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BIO-CIRC Project

European Regional Development Fund

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Bio(and)**Circular** **I**nsulation for **R**esourceful
Construction

Industrial Development Strategy

30 June 2022 – Final Version



EUROPEAN UNION
European Regional Development Fund



Abstract of the project

The BIO-CIRC Project, Bio(and)Circular Insulation for Resourceful Construction, intends to tackle the building sector's high carbon, energy and resources dependencies while taking advantage of an unused waste resource: polyester from waste bedding.

The project aims to conceive, develop and deploy 3 prototypes of innovative low-carbon thermal insulation material made from polyester and combined with natural fibres. It intends to promote the emergence of a bespoke waste polyester valorisation industry and the use of virtuous Natural and Recycled Fibre Insulation products.

This project is carried out by a cross-channel partnership of 4 key and complementary links in the building sector's value chain:

- Nomadéis (lead partner)
- Alliance for Sustainable Building Products
- Eden Renewable Innovations
- Back to Earth

Planned over 2 years, the BIO-CIRC project receives funding from the European Regional Development Fund (ERDF). The ERDF's contribution amounts to €399,600 for a total budget of €499,500.



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1 Introduction

In addition to the prototypes' development and their evaluation from a technical, environmental and economic point of view, it appears necessary to outline the remaining stages at the end of the project which are needed to bring the prototypes to market.

To this end, this report presents the strategy for the industrial development of the prototypes, reviewing the normative, regulatory or voluntary systems (certifications) implemented in France and the United Kingdom. Finally, the degree of technological maturity of the prototypes is analysed and next steps are described.

2 The regulatory and certification ecosystem in France

2.1 The standardisation system in France

2.1.1 The main frameworks of construction standardisation in France

The French insurance system does not impose any normative constraints on building materials and construction techniques. However, the imperatives of safety in construction operations and rapid repair of damage have led legislation to impose certain insurance obligations.

This obligation relates not only to the principle of insurance, but also to its content: the content of compulsory construction insurance is in fact provided for by law. The generic term "compulsory construction insurance" (*assurance construction obligatoire*) covers two compulsory insurances: **property damage insurance** and **ten-year guarantee in construction insurance**. The latter guarantees the repair of damage that occurs after acceptance of the work.

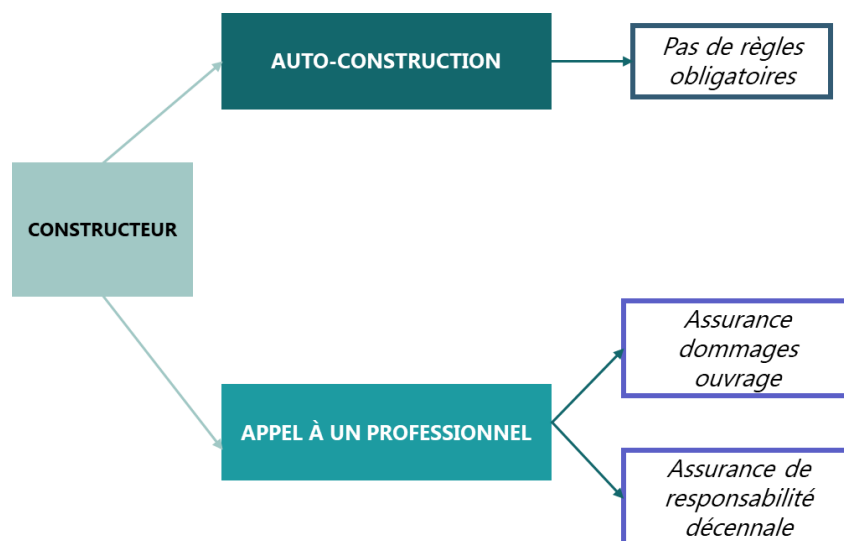


Figure 1: Compulsory insurance for builders of new and existing buildings

Ten-year insurance stipulates that any builder of a new or existing structure (various buildings, housing) is responsible for any damage that may occur to the construction for 10 years. The builder is **liable to the client** and to **successive purchasers of the property**.



The builder is linked to the client by a service contract. The client may be a contractor, a developer, a subdivider, a prime contractor, an architect, a technician, a design office, a consulting engineer, a craftsman or a self-employed contractor. A private individual who builds for himself is not obliged to take out insurance, but it is strongly recommended if the building is resold within 10 years.

Insurers may refuse to ensure a construction; in the case of non-standard techniques, an additional premium will be imposed; in the case of standard techniques, the normal rates apply.

The intervention of technical control offices for certain constructions may be necessary, in particular for i/ public buildings that receive more than 300 people, ii/ buildings located in seismic zones, and/or iii/ buildings over 28 m high.

2.1.2 Property damage insurance

Property damage insurance is defined by Article L 242-1 of the Insurance Code. According to this text, "any natural or legal person who, acting in the capacity of owner of the work, seller or agent of the owner of the work, has construction work carried out" is obliged to take out insurance against damage to the work¹.

2.1.3 Ten-year guarantee in construction insurance

Ten-year warranty is defined by Articles L 241-1 and L 241-2 of the Insurance Code. Article L 241-2 of the Insurance Code specifies the following: "Anyone who has construction work carried out on behalf of others must be covered by liability insurance guaranteeing the damage referred to in Articles 1792 and 1792-2 of the Civil Code and resulting from his actions. The same applies when the construction work is carried out with a view to sale".

2.1.4 The objectives of standardisation

The building regulations are defined to guarantee a **minimum level of quality of construction** in its essential fields. All actors in the construction process, from the commissioning of a building to its design and execution, are concerned and considered responsible for the quality of the construction:

- The **project owner**, who initiated the project;
- The **project manager**, designing the building;
- The **contractor(s)**, carrying out the work;
- The **technical controller**, checking certain provisions;
- The **insurer**, offering appropriate protection;
- The **industrialists**, manufacturing the construction products;
- Etc.

In France, the standardisation system is governed by the Decree of 16 June 2009 on standardisation. This describes standardisation as "an activity of general interest, which purpose is to provide reference documents drawn up in a consensual manner by all interested parties,

¹ <https://www.village-justice.com/articles/assurance-obligatoires-construction-contenu-defini-par-loi,27859.html>



relating to rules, characteristics, recommendations or examples of good practice, concerning products, services, methods, processes or organisations. It aims to encourage economic development and innovation while taking into account sustainable development objectives”².

2.1.5 Standardisation offices

A standardization office is a sectoral body which operates by delegation from AFNOR (the central animator of the French standardization system) and is responsible, among other things, for leading standardization committees in its field. There are 23 standardisation offices, including several in the building sector.

Standards are established at French level in **standardisation committees** which bring together people representing the various categories of actors concerned by the subject (works companies, manufacturers, technical centres, project managers, technical inspectors, etc.)³.

For the building and construction sector, the **BNTEC** (*Bureau de Normalisation des Techniques et Equipements de la Construction du Bâtiment*) is the main standardisation office. It was founded in 1990 by the *Fédération Française du Bâtiment* (FFB) and manages around 90 standardisation committees, mainly led by the FFB's trade unions and associations. Approved by the Ministry of Industry, BNTEC's field of activity is that of **building construction techniques and equipment**, including in particular: general standards, structures and shells, waterproofing, envelopes, windows and closures, frameworks, equipment, coatings, fittings and finishes, and site equipment and safety. BNTEC's core business is the development of French standards for building works (NF DTU). It is also responsible for standards for the specification of building products and the dimensioning of works, which are now mainly developed at international (ISO) or European (CEN) level.⁴

2.1.6 Types of standardisations

There are three types of procedures associated with reference documents:

- Procedures in the **regulatory domain** are **mandatory** because they generally guarantee the safety of people. They are governed by legislative or regulatory documents such as laws, decrees or orders;
- Procedures in the **normative domain** are **voluntary**. They generally deal with product performance and characteristics, dimensioning rules and implementation rules;
- Procedures in the field of **certification** and **labelling**.

2.1.7 Types of technical assessment

In order to issue insurance and to determine the premium, insurers rely on **technical assessments** of building materials and processes. Thus, in the case of construction techniques considered "**common**", insurers apply their **standard scales**. On the other hand, in the case of

² <https://www.legifrance.gouv.fr/loda/id/JORFTEXT000020749979/>

³ <https://www.frbtp.re/missions-et-expertises/reportage/2018/09/04/bureau-de-normalisation-technique.bntec.58.html>

⁴ <https://www.bntec.fr/lassociation/missions>

"unusual techniques", insurers may apply **additional premiums** or even **refuse** to insure a construction.

It can therefore be considered that in France, the obligation to insure (when a professional is involved in the act of building) creates a need for technical evaluation of building materials and techniques.

Technical assessments can take many forms and are generally classified into two broad categories:

- The **traditional domain**, which includes **standards and DTUs** (Unified Technical Documents), **RAGE** professional recommendations, and **professional rules**. These technical assessments are the result of **collective efforts** by producers and installers of construction materials;
- The **non-traditional field**, which includes the **ATec** (technical opinions), **DTA** (Technical Application Documents), and **ATEX** (Technical Assessment of Experimentation, themselves divided into several sub-categories: a, b and c; described below). These technical assessments are the result of **individual initiatives**, generally by producers for ATecs and DTAs, and frequently by contractors for type b ATEs (valid for a specific site).

The **degree of consolidation** of technical assessments is **increasing** from non-traditional to traditional.

Thus, it is frequent that pilot sites of an innovative material or process are first covered by ATEEx type b, then that a material or a technique evolves towards an ATEEx type a and then an ATec (in the framework of an individual approach), or towards professional rules (in the framework of a collective approach).

Subsequently, in the context of a market segment covering many ATecs and benefiting from a certain amount of hindsight, or in the context of proven professional rules, the market players may be invited by the public authorities to begin a process towards the formalisation of standards / DTUs, which represent the highest degree of consolidation in France. Subsequently, the drafting and validation of unified European standards (see above) may be considered.

These different technical assessment procedures are detailed in the following paragraphs. The following diagram and table summarise the elements mentioned above.

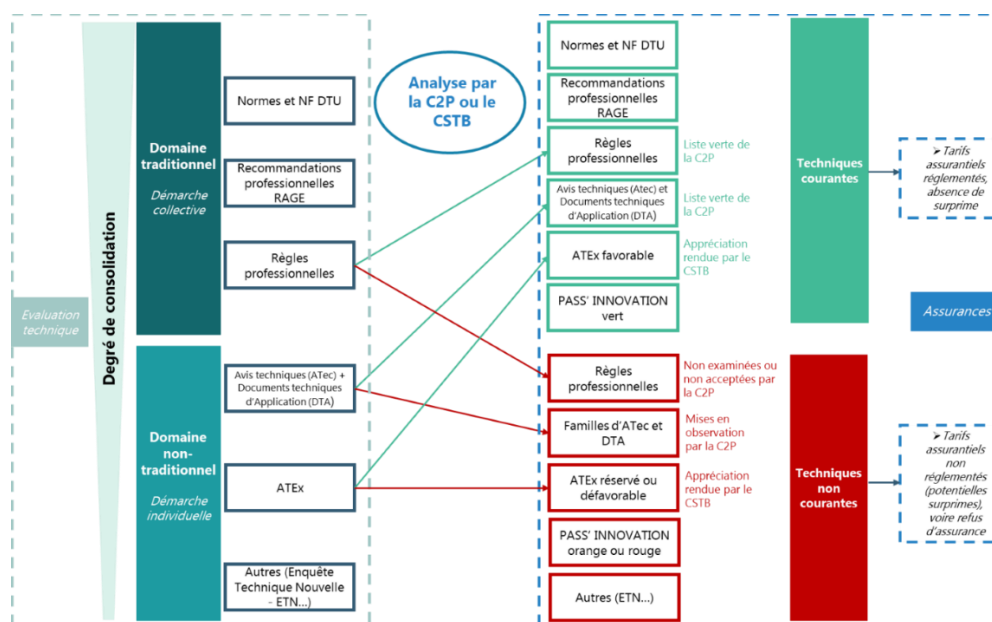


Figure 2: Technical assessments and insurability criteria



Objet de la démarche	Type de démarche		Nom	Objet / Périmètre / Cas de figure	Organisme.s agréé.s (accréditéur)	Délai d'obtention	Durée de validité	Coûts de l'accréditation (instruction du dossier, hors essais techniques)		
Matériaux / produits	Normes européennes	Démarches collectives	Normes harmonisées européennes (marquage CE), d'après le Règlement Produit de Construction (RPC)	Atteste des performances techniques d'un matériau pour un usage donné	Comité technique européen de rattachement (par exemple : TC 88 pour l'isolation thermique) et le Comité Européen de Normalisation (CEN)	3 ans maximum entre la prise du sujet et le vote formel	Tous les 5 ans, la norme européenne harmonisée est soumise à un examen systématique pour évaluer si elle doit être révisée, annulée ou confirmée. Un membre de la commission peut toutefois demander la révision d'une norme à n'importe quel moment ; et ce dès le lendemain de la parution s'il le souhaite	Frais d'adhésion à AFNOR Normalisation (financement au siège/an) suivant un barème variable : exonération des frais d'inscription (valable pour les PME, les universitaires) ou jusqu'à 5000€ à l'année (ex : les grandes entreprises). Ces frais d'inscriptions sont établis à partir d'une grille de tarifs et sont révisés chaque année.		
			Evaluations techniques européennes	Atteste des performances techniques d'un matériau pour un usage donné	Organisme d'évaluation technique (OET) d'un pays de l'UE	De 6 à 9 mois si il existe un document d'évaluation européen. Certains essais peuvent néanmoins allonger ce délai.	5 ans	Les coûts d'élaboration et d'adoption des documents d'évaluation européens sont intégralement pris en charge par les organismes d'évaluation technique, en collaboration avec l'organisation des OET. Les coûts relatifs à l'évaluation technique européenne sont pris en charge par le fabricant demandeur de l'ETE.		
			DTU et normes NF	La procédure à suivre et du même type que pour une norme harmonisée mais reste à un niveau national. Tout acteur économique peut proposer un projet de norme qui sera soumis à une commission de normalisation.	LES NF DTU sont élaborés par des professionnels au sein de bureaux de normalisation (principalement le BNETC15 et BNBA16) sous l'égide du CGN/Bat-DTU.	3 ans	Périodiquement révisée	nc		
	Normes nationales	Démarches individuelles	Règles professionnelles	Rédigées par les professionnels des filières concernées.	La C2P identifie les risques de sinistres	De 12 à 36 mois en fonction de la complexité de la technique et du champ d'application retenu.	Illimitée	30,000 €		
			ATEC	Produit	Commission Chargée de Formuler les Avis Techniques (CCFAT), de laquelle est membre le CSTB. Le CSTB assure l'instruction technique des dossiers et le secrétariat de la procédure.	9 mois en moyenne	De 2 à 7 ans renouvelable et modifiable	De 7 000 € à 25 000 € HT selon la complexité du procédé et la diversité des domaines d'emplois envisagés. Il faut également ajouter des frais d'essais ou d'ingénierie pour la conception et les calculs.		
			DTA (Document Technique d'Application)		Le DTA étant une forme particulière de l'ATEC, les mêmes règles d'instruction et d'évaluation s'appliquent.					
			ATEX type A	Produit	Le dossier du demandeur est instruit par le CSTB ou le contrôleur de l'opération, qui le présente devant un Comité d'ATEX	De 3 à 6 mois (ce délai comprend les échanges avant la réception du dossier. A compter de la réception du dossier complet, le comité est réuni sous environ 1 mois.	2 à 3 ans (la durée de validité dépend du risque estimé par le comité)	De 14 000 € à 20 000 € HT		
			ATEX type B	Technique constructive	Le dossier du demandeur est instruit par le CSTB ou le contrôleur de l'opération, qui le présente devant un Comité d'ATEX	Valable pour toute la durée de l'opération	Chantier unique	De 8 000 € à 11 000 € HT		
			ATEX type C	Technique constructive	Le dossier du demandeur est instruit par le CSTB ou le contrôleur de l'opération, qui le présente devant un Comité d'ATEX	Valable pour toute la durée de l'opération	nc	Environ 3 000 € HT		

Table 1: Summary of technical assessments

2.2 Procedures in the regulatory field

2.2.1 CE marking

CE marking is one of the few regulations directly applicable to construction products (along with the decree on the labelling of construction products on their volatile pollutant emissions). However, other regulations on works (earthquake, fire, acoustic, thermal, disabled access



regulations, etc.) may have an influence on the implementation of the product (characteristics necessary to be applicable in such cases)⁵.

The CE marking is issued by a European body accredited by CEN. Regulation (CE) N° 765/2008 of 9 July 2008 lays down the general principles of CE marking. It gives products the right to free movement throughout the EU without any further formality, national safety standard or new test being required.

CE certificate of conformity is a recognition of the performance of the product for a given use: it must be issued in order to obtain the CE marking and supports the Declaration of Performance that the manufacturer must draw up for any construction product covered by a harmonised standard or in conformity with a European Technical Assessment (ETA) to which it has been subject.

It should be noted that two families of products are subject to harmonised standards and are therefore subject to CE marking: **wood fibre insulation** and **cellulose-based loose-fill insulation**. Another project is underway since 2019: insulation in boards or rolls based on plant fibres.

2.2.2 European Technical Assessment

The European Technical Assessment is progressively succeeding the European Technical Approvals. It is issued by a technical assessment body. A European Technical Assessment certifies that a product not covered by a European harmonised standard meets sufficient criteria to be eligible for CE marking, according to special normative references, the ETAGs (from the former Construction Products Directive) and the European Assessment Documents (EADs - from the Construction Products Regulation, which came into force in 2013).

EPDs (Environmental Product Declaration) also make it possible to communicate on the environmental and health performance of construction products. This is done by carrying out a life cycle analysis (LCA) within the very precise framework of the European standard EN 15804 and its national annex (formerly French standard NF P01-010).

In addition, since 1 January 2014, whenever an environmental communication accompanies the marketing of a product intended for the building industry, the manufacturer is required to issue an environmental declaration providing the complete environmental profile of the product based on the life cycle analysis.

2.3 Procedures in the normative field

In France, the recognition of constructive solutions is based on the identification and reliability of **3 types of technical information**:

- Product **performance** (materials, components, systems)
- The **design** of structures (justification and requirement thresholds);
- The **installation** of the products in the structure (DTU for example).

⁵ <https://www.economie.gouv.fr/dgccrf/Publications/Vie-pratique/Fiches-pratiques/Le-marquage-CE>



A product is considered "traditional" when it is subject to the three generic and collective "product - design - installation" reference systems (product standards, regulations, DTU, etc.).

On the other hand, when at least one of the three collective reference systems does not exist for a construction product, it is said to be "non-traditional" and **must be subject to a specific validation in order to create the missing reference system(s)**.

In France, the usual way of validating **non-traditional products** (often new) is through the *Avis Technique* (AT) or the *Document Technique d'Application* (DTA), which are procedures managed by the CSTB.

If a product and its implementation correspond to existing standards such as NF DTU or professional rules, it is considered traditional. If not, it is considered as "non-traditional": this is the case for innovative products, for which a file must be compiled to prove that the technique complies with the claimed performance and that it will ensure the safety of people at all times. This is the role of technical assessment.

The technical assessment procedures allow several pieces of evidence on construction techniques to be presented to a peer review so that they can be classified as 'current' or 'non-current'. Technical assessment provides an opinion on **the fitness for purpose of new techniques**. Common techniques are then normally guaranteed by insurance contracts, while non-common techniques require a prior declaration (a contractual notion that can vary from one insurer to another). Non-current techniques therefore include innovative products or systems that do not yet benefit from sufficient feedback or techniques covered by documents, such as professional rules, that have not been accepted by the C2P.

Technical Opinions (ATec) and Experimental Technical Assessment (ATEx) are authorised opinions on products and processes whose new or innovative nature does not allow them to be standardised (i.e. in the traditional field). They are not regulations. These notices deal with techniques that fall within the non-traditional domain.

When a non-traditional product benefits from a CE marking which provides information on its intrinsic performance, it is advisable to associate a DTA which provides the necessary information for the "design" and "installation" parts.

The Professional Rules are non-normative documents which are nevertheless recognised by the professions and insurers and which make it possible to "traditionalise" construction techniques.

2.3.1 Technical Application Documents (DTA - *Documents Techniques d'Application*)

The Technical Opinion (TAc) and the Technical Application File (TAD) are information documents providing an authorised opinion on the foreseeable behaviour of the works carried out with the products and processes concerned, so as to enable the various users to take their decisions and responsibilities in full knowledge of the facts.

The DTA is in fact a particular form of Technical Notice, it designates the notice formulated for the use of a product or component covered by the CE marking (product covered by an ETA or a harmonised product standard).

The technical opinion issued is the result of a collegial evaluation of the foreseeable performance of an innovative process, taking into account :

- The products/materials used



- The size of the structure
- The method of execution/implementation.

The majority of bio-based insulation products and certain prefabricated products have a technical opinion: insulation made from wood fibres, hemp, flax, recycled cotton, wadding; in panels or rolls and in bulk.

2.3.2 Technical opinions (ATec)

The ATec is a written opinion on the suitability for use, durability and compliance with the regulations in force of a material or an industrialised process. It relates to the composition, structure and form of a product clearly identified by its commercial brand and technical references. The opinion is a response to a **voluntary request from an industrialist**, received by the Scientific and Technical Centre (CSTB) and examined by specialised groups of experts (GS).

The opinions are issued by the "Commission responsible for formulating ATecs" (CCFAT)³. Since 2012, an application for a ATec has taken an average of 9 months to process. In particular, the risk of accidents must be assessed. The cost, depending on whether it is a first application, a revision with a time extension, without a time extension, or an identical renewal, varies between 4,000 and 15,000 euros excluding tax.

Nevertheless, an ATec **does not provide any guarantee and does not release manufacturers and construction companies from their responsibilities**. Its validity is moreover limited in time and may be accompanied by reservations as to the conditions of use of the product or of implementation.

It should be noted that the ATec procedure requires, for the opinion to be constructive and sufficiently credible for the client, the prescriber, the foreign importer, the insurance company, etc., that serious justifications be provided, which often take a long time to gather. In addition, it requires that the applicant be consulted before and after the Opinion is formulated, which adds to the time required before the Opinion becomes operational. In order to reduce the difficulties encountered by the promoters of new techniques, it was therefore decided to make available to innovators, under the aegis of the CSTB, **a rapid procedure for the technical assessment of any product, process or equipment that is not yet the subject of a ATec** and whose development requires experimental use on one or more construction sites: this is the ATE_x.

2.3.3 Experimental Technical Assessment (ATE_x)

The ATE_x is a procedure intended for non-traditional products and processes for which **the examination of an ATec requires experimental use**. It is a sort of preliminary stage to the appraisal of a Technical Notice, with the aim of securing innovation at a **theoretically reduced cost and time** by identifying the risks of damage. The cost of the appraisal varies between 4,000 and 15,000 euros excluding tax, or even more if the applicant wants maximum support during the procedure. Approximately one hundred ATE_x are issued each year, most often by the company working on the corresponding site⁶.

The ATE_x is a **dossier-based assessment**, which means that the applicant must compile a file of evidence so that a panel of experts, known as the ATE_x Committee, can decide on the following aspects:

⁶ <https://evaluation.cstb.fr/fr/appreciation-technique-expertise-atex/demander/>



- Feasibility;
- Safety;
- Risk of disorder;
- Ability to meet a regulation.

At the end of the committee meeting, the ATEEx can be favourable or unfavourable. There are three types of ATEEx: ATEEx of case a, b and c.

2.3.3.1 ATEEx of case « a »

The ATEEx of case "a" concerns a **product or a process applied on different building sites for a limited period of time**.

This ETA is issued on the basis of elements provided by the applicant and concerns:

- The characteristics of the new innovation to be tested and its field of use;
- The nature and importance of the experimentation considered necessary, either for its development, or to constitute sufficient references before the submission of a Technical Notice application;
- The ATEEx of case "a" cannot generally be extended, so the applicant wishing to access the Technical Notice must take this into account and submit his application at least 8 months before the expiry of his ATEEx.

To apply for an ATEEx case a, the applicant must **compile a general technical file**, which justifies the three aspects to be studied (feasibility, safety, risks of disorder, and possibly suitability to comply with a regulation). This file is examined by the CSTB or the controller of the operation, who presents it to an ATEEx committee which formulates the ATEEx.

2.3.3.2 ATEEx of case « b »

The ATEEx of case "b" concerns an **identified implementation project, i.e. the application of a construction technique on a specific building site**.

The applicant must provide the following elements:

- The nature, the importance and the location of the building site concerned;
- The technique used and the justification of its suitability for use;
- The name of the project owner and the technical controller concerned.

The applicant must compile a technical file specific to a given operation, which makes it possible to justify the three aspects to be studied (feasibility, safety, risks of disorder, possibly suitability to comply with a regulation). This file is examined by the controller of the operation, who presents it to an ATEEx committee which formulates the ATEEx.

2.3.3.3 ATEEx of case « c »

The ATEEx type "c" applies to a new experimental realisation of one or more techniques having previously been the subject of a favourable ATEEx type "b".

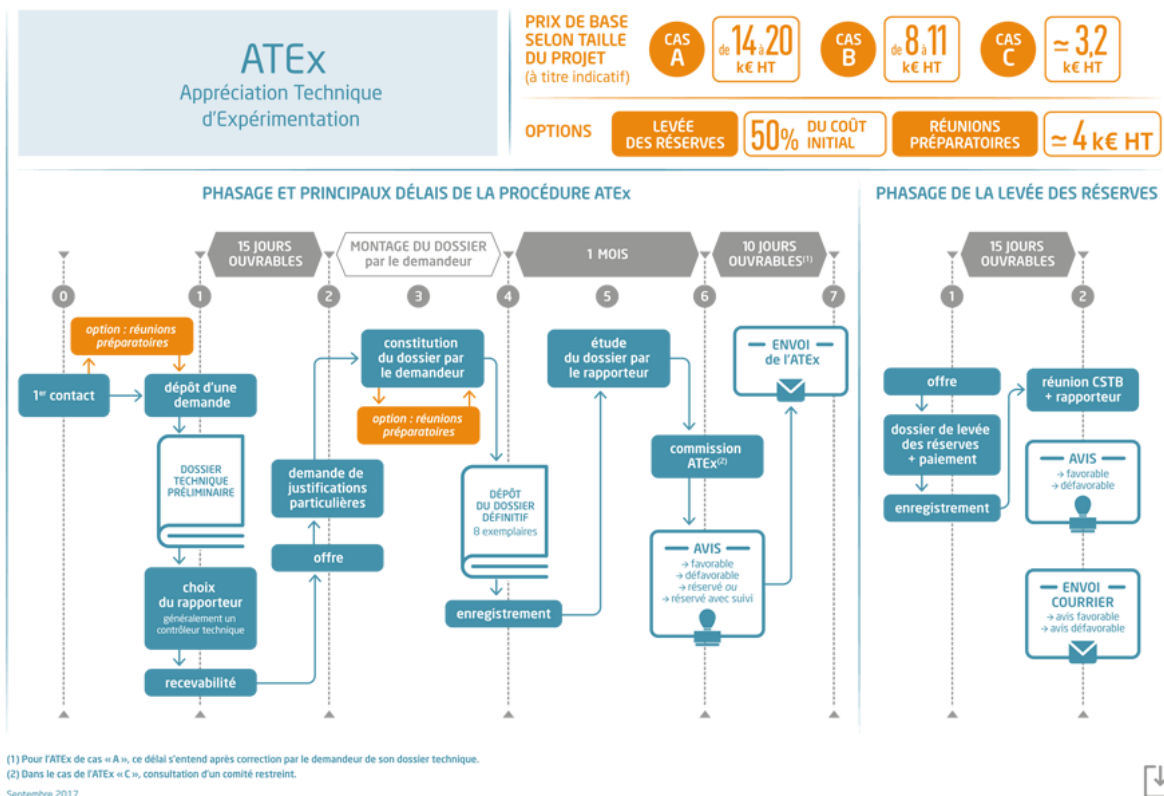


Figure 3: Price and time to obtain ATEx (CSTB)

2.3.4 Professional rules

The Professional Rules formalise a set of "good practices" that enable the construction of a compliant and durable work. They are drafted by professionals representing the entire sector who wish to put into practice a common experience.

The work described in the Professional Rules accepted by the C2P is treated as standard technique by the insurers.

There are two types of professional rules: those that are monitored over time and those that are not. This monitoring over time functions as an observatory of typical works which presents the evolution of buildings over the years and in particular the response to climatic elements, summer/winter comfort, maintenance costs, energy, user comfort and disorders if any. This observatory must be set up within two years of the validation of the professional rules by the *Agence Qualité Construction*. Once completed, it must be presented to the C2P commission, the product prevention commission, which will judge the relevance of the work done.

2.3.5 The RAGE professional recommendations

The RAGE (*Règles de l'art Grenelle Environnement*) Professional Recommendations are technical reference documents, prefiguring a preliminary draft NF DTU, on a key technical solution improving the energy performance of buildings. Their purpose is to contribute either to the revision of a NF DTU currently in force, or to the drafting of a new NF DTU. These new reference texts are recognised by insurers as soon as they are approved.



The **RAGE Professional Recommendations**, Guides and Worksite Calepins are technical reference documents made available free of charge to building professionals. They are developed and distributed within the framework of the PACTE programme.⁷

Launched by the public authorities in 2015, the Action Programme for the Quality of Construction and the Energy Transition (PACTE) aims to identify efficient technologies, to deploy them and to share tools for experimentation and feedback on the energy performance of buildings, with regard to the observed loss of life. The PACTE programme takes over from the RAGE 2012 programme.

Within the framework of these two programmes, CTICM has drawn up, in collaboration with professional organisations and actors of the metal sector, several reference documents: Professional Recommendations, Guides and Calepins. Other actions are underway, including the creation of a *Catalogue Construction Métallique*.

By referring to the NF P03-001 standard entitled "*Cahier des clauses administratives générales applicables aux travaux de bâtiment faisant l'objet de marchés privés*", the contractors of a construction operation undertake to use products and processes with an ATec in force in the event of the use of non-traditional products and/or processes (or, failing that, an agreement expressly noted by the parties).

2.3.6 Labels and EHDS

Several labels can be affixed to products in addition to certifications in order to communicate their performance, such as the European Ecolabel, NaturePlus ...

- **EHDS - Environmental and Health Declaration Sheet:** Any product placed on the building market making environmental claims must be accompanied by an ESDS qualifying the environmental impact of the products. These data sheets bring together the **environmental and health information available** on the products in question for each stage of their life cycle. These data are declared voluntarily by product manufacturers and professional associations and, since July 2017, are subject to verification by an independent third party. They present the results of the product's Life Cycle Assessment. The ESDSs are used to estimate the environmental and health performance of the building and thus to identify ecodesign areas. All verified ESDSs are available in free access on the INIES database (1,113 ESDSs as of 31/05/2018).

The standards for building insulation work with boards and rolls are summarised here:

- <https://norminfo.afnor.org/structure/bntecp75f/travaux-disolation-des-batiments-par-panneaux-et-rouleaux/123197#activite>
- <https://norminfo.afnor.org/norme/nf-dtu-4510-p1-1/travaux-de-batiment-isolation-des-combles-par-panneaux-ou-rouleaux-en-laines-minerales-manufacturees-partie-1-1-cahier/127225>

2.3.7 The opinion of the C2P

The Product Prevention Commission (C2P), led by the *Agence Qualité Construction*, evaluates construction techniques and classifies them in two categories: **standard technique** (listed in the green list) or **non-standard technique** (technique not evaluated or subject to observations).

⁷ https://www.afpac.org/Recommandations-RAGE_a138.html



As soon as a technique is said to be "non-standard", it is likely to be subject to special insurance conditions.

The C2P **green list** lists construction products and/or processes with a valid ATec or **Technical Application Document** (DTA), which are not subject to observation and are therefore considered as standard techniques by insurers. As such, they are not subject to any special insurance conditions.

Products and processes under Technical Notice which are not under observation by the Commission Prévention Produits (C2P) of the Agence Qualité Construction (AQC), are qualified as "common techniques" and therefore normally benefit from the same insurance conditions from insurers as those applied to traditional fields, such as those covered by a standard or a DTU. Favourable ATEXs are treated as "standard techniques" by insurers because they allow them to take risks into consideration on the basis of rigorous elements.

The C2P brings together members of the following professional organisations:

- AFOCERT (*Association Française des Organismes de Certification des Produits de Construction*),
- AIMCC (*Association des Industries de Produits de Construction*),
- BNTEC (*Bureau de normalisation des techniques et équipements de la construction du Bâtiment*),
- CAPEB (*Confédération de l'Artisanat et des Petites Entreprises du Bâtiment*),
- CFEC (*Compagnie Française des Experts Construction*),
- FILIANCE (*Association professionnelle qui réunit les plus grands acteurs du Testing, Inspection, Certification*),
- CSTB (*Centre Scientifique et Technique du Bâtiment*),
- FFA (*Fédération Française de l'Assurance*),
- FFB (*Fédération Française du Bâtiment*).

2.4 The case of bio-based insulation

The notion of biobased materials characterises materials that are entirely or partially derived from living organisms. This includes raw materials derived from plant biomass (e.g. straw) or animal biomass (e.g. sheep's wool), and excludes so-called "geosourced" materials (e.g. raw earth or stone), although fibrous earth materials (e.g. cob) can logically be included in this family. Biobased products have a low carbon footprint. Little energy is required for their manufacture. As they are made from renewable raw materials, their use helps to preserve natural resources. They store a significant amount of carbon during their life in a building, and are potentially recoverable at the end of their life.⁸

There are three main types of insulation:

- rigid insulation, in the form of panels;
- semi-rigid insulation, in the form of flexible batts or wool;
- loose insulation.

⁸ Comité National pour le Développement du Bois (CNDB), *Construction bois et isolants biosourcés*, Juin 2021



Hemp-derived products such as hemp chips and wools all have EC marking, health labelling and environmental declaration sheets on emissions of organo-volatile compounds in particular. These documents are mandatory and comply with French regulations.

Secondly, various standards govern hemp construction. Only test standards exist for hemp-based materials, and certain loose insulation materials, such as loose wool, are covered by standard 15101 on insulation products for buildings. Professional rules are also normative documents, which once accepted by the C2P, allow the material to enter the traditional domain. Some hemp-based construction products also benefit from certifications, such as insulating wools. Some manufacturers have obtained ACERMI certification for their insulating wools. This certification guarantees the thermal performance of their materials.⁹

⁹ Construire en chanvre, *Guide des Bonnes Pratiques Tome 1 : Préconisations techniques, optimisations et performances*, 2015.



2.5 Voluntary certification in France

In addition to the technical assessment procedures, which are not compulsory but are strongly recommended in order to allow standard access to insurance (compulsory as soon as a professional is involved) and to reassure and convince clients, voluntary certification procedures can also be undertaken in order to penetrate or consolidate a position on the market.

A benchmark of the main voluntary certifications in France has been carried out and is presented in the table below. It should be noted that some certifications relate to the buildings themselves and not to the products used. For information purposes, 3 of the main certifications relating to constructions have nevertheless been mentioned.

Objet de la démarche	Type de démarche	Nom	Texte réglementaire et/ou organisme / entité créatrice / gestionnaire	Objet / Périmètre / Cas de figure	Organisme.s agréé.s (accréditeur)	Délai d'obtention	Durée de validité	Coûts de l'accréditation (instruction du dossier, hors essais techniques)
Matériaux / produits	Certifications volontaires & labels	Label Produit Biosourcé	Karibati (entreprise ESUS)	Pourcentage de masse biosourcée dans la masse totale	Entreprise Karibitati en France, cluster eco-construction en Belgique	? (durée d'un audit)	2 ans	Environ 2500€ HT par produit
		OK biobased	TUV Austria	Pourcentage de matière renouvelable d'un produit	TUV Austria	6 semaines environ	nc	En fonction du produit
		Biobased content	NEN (sur la norme européenne EN 16785-1:2015)	Biomasse contenue dans le produit	NEN	nc	nc	nc
		NaturePlus	Cahier des charges NaturePlus	Technique constructive	NaturePlus (association internationale d'origine allemande).	nc	nc	nc
		Ecolabel européen	Union Européenne	Reconnu partout dans l'UE	AFNOR en France	En fonction du produit, de sa catégorie et donc de l'écolabel visé	En fonction du produit, de sa catégorie et donc de l'écolabel visé	En fonction du produit, de sa catégorie et donc de l'écolabel visé
		Nordic Swan	Créé par une initiative publique du Danemark, de la Suède, de la Norvège, de la Finlande et de l'Islande	ACV	Nordic Swan	Le temps d'un audit	1 an	3000€ minimum au moment de la labellisation. 2000€ minimum par an ensuite
		Ange Bleu	Tous les biens sauf industrie pharmaceutique et alimentation	Réduction des effets néfastes sur l'environnement.	Jury Umweltzeichen (regroupe 13 associations allemandes)	Le temps d'un audit	1 an	En fonction du CA, de 320 à 10500€ par an
Bâtiments	Certifications volontaires & labels	Bâtiment biosourcé	MTE, Arrêté du 19 décembre 2012	Taux d'incorporation des matériaux biosourcés dans les bâtiments	Organisme agréé par l'Etat	Pendant la phase de conception du bâtiment	Durée de vie du bâtiment	10000€ en moyenne
		Bâtiment Bas Carbone	Association BBC	Bâtiments neufs et rénovés.	4 BET agréés	Pendant la phase de conception du bâtiment	Durée de vie du bâtiment	10000€ en moyenne
		Passivhaus	International Passive House Association	Garantit la performance énergétique d'un bâtiment	International Passive House Association	nc	nc	nc

Tableau 2 : Synthèse des certifications volontaires en France



2.6 Conclusion for the BIO-CIRC prototypes in France

Considering the above elements, a potential manufacturer should be considering following the steps in order to advance with getting one or several of the prototypes developed through the BIO-CIRC project onto the market in France:

- Produire une **FDES** (Fiche de déclaration environnementale et sanitaire) par prototype.
- Du point de vue des évaluations techniques, obtenir successivement :
 - Une ou plusieurs **ATEX (Appréciation Technique d'Expérimentation) de type b** ;
 - Une **ATEX de type a** ;
 - un **ATec (Avis Technique)**.
- Consider certifying the product to an **internationally recognised product label** which has a holistic focus on aspects such as health & wellbeing, circularity and whole life cycle characteristics, such as **Natureplus**.



3 The UK regulatory and certification ecosystem

3.1 Standards and certifications

This section introduces the ecosystems of standards and certifications in the UK.

3.1.1 Building regulations

There are three sets of Building Regulations in force in the UK covering England & Wales, Scotland and Northern Ireland. All three provide regulations for materials and workmanship and provide similar guidance on ways to establish fitness of materials.

3.1.2 British Standards

Currently most, but not all British standards are British versions of harmonised European standards. The potential now exists for divergence between British standards and European standards. It is feasible if standards diverge sufficiently, that European standards may cease to be valid in the UK. Standards are currently equivalent but this should be a consideration as part of any long term strategic planning.

3.1.3 The Code for Construction Product Information

The Code for Construction Product Information developed by the Construction Product Association's Marketing Integrity Group, sets a level playing field for all construction product manufacturers to ensure that the information they provide passes five tests:

- Clear
- Accurate
- Up-to-date
- Accessible
- Unambiguous

In response to the Grenfell disaster, Dame Judith Hackitt published a report in 2018 – Building A Safer Future. The report confirmed radical change was needed for construction products, particularly in the areas of testing, information and marketing.

The Code has been published alongside manufacturer preparation information and Code guidance to drive higher standards in the presentation of construction product information in the manufacturing industry.

Management of the published Code and its verification has been formally handed over from the Construction Products Association to Construction Product Information Ltd.

3.1.4 Other national and international technical specifications

An international technical specification, including those prepared by ISO, or a national technical specification of a country other than the UK, may be used to demonstrate that a product not covered by a harmonised European standard or British standard meets the performance requirements of the Building Regulations.



3.1.5 Independent certification schemes

Although independent certification schemes provide an effective means of demonstrating fitness for purpose, products which are not certified by an independent scheme may still conform to a relevant standard.

Accreditation of a certification body by a national accreditation body belonging to the European co-operation for Accreditation (EA) provides a means of demonstrating that their certification scheme can be relied upon. Under an amendment to its articles UKAS remained a member of EA until the 31st January 2022. This has a bearing on exports from the UK to EU-27 countries. In addition, UKAS is also UK approved body, equivalent to an EU notified body. The requirements for CE, UKCA or UKNI marking do not apply to independent certification schemes.

3.1.6 Tests and calculations

Where there is no relevant harmonised European standard, tests, calculation or other means may be used to demonstrate that the material can perform the function for which it is intended. Following Brexit, UKAS or an equivalent UK approved body may accredit the testing laboratories as means of showing that the tests can be relied on.

3.1.7 Past experience

Past experience, such as in a building in use, may show that the material is capable of performing the function for which it is intended.

3.1.8 Sampling

Local Authorities have the power to take samples of materials either used or to be used in building work, to establish if that material complies with the provisions of the Building Regulations.

3.2 Marking/labels

3.2.1 CE Marking under the Construction Products Regulation

It should be noted that in Great Britain, the CE mark will be replaced by the UK Conformity Assessment (UKCA) mark from 1st January 2021 although there is a transition period allowing the use of the CE mark until the 1st January 2022. Similarly, the CE mark will be replaced in Northern Ireland with the UKNI mark.

3.2.2 CE Marking under other EU directives and regulations.

As above, it should be noted that in Great Britain, the CE mark will be replaced by the UK Conformity Assessment (UKCA) mark from 1st January 2021 although there is a transition period allowing the use of the CE mark until the 1st January 2022. Similarly, the CE mark will be replaced in Northern Ireland with the UKNI mark.



3.2.3 UKCA Mark

From the 1st January 2023, CE Marking will no longer be accepted on most new products placed on the market in Great Britain and UKCA will be required. The UKCA (UK Conformity Assessed) marking is a new UK product marking that is used for goods being placed on the market in Great Britain (England, Wales and Scotland). It covers most goods which previously required the CE marking, known as 'new approach' goods.

The technical requirements that must be met and the conformity assessment processes and standards that can be used to demonstrate conformity – are largely the same as they were for the CE marking. The circumstances for self-declaration of conformity for UKCA marking are the same as for CE marking.

3.2.4 BBA Agrément Certificate

BBA Agrément Certificate is a mark of excellence based on rigorous national and European standards that validate a construction product's specialist formulation, capability and uniqueness.

The BBA is a market-leading UKAS-accredited product certification body [No.0113] to BS EN ISO/IEC 17065:2012, testing laboratory [No.0357] to BS EN ISO/IEC 17025:2017, management systems certification body [No.0113] to BS EN ISO/IEC 17021:2015 and inspection body [No.4345] to BS EN ISO/IEC 17020:2012 within the UK, setting the standard for excellence within the construction industry for products and systems and offering technical expertise and independent 3rd party certification.

3.2.5 Environmental Product Declarations (EPD)

An Environmental Product Declaration (EPD) provides environmental information about a product in a standardised format using a consistent methodology. For construction products in Europe, the European standard EN 15804 provides the format and methodology.

The UK Government has committed to reducing UK Carbon emissions to net zero by 2050 through a legally binding amendment to the Climate Change Act.

Meeting this goal requires us to rapidly address the embodied carbon associated with the extraction, manufacture, transport, use and end of life of construction products (which accounted for 33.6 million tonnes of CO₂ in 2010), emphasising the need for credible and verifiable EPD for all construction products.

It is envisaged by 2022 that EPD will become mandatory as will mandatory assessment and reporting of whole life carbon for public buildings and the incentivisation of assessment and reporting of whole life carbon for private buildings.

Aside from embodied carbon, EPD has the ability to inform many aspects of sustainability at a product and building level as well as influencing many aspects of the entire supply and value chain. The need for credible and verified EPD has never been greater.

The number of construction product EPD has grown steadily since 2012. In 2019 there were over 7000 downloadable EPD to EN 15804 within EPD Programmes. The largest number are in France (inies, PEP ecompassport), Germany (IBU) and the USA (UL Environment).

At the start of 2021, there are 360 EPD using EN 15804 for UK produced products, from over 60 manufacturers and UK trade associations, covering a wide range of construction products.



3.2.6 NHBC Accepts

NHBC Accepts is a comprehensive review service for innovative products and systems. It is the fast-track route for acceptance of products and systems for use in homes covered by all NHBC warranty and insurance policies, equivalent to around 70-80% of the new homes built in the UK each year. NHBC is the UK's leading independent provider of warranty and insurance for new homes.

An NHBC Accepts logo shows that an innovative product or system has been rigorously assessed and that NHBC considers it can meet their robust NHBC Standards. It also demonstrates that, subject to appropriate design and installation, the system or product can be used in homes covered by NHBC warranty products.

3.2.7 LABC Assured

LABC Assured (previously Registered Details) is a one-off building regulations and standards assessment process for England, Wales and Scotland.

Following the UK Government's announcement on 19th January 2021 that a new regulator was to be established in respect of construction materials within the Office for Product Safety and Standards (OPSS), together with the details emerging from phase 2, module 2 of the Grenfell Tower Public Inquiry, the LABC Board of Directors instigated a comprehensive review of the LABC Assured scheme. This review, conducted in accordance with the general criteria within ISO 10965:2012, has now concluded and its findings reported to the LABC Board, who have resolved that the LABC Assured scheme should be discontinued.

3.2.8 Cradle to Cradle Certified

Cradle to Cradle Certified® is the global standard for products that are safe, circular and responsibly made. Cradle to Cradle Certified assesses the safety, circularity and responsibility of materials and products across five categories of sustainability performance:

- Material Health: ensuring materials are safe for humans and the environment
- Product Circularity: enabling a circular economy through regenerative products and process design
- Clean Air & Climate Protection: protecting clean air, promoting renewable energy, and reducing harmful emissions
- Water & Soil Stewardship: safeguarding clean water and healthy soils
- Social Fairness: respecting human rights and contributing to a fair and equitable society.

There are a number of certified products listed on the C2C directory, including many from companies based in the UK and France - <https://www.c2ccertified.org/products/registry>.

3.2.9 Natureplus

The international association natureplus e.V. developed the natureplus eco-label in order to offer consumers and construction professionals in Europe clear selection guidance for products in the building sector. It attests compliance with high standards of quality for all areas relevant to sustainability.



Currently, the natureplus eco-label has been awarded to over 600 building products in Europe and is recognized across Europe by building specialists, consumers environmental organisations, government bodies and building evaluation systems.

The assessments to verify the requirements are conducted by accredited laboratories and assessors in line with recognized international standards. The natureplus eco-label is the only European environmental label for building products that is founded on strict scientific criteria and it is based on three key pillars:

1. Clean and efficient production: The manufacture of the building products is environmentally friendly and energy efficient. It helps to protect the climate, avoid CO2 emissions and meet social responsibility standards. The products must be functional and recyclable.
2. Protection of the environment and health: Building products with the natureplus label do not adversely affect the environment or human health through harmful substances and ensure, in particular, healthy indoor living spaces.
3. Sustainability of resources: Only building products made from renewable resources or mineral raw materials that are available in abundance or secondary raw materials are permissible. The raw materials must stem from sustainable sources.

3.2.10 Eurofins

Eurofins "Indoor Air Comfort" (IAC) product certification is a well-established tool to show compliance of a product with low VOC emissions criteria set out in Europe on two levels:

- Standard level "Indoor Air Comfort - certified product" shows compliance of product emissions with the criteria of all legal specifications issued by authorities in the European Union and its Member States.
- Higher level "Indoor Air Comfort GOLD - certified product" shows additional compliance of product emissions with the criteria of many of the voluntary specifications issued by most relevant ecolabels and similar specifications in the EU and requirements for sustainable building certifications. Therefore certified products are those with the best-in-class low emissions, thus good for indoor air quality.

Indoor Air Comfort Gold certificates are directly accepted as proof from programs for sustainable buildings like BREEAM international and LEED.

3.2.11 BES 6001

BES 6001 has been published to enable construction product manufacturers to ensure and then prove that their products have been made with constituent materials that have been responsibly sourced. The standard describes a framework for the organisational governance, supply chain management and environmental and social aspects that must be addressed in order to ensure the responsible sourcing of construction products.

Independent, third party assessment and certification against the requirements of BES 6001 then give the organisation the ability to prove that an effective system for ensuring responsible sourcing exists and added credibility to any claims made.

BES 6001 is relevant to any organization that manufactures construction products from foundation products such as cement and steel to concrete pipes and blocks, windows, flooring, roof tiles, plastics, wood products.



3.2.12 Declare

Declare is a nutrition label for building products. It is designed to help specifiers quickly identify products that meet their project requirements. Declare labels disclose all intentionally-added ingredients and residuals at or above 100ppm (0.01%) present in the final product by weight. Each ingredient must be reported with a chemical name, CAS number, and percentage or percentage range.

In addition to the LBC Red List, the Declare label demonstrates alignment with other requirements within the Living Building Challenge and Core Green Building Certification, as well as LEED and WELL certifications.

3.2.13 ISO standards

Businesses and their manufacturing facilities can be certified to internationally recognised ISO standards such as 9001 (quality management) and 14001 (environmental management systems)

3.2.14 Made in Britain

Made in Britain is a non-profit organisation which brings together the British manufacturing community, united with the use of the registered collective mark. Their marks are protected and can only be used under licence by their members, and within their published terms & conditions. All companies that apply to use the Made in Britain mark or the Made in Britain Northern Ireland mark may be asked to submit written evidence of where they manufacture their products. A Made in Britain mark is accredited to businesses that manufacture goods in Great Britain or Northern Ireland.

3.2.15 BRE Green Guide

The BRE Green Guide to Specification presents information on the environmental impacts of building elements and specifications by ranking them on an A+ to E rating scale. These environmental rankings are based on life cycle assessments (LCA). They are generic rankings that illustrate a range of typical materials.

3.3 Building standards

There are number of international building standards that are relevant to the UK context.

3.3.1 BREEAM

BREEAM (Building Research Establishment Environmental Assessment Method) is a sustainability assessment method created by BRE that is used to masterplan projects, infrastructure and buildings. It sets standards for the environmental performance of buildings through the design, specification, construction and operation phases and can be applied to new developments or refurbishment schemes.

In order to demonstrate compliance with the relevant BREEAM criteria, the performance of specific products or materials must generally be considered in the context of each assessed building.



BREEAM is a building level certification scheme and as such, there are no “BREEAM certified” products. BREEAM recognises processes that evaluate/test the environmental performance or responsible sourcing of specific products. BREEAM provides credits where the process, and in some cases the performance, meet a specific standard.

Examples of this include credits available under the Materials category, where projects include products covered by a verified Environmental Product Declaration (EPD). There are also credits available for products that do not exceed specific VOC emission levels. standards.

3.3.2 LEED

Similarly to BREEAM, Leadership in Energy and Environmental Design (LEED) is a green building certification program used worldwide. Developed by the non-profit U.S. Green Building Council (USGBC), it includes a set of rating systems for the design, construction, operation, and maintenance of green buildings, homes, and neighbourhoods.

Most LEED certified buildings are located in North America, with only a handful in the UK. Again, LEED do not certify products but sustainable products can contribute to the achievement of certain credits, particularly in the Materials category.

3.3.3 SKA

SKA rating is an environmental assessment method, benchmark and standard for non-domestic fit-outs, led and owned by RICS (Royal Institution of Chartered Surveyors) in the UK. Unlike BREEAM and LEED, SKA provides a Product Compliance Label to help specifiers identify products that meet SKA rating criteria.

3.3.4 WELL

The WELL Building Standard is an international assessment method for buildings with a major focus on health and wellbeing. At the product level, credits can be achieved in the Materials category for products with low VOC levels and EPD.

In November 2016, the International WELL Building Institute (IWBI) and BRE announced an alignment between the WELL Building Standard (WELL) and BREEAM. Combining the two standards is intended to make it easier for projects seeking to conform with them.

3.4 Insurance

3.4.1 Product liability

Product liability insurance is “a type of cover which, in the context of the construction industry, will protect an insured against liability for death/bodily injury (other than to employees) or property damage, resulting from defects in products used in a construction project.”

Businesses which manufacture and/or supply products to be incorporated into a building structure may be at risk of legal action should defects in those products result in damage or injury to the structure in question. Product liability insurance is not a legal requirement but is vital for any business which supplies products to the construction industry.



3.4.2 Other insurance

A range of other insurance products may be required for product manufacturing businesses such as:

- Employers' liability
- Public liability
- Property insurance
- Equipment insurance
- Intellectual property insurance
- Product recall cover
- Cyber insurance

3.5 Conclusion for the BIO-CIRC prototypes in the UK

Considering the above elements, a potential manufacturer should be considering following the steps in order to advance with getting one or several of the prototypes developed through the BIO-CIRC project onto the market in the UK:

- Produce **Environmental Product Declarations (EPD)** for the prototypes to transparently show Life Cycle Assessment (LCA) results. EPD are recognised internationally and it is anticipated EPD will be stipulated in future UK government policy (see proposals by [Construct Zero](#)¹⁰ - 40% of product portfolios to have EPD by 2025 and 100% by 2030).
- Production processes should be validated in accordance to **ISO 9001** and **14001** standards.
- Consider certifying the product to an **internationally recognised product label** which has a holistic focus on aspects such as health & wellbeing, circularity and whole life cycle characteristics, such as **Natureplus** or **Cradle to Cradle**.

¹⁰ https://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2021/07/CZ-Performance-Framework-Version-1-20_7_21.pdf



4 Technology Readiness Level of the prototypes

4.1 TRL at the end of the BIO-CIRC project

The aim of the project was to reach technology readiness level 7 (TRL7). TRL7 is reached when a system prototype is **demonstrated in an operational environment**.

The project reached technology readiness level (TRL7). The prototypes demonstrated compliance to a satisfactory level with the relevant tests, were manufactured on a full-scale production line, delivered to an operational setting, and installed by a qualified operator within the operational setting.

The tests conducted on the prototypes were sufficient to proceed to TRL7, namely:

Material Property	Standard
Bulk Density	EN 1602
Porosity (%)	ISO 15901-1:2016
Thermal Conductivity	ISO 8301:1991 / BS EN 12667:2001
Water Vapor Diffusion Resistance Factor	EN ISO 12572 :2016
Water Absorption Coefficient	EN ISO 15148: 2002
Vapour Sorption	EN ISO 12571:2013
Reaction to Fire	EN 11925-2

The challenge remains to develop the prototypes beyond TRL7 which requires reaching TRL 8 and TRL9. TRL 8 means the system is complete and meets all the relevant certifications and technical requirements for full deployment and TRL9 is reached when the actual system or product is proven in an operational environment.

4.2 TRL8 – System Completed and Qualified

It should be demonstrated that the results from the above tests are **reproducible** across a number of **separate production runs**.

In addition to the EN 11925-2 ignitability test, providing the product passes it should be classed in accordance with the Euroclass fire rating system as an E in line with **EN 13501-1**. Tests would need to be conducted using a **European Accreditation approved test method and test house (UKAS in the case of GB)**.

The production processes need to be validated and included in the relevant **quality and environmental management systems**. This alongside the portfolio tests should be sufficient to proceed with obtaining a technical approval for the product.

In addition, the life cycle assessment should be conducted for the specific product and used to produce a **verified Environmental Product Declaration (EPD) in the UK, and a FDES - Fiche de**



déclaration environnementale et sanitaire in France, that can underpin environmental claims and ensure that design requirements are met.

A number of deployments in an operational environment can be conducted to provide case studies for education and promotional purposes.

4.3 TRL9 – Actual System Proven in an operational environment

This requires integration with **distribution channels** and making commercial decisions, marketing, promotion, and strategic alliances.



5 Sources of information

5.1 Interviews

- Mr Bernard BOYEUX, BioCuild Concept / Végétal(E), 8th November 2021

5.2 Articles and reports

- Comité National pour le Développement du Bois (CNDB), *Construction bois et isolants biosourcés*, 2021
- Construire en chanvre, *Guide des Bonnes Pratiques Tome 1 : Préconisations techniques, optimisations et performances*, 2015
- Fibres Recherche Développement [FRD], *Etude du potentiel de développement des bétons végétaux en France*, 2019
- Direction générale de l'aménagement, du logement et de la nature (DGALN), Direction de l'urbanisme, de l'habitat et des paysages (DHUP), *Les matériaux de construction biosourcés dans la commande publique*, 2020
- IFPEB, Carbone 4, *Brief de filière - biosourcés, messages clés*, 2021

5.3 Websites

- AFPAC : https://www.afpac.org/Recommandations-RAGE_a138.html
- ANCO : <https://www.anco.pro/bureau-de-contrôle-obligatoire/>
- Assurance Banque Epargne Info Service : <https://www.abe-infoservice.fr/assurance/assurance-construction/que-savoir-sur-l'assurance-construction#1>
- Cahiers Techniques du Bâtiment : <https://www.cahiers-techniques-batiment.fr/article/pourquoi-une-atex-17116>
- Commission Chargée de Formuler les Avis Techniques : <https://www.ccfat.fr/demander-atec/>
- Cerema : <https://www.cerema.fr/fr/cerema/directions/cerema-infrastructures-transport-materiaux/evaluations-techniques-europeennes-ete>
- Cofrac : www.cofrac.fr
- CSTB : <http://www.cstb.fr/fr/certification/>
- Construction Leadership Council: https://www.constructionleadershipcouncil.co.uk/wp-content/uploads/2021/07/CZ-Performance-Framework-Version-1-20_7_21.pdf
- Ministère de l'Economie, des finances et de la souveraineté industrielle et numérique : <https://www.economie.gouv.fr/dgccrf/publications/juridiques/panorama-des-textes/produits-construction>



- Ministère de la Transition écologique et de la Cohésion des territoires, Ministère de la Transition énergétique : https://www.ecologie.gouv.fr/respect-des-regles-construction#scroll-nav_5
- CSTB : <https://evaluation.cstb.fr/fr/pass-innovation/>
- CSTB : <https://evaluation.cstb.fr/fr/marquage-ce/>
- Fédération Nationale du Bois : <https://www.fnbois.com/produits-de-construction-et-amenagement/reglement-des-produits-de-construction/>
- Fédération Réunionnaise du Bâtiment et des Travaux Publics : <https://www.frbtp.re/missions-et-expertises/reportage/2018/09/04/bureau-de-normalisation-technique,bntec,58.html>
- INIES : <https://www.inies.fr/produits-de-construction/>
- Isolation Thermique : <https://isolation-thermique.org/reglementation-isolation-thermique/marquage-ce-isolant/>
- Legisfrance : <https://www.legifrance.gouv.fr/loda/id/JORFTEXT000020749979/>
- C2P: <http://liste-verte-c2p.qualiteconstruction.com/>
- MAF: <https://www.maf.fr/actualite/regles-de-construction-comment-sy-retrouver-dans-les-avis-et-appreciations-techniques>
- PEG Isolation: <http://www.peg-isolation.fr/fr/produits/tisoleco-ecopege#trispac-2>
- INERIS : <https://prestations.ineris.fr/fr/certification/appareils-atex-marquage/atex-certification-europeenne>
- Service Public : <https://www.service-public.fr/particuliers/vosdroits/F2034>
- Service Public <https://www.service-public.fr/particuliers/vosdroits/F2032>
- Tout sur l'Isolation : <https://www.toutsurlisolation.com/quest-ce-que-la-certification-acermi>
- Vegetal(E) : http://www.vegetal-e.com/fr/les-textes-reglementaires_225.html



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BIO-CIRC Project

European Regional Development Fund

The BIO-CIRC project is part of the cross-border European Territorial Cooperation (ETC) Programme Interreg VA France (Channel) England and benefits from financial support from the European Regional Development Fund