International Ventilation Cooling Application Database

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Introduction

IEA Annex 62 – Ventilative Cooling

Subtask B – Solutions for VC

EBC
Energy in Buildings and Communities Programme

- Analyse performance of existing systems
- Extension of the performance of existing systems
- Guidance for new solutions

Development of a qualitative database of features for buildings employing ventilative cooling strategies to gather information about existing systems

Objectives of database:

1. Illustrative collection of buildings with VC
2. Compare the solutions applied
3. Find typical patterns

Method to achieve objectives

1 Collect / Build a repository of building datasheets containing key information

2 & 3 Populate a database of categorical variables and building attributes

Database will be publicly available for researchers and practitioners at www.venticool.eu/annex-62 in the near future

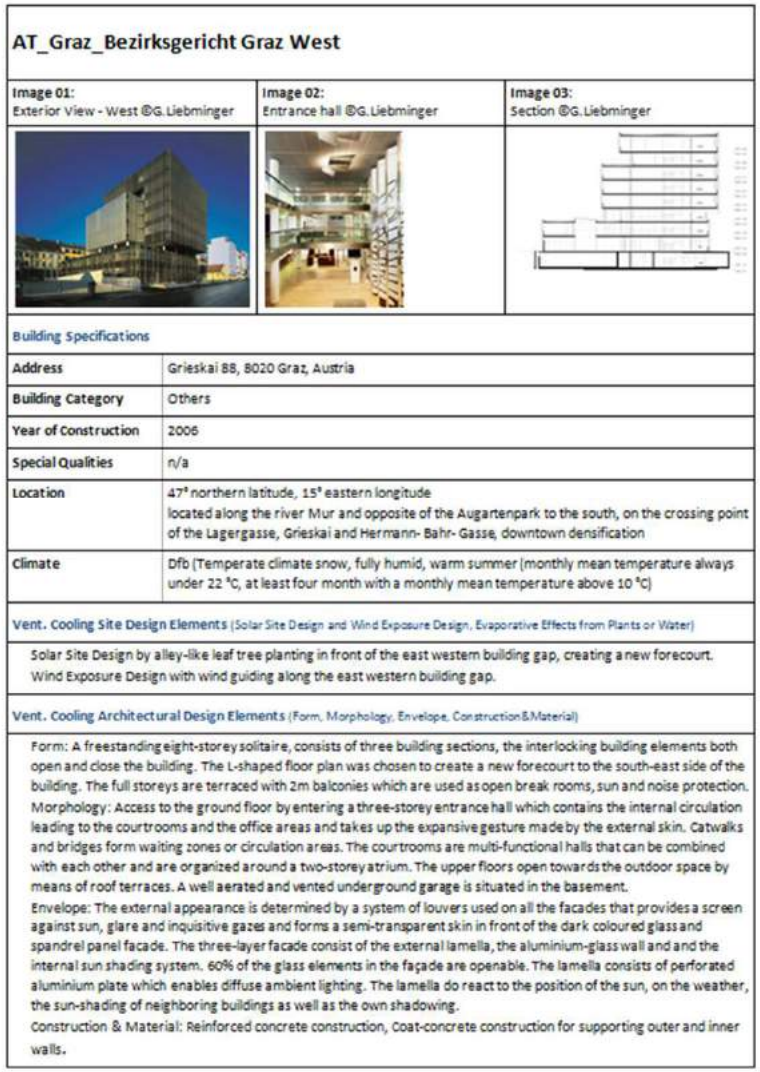
Data Sheets & Examples

Datasheet prepared for each building in database

Structure

Provide summary information relating to:

- Building Specifications
- Category, Year of Construction
- Special Qualities
- VC Site Design Elements
- VC Architectural Design Elements
- VC Technical Components
- Actuators, Sensors & Control Strategies



IEA EBC Annex 62 Ventilative Cooling
International Ventilative Cooling Application Database

EBC

AT_Graz_Bezirksgericht Graz West

Image 01: Exterior View - West ©G.Liebminger	Image 02: Entrance hall ©G.Liebminger	Image 03: Section ©G.Liebminger

Building Specifications

Address	Grieskai 88, 8020 Graz, Austria
Building Category	Others
Year of Construction	2006
Special Qualities	n/a
Location	47° northern latitude, 15° eastern longitude located along the river Mur and opposite of the Augartenpark to the south, on the crossing point of the Lagergasse, Grieskai and Hermann- Bahr- Gasse, downtown densification
Climate	Dfb (Temperate climate snow, fully humid, warm summer (monthly mean temperature always under 22 °C, at least four month with a monthly mean temperature above 10 °C)

Vent. Cooling Site Design Elements (Solar Site Design and Wind Exposure Design, Evaporative Effects from Plants or Water)

Solar Site Design by alley-like leaf tree planting in front of the east western building gap, creating a new forecourt.
Wind Exposure Design with wind guiding along the east western building gap.

Vent. Cooling Architectural Design Elements (Form, Morphology, Envelope, Construction&Material)

Form: A freestanding eight-storey solitaire, consists of three building sections, the interlocking building elements both open and close the building. The L-shaped floor plan was chosen to create a new forecourt to the south-east side of the building. The full storeys are terraced with 2m balconies which are used as open break rooms, sun and noise protection.
Morphology: Access to the ground floor by entering a three-storey entrance hall which contains the internal circulation leading to the courtrooms and the office areas and takes up the expansive gesture made by the external skin. Catwalks and bridges form waiting zones or circulation areas. The courtrooms are multi-functional halls that can be combined with each other and are organized around a two-storey atrium. The upper floors open towards the outdoor space by means of roof terraces. A well aerated and vented underground garage is situated in the basement.
Envelope: The external appearance is determined by a system of louvers used on all the facades that provides a screen against sun, glare and inquisitive gazes and forms a semi-transparent skin in front of the dark coloured glass and spandrel panel facade. The three-layer facade consist of the external lamella, the aluminium-glass wall and and the internal sun shading system. 60% of the glass elements in the façade are openable. The lamella consists of perforated aluminium plate which enables diffuse ambient lighting. The lamella do react to the position of the sun, on the weather, the sun-shading of neighboring buildings as well as the own shadowing.
Construction & Material: Reinforced concrete construction, Coat-concrete construction for supporting outer and inner walls.

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Case study Examples

Cork County Hall, Cork, Ireland

- Retrofit external louvres (double skin)
- Automated (wind speed, ext air temp, rain)
- Night cooling controlled on air temp
- Sun tracking with external louvres
- Louvres close if external wind speed > 10ms^{-1}

Figure 1: External View of the refurbished building (left)
and detail of retrofitted second skin with automated glazed louvres (right)

Home For Life, Lystrup, Denmark

- Complies with Active House principles
- Fufills energy and indoor climate targets of Danish 2020 regulations
- Mechanical heat recovery in winter for ventilation
- Hybrid system to avoid energy penalties (DK Regs)
- Automated window control with chain actuators
- Indoor air temp, CO2 & Humidity
- Weather station at the site

Fig. 1 South East view of the building

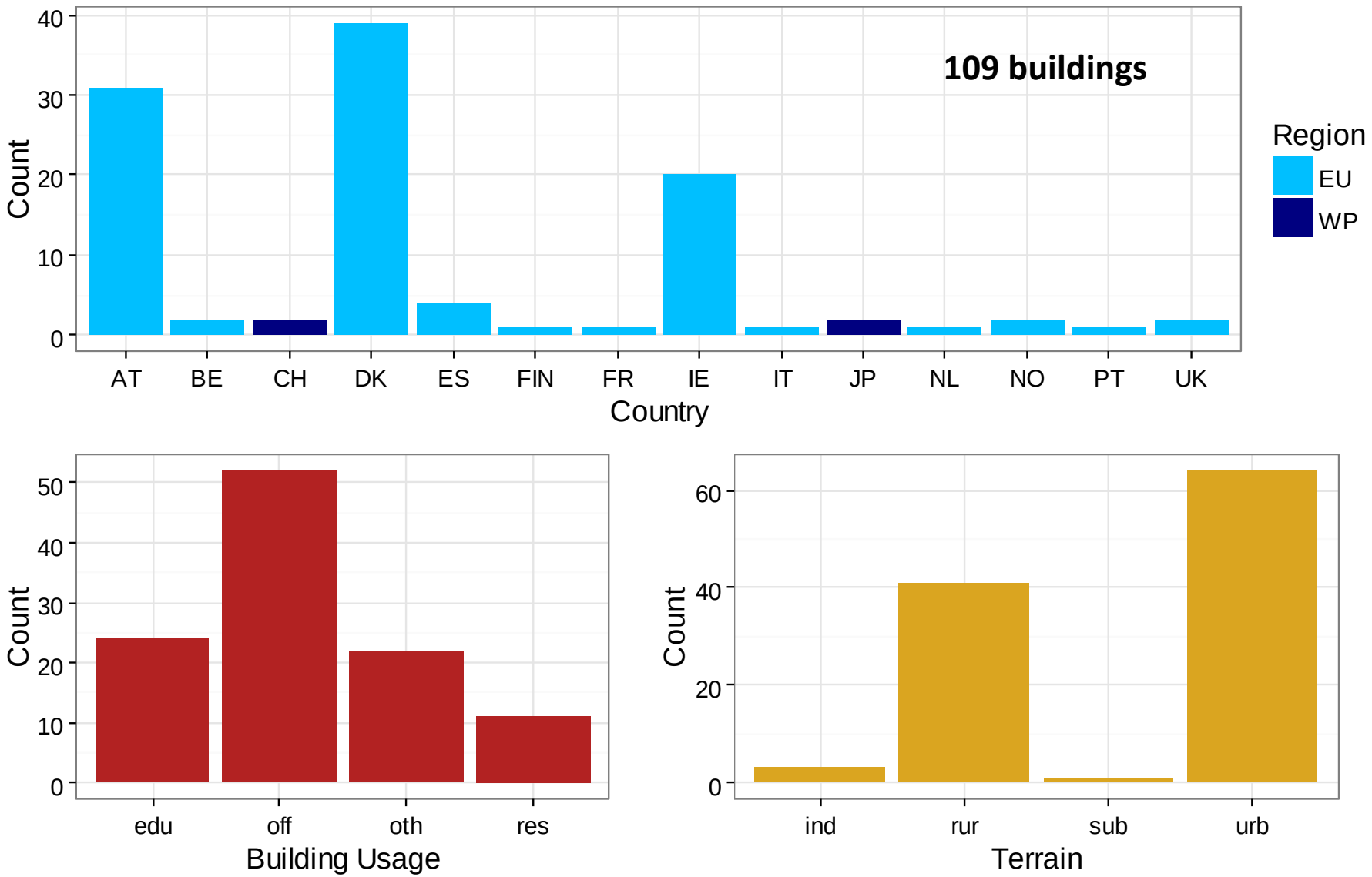
Database Structure & Content

Aim was to establish did the following influence the design or are the features present in VC strategies?

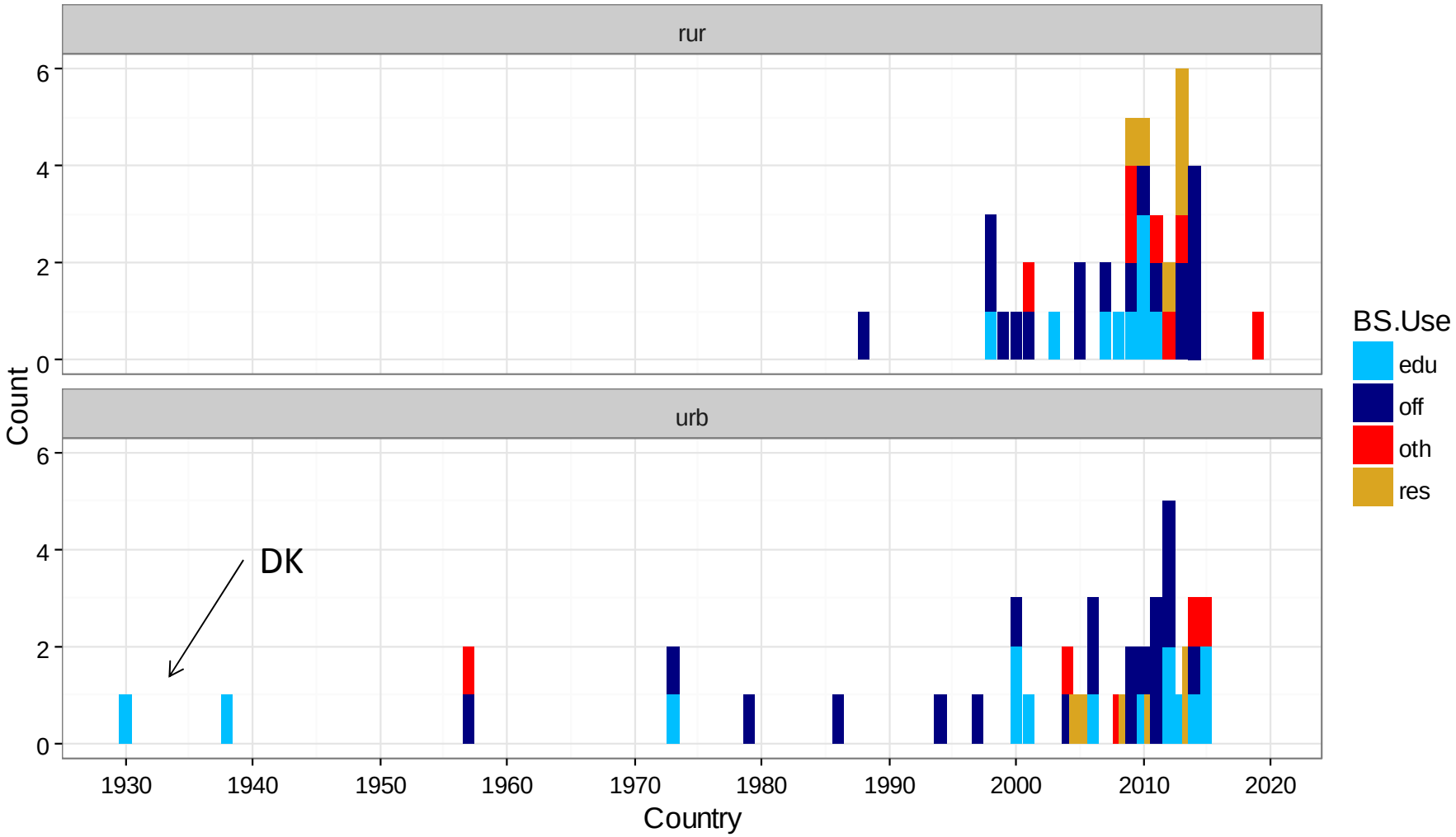
Structure

- General Building Specification
- Political, Geographic and Climatic Position
- Ventilative Cooling Site Design Elements
  - **Solar site design**
  - **Wind exposure Design**
  - **Evaporative effects from water/plants**
- Ventilative Cooling Architectural Design Elements
  - **Form, Morphology, Envelope, Materials**
- Ventilative Cooling Technical Components
  - **Windows, doors, rooflights**
  - **Dampers, Flaps, Louvres**
  - **Special Effects vents**
  - **Chimneys, Atria, Rotating exhaust vents**
  - **Mechanical exhaust ventilators**
  - **PCM**
- Actuators, Sensors & Control Strategies
  - **Chain, linear, rotary**
  - **Sensors – temp, CO2, Humidity, Rain, Presence**

Location, Usage & Terrain



Building Vintage Profile

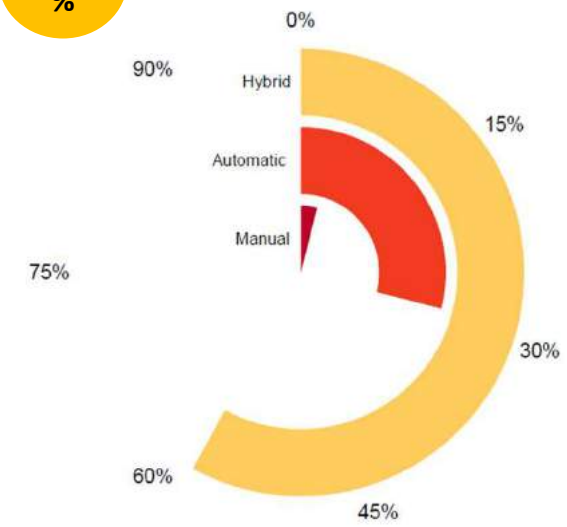


- Mainly concentrated from late 1990's onwards
- No older residential buildings

Ventilative Cooling Characteristics

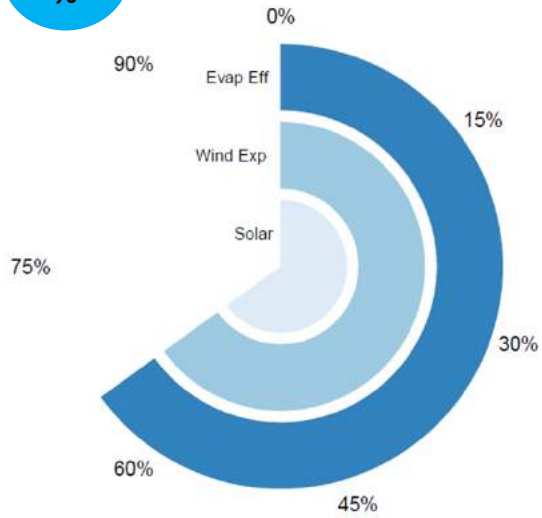
92 %

Control Strategy



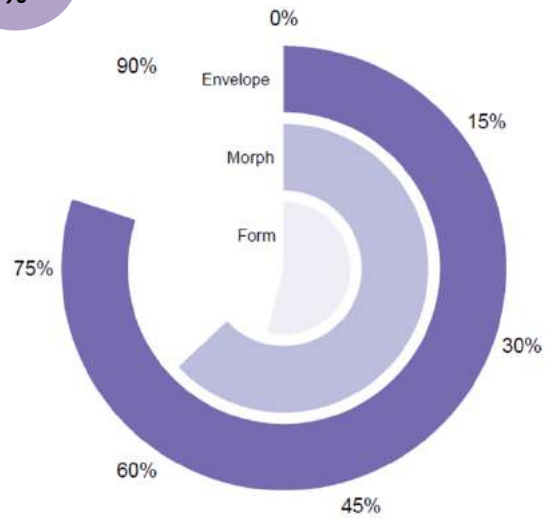
65 %

Site Design



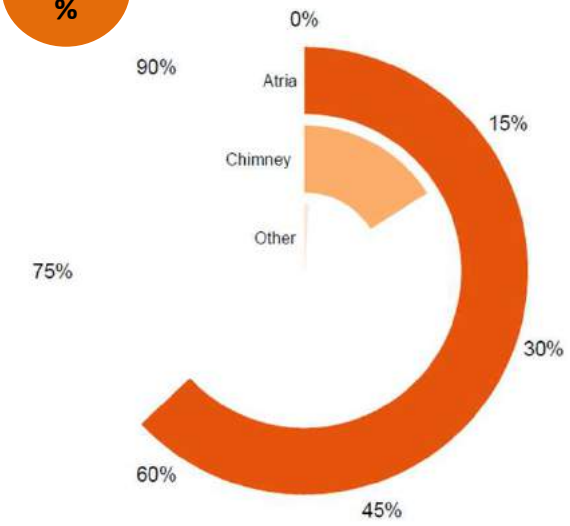
95 %

Architectural Design



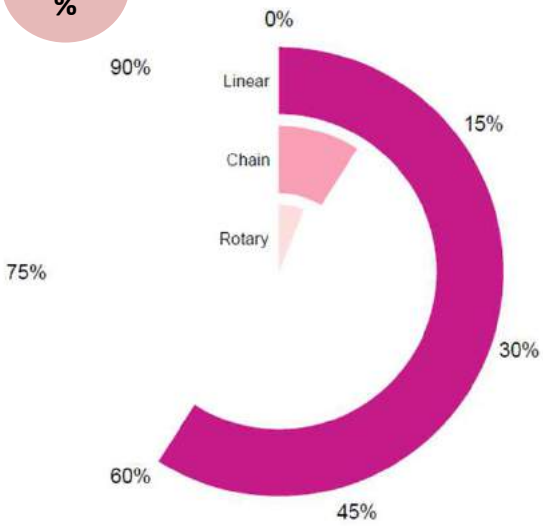
66 %

Enhancing Components



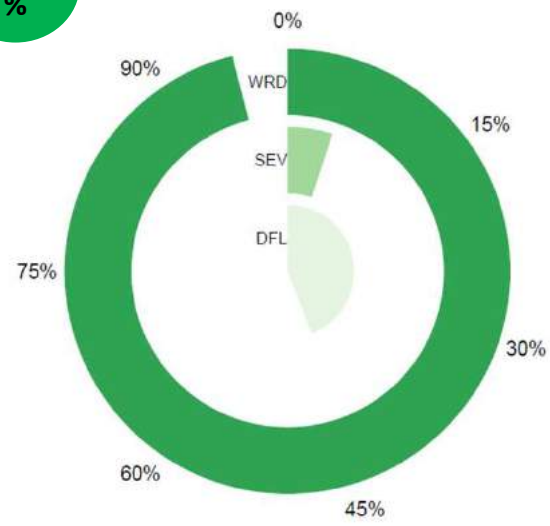
66 %

Actuators

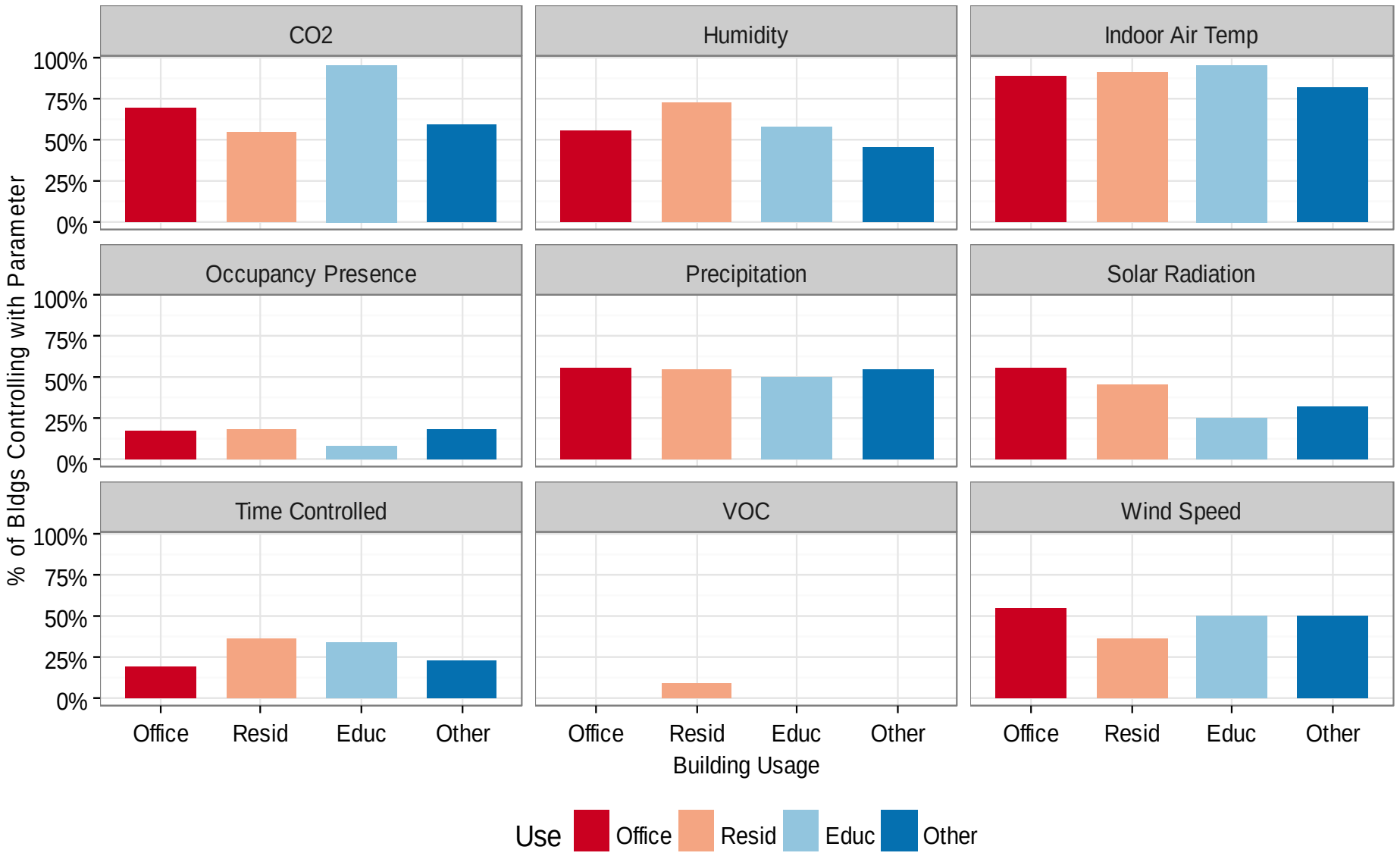


99 %

Guiding Components



Control Parameters



Conclusion

The Annex 62 joint research project of *International Ventilative Cooling database* illustrates that:

- Ventilative Cooling is used in traditional, pre-air-conditioned architecture,
- It is also in contemporary European & international Low Energy and Net Zero Energy Buildings.

VC is a technology that is far from being widespread. Obstacles to uptake are:

- limited cooling load availability
- Barriers due to noise, dust, weather and burglary,

Next steps:

- Complete correlation analysis on categorical variables

The work on the database will continue through 2016. The authors welcome any nominations of additional entries, especially from warm climates

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Questions?

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