



# Federation of European Heating, Ventilation and Air Conditioning Associations

**Professional organization with 28 member countries  
representing more than 100 000 HVAC experts in Europe**

REHVA **Rue Washington 40, 1050 Brussels**  
**Belgium**

- [www.rehva.eu](http://www.rehva.eu)
- [info@rehva.eu](mailto:info@rehva.eu)
- Tel: +32 2 514 11 71
- Fax: +32 2 512 90 62



# Use of REHVA Guidebook Power Point Presentations

- This Power Point Presentation can be freely used for training purposes by REHVA members.
- It is prepared by the main authors to the REHVA Guidebook.
- Please refer the original authors always when making the presentation.
- Inform REHVA secretariat each time the presentation is used: [info@rehva.eu](mailto:info@rehva.eu)

# Indoor Climate Quality Assessment

Evaluation of indoor thermal environment and  
indoor air quality

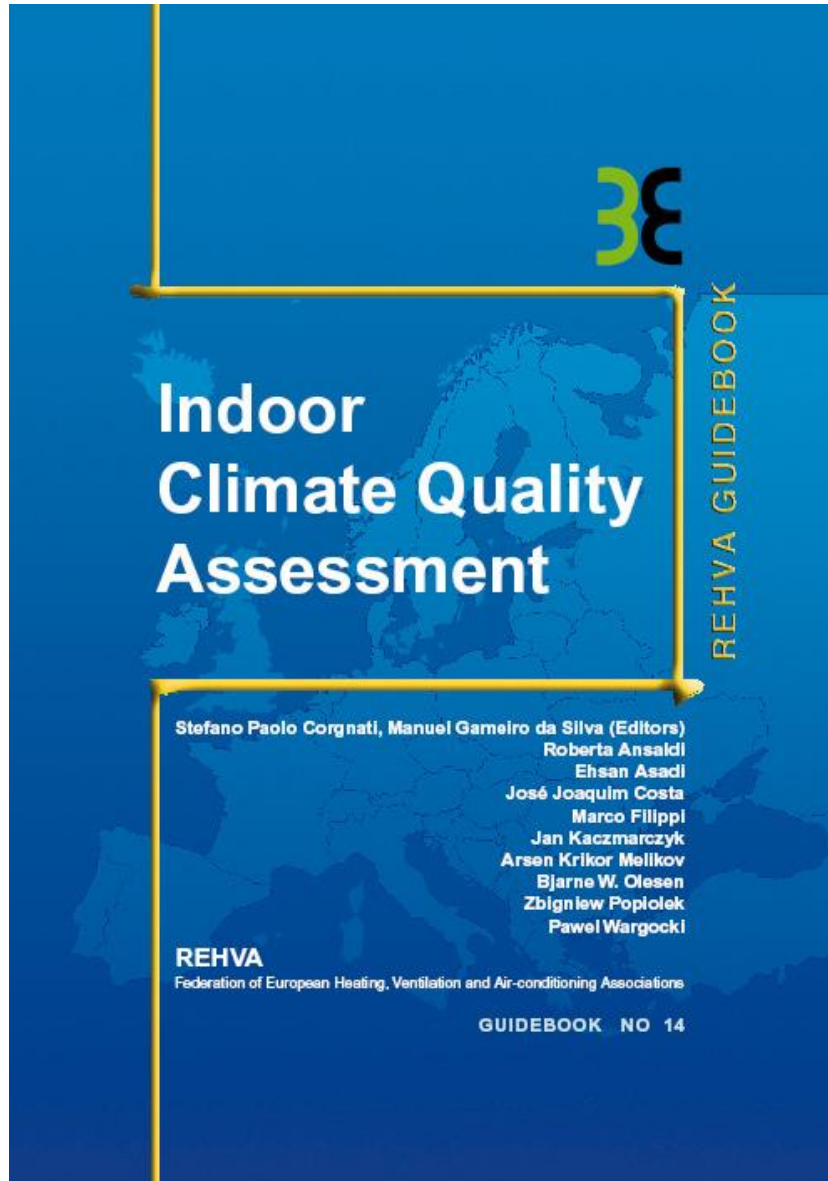
## REHVA Guidebook n° 14

**Stefano P. Corgnati<sup>1,3</sup>, Manuel Gameiro da Silva<sup>2, 3</sup>**

**1 - Polytechnic of Torino**

**2 - University of Coimbra**

**3 - REHVA**



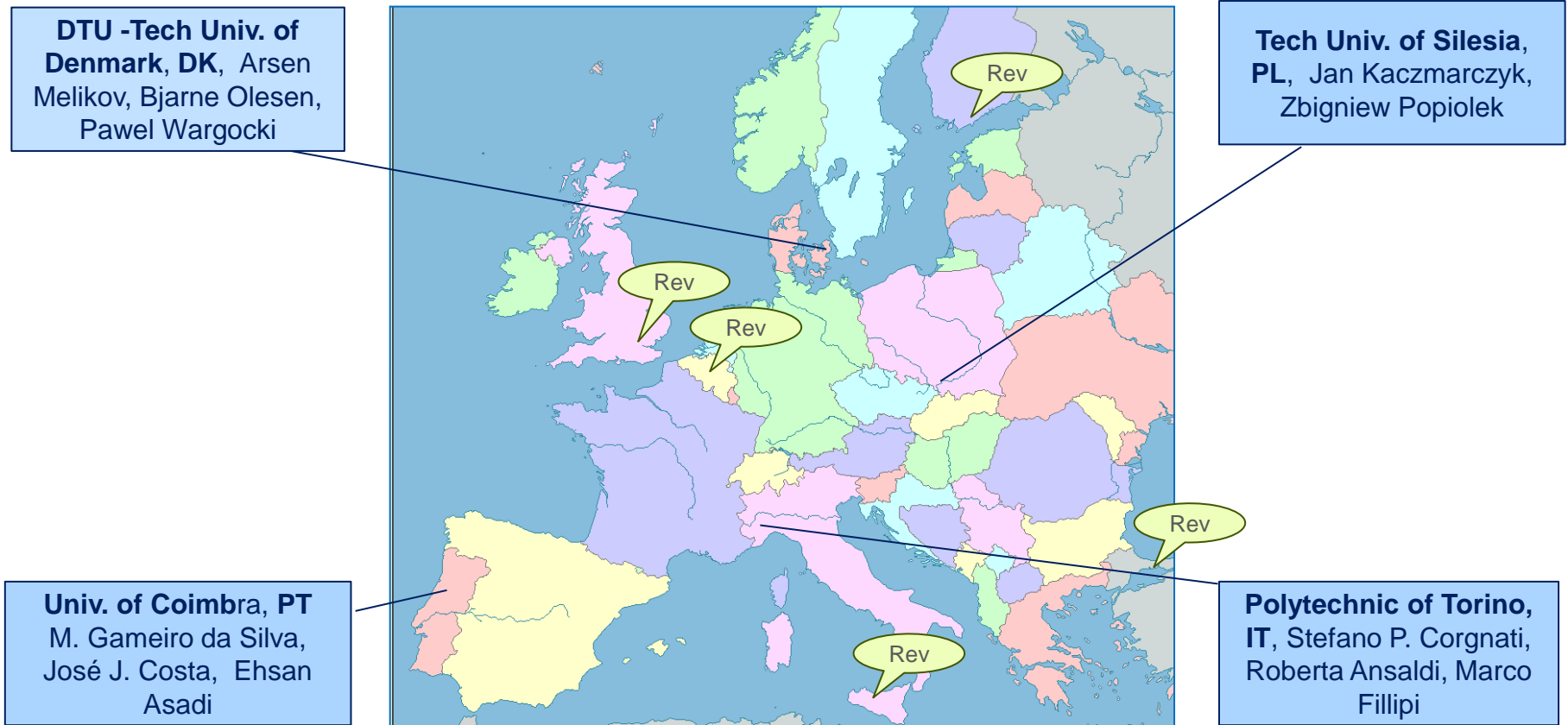
Stefano Paolo Corgnati (ed.)  
Manuel Gameiro da Silva (ed.)  
Roberta Ansaldi  
Ehsan Asadi  
José Joaquim Costa  
Marco Fillipi  
Jan Kaczmarczyk  
Arsen Krikor Melikov  
Bjarne W. Olesen  
Zbigniew Popiolek  
Pawel Wargocki

# Why this Topic ?

**Indoor climate quality** (ICQ, concerning thermal, hygrometric and indoor air quality aspects) strongly influences the **well-being** in buildings and the **productivity** in working and educational environments (see REHVA Guidebook about Indoor Environment and Productivity in offices) and the related **energy costs** to maintain suitable comfort conditions.

Complementarily, the evaluation of ICQ plays an important role on the **evaluation/certification** of buildings energy quality.

# Rehva Task Force 31 – ICQA Guidebook



**Reviewers:** Derrick Braham (UK), Jean Lebrun (Belgium), Gianfranco Rizzo (Italy), A Zerrin Yilmaz (Turkey) & Olli Seppanen (Finland)

**Chairs' operative assistant:** Valentina Fabi (Italy)  
**Layout and typesetting:** Jarkko Narvanne (Finland)

# Aim of the Guidebook

To propose a methodology for in-field investigation on ICQ based on spot measurements and/or long term monitoring

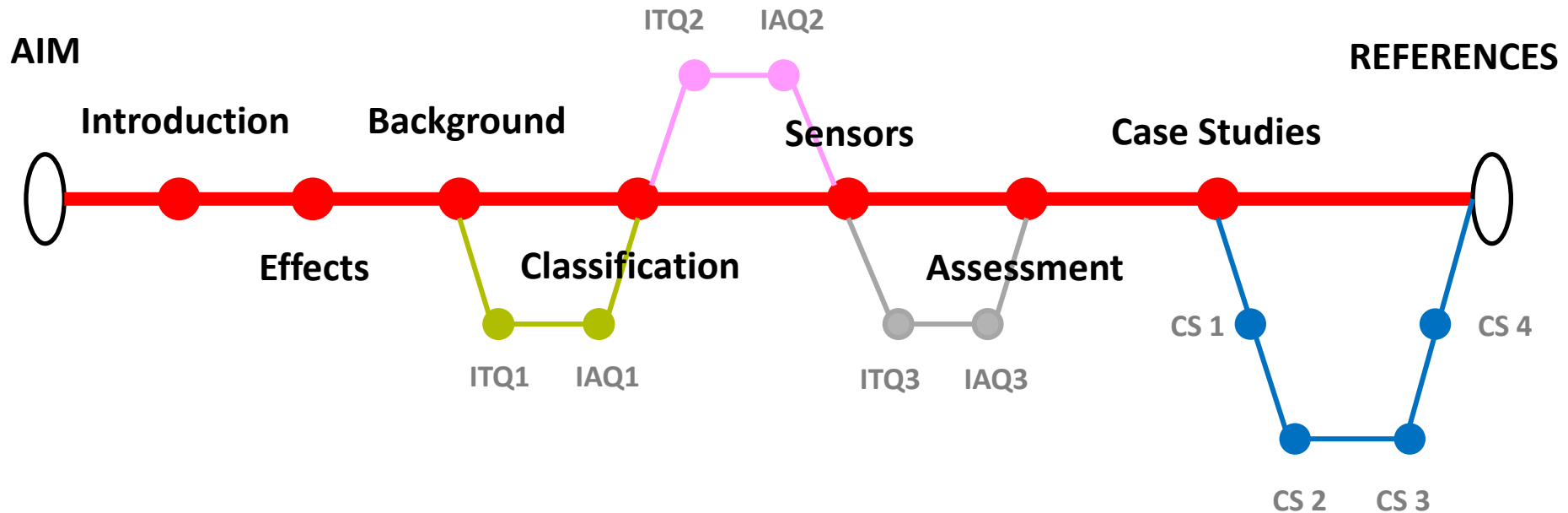
- What and how to measure ?
- Which indices to determine?
- How to present the results ?
- How to classify the ICQ level ?

Key questions

- Case studies

Learning by experiences

# A road map through the Guidebook



ITQ – Indoor Thermal Quality

IAQ – Indoor Air Quality





## AIM

*Aims of the guide book, receivers of the guidebook, building typologies this guidebook can be used for*



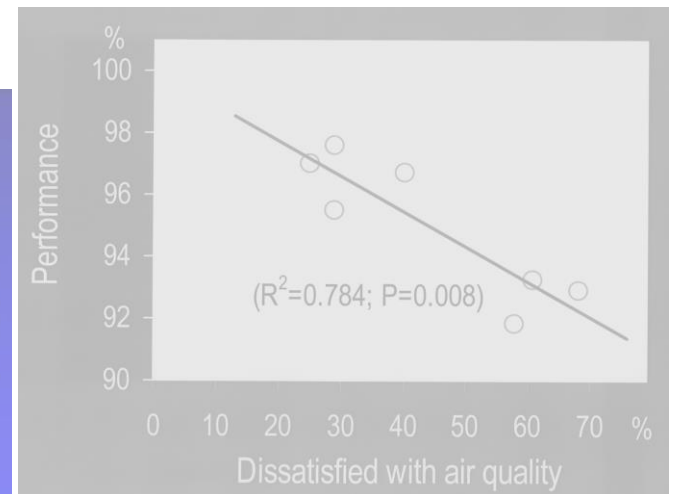
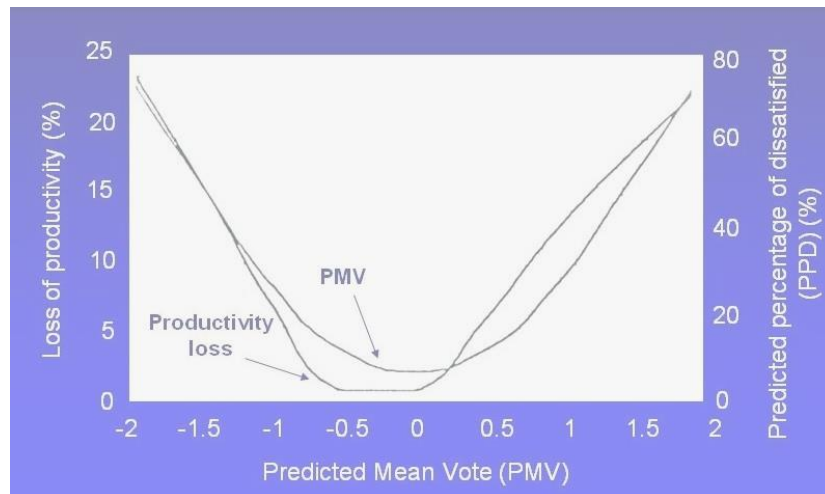
## Intro

*General introduction about indoor environmental quality, indoor climatic aspects and assessment; commissioning process; sustainability protocols*



## Effects

*Indoor climatic quality effects on productivity, effects of thermal environment and indoor air on performance and learning*





## Background

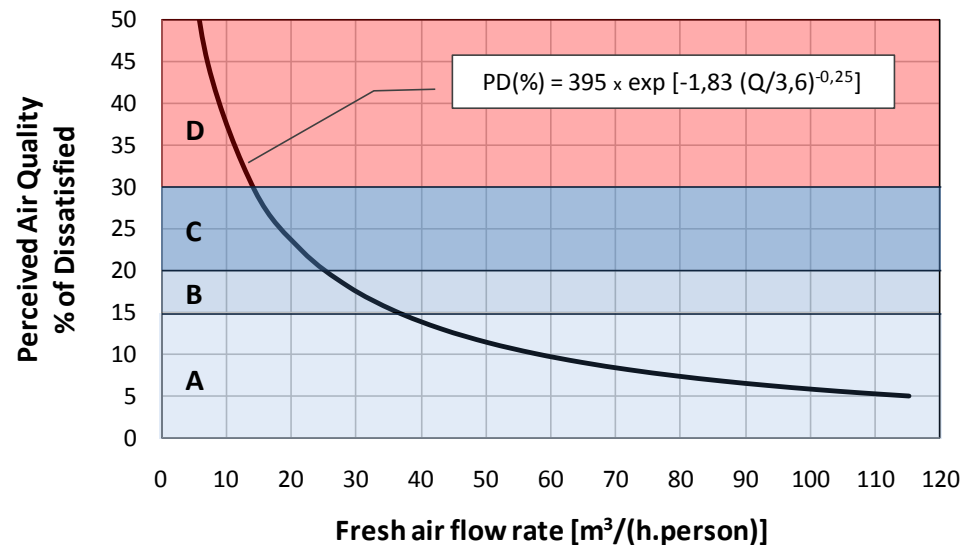
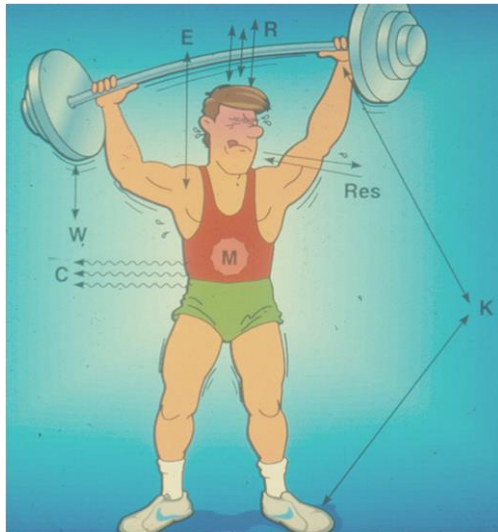
### *Theoretical background on indoor climatic quality*

ITQ 1 ●

*Indoor thermal quality, human body thermoregulation and energy balance, conditions for thermal comfort and discomfort in buildings without mechanical cooling*

IAQ 1 ●

*Indoor air quality general concepts, equations for the time evolution of a pollutant concentration, air exchange rate, local mean age of air, perceived indoor air quality, odour index*





## Classification

*Criteria for the classification of the indoor climate quality*

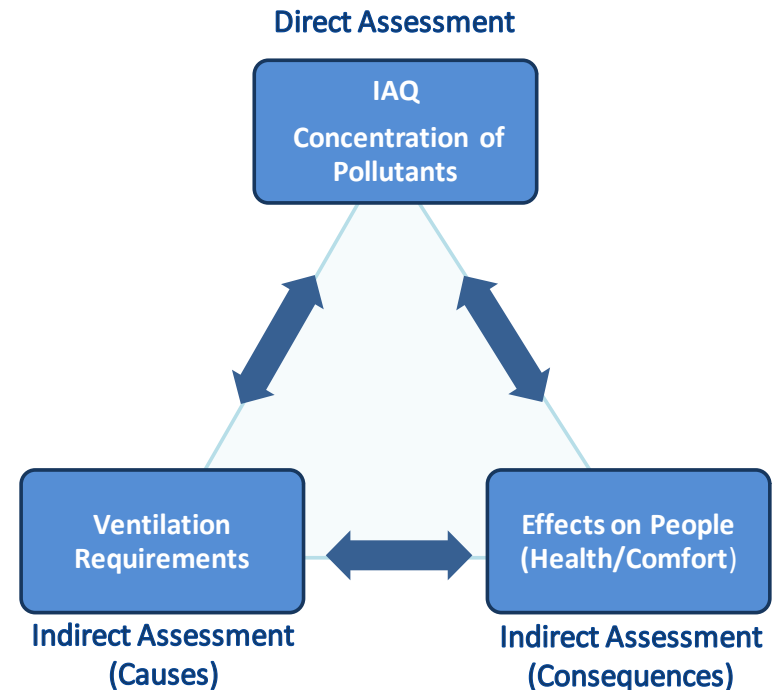
ITQ 2 ●

*Indoor thermal quality classification definition and categories, criteria for the acceptability of a thermal environment*

IAQ 2 ●

*Indoor air quality definition and categories*

CATEGORY	Thermal State of the body as a whole	
	PPD (%)	PMV
I	$\leq 6$	$-0,2 \leq pmv \leq 0,2$
II	$\leq 10$	$-0,5 \leq pmv \leq 0,5$
III	$\leq 15$	$-0,7 \leq pmv \leq 0,7$
IV	$> 15$	$pmv < -0,7; pmv > 0,7$





## Sensors and measurements

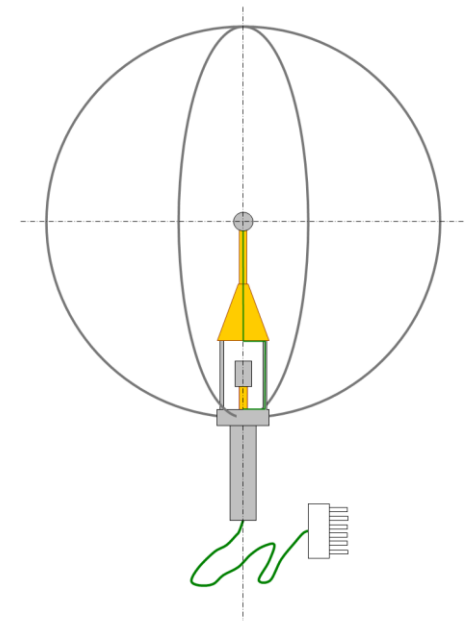
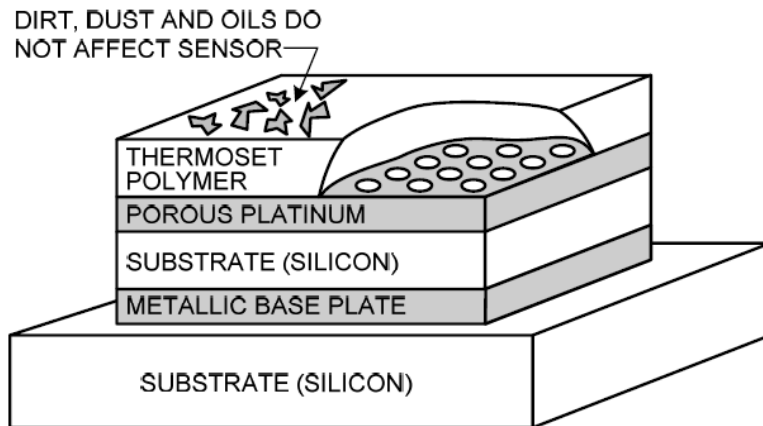
*Requirements, sensors and instruments, general remarks*

ITQ 3 ●

*Basic physical quantities used to define the indices of thermal comfort or thermal stress, sensors and instruments*

IAQ 3 ●

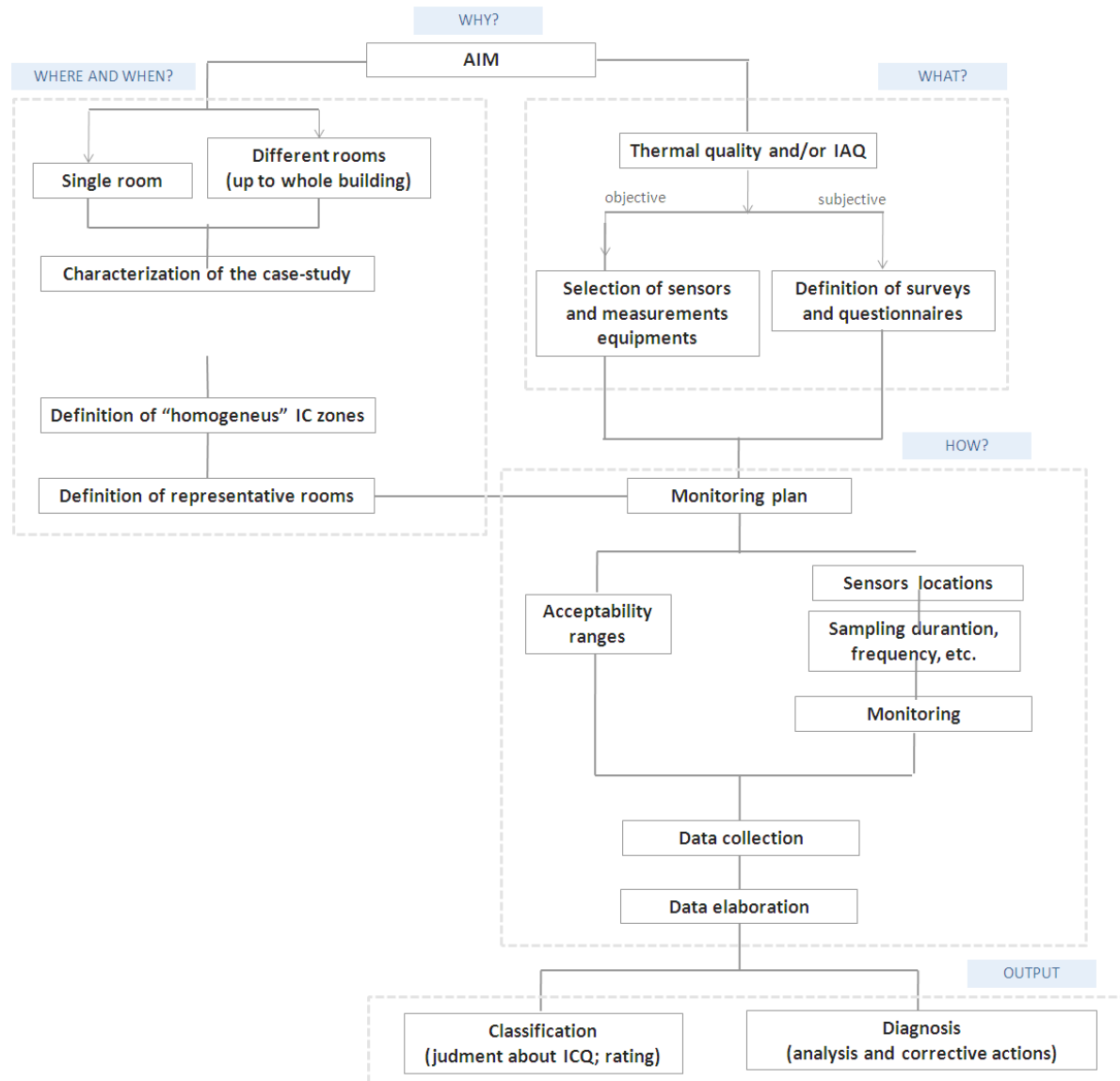
*Evaluation of pollutants concentrations and investigation of particles in indoor environments, sensors and instruments*





# Assessment

*Indoor climatic quality assessment procedure introduction, different steps to make an assessment procedure*





## Case Studies

*Several Cases on the Assessment of ICQ*

CS 1



*Indoor thermal quality, office room, displacement ventilation, spot measurements*

CS 2



*Indoor thermal and air quality, bank agency, short term measurements*

CS 3

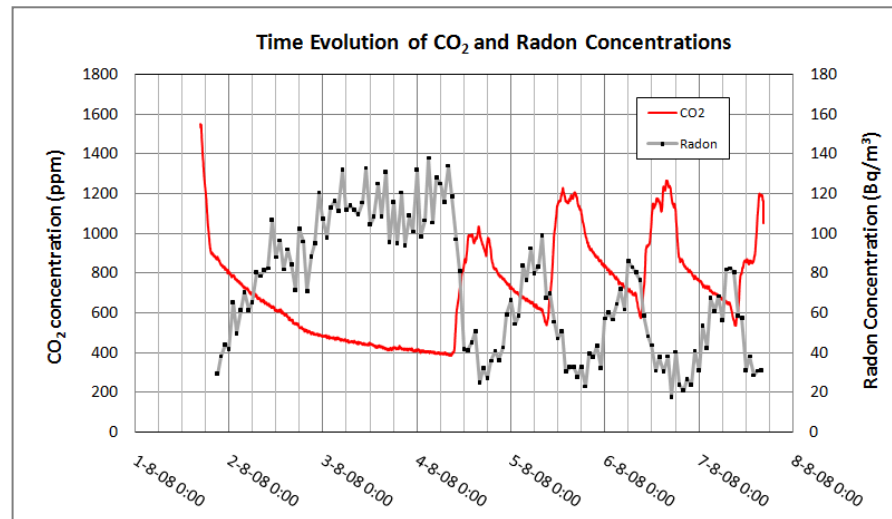
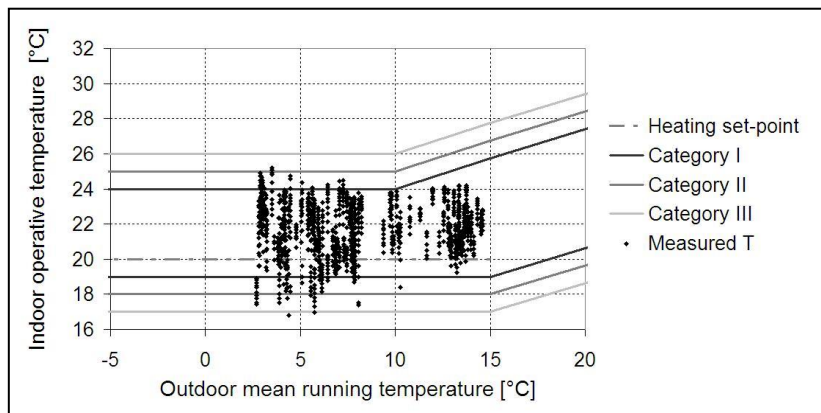
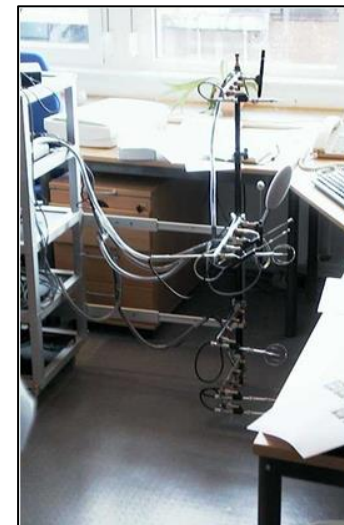


*Indoor thermal quality, office rooms, long term measurements*

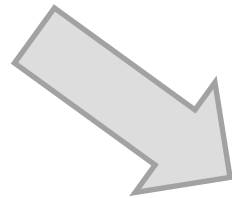
CS 4



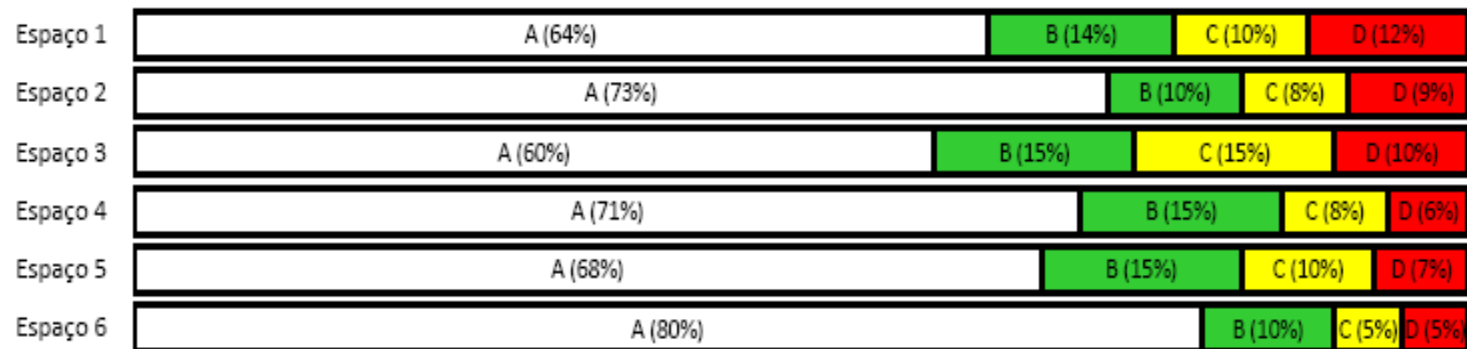
*Indoor climatic quality, energy consumptions, office building, wireless network web-based monitoring*



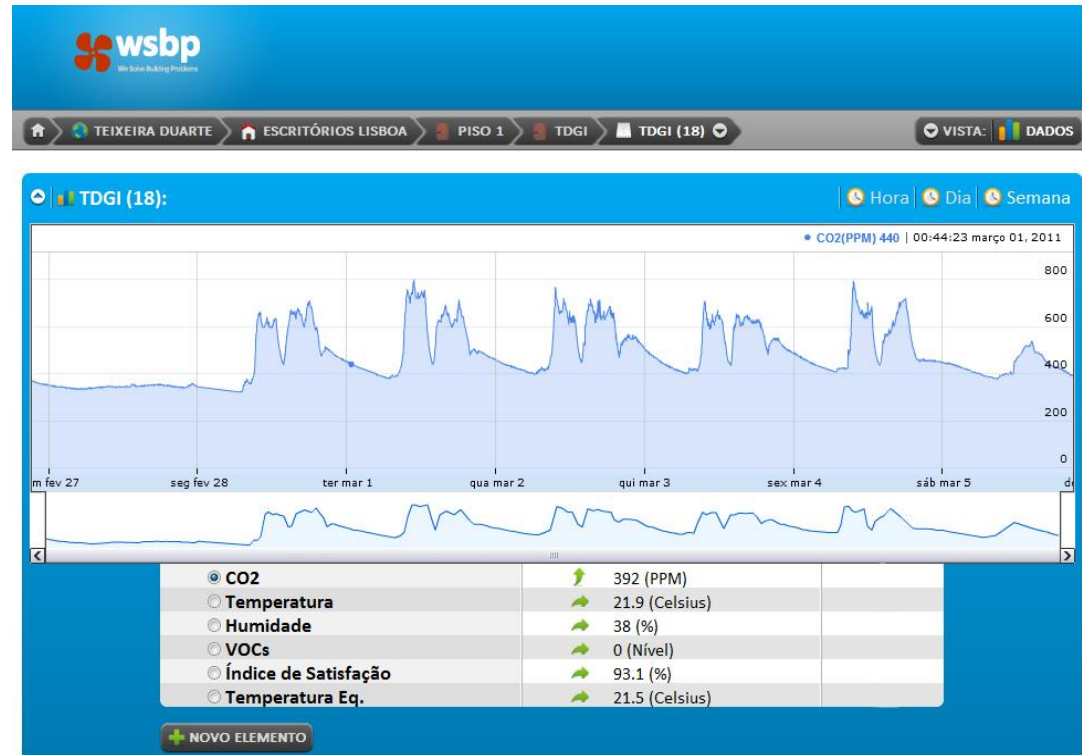
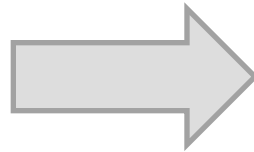
# Investigation Steps: From Measurement to ICQ Classification



Quality of indoor environment in % of time in four categories



# Case Studies: From Spot to Long Term Monitoring





# The Benefits of ICQ Assessment

**Energy Savings**

**Reduction of Environmental Impacts**

**Better Indoor Environmental Quality**

**Improved Productivity of Occupants**

**Databases and Possibility of Benchmark Tests**

**Corporative Image of Companies**



**Thank you  
for your  
attention**