Alpenkonvention – workshop Meran 23/24 July 2015

Energieinstitut Vorarlberg

on the way to zero energy buildings

achievements and constraints in Vorarlberg and Austria

Architekt DI Martin Ploß

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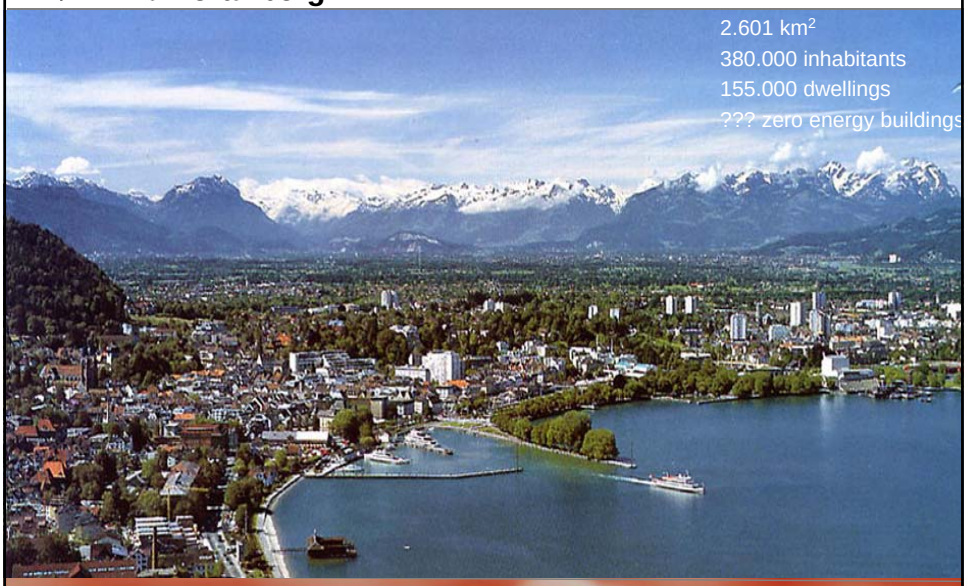
Vorarlberg



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1 long term strategies in energy policy

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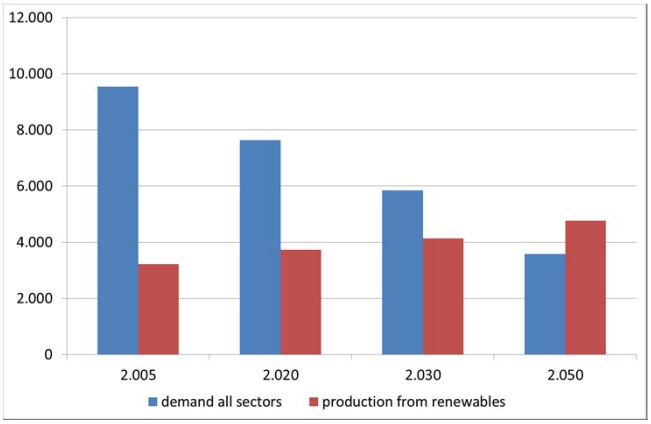
energy autonomy Vorarlberg 2050

total energy demand and production from renewables [GWh/a]



energy autonomy Vorarlberg is an all parliamentary party decision as of 2009

overall and sectoral targets for 2020 and first steps have been elaborated in a two year process till 2011

monitoring started in 2013

annual production from renewables matches total demand of all sectors by 2050

reduction of demand > 60%

increase of renewables > 50%

source: Energieautonomie Vorarlberg – unser Weg in eine unabhängige Zukunft; www.vorarlberg.at/energieautonomie

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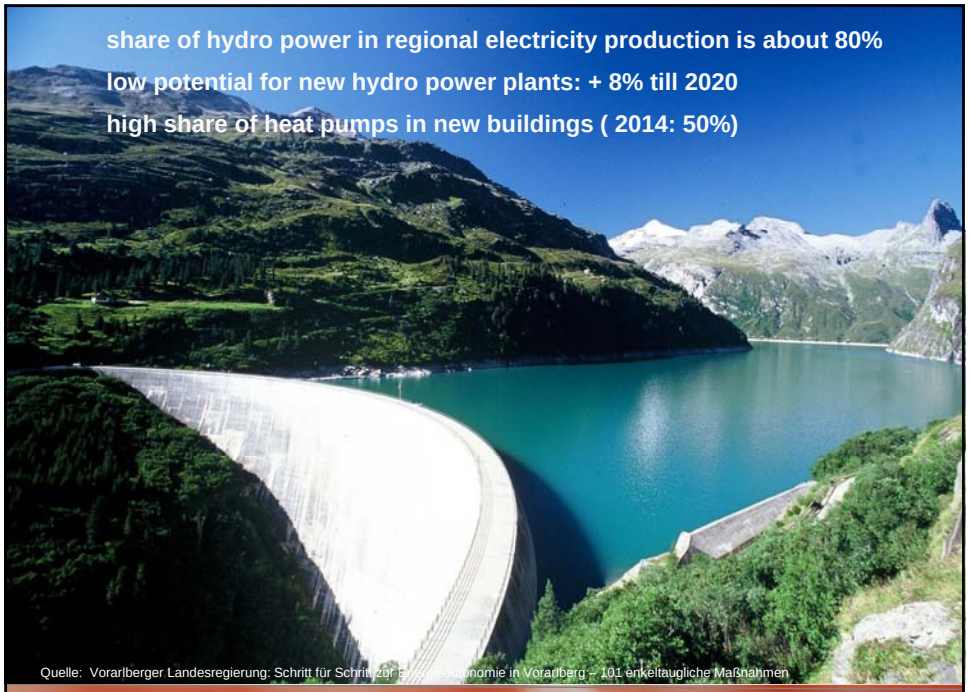

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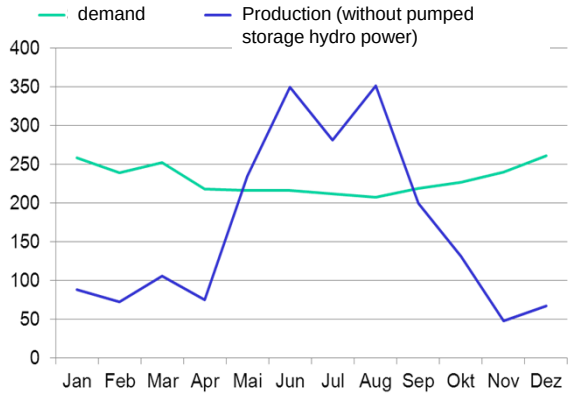
electricity – demand and production Vorarlberg 2010



demand
25% higher in winter

production
Peak of production in summer (alpine hydro power), low production and increasing import of electricity in winter

long term storage
Seasonal storage concepts are in a phase of first testing and will stay expensive

consequences for the building sector

- energy demand in winter has to be minimized in new and existing builings
- quality of energetic renovation has to be increased as well as renovation rate

source for graphics.: Energiebericht Vorarlberg 2010, Amt der Vorarlberger Landesregierung

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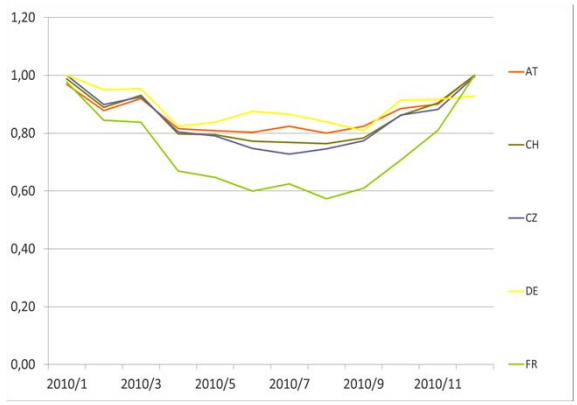
electricity demand in the course of the year

european states 2010



peak of demand
peak of electricity demand is in winter in 25 of 27 EU-countries

demand is 15 to 25% higher in winter in countries exchanging electricity with Austria

origin of imports
great share of the imported elctricity in winter is coal or nuclear based (Germany, Czech republic)

source: ENTSO-E, monthly consumption (in GWh) (Database 12.11.2011)

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2 status quo in energy efficient and ecologic building

passive house – single family

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passive house - school

PH Schule Klaus, Vorarlberg
Arch. Dietrich Untertrifaller, Fotos M. Ploss

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enerphit –refurbishment (social housing)

Bauherr: VOGEWOSI Arch. A. Sonderegger Foto: M. Ploss

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passive house + pv (zero energy?)

Plusenergiehaus in Krumbach, G. Morscher

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3 constraints

- low level of ambitions on national level
- impact of pv is overestimated in national calculation methode
- discussion about performance gap of efficient buildings
- rising building costs

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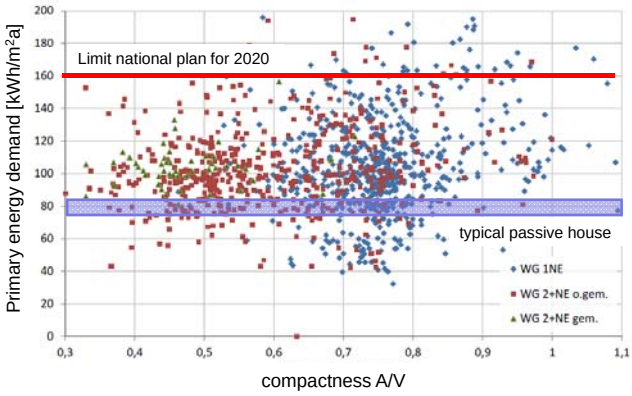
low level of ambition on national level

primary energy demand of new single and multifamily buildings
Values calculated in building certificates, Vorarlberg 2014



97% of the dwellings in new single and multifamily houses in Vorarlberg reach the primary energy limit of the national plan for 2020.

The primary energy demand of typical passive houses is about half of the limit planned for 2020.

source: Energie Ausweis Zentrale Vorarlberg – Jahresbericht 2014; Herausgeber: Amt der Vorarlberger Landesregierung, Abteilung Via, Fachbereich Energie und Klimaschutz; Autor: M. Brunn, Energieinstitut Vorarlberg

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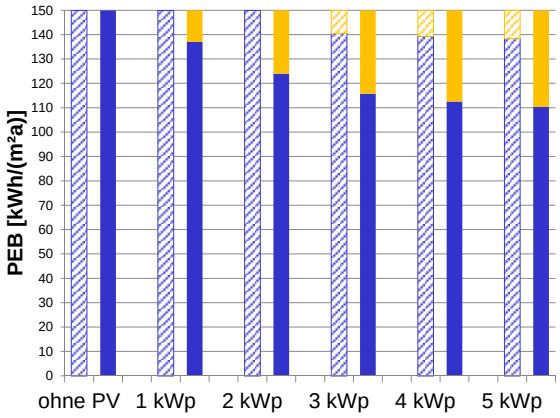
impact of pv-production on primary energy demand

comparison between hourly simulation and national calculation methode OIB RL 6



National calculation methode OIB RL 6(2011) over-estimates the share of pv-production used in the building.

While simulations on an hourly basis show, that a pv-system of $5kW_{peak}$ without batteries reduces the primary energy demand of a single familiy house at about 11 kWh/m²a, in OIB-calculations primary energy demand is reduced at about 40 kWh/m²a.

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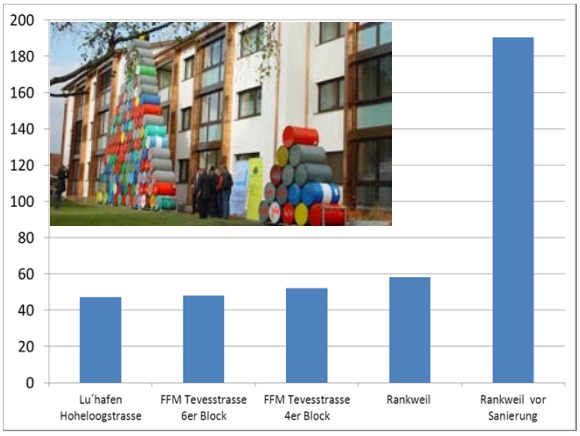
real life performance

measured final energy consumption heat + domestic hot water



very high savings in real life

good compliance between calculation and consumption

final energy consumption of refurbishment projects (measured room temp 21,5-23°C)

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Quellen: PHI (Projekte Ludwigshafen und Frankfurt); EIV für Projekt Rankweil

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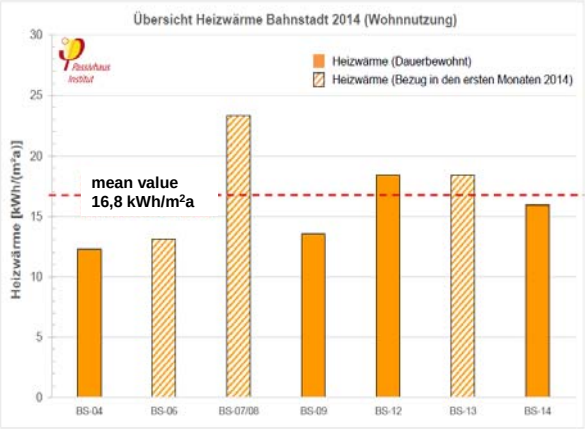
Real life performance

Measured consumption for heating an d dhw
Passive house distirict Bahnstadt Heidelberg , 1.200 dwellings, first year



source: R. Bermich: Passive house performance on a large scale: experience from passive house district Heidelberg-Bahnstadt Präsentation 19. Internationale Passivhaustagung, Leipzig, April 2015; foto: Energieinstitut Vorarlberg

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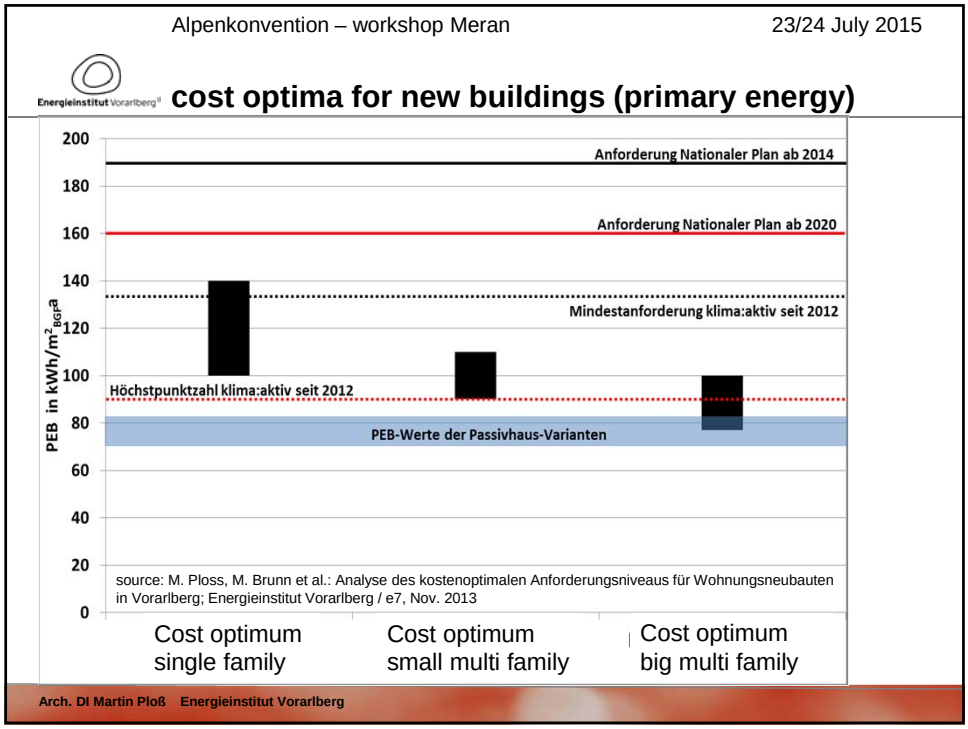

4 strategy for implementation of high efficiency buildings

- demonstration projects for efficient and ecological buildings
- implementation of more realistic calculation methodes
- new certificate rating energetic quality due to their real consumtion
- define energetic quality – leave decision for the concept to the client/planner
- demonstrate and compare economic feasibility of efficient buildings

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zero energy building Hard, Vorarlberg

passive house, 14m² solar thermal, 11kW$_{peak}$ PV, straw insulation

Planning: G. Zweier, M. Brunn; Foto: Martin Brunn

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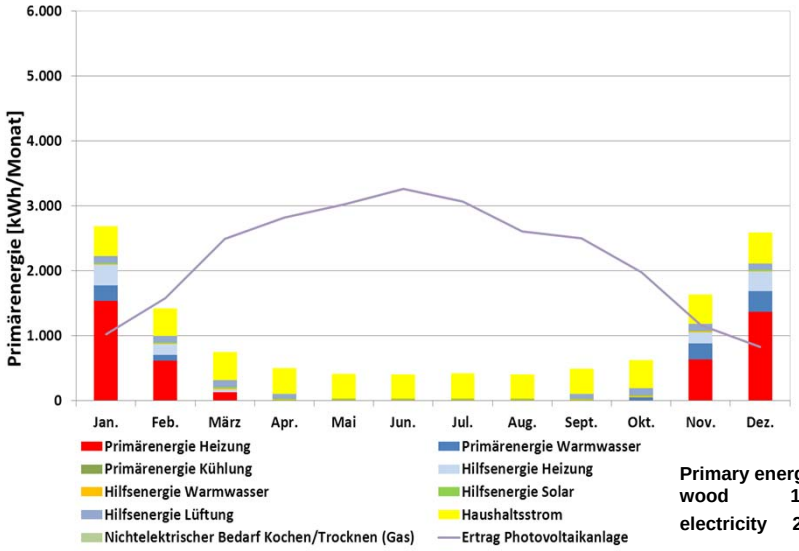
energy demand and pv production for house as realized



Primary energy factors
wood 1,08
electricity 2,62

Arch. DI Martin Ploß Energieinstitut Vorarlberg Quelle: Berechnungen Energieinstitut Vorarlberg (PHPP + Polysun)

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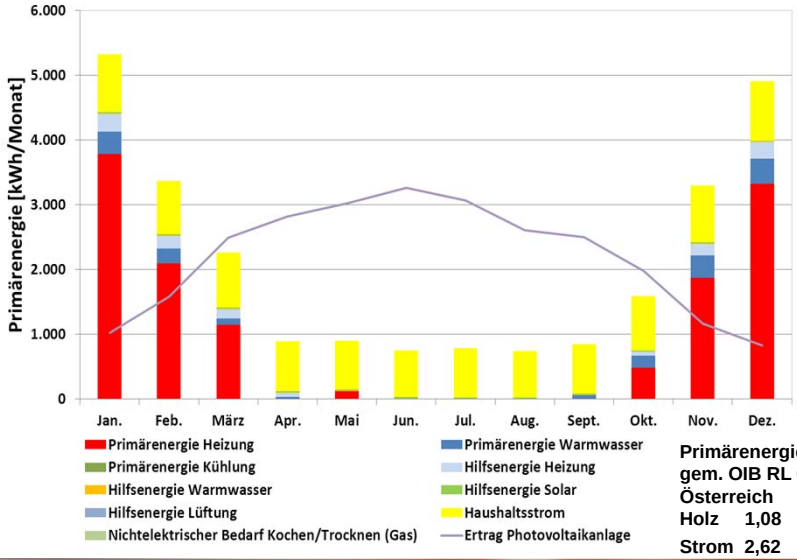
Demand and production – same house but low energy



Primärenergiefaktoren gem. OIB RL 6 für Österreich
Holz 1,08
Strom 2,62

Arch. DI Martin Ploß Energieinstitut Vorarlberg Quelle: Berechnungen Energieinstitut Vorarlberg (PHPP + Polysun)

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klimaaktiv rating system

B	**ENERGIE UND VERSORGUNG**		**max. 600**
B	**Energie und Versorgung (Alternative 1: Nachweisweg OIB-Richtlinie 6)**		
B 1	**Nutzenergie OIB**		**max. 350**
B 1.1a	Heizwärmebedarf OIB	M	250 bis 350
B 2	**End- und Primärenergie + CO_2 Emissionen OIB**		**max. 250**
B 2.1a	Komfortlüftung energieeffizient OIB		10 bis 50
B 2.2a	Primärenergiebedarf OIB	M	50 bis 100
B 2.3a	CO_2 Emissionen OIB	M	50 bis 100
B 2.4a	Photovoltaikanlage OIB		30 bis 60
B	**Energie und Versorgung (Alternative 2: Nachweisweg PHPP)**		
B 1	**Nutzenergie PHPP**		**max. 300**
B 1.1b	Energiekennwert Heizwärme PHPP	M	200 bis 300
B 2	**End- und Primärenergie + CO_2 Emissionen PHPP**		**max. 300**
B 2.1b	Komfortlüftung energieeffizient PHPP		10 bis 50
B 2.2b	Primärenergiekennwert PHPP	M	60 bis 125
B 2.3b	CO_2 Emissionen PHPP	M	60 bis 125
B 2.4b	Photovoltaikanlage PHPP		30 bis 60
C	**BAUSTOFFE UND KONSTRUKTION**		**max. 150**
C 1	**Baustoffe**		**max. 90**
C 1.1	Ausschluss von klimaschädlichen Substanzen	M	10
C 1.2	Vermeidung von PVC		10 bis 80
C 1.3	Einsatz von Produkten mit Umweltzeichen		5 bis 40
C 2	**Konstruktionen und Gebäude** (alternativ 2.1a oder 2.1b)	M	**max. 100**
C 2.1a	Ökologischer Kennwert des Gesamtgebäudes ($OI3_{BG3,BZF}$)		max. 100
C 2.1b	Ökologischer Kennwert der thermischen Gebäudehülle ($OI3_{TGH,BGF}$)		max. 75

Starting in 2016, a new class of certification will be introduced: in this class, the real consumption (and production) of buildings will be rated instead of the calculation results.

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low tec or high tec?

Upper pics from left: BE 2226 Baumschlager Eberle, Plusenergiesiedlung Freiburg, Arch. R. Disch, Nullenergiehaus Fa. Jenni
Lower pics from left: PH Bahnstadt Heidelberg, PH-school refurbishment, Arch. G. Zweier, straw-bale house, Arch. G. Bechter

source: upper right: Fa. Jenni; lower right: Arch. G. Bechter all other photographs: EIV

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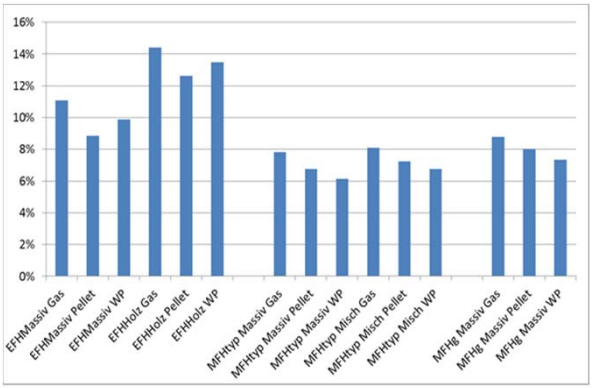
extra cost of passive houses versus minimum standard

results of cost optimality study (Energieinstitut 2013)



single family house: 8,8 to 14,4%

Multi family house: 6,2 und 8,8%

good conformance with extra cost of realized buildings: extra costs of multi family passive houses range from 4 to 8%