

Forschung

zu Energie Effizientem Bauen
Qualitätssicherung, Tools und
Weiterbildung

April 2014

Rosenheim Passivhaus Forum

Der Passivhaus- handwerker und die eingesparte Kilowattstunde

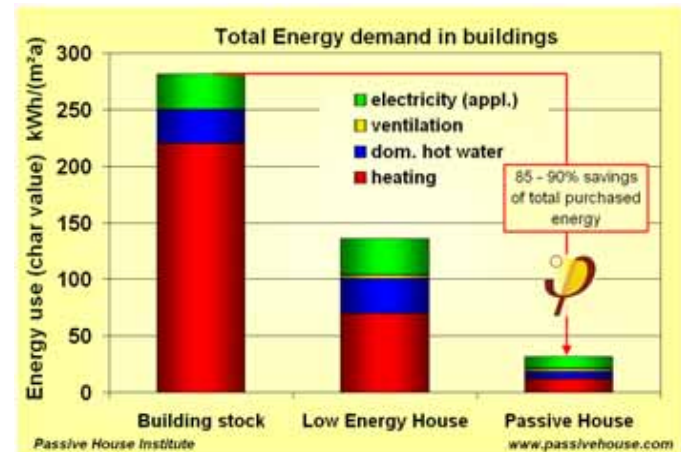
Univ. Prof. Dr. Wolfgang Feist

University of Innsbruck

Bauphysik und Energiesparendes Bauen

Passivhaus Institut (PHI)

[www. passivehouse.com](http://www.passivehouse.com)



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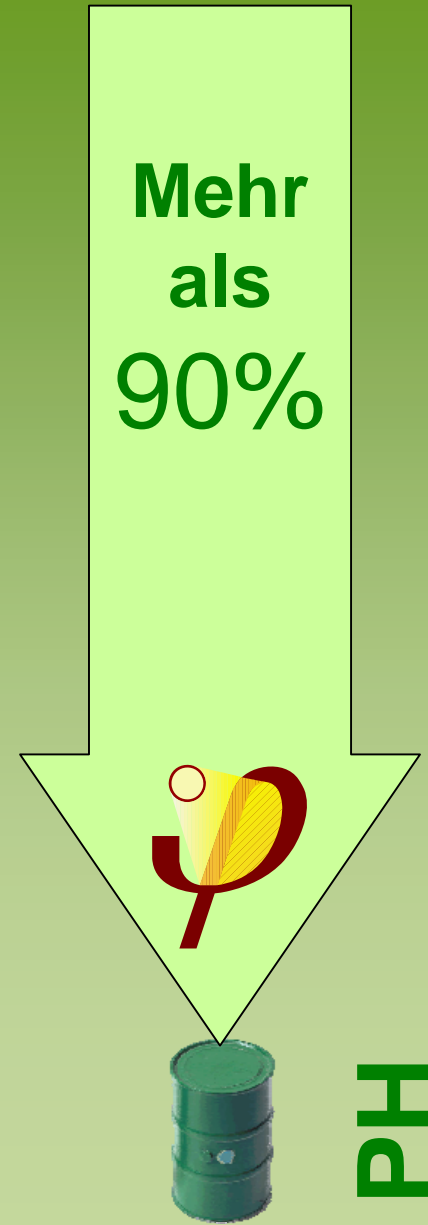
Nachhaltiger Komfort

≥ 90% Verringerung des
Heizwärmebedarfs

200 kWh/(m²a)

15 kWh/(m²a)

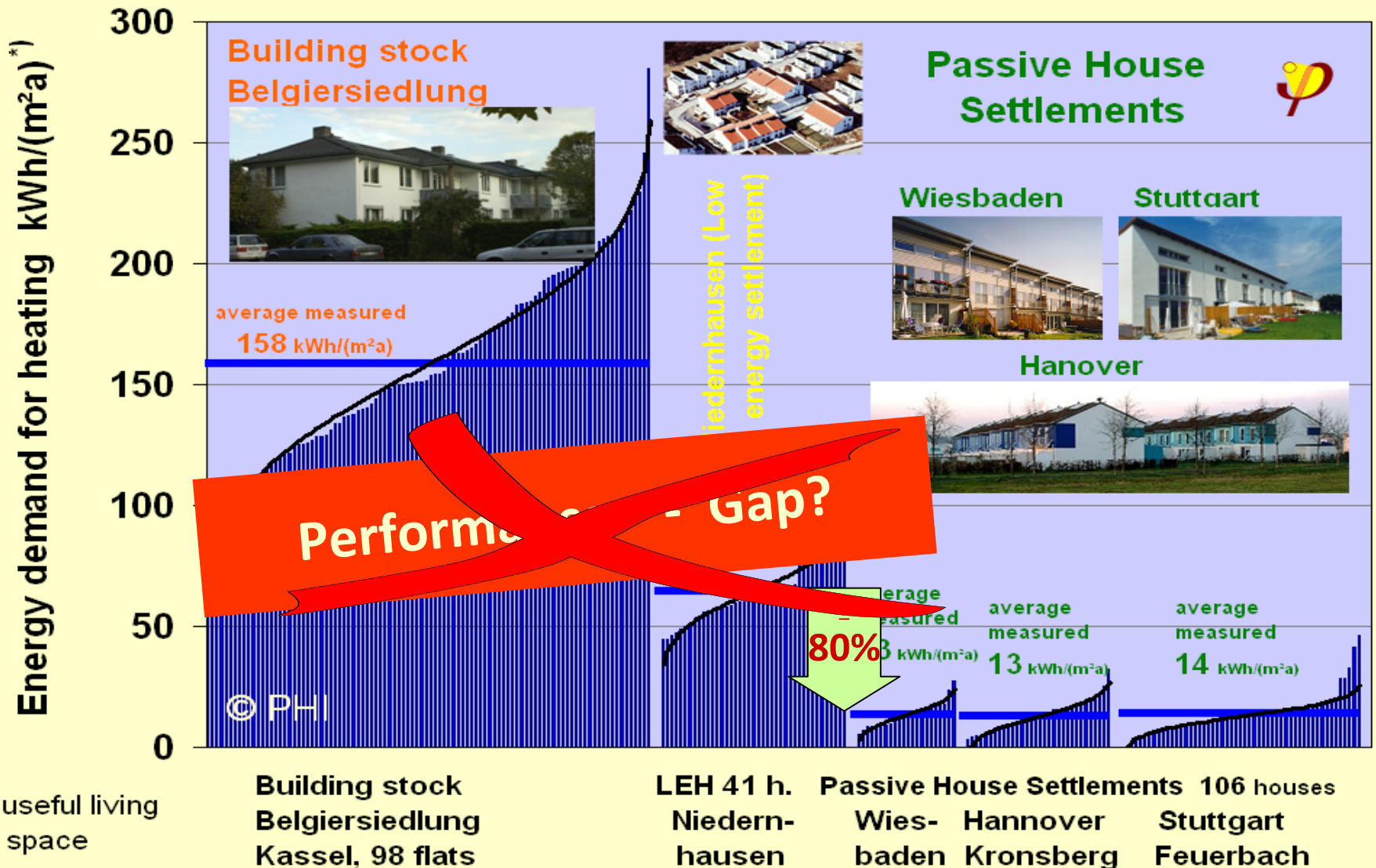
Mehr
als
90%



PH

Durchschnittliche Gebäude:
fossile Energie





*) useful living space

PHPP

Passivhaus Qualität
Entwurf von

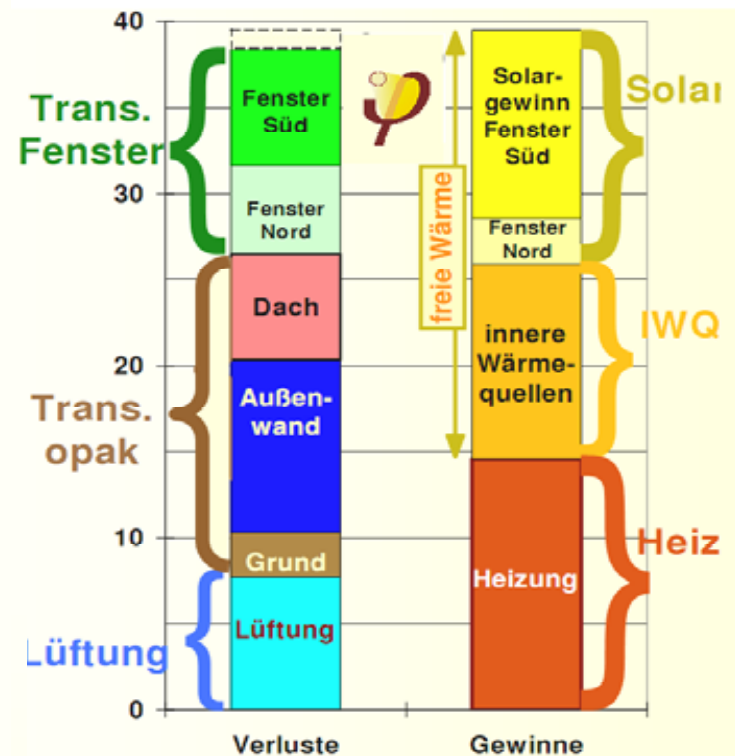
- Heizung
- Kühlung
- Lüftung
- Wärmepumpe & Solar
- Optimierung
- Validiert Neubau & EnerPHit
- Qualitätssicherung
- Datenbasis Komponenten
- Komfort
- International



neu PHPP 8 (2013)

Basis der Energiebilanz

Internationale Normen (ISO 13790)

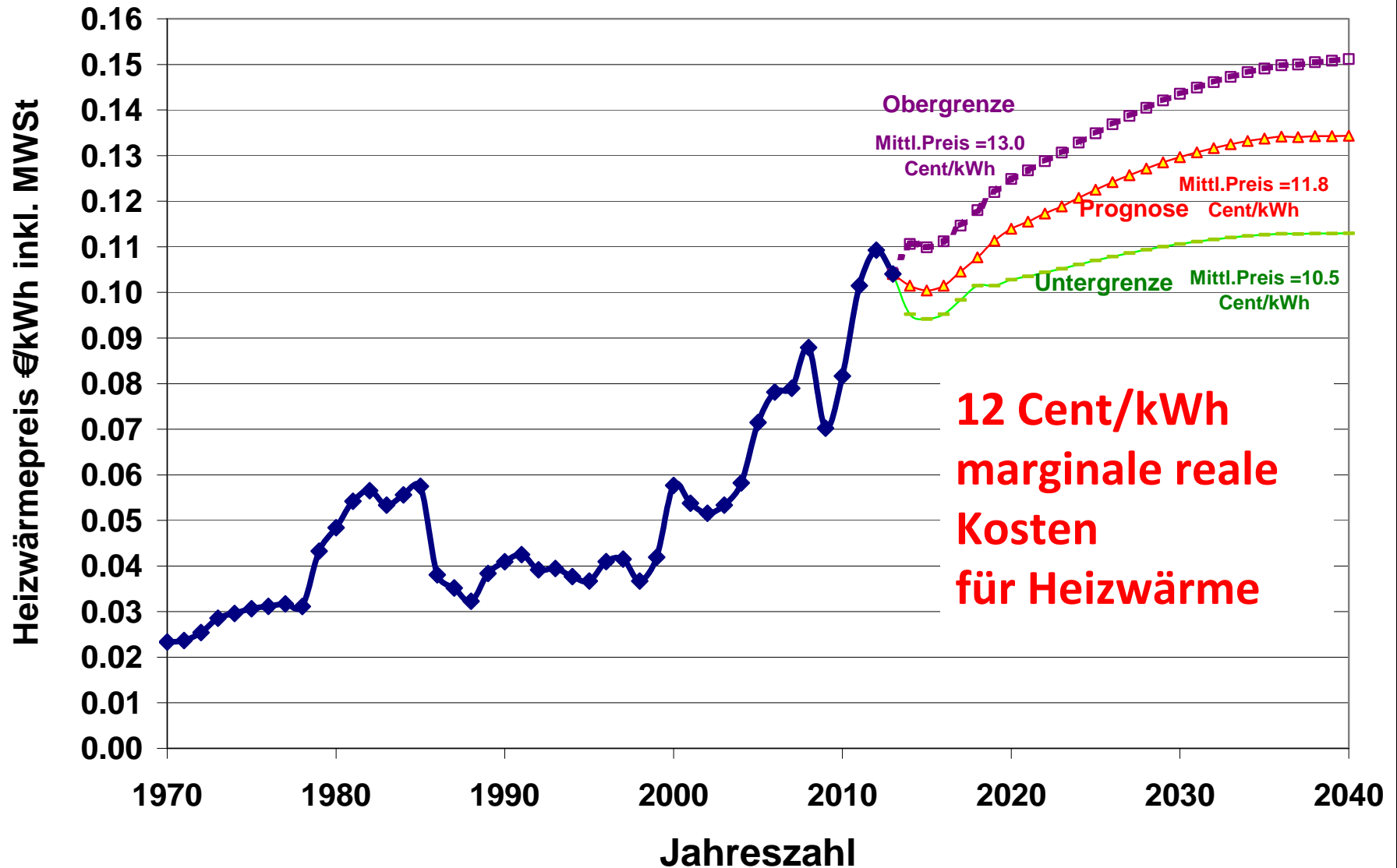


An Messungen
überprüft

1. setup Sketchup and **designPH**
2. draw your project as usually
3. automatic recognition of temperature zones building elements and area groups
4. import data into **PHPP**
5. finetuning data in **PHPP**

The screenshot displays the PHPP (Passivhaus Performance Package) software interface. The main window shows a 3D model of a building with a red roof and yellow walls. The title bar indicates the file is 'PHPP V8.1 Beispiel 130404.xls'. The interface is divided into several panes:

- Left Pane:** Contains a list of building elements and areas, including 'K13', 'K14', 'K15', 'K16', 'K17', 'K18', 'K19', 'K20', 'K21', 'K22', 'K23', 'K24', 'K25', 'K26', 'K27', 'K28', 'K29', 'K30', 'K31', 'K32', 'K33', 'K34', 'K35', 'K36', 'K37', 'K38', 'K39', 'K40', 'K41', 'K42', 'K43', 'K44', 'K45', 'K46', 'K47', 'K48', 'K49', 'K50', 'K51', 'K52', 'K53', 'K54', 'K55', 'K56', 'K57', 'K58', 'K59', 'K60', 'K61', 'K62', 'K63', 'K64', 'K65', 'K66', 'K67', 'K68', 'K69', 'K70', 'K71', 'K72', 'K73', 'K74', 'K75', 'K76', 'K77', 'K78', 'K79', 'K80', 'K81', 'K82', 'K83', 'K84', 'K85', 'K86', 'K87', 'K88', 'K89', 'K90', 'K91', 'K92', 'K93', 'K94', 'K95', 'K96', 'K97', 'K98', 'K99', 'K100'.
- Top Pane:** Displays the title 'Passivhaus Nachweis' and a small image of the building.
- Right Pane:** Contains a table of data for the building elements and areas, including 'K13', 'K14', 'K15', 'K16', 'K17', 'K18', 'K19', 'K20', 'K21', 'K22', 'K23', 'K24', 'K25', 'K26', 'K27', 'K28', 'K29', 'K30', 'K31', 'K32', 'K33', 'K34', 'K35', 'K36', 'K37', 'K38', 'K39', 'K40', 'K41', 'K42', 'K43', 'K44', 'K45', 'K46', 'K47', 'K48', 'K49', 'K50', 'K51', 'K52', 'K53', 'K54', 'K55', 'K56', 'K57', 'K58', 'K59', 'K60', 'K61', 'K62', 'K63', 'K64', 'K65', 'K66', 'K67', 'K68', 'K69', 'K70', 'K71', 'K72', 'K73', 'K74', 'K75', 'K76', 'K77', 'K78', 'K79', 'K80', 'K81', 'K82', 'K83', 'K84', 'K85', 'K86', 'K87', 'K88', 'K89', 'K90', 'K91', 'K92', 'K93', 'K94', 'K95', 'K96', 'K97', 'K98', 'K99', 'K100'.
- Bottom Pane:** Contains a table of data for the building elements and areas, including 'K13', 'K14', 'K15', 'K16', 'K17', 'K18', 'K19', 'K20', 'K21', 'K22', 'K23', 'K24', 'K25', 'K26', 'K27', 'K28', 'K29', 'K30', 'K31', 'K32', 'K33', 'K34', 'K35', 'K36', 'K37', 'K38', 'K39', 'K40', 'K41', 'K42', 'K43', 'K44', 'K45', 'K46', 'K47', 'K48', 'K49', 'K50', 'K51', 'K52', 'K53', 'K54', 'K55', 'K56', 'K57', 'K58', 'K59', 'K60', 'K61', 'K62', 'K63', 'K64', 'K65', 'K66', 'K67', 'K68', 'K69', 'K70', 'K71', 'K72', 'K73', 'K74', 'K75', 'K76', 'K77', 'K78', 'K79', 'K80', 'K81', 'K82', 'K83', 'K84', 'K85', 'K86', 'K87', 'K88', 'K89', 'K90', 'K91', 'K92', 'K93', 'K94', 'K95', 'K96', 'K97', 'K98', 'K99', 'K100'.



Kein Geld?

Geld ist billig, gerade: Kredit!

Gebäude: Hypothekenkredit
Derzeit ca. 2,5% Zins (nominal!)

Nutzungsdauer: z.B. 10 Jahre

Bank bestimmt jährliche Rate:
Annuität $a(2,5\%, 10 \text{ Jahre})$

$$= 0,025 / (1 + 1/(1.025)^{10}) = 11,4\%/a$$

Annuität / Beispiel

LED-Lampe, 5W kostet 10 Euro

Hält: 10000 h; entspr. 10 Jahre

(Ersetzt: Glühlampe, 40 W, hält 2 Jahre,
kostet 0,5 Euro oder 0,25 €/a)

Kosten LED: $11,4\% \cdot 10\text{€} = 1,14 \text{ €/a}$

Jahreskosten neu – alt = $(1,14 - 0,25) \text{ €/a}$
 $= 0,99 \text{ €/a}$

Eingesparter Verbrauch (25 Cent/kWh)
35 kWh/a

Kosten der eingesparten kWh
 $= 0,99 \text{ €/a} / 35 \text{ kWh/a} = 2,83 \text{ Cent/kWh}$

Zins →

2,00% 2,50% 3,00% 3,50% 4,00%

10 11,1% 11,4% 11,7% 12,0% 12,3%

15 7,8% 8,1% 8,4% 8,7% 9,0%

20 6,1% 6,4% 6,7% 7,0% 7,4%

25 5,1% 5,4% 5,7% 6,1% 6,4%

30 4,5% 4,8% 5,1% 5,4% 5,8%

35 4,0% 4,3% 4,7% 5,0% 5,4%

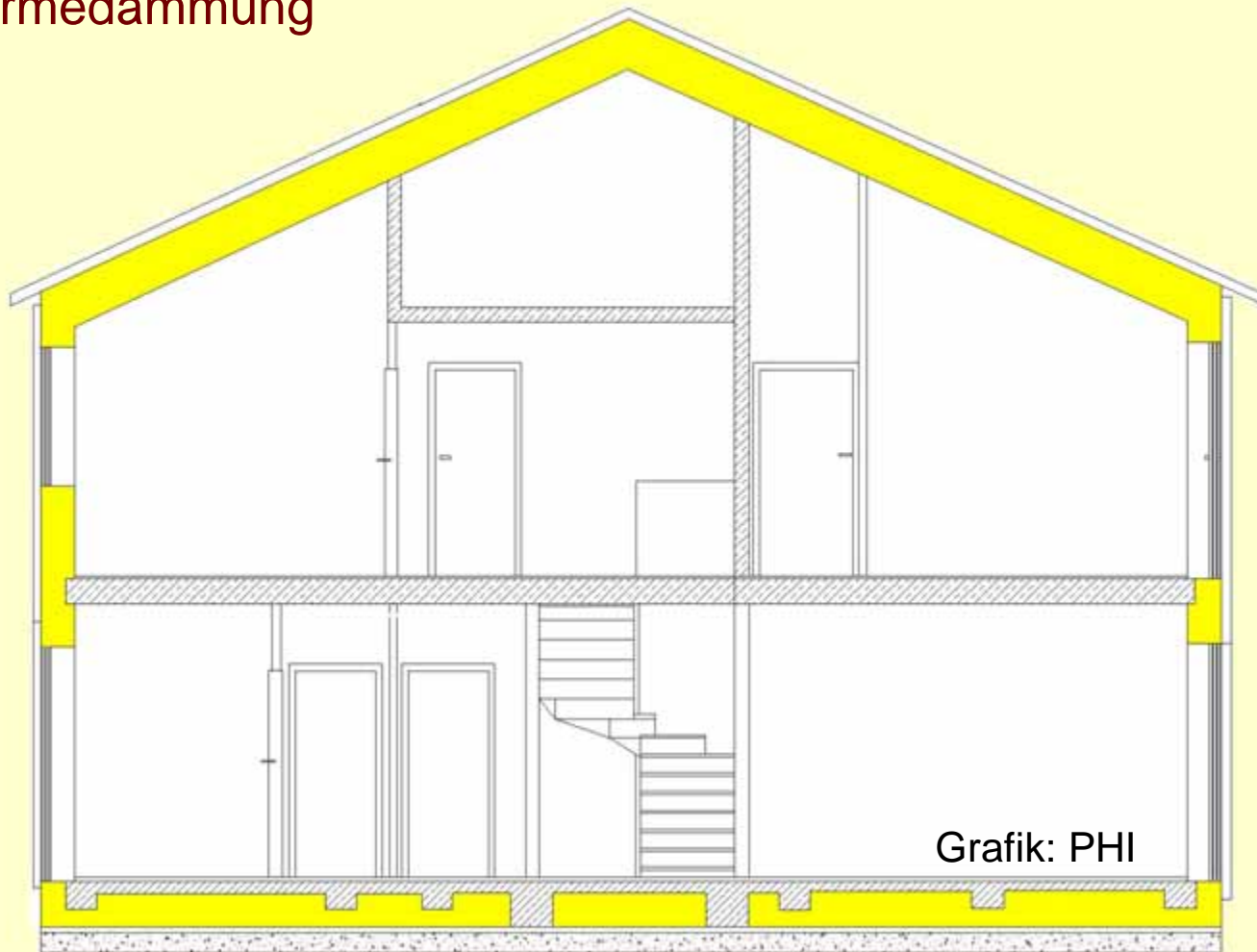
40 3,7% 4,0% 4,3% 4,7% 5,1%

45 3,4% 3,7% 4,1% 4,4% 4,8%

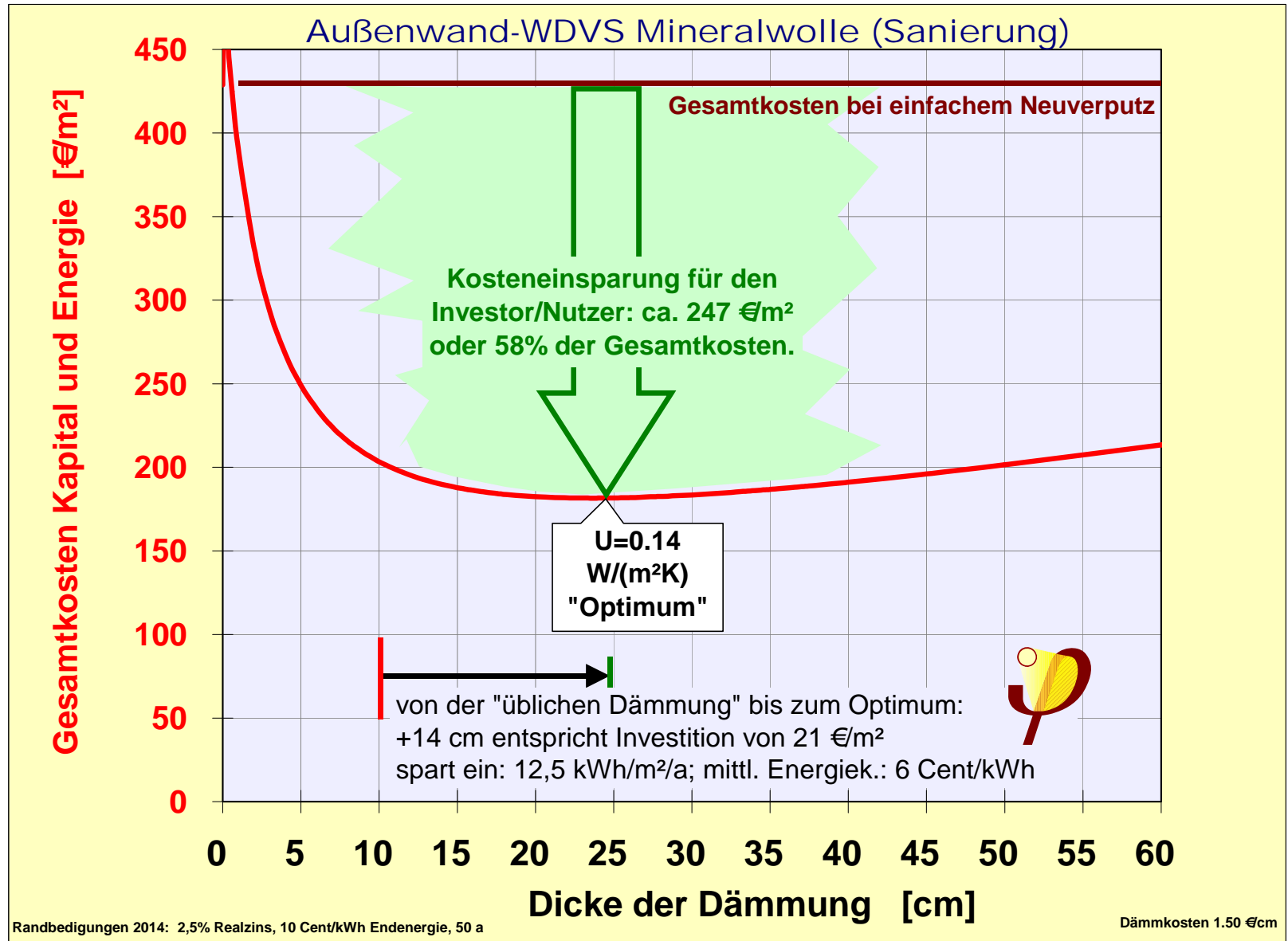
50 3,2% 3,5% 3,9% 4,3% 4,7%

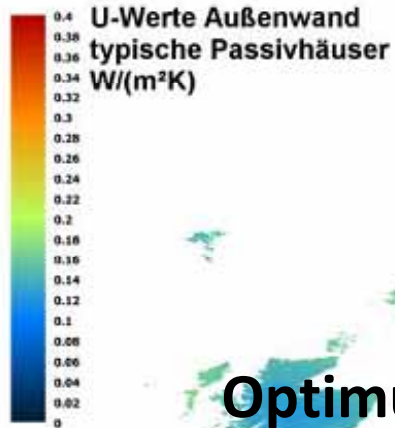
Nutzungsdauer

(1) Wärmedämmung



Wärmeschutz – komfortabel und extrem günstig



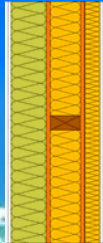
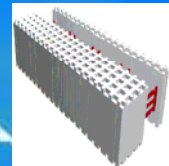


Optimum in Mitteleuropa

85 kWh; 12 Cent/kWh; 50a; Zins 2.5%

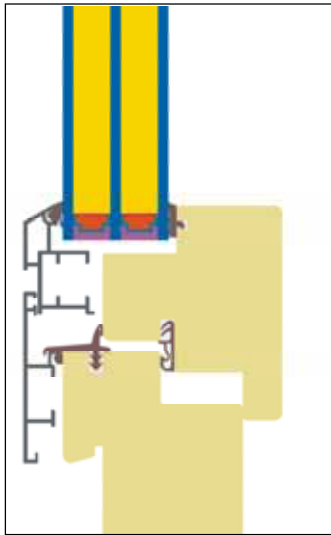
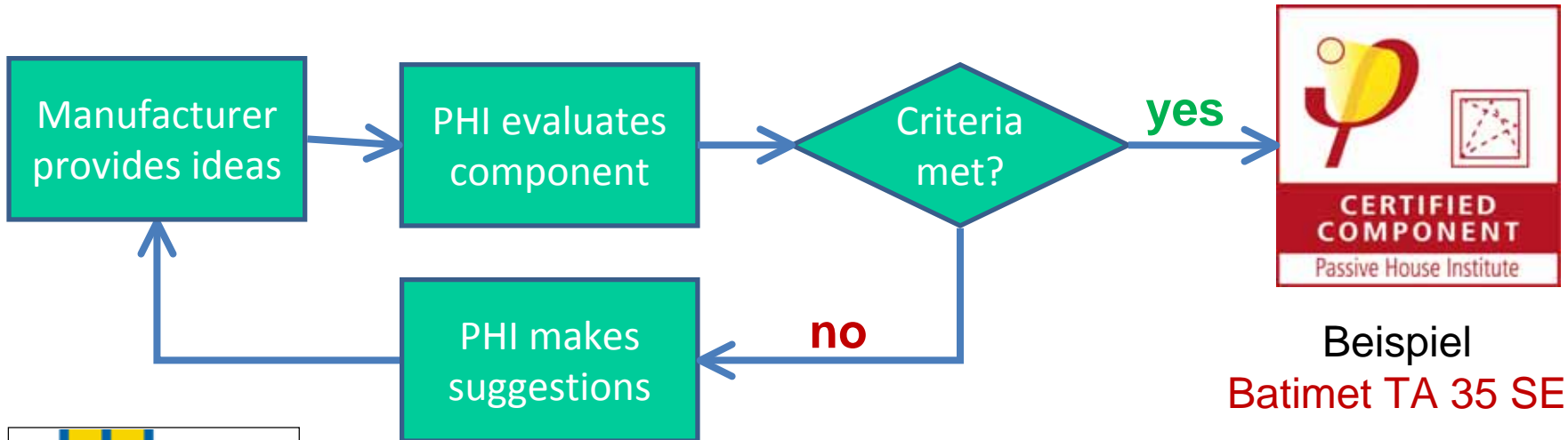
Wandaufbauten: 0.12 bis 0.17 W/m^2K

Dachaufbauten: 0.09 bis 0.13 W/m^2K



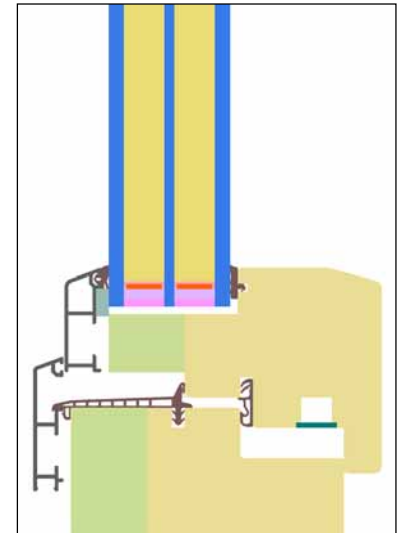
(2) Fenster und Verglasungen



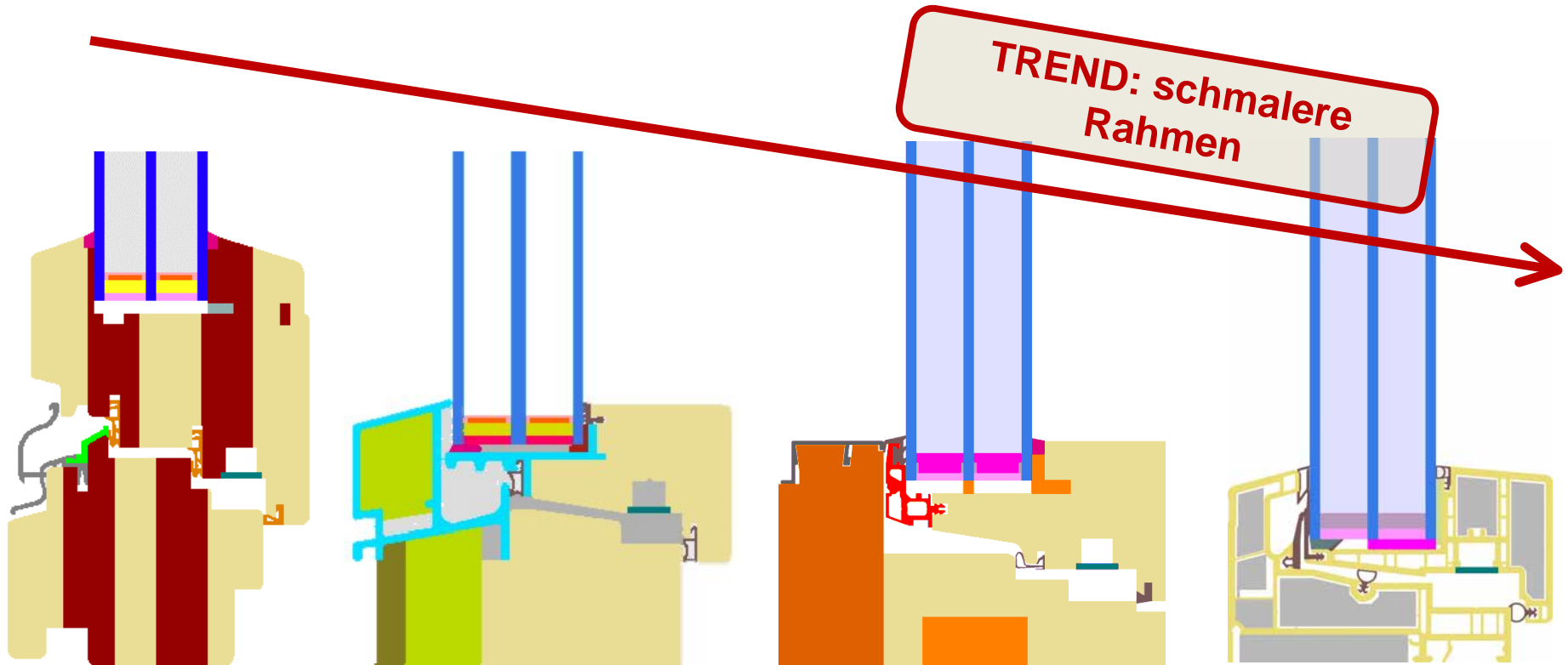


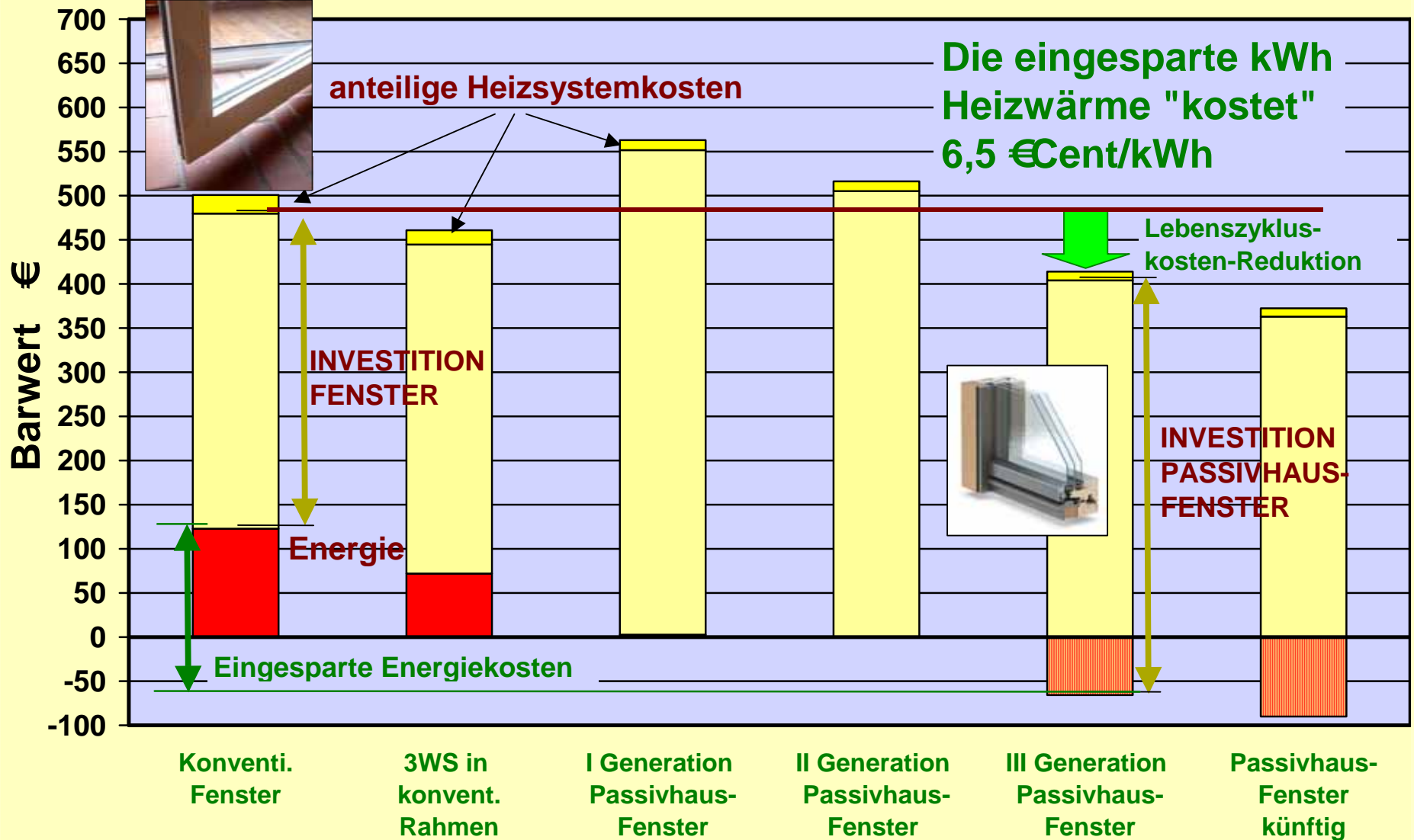
PHI Komponenten Zertifizierung
bewirkt:

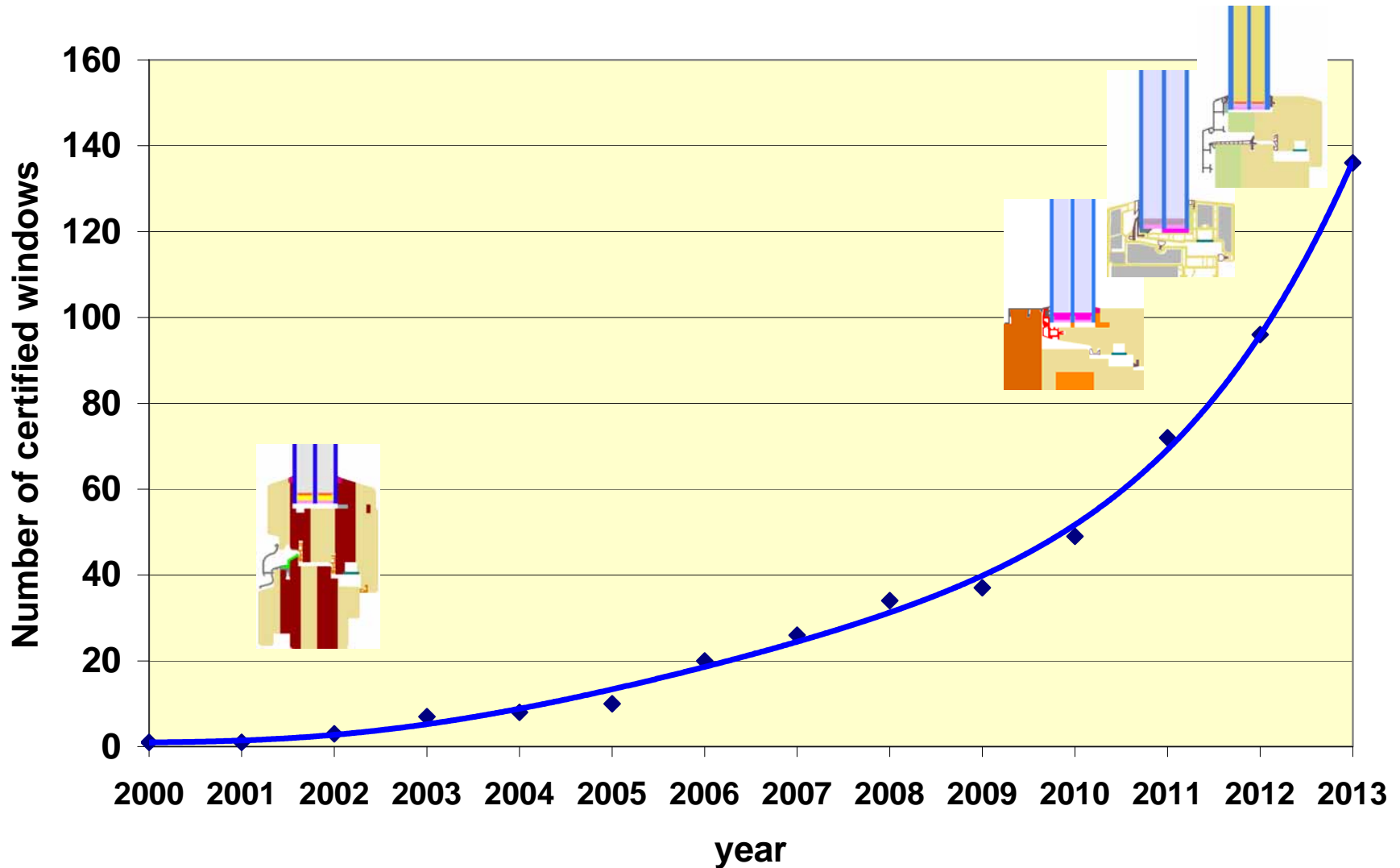
**Unterstützung der
Entwicklung**



Passivhaus zertifizierte Komponente

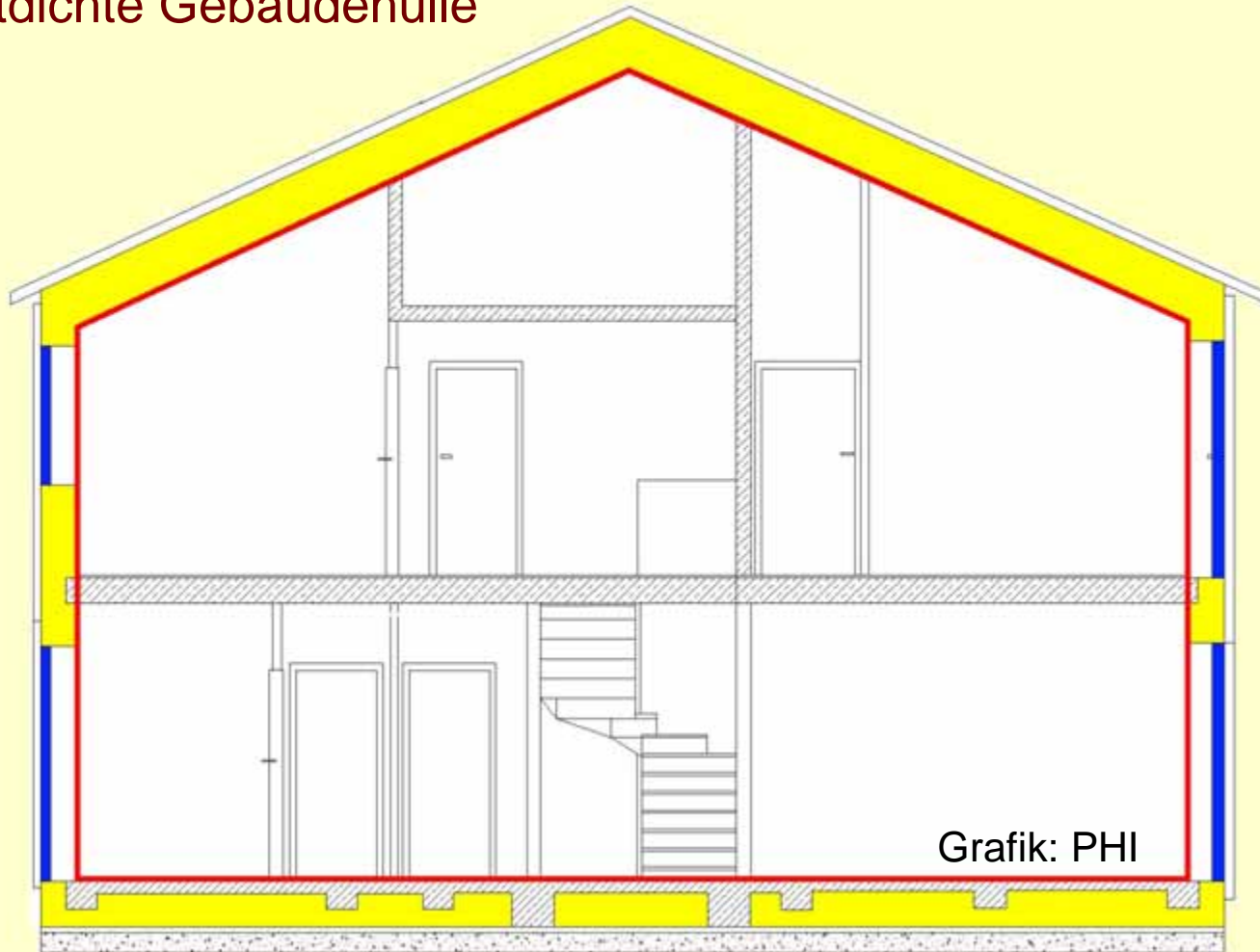




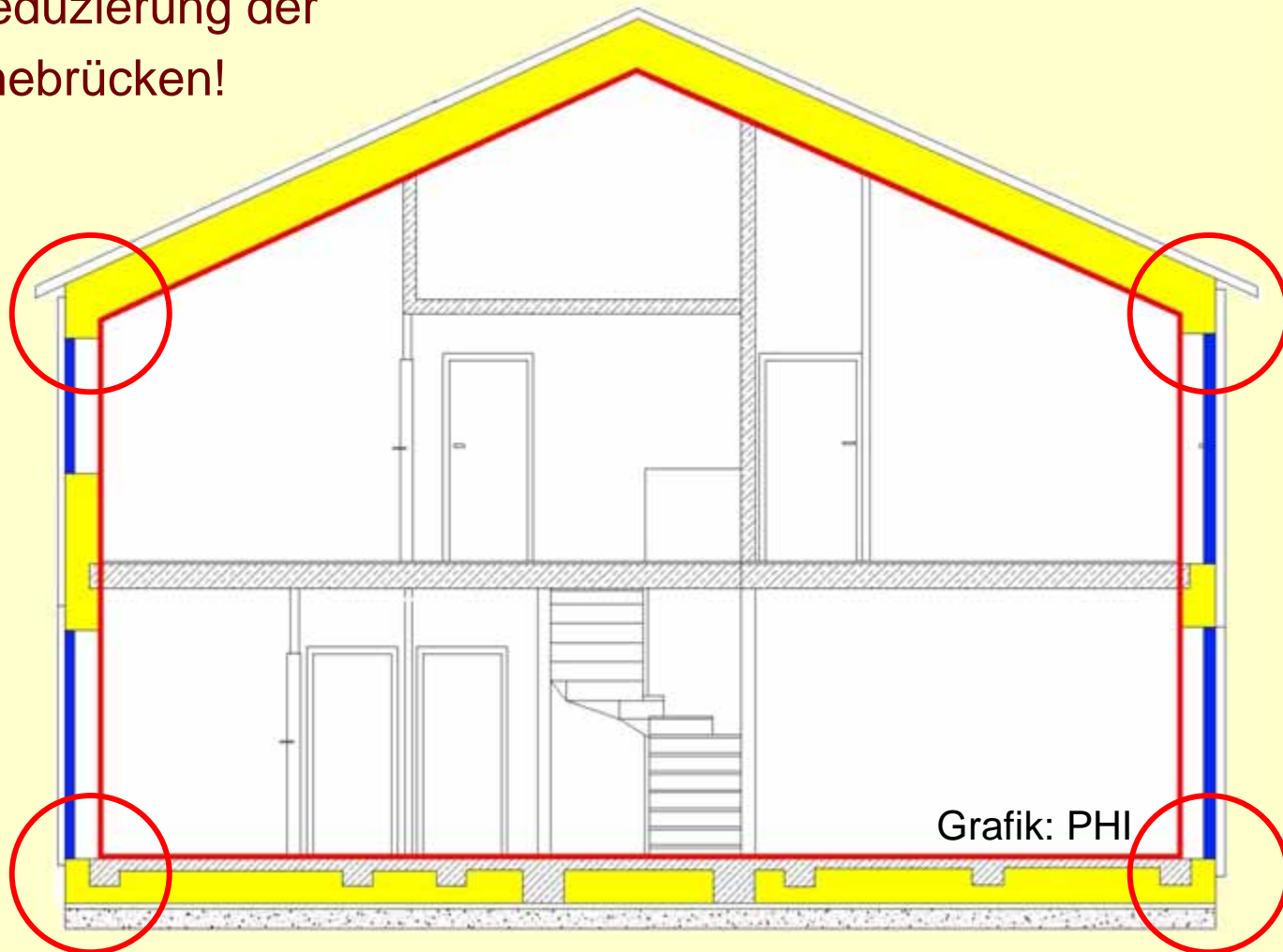


Passive House Component Certification

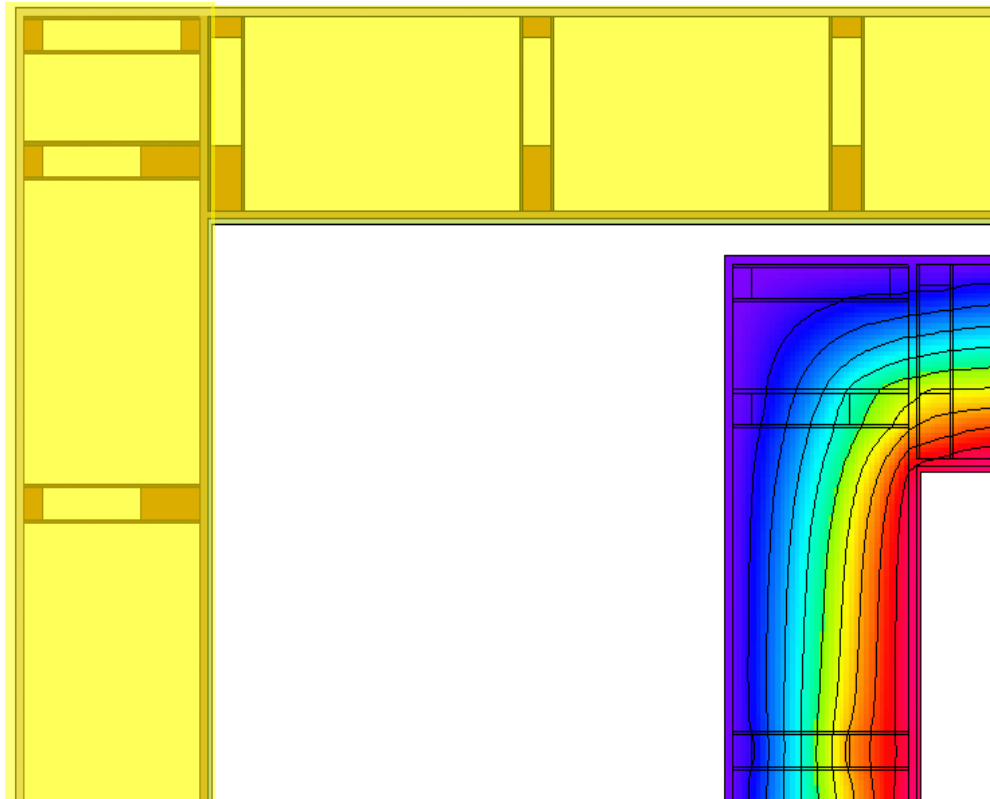
(3) Luftdichte Gebäudehülle



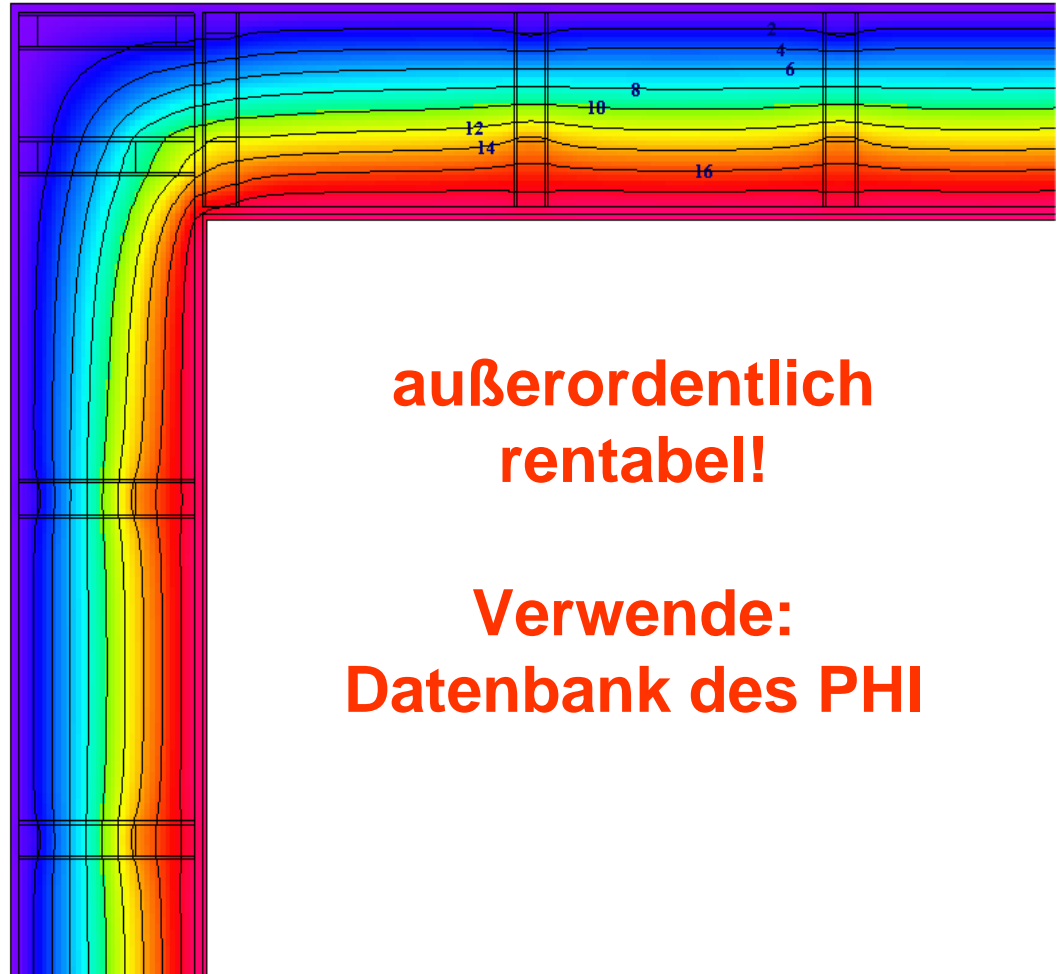
(3) Reduzierung der
Wärmebrücken!



Verbindung Kante Außenwand / Außenwand



wärmebrückenfrei
 $\Psi_a = -0.022 \text{ W/(mK)}$

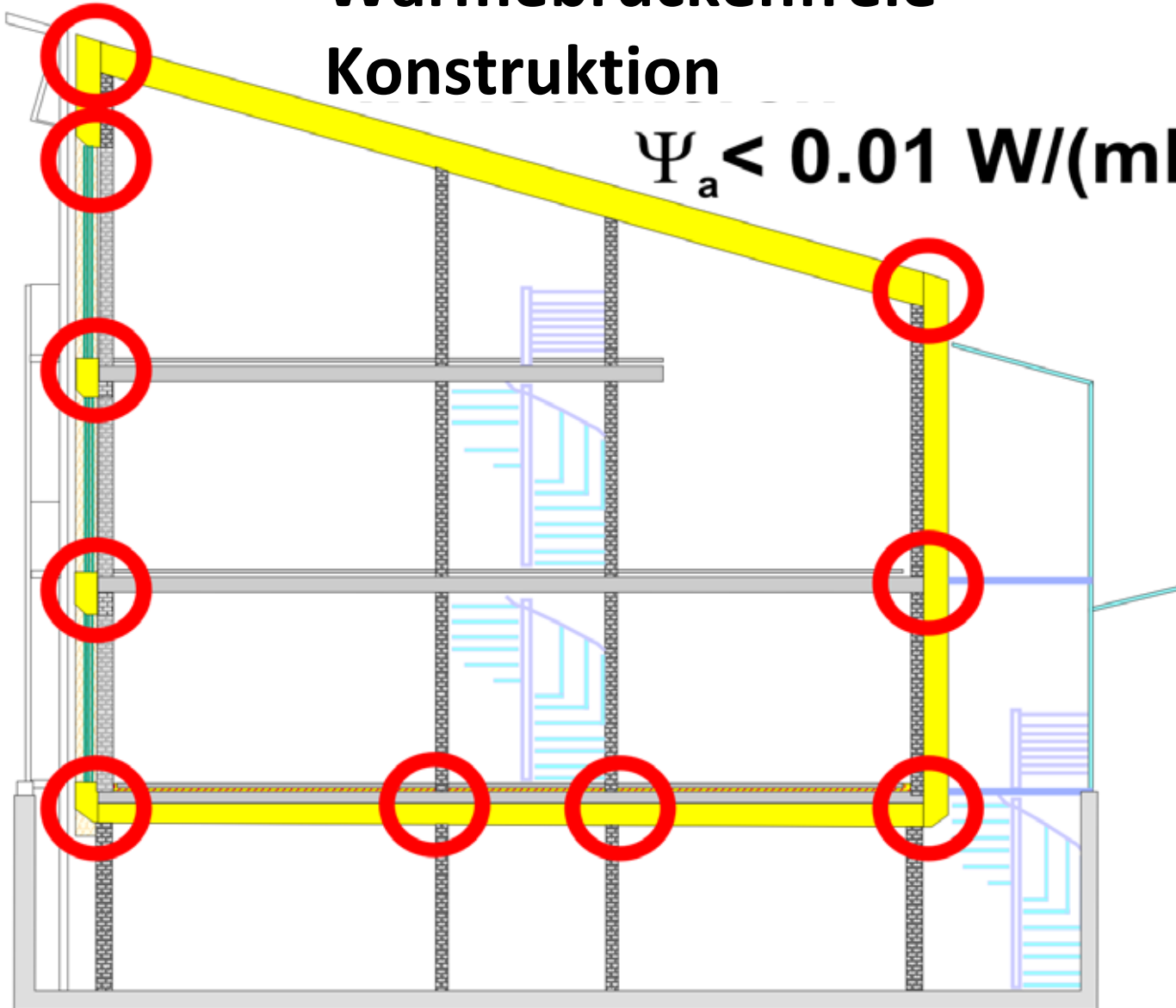


außerordentlich
rentabel!

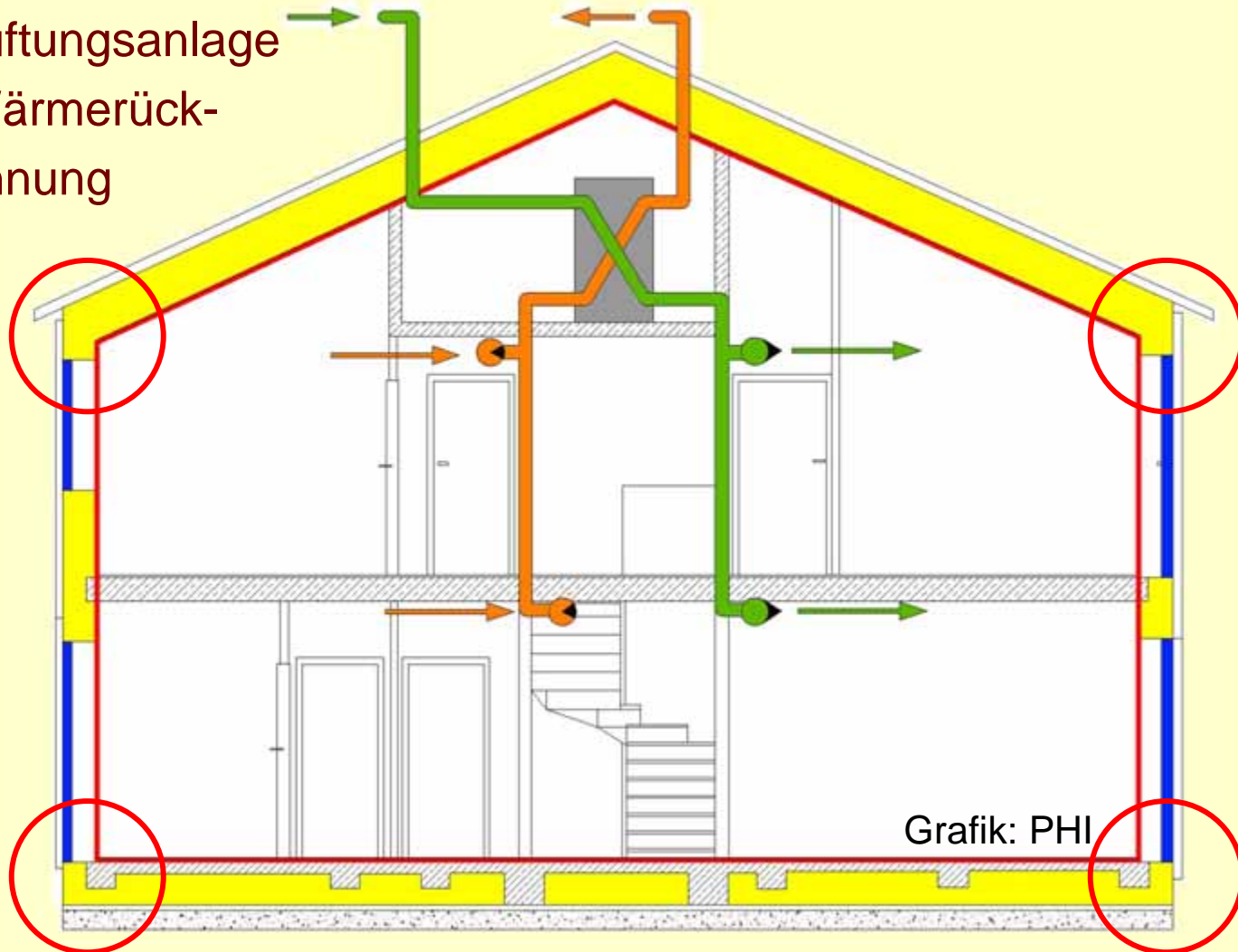
Verwende:
Datenbank des PHI

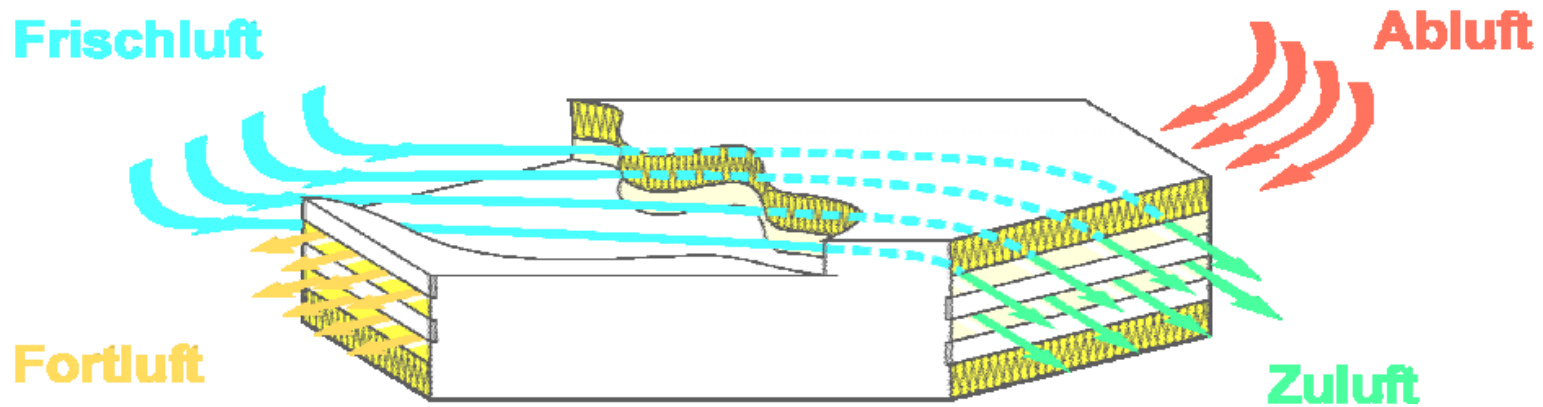
Wärmebrückenfreie Konstruktion

$$\Psi_a < 0.01 \text{ W/(mK)}$$

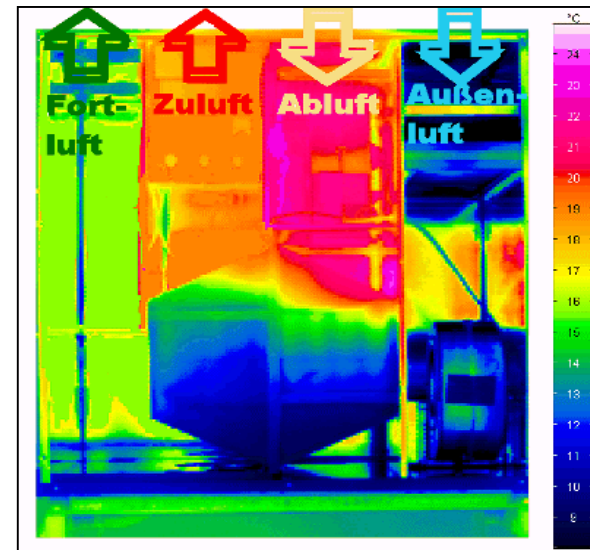



(4) Lüftungsanlage
mit Wärmerück-
gewinnung

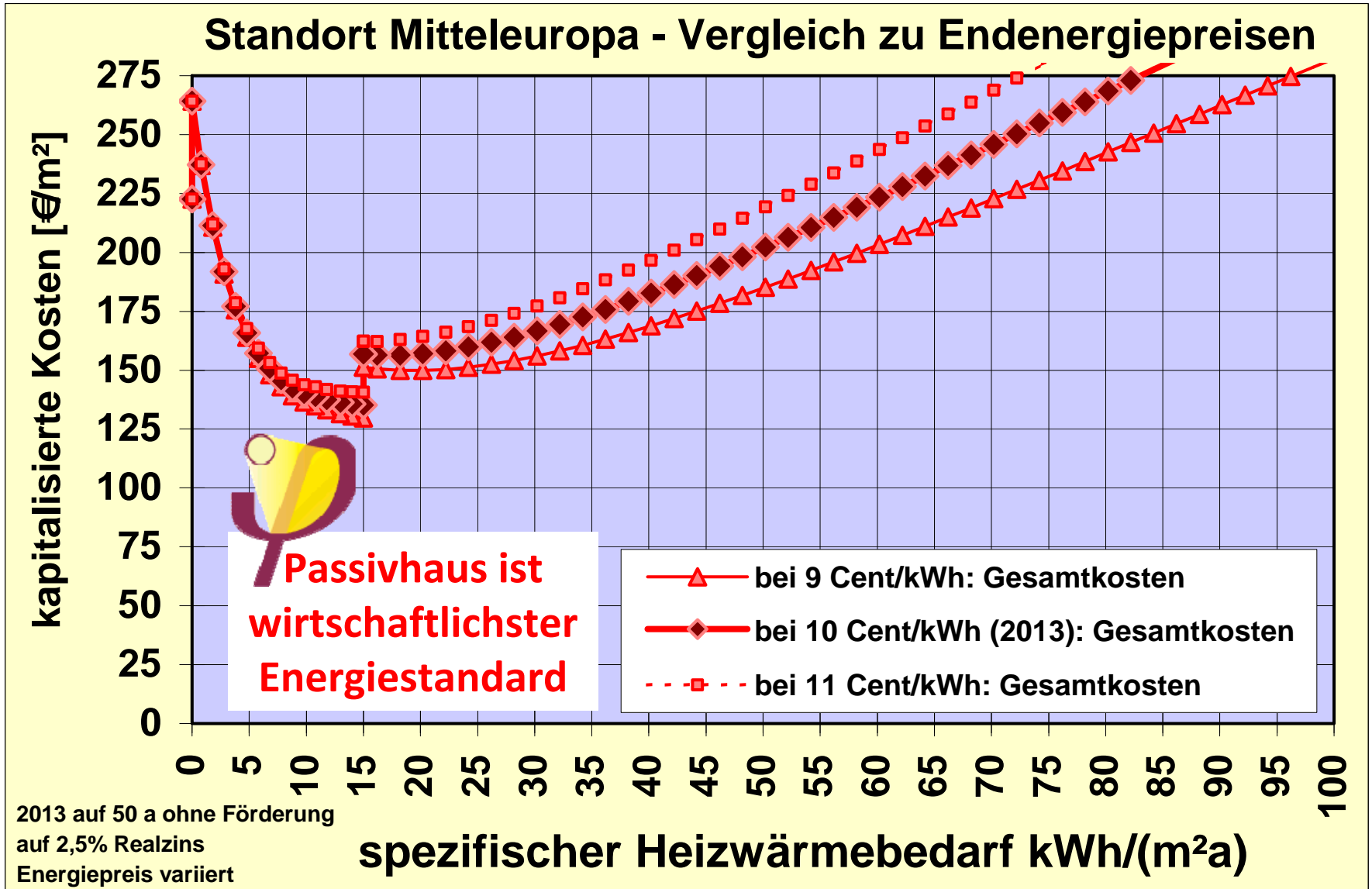




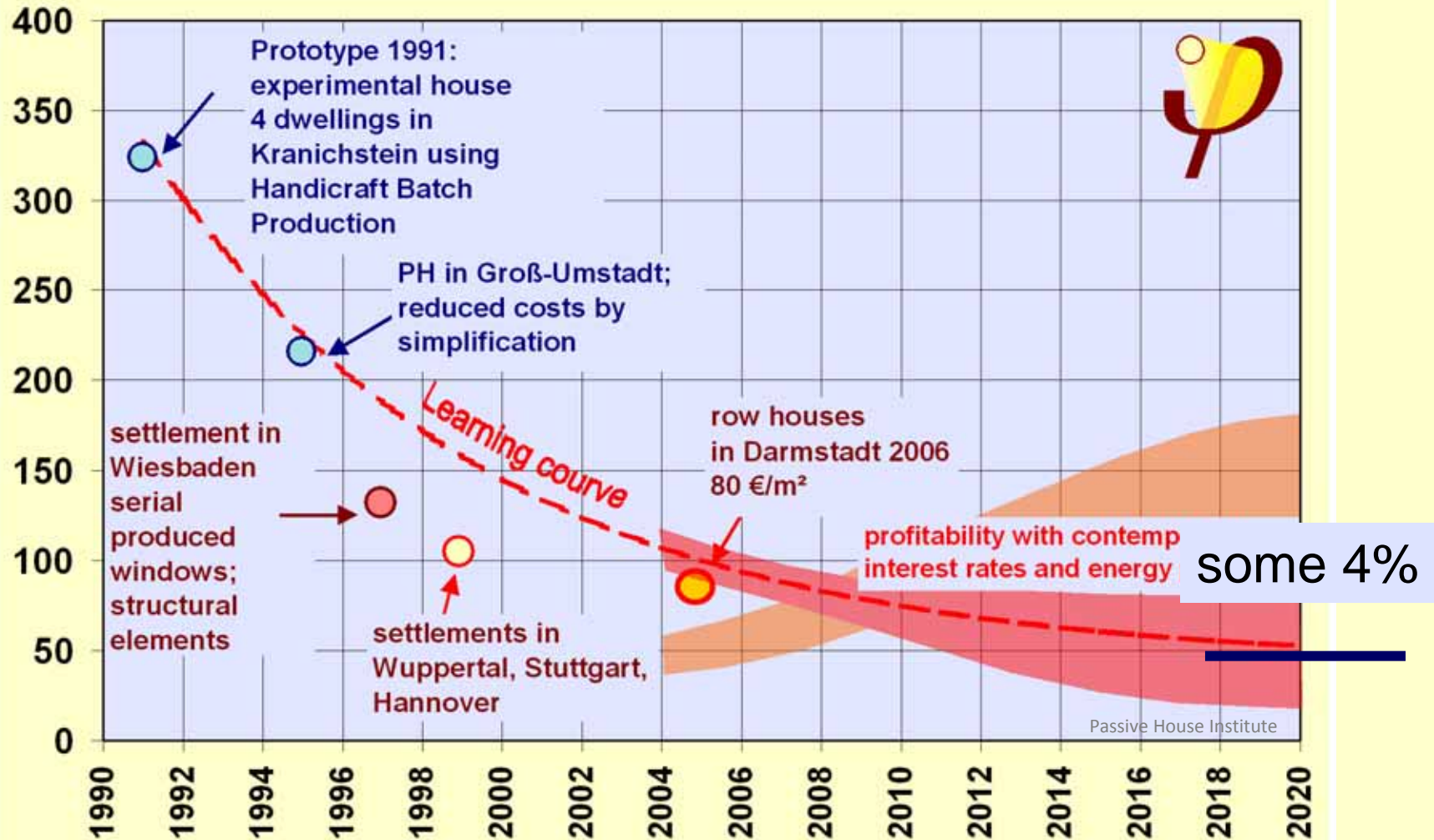
80% bis
90%
Rückge-
winnung



<div>  <h1>Die Ökonomie</h1> </div>					
	1. Variante häufig angetroffene Anlage	2. Variante nach DIBT zulässige Anlage	3. Variante Passivhaus geeignete Anlage	4. Variante optimiertes System im Passivhaus	
n-50-Wert	4.0	1.5	0.3	0.3	1/h
mittl. Zuluftstrom	150	140	100	100	m³/h
Wärmebereitstellungsgrad	56%	65%	88%	92%	
Jahreslüftungswärmeverlust	3248	1897	441	329	kWh/a
mittl. Ventilatorleistung	150	78	35	30	Watt
Jahresstromverbrauch	983	508	229	197	kWh/a
Jahresstromkosten	246	127	57	49	€/a
Filterkosten je Jahr	50	50	38	38	€/a
Heizkosteneinsp. je Jahr	114	276	451	465	€/a
SUMME: Jährliche Betriebskosteneinsp.	-181	99	356	378	€/a
Mehrinvestition	Unrentabel!		7 bis 11 Cent/kWh		€
Annuität					
annuitätische Kapitalkosten					€/a
Kosten je eingesparte kWh					€/ kWh
Jahresheizzahl					
Primärenergie-Einsparung					kWh/a
% PE-Einsp. gegen Fensterl.			rentabel und komfortabel		



specific additional Investment (€/m²) of Passive-Rowhouses





Kindergarten



Schule



Sporthalle



Bank Niederlassung



Büro



Produktion



Archiv



Hallenbad



Supermarkt



Möbelgeschäft



Feuerwache

Bauphase: 2010 -2013
Bezogen: 15 April 2013





Office A.S.S.A. in
Santa Croce,
Italien. Architekt:
Silvia Mazzetti



Sanierung des
Marconi-Labors in
Coltano bei
Pisa/Italien zum PH



Ex Post Bolzano:
Passivhaus
Sanierung. Architekt:
Michael Tribus

PH in unterschiedlichen Klimaten:
**Die Prinzipien sind gleich,
die Details müssen angepasst werden.**



Lleida/Spain EF
Hen

© Architect Josep Bunyesc, Lleida



Meran/Italy

© Architect Michael
Tribus, Lana



Meltina/
Italy

18TH INTERNATIONAL PASSIVE HOUSE CONFERENCE 2014

Eurogress Aachen

25 - 26 April, 2014

with exhibition and
framework programme

(13 – 27 April 2014)



Ministerium für Klimaschutz, Umwelt,
Landwirtschaft, Natur- und Verbraucherschutz
des Landes Nordrhein-Westfalen



IG PASSIVHAUS
Informations-Gemeinschaft Passivhaus Deutschland



EnergieAgentur.NRW



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