SWICE + LANTERN CONFERENCE

4th edition

FRIBOURG 10.06.26

Building bridges for an energy transition that accounts for human needs

sweet swiss energy research for the energy transition

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Full programme

Abstracts

EN

FR

DE

Wifi

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Welcome address

Luca Castiglioni (SFOE)

Joëlle Mastelic (Lantern)

Philippe Thalmann (SWICE)

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Keynote presentation

Delphine Ding (DD Architecture)
Stéphane Emery (AAE Architectes)
Paolo Basso Ricci (RBRC Fribourg)

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Session 1

Sufficiency in the built environment & renovation strategies

Moderated by
Julia Steinberger
Martin Patel

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Evaluating buildings and mobility energy impacts of emerging working models: a decision-support tool

Sebastiano Maltese, Evelyn Lobsiger-Kägi,
Jasmin Oberkalmsteiner, Uroš Tomic, Stephanie Moser,
Rafaël Weissbrodt, Jessica Marques

10:00 - 10:20

Evaluating buildings and mobility energy impacts of emerging working models: a decision-support tool

Understanding the true energy impact of flexible working models

- **Context-dependent savings:** energy reductions are not automatic; they rely heavily on specific contextual factors;
- **Key variables to consider:** building energy systems, building age, employee mobility patterns, and work organisation opportunities;
- **Corporate perspective:** what is the actual room for action for companies given this complexity?
- **Goal:** providing a tailored decision-support tool to help companies identify real energy-saving potentials in their specific case.

Context and objectives

WP5 assumptions and directions

- Interactive dashboard: a user interface designed to evaluate the impact of remote-work policies;
- Core purpose: accurately quantify actual energy savings and CO_2 emission reductions;
- Data integration: merges building thermal simulations (EnergyPlus) with employee mobility patterns;
- Analysis & visualisation: translates complex company data into actionable metrics for sustainable decisions.

Simulation engine: domain integration

The tool development

- Based on actual data of cooperating partners (the tool is tuned to their baseline);
- Building:
  - Annual energy simulations performed in energy+;
  - Operational schedules and systems setting can be tuned.
- Mobility:
  - Takes into account commuting, business travels and spillover effects on non-work commuting.
- Post-processing of energy sources;
- Visualisation html app for easier access to scenarios;
- Decision-making possibility of deepening scenarios or testing solutions in real environment.

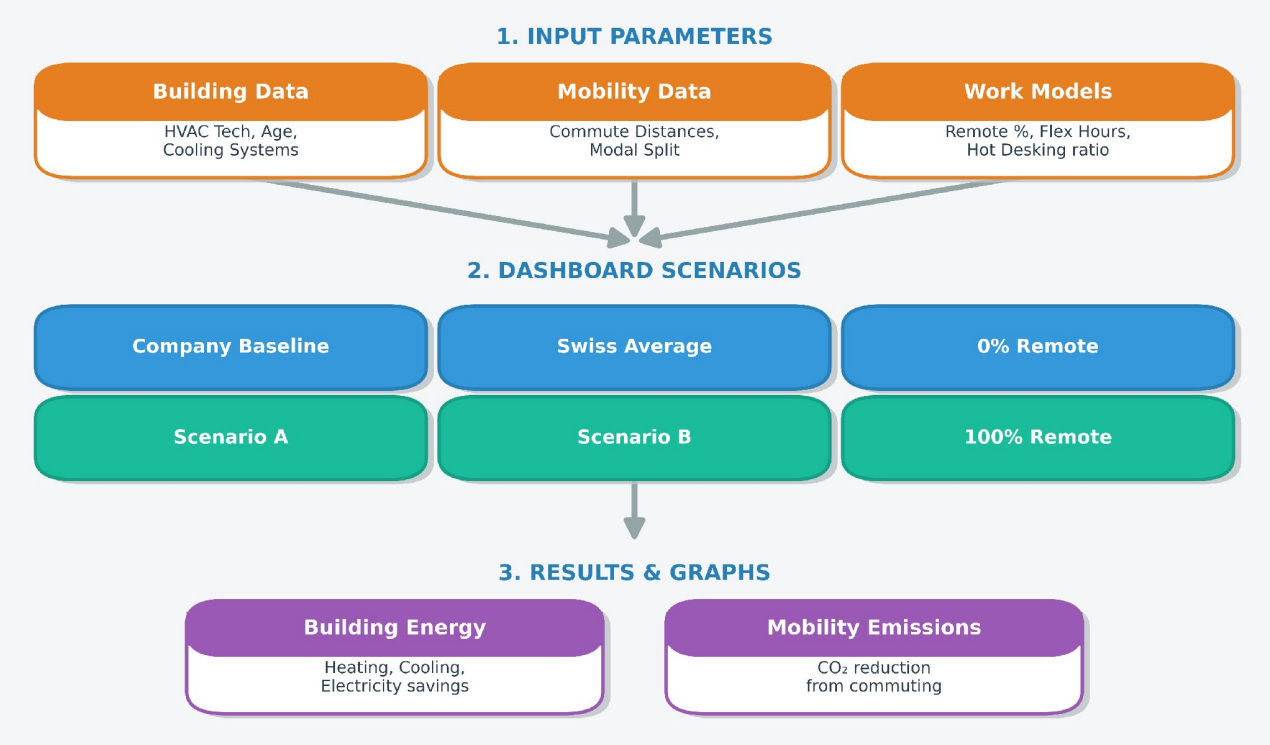
Model dimensions & scenarios

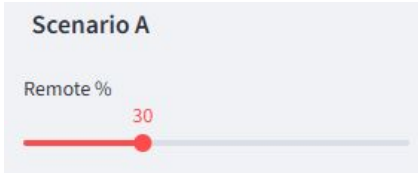
The tool development

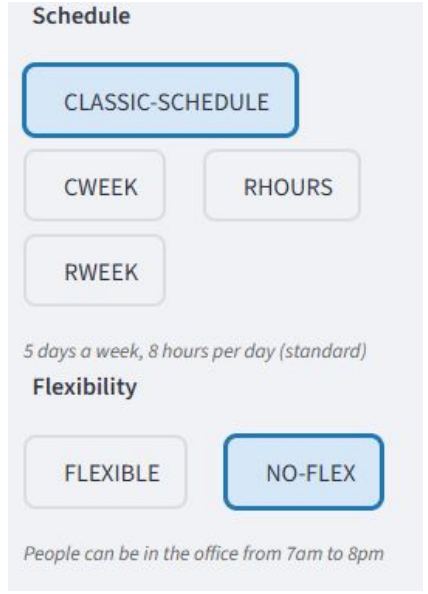
- A matrix of 2’688 operational scenarios;
- Four key intersecting variables:
  - **Remote work frequency**: from 0% (no remote) to 100% (full remote) working;
  - **HVAC strategies**: always on, working hours, working week, smart;
  - **Occupancy scheduling**: classic, short week, short days, compressed week;
  - **Flexible working hours**: possibility to work early/late.

Workflow

The tool development







- Parameters can be selected for 3 scenarios (2 personalised, 1 company baseline);
- Additional data can be personalised.

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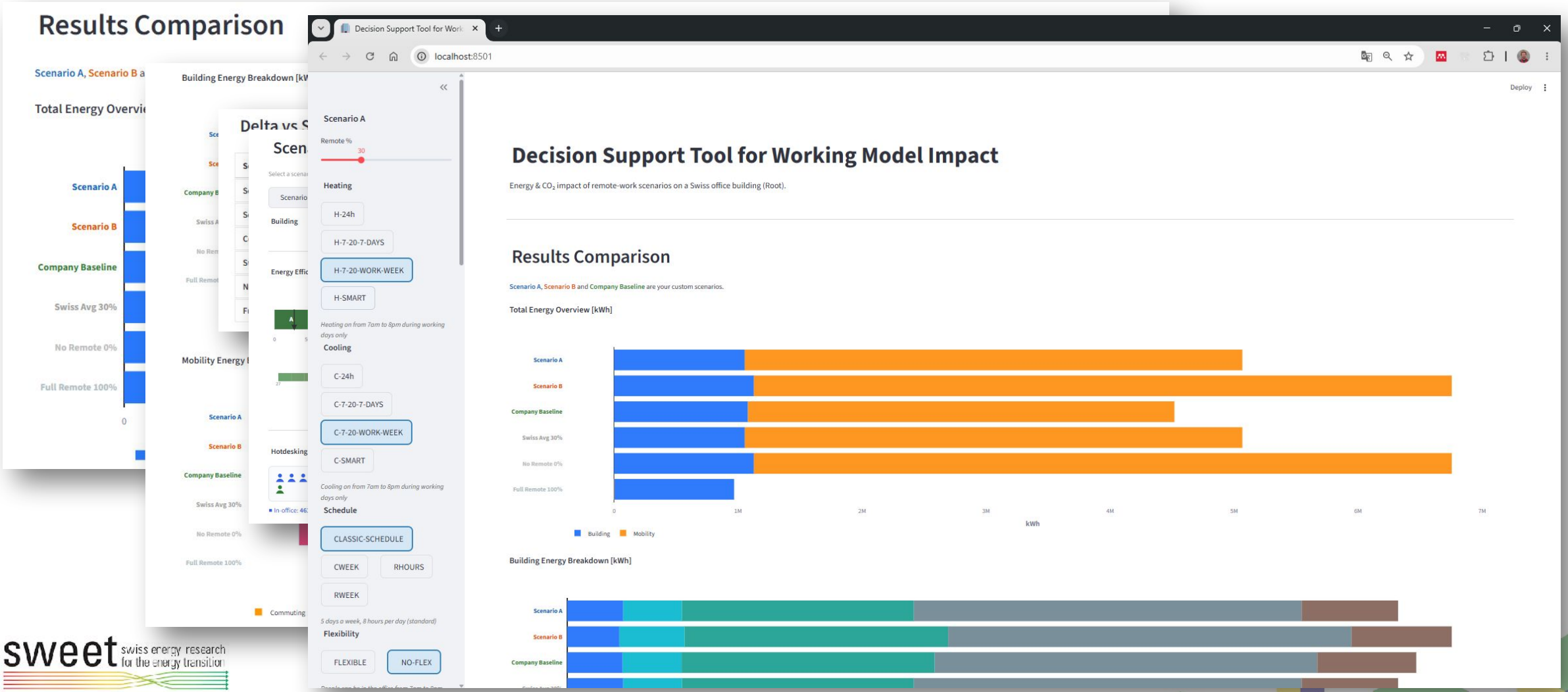
Demonstration / scenario comparison

The tool development



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The empty office penalty

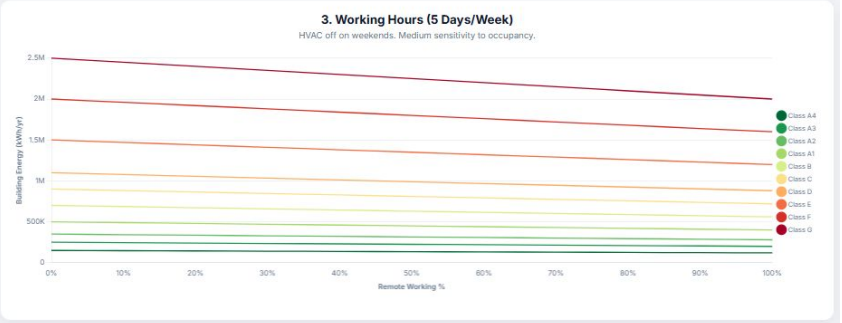
Findings

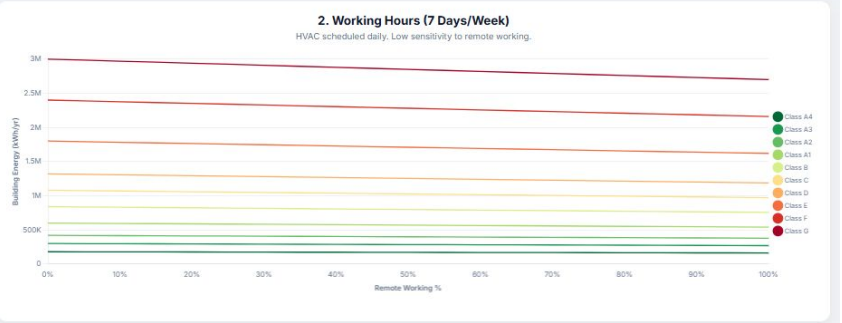
- **Remote work without optimisation**: increasing telework while leaving HVAC operations "as usual" yields minimal or even negative savings.
- The residual burden: office base-load energy consumption remains high even with significantly reduced occupancy, diluting the benefits of teleworking.
- A possible solution: remote work must be coupled with coordinated actions (e.g. synchronized remote/office days, HVAC controls improvement).

The need for smart HVAC

Findings

- Local interventions: active zone closure and dynamic setpoint reduction.
- Saving potentials are building-dependent, making customised simulation tools essential.
- Energy class + % remote + HVAC settings have to be considered in the equation to guarantee the best savings.





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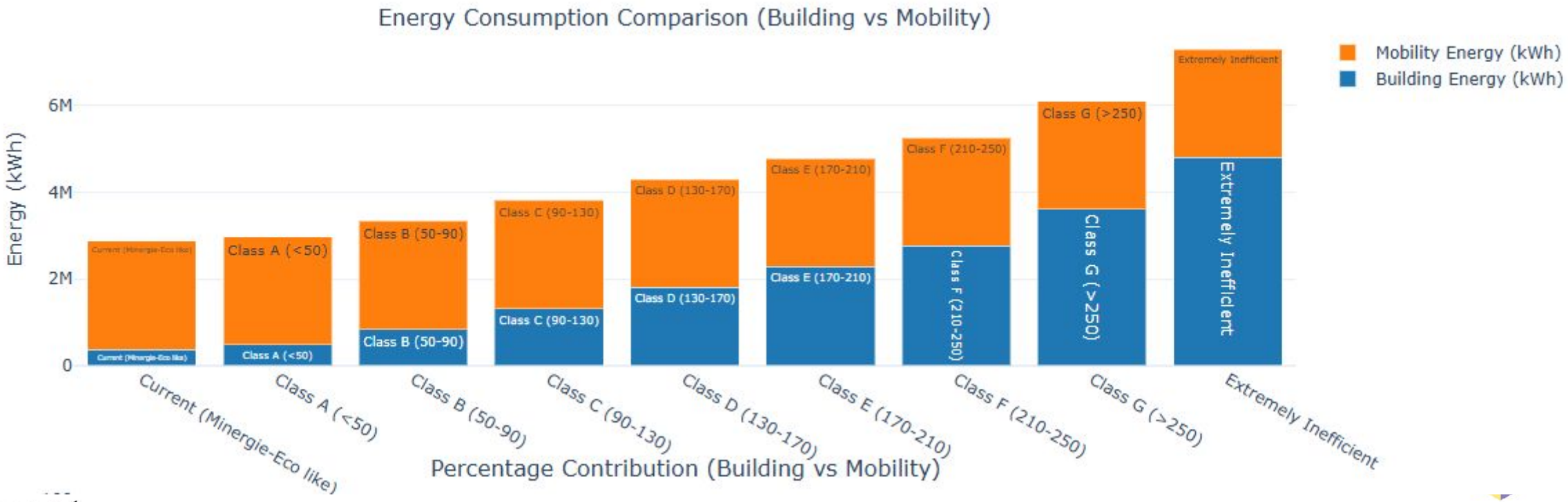
The weight of mobility

Findings

When does it become more effective to act on the building rather than mobility?



Broad implications for companies and policy

First insights and implications

- **Organisational alignment**: success relies on harmonising employee behaviour with corporate policies, desk-sharing strategies, and "smart" infrastructure;
- **Individual mobility**: commuting distance and the chosen means of transport remain critical variables in the overall energy equation;
- **Spill-over effects**: remote work can trigger unintended consequences, such as relocating further away, accepting longer commutes, or increasing leisure travel;
- **Policy relevance**: data-backed guidelines are essential at both the company and policy levels to promote energy-saving working models.

Working next door: An evaluation of a coworking space intervention in a living lab on commuting and housing space demand

Noah Balthasar, Jana Z'Rotz, Dr. Thao Thi Vu, Prof. Dr. Timo Ohnmacht

10:20 - 10:40 h

Agenda

1. Rationale of the study
2. Living lab research
3. Intervention
4. Data
5. Results
6. Conclusions
7. Recommendations (Future Research / Policy)

Rationale of the study

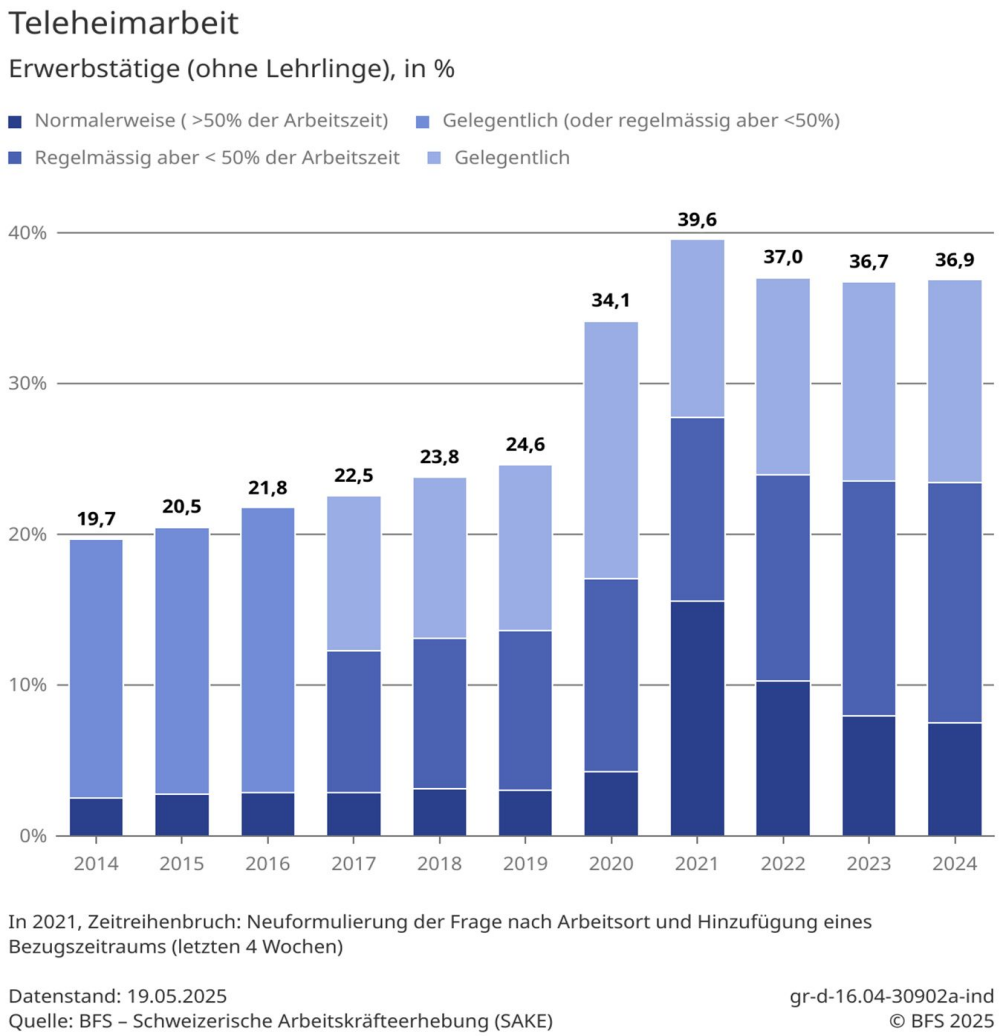
Teleworking, mobility and housing space demand in Switzerl

Telework: Work conducted outside the employers' office (home-office and work in third places, e.g. coworking spaces, cafés, on the move).

- Teleworking: 1/3 of Swiss employees telework at least occasionally: +90% since 2014 (FSO, 2024).
- Mobility: Mean daily travel distance for work purposes per person increased from 6.5 km in 1994 to 8.6 km in 2015: +37% (BFS/ARE, 2017).
- Housing space demand: Increased from 30.0 m² in 1970 to 46.6 m² per person in 2024: +55% (FSO, 2025). Effects of telework on housing space demand (e.g., due to an additional home-office room) (Z'Rotz et al. 2026)

Coworking spaces (CWS) are shared workspaces.
To what extend do residental CWS decrease

- motorised commuting distances
- housing space demand due to the externalisation of home-office infrastructure (separate rooms, work corners/places)?



Living lab research

Living lab (LL): Real-world setting for testing transformative change based on interventions, co-designed between users, researchers and public/private actors (Voytenko et al., 2016)

LL Suurstoffi

- municipality of Risch-Rotkreuz
- 1’500 residents, 2’000 students, 2’500 employees
- well connected by public transport
- high share of motorised individual transport

Baseline survey (Balthasar et al., 2023) shows:
65% of inhabitants can telework - of these:

- 59% have a separate home-office room at home
- 6% already used a CWS

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Intervention

Test a Coworking Space!

- SPACES: CWS in Suurstoffi with flexible workspaces, meeting rooms, ergonomic furniture, lounge areas etc.
- Recruitment of testers: through a teleworker survey in the LL
- Target group: teleworkers with home office use ≥ 1 day/week, little/no coworking experience
- Testers: 13
- Trial period: three months free access to SPACES (February – April 2025)
- Attendance check: via registration at Check-in-Desk

Research Questions (RQ's):

- What are the overall **experiences** of the testers with the CWS?
- How does **mobility behavior** differ between CWS-days vs. non-CWS-days?
- Do residential coworking spaces (CWS) **reduce residents' need for a dedicated home office room** in their dwelling **when considering a future relocation**?

SPACES.

ZugEstates

COWORKING SWITZERLAND

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Data

Source	n	Field Time
Teleworker survey in LL Suurstoffi	86	Nov 2024 - Jan 2025
Recruitment of testers at the end of the teleworker survey (Thus, includes information before the intervention of testers)	13	
Tester survey regarding information during the intervention	13	May 2025 - Jun 2025
3 month app-based GPS-mobility-tracking during the intervention (WP 1)	6	Feb 2025 - Apr 2025

Comparison of sample characteristics

Variables	Categories	Swiss working population	LL Teleworkers (n=86)	Testers (n=13)
Age	Years (mean)	42.5	40.4	41.8
Gender	Male	54 %	55 %	84 % (11/13)
	Female	46 %	43 %	8 % (1/13)
	Not stated	–	2 %	8 % (1/13)
Household	Single-person	37 %	19 %	8 % (1/13)
	Couple, no children	27 %	25 %	15 % (2/13)
	Family with children	29 %	50 %	77 % (10/13)
	Other household types	7 %	6 %	0 % (0/13)

Source: FSO SAKE 2022 / FSO 2022; LL Teleworker-survey.

Testers of the intervention are more or less the same age as the Swiss working population and the LL Teleworkers, predominantly male and predominantly from family households.

Experiences of testers based on qualitative quotes in the survey (n=13)

The CWS …	Exemplary Statements
… is welcoming.	*"Very easy and friendly access." (P02, translated)*
… offers variety and flexibility.	*"Different seating styles throughout, easy to change the environment you're working in." (P11)*
… provides a modern, professional atmosphere.	*"Modern office, variety." (P01, translated)*
… creates a pleasant working environment.	*"The aura of the place is just amazing." (P09)*

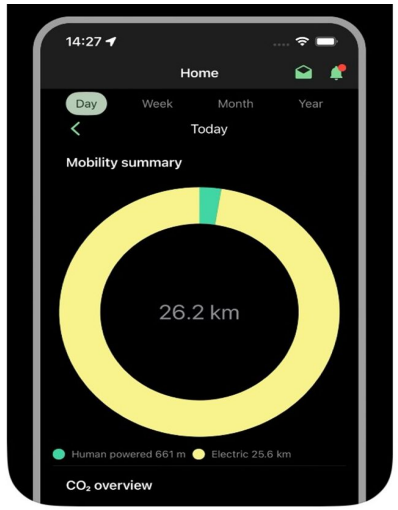
Mobility: Workplace use in a typical workweek (Survey)

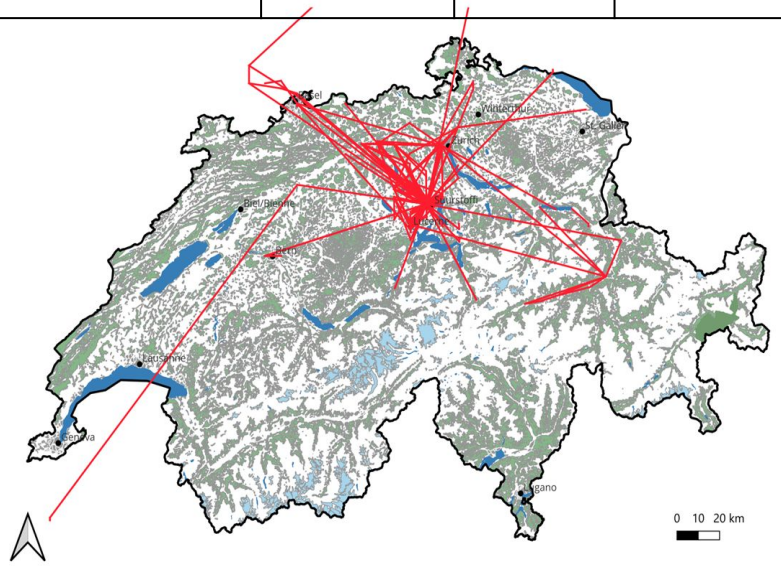
Workplace / attendance time per week (mean)	LL Teleworkers (n=86)	Testers before (n=13)	Testers during Intervention (n=13)	Δ (mean)
Regular Office	2.2	1.3	1.2	- 0.1
Home-office	1.9	2.8	2.5	- 0.3
On the move	0.6	0.9	0.8	- 0.1
CWS	0.1	0	1.6	+ 1.6

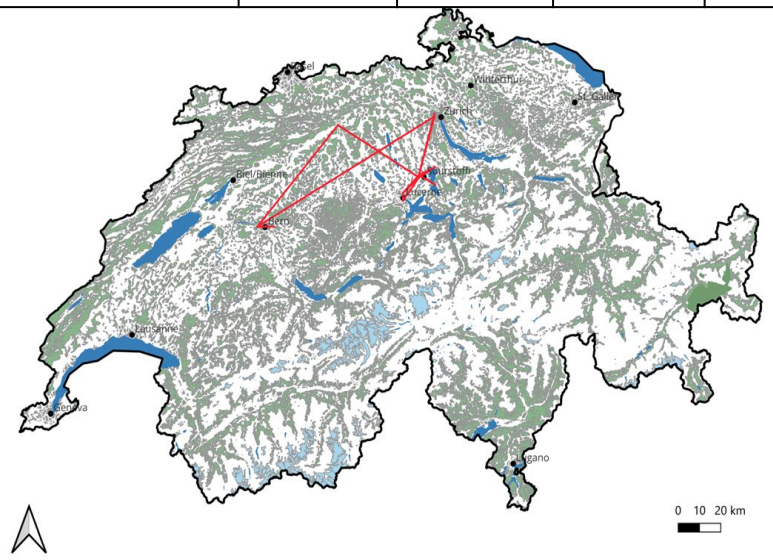
Indicator	LL Teleworkers (n=86)	Testers before (n=13)	Testers during Intervention (n=13)	Δ (%)
Commuting distances (km/week)	163	144	87	- 39%
Commuting CO_2 (kg/week)	6.4	1.0	0.8	- 17%

Mobility: Commuting distance and CO_2 (n=6) (Tracking)

	Non-CWS days				CWS days				Total
n days	155				11				166
n trips	845				43				888
	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.	Δ (mean diff.)
Commuting distance (km/day)	77.2	86.5	0.3	594.0	41.6	80.5	0.3	268.0	-35.6
Commuting CO_2 (kg/day)	5.5	11.7	0.0	86.0	2.6	5.5	0.0	18.5	-3.4







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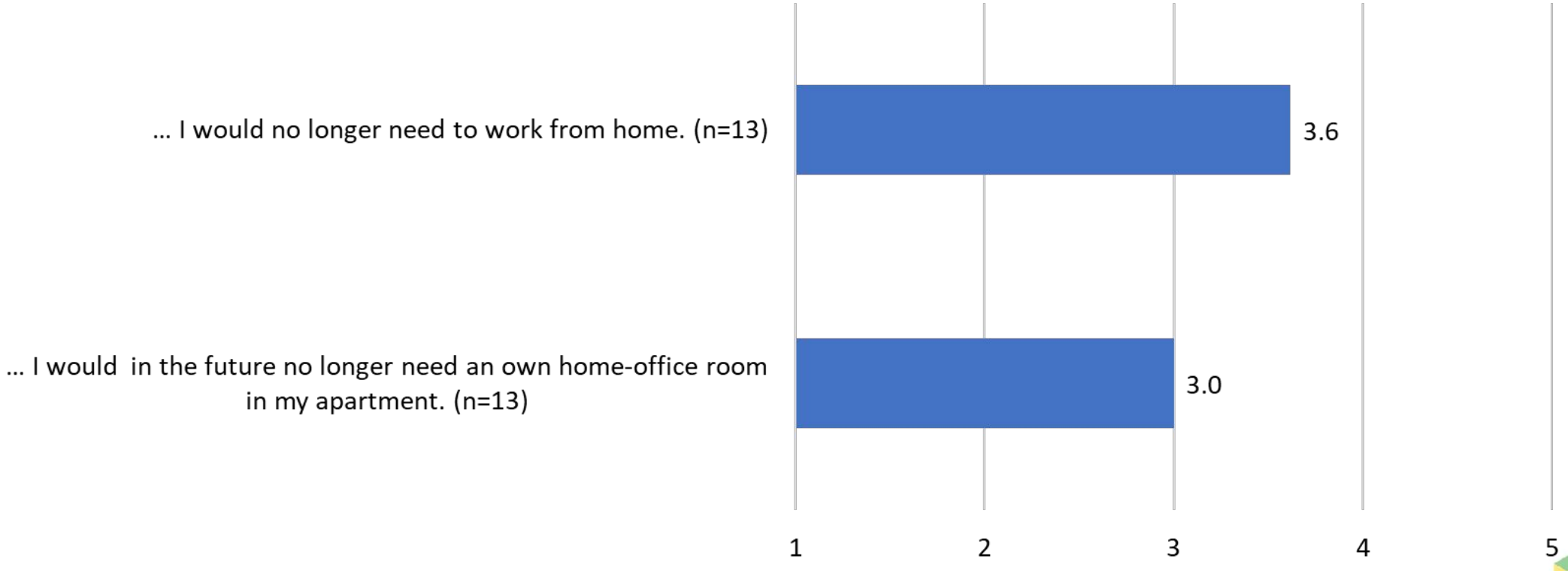
Housing space: Future need for an own home-office room

Agreement with the statement “With a residential CWS available…”.
(1 = fully disagree; 5 = fully agree)



Housing space: Future need for an own home-office room (n=13)

Rating	The CWS …	Statement(s)
Positive	… enables concentrated work outside the home.	*"It structures my working day better than working exclusively from home." (P04, translated)* *"Possibility to work in a focused and undisturbed way." (P04, translated)*
	… creates spatial separation between work and private life.	*"Knowing that a coworking spot is available eases the situation between home office and private life." (P08, translated)* *"Better separation, especially in the evening." (P13, translated)*
	… allows to have meetings outside the home.	*"Particularly positive: separate, closed rooms for meetings." (P13, translated)*
Negative	… lacks infrastructure for certain work tasks.	*"Sometimes I need a big monitor or have long calls and then I stay home." (P06)*
	… has restricted opening hours that limit flexible use.	*"The opening hours don't always match my working schedule." (P04, translated)*

Integration: Profiles

Profile	Commuting distance (one-way, mean)	Home-office / times per week		No working from home (mean)	No own home-office room (mean)	Statement
		before the intervention (mean)	after the intervention (mean)			
Mostly externalisation (n=4) •CWS replaces home-office room •Walk replaces a motorised commute •More strict work–home separation	*27.8 km*	*2.5*	*1.8*	*4.0*	*3.8*	*"It was nice to plan the things and get them done there and only then return to home. At home, I didn't feel like even starting the task."* (P09)
Conditional use (n=7) •CWS used for tasks compatible with available infrastructure •Home-office room used for other work	*17.3 km*	*3.4*	*3.3*	*3.6*	*2.7*	*"My home office is better set up and quieter, making it easier to concentrate on work." (P07, translated)*
Symbolic availability (n=2) •CWS not used regularly •The added value lies in knowing that there is an alternative for special occasions	*30.0 km*	*1.0*	*1.0*	*3.0*	*2.5*	*"Knowing that a coworking spot is available eases the situation between home office and private life." (P08, translated)*

Conclusions

A LL intervention of this kind provides an opportunity to (qualitatively) explore the mechanisms through which residential CWS may influence mobility behaviour and perceptions of individual housing space requirements.

Key findings in light of the RQs:

1. **User experience:** Residential CWS are perceived as adequate and highly valued third places for work. But: actual utilisation during the trial period remained moderate, with an average usage frequency of 1.5 visits per month.
2. **Mobility:** Mobility-related **CO_2 emissions** across all trip purposes were **lower** on **CWS days** than on non-CWS days, indicating potential net reductions in transport-related emissions associated with CWS use.
3. **Perception of housing space demand:** Participants expressed no clear preference regarding the reduction of a dedicated home office room (less m^2) when considering a future residential relocation in scenarios where residential CWS are available, suggesting that access to CWS may not influence decision making processes for housing space (i.e. choices for # rooms).

Recommendations

Future Research & Policy Debates:

- Why low use when highly appreciated? How and why does the home-office room hinder the rise of CWS?
- How can the provision of residential CWS in housing areas be used to promote smaller size dwellings?

Literature

- Balthasar, N., Z'Rotz, J., Ohnmacht, T. et al. (2023). Die «Suurstoffi» als Reallabor. Ergebnisbericht. Hochschule Luzern – Wirtschaft, Luzern.
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- Voytenko, Y., McCormick, K., Evans, J., & Schliwa, G. (2016). Urban living labs for sustainability and low carbon cities in Europe: Towards a research agenda. *Journal of Cleaner Production*, *123*, 45–54. https://doi.org/10.1016/j.jclepro.2015.08.053
- Z'Rotz, J., Wanzenried, G., & Amstutz, S. (2026). Exploring the relationship between telework and housing space: Empirical evidence for Switzerland. *Urban Transitions*, *6*, 100042. https://doi.org/10.1016/j.ubtr.2026.100042

Coffee break
10:40 - 11:10

Reducing demand, expanding Possibilities: A human-centered digital twin of the Swiss residential building stock

Til Sommer, Fatih Topak, Kristina Orehounig

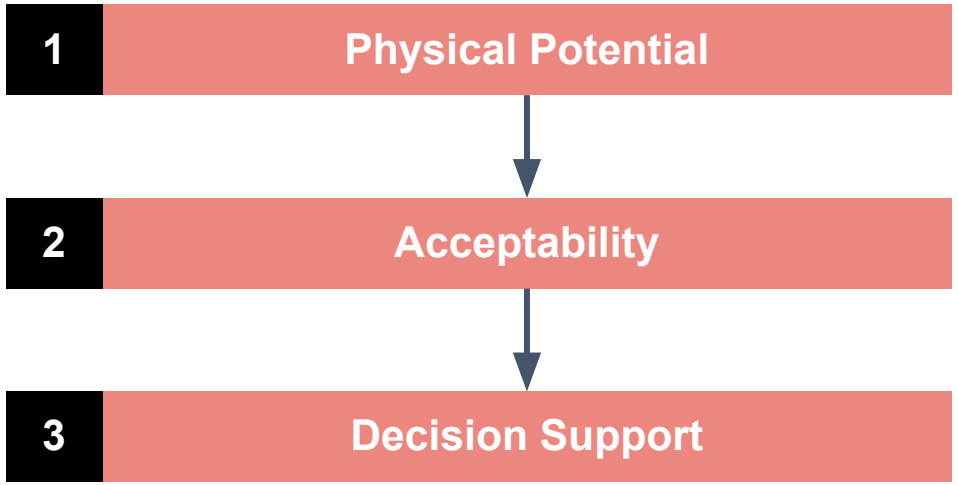
11:10 - 11:30

Background

- Sufficiency potentials in residential building stocks are increasingly well-studied.
- Yet climate sensitivity and household acceptability have rarely been addressed together.

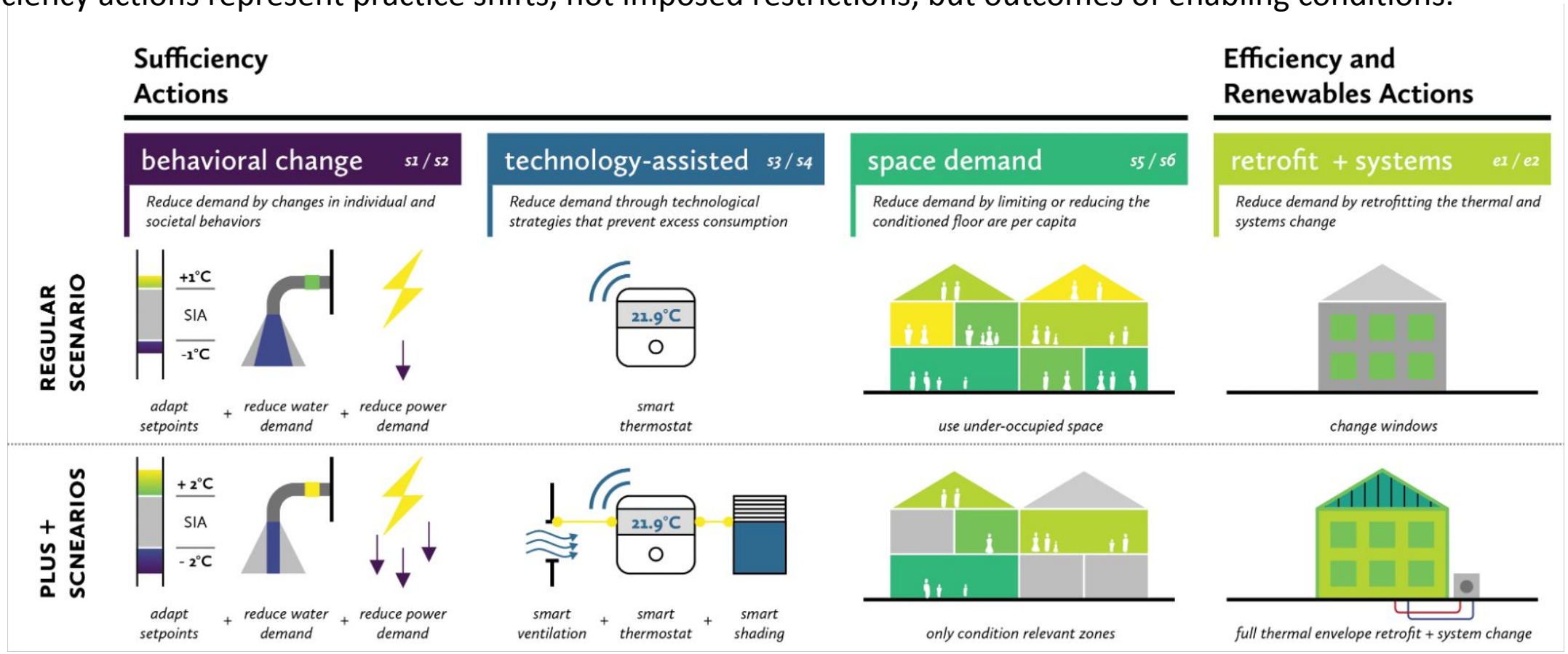
Two open questions motivate this work

1. **How robust is sufficiency compared to retrofit under future climate conditions?**
2. **How much of the theoretical potential can realistically be achieved given household diversity?**



Set of actions

Sufficiency actions represent practice shifts, not imposed restrictions, but outcomes of enabling conditions.



own subset, visualization and interpretation based on sugguestions in:
Zell-Ziegler, C., Best, B., Thema, J., Wiese, F., Vogel, B., Cordroch, L., Lage, J., Schöpf, D. (2026). European Sufficiency Policy Database [Data set]. Energy Sufficiency Research Group. https://energysufficiency.de/policy-database/

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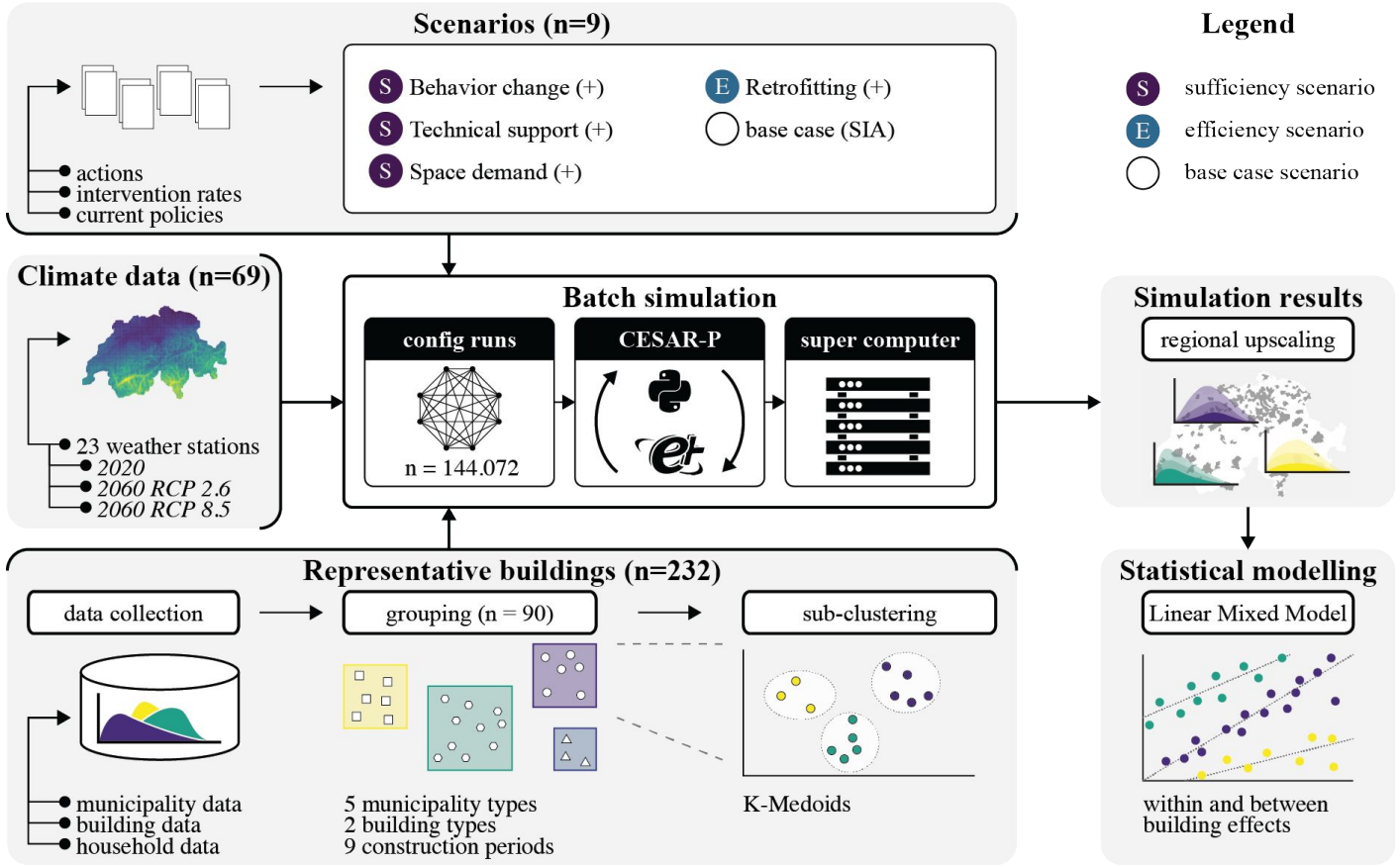
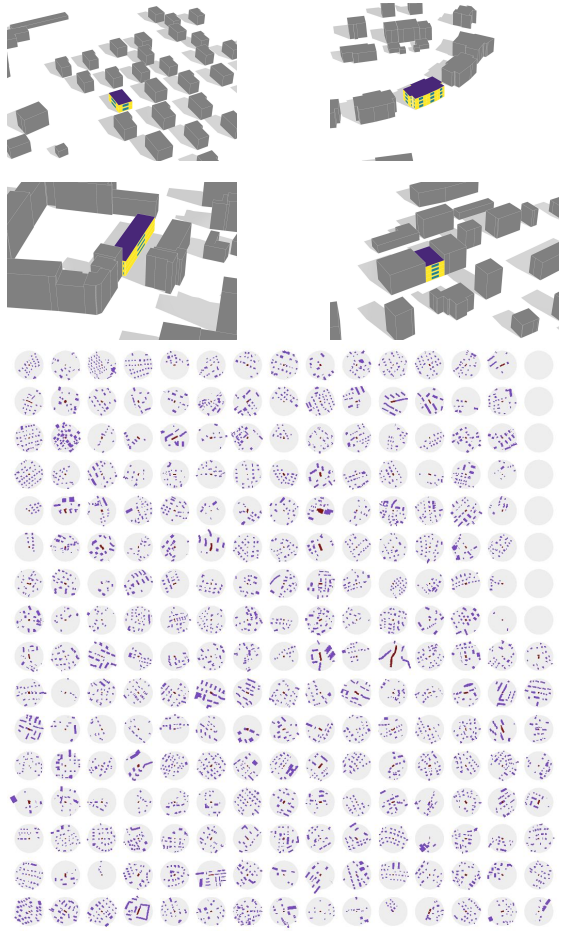
1 Method. *Energy Demand Simulation*

Sommer, T., Redl, B., Yazdanie M. & Orehounig, K. (2026)
Climate and Regional Sensitivity of Sufficiency Actions in Swiss Buildings
to be submitted to "Energy and Buildings"





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1 Results. *Energy Demand Simulation*

Sommer, T., Redl, B., Yazdanie M. & Orehounig, K. (2026)
Climate and Regional Sensitivity of Sufficiency Actions in Swiss Buildings
to be submitted to "Energy and Buildings"

Uniformity

Sufficiency effects are uniform across building types and construction periods. Retrofit effectiveness depends on baseline energy demand.

Post-1980 buildings

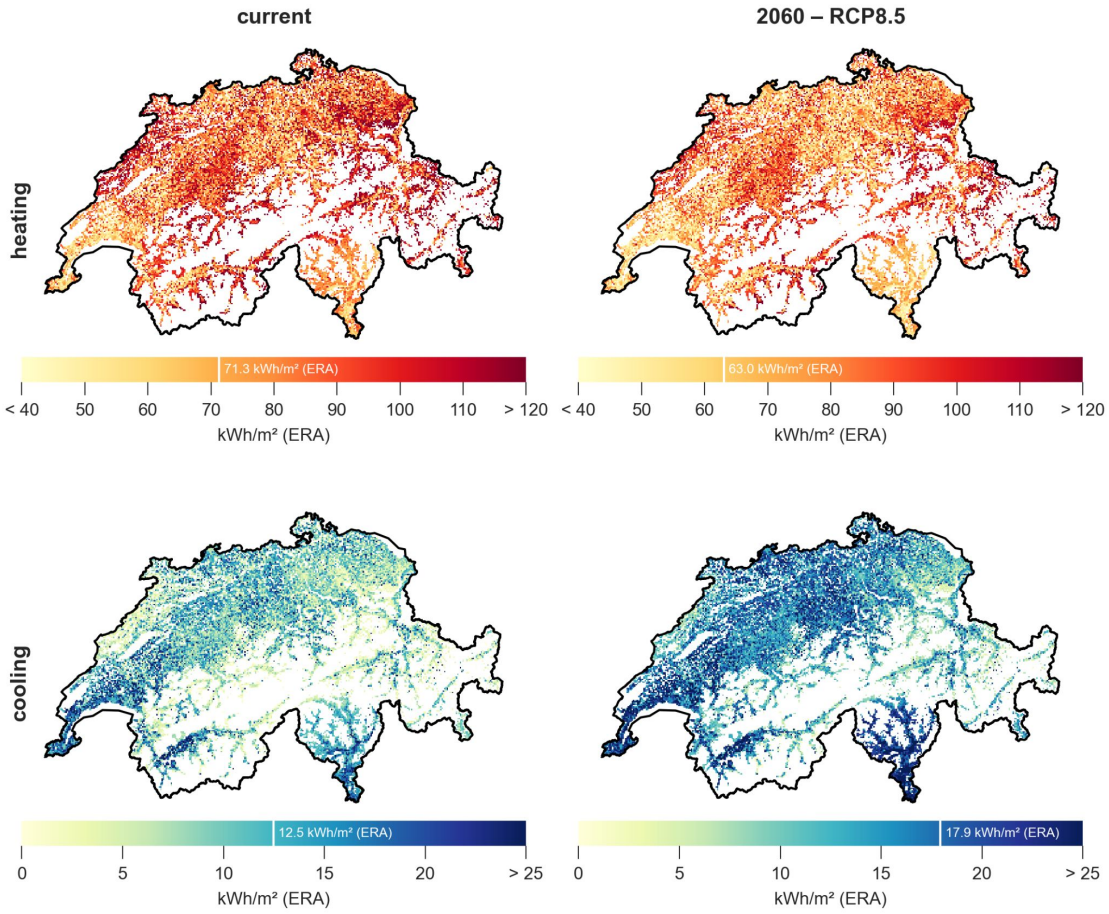
Technology-assisted sufficiency actions approach deep retrofit effectiveness for ~43% of Swiss residential floor area.

Cooling in new buildings

Retrofit has minimal cooling impact while sufficiency strategies can offset a large share of mechanical cooling requirements.

Climate advantage

Under RCP8.5, all sufficiency scenarios increase their relative effectiveness, while deep retrofit decreases slightly.



Simulation results for annual heating and cooling demand [kWh/m2] in current and future climate (2060 - RCP8.5) conditions aggregated to 1x1km grid cells.

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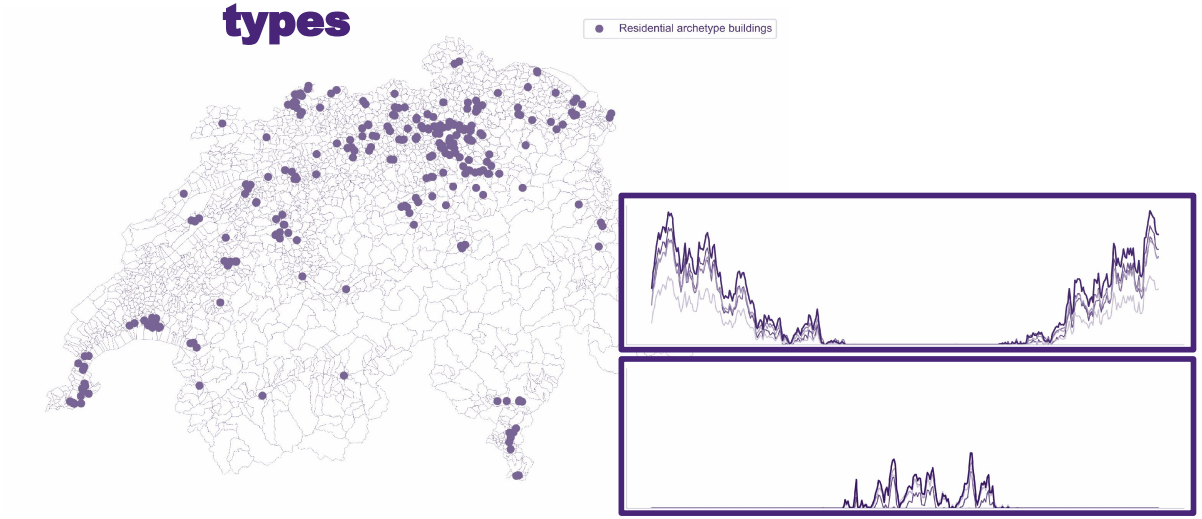
2 Method. *Acceptance Mapping*

Topak, F., Sommer, T., Schwalm, D., Redl, B., Nembrini, J., Sütterlin, B., & Orehounig, K. (2026). Mind the acceptability gap: Integrating lifestyle diversity into energy sufficiency analysis of the Swiss residential building stock. Energy Research & Social Science, 136, 104751. https://doi.org/10.1016/j.erss.2026.104751

232

Building types



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6

Lifestyle types

- Eco-Friendly Nikki
- Modest Billie
- Focused Francis
- Budget-Conscious Kim
- Techie Tony
- Comfort-Oriented Gaby

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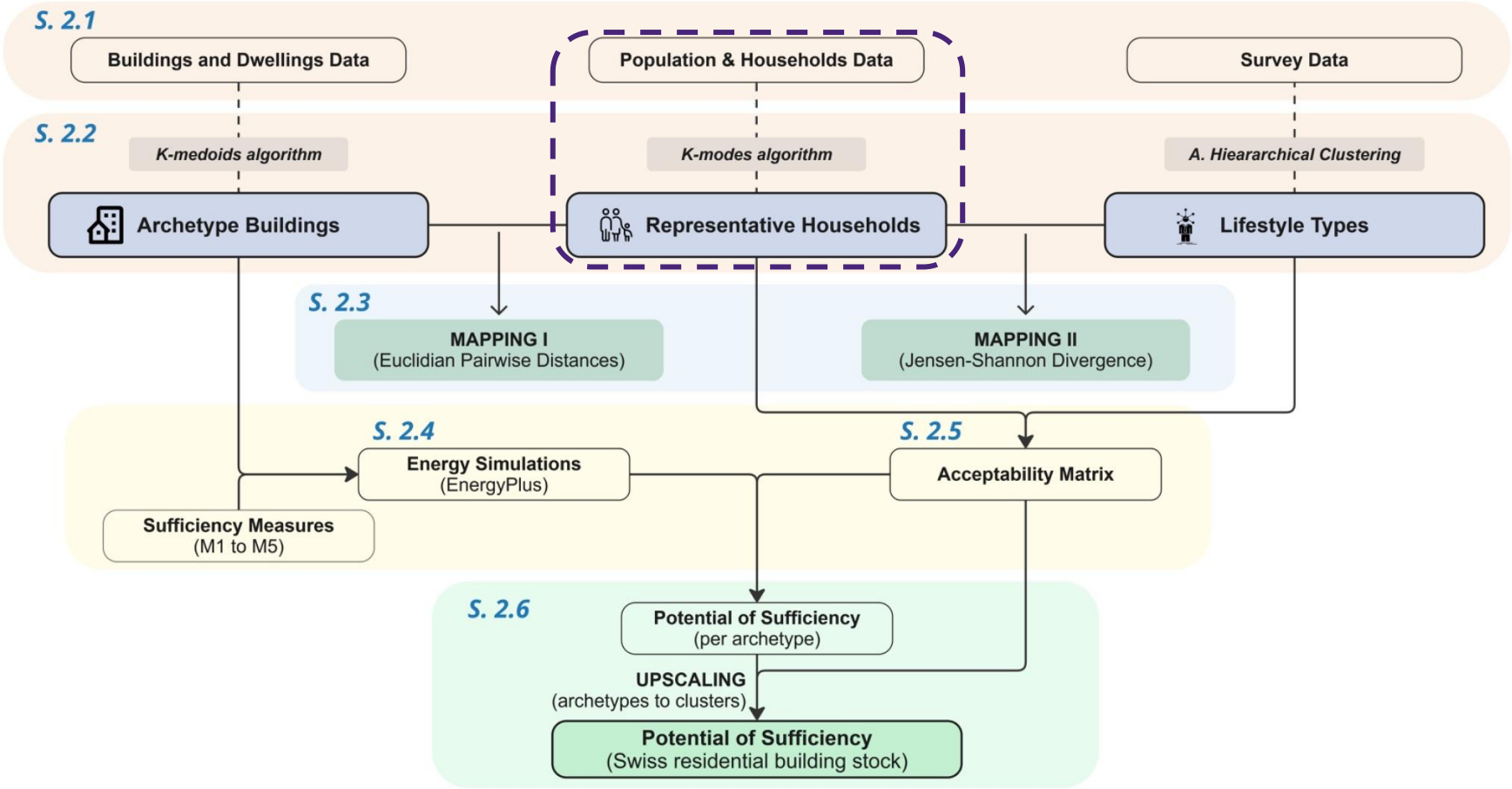
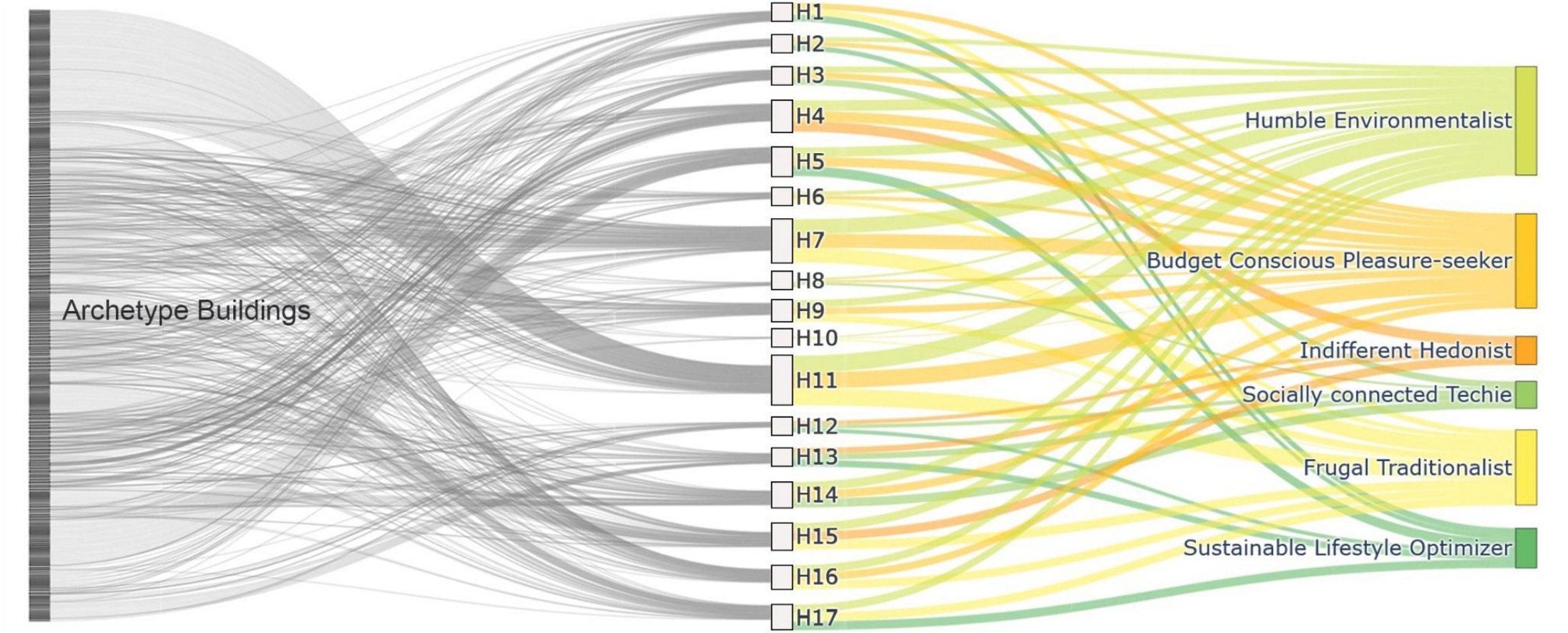
connecting piece



2 Results. *Acceptance Mapping*

Topak, F., Sommer, T., Schwalm, D., Redl, B., Nembrini, J., Sütterlin, B., & Orehounig, K. (2026). Mind the acceptability gap: Integrating lifestyle diversity into energy sufficiency analysis of the Swiss residential building stock. Energy Research & Social Science, 136, 104751. https://doi.org/10.1016/j.erss.2026.104751



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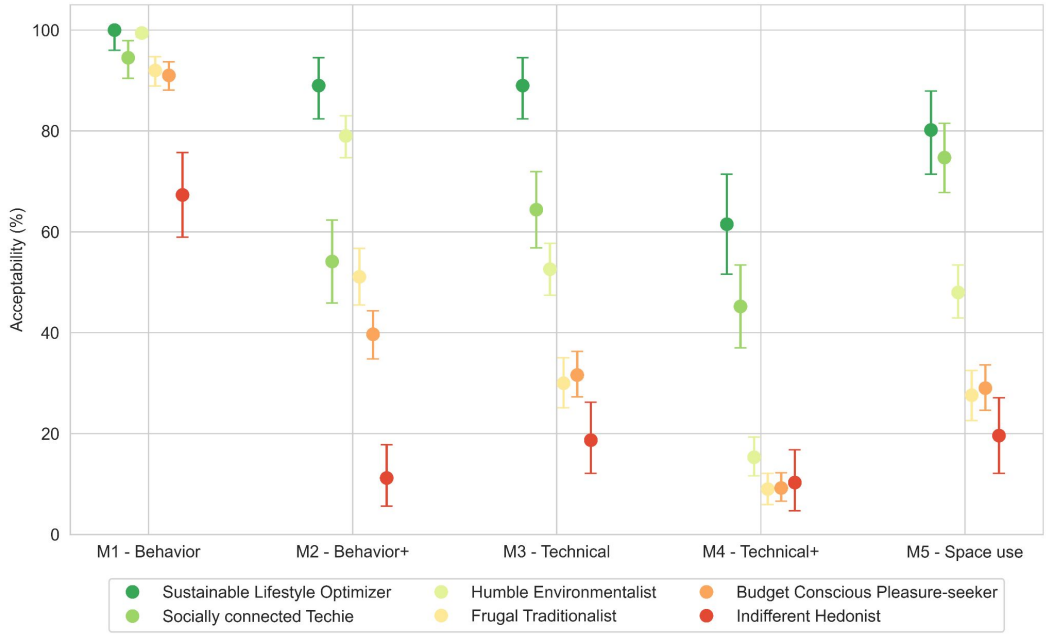
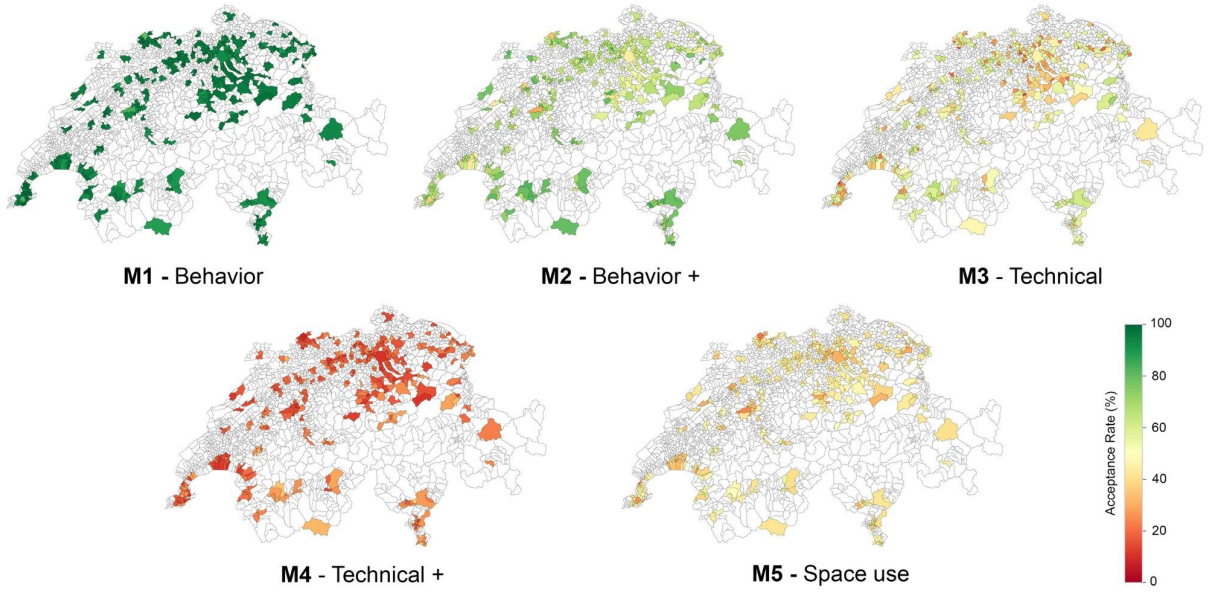


Acceptance of actions by lifestyle type



Spatial distribution of acceptance of actions aggregated on municipal level

Acceptance rate

$$R_m^h = \frac{\Delta E_m^h}{E^\circ} x100 = \frac{\sum_{i=1}^{N} A_{i,m}(S_{i,m} - B_i)}{\sum_{i=1}^{N} B_i} x100$$

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Full-scale adaptation

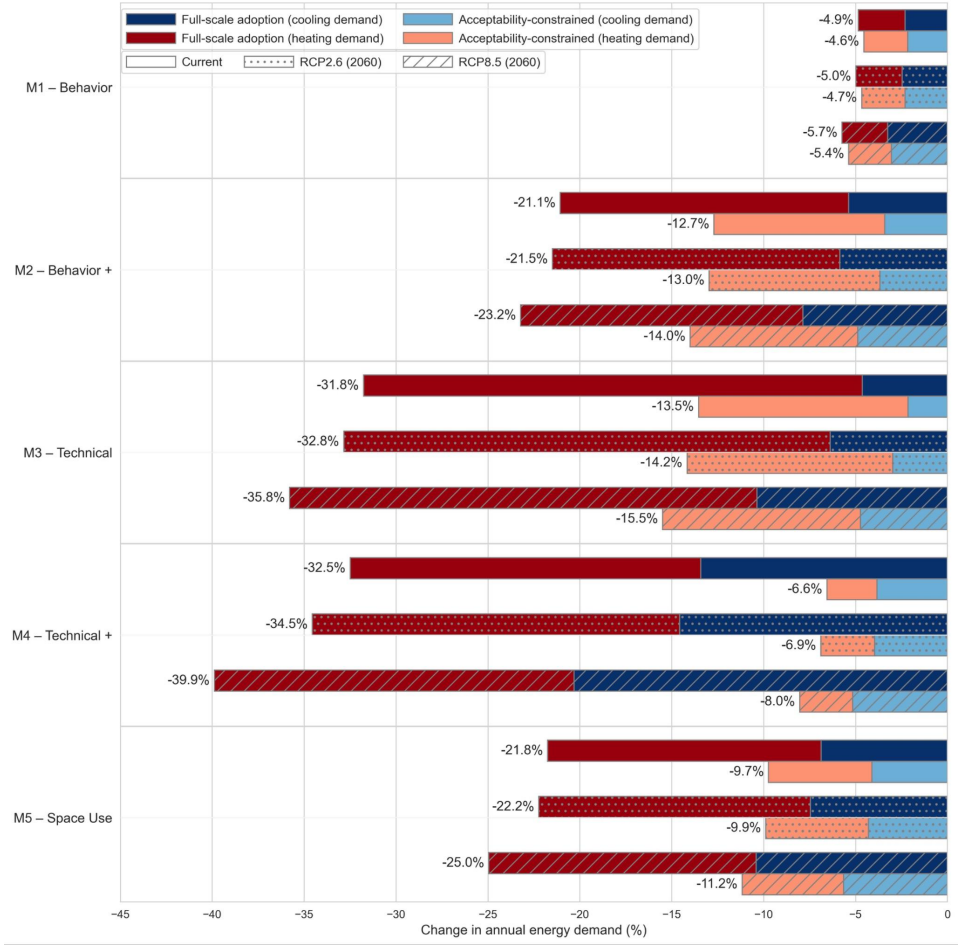
- Technology-assisted scenarios show highest potential
  ~31.8 – 32.5% savings

Acceptance constrained

- Behavioral change scenarios most accepted
  ~4.6 – 14.0% savings
- Technology-assisted+ scenario least accepted
  ~6.6% savings

The acceptability gap

- Realizable savings under acceptability constraints are below 50% of the theoretical maximum for most sufficiency actions.



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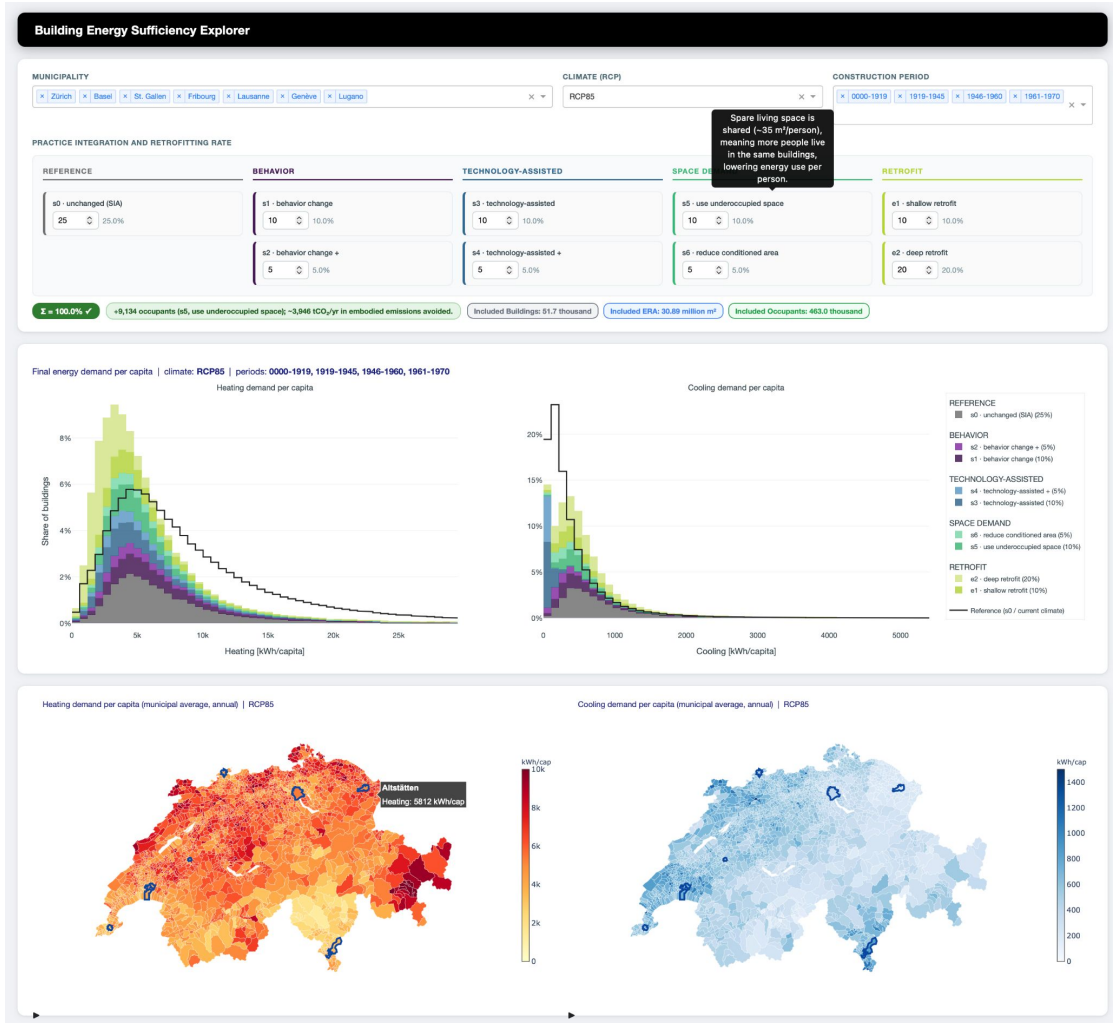
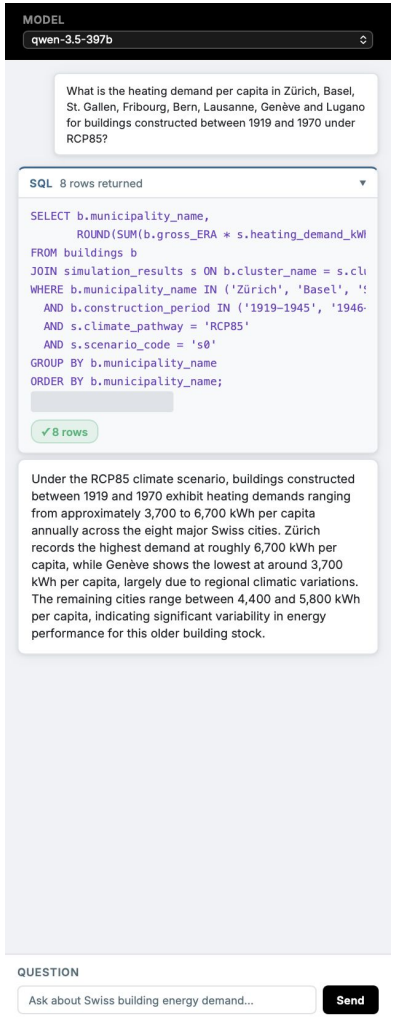
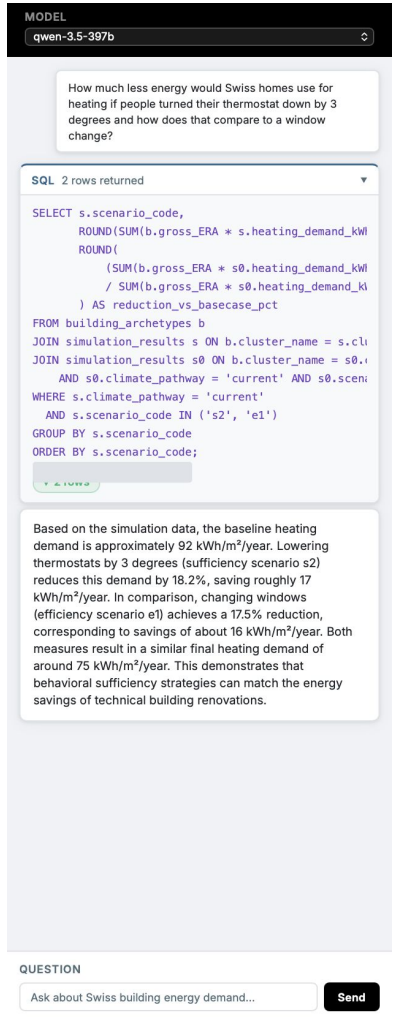
3 Tool. *Decision Support System*







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Conclusion and Limitations

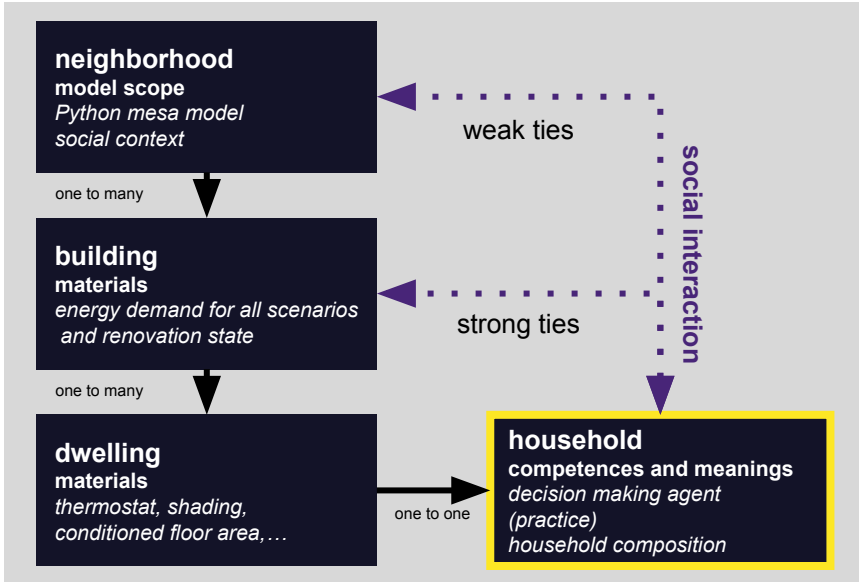
- Sufficiency actions reduce demand significantly and gain effectiveness under future warming, matching deep retrofit for post-1980 buildings, with almost no embodied emissions
- Uniform adoption assumptions systematically overestimate impact. Realizable savings fall below 50% of theoretical maximum.
- Effective sufficiency policy requires tailored approaches by lifestyle segment, building type and region

- Retrofit scenarios cover building envelope only. Full life-cycle carbon and cost comparisons are outside of the scope.

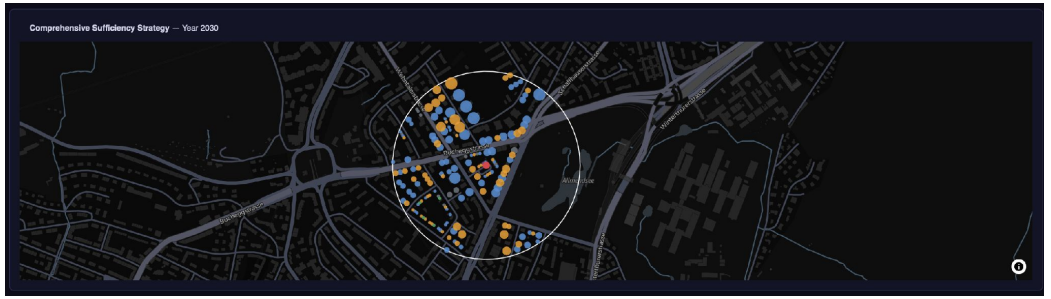
Outlook. *Practice Diffusion*

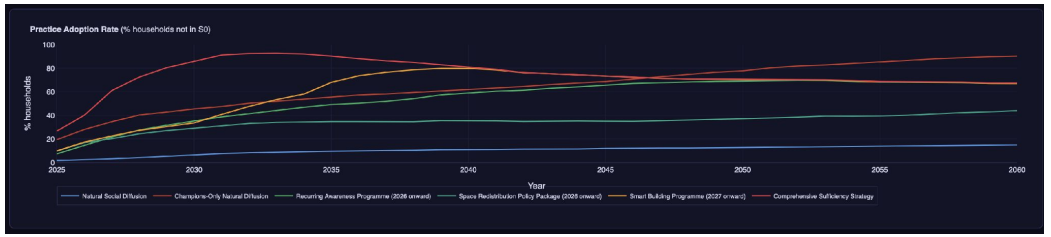
Under what social and policy conditions do sufficient practices spread across neighborhoods and when do tipping points emerge?

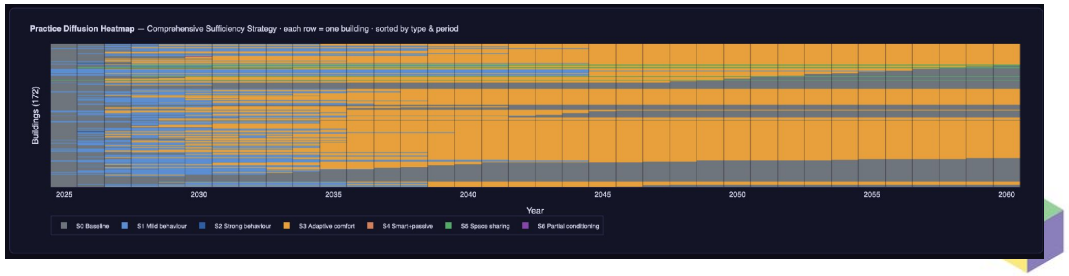
- Social Practice Theory implemented as an Agent-Based Model
- Household observes its neighbors and shifts meanings toward the neighborhood average
- Scenarios combine social influence parameters and policy instruments to represent policy narratives



first experiments







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A Switzerland-wide sufficiency pathway for renovation, housing accessibility, 8-min neighborhoods, de-sprawl, and mobility decarbonization

Esha Sharma, Andrew Sonta, Sascha Nick

11:30 - 11:50

Why housing, mobility and access must be solved together

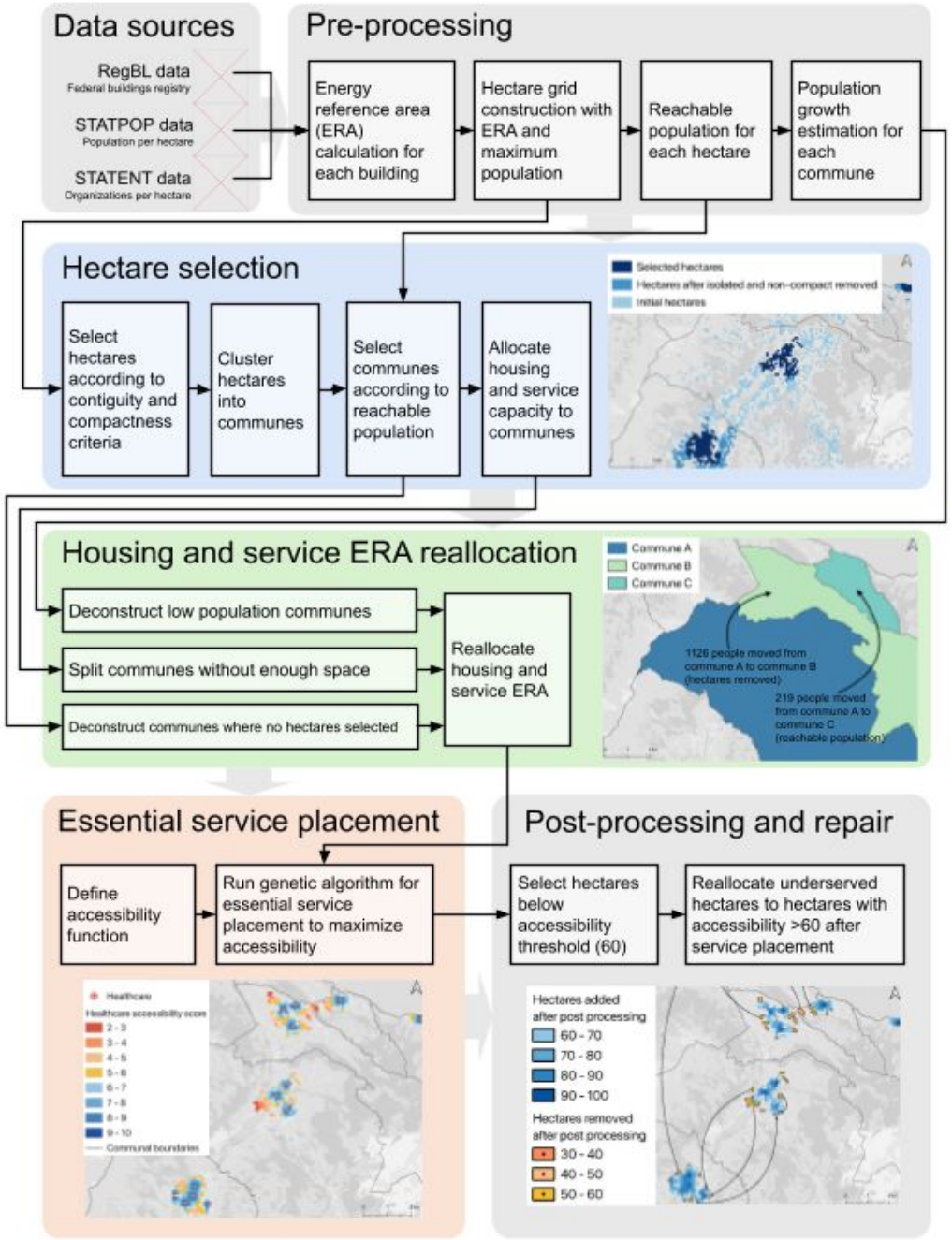
Switzerland's built habitat suffers from three interrelated problems: high space and energy demand, sprawl and car-dependency, and unequal access to housing and everyday services.

Treating housing, transport, services and land use separately reinforces sprawl and locks in costly infrastructure.

Our paper examines how the existing built environment can be reorganized into inclusive, compact, service-rich neighbourhoods without new construction.

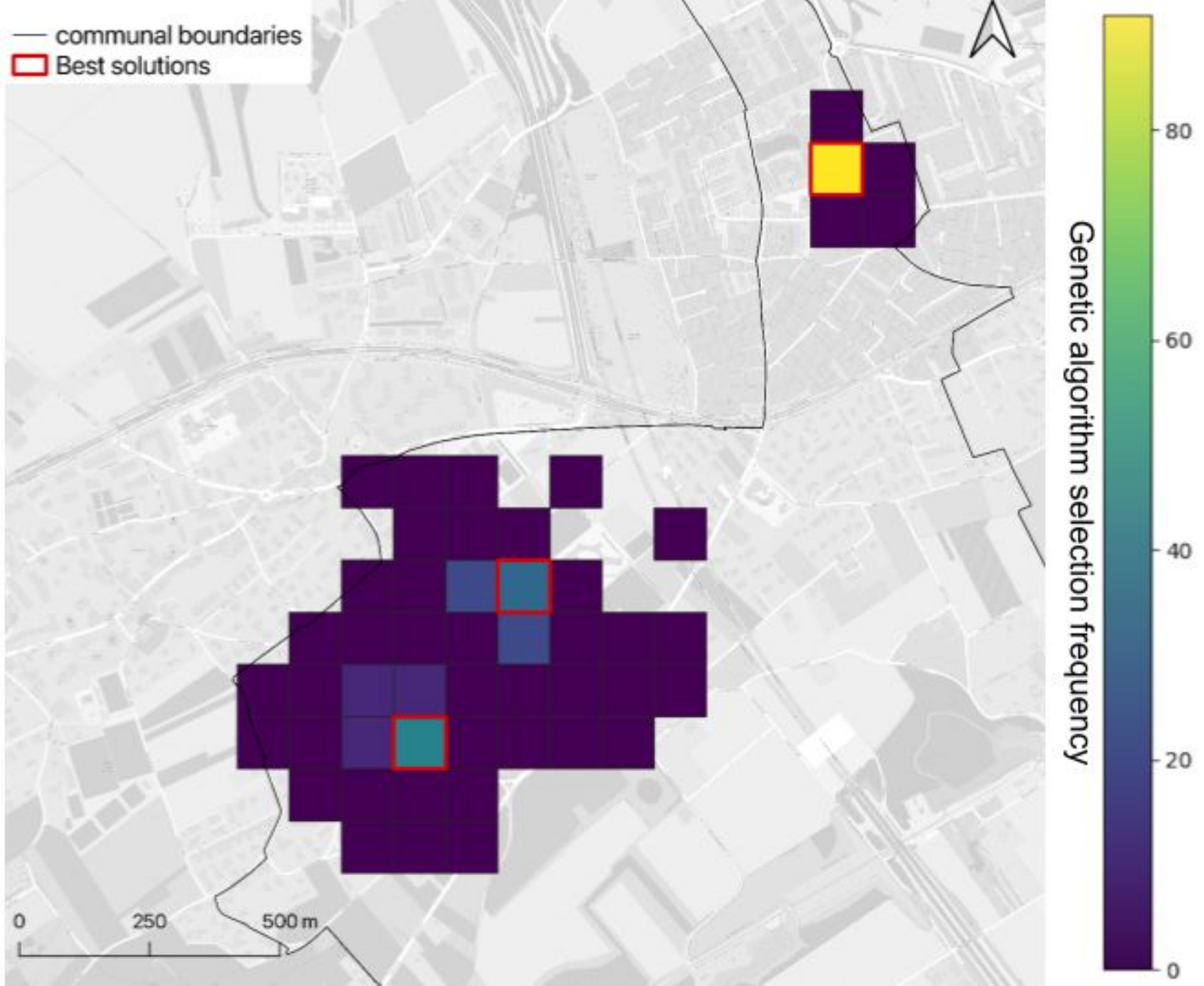
The goal is to replace today's profit-oriented development which created these problems with democratic planning for wellbeing, sufficiency, inclusion, and ecological recovery.

Conceptual workflow of country-wide habitat optimization



Genetic algorithm validation

Confignon, GE
100 runs



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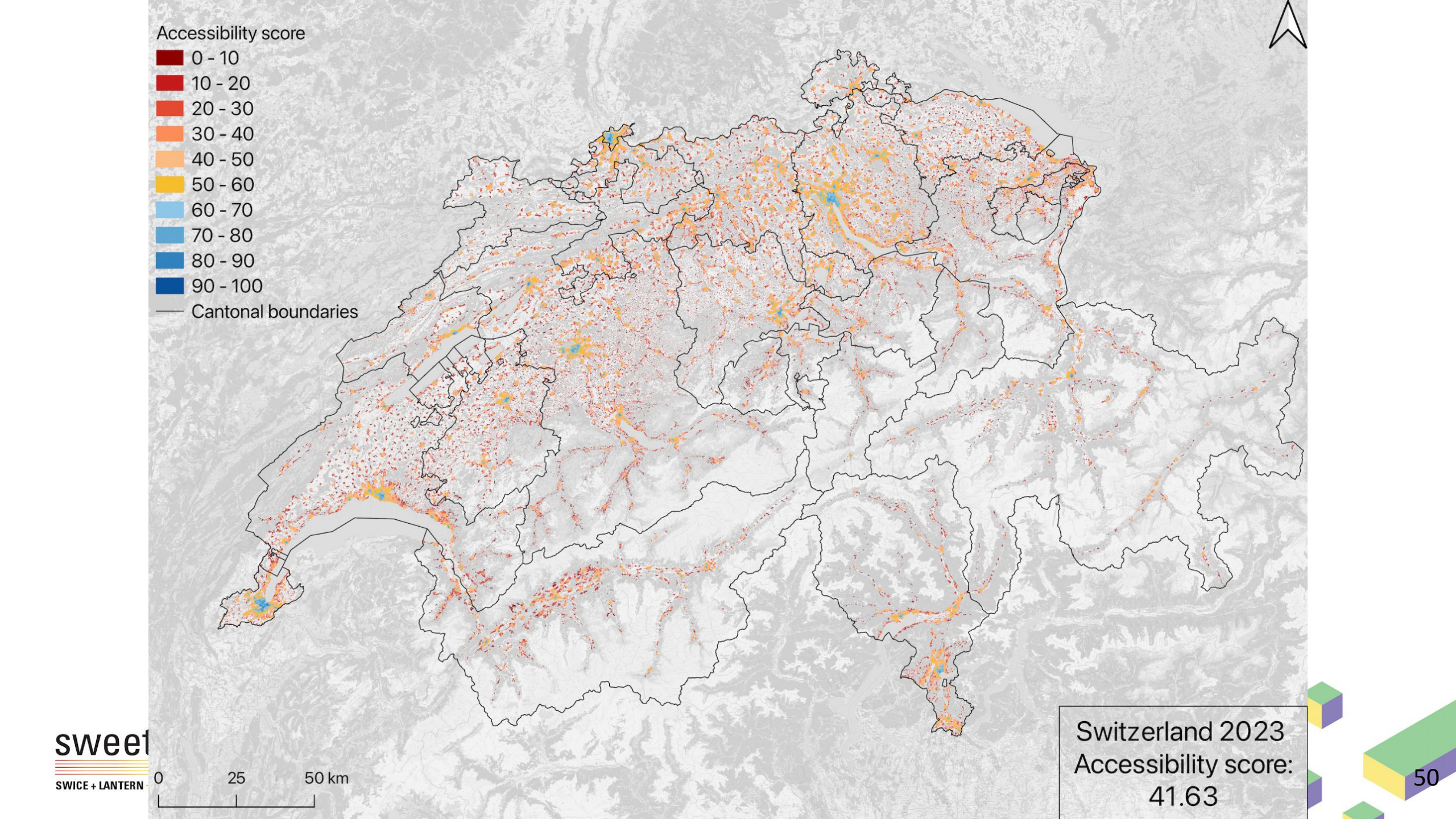
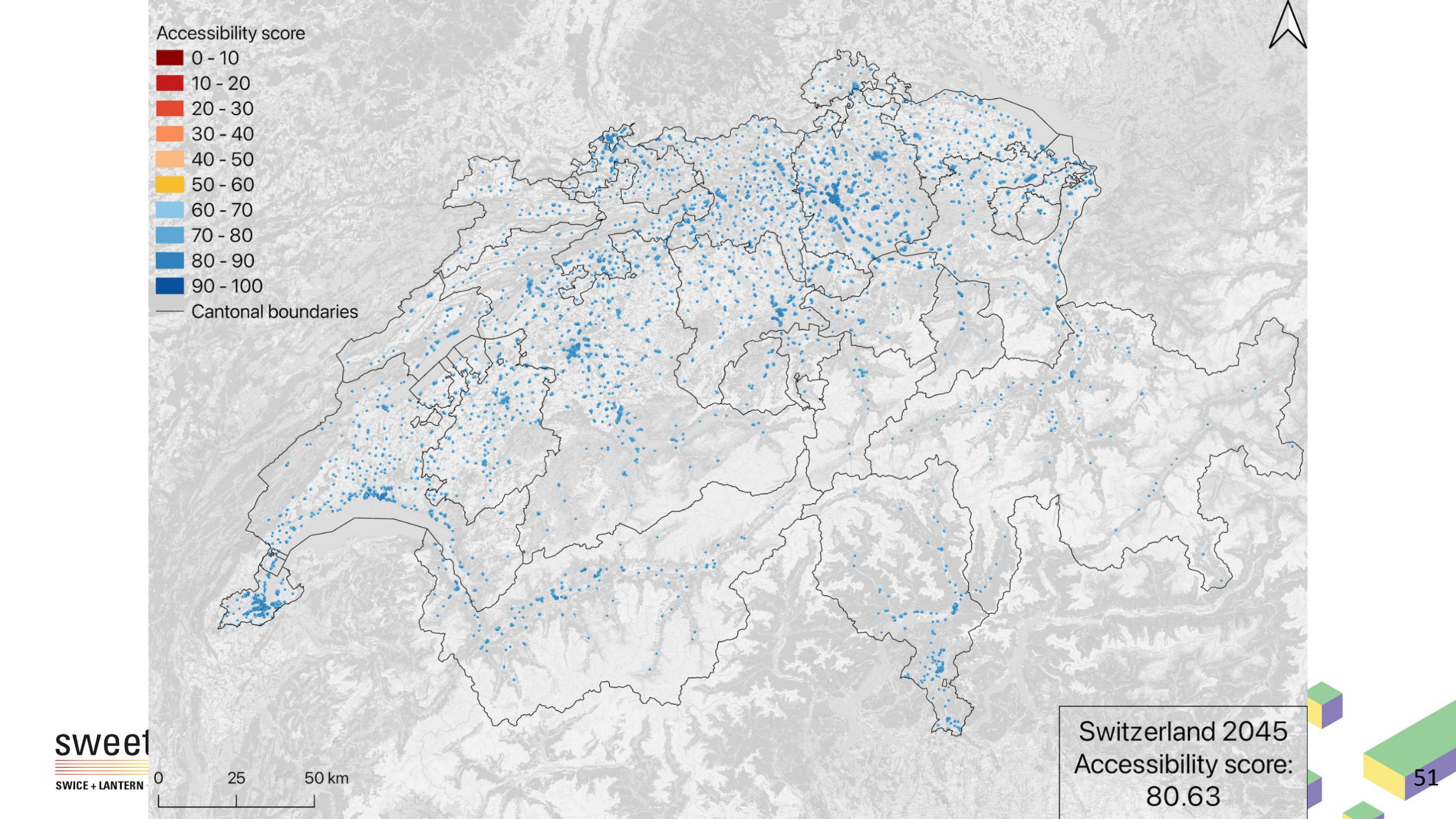

Accessibility score
0 - 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
90 - 100
Cantonal boundaries
0
25
50 km
Switzerland 2023
Accessibility score:
41.63


Accessibility score
0 - 10
10 - 20
20 - 30
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40 - 50
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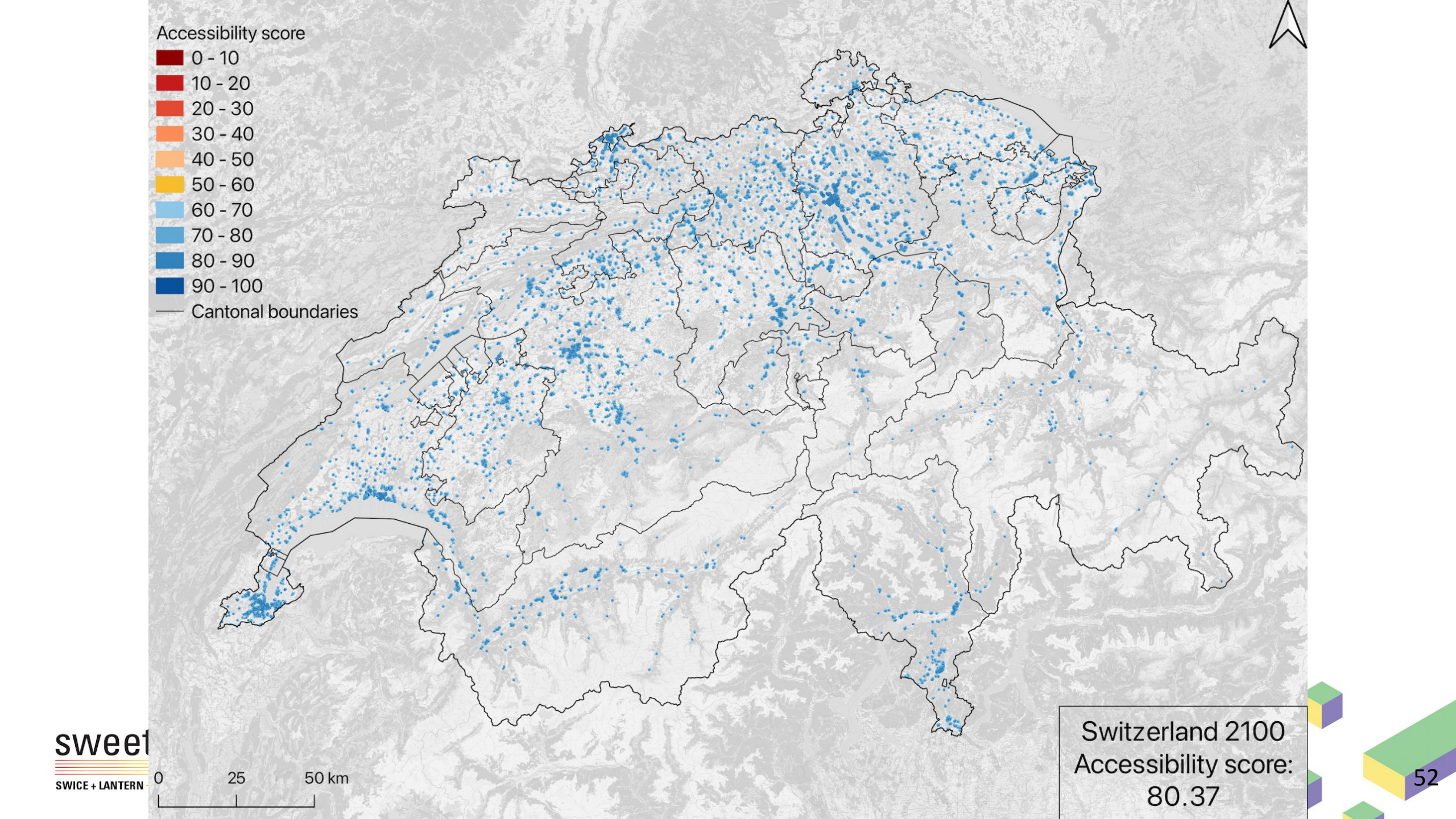
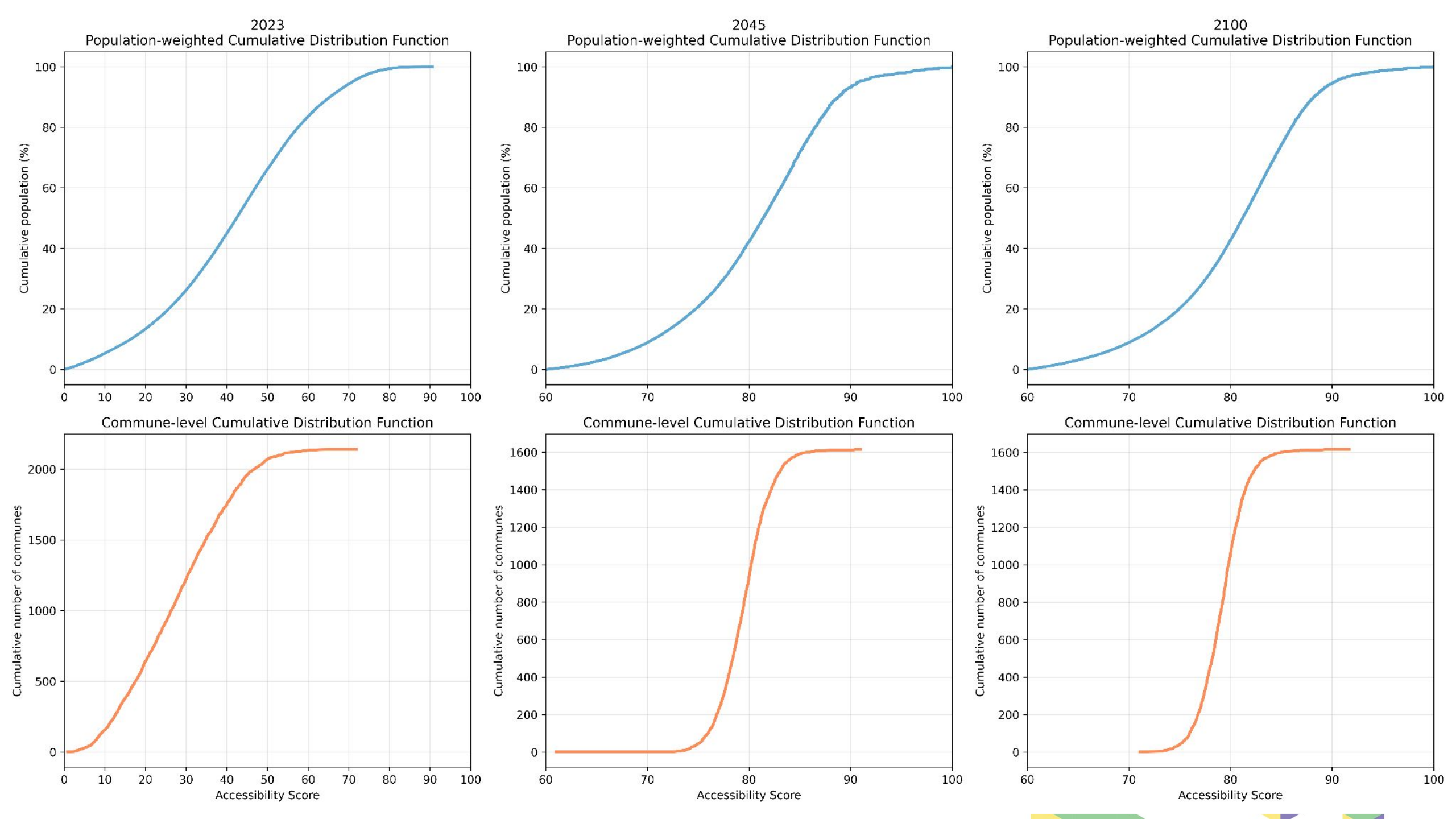
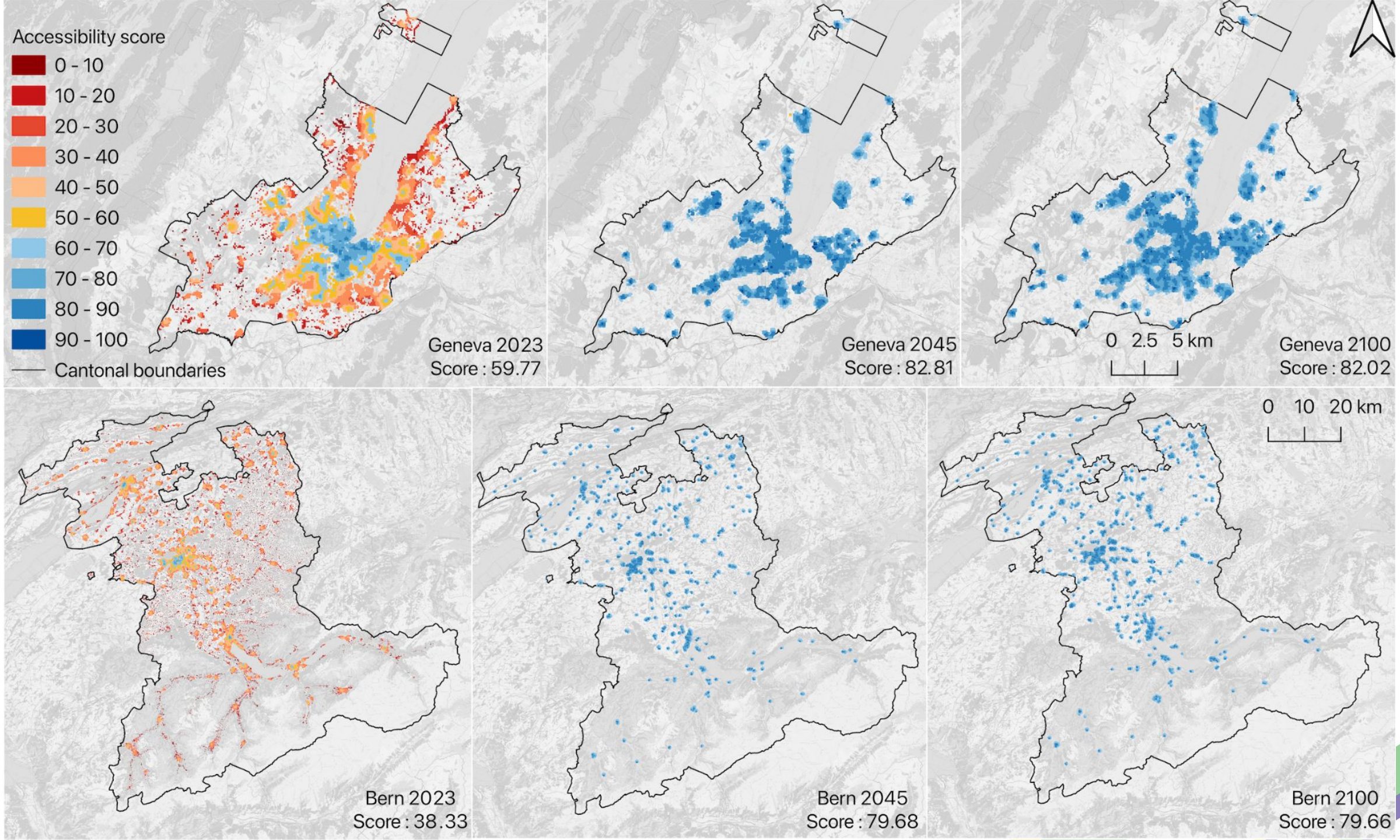
90 - 100
Cantonal boundaries
0
25
50 km
Switzerland 2045
Accessibility score:
80.63


Accessibility score
0 - 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
90 - 100
Cantonal boundaries
0
25
50 km
Switzerland 2100
Accessibility score:
80.37


2023
Population-weighted Cumulative Distribution Function
Cumulative population (%)
2045
Population-weighted Cumulative Distribution Function
Cumulative population (%)
2100
Population-weighted Cumulative Distribution Function
Cumulative population (%)
Commune-level Cumulative Distribution Function
Cumulative number of communes
Accessibility Score
Commune-level Cumulative Distribution Function
Cumulative number of communes
Accessibility Score
Commune-level Cumulative Distribution Function
Cumulative number of communes
Accessibility Score


Accessibility score
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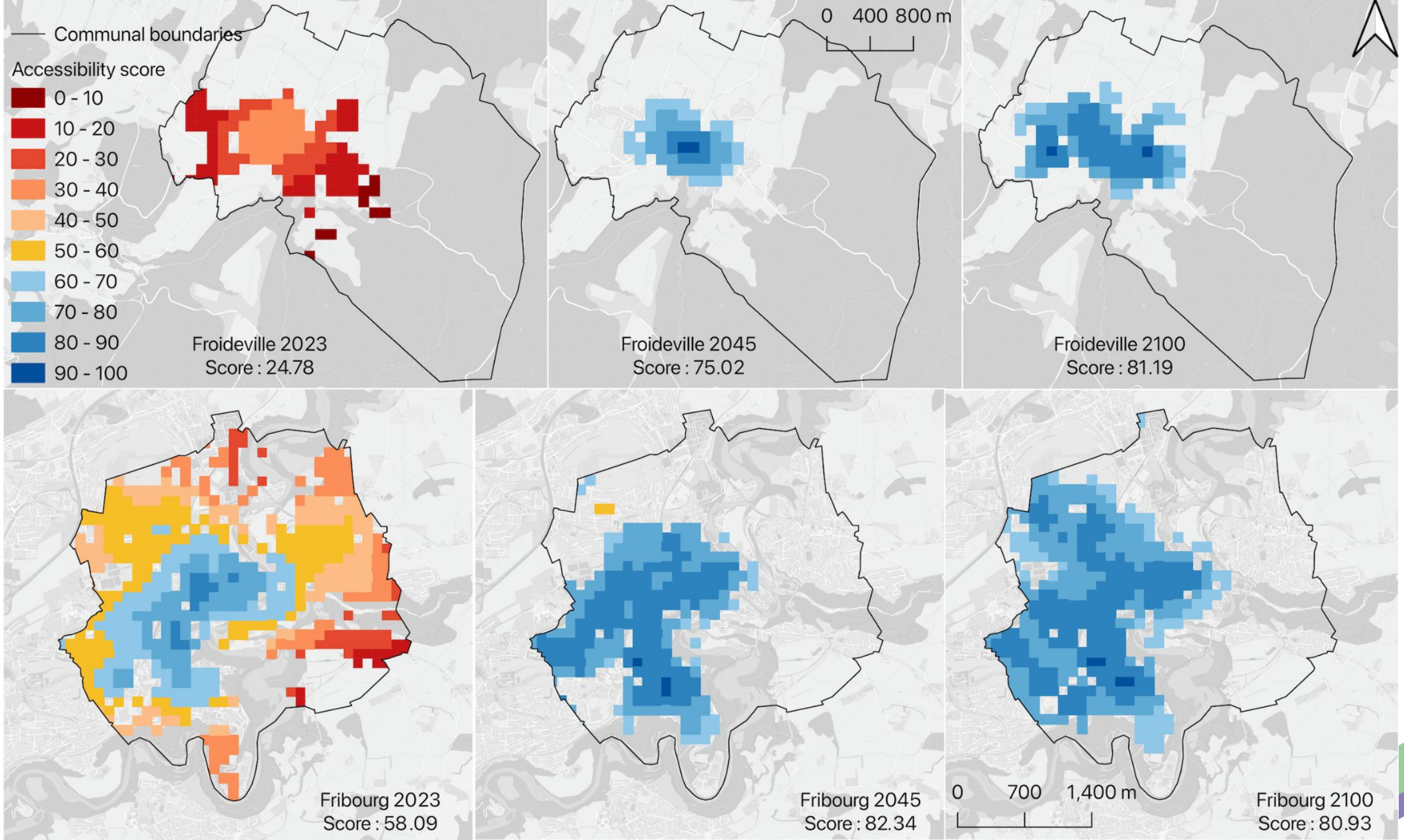
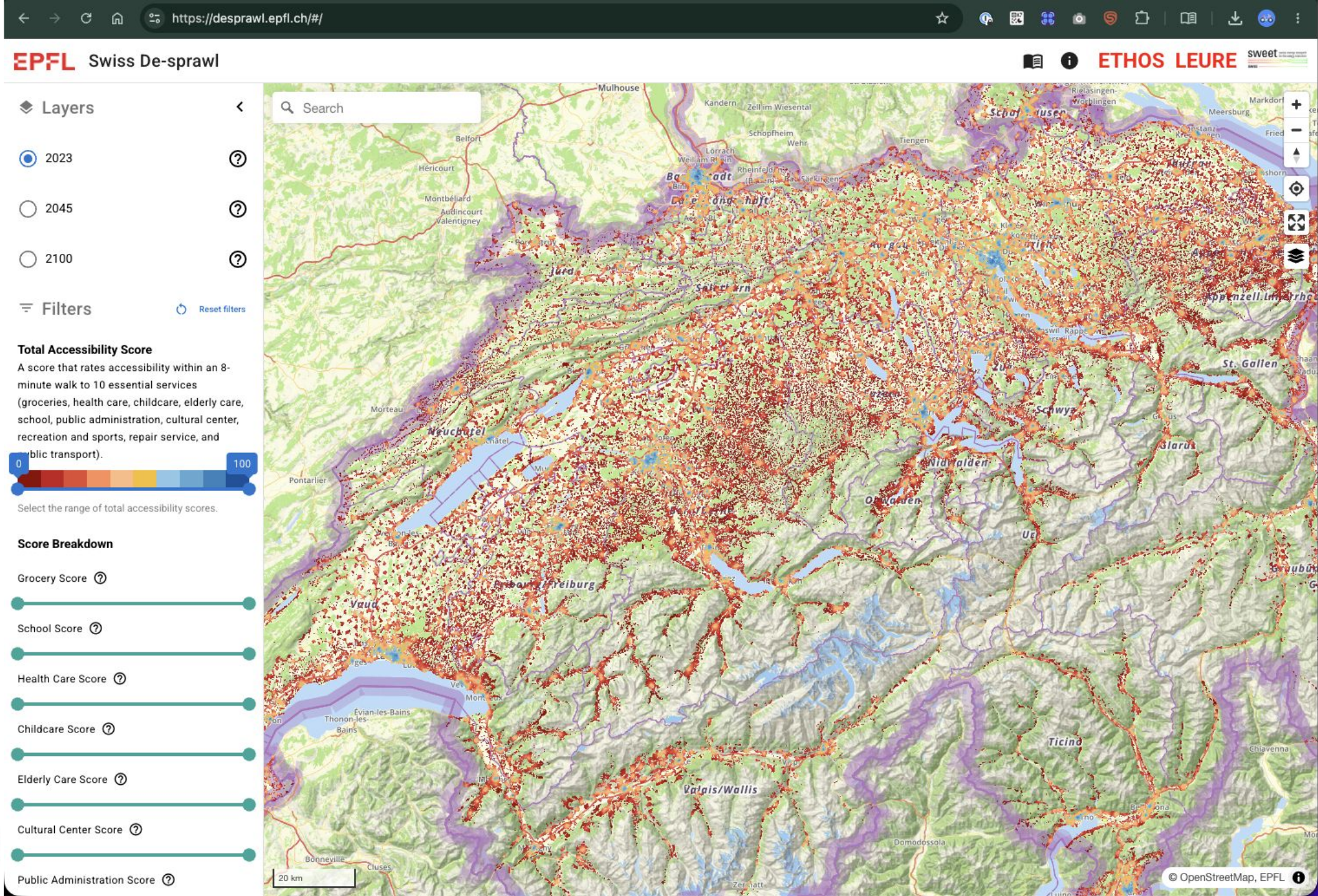
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
90 - 100
Cantonal boundaries
Geneva 2023
Score : 59.77
Geneva 2045
Score : 82.81
0 2.5 5 km
Geneva 2100
Score : 82.02
0 10 20 km
Bern 2023
Score : 38.33
Bern 2045
Score : 79.68
Bern 2100
Score : 79.66


Communal boundaries
Accessibility score
0 - 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
90 - 100
0 400 800 m
Froideville 2023
Score : 24.78
Froideville 2045
Score : 75.02
Froideville 2100
Score : 81.19
Fribourg 2023
Score : 58.09
Fribourg 2045
Score : 82.34
0 700 1,400 m
Fribourg 2100
Score : 80.93

Web app

desprawl.epfl.ch

Democracy tools



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A Switzerland-wide 8-minute habitat is feasible within the existing built environment

Optimized configurations raise accessibility from about 40 to above 80 country-wide, while keeping all neighbourhoods above a minimum threshold of 60.

Despite population growth, the approach reduces total floor space, halves per-capita space use, and strongly reduces sprawl.

The pathway is low-regret: renovate first, improve local services, restore and connect ecosystems, stop car dependency, and deconstruct sprawl when alternatives are secured.

The main challenges are democratic governance, sequencing, safeguards against exclusion, and institutional coordination. There are no technical or workforce barriers.

Between efficiency and sufficiency: Minergie P retrofit, thermal comfort and energy behaviours in a housing cooperative

Julie Vuignier, Martin K. Patel

11:50 - 12:10

La Cigale, a cooperative in Geneva

Case study and research questions

273 appartements in 2 buildings	19,000 m² SRE Minergie-P retrofit 2013-14	10 years daily energy monitoring 270 variables (SIG platform)	n=154 resident survey 56% response rate

Research questions

① Does energy efficiency (Minergie-P retrofit) lead to **sufficiency** behaviour?

② How do **temperature perceptions** impact sufficiency behaviour?

Methods: 10-year daily monitoring, n=154 resident survey, interviews with key persons

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Finding 1: The retrofit is effective but not as designed

✓ Genuine achievement

68-82%

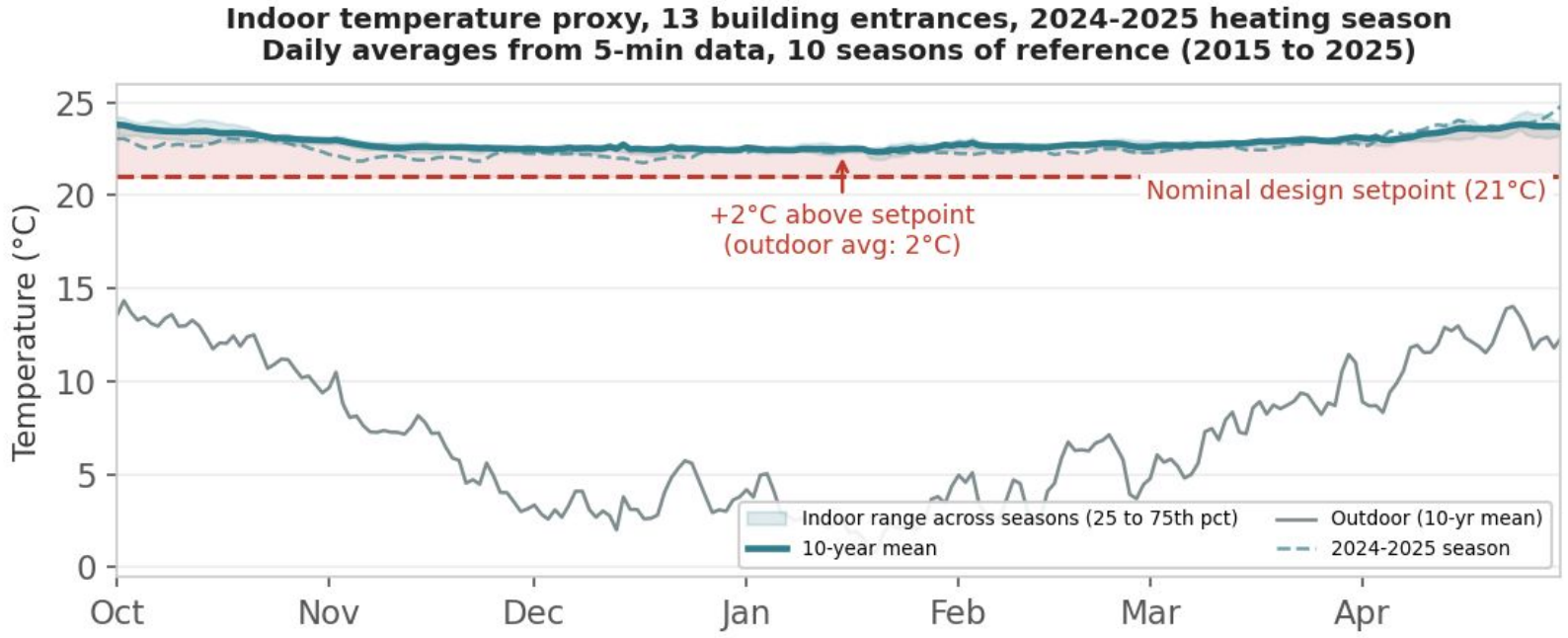
Heat demand reduction vs. Pre-retrofit baseline (116 kWh/m²/year)

Post-renovation: 21-37 kWh/m²/year

✗ Minergie-P target never reached (17.4 kWh/m²/year)

One important contributing factor:

① Indoor temperatures 2-3°C above design
22-24°C observed vs. 20-21°C design setpoint
→ approx. +14% additional heating demand



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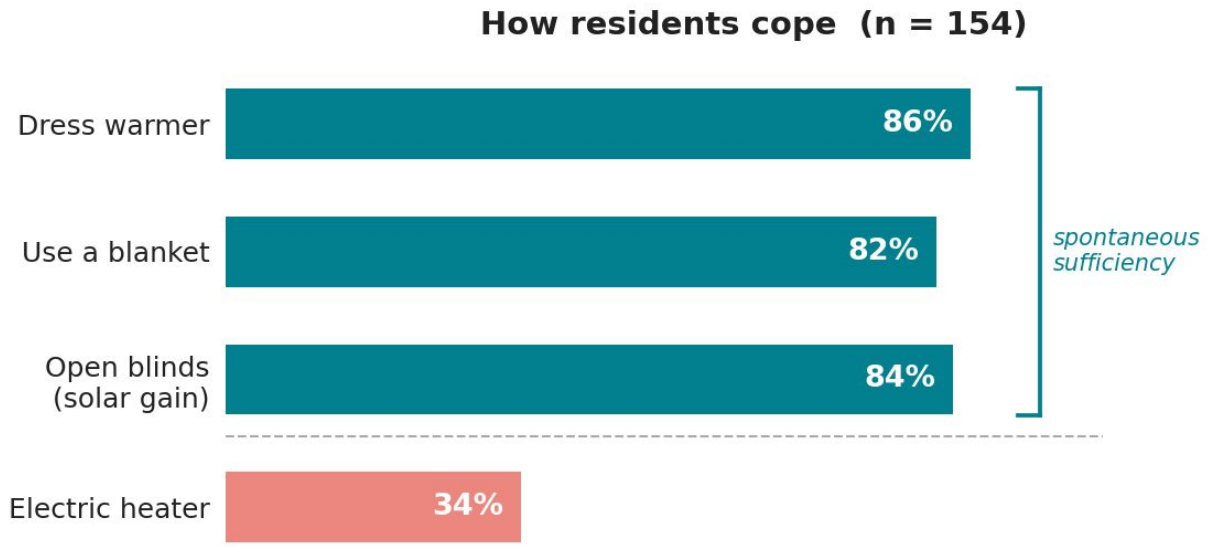
Finding 2: Buildings are warm, but residents still feel cold

22-24°C
measured indoor temperature
(ventilation sensors)

46%
report cold discomfort in winter
(30% slightly cold and 16% very cold)

51%
describe home as
"generally comfortable"



Why the paradox?

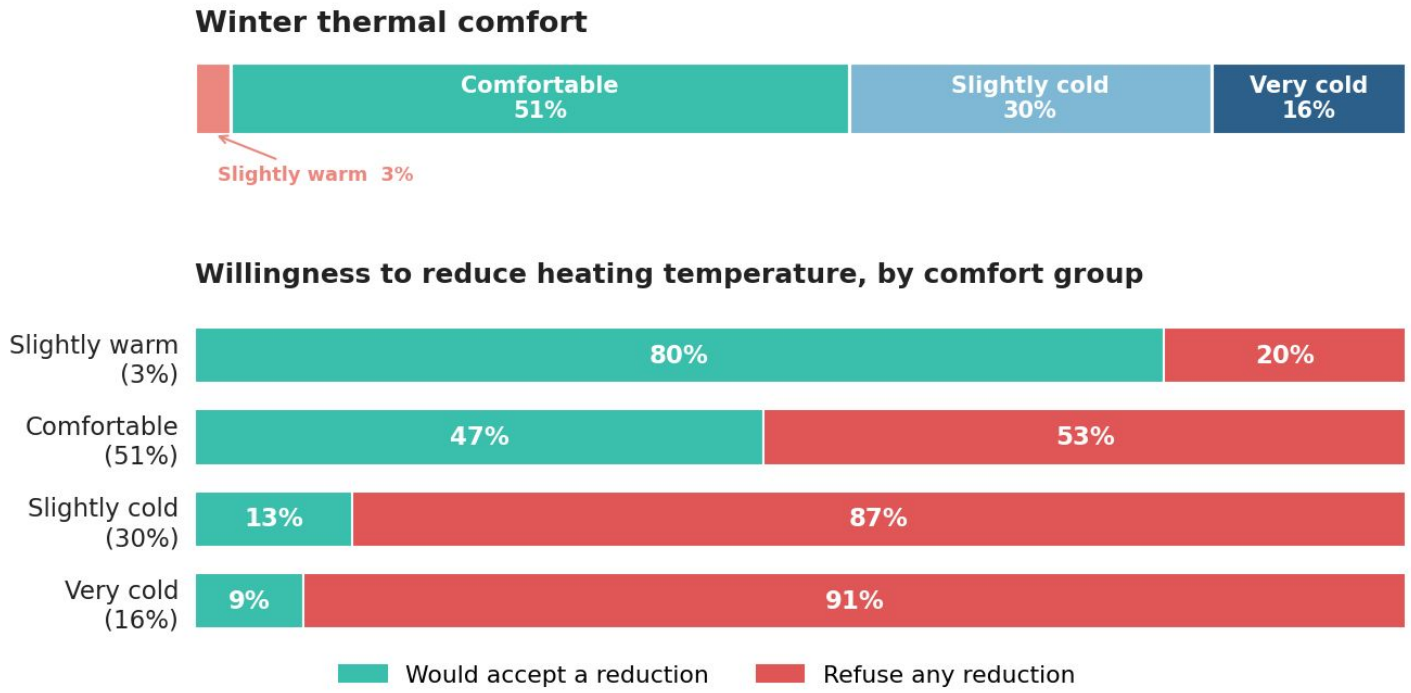
Architectural: inter-apartment heterogeneity (orientation, floor level), north exposure, etc.

Behavioural: verandas used as living space, windows open for light → cold infiltration

Individual: temperature perception varies with age and household composition

→ Residents who feel cold cannot reasonably be asked to heat less, some already work around it

Finding 3: Sufficiency is refused even by comfortable residents



68%

refuse any heating reduction

53% of "comfortable" residents still refuse

Sufficiency is accepted when it aligns with comfort improvement and resisted when it requires "sacrifice"

Comfort perceptions shape the acceptability of sufficiency

Finding 4: The cooperative model as enabler and a challenge

✓ Enabler: Collective action

CHF 20M -> cost of retrofit

Annual energy savings: ~CHF 109,000
 Covering ~34% of annual interest (CHF 323,000)

- Risk sharing across 273 households
- Retrofit was inevitable and members unanimously chose the most ambitious option A collective commitment beyond economic rationality: invest more now for long-term shared benefit

✗ Weakening economic incentive for individual efficiency

- No link between individual behaviour and individual cost.
  20°C or 24°C → similar service charge
- Net-neutral renovation (Net resident cost: approx. +100CHF/month): residents have no financial reason to engage and neither to reject

Sufficiency requires alternative motivations (environmental values, cooperative norms)
Findings suggests this threshold has not been reached

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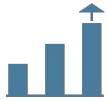
Three implementation pathways

Operating on information and agency

01 Make temperatures transparent

- Apartments run 2-3°C above design temp □ residents are unaware
- Make it visible: seasonal reports, shared dashboard, in-apartment displays

02 Make collective savings visible



- No individual price signal □ collective substitute needed
- Return energy savings as tangible benefits: lower charges, shared amenities, etc.

03 Align sufficiency with comfort

- Thermal experiences vary □ not all residents feel cold
- Target those for whom reduction improves comfort
- Where sufficiency and comfort coincide: start there

Policy implications → performance monitoring, conditional incentives and targeted behavioural support

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Conclusion

Efficiency does not automatically generate sufficiency

A successful retrofit leaves a persistent gap between design performance and everyday practices after 10 years of operation. 68% refuse any heating reduction.

The cooperative model: enabler and constraint

It enables large-scale investment through risk sharing, but weakens individual incentives for behavioural change.

Comfort perceptions shape the acceptability of sufficiency

Residents who experience discomfort cannot reasonably be expected to reduce heating, while even comfortable residents often resist reductions perceived as sacrifice.

Bridging the gap requires more than better technologies

Closing the efficiency-sufficiency gap requires attention to comfort, perceptions and the social organisation of energy use.

Sharing model explorer - Simplify implementing shared living with the sustainable business model canvas for sharing solution

Felix Bucher, Fabienne Keller, Flavio Sütterlin

12:10 - 12:30

What is Shared Living?

Definition

Shared living refers to the long-term sharing of residential space, ranging from traditional shared flats to innovative housing concepts that combine reduced private living areas with shared infrastructure, communal spaces.

This includes:

- Multigenerational housing
- (Large) Flat shares
- Communal living, e.g., satellite apartments
- Residential communities, e.g., co-housing
- Cluster apartments
- Hall living

Integrated Shared Living

Extension of Definition and Benefits for Residents

Integrated Shared Living includes the sharing of living space as well as additional rooms, items, and services in the living environment, such as:

- Workshop and sewing room
- Cars and e-bikes
- Childcare and meal preparation

For residents and society, this results in several benefits:

- Reduced space demand
  - Fewer emissions
- Fewes new purchases of goods and vehicles
- Promotion of social interactions

Barriers to Dissemination

Shared living remains a niche phenomenon in Switzerland:
Current usage 3%, but willingness to use 20% (Georgi et al., 2023)

- Low acceptance among users lead to high risk for investors
- Reasons for this low acceptance:
  - Loss of status,
  - Incompatibility with individual lifestyle,
  - Need for privacy and control over one's environment (Williams, 2008; Put & Pasteels, 2022)
- Lack of property rights as main barrier to using access-based services (Akbar & Hoffmann, 2018; Tunn et al., 2021)

Acceptance of Shared Living

Exploratory Hypotheses

- The acceptance of shared living can be increased by implementing a degree of ownership to the local sharing community.
- The intention to share privately owned things in a sharing community increases with social recognition.
- A degree of ownership and social recognition can prevent the tendency to use shared things less carefully, but instead foster attentiveness. This prolongs their operational lifetime.

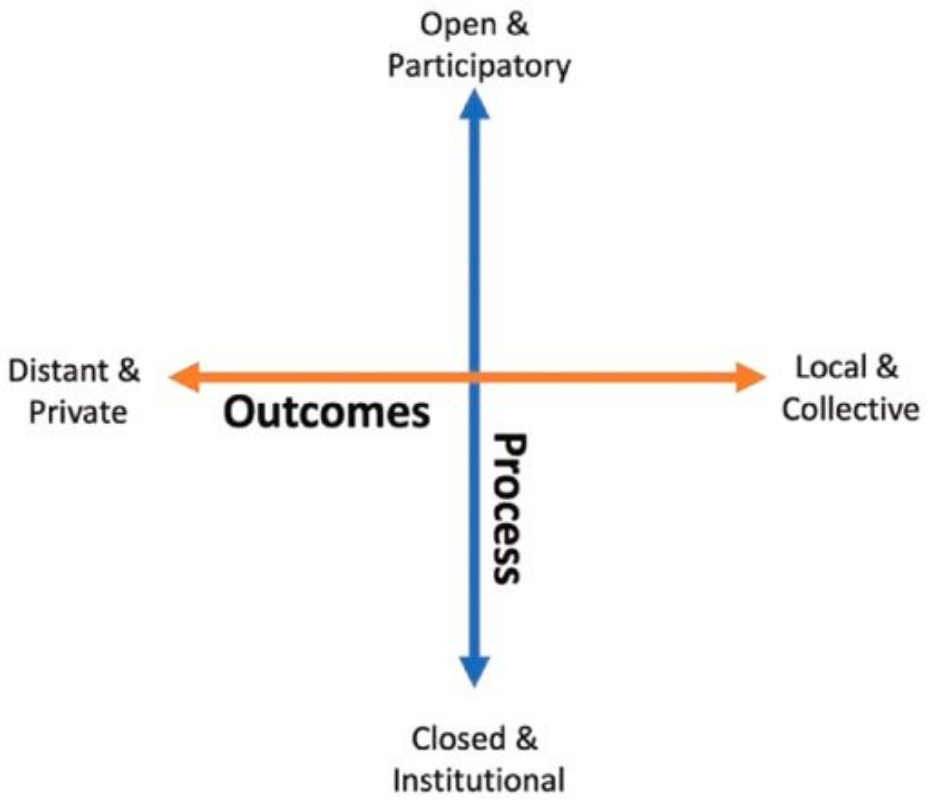


Fig. 1. Conceptual dimensions of community renewable energy projects (adapted from Walker and Devine-Wright (2008)).

Data Basis

Systematic collection of existing and planned shared Living projects, focus on German-speaking Switzerland

- Permanent residential sharing + sharing offers in the living environment

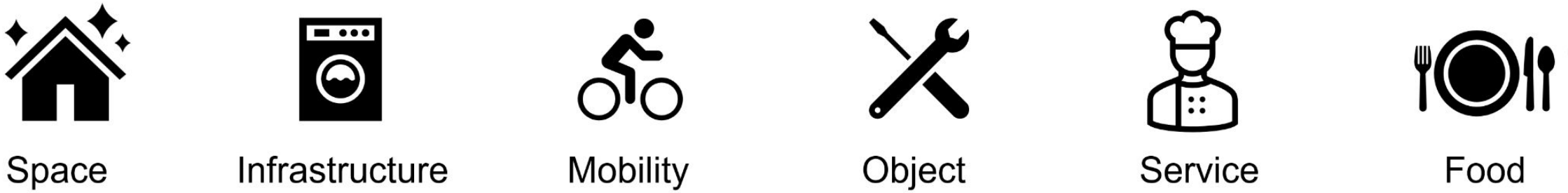
Exclusions: Housing projects restricted to specific target groups (e.g., retirement homes or student residences) and "conventional" flatshares

Sample

- 49 identified projects
- 44 projects and 326 shared items analysed
  - 31 implemented projects
  - 13 projects in planning stages

Methodology

For categorization, the shared items are divided into categories:



… and distinguished along further dimensions:

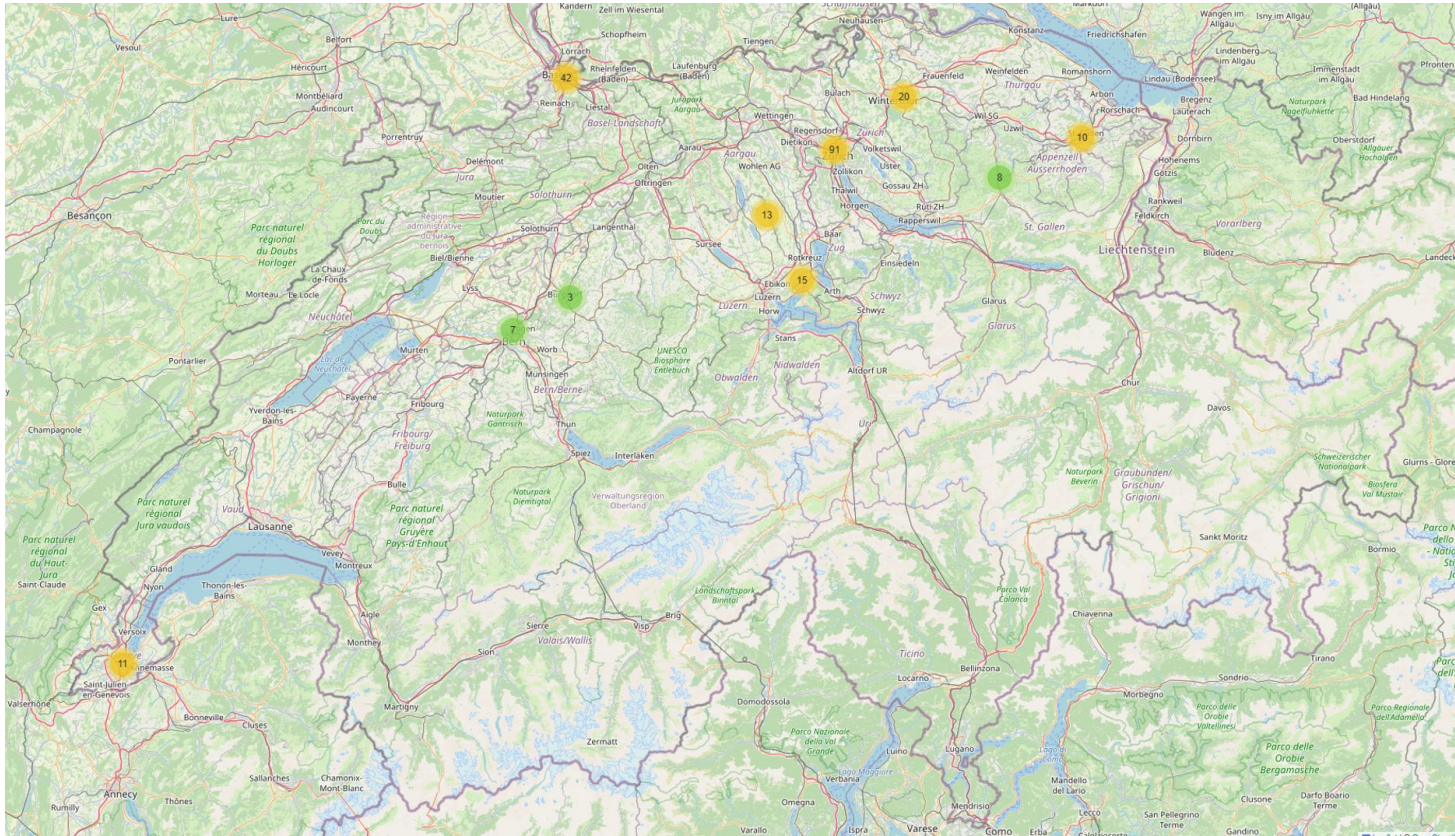
- What is it and for whom? Category, place, number of users, user group
- Business case: Legal owner, ownership transfer, expected return for owner, user fee
- How is it organised? Organisation of maintenance and utilisation
- Participation and distribution of costs / benefits: Degree of ownership - process & outcome

Results

- Strong dominance of housing cooperatives (≈ 70%)
- Less common: foundations, private / institutional providers
- Geographic distribution: predominantly urban areas

Top 5 shared items:

- Rooftop
- Community room
- Laundry room
- Workshop
- Communal kitchen



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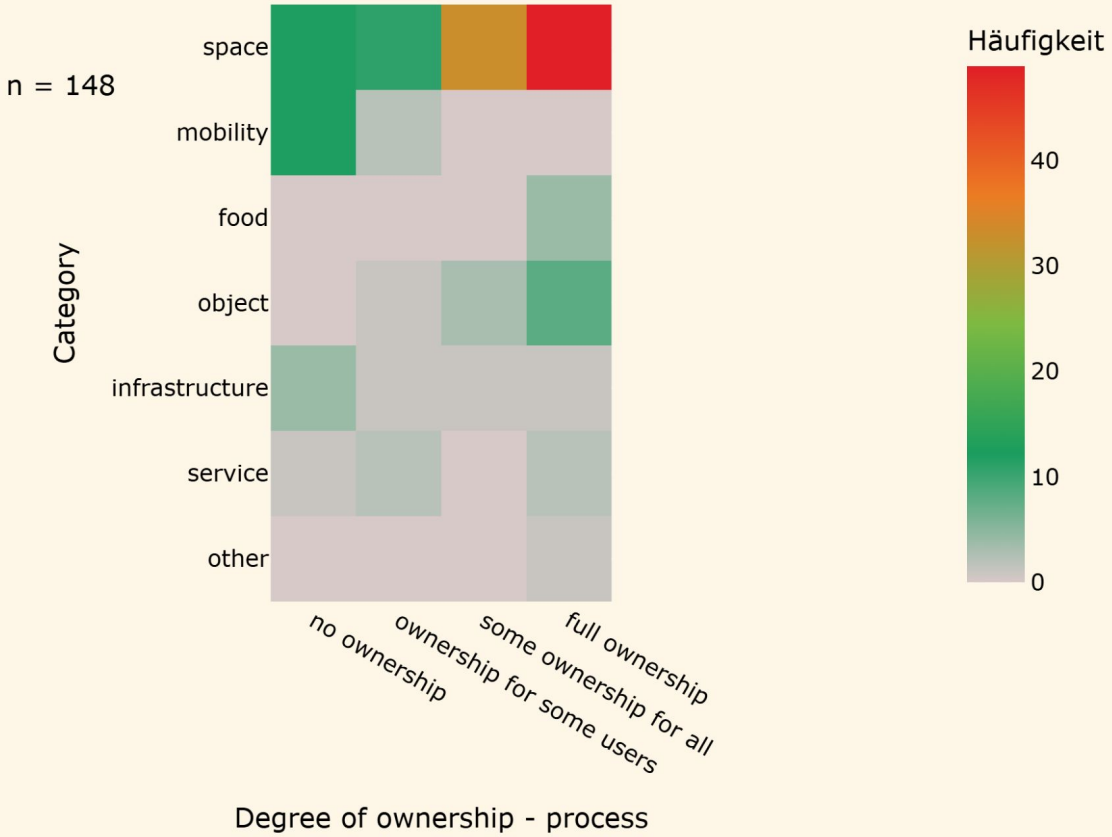
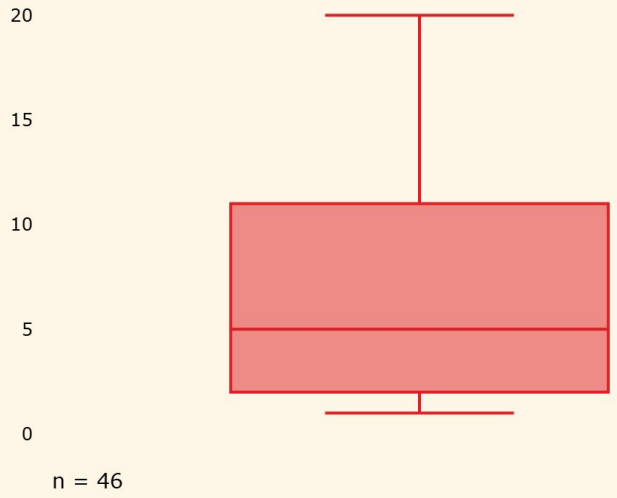
Results

Heatmap: Category vs Ownership process



Boxplot der Anzahl Items pro Projekt

Statistik	Wert
Mittelwert	6.72
Median	5
Spannweite	19
Modus	1



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The Sharing Model Explorer

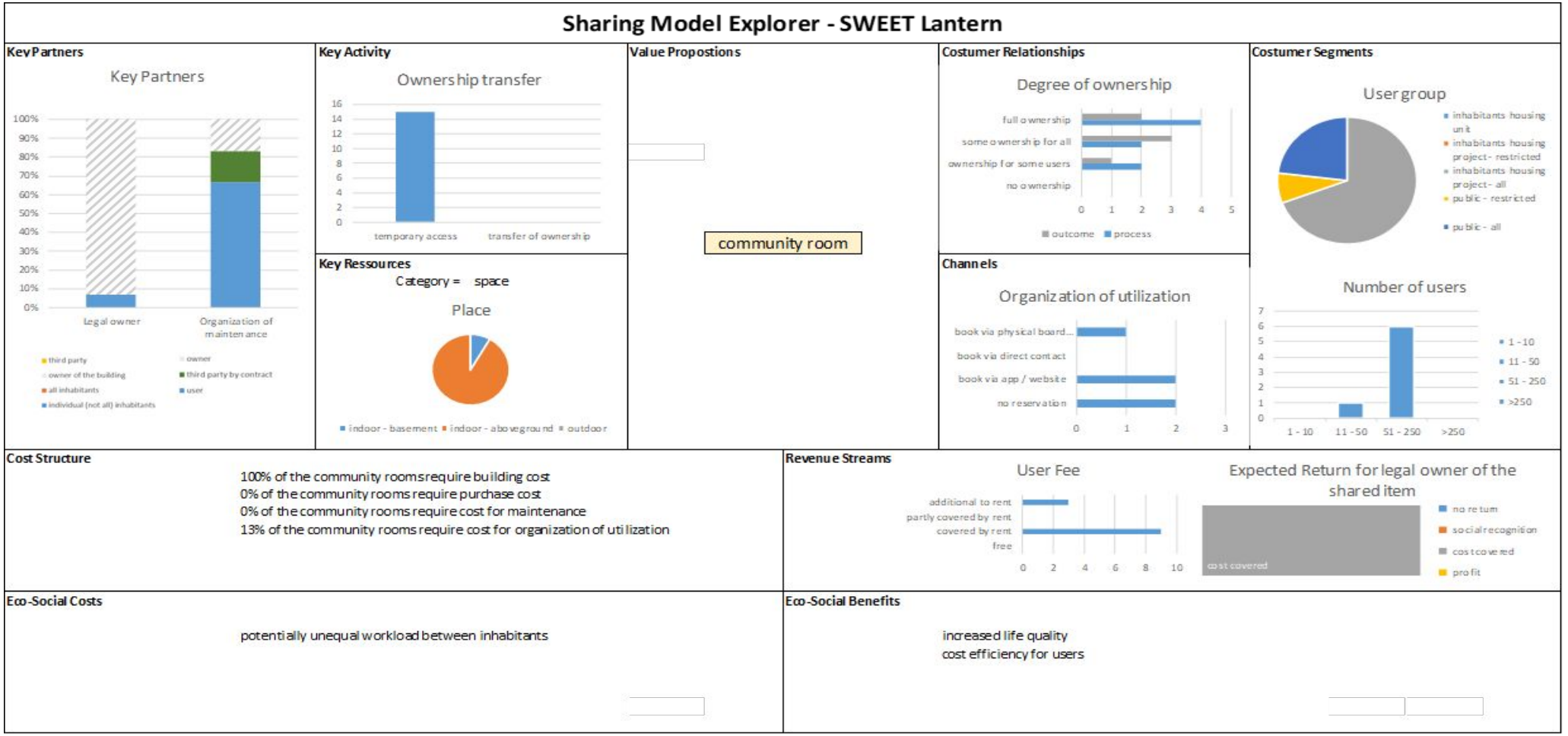
Objectives

The Sharing Model Explorer is a planning tool for housing developers, building owners, and planners. It enables them to…

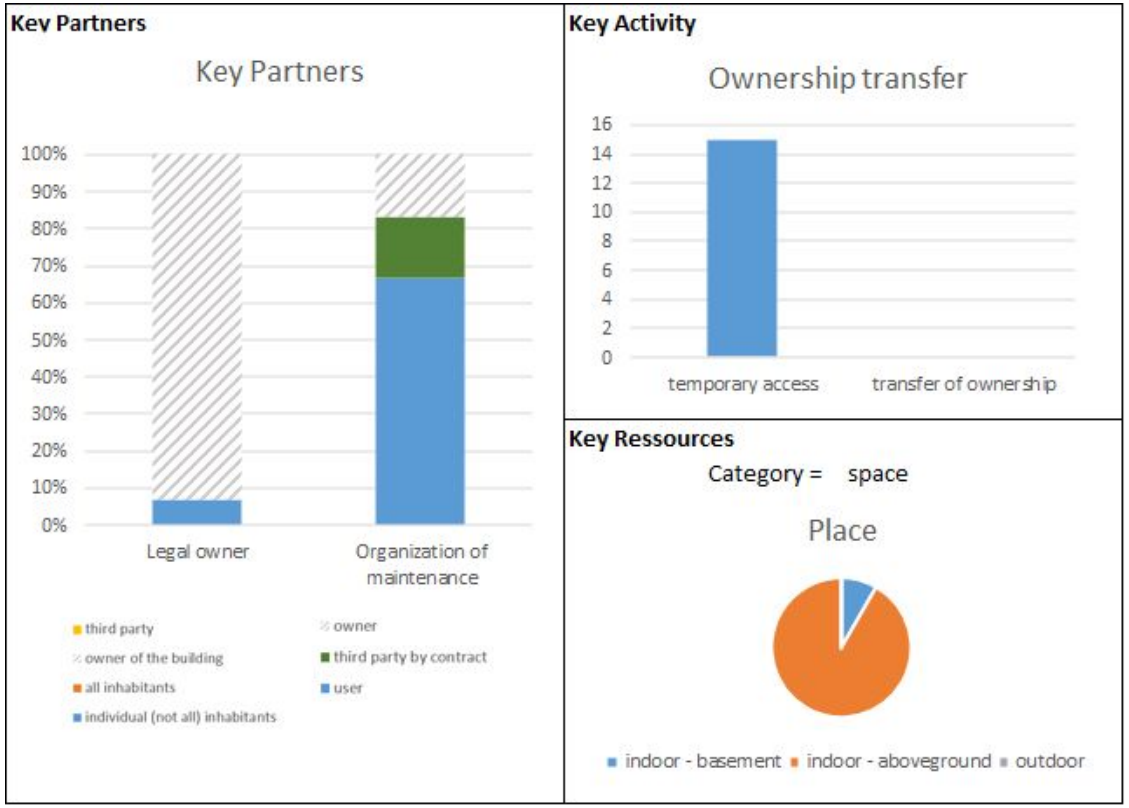
- Explore models of accepted shared living solutions
- Reduce the risk of integrated shared living
- Create affordable and more ecological housing offers
- Realize additional rental opportunities through more efficient use of space

The Sharing Model Explorer

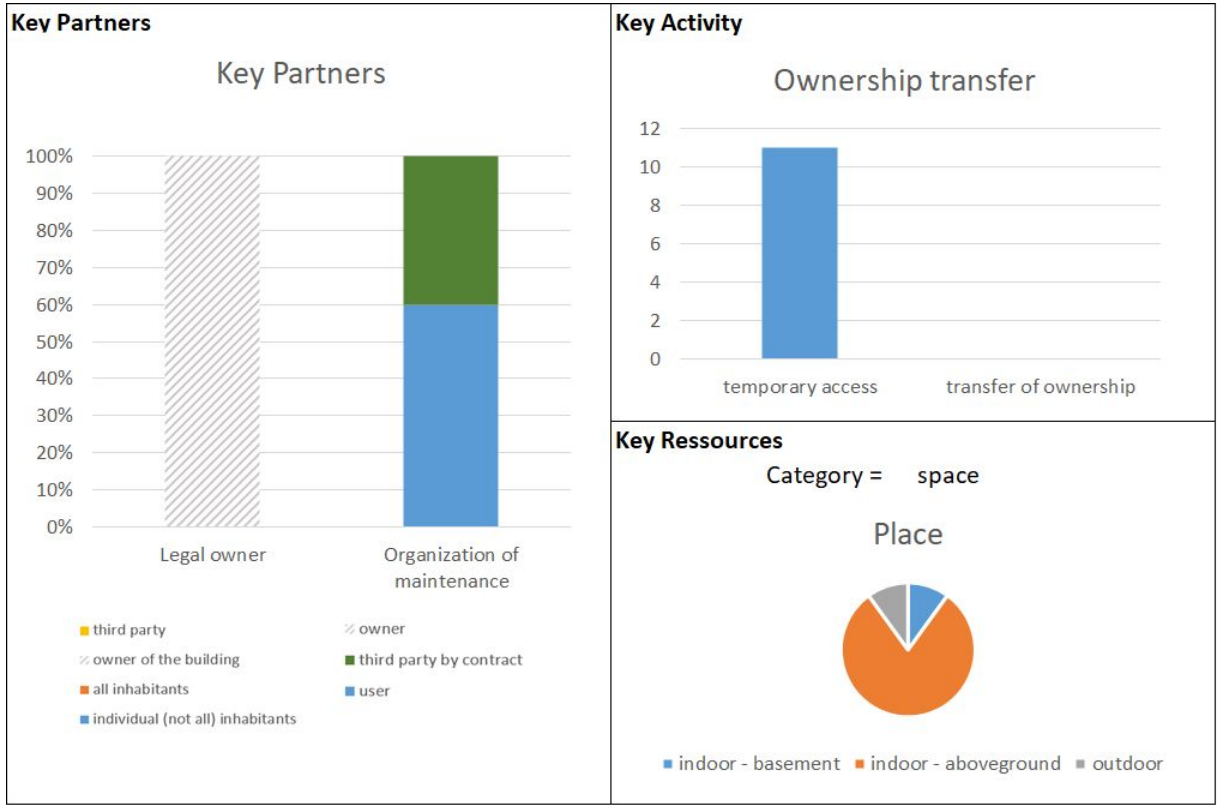
Overview



The Sharing Model Explorer



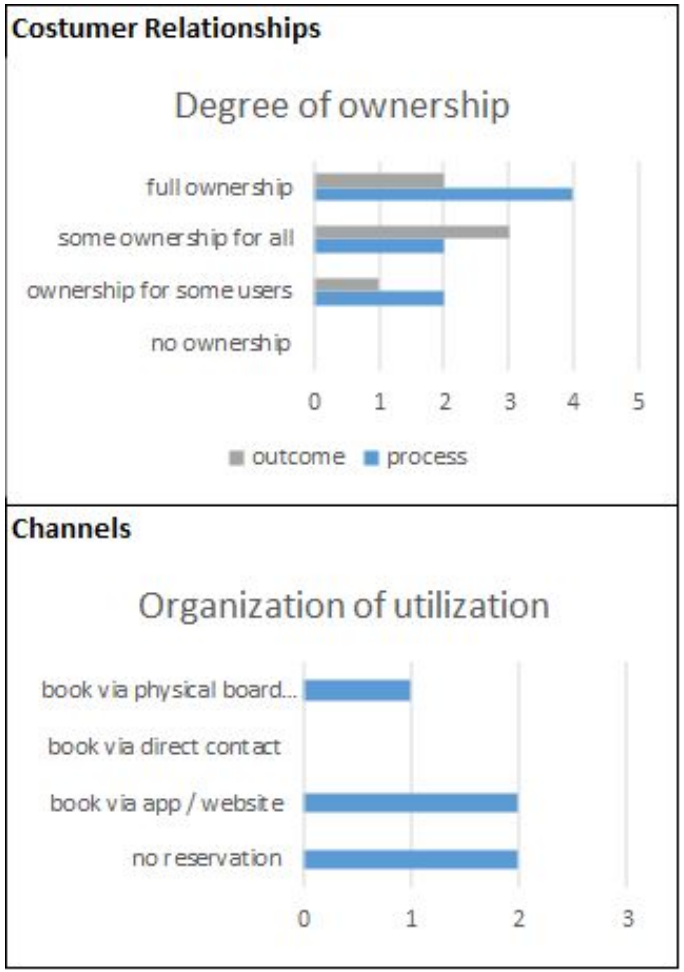
Community Room



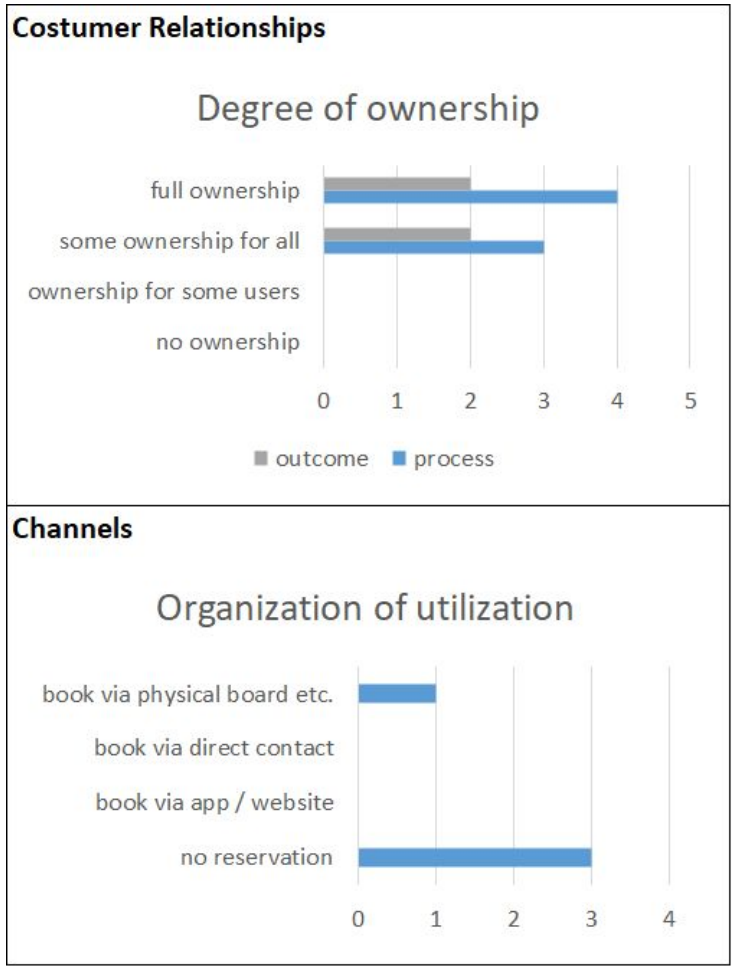
Communal Kitchen

The Sharing Model Explorer

Community Room



Communal Kitchen



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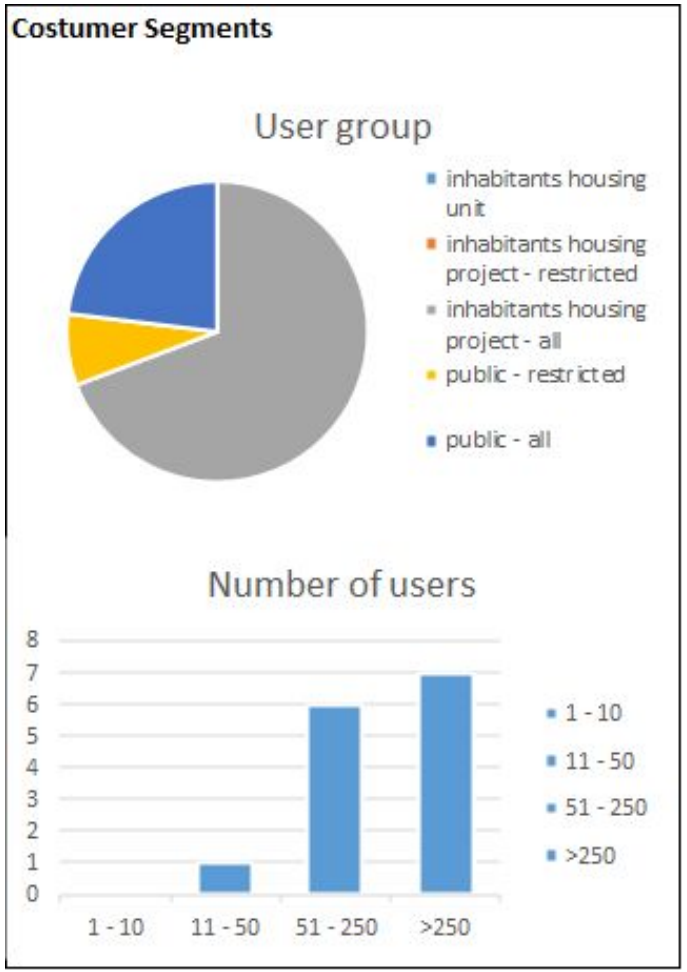
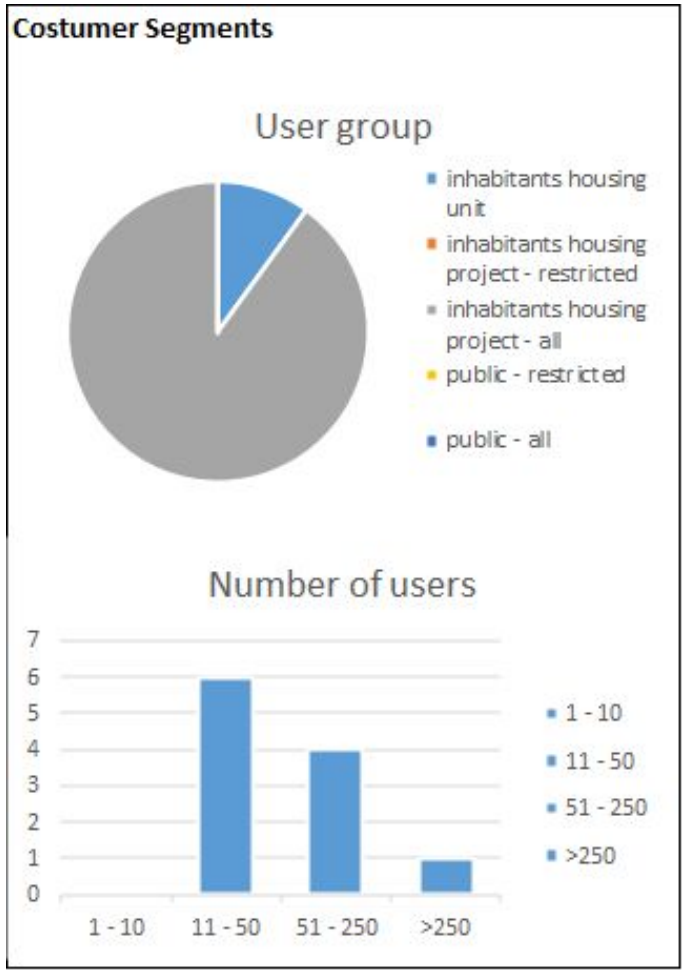
The Sharing Model Explorer

Community Room



Communal Kitchen



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The Sharing Model Explorer

Cost Structure

100% of the community rooms require building cost
0% of the community rooms require purchase cost
0% of the community rooms require cost for maintenance
13% of the community rooms require cost for organization of utilization

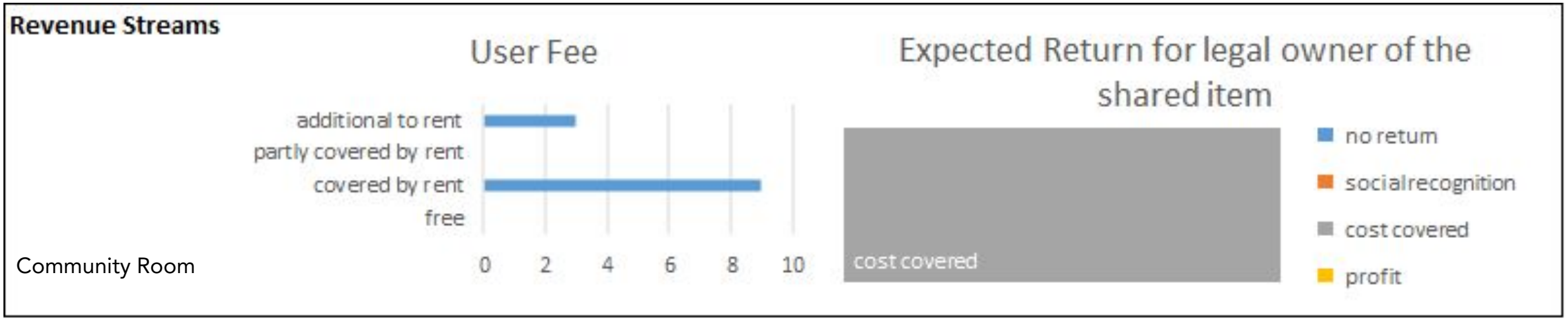
Community Room

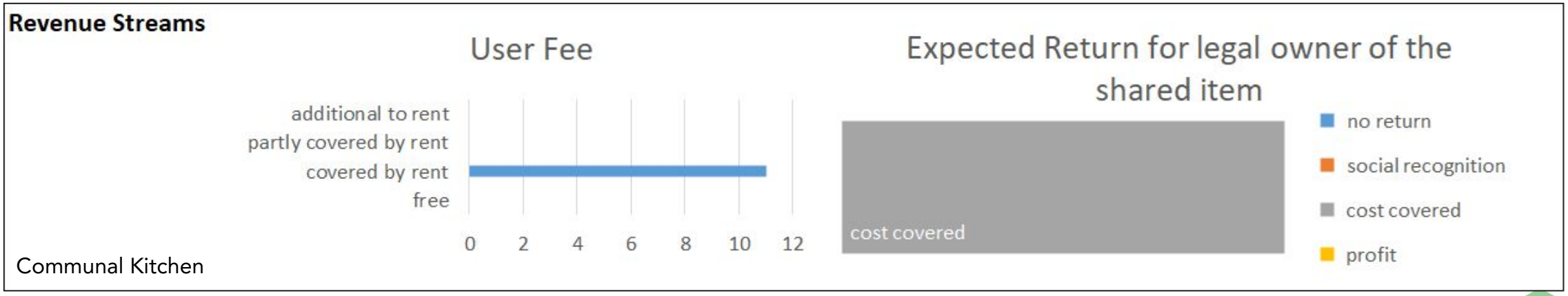
Cost Structure

100% of the communal kitchens require building cost
0% of the communal kitchens require purchase cost
0% of the communal kitchens require cost for maintenance
9% of the communal kitchens require cost for organization of utilization

Communal Kitchen

The Sharing Model Explorer





The Sharing Model Explorer

Value Proposition	Eco Social Costs	Eco Social Benefits
❖ Social exchange ❖ More space available	❖ Potentially unequal distribution of maintenance work	❖ Improved quality of life ❖ Cost efficiency for users

Community Room

Further Development of Sharing Model Explorer

Next steps with future project partners

Using a co-creation approach, the Sharing Model Explorer will be further developed together with interested partners from the construction industry

- Expansion of the database
- Development of a web-based version
- Extension of functionalities (e.g., filters, generation of project-specific offerings)
- Application in a pilot project

Lunch break
12:30 - 13:45

World café
16:00 - 16:45

3 groups - Interactive summary and discussion of morning session topics

Sufficiency in the Built Environment & Renovation Strategies	Recreational Practices and Sustainable Mobility	Energy Communities & Energy Demand

You change discussion group every 10-15’

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4th edition

FRIBOURG 10.06.26

Building bridges for an energy transition that accounts for human needs

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Wifi

Restaurant Punkt
Password: punkt3002