

# Criteria for climate-compatible building finance in Switzerland

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Lia Weinberg, Martin Jakob, (TEP Energy)  
Christian Hofer (Raiffeisen) | 11 June 2021 | Zurich

# Abstract

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## Keywords: green buildings, energy efficiency policies

Buildings are responsible for around 36% of greenhouse gas emissions worldwide, and for around a quarter in Switzerland. In order for Switzerland to achieve its Paris climate targets, the building stock must become significantly more climate-friendly. Clear criteria are crucial to determine the environmental sustainability of a building to steer investments towards climate-friendly buildings.

With reference to the work of the EU Technical Expert Group on Sustainable Finance and the Climate Bond Initiative (CBI), generally applicable criteria for buildings in Switzerland are determined. Both are based on a best-in-class approach. While the EU Technical Taxonomy refers to the top 15% of buildings in terms of primary energy demand, CBI uses CO<sub>2</sub>-emissions as a benchmark. To compare the current state of buildings sector with these criteria, a distributional building stock model is used, which also addresses the fact that the data availability on energy efficiency and climate compatibility of the building stock is unsatisfactory in many European countries. To be easily applicable in practice, the criteria are mainly based on two dimensions: on the one hand, on the requirements of codes (in Switzerland the model regulations of the cantons, MuKEn) and widely used standards and labels (Minergie, GEAK), and on the other hand, on the energy sources used for the generation of space heat and hot water.

The study shows that ecologically sustainable, climate-compatible building financing can always be assumed in Switzerland if one of the following two criteria are met for new buildings: multi-family, office or other non-residential buildings according to Minergie from 1998 on, MuKEn from 2000 on or GEAK B that use heat-pumps, wood, pellets or solar energy. Or, any building with Minergie from 2009 on label, MuKEn 2014 or GEAK A that use heat pumps, wood, pellets, solar energy or district heating based on non-fossil energy.

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# Background

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- Buildings: 39% of CO<sub>2</sub>-emissions worldwide<sup>1)</sup>  
25% in Switzerland<sup>2)</sup>
- Green building investment
- “green Bond” program of Raiffeisen
- What are green buildings?  
→ Goal: Criteria for climate-compatible building finance in Switzerland



# Approaches

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## EU Taxonomy and CBI

	EU Taxonomy	CBI
Existing buildings	Top 15% primary energy	Top 15% CO <sub>2</sub> -emissions
New buildings	20% more efficient than minimum requirement of country	
Building renovation	Reduction of 30% of primary energy compared to before refurbishment	Reduction of 34% of primary energy
Individual measures		

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# Methodology

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- Definition of criteria: based on EU Technical expert group on sustainable finance and Climate Bond Initiative (CBI)
  - EU Taxonomy: primary energy<sup>3)</sup>
  - CBI: CO<sub>2</sub>-emissions<sup>4)</sup>
- Existing buildings, new buildings
- Building renovations

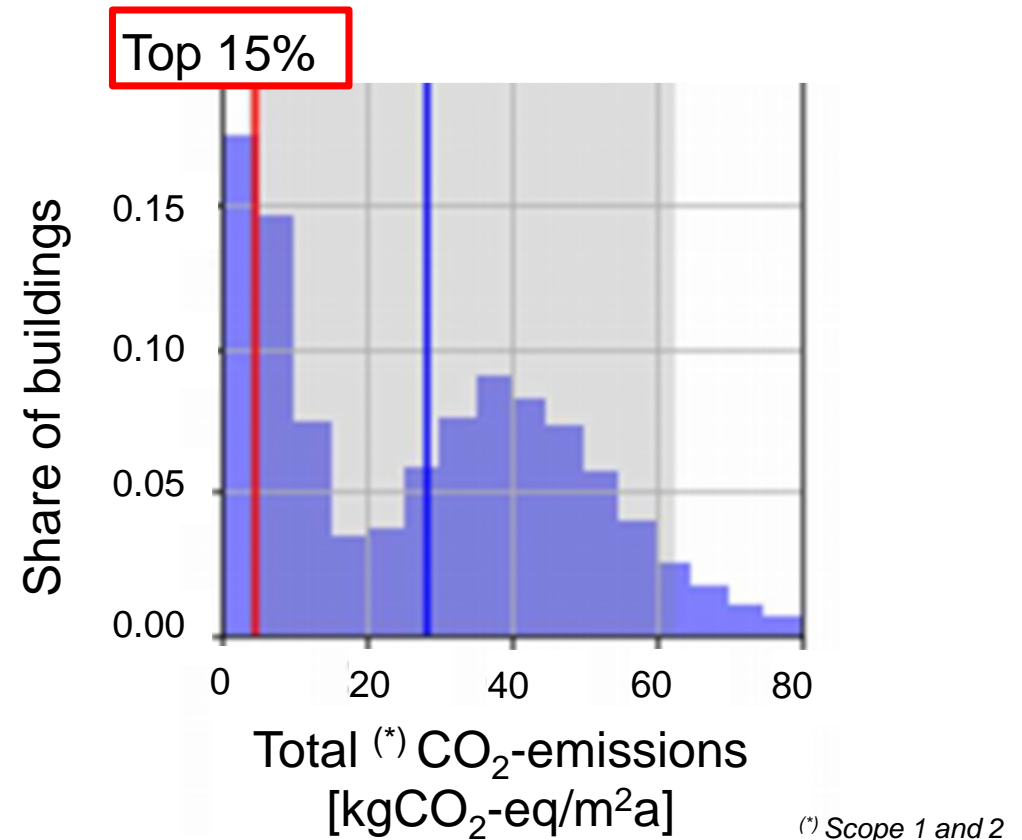


Climate Bonds INITIATIVE

# Methodology

## Existing buildings, new buildings

- Best-in-class approach: top 15% primary energy and CO<sub>2</sub>-emissions
    - Building stock model TEP Energy & Chalmer's University
  - Linear lowering path until 2050
  - Local building labels, standards
- **Top 15%**
- primary energy
  - CO<sub>2</sub>-emissions



Source: Calculation based on the Building Stock Model (BSM), see 5) for details

# Methodology

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## Building renovations

→ Reduction of 34% of primary energy (requirement of CBI)



Source: [https://www.geak.ch/media/rz\\_gea\\_903\\_basisbroschuere\\_a4\\_leporello\\_d\\_web.pdf](https://www.geak.ch/media/rz_gea_903_basisbroschuere_a4_leporello_d_web.pdf)



# Methodology

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## Energy labels, regulation and certificates in Switzerland

- Minergie
- MuKEn: model regulations of the Cantons
- GEAK: cantonal building certificate

**MINERGIE®**

**EnDK**  
Konferenz Kantonaler Energiedirektoren  
Conférence des directeurs cantonaux de l'énergie  
Conferenza dei direttori cantonali dell'energia  
Conferenza dals directurs chantunals d'energia



# Results

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# Results: Top 15% in Switzerland

## Existing buildings, new buildings

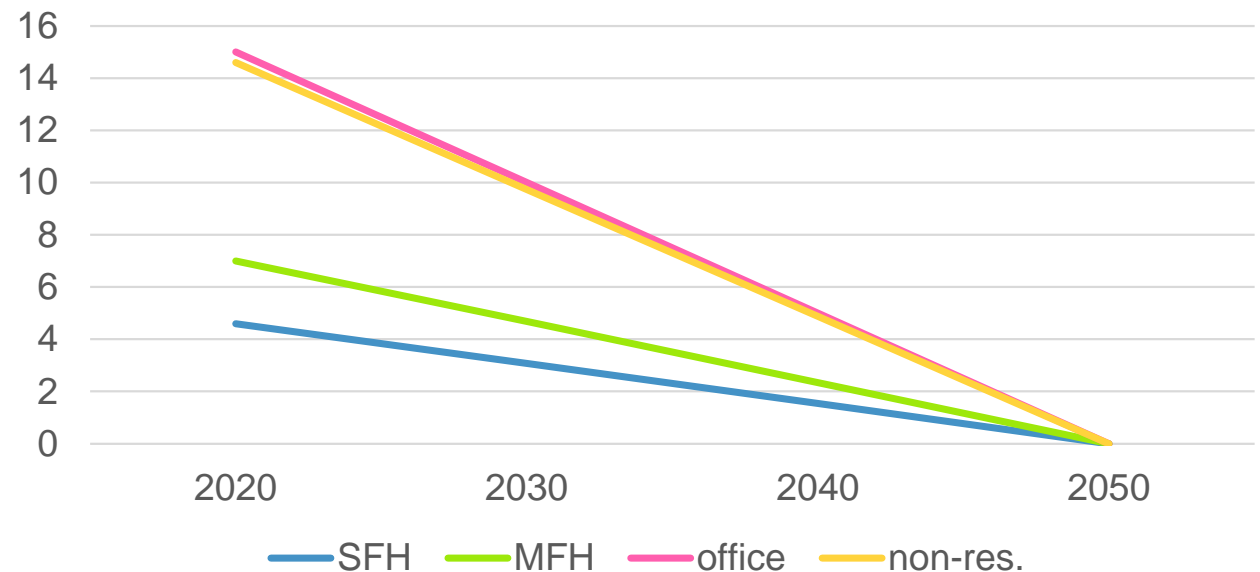
### Current situation

Total (*) CO <sub>2</sub> -emissions [kgCO <sub>2</sub> -eq/m <sup>2</sup> a]	
Single family houses (SFH)	4.6
Multi family houses (MFH)	7.0
Office	15.0
Non-residential	14.6

(\*) Scope 1 and 2

### Outlook up to 2050

#### Total CO<sub>2</sub>-emissions [kgCO<sub>2</sub>-eq/m<sup>2</sup>a]

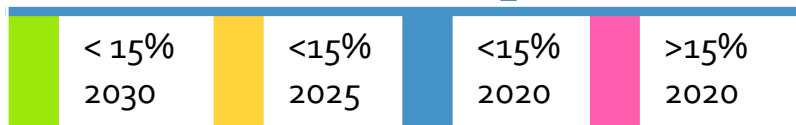


# Criteria for environmentally sustainable buildings

## Existing buildings, new buildings

- No fossil fuels

### Total CO<sub>2</sub>-emissions



	Gas				Oil				HP				DH				Wood				Pellets			
	SFH	MFH	office	non-res.	SFH	MFH	office	non-res.	SFH	MFH	office	non-res.	SFH	MFH	office	non-res.	SFH	MFH	office	non-res.	SFH	MFH	office	non-res.
Minergie 1998																								
Minergie 2002																								
MuKEn 2000																								
MuKEn 2008																								
MuKEn 2014																								
Minergie-P 2003																								
Minergie 2009																								
Minergie 2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Minergie-P 2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Minergie-A 2011	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
Minergie-A 2017	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	
GEAK A (H)																								
GEAK A (E)																								
GEAK B (H)																								
GEAK B (E)																								
GEAK C (H)																								
GEAK C (E)																								

X proposed as environmentally sustainable building  
 \* not applicable

# Criteria for environmentally sustainable buildings

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## Existing buildings, new buildings

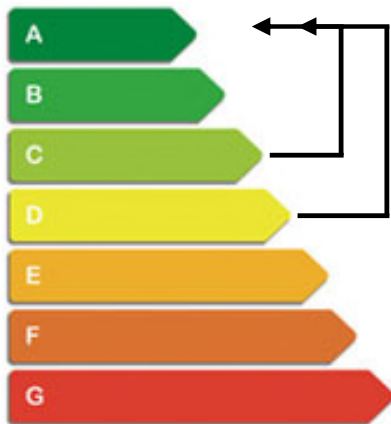
Energy carrier	Building category	Standard, label, regulation
Heat pumps, wood, pellets, solar energy	SFH	Minergie 2002, GEAK A, MuKEn 2014
	All other building categories	Minergie 1998, GEAK A/B, MuKEn 2000/2008/2014
District heating (based on non-fossil energy)	All building categories	Minergie 2009, GEAK A, MuKEn 2014

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# Results: Reduction of 34% of primary energy

## Building renovations

- Reduction of 34% of primary energy



	GEAK improvement of 2 classes from	GEAK improvement of 3 classes from	GEAK improvement of 4 classes from
SFH	C	D, E, F	G
MFH		D, E	F, G
Office and other non-residential buildings		D	E, F, G

# Conclusion

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- Discussion on the setting of criteria is important and not yet concluded
  - CO<sub>2</sub>-emission vs. primary energy
- Data availability on energy efficiency and climate compatibility of buildings in Switzerland and EU must be improved

**Thank you for your  
attention!**



# Literature

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# Annex

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# Annex

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## Methodology

- Building Types: single family houses (SFH), multi family houses (MFH), office buildings, non-residential buildings (hotel, office, industry, etc.)
- Energy carriers: oil, gas, heat pump, district heating, wood, pellets.
- Energy consumption: heating, hot water, electricity (lighting, ventilation, air conditioning and auxiliary energies)
- Conservative assumptions (high ratio of building envelope to floor area)

# Annex

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## Definitions and key assumptions

$$\text{Endenergie} = \frac{\text{Nutzenergie}}{\text{Nutzungsgrad}} \quad (1)$$

$$\text{THG-Emissionen} = \text{Endenergie} * \text{THG-EK} \quad (2)$$

$$\text{Primärenergie} = \text{Endenergie} * \text{PEF} \quad (3)$$

Tabelle 17: 95%-Quantile von A/EBF der 4 Gebäudekategorien

<b>Gebäudekategorie</b>	<b>A/EBF</b>
EFH	3.5
MFH	2.5
Büro	2.0
NWG	2.5

Quelle: Berechnungen TEP Energy

# Annex

## Definitions and key assumptions: primary energy factor (PEF) and Coefficient of Greenhouse Gases (“THG-EK”)

Tabelle 9: Primärenergiefaktoren (PEF) und Treibhausgasemissions-Koeffizienten (THG-EK) für verschiedene Energieträger gemäss KBOB 2009/1:2016

Energieträger	PEF	THG-EK [kg/kWh Endenergie]	
	Gesamt	Direkt	Total
Öl	1.24	0.213	0.301
Gas	1.07	0.242	0.228
Fernwärme (CH-Durchschnitt)	0.88	0	0.089
Stückholz	1.11	0	0.027
Pellets	1.20	0	0.027
Solarenergie*	1.00	0	0
Strom (CH-Verbraucher mix)	3.00	0	0.102
Strom aus PV am Standort erzeugt	3.00	0	0.081

\* Für Solarenergie wird ein PEF von 1 und THG-EK von 0 kg/kWh Endenergie angenommen.

Quelle: TEP Energy basierend auf KBOB 2009/1 (2016)

# Annex

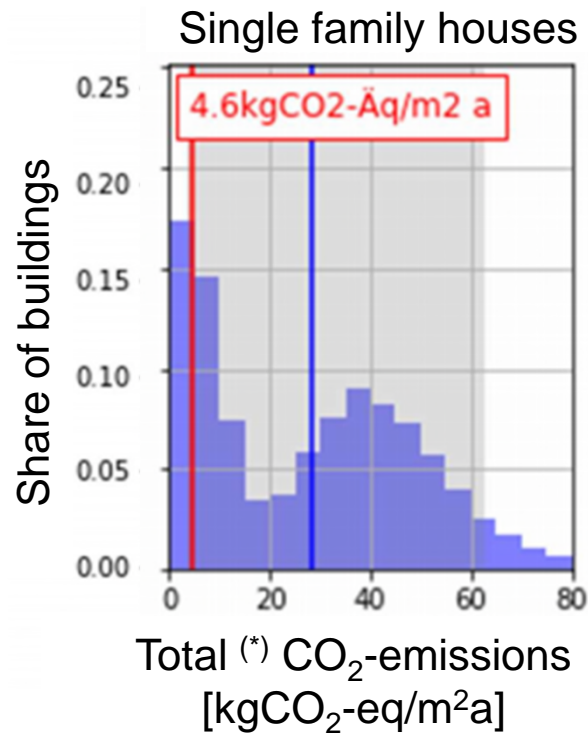
## Energy certificate (GEAK) classes: Mapping to building states

Klasse	Effizienz der Gebäudehülle	Gesamtenergieeffizienz
<b>A</b>	Hervorragende Wärmedämmung (Dach, Fassade, Keller), Fenster mit Dreifach-Wärmeschutzverglasungen (z.B. Minergie-P).	Hocheffiziente Gebäudetechnik für Heizung und Warmwasser, effiziente Beleuchtung und Geräte, Einsatz erneuerbarer Energien und Eigenstromerzeugung (z.B. Minergie-A).
<b>B</b>	Gebäude mit einer thermischen Gebäudehülle, die den gesetzlichen Anforderungen entspricht.	Gebäudehülle und Gebäudetechnik im Neubaustandard, Einsatz erneuerbarer Energien (Beispiel Minergie-Systemerneuerung).
<b>C</b>	Altbauten mit umfassend erneuerter Gebäudehülle (Beispiel Minergie-Systemerneuerung).	Umfassende Altbausanierung (Wärmedämmung und Gebäudetechnik), meist kombiniert mit erneuerbaren Energien.
<b>D</b>	Nachträglich gut und umfassend gedämmter Altbau, jedoch mit verbleibenden Wärmebrücken.	Weitgehende Altbausanierung, jedoch mit deutlichen Lücken oder ohne den Einsatz von erneuerbaren Energien.
<b>E</b>	Altbauten mit Verbesserung der Wärmedämmung, inkl. neuer Wärmeschutzverglasung.	Teilsanierte Altbauten, z.B. neue Wärmeerzeugung und evtl. neue Geräte und Beleuchtung.
<b>F</b>	Gebäude, die teilweise gedämmt sind.	Bauten mit einzelnen neuen Komponenten (Gebäudehülle, Gebäudetechnik, Beleuchtung etc.)
<b>G</b>	Altbauten ohne oder mit mangelhafter nachträglicher Dämmung und grossem Sanierungspotenzial.	Altbauten mit veralteter Gebäudetechnik und ohne Einsatz erneuerbarer Energien, die ein grosses Verbesserungspotenzial aufweisen.

# Annex

## Results existing buildings and new buildings

- Top 15% primary energy and CO<sub>2</sub>-emissions



	Primary energy [kWh/m <sup>2</sup> a]	Direct CO <sub>2</sub> -emissions [kgCO <sub>2</sub> -eq/m <sup>2</sup> a]	Total (*) CO <sub>2</sub> -emissions [kgCO <sub>2</sub> -eq/m <sup>2</sup> a]
SFH	151	0.0	4.6
MFH	159	0.0	7.0
office	263	0.0	15.0
non-res.	231	0.0	14.6

(\*) Scope 1 and 2