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The potential of energy flexibility based on the Austrian typology

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Overview

- Motivation
- Why energy flexibility (EF)
- Energy vs. CO_2-efficiency
- National energy characteristics
- Austrian typology and EF potential
- Conclusion and prospects

Motivation

COP21 – long-term target:

A clear limitation of the global warming below 2°C with the aim to achieve 1,5°C

→ **Means global decarbonization until 2050 !**

→ **Means change of the energy system !**

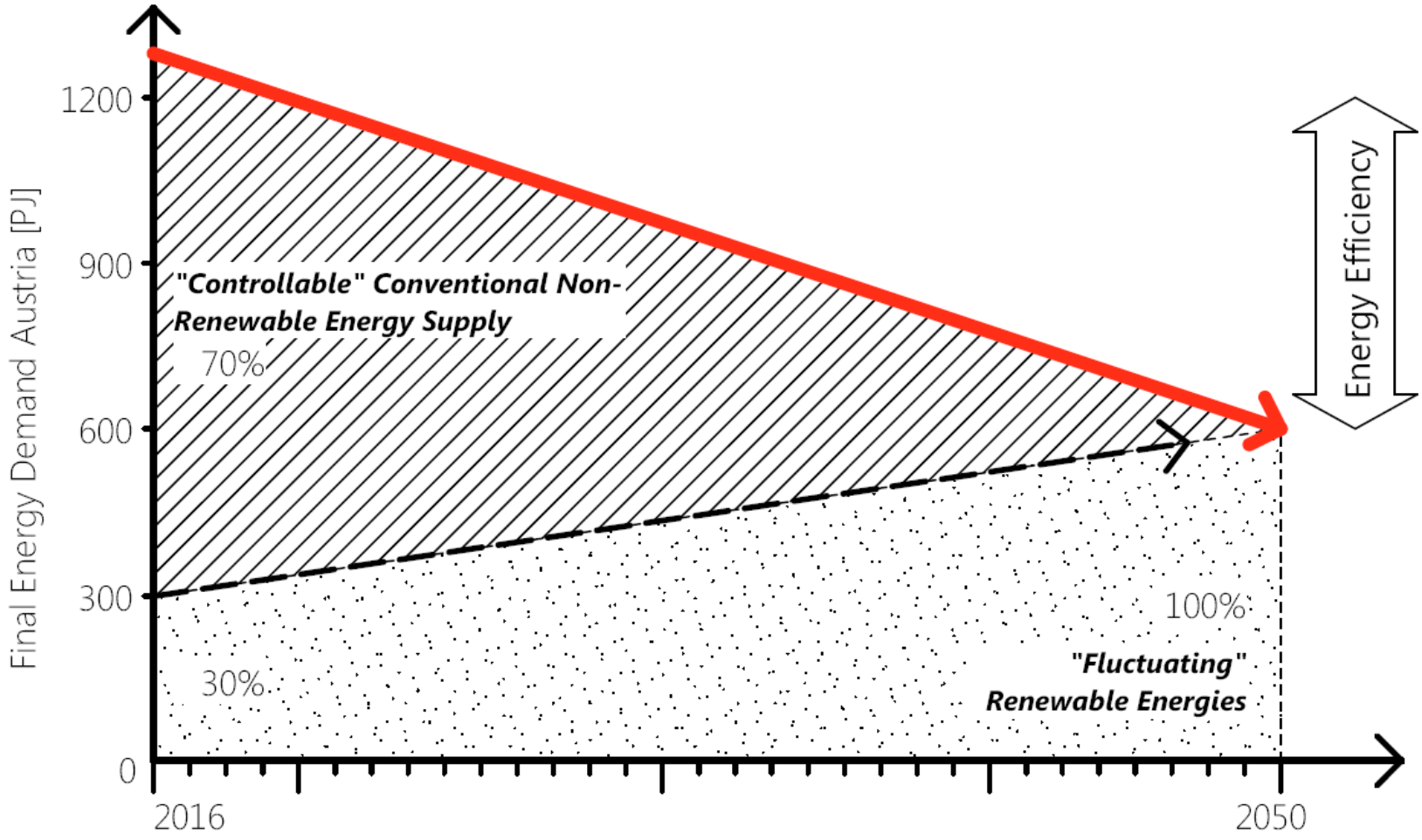
↓

Austrian „National Plan“ goals for 2020
(for new residential buildings):
160 kWh PE/m^2_{GFA}.a and 24 kg CO_2/m^2_{GFA}.a

?

(Austrian Institute of Construction Engineering, OIB 2014)

Why energy flexibility?



Source: Austrian Energy Research Strategy – 2050, Austrian Ministry of Transport, Innovation and Technology 2009; illustration by AEE INTEC

Why energy flexible buildings?

"The Energy Flexibility of a building is the ability to manage its demand and generation according to local climate conditions, user needs and grid requirements…" (IEA EBC Annex 67)

Main interest of the target groups to manage:

- Grid-supportive / community / aggregator optimized: Stabilize the surrounding grid and minimize infrastructure costs
- Grid-independency / self-consumption optimized: Reduce the energy costs
- Market-principle optimized: Maximize the profit

Time aspects, frame conditions

Long-term

↓

Flexibility by design and equipment (years)

Short-term

↘

Currently available physical flexibility (hours to days)

Forcing factors

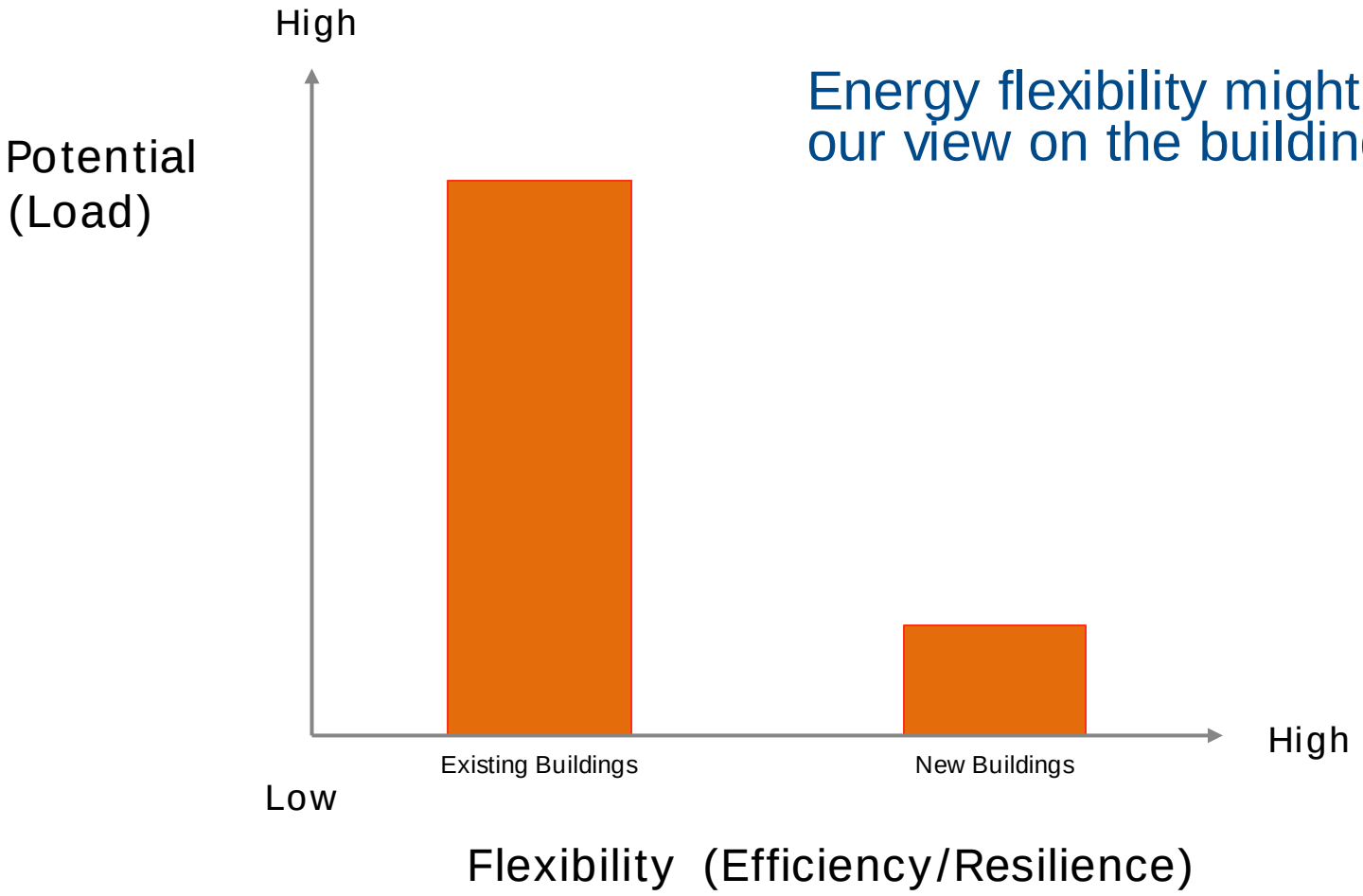
Low frequency factors

- climate change
- macro economic factors
- technology improvement
- general energy costs
- building use

High frequency factors

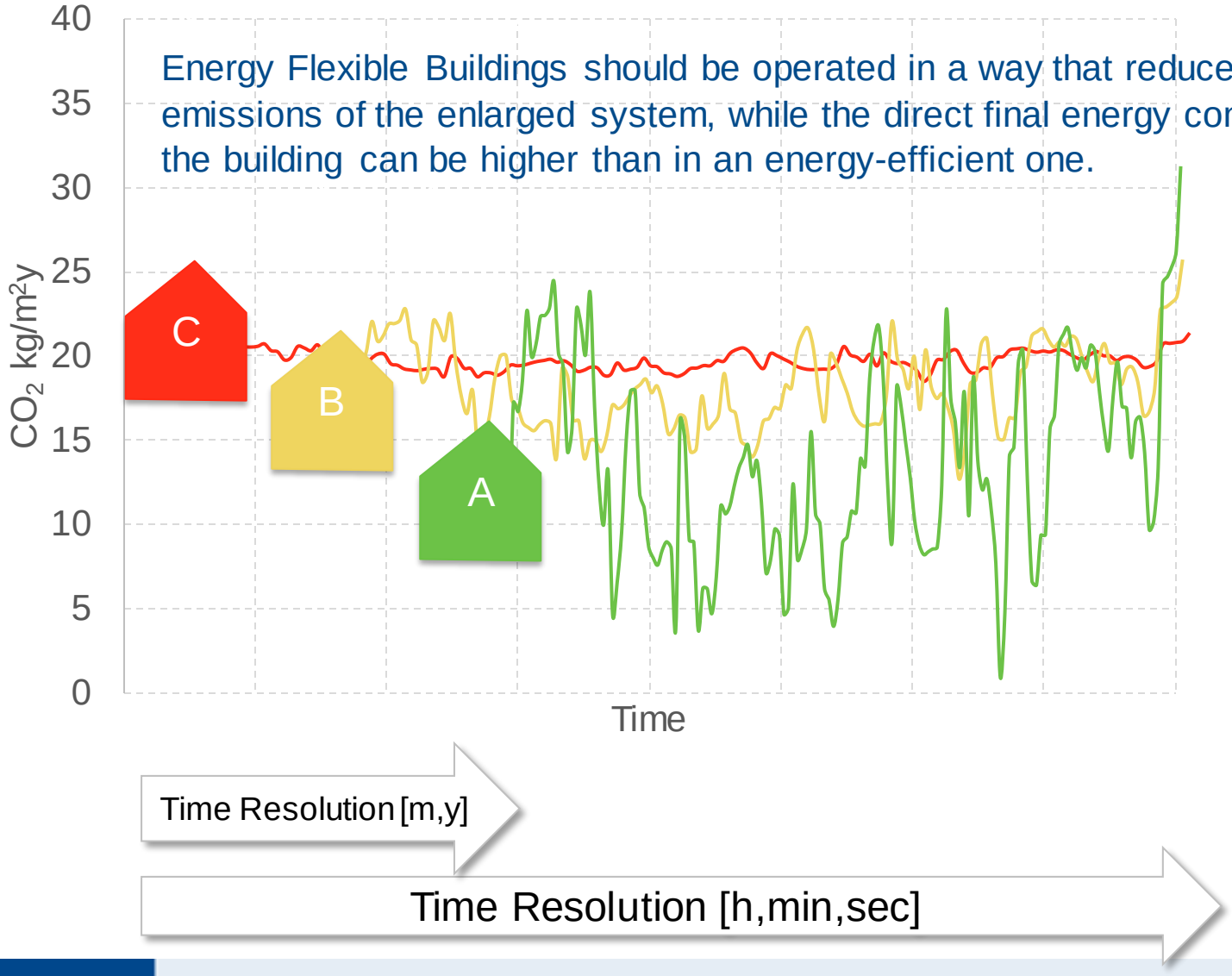
- internal/solar gains
- user behaviour
- hourly energy cost

Which is the better building?



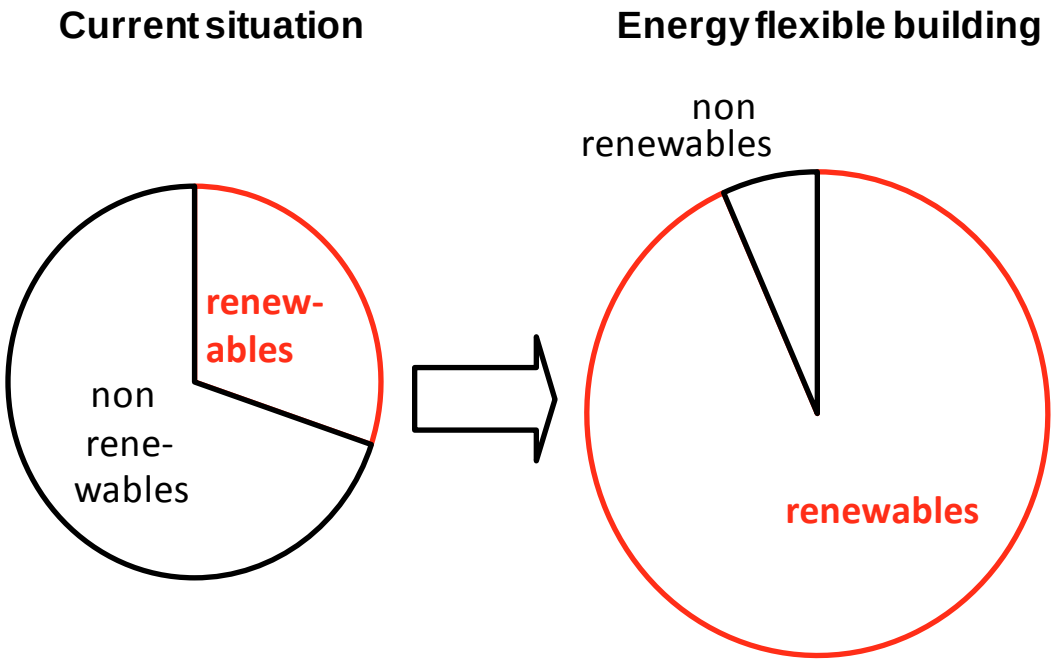
Energy flexibility might change our view on the buildings

Which is the better building?

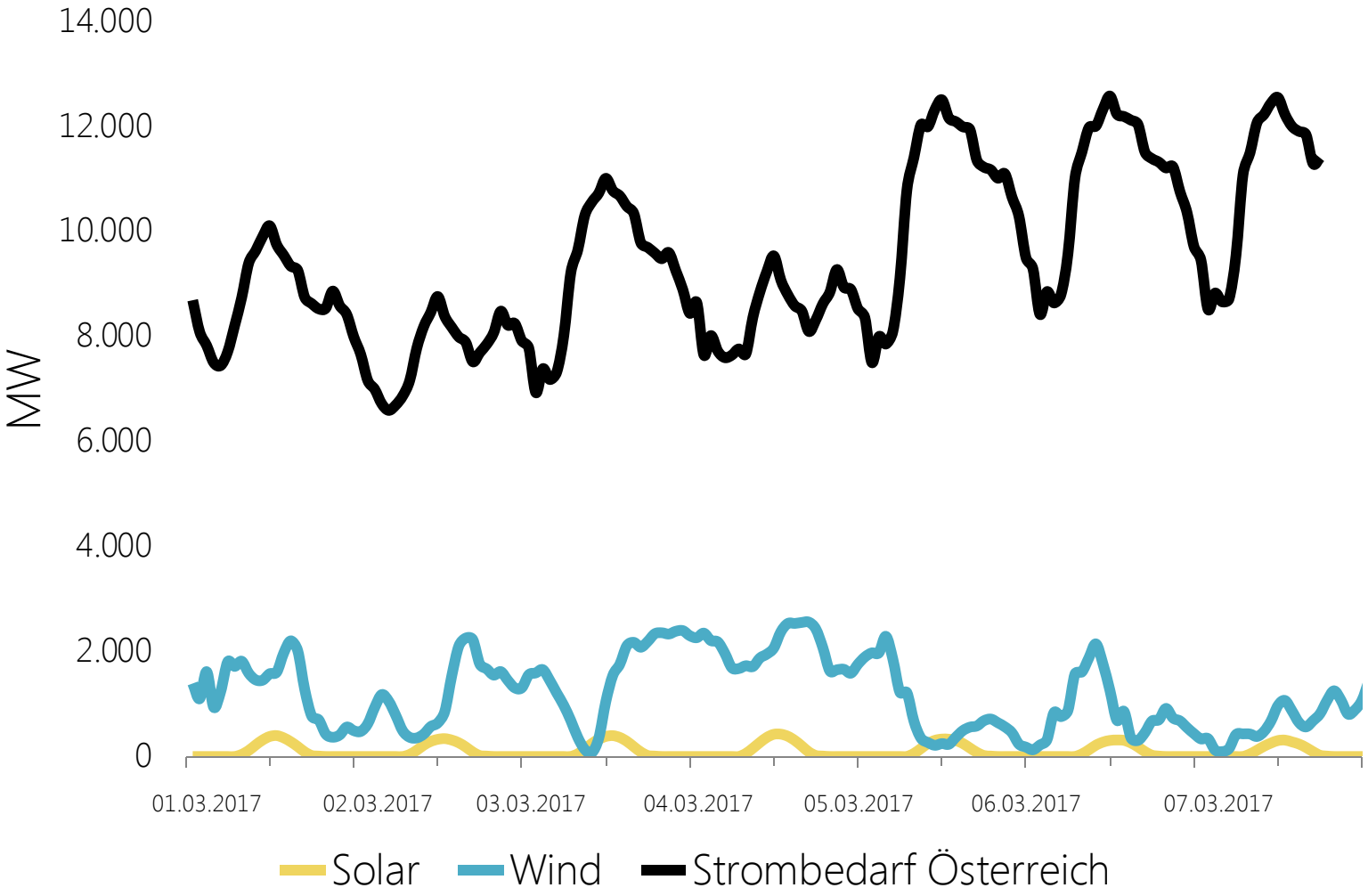


Which is the better building?

Shifting domestic loads reduces peak loads, but sometimes at the expense of greater energy use during the off-peak periods (response period) because of a certain rebound effect

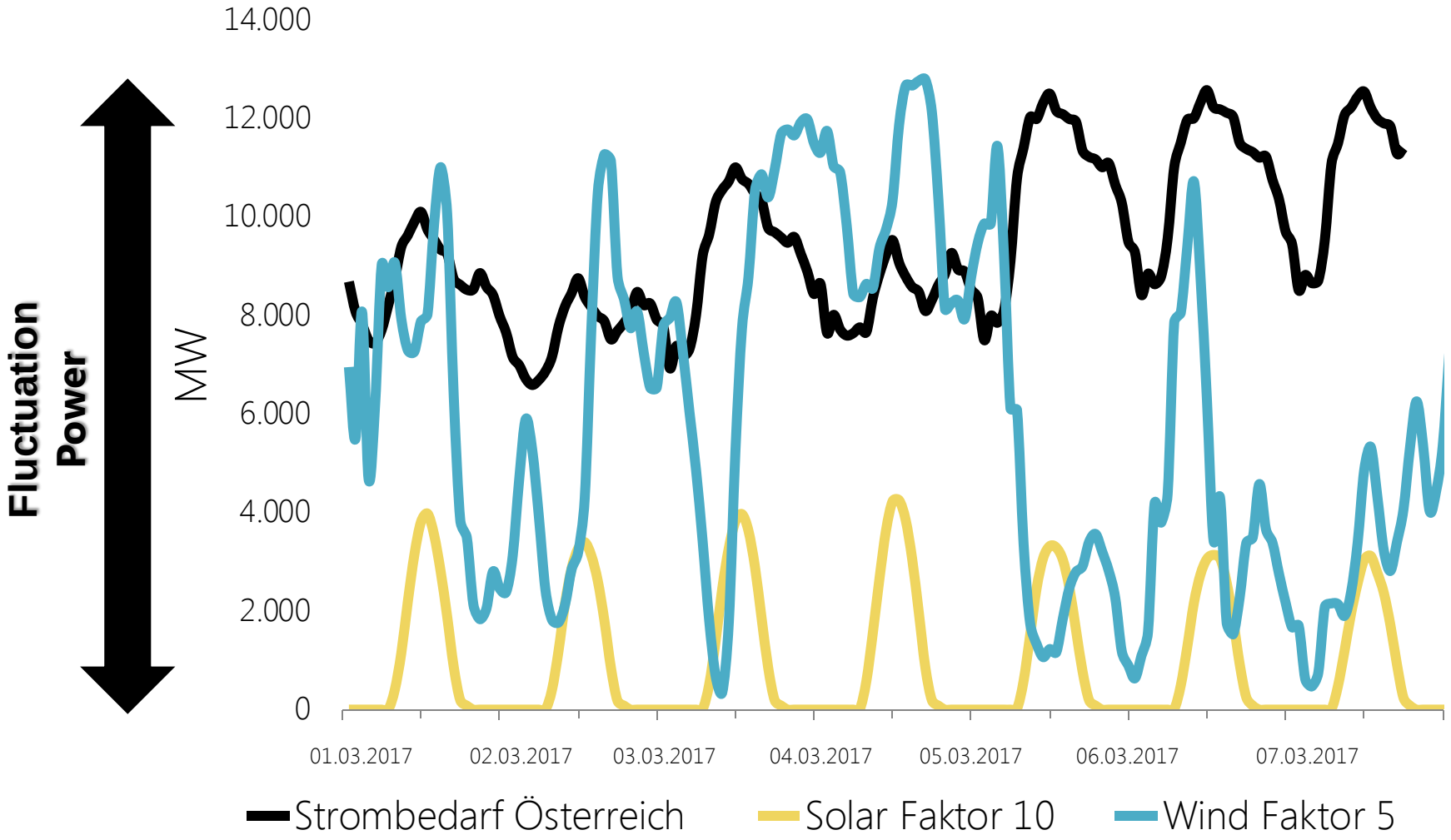


Electricity generation Austria, March 2017



Quelle: ENTSO-E, European Network of Transmission System Operators

Electricity generation Austria, 2030-2050 (?)



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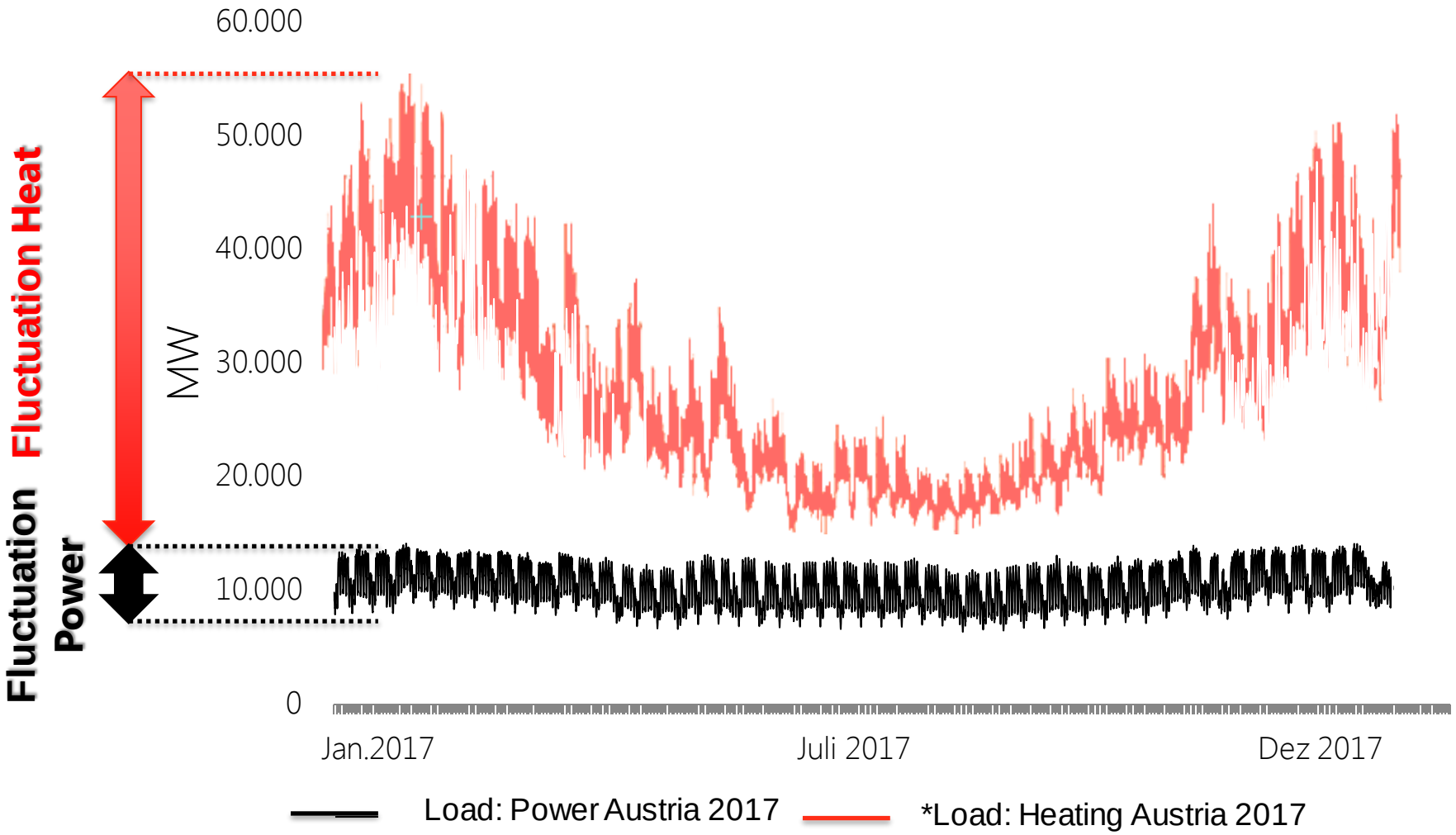
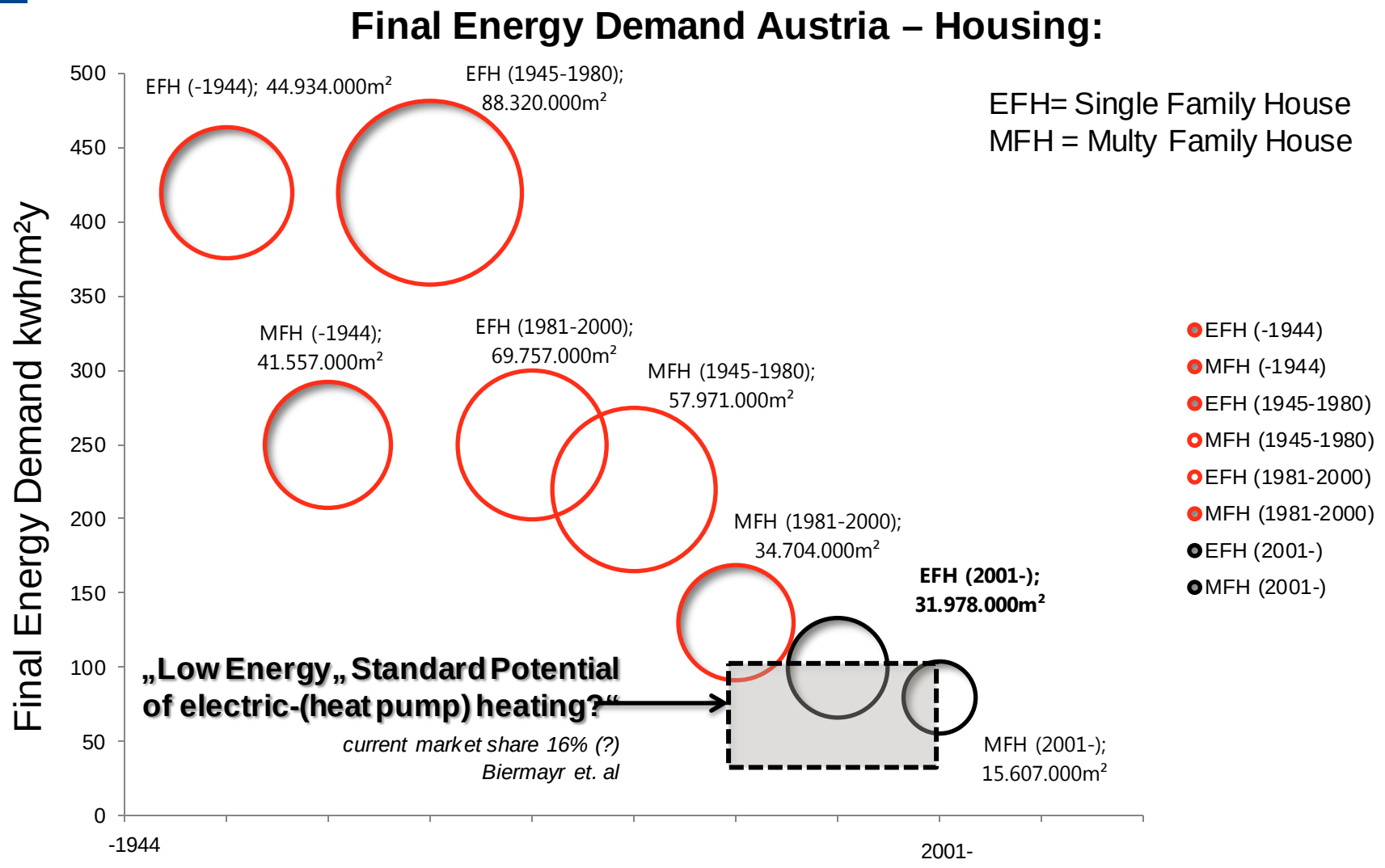
Why Focus on „Domestic Thermal Loads“?



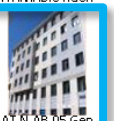
*grobe Abschätzung des Lastgangs der Wärme auf Basis der Statistik Austria / ENTSO-E /BMWFW/AGGM Report 2044) (Tobias Weiß – AEE INTEC)

Why Focus on „Domestic Thermal Loads“?



Building stock construction periods are shown with their share of the final energy demand (Tobias Weiß AEE INTEC / Data Source: Statistik Austria)

Archetypes of buildings in Austria Tabula/Episcope Database

	Region	Construction Year Class	Additional Classification	SFH Single-Family House	TH Terraced House	MFH Multi-Family House	AB Apartment Block
1	national (Gesamt-Österreich)	... 1919	generic (Standard / allgemein typisch)	 AT.N.SFH.01.Gen	 AT.N.TH.01.Gen	 AT.N.MFH.01.Gen	 AT.N.AB.01.Gen
2	national (Gesamt-Österreich)	1919 ... 1944	generic (Standard / allgemein typisch)	 AT.N.SFH.02.Gen	 AT.N.TH.02.Gen	 AT.N.MFH.02.Gen	 AT.N.AB.02.Gen
3	national (Gesamt-Österreich)	1945 ... 1960	generic (Standard / allgemein typisch)	 AT.N.SFH.03.Gen	 AT.N.TH.03.Gen	 AT.N.MFH.03.Gen	 AT.N.AB.03.Gen
4	national (Gesamt-Österreich)	1961 ... 1980	generic (Standard / allgemein typisch)	 AT.N.SFH.04.Gen	 AT.N.TH.04.Gen	 AT.N.MFH.04.Gen	 AT.N.AB.04.Gen
5	national (Gesamt-Österreich)	1981 ... 1990	generic (Standard / allgemein typisch)	 AT.N.SFH.05.Gen	 AT.N.TH.05.Gen	 AT.N.MFH.05.Gen	 AT.N.AB.05.Gen
6	national (Gesamt-Österreich)	1991 ... 2000	generic (Standard / allgemein typisch)	 AT.N.SFH.06.Gen	 AT.N.TH.06.Gen	 AT.N.MFH.06.Gen	 AT.N.AB.06.Gen
7	national (Gesamt-Österreich)	2001 ... 2009	generic (Standard / allgemein typisch)	 AT.N.SFH.07.Gen	 AT.N.TH.07.Gen	 AT.N.MFH.07.Gen	 AT.N.AB.07.Gen

1919-1945

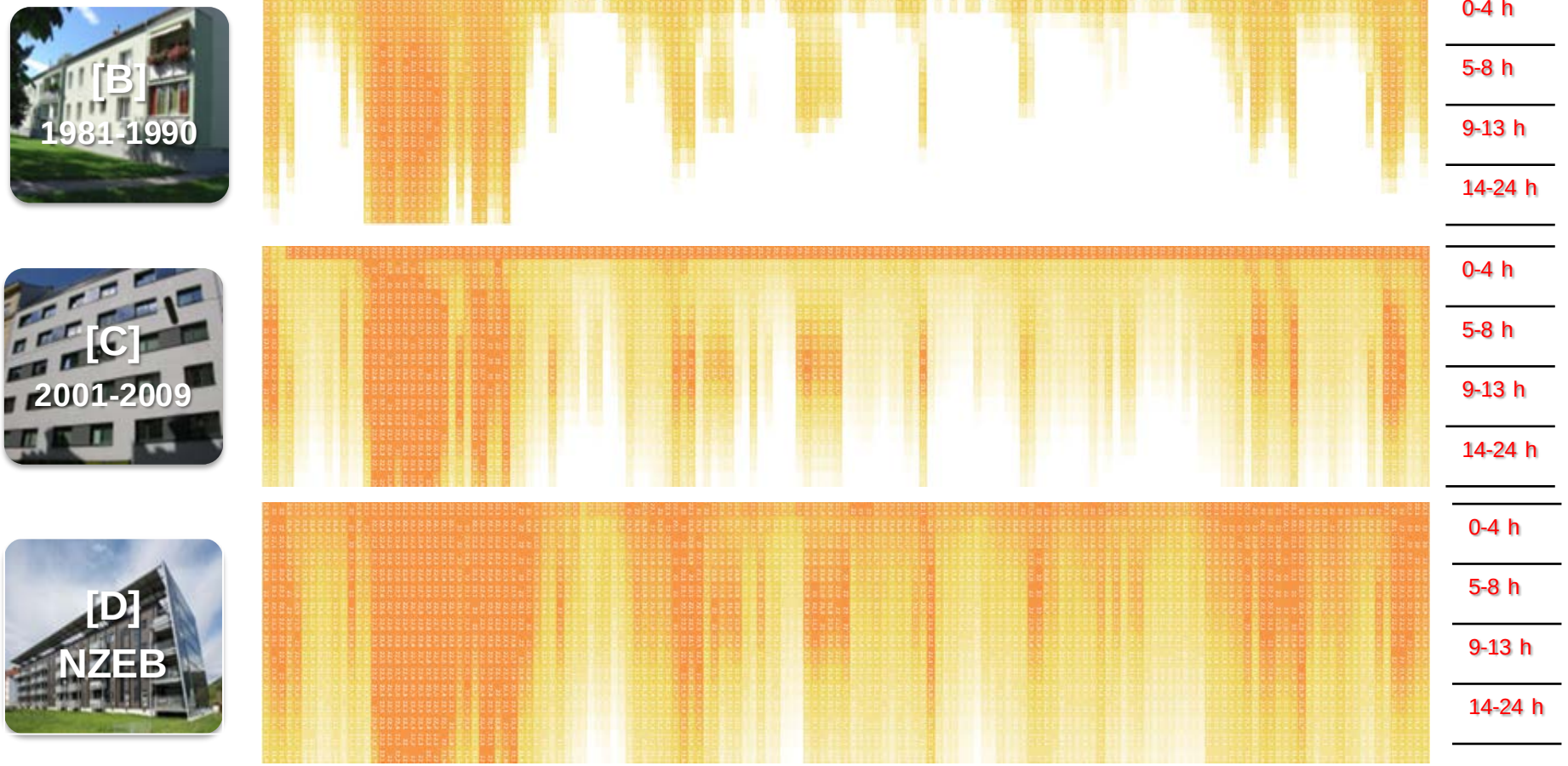
1981-1990

2001-2009

NZEB – Passivhouse (?) > Cases ?

Source: TABULA/EPISCOPE

Flexibility of different archetypes



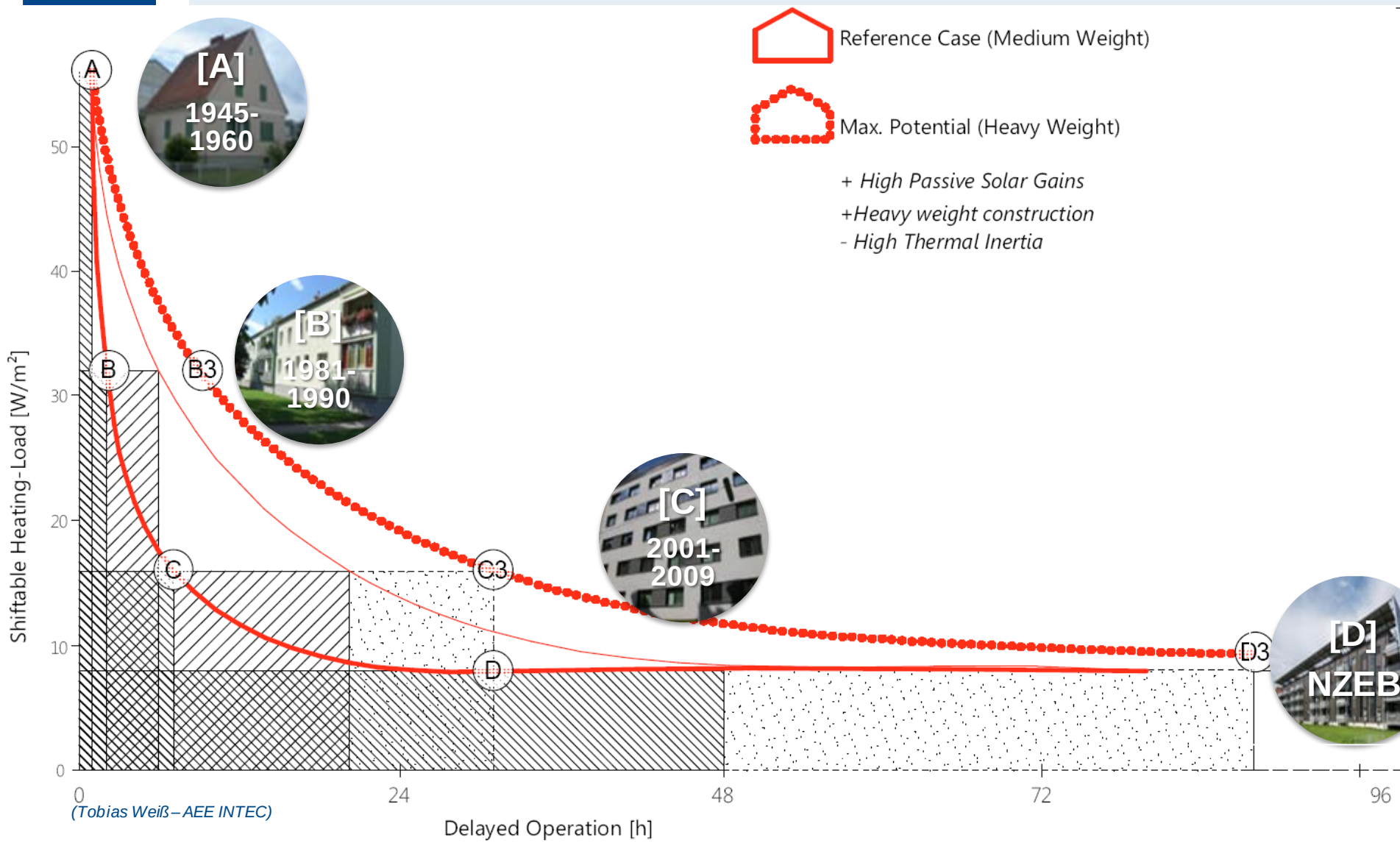
Load duration curves of case studies

Min. Potential of shiftable domestic heating load over time (Δt1)

(Tobias Weiß – AEE INTEC)

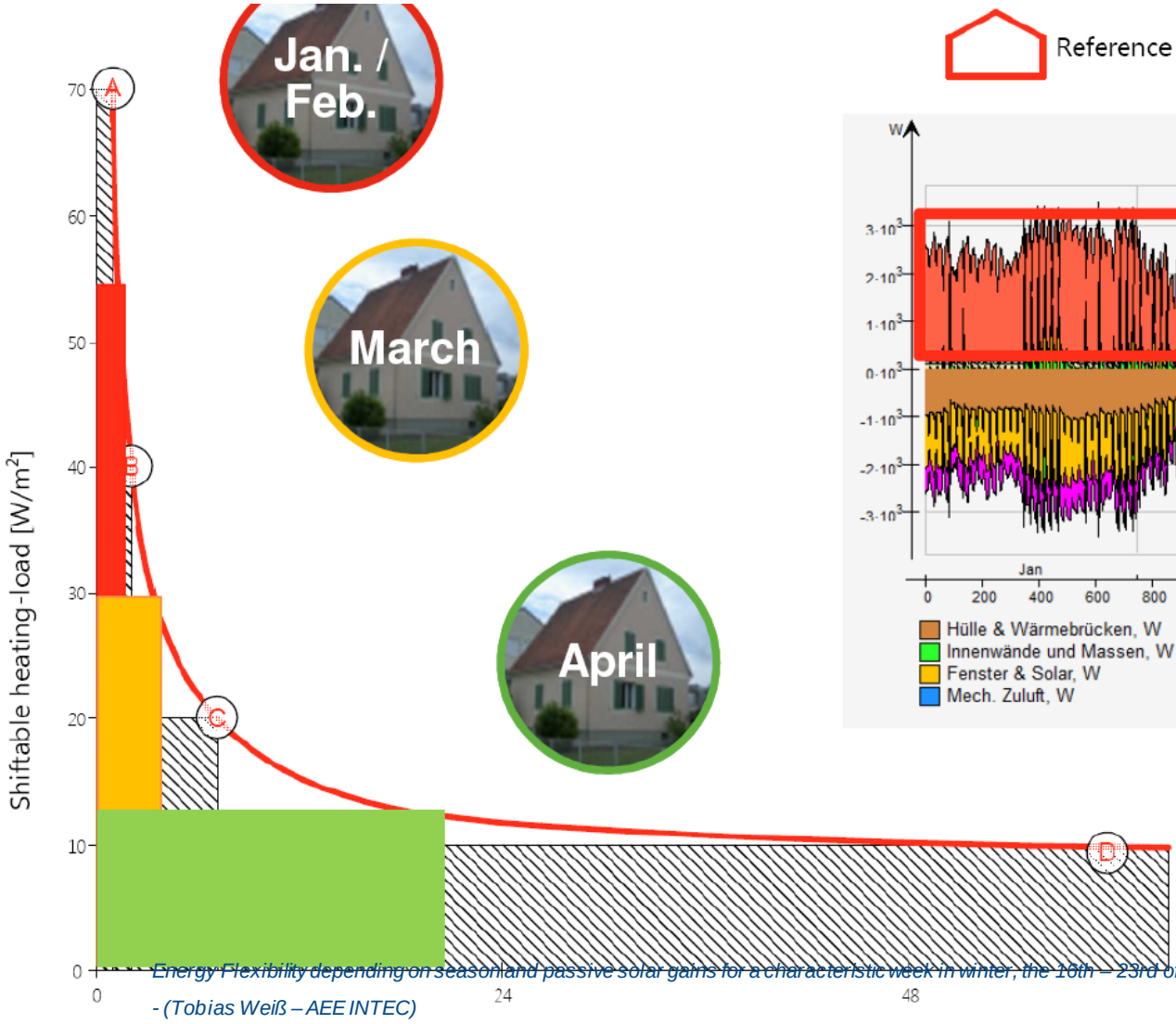
Load duration curves of case studies

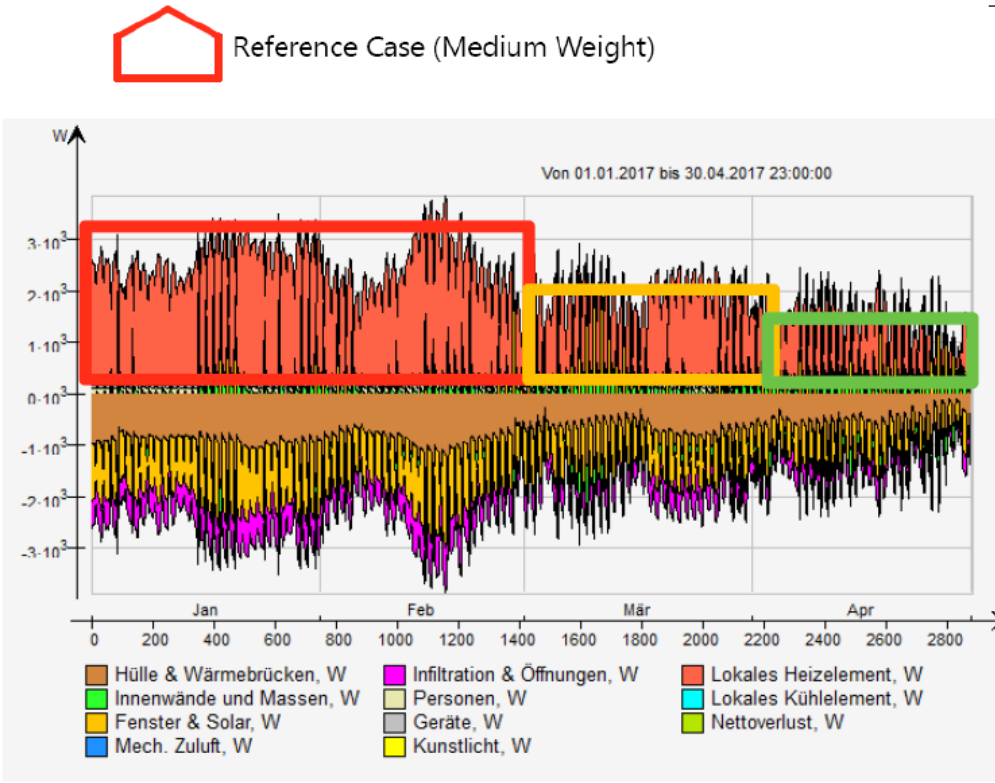
Min. Potential of shiftable domestic heating load over time (Δt1)



(Tobias Weiß – AEE INTEC)

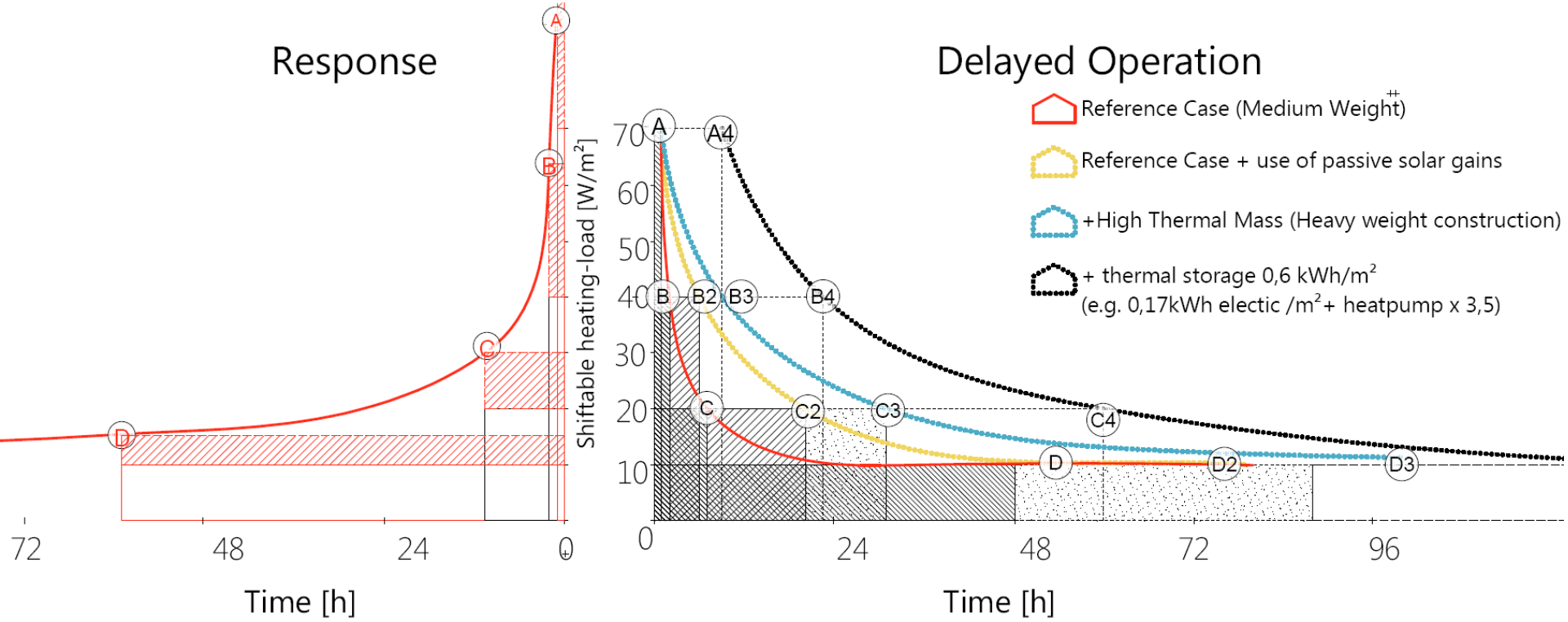
Energy Flexibility depending on climate:
Characteristic weeks





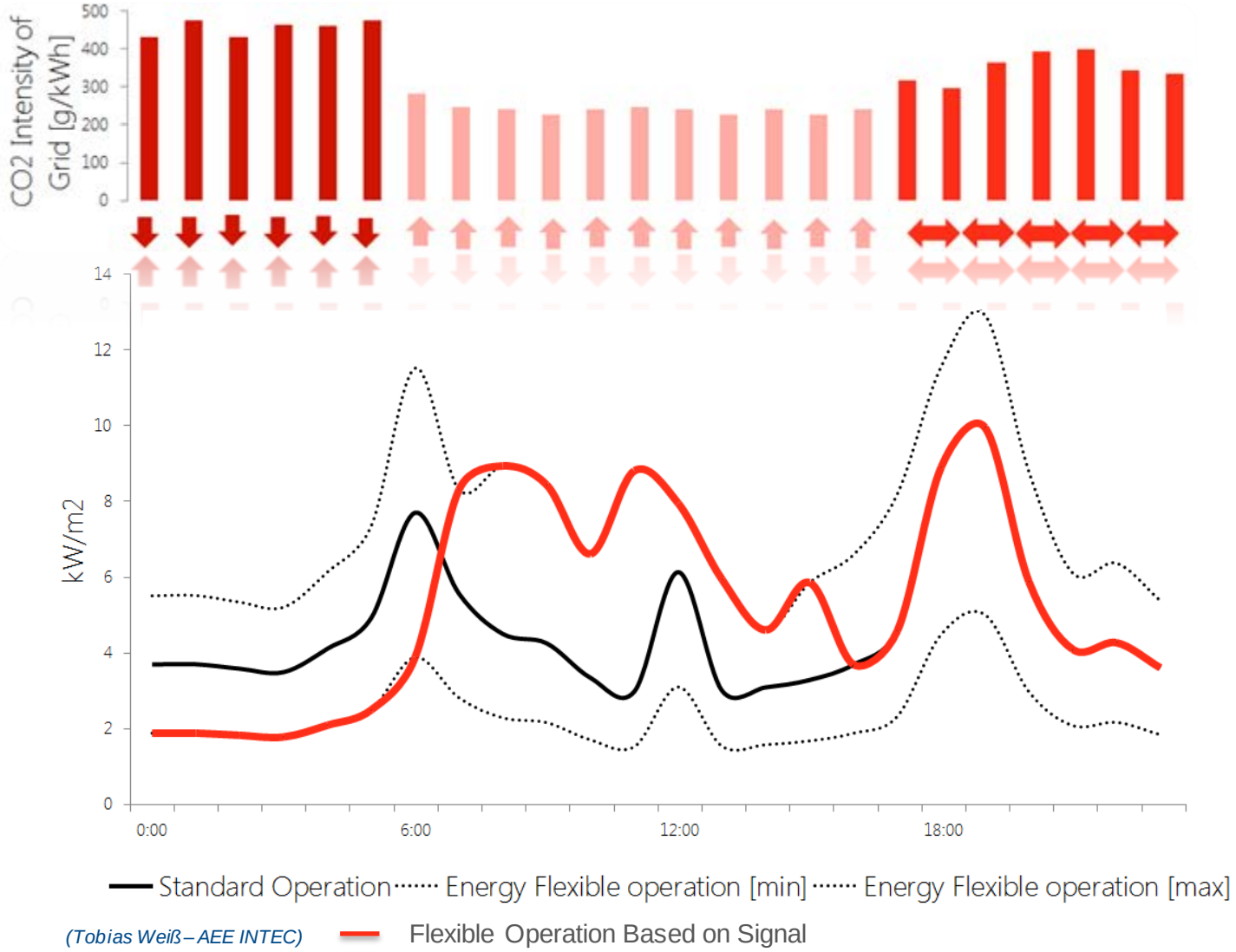
Energy Flexibility depending on seasonland passive solar gains for a characteristic week in winter, the 16th – 23rd of January, and in spring, the 16th – 23rd March - (Tobias Weiß – AEE INTEC)

Rebound-effect of shiftable thermal loads:
delayed operation (Δt1) and response (Δt2)



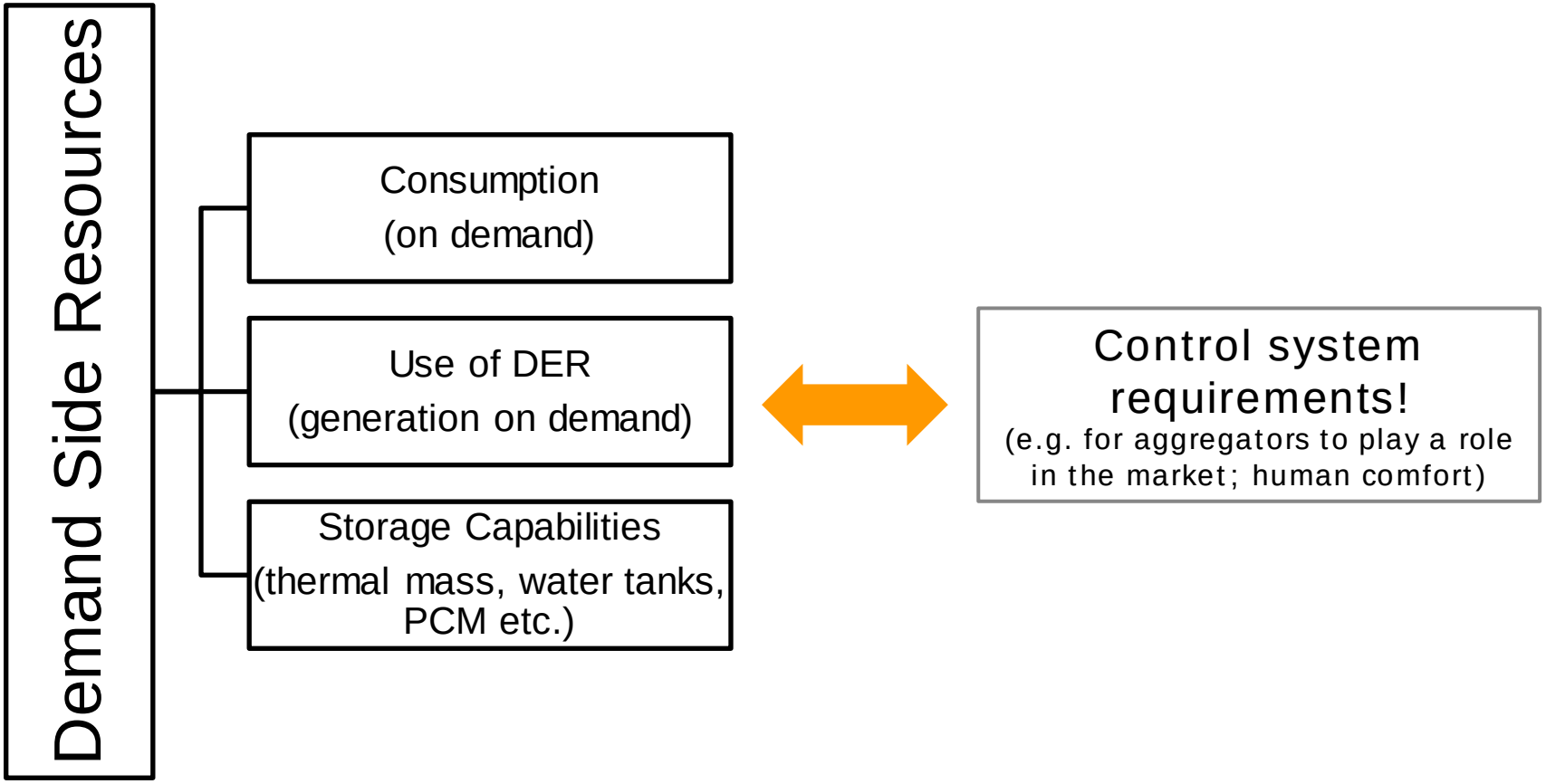
Rebound effect of shiftable domestic heating loads over time delayed operation (Δt1) and response (Δt2)- (Tobias Weiß – AEE INTEC)

Grid Signal



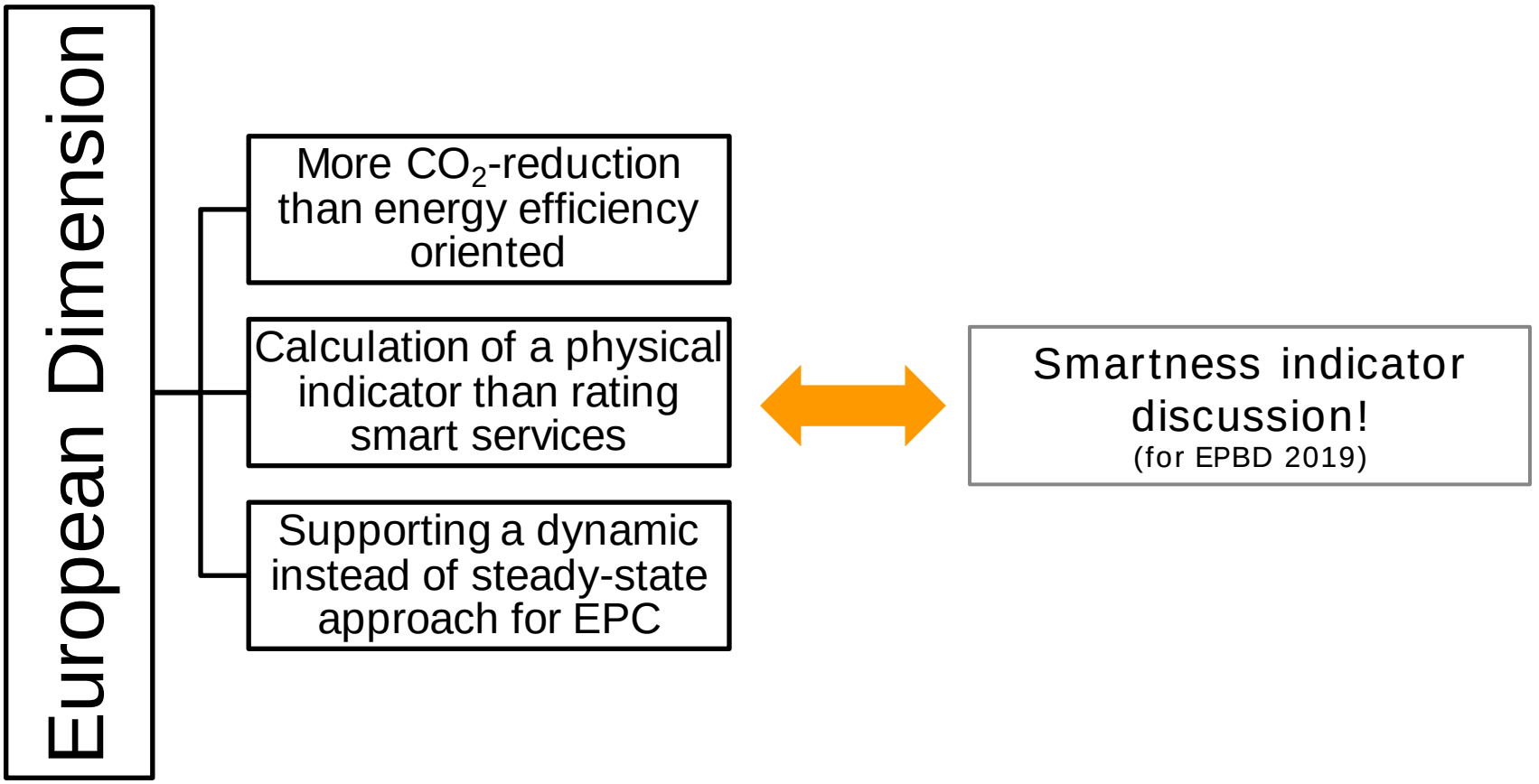
(Tobias Weiß – AEE INTEC)

Conclusion



Source: AEE INTEC based on SEDC 2015

Prospects


European Dimension
More CO_2-reduction than energy efficiency oriented
Calculation of a physical indicator than rating smart services
Supporting a dynamic instead of steady-state approach for EPC
Smartness indicator discussion!
(for EPBD 2019)

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IDEA TO ACTION

Thank you
for your Attention