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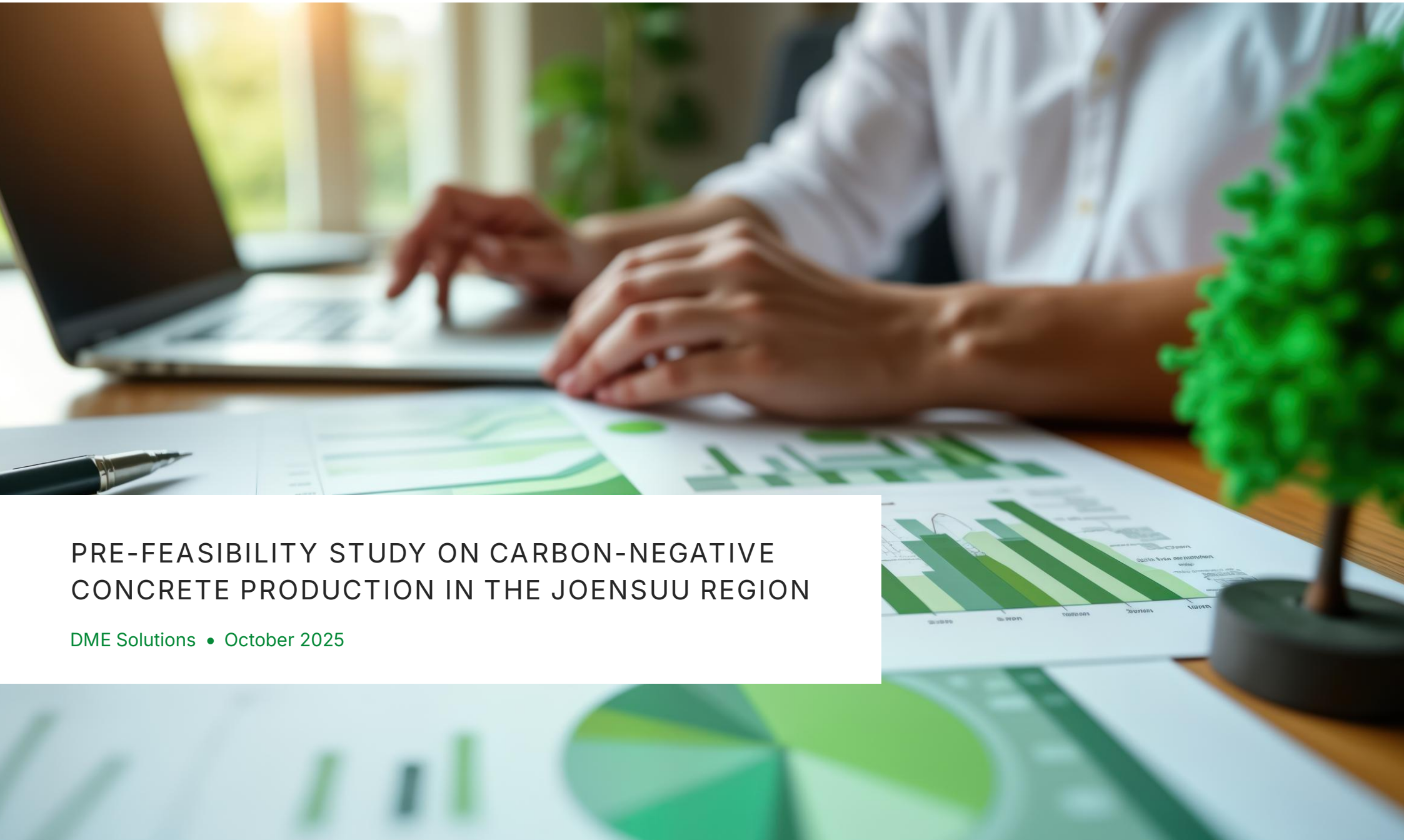


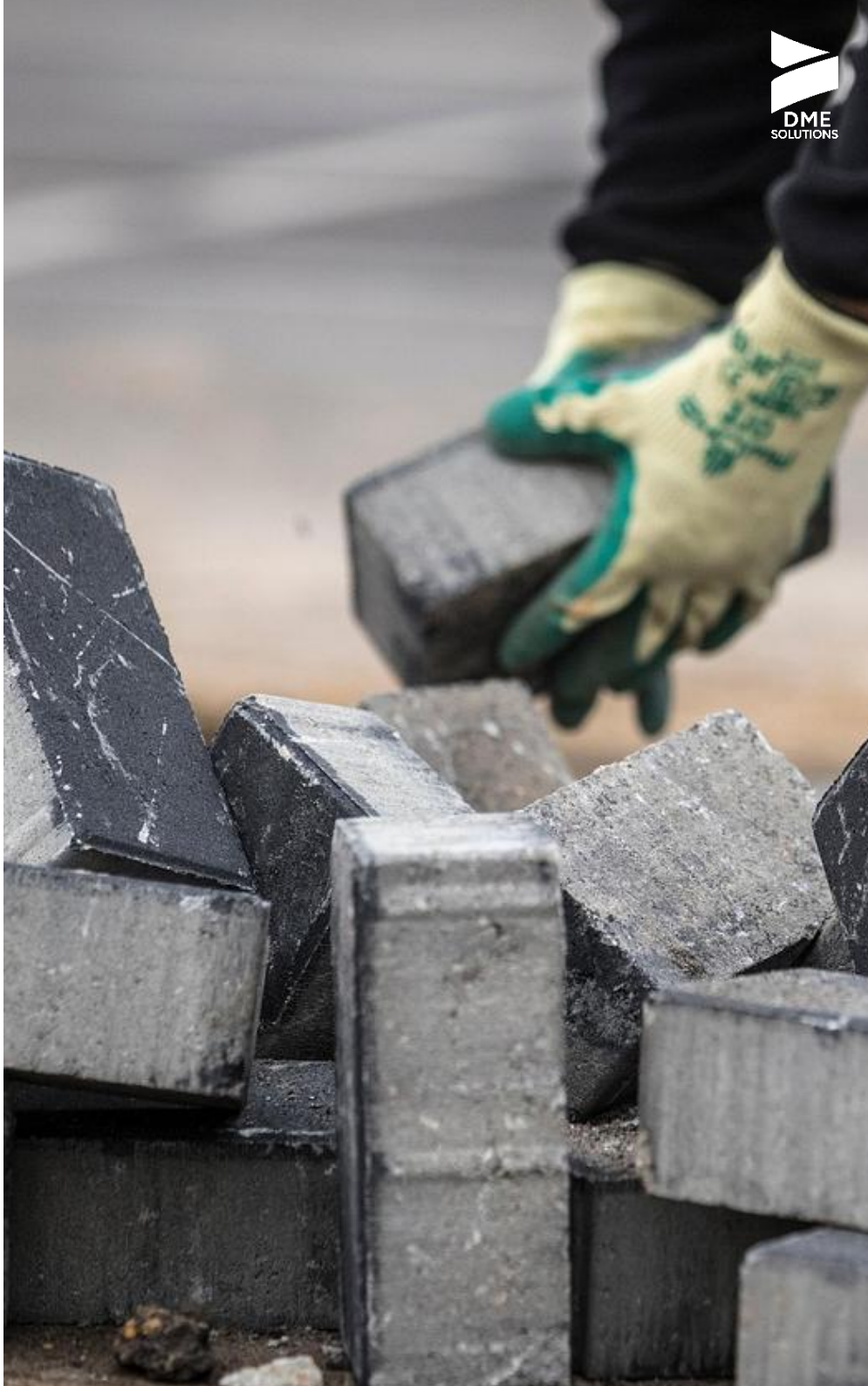
PRE-FEASIBILITY STUDY ON CARBON-NEGATIVE CONCRETE PRODUCTION IN THE JOENSUU REGION

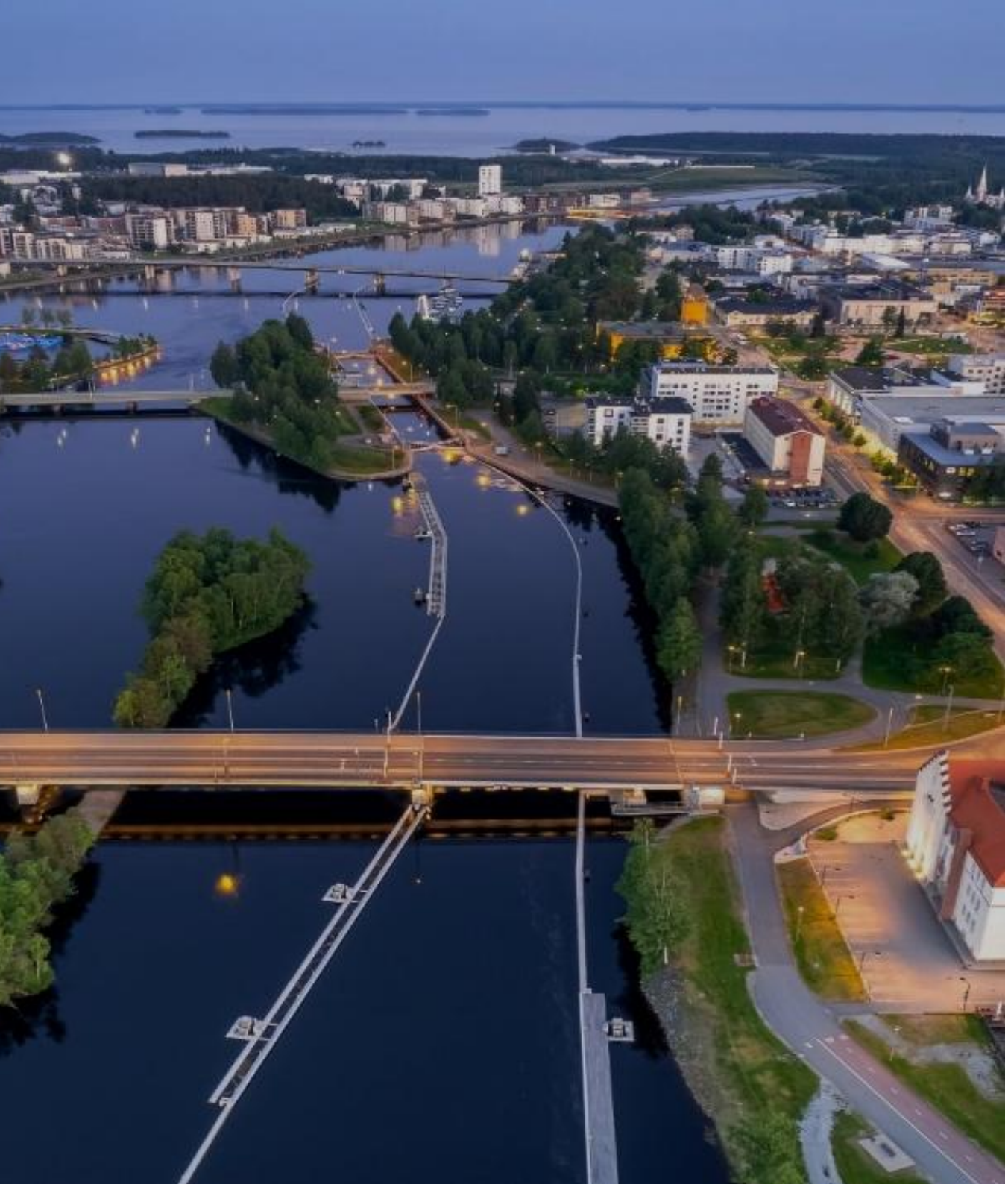
DME Solutions • October 2025

EXECUTIVE SUMMARY

This pre-feasibility study examines the technical, environmental, and economic potential for carbon-negative concrete in Joensuu (North Karelia), leveraging local biogenic CO_2 sources.

- Three pathways are assessed: Carbonaide (CO_2-curing with high SCMs), CarbonCure (in-mix mineralization), and PrimX (steel-fiber slabs).
- Regional clustering of Savon Voima's CHP and Stora Enso's pulp mill enables efficient CO_2 logistics.
- Results show Carbonaide delivers the largest reductions, CarbonCure the fastest returns, and PrimX design-based savings. Profitability depends on price, OPEX, and CO_2 supply; carbon credits significantly enhance feasibility.
- Pilot projects are recommended.





BACKGROUND AND GOAL

Concrete is one of the world's most important building materials, but it is also a major source of carbon dioxide (CO_2) emissions.

This study explored whether carbon-negative concrete production could be established in Joensuu, North Karelia, by benchmarking new low-carbon technologies using locally available biogenic CO_2.

WHY JOENSUU?

Joensuu is well-positioned for carbon capture and utilization (CCU) due to nearby biogenic CO_2 sources.

Facilities such as Savon Voima's Iiksenvaara CHP and Stora Enso's Enocell pulp mill provide concentrated, cap-turable CO_2 streams that can supply future pilots with low-cost logistics.

TECHNOLOGIES EVALUATED

Based on the Technology Readiness Level (TRL), Carbon reduction potential and footprint, availability of required feedstock in the region, Political, Economic, Social, Technological, Environmental, and Legal (PESTEL) analysis, these three technologies were selected for evaluation of their suitability for deployment in the region.

Carbonaide (Finland): CO_2 curing combined with high SCM substitution; the largest footprint reduction per m^3.

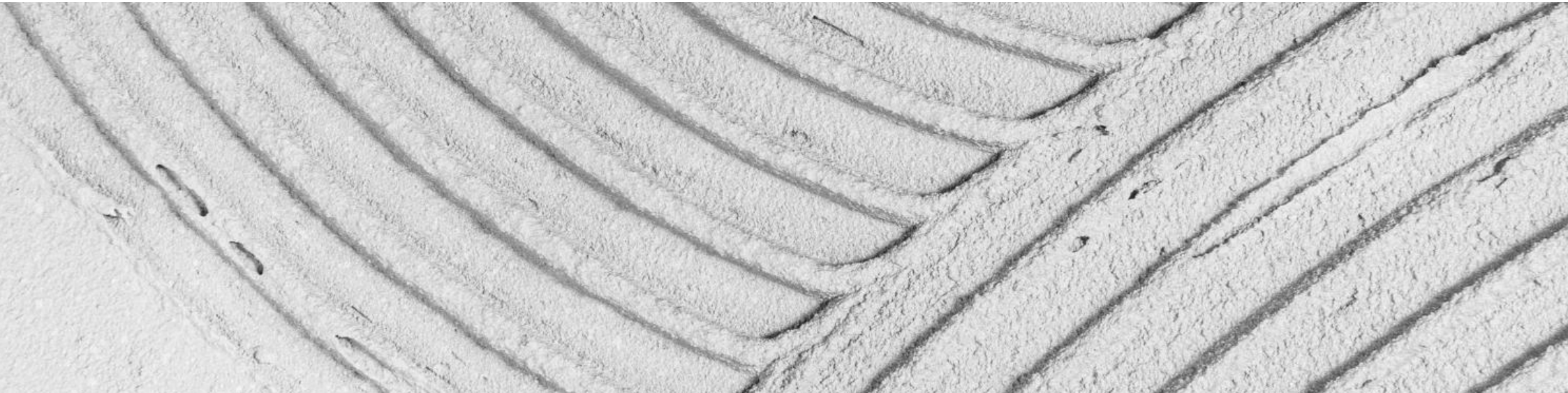
CarbonCure (Canada): In-mix CO_2 mineralization; easy integration with wide deployment potential.

PrimX (Latvia): Steel-fiber slabs requiring less concrete; performance gains per unit area.

KEY FINDINGS

All three technologies deliver measurable CO_2 reductions compared to traditional concrete.

- CarbonCure provides the quickest returns, Carbonaide balances significant abatement with moderate profitability, and PrimX delivers steady results through efficient design.
- Profitability is most sensitive to sales price, operating costs, and CO_2 supply.
- Revenue from carbon credits could further improve economic feasibility when robust MRV systems are applied.



NEXT STEPS

The study recommends:

1. Launching a Phase-1 pilot that pairs one pre-cast/ready-mix plant with a local CO_2 source.

2. Refining techno-economic assessments with site-specific data.

3. Establishing MRV protocols and validating carbon credit pathways.

4. Aligning pilots with Joensuu's planned hydrogen/ CCU industrial park for scalability.

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