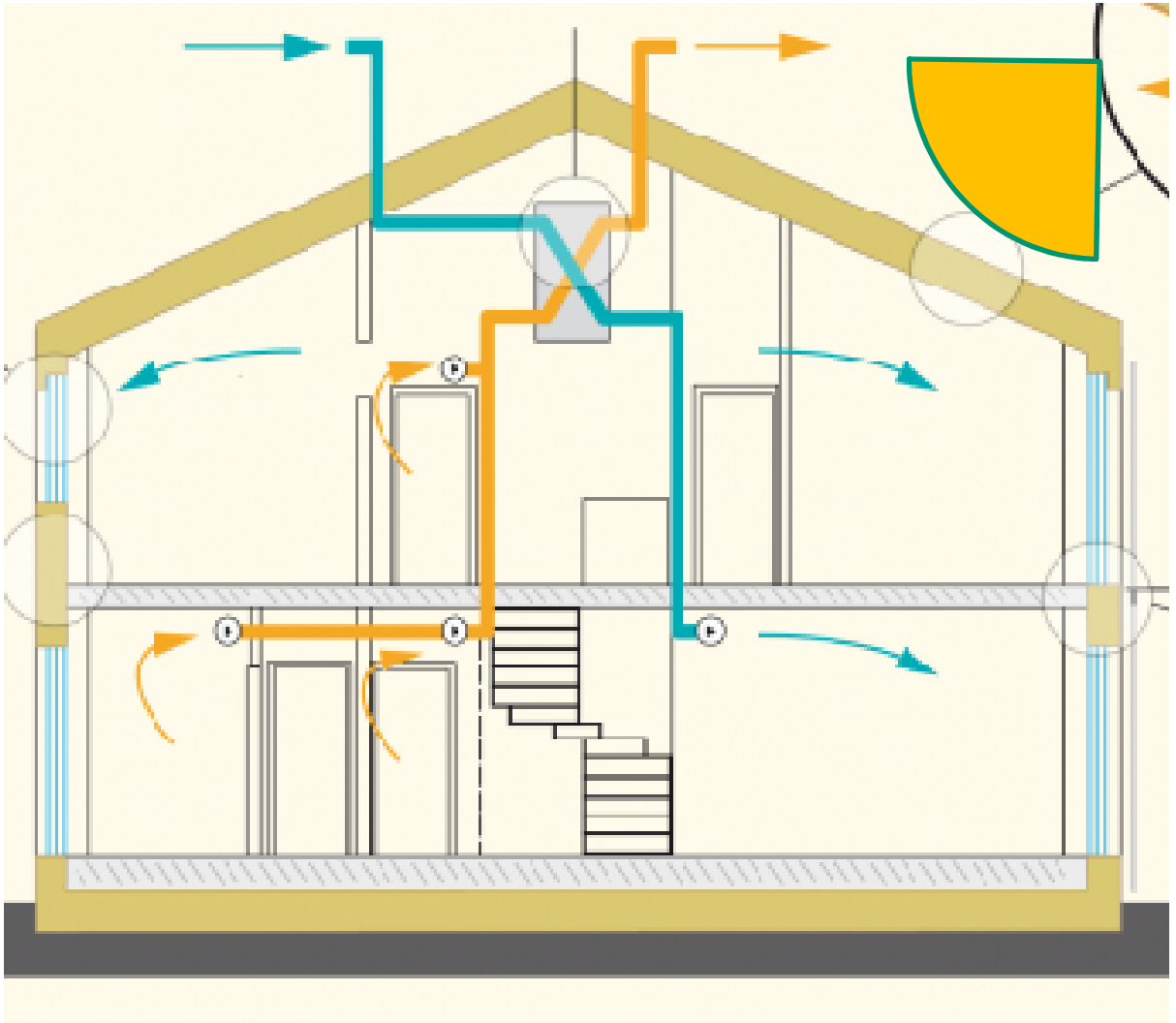
www.passipedia.org/planning/thermal_protection

about 60 €ct /cm/m²

Mechanical Ventilation As Simple As Possible, 20-30 m³/hP

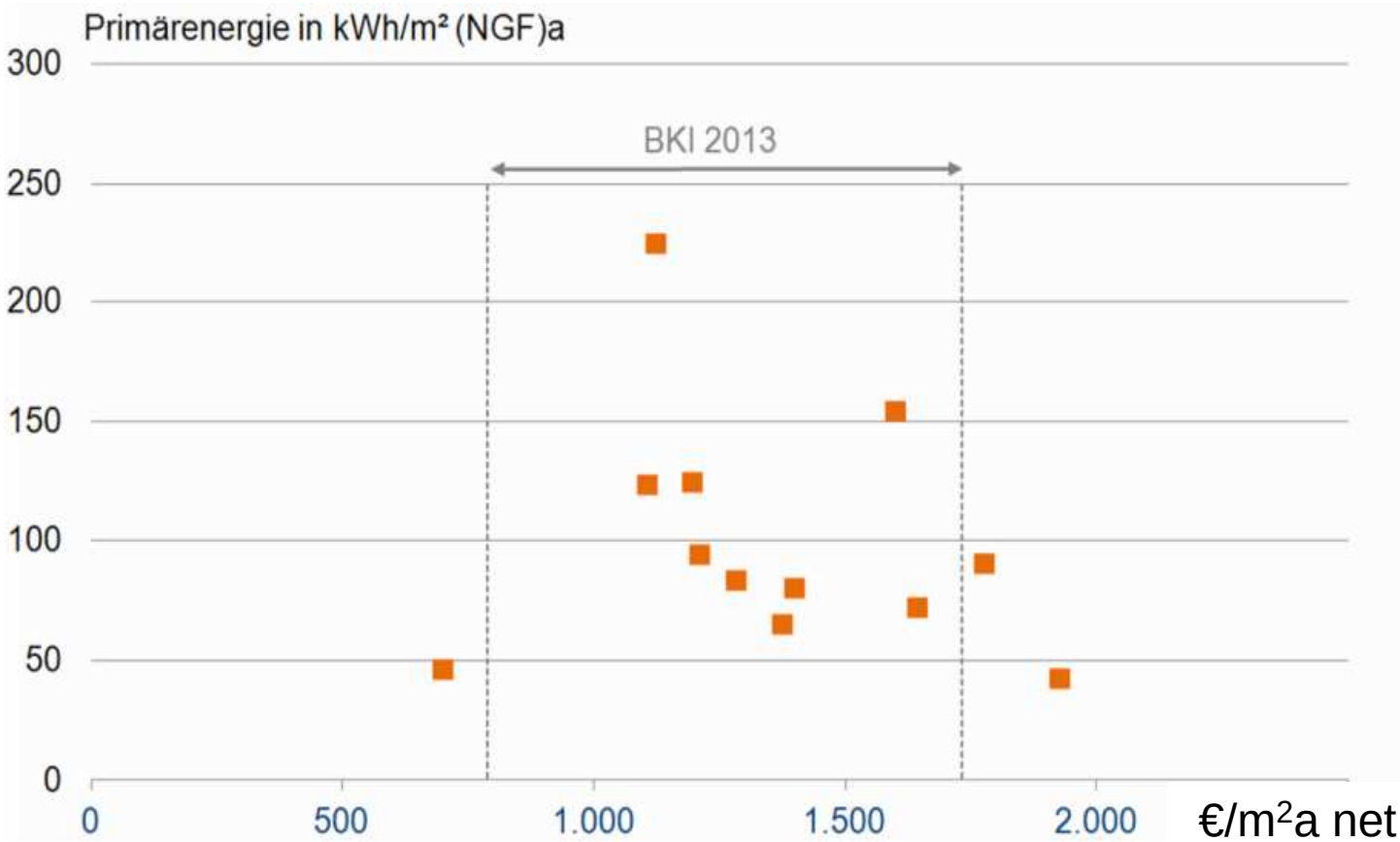
Running only during heating and cooling season (very short in PH), most of the year window-ventilation, even in winter with some more friends in the house a.s.o.!

www.passipedia.org/_detail/picopen/5ph_grundprinzipien_07.png?id=basics



Energy - Optimized Office Building (ENOB) - Net Construction Costs (300 + 400) In Relation to Primary Energy Consumption

"It is therefore recommended to give up the identification and designation of energy-related costs"



Aus: Lützendorf u.a.: Baukosten von energetisch optimierten Bürobauten, ENOB, 2014

Experience Frankfurt and Others, Short Arguments List For High Efficient Buildings (PH)

- All surfaces have comfortable temperature, humidity is in good range, CO2 level also
- Much more comfort and performance for/of the users (the best for the educational success of our children)
- Overwhelming success on the market (if price is‘nt unbelievable high)
- Simple technical system and regulation is possible
- More space cause of less technical systems (radiator etc.)
- high acceptance of the users
- Building is good natured, e.g. breakdown of heating system do‘nt need sudden reaction
- Much less maintanance is possible
- Last but not least: Saving a lot of money for energie
- . . . .

PH Decisions, Frankfurt 2004 and Beyond

- **Cities (Antwerpen, Aschaffenburg, Freiburg, Hannover, Leipzig, Nürnberg, Wiesbaden, aso.), Counties (Lippe, Kulmbach, uvm.) public and private building and housing companies (HIM, ABG, Sachsen, aso.)**
  PH is standard, after visiting or presentations about Frankfurt
- **Counties Austria Vorarlberg, Sachsen, Hessen aso.**
  government funding for residential buildings only for PH standard
- **Belgium/Flandern 2007/08**
  Decision for new school buildings to PH-standard. Minister and parliament visit Riedberg primary school before
- **GB government**
  PH should be standard from 2013?, zero carbon standard from 2016 (canceled in Mai 2015)
- **France**
  Loi Grenelle 1+2: new buildings primary energy demand < 50 kWh/m^2 a from 2010 (NRB) and 2012 (residential buildings)
- **EU- Germany**
  til 2020: reducing energy consumption for **all** buildings - 20%!, new only **near-zero-Energy**)
- **Dänemark 2013**
  Ban on oil and gas heating for new buildings

PH Decisions, Frankfurt 2004 And Beyond

EU-parliament in 2008: PH should be standard from 2011 . . . .

EU-EPBD (2010): Target Energy for all buildings: - 20% till 2020

- **new buildings are nearly zero- energy buildings** by 31 December **2018** if they are occupied and owned by **public** authorities, after 31 December **2020 all others!**
- **national plans for increasing the number of nearly zero- energy buildings till 2019,** Member States shall report to the Commission intermediate targets for improving the energy performance of new buildings **by 2015**, with view to preparing the implementation till 2017
- **regular inspection of energy performance of heating and air-conditioning systems** in buildings
- **methodology for calculating the integrated energy performance of buildings** and building units, common general framework
- **minimum requirements** to the **energy performance of existing buildings**, building units and building elements for major renovation
- **energy performance certificates for public buildings,** displayed in a prominent place clearly visible to the public, over 500 m^2, 2015 > 250 m^2

Experience Frankfurt

- www.energiemanagement.stadt-frankfurt.de
- www.energiemanagement.stadt-frankfurt.de/Englisch/Englisch.htm
- www.energiemanagement.stadt-frankfurt.de/Investive-Massnahmen/Bauprojekte/Bauprojekte.htm
- List of non domestic PH-building projects public buildings city Frankfurt: 74 new, 8 renovation, 18 new, 2 renovation under construction (more than 160.000 m^2 for instance also home of fire department)
- Much more projects of private and public companies and people, only in Frankfurt, more exampels (!) see: www.passivhausprojekte.de/index.php?lang=en