



RETROFITTING TIMBER FRAMES FOR BUILDING INSULATION

APPLICATION OF TIMBER FRAME PANELS WITH
INSULATION OUTSIDE OR INSIDE?

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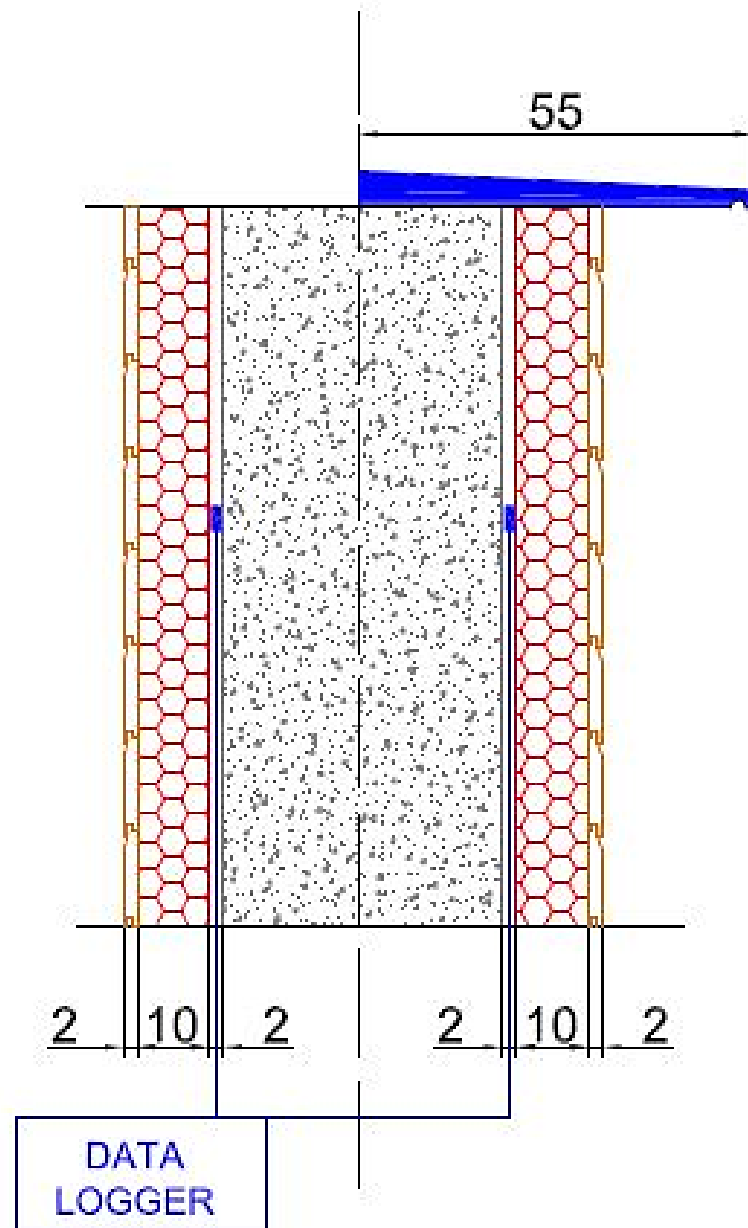
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INTRODUCTION



- APPROX 18,2 MILLION OF STOCK RESIDENTIAL BUILDINGS.
- APPROX 20% OF THE AREA IS FROM FEDERAL BUILDINGS.
- PROPOSE? → REDUCE ENERGY BY 50% TO 2020.
- 70 % OF THE 18 MILLION AFTER 2005
- BASED IN A STUDY IN NORWAY (2009)

PROBLEM STATEMENT



HOW AND WHERE RETROFIT
THE INSULATION IN A WALL?

→ INSIDE OR OUTSIDE?

→ TIMBER FRAME PANEL WITH....WHAT KIND
OF INSULATION?

→ ENERGY EFFICIENCY?

→ REDUCTION OF FLOOR?

→ ECONOMIC AND TIME SAVING?

LITERATURE REVIEW

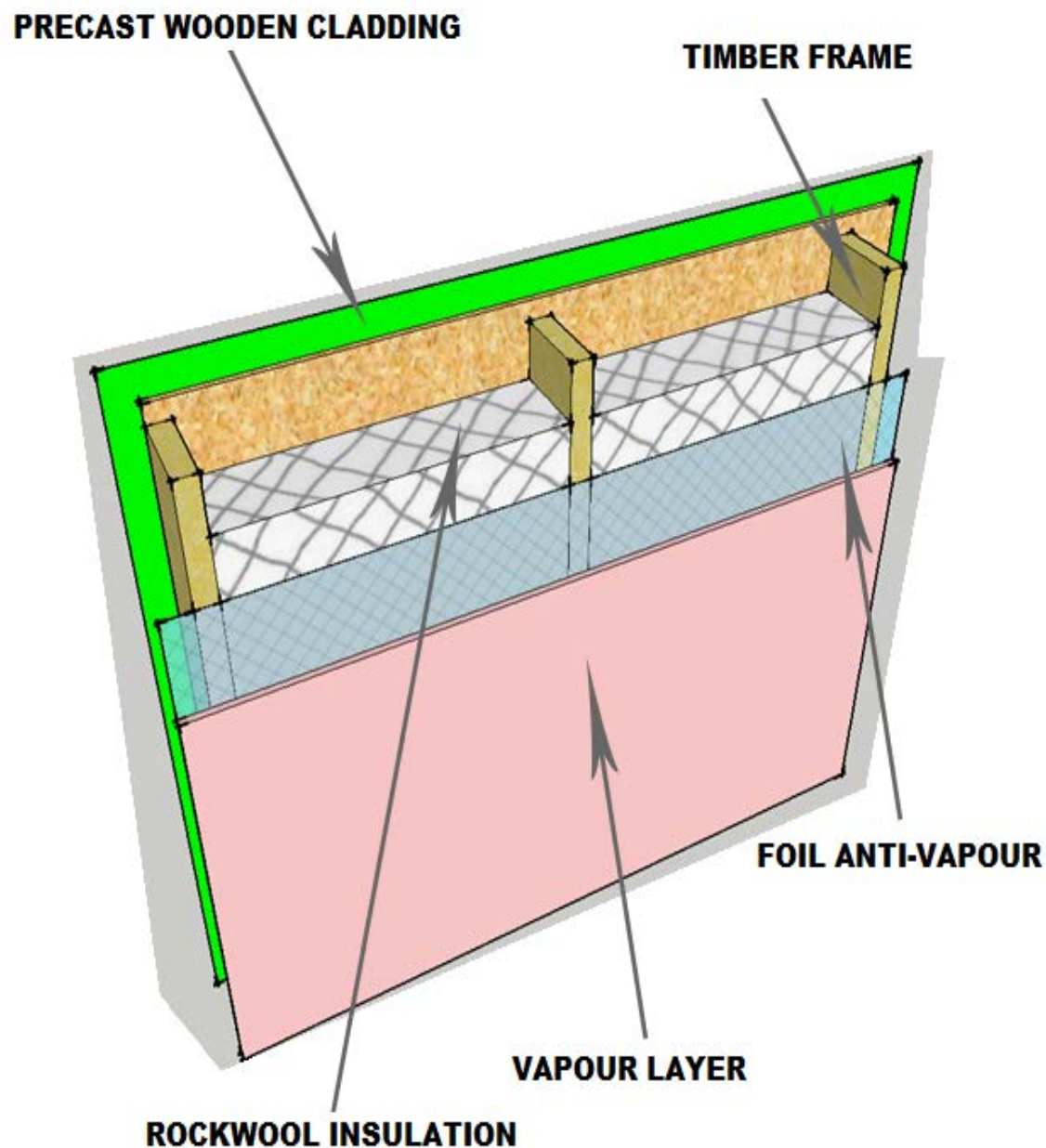
MORE THAN 25 REFERENCES
DIVEDED IN 3 GROUPS:

- WEB PAGES AND DATA BASE.
- TECHNIQUES GUIDES, COMPANIES CATALOGUES AND MAGAZINES.
- COMPARABLES STUDIES AND RESEARCH METHODS.



TOPIC REFERENCES	SPACE	ECONOMY	TEMPERATURE	MOISTURE	TIMBER FRAME	ENVIROMENTA L IMPACTS	WEATHER	OLD BUILDINGS	WALLS	PRICES	INSULATION PANELS	THERMAL INSULATION	SCAFFOLDS	ENERGY EFFICIENCY	THERMAL PERFORMANC E	NEW MATERIAL	REGULATIONS
ACCUWEATHER (2015)		X	X				X										
AUSTRALIAN SCAFFOLDS (2015)													X				
BICHMAIR , KRUS AND KILIAN (2014)			X	X	X			X						X	X		
BRE (2005)	X				X	X			X			X					
CLAY BRICK (2011)														X	X		
COMMUNICATION FROM THE GOVERNMENT OF THE FEDERAL REPUBLIC OF GERMANY TO THE COMISSION OF THE EUROPEAN UNION (2014)		X												X			X
ECONOMIC THEORY (2015)		X															X
ENERGY EFFICIENCY IN OLD BUILDINGS (N/d)					X			X			X	X					
ENGLISH HERITAGE (2015)					X			X	X		X				X		
ENVIRONMENTAL BENEFITS OF BUILDING WITH TIMBER (2003)					X	X						X		X			
FIVE DATABASE (2014)										X							
FUNG AND PAGE (2011)	X	X	X	X	X				X								
GLOBAL PROPERTY GUIDE (2015)		X								X							
HARRESTRUP , SVENDSEN AND PAPADOPOULOS (2014)			X	X	X			X	X					X			
JOHANSSON (2012)		X	X			X					X	X					
JOHANSSON, ET. AL. (2014)	X		X	X	X				X					X			
KINGSPAN (2015)			X	X					X		X			X			
KNAUF INSULATION (N/d)	X				X				X		X	X					
KRUS, THEUERKORN , GROBKINSKY AND KÜNZEL (2014)			X	X	X				X			X				X	
MARAVEAS, TASIOULI, MIAMIS AND FASOULAKIS (2014)					X			X	X								
MOSHER AND McGEE (2013)						X		X	X			X		X			
NORE , MATTSON AND AUSTIGARD (2014)			X	X	X				X		X						
NYERS, TOMIC, NYERS (2014)		X	X	X										X	X		
RETROFIT INSULATION IN EXISTING WOODEN WALLS (2000)					X			X	X			X			X		
ROBERTSON, LAM AND COLE (2012)					X	X								X			
SUSTAINABLE ENERGY IRELAND (N/d)	X								X		X						
SUSTAINABLE ENERGY IRELAND (N/d)	X					X								X			
SVEIPE, ET. AL. (2010)			X	X	X				X		X			X			

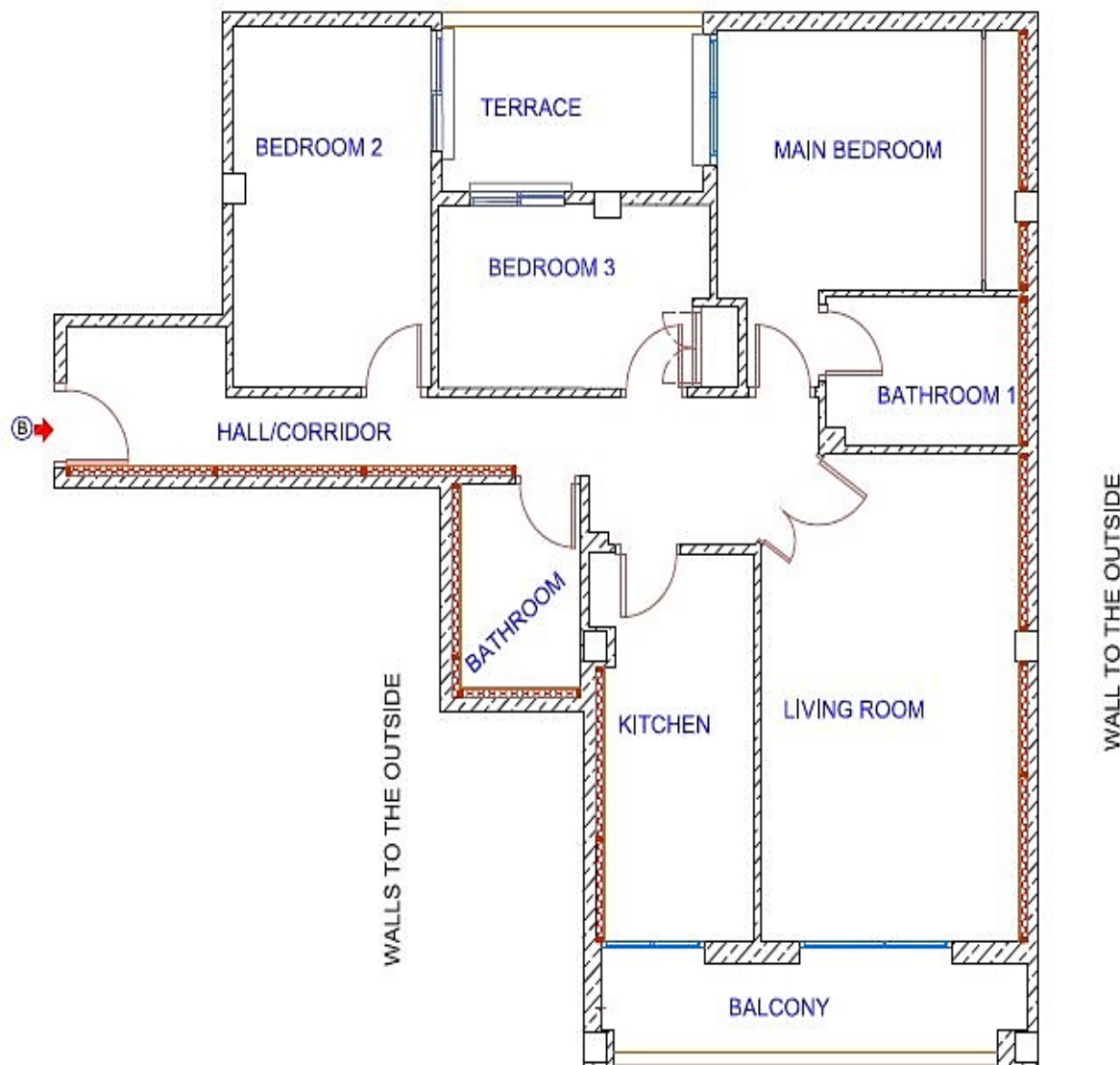
METHODOLOGY



I. ENERGY EFFICIENCY

- PROPOSED RESEARCH:
 - RETROFIT INSULATION IN EXISTING WOODEN WALLS (2000)
 - APPLICATION OF VACUUM INSULATION PANELS IN RETROFITTING OF TIMBER FRAMES (2010)
- ELABORATE 2 PANELS (INSIDE&OUTSIDE)
- TEST THE TEMPERATURE AND MOISTURE DURING 6 DAYS (SLOTS TIMES OF 8 HOURS)

METHODOLOGY



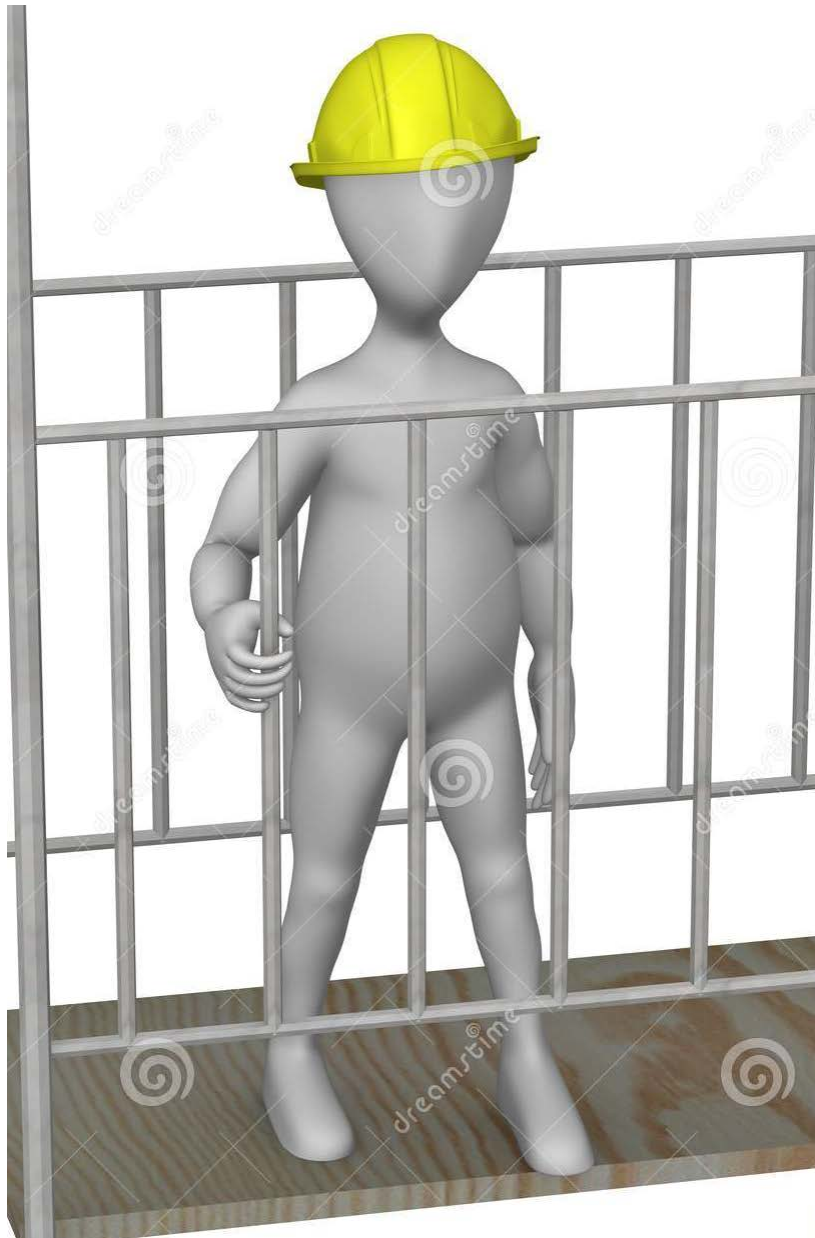
II. REDUCTION OF FLOOR

- PROPOSED RESEARCH:
 - BRE (2005)
 - FUNG AND PAGE (2011)
 - KINGSPAN (2015)
 - KNAUF INSULATION (2015)
- THICKNESS OF THE PANEL 13 cm
- DRAW A FLOOR DWELLING PLAN
- AMOUNT OF M² LESS

METHODOLOGY

III. ECONOMIC AND TIME SAVING

- PROPOSED RESEARCH:
 - ECONOMY THEORY (2015)
 - FIVE DATA BASE (2014)
 - AUSTRALIAN SCAFFOLDS (2015)
- PRICE OF MATERIALS
- PERFORMANCE APPLYING THE MATERIAL
- COST ADDED OF RENT A SCAFFOLD

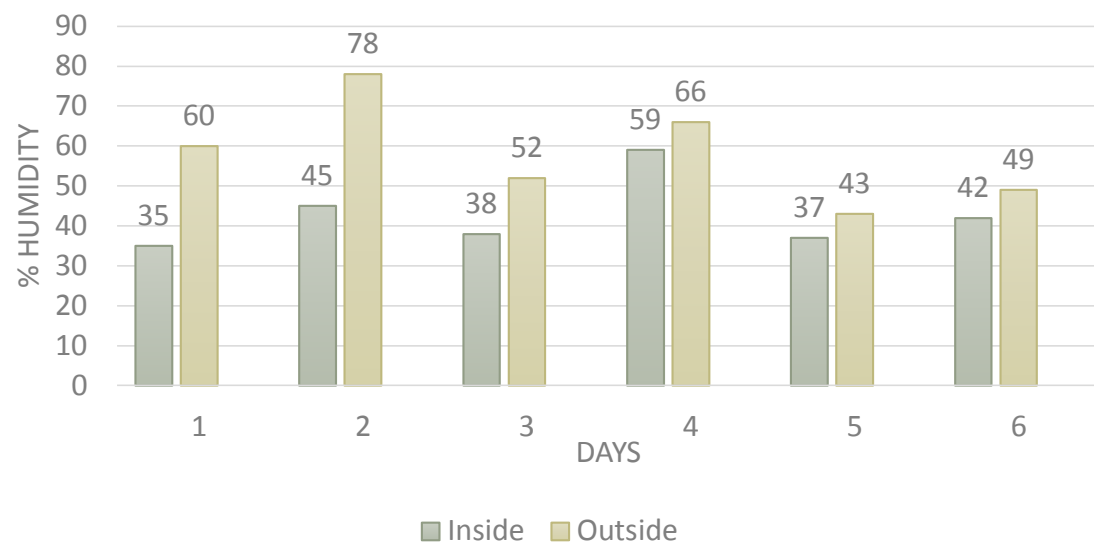


DATA ANALYSIS, RESULTS & DISCUSSION

Temperature each day



Humidity each day



I. ENERGY EFFICIENCY

- GET THE RESULTS TESTED
- ESTABLISH A RELATION BETWEEN THEM
- COMPAIR WITH THE WEATHER IN MAINZ
- NO RELIABLE STUDY
 - WHY?
 - WHAT AND HOW WOULD I DO?

DATA ANALYSIS, RESULTS & DISCUSSION

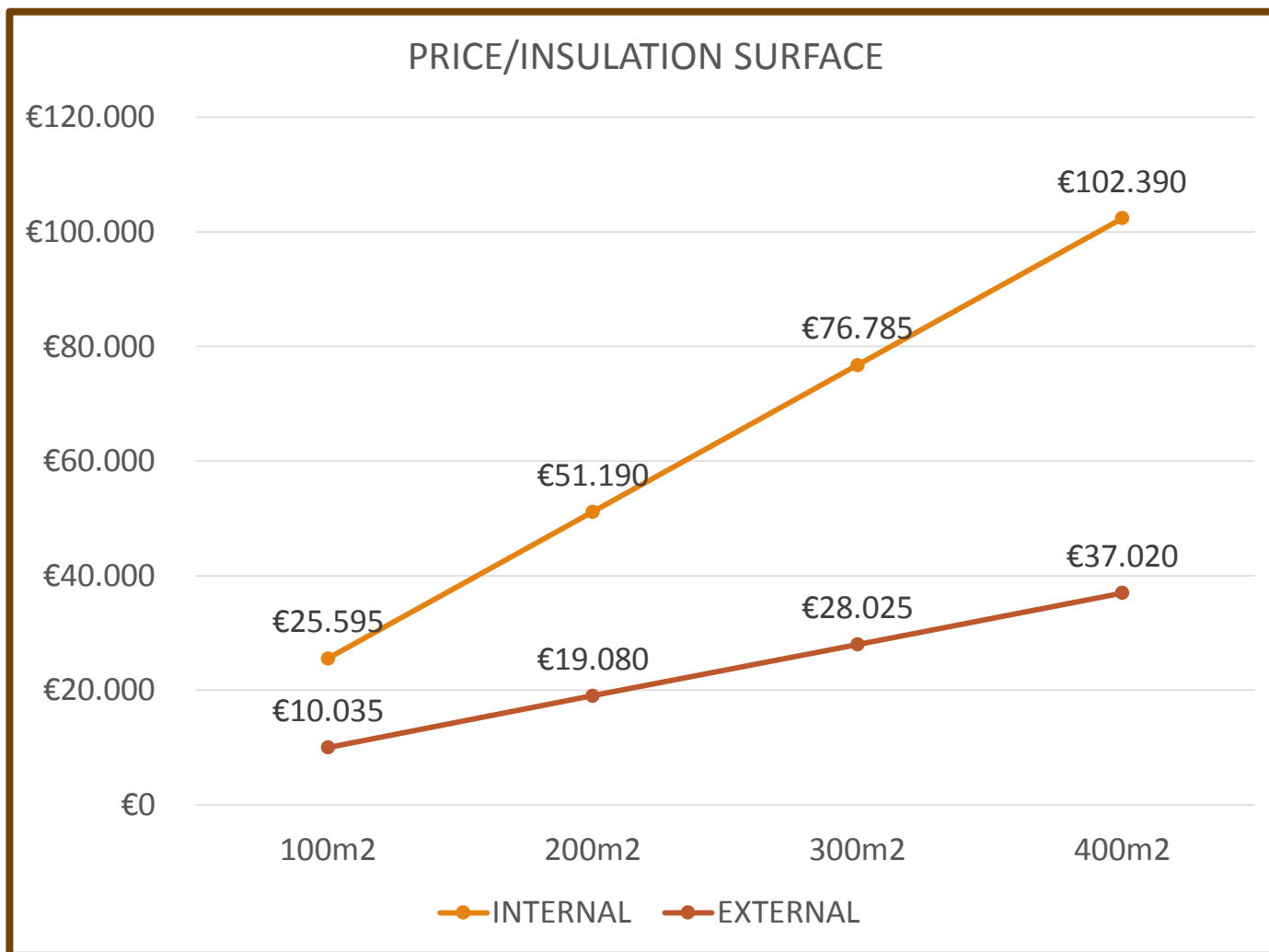
USEFUL AREA	EXTERNAL INSULATION	INTERNAL INSULATION
BEDROOM 2	10,73	10,73
TERRACE	6,53	6,53
MAIN BEDROOM	13,23	12,76
BATHROOM 1	4,46	4,27
LIVING ROOM	19,20	18,57
BALCONY	6,15	6,15
KITCHEN	9,20	8,82
BATHROOM	4,16	3,68
CORRIDOR/HALL	12,50	11,95
BEDROOM 3	7,77	7,77
TOTAL	93,93 m²	91,23 m²

II. REDUCTION OF FLOOR

- 13 cm THICKNESS $\rightarrow 1\text{m}^2 = 0,13\text{m}^2$
- 2,70 m² LESS.
- 4,078 €/m² GERMANY (GLOBAL PROPERTY GUIDE, 2015)
- LOSS OF VALUE (> 11000 €)

DATA ANALYSIS, RESULTS & DISCUSSION

III. ECONOMIC AND TIME SAVING



- MATERIAL COST ¿=?
- LABOUR GANG PERFORMANCE
- ADDITIONAL COSTS OF SCAFFOLD
- FOR 100 m²:
 - EXTERNAL: 10035 €
 - INTERNAL 25595 €

CONCLUSION



- PURPOSE?
 - IMPROVE THE INSULATION IN STOCK BUILDINGS
- HOW ?:
 - APPLY TIMBER FRAME INSULATION PANELS
- WHERE ?:
 - INSIDE: RESULTS OF TEMPERATURE AND HUMIDITY?
 - OUTSIDE: ↑ FLOOR AREA, ↓ AMOUNT OF MONEY
- RECOMMENDATIONS?
 - PROLONG THE TESTS
 - TESTING WITH A REAL HOUSE
 - SEARCH AND THICKNESS SUITABLE MATERIAL