



Sustainable solutions for affordable **REtroFIT** of domestic buildings

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Abbreviations

A/C	Air condition
CAD	Computer-aided design
CO ₂	Carbon Dioxide
DX SAHP	Direct Expansion Solar Assisted Heat Pump
EPC	Energy Performance Certificate
GSHP	Ground Source Heat Pump
HVAC	Heating Ventilation Air Conditioning
IT	Internet Technology
KER	Key Exploitable Result
OSS	One Stop Shop
PCM	Phase Change Material
PV	Photovoltaic
PVD	Physical Vapor Deposition
PV-VG	PV vacuum glazing
RES	Renewable Energy Sources
ROI	Return of investment
SAHP	Solar Assisted Heat Pump
TP GSHP	Thermal Pipe Ground Source Heat Pump
TRL	Technology Readiness Level
U-value	Thermal transmittance
WP	Work package

Publishable summary

SUREFIT technologies aim to significantly reduce primary energy use, carbon emissions, renovation time, and costs. Achieving these ambitious goals presents a challenging path to market scalability. Therefore, a coordinated effort is essential to raise awareness about the potential future return on investment in SUREFIT's innovative technologies, such as cost-optimal energy conservation measures and renewable energy solutions, while meeting both environmental and economic criteria.

A business model defines how a company will create, deliver, and capture value. It is a strategy of how a company will generate revenue and operate in a sustainable way. A general approach towards developing a business model is the use of the Business Model Canvas.

The first exploitation plan of the SUREFIT project was created at an early stage of the project. This document presents the Key Exploitable Results of the project, their exploitation characterization and the results derived from the business model canvas for each one of the Key Exploitable Results.

Based on the Business Model Canvas and the Key Exploitable Results, an overall business model approach for SUREFIT technologies and services has been designed. This approach aims to create a network of stakeholders that will facilitate the coordinated exploitation of results, while also accommodating the unique characteristics of the entities within the SUREFIT Consortium. A SWOT analysis was undertaken to help the partners overcome challenges and determine which path to take.

To ensure continuous goals and active contributions beyond the project's lifetime, the SUREFIT Consortium presents five strategic concepts:

- (1) SURE³FIT tool training, focused on qualified experts preparing energy performance certificates.
- (2) One stop shop, with experts offering free consultancy with the support of SURE³FIT tool, guiding building owners on cost-optimal technologies for each case.
- (3) Immediate marketing and commercialisation through independent businesses by industrial partners with established sales structures.
- (4) Agreements with manufacturers for commercial exploitation of patented solutions developed by non-industrial partners of the SUREFIT project, and
- (5) Continuous dissemination through a geo-clusters network.

This comprehensive business model aims to create a network of experts and policymakers, facilitating the exploitation of project results. It will particularly focus on raising awareness of the return on investment in SUREFIT's innovative technologies, which include energy conservation and cost-optimal measures for renewable energy sources, meeting both environmental and economic criteria.

1 Business model canvas introduction

A business model defines how a company will create deliver, and capture value. It is a strategy of how a company will generate revenue and operate in a sustainable way. A general approach towards developing a business model is the use of the Business Model Canvas. In the following paragraphs are briefly described the main components of the Canvas that have been considered and answered by the main owners of the Key Exploitable Results of the SUREFIT that are presented in chapters 3 to 15.

1.1 Key partners

- Who are the key partners of the company (e.g. advisors, accountant, lawyers, chamber of commerce etc.)
- Who are the key suppliers of the company
- What are the key resources that the company receives from these partners
- What are the key activities that these partners perform that are related to your company

1.2 Value proposition

- What is the core value that your company provides to customers
- Which customer needs the company satisfies
- What kind of customers' problems the company ties to solve

1.3 Key resources

- What are the resources needed to deliver the value proposition
- Does the company's activity require a lot of capital or human resource

1.4 Key activities

- In order for the company to deliver the value proposition, what are the key activities that should be realised

1.5 Customer relationships

- Describe the type of relationship that you have/will have with the customers
- How do you interact or will interact with them
- How costly are they

1.6 Channels

- Through which channels will you deliver the value proposition
- What is the cost

1.7 Customer segments

- Who are you creating value for
- Who are your most important customers
- Are you targeting a mass market, niche market, segmented, diversified, multi-sided platform, any other

1.8 Cost structure

- What are the key costs in the business model
- Describe how your key activities and the key resources contribute to the costs

1.9 Revenue Streams

- How will your value proposition generate money
- What is the pricing strategy for this KER
- What will be the forms of payment

2 Update of the Key Exploitable Results

The first exploitation plan of the SUREFIT project was created at an early stage of the project that is in M12 in the deliverable D9.4. There have been regular updates of the Key Exploitable Results (KER) since then and the current status is presented in the following Table.

Table 1 - Key Exploitable results updated in M48

No	Key Exploitable result	Description	Main owner	Contributing partners	Other interested partner
1	Optimum design, operation and control of renovation technologies	Use of commercial software to achieve optimum design, operation and control of technologies	UNOTT	AALTO : will study the optimal sizing of the technologies, energy consumption and indoor conditions	-
2	Renovation concepts	Parametric optimization to find the most cost effective energy renovation measures.	AALTO	ISQ : development of models for the technologies, cost analysis for the optimization. UNOTT : energy performance of the technologies, UK retrofit standards, indoor thermal & lighting comfort evaluation.	-
3	Next generation bio/silica-aerogel panel and prefabrication	Alternative aerogel insulation panels, including bio-aerogel, silica-aerogel and other	UNOTT	WINCO : measurements of conductivity of bio aerogel panels combined or laminated with breathable membranes, reflective and breathable membranes and aluminium foils.	-
4	PCM panels	The PCM will be encapsulated in a watertight container, utilizes waste heat/cooling in order to store thermal energy for later use which can be used passively or actively.	PCM	UNOTT : will simulate the indoor comfort and provide suggestions on the selection of the PCM melting points.	-
5	PV vacuum glazing windows (PV-VG)	A unique solution to conventional glazing. It is a power generator and a thermal insulator and can convert up to 10% of the solar irradiation into electricity and reduce air conditioning energy consumption by up to 75%. Meanwhile, it can provide a much lower U-value for windows (1 W/m ² K or lower).	UNOTT	SOLIMPEKS : contribution in manufacturing, if needed AALTO : study the energy and CO ₂ emission savings potential.	-

6	Window heat recovery devices	Small heat recovery and air filtering units can be installed on window frame. The system uses heat normally lost from the room to bring in and preheat fresh air and save energy.	UNOTT	ISQ: development of models and simulations to design and size the technology.	-
7	Evaporative coolers	This novel dew point core takes the same structure of the evaporative cooling pad structure. It has both advantages of the evaporative cooling pad, and dew point cooling, but without the drawbacks described above. Two core techniques are included in the novel cores, namely special corrugated plates for dew point cooling, and special sealing technology for the sealing. The core could be easily to be enlarged to treat large airflow without increase in pressure drop.	UNOTT	ISQ: development of models and simulations to design and size the technology.	-
8	Membrane wrapping	-100% non-combustible roofing and rain screen reflective membranes with swelling clay as raw materials -Black Rainscreen membrane with A1 classification for facades. -Hygro-variable vapor barrier non-combustible membranes for indoor application	WINCO	-	-
9	Innovative multipurpose heat pumps	A solar-assisted heat pump combines solar air collector with heat pump technology. Such a heat pump including direct expansion type and will be used for retrofitting in domestic buildings to provide heating and/or cooling and hot water for buildings. Also, it can be driven into the ground using a handheld ground drill and act as a heat source/sink for a heat pump. In comparison to conventional ground coil heat exchangers. The TP provides significant advantages, notably low cost, and easy installation,	UNOTT	ISQ: development of models and simulations to design and size the technology. PCM: support with experience in the HVAC industry and also in secondary refrigerants	-

		especially in locations inaccessible to drilling machines. The TP can either be a solid rod or a “hybrid” tube containing a liquid such as propylene glycol/water. Heat transfer from the TP to the heat pump is achieved via a glycol circuit that includes a heat exchanger on the top of the TP.			
10	User friendly computer program for planning and retrofitting of residential buildings	User-friendly computer program for supporting the selection of optimal retrofitting and technologies for different scenarios, with the aim of enabling optimization of the renovation process and decision-making.	ISQ	-	-
11	Methodology and guidelines for retrofitting	A method of generating a planning of building retrofit for a portfolio of buildings.	ISQ	AALTO: define by simulations optimal renovation packages. UNOTT: suggest the retrofit installation methods and to avoid the overheating issues, grid stability and operational guidance.	WINCO

There have been two results/products that are no longer considered as KER: i) the Solar Thermal and PV system and ii) the Daylight louvers. This is due to the fact that these technologies already existed prior to the SUREFIT project. However, these very important technologies of the SUREFIT renovations will be taken into account for the overall business plan of the holistic SUREFIT solution that will be presented in this deliverable. In addition, the **KER#2: Renovation concepts** has no longer AALTO as main owner and it is considered as a joined results of all partners with different weight of contribution and shares.

In the following chapters, 3 to 13, are presented the eleven KER of the project, their exploitation characterization and the results derived from the business model canvas for each one of the KER. Although no longer a KER, the Solar Thermal and PV systems and the Daylight louvers exploitation characterization is also presented in chapters 14 and 15.

3 KER#1: Optimum design, operation and control of renovation technologies

This KER developed by UNOTT, is considered as a service to a broad target group of building stakeholders, i.e. architects, engineers, HVAC experts, constructors. Through a commercial software suite, it will provide an important service to achieve optimum design of the SUREFIT technologies, the operation and control. The main characterization of this result is presented in the Table below and the results of the business model canvas are shown in the following sub paragraphs.

Table 2 - Characterization of Exploitable Result #1

Exploitable Result #1	Optimum design, operation and control of renovation technologies
Description	Use of commercial software to achieve optimum design, operation and control of technologies
Owner	UNOTT 100%
Other contributors	AALTO: will study the optimal sizing of the technologies, energy consumption and indoor conditions
Category	Service
Innovative concept of result	Ambient and indoor comfort-controlled space heating and hot water supply
Expected date of achievement in the project	August 2021
Customers	Dwelling occupants
Benefits for the customer	Occupants can save energy bills and improve the indoor air quality
Costs to be incurred after the project	3,000€ for further process integration and development, 1,000€ for marketing.
Expected time to market	24months post project
Price range	2,000€ for each optimum design fees
Competitors	No
Will you protect this result? How? When?	Copyright, at the end of 2024
Possible barriers for implementation	Possible mismatch with occupancy schedule due to sensor sensitivity and response delay

3.1 Key partners

Who are the key partners of your company related to this KER:

- **Software Providers:** such as IES VE and Energy Pro play a crucial role in providing the necessary tools and platforms that enable the optimum design, operation, and control of technologies.
- **Industry Collaborators:** Arkaya, LandVac, and Polysolar that use or benefit from the application of commercial software in their operations. This could involve joint projects, software customization, or specific applications tailored to industry needs.

Who are the key suppliers of your company related to this KER:

- **Software Licenses and Updates:** Consider suppliers who provide the commercial software licenses and updates. Maintaining a strong relationship with these suppliers ensures access to the latest features and support.
- **IT Infrastructure Providers:** If there are specific IT infrastructure requirements for running the commercial software effectively, these providers can be considered key suppliers.

What are the key resources that your company receives from these partners for this KER:

- **Software Licenses:** The University received software licenses from commercial providers, allowing researchers to access and use the software for product research and optimization purposes.
- **Technical Support and Training:** IES VE and EnergyPro software providers offer technical support and training resources. Access to these resources is crucial for ensuring that the university researchers can effectively utilize the commercial software.

What are the key activities that these partners perform that are related to your company and the specific KER:

- **Customization and Integration:** software providers involved customization of the software to suit the specific needs of the university's research and academic activities. Integration with other technologies is also part of these activities.
- **Collaborative Research and Development:** Engage in collaborative research and development projects with software providers to explore new features, improvements, and applications of the software in the context of optimum design, operation, and control of technologies.
- **Training Programs:** Work with software providers to organize training programs, workshops, or seminars for researchers and industry professionals. This ensures that the researchers are well-versed in utilizing the software for its intended purposes.

3.2 Value propositions

What is the core value that your company provides to customers related to this KER:

- Expertise and Research Innovation
- Access to Advanced Software Solutions
- Customized Solutions and Applications
- Training and Knowledge Transfer
- Collaborative Opportunities
- Continuous Support and Engagement

Which customer needs are you satisfying:

- Efficiency in Renovation Processes
- Precision and Accuracy in Design
- Optimized Operation and Control
- Cost Effectiveness
- Risk Mitigation
- Compliance with Regulations
- Data Driven Decision Making
- Adaptability and Scalability

What kind of customers' problems are you trying to solve with this KER:

- Complex Design Challenges
- Inefficient Operation and Control
- Lack of Precision in Planning
- Budget Overruns
- Risk of Compliance Violations
- Limited Data Driven Decision Making
- Difficulty in Scaling Operations
- Inability to Address Dynamic Project Requirements

3.3 Key resources

What are the resources needed to deliver the value proposition:

- Commercial Software Licenses: Access to tailored software tools.
- Skilled Personnel: Experienced researchers, engineers, and software experts.
- Research Facilities: Well-equipped labs for experiments and testing.
- Partnerships: Collaborations with software providers, industry partners, and research institutions.
- Training Programs: Educational resources for user proficiency.
- Data Sources: Access to relevant industry data and regulatory information.
- Financial Resources: Funding for research, licenses, personnel, and infrastructure.
- Project Management Tools: Tools for efficient planning and collaboration.
- Customer Support: Ongoing support for users.
- Intellectual Property Protection: Mechanisms to safeguard research outcomes.
- Communication Platforms: Outreach for disseminating findings and engaging stakeholders.

Does your activity related to this KER, require a lot of capital or human resources:

The resource requirements, both in terms of capital and human resources, for activities related to the Key Exploitable Result (KER) involving the use of commercial software for the optimum design, operation, and control of renovation technologies can vary based on the scale, complexity, and objectives of the initiative. The extent of resource requirements will depend on factors such as the scope of research, the level of collaboration, the complexity of the renovation technologies involved, and the goals of the initiative. Additionally, efforts to secure external



funding through grants, industry partnerships, or other sources can offset some of the capital requirements.

3.4 Key activities

In order for your company to deliver the value proposition, what are the key activities that should be realized:

- Software Implementation and Optimization.
- Partnership Development. Training and Education. Project Management. Communication and Outreach.
- Customer Support. Regulatory Compliance. Intellectual Property Management. Continuous Improvement

3.5 Customer relationships

Describe the type of relationship that you have/will have with your customers related to this KER:

Depending on the business model, this could range from self-service tools enabled by the software, to personalized support for operation and troubleshooting.

How do you interact/will interact with them:

Through training sessions, technical support, online platforms, and direct consultations.

How costly are they:

Costs can vary significantly based on the level of support and customization required by each customer.

3.6 Channels

Through which channels will you deliver the value proposition:

Direct sales teams, online platforms for software distribution, partner channels with technology providers, and through consultancy services.

What is the cost:

Investment in channel development and maintenance, commission for partners, and costs associated with digital distribution platforms. We suggest 2000€ for each optimum design fees.

3.7 Customer segments

Who you are creating value for:

For construction companies, real estate developers, and renovation service providers looking for efficient, cost-effective solutions.

Are you targeting a mass market, niche market, segmented, diversified, multi-sided platform, any other:



Focus may be on niche markets initially, such as high-end residential or commercial renovations, expanding to broader markets as the solution proves its value.

3.8 Cost structure

What are the key costs in the business model related to this KER:

Software development/licensing, training, customer support, marketing, and sales efforts.

Describe how your key activities and key resources contribute to the costs:

Key activities like software customization and support, as well as resources like skilled personnel and technology infrastructure, significantly contribute to overall costs.

3.9 Revenue Streams

How will your value proposition generate money:

Through software sales/licensing fees, subscription models for ongoing support and updates, consultancy fees for customization and integration services.

What is the pricing strategy for this KER:

Could range from premium pricing for highly customized solutions to competitive pricing for more standardized offerings.

What will be the forms of payment:

Flexible payment options including upfront payments, subscriptions, or financing options for larger installations.

4 KER#2: Renovation concepts

This KER refers to the skills, knowledge and know how that was gained by all partners contributed (see Table below) to the parametric optimization in order to set the most cost-effective energy renovation scenarios with the SUREFIT technologies. The main characterization of this result is presented in the Table below. No business model canvas was used for this result since there is no intention of commercial exploitation. However, the relevant skills, knowledge and know-how will be used for the overall business model that will combine all the KER of the SUREFIT project.

Table 3 - Characterization of Exploitable Result #2

Exploitable Result #2	Renovation concepts
Description	Parametric optimization to find the most cost-effective energy renovation measures.
Owner	All SUREFIT partners
Other contributors	AALTO: energy performance simulations ISQ: development of models for the technologies, cost analysis for the optimization UNOTT: energy performance of the technologies, UK retrofit standards, indoor thermal & lighting comfort evaluation AMS: economic evaluation FSM: social evaluation, LCA PCM: information about the technology KOST: information about the technology CJR, WINCO, SOLIMPEKS, ONCONTROL: information about technology
Category	Skills, Knowledge, know how
Innovative concept of result	Cost effective renovation concepts to reach 60% energy and CO ₂ emission reductions.
Expected date of achievement in the project	At the end of WP2
Customers	All the stakeholders
Benefits for the customer	Energy and CO ₂ emission saving potential by renovation concepts.
Costs to be incurred after the project	No
Expected time to market	N/A
Price range	Renovation concepts will be publicly available for free.
Competitors	-

Will you protect this result? How? When?	No. The concepts will be published in open access publications.
Possible barriers for implementation	No, results will be publicly available.

5 KER#3: Next generation bio/silica-aerogel panel and prefabrication

UNOTT have developed konjac glucomannan (KGM)/starch-based aerogels⁸ with natural raw materials from the waste of agriculture such as wheat straw and the environmentally friendly preparation method (freeze-drying) presenting good thermal insulation and mechanical properties. With the addition of wheat straw, aerogel pores were changed from polygons into irregular, big into small shape because of their multi-cavities structure impacting the thermal insulation property of KGM/starch-based aerogels. Smaller and complex pores of KGM/starch-based aerogels are preferred in the application of building insulation in order to achieve lower thermal conductivity – 0.046 W/mK achieved so far. The main goal and advantage of the KGM/starch-based aerogels are the biodegradable performance after being disposed which will not increase the burden on the environment.

Key innovations/advantages of new bio aerogel materials:

- Made from agriculture waste (e.g. straws), grass, leaves, etc. and can be recycled
- K-value: Target 0.02 W/mK (1/2 of that for the best conventional insulation materials)
- Wide applications including car filters, buildings/HVAC filters, air quality masks

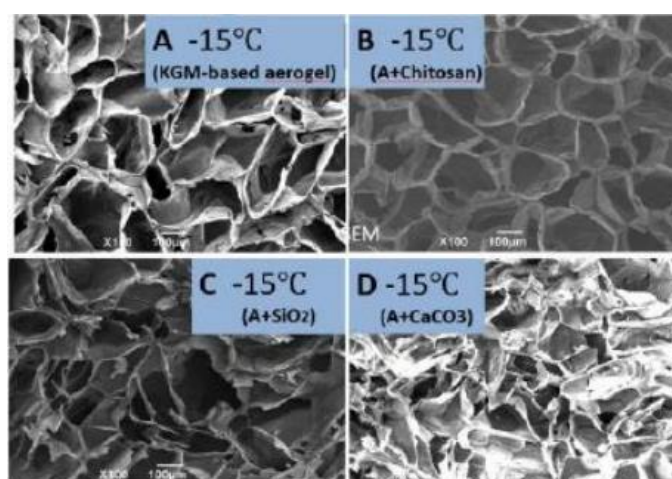


Figure 1 - SEM images of bio aerogel materials

The main characterization of this result is presented in the Table below and the results of the business model canvas are shown in the following sub paragraphs.

Table 4 - Characterization of Exploitable Result #3

Exploitable Result #3	Next generation bio/silica-aerogel panel and prefabrication
<i>Innovative concept of result</i>	Next generation alternative and environmentally friendly bio-aerogel based prefabricated thermal insulation panel with lower U-value.

Description	Alternative aerogel insulation panels, including bio-aerogel, silica-aerogel and other. Besides, the prefabrication concept for rapid wall installation.
Category	Prototype
Owner	UNOTT (100%)
Contributors	WINCO: measurements of conductivity of bio aerogel panels combined or laminated with breathable membranes, reflective and breathable membranes and aluminium foils. ISQ: prototype fabrication of the bio/silica-aerogel panel and prefabrication panel production.
Expected date of achievement in the project	June 31 st 2021
Customers	Individuals, constructors, engineers
Benefits for the customer	Do not change the building outlook, energy bills saving and improvement of indoor comfort.
Costs to be incurred after the project	2,500€ for further laboratory research, 1,000€ for marketing, 4,500€ for bigger production facilities. In total 8,000€.
Expected time to market	June 2026
Price range	100-150 €/m ² (the auxiliaries and installation cost are included)
Competitors	Aerogel composite blanket, silicon-aerogel insulation panels, vacuum insulation panels, PIR insulation panels
Will you protect this result? How? When?	Licensing, at the end of 2024
Possible barriers for implementation	High unit cost, condensation issues of the material surface
Starting TRL	6
TRL M48	8
TRL at the end of the project	8-9

5.1 Key partners

Who are the key partners of your company related to this KER:

University of Nottingham (UNOTT) and CJR are the primary partners.

Who are the key suppliers of your company related to this KER:



WINCO: they include raw material providers for bio-aerogel, silica-aerogel, and other components required for the panel production.

What are the key resources that your company receives from these partners for this KER:

Technical expertise in prototype fabrication, measurements of conductivity, and the integration of bio-aerogel technology with other materials.

What are the key activities that these partners perform that are related to your company and the specific KER:

UNOTT is involved in the conceptualization and research, while WINCO and CJR are involved in the measurements, practical implementation, and prototype fabrication.

5.2 Value propositions

What is the core value that your company provides to customers related to this KER:

Offering an environmentally friendly, efficient thermal insulation panel that doesn't alter the building's aesthetic and improves indoor comfort.

Which customer needs are you satisfying:

Energy efficiency, aesthetic maintenance of buildings, and improved indoor comfort.

What kind of customers' problems are you trying to solve with this KER:

The technology addresses the need for sustainable insulation materials that provide better performance than conventional options without compromising the building design.

5.3 Key resources

What are the resources needed to deliver the value proposition:

Expertise in material science, partnerships for technology development, manufacturing facilities, and capital for research, development, and scaling production.

Does your activity related to this KER, require a lot of capital or human resources:

The project appears capital intensive due to the need for laboratory research and setting up production facilities, and it also requires specialized human resources for research and development.

5.4 Key activities

In order for your company to deliver the value proposition, what are the key activities that should be realized:

Research and development of the aerogel material, prototype production, testing for conductivity and performance, and scaling up production capabilities.

5.5 Customer relationships

Describe the type of relationship that you have/will have with your customers related to this KER:

Likely a combination of personal assistance and self-service, especially in the post-sale phase for installation support.

How do you interact/will interact with them:

Through direct communication channels during the installation and service phases, possibly supported by user manuals and online support.

How costly are they:

Likely high at the start due to the need for hands-on support and education of customers about this new product.

5.6 Channels

Through which channels will you deliver the value proposition:

Direct sales to constructors and engineers, partnerships with construction companies, online marketing, and participation in trade shows and industry events.

What is the cost:

Likely substantial due to the need for targeted marketing and the establishment of a supply and distribution network.

5.7 Customer segments

Who you are creating value for:

For environmentally conscious consumers, construction companies looking for innovative materials, and engineers focused on sustainable development.

Who are your most important customers:

The main customers are likely to be construction companies and engineers specialized in building renovations and eco-friendly constructions.

Are you targeting a mass market, niche market, segmented, diversified, multi-sided platform, any other:

Given the specialized nature of the product, the initial target market is likely to be a niche market, which may expand to segmented markets as the product proves its value and gains recognition.

5.8 Cost structure

What are the key costs in the business model related to this KER:

Research and development, prototype fabrication, marketing, and capital investment for production facilities.

Describe how your key activities and key resources contribute to the costs:



Key activities such as R&D and prototype production contribute to upfront costs, while key resources like specialized staff and manufacturing facilities contribute to ongoing operational costs.

5.9 Revenue Streams

How will your value proposition generate money:

Selling the aerogel panels, likely based on the size and specifications of the installation.

What is the pricing strategy for this KER:

The panels are priced 150-230 €/m², indicating a value-based pricing strategy that reflects the benefits of improved insulation and sustainability.

What will be the forms of payment:

Not detailed, but standard industry practices could include upfront payments, progress payments, and possibly financing options for large projects.

6 KER#4: PCM panels

Phase Change Materials (PCM's) are simply chemical solutions, capable of storing and releasing thermal energy during the process of melting & freezing. During this process they can both store and release large amounts of energy in the form of either heating or cooling. In simple terms, PCM's can be seen to act like a thermal battery. The main characterization of this result is presented in the Table below and the results of the business model canvas are shown in the following sub paragraphs.



Figure 2 - PCM operation



Figure 3 - Schematic of PCM

Table 5 - Characterization of Exploitable Result #4

Exploitable Result #4	PCM panels
Innovative concept of result	PCM panel for building integration
Description	The PCM will be encapsulated in a watertight container, utilizes waste heat/cooling to store thermal energy for later use which can be used passively or actively.
Owner	PCM (80%)

Contributors	UNOTT (20%): will simulate the indoor comfort and provide suggestions on the selection of the PCM melting points.
Expected date of achievement in the project	Month 15
Customers	Aimed at residential sector for new build and retrofit passive cooling and heating.
Benefits for the customer	Reduced energy bills by utilising PCM to shift the load from peak times and provide passive cooling/heating.
Costs to be incurred after the project	An initial budget of £10,000 promotion and marketing primarily
Expected time to market	2-3 months post project completion
Price range	45-60 €/m ²
Competitors	Armstrong (USA), Datum Ceiling (UK), BASF (Germany), Knauf (Germany), Winco (France), BioPCM (USA)
Will you protect this result? How? When?	Trademark or Patent.
Possible barriers for implementation	A detailed installation project is necessary, as in case of refurbishment and installation on the ceiling, it means a reduction in the height of the room, which cannot be allowed either by town planning regulations or by the owners. The correct ventilation of the room must be considered, because if this is not possible, the PCM will not work properly.
Starting TRL	7
TRL M48	8
TRL at the end of the project	8-9

6.1 Key partners

Who are the key partners of your company related to this KER:

- Nottingham University
- Santa María la Real Foundation

Who are the key suppliers of your company related to this KER:

- Chemical Suppliers (Too Various)
- Plastics Moulding Co. (Too Various)

What are the key resources that your company receives from these partners for this KER:

- Academia intellectual research and data
- Modelling
- Real world site testing and validated data

What are the key activities that these partners perform that are related to your company and the specific KER:

- Research, intellectual and academic contribution
- Testing our KER in a real-world pilot house (Spain)

6.2 Value propositions

What is the core value that your company provides to customers related to this KER:

- Sustainable Energy
- Low cost/Free Energy
- Zero Carbon emitting
- Peak Energy Demand Levelling

Which customer needs are you satisfying:

- Environmental comfort
- Air Cooling
- Low-cost/Free Cooling Energy
- Low-cost solution (upfront)
- Zero-cost Solution (maintenance)
- Improve room comfort through improved and efficient air/room stratification

What kind of customers' problems are you trying to solve with this KER:

- Lower cooling energy costs
- Lower product costs

6.3 Key resources

What are the resources needed to deliver the value proposition:

- Data modelling (academia)
- CAD modelling (academia)
- Pilot House (Testing)
- Project Manager (PCM)
- Scientists/Chemists (PCM)

- Engineers (PCM)

Does your activity related to this KER, require a lot of capital or human resources:

- Financial (PCM employees for research, Chemists, Engineers, Project Management, Materials)
- Physical (Academia personnel for intellectual aid, data modelling and CAD design)

6.4 Key activities

In order for your company to deliver the value proposition, what are the key activities that should be realized:

- Effective communication between partners and suppliers
- Data integrity via modelling and real-world trials

6.5 Customer relationships

Describe the type of relationship that you have/will have with your customers related to this KER:

- Likely for our KER to be supplied via distribution partners, so a likely 3rd party relationship, supplied via architects and the building trade.
- PCM will provide technical support and backup.

How do you interact/will interact with them:

- B2B relationship not D2C transactional
- Direct marketing to B2B
- Dissemination via Social Media

How costly are they:

- Distribution will require 25-30% of KER Profit margin
- Marketing and Social Media 1-2% KER Profit Margin

6.6 Channels

Through which channels will you deliver the value proposition:

- B2B is and shall be the primary Route to Market (Architects, House Builders, Builders merchants, Energy consultants, Business consultants)
- Social Media/Web Company who look after SEO for our marketing
- Consider advertising in national builders and energy publications

What is the cost:

See previous answers under Customer Relationships

6.7 Customer segments

Who you are creating value for:

- PCM Products
- Customers
- Distributors
- Our Planet (Zero Carbon emitting Energy)

Who are your most important customers:

Distributors and Trade Bodies

Are you targeting a mass market, niche market, segmented, diversified, multi-sided platform, any other:

- Unlikely to hit the mass market and falls most likely to a niche market. Proven or otherwise, our KER will never provide on demand cooling, so offers energy reduction savings and sustainable purchasing.
- This is therefore a supplementary expenditure unlikely to be affordable by all and likely to need a hard marketing campaign to drive the benefits to homeowners or house builders.

6.8 Cost structure

What are the key costs in the business model related to this KER:

- Development (10%)
- Materials (30%)
- Production (20%)
- Leaving 40% operating margins for marketing and distribution

Describe how your key activities and key resources contribute to the costs:

- Employing published scientific Researchers and Chemists to further develop and produce substrates required.
- Employing published mechanical engineers to provide knowledge of customer requirements and solutions.
- Long term, rare, skilled employees required for production, so retention is key and requires continual investment to sustain and retain.

6.9 Revenue Streams

How your value proposition will generate money:

Our PCM passive cooling FlatICE panels offer an energy-efficient solution for building temperature management, reducing reliance on HVAC systems. By using advanced phase change materials (PCMs), these panels absorb heat during the day and release it at night, maintaining comfortable indoor environments and cutting energy costs.

The value proposition lies in substantial energy savings and reduced operational costs for building owners. Clients can lower energy bills, achieve a rapid return on investment, and enhance their sustainability credentials, attracting environmentally conscious tenants. Revenue generation includes direct sales, installation and maintenance services, and partnerships with construction companies and real estate developers, driving financial benefits for clients and steady revenue for our company.

What is the pricing strategy for this KER:

- As a supplementary product to customers, we aim to use our KER as a cost reduction product to those already using Air Conditioning and/or as a Room Comfort product to those without.
- By displaying ROI energy savings from Yr2-3 onwards for our customers in our pricing model, this should appeal to most interested customers regardless of price.

What will be the forms of payment:

Trade credit terms apply

7 KER#5: PV vacuum glazing windows (PV-VG)

The structure of vacuum glazing window is commercially mature, and it is similar to the double-glazed unit, however the cavity contains no gas, but a vacuum. The vacuum gap acquires significantly more effective insulation levels compared to any gas. In addition, greater performance in terms of acoustics and sound reduction accompany the VG windows. The PV component on the window is integrated in the form of thin-elastic-films. PVVG exhibits three different components:

- the self-cleaning coated glass,
- the vacuum-filled layer and finally,
- a thin film PV glass with additional grass cover.

The system is thinner than 30 mm and presents lower U-value than $2.5 \text{ W/m}^2\text{K}$. The thin film will bear solar shading coefficient of 0.45 and solar heat gain coefficient of 0.39, while light transmittance is 70%.

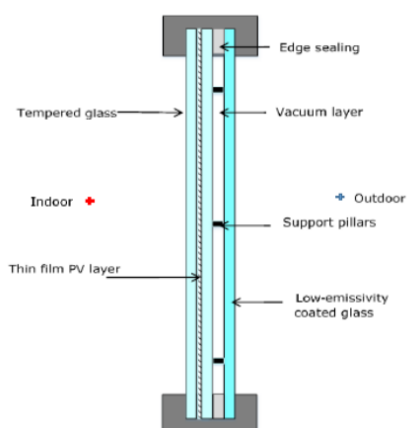


Figure 4 - Schematic of PV Vacuum glazing unit



Figure 5 - Photos of the PV Vacuum glazing systems

The main characterization of this result is presented in the Table below and the results of the business model canvas are shown in the following sub paragraphs.

Table 6 - Characterization of Exploitable Result #5

Exploitable Result #5	PV vacuum glazing windows (PV-VG)
Innovative concept of result	PV vacuum glazing windows with U-value lower than 0.60 W/m ² , and electricity generation efficiency of 5.5%
Description	A unique solution to conventional glazing. It is a power generator and a thermal insulator and can convert up to 10% of the solar irradiation into electricity and reduce air conditioning energy consumption by up to 75%. Meanwhile, it can provide a much lower U-value for windows (1 W/m ² K or lower).
Owner	UNOTT (100%)
Contributors	AALTO: study the energy and CO ₂ emission savings potential
Expected date of achievement in the project	May 2021
Customers	Individuals, constructors, engineers
Benefits for the customer	Energy bills saving and improvement of indoor thermal comfort
Costs to be incurred after the project	1,000€ for marketing, 8,000€ for bigger production facilities
Expected time to market	December 2026
Price range	704 €/m ²
Competitors	N/A
Will you protect this result? How? When?	Patent & Licensing, at the end of 2024
Possible barriers for implementation	High-cost investment, Daylighting reduce. Extra equipment needed to use the produced energy that must be integrated into the window frame. The participation of different experts is needed to guarantee the maximum benefit of this technology. The amount of energy produced is not very significant
Starting TRL	6
TRL M48	7-8
TRL at the end of the project	8-9

7.1 Key partners

Who are the key partners of your company related to this KER:

The University of Nottingham (UNOTT) and AALTO (who studies the energy and CO₂ emission savings potential).

Who are the key suppliers of your company related to this KER:

Not specified in the provided information, but they would typically include suppliers of materials required for manufacturing the PV-VG, such as the glass, thin-film PV, and other components.

What are the key resources that your company receives from these partners for this KER:

Expertise in energy and CO₂ emission savings potential, manufacturing of the PV-VG, and research data.

What are the key activities that these partners perform that are related to your company and the specific KER:

UNOTT is the owner and likely contributes to research and development, while AALTO contributes to the study of energy and emission savings potential.

7.2 Value propositions

What is the core value that your company provides to customers related to this KER:

The PV-VG offers exceptional insulation (with a U-value lower than 0.60 W/m²) and the ability to generate electricity with an efficiency of 5.5%, serving as both a power generator and thermal insulator.

Which customer needs are you satisfying:

Reducing energy bills and improving indoor thermal comfort.

What kind of customers' problems are you trying to solve with this KER:

High energy consumption due to inefficient windows and the need for better insulation without compromising the ability to generate electricity.

7.3 Key resources

What are the resources needed to deliver the value proposition:

Expertise in vacuum glazing technology, materials for manufacturing the PV-VG, facilities for testing and production, and financial resources for development and marketing.

Does your activity related to this KER, require a lot of capital or Human resources:

The project appears to require substantial capital investment for research and production (700-850 €/m²) and human resources for R&D and manufacturing.

7.4 Key activities

In order for your company to deliver the value proposition, what are the key activities that should be realized:

Research and development, manufacturing cost reduction of PV-VG units, quality control, and performance testing under various conditions.

7.5 Customer relationships

Describe the type of relationship that you have/will have with your customers related to this KER:

Given the innovative nature of PV-VG, a consultative and supportive relationship would be necessary.

How do you interact/will interact with them:

Likely through direct engagement for installation support, technical troubleshooting, and perhaps through digital platforms for performance monitoring.

How costly are they:

Likely high initially due to the need for active customer education and support.

7.6 Channels

Through which channels will you deliver the value proposition:

Direct sales to individuals, constructors, and engineers; partnerships with construction firms; marketing through trade fairs, publications, and online platforms.

Some window frame manufacturers in the Spanish pilot have been contacted and showed interest in integrating the PV-VG into their portfolio. They already developed a system to integrate the wiring safely into the frame.

What is the cost:

Specific costs aren't provided, but considering the nature of the product, the channels could be significant, including R&D dissemination and commercial marketing.

7.7 Customer segments

Who you are creating value for:

Individuals seeking sustainable living, construction companies, and engineers focused on energy-efficient building designs.

Who are your most important customers:

Constructors and engineers appear to be the most important customers, as they will implement the technology.

Are you targeting a mass market, niche market, segmented, diversified, multi-sided platform, any other:



Initially, a niche market of eco-conscious builders and renovators, potentially expanding to segmented markets in both residential and commercial sectors.

7.8 Cost structure

What are the key costs in the business model related to this KER:

Development, testing, production, and marketing of the PV-VG units.

Describe how your key activities and key resources contribute to the costs:

R&D and manufacturing contribute significantly to upfront costs, while marketing and customer relationship management contribute to operational costs.

7.9 Revenue Streams

How will your value proposition generate money:

Sale of PV-VG units.

What is the pricing strategy for this KER:

703 €/m², which seems to be value-based pricing given the innovative dual benefits of insulation and power generation.

What will be the forms of payment:

Not specified, but typically would include full payment upon delivery or installation, possibly with financing options for larger projects.

8 KER#6: Window heat recovery devices

Window Heat Recovery systems are heat exchangers coupled to building windows frames that enable to exchange heat between exhausted and supplied air during the building ventilation. Heat pipes have two main parts, the cold side (condenser) and the hot side (evaporator), where heat is transferred from evaporator to condenser. One axial fan is installed on the supply air side and another at the exhaust air outlet. The Window Heat Recovery system works in all four seasons, for example, in winter, its purpose is to recover heat from exhausted air to the supplied fresh air, and in summer, the exhausted air cools the supplied air. The detailed design configuration has dimensions of 1125mm length, 220mm width and 90mm height. Louvers with filters are installed in the indoor side, with two supply fans and two exhaust fans installed in the outdoor side. Moreover, only a power button and a ventilation rate adjust button is shown on the indoor surface. This design is for aesthetic view with slim, simple outlook, as well as minimum the noise level to maximum of 35dB.



Figure 6 - Photos and schematic of the Window Heat Recovery unit

The main characterization of this result is presented in the Table below and the results of the business model canvas are shown in the following sub paragraphs.

Table 7 - Characterization of Exploitable Result #6

Exploitable Result #6	Window heat recovery devices
<i>Innovative concept of result</i>	Heat pipe-based window heat recovery
<i>Description</i>	Small heat recovery and air filtering units can be installed on window frame. The system uses heat normally lost from the room to bring in and preheat fresh air and save energy. Moreover, the PV-VG generated electricity can also supply the work of the window heat recovery devices as an alternative of electricity supply by the grid.
<i>Owner</i>	UNOTT (70%)
<i>Contributors</i>	ISQ (30%): development of models and simulations to design and size the technology
<i>Expected date of achievement in the project</i>	1 st August 2021
<i>Customers</i>	Dwelling occupants
<i>Benefits for the customer</i>	Energy bills saving and improvement of indoor thermal comfort and air quality
<i>Costs to be incurred after the project</i>	2,000€ for further laboratory research, 1,000€ for marketing, 7,000€ for larger production facilities
<i>Expected time to market</i>	24 months post project
<i>Price range</i>	1200 € per unit (the auxiliaries and installation cost are included)
<i>Competitors</i>	Central controlled mechanical ventilation with heat recovery
<i>Will you protect this result? How? When?</i>	Patent & Licensing at the end of 2024
<i>Possible barriers for implementation</i>	Heat pipe energy efficiency may be reduced in extreme low ambient temperature. At this stage of development, the units are too noisy, and the homeowner is very likely to switch them off. Extra effort is needed to integrate the units into the frame, as in case of small windows the owners will not want to lose lighting surface.
<i>Starting TRL</i>	6
<i>TRL M48</i>	7-8
<i>TRL at the end of the project</i>	8-9

8.1 Key partners

Who are the key partners of your company related to this KER:

The key partners related to the Window Heat Recovery Devices are the University of Nottingham (UNOTT) and the Instituto de Soldadura e Qualidade (ISQ).

Who are the key suppliers of your company related to this KER:

UNOTT as supplier will provide materials and components for the heat recovery devices.

What are the key resources that your company receives from these partners for this KER:

Key resources include expertise in modelling and simulation, research facilities, and potentially, financial investments for technology development.

What are the key activities that these partners perform that are related to your company and the specific KER:

Partners are involved in the development and testing of key components, assembly of prototypes, and performance assessments in lab settings.

8.2 Value propositions

What is the core value that your company provides to customers related to this KER:

The core value is an innovative heat recovery system that saves energy and improves indoor air quality and thermal comfort.

Which customer needs are you satisfying:

The customer needs being satisfied include the demand for energy efficiency, improved indoor comfort, and better air quality within dwellings.

What kind of customers' problems are you trying to solve with this KER:

The KER aims to solve the problem of heat loss and inefficient energy use due to ventilation in homes, especially in retrofit buildings.

8.3 Key resources

What are the resources needed to deliver the value proposition:

Resources needed include heat pipe technology, production and testing facilities, and a distribution network.

Does your activity related to this KER, require a lot of capital or human resources:

Yes, the activity related to this KER is capital intensive and requires significant human resources, particularly in R&D and production.

8.4 Key activities

In order for your company to deliver the value proposition, what are the key activities that should be realized:

Key activities include R&D of heat recovery technology, manufacturing of the devices, and their testing for efficiency and performance.

8.5 Customer relationships

Describe the type of relationship that you have/will have with your customers related to this KER:

The relationship type will involve technical support, warranty services, and potentially consulting services for optimal utilization of the heat recovery devices.

How do you interact/will interact with them? How costly are they:

Interactions will occur through direct sales, customer service departments, and possibly through digital communication channels.

8.6 Channels

Through which channels will you deliver the value proposition:

The value proposition will be delivered through direct sales to individuals and professionals, as well as through distributors or retailers specializing in building supplies.

Some window frame manufacturers in the Spanish pilot have been contacted and showed interest in integrating the Heat recovery units into their windows frames. They already developed a system to integrate the wiring safely into the frame.

What is the cost:

Costs will encompass the expenses related to establishing and maintaining sales channels, distribution logistics, and marketing.

8.7 Customer segments

Who you are creating value for:

Value is being created for occupants of dwellings seeking energy-efficient solutions.

Who are your most important customers:

The most important customers are individuals, constructors, and engineers involved in dwelling construction or retrofitting.

Are you targeting a mass market, niche market, segmented, diversified, multi-sided platform, any other:

The target market appears to be segmented, focusing on both retrofitting existing buildings and new constructions that prioritize energy efficiency.

8.8 Cost structure

What are the key costs in the business model related to this KER:

Key costs include R&D, production, marketing, and distribution of the heat recovery units.

Describe how your key activities and key resources contribute to the costs:

R&D and prototype testing contribute to upfront costs, while manufacturing and distribution contribute to operational costs.



8.9 Revenue Streams

How will your value proposition generate money:

The value proposition will generate revenue through sales of the window heat recovery devices.

What is the pricing strategy for this KER:

The pricing strategy is likely based on the value provided, with a price range of 704€/m², reducing to 250-350 €/m² as the technology matures.

What will be the forms of payment:

Forms of payment are not specified but will likely adhere to standard industry practices.

9 KER#7: Evaporative coolers

Air-conditioning systems consume substantial amounts of energy with an accompanied peak demands on the electricity supply infrastructure contributing to a large proportion of carbon dioxide emissions. Evaporative cooling is a highly energy efficient alternative where applicable. Dew point cooling could decrease the air temperature close to the dew point without moisture increase, so it maximises the cooling capability of the dry air, but most of the dew point cooling heat exchanger is complicated and not easy to make and also costly and not suitable for large airflow. The main characterization of this result is presented in the Table below and the results of the business model canvas are shown in the following sub paragraphs.



Figure 7 - Evaporative cooler - Installation at the UK demo building

Table 8 - Characterization of Exploitable Result #7

Exploitable Result #7	Evaporative coolers
Innovative concept of result	Desiccant cooler and evaporative cooler with efficient temperature and humidity control
Description	This novel dew point core takes the same structure of the evaporative cooling pad structure. It has both advantages of the evaporative cooling pad, and dew point cooling, but without the drawbacks described above. Two core techniques are included in the novel cores, namely special corrugated plates for dew point cooling, and special sealing technology for the sealing. The core could be easily to be enlarged to treat large airflow without increase in pressure drop.
Owner	UNOTT (70%)
Contributors	ISQ (30%): development of models and simulations to design and size the technology
Expected date of achievement in the project	End of August 2021
Customers	Dwelling occupants

Benefits for the customer	Cooling and dehumidification in summer
Costs to be incurred after the project	1,000€ for further laboratory research, 1,000€ for marketing, 3,000€ for bigger production facilities
Expected time to market	A year after the end of the project
Price range	700-900 € per unit
Competitors	Air conditioner
Will you protect this result? How? When?	Patent & Licensing at the end of 2024
Possible barriers for implementation	It is installed in one room not the whole house, central control
Starting TRL	6
TRL M48	7-8
TRL at the end of the project	8-9

9.1 Key partners

Who are the key partners of your company related to this KER:

The University of Nottingham (UNOTT) holds a 70% stake.

The Instituto de Soldadura e Qualidade (ISQ) holds a 30% stake and contributes to the development of models and simulations.

Who are the key suppliers of your company related to this KER:

Not specified, but would include suppliers of desiccant materials, cooling system components, and manufacturing equipment.

What are the key resources that your company receives from these partners for this KER:

Expertise in development, modelling, and simulation from ISQ.

Research facilities and initial technology development from UNOTT.

What are the key activities that these partners perform that are related to your company and the specific KER:

UNOTT and ISQ perform modelling and simulation to design and size the evaporative cooling technology, as well as the fabrication and testing of key components.

9.2 Value propositions

What is the core value that your company provides to customers related to this KER:



The evaporative cooler offers efficient temperature and humidity control for indoor environments, particularly during summer for cooling and dehumidification.

Which customer needs are you satisfying:

The need for energy-efficient climate control within dwellings and improved indoor comfort.

What kind of customers' problems are you trying to solve with this KER:

The product addresses the issue of high Energy consumption and poor humidity control with conventional air conditioning systems, providing an environmentally friendly alternative.

9.3 Key resources

What are the resources needed to deliver the value proposition:

Desiccant materials, production facilities, skilled labour for manufacturing, and testing equipment.

Does your activity related to this KER, require a lot of capital or human resources:

Yes, substantial capital is required for further laboratory research, marketing, and scaling up production. Human resources are also necessary for R&D and operational activities.

9.4 Key activities

In order for your company to deliver the value proposition, what are the key activities that should be realized:

Research and development, laboratory testing, system optimization, and preparation for field trials.

9.5 Customer relationships

Describe the type of relationship that you have/will have with your customers related to this KER:

Likely technical support and maintenance services post-installation, and possibly consulting for system integration.

How do you interact/will interact with them:

Interactions may include direct consultations, support services, and possibly user training for system operation.

How costly are they:

Customer support and technical services could be significant given the specialized nature of the system.

9.6 Channels

Through which channels will you deliver the value proposition:



Through direct sales, installation services, and partnerships with construction and HVAC companies. Marketing may occur through industry events and digital platforms.

What is the cost:

Research, marketing, and production facility costs are detailed as follows: 1,000€ for further laboratory research, 1,000€ for marketing, and 3,000€ for bigger production facilities.

9.7 Customer segments

Who you are creating value for:

Occupants of dwellings seeking sustainable cooling and dehumidification solutions.

Who are your most important customers:

Dwelling occupants, likely including homeowners and building operators.

Are you targeting a mass market, niche market, segmented, diversified, multi-sided platform, any other:

Primarily a niche market focusing on environmentally conscious consumers and buildings requiring efficient Cooling and dehumidification.

9.8 Cost structure

What are the key costs in the business model related to this KER:

Further research, marketing, scaling production, and the cost of developing a single-room installation system rather than whole-house.

Describe how your key activities and key resources contribute to the costs:

R&D contributes to laboratory research costs, while marketing and scaling production facilities relate to the overall cost of bringing the product to market.

9.9 Revenue Streams

How will your value proposition generate money:

Sales of the evaporative coolers.

What is the pricing strategy for this KER:

The price range is set at 700-900 €/m², indicating a value-based pricing strategy.

What will be the forms of payment:

Not specified, but typically could include direct purchase, leasing, or financing options.

10 KER#8: Membrane wrapping

SKYTECH PRO XL by WINCO creates a closed envelope, increases wind-tightness, reflects 95% of radiation and avoids thermal bridges for a better comfort in summer as well as during winter. Thanks to its patented technology, SKYTECH PRO XL makes it possible to install a breather membrane and an insulating material at the same time while ensuring that the building remains breathable (allowing the water vapour to escape). Besides its thermal benefits and thanks to its high tear resistance and its high density (105 kg/m³), SKYTECH PRO XL alone gives a 16 dB sound reduction performance. The main characterization of this result is presented in the Table below and the results of the business model canvas are shown in the following sub paragraphs.

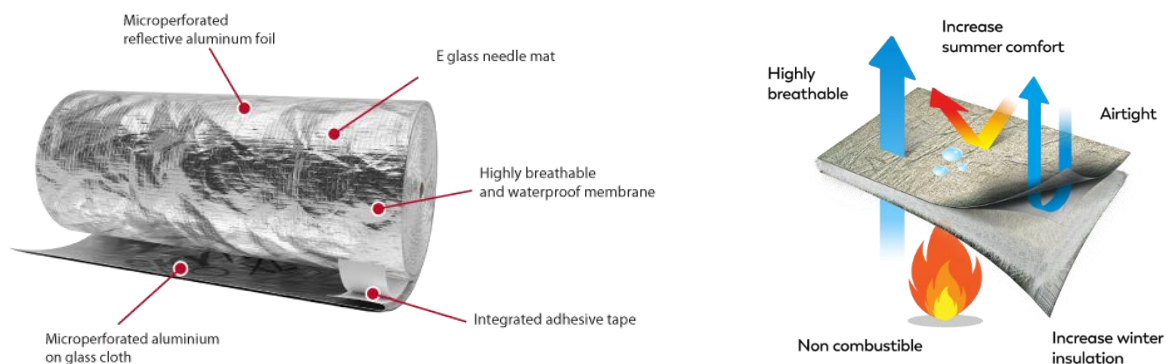


Figure 8 - SKYTECH Pro XL membrane

Table 9 - Characterization of Exploitable Result #8

Exploitable Result #8	Membrane wrapping
Innovative concept of result	Non-combustible thin waterproof breathable membrane does not exist in the market.
Description	100% non-combustible roofing and rain screen reflective membranes with swelling clay as raw materials. Black Rain screen membrane with A1 classification for facades. Hygro-variable vapor barrier non-combustible membranes for Indoor application.
Owner	WINCO (100%)
Contributors	-
Expected date of achievement in the project	August 2023 (M36)
Customers	Any contractor involved in façade and/or roof membranes installation-Any specifier for thermal renovation of building.
Benefits for the customer	Fire protection and better insulation in case of heatwave.

<i>Costs to be incurred after the project</i>	N/A
<i>Expected time to market</i>	A year after the end of the project
<i>Price range</i>	24 euro/m ²
<i>Competitors</i>	Dorken but B euro class instead of A (fire reaction)
<i>Will you protect this result? How? When?</i>	Patent
<i>Possible barriers for implementation</i>	Price. Depending on the thickness of the membrane the installation can be very time consuming.
<i>Starting TRL</i>	7
<i>TRL M48</i>	8-9
<i>TRL at the end of the project</i>	8-9

10.1 Key partners

- Suppliers: Winco Korea – Valmiera Glass UK -Finipur
- Certified bodies: TSUS – Efectis -KTU
- Key resources : Manufacturing and testing

10.2 Value propositions

- Core values: Security (Non combustibility, Breathability), thermal performance (Water and Air tightness, Thermal insulation, summer comfort).
- Security, comfort and energy saving
- Fire protection and building performance

10.3 Key resources

- Building envelope know-how
- Production know-how
- Design and testing know-how
- Marketing and sales know-how

10.4 Key activities

- R&D, product design, testing, standards, methods

10.5 Customer relationships

- Sales contract with biggest building distributors in Europe.
- Negotiation of marketing and communication expenses

10.6 Channels

- Sales channels: Building materials distributors, industrial companies, specifiers.

- Marketing channels: Web, social network, visits to customers and specifiers.

10.7 Customer segments

- Building owners (indirect customers)
- Distributors (direct customers)
- Niche market, unique product offer, very innovative solutions, customized offer.
- The contractor in the Spanish pilot has shown interest in using the product in their refurbishments

10.8 Key partners Cost structure

- Bill of material: 50%
- Marketing and sales: 25%
- R&D: 8%
- Other: 17%

10.9 Revenue Streams

- High end pricing adapted to performing renovation
- Pricing connected to competition conditions
- Customer payments: 30 to 60 days

11 KER#9: Innovative multi-purpose heat pumps

The concept of Solar assisted heat pump (SAHP) is the same as a traditional heat pump. The main difference is the using of a thermodynamic solar panel as evaporator, which permits extraction of heat from environment and the absorbed solar radiation in the solar panel.

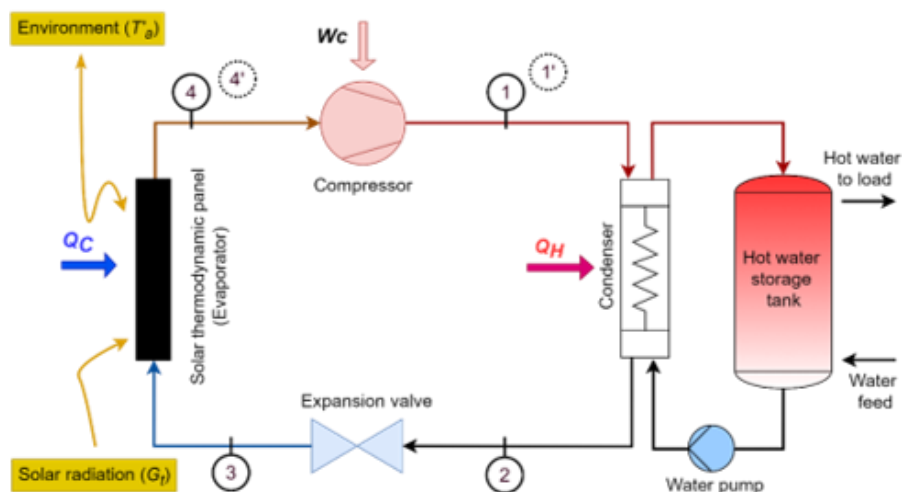


Figure 9 - Schematic of Solar Assisted Heat pump

The Ground source heat pump (GSHP) system harnesses heat stored in the shallow ground for heating and cooling. Surface geothermal is more efficient and sustainable than conventional systems, as the ground serves as a constant source of thermal energy.



Figure 10 - Construction works at the UK demo building for the installation of the Ground Source heat pump



Figure 11 - Installation of the Solar assisted heat pump and the Ground source heat pump at the UK demo building

The main characterization of this result is presented in the Table below and the results of the business model canvas are shown in the following sub paragraphs.

Table 10 - Characterization of Exploitable Result #9

Exploitable Result #9	Innovative multi-purpose heat pumps
Innovative concept of result	Highly efficient solar assisted heat pump and ground source heat pump
Description	A solar-assisted heat pump combines solar thermodynamic panel with heat pump technology. Such a heat pump including direct expansion type and will be used for retrofitting in domestic buildings to provide heating and hot water for buildings. Also, it can be driven into the ground using a handheld piler and act as a heat source/sink for a heat pump. In comparison to conventional ground coil heat exchangers, the thermal pipe provides significant advantages, notably low cost, and easy installation, especially in locations inaccessible to drilling machines. The thermal pipe can either be a solid rod or a “hybrid” tube containing a liquid such as propylene glycol/water. Heat transfer from the TP to the heat pump is achieved via a glycol circuit that includes a heat exchanger on the top of the thermal pipe. Moreover, the combination work of both SAHP and GSHP is also investigated with higher energy efficiency and lower ground area occupied.
Owner	UNOTT (70%)
Contributors	ISQ (30%): development of models and simulations to design and size the technology.

<i>Expected date of achievement in the project</i>	31 st August, 2021
<i>Customers</i>	Dwelling occupants
<i>Benefits for the customer</i>	Occupants can save energy bills
<i>Costs to be incurred after the project</i>	2,000€ for further laboratory research, 1,000€ for marketing, 5,000€ for bigger production facilities
<i>Expected time to market</i>	1 year after the end of the project
<i>Price range</i>	14,237€ - 24,586€ depending on the heating capacity (1.3kW – 7 kW) and hot water tank sizes, tax is not included (the auxiliaries and installation cost is included)
<i>Competitors</i>	Ground source heat pump, air source heat pump, water source heat pump
<i>Will you protect this result? How? When?</i>	Patent & Licensing at the end of 2024
<i>Possible barriers for implementation</i>	The solar assisted heat pump cannot provide space cooling
<i>Starting TRL</i>	6
<i>TRL M48</i>	7-8
<i>TRL at the end of the project</i>	8-9

11.1 Key partners

Who are the key partners of your company related to this KER:

- University of Nottingham (UNOTT)
- Instituto de Soldadura e Qualidade (ISQ)

Who are the key suppliers of your company related to this KER:

UNOTT is the key supplier includes component manufacturers, material suppliers, and service providers related to heat pump technology.

What are the key resources that your company receives from these partners for this KER:

- Expertise in developing models and simulations to design and size the heat pump technology (ISQ contribution)
- Research and development, design, and construction of heat pump systems (UNOTT's contribution)

What are the key activities that these partners perform that are related to your company and the specific KER:

- UNOTT: Development and construction of Direct Expansion Solar Assisted Heat Pump (DX SAHP) and Thermal Pipe Ground Source Heat Pump (TP GSHP)
- ISQ: Development of models and simulations for system design and performance analysis

11.2 Value propositions

What is the core value that your company provides to customers related to this KER:

Offering an efficient, sustainable retrofit heating and cooling solution for domestic buildings that leverages solar energy and advanced heat pump technology to reduce energy bills and enhance indoor comfort.

Which customer needs are you satisfying:

- Need for cost-effective heating and cooling solutions
- Demand for environmentally friendly retrofit options for existing buildings

What kind of customers' problems are you trying to solve with this KER:

- High energy costs associated with traditional heating and cooling systems
- Environmental impact of conventional HVAC systems
- Difficulty of retrofitting efficient heating and cooling systems in existing buildings

11.3 Key resources

What are the resources needed to deliver the value proposition:

- Innovative heat pump technologies (DX SAHP and TP GSHP)
- Solar thermodynamic panels and photovoltaic panels
- Expertise in system design and energy efficiency

Does your activity related to this KER, require a lot of Capital or Human resources:

- The project likely requires significant capital for research, development, and scaling up production.
- Human resources are also crucial for R&D, system design, installation, and maintenance.

11.4 Key activities

In order for your company to deliver the value proposition, what are the key activities that should be realized:

- Research and development of the heat pump systems
- System design and optimization
- Prototyping and laboratory testing
- Preparation for field trials and commercial scaling

11.5 Customer relationships

Describe the type of relationship that you have/will have with your customers related to this KER:

Consultative relationship focusing on providing tailored solutions for energy-efficient retrofitting.

How do you interact/will interact with them:

Direct interactions through consultations, installations, and maintenance services.

How costly are they:

Costs include customer service, technical support, and maintenance services, which could be significant depending on the level of support required.

11.6 Channels

Through which channels will you deliver the value proposition:

- Direct sales to consumers
- Partnerships with construction companies and retrofitting specialists
- Marketing channels include online platforms, trade shows, and industry publications

What is the cost:

Cost details are not specified, but typically include marketing, distribution, and sales force expenses.

11.7 Customer segments

Who you are creating value for:

For dwelling occupants looking for sustainable and efficient heating and cooling solutions.

Who are your most important customers:

Households requiring retrofitting for improved energy efficiency.

Are you targeting a mass market, niche market, segmented, diversified, multi-sided platform, any other:

Niche market focused on energy-efficient retrofit solutions for domestic buildings.

11.8 Cost structure

What are the key costs in the business model related to this KER:

R&D, materials, manufacturing, marketing, and distribution.

Describe how your key activities and key resources contribute to the costs:

Development of technologies and prototypes, as well as scaling for market readiness, are major contributors to costs.



11.9 Revenue Streams

How will your value proposition generate money:

Sales of heat pump systems and related services.

What is the pricing strategy for this KER:

The price range for the heat pump systems is indicated in the documents, such as €6,500-12,000, depending on various factors like heating capacity and hot water tank sizes.

What will be the forms of payment:

Not specified, but typically include upfront payment, financing options, or leasing models for equipment.

12 KER#10: User friendly computer program for planning and retrofitting of residential buildings

This KER has been developed by ISQ within the framework of WP7. It is a computer program designed to support the selection of optimal retrofitting solutions for various scenarios, thereby optimizing renovation and decision-making processes.

The SURE³FIT tool, built on Microsoft Excel®, comprises six modules distributed across four separate Excel files, as illustrated in Figure 12. Further details can be found in deliverable D7.3 - Operational Tool.

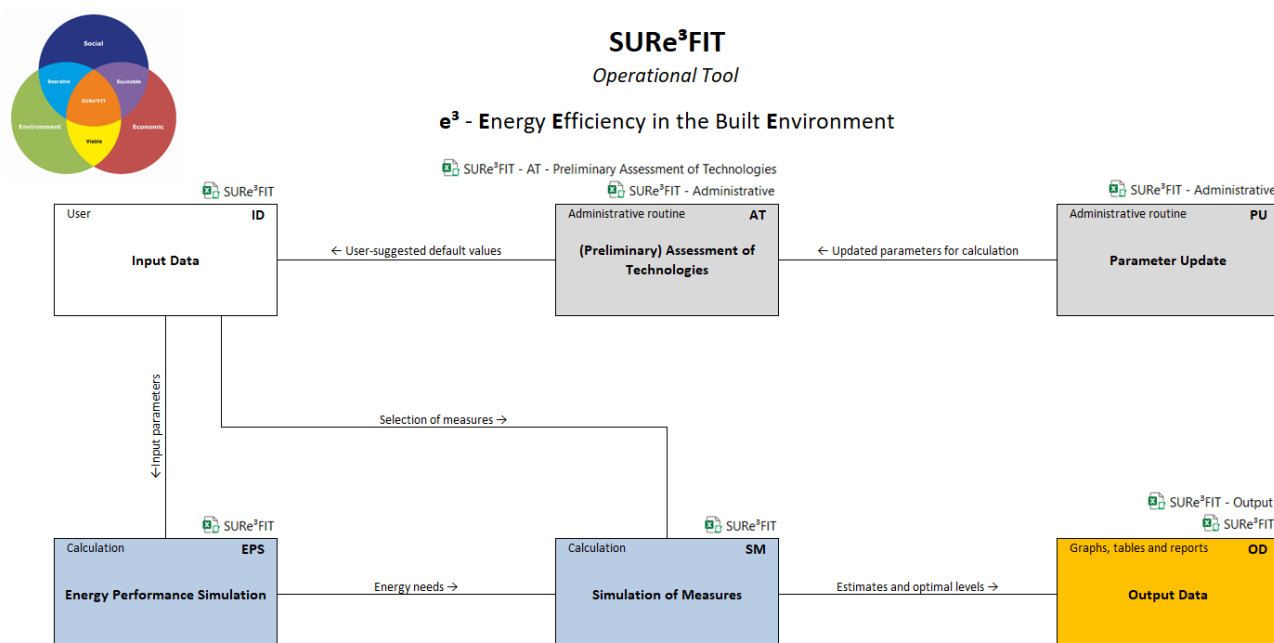


Figure 12 - SURE³FIT tool structure

The main characteristics of this result are presented in the table below, and the outcomes of the business model canvas are detailed in the following subparagraphs.

Table 11 - Characterization of Exploitable Result #10

Exploitable Result #10	User friendly computer program for planning and retrofitting of residential buildings
Innovative concept of result	User-friendly computer program to support the selection of optimal retrofitting strategies in each building, easing the selection of different technologies for different scenarios
Description	User-friendly computer program for supporting the selection of optimal retrofitting and technologies for different scenarios, with the aim of enabling optimization of the renovation and decision-making processes.
Owner	ISQ (100%)
Contributors	-

Expected date of achievement in the project	By the end of the project
Customers	Building owners and stakeholders (qualified experts, suppliers of products and services - architects, engineers, constructors - and local authorities)
Benefits for the customer	The operational tool to be an open-source application that will help stakeholders to decide different possibilities for building retrofitting and renovation. Given the conditions of a building, the program will study available technologies for a specific function (e.g. insulation, glazing, domestic hot water, heating and cooling, use of renewable energy sources - RES) or a combination of them, and show an integrated economic and environmental analysis, as well as the potential energy saved.
Costs to be incurred after the project	An initial budget of €5000 promotion and marketing primarily, plus €50000 per year, as expenses with personnel costs and dedicated infrastructure
Expected time to market	A year after the end of the project
Price range	An average of €120 per annual subscription, per qualified expert, for a total of 100 experts in the first year, totalling €12000/y. However, the relevant part of the revenue will come from commercial leads provided by qualified experts to offer similar service to large buildings, which is ISQ's target market.
Competitors	Itecons (PT)
Will you protect this result? How? When?	Although this is a tool that must be submitted as a public deliverable within the project, after the action the tool can be susceptible of improvements and adaptations to be sold as a service.
Possible barriers for implementation	Lack of interest of potential clients.
Starting TRL	6
TRL M48	7
TRL at the end of the project	8

12.1 Key partners

- Certified partners: Qualified experts from the Buildings Energy Performance Certificates (EPC) System.
- Suppliers: consulting company (for the business plan - not mandatory).
- Local public energy authorities.

12.2 Value propositions

- User-friendly computer program for supporting the selection of energy conservation measures (ECMs) for different scenarios.

- Enabling optimization of the retrofitting and decision-making processes.
- Customer needs to satisfy: Technical support for investment decisions, for example when using environmental funds.
- Problems to solve: Mitigate complexity in investment decisions.

12.3 Key resources

- Project Manager, Product Manager, Product Owner, and Scrum Master with high experience.
- Intellectual contribution from a highly qualified systems development team (SID).
- Building sector market view (SIE and/or consulting company)
- Capital and human resources from projects financed with European funds.
- Internal departments: Intelligent and Digital Systems (SID), Integrated Energy Solutions (SIE) and ISQ Academy.

12.4 Key activities

- Programming and computational maintenance of the platform, feedback and updating of the database, professional training and leads for EPCs of medium and large buildings (Experts).
- Offer certification training for Experts.
- Consultancy services and preparation of EPCs.

12.5 Customer relationships

- Expert service centre (support for action in the field) and receiving leads for consultancy.
- Interaction through contacts via the webpage and telephone.

12.6 Channels

- ISQ webpage.
- Certified Experts dissemination.
- One stop shop with experts, working with the support of digital tools.

12.7 Customer segments

- Building/house owners, buildings stakeholders (architects, constructors, etc.) and responsible for public buildings.
- Medium and large building owners are the most important customers.
- The Experts are both partners (for medium and large buildings - segmented market) and customers of the platform (small buildings - mass market).

12.8 Cost structure

- Cost of a work position (with workstation) with higher technical qualifications, during working hours.
- Application server cost.
- Cost of platform maintenance and updates.

12.9 Revenue Streams

- Charges to building owners/responsible parties for consultancy services and EPCs carried out by ISQ professionals.
- Charges to Experts for using a restricted area to perform calculations and simulations on the platform.
- Charges to building sector stakeholders for training at the ISQ Academy.
- Value-added pricing strategy.
- Payment upon presentation of service invoice.

13 KER#11: Methodology and guidelines for retrofitting

This KER is a handbook developed mainly by ISQ, with the contribution of UNOTT and AALTO. It aims to give to every end user of the operational tool (homeowner, contractor, etc.) the essential knowledge, the requirements, method and best practices for a guided implementation and decision making and needed for renovation and retrofitting. According to the Grant Agreement, it will be an Open Research Data Pilot and not be a commercial product, therefore no business model canvas has been made for this KER. However, it will be a result that will be integrated in the overall business model that will combine all SUREFIT results.

Table 12 - Characterization of Exploitable Result #11

Exploitable Result #11	Methodology and guidelines for retrofitting
Innovative concept of result	Brief handbook to give to every end user of the operational tool (homeowner, contractor, etc.) the essential knowledge, the requirements, method and best practices for a guided implementation and decision making and needed for renovation and retrofitting.
Description	A method of generating a planning of building retrofit for a portfolio of buildings.
Owner	ISQ (60%)
Contributors	UNOTT (40%): suggest the retrofit installation methods and to avoid the overheating issues, grid stability and operational guidance. AALTO: define by simulations optimal renovation packages.
Expected date of achievement in the project	M48
Customers	Building/house owners, contractors, operators, buildings stakeholders (architects, constructors, etc.)
Benefits for the customer	Innovative guidelines and best practice will be described for retrofitting of residential buildings
Costs to be incurred after the project	0
Expected time to market	-
Price range	-
Competitors	-
Will you protect this result? How? When?	ORDP: Open Research Data Pilot
Possible barriers for implementation	-

14 Solar Thermal and PV system

SOLIMPEKS manufactures the Hybrid PV-Thermal (PV/T) solar collectors to achieve both hot water and power generation from the sun as a clean and free energy source. As a combination of solar PV and solar thermal in a single unit, the system is capable of delivering twice as much renewable energy in the same rooftop footprint as standard solar, therefore also delivering twice as much carbon displacement.

This system existed before the SUREFIT project. During the project implementation, SOLIMPEKS designed the PV/T system specifically for its application in the demo sites.

The main characterization of this result is presented in the Table below.

Table 13 - Characterization of PV/T

Technology	Solar Thermal and PV system
<i>Innovative concept of result</i>	SOLIMPEKS will also produce novel solar thermal and PV/T systems for integration into buildings. Advanced PV/T collectors will be investigated where the absorber is treated with a selective Tinox coating to maximise the solar energy absorbed and minimise heat loss through radiation. Novel PV/T solar collectors which could form a component of roofing structure will be produced by this partner for heating hot water and as a heat source for heat recovery or solar powered cooling.
<i>Description</i>	Integrated solar thermal and photovoltaic system
<i>Owner</i>	SOLIMPEKS (100%)
<i>Contributors</i>	-
<i>Expected date of achievement in the project</i>	Already a product, prior to SUREFIT
<i>Customers</i>	Individuals, constructors, engineers.
<i>Benefits for the customer</i>	Having highly efficient hybrid panels producing both electricity and thermal energy. This also allow users couple PV/Ts with heat pumps and evaporative coolers.
<i>Costs to be incurred after the project</i>	-
<i>Expected time to market</i>	Already
<i>Price range</i>	€385/PVT
<i>Competitors</i>	DUALSUN



<i>Will you protect this result? How? When?</i>	Patented already
<i>Possible barriers for implementation</i>	Technical barriers, conflict, diverging interests
<i>TRL M48</i>	9
<i>TRL at the end of the project</i>	9

15 Daylight louvers

SUREFIT is researching a louver shutter system in which the slats that make up the shutters are specifically designed for each orientation and geographic location as well as for the façade construction and type of building. The aim is to reduce glare and overheating of buildings. The direct sun is reflected while the diffuse daylight transmits into the interior. The goal is to achieve a reduction in cooling demand without a loss of interior brightness.

The daylight louvers have been designed and already been produced before the SUREFIT project. During the project implementation, the specific application was designed for the specific use cases, i.e. for the Spanish (glass bead installation) and Finnish (box window) demo sites.

The main characterization of this result is presented in the Table below and the results of the business model canvas are shown in the following sub paragraphs.

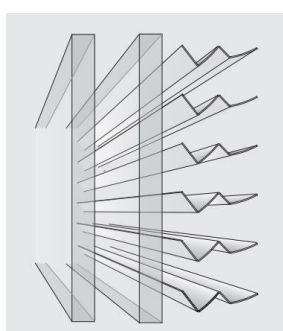


Figure 13 - Daylight louvers RETROLux 20 mm used in Spain and Finland

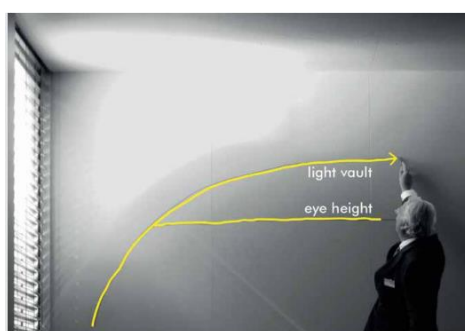


Figure 14 - Daylight louvers

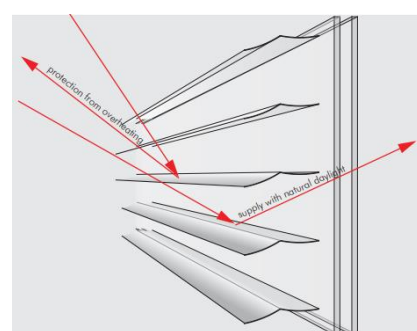


Figure 15 - Daylight louvers RETROLux 80 mm used in Finland

Table 14 - Characterization of Daylight louvers

Technology	Day light louvers
Innovative concept of result	Integration of daylight and electric lighting by harmonizing the light colour and integrating the luminous fluxes
Description	Daylight systems with internal/external louvers
Owner	KOST (100%)
Contributors	-
Expected date of achievement in the project	Already a product, prior to SUREFIT
Customers	Individuals
Benefits for the customer	Reduced energy cost for electric lighting

<i>Costs to be incurred after the project</i>	Less energy cost for the consumer
<i>Expected time to market</i>	Already in the market, prior to SUREFIT. During the project time the specific application for Retrofit has been designed. Since the louvers have been delivered for the SUREFIT Retrofit projects, marketing has been increased and larger projects have already been done.
<i>Price range</i>	150 - 250 €/m ² , depending on motorisation or hand crank
<i>Competitors</i>	No competitors for mirror louvers
<i>Will you protect this result? How? When?</i>	KOST had applied patents and designed patents already before the SUREFIT project
<i>Possible barriers for implementation</i>	None
<i>Starting TRL</i>	7
<i>TRL M48</i>	9
<i>TRL at the end of the project</i>	9

15.1 Key partners

Who are the key partners of your company related to this KER:

RETROSolar Gesellschaft für Tageslichtsysteme mBH, furthermore we are in contact with company REHAU Germany (supplier of window profiles) and Internom from Austria (supplier of prefabricated windows).

Who are the key suppliers of your company related to this KER:

RETROSolar, Alanod (mirror louver material)

What are the key resources that your company receives from these partners for this KER:

Aluminium with mirror surface, anodized or with PVD coated

What are the key activities that these partners perform that are related to your company and the specific KER:

Daylight blinds

15.2 Value propositions

What is the core value that your company provides to customers related to this KER:

- Better daylight supply for less consumption of electric lighting



- Better passive cooling to minimize A/C consumption

Which customer needs are you satisfying:

- We develop the optical systems to realize the energy savings
- We take care of better view through in order to increase the acceptance of blinds

What kind of customers' problems are you trying to solve with this KER:

We have the knowledge and the software to develop the daylight systems and to calculate the savings.

15.3 Key resources***What are the resources needed to deliver the value proposition:***

The knowhow built up in the professional life.

Does your activity related to this KER, require a lot of capital or human resources:

Capital and human resources are needed. All those resources like physical, intellectual, human, financial are essential.

15.4 Key activities***In order for your company to deliver the value proposition, what are the key activities that should be realized:***

- Calculation of the daylight optics
- Production of the optical systems

15.5 Customer relationships***Describe the type of relationship that you have/will have with your customers related to this KER:***

License agreement

How do you interact/will interact with them:

Developing the tools for the daylight louvers.

How costly are they:

- Different tools have different costs
- Main costs are not only for the tools, but for the engineering to develop the technology

15.6 Channels***Through which channels will you deliver the value proposition? Please, try to include supply & distribution but also, marketing channels:***

We are in contact with architects, façade designers and A/C planners. We develop software and calculate the energy savings as basis of an implantation of technologies. Sometimes we are working on honorary basis, sometimes as contractors of the builder, but also in an own interest as scientists and inventor. Dr. Köster develops patents and hopes to find licensees to recover the development costs by royalties.

15.7 Customer segments

Who you are creating value for:

- producer of daylight blinds
- designing the facades for lowest energy consumption
- reducing the cooling load of buildings
- reducing the consumption of electric energy for electric lighting

Who are your most important customers:

- blind industry
- insulation glass industry
- architects
- façade planers
- lighting designers
- building physicists

Are you targeting a mass market, niche market, segmented, diversified, multi-sided platform, any other:

At present we attack a mass market in office buildings, later we attack the home market.

15.8 Cost structure

What are the key costs in the business model related to this KER:

Engineering and personnel costs.

Describe how your key activities and key resources contribute to the costs.

The main contribution is the know how no one else has.

15.9 Revenue Streams

How your value proposition will generate money:

Royalties, planning contracts in the field of daylighting/façade planning

What is the pricing strategy for this KER:

150 - 250 € / sqm, depending on motorisation or hand crank

What will be the forms of payment:

Royalties/fees

16 Overall business model of the combination of the SUREFIT technologies

SUREFIT technologies aim to significantly reduce primary energy use, carbon emissions, renovation time, and costs. Achieving these ambitious goals presents a challenging path to market scalability. Therefore, a coordinated effort is essential to raise awareness about the potential future return on investment in SUREFIT's innovative technologies, such as cost-optimal energy conservation measures and renewable energy solutions (RES), while meeting both environmental and economic criteria.

Given the market barriers and the potential size of the European market, the non-profit and non-industrial partners of the Consortium have adopted a conservative approach towards the institutional post-life model of the project. This cautious stance stems from the uncertainty surrounding the commercial exploitation of the patented solutions. Consequently, these partners have formed a mutual partnership to ensure the continuity and replication of the project at the European level.

Based on the Business Model Canvas and the Key Exploitable Results outlined in chapters 3 to 15, an overall business model approach for SUREFIT technologies and services has been designed. This approach aims to create a network of stakeholders that will facilitate the coordinated exploitation of results, while also accommodating the unique characteristics of the entities within the SUREFIT Consortium.

Thus, the beneficiaries were categorized into three groups based on their primary roles as contributors to this project: (1) service providers and/or non-profit entities, (2) industrial technology providers, and (3) non-industrial technology developers. These groups are detailed in Table 15.

Table 15 - Primary roles of the beneficiaries

Services providers and/or non-profit entities	Industrial technology providers	Non-industrial technology developers
AALTO	KOST	CJR
AMS	ONCONTROL	UNOTT
FSM	PCM	
ISQ	SOLIMPEKS	
	WINCO	

From this, a SWOT analysis was undertaken, as well as strategic concepts were defined and subsequently developed into a tactical plan, as described below.

16.1 SWOT Analysis

A comprehensive planning process was initiated to assist the partners in overcoming challenges and identifying the best paths forward. To ensure the partners had a thorough understanding of all factors involved in making these business decisions, a SWOT analysis was conducted prior to the Consortium committing to any post-project actions or initiatives. Following a brainstorming session, this straightforward four-step process identified the subsequent factors:

16.1.1 Internal Factors

Strengths

The SUREFIT project boasts several key strengths that position it favourably within the market:

- **Market position and reputation:** The service providers and non-profit entities involved in the project are well-positioned in the market and are recognized as leaders in innovation within their respective countries.
- **Strong research and development:** Continuous investment in R&D ensures that the project stays at the forefront of technological advancements.
- **Attractive partnerships:** These institutions are highly attractive for partnerships due to their extensive research capabilities and well-maintained databases covering environmental, economic, and technical aspects.
- **Innovative solutions:** The project includes cutting-edge technologies and innovative solutions that can significantly improve energy efficiency in buildings.
- **Expertise in decision support tools:** ISQ has a long-standing history of developing decision support tools, supported by a highly qualified team capable of developing advanced platforms. Additionally, ISQ's Academy offers online training for specialist professionals, enhancing their expertise and reach.
- **Comprehensive training programs:** The availability of comprehensive training programs helps in building a skilled workforce capable of implementing energy-efficient technologies.

Weaknesses

On the other hand, the project faces several notable weaknesses:

- **Cost-effectiveness of technologies:** Many SUREFIT technologies are currently not cost-effective, posing a challenge for widespread adoption.
- **Investment requirements:** Significant investment is needed to scale these technologies, which can be a barrier for smaller entities or those with limited funding.
- **High initial costs:** The initial costs for implementing these energy-efficient technologies can be prohibitively high for some stakeholders.
- **Labour challenges:** There is a considerable difficulty in finding and training skilled labour to implement these advanced technologies.
- **Maintenance and upkeep:** Advanced technologies may require specialized maintenance, which can be costly and complex.

- **Limited service integration:** Few services in the building sector can be associated with these technologies, limiting a more comprehensive market approach.
- **Market penetration:** Achieving significant market penetration can be challenging due to the niche nature of these technologies.

16.1.2 External Factors

Opportunities

These opportunities can significantly enhance energy efficiency in buildings, leading to cost savings, reduced environmental impact, and improved occupant comfort:

- **Addressing misinformation and awareness:** The primary barriers to investing in energy efficiency measures are misinformation and a lack of awareness.
- **Behavioural change programs:** Encouraging occupants to adopt energy-saving behaviours through education and incentives.
- **Public awareness campaigns:** Launching campaigns to educate the public about the benefits and methods of improving energy efficiency.
- **Energy certification challenges:** While energy certification is mandatory for all buildings, experts often struggle to recommend effective improvement measures.
- **Certification standards:** Certification ensures that buildings meet established minimum energy performance requirements.
- **Government incentives:** Taking advantage of government grants, tax credits, and rebates for energy-efficient upgrades.
- **Environmental funds awareness:** Most citizens are unaware of the possibility of using environmental funds.
- **Smart building technologies:** Implementing smart sensors and automation systems to optimize energy use in real-time.
- **Energy management systems:** Implementing comprehensive energy management systems to monitor and control energy use across multiple buildings (for example, mirror systems in the facades using the sun's angles of incidence for self-control).
- **Renewable energy integration:** Incorporating solar panels, surface geothermal, and other renewable energy sources to reduce reliance on non-renewable energy.
- **Green building materials:** Using sustainable and energy-efficient materials in construction and renovation projects.
- **Retrofitting existing buildings:** Upgrading older buildings with modern energy-efficient technologies and materials.
- **Expert and policymaker networks:** Establishing a network of experts and policymakers can meet market needs without incurring significant marketing costs.

Threats

The project faces several potential threats that could impact its success:

- **Economic fluctuations:** Economic downturns can reduce the availability of funding and investment for energy efficiency projects.

- **Regulatory changes:** Changes in government policies or regulations can impact the feasibility and attractiveness of energy efficiency initiatives.
- **Technological obsolescence:** Rapid technological advancements can render existing technologies obsolete, requiring continuous investment in upgrades.
- **Public perception and acceptance:** Resistance from building owners or occupants to adopt new technologies or practices can hinder implementation.
- **Market competition:** The emergence of new competitors offering similar or superior energy-efficient technologies can pose a threat.
- **Potential competition in the provision of services:** While no competing similar services are anticipated in the short to medium term, the possibility of new entrants cannot be ruled out.
- **Brand misuse:** There is a risk of inappropriate use of the partner entities' brands in the provision of these technologies and services.

16.2 Strategic concepts

Combining the interests of entities with such diverse characteristics as those within the SUREFIT Consortium into a single results exploitation strategy proved to be a challenge. Despite this, to ensure continuous goals and active contributions beyond the project's lifetime, the SUREFIT Consortium presents five strategic concepts:

- Training for qualified experts in the use of the SURE³FIT tool
ISQ Academy offers online training for various stakeholders (suppliers of products and services, architects, engineers, constructors, and local authorities), focusing on preparing qualified experts for the use of the tool in a new generation of energy performance certificates (EPCs) context.
- Collaboration with local public energy authorities
Contribution to the establishment of one stop shops (OSS) with necessary infrastructure funded by municipalities.
- Exploitation through independent businesses
Marketing and commercialization of proprietary technologies by industrial partners through their established sales structures.
- Agreements with manufacturers for commercial exploitation
Exploitation of patented solutions developed by non-industrial partners through agreements with manufacturers outside the project.
- SUREFIT technologies dissemination network
Beyond the project's lifetime, maintaining the dissemination of its achievements through participation in strategic events across Europe.

16.3 Tactical plan

Despite this conservative approach, the exercise demonstrates a sustainable basis for this model, enabling the generation of income sufficient to cover operational costs and enhance positive

outcomes, such as consultancy services, while also allowing for a residual net income to finance future developments.

The proposed SUREFIT tactical plan includes the following elements:

- Online training by ISQ Academy

ISQ Academy will offer online training focused on domestic buildings to qualified experts. Resources for this training will be obtained through a successor project, specifically within the scope of the LIFE-2024-CET-OSS call. The OSS will feature experts supported by an open-source application of the SURE³FIT tool, hosted on the ISQ webpage. This tool will assist stakeholders in deciding among various alternatives for domestic building retrofitting and renovation, including cost-optimal SUREFIT technologies. The program will analyse available technologies for specific functions (e.g., insulation, glazing, domestic hot water, heating and cooling, use of RES) or combinations thereof, providing an integrated economic and environmental analysis, as well as potential energy savings. This training should be sponsored by related entities or, preferably, subsidized by public funds.

- Expansion of SURE³FIT Tool by ISQ

ISQ will invest in a specific business plan to develop a new instance of the SURE³FIT tool, adding functionalities to extend the provision of services to large buildings. Resources for this expansion will also be sought through financing within the scope of a subsequent project.

- Commercialization by Industrial Partners

Industrial partners owning TRL 8-9 technologies and having established sales structures will commercialize these technologies, leveraging the experience, prestige, and networking gained through the SUREFIT project.

- Agreements for commercial exploitation by Non-Industrial Partners

Non-industrial partners will establish contacts with manufacturers to reach initial agreements for the commercial exploitation of patented solutions developed within the project.

- Dissemination of project achievements

All partners are responsible for maintaining the dissemination of project achievements to ensure that cost-optimal SUREFIT technologies are considered for specific building types and geo-clusters across Europe. This will be achieved through continuous involvement in meetings, workshops, and trade fairs promoted by clustering partners and other initiatives at local, national, and European levels.

Given the current stage, this overall business model of the combination of SUREFIT technologies provides a foundation for future developments. If successful, it will create projects that extend this approach beyond residential buildings.

Conclusions

As outlined in the exploitation plan, a set of products and services was identified, and the current business model estimated the operational costs and potential income generated by the project's results. The SUREFIT project's Key Explorable Results drivers utilized the Business Model Canvas to describe each company's strategy to create, deliver, and capture value, aiming for sustainable revenue generation and operations.

A SWOT analysis was undertaken to help the partners overcome challenges and determine which paths to take. To ensure continuous goals and active contributions beyond the project's lifetime, the SUREFIT Consortium presents five strategic concepts: (1) training for the use of the SURE³FIT tool, focused on qualified experts preparing energy performance certificates (EPCs); (2) one stop shops (OSS), with experts offering free consultancy with the support of SURE³FIT tool, guiding building owners on cost-optimal technologies for each case; (3) immediate marketing and commercialisation through independent businesses by industrial partners with established sales structures; (4) agreements with manufacturers for commercial exploitation of patented solutions developed by non-industrial partners of the SUREFIT project, and (5) continuous dissemination through a geo-clusters network.

The proposed SUREFIT tactical plan defines several key initiatives: (1) ISQ Academy will offer specialized training focused on domestic buildings to qualified experts; (2) ISQ will invest in a specific business plan to develop a new instance of the SURE³FIT tool, incorporating functionalities that extend services to large buildings. Resources for these initiatives will be sourced from successor projects; (3) Industrial partners with TRL 8-9 solutions and established sales structures will commercialize SUREFIT technologies, leveraging the experience, prestige, and networking gained through the SUREFIT project; (4) Non-industrial partners will establish contacts with manufacturers to secure initial agreements for the commercial exploitation of patented solutions developed within the project; and (5) All partners will be responsible for maintaining the dissemination of project achievements, ensuring that cost-optimality is addressed for specific building types across various geo-clusters in Europe.

This comprehensive business model aims to create a network of experts and policymakers, facilitating the exploitation of project results. It will particularly focus on raising awareness of the return on investment in SUREFIT's innovative technologies, which include energy conservation and cost-optimal measures for renewable energy sources, meeting both environmental and economic criteria.