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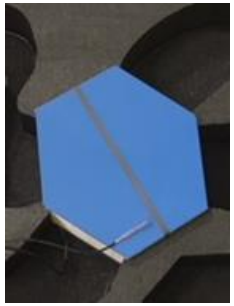
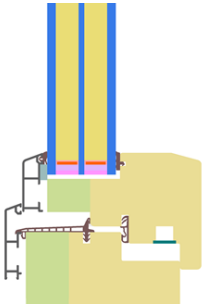
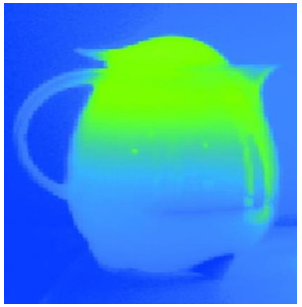
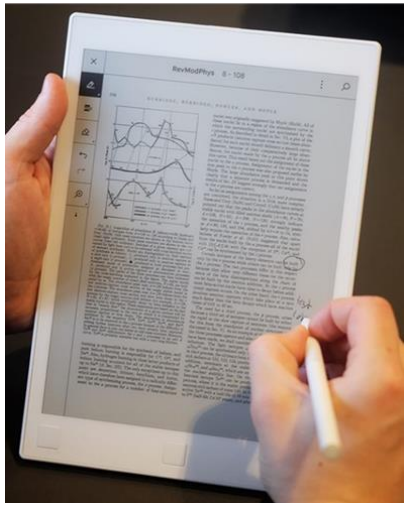
Energy Efficiency: Key for sustainable development

Prof. Dr. Wolfgang Feist









Dramatic Loss of Insects

Zoologists: -75% in 30 years…

- **causes: reduced habitats, fertilizer &pesticides, Climate Change**
- **Just this is a serious problem!**
- **But only one out of many: extreme weather, ocean level, aciditation,…**

- **Climate Change: no doubt, it‘s getting warmer**
  (Science: Susskind et al 2019; citizen scientists: Glaciers)

- **Causes: It‘s the greenhouse gases, especially CO_2**
  (Science: Miller et al 2014; citizen scientists: video Cox; CO_2)

- **This is an existentiel problem for human civilisation!**
  (Science: IPCC; citizens: world wide reaction to migration)

- **But we can still limit it to an acceptable level.**
  (…that is what this conference is about!)

Make no mistake: Temp. will at the beginning still continue rising.

The laws of nature don‘t care about human psychology.

Susskind et al 2019: Recent global warming as confirmed by AIRS; Environ. Res. Lett. 14(2019)
Miller et al 2014: CMIP5 historical simulations (1850–2012) with GISS ModelE2;J. Adv.Model.EarthSyst.6, 441–47

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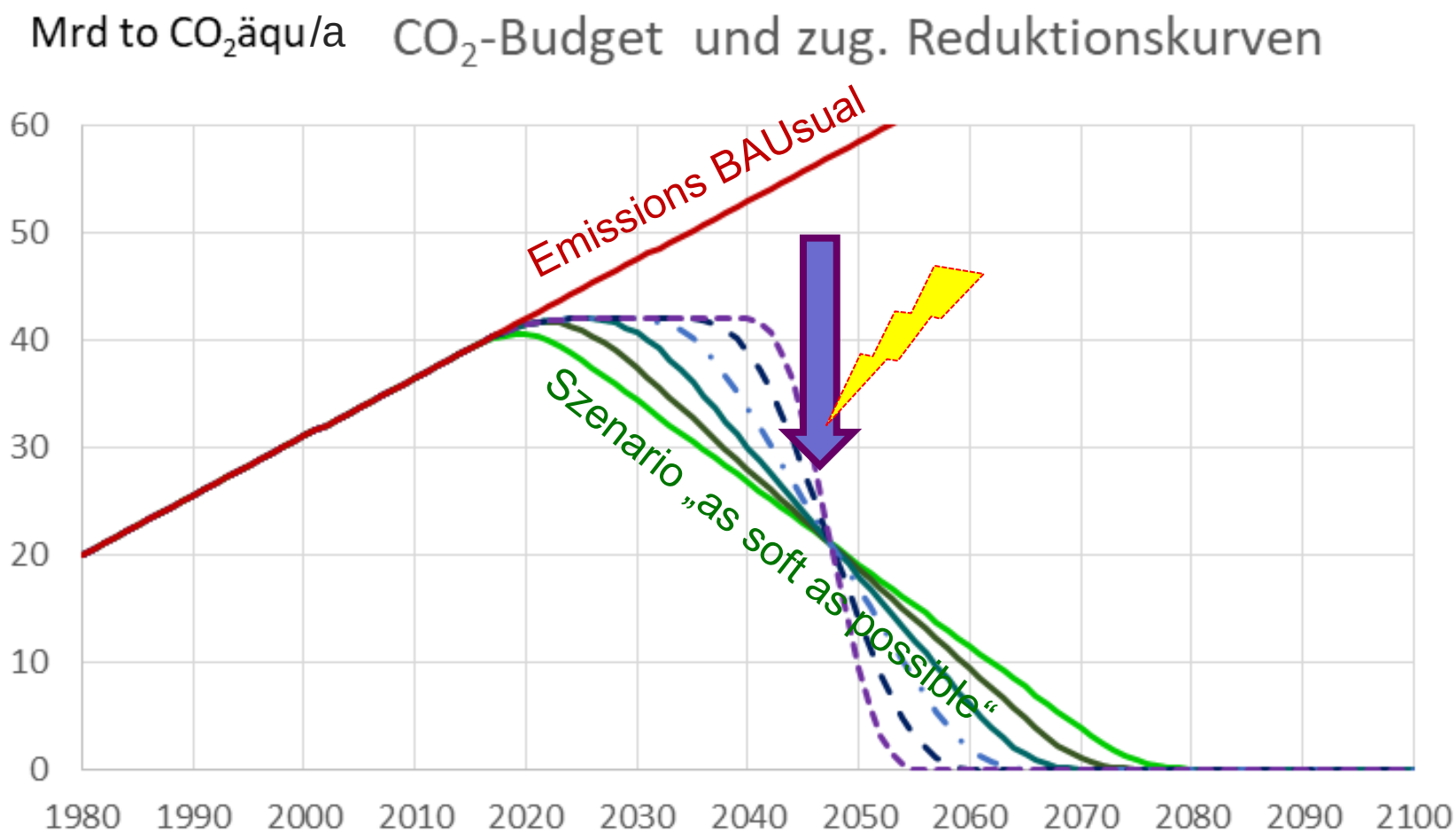
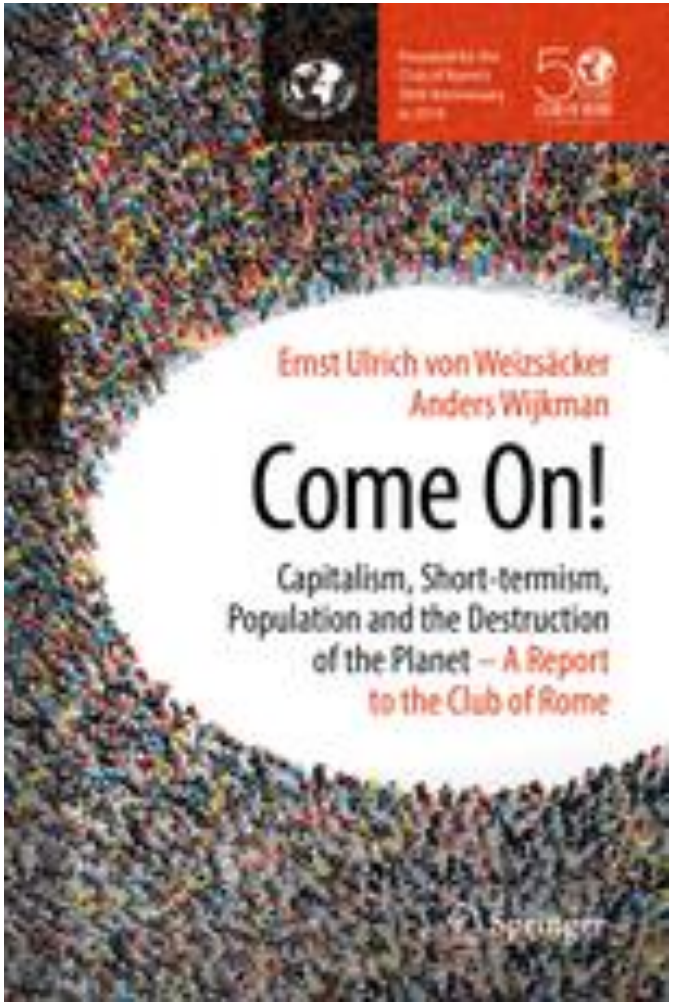


➢ **Curves of equal budget-emissions Billion tons CO_2-equi (IPPC 1170Gt)**



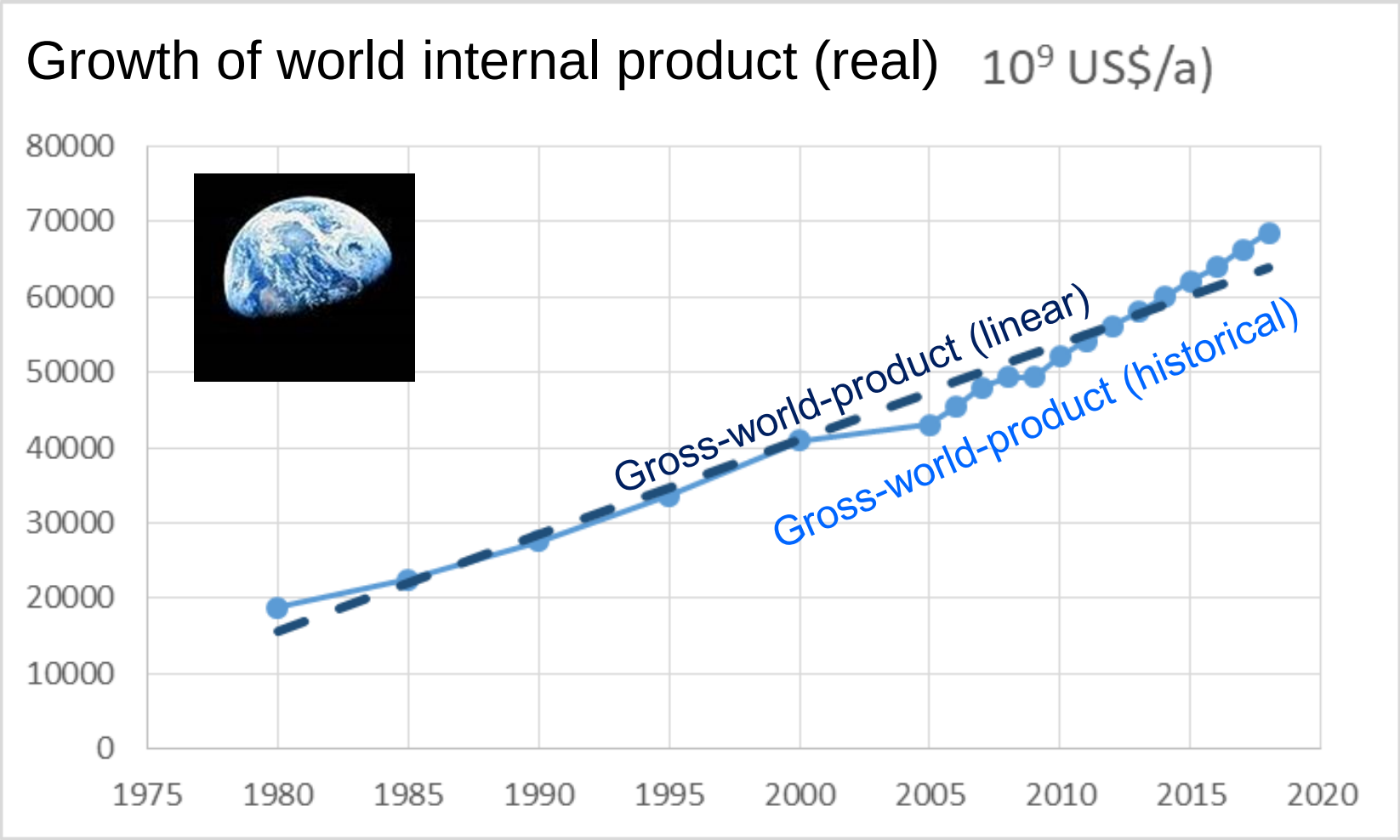
Can we still manage this?

What will not work: the extremes:

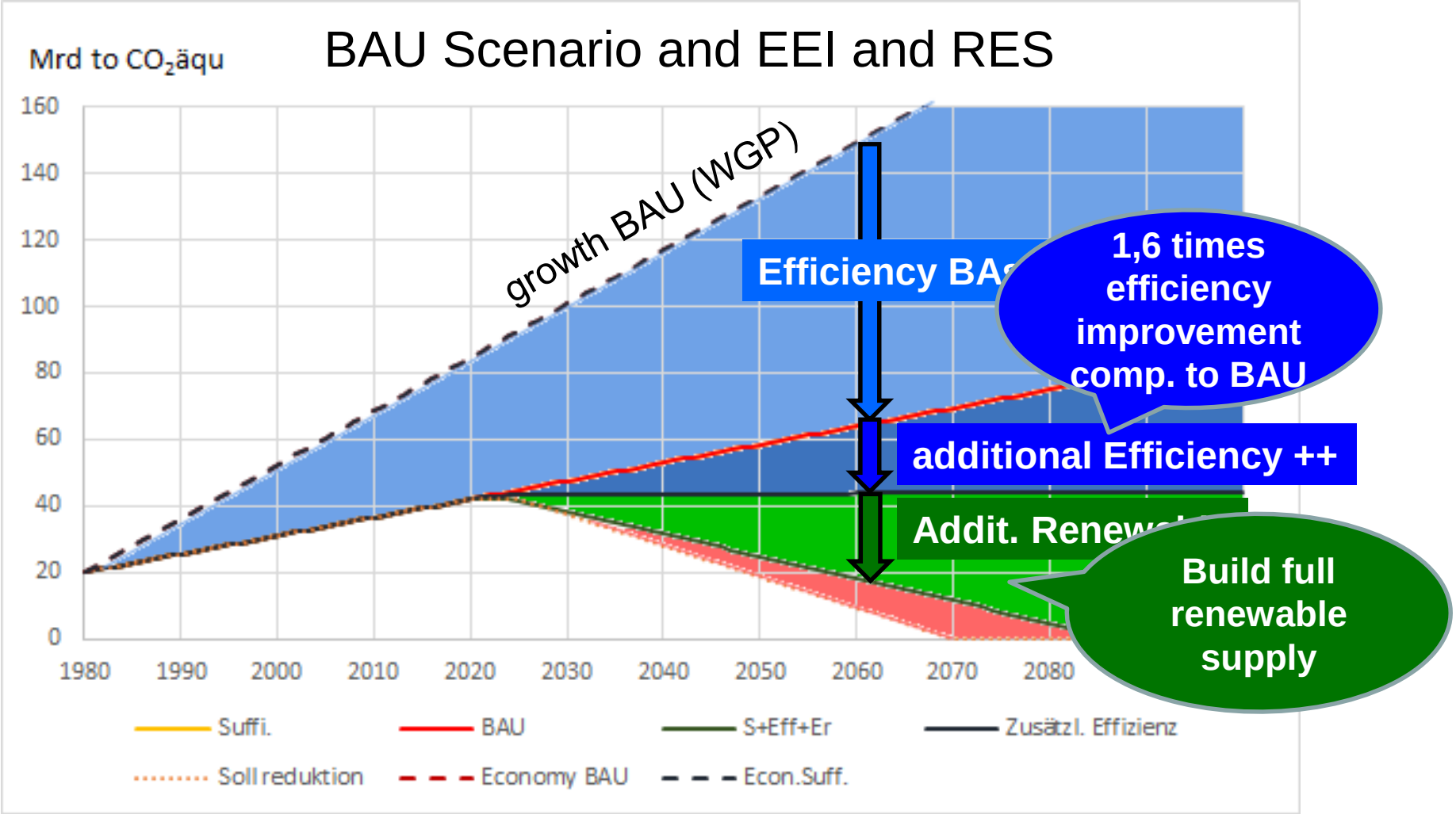
- **Busin. As Usual (BAU)**
- **Fast Total Emission Stop**

We will need:

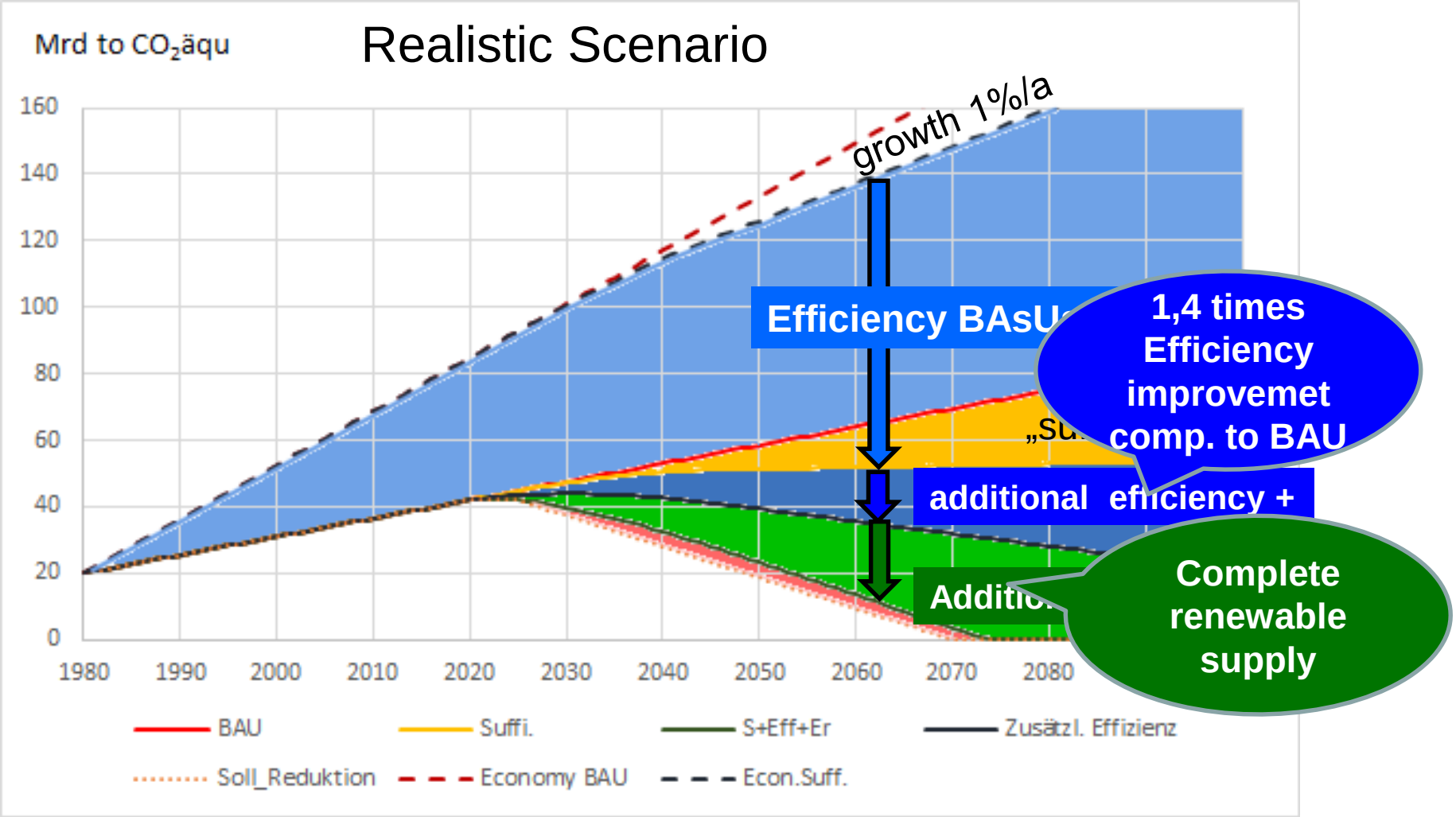
- **Real change**
- **Decisive action**
- **Everything doable**
- **Transformation of the whole energy system**



Global wealth (gross-world-product)

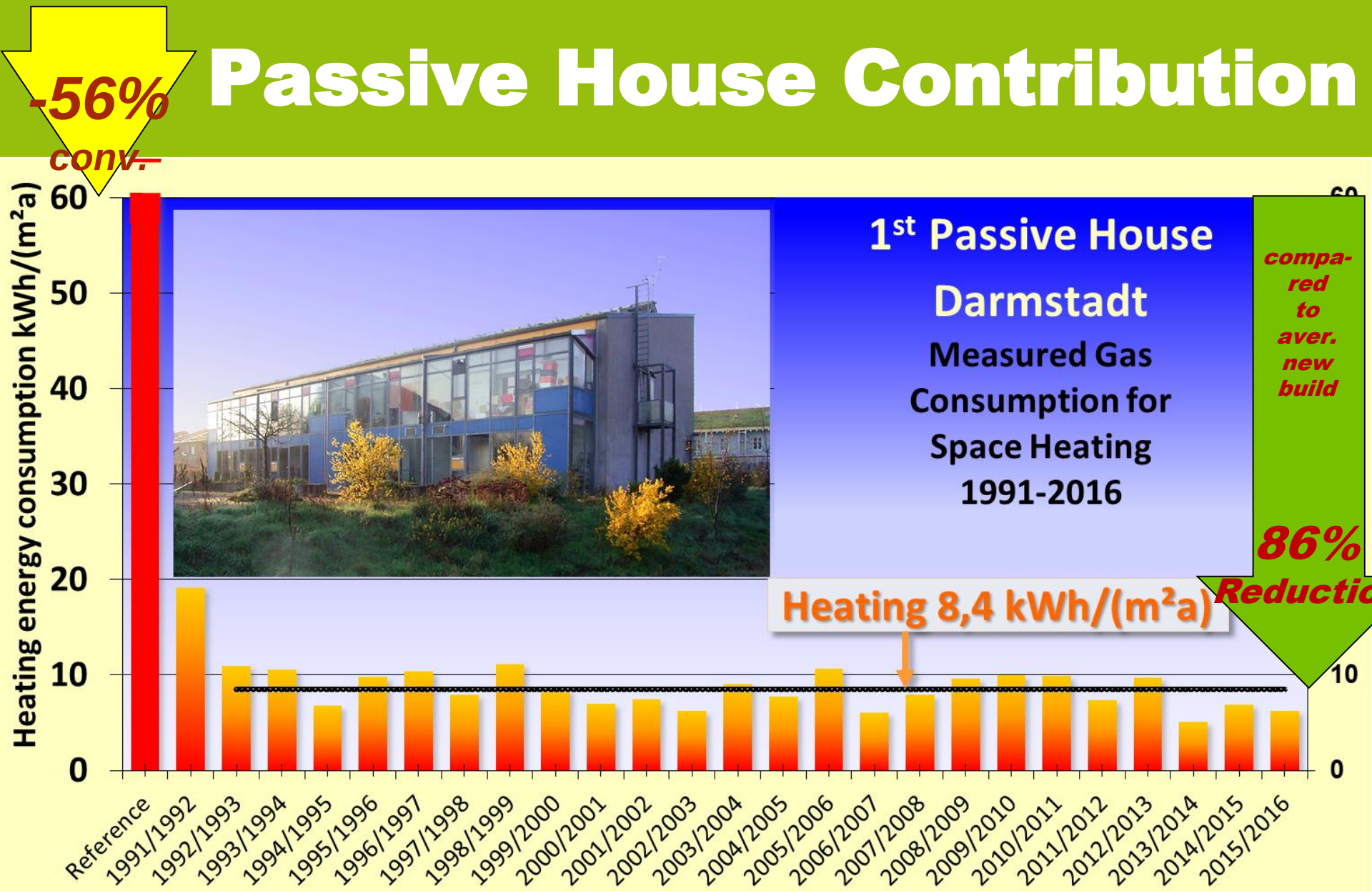


- Scenario on the basis of economy „Business As Usual“ (BAU)
- + maximum improvement of efficiency for all services EEI
- + massive installation of Renewable Energy RES



- Scenario based on „sufficiency“ economie 1%/a from 2040
- + realistic consequent Efficiency improvement all services
- + realistic deployment of Renewable Energy

Passive House Contribution



- Passive House Eff.: Factor 1,5*improved to std-new construction (>1,4)

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More than 200 $\frac{kWh}{m^2a}$

85% im-prove-ment

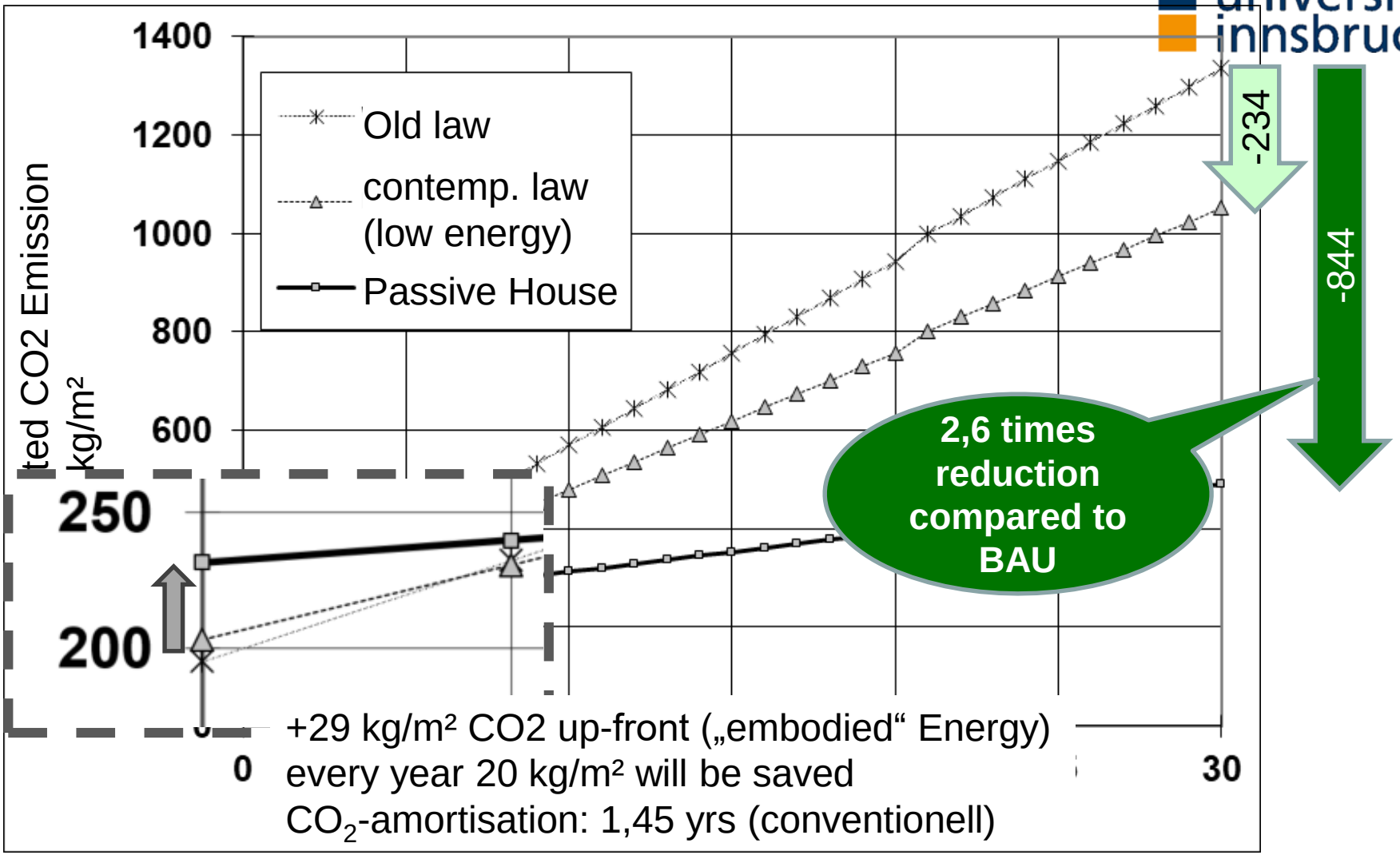
55% conv.

26 kWh/m^2a

After

Before

- EnerPHiT-Eff.: Factor 1,6*improved to std refurbishment (>1,4)



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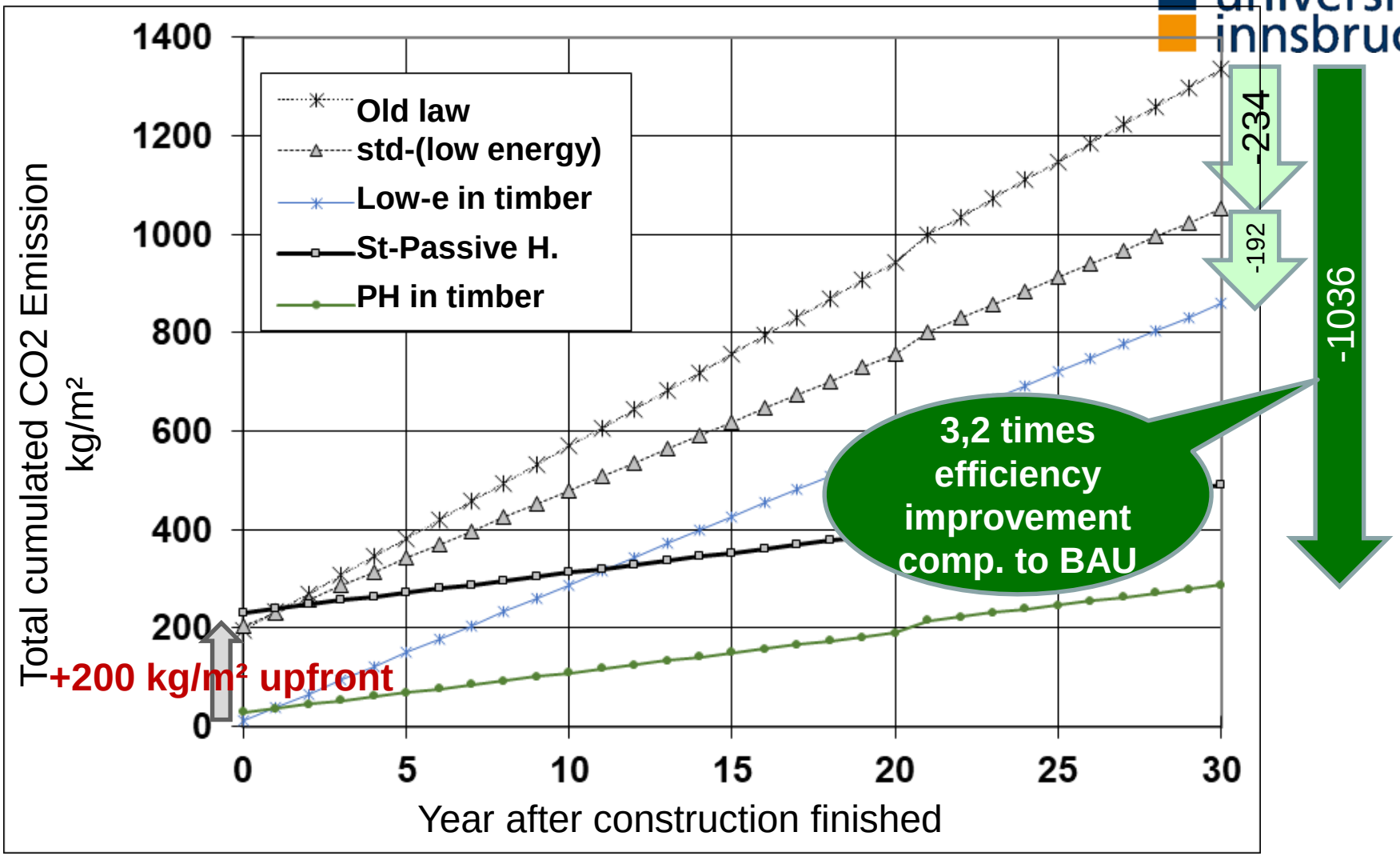
- **ecological Balance (CO_2 / embodied energy)**



➢ **ecological Balance (CO_2 / embodied energy)**

Architect Björn Kierulf / Bratislava; production in Vilnius

Ecococon – certified straw-prefabricated Passive House-Constr. System

- **Passive House: +Renewable + sustainable material (Timber/Straw)**

Passive Houses for affordable residential buildings

Quelle: Fotograf Herbert Kratzer

Savings

45kWh/(m²a)

@83 €/m²

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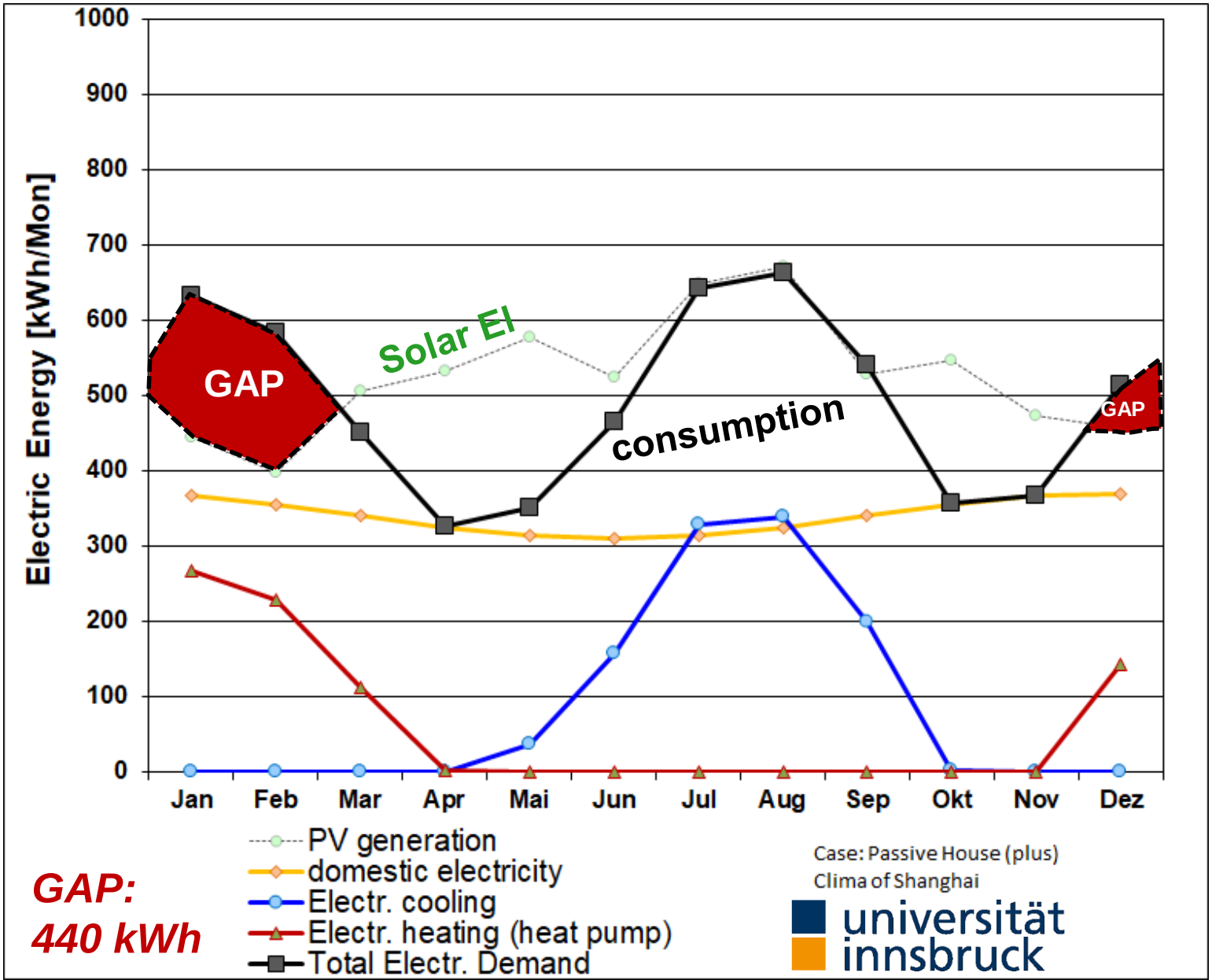
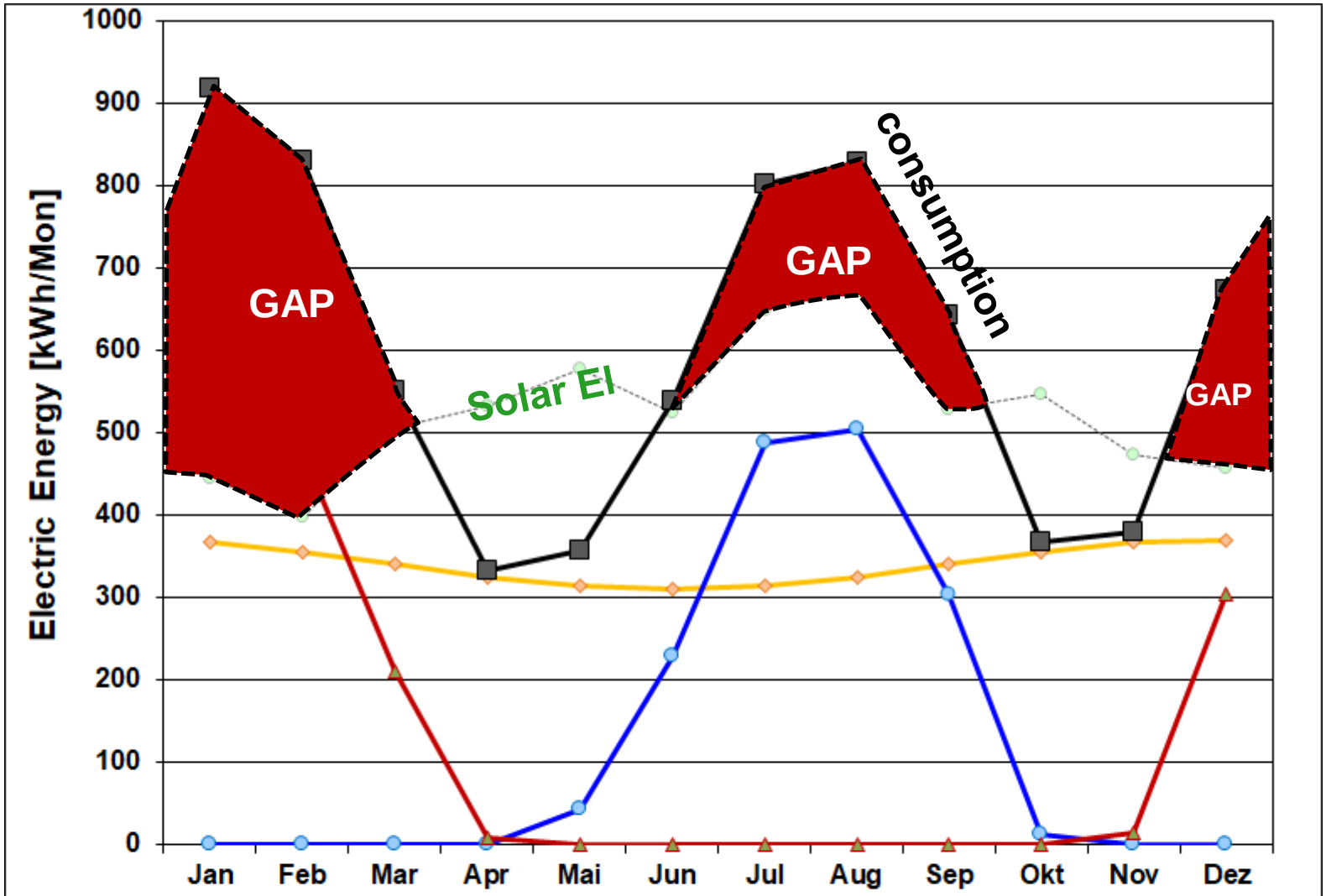
Passive Houses in Shanghai Climate



Low E House in Shanghai Climate



GAP: 1867 kWh

Case: Low Eneregy Std
Clima of Shanghai

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IWU
[Großklos 2017]
(… here also measurement results)

IWU Institut Wohnen und Umwelt

Monitoring of Passive House Plus (Frankfurt)

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Passivhaus:

- optimal comfort
- healthy indoor air
- reduced total cost
- solution for climate protect.
- sustainable growth
- participation and comprehension

win^6

彻底改善农民的生活
Thoroughly improve the lives of farmers

Source: Zhang Xiaoling / former Mohurd China

彻底改善农民的生活
Thoroughly improve the lives of farmers

- 极大地改善了农民的居住环境

Improving farmer living inside environment.

- 帮助农民摆脱贫困

Help farmer to get rid of poverty

1)采暖费少了 Reducing heating cost

2）获得了可留给子孙的财产 Obtain property that be left to future generations.

3）助农户获得房产收入 Help farmer to obtain income from passive housing

3 降低了农民的日常劳动强度 Reduce labor intensity

4 村民病痛得到缓解To alleviate their pain and suffering.

5人们可以随时洗个澡了Take a bath at any moment

6 农民回流了 Backflow to countryside

7对保护青山起了积极作用Protect the green mountains

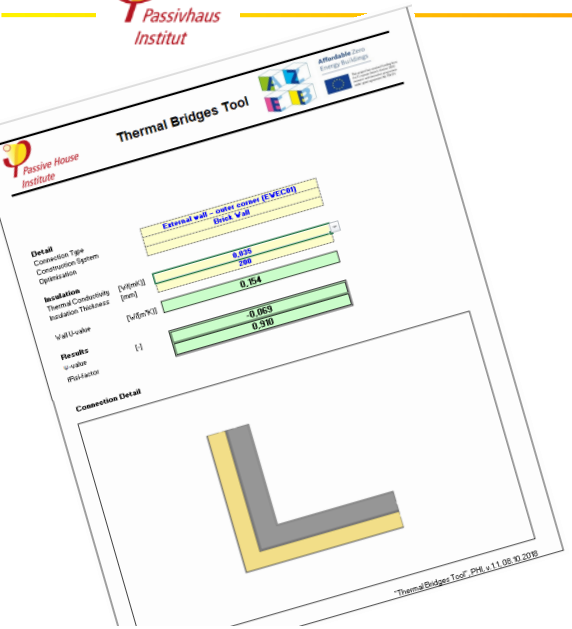
8 改变了农民的生活方式 Change farm’s life- style.

Source: Zhang Xiaoling (Beijing Qangjy certification center)

Tools | Newly developed supproting Tools

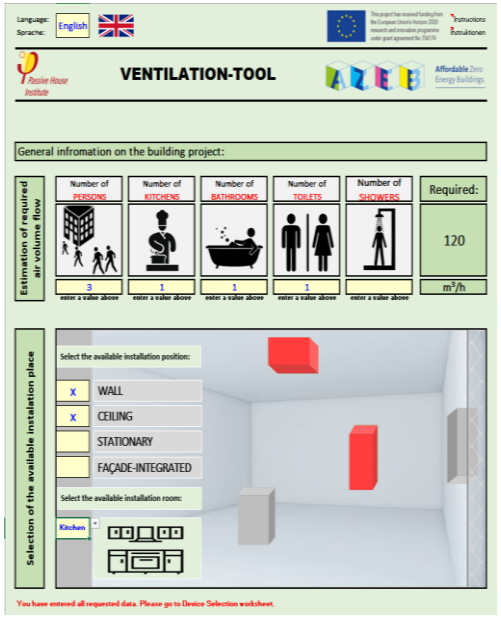
Affordable Zero Energy Buildings

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 754174



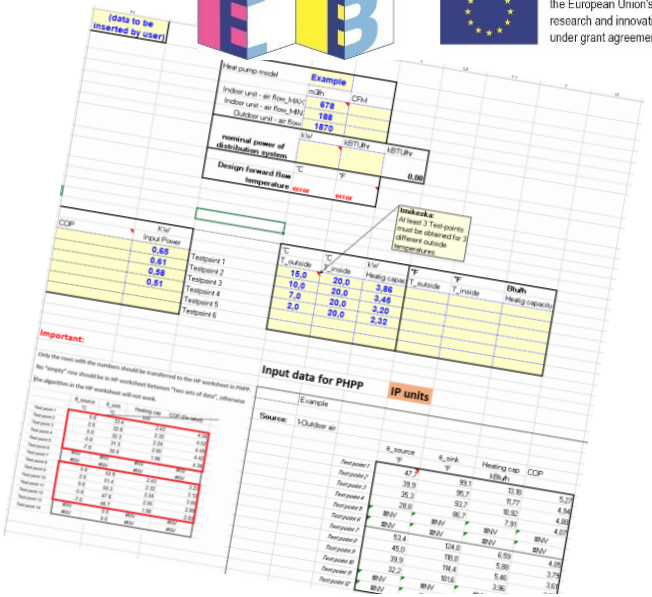
Wärmebrücken-Tool

Thermal Bridge Tool



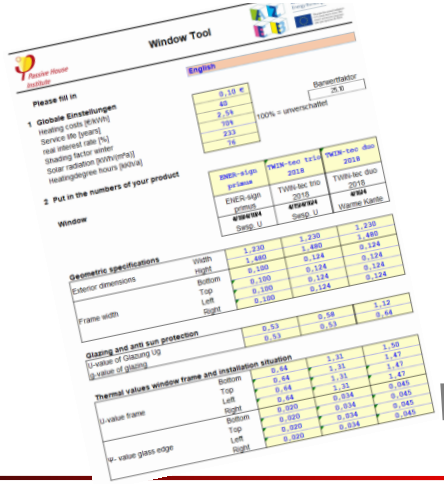
Lüftungs-Tool

Ventilation Tool



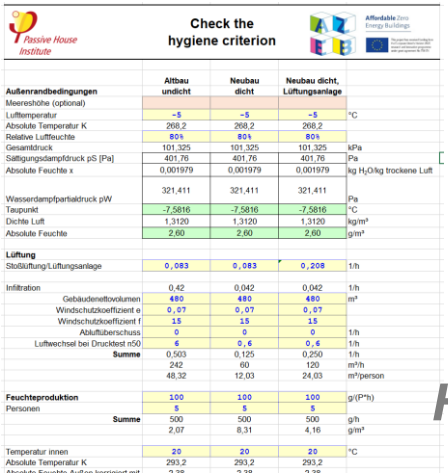
WärmepumpeTool

Heat Pump Tool



Fenster-Tool

Window Tool



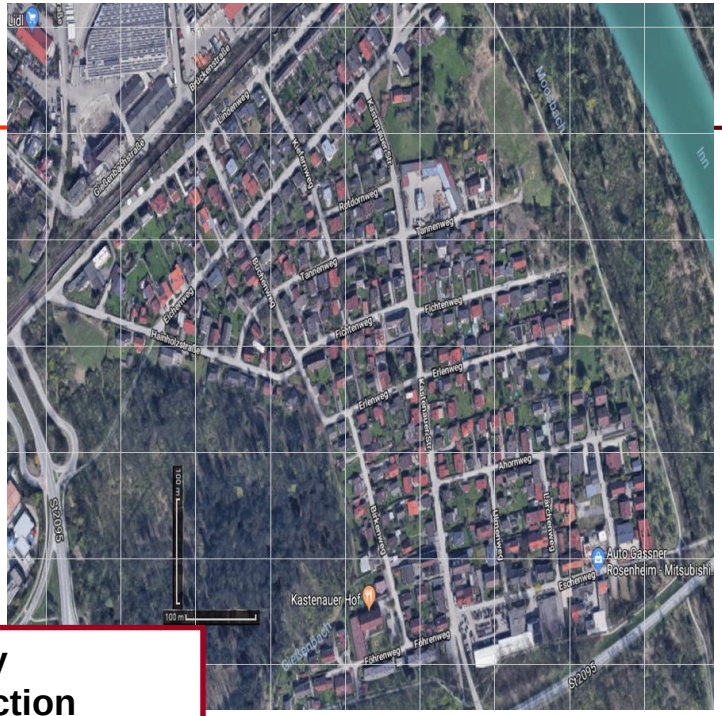
Hygiene-Tool

Hygiene Criteria Tool

Autor: AG PHPP

districtPH

energy balance on district level



statistical distribution of building types

load profile

PHPP

District Tool

Grids
electricity
heating

Energy Production
PV
solar thermal
wind
biomass
waste heat
CHP
non-renewable

simple energy balance

monitored energy consumptions of refurbishments

Public Consumers
street lights
public transport
electric passenger cars

- Excel based
- Focusing on refurbishment scenarios

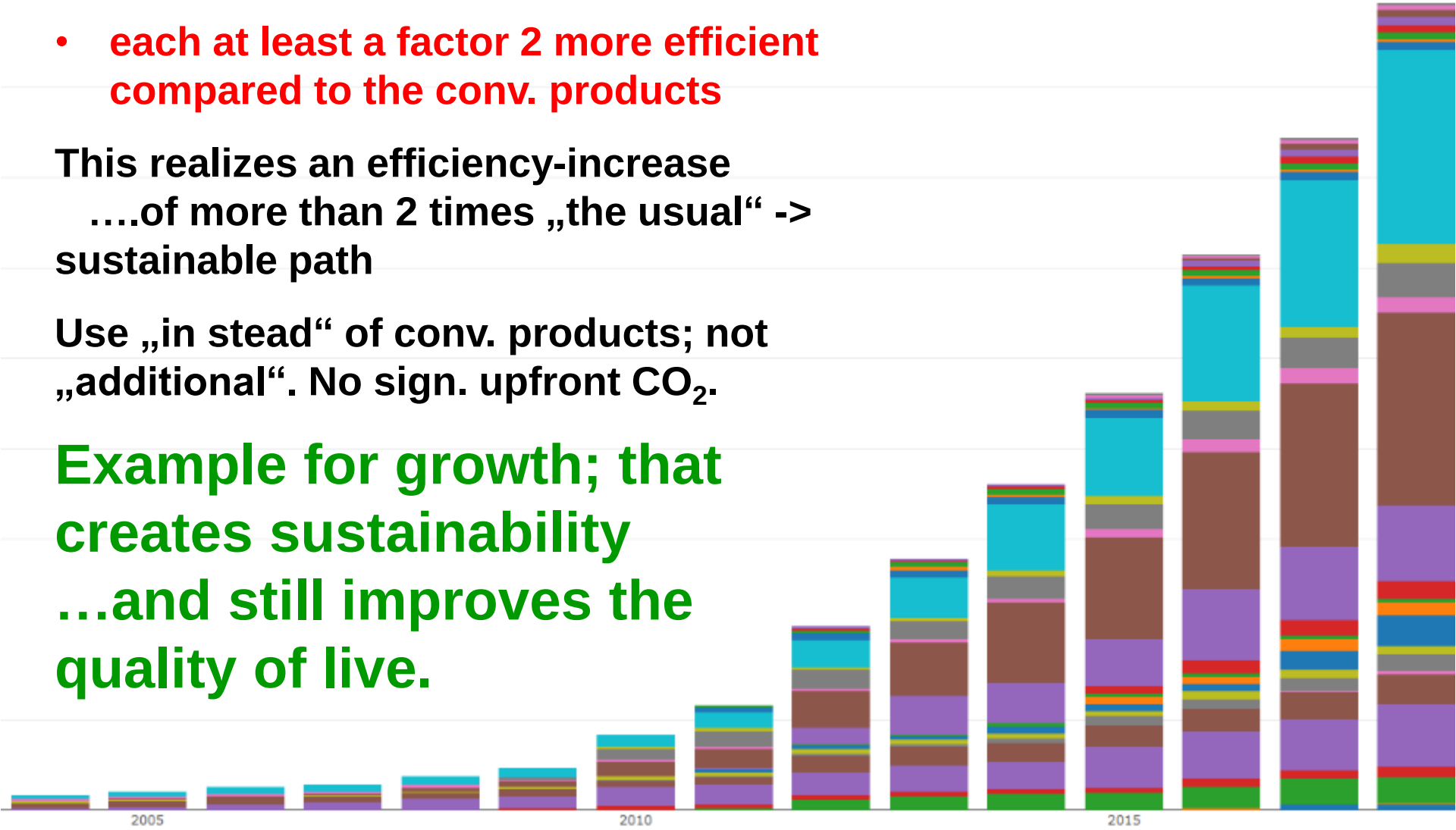
These Components are:

- **each at least a factor 2 more efficient compared to the conv. products**

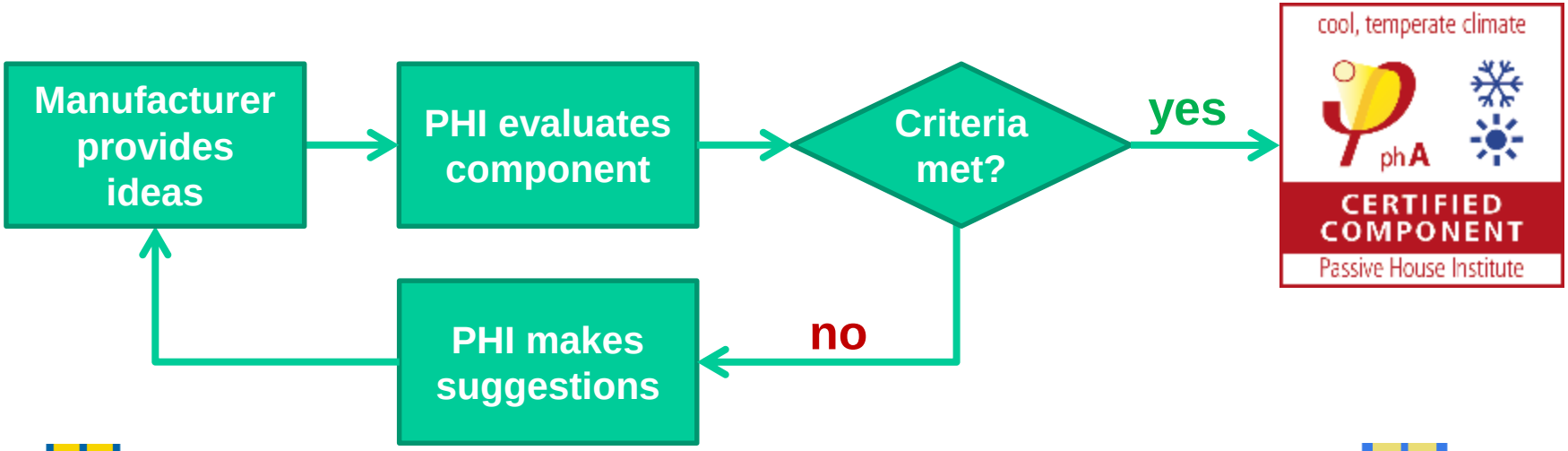
This realizes an efficiency-increase ….of more than 2 times „the usual“ -> sustainable path

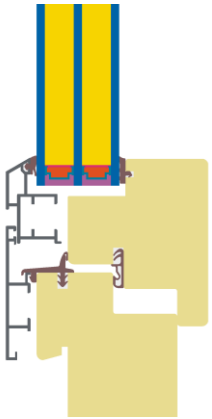
Use „in stead“ of conv. products; not „additional“. No sign. upfront CO_2.

Example for growth; that creates sustainability …and still improves the quality of live.

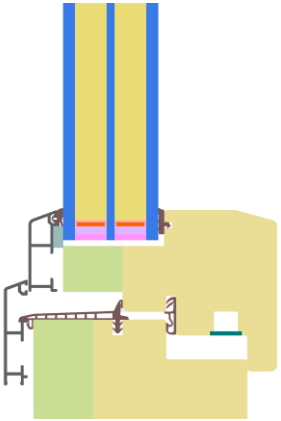


Component Certification | *Komponentenzertifizierung*





- **Can be done in one week…**
- **But many cycles might be necessary. In some cases this process might take more than a year**
- **So far, every request has led to successful certification!**



… means helping to develop

Offenes Passivhaus

Passive House Training

Weltweites Training / Netzwerk von akkreditierten Kursanbietern

Worldwide training / network of accredited course providers

Weltweites Zertifizierungssystem für Bauschaffende

Worldwide certification system for building professionals

Kursmaterialien / E-Learning-Module in verschiedenen Sprachen

Course material / e-learning modules in different languages

2019 internationale Passivhaus-Tagung

9 – 11 October 2019
Gaobeidian | China

23RD INTERNATIONAL PASSIVE HOUSE CONFERENCE 2019

SESSION 07 China implementing Passive House 中国被动房项目实施

SESSION 07 China implementing Passive House 中国被动房项目实施

Source: Xu Wei CABR China

3.5 Future Different Scenarios Prediction

Scenarios analysis

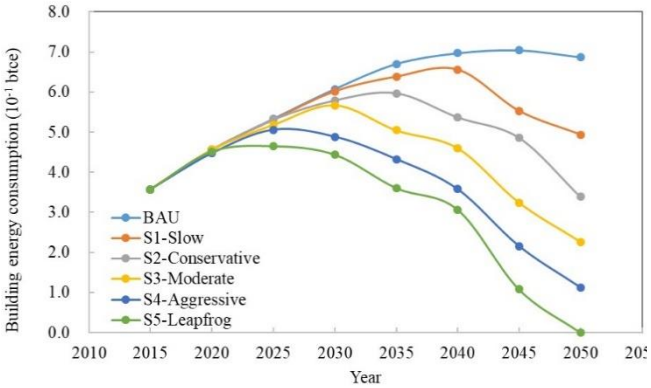
随发展速度增快
From the BAU to leapfrog

1. 能耗峰值下降
   The peak decreases.
2. 能耗峰值发生年份提前
   The occurrence time of the peak advances.
3. 峰值后下降速率增快
   The decline rate after the peak increases.

达峰条件Peak condition：

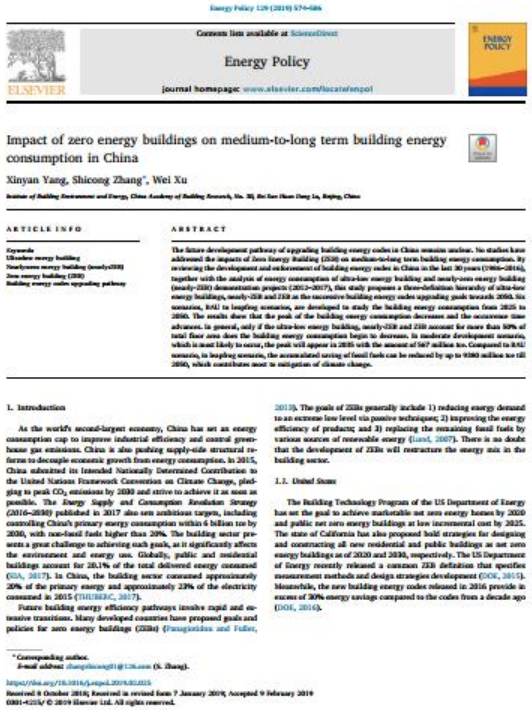
总体而言，**当超低/近零/零能耗建筑占约50%时，**建筑领域能耗才会达峰、然后下降。

In general, only if the total percentage of ultra-low, nearly-ZEBs and ZEBs is larger than 50% does the building energy consumption begin to decrease



不同情境下建筑领域能耗发展预测
Building energy consumption pathway 2015-2050

	峰值（亿tce）Peak (million tce)	峰值年份 Peak Year
BAU	704	2045
S1-Slow	656	2040
S2-Conservative	596	2035
S3-Moderate	567	2030
S4-Aggressive	506	2025
S5-Leapfrog	465	2025



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journal homepage: www.elsevier.com/locate/enpol

Impact of zero energy buildings on medium-to-long term building energy consumption in China

Xinyan Yang, Shicong Zhang*, Wei Xu

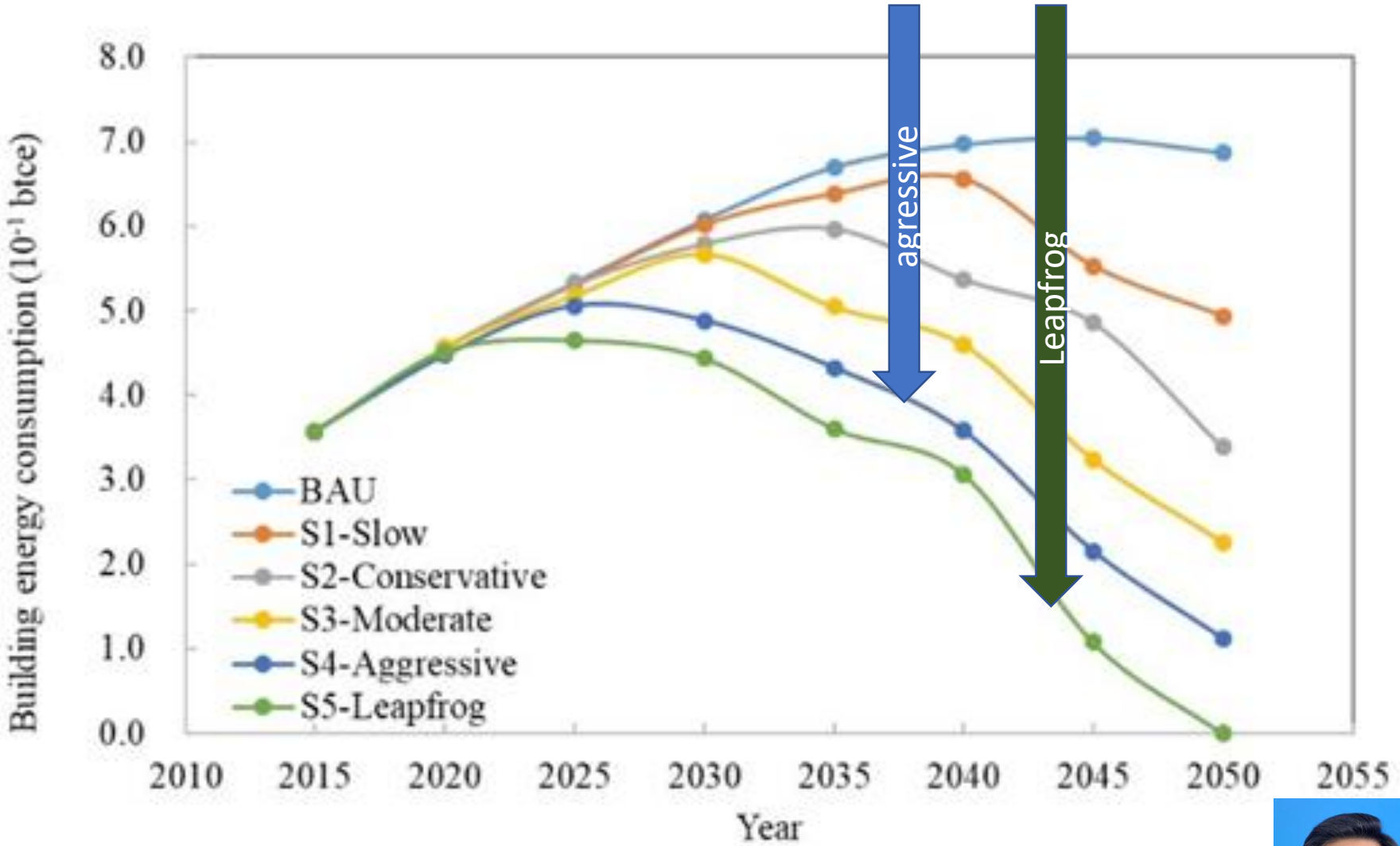
ARTICLE INFO

ABSTRACT

1. Introduction

1.1. United States

China implementing Passive House



Source: Xu Wei CABR China

…let‘s see next year in Berlin!