

Dörr, H., Späth, P. & Goñi, I. (2026). Scaling up retrofit: regional challenges and opportunities for MMC. *Buildings and Cities*.

SUPPLEMENTAL DATA

Table 1. List of interviewees and workshop participants.

Stakeholder groups (number of interviews)	Interviewees	Workshop participation (number of persons)
Industry (5)	I1 = regional office of chamber of industry and commerce	Yes (1)
	I7 = state construction industry association	Yes (1)
	I8 = freelance architect & energy consultant	Yes (1)
	I9 = local carpenter cooperative	Yes (1)
	I11 = local renovation centre	No
Energy agency (2)	I5 = local energy agency	No
	I6 = regional energy agency	Yes (1)
Civil society (1)	I4 = local civil society association	Yes (2)
Property owners (4)	I2 = local homeowners' association	Yes (1)
	I3 = regional housing industry association	No
	I13 = local student services agency	Yes (1)
	I12 = local housing cooperative	No
Tenants (2)	I10 = regional tenants' association	No
	I14 = state tenants' association	No
Municipality (0)		City administration, department of environmental protection (1)

Table 2. Assessment of scaling up potential for serial retrofits in the Freiburg region.

Source: adapted from Petrovics & Giezen (2022); van Doren *et al.* (2018).

Category	Success factor	Assessment of case study
Characteristics	Financial advantage	Given — serial retrofit attractive for both homeowners and trades; digital planning costs and OSS funding remain open questions
	Reliability	Given — high quality and guaranteed success in terms of energy performance outcomes
	Low complexity	Mixed — reduces overall retrofit complexity (project bundling, data-based approaches) but increases planning complexity and preparation for single projects (coordination, digital tools, prefabrication); low-threshold OSS support needed
	Integrative functions	Combines housing transition with affordability (cost-efficiency) and sustainability (resource efficiency), plus capacity building for CORIS; OSS as bundled service point
Operational Arrangements	Leadership	Lacking beyond pioneers, institutionalization in energy agencies/networks/OSS remains to be created
	Stakeholder involvement	Cooperative approaches prove effective/efficient with great potential for support across industry, policy and homeowners
	Resource mobilization	Can be improved by boosting capacities (personnel, expertise, infrastructure); also contributes resources (digital tools, information, funding), potentially supported by OSS
	Communication	Channels exist; Would be improved by platform tools (outreach) to mobilize and access resources effectively; enable/enhance internal cooperation
	Logistics	To be built on different governance levels (energy, recycling), but especially regionally (data, communication, platform)
Policy context	Regulations and financing	Landscape policies and funding schemes are pushing serial approaches; frameworks for platforms/OSS are rather developed bottom-up, lack top-down support
	Information	Regional campaigns targeting homeowners and companies exist and can be enhanced, potentially by bundling in OSS
	Leadership	Lacking at municipal level, but energy agencies are promoting
	Trust in framework	Low — uncertainty around long-term policy stability and funding continuity
Market context	Low costs	Serial approaches reduce costs relative to conventional retrofits, but generally high cost levels remain a barrier
	Expertise and skills of supply actors	Lacking — need for spread from pioneers to mainstream; skilled labor shortage in construction sector

	Information availability	High — many sources, but rather overload and fragmentation; visibility of innovative approaches could be increased
	Access to credit	Given for property owners with individual projects; municipalities lack personnel for applications for bundled projects; highly bureaucratic
	Dynamics and conditions of peripheral industries	Potential for scaling timber retrofits and local industries' cooperation for resilience of CORIS
Natural and Built Context	Technical compatibility	Mixed — multi-family buildings suitable for serial approaches; single-family homes (high energy consumption per capita) not economically viable for prefabrication due to geometric heterogeneity; Wood construction cluster represents place-based asset; recycling infrastructure for components lacking; Dense urban fabric in Freiburg city enables bundling; surrounding rural areas more challenging
Socio-cultural context	Environmental awareness and values	Relatively high in Freiburg region; acceptance of retrofits' meaningfulness
	Consumption culture	Cultural expectations of individualization may hinder standardization