



NUDGING OCCUPANTS' BEHAVIOUR TOWARDS LESS ENERGY CONSUMPTION IN BUILDINGS

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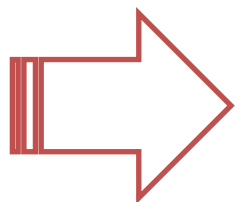
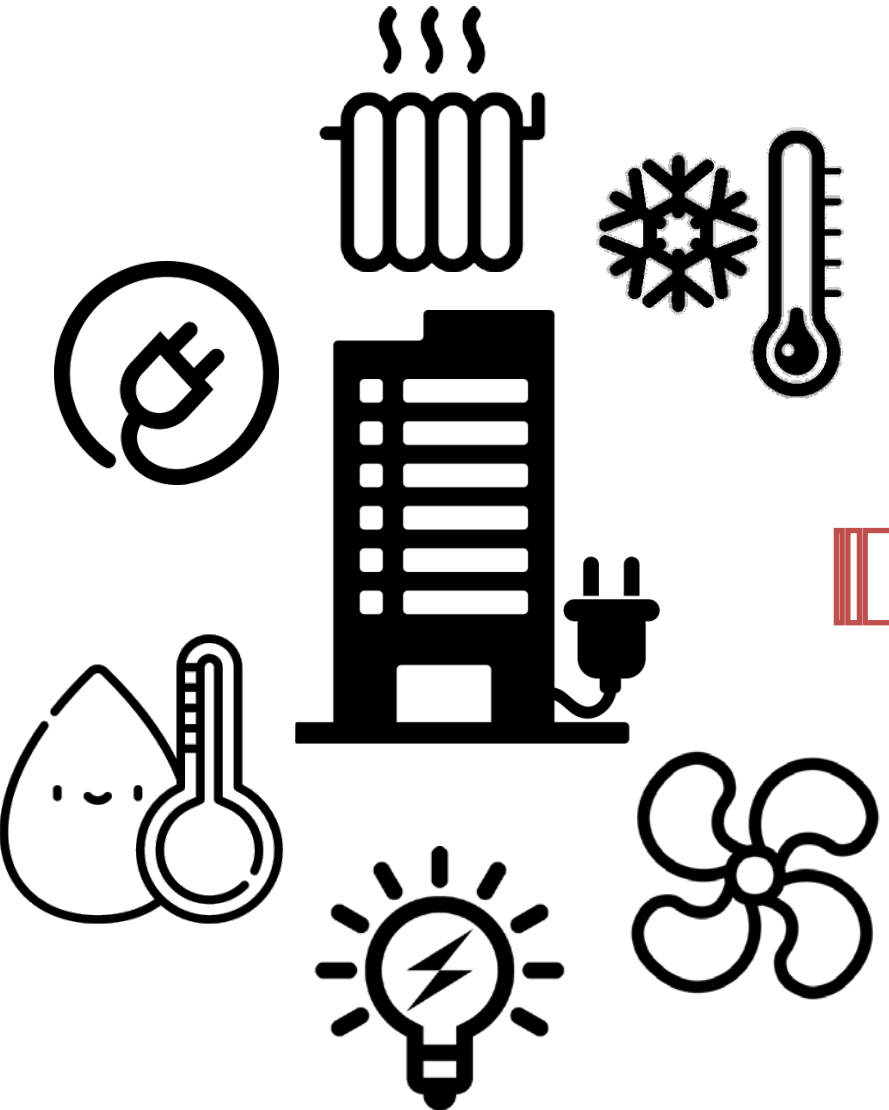


Région
Provence
Alpes
Côte d'Azur

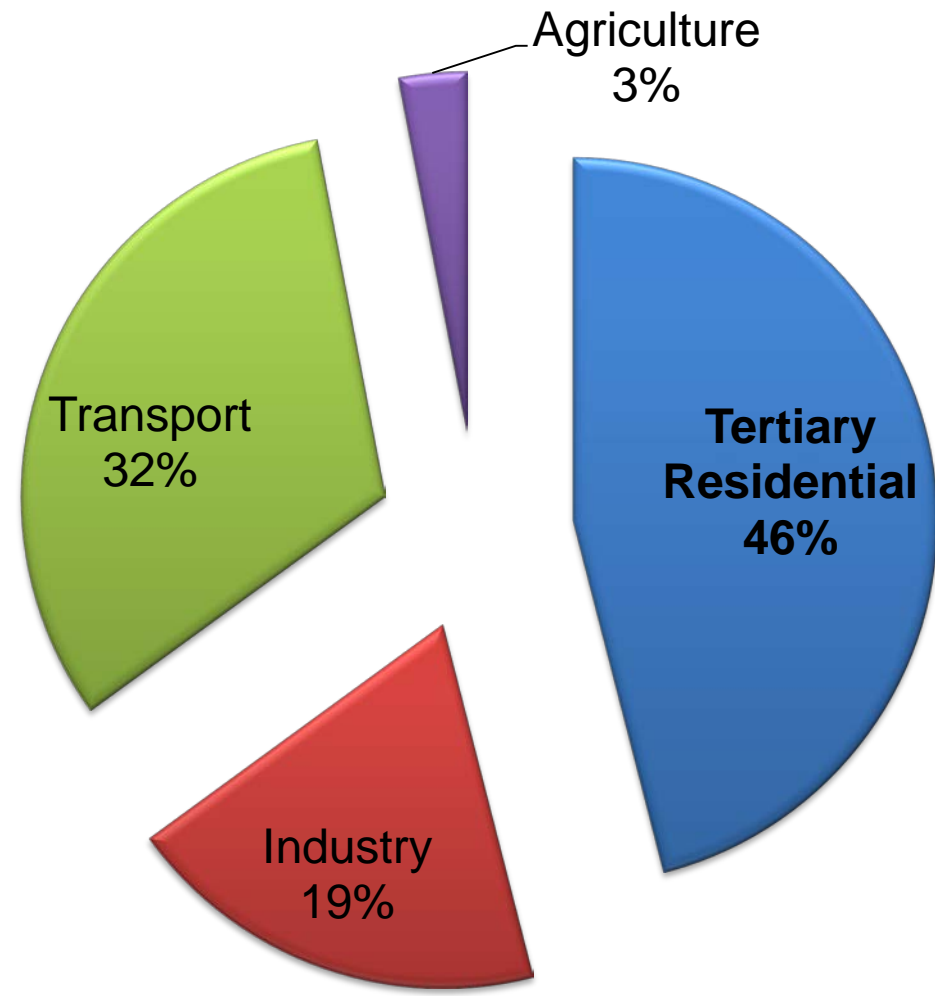


General Context

1 General Context



FINAL ENERGY CONSUMPTION BY SECTORS
TOTAL : 144 Mtep in 2018



Source : calculs SDES, d'après les sources par énergie

1 General Context



The building

- Performance of the envelope
- Insulation
- Architecture
- « Bioclimatic » Design
- Performance of materials



Improve energy efficiency in buildings



Efficient equipments

Active Energy Efficiency



- Technological solutions
- Monitoring
- Energy consumption regulation and control

1 General Context

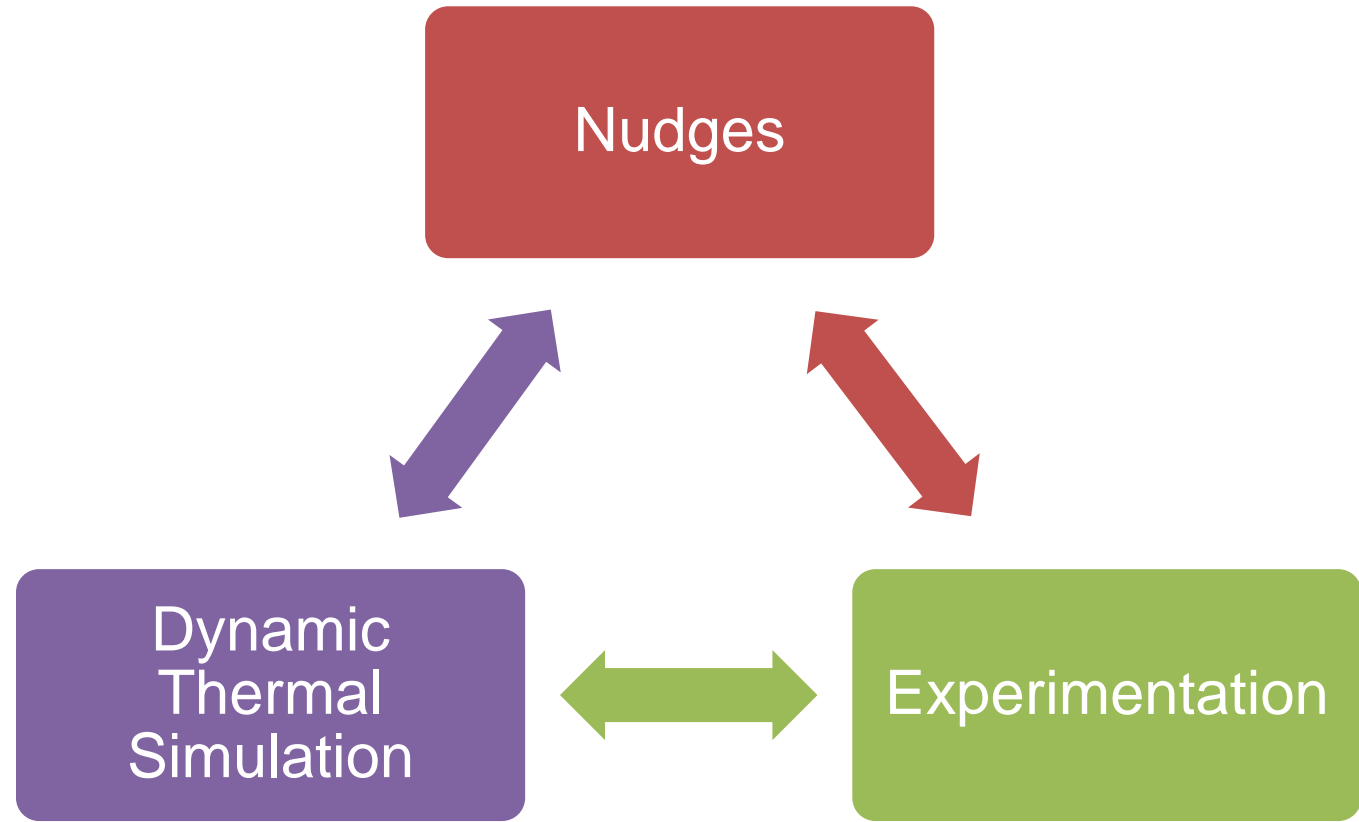


- Survey Data Collection
- Dynamic Thermal Simulation
- Behavioural models
- NUDGES
- Data Collection
- Dynamic thermal simulation





1 General Context



- Dynamic Thermal Simulation (DTS) is used to predict the way a building responds when subject to external environmental factors
- It is also a way to prove the energy performance of buildings and achieve certain ratings.



Dynamic Thermal Simulation: Case study: Office building

2 Dynamic thermal Simulation



Office building

- 3 floors
- 1 meeting room
- 1 kitchen
- **34 Offices**

Localisation: **Nice, France**

50 Occupants

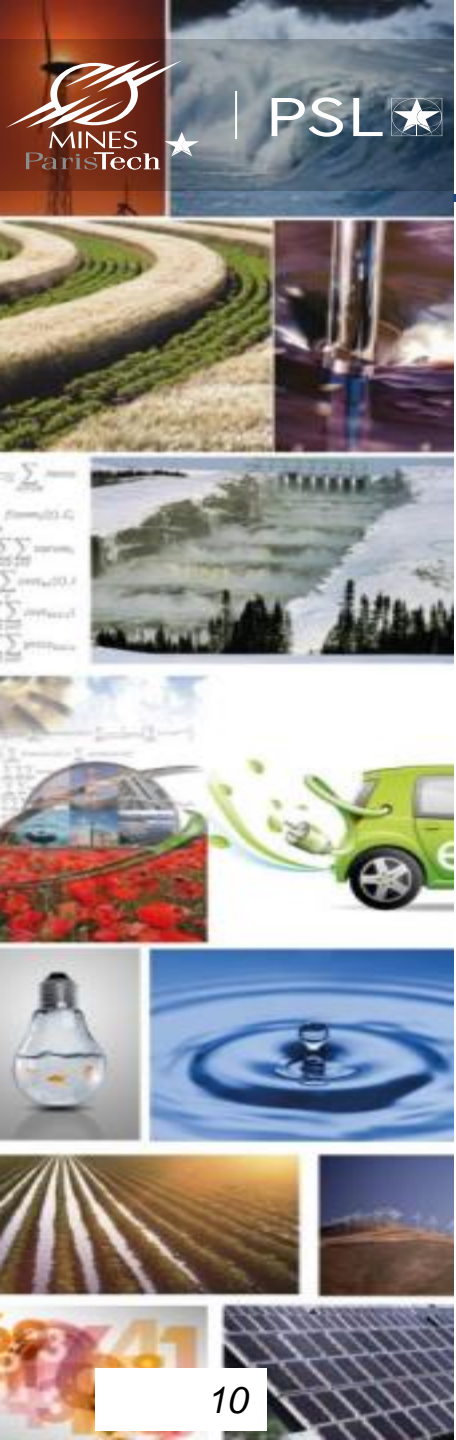
2 Dynamic thermal Simulation

➤ Increasing energy performance of the building:

- Performance of materials
- Efficient Equipements (Heating + Cooling)
- Performance of Windows
- Insulation

⇒ **19% of energy consumption reduction**



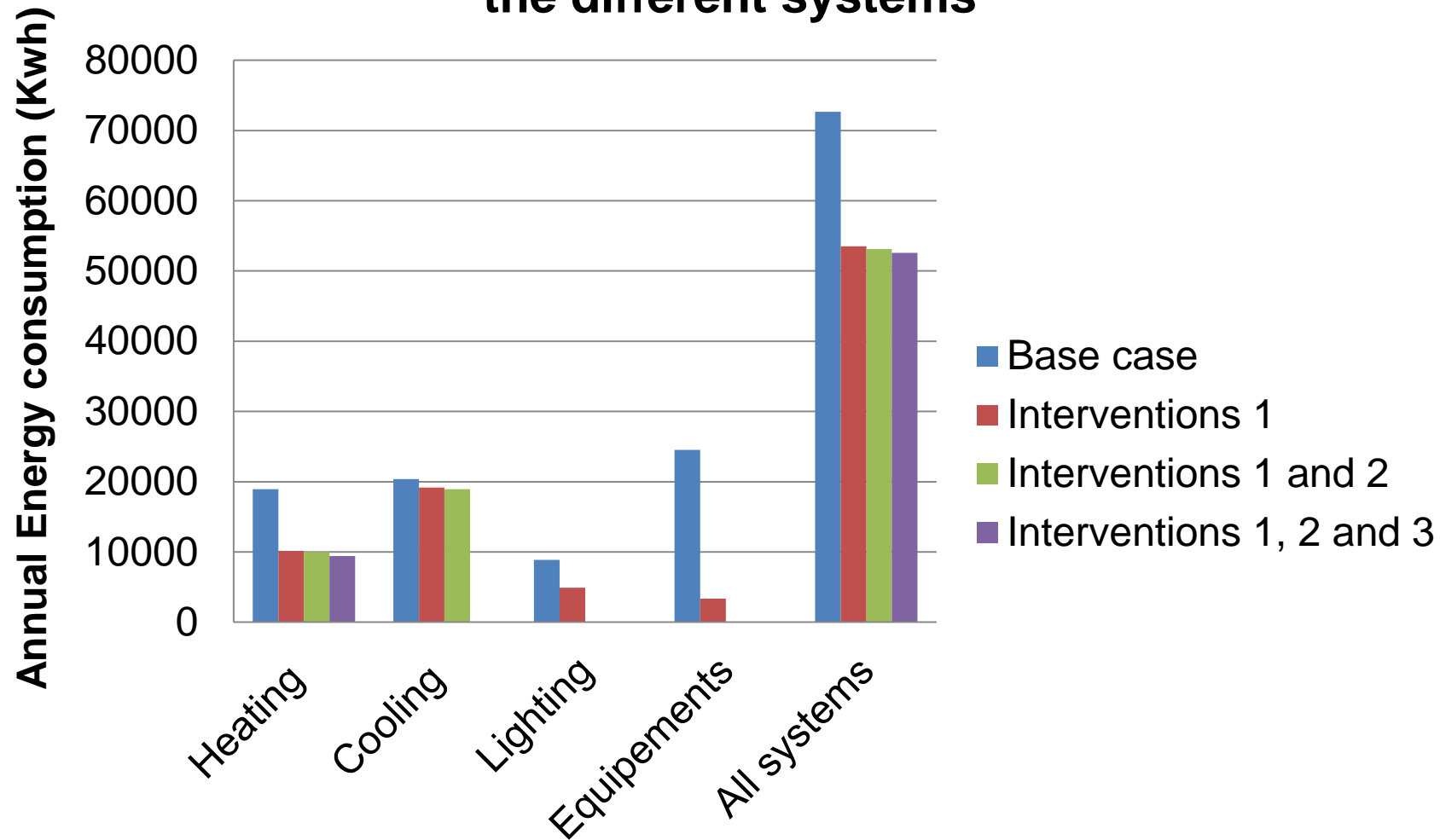


Behaviour Change	Heating	Cooling	Lighting	Devices
Base case	21 C° Winter	23 C° Summer	- Lighting ON all day: 8h – 18h	- Phone - Computer + 2 Screens ON: 8h – 18h STAND BY after work hours
Intervention 1	- Night / Weekend Mode: 16 C° - Absence more than 2 days: 8 C°	- No cooling at night - Open windows at night	- Switching off lighting when leaving office	- Switching off computers when leaving office
Intervention 2	- Turn off heating if a window is open	- Open windows in the morning with no cooling - Using shutters		
Intervention 3	- Close shutters in winter evenings - Turn Off Heating 1 hour before the office			

2 Dynamic thermal Simulation



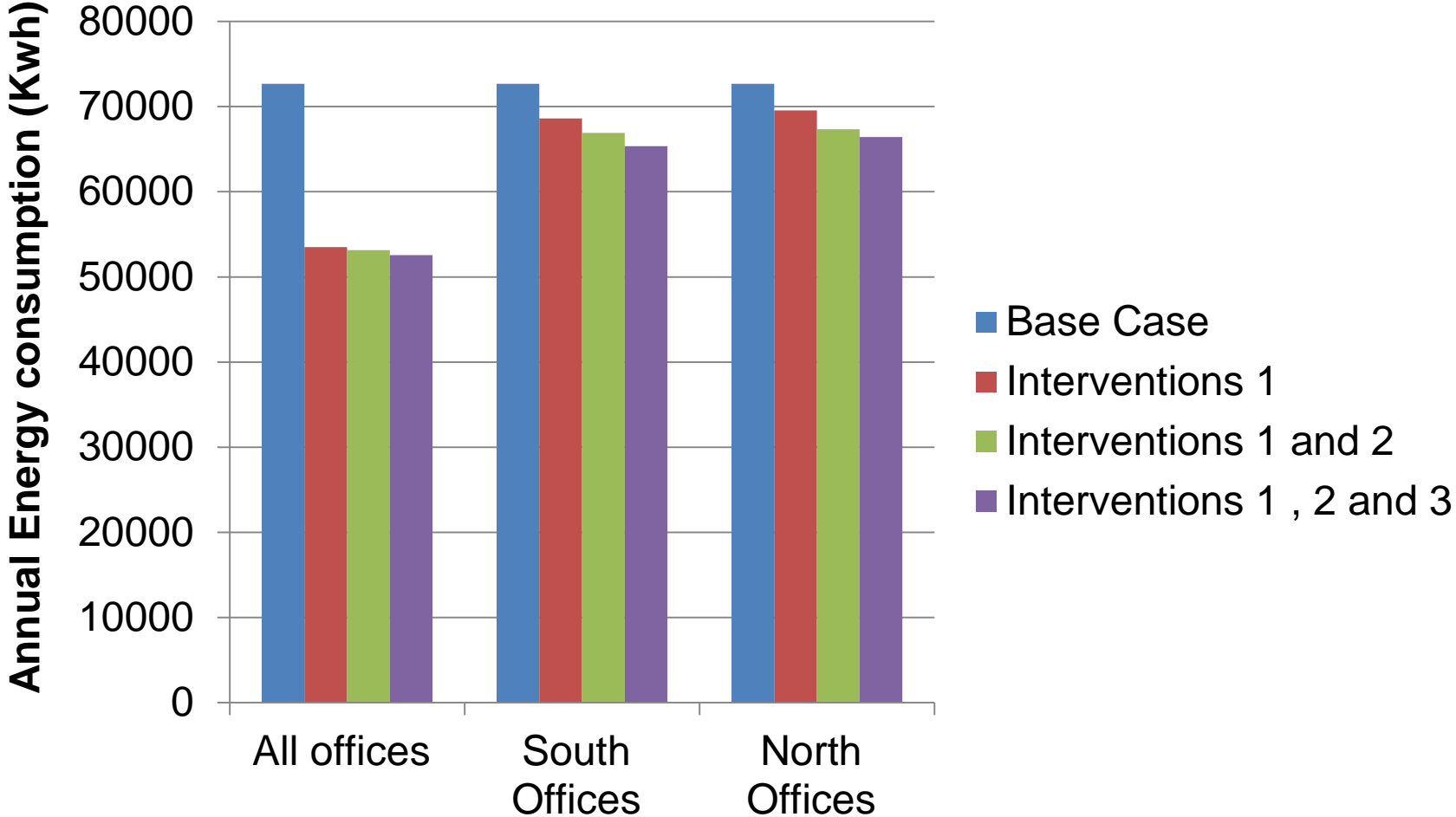
Energy savings based on behavior change for the different systems



2 Dynamic thermal Simulation



Energy savings based on behavior change in different offices



2 Dynamic thermal Simulation



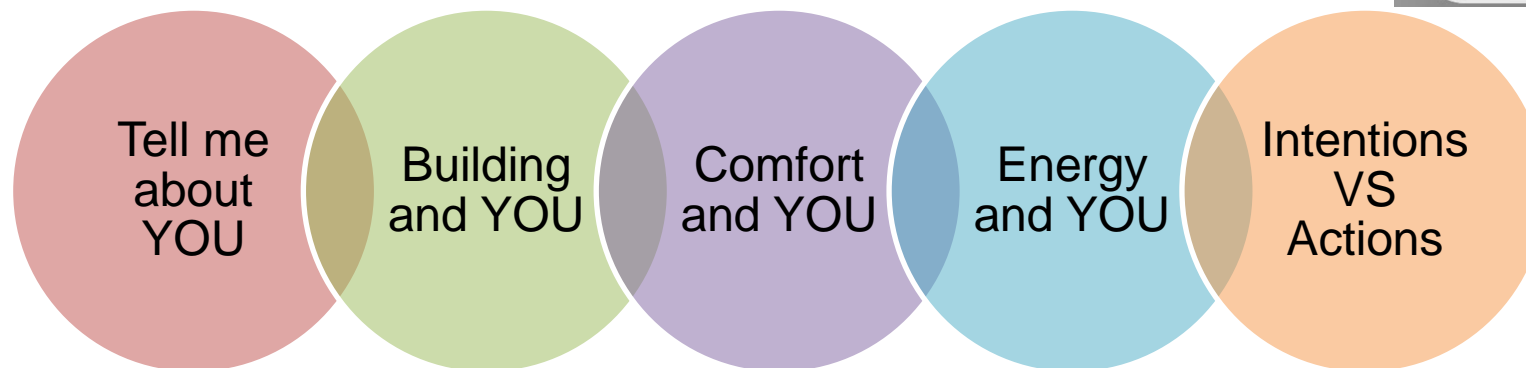
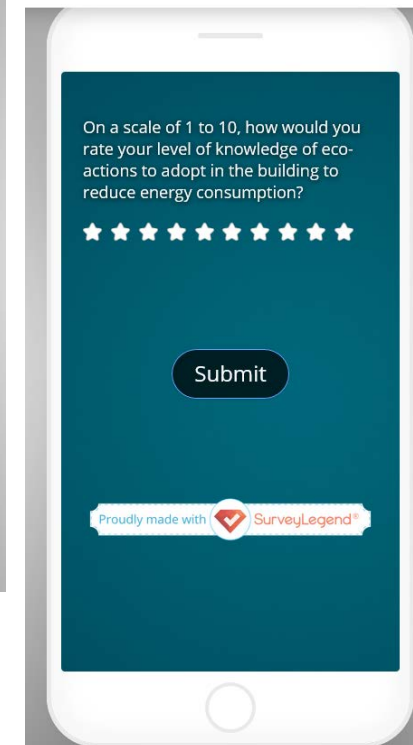
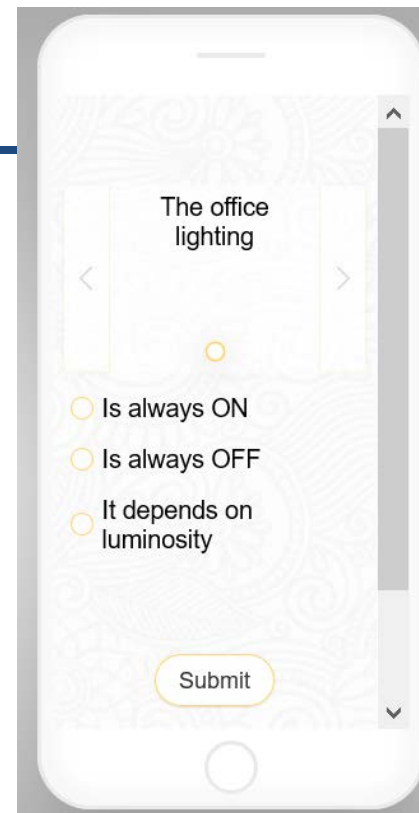
- **Energy saving interventions applied to all the offices**
 - Heating : 50% of reduction
 - Cooling : 7% of reduction
 - Lighting : 45% of reduction
 - Total : 28 % of reduction
- **In South Offices:**
 - Total Reduction of : 10%
- **In North Offices :**
 - Total Reduction of: 8%



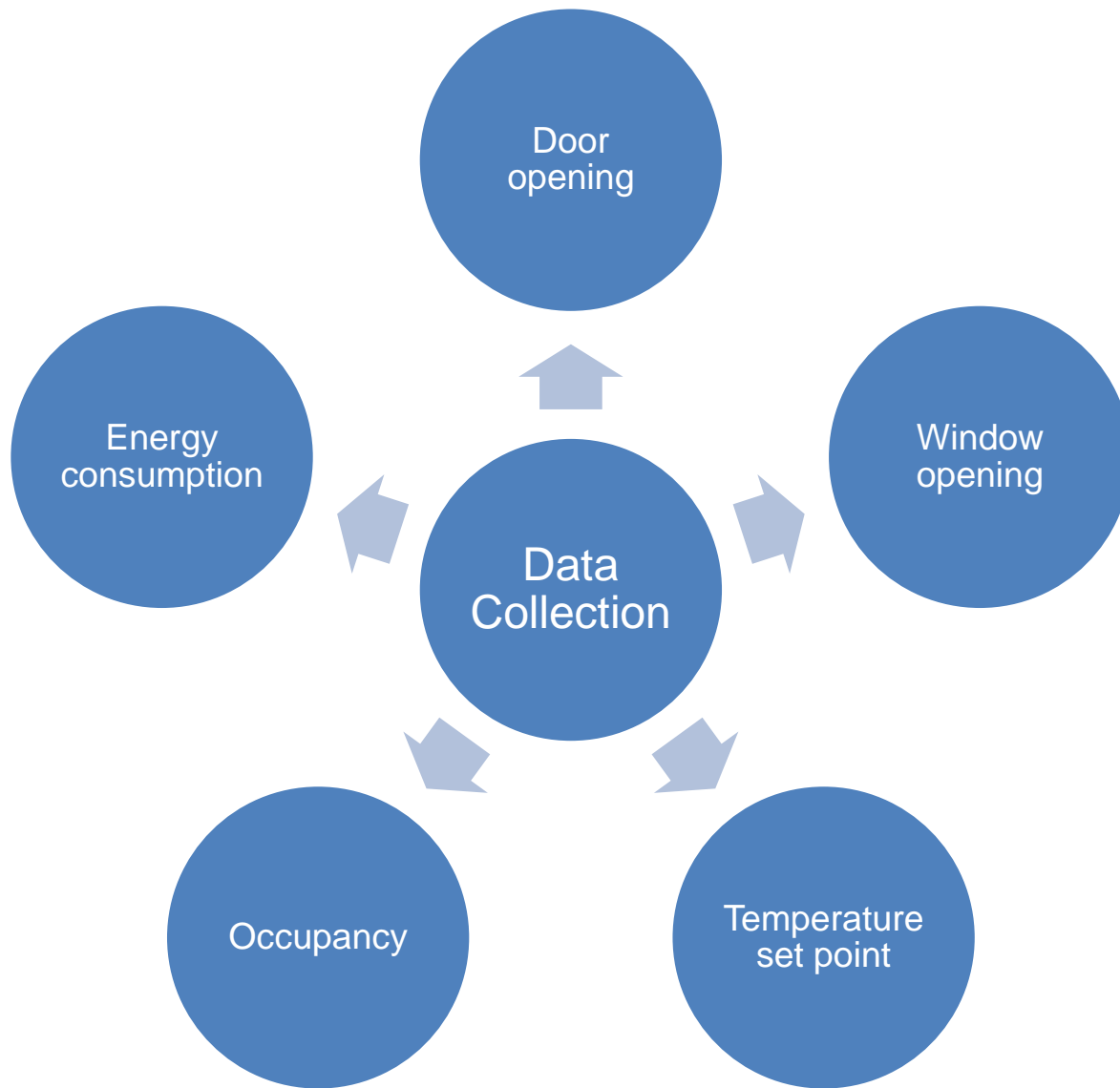
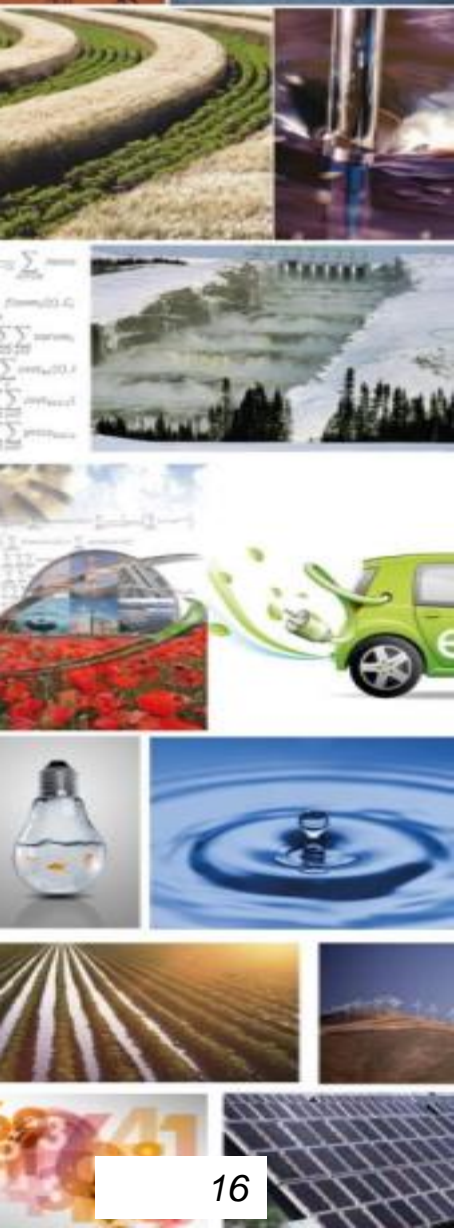
Experimentation

3 Survey

- Collect information about occupants
- Understand occupant's interaction with the building and energy use
- Identify energy consuming behaviours
- Understand the gap between intentions and actions
- Understand energy reduction importance for occupants
- Comfort perception and actions
- Understand occupants motivations to change behaviours
- Draw occupants profiles



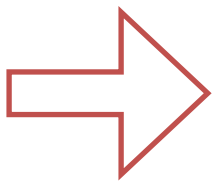
3 Data collection



4 NUDGES



NUDGE



Transform incentives to actions by making individuals choose the wished decision

A low cost solution

Use of cognitive biases

No use of financial incentives or order

Doesn't affect choices based on explicit preferences

“To count as a mere nudge, the intervention **must be easy and cheap to avoid**. Nudges are not mandates. Putting fruit at eye level counts as a nudge. Banning junk food does not.”
[Thaler et Sustein , 2008]

4 NUDGES



Peer to peer comparison

- Comparing occupants' consumption to their colleagues
- Benchmarking eco-friendly behaviours of other occupants
- Giving suggestions in order to reduce consumption



Feedback

- Giving feedback to occupants about their energy use
- Tailored messaging



Moral appeal

- Messages expressing a responsible consideration and human consequences of global warming
- Using pictures



Social reviews

- Defining right behaviors adopted by the majority

- Applying different types of Nudges to different offices
- Adapting Nudges to energy consumption evolution



Conclusions and perspectives



- Importance of changing occupants' behaviors in reducing energy consumptions in tertiary buildings
- Impact of offices location in reducing energy consumption
- Importance of identifying occupants profiles for more energy reductions
- Integrating behavior models in order to have more accurate results in predicting energy consumptions
- Defining occupants' patterns depending on experimental results in order to quantify the impact of Nudges
- Suggesting the type of Nudges to use depending on occupant's response to the different intensives used