

# AT FAÇ[AD]E VALUE

*REVISITING THE ADDED VALUE OF FAÇADE PRODUCT  
SERVICE SYSTEMS FOR SEMI-PUBLIC REAL ESTATE OWNERS.*

JANUARY 14th, 2025

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# 01 Introduction

Linear economic model

Circular Economy

better resilience

minimizing waste

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## Impact

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**~31%**

raw material consumption

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**~60%**

waste generated

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**~30%**

water consumption

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**8 bil**

world  
population  
2023

**9.7 bil**

world  
population  
2050

# 01 Introduction

Paris Climate Agreement  
2050 Net Zero  
2030 43% reduction

Current Building Stock  
will be 2/3 of total in 2050<sup>1</sup>

1% Deep energy retrofits / year<sup>2</sup>

1. European Commission. Directorate-General for Energy. (2014). *Financing the energy renovation of buildings with cohesion policy funding*.

2. Caloia, F., Jansen, D.-J., Koo, H., van der Molen, R., & Zhang, L. (2022). *Real estate and climate transition risk: A financial stability perspective* (Occasional Studies, Issue. [https://www.dnb.nl/media/cniottiu/web\\_134119\\_os\\_real-estate\\_and\\_climate.pdf](https://www.dnb.nl/media/cniottiu/web_134119_os_real-estate_and_climate.pdf)

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## Impact

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**~30%**

global final energy consumption

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**~40%**

global primary energy  
consumption

---

**~42%**

CO2 emissions

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**65%**

operational  
emissions

**35%**

construction  
emissions

# 02 Problem Statement

Introduction of Product Service Systems (PSS)

- Deviates from the conventional ownership

- Consumer paying for access to a product's utility

- Maintained ownership by provider

- Separate value creation from resource use

# 02 Problem Statement

## Building Façades<sup>1</sup>

Big determinant in energy efficiency and user comfort

40% initial expenses

90% in transformation projects

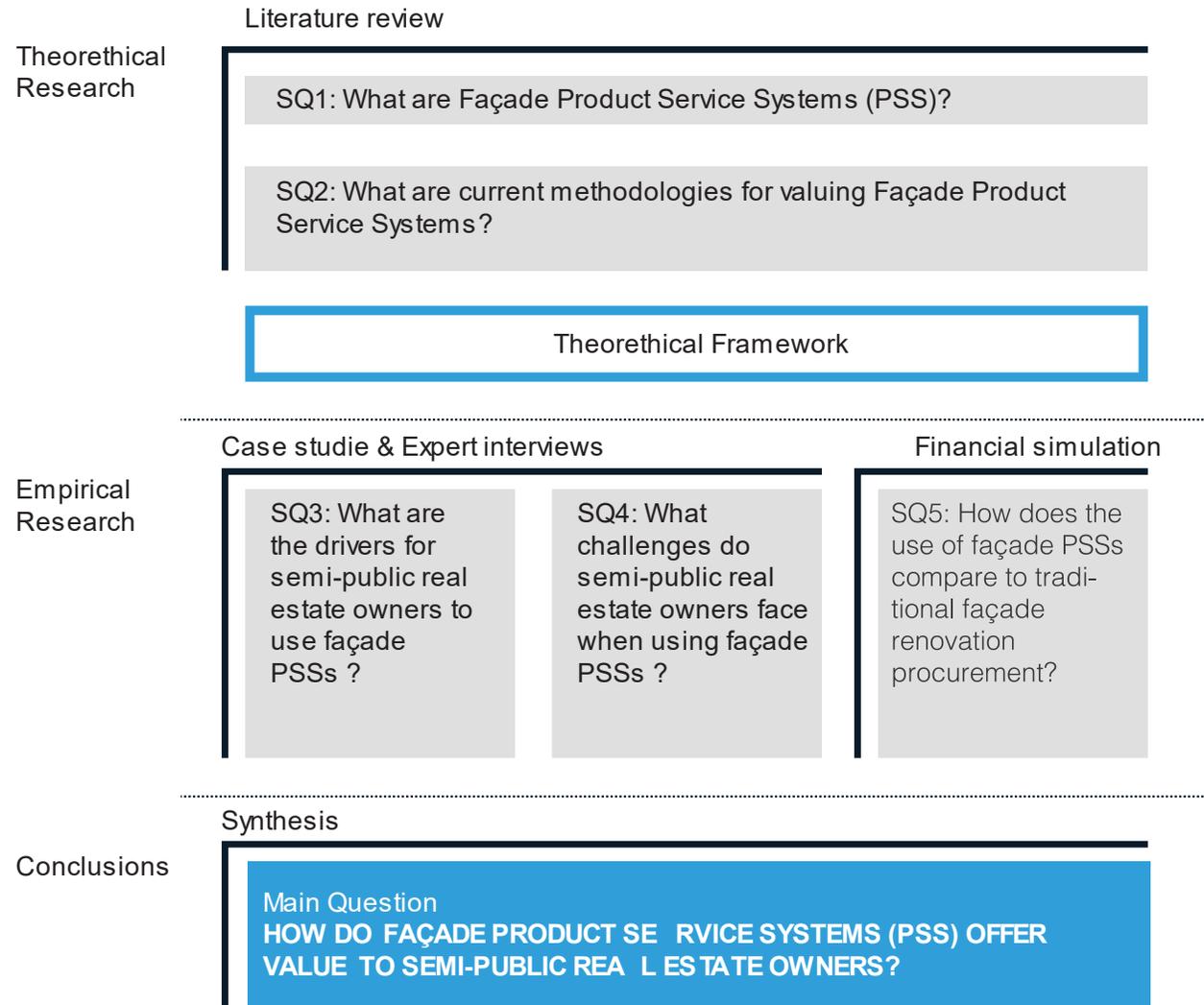
1. Dall'O, G., Bruni, E., & Panza, A. (2013, 12/01). Improvement of the Sustainability of Existing School Buildings According to the Leadership in Energy and Environmental Design (LEED)(R) Protocol: A Case Study in Italy. *Energies*, 6, 6487-6507. <https://doi.org/10.3390/en6126487>

# 03 Research Question

Main question:

**“HOW DO FAÇADE PRODUCT SERVICE SYSTEMS (PSSs) OFFER VALUE TO SEMI-PUBLIC REAL ESTATE OWNERS?”**

# 04 Methodology



## 04 Methodology

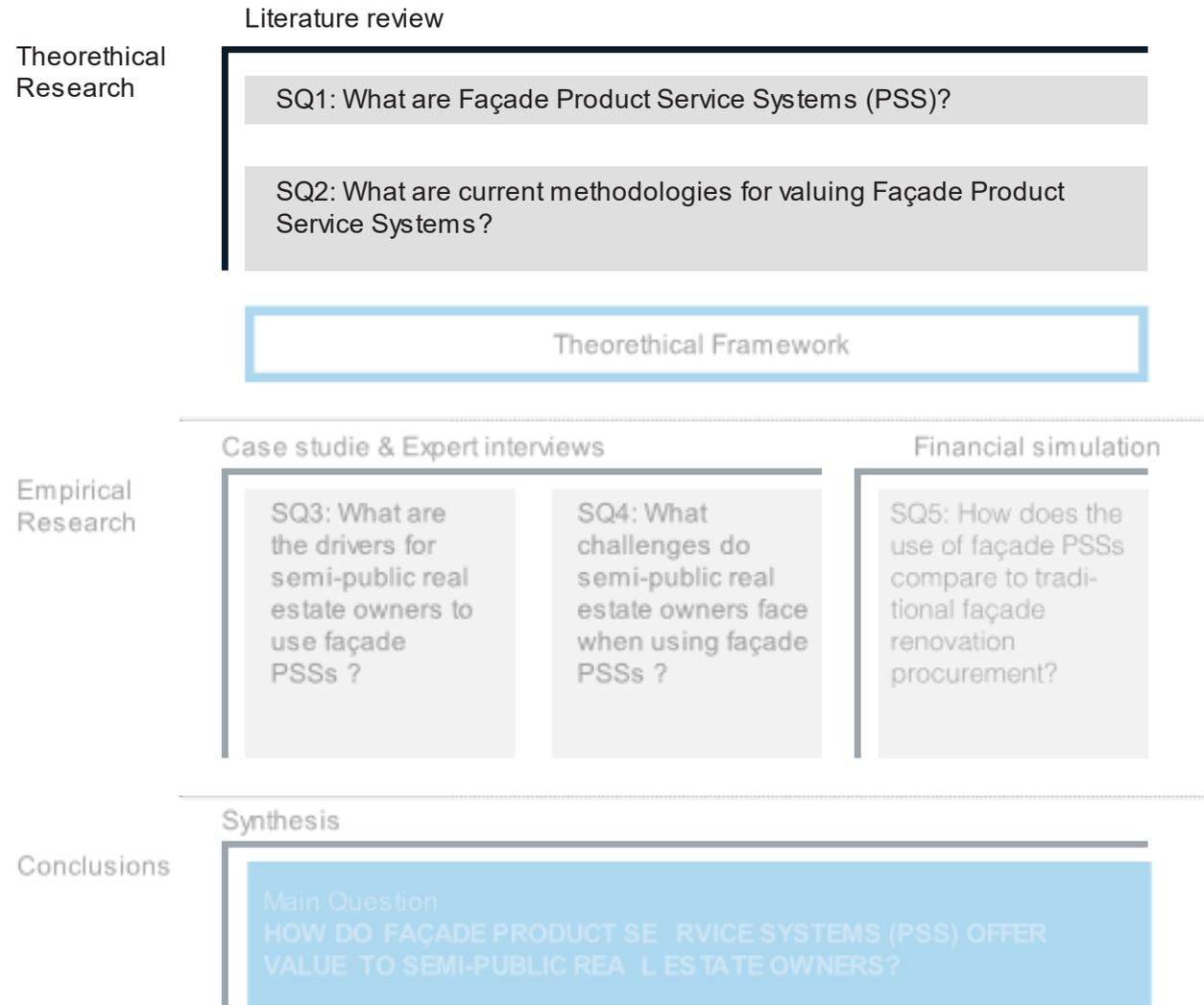
### Action Research

Not positioned at any involved stakeholder or external market party.

Engagement in non-planned or off the record meetings.

Cycles of planning, action, observation, and reflection.

# Methodology



# What are PSS?



Any combination of a  
product and a service  
that fulfil customer needs

Fig. 1 Tukker, A. (2004). Eight types of product-service system: eight ways to sustainability? Experiences from SusProNet. *Business Strategy and the Environment*, 13(4), 246–260. <https://doi.org/https://doi.org/10.1002/bse.414>

Type	>50% PRODUCT		>50% SERVICE	
	1. INPUT BASED	2. AVAILABILITY BASED	3. USAGE BASED	4. PERFORMANCE BASED
<b>Payment allocation</b>	Product related payments	Service related payments		
<b>Payment Structure</b>	At moment of purchase and at completion of service	When component is available	When component is Used	When performance criteria is met
<b>Utility accessed</b>	Purchased	Commonly leased		
<b>Owner of product</b>	Building owner	PSS provider / Bank		
<b>Maintenance and operator</b>	PSS Provider / Building Owner	PSS Provider		



**PURCHASE**





LEASE





LEASE







LEASE



LEASE



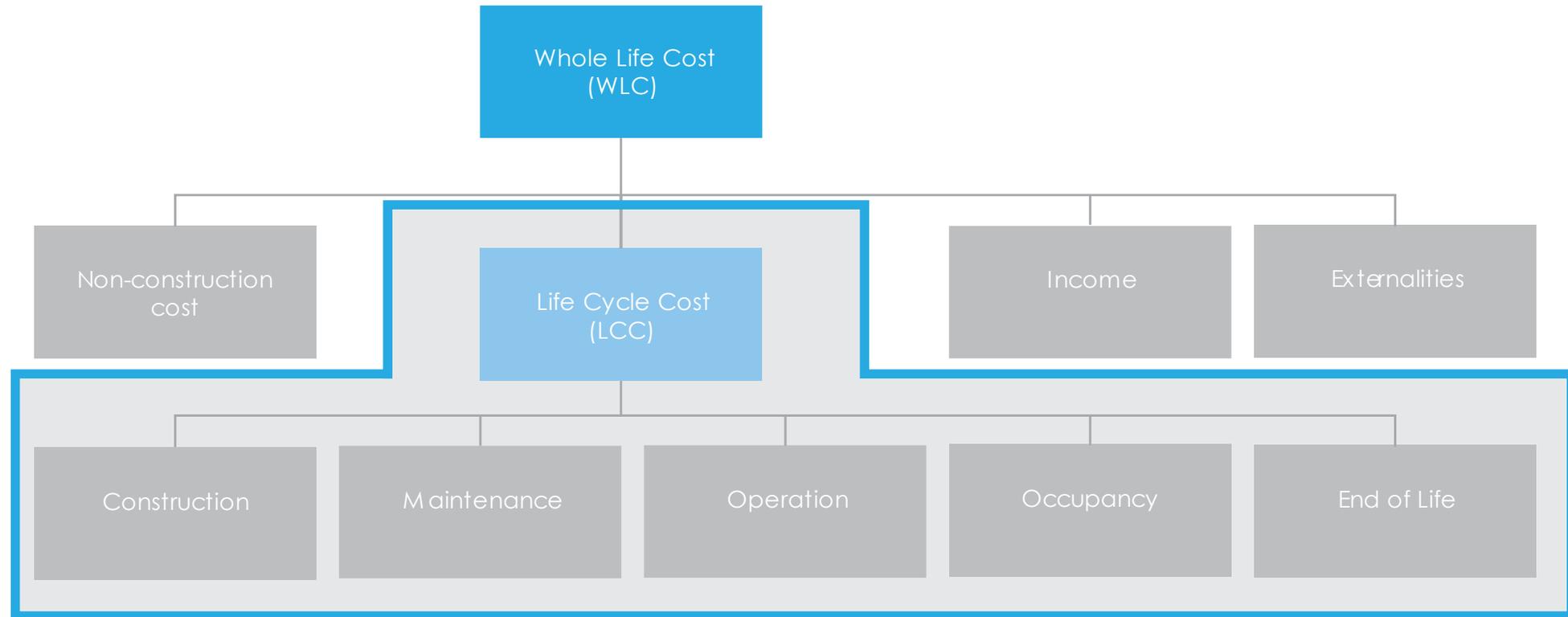
LEASE



What valuation methodologies are there?

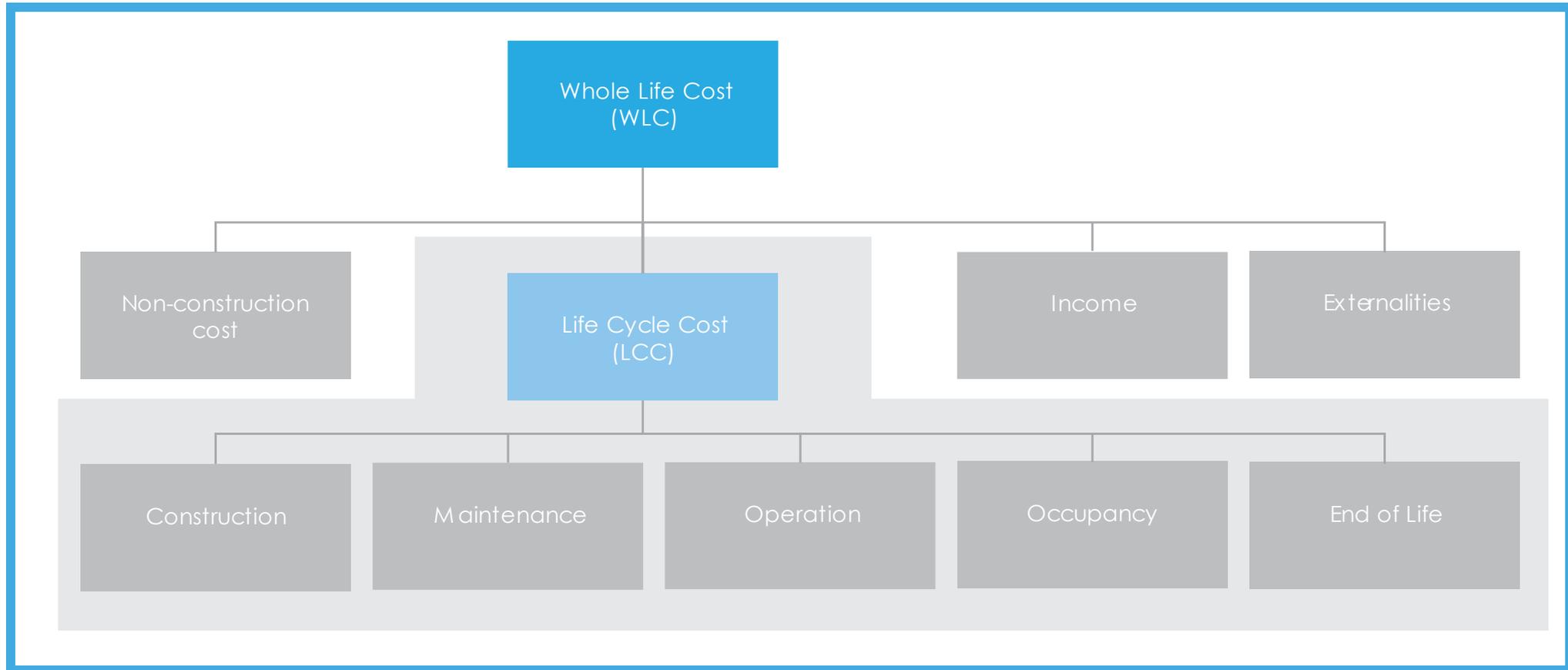
- 1 – Total Cost of Ownership / Life Cycle Cost method
- 2 – Total Value of Ownership / Whole Life Cost method
- 3 – Total Value of Use

# What valuation methodologies are there?



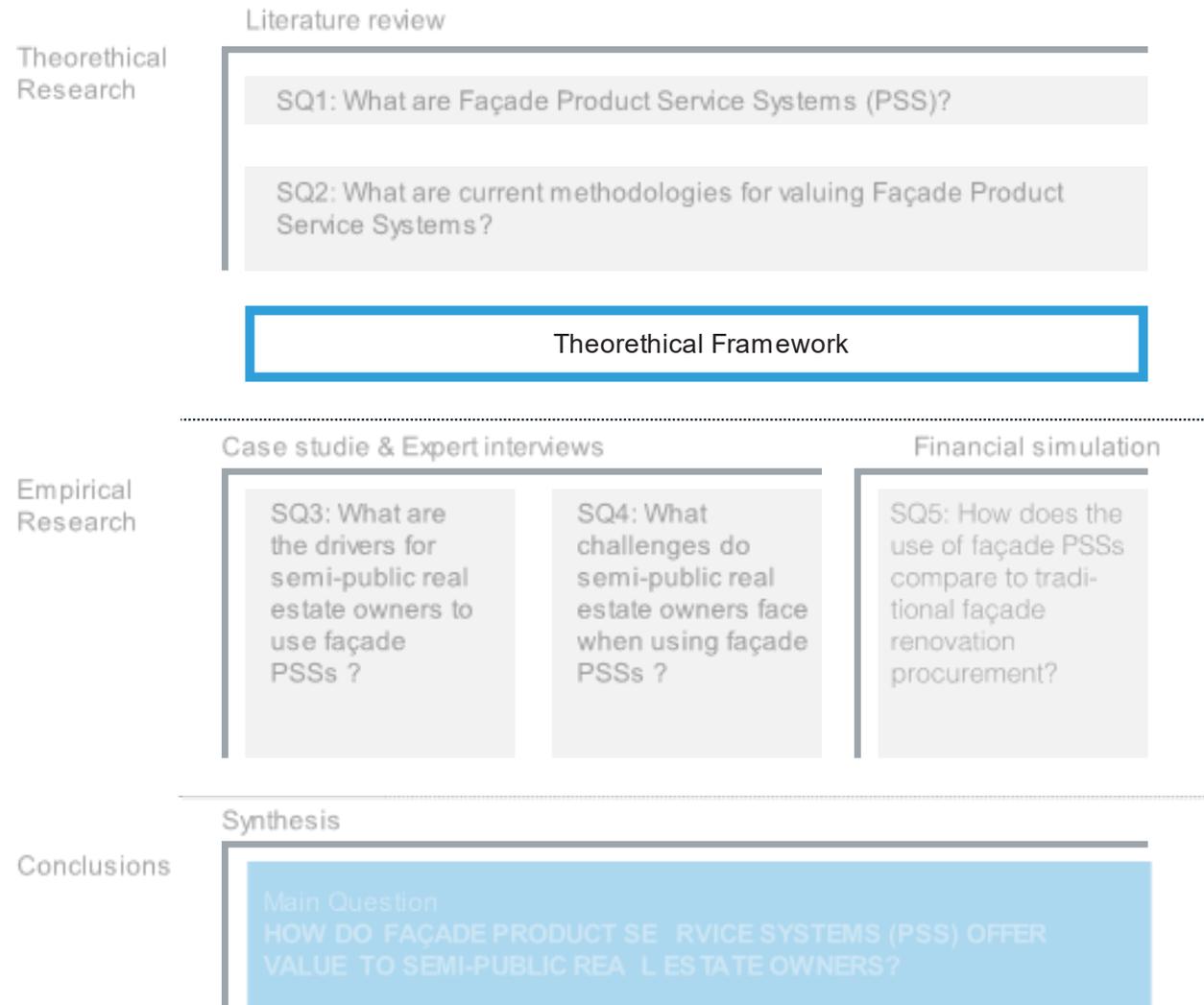
TCO

# What valuation methodologies are there?



TVO

# Methodology

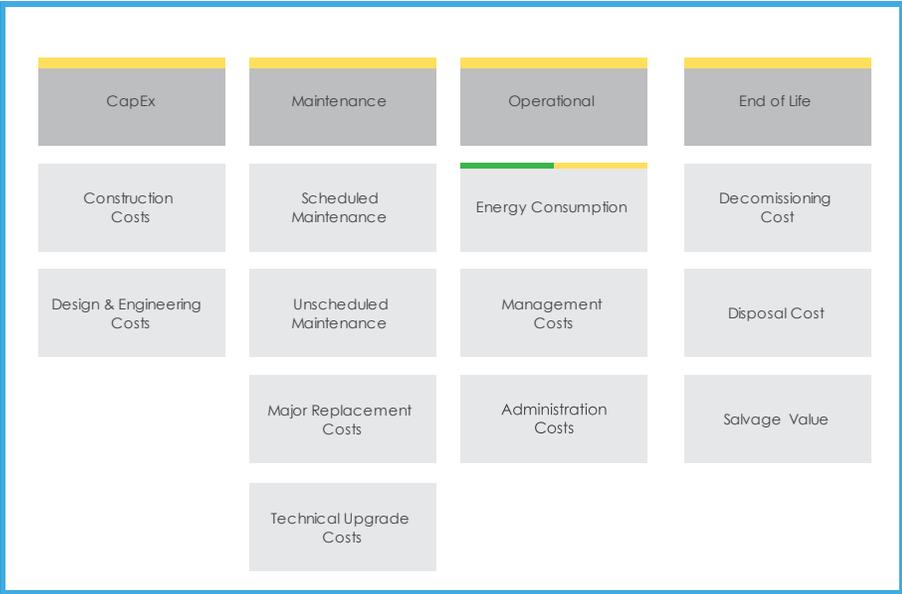


PSS  
PROVIDER

TOTAL VALUE OF ACCESS



Real Estate  
Owner



TCO

PSS PROVIDER

### TOTAL VALUE OF ACCESS



Real Estate Owner

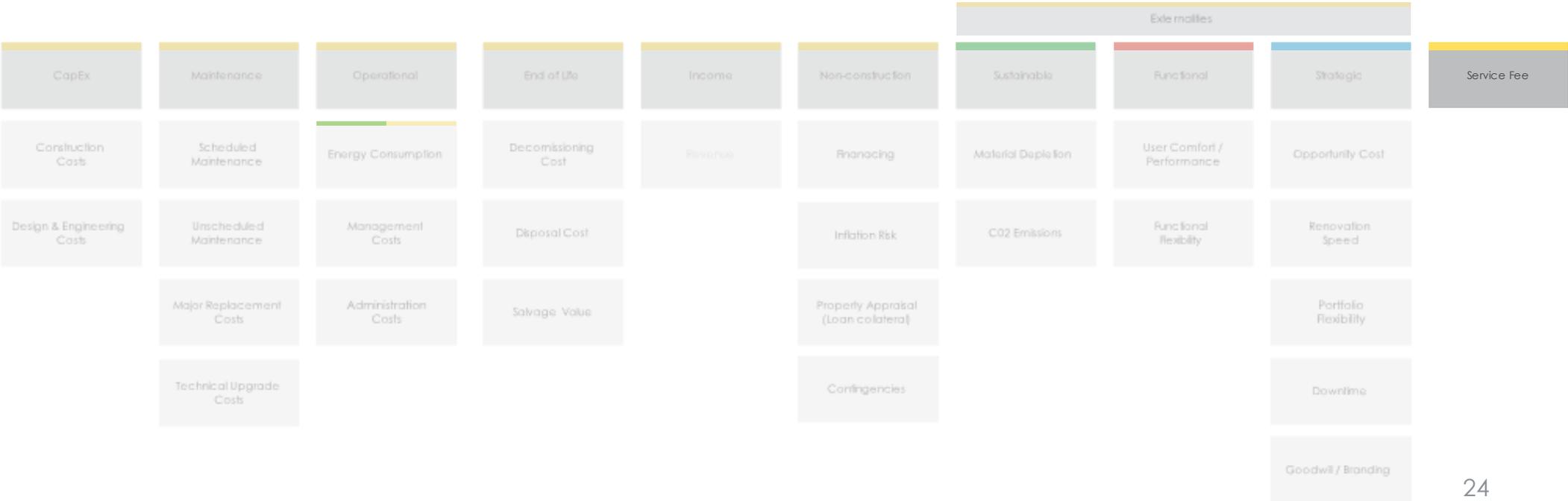


PSS  
PROVIDER

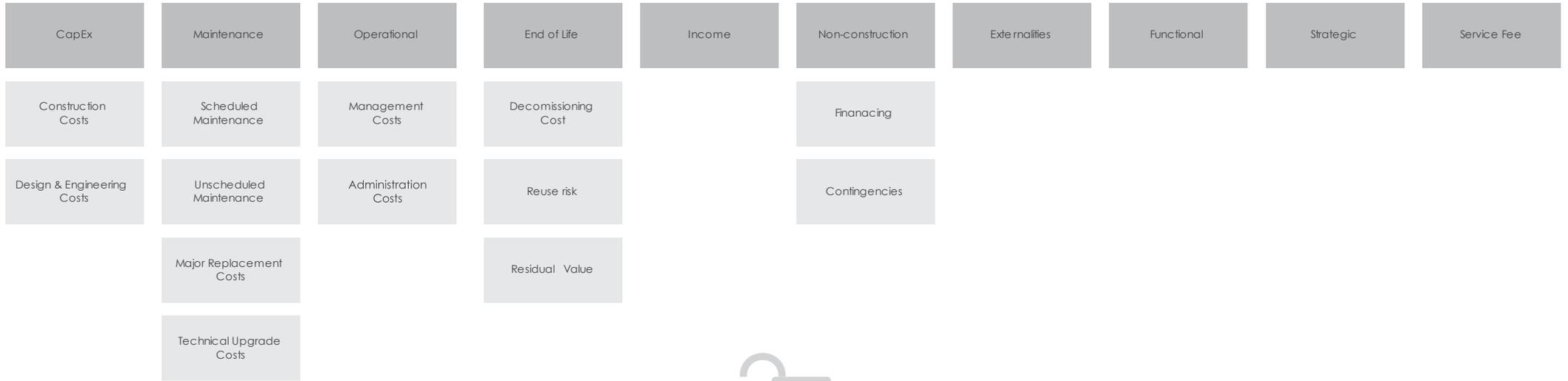
TOTAL VALUE OF ACCESS



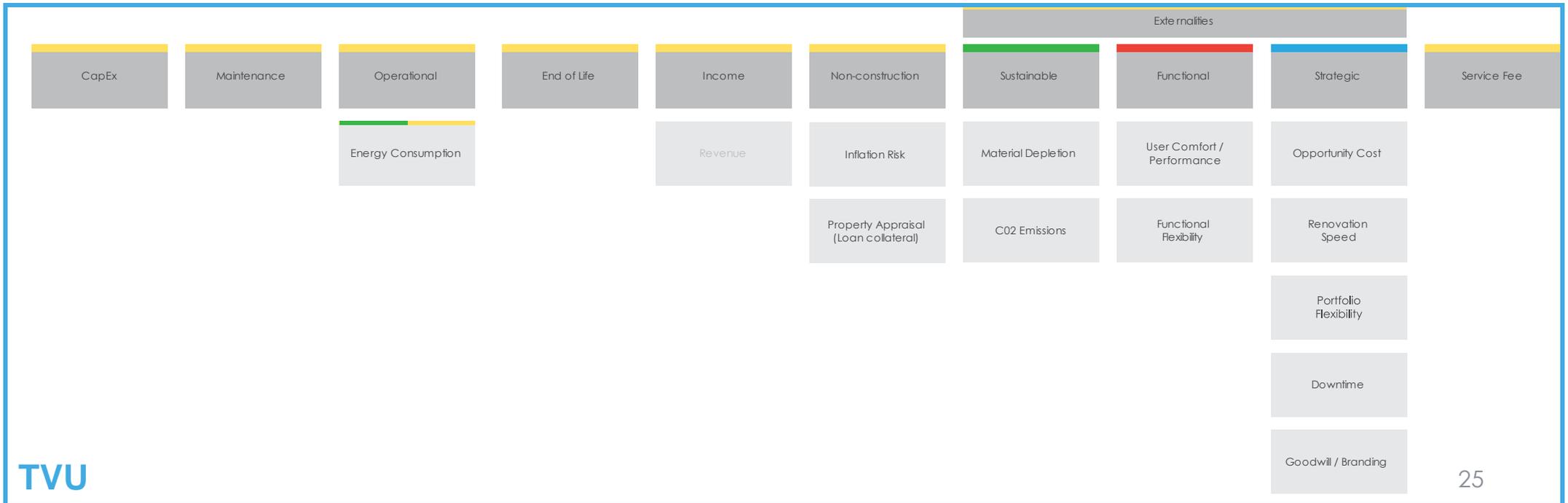
Real Estate  
Owner



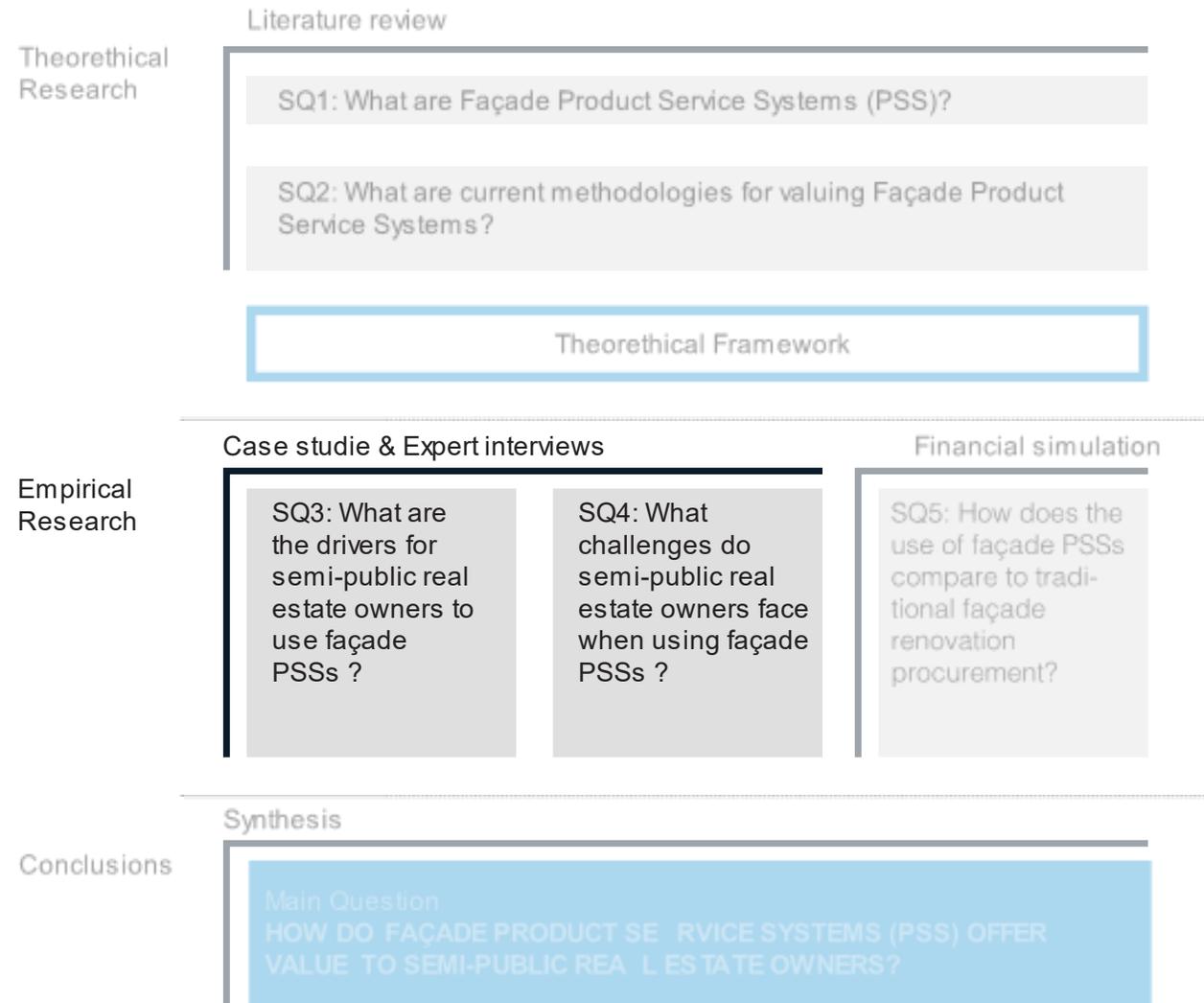
# PSS PROVIDER



# Real Estate Owner

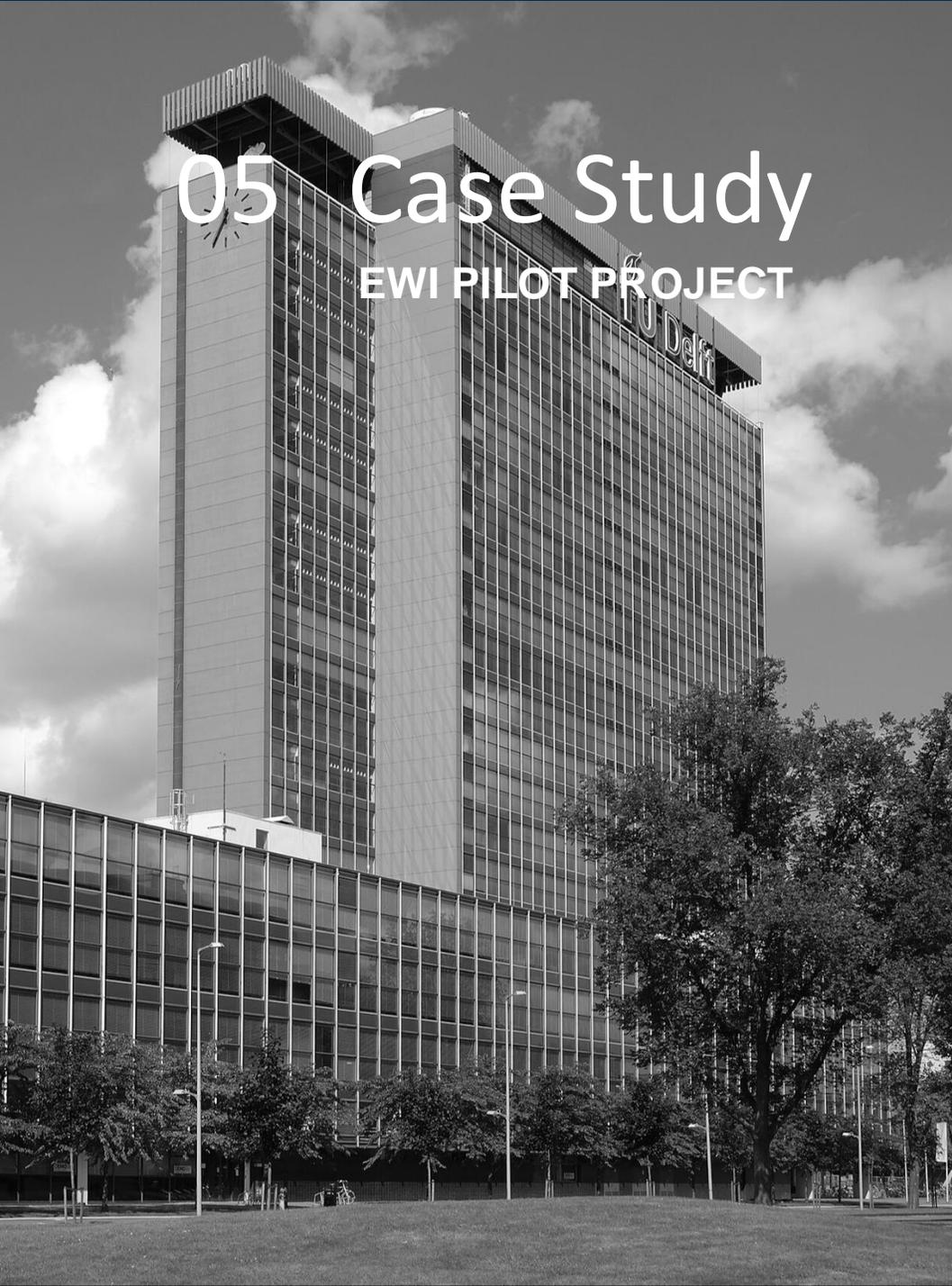


# Methodology



# 05 Case Study





# 05 Case Study

EWI PILOT PROJECT

The Faculty of Electrical Engineering, Mathematics & Computer Science (EWI)

- 1960s
- 68,000m<sup>2</sup> GFO
- 2015
- DBFMO contract
- 4 panels

# 05 Case Study

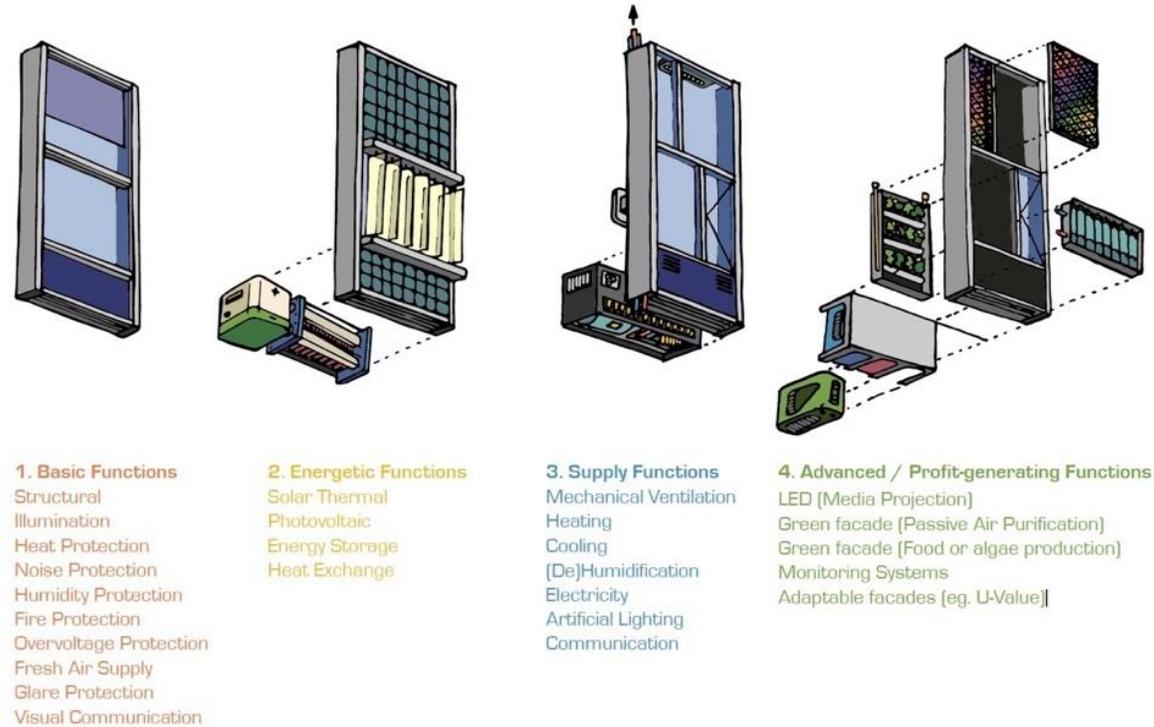


Fig. 2 Azcárate-Aguerre, J. F., T. Klein and A. C. den Heijer (2016b). Integrated Façades as a Product-Service System: An innovative business model for the implementation of Circular Economies in the construction industry. Delft, Delft University of Technology

# Case Study

CiTG Leasegevel 1.0

Civiele Techniek en  
Geowetenschappen (CiTG)

East Facade

- 1960s
- 66,500m<sup>2</sup> GFO
- 2018
- PSS (attempted)
- 2600m<sup>2</sup> façade

# Case Study

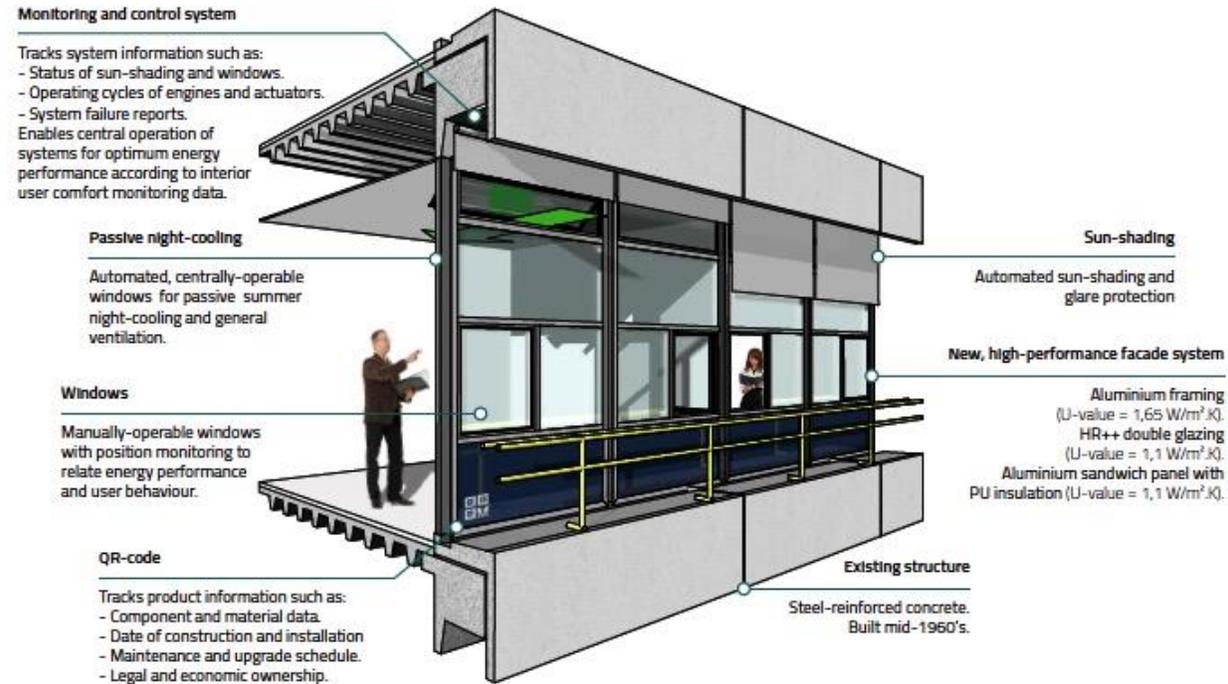


Fig. 3 Azcárate-Aguerre, J. F., T. Klein, A. C. Den Heijer, R. Vrijhoef, H. D. Ploeger and M. D. I. Prins (2018). "Façade Leasing: Drivers and barriers to the delivery of integrated Facades-as-a-Service." Real Estate Research Quarterly 17(3).

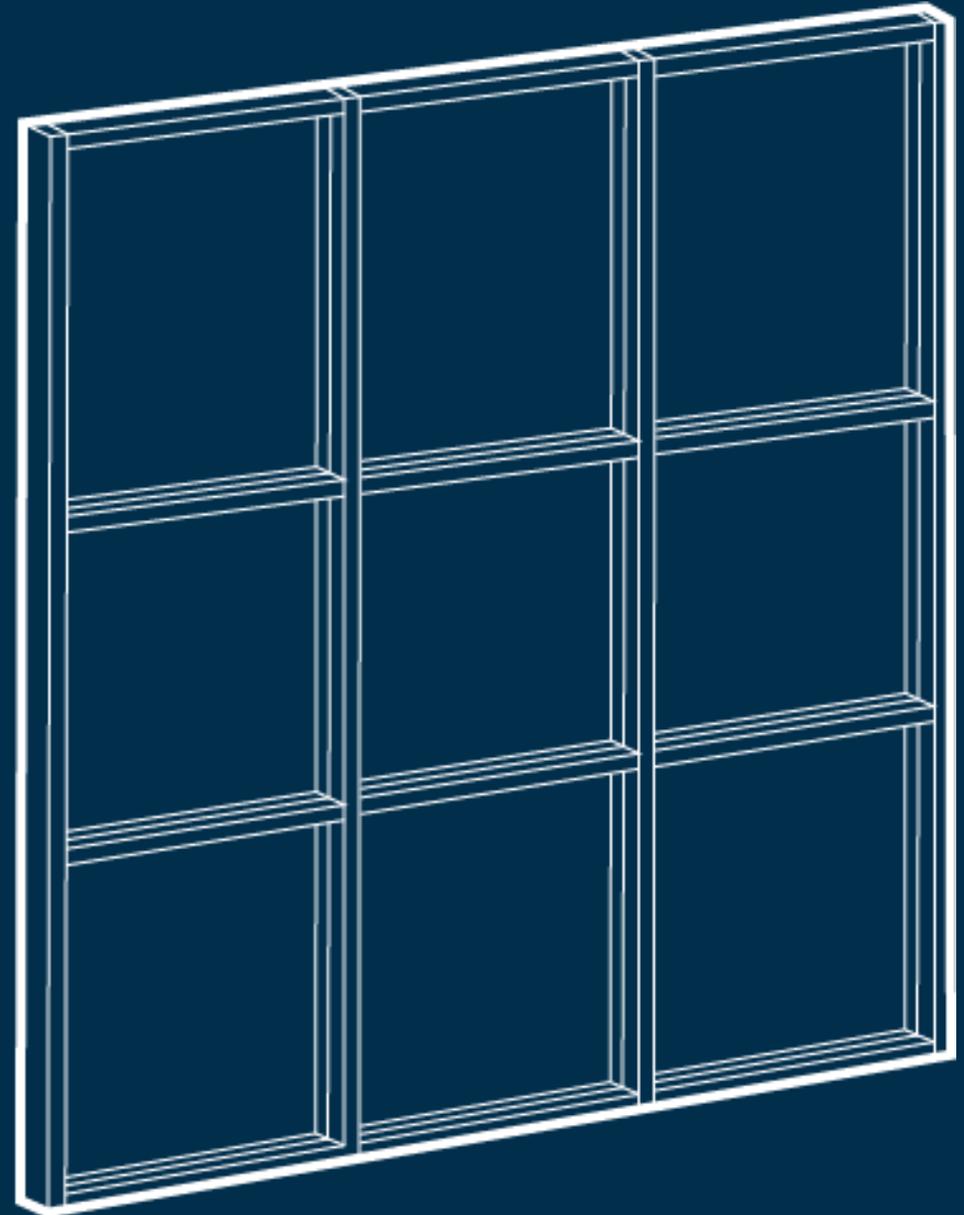
# 05 Case Study

CiTG Leasegevel 2.0

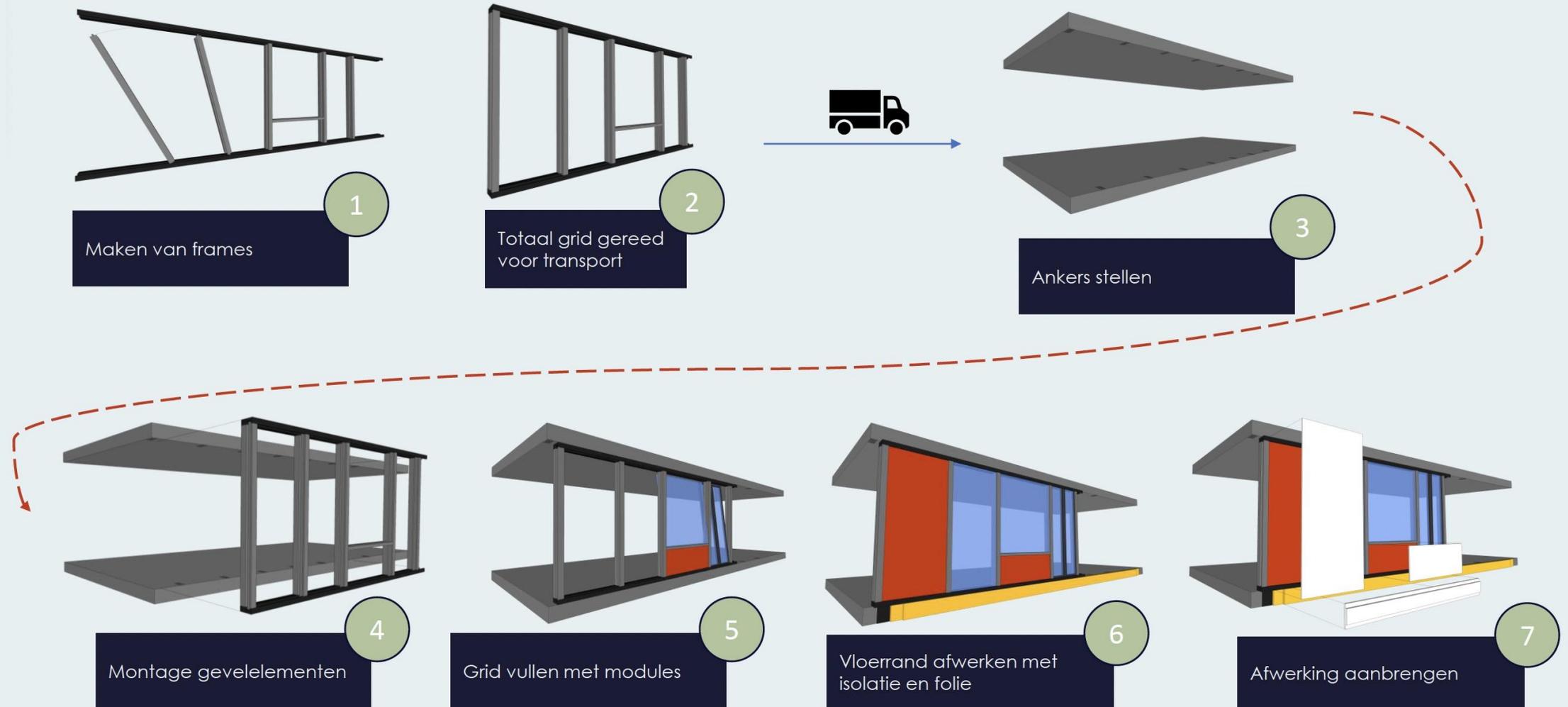
Civiele Techniek en  
Geowetenschappen (CiTG)

West Facade

- 1960s
- 66,500m<sup>2</sup> GFO
- 2023-24
- PSS (attempted)
- 2600m<sup>2</sup> façade



# Product - Ciskin



# PSS Contract

## 2 THE SOLUTION – CiSe Participation Agreement



CiSe Participation Agreement

Includes



1. **Participation** of service providers and financiers in any PaaS proposition
2. **Allocation of rights and responsibilities** of these participants
3. **Adherence to circular economy principles** through Code of Conduct
4. **Standardized financing option** → made attractive for any type of funder (anyone can invest)
5. **Financing terms** always subject to terms of the CiSe Participation Agreement
6. Pre-set acceptance of **step-in and security arrangements** for financiers
7. No longer the need to incorporate new special purpose vehicles or set up new separate bank accounts for each PaaS proposition because of **de iure limited course arrangement** agreed in the CiSe Participation Agreement

# Drivers CiTG 2.0

Lack of capital and uncertainty of future available capital

Improved solvability and lending capacity

Increased speed of renovation of portfolio and, sustainability and circularity goals

Financiers readiness and upscalability potential

Increased strategic flexibility (functional, durational)\*

# Barriers CiTG 2.0

Contract uncertainties and building value appraisal

Loan against entire portfolio

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Contract uncertainties and building value appraisal

Loan against entire portfolio

User comfort, Energy performance and CO2 emissions inherent to the facade

Interest rate 2,95% treasury banking and 6% commercial rate

# Barriers CiTG 2.0

Contract uncertainties and building value appraisal

Loan against entire portfolio

User comfort, Energy performance and CO2 emissions inherent to the facade

Interest rate 2,95% treasury banking and 6% commercial rate

Financial lease vs operational lease

# Barriers CiTG 2.0

Contract uncertainties and building value appraisal

Loan against entire portfolio

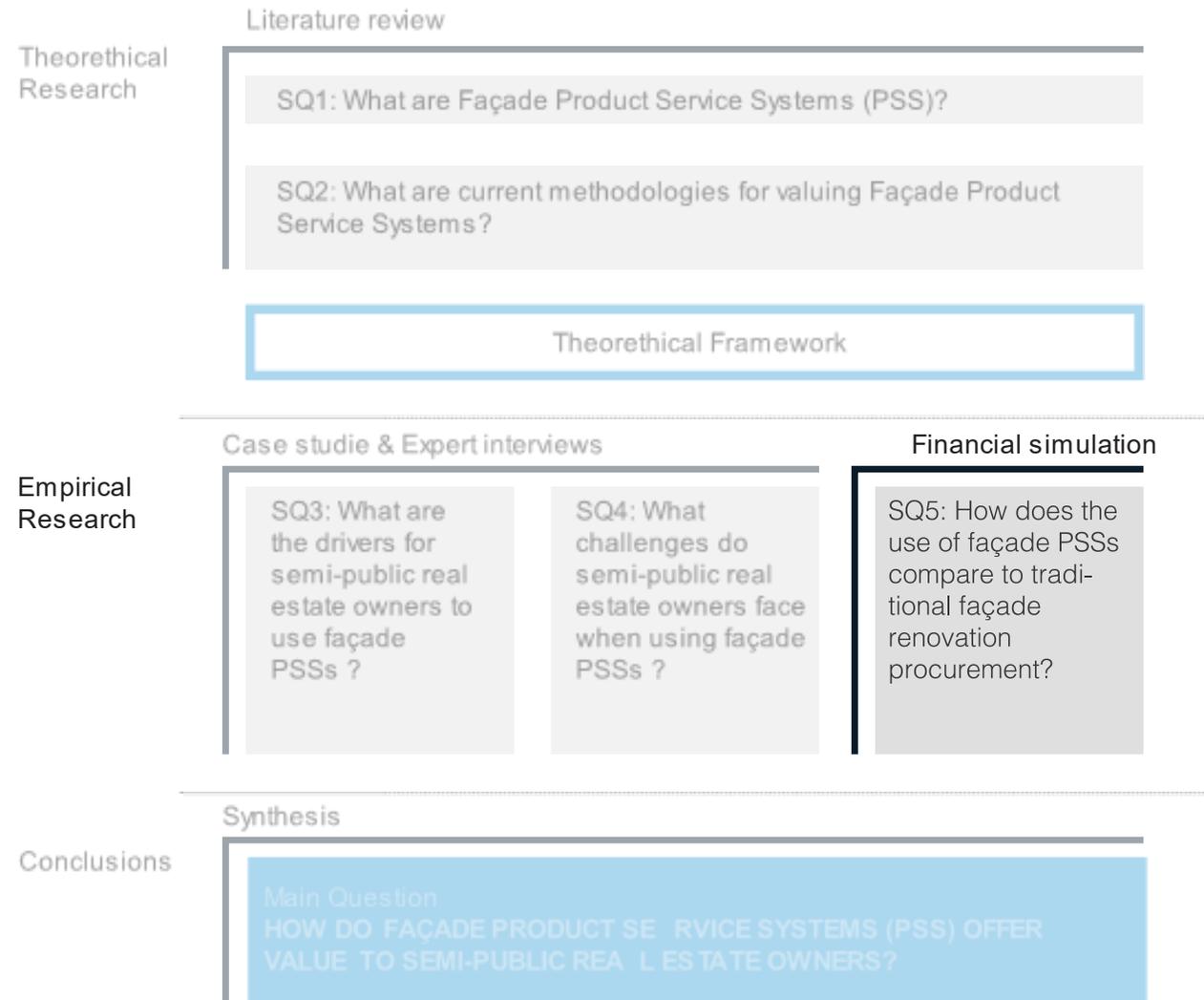
User comfort, Energy performance and CO2 emissions inherent to the facade

Interest rate 2,95% treasury banking and 6% commercial rate

Financial lease vs operational lease

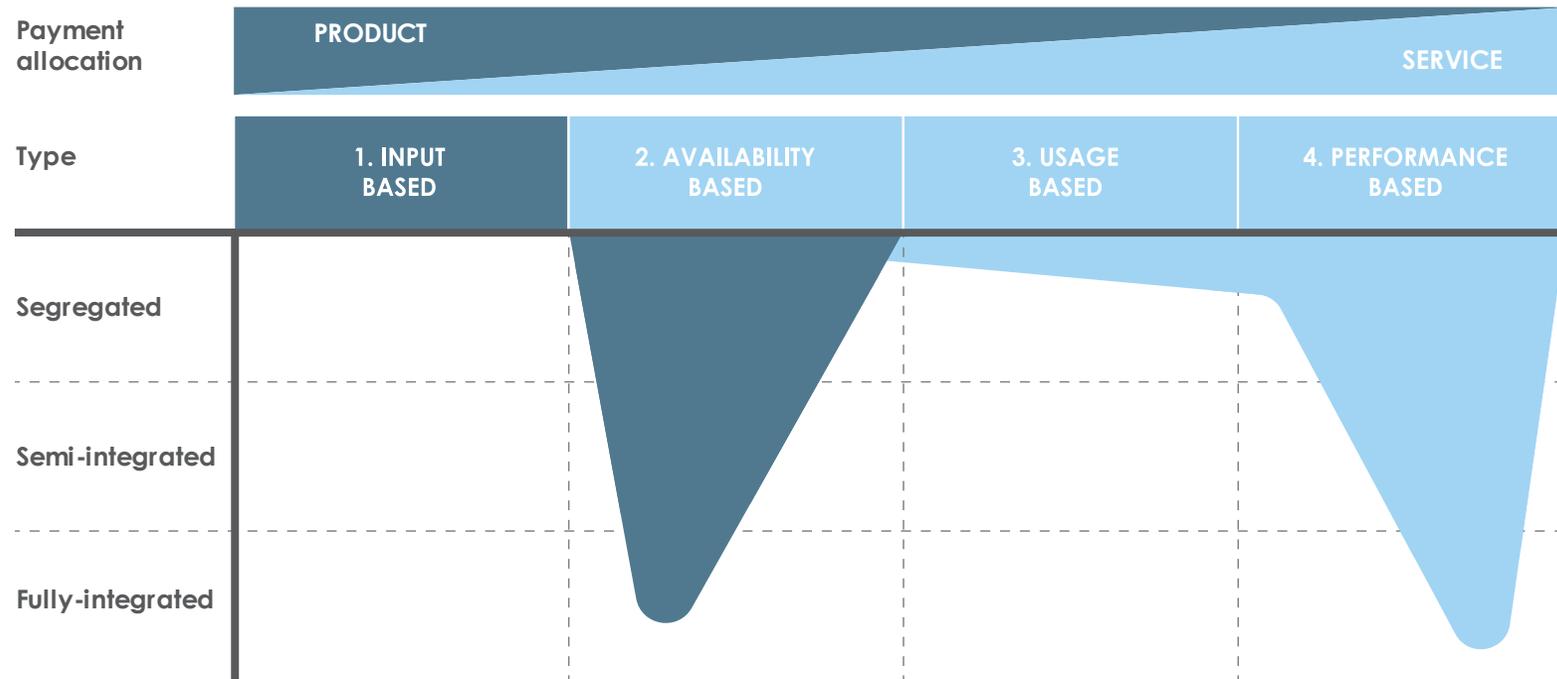
Cognitive readiness

# Methodology



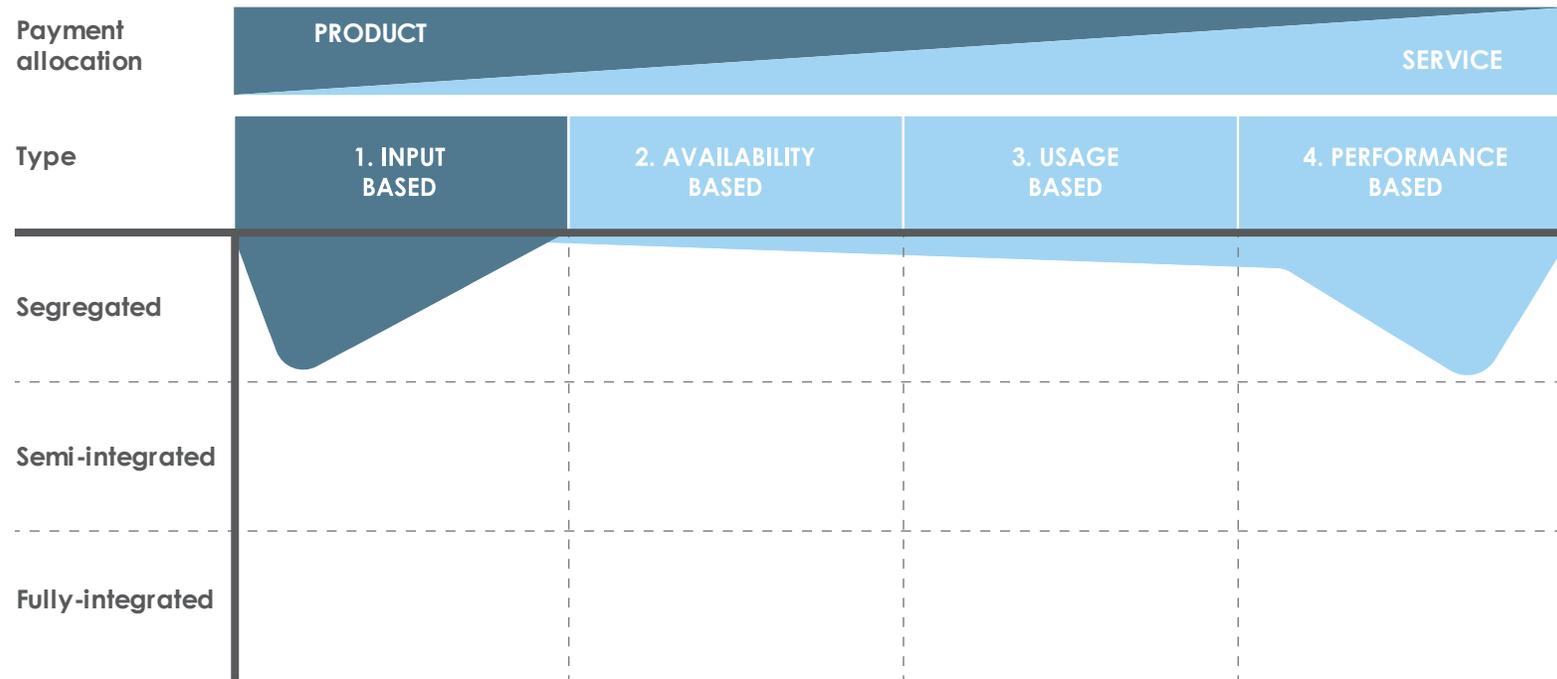
# 3 Scenario's

# Full PSS



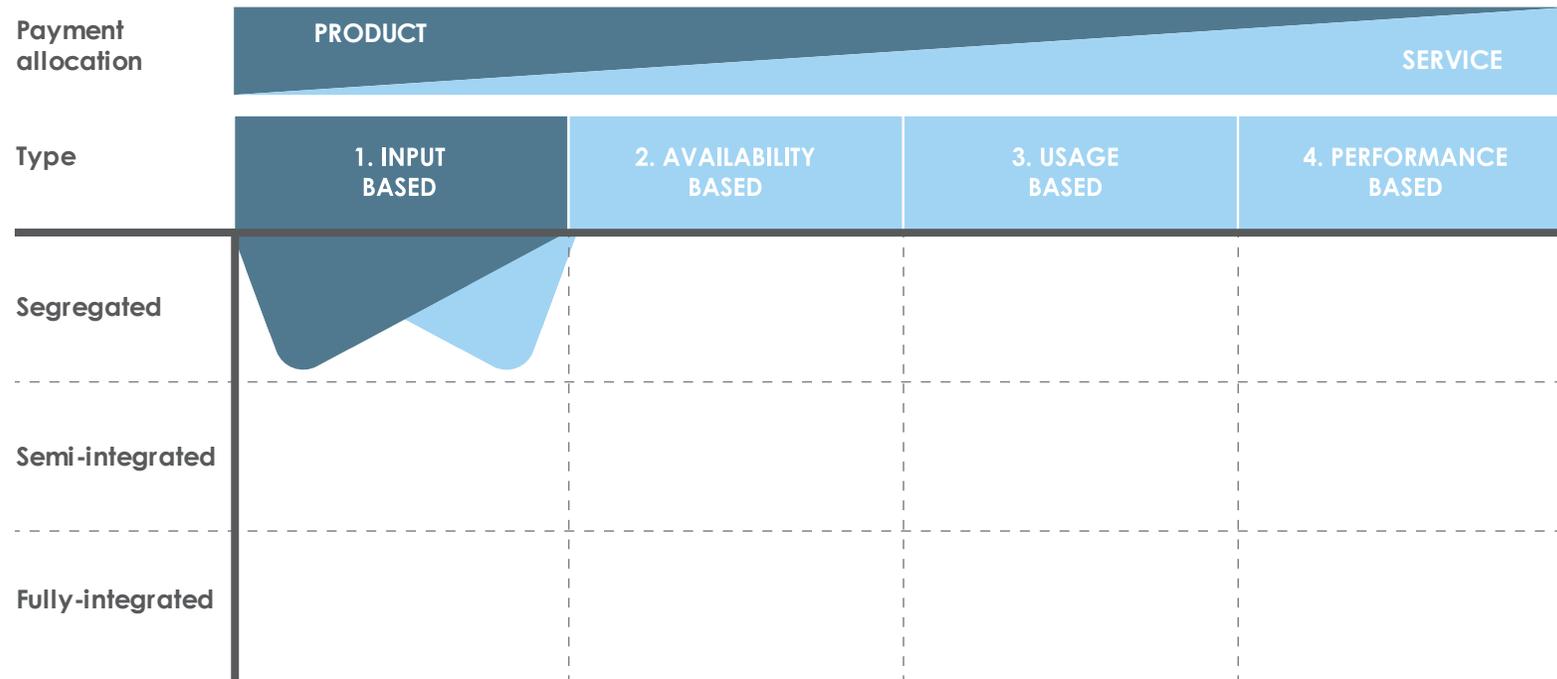
**Circular façade (Ciskin) Lease**  
**Full service maintenance contract**

# PSS - Purchase



**Circular façade (Ciskin) purchase**  
**Full service maintenance contract**

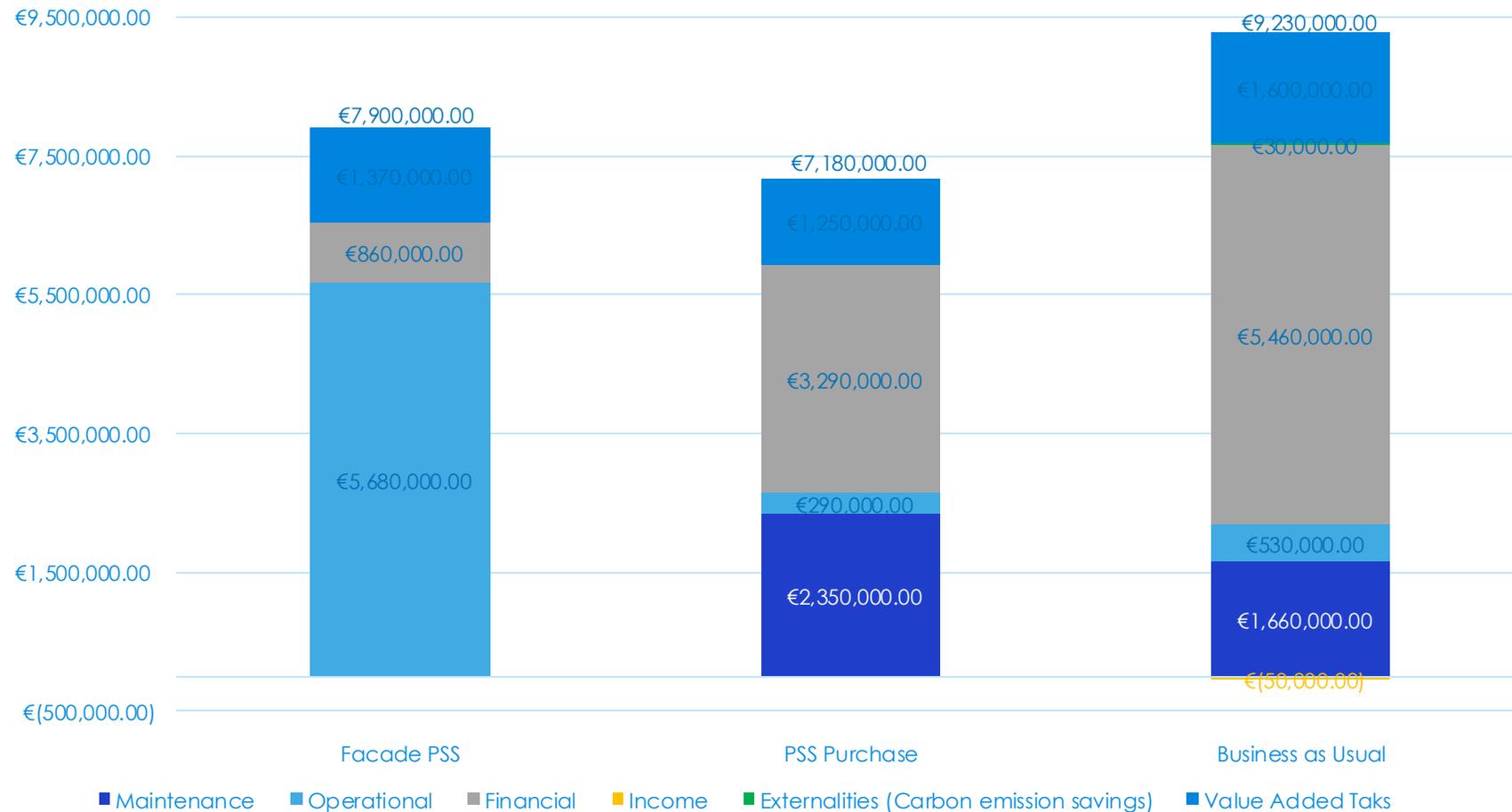
# Business as Usual (BaU)



**Non-Circular façade**  
**Build and let decay maintenance**

# How does the use of a façade PSS compare to traditional façade renovation procurement?

Whole Life Cost



60 year period, € in NPV

# Sensitivity analysis

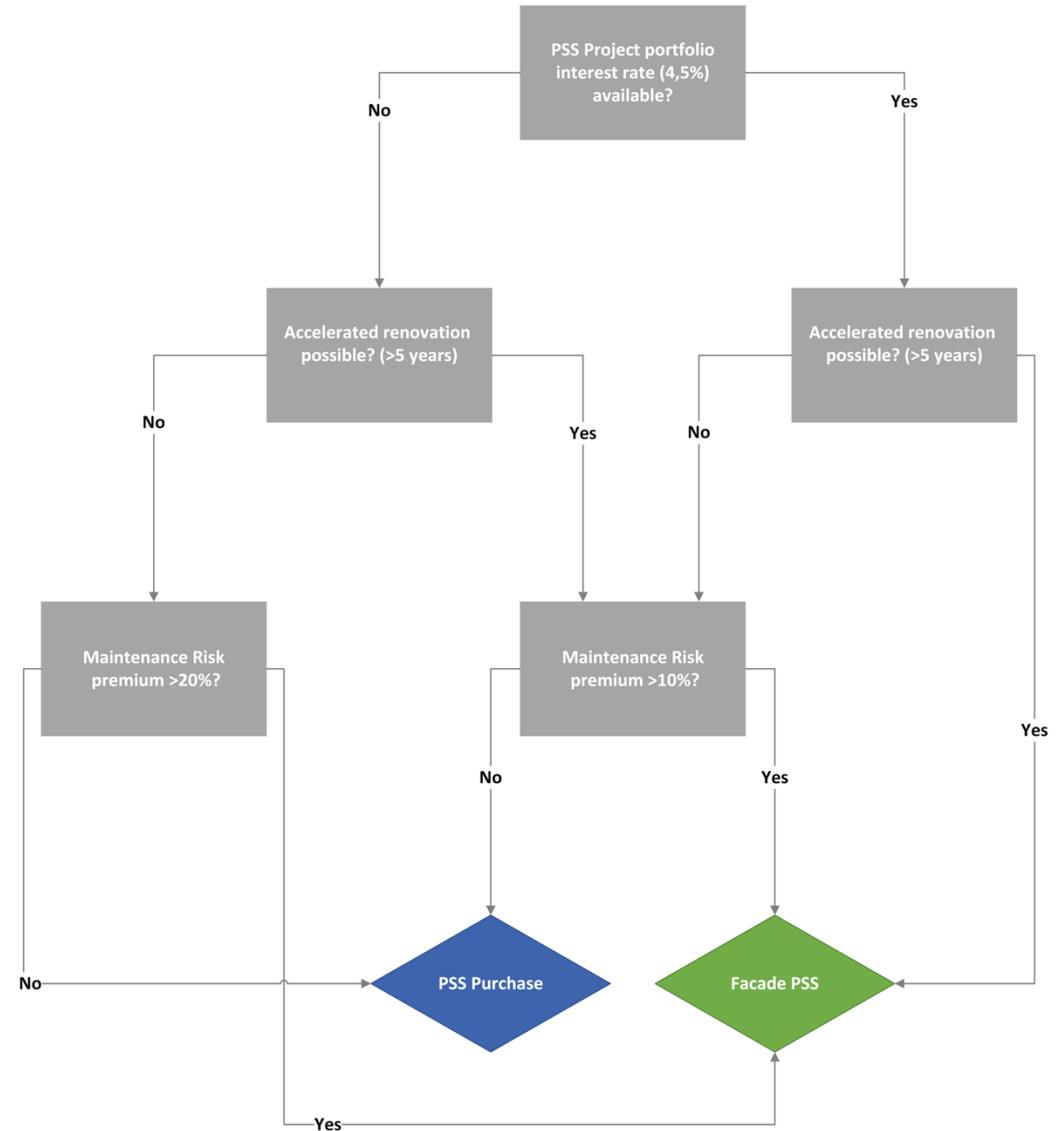
	BaU	OWN	PSS		
Accelerated	0 years	0 years	0 years	5 years	10 years
Max	€ 22.500.000	€ 8.000.000	€ 9.100.000	€ 8.500.000	€ 7.600.000
Mean	€ 9.600.000	€ 7.500.000	€ 7.900.000	€ 7.300.000	€ 6.500.000
Min	€ 6.900.000	€ 7.000.000	€ 6.600.000	€ 6.100.000	€ 5.300.000

## Parameters

- Aluminium index rate
- Loan Interest rate
- Risk premium on maintenance
- Accelerated renovation

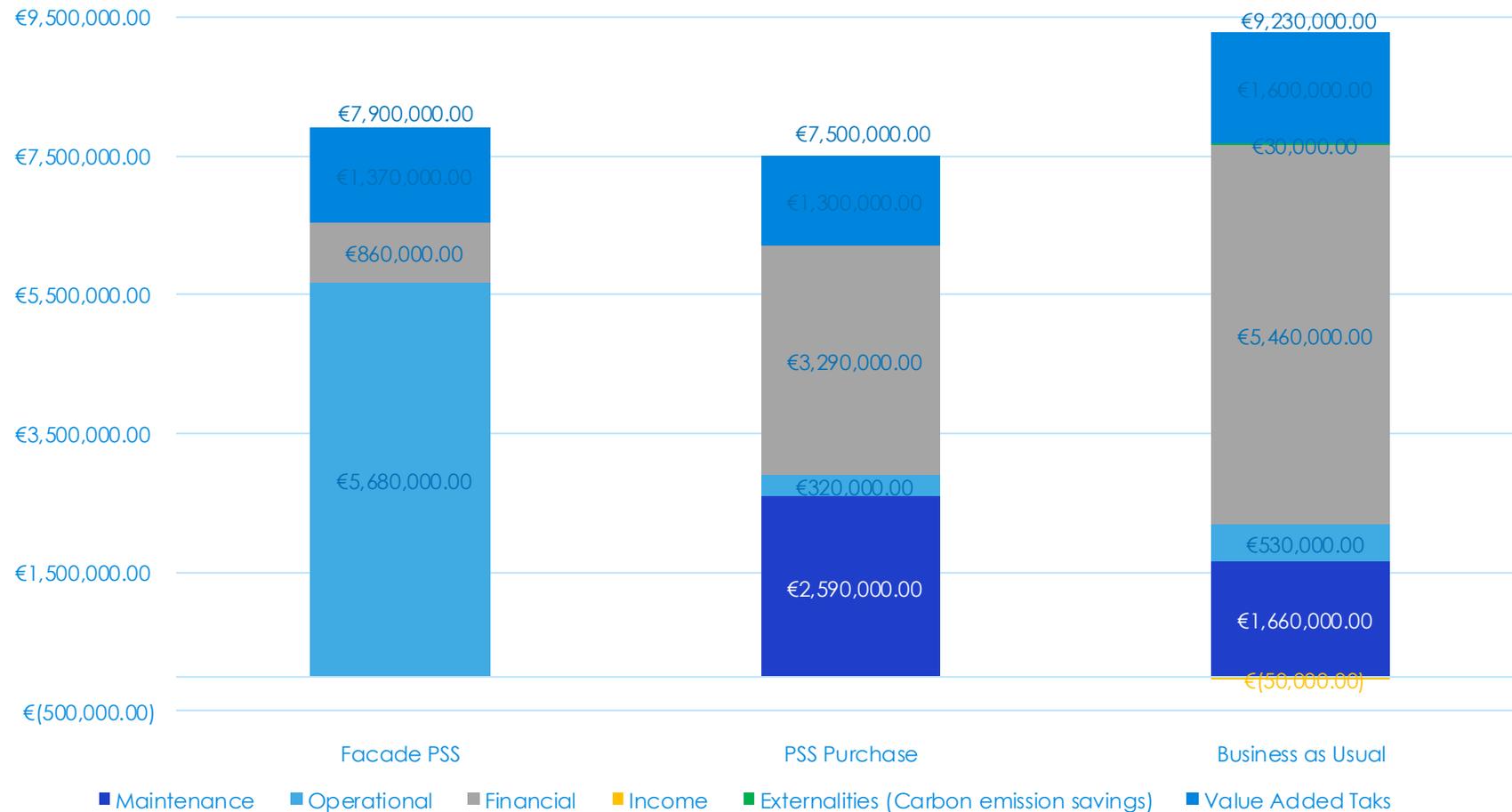
# Decision tree

	BaU	OWN	PSS		
Accelerated	0 years	0 years	0 years	5 years	10 years
Max	€ 22.500.000	€ 8.000.000	€ 9.100.000	€ 8.500.000	€ 7.600.000
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# Sensitivity analysis

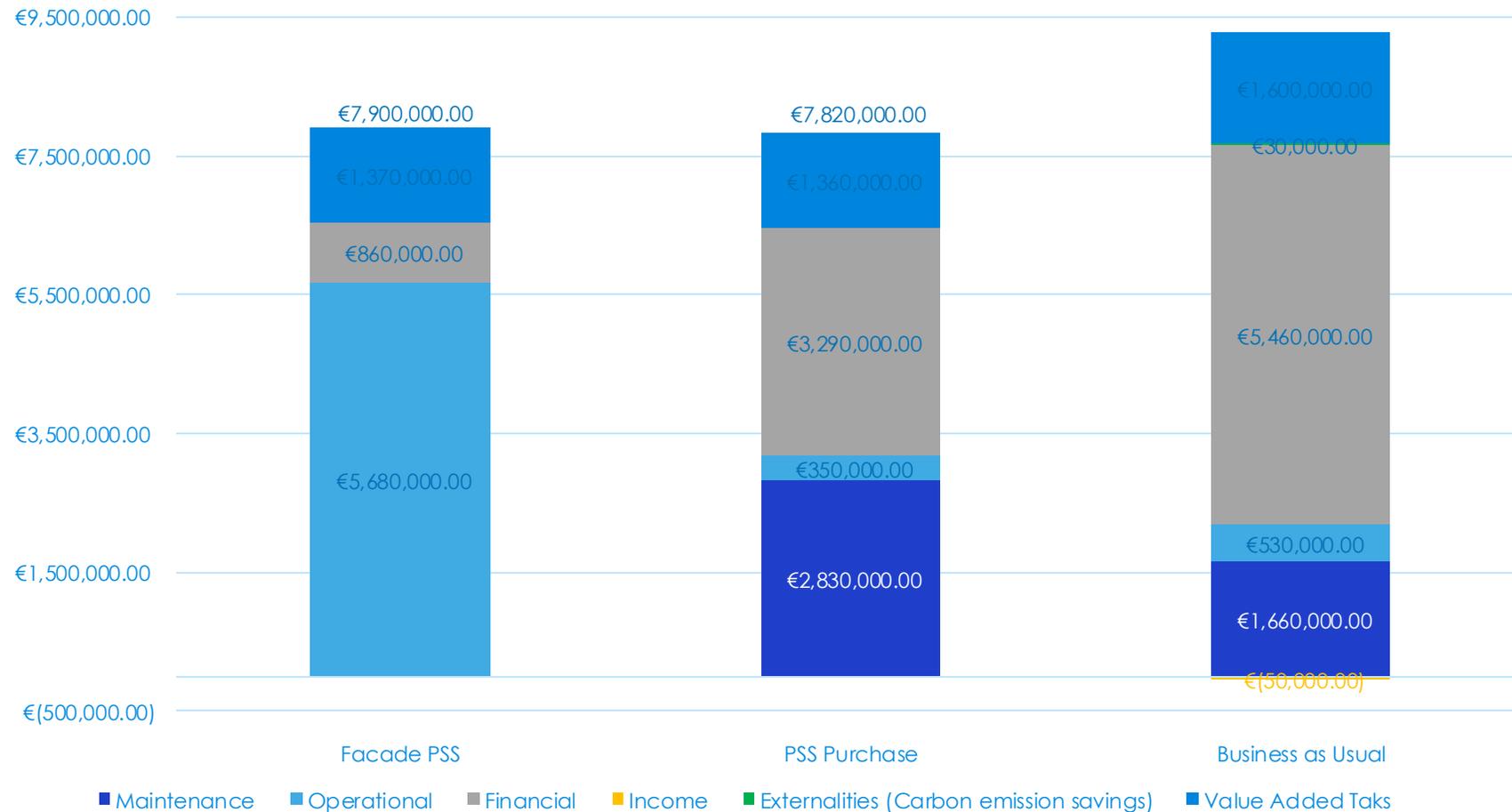
## Whole Life Cost



- **10% Risk premium maintenance**

# Sensitivity analysis

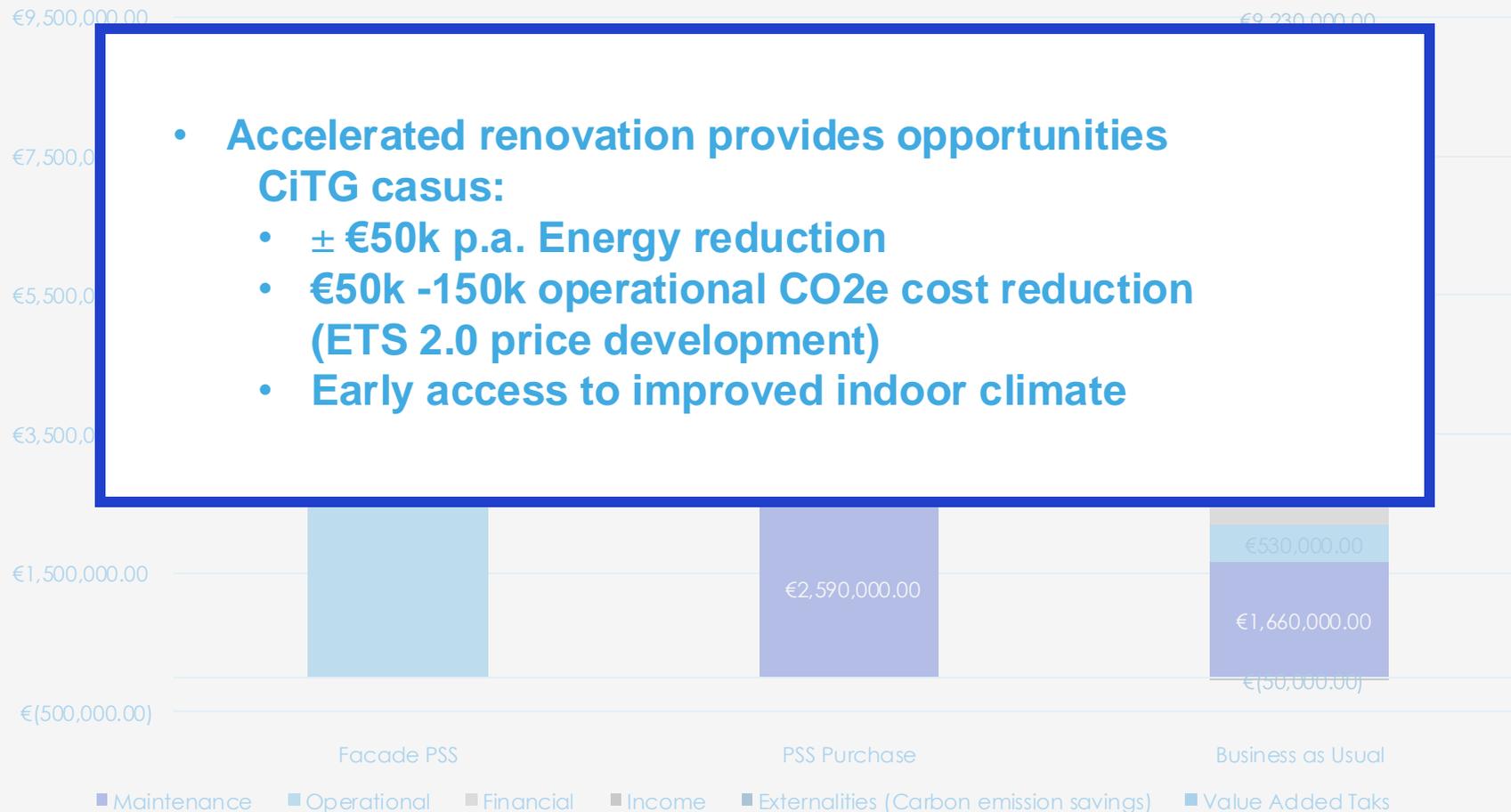
## Whole Life Cost



- **20% Risk premium maintenance**

# Sensitivity analysis

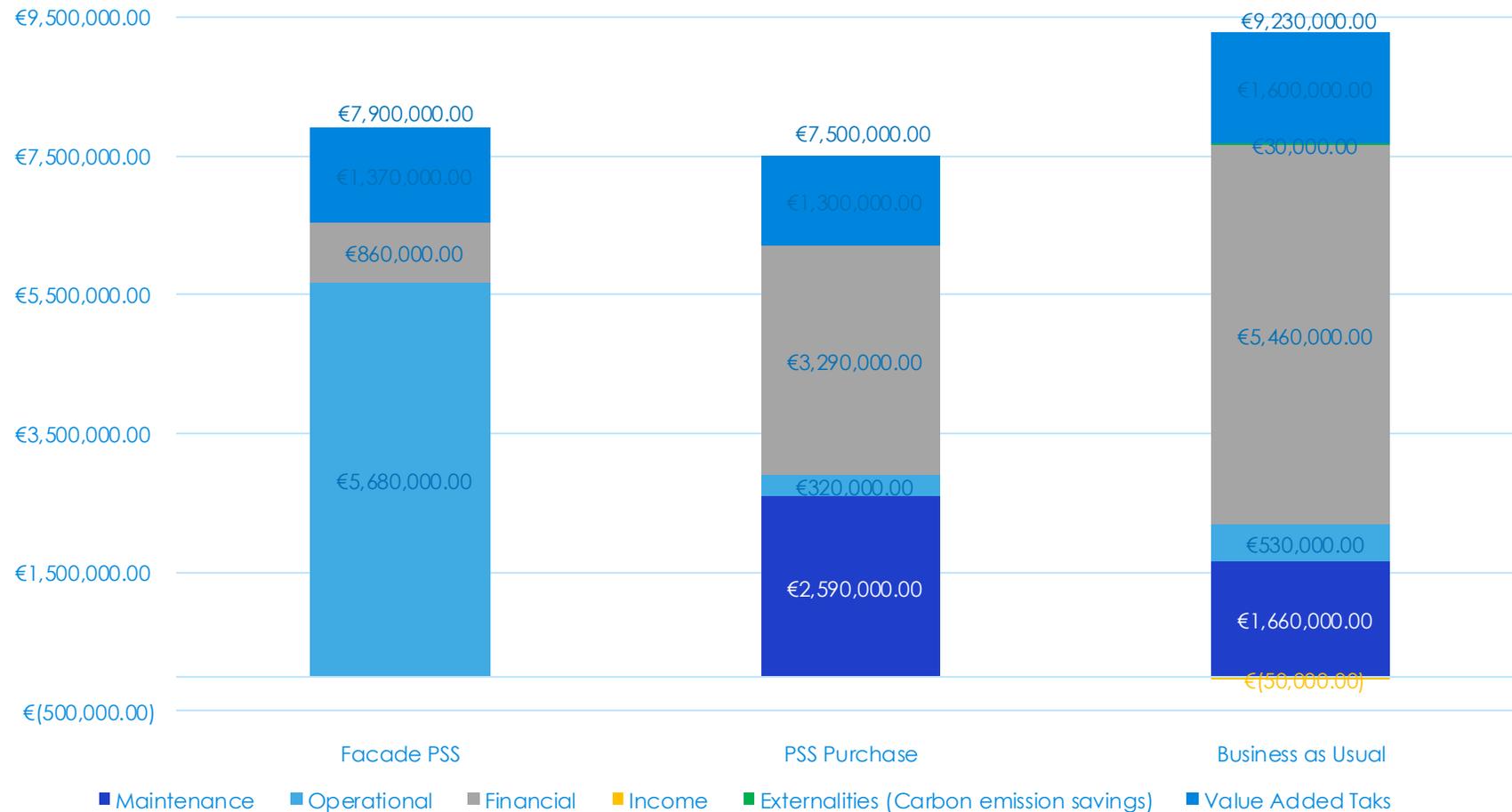
## Whole Life Cost



- **10% Risk premium maintenance**

# Sensitivity analysis

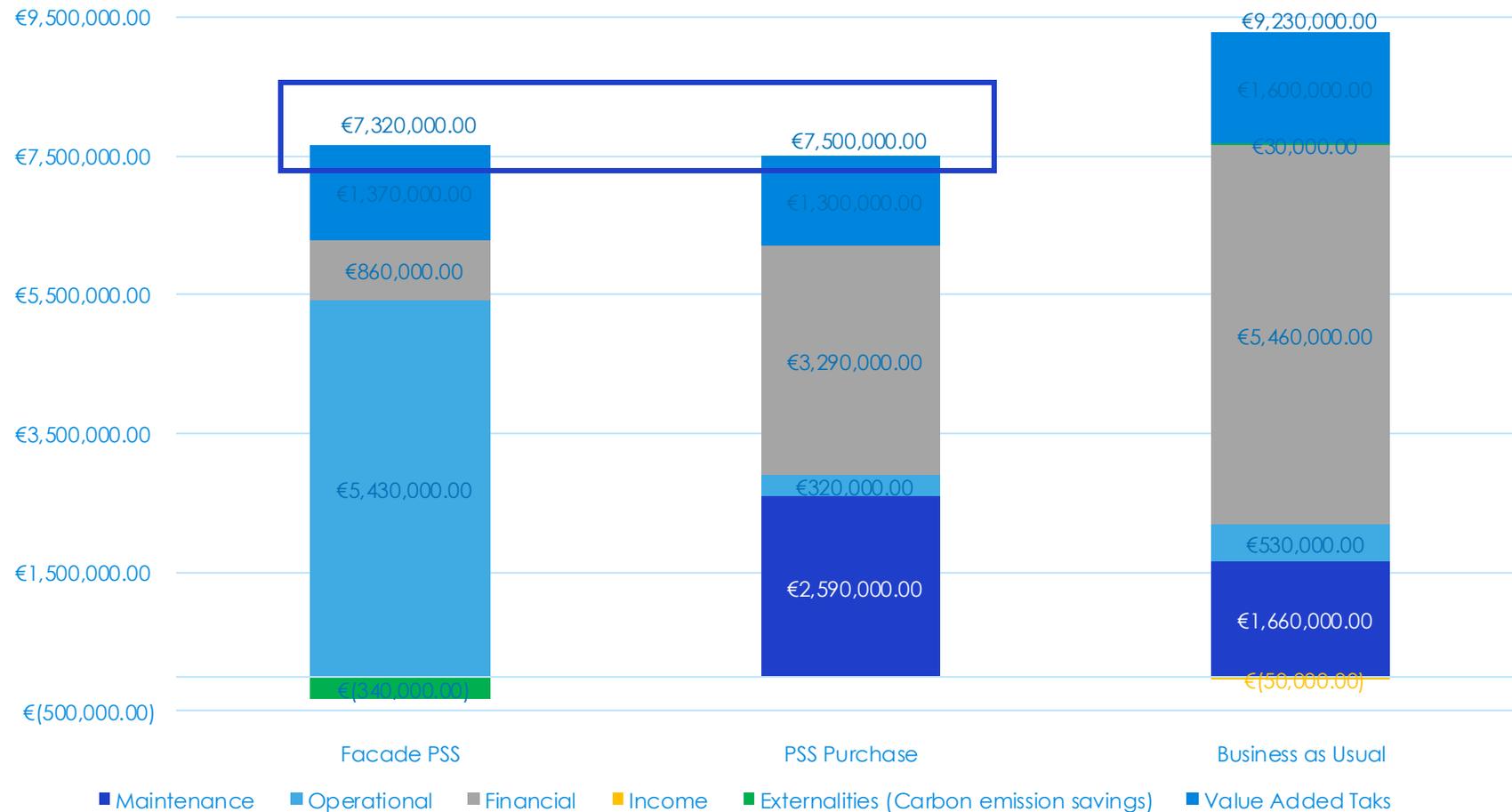
Whole Life Cost



- **10% Risk premium maintenance**

# Sensitivity analysis

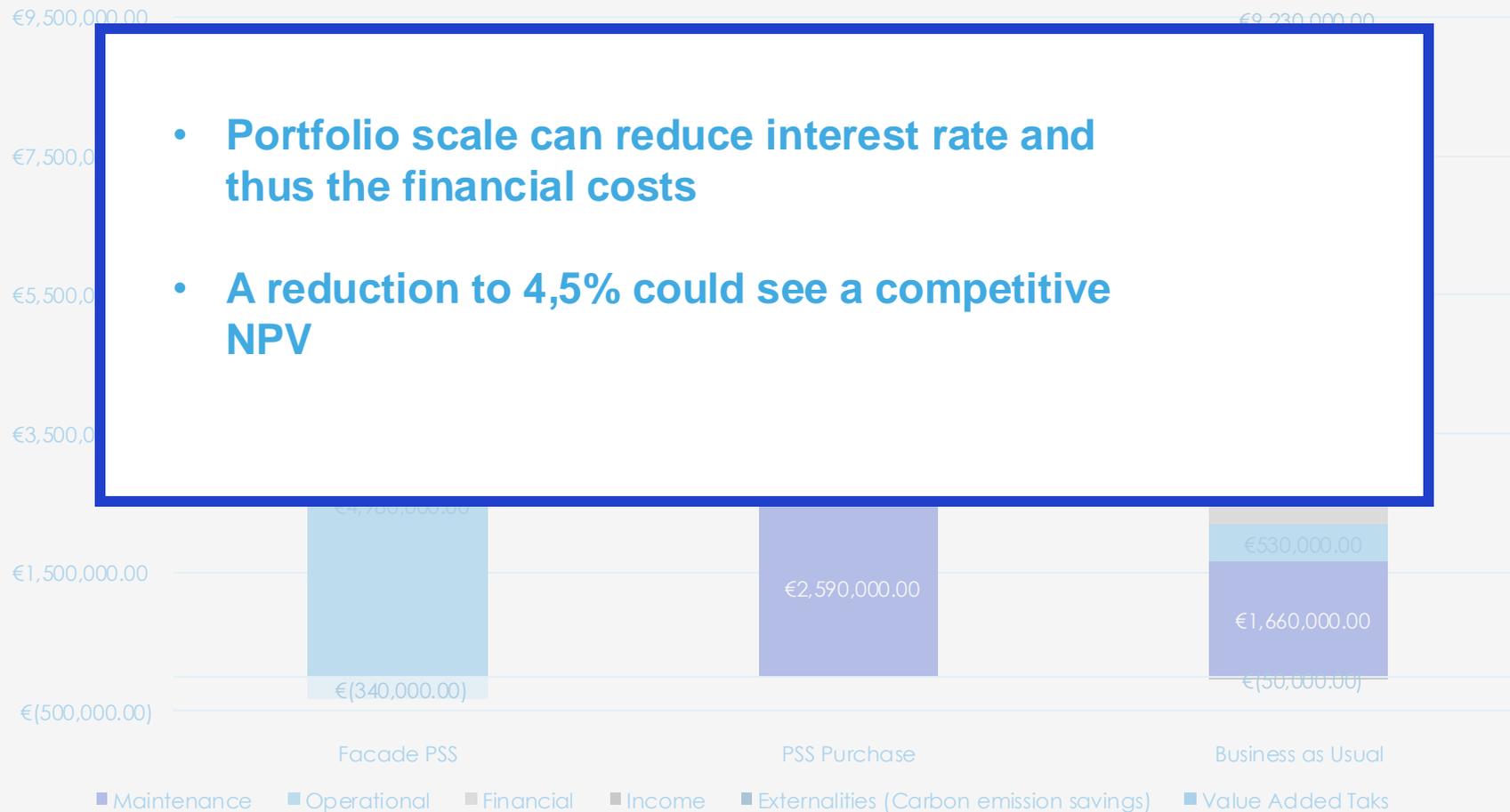
Whole Life Cost



- Renovation accelerated 5 years and 10% risk premium

# Sensitivity analysis

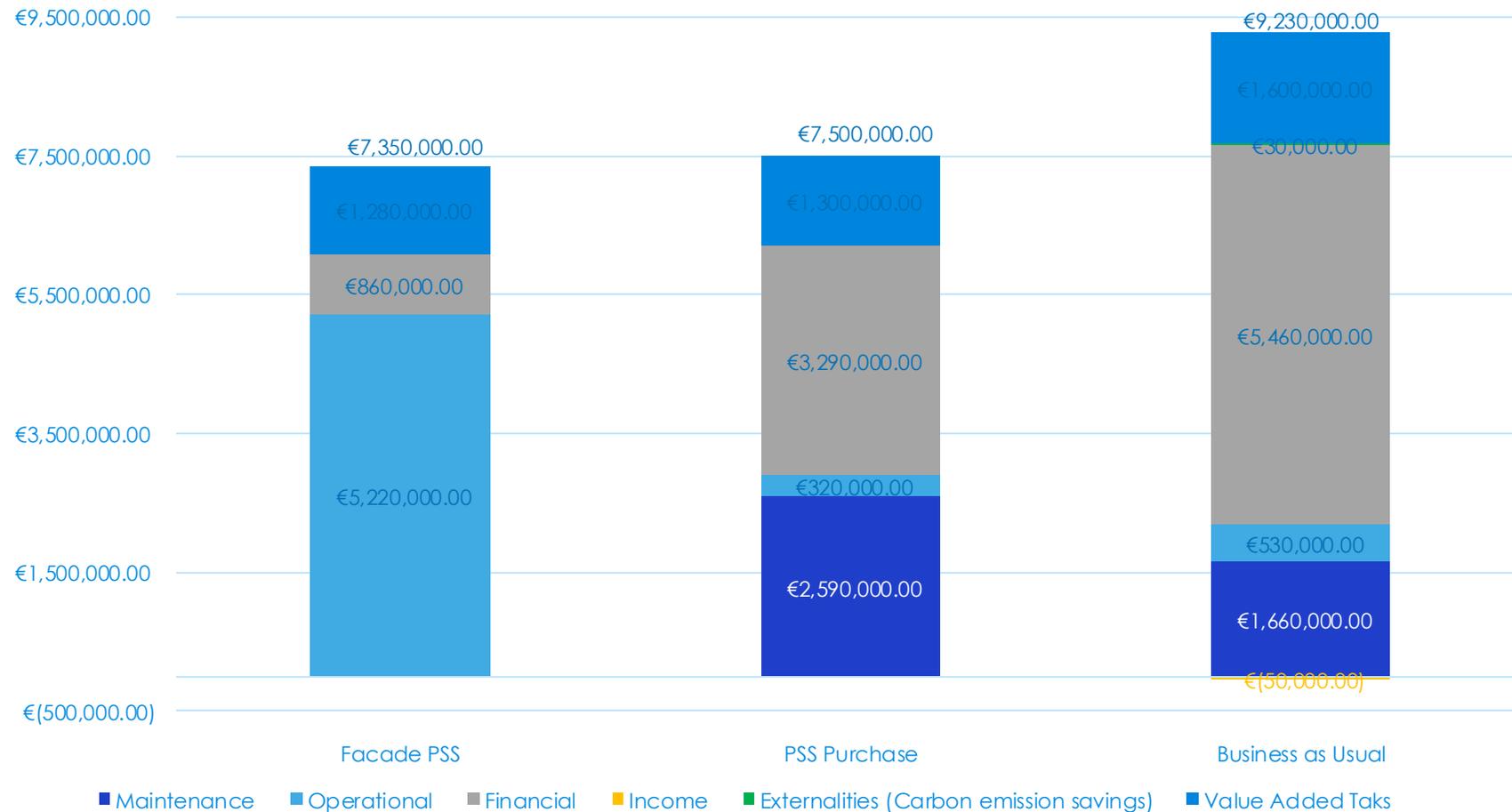
## Whole Life Cost



- **4,5% Interest rate**

# Sensitivity analysis

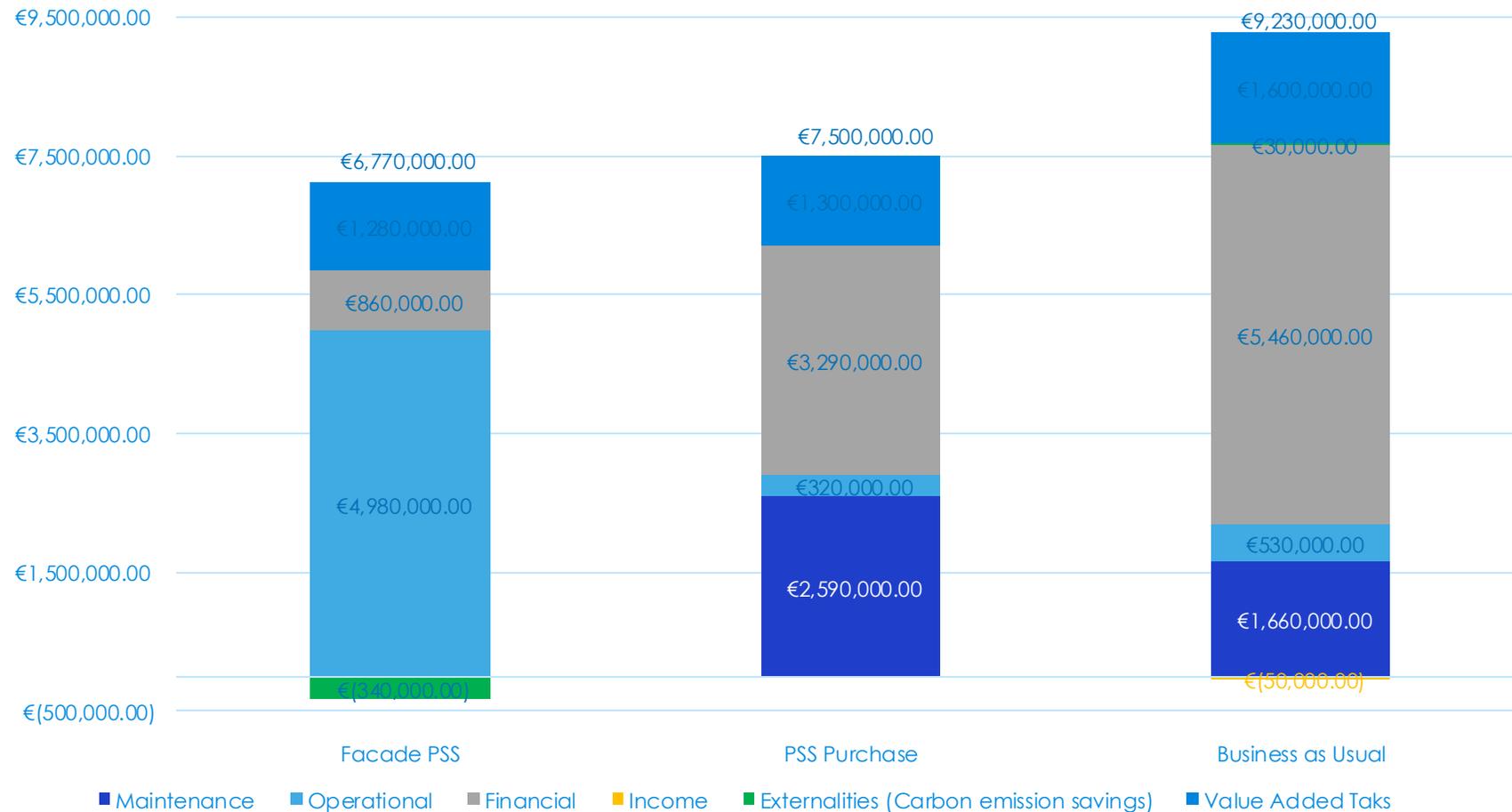
Whole Life Cost



- 4,5% Interest rate years and 10% risk premium

# Sensitivity analysis

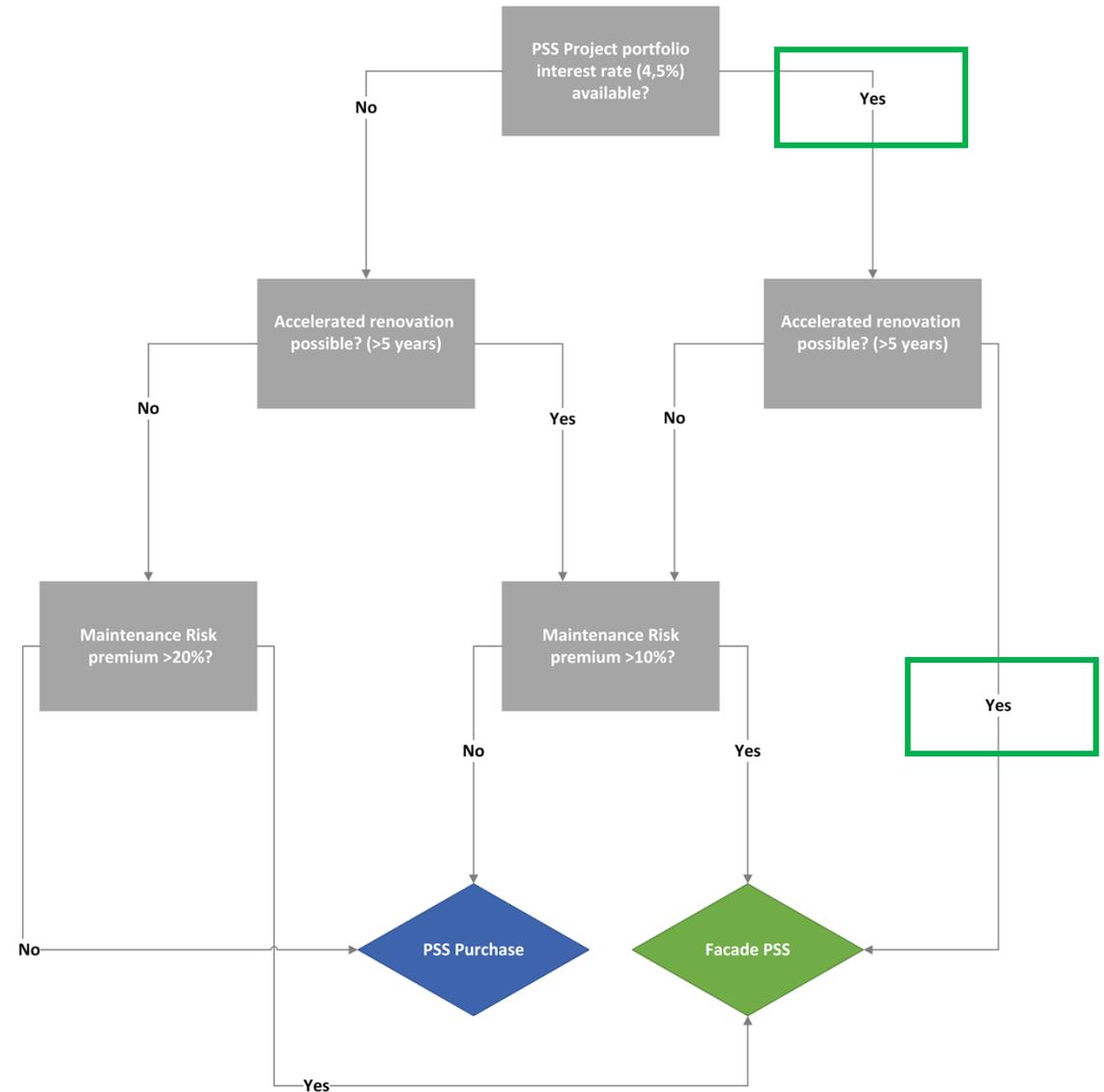
## Whole Life Cost



- 4,5% Interest rate and 5 years accelerated renovation

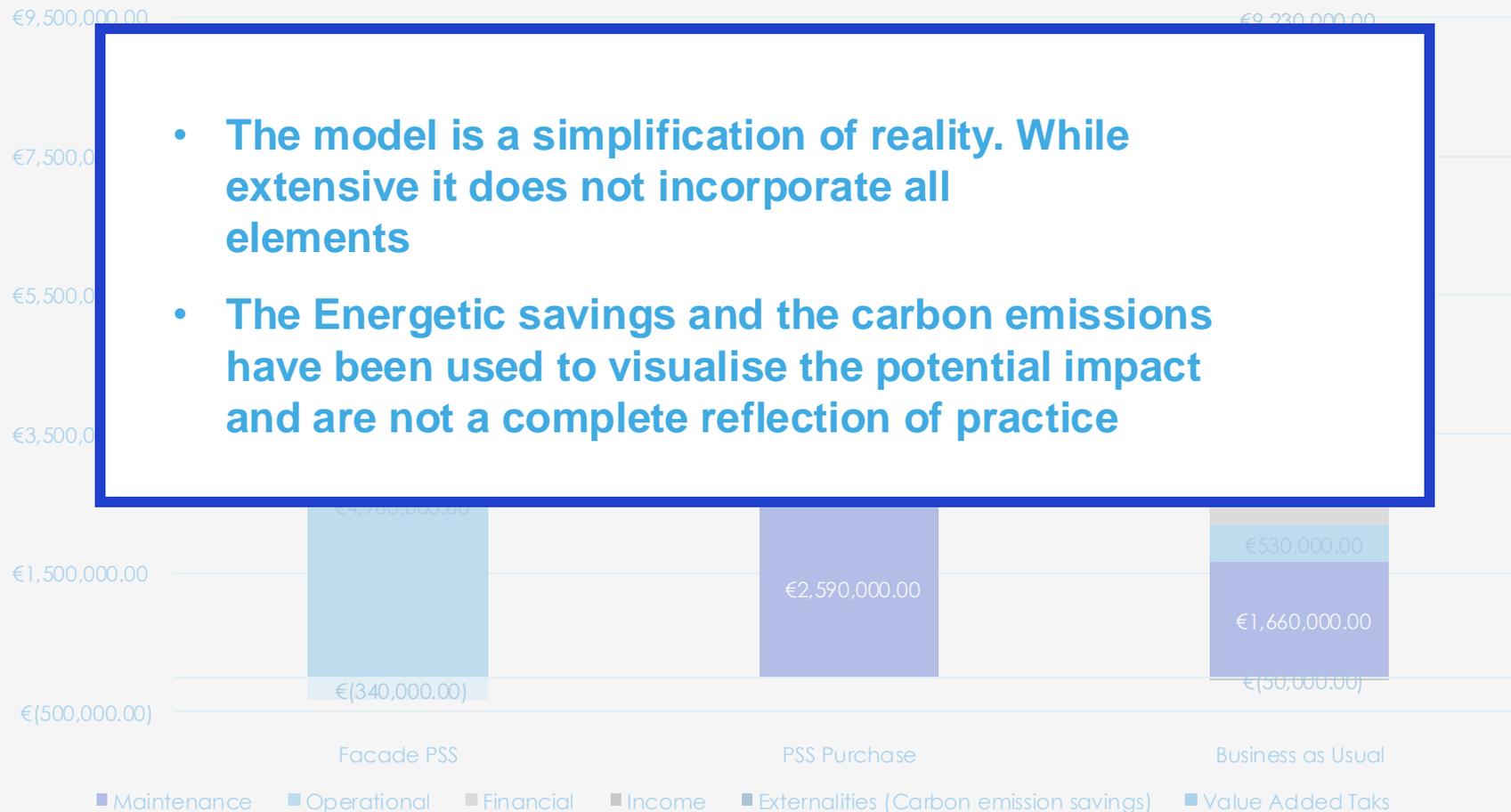
# Decision tree

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Min	€ 6.900.000	€ 7.000.000	€ 6.600.000	€ 6.100.000	€ 5.300.000



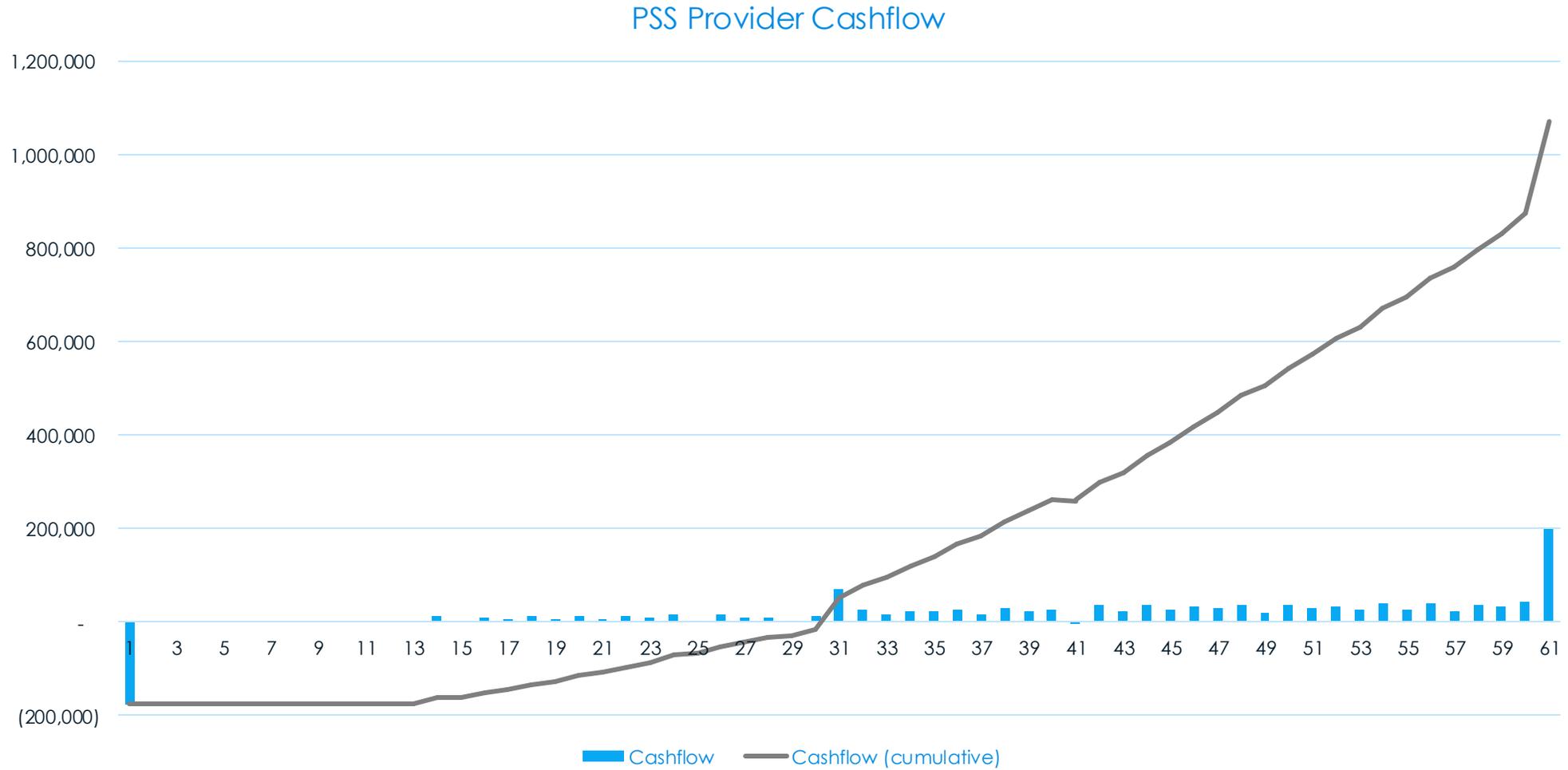
# Sensitivity analysis

## Whole Life Cost



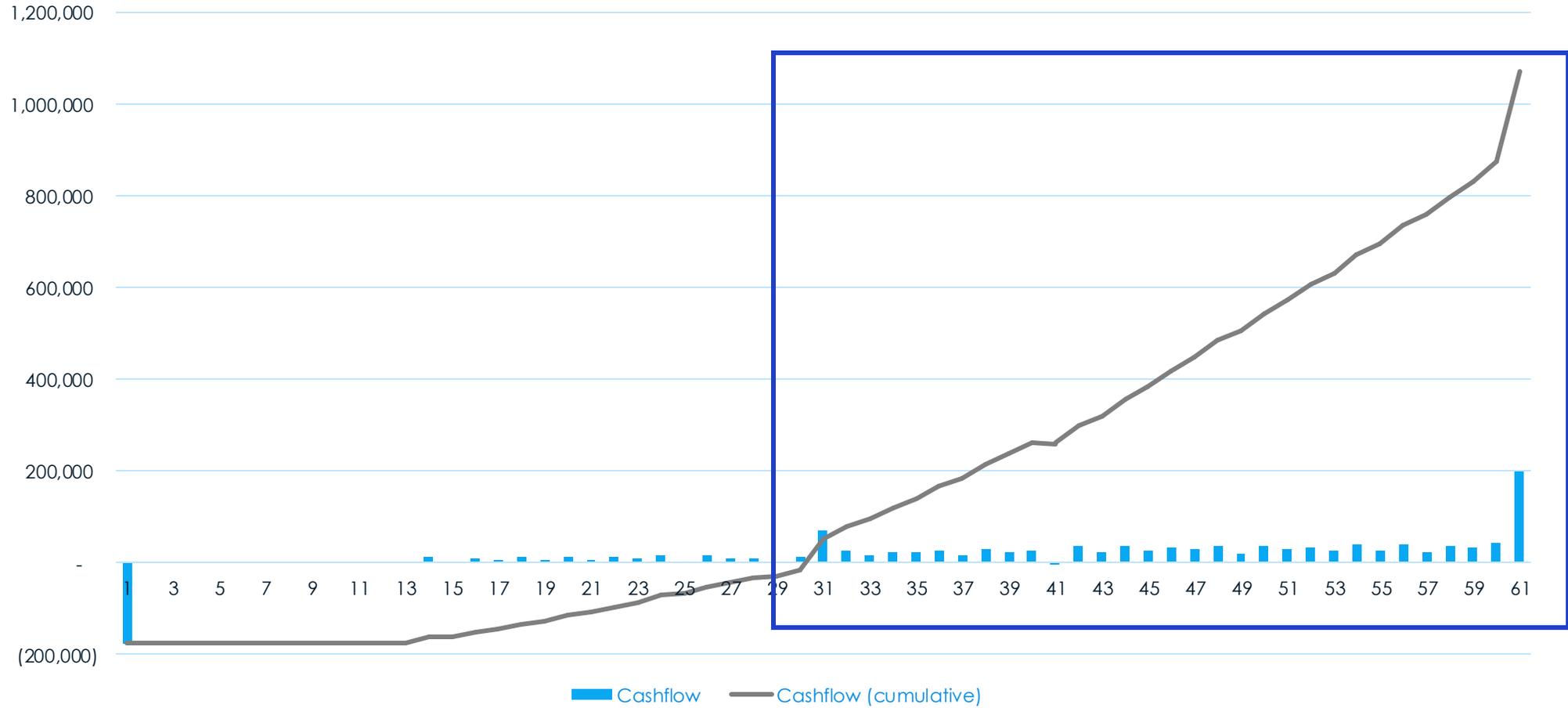
- 4,5% Interest rate

# PSS provider

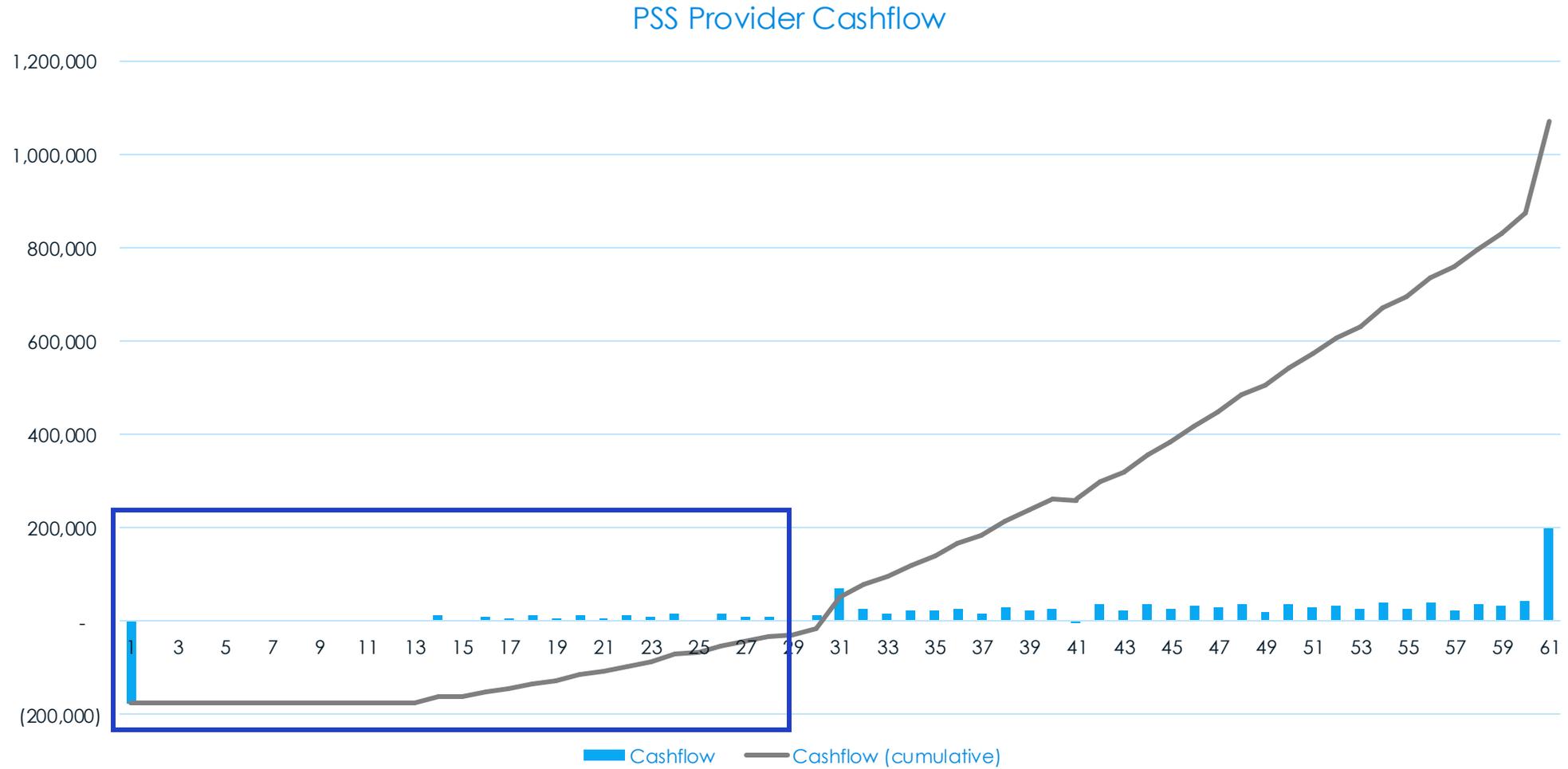


# PSS provider

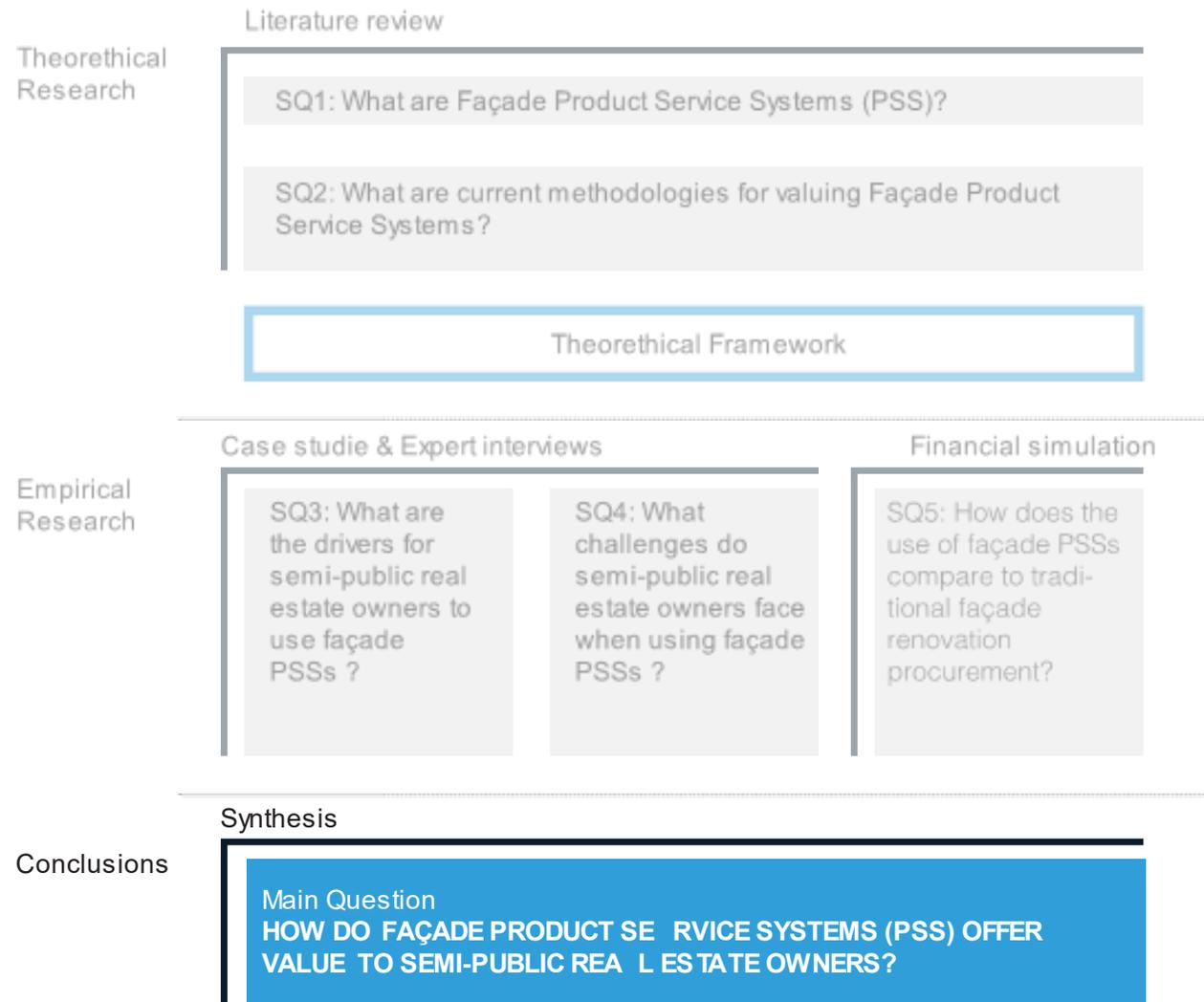
PSS Provider Cashflow



# PSS provider



# Methodology



# How do facade PSS offer value to semi-public real estate owners?

Achieve improved indoor climate, and energy performance and reduce carbon emissions and material consumption and do so accelerated

“Circular” facades hold high value in comparison to traditional facades” Deviate from build and decay methodology

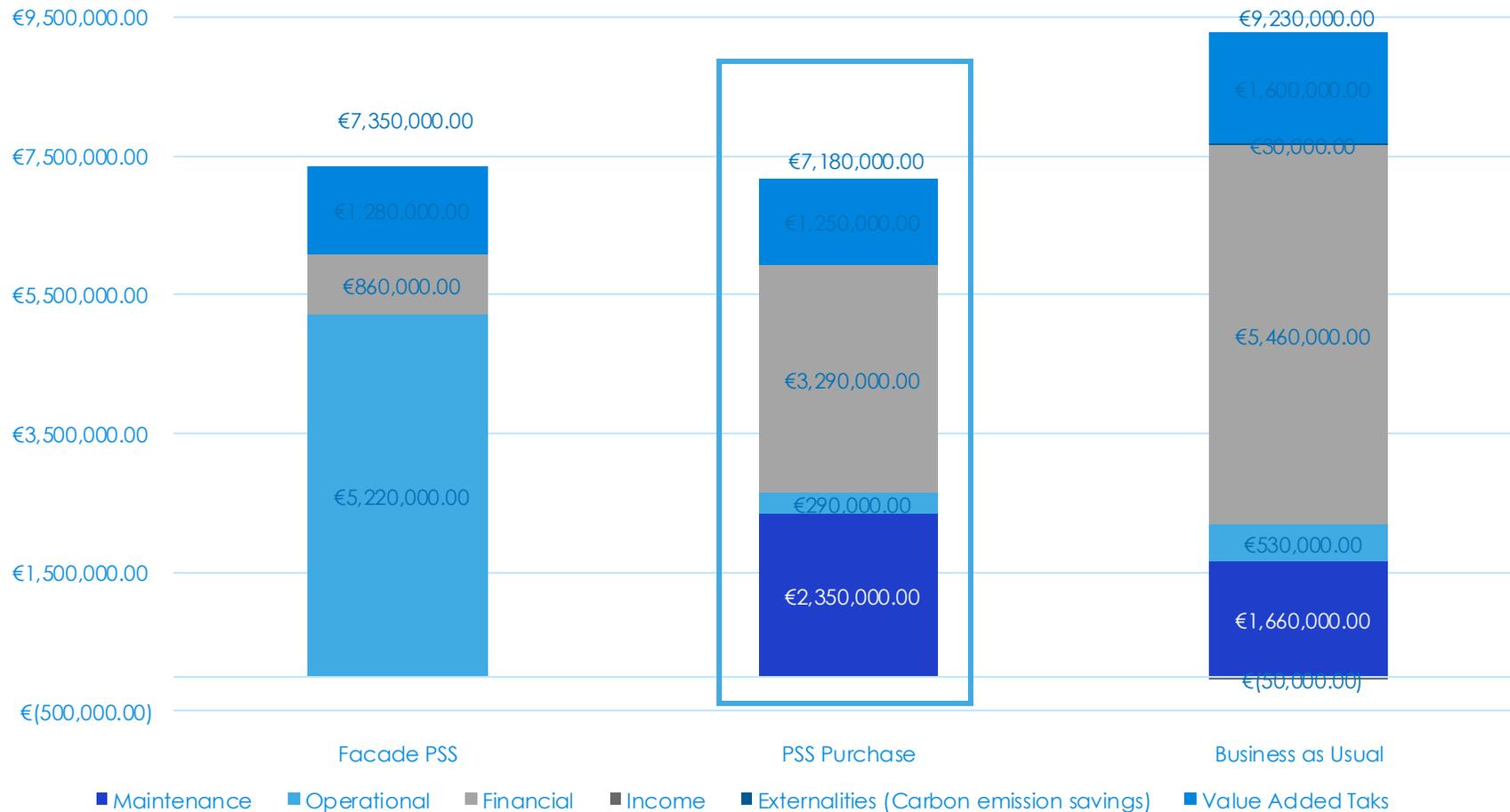
Full PSS contracts can be interesting depending on available capital and interest rates

PSS Contracts offer flexibility through its modularity if used in the strategy

The benefits of a façade PSS are based on the CiTG case study and are not directly applicable to other cases. However they can be used as lessons learned

# Conclusion

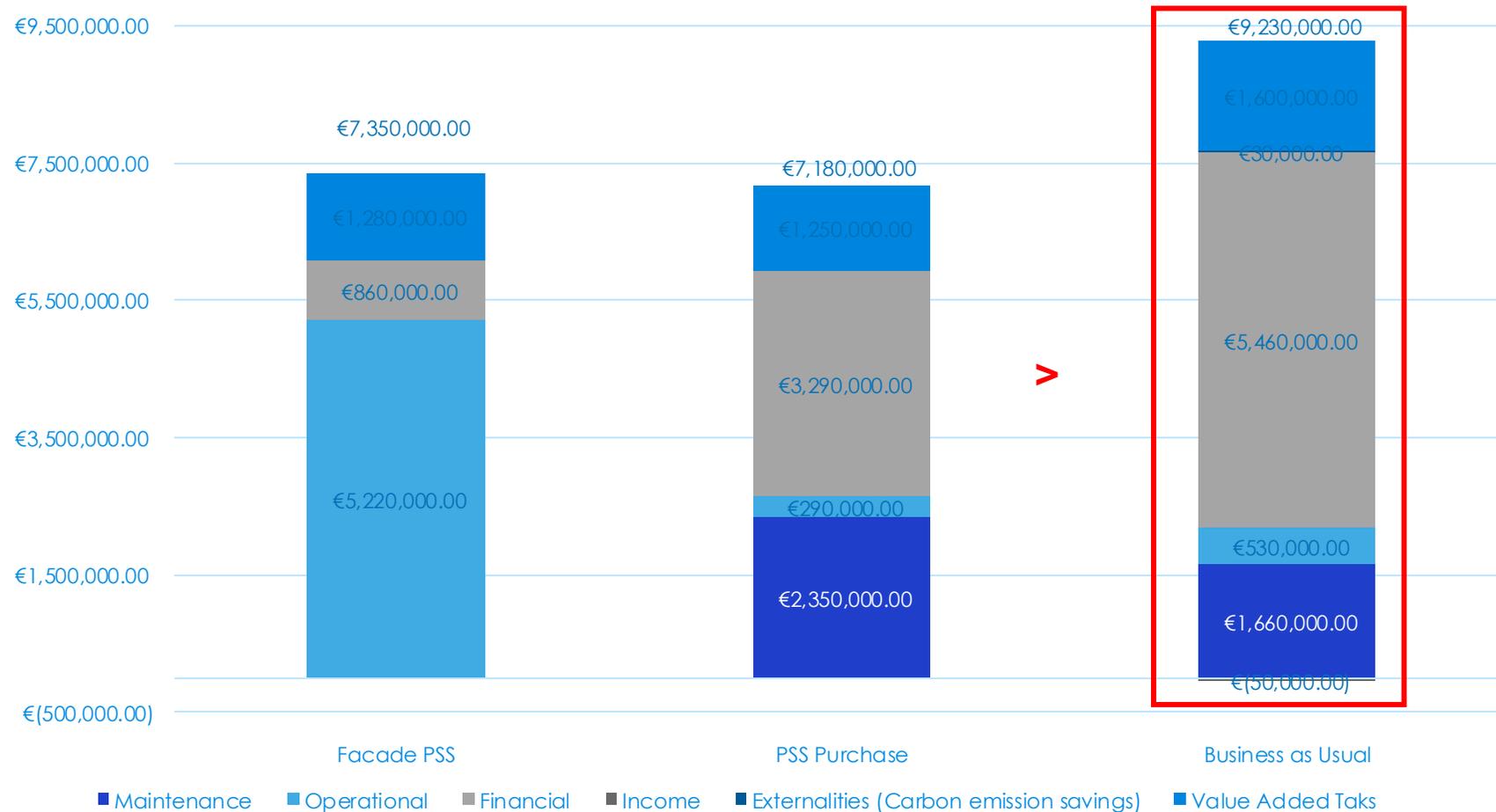
Whole Life Cost



- Purchase is most favourable, but comes with **risk**

# Conclusion

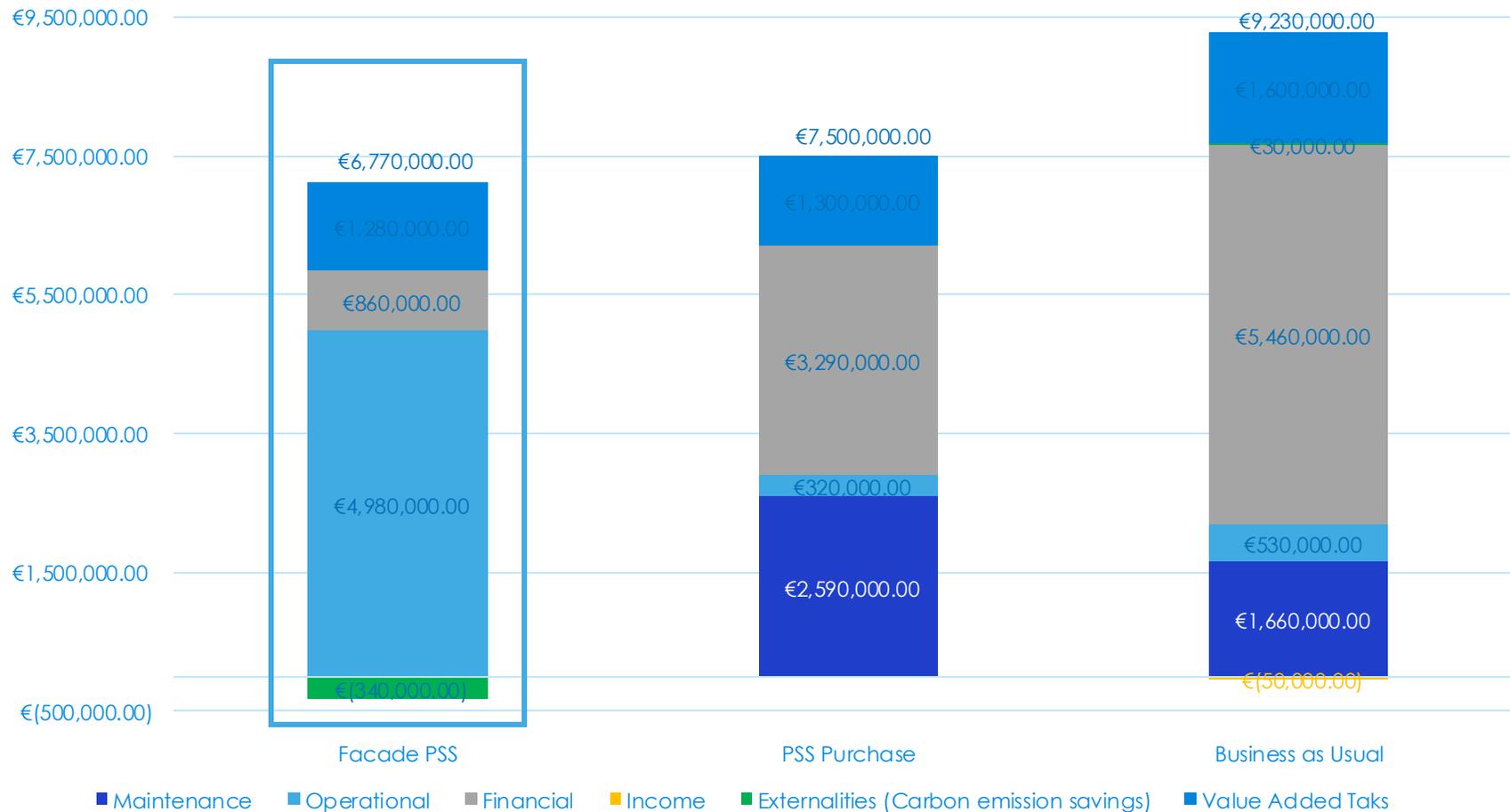
Whole Life Cost



- Can turn out higher than BaU

# Conclusion

Whole Life Cost



- **4,5% Interest rate and 5 years accelerated renovation**

# QUESTIONS?

# AT FAÇ[AD]E VALUE

*REVISITING THE ADDED VALUE OF FAÇADE PRODUCT  
SERVICE SYSTEMS FOR SEMI-PUBLIC REAL ESTATE OWNERS.*

JANUARY 14th, 2025