

Evaluation of the applicability of the quasi-steady-state overheating indicator for offices and schools



Kim Goethals

supervisor: Arnold Janssens

*Laboratory of Building Physics,
Construction and Services*

*Funded by the Brussels Institute for
Environmental Protection
(project IBGE/BIM-EPICOOOL)*

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USE A HINT OF MINT



FIND A COOL PLACE



KEEP THE AIR FLOWING

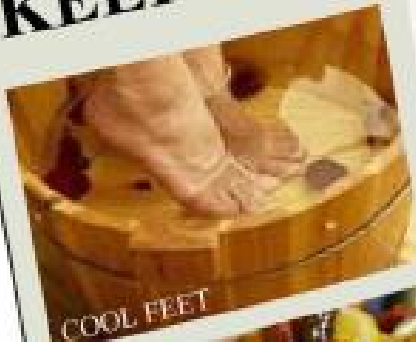


EUROPEAN COMMISSION



EPBD

KEEP COOL! AT WORK



COOL FEET



EAT SPICY



COOL AS A CUCUMBER

played by ... Pasadena campus ... of the weight-lifting area of the ... ical-fitness department. But you may not know how he came to be there. *The Journal*, recently spoke with Mr. Sneider about his life, including the interesting events that led up to his employment with AC.

Harry Sneider was born in 1941 in Riga, Latvia, but when the Russians arrived in 1944 he and his family escaped into Poland, then into Czechoslovakia and later Germany.

and instead ... together at the hip, and the joint was completely ruined."

In 1949 the Sneider family came to the United States and settled in Minneapolis, Minn.

It was there that Harry underwent another surgery, this one requiring a nine-inch plate near his hip joint.

In 1963, ... university of Minnesota ... began his career in p ... See **WGG'S FORMER 1**

ABR to open first of 25 schools in December

GERMANTOWN, Md.—The Association for Biblical Research (ABR), operated by Al Carozzo of Esccondido, Calif., Ann Molaros of Conroe, Texas, and others, announced in November plans to open 25 Advanced Biblical Studies, North Little Rock, Ark. The first campus will open in Brooklyn, N.Y., on Dec. 7, 2008, announced general registrar Lennox Abrigo of Germantown.

The first school will meet temporarily at Mount Zion Church of God (7th Day), powered by Gilford Monroe, 203 E. 37th St., Brooklyn.

"The Association for Biblical Research intends to open these schools in several cities across America and around the world," Abrigo told *The Journal*.

Students can earn a certificate and diploma in ministry and bachelor's and master's degrees in biblical studies. The director of the schools will be Ron Mosley of North Little Rock.

"For information on accreditation, prospective students may contact me," Mr. Abrigo said. Write him at P.O. Box 1068, Germantown, Md. 20875, U.S.A., or phone him at (240) 467-2741.



Lennox Abrigo

CGBS offers Bible MP3 CDs in Spanish

GLADENWATER, Texas—A set of Bible studies in Spanish by a long-time God member who died early through the Church of Christ ... available through the Church of Christ (CGBS).

Seventy-nine-year-old Donald ... worked for the Spanish ... the Workweek. ... Pasadena, Calif., ... while attending the ... 15 years from the ... The ... Church of Christ ...

In ... Mr. ...



Donald V. Barrett



David Barrett

England—One night 18-year-old ... awakened by her father and ... to marry 50-year-old Merrill Jess ... man she had never met. Two ... later she became his fourth wife. ... the next 15 years she bore him ... children, and he took several ... wives.

Carolyn tells her story in *Escape*, a 400-page hardback from Broad Books, widely available in bookstores and for \$17 at Amazon.com.

Although she was unhappy about it, for Carolyn this arrangement seemed normal. She was born and raised in Colorado City, Ariz., just south of the Utah state line, in the Fundamentalist Church. See **FOR DECADES**, page 9.

... seeking to ... Through Abra- ... progeny. Yahweh ... would bring forth a nation. ... **NEBOR CALLS FOR A RETURN**, page 9

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By Dixon Cartwright
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 Seventy-nine-year-old Dixon
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 while attending the
 13 years from the
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 Church of God in
 into CD format, is
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 and English. The
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 purchase from the
 CGBS website at
 www.cgbs.org.



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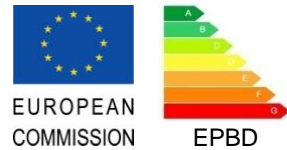
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Constitutive stimulus of alternative cooling methods badly needed

EU set the EPBD



Common calculation method (EN 13790):
preferably quasi-steady-state (instead of BES)
Minimum requirements on energy performance

Summer comfort
and cooling
underrepresented

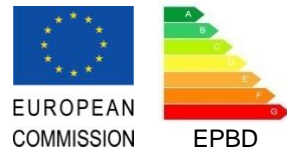


Focus on heating vs increasing cooling demand:
e.g. 5 out of 9 EU countries have a (limited)
summer analysis

Additional requirement(s) to
limit the overheating risk
promote passive cooling

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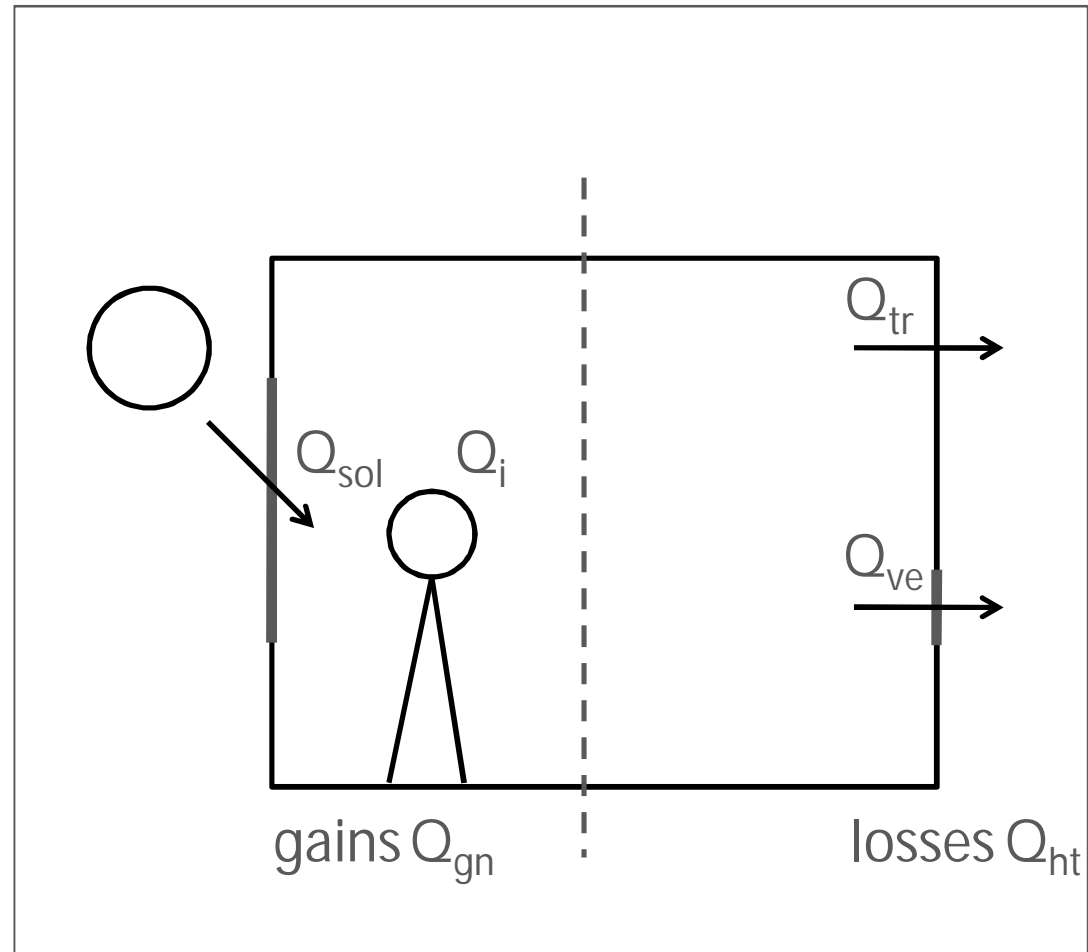


Focus on heating vs increasing cooling demand:
e.g. 5 out of 9 EU countries have a (limited)
summer analysis

Additional requirement(s) to
limit the overheating risk
promote passive cooling
such as an overheating indicator

Quasi-steady-state calculation in a nutshell

Heat balance over
long time (month)

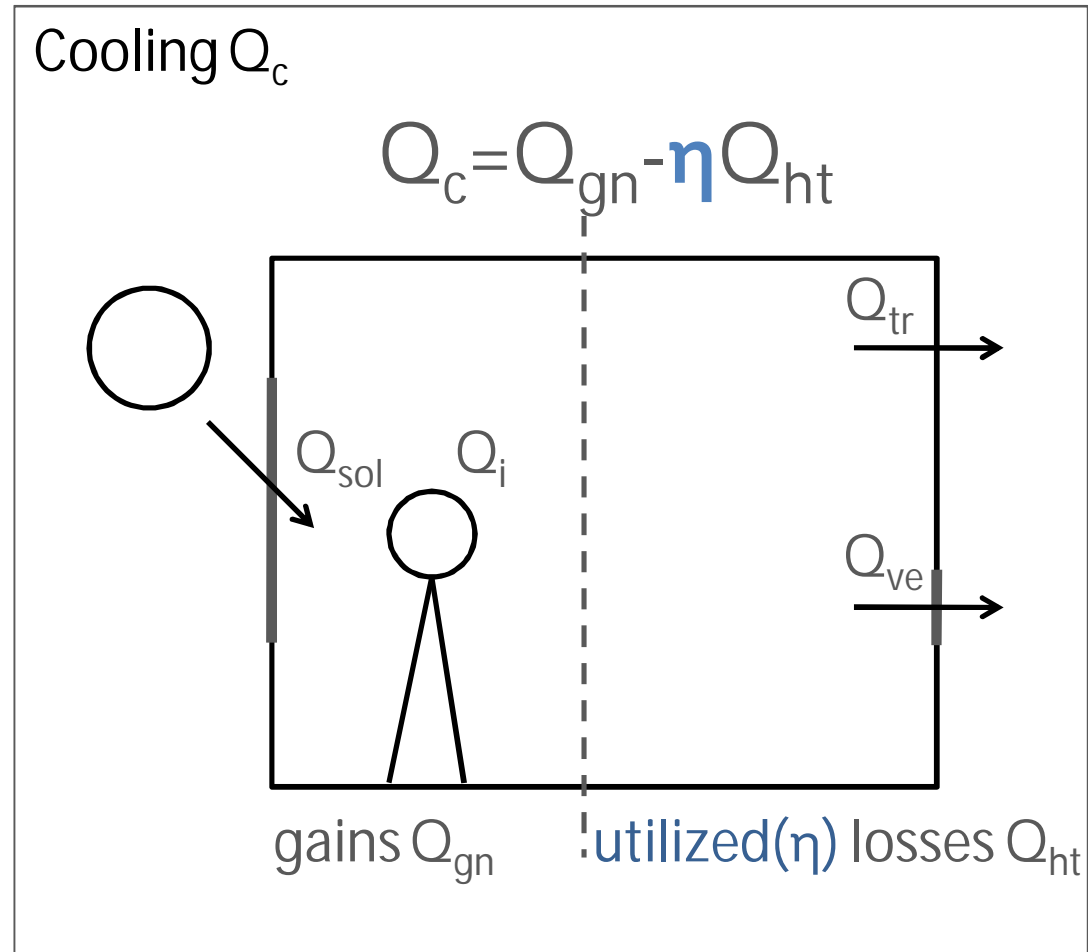


Quasi-steady-state calculation in a nutshell

Heat balance over
long time (month)

Utilization factor
for dynamic effects

$\eta \sim Q_{ht}/Q_{gn} = 1/\gamma_c$
~ thermal mass



Summer analysis: original overheating indicator

Deutscher et al. (2000)

In line with method
for heating demand
(EN 832, predecessor
of EN 13790)

$$Q_{NN} = \sum_{i=1}^{12} \frac{(1 - \eta_{H,gn}) \cdot Q_{H,gn}}{(H_{tr,adj} + H_{ve,adj})}$$

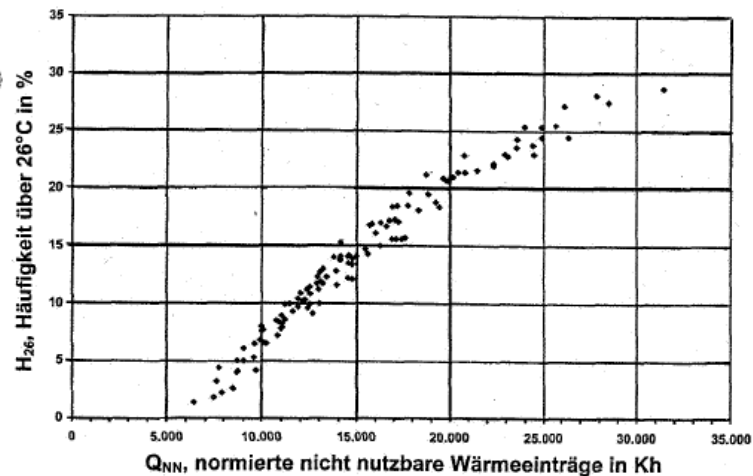


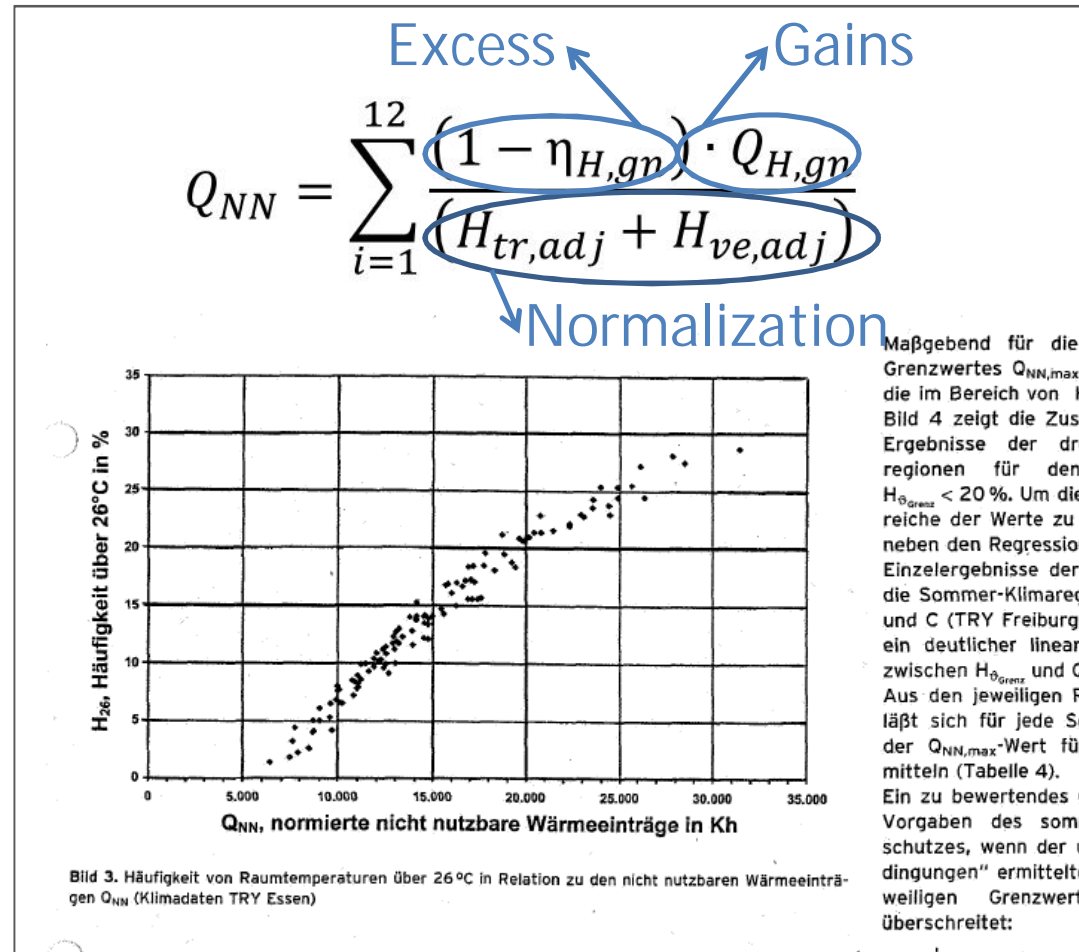
Bild 3. Häufigkeit von Raumtemperaturen über 26°C in Relation zu den nicht nutzbaren Wärmeinträgen Q_{NN} (Klimadaten TRY Essen)

Maßgebend für die Grenzwert $Q_{NN,max}$ die im Bereich von H_{26} Bild 4 zeigt die Zusammenhänge der Ergebnisse der drei Regionen für den $H_{26, Grenzwert} < 20\%$. Um die Reihe der Werte zu neben den Regression Einzelergebnisse der die Sommer-Klimareg und C (TRY Freiburg) ein deutlicher linearer Zusammenhang zwischen $H_{26, Grenzwert}$ und $Q_{NN,max}$ liegt sich für jede Sommer-Klimaregion der $Q_{NN,max}$ -Wert für die jeweiligen Klimaregionen fest (Tabelle 4). Ein zu bewertendes Q_{NN} muss die Vorgaben des sommerlichen Wärmeschutzes, wenn der Grenzwert überschreitet:

Summer analysis: original overheating indicator

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In line with method
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Summer analysis: Flanders' adoption

Flanders (Belgium)

$$I_{overh} = \sum_{i=1}^{12} \frac{(1 - \eta_{H,gn}) \cdot Q_{H,gn}}{(H_{tr,adj} + H_{ve,adj})}$$

Input and calculation
parameters of heating

$\theta_{int} = 18^{\circ}\text{C}$ (instead of 20°C)

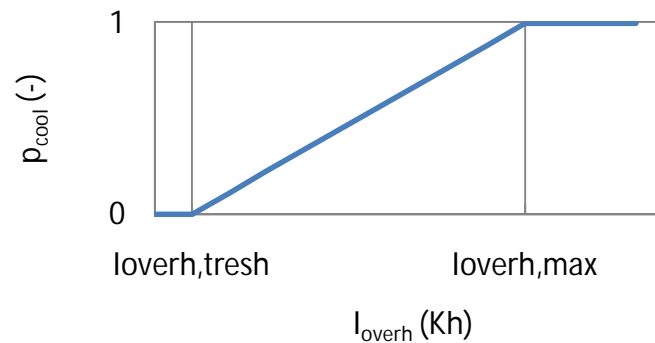
$n = 1.0\text{h}^{-1}$ (instead of 0.7h^{-1} or 3.0h^{-1})

Limited applicability

Dwellings

Fictitious cooling

Penalizes the instalment of mechanical
cooling afterwards



Summer analysis: revised overheating indicator

Proposal

$$I_{overh} = \sum_{i=1}^{12} \frac{(1 - \eta_{C,gn}) \cdot Q_{C,gn}}{(H_{tr,adj} + H_{ve,adj,ext} + H_{ve,adj,hyg})}$$

Input and calculation
parameters of cooling

e. g. $\theta_{int} = 23^{\circ}\text{C}$

Additional heat transfer
coefficients

Passive cooling techniques
(e.g. windows, increased mechanical
ventilation during daytime, night cooling)

Upper and lower bounds

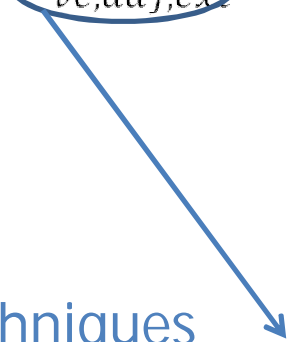
Reusing fictitious cooling

Extended applicability

Dwellings + offices, schools

Summer analysis: revised overheating indicator

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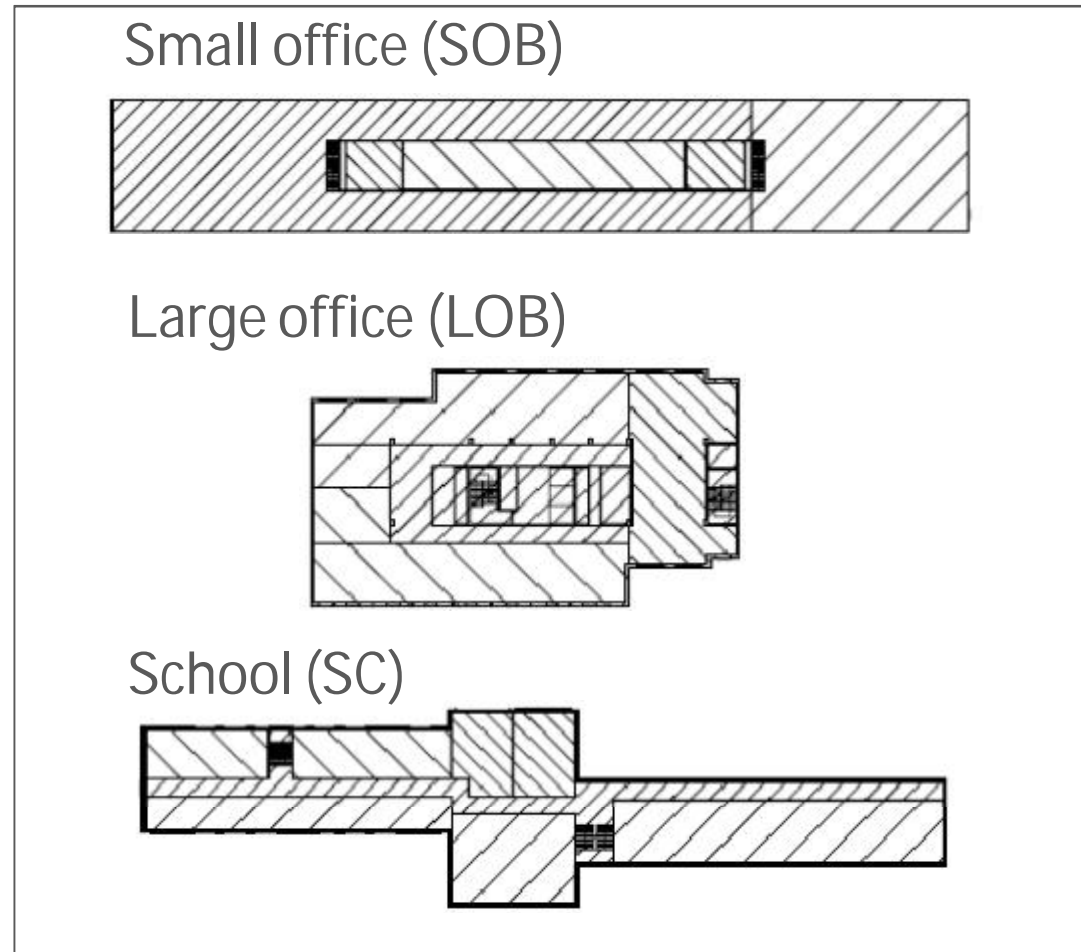
Dwellings + offices, schools

Dynamic simulations of three non-residential buildings

>1 building zone
(concurring in
EPB and TRNSYS)

3 quality levels
(ACCeptable,
GOOd,
VERy good)

8 x 2 levels of
internal loads
(real, mean)



Comfort assessment based on dynamic simulations

Discomfort when...

Number of hours for which a PMV-value larger than 0.5 applies, exceeds 100h/year or $TE(PMV > 0.5) > 100\text{h/year}$ (ISSO, 2004)

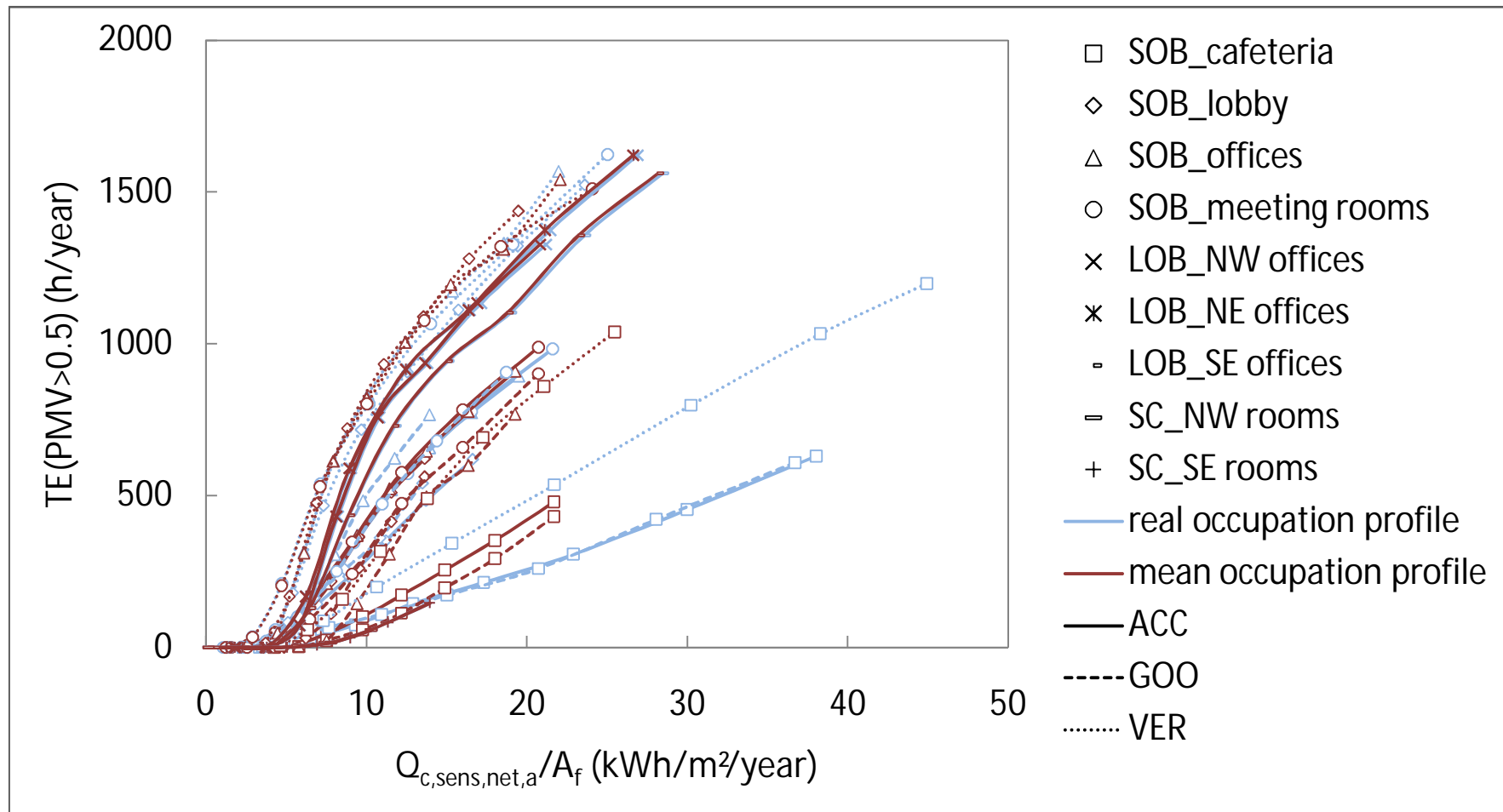
ASIEPI suggests adaptive comfort

Higher tolerance when users are allowed to adapt to the building's environment

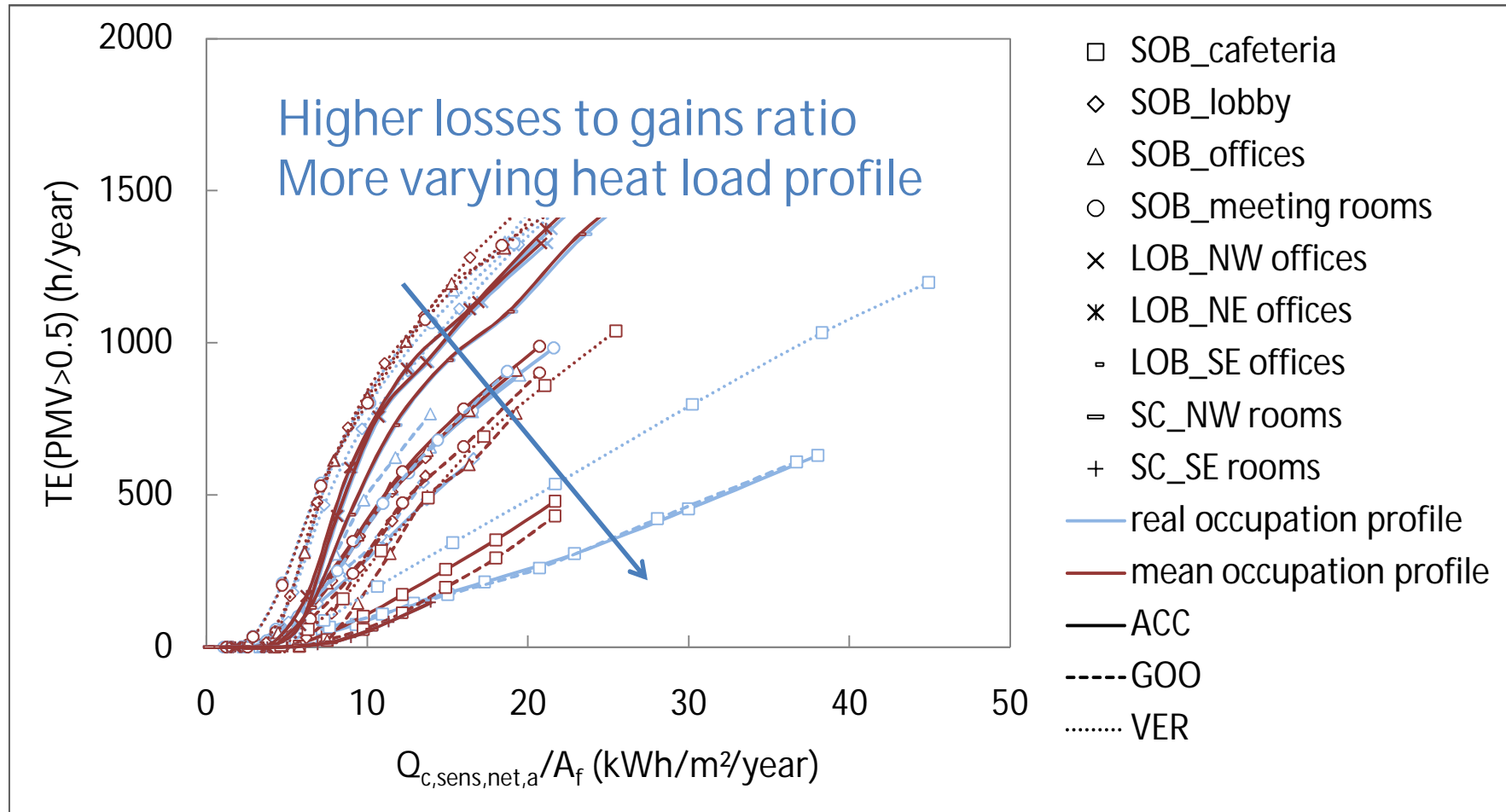
EPBD for compliance control

Safe approximation: PMV only takes into account a varying clothing resistance

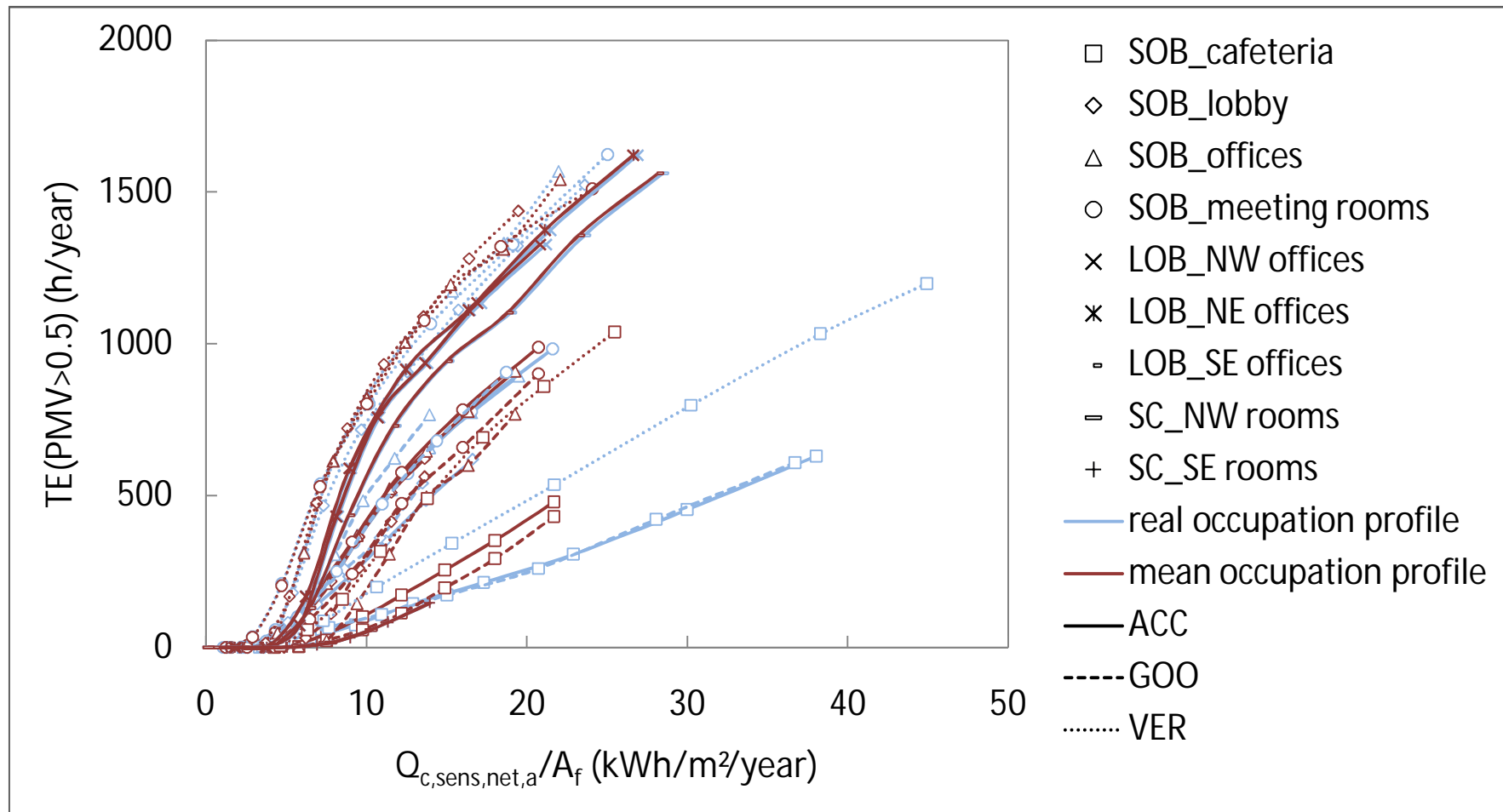
Input and calculation parameters used for cooling as a reference



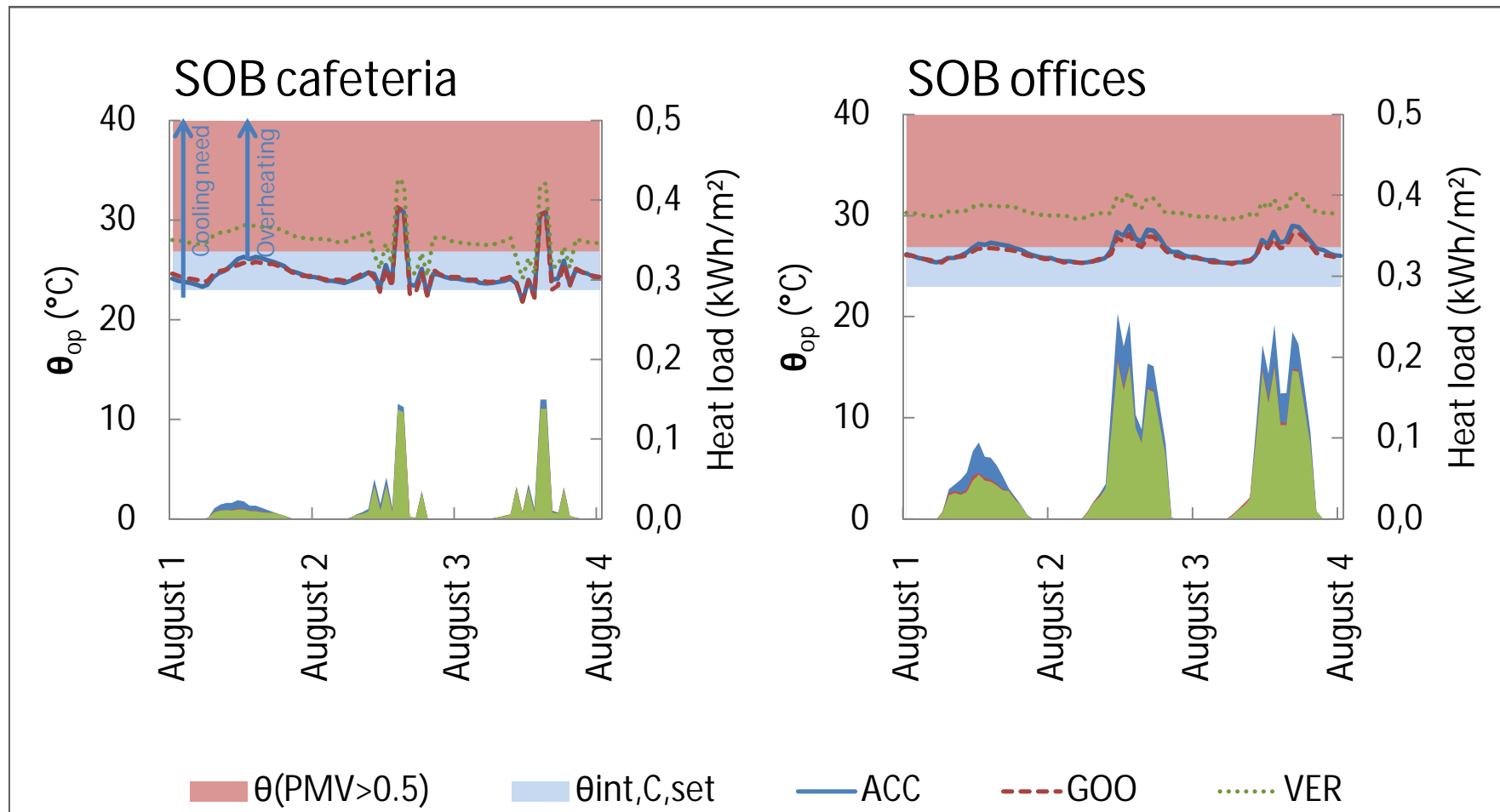
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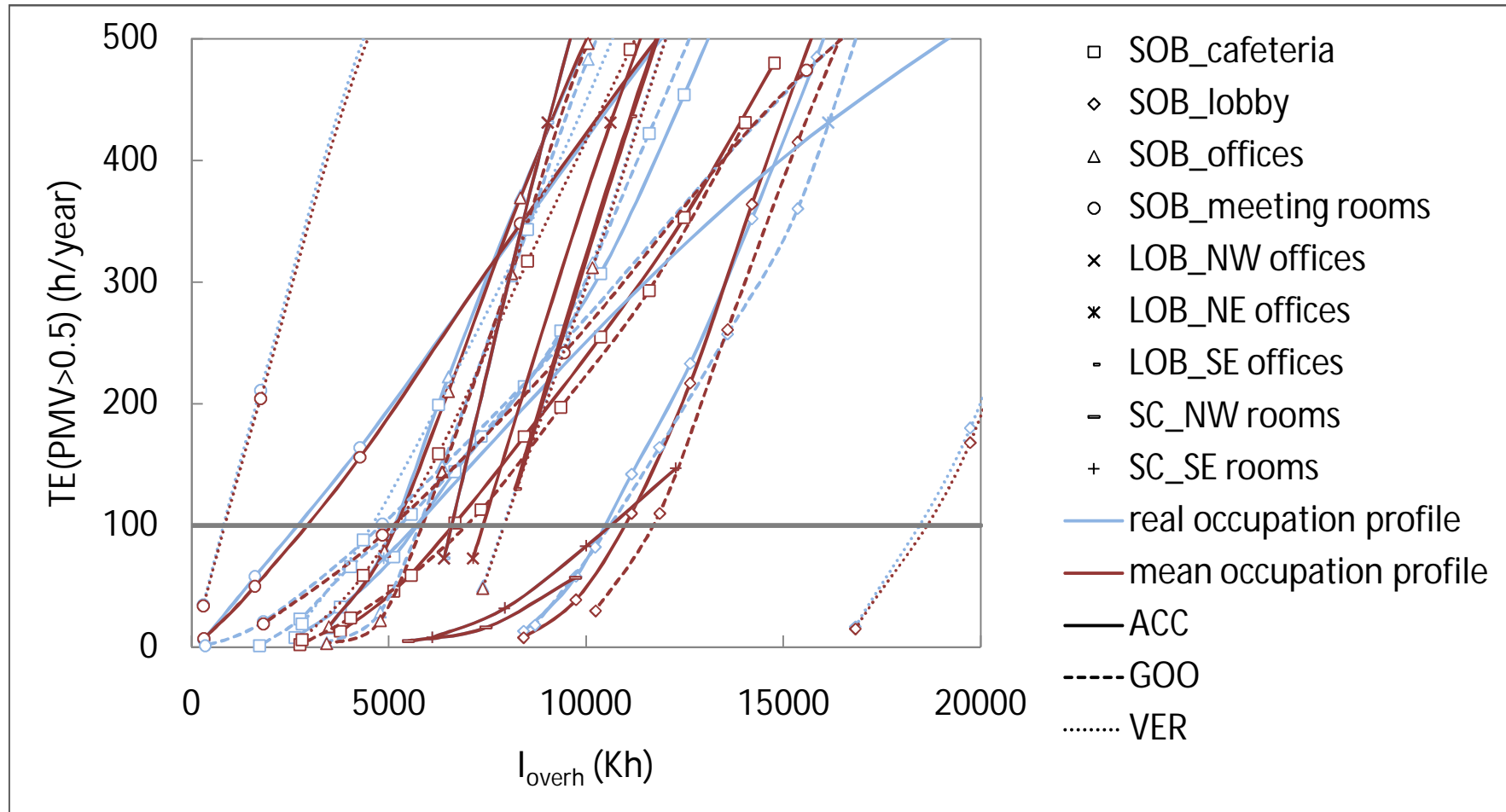
Input and calculation parameters used for cooling as a reference



Impact of occupation profiles



Overheating indicator applicable to offices and schools ...

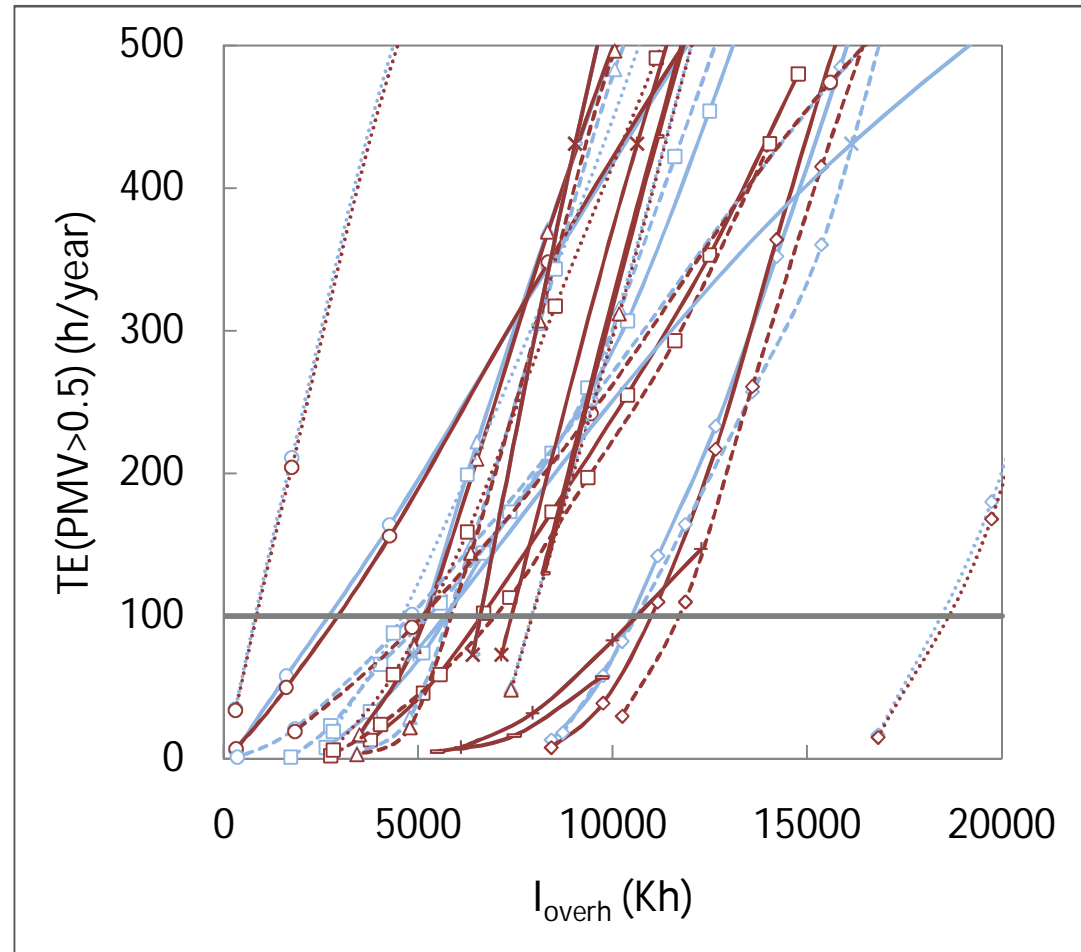


... but shows differing relations

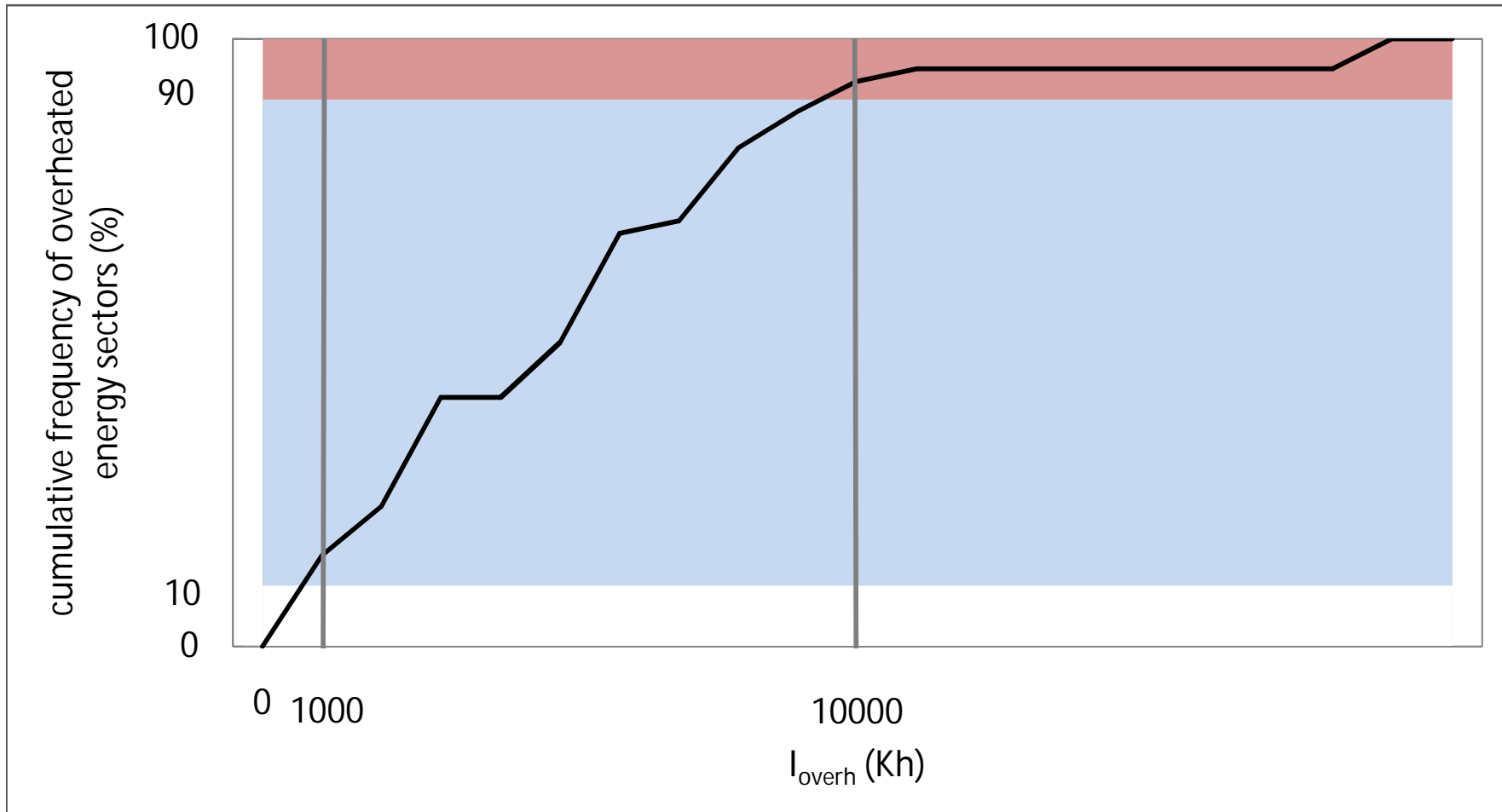
Heat load profiles

Period of excess gains
<> occupation period

Fixed indoor
temperature <>
thermal mass



Lower and upper bounds useful to implement fictitious cooling



Revised overheating indicator is suited

Calculation parameters
used for cooling

More logic

Large spread

Introduction of fictitious cooling

Promote passive
cooling techniques

Opening windows during daytime (Goethals
and Janssens, 2010a)

Increased mechanical ventilation during
daytime (Goethals and Janssens, 2010b)

Night ventilation (Breesch et al., 2011)

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