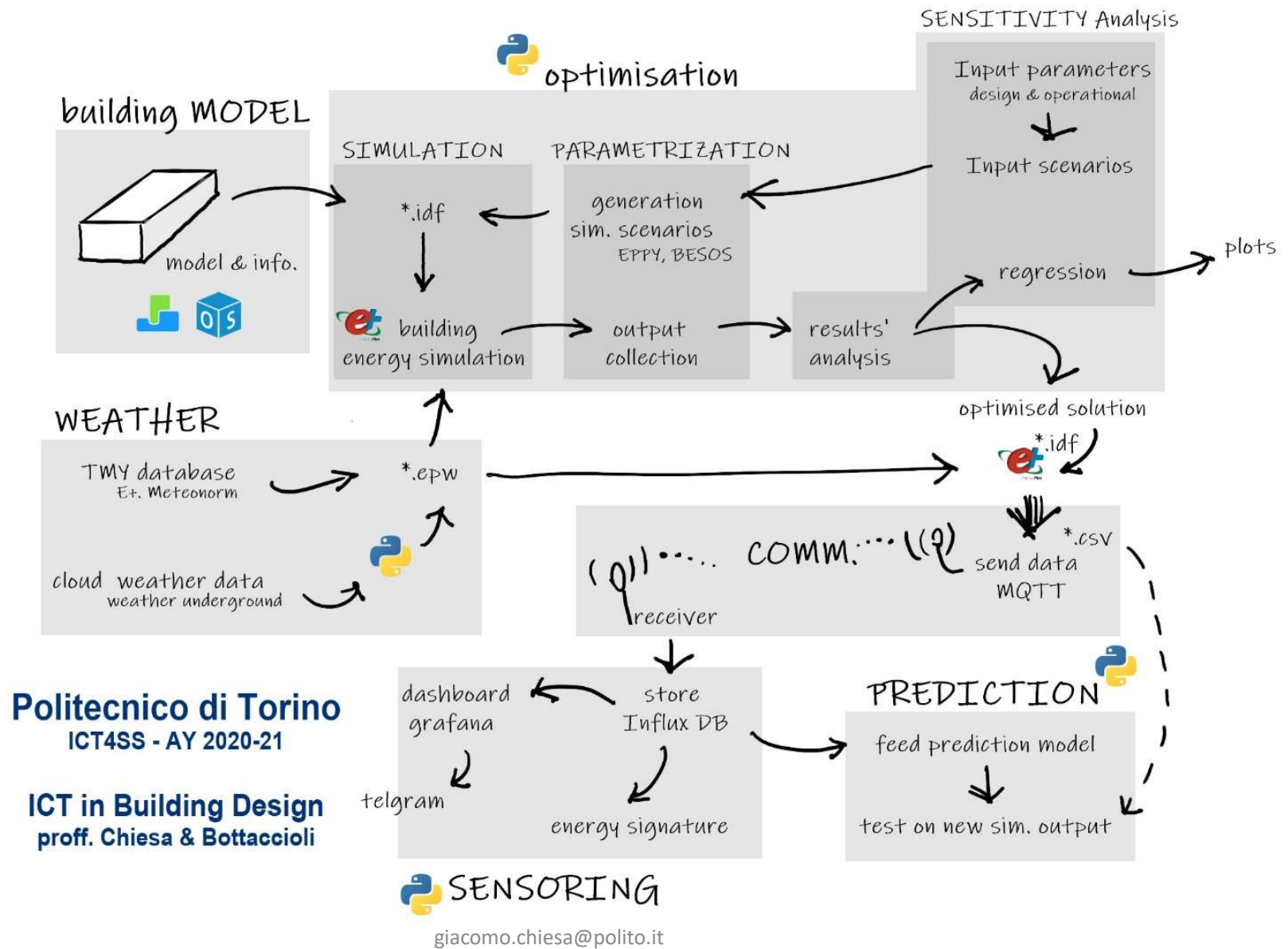


# Ex. topics

ICT for Building Design

AY 2020-21

# Ex. flowchart



# Main overview – step I (design optimization)

Building type	Variable to be optimized			Climate
	U-values		WWR	
Residential	X		X	Cold, temperate, hot
Office	X		X	
Group	Type	Variable		Climate
#1	Residential	U-value		Oslo
#2	Residential	U-value		Rome
#3	Residential	U-value		Athens
#4	Office	U-value		Oslo
#5	Office	U-value		Rome
#6	Office	U-value		Athens
#7	Residential	WWR		Moscow
#8	Residential	WWR		Geneva
#9	Residential	WWR		Larnaca
#10	Office	WWR		Moscow
#11	Office	WWR		Geneva
#12	Office	WWR		Larnaca
#13 +	Residential/Office	U/WWR		New York; Miami; Antofagasta

# Main overview – step II (profiling & control)

Building type	Variable to be optimized				Target
	ACH	% opening	Scheduling eq.	Shading	
1 building conf.	a.	b.	c.	d.	Q or Temp. or ACH

Group	Target var.	Main season
#i	a.Q	S
#ii	a.T	S
#iii	b.Q	S
#iv	b.T	S
#v	b.ACH	S/W
#vi	c.Q	S/W
#vii	d.Q	S
#viii	d.T	S

Better defined together with  
prof. Bottaccioli

# Group #1-3 | U-value Residential - Step I

- Main objective: describe energy need variations varying the U-value of opaque surfaces and the U-value of windows.
- seasonal and yearly values are analysed to define correlations using polynomial regressions
- Three WWR configurations are considered (5% - 15% - 50%)
- Two ventilative cooling mode (on/off) (scheduled)

# Group #1-3 | U-value Residential – step I

- Target variable: Q [kwh/m<sup>2</sup>] (separately summer and winter + annual)
- Input variables: – U-value of opaque surfaces, U-value of windows – To change the U-value, change insulating layer (0-35cm) in Energy plus for opaque surfaces and change the windows\* (0.7-5) (or define at least 3 window configurations) – Use design builder to get a translation to U-value or you can use the formula in the lectures directly inside the python script
- Scenario variables: ventilative cooling on/off (in summer) (on mode = 6 ACH with external temperature 24 to 18°C 24hs/7day, while a critical difference between building temperature and external one is set to 3 K for effective convection)
- Energy signature will be calculated and different scenarios compared

\*Please discuss the way you choose for Window U-value changes.

# Group #4-6 | U-value Office - Step I

- Main objective: describe energy need variations varying the U-value of opaque surfaces and the U-value of windows.
- seasonal and yearly values are analysed to define correlations using polynomial regressions
- Three WWR configurations are considered (15% - 50% - 90%)
- Two ventilative cooling mode (on/off) (scheduled)

# Group #4-6 | U-value Office – Step I

- Target variable:  $Q$  [kwh/m<sup>2</sup>] (separately summer and winter, and annual)
- Input variables: – U-value of opaque surfaces, U-value of windows – To change the U-value, change insulating layer (0-35cm) in Energy plus for opaque surfaces and change the windows\* (0.7-5) (or at least 3 window configurations) – Use design builder to get a translation to U-value or you can use the formula in the lectures directly inside the python script
- Scenario variables: ventilative cooling on/off (in summer) (on mode = 6 ACH with external temperature from 24 to 10°C during night (19:00-7:00), while a critical difference between building temperature and external one is set to 3 K for effective convection)
- Energy signature will be calculated and different scenarios compared

\*Please discuss the way you choose for Window U-value changes.



# Group #7+ | WWR – Step I

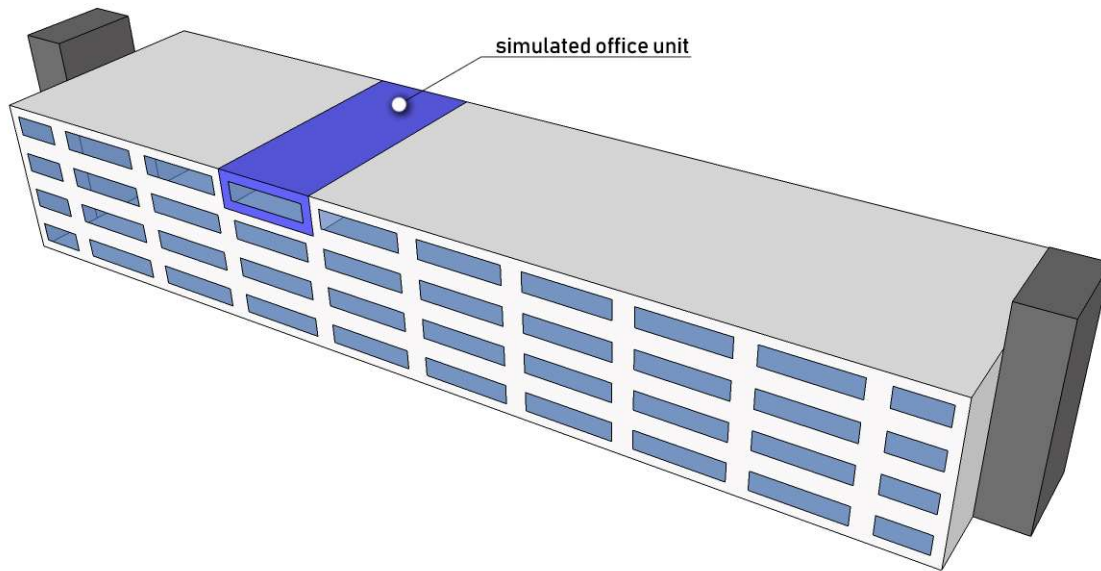
- Main objective: describe energy need variations varying the WWR.
- yearly values are analysed to define correlations using polynomial regressions
- 3 configurations are assumed by modifying the same reference building: not insulated (e.g. envelopes of 50-60's), insulated (current U-value limits for climate zone), highly insulated (U wall half of the limit; Uwind. A/B 1.4; C/D 1, E/F 0.6),
- Two ventilative cooling modes (on/off) (scheduled) - summer
- Two shading modes (on/off) - summer

# Group #7+ | WWR – Step I

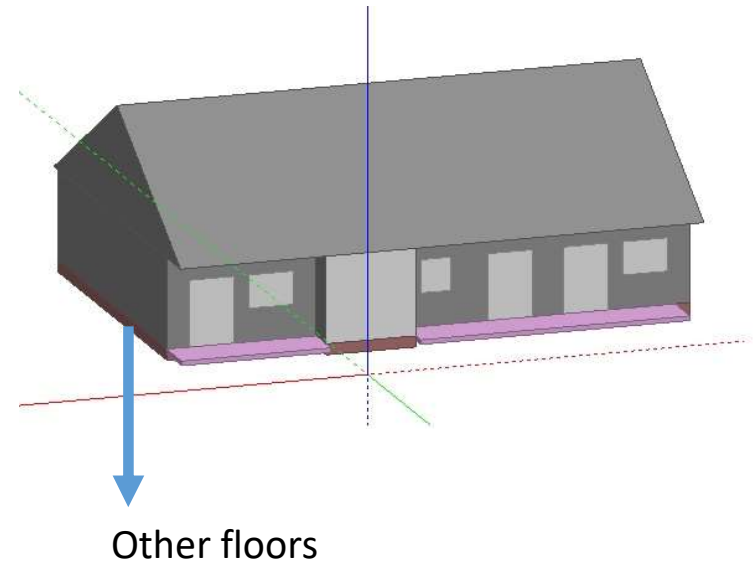
- Target variable:  $Q$  [kwh/m<sup>2</sup>] (year balance) assuming all electrical – heating + cooling + lighting
- Input variables: window percentage in respect to outdoor facing wall
- Scenario variables: – 3 configurations are assumed by modifying the same reference building: not insulated (e.g. envelopes of 50-60's), insulated (current U-value limits for climate zone), highly insulated building (U value walls = ...; U value windows = ...) + 2 shading configurations (on/off) + 2 CNV summer configurations (on/off) (schedule)
- Energy signature will be calculated and different scenarios compared

- Each group is characterized by working in a specific climate.

# Office



# Residential

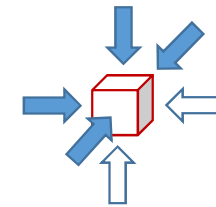
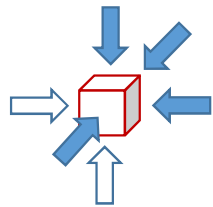


# Group #1-3 | U-value Residential

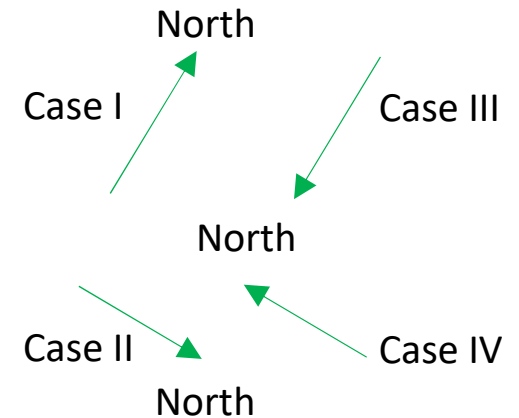
min. windows' area = 1/8 pavement  
(min 7.5 m<sup>2</sup> → 3.75 for façade)

Domestic Bedroom  
Domestic Lounge  
TM59\_Studio  
Domestic Kitchen  
Domestic Bathroom

Residential - Dwelling unit (with kitchen)  
Domestic Toilet  
Domestic Bedroom



Not-adiabatic  
adiabatic



Alternative design  
configurations are accepted

04/10/2020

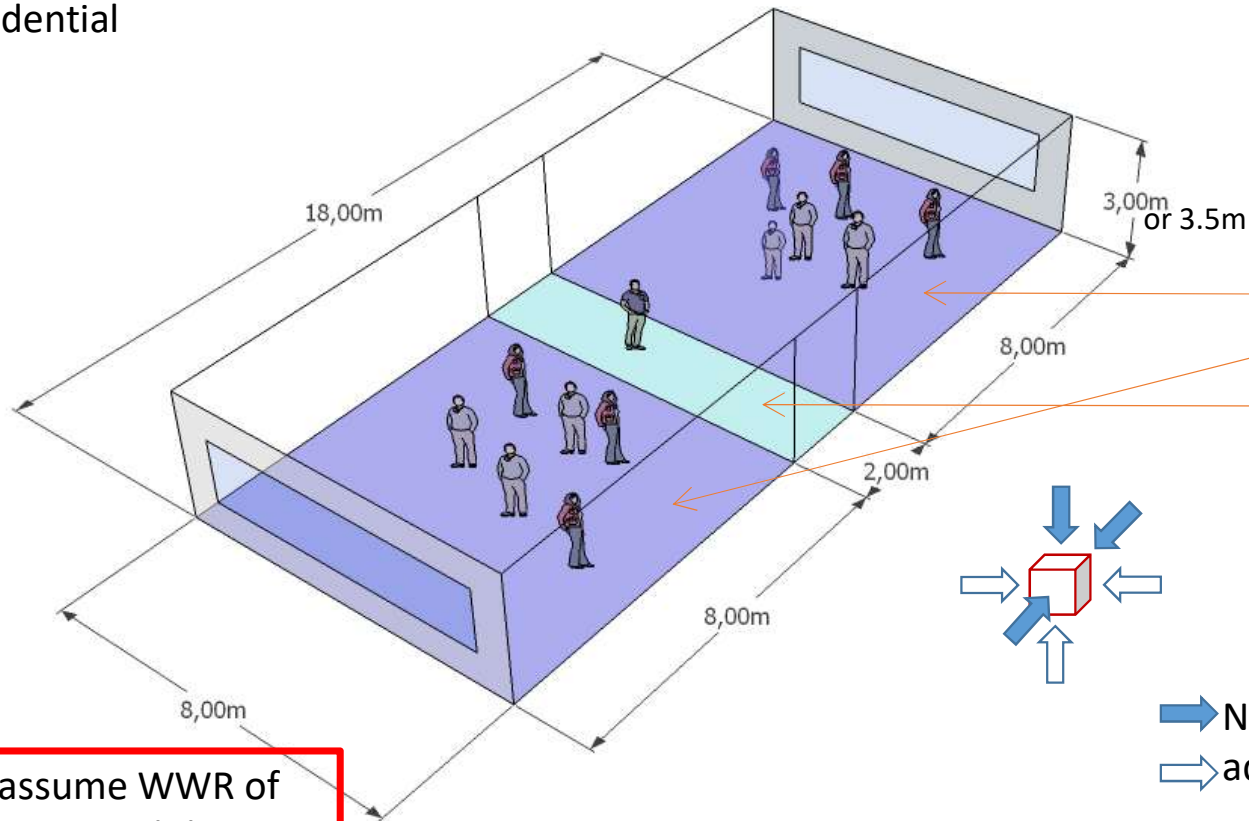
giacomo.chiesa@polito.it

# Group #4-6 | U-value Office

min. windows' area = 1/8 pavement – you can also consider continuous windows – in office is general bigger than in residential

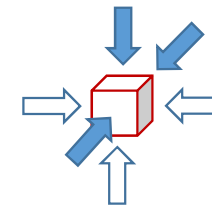


Case I  
North  
Case II  
North  
Symmetry N-S & E-W



Occupancy from Design  
Builder schedule for  
the specific activity

Office  
schedule  
Office  
corridor  
schedule



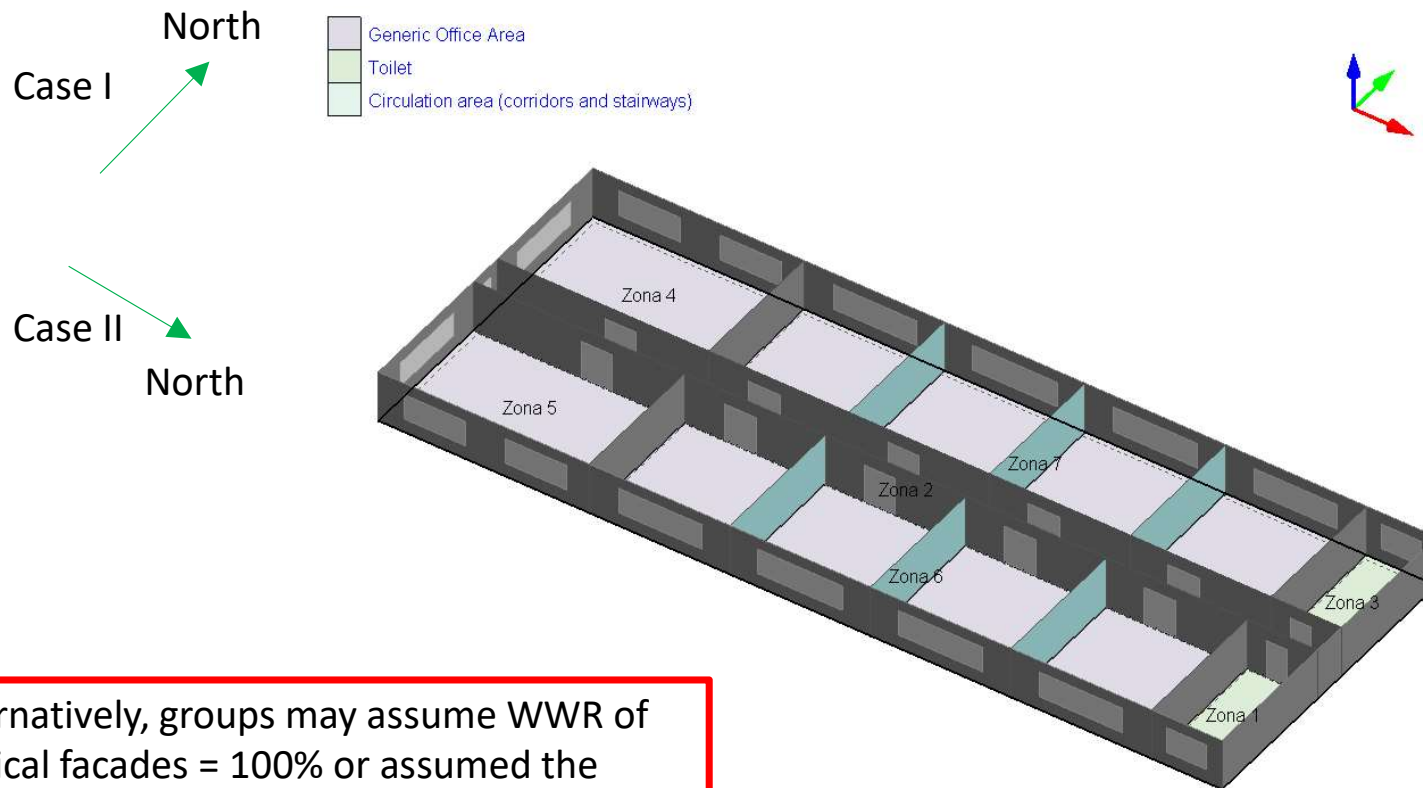
➡ Not-adiabatic  
➡ adiabatic

Alternatively, groups may assume WWR of vertical facades = 100% or assumed the following design configuration (or another)

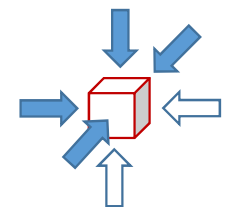
giacomo.chiesa@polito.it

# Group #4-6 | U-value Office

min. windows' area = 1/8 pavement – you can also consider continuous windows – in office is general bigger than in residential



Occupancy from Design  
Builder schedule for  
the specific activity



→ Not-adiabatic  
⇨ adiabatic

Alternatively, groups may assume WWR of vertical facades = 100% or assumed the following design configuration (or another)

giacomo.chiesa@polito.it

# Group #7+ | WWR Residential

windows' area from 0% to 100% of WWR

- Domestic Bedroom
- Domestic Lounge
- TM59\_Studio
- Domestic Kitchen
- Domestic Bathroom

- Residential - Dwelling unit (with kitchen)
- Domestic Toilet
- Domestic Bedroom



Alternative design configurations are accepted

04/10/2020

giacomo.chiesa@polito.it



# Group #7+ | WWR Office

windows' area from 0% to 100% of WWR

