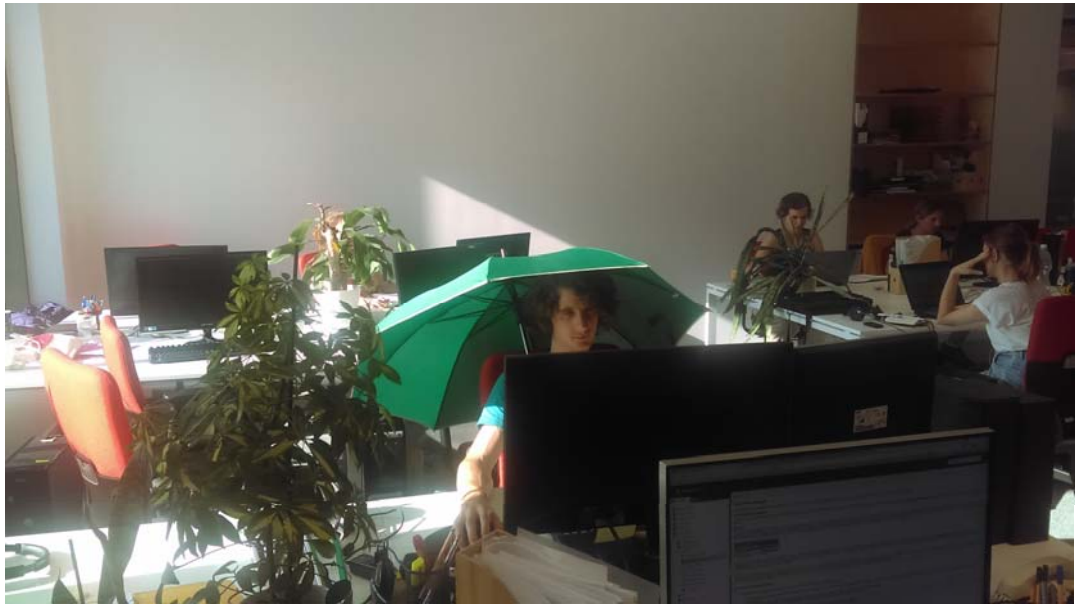
# Roadmap and Goals of an Office Occupant Moving Study



**DTU**

OB-17 Symposium on
Occupant Behaviour and
Adaptive Thermal Comfort
May 17, 2017

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BME- Department of Building
Energetics and Building Services
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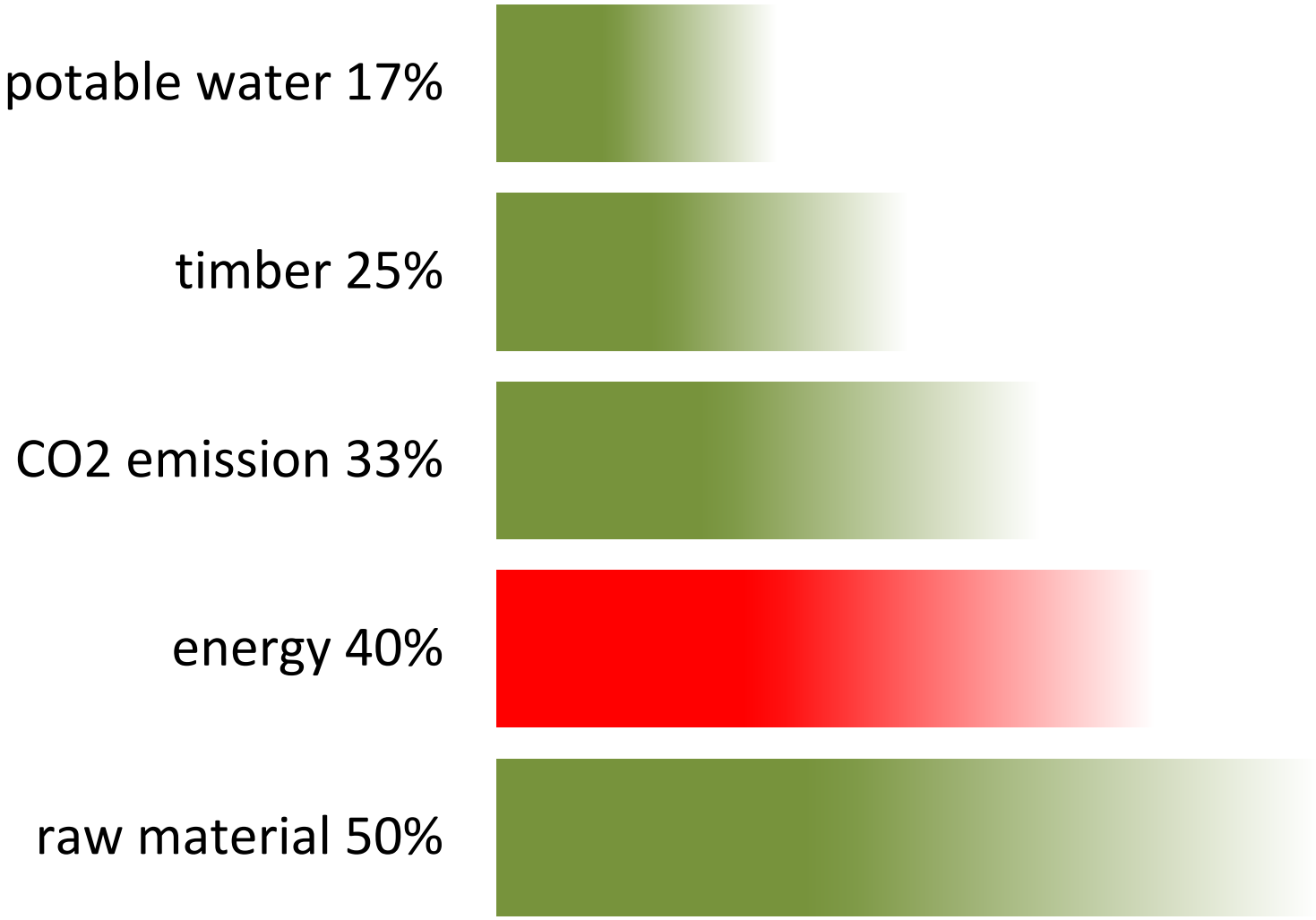
# **building** impact

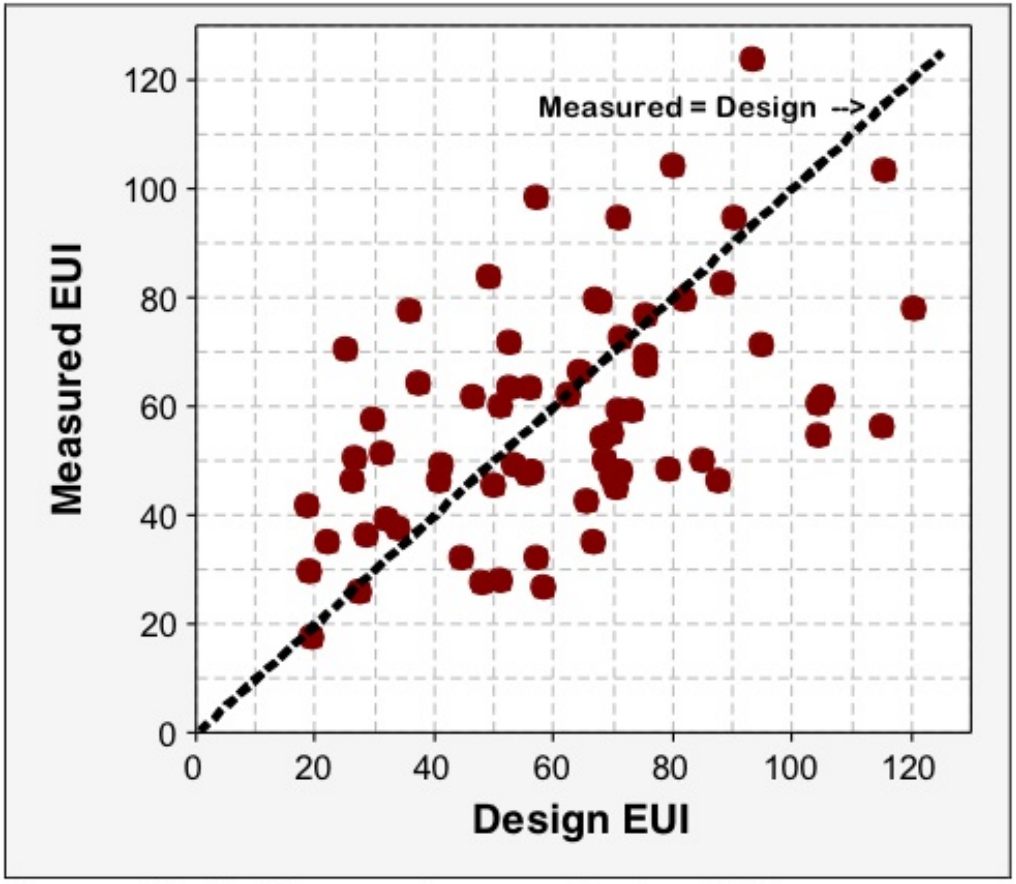



forrás: USGBC

# performance **gap**

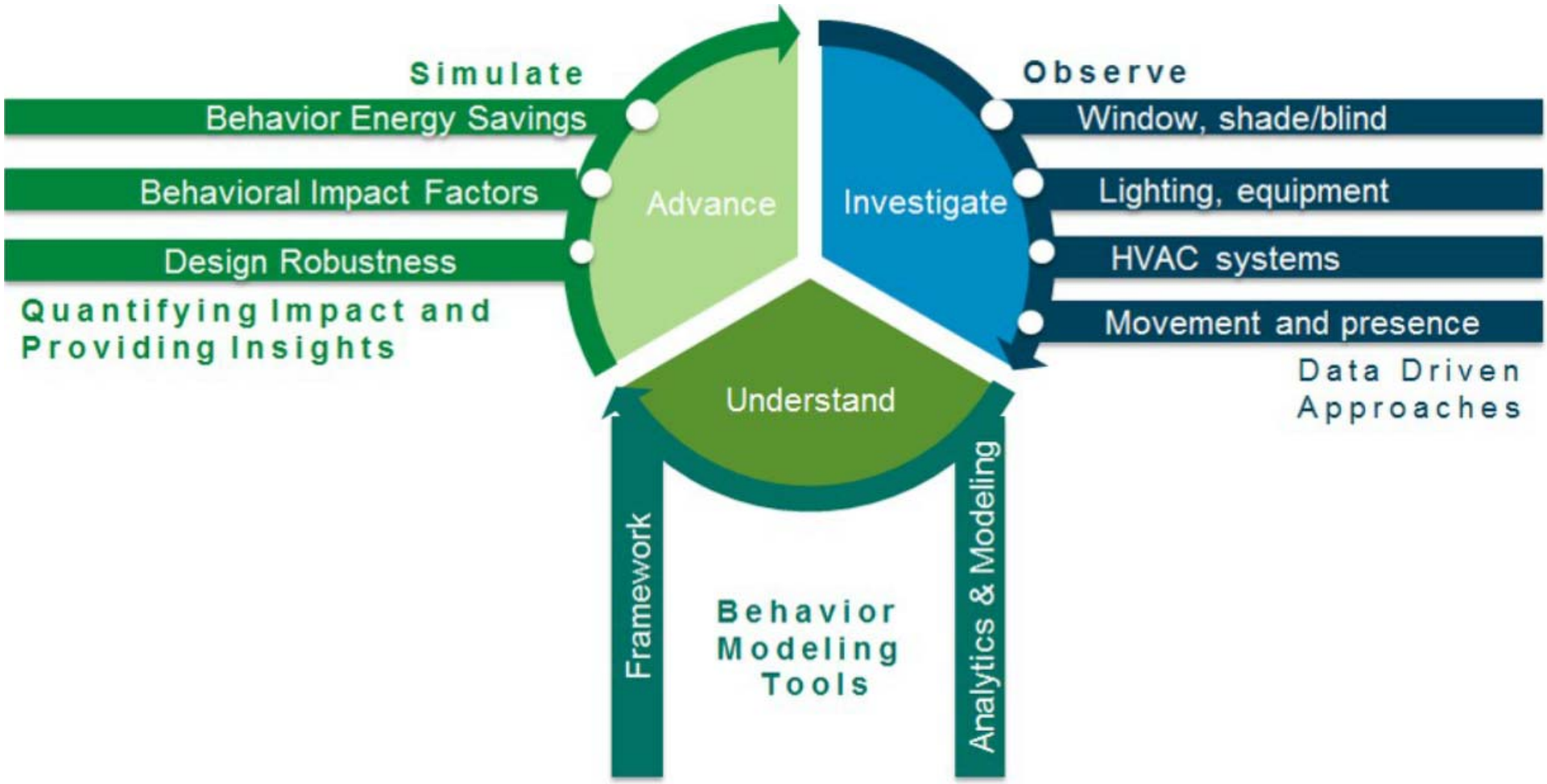
Reasons:

- Weather
- **Occupant Behaviour**
- Workmanship
- Operation parameters
- Modeller‘s competency
- Software capabilities
- etc.




Source: 2008 NBI Study of LEED NC certified buildings

# understand and model **humans**




Source: LBNL, Simona D'Oca, 2015

# background **- opportunity**

## *Limitation in literature:*

In a usual study:

- **one** sample of office workers shows
- **one** kind of behavioural pattern
- in **one** specific space setting

No data about their behaviour in a different setting.

Exact performance, validity and generalizability of the models?

## *Opportunity:*

Company headquarter change - office moving:

- **one** sample of office workers
- **two** sets of behavioural patterns
- in **two** different office settings

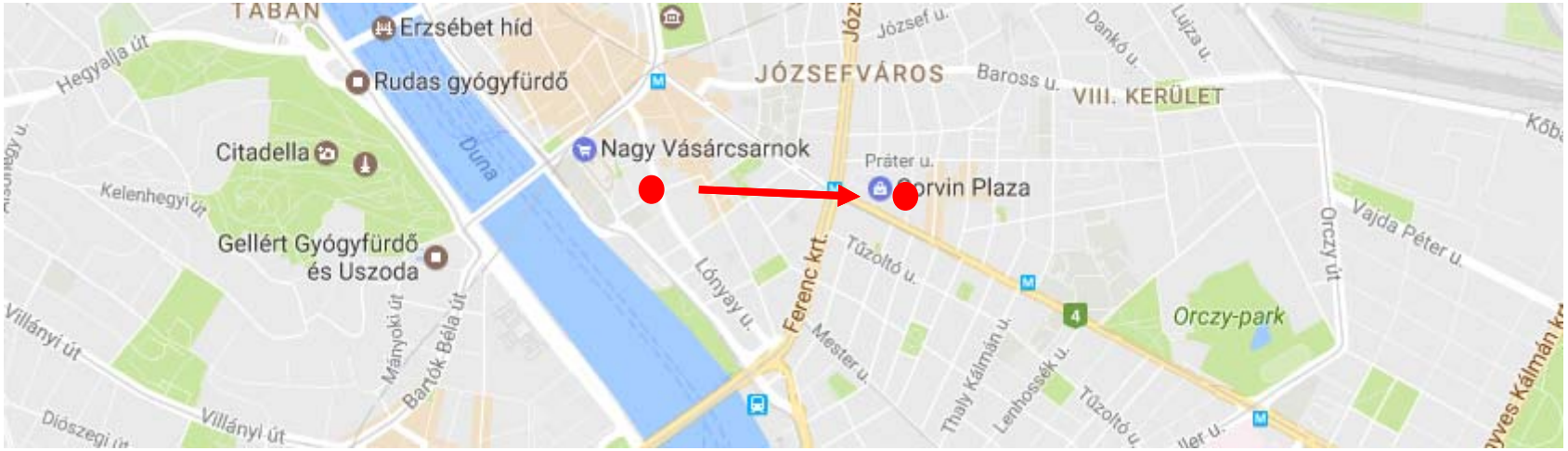
# office moving - **settings**

Budapest – Hungary

Architectural studio

~60 people

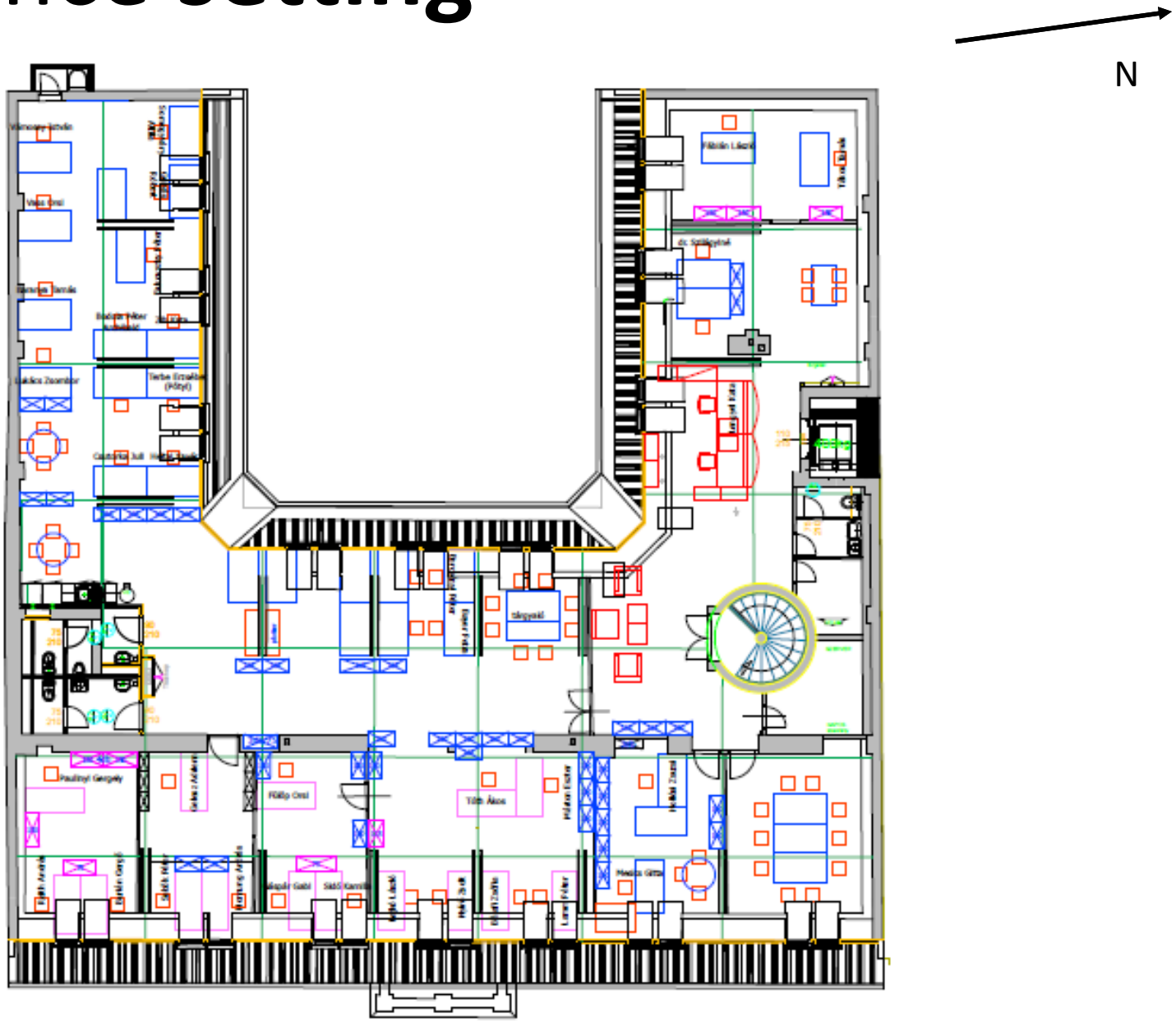
Moving: 2016 August



# office moving - **setting**

| Old office (Lonyay street) | **Aspect** | New office (Kisfaludy street) |
|---|---|---|
| 1910s | **Year built** | 2009 |
| Fair / renovation needed | **Condition** | New, modern, „green” (BREEAM) |
| 3-4 person offices | **Seating** | Open office with phone booths |
| Radiators | **Heating** | FC |
| Split units | **Cooling** | FC |
| Natural (windows) | **Ventilation** | CAV (25 $m^3$/hr,person) |
| Radiator valves<br>Split remote controls<br>Window opening for all<br>Indoor shading devices<br>Light switches (on/off)<br>Desk lighting for all | **Control options** | Thermostat for heating and cooling<br>Window opening for half of the office<br>No shading devices<br>Automated lighting with manual overwrite („don’t touch panel”)<br>No desklights |

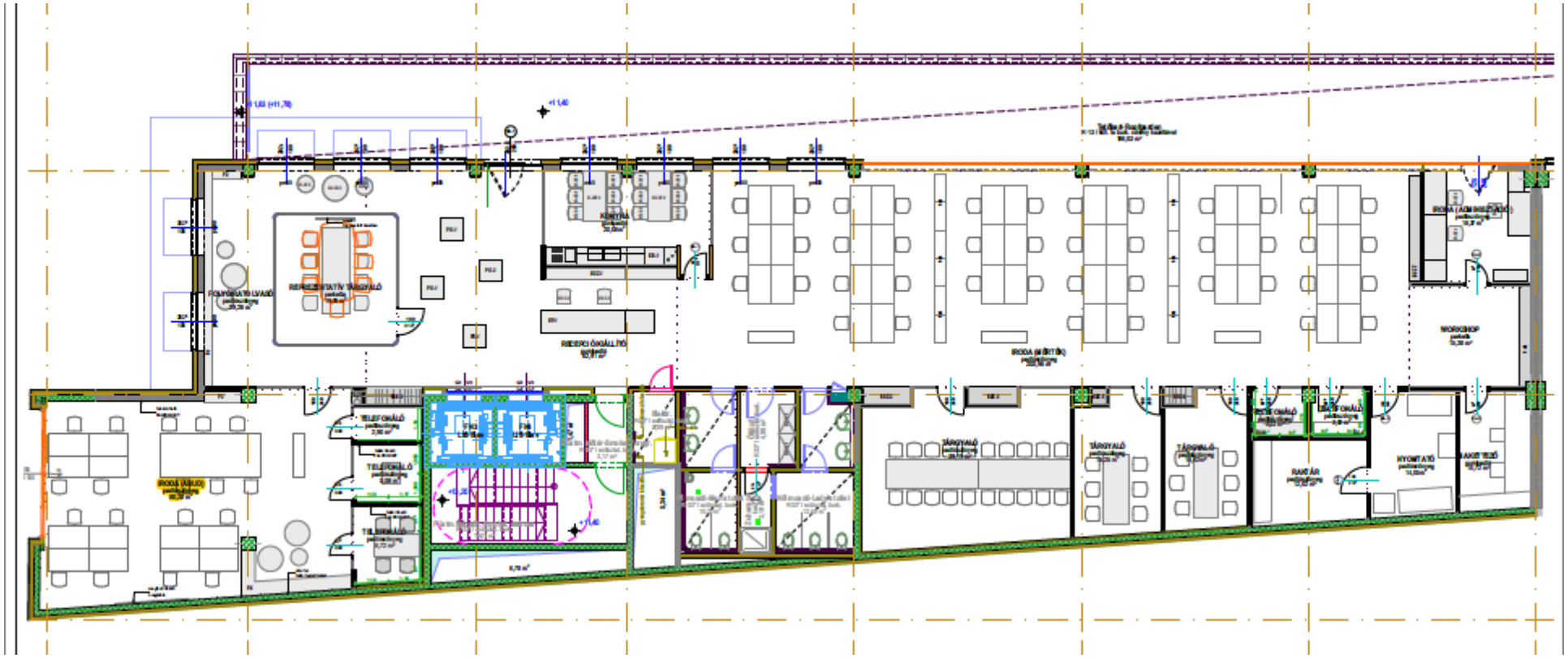
# old office **setting**



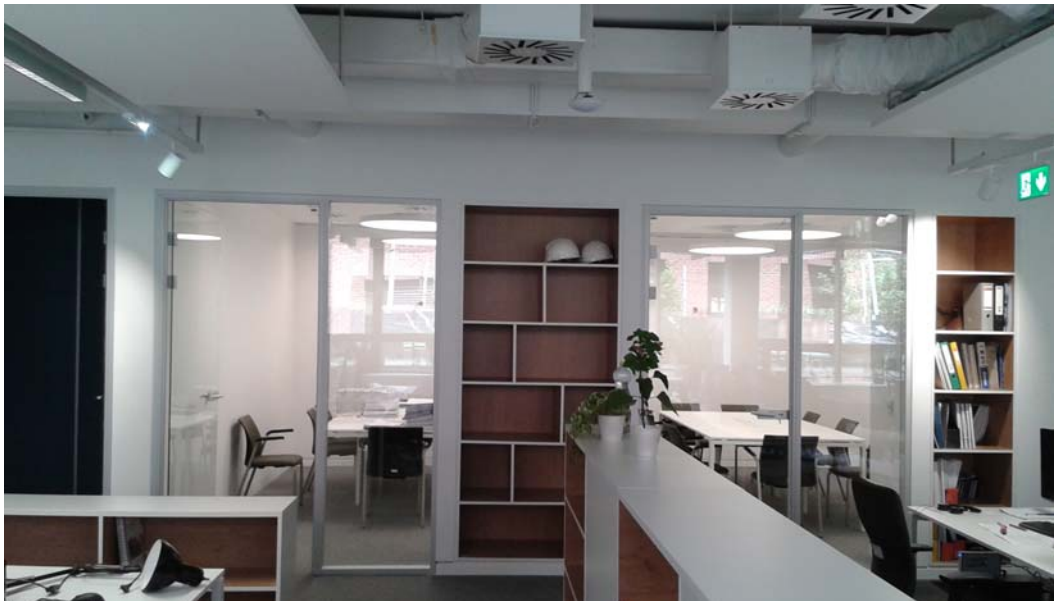
# old office **setting**

# new office **setting**

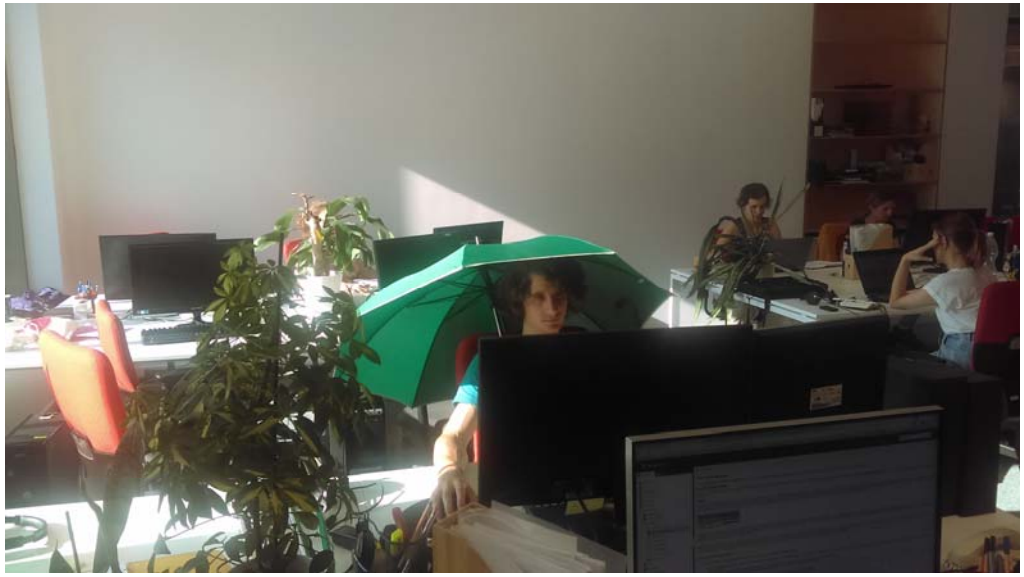
N



# new office **setting**



# new office – **training, comfort**



# **methods** used

Cross-sectional surveys

- both before and 1 year after moving in
- in the summer season

IEQ and energy consumption submetering

- electricity and heat for FCs
- lighting, plugloads
- IEQ, occupancy and thermostat control in 16 zones
- window opening sensors

Interviews – discover other potential influencing factors

Occupancy and usage pattern analysis with Kinekts (? Jakub?)

# **methods -**questionnaire framework

| | **Measured variables** |
|---|---|
| 1 | Thermal comfort, summer |
| | Thermal comfort, winter |
| | Daylighting, natural |
| | Lighting |
| | IAQ |
| 2 | Frequency of temp. Setting, winter, summer |
| | Efficacy cy of temp. Setting, winter, summer |
| | Other thermal comfort restoration |
| | Frequency of fresh air inlet |
| | Perceived efficacy of fresh air inlet |
| | Group decision making |
| | Sving lighting energy |
| | Use of desk lighting |
| | Computer usage (hrs/week) |
| 3 | TPB Attitude general |
| | TPB Attitude general - control |
| | TPB Attitude in offices |
| | TPB Attitude in offices - control |
| 4 | Satisfaction |
| 5 | Education program, employer's attitude |
| | Efficacy |
| | Knowledge |

| **Control variables** |
|---|
| Age |
| Sex |
| Years worked in the old office |
| Time spent in the office weekly |

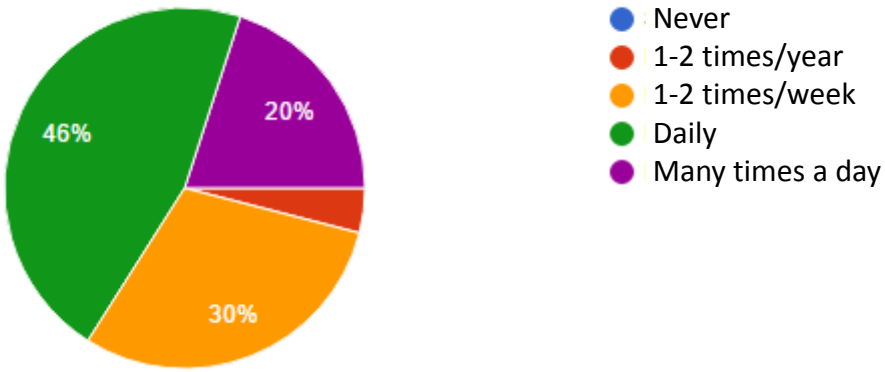
Data acquisition period:
2016. Summer

Response rate:
50/60 – 83%
(incentive: chocolate)

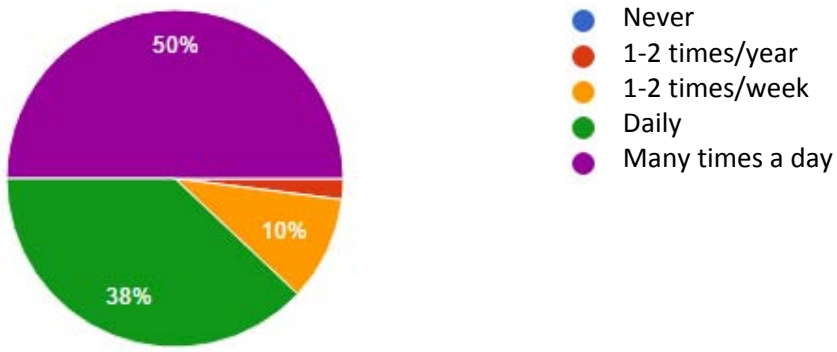
# **1st round** – old office

## questionnaire initial results

How often do you use the AC?
(Remote control)



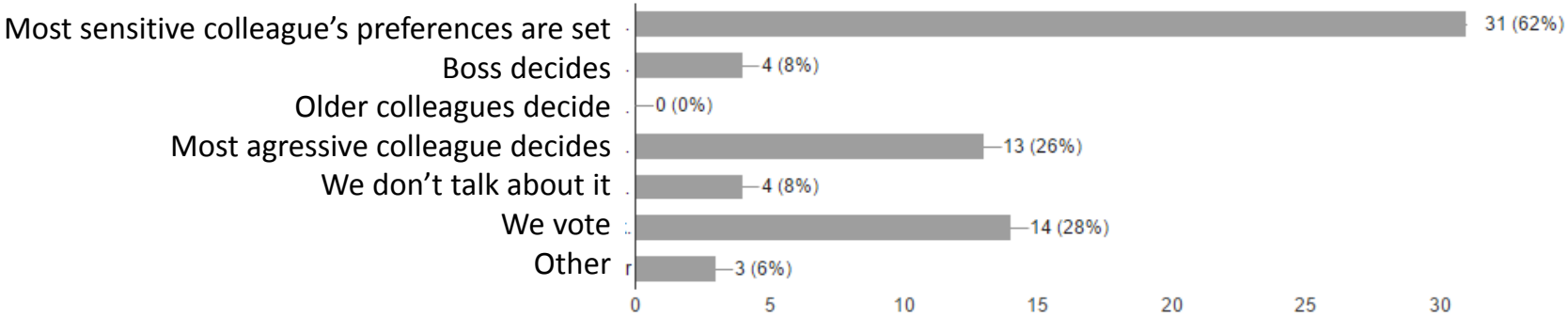

How often do you open the window?



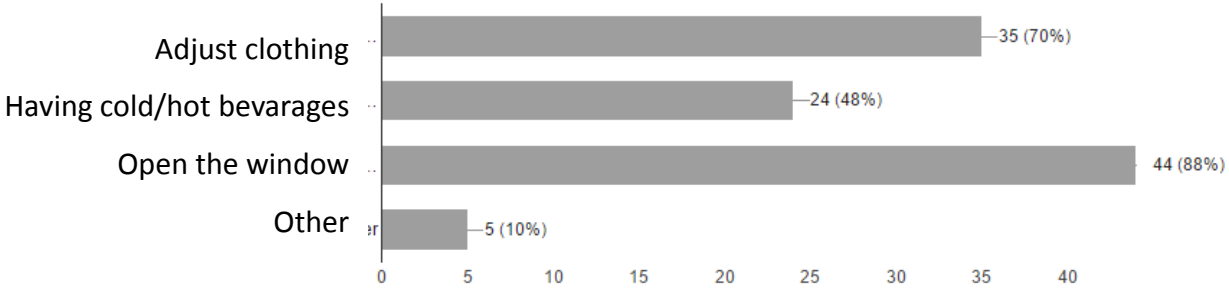
# **1st round** – old office

## questionnaire initial results

If indoor environmental preferences differ among colleagues, how is the decision generally made to use a control option (Temperature, lighting, window opening)




How do you usually make indoor temperature more comfortable?



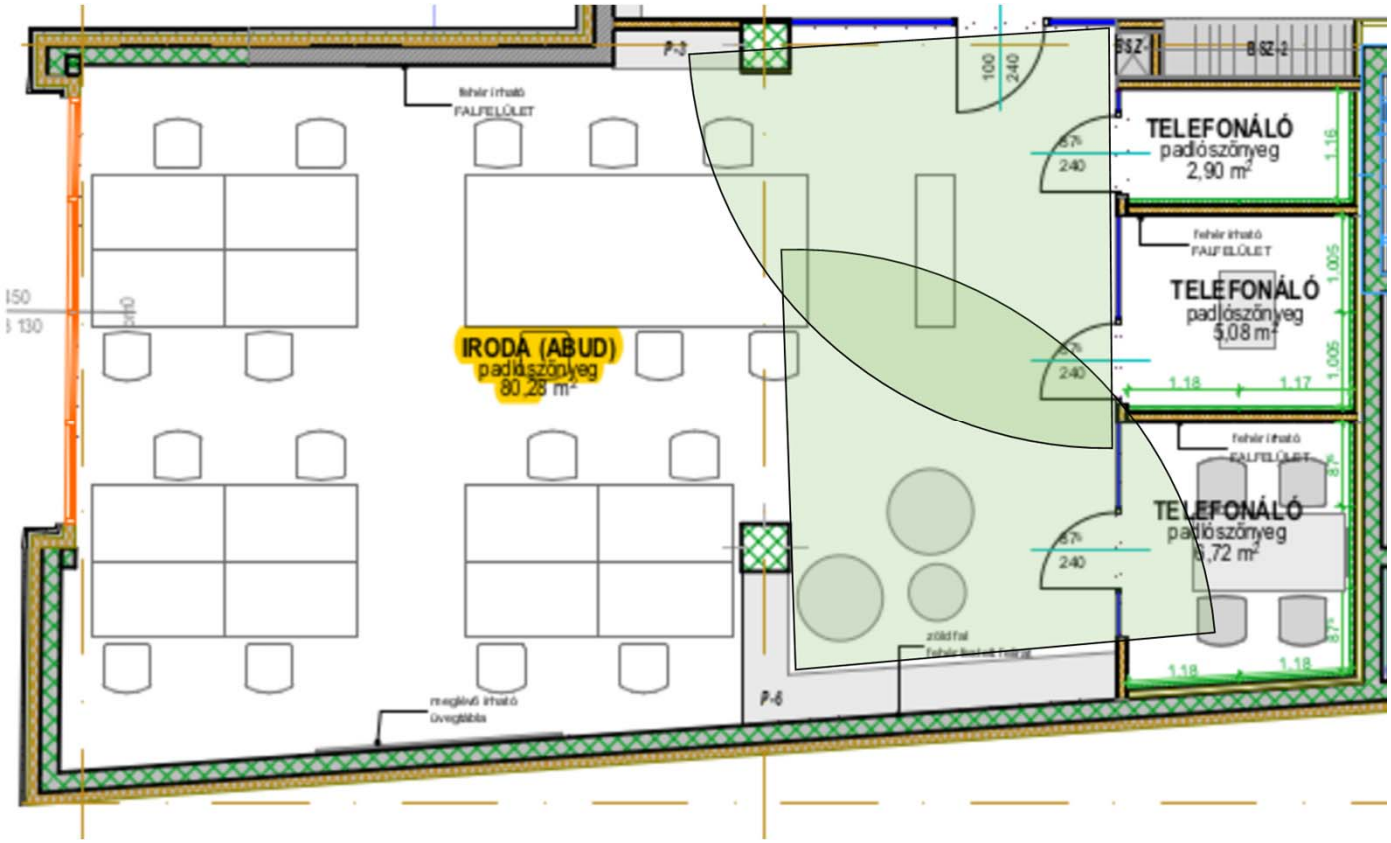
# **2nd round** & future work

| | |
|---|---|
| 2nd round of questionnaire – | August 2017 |
| Interviews with occupants – | Autumn 2017 |
| Siemens energy and IEQ monitoring – | Q3 2017 |

# **2nd round** – future work

Kinekt testing

for occupancy, clo levels and acticity, habit detection



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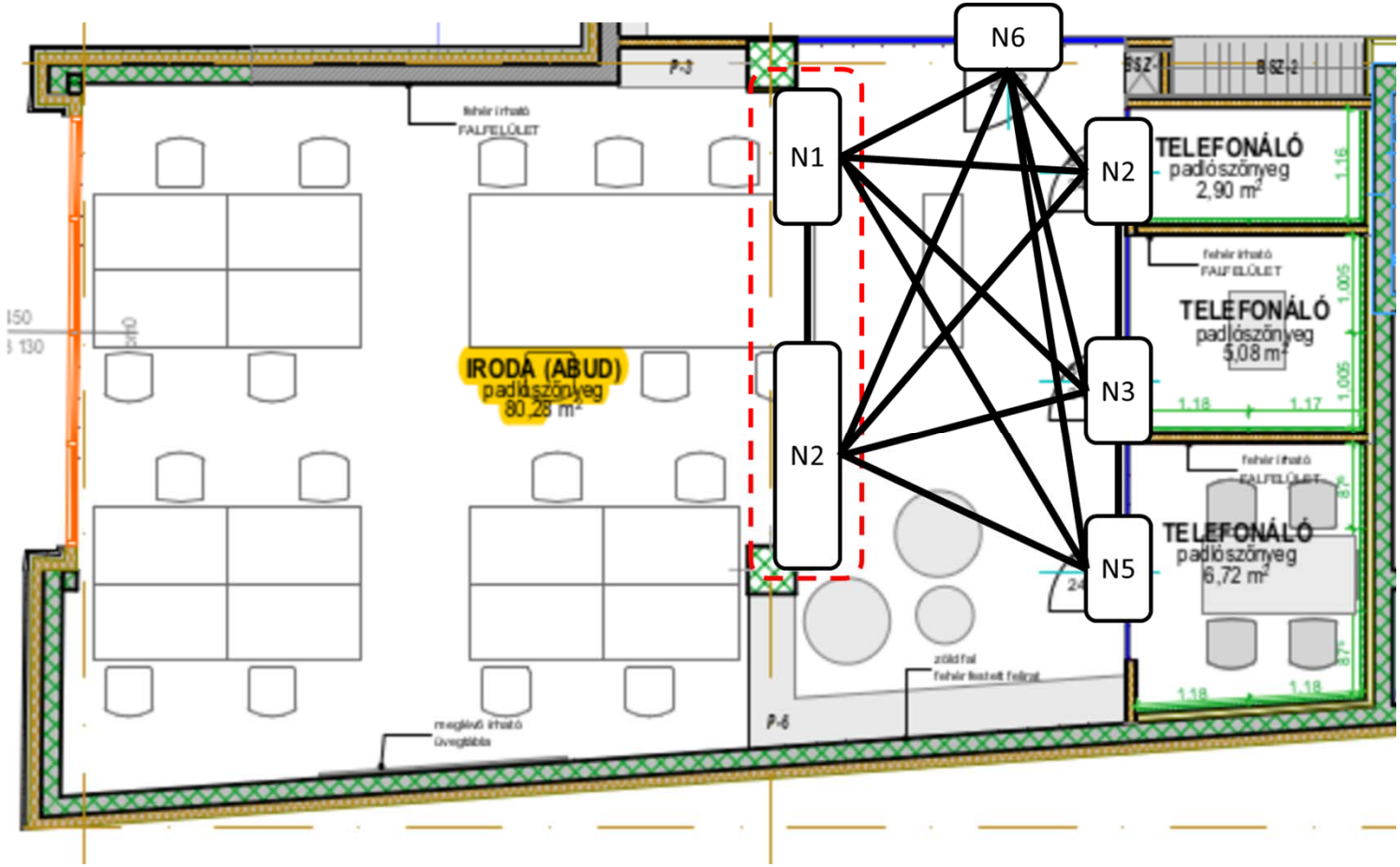

# Thank you for your attention!

Contact: belafi@egt.bme.hu

# Discussion, feedback needed:

- Other interesting questions to be asked?
- Other methods to be applied?