High-level planning on the highest mountain

Fighting for healthier air and fewer energy-poor households in one of the highest Hungarian villages

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Rural area
  Forest: 52%
  Cropland: 29%

31 settlements
Population: ~50 000
Nr. of households: ~18 000
Methodology

1. Door-to-door survey with questionnaires (2015-2021)
   - ~2000 questionnaires (~11%);
   - >1 million data elements;
   - quantitative and qualitative dataset

2. Building-typology survey

3. GIS analyses
   - Renewable energy potentials
   - Energy storage potentials

4. Software-based energy planning

Research goal:
to support RE-based energy transition with complex energy planning
Bükkszentkereszt

September, 2021
Bükkszentkereszt
Located in a high-altitude valley

→ Longer heating season (Sept-May)

→ Air pollution settles in the valley

Tourist destination

Environmentally aware local governance

→ Operational air quality meters

→ Cooperation with Miskolc University

→ Member of Covenant of Mayors Agreement

Sustainable Energy Action Plan (2012)
~450 households
~1100 inhabitants

Survived: 160 households

• 36% of the permanently inhabited buildings
• covering all street
Results of the door-to-door survey and the building typology methodology.
Heating energy mix of households in Bükkszentkereszt

No natural gas network has been built

- Firewood
- PB-gas
- Lignite
- Electricity for hot water
- Electricity for heating
- Ambient heat
Firewood use = very hard work

moisture content: 50%

480-500 kg

300 cm

50 cm
Energy affordability analysis: 60% perceived as a difficulty

- Very expensive: 5% of respondents
- Expensive: 35% of respondents
- Normal: 34% of respondents
- Cheap: 25% of respondents
- Very Cheap: 1% of respondents

Energy expenditures of more than 10% of family income: 65%
Tightly-connected 4 major problems

inappropriate technology (without heat storage)

wet firewood

missing knowledge about clean ignition

waste as fuel
PM 2.5 pollution in Bükkszentkereszt (May 2020 - April 2021)
The magic of **dried** and well-prepared firewood
Contribution of DRY firewood use to decrease PM2.5 air pollution in Bükkszentkereszt

- Current Achievable
- 66% less PM2.5 emission
Contribution of DRY firewood use to decrease fuel consumption

Due to the higher calorific value, using dry firewood reduces fuel demand by \(~10\%\).

\(~1\ m^3\) of firewood can be saved per household per year

\((\sim 35,000\ Ft/\text{year}\ in\ 2023)\)
PowerPoor (H-2020) project in Bükkszentkereszt (2021-2022)
1. Increasing **public engagement** and **awareness** on CLEAN and EFFICIENT firewood heating

2. Creating a **concept study** to establish an **energy courtyard**
   • to provide **ready-to-use, dried firewood**
Some of our related publications in English:

• Csontos, Cs. ; Campos, J. ; Soha, T. ; Harmat, Á. ; Csüllög, G. ; Munkácsy, B. (2021): Validation of household heat demand in rural settlements using software-based heat atlases
• Campos, J. ; Csontos, Cs. ; Harmat, Á. ; Csüllög, G. ; Munkácsy, B. (2021): Individual heat pumps as an opportunity for smart and sustainable heating in rural communities
• Soha, Tamás ; Papp, L. ; Csontos, Cs. ; Munkácsy, B. (2021): The importance of high crop residue demand on biogas plant site selection, scaling and feedstock allocation – A regional scale concept in a Hungarian study area
• Campos, J. ; Csontos, Cs. ; Harmat, Á. ; Csüllög, G. ; Munkácsy, B. (2020): Heat consumption scenarios in the rural residential sector: the potential of heat pump-based demand-side management for sustainable heating
• Csontos, Cs. ; Soha, Tamás ; Harmat, Á. ; J., Campos ; Csüllög, G. ; Munkácsy, B. (2020): Spatial analysis of renewable-based hybrid district heating possibilities in a Hungarian rural area

Thank you for your kind attention!

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