PaluWise

DEVELOPMENT OF ADVANCED SOLUTIONS FOR THE PRODUCTIVE USE OF REWETTED DEGRADED PEATLAND ECOSYSTEMS

Including Paludiculture Products in the Advanced Materials Act

APRIL 2026

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.

Highlights

- Paludiculture –the productive land use of rewetted peatlands– has shown great potential in providing biomass for construction applications with enhanced properties, among others.
- The inclusion of innovative paludiculture products in the Advanced Materials Act could contribute to a transition to a circular and low-carbon economy minimising negative environmental impacts.
- Policies need to more strongly support paludiculture production, aligned with other relevant EU policy files.
- Connecting research and industry could trigger the scale up of paludiculture and expand the bio-based market.

Introduction

The EU has a set of main goals addressing climate change challenges:

- **EU Climate Law** [1]: Reduction of net greenhouse gas (GHG) emissions by at least 55% by 2030 and 90% by 2040, compared to 1990's levels.

- **Land Use and Land-Use Change Forestry Regulation (LULUCF)** [2]: Net carbon removals of 310 million tonnes of CO_2 equivalent as a sum of the GHG net emission reductions and removals by Member States by 2030.

As a pathway to move in this direction, the EU Bioeconomy Strategy [3] aims to contribute to climate change adaptation and mitigation by creating and expanding markets for innovative bio-based products improving circular economies. In this way, the bioeconomy maximises co-benefits in achieving the targets of EU Climate Law and LULUCF.

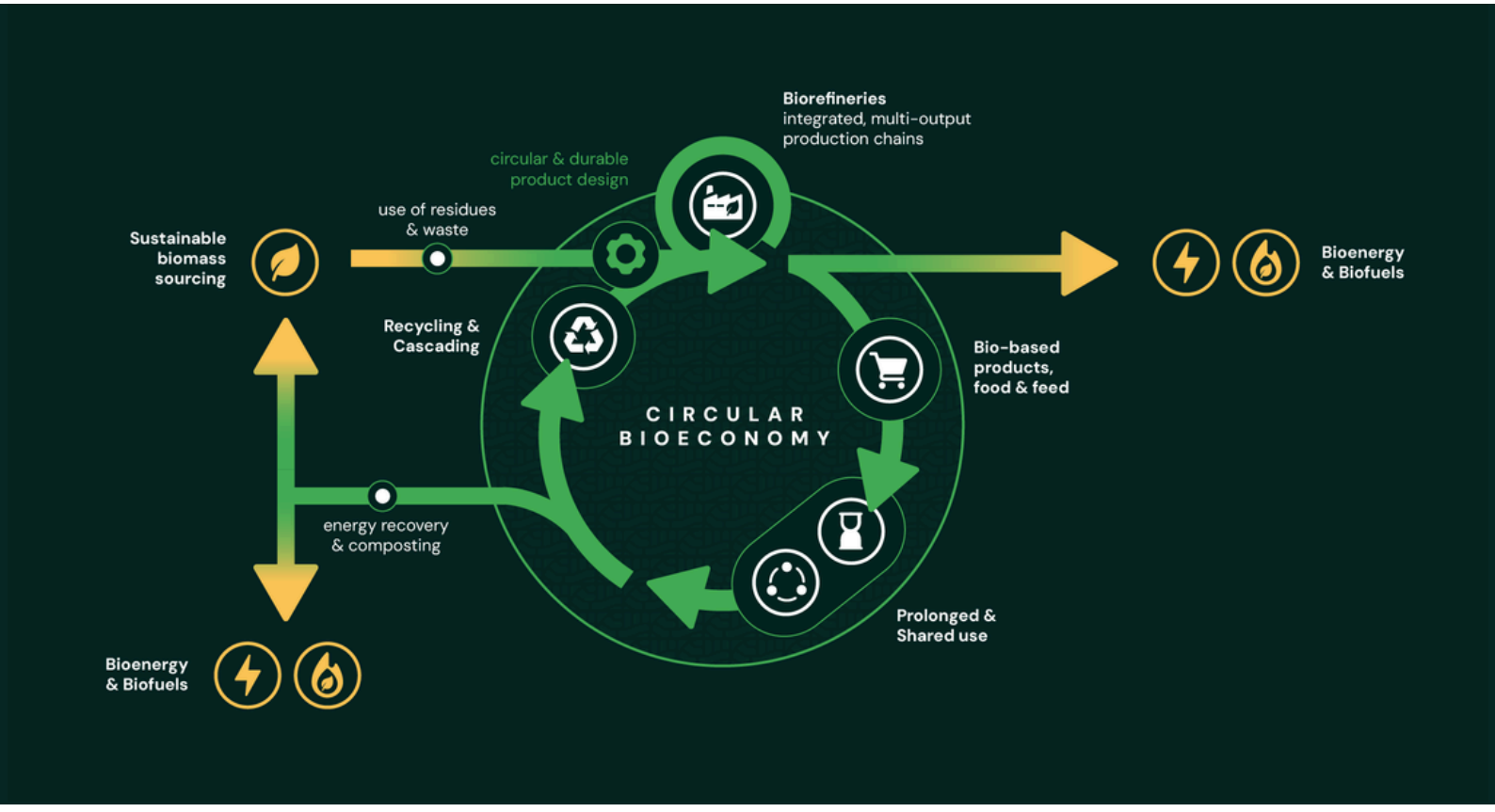

Figure 1. The circular bioeconomy and its elements. Source: Stegmann, P., Londo, M., Junginger, M., 2020. The circular bioeconomy: Its elements and role in European bioeconomy clusters. Resources, Conservation & Recycling 6, 100029. Visual adapted by PaluWise to align with publication styling.

Rewetting of drained peatlands has been recognized as a key GHG mitigation measure [4], with an estimated potential of GHG emissions reduction in the EU amounting to around 220 Mt CO_2 equivalent annually [5].

Since the majority of drained European peatlands are under agricultural use [6], a shift away from drainage-based agriculture is necessary to reach this potential. A reduction of annual emissions by 70 Mt CO_2 equivalent can be achieved with the rewetting of 80% of the EU's currently drained peatlands [7].

Paludiculture – a productive land use of rewetted peatlands [8] – can provide resilient and profitable business models for farmers and landowners, be a source of biomass for advanced materials, and significantly contribute to a sustainable circular economy [9], while preserving peat soils, minimising GHG emissions and bringing benefits for biodiversity. Paludiculture has been already included in EU policy areas such as the Nature Restoration Regulation (NRR) and the Carbon Removal and Carbon Farming (CRCF) regulation.

The expansion of bio-based material markets should be driven by innovation, performance, and competitiveness [10]. The inclusion of paludiculture products within the Advanced Materials Act would broaden the portfolio of advanced materials available to industry supported by research and industrial cooperation, allowing for gradual integration of paludiculture-based inputs alongside established value chains and strengthening material security and diversification [3, 11]. In this context, the EU's aim for a transition to a sustainable and competitive economy requires the exploration of bio-based markets. The large-scale implementation of paludiculture could offer a valuable contribution to the development of these markets and a sustainable circular economy [9].

Considering this, paludiculture biomass applications should be accounted for in the Advanced Materials Act for ensuring cohesion with other climate objectives and to facilitate a large-scale market development. This joint policy brief summarises the evidence found in paludiculture biomass applications to contribute to the Advanced Materials Act from the EU-funded projects PaluWise, Palus Demos, Paludi4All, FIBSUN and PaludiAllianz.

Paludiculture products as advanced materials

Bio-based materials from paludiculture offer an alternative to conventional materials including plastics. Since bio-based markets are expected to increase [11], paludiculture could contribute to achieving the objectives of the EU Bioeconomy Strategy in providing bio-based materials. Paludiculture crops, such as cattail (*Typha* spp.), reeds (*Phragmites australis*), peat mosses (*Sphagnum* spp.), sedges (*Carex* spp.), alder (*Alnus glutinosa*), and reed canary grass (*Phalaris arundinacea*), are used for building and insulation materials, paper and packaging, substrate and soil improvement products, energy, livestock bedding, fodder, medicine, food, and textiles [12]. For example, a German company is developing bio-based packaging products coming from paludiculture that could substitute plastic packaging products in a more sustainable way [13].

Similarly, a German company produces paludiculture cardboards using fibres from rewetted peatlands [14] and another German company produces cartons containing 10% paludiculture biomass, aiming to increase the paludiculture biomass content in their products [15]. In the UK, seedheads of cattail are being used for insulating textiles [16]. To phase out peat use, a Finnish company produces peat-free growing media and compost bedding applications from naturally established or cultivated reed beds [17].

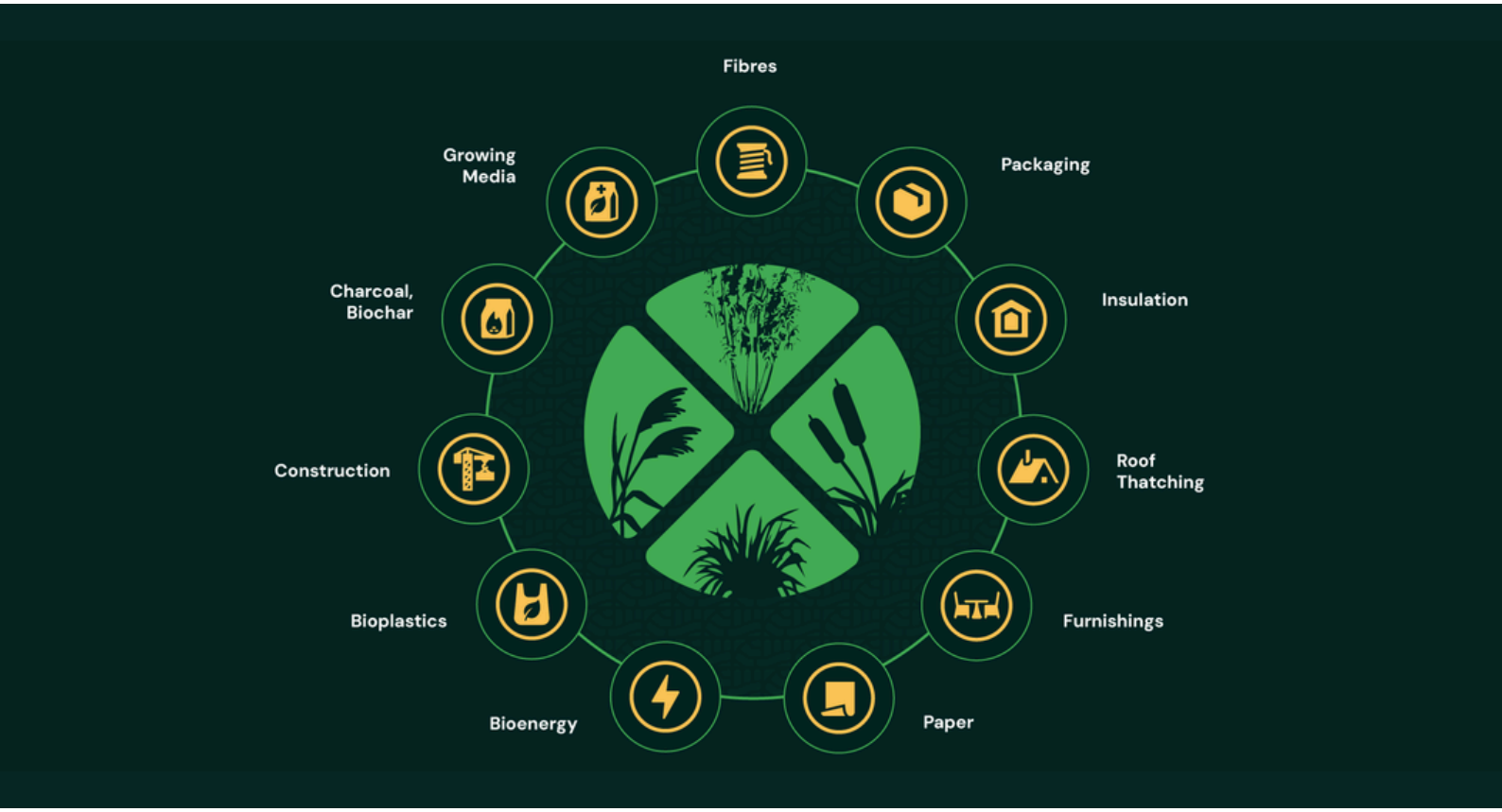

Figure 2. Main uses of paludiculture biomass with high market potential. Visual adapted by PaluWise to align with publication styling. Inspired by original source: The paludiculture crops cattail (Typha spp.), and common reed (Phragmites australis) expected to require the greatest land area and the markets they may or do supply. Source: Ross, K., 2025. Potential markets for paludiculture crops. Department for Environment, Food and Rural Affairs, the UK. Visual adapted by PaluWise to align with publication styling.

Figure 3. Paludiculture biomass from varied crops such as sedges, reed canary grass, cattail and reed for different industry applications such as foil strips and biopolymers depicted in the picture. Exhibited during Greifswald RRR conference 2025. Author: Alba Alonso Adame.

The potential is especially large in the building materials sector which faces challenges to reduce energy consumption during all life phases and to reduce the use of resources coming from fossil raw materials [18]. The use of paludiculture biomass for the construction and insulation materials production not only saves energy, but also significantly reduces the carbon footprint [19] and presents lower thermal conductivity and a good hygrothermal performance in the case of cattail [20]. Some paludiculture crops such as reed have been already used as a construction material for millennia, particularly for thatched roofing [21].

Payments for carbon storage in buildings, included in the CRCF, will further advance paludiculture material use. Companies are urgently looking for sustainable options, thus fast upscaling of paludiculture e.g. by large-scale pilots, is required. An example of an innovation for circularity in the building sector is a no-waste solution from a company that harvests reeds and other fibre sources for using them together with paper recycling waste as the basis of a construction board [22].

Alternative sources for fibres are thus in the right direction. Perennial paludiculture sustainably provides renewable annual biomasses for fibre and construction materials while conserving the peat soil by non ploughing and wet management. There is a need for high quality fibres or particles for many applications. In the future, many different options for different crops will be needed, thus having as many companies as possible to use the materials might be appropriate.

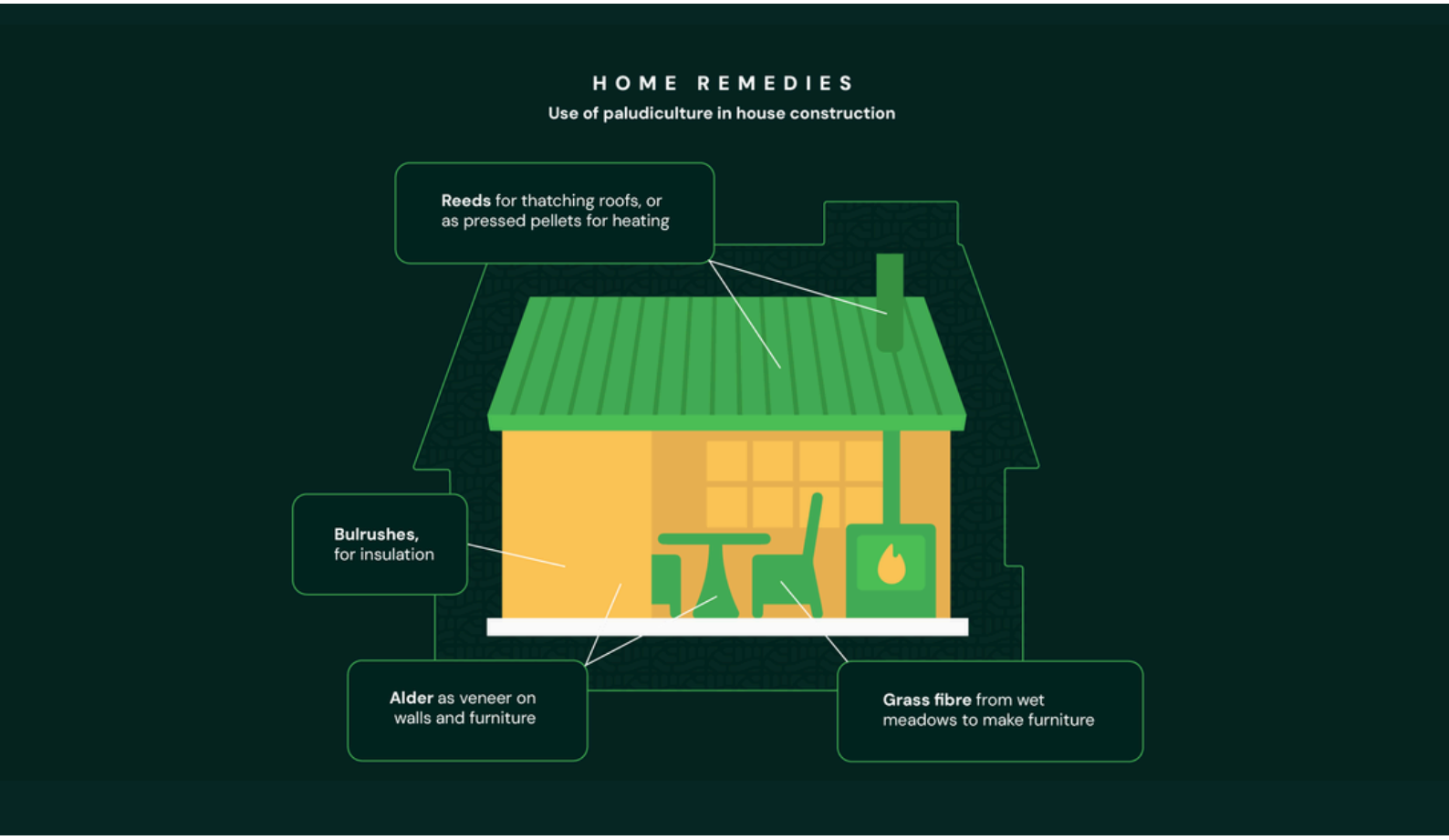

Figure 4. Paludiculture products with potential to be used in regular houses. Source: Peatland Atlas 2023. Visual adapted by PaluWise to align with publication styling.

Challenges for paludiculture

The high initial cost of paludiculture and the need for homogeneous biomass lead to expensive products from paludiculture compared to others. Therefore, it is hard to compete with plastic products in the current situation, since the cost of plastic has been decreasing.

In the building sector, it is often not permitted to have products in the market without the CE certification, which requires tests for heat conductivity, water and fire resistance. Although paludiculture materials have excellent fire resistance and heat conductivity properties, both material production and certification are expensive. Currently, paludiculture applications are competing with large-scale, well-tested, optimized and established materials. The EU will increasingly require life cycle assessments (LCA) and other proof of sustainability for products that are seen as fundamental for good business models. Standardising or including estimates of land use change in LCA calculations would better reflect the strengths and weaknesses of paludiculture value chains.

Paludiculture should be market-driven in order to make the production attractive. However, it seems that problems related to rules and regulations are persistent. Policies should be designed to steer the markets to be more favourable for paludiculture. For instance, in countries such as the Netherlands, cattail cultivation could provide synergies with the Dutch goal of a climate neutral agriculture and land use by 2050 [23]. Cattail cultivation in the Netherlands also contributes to the Dutch circular building economy [20].

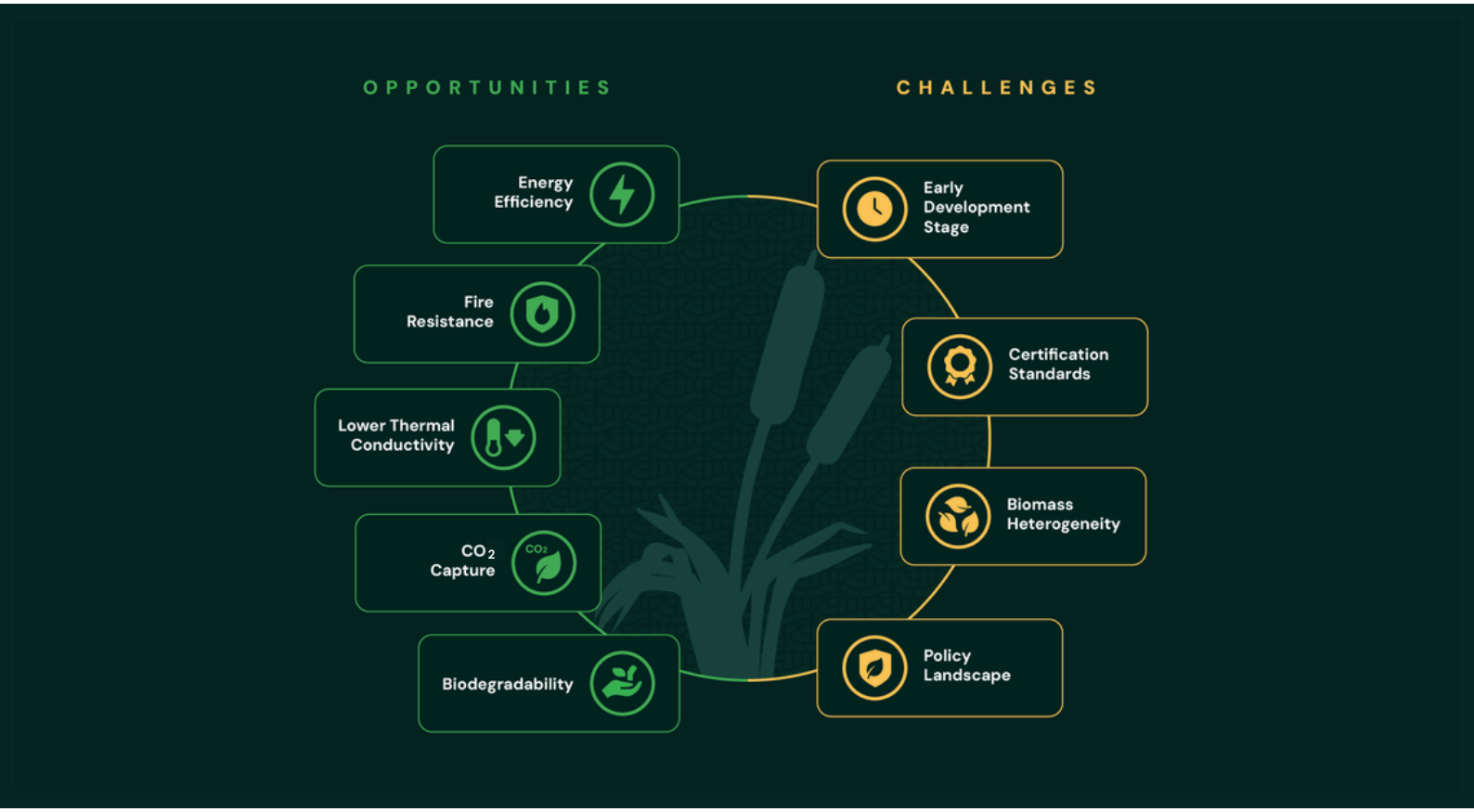

Figure 5. Opportunities and challenges of paludiculture products in the construction sector. Author: Alba Alonso Adame.

Addressing these challenges requires a balanced policy framework that supports innovation and scaling while ensuring predictability for existing peatland-based industries [24]. Policy instruments should focus on enabling favourable market conditions, investment security, and research-based development, avoiding regulatory uncertainty that could negatively affect regional economic stability [25].

Information contained in this document is based on discussions with experts pioneering in sustainable fibre technologies and applications from the joint FIBSUN and PaluWise workshop during the Renewable Resources from Wet and Rewetted Peatlands Conference in Greifswald (Germany) in September 2025. This study was complemented with literature review and expert knowledge. The policy brief focused on the main applications within the construction section.

Recommendations for paludiculture as part of the Advanced Materials Act

This joint policy brief presents the potential of paludiculture applications to transform industries and improve circularity while contributing to climate objectives for a net-zero carbon Europe. From PaluWise, Paludi4All, Palus Demos, FIBSUN and PaludiAllianz projects, the following priority recommendations are delineated:

- **Promote innovative paludiculture products contributing to a transition to a circular and low-carbon economy**, which further minimises negative environmental impacts and supports a sustainable and competitive industry. Including paludiculture products in the Advanced Materials Act will strengthen the Bioeconomy Strategy and support the achievement of the targets of EU Climate Law and LULUCF. More sustainable products with better performance can lead to an increase of the industrial uptake of advanced materials to achieve the Green Deal's ambitions for zero pollution and a toxic-free environment.

In doing so, policy development should explicitly recognise the complementary role of paludiculture within peatland regions. Supporting multiple sustainable land-use pathways enhances economic resilience and facilitates a balanced just transition [25].

- **Design policies to more strongly support paludiculture production**, including direct agricultural subsidies and complementary political measures to reduce the high prices of paludiculture products. The Common Agricultural Policy (CAP), the EU's largest financial instrument for agriculture, will need to support paludiculture well enough [24] as well as halt drainage-based agriculture. Paludiculture is also a solution for phasing out peat use in growing media and bedding production. Paludiculture can provide renewable biomass for the diversification of alternative raw substrates for peat in professional horticulture. It can thus contribute to phasing out peat extraction and to achieving the objectives of the EU Climate Law and the LULUCF through peatlands rewetting.

- **Connect research and industry to trigger the scale up of paludiculture**. Experimental paludiculture fields should be increasingly established with a clear prospect for the future in mind. This will accelerate the development of paludiculture applications, being an important factor to develop a bio-based market. This market will ultimately contribute to the Bioeconomy Strategy as well as offer emission reduction opportunities within the CRCF.

The inclusion of paludiculture in the Advanced Materials Act should be framed within a broader industrial ecosystem perspective. Diversification of peatland-based economies enchases resilience, supports technological leadership and contributes to EU strategic autonomy in advanced materials. In addition, it could contribute to a faster economic growth in markets such as building and insulation sector with more sustainable materials while contributing to EU climate goals. With this, industrial ecosystems could accelerate the development and testing of new advanced materials such as paludiculture products, which has already gained attention from the European Commission in several granted paludiculture EU projects. This can potentially boost the upscale of paludiculture while significantly improving sustainability in different critical sectors.

REFERENCES

[1] Regulation (EU) 2021/1119 of the European Parliament and of the Council of 30 June 2021 establishing the framework for achieving climate neutrality and amending Regulations (EC) No 401/2009 and (EU) 2018/1999 ('European Climate Law').
[2] Regulation (EU) 2018/841 of the European Parliament and of the Council of 30 May 2018 on the inclusion of greenhouse gas emissions and removals from land use, land use change and forestry in the 2030 climate and energy framework, and amending Regulation (EU) No 525/2013 and Decision No 529/2013/EU (Text with EEA relevance).
[3] European Commission, 2018. A sustainable bioeconomy for Europe: Strengthening the connection between economy, society, and the environment.
[4] UNEP, 2022, Global Peatlands Assessment – The State of the World's Peatlands: Evidence for action toward the conservation, restoration, and sustainable management of peatlands. Main Report. p17. Global Peatlands Initiative. United Nations Environment Programme, Nairobi.
[5] Greifswald Mire Centre, National University of Ireland, Galway & Wetlands International European Association, 2020. Peatlands in the EU – Common Agriculture Policy (CAP) after 2020. Position Paper (version 4.8).
[6] European Commission, 2020. Peatlands for LIFE.
[7] Agora Agriculture, 2024. Agriculture, forestry and food in a climate neutral EU. The land use sectors as part of a sustainable food system and bioeconomy.
[8] Wichtmann, W., Schröder, C. & Joosten, H., 2016. Paludiculture - Productive Use of Wet Peatlands. Climate Protection - Biodiversity - Regional Economic Benefits. Schweizerbart Science Publishers, Stuttgart.
[9] Schäfer, A. & Wichtmann, W., 2022. Strategy and economic assessment of paludiculture for nutrient retention and other ecosystem services in the Neman River basin. Greifswald University and Michael Succow foundation, partners in the Greifswald Mire Centre, Greifswald, Germany.
[10] Communication (COM/2024/98 final) from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on Advanced Materials for Industrial Leadership.
[11] Asada, R., Krisztin, T., Di Fulvio, F., Kraxner, F., Stern, T., 2020. Bioeconomic transition?: Projecting consumption-based biomass and fossil material flows to 2050. Journal of Industrial Ecology 24, 1059-1073.
[12] Greifswald Mire Centre, 2025. Paludiproducts – Inspired by peatlands, designed for the future.
[13] See: https://www.ivv.fraunhofer.de/en/packaging/sustainable-packaging/paludi.html
[14] See: https://www.leipa.com/en/news/detail/schrobenhausen-cardboard-made-from-paludicultures
[15] https://www.ottogroup.com/en/stories/story/peatlands-must-be-wet-ground-breaking-ceremony-in-german-region-uckermark-sets-a-sign-for-climate-protection.php
[16] https://www.ponda.bio
[17] https://www.matojamulta.com/
[18] Lahtinen, L., Mattila, T., Myllyviita, T., Seppälä, J., Vasander, H., 2022. Effects of paludiculture products on reducing greenhouse gas emissions from agricultural peatlands. Ecological Engineering 105, 106502.
[19] Staniaszek D., 2015. Renovation in practice – Best practice examples of voluntary and mandatory initiatives across Europe. Buildings Performance Institute Europe (BPIE).
[20] De Jong, M., Van Hal, O., Pijlman, J., Van Eekeren, N., Junginger, M., 2021. Paludiculture as paludifuture on Dutch peatlands: an environmental and economic analysis of Typha cultivation and insulation production. Science of the Total Environment 792, 148161.
[21] Lowland Peat, 2021. An assessment of the potential for paludiculture in England and Wales.
[22] https://www.zelfo-technology.com/applications-source-materials
[23] Rijksoverheid Nederland, 2019. Klimaatakkoord. Https://www.klimaatakkoord.nl/klimaatakkoord
[24] Nordbeck, R., Hogl, K., Schaller, L., 2025. The integration of peatlands into the EU Common Agricultural Policy: Recent progress and remaining challenges. Environmental Science and Policy 169, 104077.
[25] Communication (COM/2019/640 final) from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. The European Green Deal.

Projects

Funded by the European Union under the Grant Agreement number 101181479.

Funded by the European Union under the Grant Agreement number 101112318.

Funded by the European Union under the Grant Agreement number 101181392.

Funded by the European Union under the Grant Agreement number 101182338.

Funding programme: "Sustainable Renewable Resources" of the Federal Ministry of Food and Agriculture (BMEL) through the Agency for Renewable Resources (FNR)

Contact Information

Dr. Alba Alonso Adame,
Technical Officer Peatlands,
Wetlands International Europe,
alba.alonso@wetlands.org

PaluWise

DEVELOPMENT OF ADVANCED SOLUTIONS FOR THE PRODUCTIVE USE OF REWETTED DEGRADED PEATLAND ECOSYSTEMS

Funded by the European Union

Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Research Executive Agency (REA). Neither the European Union nor the granting authority can be held responsible for them.