

**International Passive House solutions**  
Energy efficient building worldwide –  
Passive House Standard as one proven solution!  
COP21 Workshop Paris  
Günter Lang / Passivhaus Austria

**We love how comfortable our school is!**

Passive House Primary school Mariagrün Graz  
Architekturwerk Berktold Kalb  
GBG Gebäude und Baumanagement Graz GMBH  
Treated floor area: 2,015 m<sup>2</sup> = 21,700 ft<sup>2</sup>  
Heating demand: 11 kWh/m<sup>2</sup>a = 3.47 kBTU/ft<sup>2</sup>a  
Photo credits: Kurt Hörbst



# 55.000 Passive Houses exist in 28 European member countries



Sweden



UK



Belgium



Bulgaria



Denmark



Germany



Austria



Estonia



Finland



France



Greece



Ireland



Italy



Latvia



Lithuania



Croatia



Czech Rep.



Hungaria



Luxembourg



Netherlands



Poland



Portugal



Romania



Slovakia



Slovenia



Spain



Cyprus



# 2<sup>nd</sup> Largest Passive House worldwide

## Lodenareal / Innsbruck

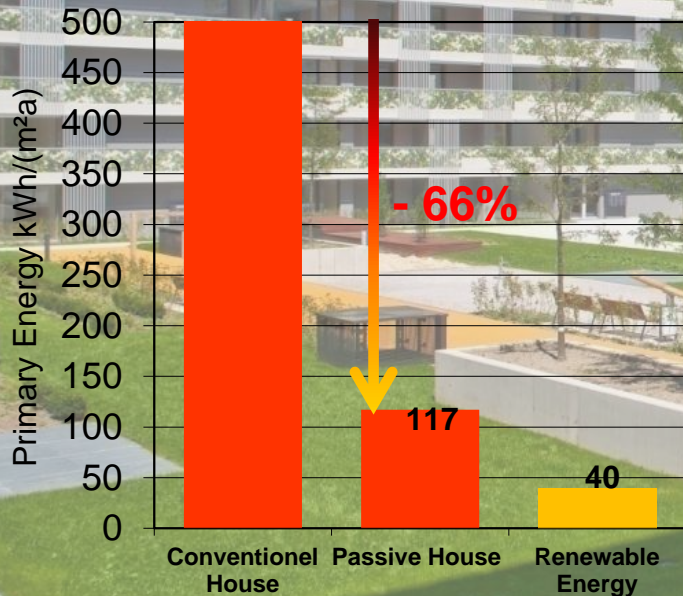
Developer: Neue Heimat Tirol

Architect: teamk2 / din a4 + Building physics: Herz & Lang GmbH

361 flats/ 27,800 m<sup>2</sup> = 299,300 ft<sup>2</sup>

Primary energy consumption 117kWh/m<sup>2</sup>a = 37.1kBTU/ft<sup>2</sup>yr

Developer NEUE HEIMAT TIROL builds only in Passive House Standard.  
Over 2,800 apartments finished, 700 more each year.

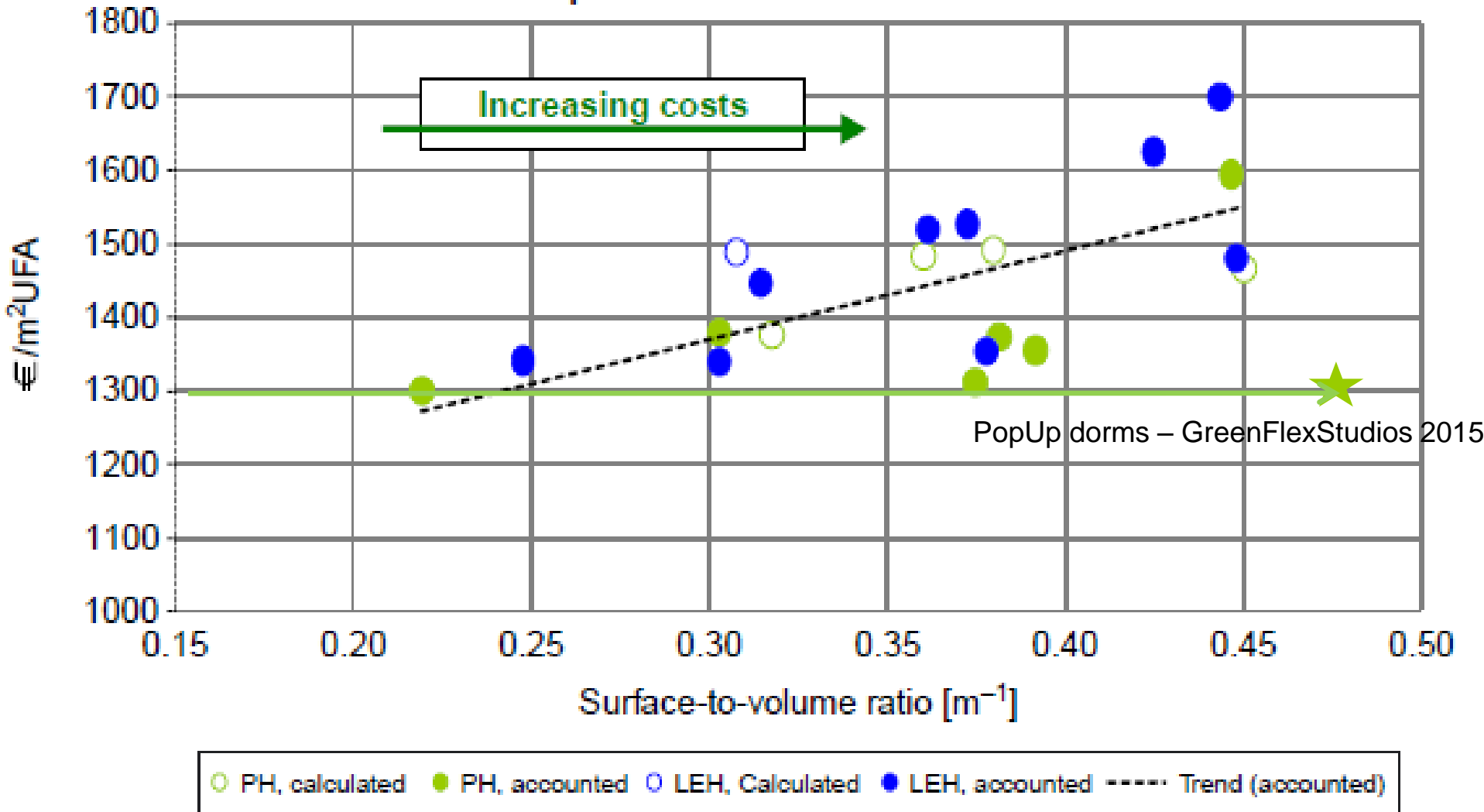


Pellets consumption 246m<sup>3</sup>/a = 8,690 ft<sup>3</sup>/yr,  
same consumption as 6 single family houses.

Inhabitant satisfaction result: 95%

# Sustainability evaluation of Viennese housing estates in the passive house standard – A post occupancy evaluation of selected criteria

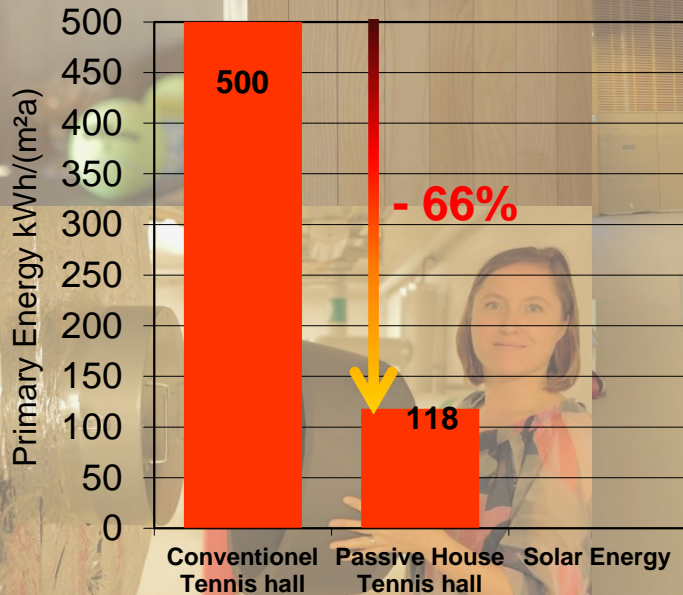
## Compactness and construction costs



BOKU 2009 Roman Smutny, Christoph Neururer & Martin Treberspurg



**Tennis hall Stefan Edberg in Växjö / Sweden**  
 Architecture Kent Pedersen Arkitektfirma Aps  
 Building physics Tyréns / IG Passivhus Sverige



Exterior wall U-value: 0.094W/m²K  
 Floor slab U-value 0.125 W/m²K  
 Roof U-value 0.068 W/m²K  
 Primary energy demand 118 kWh /m²a

Treated Floor Area 3,589 m²  
 Mixed construction

# New Plus Energi Headquarters for Syd Energi

Esbjerg / Denmark



Architecture GPP Arkitekter A/S  
Building physics Esbensen A/S

Treated Floor Area  $10,952 \text{ m}^2 = 117,900 \text{ ft}^2$   
Year of construction 2013



Annual heating demand:  $8 \text{ kWh / m}^2\text{a} = 2.53 \text{ BTU/ft}^2\text{a}$   
Primary energy demand:  $217 \text{ kWh / m}^2\text{a} = 68.8 \text{ BTU/ft}^2\text{a}$   
Curtain wall U-value:  $0.188 \text{ W/m}^2\text{K} = \mathbf{R 30}$   
Roof U-value:  $0.065 \text{ W/m}^2\text{K} = \mathbf{R 87}$

Heat pump using both heat recovery from the server room and a geothermal system.



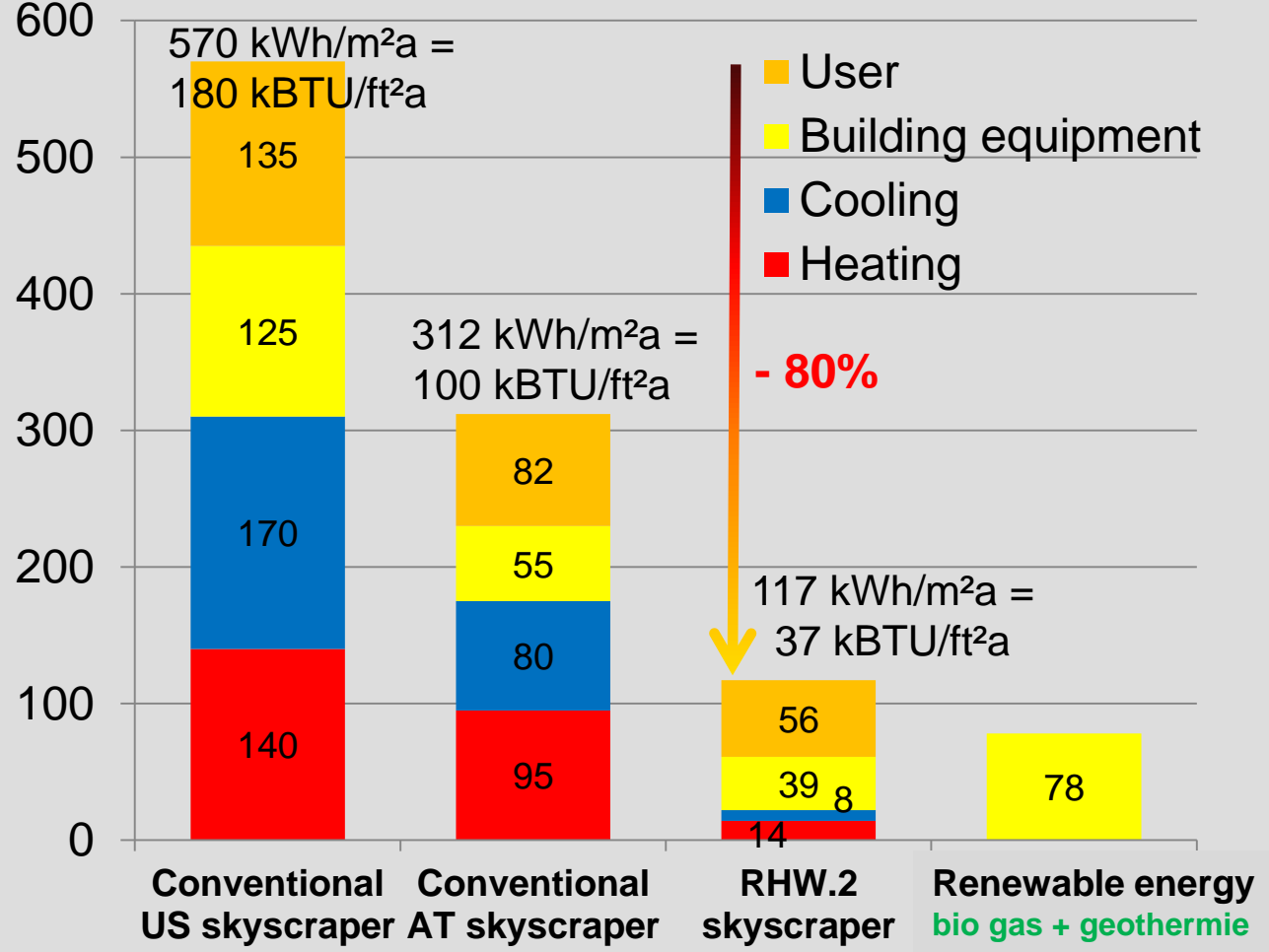


# RHW.2 Tower Raiffeisen-Holding NÖ-Vienna office

## World's first Passive high-rise office building

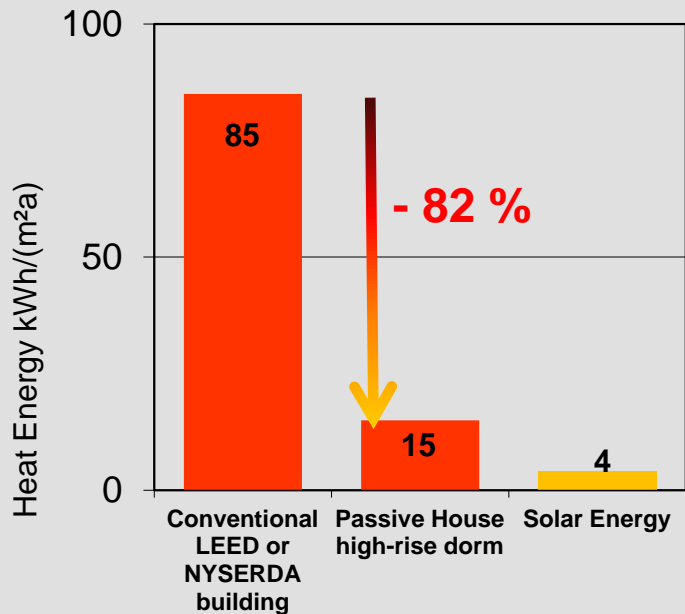
Architects DI Dieter Hayde and DI Ernst Maurer

### High-rise benchmarks energy consumption in kWh/m<sup>2</sup>a





Mayor Bill de Blasio



**Cornell University Residences**  
**World's Tallest Passive House High-Rise**  
**New York City / US**  
 26-story residential tower for Cornell University's new Roosevelt Island Campus  
 350 residences for students  
 save 882 tons of CO<sub>2</sub> per year

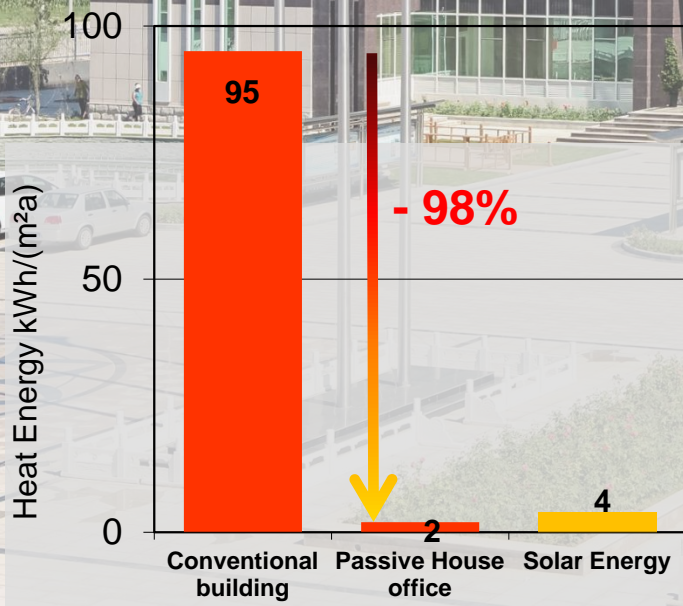


# Passive House office in China, Zhuozhou, Hebei (Beijing)

Passive House consulting Schöberl & Pöll GmbH

Treated Floor Area 2868 m<sup>2</sup>

## 河北新华幕墙有限公司



Exterior wall	U-value 0.095 W/(m <sup>2</sup> K)
Basement floor	U-value 0.085 W/(m <sup>2</sup> K)
Roof	U-value 0.069 W/(m <sup>2</sup> K)

Heating energy demand	2 kWh/(m <sup>2</sup> a)
Primary energy	100 kWh/(m <sup>2</sup> a)
Emission CO <sub>2</sub> -equivalent	26,3 kg/(m <sup>2</sup> a)

# Belgian & Netherland embassy (currently under construction)

Client: Foreign affairs ministry of Belgium

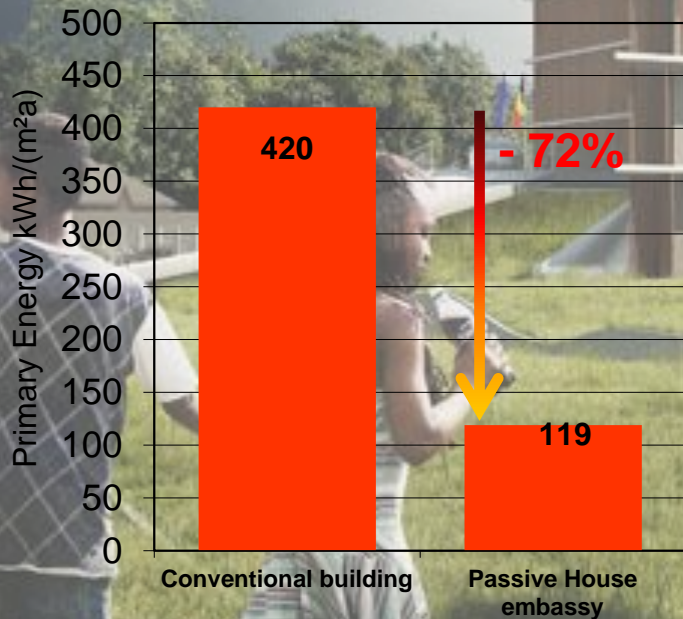
Kinshasa / République Démocratique du Congo

Architecte + physique du bâtiment: A2M

The most important impact in design is: sunshade and airtightness!  
Insulation 5cm PIR wall and roof

Surface 5 769 m<sup>2</sup>

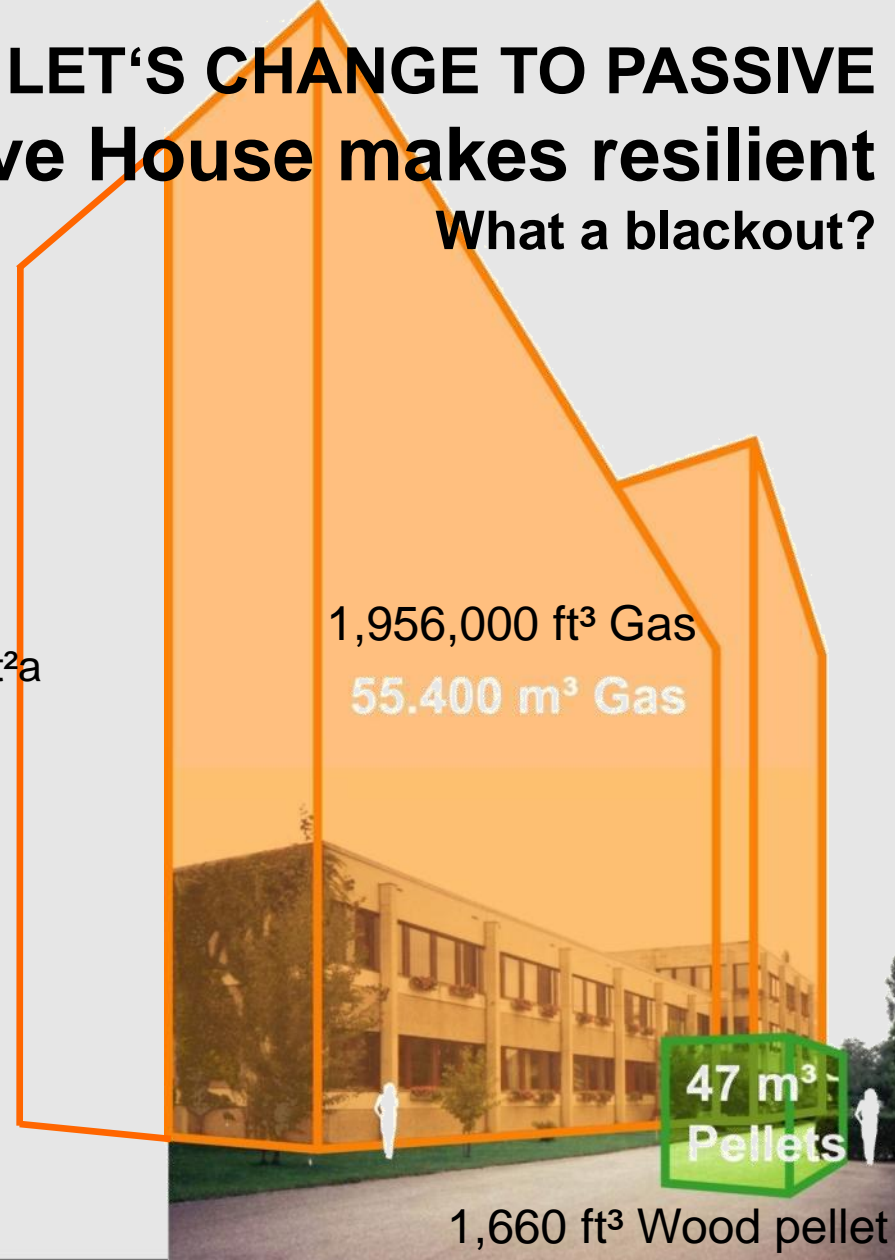
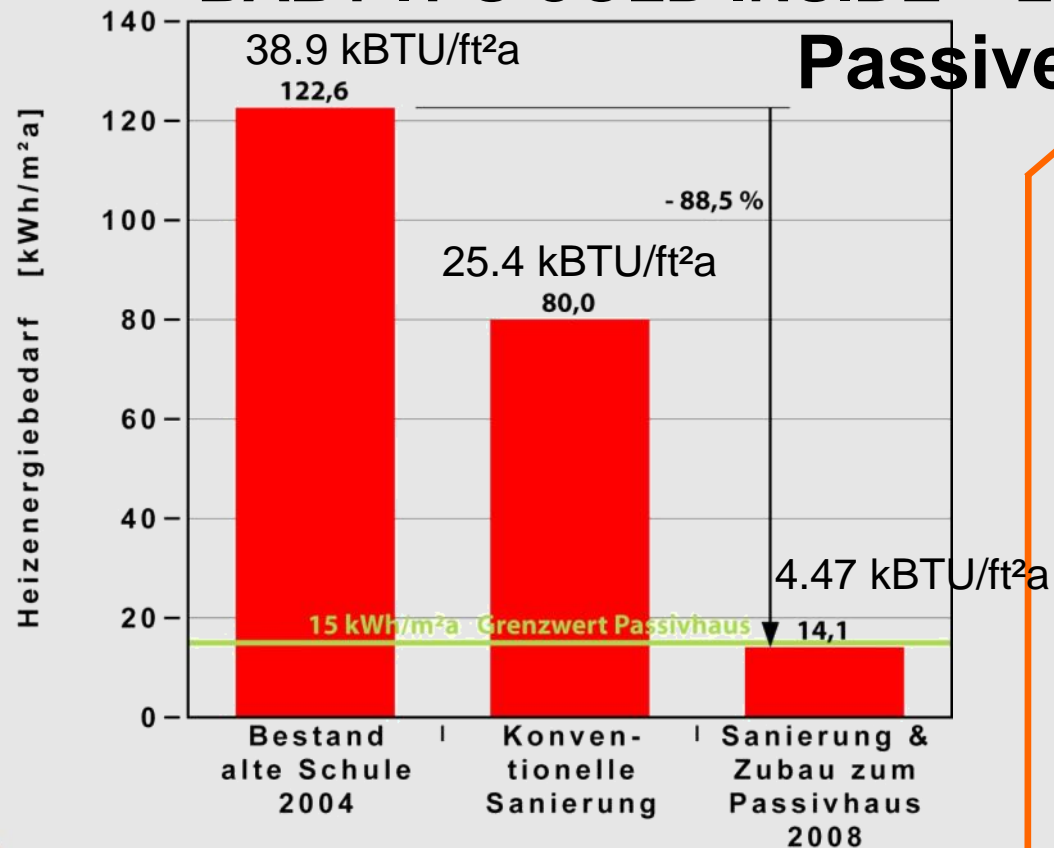
Cooling, dehumididity

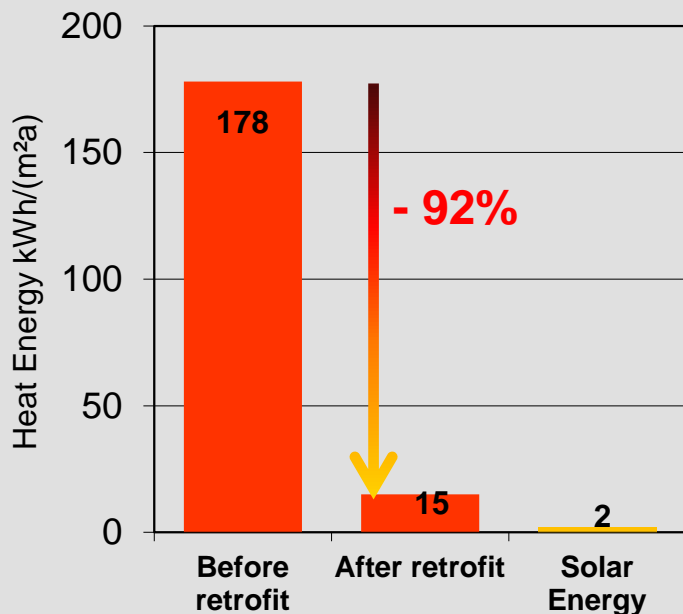
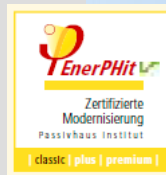


# BABY IT'S COLD INSIDE – LET'S CHANGE TO PASSIVE

## Passive House makes resilient

What a blackout?





## Historic building Eberlgasse

### Retrofit to Passive House

Net floor area 668.3 m<sup>2</sup>

Wall U-value 0.089 W/m<sup>2</sup>K

Heating demand from 178 kWh/m<sup>2</sup>a to 15 kWh/m<sup>2</sup>a

Primary energy demand: 108 kWh/m<sup>2</sup>a

for heating, hot water, household electricity

Owner: Andreas Kronberger Unternehmensberatung

Building physics: Schöberl & Pöll GmbH

# First retrofit to Passive House Plus

Office building **Technical University Vienna**

Architect: Arch. DI Gerhard Kratochwil

Building physics: Schöberl & Pöll GmbH

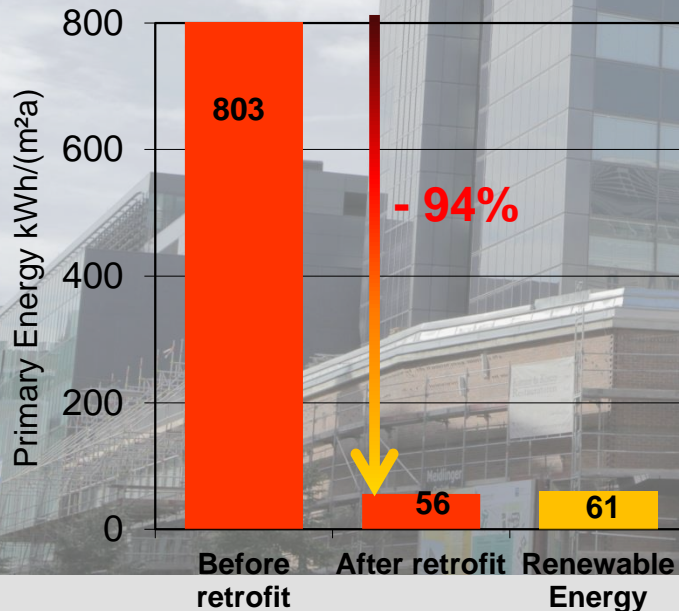
Owner: BIG Bundesimmobilien gesmbH

Treated floor area: 7,322 m<sup>2</sup> = 80,000 ft<sup>2</sup>

Heating demand: 14 kWh/m<sup>2</sup>a = 4.4 kBTU/ft<sup>2</sup>a

Heat load: 9 W/m<sup>2</sup> = 2.85 BTU/ft<sup>2</sup>

Primary energy: 56 kWh/m<sup>2</sup>a = 17.75 kBTU/ft<sup>2</sup>a



# Retrofit from old beer factory to Meininger Hotel

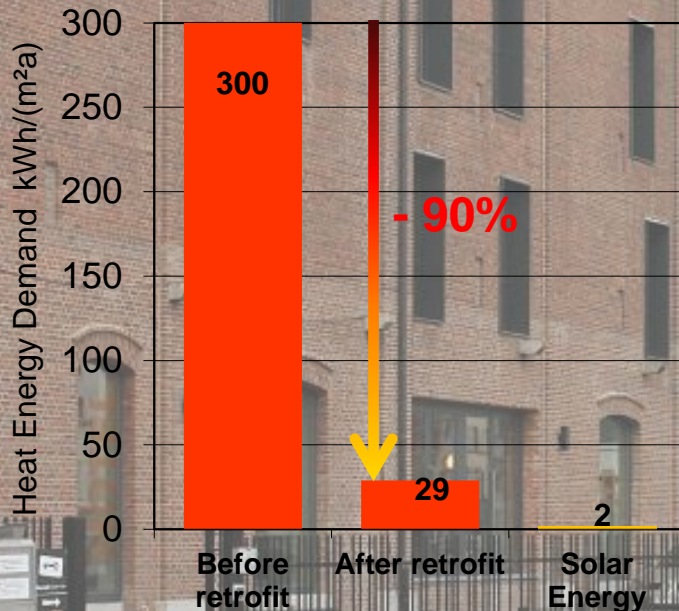
Molenbeek-Saint-Jean / Brussels / Belgium

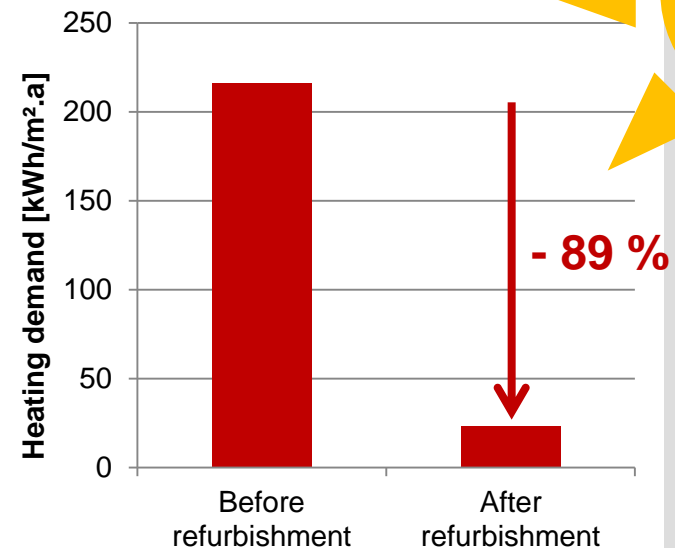
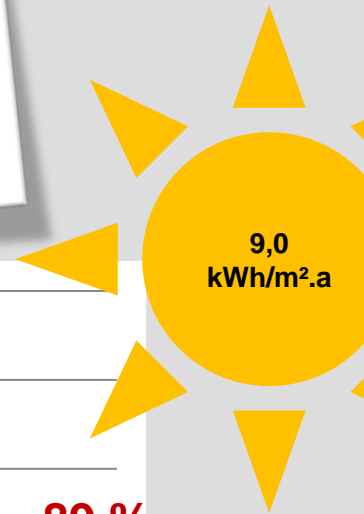
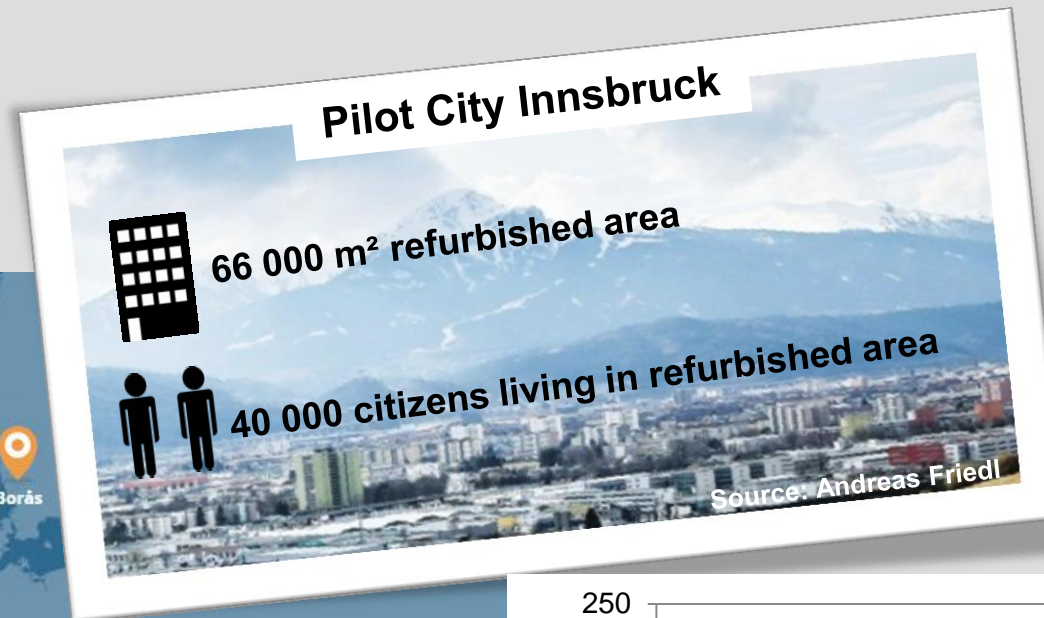
Architect A2M

Surface 8 714 m<sup>2</sup> with 150 rooms

Reduction of 520 tons of CO<sub>2</sub>-Emissions per anno

Building costs 872 €/m<sup>2</sup>

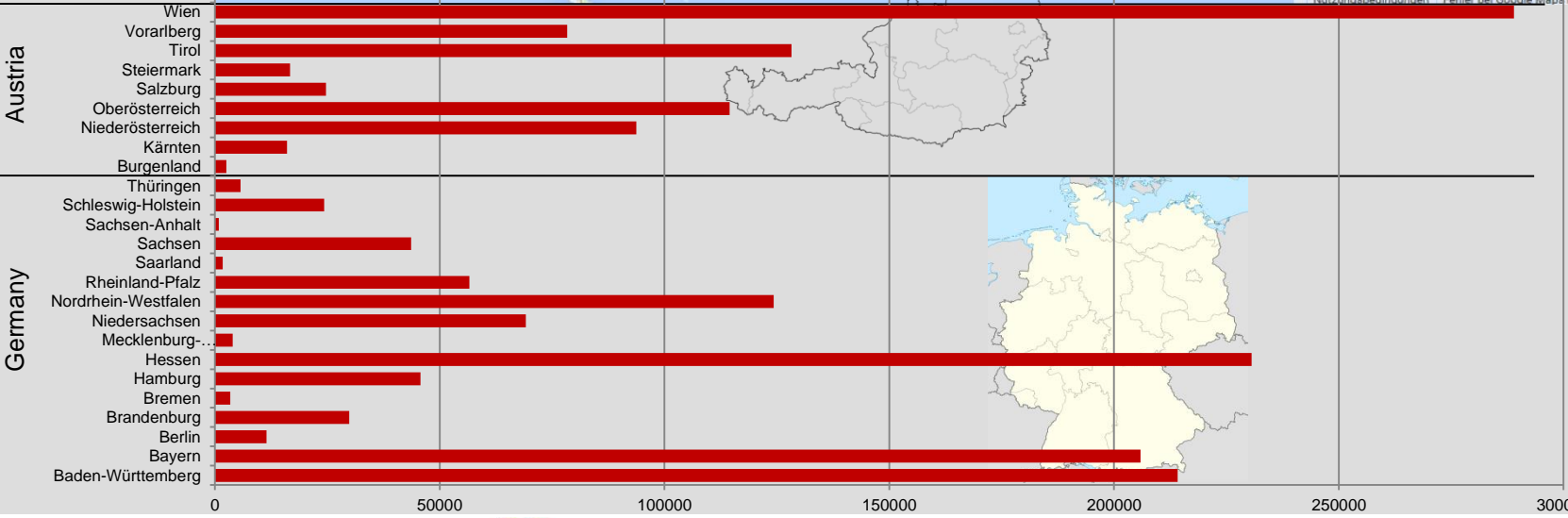




**Pilot City Innsbruck: 36 buildings**  
 12.5 GWh Energy saving per anno  
 0.6 GWh Renewable energy production

# International Passive House Database

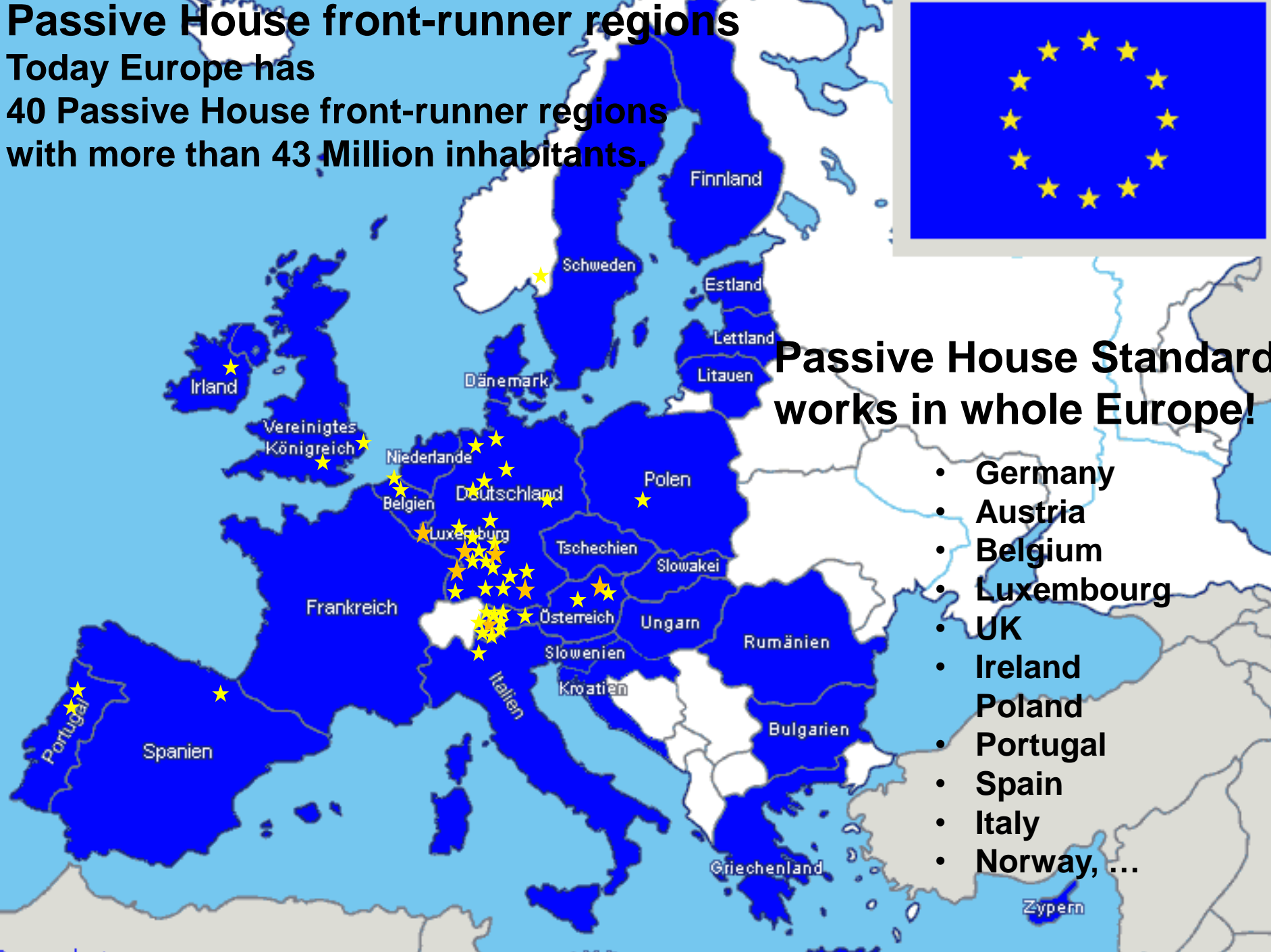
3,500 Passive Houses documented  
 2,173,196 m<sup>2</sup> sum of floor area  
 700 to visit during Passive House Days  
[www.passivehouse-database.org](http://www.passivehouse-database.org)





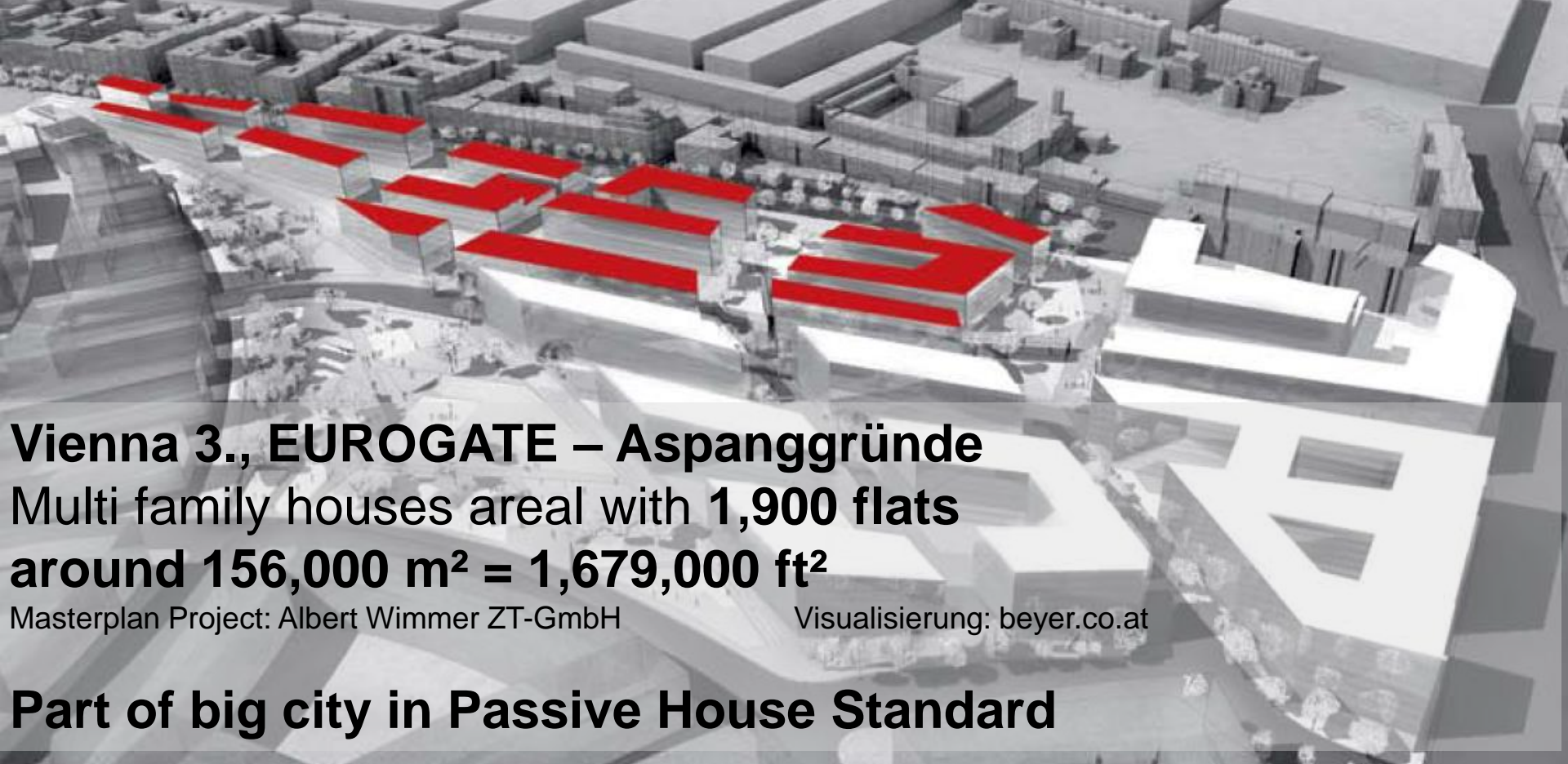
# Passive House front-runner regions

Today Europe has 40 Passive House front-runner regions with more than 43 Million inhabitants.



Passive House Standard works in whole Europe!

- Germany
- Austria
- Belgium
- Luxembourg
- UK
- Ireland
- Poland
- Portugal
- Spain
- Italy
- Norway, ...



# Vienna 3., EUROGATE – Aspanggründe

Multi family houses areal with **1,900 flats**  
**around 156,000 m<sup>2</sup> = 1,679,000 ft<sup>2</sup>**

Masterplan Project: Albert Wimmer ZT-GmbH

Visualisierung: beyer.co.at

## Part of big city in Passive House Standard





116 ha

**World's largest Passive House city district**  
Zero-Emission-City areal **Heidelberg-Bahnstadt**  
116 ha for 5,000 new job places + 1,700 flats  
Passive House as Standard for urban development

[www.heidelberg-bahnstadt.de](http://www.heidelberg-bahnstadt.de)





On 19 July 2011, the council of ministers of the State of Bavaria passed legislation regarding energy standards for public buildings stipulating that all new build administrative buildings be constructed to the Passive House Standard. In special cases, such buildings will be chosen as pilot Passive House projects.

[energiebericht\\_6 Bayern 2011.pdf](#)



Bavarian Parliament  
Bayerischer Landtag in München  
Maximilianum

Architect:  
Léon Wohlhage Wernik Architekten  
Construction: Massive  
2012

Heating demand  
 $5 \text{ kWh/m}^2\text{a} = 4,75 \text{ kBtU/ft}^2\text{yr}$   
Primary energy demand:  
 $116 \text{ kWh/m}^2\text{a} = 34 \text{ kBtU/ft}^2\text{yr}$

# Belgian Energy provider Elia

## Brussels mandated Passive House in January 2015



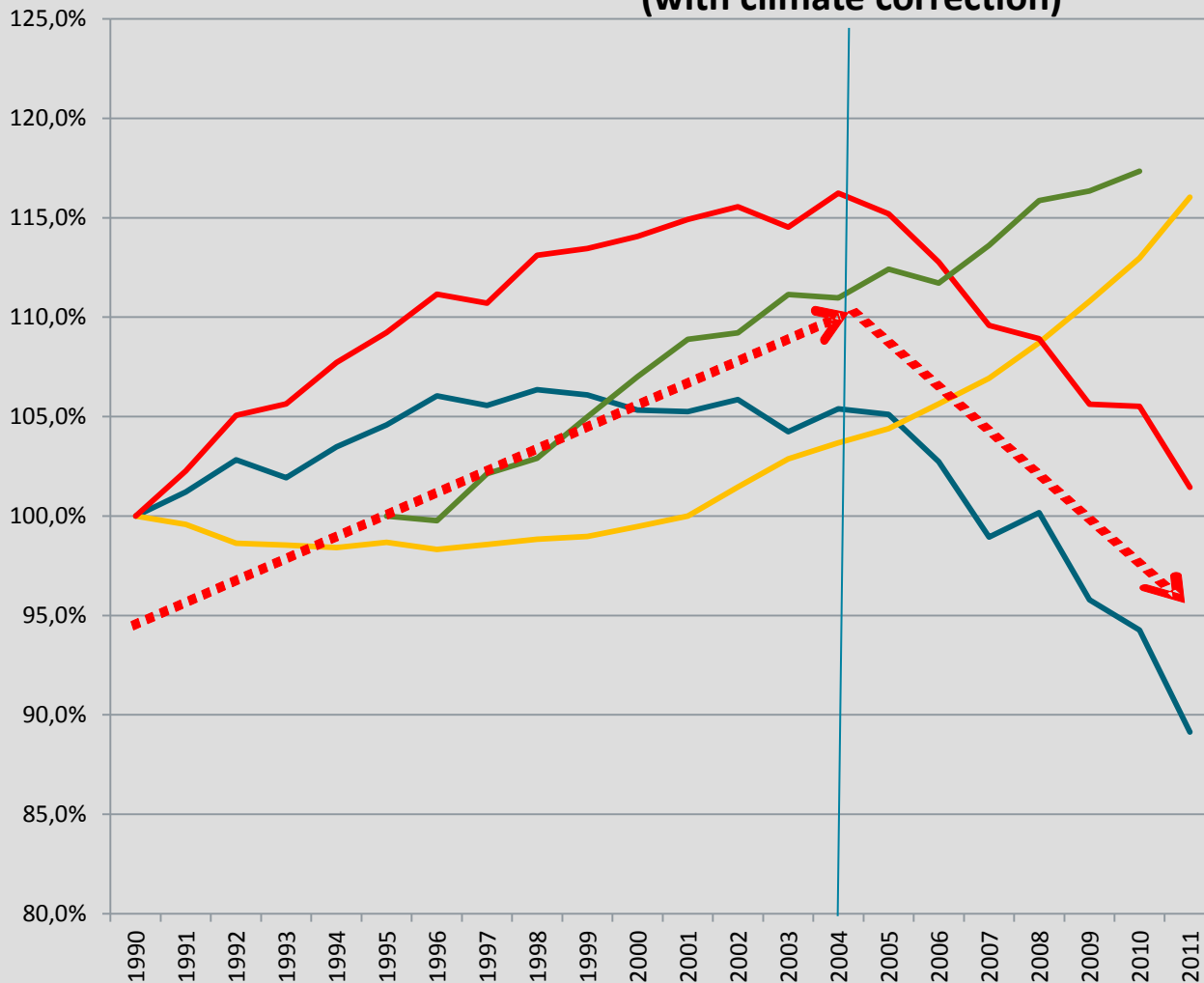
### High rise renovation to full PH



### Brussels Environnement Ministry

# Passive House performs!

## Energy consumption & Greenhouse gas evolution in Brussels (with climate correction)



**Tertiary sector Jobs**  
1995 - 2010 : **+17%**

**Population**  
1990 - 2011 : +16%  
1990 - 2004 : +4%  
2004 - 2011 : **+12%**

**Energy consumption**  
1990 - 2011 : + 1 %  
**1990 - 2004 : + 16%**  
**2004 - 2011 : - 15 %**

**Greenhouse Gas (GHG)**  
1990 - 2011 : - 11 %  
1990 - 2004 : + 5 %  
**2004 - 2011 : - 16 % -20%...**

# New York City goes Passive!

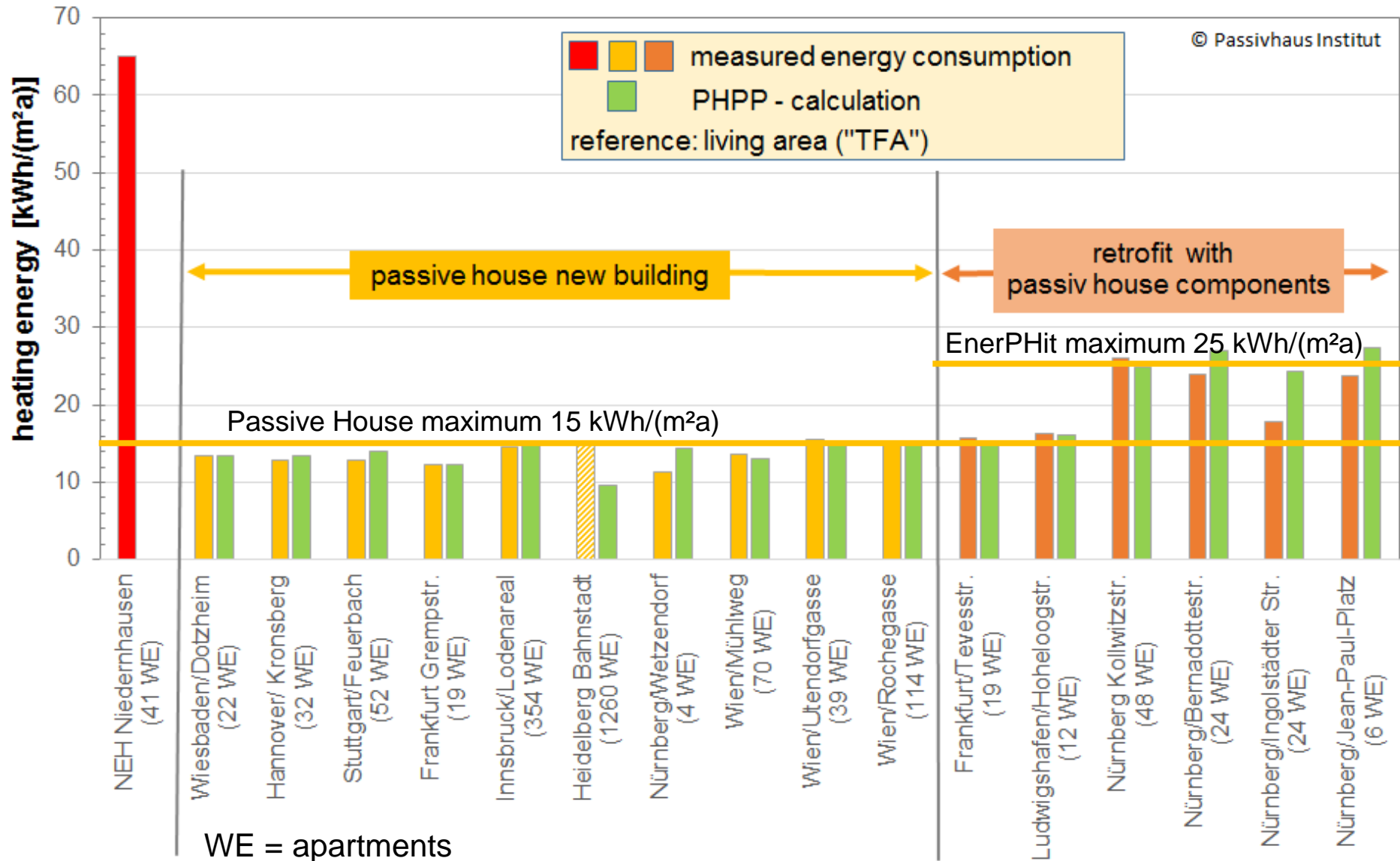


NYC Mayor De Blasio

## A Roadmap for New York City's Buildings:

“The City Government will implement leading edge performance standards for new construction that cost effective achieve highly efficient buildings, **looking to Passive House to inform the standards**”

# No Performance Gap with Passive House - Measured by over 2,100 apartments





# World Energy Efficiency Revolution

## Master Plan 2016 - 2036

€ 100.- /m<sup>2</sup> = 13.- \$/ft<sup>2</sup> subsidy for retrofits with 85% Energy Efficiency to EnerPHit-Standard for all buildings from 1930 to 1980

**Efficiency first!**

### One planet energy efficiency revolution

€ 5,000 (\$ 6,900) billion subsidy until 2036

= **€ 250 billion per year**

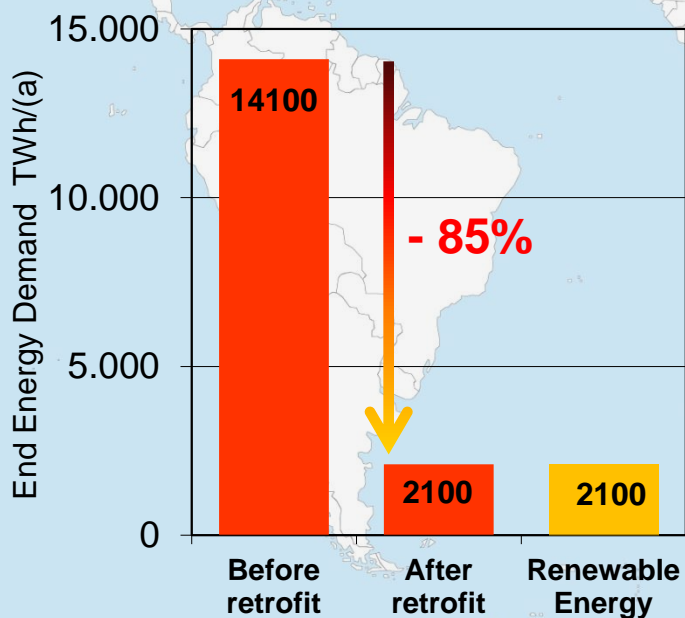
€ 7,000 (\$ 9,500) billion taxes + VAT

€ 2,000 (\$ 2,600) billion benefits for finance governments

€ 36,000 (\$ 49,000) billion invest volumina

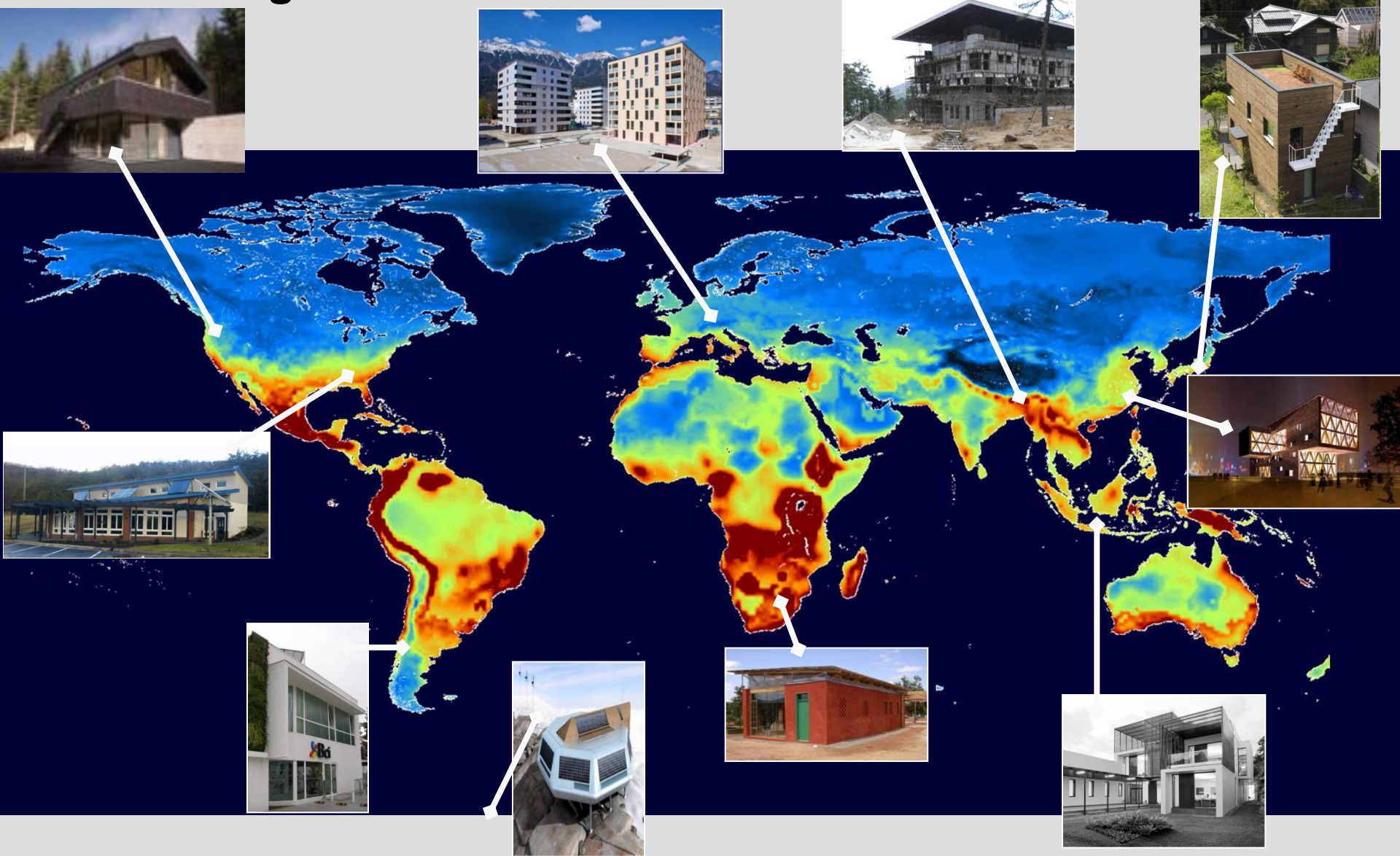
€ 46,000 (\$ 62,000) billion energy savings

€ 10,000 (\$ 13,000) billion benefit for humans on planet



- 60.0 billion m<sup>2</sup> living area
- **12,000 TWh in energy savings per yr**
- **6,620 million tons CO<sub>2</sub> reduction per yr**
- 39 million additional green jobs per yr

# More than 65,000 Passive House buildings and counting in all climate zones!





# Good envelope → low heating load

**High quality – good results!**

**Thank you for your attention!**

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

**[www.langconsulting.at](http://www.langconsulting.at)**

**[www.better-bee.com](http://www.better-bee.com)**

**[www-passivhaus-austria.org](http://www-passivhaus-austria.org)**

**[www.passivehouse-international.org](http://www.passivehouse-international.org)**