



**CBDC powered Smart PerFORrmance contracTs for Efficiency, Sustainable,
Inclusive, Energy use**

**D2.7 Business models analysis for each service
M30**

Report Identifier:	D2.7		
Work-package:	WP2	Task:	T2.4
Responsible Partner:	450 (CC02)	Version Number:	1.0
Due Date	M30	Document Date	20/06/2025
Distribution Security:	PU	Deliverable Type:	R
Keywords:	Business models, European market, Planning		
Project website: http://www.fortesie.eu/			



Quality Control

	Organisation	Date
Editor	CCO2	05/06/2025
Peer review 1	INCL	12/06/2025
Peer review 2	TGT	16/06/2025
Authorised by (Technical Coordinator)	ED	19/06/2025
Authorised by (Quality Manager)	ED	19/06/2025
Submitted by (Project Coordinator)	ED	20/06/2025

Legal Disclaimer

FORTESIE is an EU project funded by the Horizon Europe (HORIZON) research and innovation programme under grant agreement No. 101080029. The information and views set out in this deliverable are those of the author(s) and do not necessarily reflect the official opinion of the European Union. The information in this document is provided “as is”, and no guarantee or warranty is given that the information is fit for any specific purpose. Neither the European Union institutions and bodies nor any person acting on their behalf may be held responsible for the use which may be made of the information contained therein. The FORTESIE Consortium members shall have no liability for damages of any kind including without limitation direct, special, indirect, or consequential damages that may result from the use of these materials subject to any liability which is mandatory due to applicable law.

Copyright notice

© Copyright by the FORTESIE Consortium

This document contains information that is protected by copyright. All Rights Reserved. No part of this work covered by copyright hereon may be reproduced or used in any form or by any means without the permission of the copyright holders.

Table of Contents

List of Figures	5
List of Tables	6
Abbreviations	8
Executive Summary	11
1 Introduction	12
1.1 Project Introduction	12
1.2 Deliverable Purpose	12
2 Update on early Business models for pilots based on BASE/X approach	13
2.1 OKT (Demo 2)	13
2.2 TGT (Demo 1) and CRD (Demo 5)	19
2.3 VEO (Demo 2)	25
2.4 GAR (Demo 2)	29
2.5 JUST (Demo 3)	35
2.6 COOP	40
2.6 MESH (Demo 7)	42
2.7 +48 (Demo 6)	46
2.8 Slovakian case	51
2.9 Conclusion from the radars	54
3 Update on the proposed European Central Bank CBDC, so-called “digital-euro”	57
3.1 Update on Digital-euro (D€) development	57
3.2 Conclusion for FORTESIE on the D€ development	63
3 Development of Market-Ready Renovation Packages	64
4 Conclusions	66

List of Figures

Figure 1 OKT's business model radar for exploitation: early version	14
Figure 2 OKT's business model radar for exploitation : updated version.....	15
Figure 3 TGT's business model radar for exploitation : old version.....	19
Figure 4 CRD's business model radar for exploitation : updated version.....	20
Figure 5 TGT's & CRD's business model radar for exploitation : updated version	21
Figure 6 VEO business model radar for exploitation : early version	25
Figure 7 VEO business model radar for exploitation :updated version	26
Figure 8 GAR business model radar for exploitation : early version	29
Figure 9 GAR business model radar for exploitation : updated version	30
Figure 10 UST business model radar for exploitation : early version	35
Figure 11 JUST business model radar for exploitation : updated version	36
Figure 12 COOP's radar for green and comfortable households through prosumer engagement in cooperatives	40
Figure 13 MESH business model radar for exploitation : final version.....	42
Figure 14 +48 business model radar for exploitation : early version	46
Figure 15 +48 business model radar for exploitation : updated version	47
Figure 16 +48 business model radar for exploitation :updated version on business canvas.....	50
Figure 17 APES/ECN business model radar for exploitation	51
Figure 18 Figure 15 APES/ECN business canvas.....	54
Figure 19 Prototype design of the D€ by the ECB.....	57
Figure 20 Oxyoron slide title illustrates the confusion around the concept of currency and payment systems.....	59
Figure 21 A central body (ECB) calling for the use and control of decentralised tools.	60
Figure 22 ECB vision of a Digital-euro, i.e. the construction of a new payment system rather then introducing a new currency.....	61
Figure 23 Money is neutral, payment systems are political.....	62
Figure 24 Museum Initial Renovation Package.....	65

List of Tables

Table 1	Offered experience	16
Table 2	Customer: Home Owner	16
Table 3	Renovation Engineering and Consulting Supplier (OKT)	16
Table 4	Installer of Equipment.....	17
Table 5	Equipment (heat pump/PV/etc).....	17
Table 6	ESCO.....	17
Table 7	Digitisation Supplier	17
Table 8	Refinancing Actor	18
Table 9	CCO2.....	18
Table 10	Offered experience.....	22
Table 11	Customer: Building Owner	22
Table 12	Renovation Engineering and Consulting Supplier (TGT)	23
Table 13	Installer of Equipment.....	23
Table 14	Equipment (PVs/PV windows/etc).....	23
Table 15	ESCO (CRD).....	24
Table 16	Digitisation Supplier	24
Table 17	Cash in/ Bank.....	24
Table 18	Offered experience.....	27
Table 19	Customer: Home Owner	27
Table 20	ESCO.....	27
Table 21	Digitisation Supplier	28
Table 22	Bank/ Cash in.....	28
Table 23	CCO2.....	28
Table 24	Offered experience.....	32
Table 25	Home owner.....	32
Table 26	Renovation Engineering and Consulting Supplier	32
Table 27	Local government.....	33
Table 28	Equipment.....	33
Table 29	Installer of Equipment.....	33

Table 30	Digitisation Supplier	33
Table 31	Offered experience	38
Table 32	Home Owner	38
Table 33	NGO renovating homes	38
Table 34	Local Municipalities	38
Table 35	Equipment Equipment/ Materials providers	39
Table 36	Cash in/Bank (GOP)	39
Table 37	Offered experience	44
Table 38	Public building users	44
Table 39	MESH Energopārvaldība	44
Table 40	ESCO	45
Table 41	Policy Maker	45
Table 42	Financial Organization	45

Abbreviations

AMI	Advanced Metering Infrastructure
AML	Antimoney laundering
APR	Annual Percentage Rate
BIPV	Building Integrated Photovoltaics
bn	billion
BPIE	Buildings Performance Institute Europe
CAGR	Compound Annual Growth Rate
CBDC	Central Bank Digital Currency
CO ₂	Carbon Dioxide
DCA	Dedicated Cash Account
DEAN	Digital Euro Account number
D€	Digital Euro
DSO	Distribution System Operator
EBITDA	Earnings Before Interest, Taxes, Depreciation, and Amortization
EBRD	European Bank for Construction and Development
ECB	European Central Bank
EE	Energy Efficiency
EED	Energy Efficiency Directive
EPBD	Energy Performance of Buildings Directive
EPC	Energy Performance Contracts
ESCO	Energy Service Company
ESG	Environmental, Social, and Governance considerations

ESIE	Efficient, Sustainable and Inclusive Energy
EU	European Union
EU GDP	European Union Gross Domestic Product
EUR	Euro
G€	Green Euro
GDP	Gross Domestic Product
GEFFs	Green Energy Finance Facilities
GET	Green Economy Transition
GHG	Greenhouse Gas
GWP	Global Warming Potential
IEA	International Energy Agency
IT	Information Technology
JRC	European Commission's Joint Research Centre
KYC	Know Your Customer
LEED	Leadership in Energy and Environmental Design
m	million
MEES	Minimum energy efficiency standard
MFJ	Multiannual Financial Framework
NGEU	NextGenerationEU
nZEB	Nearly zero-energy building
N€XT	Eurosystem centralised settlement engine
OSS	One Stop Shop
POC	Proof Of Concept
PSP	Payment Service Providers

PFIs	Partner Financial Institutions
PV	Photovoltaic
RDG	Digital-Euro rule book
RES	Renewable Energy Sources
ROI	Return on Investment
RPI	Responsible property investing
RRPs	Recovery and Resilience Plans
SSH	Social Sciences and Humanities
UK	United Kingdom
UNEP	United Nations Environment Programme
UTXO	unspent transaction output
WP	Work Package
ZEB	Zero-Emission Building

Executive Summary

FORTESIE's overarching vision is to design, demonstrate, validate, and replicate innovative renovation packages within the building industry, featuring Smart Performance-Based guarantees and financing. The primary objective is to promote Efficient, Sustainable, and Inclusive Energy (ESIE) usage, with the aim of expediting the Renovation Wave throughout Europe.

This deliverable updates the following chapters of deliverable D2.4:

- early expected exploitable results of FORTESIE,
- BASE/X business models radars of consortium partner's,
- further elaboration of identified models that could be transformed into actionable strategies to engage a broader audience.

1 Introduction

1.1 Project Introduction

The overall vision of FORTESIE is to design, demonstrate, validate and replicate innovative renovation packages in the building industry with Smart Performance-Based guarantees and financing, aiming at Efficient, Sustainable and Inclusive Energy (ESIE) use to accelerate the Renovation Wave in Europe. The renovation packages will combine state-of-the-art construction materials and technologies components (prefabricated facades, BIPV, heat pumps, etc.), innovative digital technologies for measurement and verification, and attractive financing (e.g. contractual frameworks for smart performance guarantees, financing mechanisms, engagement techniques, green-euros, etc.), to raise the overall EPC value proposition. The renovation packages will be tailored to specific target groups needs and optimised to improve the ESIE performance considering energy, CO₂ and comfort. Each package will be demonstrated and validated in real life use cases and customised for replication in all other partner countries for immediate market take-up.

Complementary to the renovation packages, ESIE performance will be recorded on a blockchain, and will power smart contracts (i.e. automated execution) that could open to new energy services business models presented in this document.

Methodologies from Social Sciences and Humanities (SSH) will be adopted for:

- a. the creation of collaborative business models that boost the Renovation Wave by considering all stakeholders' value and revenue streams,
- b. novel incentivisation and behavioural change models that aim to stimulate long term engagement with focused interactions to adopt green behaviour
- c. the incorporation of a digital currency, green-euro, (€G) for financing, rewarding and creating an inclusive / collective narrative in the fight against climate change
- d. the collection of feedback for recommendations to policy and business stakeholders,
- e. Mapping and understanding the complex interplay between the different stakeholders to deliver an engagement strategy across the value chain.

These demonstrations and smart EPC will illustrate a new use case for new payments methods and new currency that could position the green-euro as a retail Central Bank Digital Currency (CBDC), hence revolutionising the financing of renovation approaches. An online marketplace, will be offering first level advice, directing consumers through the value chain of stakeholders and facilitating access to these "packaged" renovation services.

1.2 Deliverable Purpose

This deliverable updates the position of the FORTESIE results of D2.4 with regards to:

- early expected exploitable results of FORTESIE,
- BASE/X business models radars of consortium partner's,
- further elaboration of identified models that could be transformed into actionable strategies to engage a broader audience.

This deliverable is considered complementary to the work in WP5 which outlines the business plans and policy recommendations and market development activities.

2 Update on early Business models for pilots based on BASE/X approach

In this section, we provide an update of the radars presented by all pilots in D2.4.

As the FORTESIE project progressed, we recognized the need to transition our business radars and canvases that were created in D2.4 from a theoretical foundation to a more practical, market-oriented approach to ensure their applicability in real-world settings. Initially, the models included elements such as the ECB (European Central Bank) interaction, considering the potential relevance of the Digital Euro in facilitating transactions within renovation ecosystems. However, through deeper analysis and alignment with the project's objectives, it became clear that the ECB's development of the Digital Euro does not align with the operational or financial realities of FORTESIE. As such, it was neither necessary nor practical to include this interaction. To enhance relevance and usability, we developed tailored business radars for each pilot site, analyzing their specific contexts and ecosystems. In this process, we removed actors and roles that were either incompatible or not applicable to the real market, and retained only those that represent actual, active stakeholders who can drive the uptake and implementation of renovation solutions. This resulted in grounded, streamlined models that reflect real market dynamics and support actionable strategies for deployment.

With these refined and pilot-specific business radars in place, we are now able to translate market insights directly into the design and structuring of renovation packages. The radars clearly map out the ecosystem of real actors—such as one-stop shops, construction companies, technology providers, financial institutions, and local authorities—detailing their roles, interactions, and value flows. This clarity allows us to define renovation packages that are tailored to specific market conditions, incorporating services, technologies, and financing mechanisms that are both feasible and desirable. By aligning the content and delivery of the renovation packages with the realities captured in each radar, we ensure that they are well-positioned for uptake, replication, and scalability. This approach bridges the gap between market demand and integrated renovation offerings, turning strategic insights into deployable, user-centric solutions

2.1 OKT (Demo 2)

The first approach of OKT's business model radar was created in a co-creation workshop that took place in Strasbourg in May 2022 with the cooperation of some key partners including TGT to function as an example for the other partners to develop their own offering. This radar was further developed during the course of the project and presented in 2024 at the Gijon plenary meeting. As for all the pilots, the update is due to the removal of the ECB interaction, as ECB development on the Digital-Euro does not cope with the objectives of FORTESIE.

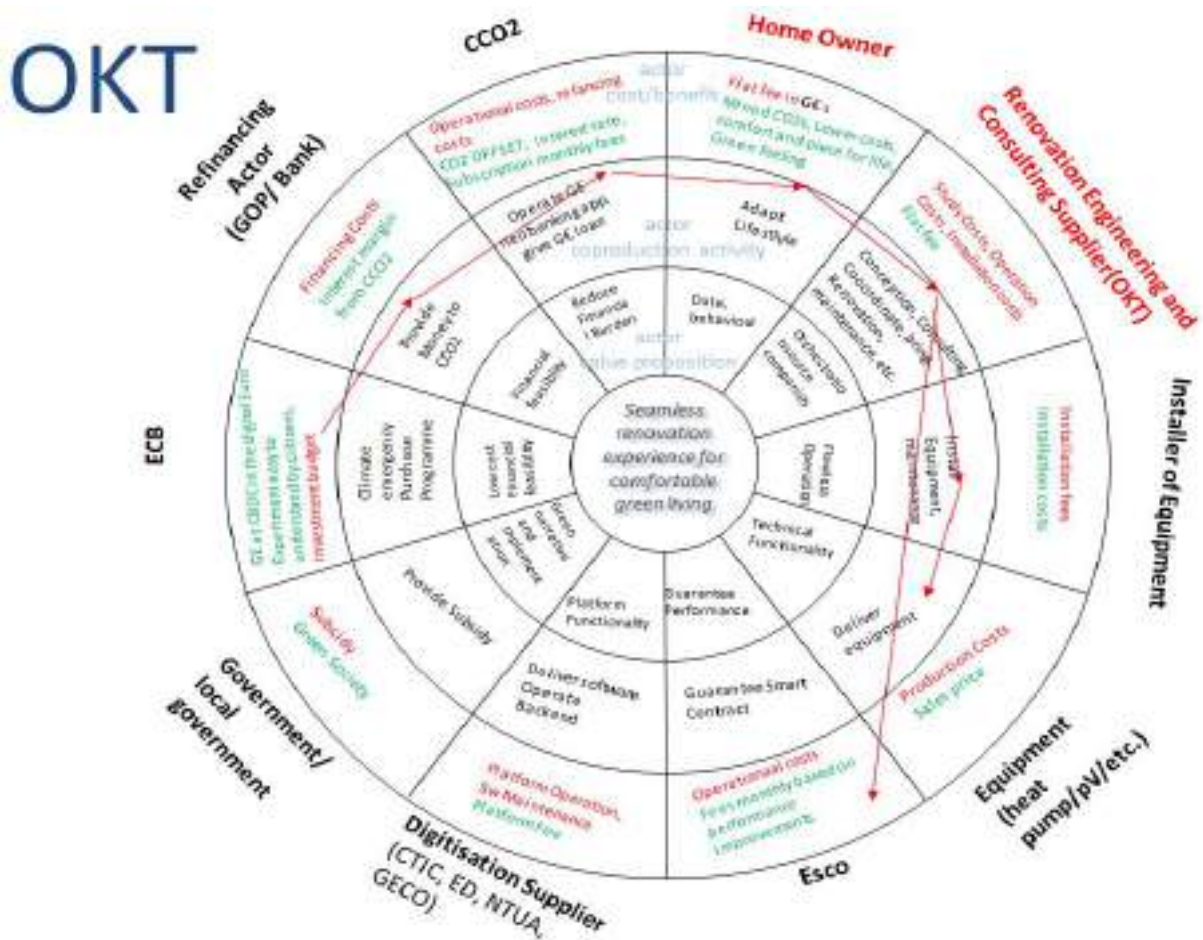


Figure 1 OKT's business model radar for exploitation: early version

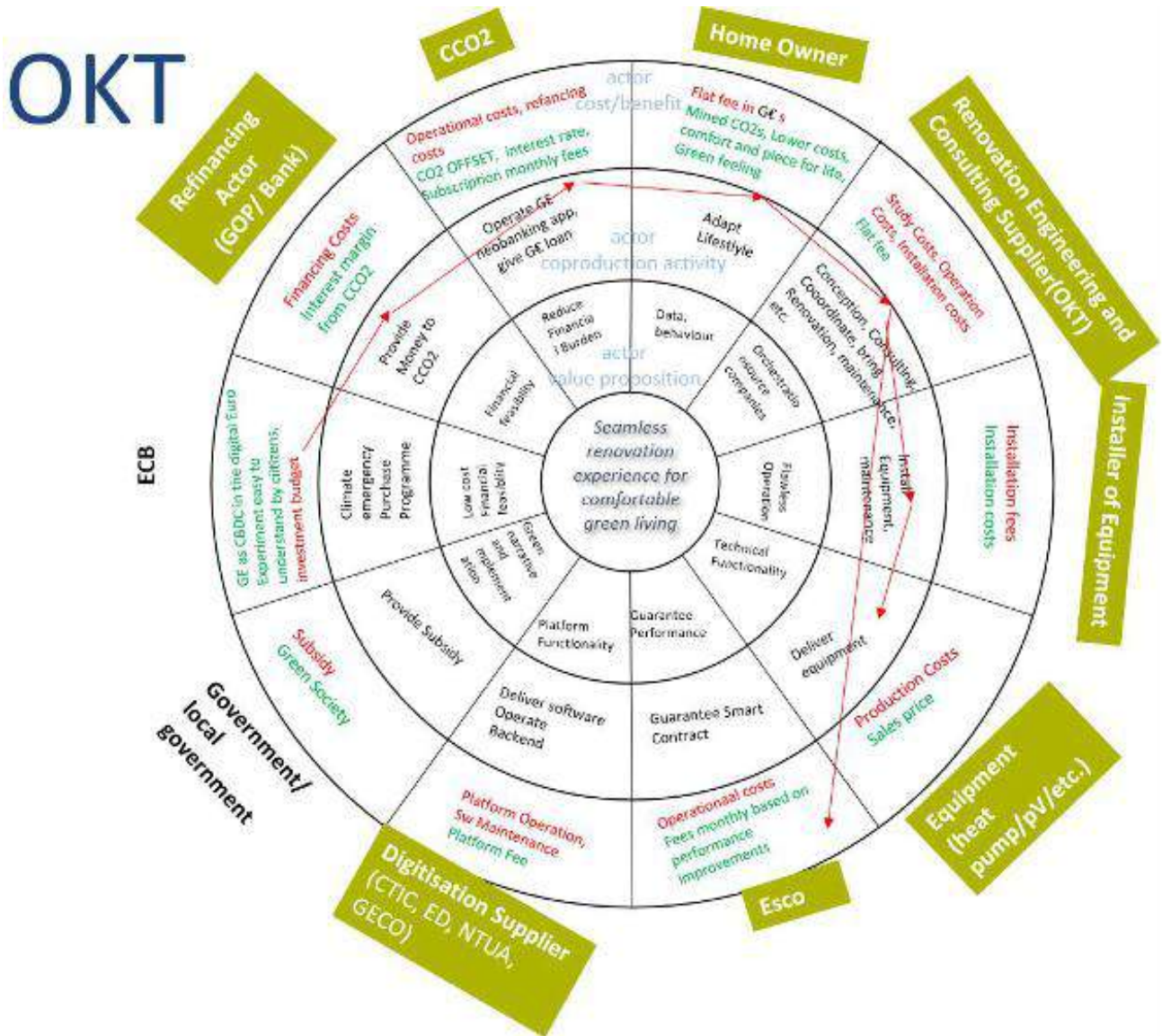


Figure 2 OKT's business model radar for exploitation : updated version

Table 1 Offered experience

Focal organisation	OKT has the link to the customer, will stay the contact point with the customer and offer the entire renovation and financing service.
Experience offered	Seamless renovation experience for comfortable green living: Renovation as-a-service, this means that when a customer goes to OKT they will get a complete end-to-end service, including, all the digital and renovation components, with guarantees, documented in smart contracts and financing.

Table 2 Customer: Home Owner

Value Proposition	Residential energy consumers offer their energy usage pattern and energy consumption measurements for further analysis. They are the target group where the service is offered.
Co-production activity	Residential energy consumers can adapt their lifestyle to achieve green efficiency, adopt a more energy efficient behaviour, save energy and money and earn CO2 coins and enjoy an increased level of comfort at their home. At the same time they enjoy care and pain free renovation services.
Cost / benefit	<ul style="list-style-type: none"> - Service fee, includes energy costs and FORTESIE service, paid in Green Euro + Continuous Minting of Green Euro and generated out of their investment for renovation and by adhering to proposed recommendations and/or challenges. + Save energy and money (reduced energy bills) and enjoy upgraded comfort (less humidity, tailored to their preferences heating (without wastages). + Adopt a more energy efficient behaviour and contribute to a green social community.

Table 3 Renovation Engineering and Consulting Supplier (OKT)

Value Proposition	The Renovation Engineer and Consulting Supplier orchestrates the entire renovation on behalf of the homeowner. They are the contact point for the customer and all the providers.
Co-production activity	The Renovation Engineer and Consulting Supplier will bring the renovation to the home owner as well as design the concept and renovation approach. They are in charge of consulting the homeowner on what is required, coordinating the entire renovation process, and overseeing maintenance. During the renovation, they also source companies.
Cost / benefit	<ul style="list-style-type: none"> -Study Costs -Operation Costs - Installation costs + Flat fee

Table 4 Installer of Equipment

Value Proposition	The installer of Equipment supplies and installs the equipment and ensures flawless operation throughout the renovation process and during maintenance.
Co-production activity	The Equipment Installer is responsible for installing all renovation equipment per the requests of the Renovation Engineering and Consulting Supplier, but he is also in charge of maintaining the equipment after the renovation process is completed.
Cost / benefit	-Installation fees +Installation costs

Table 5 Equipment (heat pump/PV/etc)

Value Proposition	The equipment suppliers provide the renovation's technical functionality.
Co-production activity	The equipment suppliers are responsible for delivering the equipment required for house renovations following the requests of the Renovation Engineering and Consulting Supplier. The equipment suppliers deliver the equipment to the equipment installer, allowing the renovation to begin.
Cost / benefit	-Production Costs + Sales price

Table 6 ESCO

Value Proposition	The ESCO provides a performance guarantee contract for certain savings on the homeowner's energy bill and for the house energy efficiency.
Co-production activity	The ESCO is responsible for ensuring that by implementing FORTESIE's Smart Contract, the Homeowner will benefit from a standard amount of energy efficiency, which will result in a predetermined percentage of decreased energy usage and, as a result, a reduced energy bill.
Cost / benefit	-Operationaal costs +Fees monthly based on performance improvements

Table 7 Digitisation Supplier

Value Proposition	The digitisation supplier is responsible to provide the FORTESIE platform and mobile application functionality.
Co-production activity	The digitisation supplier will be responsible to deliver the software: FORTESIE platform (front end and backend) and the mobile application and also operate the platform

	(handling of data and communication with the data consuming applications).
Cost / benefit	<ul style="list-style-type: none"> - FORTESIE platform operation and maintenance - FORTESIE mobile application operation and maintenance + Platform fee + Mobile application fee

Table 8 Refinancing Actor

Value Proposition	The Refinancing Actor will enable the financial feasibility of CCO2
Co-production activity	The Refinancing Actor is responsible for providing funds to the CCO2 in order for them to establish their green euro loan.
Cost / benefit	<ul style="list-style-type: none"> - Financing costs (they pay interest to their investors) + Interest margin from CCO2

Table 9 CCO2

Value Proposition	CCO2, as the operator of the CO2 credit management system, will facilitate CO2 transactions by allowing CO2s to be exchanged for Euros, thereby reducing the financial burden.
Co-production activity	Development and Operation of the CO2 credit management system (neobanking application), CO2s balance maintenance, monetarize the CO2 emission reduction, and provision of G€ loans
Cost / benefit	<ul style="list-style-type: none"> - Operational costs - Exchange from CO2 to Euro costs + Interest rate + Subscription monthly fees + CCO2 offset

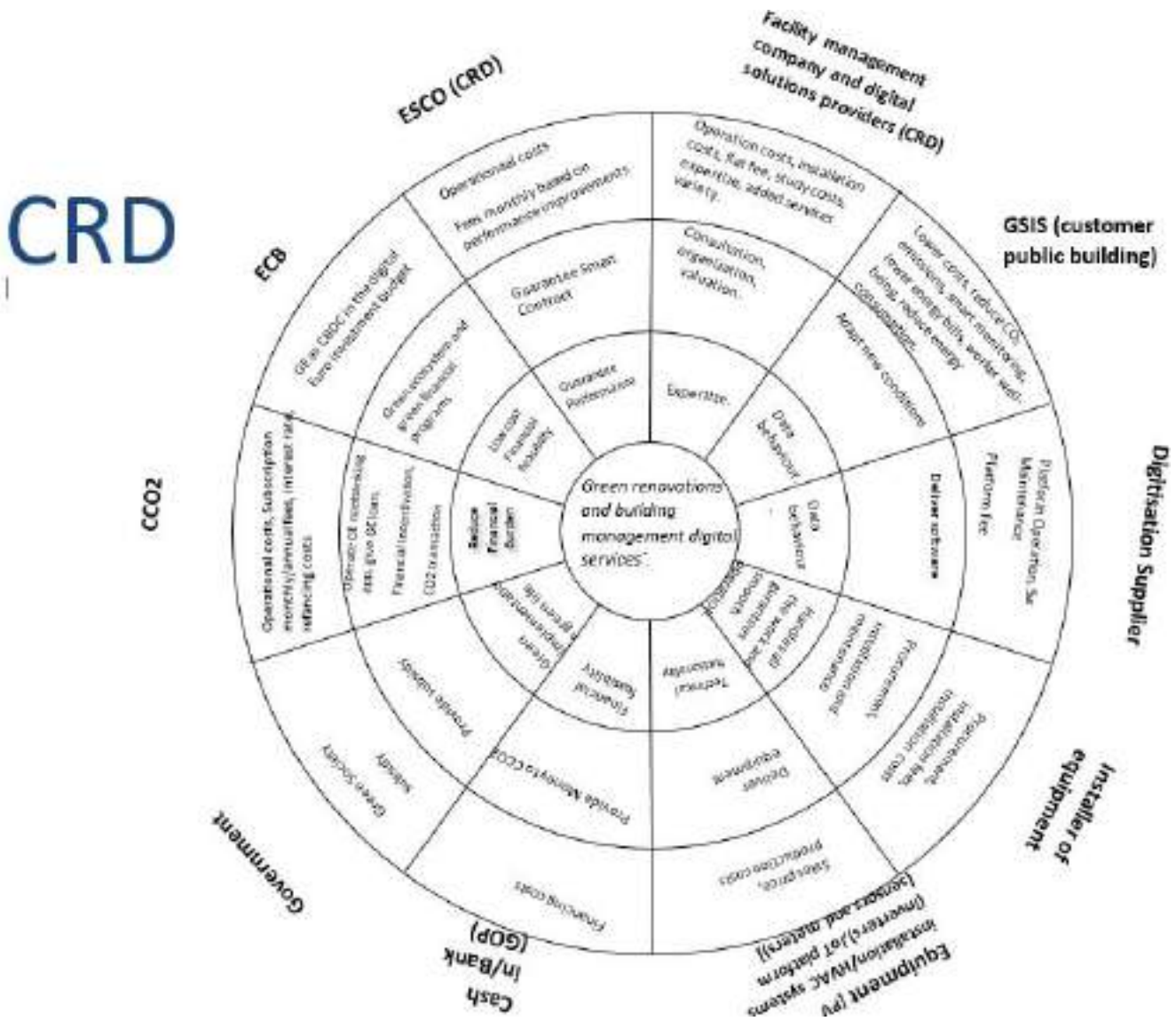


Figure 4 CRD's business model radar for exploitation : updated version

TGT/CRD

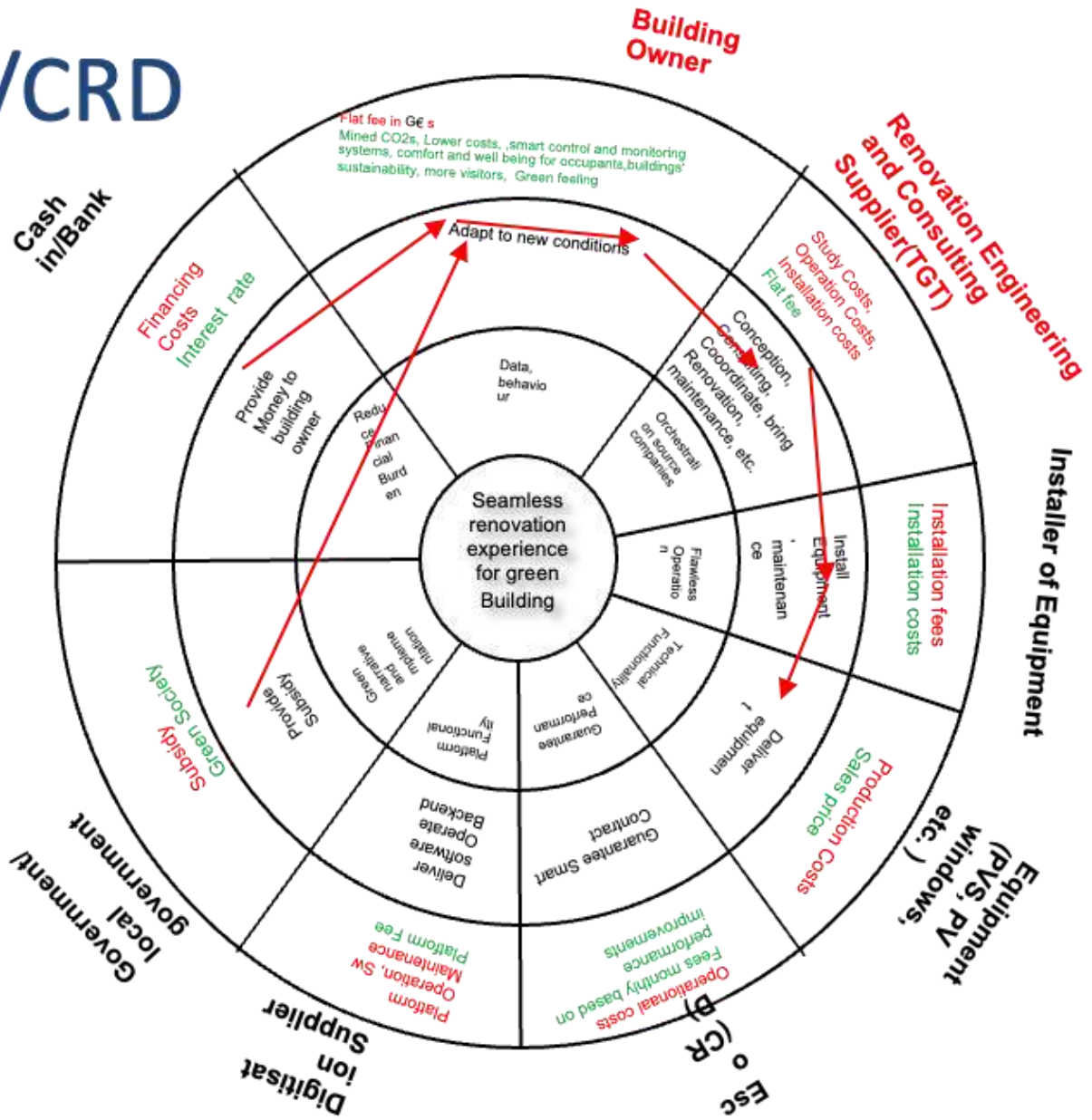


Figure 5 TGT's & CRD's business model radar for exploitation : updated version

The updated RADAR presented here represents a practical and applicable business model that combines insights and stakeholder roles from both CRD and TGT. This combined

RADAR captures the essential dynamics, interdependencies, and value flows required to deliver a seamless renovation experience for green buildings.

The model clearly defines the responsibilities, benefits, and co-production activities of key actors involved in the green building renovation process, including the Building Owner, Renovation Companies, Energy Service Companies (ESCOs), Public Authorities, Financial Institutions, Technology and Equipment Providers . It highlights the collaborative nature of green renovation, where success relies on coordinated efforts across the public and private sectors, supported by digital tools, funding mechanisms, and policy frameworks.

This RADAR provides a realistic operational framework by illustrating both incentives (green) and risks or costs (red) for each stakeholder. It emphasizes measurable outcomes, such as energy performance improvements, CO₂ savings, and financial returns, while also acknowledging challenges like upfront investment risks, data complexity, and regulatory compliance.

As a result, the combined CRD/TGT RADAR serves not only as a visual roadmap for implementation but also as a strategic guide for stakeholders involved in large-scale, sustainable renovation efforts. Its clarity and practicality make it a valuable tool for replication, funding alignment, and policy support in the transition toward energy-efficient, climate-resilient building stock.

Table 10 Offered experience

Focal organisation	TGT has the link to the customer, will stay the contact point with the customer and offer the entire renovation and financing service.
Experience offered	Seamless renovation experience for green museums: Renovation as-a-service, this means that when a museum goes to TGT they will get a complete end-to-end service, including, all the digital and renovation components, with guarantees, documented in smart contracts and financing.

Table 11 Customer: Building Owner

Value Proposition	Building Owner offers their data, energy usage pattern and energy consumption measurements for further analysis. They are the target group where the service is offered.
Co-production activity	Museum (workers/ visitors/ owner) can adapt their lifestyle to achieve green efficiency, adopt a more energy efficient behaviour, save energy and money and earn CO ₂ coins and enjoy an increased level of comfort at the museum. At the same time, they enjoy care and pain free renovation services.
Cost / benefit	<ul style="list-style-type: none"> - Flat fee, includes energy costs and FORTESIE service, paid in Green Euro + Mined CO₂s, + Lower costs + Smart control and monitoring systems + Comfort and wellbeing for visitors/workers + Buildings' sustainability

	<ul style="list-style-type: none"> + More visitors + Green feeling
--	--

Table 12 Renovation Engineering and Consulting Supplier (TGT)

Value Proposition	The Renovation Engineer and Consulting Supplier orchestrates the entire renovation on behalf of the museum. They are the contact point for the customer and all the providers.
Co-production activity	The Renovation Engineer and Consulting Supplier will bring the renovation to the museum as well as design the concept and renovation approach. They are in charge of consulting the museum on what is required, coordinating the entire renovation process, and overseeing maintenance.
Cost / benefit	<ul style="list-style-type: none"> -Study Costs -Operation Costs - Installation costs + Flat fee

Table 13 Installer of Equipment

Value Proposition	The installer of Equipment supplies and installs the equipment and ensures flawless operation throughout the renovation process and during maintenance.
Co-production activity	The Equipment Installer is responsible for installing all renovation equipment per the requests of the Renovation Engineering and Consulting Supplier, but he is also in charge of maintaining the equipment after the renovation process is completed.
Cost / benefit	<ul style="list-style-type: none"> -Installation fees +Installation costs

Table 14 Equipment (PVs/PV windows/etc)

Value Proposition	The equipment suppliers provide the renovation's technical functionality.
Co-production activity	The equipment suppliers are responsible for delivering the equipment required for house renovations following the requests of the Renovation Engineering and Consulting Supplier. The equipment suppliers deliver the equipment to the equipment installer, allowing the renovation to begin.
Cost / benefit	<ul style="list-style-type: none"> -Production Costs + Sales price

Table 15 ESCO (CRD)

Value Proposition	The ESCO provides a performance guarantee contract for certain savings on the building's energy bill and for the house energy efficiency.
Co-production activity	The ESCO is responsible for ensuring that by implementing FORTESIE's Smart Contract, the museum will benefit from a standard amount of energy efficiency, which will result in a predetermined percentage of decreased energy usage and, as a result, a reduced energy bill.
Cost / benefit	-Operational costs +Fees monthly based on performance improvements

Table 16 Digitisation Supplier

Value Proposition	The digitisation supplier is responsible to provide the FORTESIE platform and mobile application functionality.
Co-production activity	The digitisation supplier will be responsible to deliver the software: FORTESIE platform (front end and backend) and the mobile application and also operate the platform (handling of data and communication with the data consuming applications).
Cost / benefit	- FORTESIE platform operation and maintenance - FORTESIE mobile application operation and maintenance + Platform fee + Mobile application fee

Table 17 Cash in/ Bank

Value Proposition	This partner will provide an alternative financing in order to pursue the renovations.
Co-production activity	Ensuring financial feasibility of the renovations
Cost / benefit	-Financing Costs + Interest margin

2.3 VEO (Demo 2)

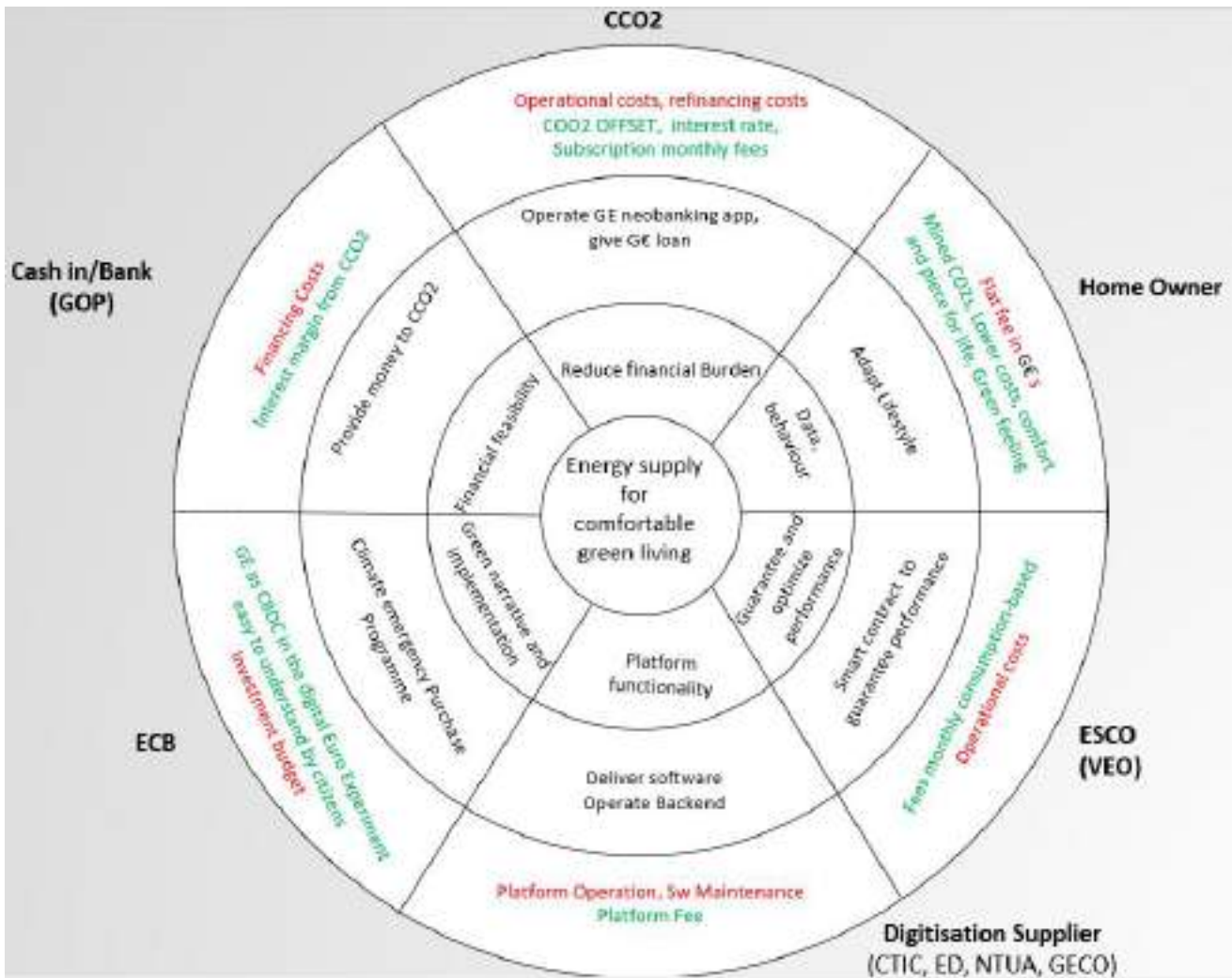


Figure 6 VEO business model radar for exploitation : early version

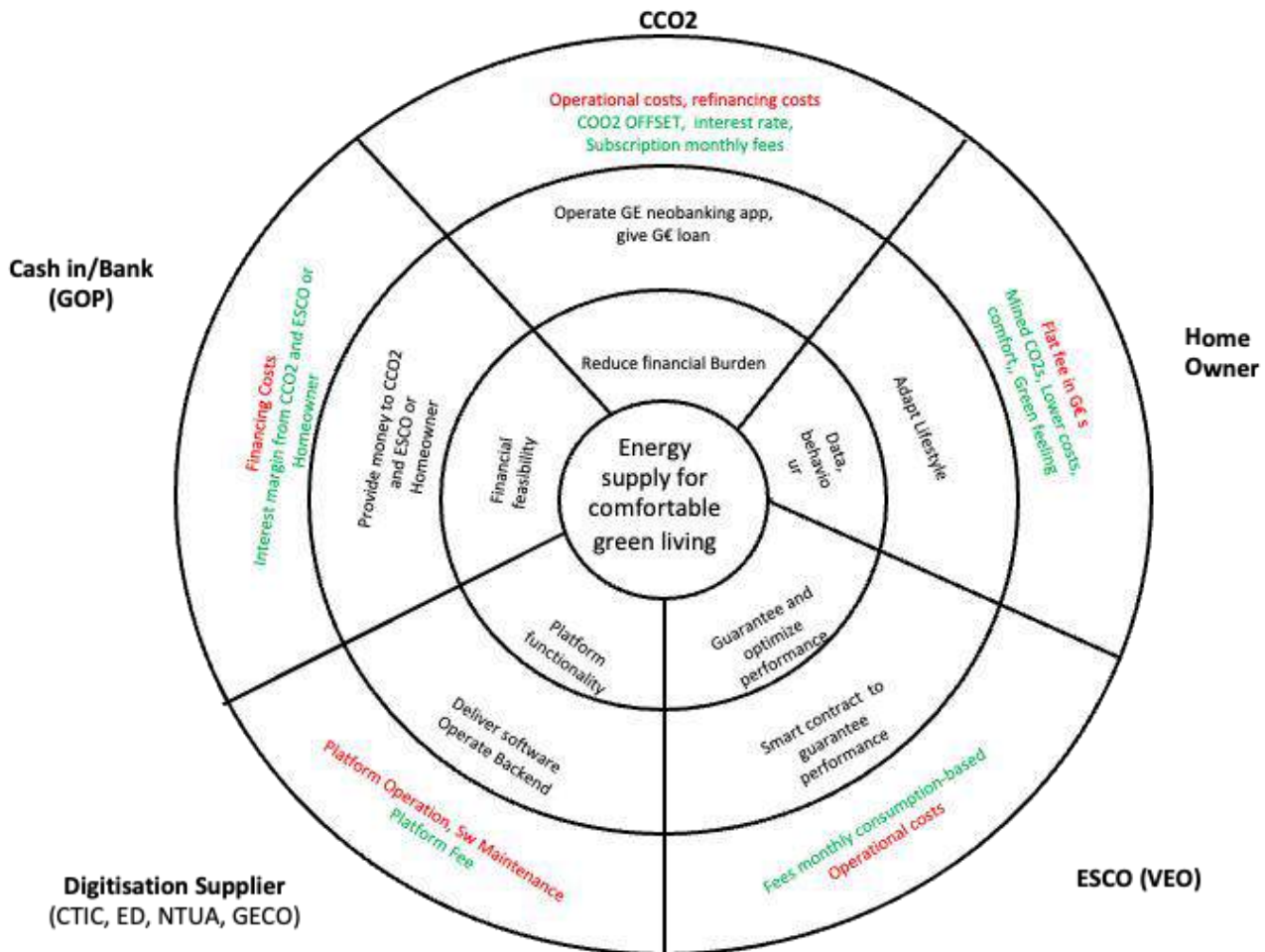


Figure 7 VEO business model radar for exploitation :updated version

The VEO business model has evolved from an initial conceptual framework to a more streamlined and applicable version. This transition is reflected in the update from the first to the second RADAR diagram, both centered on the shared goal of enabling “**energy supply for comfortable green living.**” The model maps key stakeholders—including homeowners, ESCOs (VEO), CCO2, banks (GOP), digitisation suppliers—working together to deliver accessible, performance-based, and user-centric energy services.

The original RADAR served as a **theoretical blueprint**, capturing all possible financial and operational interactions. It included the European Central Bank (ECB) as a potential facilitator of investment, assuming its support through green bonds or strategic alignment with climate emergency programs. However, as the model matured and its real-world deployment became clearer, it became evident that the **role of the ECB was not directly applicable or realistic** in the current implementation context.

In the revised RADAR—the second version—the ECB was removed, leading to a **cleaner and more actionable ecosystem**. All remaining actors were retained with clarified responsibilities and financial flows:

- ✓ The **GOP (public bank or cash-in institution)** is now the sole provider of financing, offering loans or capital to either the ESCO, CCO2, or directly to homeowners.
- ✓ This maintains the model’s focus on **financial feasibility**, while ensuring alignment with institutional actors who are actually engaged in implementation.
- ✓ The rest of the model remains intact, including key elements such as smart contracts, behavior change, data-driven performance guarantees, and the central role of the VEO in ensuring energy efficiency through monthly, consumption-based services.

Table 18 Offered experience

Focal organisation	Veolia guarantees homeowners and neighbors’ savings and maximum comfort by improving the energy efficiency of their facilities.
Experience offered	Veolia puts its extensive experience and in-depth knowledge in the field of renewable energies at the service of homeowner’s comfortable living. From photovoltaic systems that harness solar energy, to micro generation, to integrated management of the biomass chain, Veolia tries to reduce costs, extend the life of buildings, improve user comfort and respect the environment.

Table 19 Customer: Home Owner

Value Proposition	Residential energy consumers offer their energy usage pattern and energy consumption measurements for further analysis. They are the target group where the service is offered.
Co-production activity	Residential energy users have the opportunity to modify their daily routines to achieve greater environmental efficiency, adopt more energy-conscious behaviors, save energy and money, gain valuable information to optimize their consumption patterns, and improve the comfort of their homes.
Cost / benefit	- Service fee, includes energy costs and FORTESIE service. + Green euros outflow generated by compliance with the recommendations and/or challenges proposed. + Save energy and money (reduced energy bills) and enjoy upgraded comfort (less humidity, tailored to their preferences heating (without wastages). + Adopt a more energy efficient behavior and contribute to a green social community.

Table 20 ESCO

Value Proposition	The ESCO offers a performance assurance agreement that ensures energy savings on the homeowner's utility bills and enhances the overall energy efficiency of the house.
Co-production	The ESCO's responsibility lies in guaranteeing that through the implementation of

activity	FORTESIE's Smart Contract, the Homeowner will experience a consistent level of energy efficiency, leading to a pre-determined reduction in energy consumption and consequently, a lowered energy bill.
Cost / benefit	+Fees monthly consumption-based -Operational cost

Table 21 Digitisation Supplier

Value Proposition	The digitisation supplier is responsible to provide the FORTESIE platform and mobile application functionality.
Co-production activity	The digitisation supplier will be responsible to deliver the software: FORTESIE platform (front end and backend) and the mobile application and also operate the platform (handling of data and communication with the data consuming applications).
Cost / benefit	+Platform fee - Platform maintenance -Platform operation

Table 22 Bank/ Cash in

Value Proposition	The Refinancing Actor will enable the financial feasibility.
Co-production activity	The Refinancing Actor is responsible for providing funds to the CCO2 in order for them to establish their green euro loan.
Cost / benefit	-Financing Costs +Interest margin from CCO2

Table 23 CCO2

Value Proposition	As the operator of the CO2 credit management system, CCO2 will enable CO2 transactions, allowing the conversion of CO2 credits into Euros, effectively alleviating the financial burden.
Co-production activity	As the operator of the CO2 credit management system, CCO2 will enable CO2 transactions, allowing the conversion of CO2 credits into Euros, effectively alleviating the financial burden.
Cost / benefit	-Operational costs, refinancing costs +CCO2 OFFSET, interest rate, +Subscription monthly fees

2.4 GAR (Demo 2)

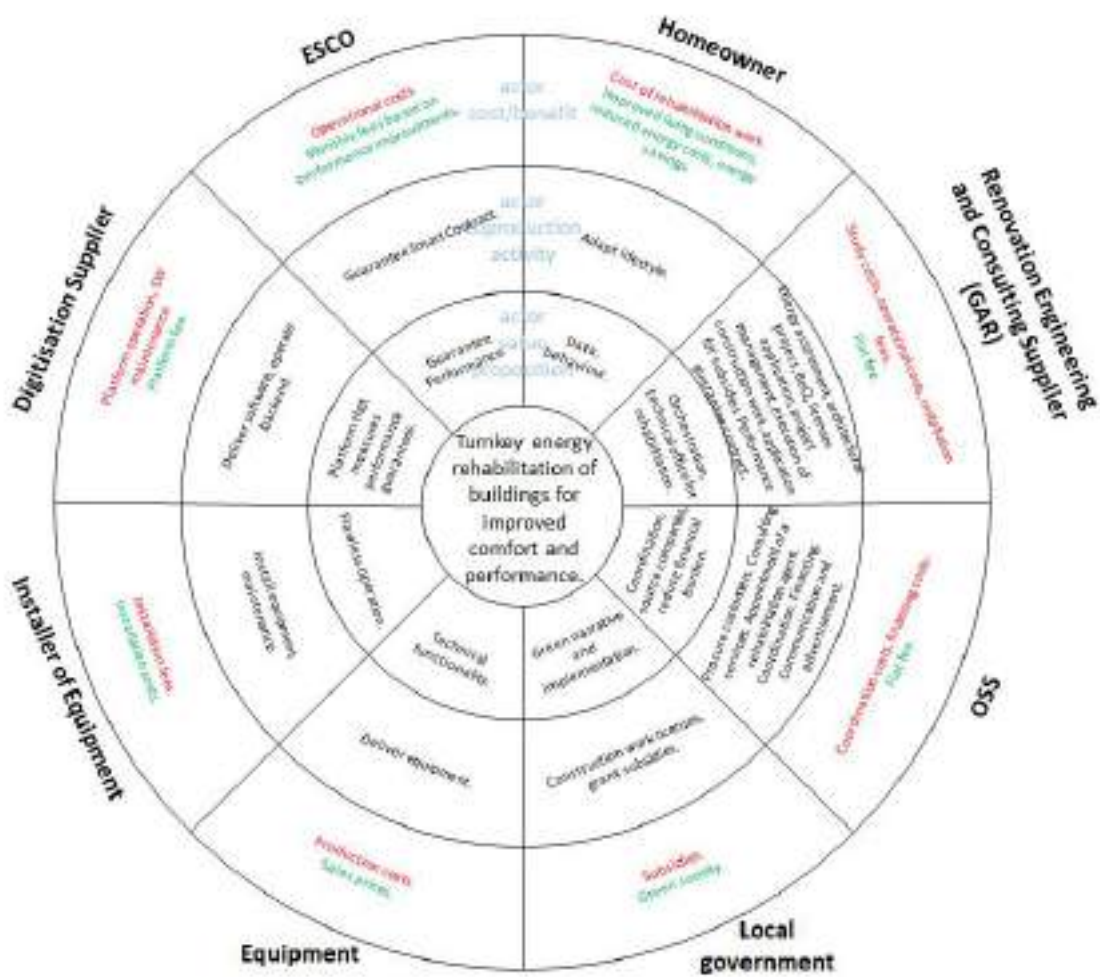


Figure 8 GAR business model radar for exploitation : early version

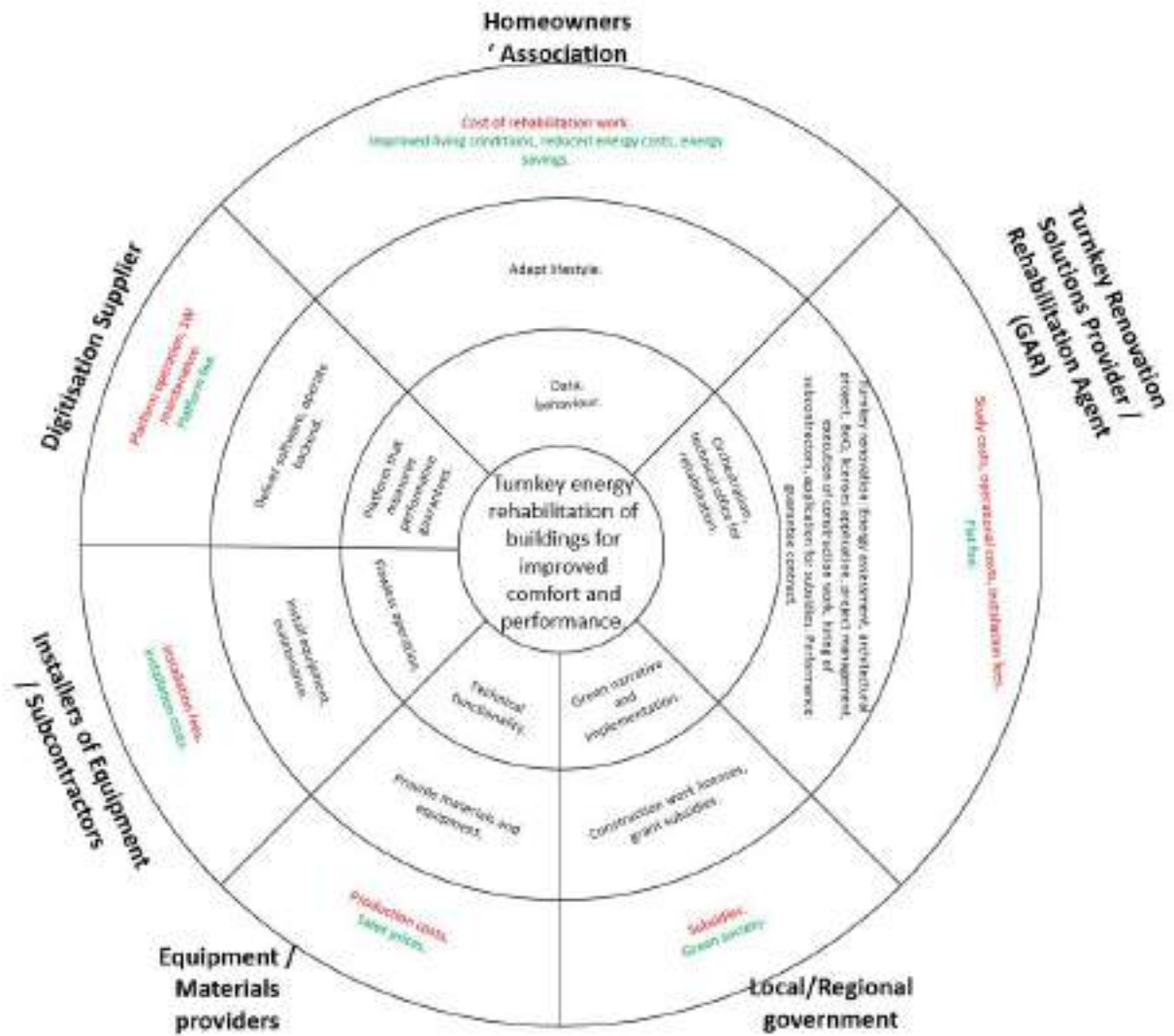


Figure 9 GAR business model radar for exploitation : updated version

The GAR business model has evolved from a broad conceptual framework into a focused and implementable system. This transformation is captured in the transition from the initial RADAR diagram to the final, more operational version. The business model centers on delivering “turnkey energy rehabilitation of buildings for improved comfort and performance”, through coordinated stakeholder collaboration, smart technologies, and streamlined service delivery.

In its initial form, the RADAR mapped a wide ecosystem of actors: ESCOs, One-Stop Shops (OSS), renovation consultants (GAR), digitisation suppliers, installers, local government, equipment providers, and homeowners. Each actor was linked to a distinct set of value propositions, cost-benefit mechanisms, and co-production activities.

While this version offered a comprehensive view of the ecosystem, it also reflected fragmentation of responsibilities, particularly across the ESCO, OSS, and GAR roles. The distribution of technical, financial, and coordination tasks among these entities created potential overlaps and inefficiencies in implementation.

The final business model addresses this fragmentation by consolidating the roles of the ESCO, OSS, and renovation consultant under a unified actor: the Turnkey Renovation Solutions Provider / Rehab Agent (GAR). This new, integrated role becomes the central orchestrator of the entire renovation process—from assessment and planning to execution, commissioning, and post-renovation performance monitoring.

Additionally, the Homeowners' Association is placed at the heart of the customer interface, reflecting the reality of multi-unit buildings where collective decision-making is essential for large-scale energy retrofits. This change streamlines communication and aligns responsibilities with real governance structures.

Key Improvements and Practical Features

- ✓ The GAR now delivers a full-service model, managing energy assessments, architectural and technical planning, procurement of contractors and materials, coordination of subcontractors, and performance guarantees.
- ✓ ESCO responsibilities, such as energy performance contracting and financing logic, are now embedded within GAR’s scope.
- ✓ OSS functions, like customer support, data collection, and coordination, are also internalized by GAR, eliminating service silos and improving efficiency.
- ✓ Digitisation suppliers, installers, and material providers retain supportive roles, with clearly defined contributions and cost structures.
- ✓ Local/regional governments maintain their role in providing construction permits, financial subsidies, and promoting the green transition narrative.

This consolidation results in clearer accountability, simplified procurement, and a more attractive proposition for both private clients and public sector partners.

Table 24 Offered experience

Focal organisation	GAR serves as the central point of contact for homeowners, from the initial inquiry stage throughout the entire building energy rehabilitation process.
Experience offered	GAR offers a seamless turnkey renovation solution to enhance building comfort and energy performance. GAR provides comprehensive building renovation services, encompassing guidance, energy performance evaluation, license applications, façade installation, etc.

Table 25 Home owner

Value Proposition	Homeowners in residential buildings seeking solutions for issues like detached façade coatings, water leakage, condensation, and dampness that impact building comfort and overall energy performance.
Co-production activity	Homeowners can enhance the comfort of their homes, save energy and money, reduce CO2 emissions, and gain valuable insights for optimising their consumption patterns.
Cost / benefit	<ul style="list-style-type: none"> - Cost of rehabilitation work. + Improved living conditions. + Reduced energy costs. + Energy savings.

Table 26 Renovation Engineering and Consulting Supplier

Value Proposition	The Renovation Engineering and Consulting Supplier oversees the entire renovation process, including the technical aspects of rehabilitation. They act as the central point of contact between the customer, the local government authorities, and suppliers.
Co-production activity	The Renovation Engineer and Consulting Supplier delivers the renovation to homeowners, including design concepts and renovation strategies. Their responsibilities encompass advising homeowners on project requirements, overseeing the complete renovation process (initial building energy performance assessment, architectural design, Bill of Quantities, licenses applications, project management, construction execution, and subsidy applications), as well as sourcing companies for the project.
Cost / benefit	<ul style="list-style-type: none"> - Study costs. - Operational costs. - Installation costs. + Flat fee.

Table 27 Local government

Value Proposition	The local government is committed to achieving goals related to reducing CO ₂ emissions and promoting energy savings. Consequently, the government offers certifications related to Energy Efficient Behaviour and subsidies for renovation projects aimed at enhancing energy efficiency. The local government is also essential for ensuring regulatory compliance, including obtaining construction licenses.
Co-production activity	The local government contributes a portion of the required funding for the interventions and facilitates the issuance of construction work licenses.
Cost / benefit	- Subsidies. + Foster a Green Society.

Table 28 Equipment

Value Proposition	The equipment suppliers offer the necessary equipment, devices, and building materials required for the renovation.
Co-production activity	The equipment suppliers are responsible for delivering the equipment required for the renovation project as per the requests of the Renovation Engineering and Consulting Supplier. They ensure timely delivery of the equipment to commence the construction work.
Cost / benefit	- Production costs. + Sales prices.

Table 29 Installer of Equipment

Value Proposition	The equipment installer provides the necessary devices, supplies, and ensures their seamless installation, guaranteeing optimal performance throughout the renovation process and upon project completion.
Co-production activity	The equipment installer is responsible for the installation of all renovation equipment as per the requests of the Renovation Engineering and Consulting Supplier. Additionally, they are in charge of the maintenance of the equipment even after the renovation process is completed.
Cost / benefit	- Installation fees. +Installation costs.

Table 30 Digitisation Supplier

Value Proposition	The Digitisation Supplier will offer a performance measurement platform that ensures guarantees are met. This platform will deliver insights on measurements both before and after the renovation, as well as the energy performance evolution of the building.
--------------------------	---

	This data will validate the renovation's impact.
Co-production activity	The Digitisation Supplier will be responsible for delivering the FORTESIE platform software, both the front end and back end, along with the mobile application. Additionally, they will operate the platform, managing data and facilitating communication with data-consuming applications.
Cost / benefit	<ul style="list-style-type: none"> - FORTESIE platform operation and maintenance. - FORTESIE mobile application operation and maintenance. + Platform fee. + Mobile application fee.

2.5 JUST (Demo 3)

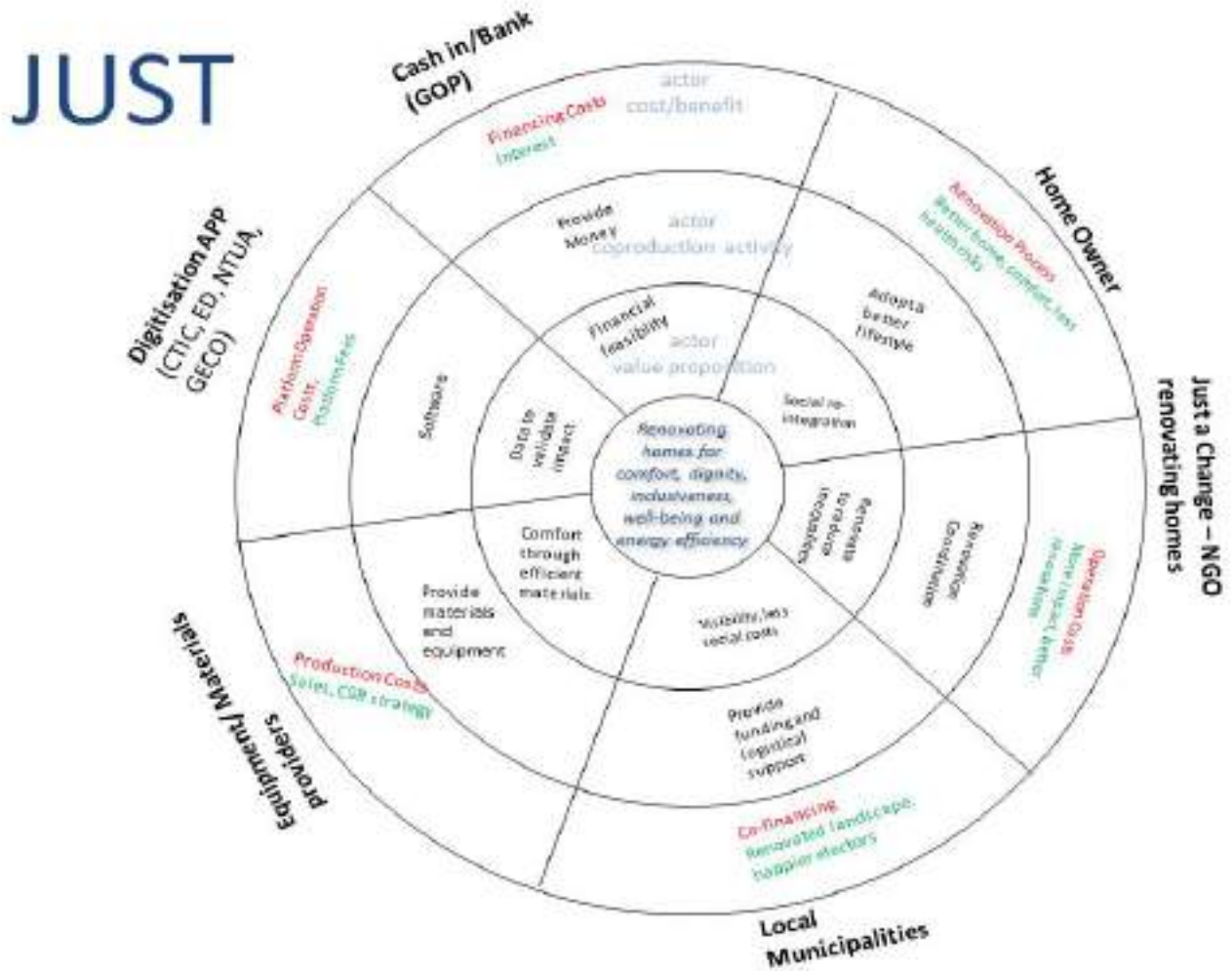


Figure 10 UST business model radar for exploitation : early version

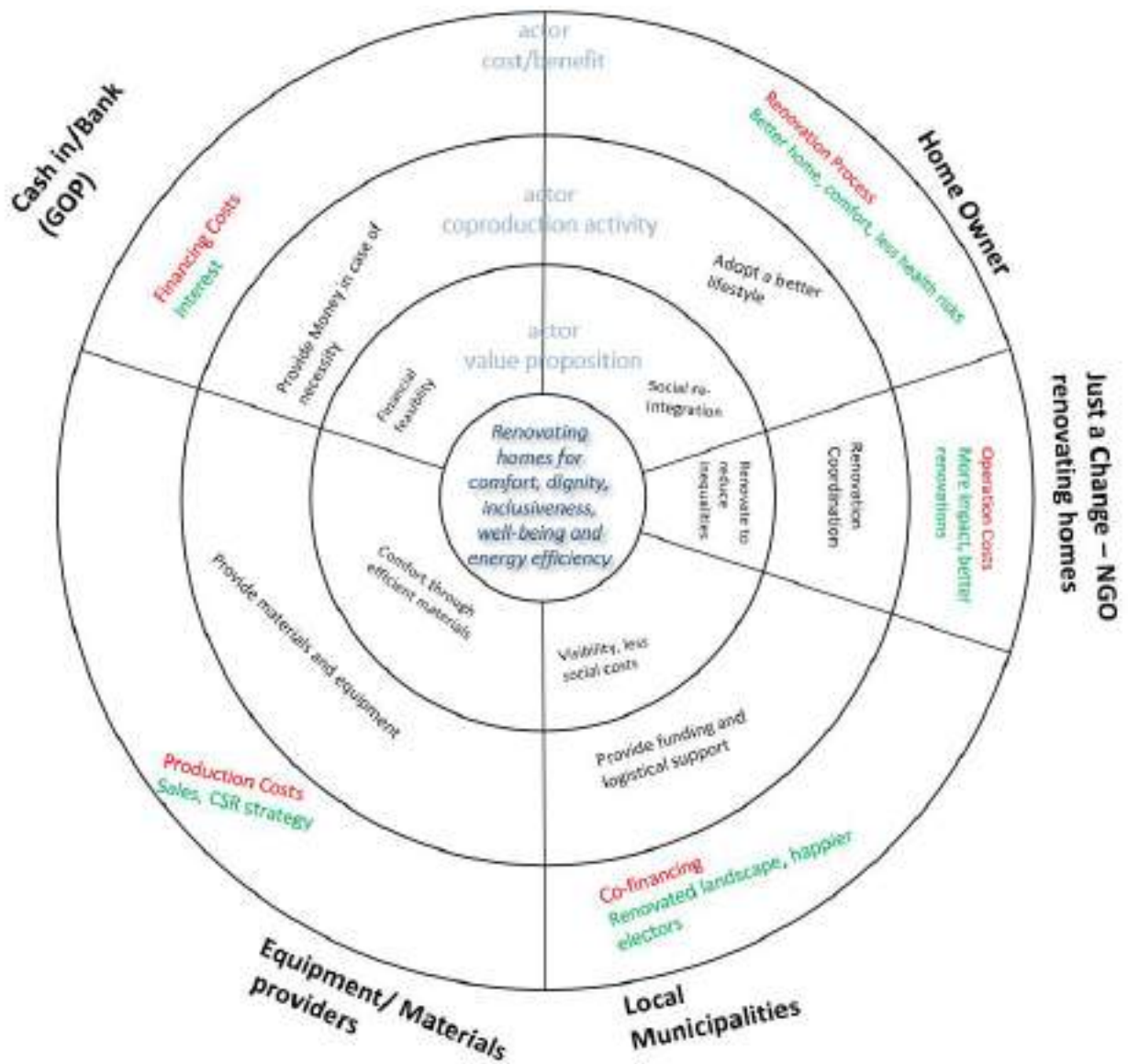


Figure 11 JUST business model radar for exploitation : updated version

The business model of JUST—centered on renovating homes to promote comfort, dignity, inclusiveness, well-being, and energy efficiency—has undergone a thoughtful evolution from a broad conceptual framework to a more realistic and context-specific model. This transition is evident in the shift from the initial to the final business RADAR diagrams, reflecting the operational and social conditions under which the initiative functions.

The initial RADAR mapped a comprehensive ecosystem, including homeowners, NGOs (Just a Change), local municipalities, equipment/materials providers, financing institutions (GOP), and digitisation providers. This version aimed to capture the full spectrum of value creation activities, with a focus on data-driven renovation, digital coordination, and co-financed material provision.

While this model provided a holistic and aspirational view, it included certain technological features—particularly the digitisation app layer (software platforms, performance data tools, etc.)—that were later identified as incompatible with the on-the-ground realities of the JUST initiative. The homes targeted by the NGO are typically in severely under-resourced conditions, often involving vulnerable households where digital solutions are neither necessary nor practical for the scope and scale of intervention. As such, the inclusion of a digital infrastructure layer was reassessed and ultimately deemed non-essential to the model’s effectiveness.

In the final, streamlined RADAR, the digitisation actor has been removed, resulting in a model that is better aligned with the specific social mission and operational context of JUST. This version highlights five core actors:

- Homeowners, who benefit from improved comfort, reduced health risks, and safer living conditions.
- Just a Change (NGO), which leads renovation coordination and targets social reintegration through housing improvement.
- Local municipalities, which provide logistical support and co-financing, while benefiting from urban improvement and social cost reduction.
- Equipment/material providers, who support the process through materials and sometimes CSR-aligned contributions.
- Cash-in institutions (GOP), who offer financing support when necessary.

The model now reflects the reality of mission-driven, socially focused renovations, which rely more heavily on local partnerships, physical intervention, and community engagement than on high-tech or data-intensive solutions.

This refinement strengthens the core value proposition: “Renovating homes for comfort, dignity, inclusiveness, well-being, and energy efficiency.” It also deepens the social impact narrative by:

- Emphasizing social re-integration and reduction of inequalities through dignified living conditions.

- Highlighting co-production activities such as behavioral change (adopting better lifestyles) and shared visibility with local authorities.
- Illustrating cost-benefit exchanges that are tailored to grassroots, non-profit renovation efforts—such as co-financing, reduced operational costs, and CSR-aligned material sourcing.

Table 31 Offered experience

Focal organisation	JUST is the contact point with the home-owner, offering the house renovation and social support, also engaging with them and promoting better energetic behaviours
Experience offered	JUST offers a seamless renovation experience, focusing on well-being, energetic efficiency, comfort, dignity and social re-integration

Table 32 Home Owner

Value Proposition	Low-income home-owners who live in un-dignified homes, with no basic conditions. Usually there is an underlying condition who threw them into poverty and needs to be addressed. The measurements made in their house before and after the intervention will show the improvements made.
Co-production activity	Adopting a better lifestyle, gain some insights and basic information about energy efficiency and tips on how to improve their behaviour
Cost / benefit	<ul style="list-style-type: none"> - renovation process is quite disruptive and demanding + a better and dignified home to live + a comfortable dwelling + less home-associated health risks

Table 33 NGO renovating homes

Value Proposition	JUST renovates homes to fight housing and energy poverty. they are in charge of the entire renovation and to accommodate special needs and requests from the beneficiary/home-owner.
Co-production activity	JUST is in charge of the coordination of the entire renovation. Dealing with many stakeholders and overseeing the works.
Cost / benefit	<ul style="list-style-type: none"> - Operating costs + More houses renovated + more impact + Less poverty

Table 34 Local Municipalities

Value Proposition	Local municipalities are interested in reducing local poverty levels, ensuring quality of life to all their population, and gaining visibility and reducing their social costs by not having to relocate these people to other facilities.
Co-production	They will provide a part of the funding needed for the interventions as well as logistical

activity	support in housing and feeding the volunteers.
Cost / benefit	<ul style="list-style-type: none"> - Co-funding costs + Local landscape renovated - Happier electors - Reduced social care costs

Table 35 Equipment Equipment/ Materials providers

Value Proposition	These providers will promote the usage of their equipment and building material that ensure proper insulation or thermal comfort.
Co-production activity	Providing the materials and equipment necessary
Cost / benefit	<ul style="list-style-type: none"> - Production Costs + Sales price + Installation costs

Table 36 Cash in/Bank (GOP)

Value Proposition	This partner will provide a financing alternative to pursue the renovations
Co-production activity	Ensuring financial feasibility of the renovations
Cost / benefit	<ul style="list-style-type: none"> - Financing Costs + Interests

encouraging broader participation in sustainable renovation practices. As members share their experiences and outcomes, they contribute to a growing body of practical knowledge that informs future renovation projects and enhances collective resilience.

What truly differentiates the COOP within the market is its capacity to generate co-created value in use. The cooperative is envisioned not merely as a service provider but as a community—a network of individuals who have undergone the renovation process and who actively share the benefits and lessons learned with others. This social dimension of the business model adds a layer of trust and relatability that enhances user engagement and reinforces the cooperative’s role as a facilitator of meaningful, user-driven transformation in the built environment.

The RADAR framework also situates the COOP within a larger constellation of stakeholders, each contributing specific roles and resources to the ecosystem. Energy Service Companies (ESCOs) support the technical implementation by defining renovation scopes and providing solutions. Government bodies and public institutions play a crucial role in enabling the market through regulatory support, subsidies, and policy incentives. Technology providers offer access to innovative systems such as renewable energy solutions, HVAC upgrades, and digital tools for monitoring performance. Financial institutions and platforms contribute to the aggregation of investments and the development of tailored financial instruments to support renovation efforts. In parallel, environmental stakeholders and CO2 offset entities ensure alignment with sustainability and climate goals.

The strategic outcomes pursued through this model include energy savings, reductions in CO2 emissions, and improved thermal comfort for building occupants. These objectives are supported by initiatives that promote the adoption of sustainable behaviors, improve the investment appeal of renovations, and encourage collaboration among actors. In this regard, the RADAR framework serves not only as a conceptual tool for mapping the roles and interactions of different stakeholders but also as a strategic guide for implementing a cooperative-driven, community-centric renovation model.

2.6 MESH (Demo 7)

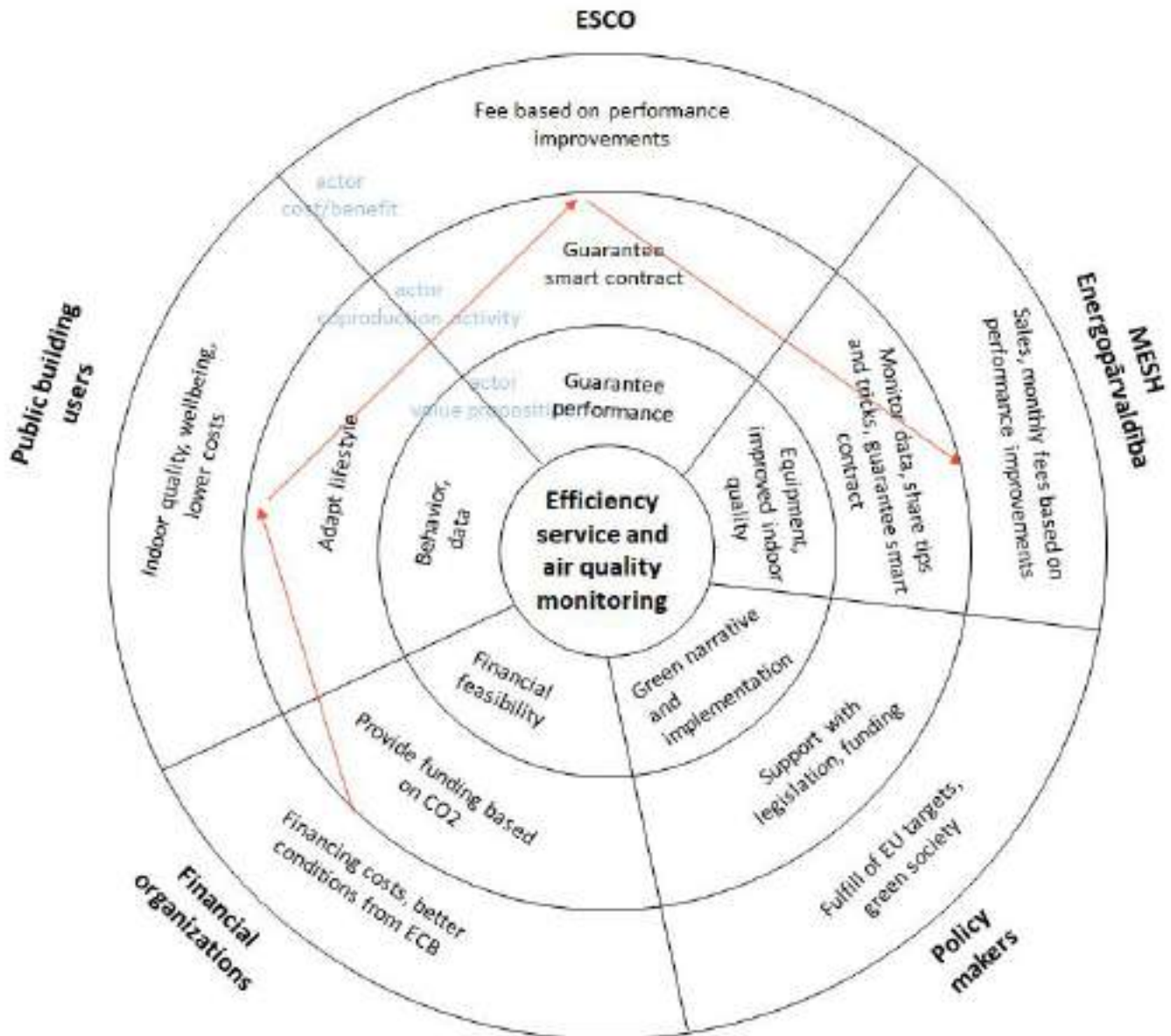


Figure 13 MESH business model radar for exploitation : final version

The RADAR diagram shown outlines the business model for MESH, a service platform offering efficiency services and indoor air quality monitoring, with a specific focus on public buildings. MESH radar did not change at all from the initial one that was created during D2.4. The model maps out a network of key stakeholders—public building users, Energy Service Companies (ESCOs), policy makers, financial organizations, and MESH itself—and illustrates how each actor contributes to and benefits from this service ecosystem. The diagram highlights value propositions, coproduction activities, and cost-benefit dynamics in the delivery and adoption of indoor environmental quality solutions.

At the heart of this business model lies the value proposition of MESH, which centers on guaranteeing the performance of indoor environmental quality improvements through real-time monitoring and smart contracts. MESH offers an integrated service that combines digital monitoring, data analytics, and feedback mechanisms, enabling public building users to benefit from improved indoor air quality, greater well-being, and lower operational costs. The system's ability to measure, assess, and report indoor conditions is pivotal to building user trust and securing long-term engagement.

A crucial component of this model is actor coproduction activity, which involves knowledge exchange and behavioral adaptation. Public building users are not merely passive beneficiaries; they actively contribute to the value creation process by adapting their lifestyles and behaviors based on feedback provided by the system. These changes are informed by shared data and usage patterns, fostering a culture of continuous improvement and co-responsibility. MESH facilitates this exchange by sharing tips, monitoring data, and offering insights that empower users to make informed decisions regarding their indoor environment.

Through smart contracts and performance-based guarantees, MESH ensures a transparent and accountable relationship between service providers and building operators. ESCOs, in this framework, are compensated based on measurable performance improvements, aligning financial incentives with sustainability goals. This outcome-based payment structure enhances credibility and reduces risk for all involved parties.

From the perspective of financial organizations, the MESH model enables more favorable financing terms. Financial actors can provide funding based on quantifiable CO₂ reductions and other sustainability metrics, supported by robust data generated from the MESH platform. Improved financing conditions—such as lower interest rates or specialized green funding instruments—are further encouraged by the alignment of the service with European Central Bank (ECB) priorities and climate-related monetary policies.

Policy makers are integrated into this ecosystem as enablers and beneficiaries of systemic impact. By supporting with legislation and funding, they promote green narratives, contribute to the fulfillment of EU climate targets, and ensure broader societal benefits. The policy component underscores the model's alignment with the European Green Deal and related directives promoting healthier, more sustainable public infrastructures.

In terms of cost/benefit analysis, each actor experiences tangible gains. Public building users enjoy improved well-being and reduced energy and maintenance costs; ESCOs benefit from performance-based revenues; financial institutions engage in lower-risk, impact-driven lending; and policy makers advance strategic environmental goals. MESH orchestrates this synergy by ensuring reliable data flows, performance verification, and stakeholder engagement.

Table 37 Offered experience

Focal organisation	SIA MESH Energopārvaldība
Experience offered	Efficiency service and air quality monitoring

Table 38 Public building users

Value Proposition	Public building users offer their energy usage pattern and energy consumption measurements for further analysis. They are the target group where the service is offered.
Co-production activity	Public building users can adapt their lifestyle to achieve green efficiency, adopt a more energy efficient behavior, save energy and money and enjoy an increased level of comfort at their premises.
Cost / benefit	<ul style="list-style-type: none"> - Service fee, includes energy costs and FORTESIE service + Save energy and money (reduced energy bills) and enjoy upgraded comfort (comfortable temperature, CO2 and humidity), tailored to their preferences heating (without wastages). + Adopt a more energy efficient behavior and contribute to a green social community.

Table 39 MESH Energopārvaldība

Value Proposition	MESH ensures equipment, technical support, monitoring of data, analysis and recommendations. They are the contact point for the customer and all the providers.
Co-production activity	MESH Energopārvaldība will monitor data, analyze, give recommendations, share tips and tricks, guarantee smart contract. For building users there will be possibility to save energy and money and live in more qualitative microclimate.
Cost / benefit	<ul style="list-style-type: none"> - Production costs - Operation costs - Installation costs + Revenues + Sustainable image in society

Table 40 ESCO

Value Proposition	The ESCO provides a performance guarantee contract for certain savings on the public building's energy bill and for the building energy efficiency.
Co-production activity	The ESCO is responsible for ensuring that by implementing FORTESIE's Smart Contract, the building owner will benefit from a standard amount of energy efficiency, which will result in a predetermined percentage of decreased energy usage and, as a result, a reduced energy bill.
Cost / benefit	- Operational costs + Fees monthly based on performance improvements

Table 41 Policy Maker

Value Proposition	The government is committed (for example through the Paris agreement) to achieve some goals related to the CO2 emission reduction and energy savings and also comply with national and EC regulations. Hence, the government provides funding for the adoption of initiatives such as FORTESIE.
Co-production activity	The government sets targets based on national and EC regulations in order to foster Energy Efficient behavior and achieve CO2 emissions reduction.
Cost / benefit	- Funding in Euro + Foster Green Society + Achieve social goals and policy targets

Table 42 Financial Organization

Value Proposition	The financial organisations will enable the financial feasibility of MESH Energopārvaldība
Co-production activity	The financial organisations are responsible for providing funds to the MESH in order for them to establish their green projects.
Cost / benefit	- Financing costs (they pay interest to their investors) + Interest margin from MESH Energopārvaldība

2.7 +48 (Demo 6)

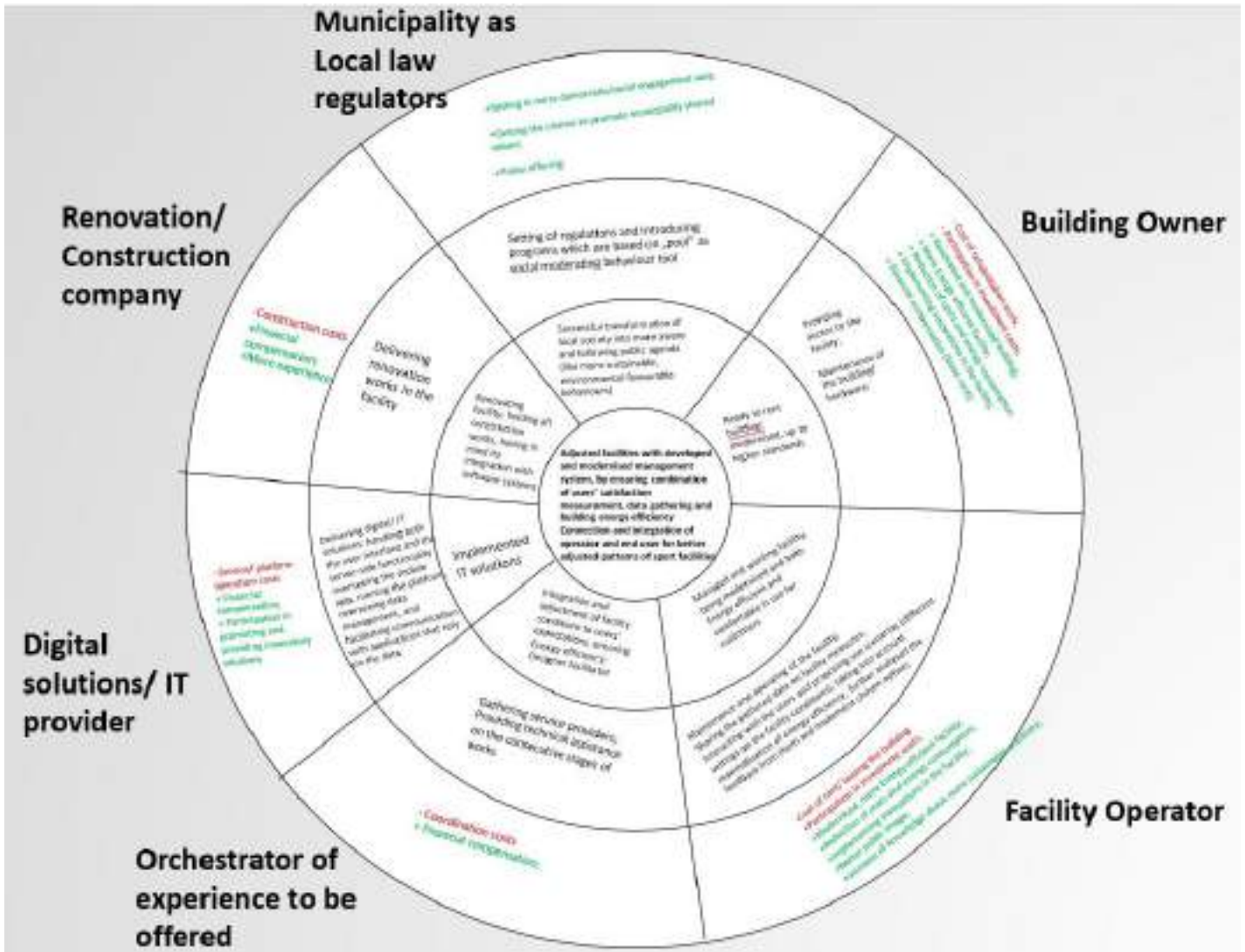


Figure 14 +48 business model radar for exploitation : early version

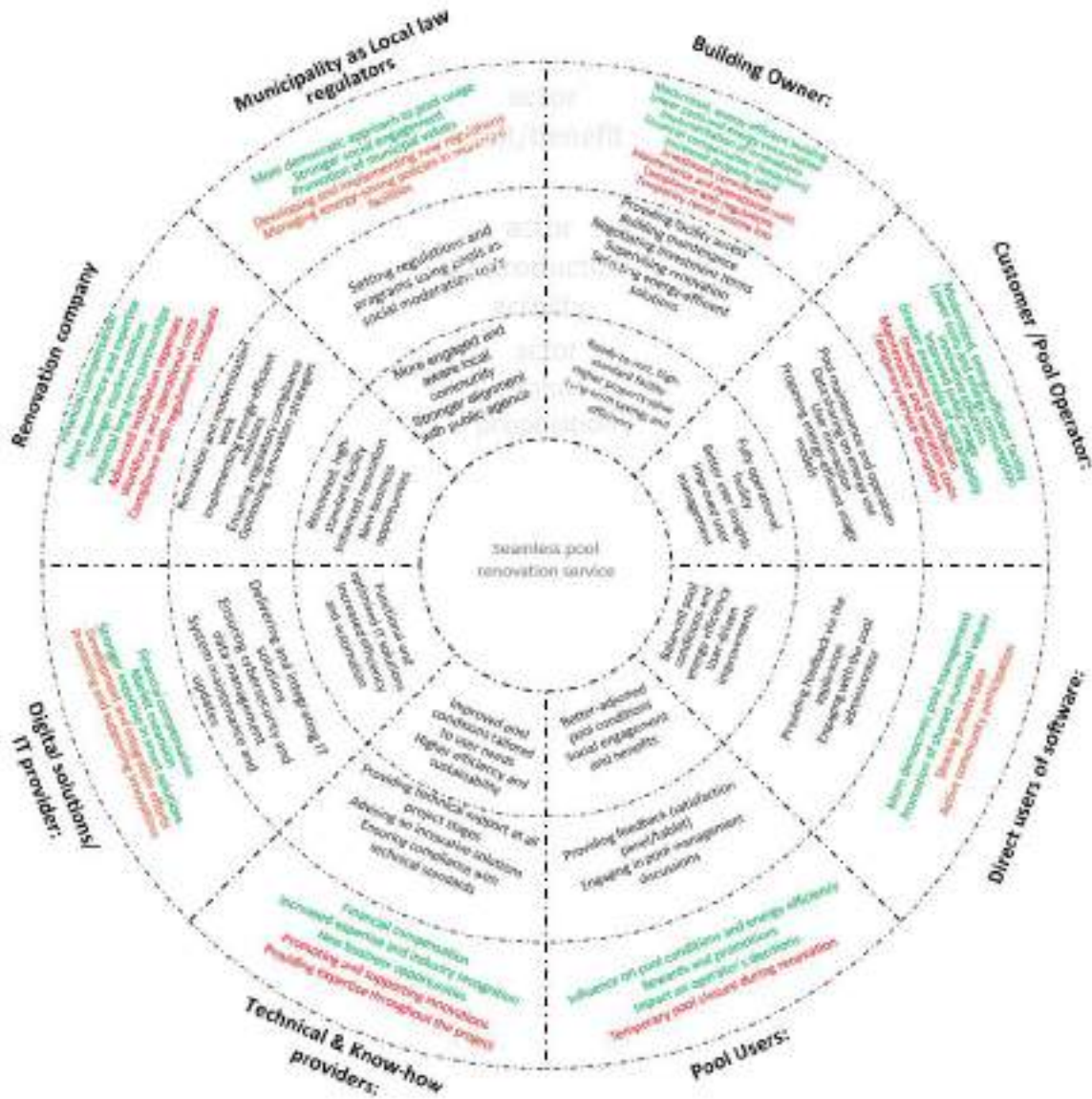


Figure 15 +48 business model radar for exploitation : updated version

The business model of the Polish pilot, aimed at the renovation and modernization of public pool facilities, has progressed from an initial conceptual framework to a mature, operationally viable model. This evolution is represented in the final dotted-line RADAR diagram and the supporting business model canvas, both of which articulate a coordinated, multi-actor service ecosystem designed to deliver high-efficiency, user-responsive public infrastructure.

At the heart of the model is the central value proposition: the delivery of a “Seamless Pool Renovation Service”—an integrated solution combining physical renovation, digital optimization, and user-centered management. The model is built around a clearly defined logic of co-production, with each actor contributing specific inputs and deriving tailored benefits.

Stakeholder Roles and Value Contributions

Municipalities (as Local Law Regulators) serve as institutional enablers of the model. Their role includes setting regulatory frameworks for renovation and operation, and aligning public infrastructure upgrades with energy and sustainability goals.

Building Owners (often public institutions) provide access to the physical facilities, maintain structural responsibilities, and negotiate renovation contracts. Their key benefits include long-term reductions in maintenance and operational costs, as well as the modernization of assets aligned with energy efficiency standards.

Pool Operators are responsible for the day-to-day management of the renovated facilities. They collect and respond to user feedback, coordinate with IT providers and renovation teams, and ensure optimal pool functioning.

Renovation Companies execute the physical transformation of the facilities. Their responsibilities range from upgrading pool infrastructure to integrating digital systems in collaboration with technical providers. The model also creates business opportunities for renovation firms by aligning their services with public procurement goals for sustainable infrastructure.

Digital Solutions and IT Providers design and implement smart systems that enable monitoring, data analysis, automation, and interaction with pool users. Their tools make it possible to optimize pool operations in real time and support energy-saving measures. Their involvement also boosts market visibility, innovation positioning, and commercial potential.

Technical and Know-How Providers play a crucial role in advising on compliance, standards, and integration across renovation and digital domains. They ensure that the solutions deployed meet the necessary technical requirements, providing support throughout the project lifecycle.

Direct Users of Software interact with the IT systems to manage pool settings, collect satisfaction data, and coordinate operational adjustments. Their feedback is essential for maintaining continuous improvement loops and ensuring the system’s responsiveness to actual user behavior.

Pool Users are active participants in the value creation process. Through their engagement with the facility and interaction with the system (e.g., feedback, behavioral adaptation), they help shape the operational profile of the pool. They benefit from cleaner, more comfortable, and responsive environments, while also contributing to the overall efficiency of the system.

The final model represents a significant refinement over its earlier version. The initial RADAR provided a wide-ranging conceptual overview but lacked operational detail. The current version delivers a structured, actor-specific model grounded in real-world feasibility and mutual accountability.

- ✓ Value propositions are clarified across all actors.
- ✓ Coproduction activities are mapped to tangible interactions.
- ✓ Cost/benefit dynamics are detailed, including incentives and responsibilities.

The model shifts focus from "what is possible" to "what is actionable"—establishing clear roles, smart data systems, financial mechanisms, and governance structures for implementation.

The accompanying business model canvas further operationalizes this framework:

1. Under Value-in-Use, pool operators gain optimized facilities tailored to user needs and energy efficiency.
2. The Service Ecosystem identifies the municipal pool operator as the focal actor, working in tandem with enriching services such as digital monitoring and core partners like renovation and IT providers.
3. Collaboration Management structures relationships between core and enriching actors. Effective communication, technical upgrades, and data-driven decision-making underpin the success of the model.
4. Enriching Relationships highlight how digital and renovation partners contribute to ongoing modernization, while Core Relationships capture how municipalities and operators facilitate user engagement and co-management.

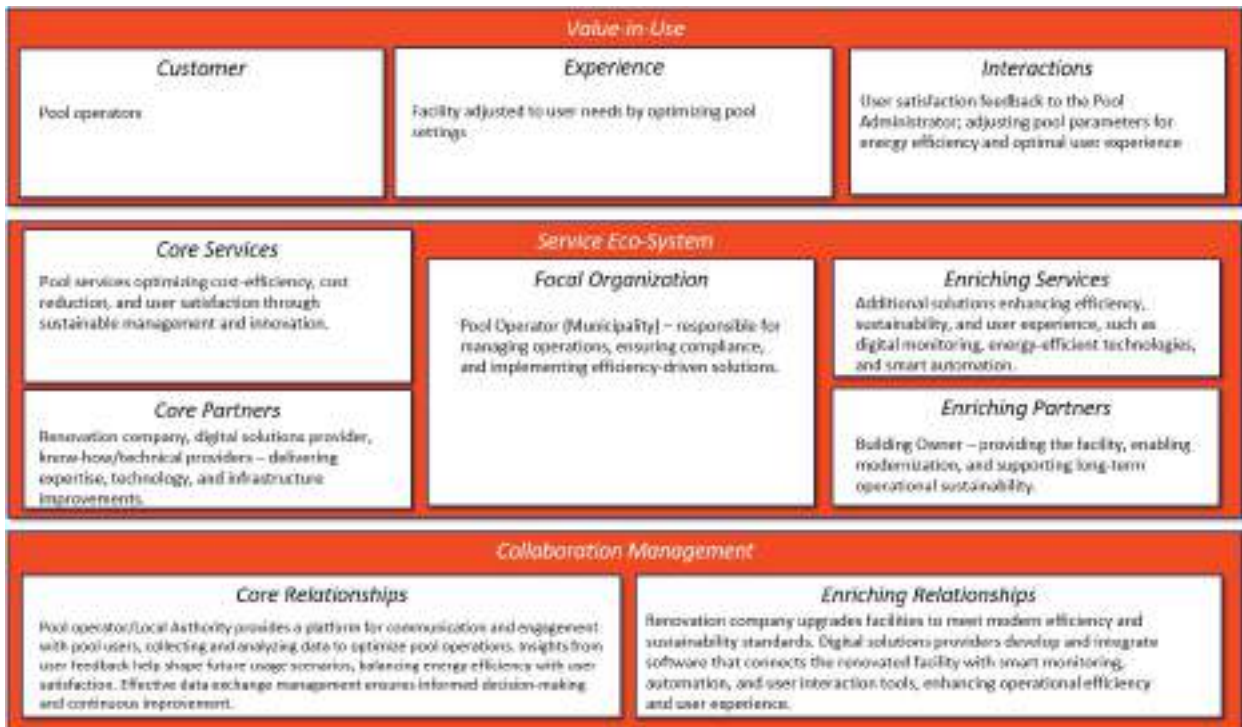


Figure 16 +48 business model radar for exploitation :updated version on business canvas

2.8 Slovakian case

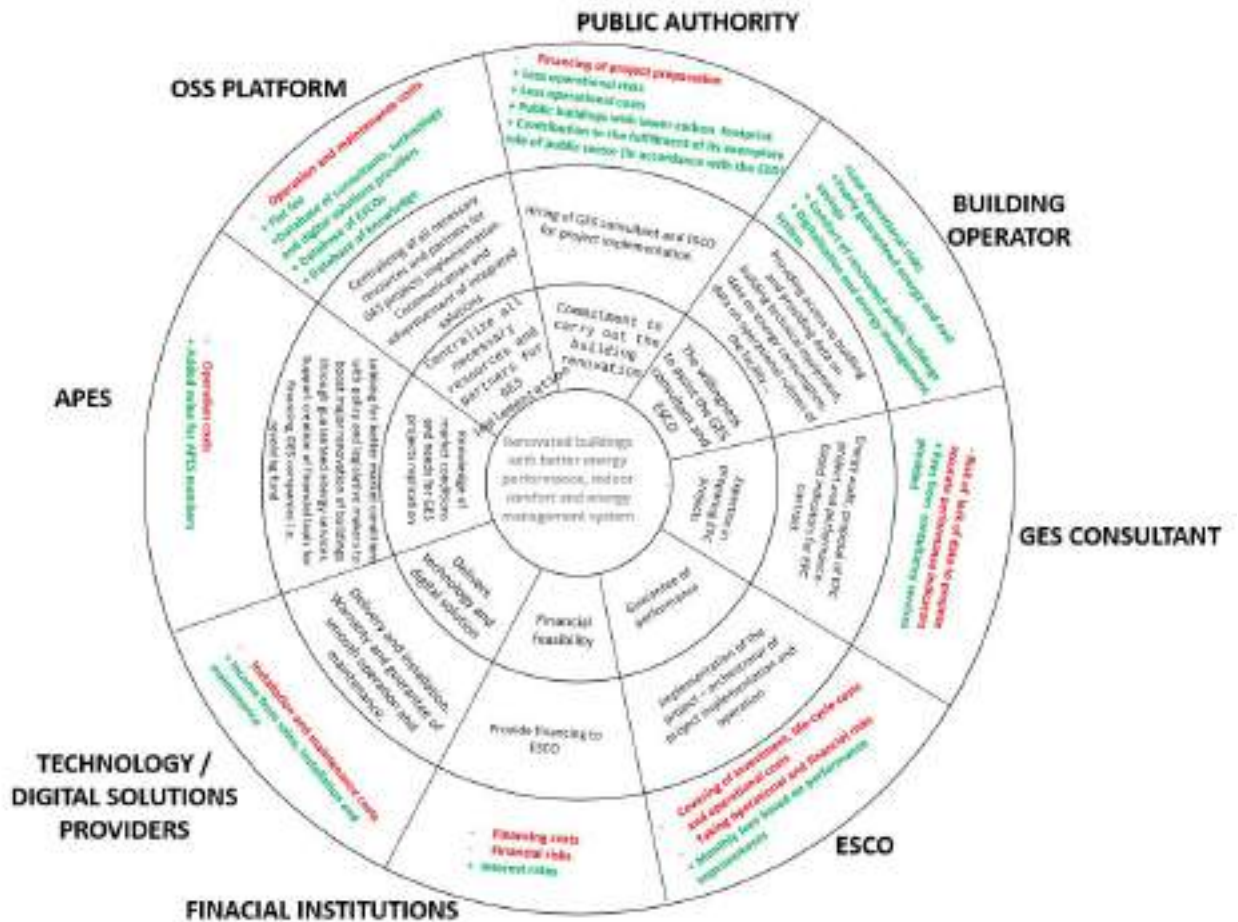


Figure 17 APES/ECN business model radar for exploitation

The Slovakian partners have developed a comprehensive and well-structured business model to support the renovation of public and municipal buildings through Guaranteed Energy Savings (GES) contracts and Energy Performance Contracting (EPC). This model is centered on improving energy performance, ensuring financial feasibility, and delivering a user-oriented building environment. Through its RADAR and accompanying business model canvas, the Slovakian case demonstrates an integrated approach that aligns public goals, private capabilities, and digital innovation.

At the core of the Slovakian model is the delivery of renovated buildings with better energy performance, indoor comfort, and energy management systems. The central strategy involves the coordination of diverse stakeholders—public authorities, building operators, ESCOs, GES consultants, technology providers, financial institutions, OSS platforms, and the national association APES—in a value-generating, performance-based renovation ecosystem.

Each actor plays a specific role in driving both implementation and long-term benefits:

- Public Authorities initiate and support renovation through the financing of project preparation and procurement coordination. Their motivation includes lowering operational risks, reducing carbon footprints, and fulfilling their exemplary role under the Energy Efficiency Directive (EED).
- Building Operators are key beneficiaries, gaining modernized facilities with lower energy costs, improved comfort, and reduced operational risks. They also support project implementation by providing access to building data and infrastructure.
- ESCOs implement the renovation works and assume performance risk, recovering investment through performance-based monthly fees. Their incentive is built on the ability to deliver measurable improvements that justify return on investment.
- GES Consultants offer technical and economic evaluations, prepare GES/EPC documentation, and facilitate communication between actors. They play a critical advisory role in aligning the expectations of the public sector, financiers, and ESCOs.
- Technology and Digital Solutions Providers supply integrated smart systems, software, and infrastructure that enable data collection, monitoring, and optimization. These solutions help ensure operational performance and streamline building management.
- Financial Institutions enable the model's viability by financing ESCO operations, with benefits derived from interest income and participation in risk-mitigated investments in public infrastructure.
- APES (Slovak Association of Energy Service Providers) contributes to stakeholder coordination, knowledge dissemination, and replication of good practices. It also provides a platform for lobbying, market monitoring, and standardization of methodologies.
- OSS Platforms provide digital infrastructure for centralized coordination of actors, publication of opportunities, and promotion of technologies. They serve as a shared resource for matchmaking and project monitoring.

The RADAR illustrates the business model's clear alignment of actor value propositions, co-production activities, and cost/benefit mechanisms. Public authorities and building operators benefit from performance guarantees and improved facilities. ESCOs are compensated based on measurable outcomes. GES consultants help mitigate technical and administrative risks. Technology providers and financial institutions are rewarded for enabling efficient, scalable project delivery.

The core mechanism of value generation lies in joint commitment to building renovation through GES/EPC contracts, where risk is distributed, and accountability is driven by data, monitoring, and guaranteed outcomes.

Co-production activities include:

- Shared data collection and analysis.
- Coordination through OSS platforms.
- Iterative feedback from building users.
- Joint procurement planning.
- Implementation tracking and performance auditing.

The business model canvas provides a practical translation of the ecosystem into key operational components:

- Value-in-Use focuses on customer outcomes: improved air quality, reduced energy costs, and better indoor comfort in public buildings. It also emphasizes the experience of ENC (Energy Consultancy) in designing GES projects and APES's market knowledge.
- The Service Eco-System identifies ENC/APES as the focal organization. ENC offers consultancy for project design and implementation, while APES brings together ESCOs and promotes replication across the market. Core services include project evaluation, savings verification, and stakeholder coordination.
- Core and Enriching Partners include ESCOs, local authorities, financial bodies, GES consultants, and technology providers. These actors contribute to market development, technical delivery, and policy alignment.
- Collaboration Management is built on structured relationships: regulatory compliance, partner coordination, and strategic alliances with national policymakers. OSS platforms facilitate seamless, real-time communication and engagement between stakeholders.

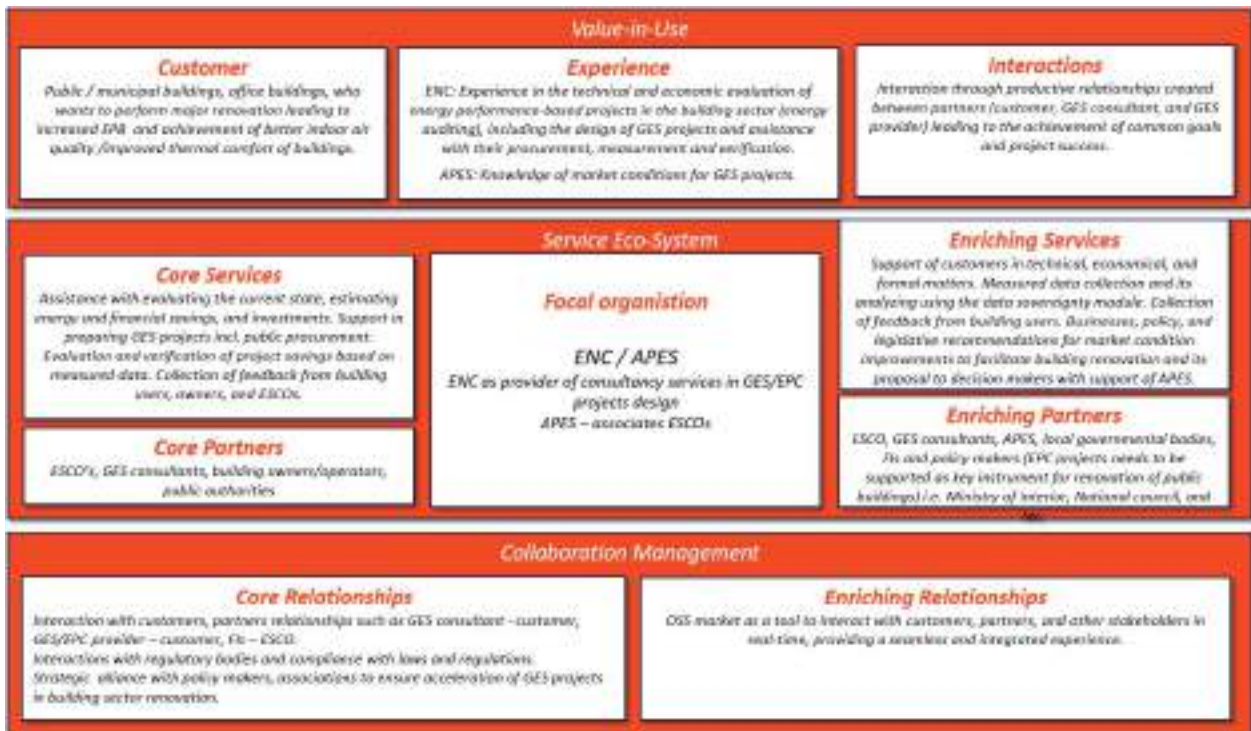


Figure 18 Figure 15 APES/ECN business canvas

2.9 Conclusion from the radars

The above radars, and the work done on energy savings could provide food for thought on the methods of distributing the public subsidy, in order to create traction (demand) at large scale on renovation, at an optimized cost for public spending.

In particular the white certificate schemes, in place in many countries, including in the transportation sector in Germany (under the name of THG Quota scheme¹) is a scheme where subsidy is given on a theoretical ex-ante energy saving estimation and generating a vast amount of fraud. We show here with those radars that we could substitute this ex-ante certificate by an ex-post certificate and use the legal framework to create a strong demand for those certificates (carbon and or energy savings certificates) that would fuel the generalisation of the €G loans

¹ The THG Quota (Treibhausgas-minderungs-Quote) is a regulatory mechanism requiring fuel suppliers to reduce their greenhouse gas emissions annually by a set percentage. EV owners can benefit by certifying and selling their vehicle's avoided emissions as tradable CO₂ certificates. Objectives of the THG scheme are: 1) Reducing CO₂ emissions – Germany aims to cut CO₂ emissions in the transportation sector by 65% by 2030 compared to 1990 levels, 2) Promoting renewable energy – The system creates a financial incentive for clean mobility.

In particular, there is reason to believe that the distribution of all the aid at once as with current white *ex-ante* certificates schemes, without any *ex-post* conditionality, is by construction an incentive to fraud. What's more, the higher the subsidy, the greater the incentive to commit fraud.

This incentive to fraud on the white certificate mechanism is well documented in many countries. In France in 2024, total energy was suited by the energy ministry for fraudulent distribution of white certificates. In 2021, the European Union Agency for Cooperation in Criminal Justice Eurojust helped the Italian and German authorities to dismantle a complex fraud scheme involving the trading of energy efficiency certificates. The fraudsters deprived the Italian authorities of at least €27 million in illegally obtained certificates and allegedly laundered more than €14 million through bank accounts in various European countries. During a joint day of action, 20 suspects were arrested in Italy, Germany and Switzerland, and property, vehicles and financial assets worth an estimated €41 million were seized, including cash.

In response to these crucial issues of proper use, the '*ex-post*' certificate distribution proposed in FORTESIE will make it possible to set up an experimental basis for the *ex-post* distribution of the subsidy, based on observations over several years, and establishing a precise link between the certificate distributed and the actual energy savings observed. In our opinion:

- A staggered *ex-post* distribution of the subsidy (certificate) would considerably reduce the amount unduly paid out, since as soon as fraud is detected, payment of the subsidy stops.
- Payment of the subsidy in instalments also makes it possible to correct errors in past payments, both upwards (poorly prepared application by a household acting in good faith) and downwards (fraud), by adjusting the amount of the subsidy paid in subsequent years.
- Linking the subsidy to real *ex-post* savings guarantees the effectiveness of public spending.

The FORTESIE work endeavour to demonstrate that taking into account consumption before and after works will NOT complicate subsid distribution, i.e. the production process of the certificates. To this end, we have provided ample details in the proposal of the technical data management tools to be used, which will be those for automated *ex-post* certificate production. The considerable progress made in new digital and cloud technologies, as well as in AI, now makes it possible to manage energy consumption or diffuse CO₂ emissions on an individual basis rather than using conventional methods. Taking data into account opens up new avenues for thinking about how to accelerate the energy and ecological transition. From an operational point of view, several scenarios could be envisaged, such as the distribution of 'energy reduction credits' to households on the model of the carbon credits operated under the law on domestic projects. In this way, the evaluation could serve as a preparation for the enlargement of the EU-ETS provided for in the 'fit for 55' agreement. The consortium will be able to share its feedback with the steering committee and the scientific committee and demonstrate the operational feasibility of these 'individual rewards'.

On the other hand, distributing the subsidy on the basis of real *ex-post* measurements, spread over several years, will encourage the development of innovative financing methods, such as zero or negative interest rate loans, with the subsidy covering the interest on the loan. Distributing the subsidy over time will also make it possible to draw up energy performance contracts based on real energy savings, with the occupants of the homes involved over a long period to speed up the energy transition (ET). The members of the consortium are already working on these issues as part of

European projects, and will be able to contribute their expertise to the steering and scientific committees.

Finally, the *ex-post* distribution of “energy saving certificate” would open the door to extending the scheme to companies other than just energy suppliers as it is for the white certificate scheme, and consequently to increasing the ‘base’ of the new scheme. For example, a loan to renovate a house or purchase an electric vehicle generates *ex-post* certificates. These are used by the household to pay the interest on the loan and reduce its interest rate to zero, or even subsidize it. To do this, households sell their certificates either to current obligated parties, as is the case today, or to banks, which would either act as intermediaries in the certificates clearing market, or become new obligated parties, responsible for financing the Energy Transition (ET). The system could also be extended to producers of goods that help to reduce energy consumption and CO₂ emissions, who would develop commercial offers to retain certificates and highlight the specific advantages of their products in terms of ET. In the future, all companies could have certificates obligations, whatever their sector of activity.

3 Update on the proposed European Central Bank CBDC, so-called “digital-euro”.

3.1 Update on Digital-euro (D€) development

In D2.4 we explained the Digital euro work conducted by ECB and we highlighted some antagonisms within the work currently undertaken by ECB.

For full and complete details update the reader can go the the digital euro page of the ECB : https://www.ecb.europa.eu/euro/digital_euro/html/index.en.html and other ECB web pages that are very reach on the development stage of this digital-euro (D€).

Our intention in this section is only to give the reader our understanding of the evolution of the D€ and to analyse how this D€ could potentially be used as a CBDC in smart EPC contracts. This analysis results from the reading of public ECB documents on D€, the reading of various documents (white papers, research papers, etc.) on blockchains and crypto currencies, and the participation by CCO2 on May 15 and 16 to a Digital-Euro conference in Paris held at the French National Bank (Banque de France). We observe that antagonism have not been solved

From July 2022 to February 2023 ECB designed the Digital Euro project which is summarized in the figure below:

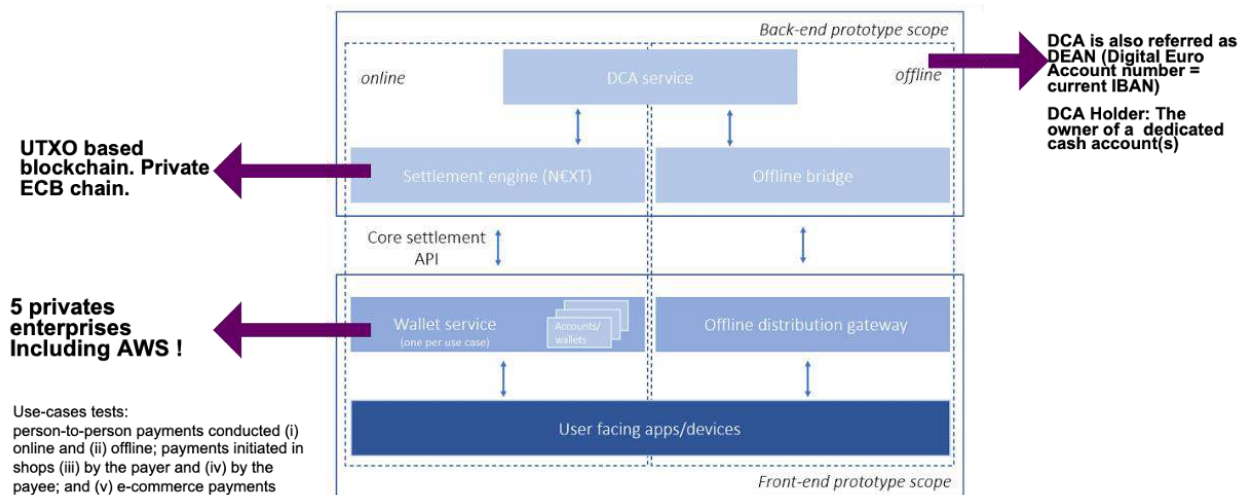


Figure 19 Prototype design of the D€ by the ECB

Every citizen in EU (unknown for foreigners) will be able to hold a D€ account know as a DCA (Dedicated Cash Account) or DEAN (Digital Euro Account number) which is the equivalent to current IBAN we all have. However, as the ECB does not want to run/manage individual accounts those DEANs will be held as Payment Service Providers (PSP) or by commercial banks, as it is the case today with IBANs.

For the back-end prototype, the Eurosystem developed a centralised settlement engine (N€XT), based on an unspent transaction output (UTXO) data model commonly used for transactions with digital currencies wallets.

The UTXO and Account/Balance models are two different ways of tracking funds and transactions. Bitcoin uses UTXO, while Ethereum uses the Account/Balance model.

The Bitcoin network is based on the UTXO blockchain model, in which a transaction is divided into several parts (inputs and outputs). The user's wallet balance keeps track of all UTXO transactions.

The Ethereum network is based on the Account/Balance model. This model ensures that the account balance is greater than or at least equal to the amount of the transaction to be carried out.

Most developers consider that the UTXO model is more secure and requires less storage space than the Account/Balance model, which requires more space for large blocks of data.

The ECB however does not communicate much on the choice of the chain. It is likely that it will be a private chain, with nodes of the network held by all ECB affiliates or partners of the ECB D€ project. Indeed, should the chain be public, Bitcoin for example, it would imply that an exchange rate between the D€ and the chain token (BTC for example) would exist, and consequently a payment in D€ between two wallets would be subject to a variable cost priced in chain token (BTC for example). Thus compared to SEPA payments, D€ transfers would be more expensive for users or commercial banks, PSP managing D€ wallets, hence potentially limiting their use.

With a private ECB chain, the chain token can be set a fix euro value, or can stay as token and used only by ECB, with no financial impact of D€ wallet holder or PSP/commercial banks managing D€ wallets. The private chain option does not also guarantee the robustness of a public chain such as Bitcoin, which raises the question of why should public money be spent to reproduce in a less robust way a tamper proof solution ? It shows one more time that currency is a not a neutral matter but a politic subject.

This co-existence of the fiat euro as we know it, together with a token of a chain subsists in the presentations made at the Banque de France D€ French ECB affiliate on May 15 and 16 2025 as shown on the two photos below. The oxymoron of “tokenisation” and “settlement in central bank money” as stated in the title of the slide of the picture below shows that the confusion remains between currency and payment systems. We still consider that a public ledger or DLT such as the blockchain offers the most secure payment system ever, and services on this ledger are paid by a specific currency, the token of the chain. Consequently a token exchange rate with any other currency or tokens will always remain. The “monetary policy of the token” being defined once for all in a public/white paper.

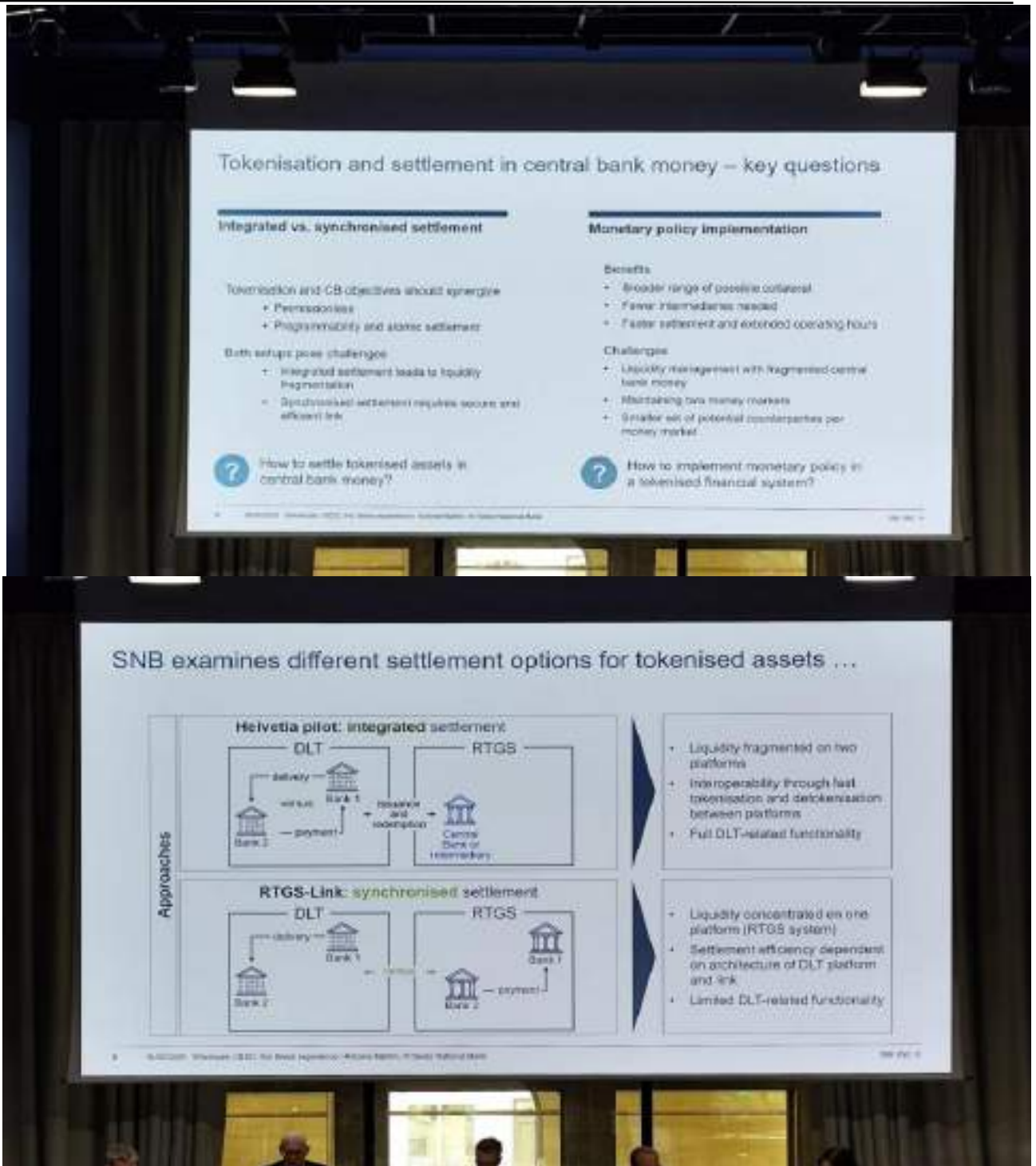


Figure 20 Oxymoron slide title illustrates the confusion around the concept of currency and payment systems.



Figure 21A central body (ECB) calling for the use and control of decentralised tools.

More importantly, as rules for use of tokens are defined in a white paper, and then coded, with no change made possible, anybody on earth can decide to use those tokens or not, regardless of any regulation. This led to Defi financing which stands for Decentralised financing. It cannot thus be possible to claim for decentralized ledger and Defi finance ruled under a centralized body such as ECB as shown on the picture below.

As we see the progress made by ECB we understand that ECB is still interested in trying to build a new payment system as opposed to create a new currency as shown on the two pictures below. Which for a central bank managing one single currency is logic: why bother introducing another currency after having built the euro and suppressing all European fiat currencies? We understand that the ECB is trying to cope with this new blockchain technology. To our understanding, this euro-token coexistence will continue to create confusion also within the public, will not be competitive with existing SEPA payments or card payments, and can potentially thus reduce traction on the D€.

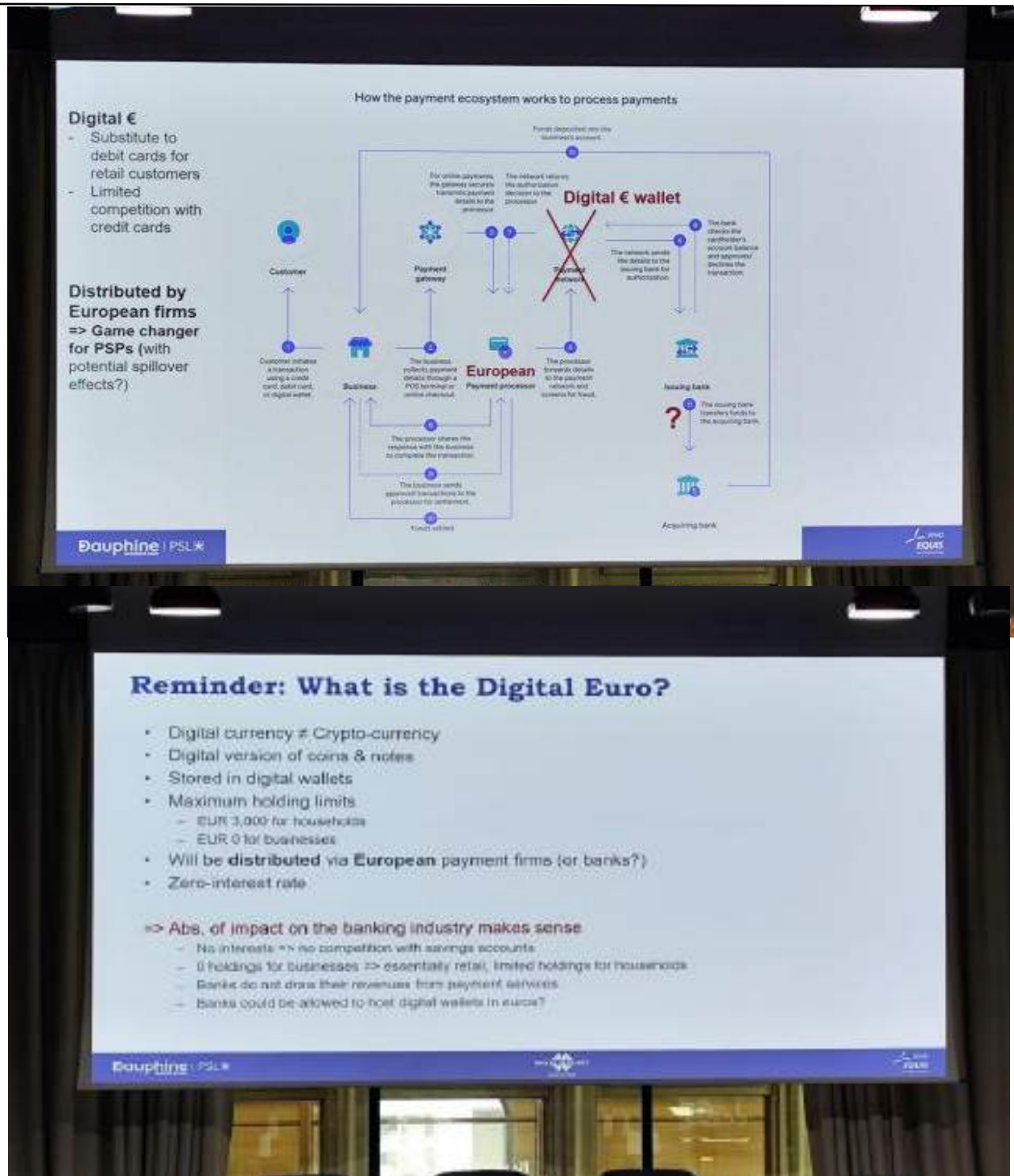


Figure 22 ECB vision of a Digital-euro, i.e. the construction of a new payment system rather than introducing a new currency.

One other element to report is that the ECB, which promotes mainstream economic theory, where money is considered as neutral, takes into consideration geopolitical elements as shown on the picture below to defend a new EU payment system. This point reinforces the ECB's vision centred on a means of payment rather than on a currency. But isn't it strange to name a payment system "digital-euro", which sounds more like a currency name ?

The D€ prototype focused on retail usage has listed 5 use-cases, and has chosen 5 companies to run the experiments. One of those companies being Amazon Web Services, one of the largest company in the world, a US based company, the geopolitical argument disappears for execution of the experiment.

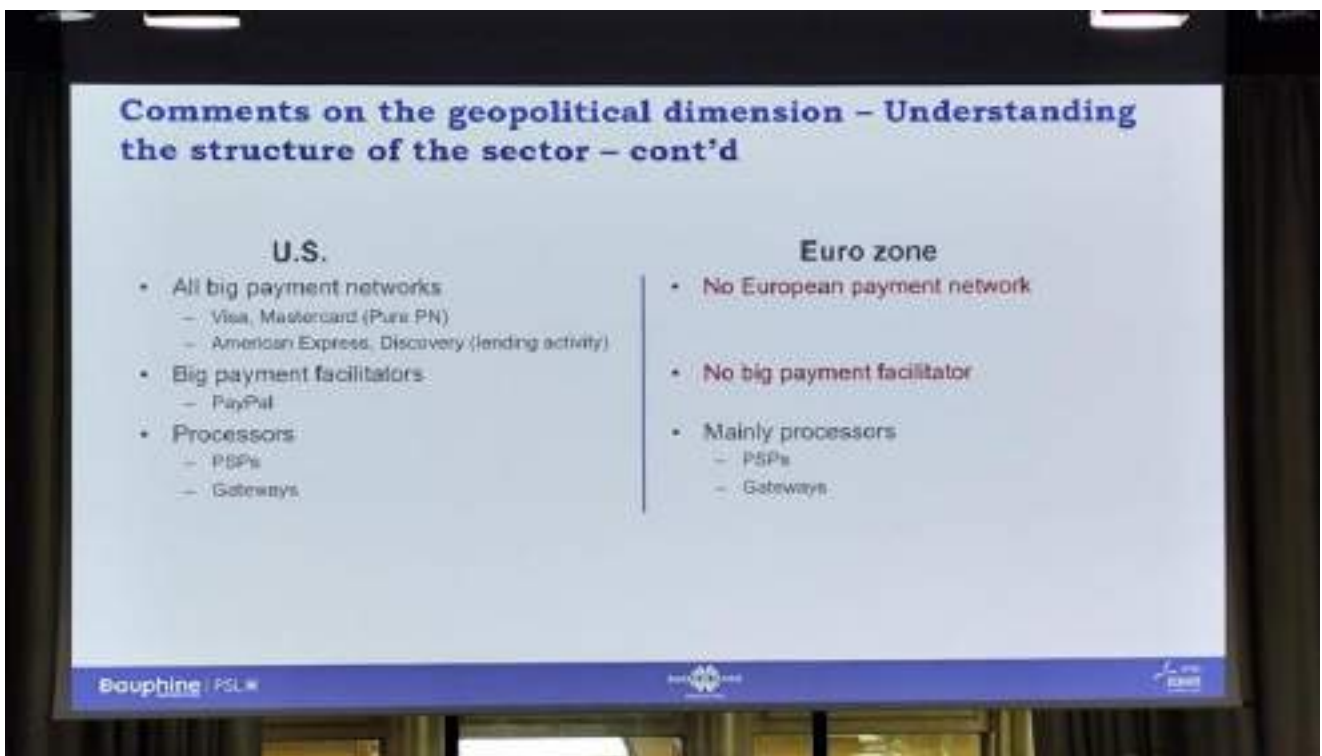


Figure 23 Money is neutral, payment systems are political.

3.2 Conclusion for FORTESIE on the D€ development

2024-2025 is a two year preparation phase for the D€. This does not fit the FORTESIE timing, and consequently we can not incorporate the EU CBDC into our smart EPC contracts.

The ECB focus on a payment system rather than on a currency, that could be for example dedicated to the execution of the Green Deal, where smart EPC contracts at no interest rate thanks to *ex-post* subsidies which could accelerate the energy transition, implies that the €G proposed by FORTESIE will never be in the short run a candidate for a D€ experiment. Consequently FORTESIE needs to continue to work with policy makers to create traction of the €G via an *ex-post* subsidy scheme. When this traction will exist, hopeful the D€ experiment will also have progressed, the token-euro confusion will have been solved, the currency-payment system will have been solved also, the public will not be confused any more, and thus, we could approach again ECB to propose a retail use case for the €G as a form a the D€.

Therefore, as ECB is building a Digital-Euro rule book (RDG), FORTESIE should get in contact with RDG's members in order to explain its energy transition use case.

Finally, CCO2 should continue to follow the D€ development in order to make sure it could connect one day as a PSP on the D€ API proposed by ECB.

3 Development of Market-Ready Renovation Packages

Building upon the solid foundation established through the development of business canvases and tailored business radars for each pilot, the FORTESIE project is now progressing toward the creation of integrated Renovation Packages. These packages represent the transition from theoretical modeling and strategic planning to real-world application, offering practical, market-ready solutions that respond to the needs of building owners, stakeholders, and energy renovation actors.

The business radars developed during the previous phase were designed to reflect the actual market conditions of each pilot site. Initially, some conceptual roles—such as interactions with the ECB and the Digital Euro—were explored but ultimately removed, as they did not align with the objectives or implementation needs of FORTESIE. Through careful refinement, each pilot retained only real, relevant, and active actors capable of taking up and delivering renovation services in their local contexts. These revised radars provided a clearer picture of the existing value chains, real market opportunities, and the ecosystem dynamics required to support energy renovations.

With these validated frameworks in place, each pilot is now preparing its own Renovation Package. These packages are envisioned as ready-to-offer solutions, built on real-life interventions and tested under operational conditions. They bring together three critical components: **renovation technologies** (such as insulation, energy-efficient systems, smart windows, PVs, etc.), **digital tools** (including sensors, monitoring platforms, user engagement apps), and **financial initiatives** (like green loans, subsidies, or alternative funding). The objective is to offer *Renovation-as-a-Service*—a pre-designed, trustworthy, and replicable solution that minimizes complexity for end users, while maximizing impact and scalability.

A key feature of these packages is their strong foundation in measured outcomes. Each pilot has installed monitoring systems to collect data before and after the renovation activities. This allows the project to quantify the benefits with confidence—such as reductions in energy use and CO₂ emissions, improved air quality, and enhanced indoor comfort. These indicators are critical for building trust, engaging building owners, and demonstrating the tangible value of renovation efforts.

The first step in this next phase involves the creation of a structured **template** that will be used to document each Renovation Package. This template has been developed through a co-creation process with pilot leaders and technical partners, ensuring that it captures all essential elements while remaining adaptable to diverse building types and contexts. It includes sections on the renovation technologies applied, the digital tools used for performance measurement and user interaction, the financial mechanisms available, and a dedicated area for **KPIs**—both from baseline (pre-renovation) and post-renovation phases.

The content generated using this template will be progressively developed as pilots finalize their implementation and collect post-renovation data. The **first example**, included below, refers to the museum pilot 1. At this stage, the template has been partially filled with information on the renovation technologies deployed, the digital components installed, and initial KPI data based on baseline (pre-renovation) monitoring. The completed version will follow after the renovation works are finalized and full performance data becomes available.

4 Conclusions

In conclusion, the FORTESIE project has made significant progress in transitioning from theoretical concepts to practical, market-ready solutions for energy renovation. This deliverable marks a key milestone in refining our early business models, evolving from abstract business radars to pilot-specific, ecosystem-aligned frameworks that reflect real-world dynamics and stakeholder interactions.

Through the development of tailored business radars and canvases, we have been able to identify and engage only those actors who are actively positioned to deliver renovation services and support market uptake. This has resulted in streamlined models that serve as the foundation for integrated, scalable Renovation Packages—combinations of proven technologies, digital monitoring tools, and innovative financing schemes designed for real deployment across diverse European markets.

A critical advancement introduced in this deliverable is the proposal of an ex-post subsidy distribution model based on actual, measured energy savings. This approach addresses widespread issues of inefficiency and fraud in existing ex-ante schemes by tying public funding directly to verified outcomes. By leveraging digital infrastructure, cloud technologies, and AI-based monitoring systems, the model supports new financing mechanisms—such as zero- or negative-interest loans—making sustainable renovations more accessible and trustworthy.

Furthermore, while the potential of the Digital Euro was initially explored, the timing and current direction of the ECB's development process are not aligned with FORTESIE's implementation needs. Consequently, the project has opted to focus on more immediate, impactful financial tools that are rooted in operational feasibility.

The work presented here not only contributes to policy discussions around energy efficiency and public subsidy management but also lays a solid foundation for future experimentation with data-driven performance contracts, individual carbon credits, and broader stakeholder engagement models. As the project prepares to finalize its Renovation Packages and gather post-renovation data from pilot sites, FORTESIE is positioned to offer credible, replicable, and high-impact solutions for accelerating Europe's energy transition.

By aligning strategic insights with actionable market deployment, this deliverable reinforces FORTESIE's core mission: to enable effective, transparent, and user-centric renovation pathways that contribute to both climate goals and socioeconomic value creation across the European Union.