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 but stuffy

Fresh but energy inefficient
Buildings energy consumption

Total consumption

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

business centers
shopping malls
residential buildings
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

Energy efficient building: HVAC control

Comfort

Power/DH grid
**Existing solutions: energy efficiency + comfort**

- **Tion MagicAir**
  - Air conditioners and TION ventilation control

- **Nest**
  - Controls HVAC equipment
  - Learns user preferences

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**Skoltech “Polygon” smart microclimate lab**

- Radiators control
- Fancoil control
- VAV
- Heat counters
- People counter
- Air quality sensor
- Server
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

Elena Gryazina  
*Assistant Professor*  
✓ R&D supervision  
✓ Guidance and management  
✓ Contacts with industry/partners

Alexander Ryzhov  
*Research Scientist*  
✓ Algorithms implementation  
✓ Prototypes development and testing

Arseniy Sleptsov  
*PhD Student*  
✓ Patent and market analysis  
✓ Building modeling  
✓ Proof of concept