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Innovative circular economy & AI methodology for sustainable high-energy performance buildings

SNUG Project Unveils Four Core Solutions to Revolutionize Sustainable Construction Across Europe

[March, 2026] – The SNUG Project, a pioneering initiative co-funded by the European Union's Horizon Europe program, is proud to announce the development of its "Project 4 Solutions" framework. This strategic pillar is designed to accelerate Europe's transition to Zero-Energy Buildings (ZEBs) by combining advanced material science with Artificial Intelligence to reduce both operational energy use and the embodied carbon footprint of the built environment. As buildings currently account for 40% of the EU's energy consumption, the SNUG methodology introduces a circular economy approach to thermal insulation. By replacing carbon-intensive synthetic materials with local waste and bio-resources, SNUG is delivering the next generation of high-performance building envelopes through four specific technical breakthroughs:

1. Bio-Based Insulation Panels (Biopanels)

The first solution focuses on the development of high-performance Biopanels as a sustainable alternative to petroleum-based products like EPS. These panels use hemp shives — a natural carbon sink — bound with natural tannin-based adhesives. By achieving a thermal conductivity of less than 0.055 W/mK, these panels meet rigorous European energy standards while reducing embodied energy. Beyond their environmental credentials, these bio-based materials improve indoor air quality through significantly lower VOC emissions compared to synthetic counterparts.

2. Aerated Eco-Concrete Blocks

SNUG has also reinvented traditional masonry through its Aerated Eco-Concrete Blocks. By removing high-carbon Portland cement and a significant portion of lime

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from the production process, the project uses industrial byproducts such as Ground Granulated Blast Furnace Slag (GGBFS) and calcium carbide slag. These lightweight, load-bearing blocks maintain the structural integrity and density (400 kg/m³) required for modern construction but with a drastically lower carbon footprint, effectively turning industrial waste into a cornerstone of durable infrastructure.

3. Sustainable Self-Leveling Mortars with PCMs

To address smart thermal management, the project has developed Sustainable Self-Leveling Mortars integrated with Phase Change Materials (PCMs). Developed at Østfold University College, these mortars act as a "thermal battery" within the building's structure by absorbing excess heat during off-peak hours and releasing it when temperatures drop. This passive regulation significantly reduces the energy required for active heating and cooling systems, particularly in climates with high temperature fluctuations, while utilizing local waste streams for the geopolymer base.

4. Aerogel-Based Super-Insulation

The final solution targets the complex challenge of retrofitting heritage buildings and thin-wall applications where space is limited. SNUG is developing recycled aerogel solutions, including blown-in insulation and insulating lime plasters, derived from Construction and Demolition Waste (CDW). By using CDW-based aerogel granulates, the project achieves "super-insulating" performance with ultra-low thermal conductivity. This innovative circular sourcing model overcomes the high production costs and energy intensity typically associated with traditional aerogel manufacturing, making high-efficiency retrofitting more accessible.

Validation Through Real-World Demonstrators

These solutions are not merely theoretical; they are currently being validated across three diverse European climates to ensure versatility:

- **Norway (Scandinavian):** New residential construction in Fredrikstad.
- **Switzerland (Continental):** Residential renovation in Kilchberg.
- **Spain (Mediterranean):** Office building retrofitting in Almassora.

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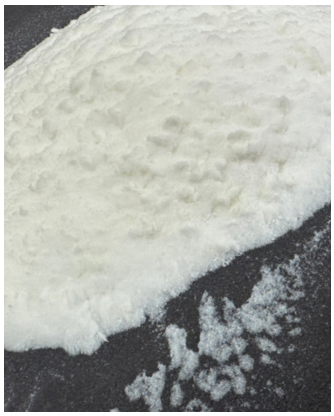
"SNUG is not just about better insulation; it's about a smarter, AI-supported way to build," says the SNUG consortium. ***"By integrating these four solutions, we are empowering architects and builders to make greener choices that are cost-effective, safe, and truly sustainable for the long term."***



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SNUG is pioneering sustainable construction solutions, addressing the significant environmental impact of buildings. Through an innovative methodology designed to assist architects and builders in choosing the most appropriate thermal insulation materials and strategies for new construction or renovations, this EU project aims to reshape the construction industry, maximizing energy efficiency, minimizing greenhouse gas emissions and fostering a greener future for buildings and communities.

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