Skoltech Innovation Workshop 2018

Innovative project idea

Smart microclimate control system

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Indoor microclimate and comfort

Comfort can be determined by:

- Temperature **20 to 25°C**
- CO2 concentration **<1000 ppt**
- Relative humidity **45 to 60%**

… as well as …

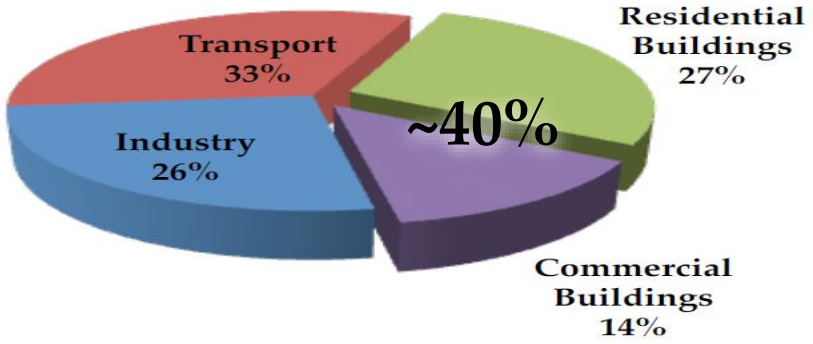
- Radiative heat
- Illumination
- Noise
- Dustiness PM 10/2.5/1.0
- Air pollution

Energy efficient <u>but</u> stuffy

Fresh <u>but</u> energy inefficient

Buildings energy consumption

Total consumption



business centers

shopping malls

residential buildings

- ~40% of primary energy is consumed by buildings
- Microclimate (heating/ cooling/ventilation) is a dominant "consumer"

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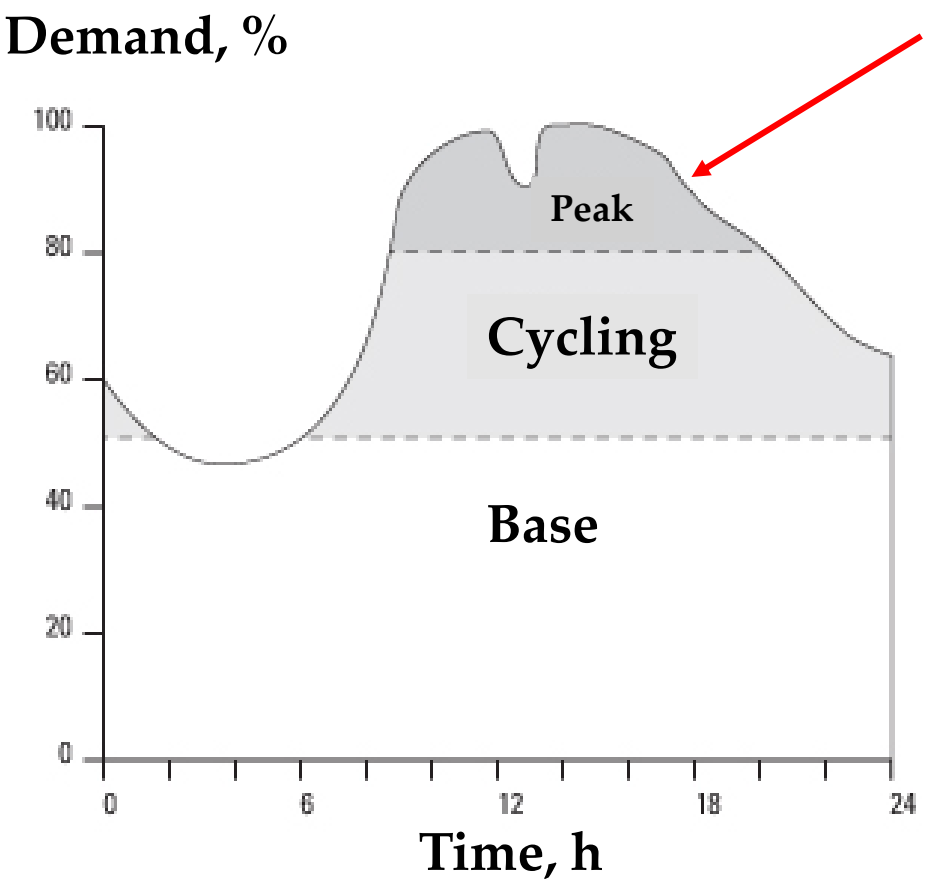
Power grid load



Peak demand leads to:

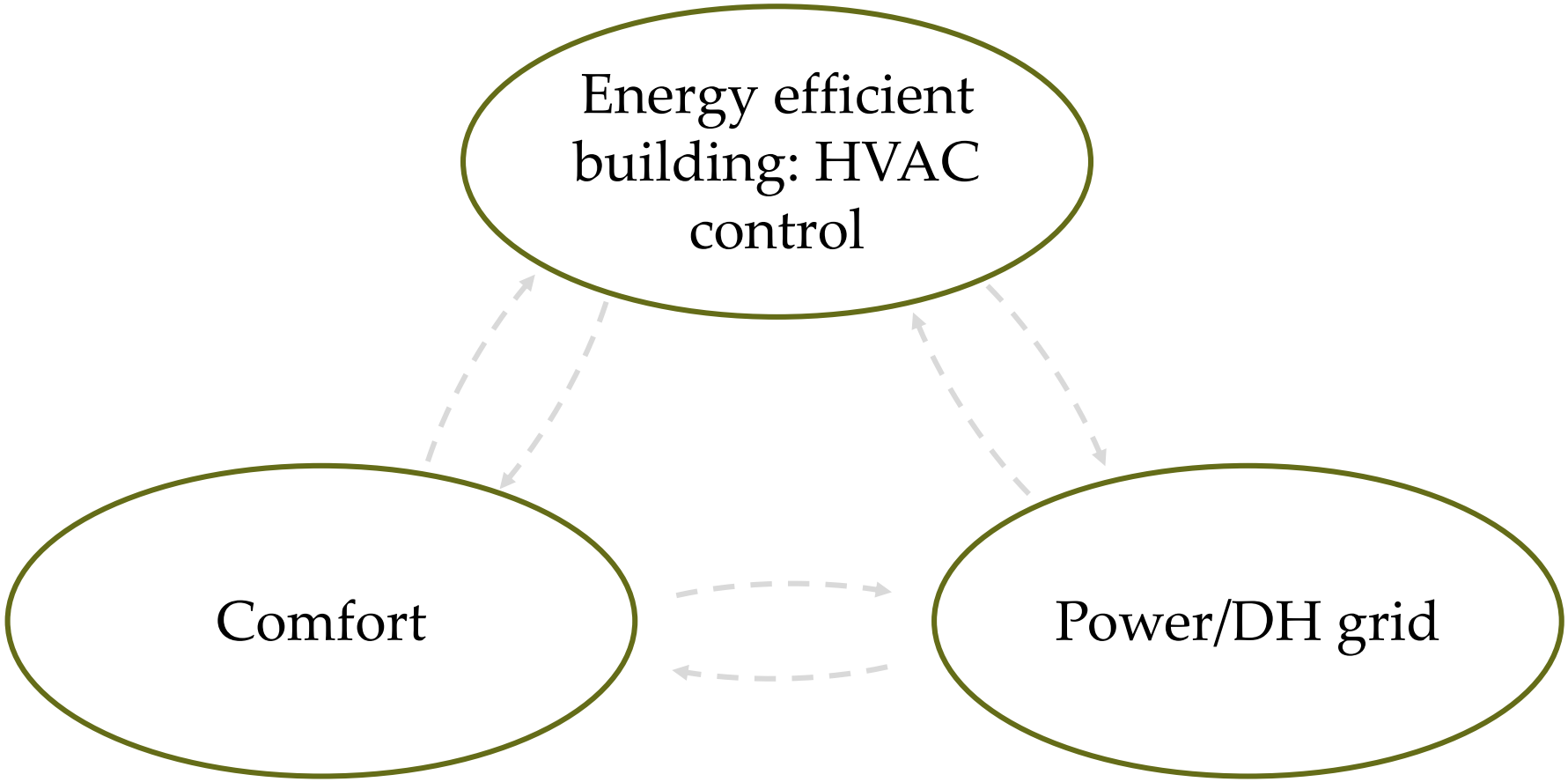
- Considerable stress on the grid
- Use of additional generators
- Increase of transmission lines load
- Inefficiency

Can be compensated by:

- Storage
- Demand control

Innovation challenge

Combine energy efficiency, comfort and power grid



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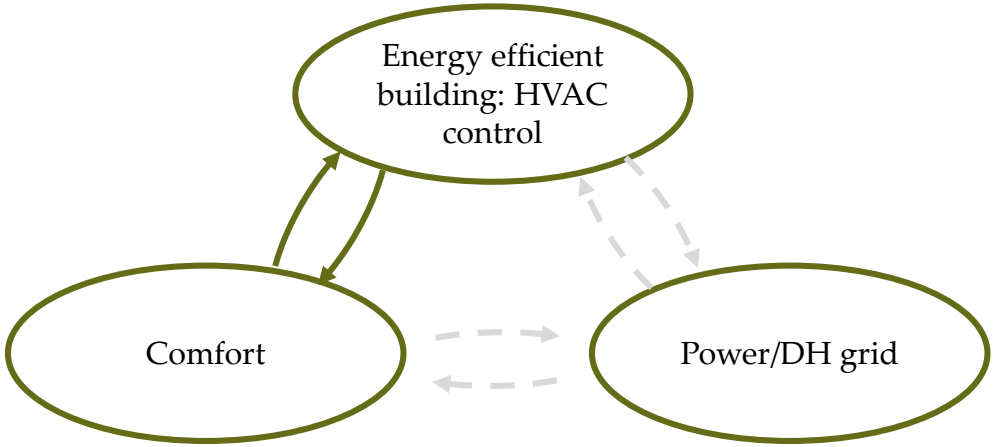
Existing solutions: energy efficiency + comfort

TION. MagicAir

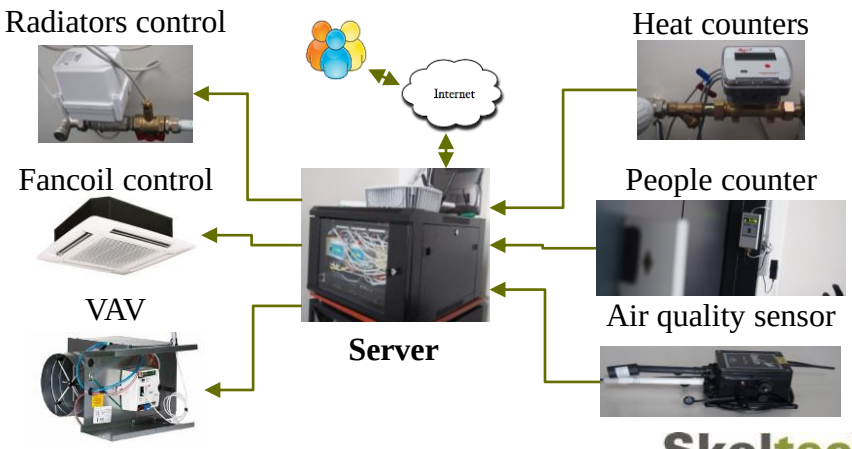
- Air conditioners and TION ventilation control



nest

- Controls HVAC equipment
- Learns user preferences

Skoltech "Polygon" smart microclimate lab



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Tasks for Innovation Workshop

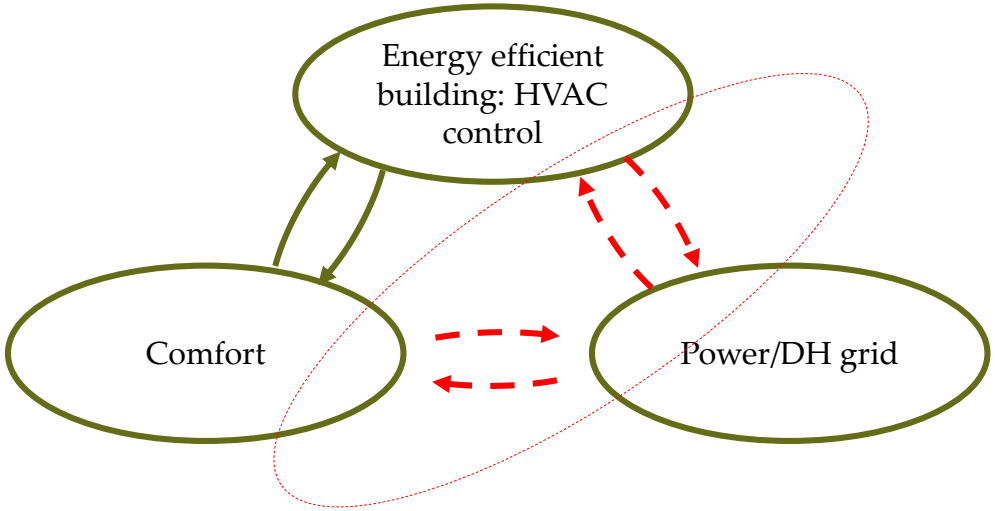
- Generate ideas on how the connections can be set

or/and

- Develop demand response algorithm, that will combine all three aspects, including an option for renewable sources

or/and

- Develop a code and implement it on Polygon



How to combine all three?

Possible impact

Up to **30%** consumption decrease*

Excellent comfort

Happy power/ DH grids

** **ETH** experimental studies in a Swiss office building (M.Morary, IEEE Transactions and Control [2016])*

Skoltech team

Henni Ouerdane

Assistant Professor

- ✓ Mathematical models development
- ✓ Scientific work supervision

Alexander Ryzhov

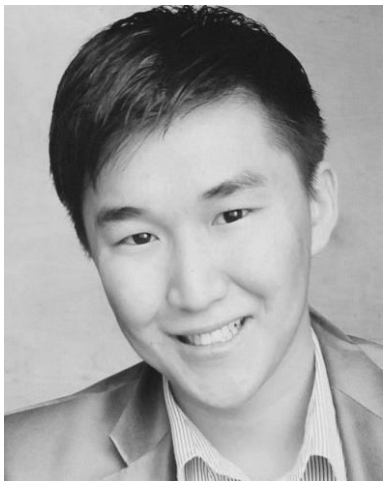
Research Scientist

- ✓ Algorithms implementation
- ✓ Prototypes development and testing

Elena Gryazina

Assistant Professor

- ✓ R&D supervision
- ✓ Guidance and management
- ✓ Contacts with industry/partners



Arseniy Sleptsov

PhD Student

- ✓ Patent and market analysis
- ✓ Building modeling
- ✓ Proof of concept