Testing Applicability of European Financial Models for Sustainable Building Renovation in a Middle Eastern context

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November 27, 2020

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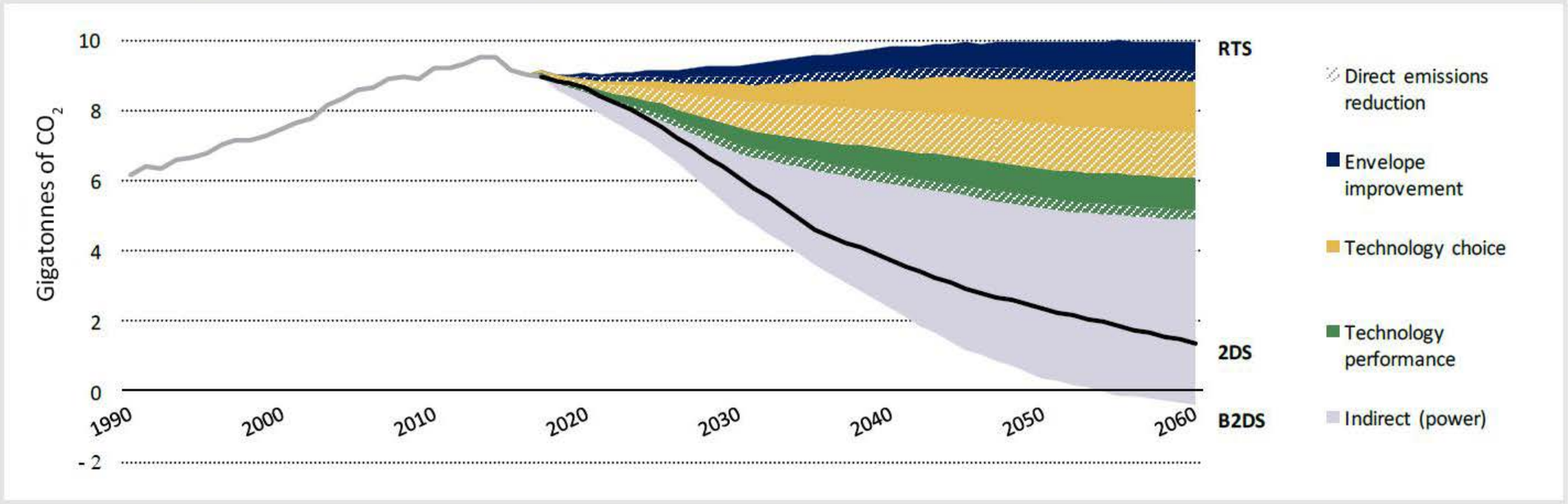
I: INTRODUCTION

INTRODUCTION

- Financial Feasibility in the face of climate change - and the importance of rehabilitation

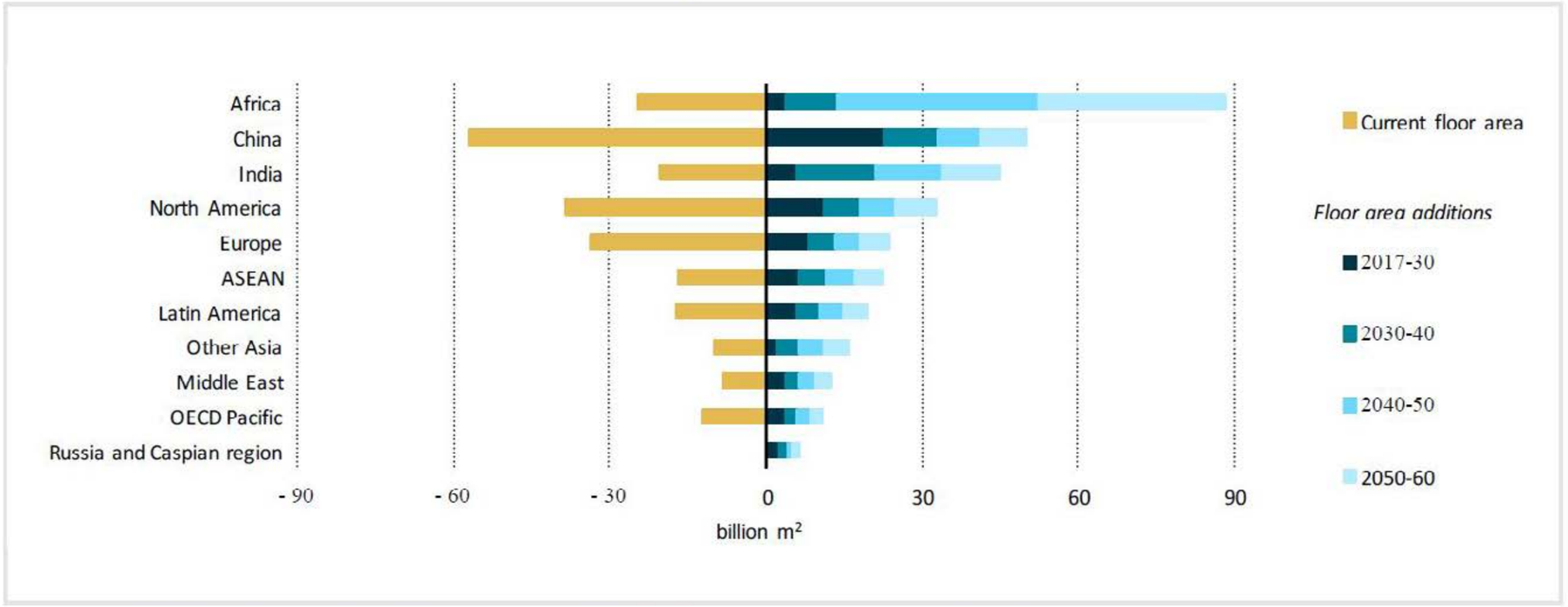
FIGURE 13 Key contributions to CO_2 emissions reduction in the global buildings sector to 2060



INTRODUCTION

- Most of the floor area we need already exists

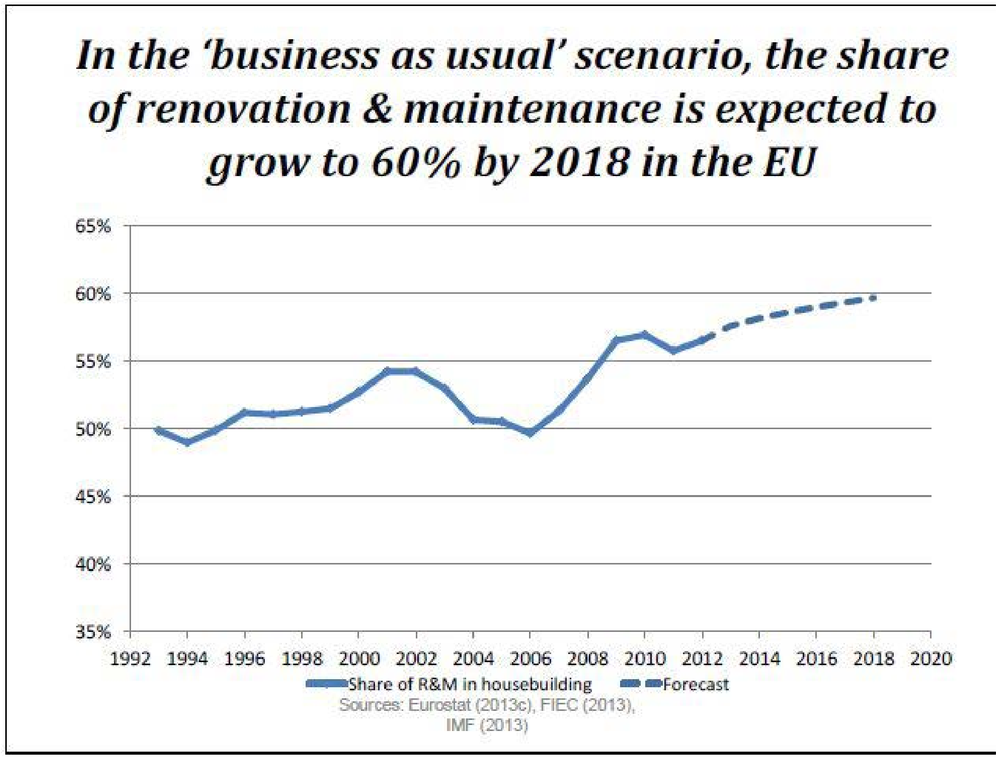
FIGURE 3 Floor area additions to 2060 by key regions



Notes: OECD Pacific includes Australia, New Zealand, Japan and Korea; ASEAN = Association of Southeast Asian Nations.
Source: IEA (2017), Energy Technology Perspectives 2017, IEA/OECD, Paris, www.iea.org/etp

INTRODUCTION

- Slow and steady growth of rehabilitation market



INTRODUCTION - RESEARCH PROBLEM

- ING report - majority of stakeholders claim that it is financially unfeasible
- Sample sizes come mainly from Western countries
- There are financial models - only the models have been extensively tested in western contexts

ING. (2018), ING International Survey: Paying the Price for Greener Homes. ING.

INTRODUCTION - RESEARCH GOALS

- Examine applicability of financial models created in a non western context
- Create a methodical approach to the application of financial models to a non western context
- Examine the opportunities and barriers that come with the specific context selected - Kuwait
- Summarize in a PESTLE analysis of each model

II: RESEARCH QUESTIONS

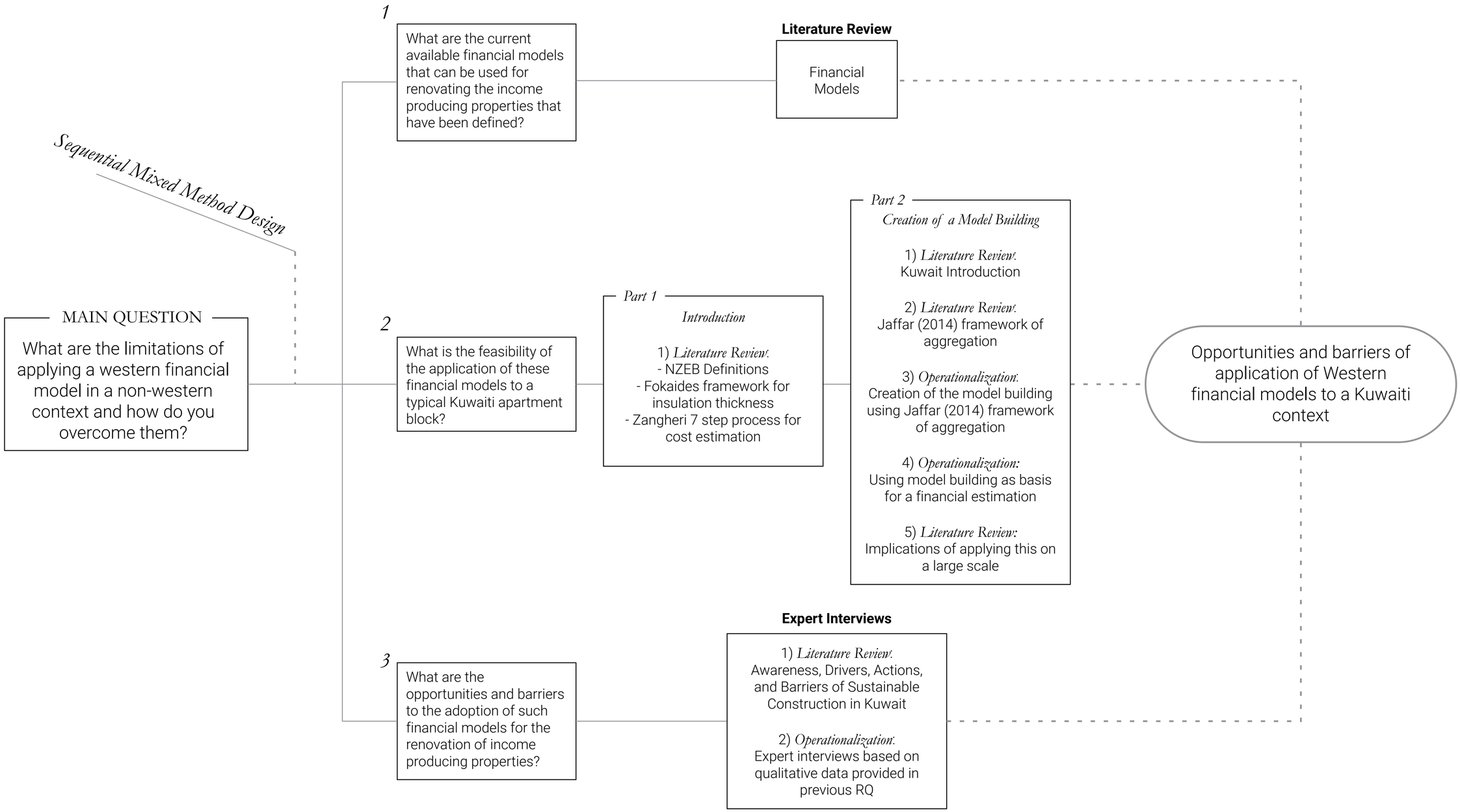
Main Research Question:
What are the limitations of applying European Financial Models to Kuwait and how can they be addressed?

Sub Question 1: What are the current available financial models that can be used for renovating the income producing properties?

Sub Question 2: What is the feasibility of the application of these financial models to a typical Kuwaiti apartment block?

Sub Question 3: What are the opportunities and barriers to the adoption of such financial models for the renovation of income producing properties?

III: RESEARCH DESIGN


Sequential Mixed Method Design
MAIN QUESTION
What are the limitations of applying a western financial model in a non-western context and how do you overcome them?
1
What are the current available financial models that can be used for renovating the income producing properties that have been defined?
Literature Review
Financial Models
2
What is the feasibility of the application of these financial models to a typical Kuwaiti apartment block?
Part 1
Introduction
1) Literature Review:
- NZEB Definitions
- Fokaides framework for insulation thickness
- Zangheri 7 step process for cost estimation
Part 2
Creation of a Model Building
1) Literature Review:
Kuwait Introduction
2) Literature Review:
Jaffar (2014) framework of aggregation
3) Operationalization:
Creation of the model building using Jaffar (2014) framework of aggregation
4) Operationalization:
Using model building as basis for a financial estimation
5) Literature Review:
Implications of applying this on a large scale
3
What are the opportunities and barriers to the adoption of such financial models for the renovation of income producing properties?
Expert Interviews
1) Literature Review:
Awareness, Drivers, Actions, and Barriers of Sustainable Construction in Kuwait
2) Operationalization:
Expert interviews based on qualitative data provided in previous RQ
Opportunities and barriers of application of Western financial models to a Kuwaiti context

IV: RESEARCH FRAMEWORKS + LITERATURE

LITERATURE REVIEW - FINANCIAL MODELS

Energy Performance Contracting

- Utilizing the energy saved through energy costs to finance the changes made
- Easy to understand
- Simply to apply
- Requires presupposition that energy is expensive

LITERATURE REVIEW - FINANCIAL MODELS

Add-on Business Model

- Using a buildng extension to finance the changes made
- Attractive for places with cheap energy
- Attractive as a means to reduce time to pay off
- Can be used as a “bonus”

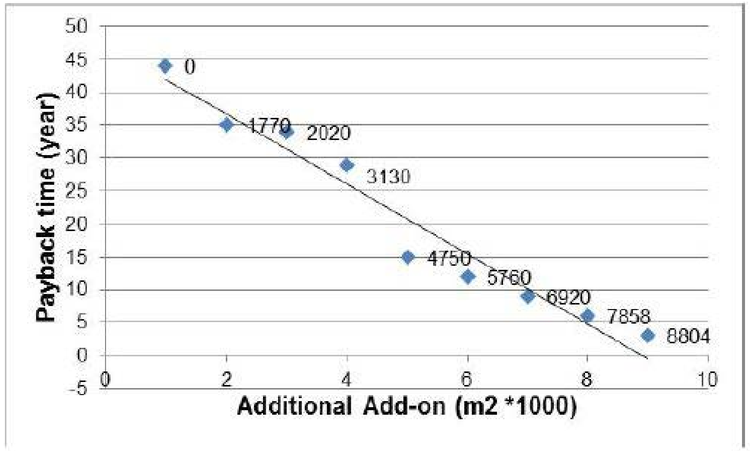
LITERATURE REVIEW - FINANCIAL MODELS

Add-on Business Model

- Case in Bologna

$$PBT = \frac{C_r y + C_c x + P x}{R y}$$

Where:
PBT = pay back time with investment rate of 5% (year)
Cr = unit renovation costs including RES to set to nZEB the existing building (€ / m^2);
y = floor surface of existing building (m^2) ;
Cc = construction costs of the Volumetric Addition (€/m^2);
x = floor surface of additional volumes (m^2);
P = Assistant building's real estate market value (€/m^2);
R = Energy savings (€/m^2).



Semprini, G., Ferrante, A., Cattani, E., & Fotopolulou, A. (2017). New strategies towards nearly zero energy in existing buildings: the ABRACADABRA project. Energy Procedia, 140, 151–158. doi: 10.1016/j.egypro.2017.11.131

RESEARCH FRAMEWORKS

Adapted Zangheri (2017) 7 step process:

- Description of representative climate
- Definition of reference building types
    - Creation of a typical market rental building typology using data and aggregation methods used by Jaffar (2014)
- Selection of energy measures
    - Utilisation of Fokaides' and Papadopolous (2014) Framework for creation of cost optimal insulation thickness
    - Using cost analysis verified by consultant in order to estimate min - mid - max scenarious
- Use discounted cash flow method based on median rent of each respective method to see financial performance over a 10 year period
    - Use sensitivity analysis to find which factors are most influential in changing the break even point
    - Use Scenario Analysis to find optimal mix of variables
    - Use Monte Carlo analysis to find probability of success
    - Use results to investigate the performance of models - then use the results for interviews

RESEARCH FRAMEWORKS - MODEL BUILDING CREATION

- Jaffar et al (2014) data and aggregation approach to create model building
- Aggregation model - utilizing case study approach - direct data
- Use in tandem with Kuwait Municipality building codes and information made available on Kuwait municipality website
- 3 Scenario model - Using consultant estimation for min-mid-max scenarios

Jaffar, B., Oreszczyn, T., & Raslan, R. (2014). A framework to evaluate the energy efficiency potential of Kuwaiti homes. Energy and Sustainability V. doi: 10.2495/esus140031

Kavgic, M., Mavrogianni, A., Mumovic, D., Summerfield, A., Stevanovic, Z., Djurovic-Petrovic, M., A review of bottom-up building stock models for energy consumption in the residential sector. Building and Environment, 45, pp. 1683-1697. 2010

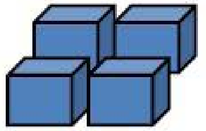
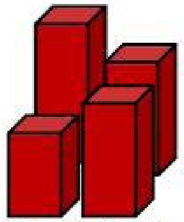
Raslan, R., and Mavrogianni, A., Developing a national stock model to support building energy efficiency research and policy in Egypt. Building Simulation Cairo 2013, Towards Sustainable and Green Life. Cairo, 23-24 June 2013. Egypt, 2013

RESEARCH FRAMEWORKS - MODEL BUILDING CREATION

KUWAIT					UK (2013)	
Dwelling type	Number of dwellings	Electricity consumed			Average kWh/ dwelling/ annum	Average kWh/m²/ dwelling/ annum
		Share	Average kWh/ dwelling/ annum	Average kWh/m²/ dwelling/ annum		
Villas	105,764	88%	145,444	264	4,170(electricity) 14,829 (gas) Total – 18,999	209
Flats	170,815	12%	20,278	127		

House type	Number of units	Approximate plot size	Approximate floor area/dwelling
Villas	105,764		
Government Low income housing 1967–1984 (2 floors)	27,626	250 m²–750 m²	350–400 m²
Government – Middle income housing 1967–1984 (2 floors)	4000	400 m²–750 m²	500 m²
Government housing 1984 – present (2 floors)	24,910	400 m² – 600 m²	400 m²–500 m²
Private villas (2–3 floors plus basement option)	49,228	350 m²–1000 m²	400 m²–1400 m²
Apartments	170,815		
Government apartments 1980s	1088	large complex with many flats/floor	350 m²
Government apartment future plans	Under planning	Low-rise 5 storey building (1 flat/floor)	400 m²
Residential apartments	169,727	In excess of 400 m²	70 m² – 250 m²
Pre-1940s courtyard houses	20,984		
	-	100–150m²	100–150m²
Palaces	47		
	-	In excess of 1000 m²	In excess of 3000 m²

RESEARCH FRAMEWORKS - MODEL BUILDING CREATION

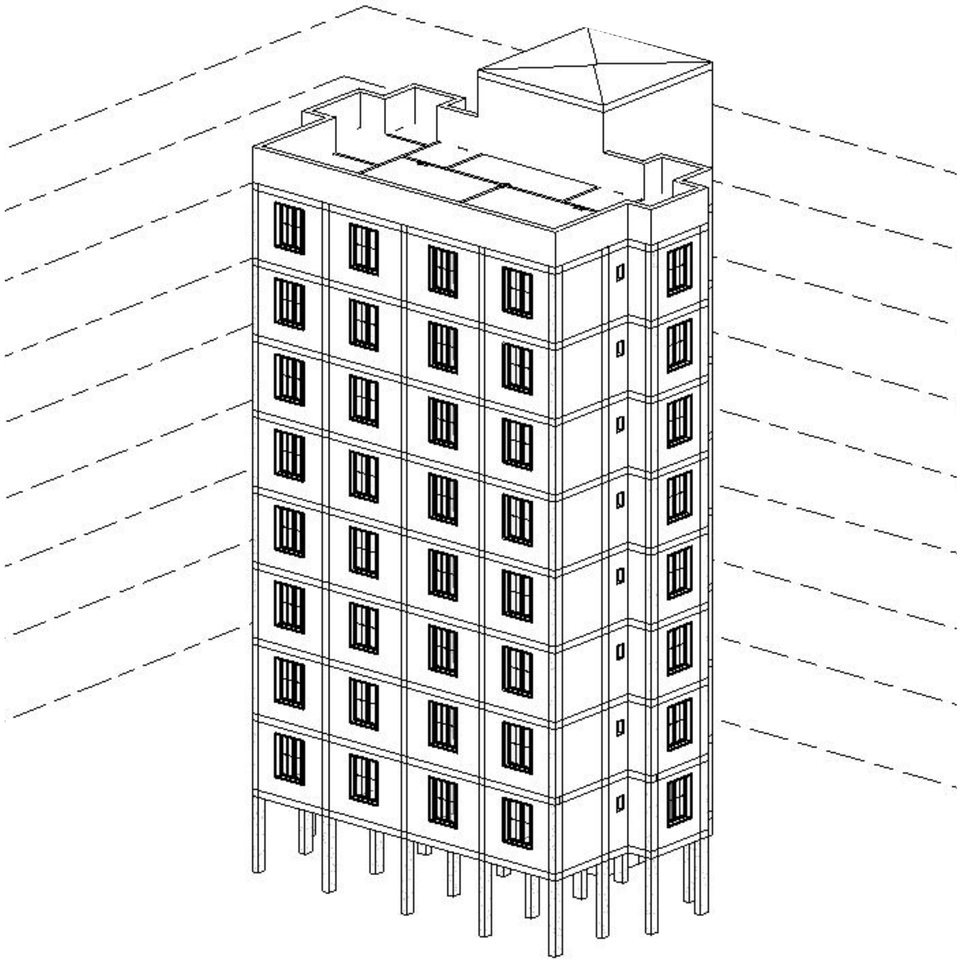
Period of construction/vintage	Dwelling type
1952-1984 1952 Kuwait's first master plan 1967-1984 PAHW allocates housing based on income stratifications	 **Private villas** Occupied mainly by Kuwaiti families. Villas range in design and form, are fully detached, consist of 2-3 floors, and a number of sleeping and living spaces as well as staff accommodation.  **Government houses** Occupied by Kuwaiti families. Houses consist of 2 levels, are fully detached, and built based on a standard size, shape and structure. All houses consist of a number of sleeping, and living spaces as well as staff accommodation
1984-2010 1983 MEW Energy Conservation Code 1984 PAHW Equal housing welfare 1985 KM first set of building regulations 1996,2000, 2002 KM increased permissible house area	
2010-2014 2010 MEW code revisions 2014 MEW code revisions	 **Mid-high rise apartment blocks** Occupied mainly by the expatriate population in Kuwait. Blocks vary in external design, form, construction and height The number of flats per block can range from 5-20 depending on the standard, quality, and governorate in which they are built.

V: OPERATIONALIZATION - MODEL BUILDING

MODEL BUILDING - context

OPERATIONALIZATION - Model Building

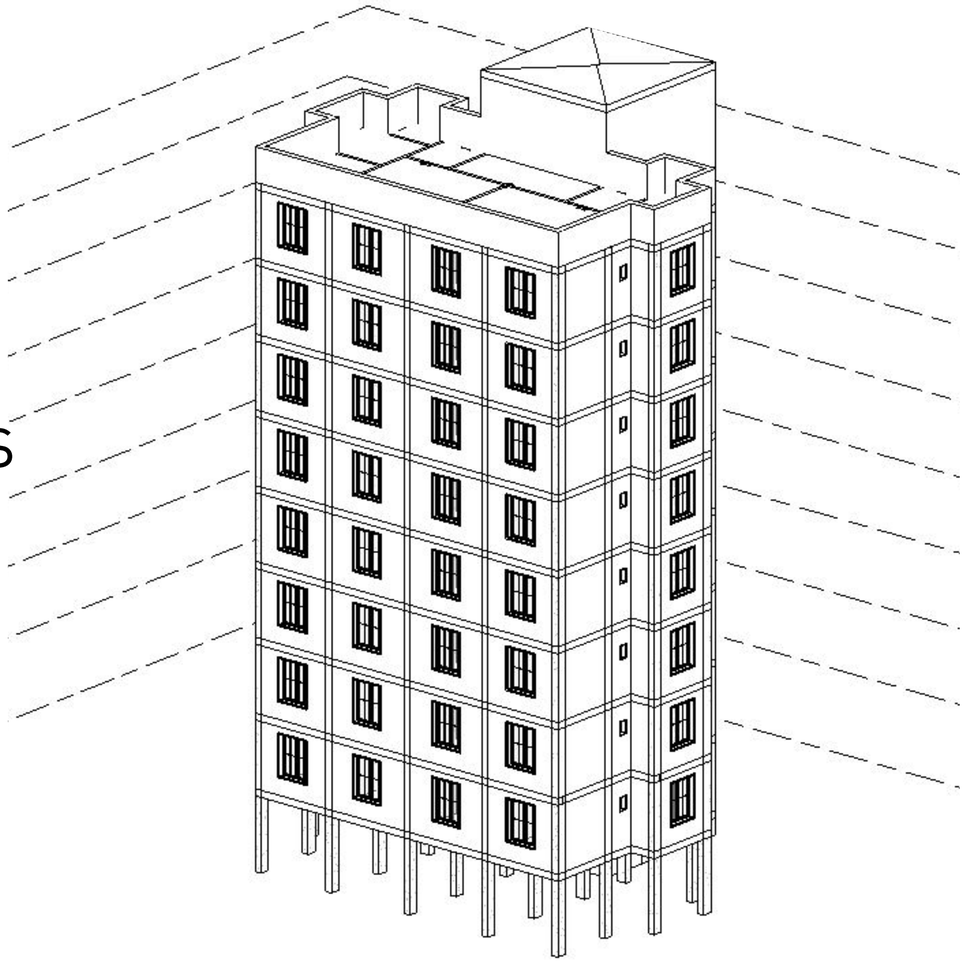
- Specific to Manatiq Istithmariya (Commercial Housing Zones)
- Usage of Jaffar (2014) data and framework to find case study data
- Aggregated with recommended municipality codes for given area



Jaffar, B., Oreszczyn, T., & Raslan, R. (2014). A framework to evaluate the energy efficiency potential of Kuwaiti homes. Energy and Sustainability V. doi: 10.2495/esus140031

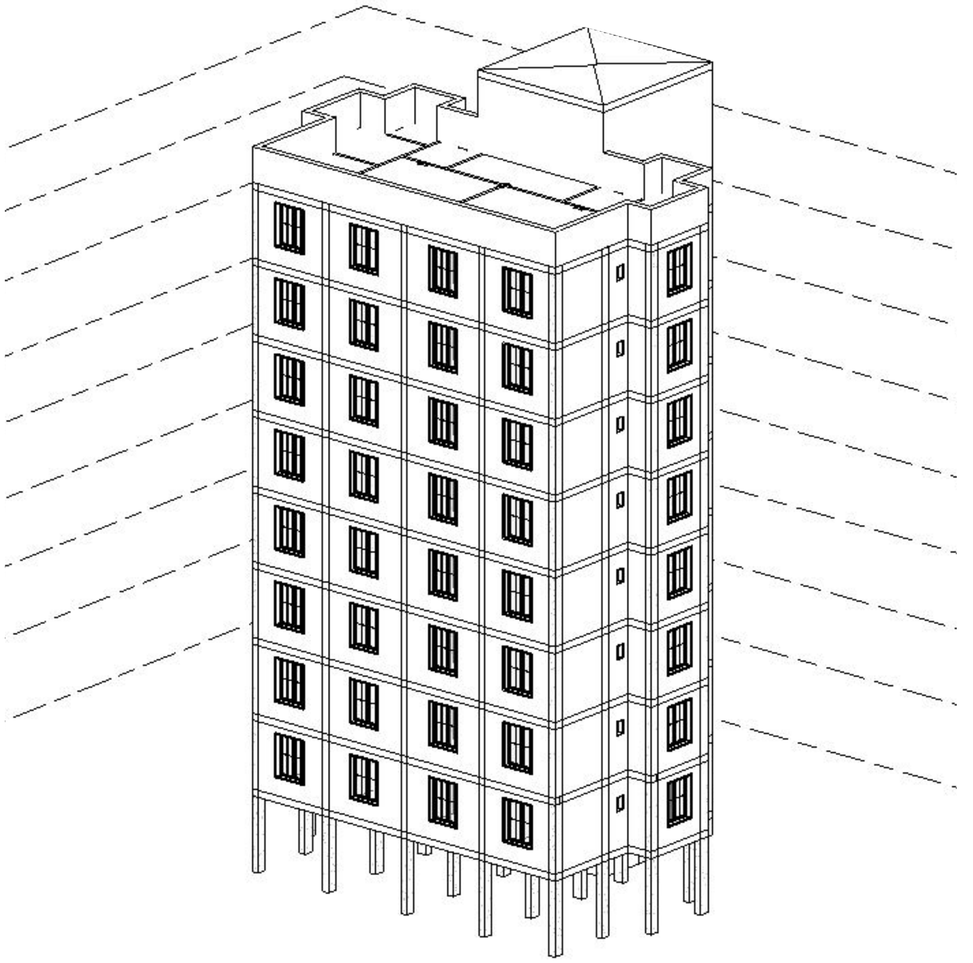
OPERATIONALIZATION - Model Building from Interviews

- Began developing after the 1990's due to successful outcome
- Lots of "copy cats"
- Hosts about 60% of the population (from Municipality GIS data)
- Is quickly filling the urban stock and is still probably going to be used in the near future
- If renovation not necessary now, definitely needed in the future



OPERATIONALIZATION - Extent of Renovation

- Complete change of cladding
- Complete change of all windows
- Complete change of ducting
- Complete change of HVAC systems
- No change in heating systems - barely used, account for less than 1% of energy use (Krarti, 2014)
- Provision made in case of excess or additional items



VI: FINANCIAL ANALYSIS

FINANCIAL MODEL - ASSUMPTIONS

- Used historical data from 2000 - 2020 to assume an average inflation rate of 2.74%
- Assumed a standard IRR of 10%
- Assumed 3 year construction Period
- Assumed payback period within a 10 year period only
- Assumed NZEB Definition of reduction to 50kwh/m^2
- Assuming average median rent of KWD 4.120 / m^2 (found through real estate data online)
- All Monte Carlo simulations are done with 5000 simulation runs

FINANCIAL MODEL - FINDINGS - FINANCING THROUGH RENT

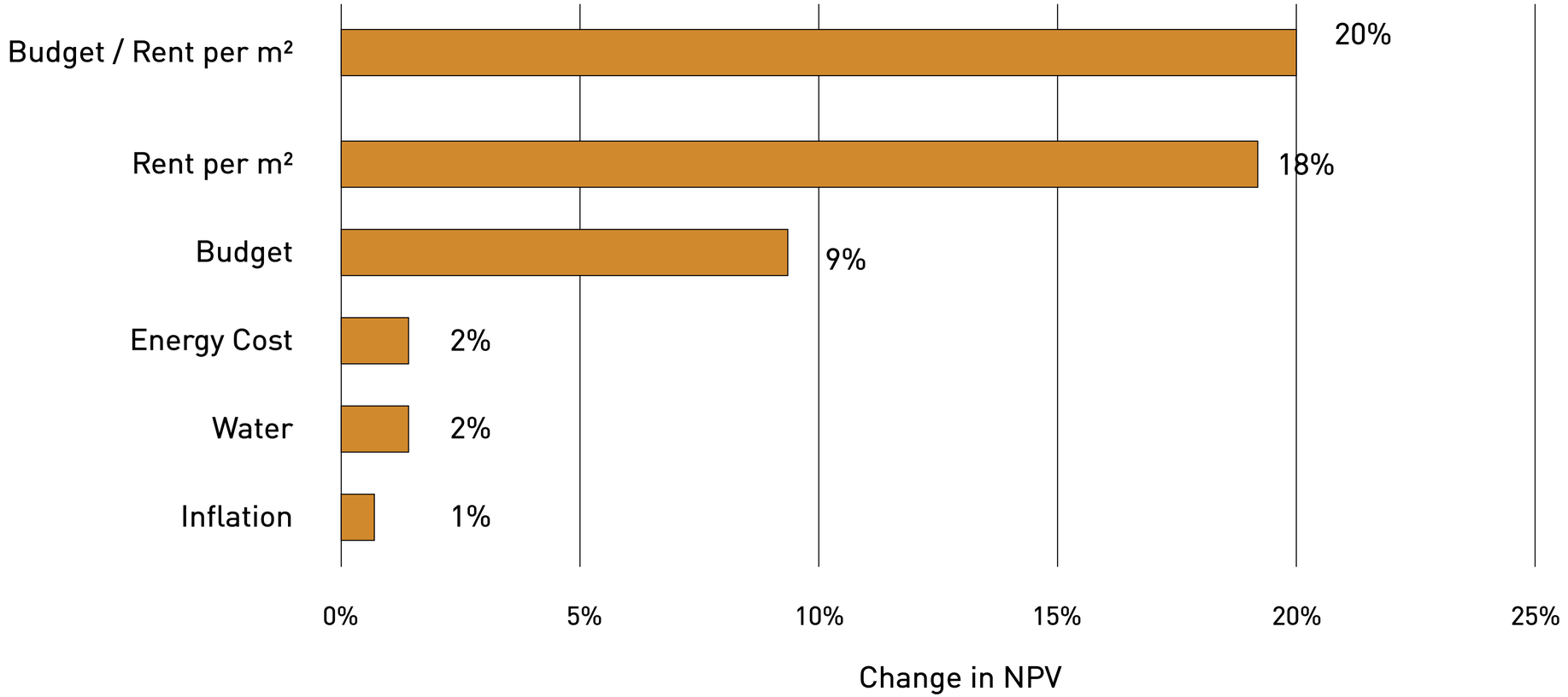
- This is assuming using the existing rent of the building to finance major renovations
- Completley feasible, with a consistent payback period of 4 years with Monte Carlo Analysis
- Very low chance of failure, showing 7.8% Chance of Loss with monte carlo analysis

Monte Carlo - Regular			Prob loss	7.50%	
	Rent	**Energy Cost**	**Inflation**	**Budget**	**NPV**
	4.236	0.089	0.034	130,383.577	21,165.440
1	4.355	0.080	0.037	127,403.633	37,795.815
2	3.865	0.079	0.038	134,091.989	8,806.746
3	4.814	0.113	0.019	111,428.850	36,955.488

Period	0	1	2	3	4	5	6	7
Occupancy Rate	0%	0%	0%	0%	50%	60%	90%	90%
Hotel income and expenses								
Potential gross income	KWD 48,366.13	KWD 49,712.68	KWD 51,096.73	KWD 52,519.31	KWD 53,981.49	KWD 55,484.39	KWD 57,029.12	KWD 58,616.87
Vacancy allowance	KWD (48,366.13)	KWD (49,712.68)	KWD (51,096.73)	KWD (52,519.31)	KWD (26,990.75)	KWD (22,193.75)	KWD (5,702.91)	KWD (5,861.69)
Gross Rent Income	0	0	0	0	26,991	33,291	51,326	52,755
Hotel income and expenses								
Annual rental income	KWD -	KWD -	KWD -	KWD -	KWD 26,990.75	KWD 33,290.63	KWD 51,326.21	KWD 52,755.18
Annual energy expenditure	KWD -	KWD -	KWD -	KWD -	KWD (2,846.06)	KWD (3,510.35)	KWD (5,412.13)	KWD (5,562.81)
Annual Water expenditure	KWD -	KWD -	KWD -	KWD -	KWD (2,243.12)	KWD (2,766.69)	KWD (4,265.57)	KWD (4,384.33)
Annual Maintenance	KWD -	KWD -	KWD -	KWD -	KWD (4,318.52)	KWD (4,438.75)	KWD (4,562.33)	KWD (4,689.35)
Net annual property income	0	0	0	0	17,583	22,575	37,086	38,119
Investment								
Renovation	103,148							
Investment	-103,148							
Cumulative Net Income								
Net Cash Flow	-103,148	0	0	0	17,583	22,575	37,086	38,119
Cumulative Net Income								
Cumulative Net Income	-103,148	-103,148	-103,148	-103,148	-85,565	-62,990	-25,904	12,215

FINANCIAL MODEL - Sensitivity Analysis

- Sensitivity analysis was done by changing each factor by 5% and observing the percentage change in the NPV



FINANCIAL MODEL - Financing without utilizing rent at all

- This is assuming that existing rent is not going to be used at all, instead that repayment of renovation will be done exclusively through energy savings or rental increases
- Final price of electricity is 0.142 KWD, which is close to Krarti (2014) calculation and recommendation of 0.136 KWD (adjusted for inflation)

Net Present Value		KWD 50,935.524					
Net Present Value - Energy Only		KWD (60,698.308)		**Energy price Increase for NPV 0 =**		KWD 0.142	284% increase
Net Present Value - Rent Increase		KWD (27,377.507)		**Rent Increase for NPV 0 =**		KWD 7.504	82% increase

FINANCIAL MODEL - Financing without utilizing rent - Scenario Analysis

- Though financing exclusively through rent increases and electricity cost alone is unfeasible, looking at both items at the same time results in some feasible combinations to achieve an NPV of 0

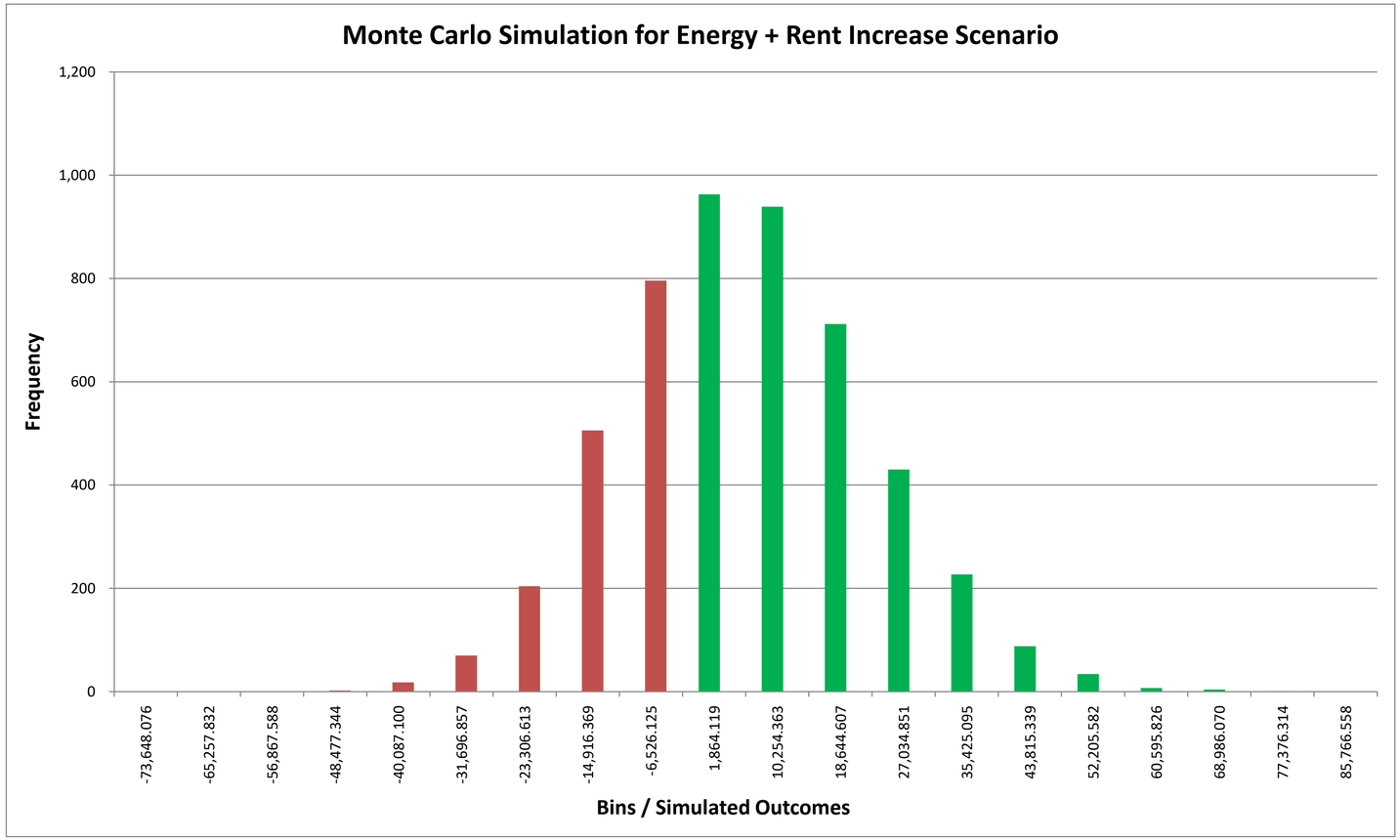
	0.050	0.055	0.060	0.065	0.070	0.075	0.080	0.085	0.090
3.500	-32,381	-26,924	-21,468	-16,011	-10,554	-5,098	359	5,816	11,272
3.600	-31,572	-26,115	-20,659	-15,202	-9,745	-4,289	1,168	6,624	12,081
3.700	-30,763	-25,307	-19,850	-14,393	-8,937	-3,480	1,977	7,433	12,890
3.800	-29,955	-24,498	-19,041	-13,585	-8,128	-2,671	2,785	8,242	13,699
3.900	-29,146	-23,689	-18,233	-12,776	-7,319	-1,863	3,594	9,051	14,507
4.000	-28,337	-22,880	-17,424	-11,967	-6,510	-1,054	4,403	9,859	15,316
4.100	-27,528	-22,072	-16,615	-11,158	-5,702	-245	5,212	10,668	16,125
4.200	-26,720	-21,263	-15,806	-10,350	-4,893	564	6,020	11,477	16,934
4.300	-25,911	-20,454	-14,997	-9,541	-4,084	1,372	6,829	12,286	17,742
4.400	-25,102	-19,645	-14,189	-8,732	-3,275	2,181	7,638	13,094	18,551
4.500	-24,293	-18,837	-13,380	-7,923	-2,467	2,990	8,447	13,903	19,360
4.600	-23,484	-18,028	-12,571	-7,115	-1,658	3,799	9,255	14,712	20,169
4.700	-22,676	-17,219	-11,762	-6,306	-849	4,607	10,064	15,521	20,977
4.800	-21,867	-16,410	-10,954	-5,497	-40	5,416	10,873	16,330	21,786
4.900	-21,058	-15,602	-10,145	-4,688	768	6,225	11,682	17,138	22,595
5.000	-20,249	-14,793	-9,336	-3,880	1,577	7,034	12,490	17,947	23,404
5.100	-19,441	-13,984	-8,527	-3,071	2,386	7,843	13,299	18,756	24,212
5.200	-18,632	-13,175	-7,719	-2,262	3,195	8,651	14,108	19,565	25,021
5.300	-17,823	-12,367	-6,910	-1,453	4,003	9,460	14,917	20,373	25,830
5.400	-17,014	-11,558	-6,101	-645	4,812	10,269	15,725	21,182	26,639
5.500	-16,206	-10,749	-5,292	164	5,621	11,078	16,534	21,991	27,447
5.600	-15,397	-9,940	-4,484	973	6,430	11,886	17,343	22,800	28,256
5.700	-14,588	-9,132	-3,675	1,782	7,238	12,695	18,152	23,608	29,065
5.800	-13,779	-8,323	-2,866	2,591	8,047	13,504	18,960	24,417	29,874
5.900	-12,971	-7,514	-2,057	3,399	8,856	14,313	19,769	25,226	30,682
6.000	-12,162	-6,705	-1,249	4,208	9,665	15,121	20,578	26,035	31,491
6.100	-11,353	-5,896	-440	5,017	10,473	15,930	21,387	26,843	32,300
6.200	-10,544	-5,088	369	5,826	11,282	16,739	22,195	27,652	33,109
6.300	-9,736	-4,279	1,178	6,634	12,091	17,548	23,004	28,461	33,918
6.400	-8,927	-3,470	1,986	7,443	12,900	18,356	23,813	29,270	34,726
6.500	-8,118	-2,661	2,795	8,252	13,708	19,165	24,622	30,078	35,535
6.600	-7,309	-1,853	3,604	9,061	14,517	19,974	25,431	30,887	36,344
6.700	-6,501	-1,044	4,413	9,869	15,326	20,783	26,239	31,696	37,153
6.800	-5,692	-235	5,221	10,678	16,135	21,591	27,048	32,505	37,961
6.900	-4,883	574	6,030	11,487	16,943	22,400	27,857	33,313	38,770
7.000	-4,074	1,382	6,839	12,296	17,752	23,209	28,666	34,122	39,579
7.100	-3,266	2,191	7,648	13,104	18,561	24,018	29,474	34,931	40,388
7.200	-2,457	3,000	8,456	13,913	19,370	24,826	30,283	35,740	41,196

FINANCIAL MODEL - Financing without utilizing rent - Scenario Analysis

- Feasible?
- Considered feasible because the change in the rent from the median is within the standard deviation of the rents from real estate study
- Considered feasible because the energy prices of are lower than that of 0.110 KWD, which is what electricity should cost today considering available CPI from 1973 (limitation of availability of data)

FINANCIAL MODEL - Financing without utilizing rent - Monte Carlo Analysis

- Monte Carlo Analysis shows a current possibility of 46% chance of loss given the current electricity prices, as opposed to a 100% guarantee of loss if financed exclusively through energy savings



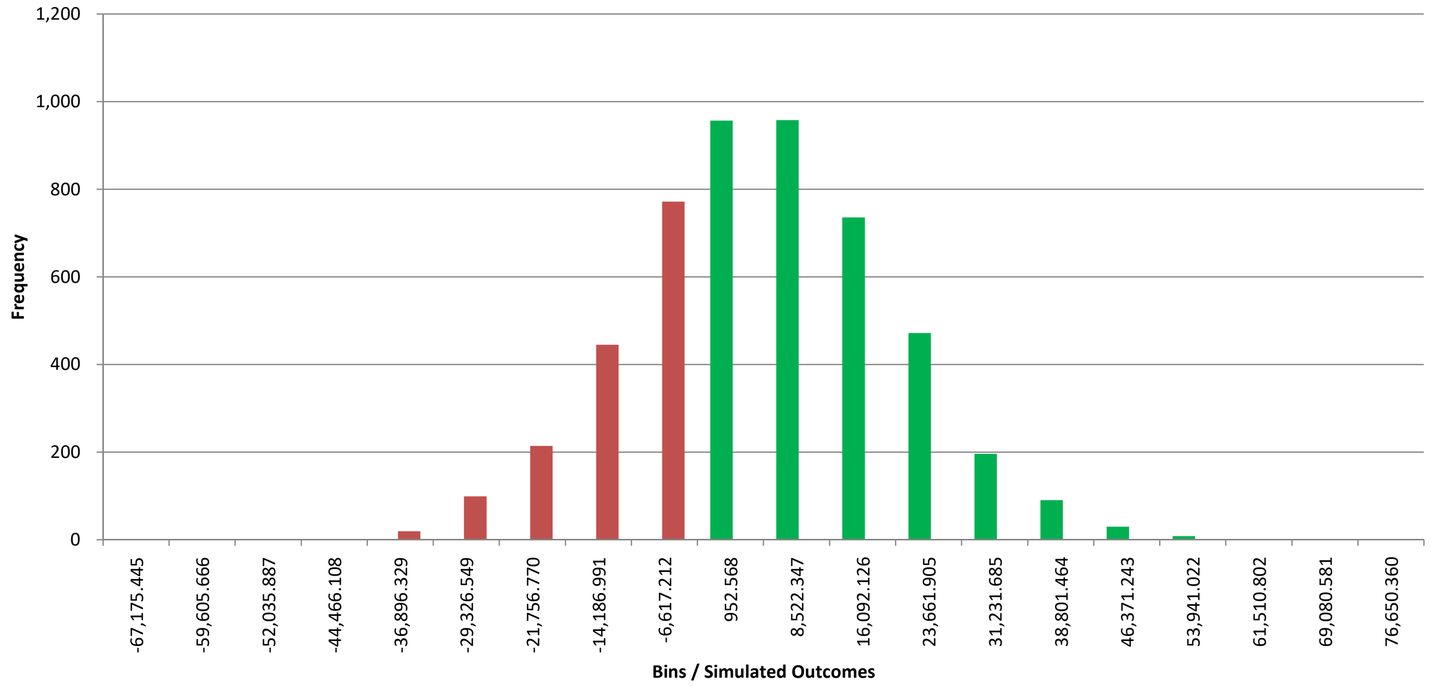
FINANCIAL MODEL - Financing without utilizing rent - with Islamic Banking

- In Kuwait there is the option to finance with Islamic banking
- Limited to 70,000 KWD in accordance with the rules of the central bank of kuwait (Kuwait Finance House, 2020)
- Works more or less the same as a regular loan, but with a few minor differences (Farooq, 2005)

FINANCIAL MODEL - Financing with Islamic Loan

- When assuming a potential range of loans from 0 - 70,000 KWD, there is little to no change in the feasibility, with a 47% chance of loss.

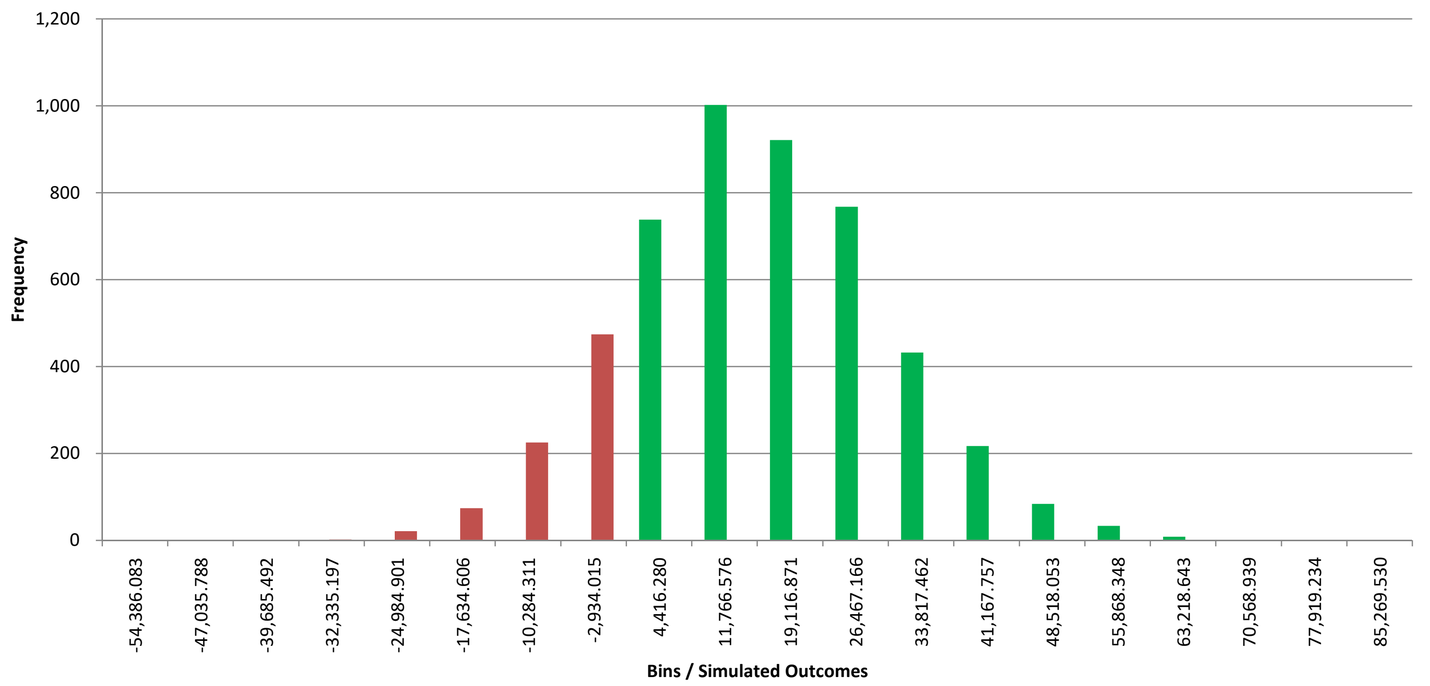
							47.60%
	Rent	Energy cost	Inflation	Budget	Bank Loan	Profit %	NPV
	5.283	0.104	0.044	139,157.483	31,279.567	0.260	-6,886.964
1	4.664	0.097	0.028	116,615.218	30,777.115	0.269	6,811.020
2	5.204	0.097	0.033	121,317.708	36,884.327	0.263	3,102.647
3	5.667	0.107	0.027	122,264.511	44,076.971	0.266	3,446.715
4	5.108	0.098	0.041	127,995.182	34,764.675	0.267	-1,137.886
5	5.144	0.091	0.023	123,002.080	28,183.753	0.264	-7,535.191
6	5.812	0.066	0.048	126,035.262	18,947.703	0.267	-18,298.140



FINANCIAL MODEL - Financing with Islamic Loan

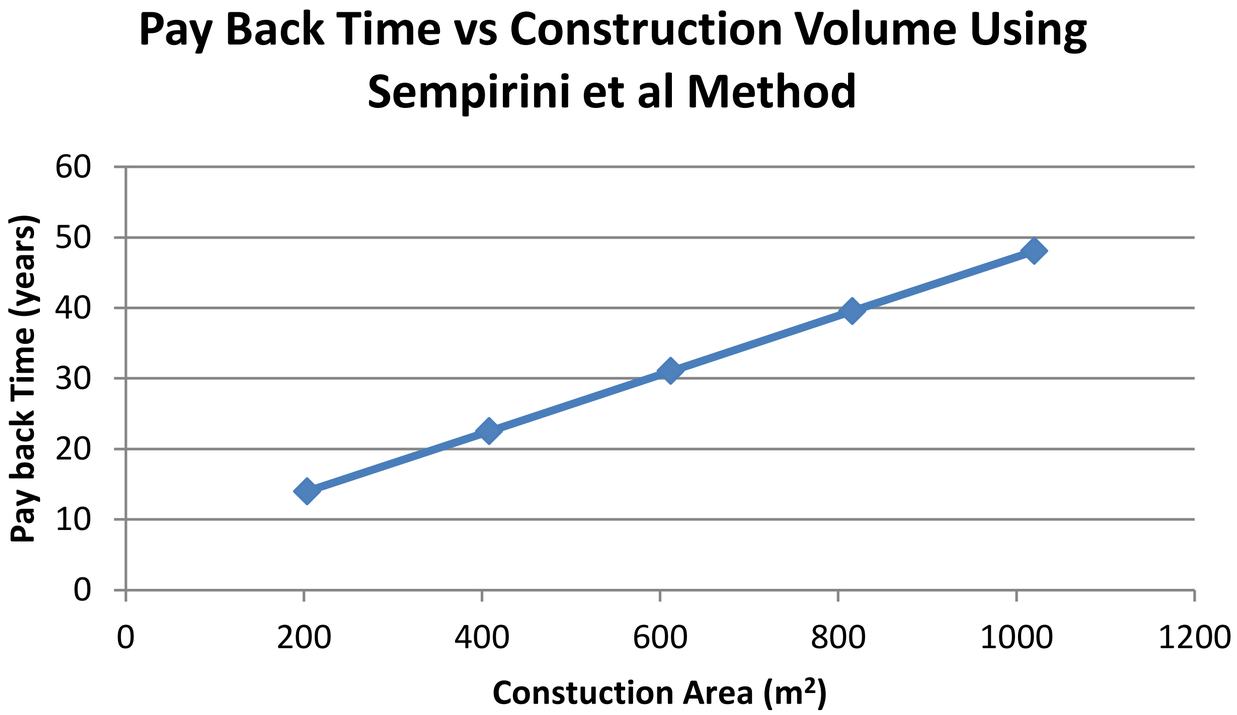
- When there is a guaranteed loan of 70,000KWD, then the feasibility is much better with a chance of loss reduced to between 21-26%

							21.66%
	Rent	Energy cost	Inflation	Budget	Bank Loan	Profit %	NPV
	5.466	0.084	0.017	128,075.085	69,999.545	0.260	-12,859.204
1	5.230	0.093	0.036	121,125.789	69,999.404	0.257	11,492.990
2	5.537	0.093	0.035	115,030.190	69,999.562	0.263	18,041.350
3	5.939	0.076	0.033	138,935.373	69,999.741	0.263	-22,844.997
4	5.177	0.080	0.055	130,123.772	69,999.444	0.258	4,642.184
5	4.851	0.082	0.045	126,117.872	69,999.556	0.267	10,778.786
6	5.089	0.110	0.041	125,629.275	69,999.767	0.259	19,654.396



FINANCIAL MODEL - Add on Business Model

- Using the Semprini et Al Add-on Business model has proven completely unfeasable for the model building, due to the expenses of electricity being completely outweighed by the cost of building



FINANCIAL MODEL - Add on Business Model - Goal Seek Analysis

- Using a goal seek analysis and cash flow method, it was found that it would take 11 floors of addition for the break even point to be feasible within 10 years

FINANCIAL MODEL - 4 Scenarios for the ABM

- 4 Scenarios are based on successful combinations found from the Scenario analysis in the first model
- Second scenario analysis is run with half floor increments in additional area and changes in construction cost/m²

FINANCIAL MODEL - 4 Scenarios for the ABM

- Scenario analysis of Scenario 1 and 2 are a failure

Scenario 1		KWD 4.120	KWD 0.050			
	0.50	1.00	1.50	2.00	2.50	3.00
KWD (69,562.39)	**102.00**	**204.00**	**306.00**	**408.00**	**510.00**	**612.00**
KWD 200.00	KWD (43,833.58)	KWD (60,289.66)	KWD (76,745.74)	KWD (93,201.81)	KWD (109,657.89)	KWD (126,113.97)
KWD 250.00	KWD (48,469.95)	KWD (69,562.39)	KWD (90,654.83)	KWD (111,747.27)	KWD (132,839.71)	KWD (153,932.15)
KWD 300.00	KWD (53,106.31)	KWD (78,835.11)	KWD (104,563.92)	KWD (130,292.72)	KWD (156,021.53)	KWD (181,750.33)
KWD 350.00	KWD (57,742.67)	KWD (88,107.84)	KWD (118,473.01)	KWD (148,838.18)	KWD (179,203.34)	KWD (209,568.51)
KWD 400.00	KWD (62,379.04)	KWD (97,380.57)	KWD (132,382.10)	KWD (167,383.63)	KWD (202,385.16)	KWD (237,386.69)
KWD 450.00	KWD (67,015.40)	KWD (106,653.30)	KWD (146,291.19)	KWD (185,929.09)	KWD (225,566.98)	KWD (265,204.87)
KWD 500.00	KWD (71,651.77)	KWD (115,926.02)	KWD (160,200.28)	KWD (204,474.54)	KWD (248,748.80)	KWD (293,023.06)

Scenario 2		KWD 4.200	KWD 0.075			
	0.50	1.00	1.50	2.00	2.50	3.00
KWD (52,297.94)	**102.00**	**204.00**	**306.00**	**408.00**	**510.00**	**612.00**
KWD 200.00	KWD (26,609.71)	KWD (43,025.21)	KWD (59,440.72)	KWD (75,856.22)	KWD (92,271.73)	KWD (108,687.24)
KWD 250.00	KWD (31,246.07)	KWD (52,297.94)	KWD (73,349.81)	KWD (94,401.68)	KWD (115,453.55)	KWD (136,505.42)
KWD 300.00	KWD (35,882.43)	KWD (61,570.67)	KWD (87,258.90)	KWD (112,947.13)	KWD (138,635.37)	KWD (164,323.60)
KWD 350.00	KWD (40,518.80)	KWD (70,843.39)	KWD (101,167.99)	KWD (131,492.59)	KWD (161,817.19)	KWD (192,141.78)
KWD 400.00	KWD (45,155.16)	KWD (80,116.12)	KWD (115,077.08)	KWD (150,038.04)	KWD (184,999.00)	KWD (219,959.96)
KWD 450.00	KWD (49,791.52)	KWD (89,388.85)	KWD (128,986.17)	KWD (168,583.50)	KWD (208,180.82)	KWD (247,778.15)
KWD 500.00	KWD (54,427.89)	KWD (98,661.58)	KWD (142,895.26)	KWD (187,128.95)	KWD (231,362.64)	KWD (275,596.33)

FINANCIAL MODEL - 4 Scenarios for the ABM

- Scenario analysis of Scenario 3 and 4 are a failure

Scenario 3		KWD 4.900	KWD 0.070			
	0.50	1.00	1.50	2.00	2.50	3.00
KWD (49,233.92)	**102.00**	**204.00**	**306.00**	**408.00**	**510.00**	**612.00**
KWD 200.00	KWD (23,900.67)	KWD (39,961.19)	KWD (56,021.70)	KWD (72,082.22)	KWD (88,142.73)	KWD (104,203.25)
KWD 250.00	KWD (28,537.04)	KWD (49,233.92)	KWD (69,930.79)	KWD (90,627.67)	KWD (111,324.55)	KWD (132,021.43)
KWD 300.00	KWD (33,173.40)	KWD (58,506.64)	KWD (83,839.89)	KWD (109,173.13)	KWD (134,506.37)	KWD (159,839.61)
KWD 350.00	KWD (37,809.77)	KWD (67,779.37)	KWD (97,748.98)	KWD (127,718.58)	KWD (157,688.19)	KWD (187,657.79)
KWD 400.00	KWD (42,446.13)	KWD (77,052.10)	KWD (111,658.07)	KWD (146,264.04)	KWD (180,870.01)	KWD (215,475.97)
KWD 450.00	KWD (47,082.49)	KWD (86,324.83)	KWD (125,567.16)	KWD (164,809.49)	KWD (204,051.82)	KWD (243,294.16)
KWD 500.00	KWD (51,718.86)	KWD (95,597.55)	KWD (139,476.25)	KWD (183,354.95)	KWD (227,233.64)	KWD (271,112.34)

Scenario 3		KWD 4.900	KWD 0.070			
	0.50	1.00	1.50	2.00	2.50	3.00
KWD (47,080.08)	**102.00**	**204.00**	**306.00**	**408.00**	**510.00**	**612.00**
KWD 200.00	KWD (22,051.11)	KWD (37,807.35)	KWD (53,563.58)	KWD (69,319.82)	KWD (85,076.06)	KWD (100,832.29)
KWD 250.00	KWD (26,687.48)	KWD (47,080.08)	KWD (67,472.68)	KWD (87,865.28)	KWD (108,257.87)	KWD (128,650.47)
KWD 300.00	KWD (31,323.84)	KWD (56,352.80)	KWD (81,381.77)	KWD (106,410.73)	KWD (131,439.69)	KWD (156,468.66)
KWD 350.00	KWD (35,960.20)	KWD (65,625.53)	KWD (95,290.86)	KWD (124,956.18)	KWD (154,621.51)	KWD (184,286.84)
KWD 400.00	KWD (40,596.57)	KWD (74,898.26)	KWD (109,199.95)	KWD (143,501.64)	KWD (177,803.33)	KWD (212,105.02)
KWD 450.00	KWD (45,232.93)	KWD (84,170.98)	KWD (123,109.04)	KWD (162,047.09)	KWD (200,985.15)	KWD (239,923.20)
KWD 500.00	KWD (49,869.29)	KWD (93,443.71)	KWD (137,018.13)	KWD (180,592.55)	KWD (224,166.97)	KWD (267,741.38)

FINANCIAL MODEL - Monte Carlo Analysis for the ABM

	Max	Min	Mean	St Dev.	RAND#
Rent	6.000	3.000	4.500	0.500	4.059
Energy cost	0.142	0.050	0.096	0.015	0.066
Inflation	6.30%	1.00%	3.65%	0.88%	4.71%
Renovation budget	150,000.000	100,000.000	125,000.000	8,333.333	125,759.004
Rent Increase	6.500	4.120	5.310	0.397	5.254
Additional Area	612.00	102.00	357.000	85.000	504.848
Cost of Area	KWD 500.00	KWD 200.00	350.000	50.000	383.990

							99.96%
	Rent	Energy Cost	Inflation	Budget	Additional Area	Cost of addition	NPV
	5.254	0.066	0.047	125,759.004	504.848	383.990	-187,414
1	5.515	0.096	0.032	119,148.496	385.014	373.044	-133,067.950
2	5.008	0.120	0.047	107,883.571	353.134	382.809	-71,171.506
3	5.404	0.091	0.041	115,471.377	403.950	383.795	-119,096.590
4	5.206	0.095	0.047	125,410.152	364.453	267.314	-79,178.922
5	5.616	0.063	0.038	122,588.752	282.397	353.038	-106,717.083
6	4.173	0.113	0.032	134,558.130	417.844	281.183	-107,665.762

FINANCIAL MODEL - Further Comments on ABM

- Through interviews it was found that ABM is also unfeasible for structural reasons
- Many of these buildings are not built as specified
- Many of these buildings are built to the “bare minimum” of structural quality
- Documentation for these buildings is often lacking
- This case study is not consistent with the Semprini case study, and the ABM Model may be better suited for much larger projects

VII: INTERVIEWS

INTERVIEWS - Method

- Using Moerman (2010) framework for conducting interviews and open ended questions
- Using Bowen's (2006) Framework for sensitizing concepts and inductive reasoning

Moerman, G. (2010). Probing behaviour in open interviews: a field experiment on the effects of probing tactics on quality and content of the received information. s.n.

Bowen, G. A. (2006). Grounded Theory and Sensitizing Concepts. International Journal of Qualitative Methods, 5(3), 12-23. doi:10.1177/160940690600500304

INTERVIEWS - Result

- Financially feasible through rent
- Question is about maximizing profits
- Models which incentivize could be more useful - such portfolio level interventions
- Currently financing exclusively through rent difference and electricity savings is feasible, but still risky at this stage
- The money is there, and the problem is more behavioural, as also concluded by Herrero & Thronton
- Tenant - Landlord conflict is not an issue in Kuwait because the landlord pays the utility while tenants pay a flat rate

Herrero, M., & Thornton, P. (2020). What can COVID-19 teach us about responding to climate change? The Lancet Planetary Health, 4(5). https://doi.org/10.1016/s2542-5196(20)30085-1

INTERVIEWS - Result

- Broader sociological issue about building culture that must be addressed pertaining to building culture

- Change in lifestyle also changed in consumer habits, this is also corroborated by Farah Al-Nakib's research on architectural history on Kuwait (2013)

- Broader political issue - this is simply not in the culture right now

- (Researcher's conclusion) General lack of sociological studies on backgrounds of how to address this

- Some properties are encouraged to use a destruction - reconstruction method of approach due to constant changes in the FAR

- It is favourable to look at the portfolio level for commercial real estate

Al-Nakib, F. (2013). Kuwait's Modern Spectacle: Oil Wealth and the Making of a New Capital City, 1950-1990. Comparative Studies of South Asia, Africa and the Middle East, 33(1).

VIII: LIMITATIONS

LIMITATIONS - Practical

- Covid-19
- Medical Issues

LIMITATIONS - Study

- Cannot predict effect of covid-19 on economy in near future
- Lack of reliable real estate data, better to do on site survey
- Fokaides method does not take into account economies of scale
- To account for uncertainty in price vs performance of renovation, a “maximum alllowable budget” was created
- Lack of interpersonal contact (Also referring to Jafar framework)
- The conclusions led to understanding that a much broader sociological study is needed to address the non-financial issues

IX: CONCLUSIONS

PESTLE Analysis

	P Political	E Economical	S Social	T Technological	L Legal	E Environmental	SUMMARY / RECOMMENDATIONS
Existing rent	**Pros / Opportunities:** - Does not need political approval - No additional changes needed for electricity costs	**Pros / Opportunities:** - By far the most feasible - Fastest Return rate - Highest NPV in the longer run	**Pros / Opportunities:** - Not incurring additional rent on the tenants	**Pros / Opportunities:** - The high NPV gives a good chance to maximize the amount of technology that can be used - Opportunity to make the building more stable	**Pros / Opportunities:** - It needs no changes to the legal framework in order to be able to be put to use	**Pros / Opportunities:** - Most feasible for environmental, highest NPV in the long run - Most likely to produce best results given that more budget is available	Financing through existing rent has proved to be the most feasible without the need for intervention in changing the price of power. This method also has the highest NPV on the long range, and highest change of NPV before and after change, however this means of financing implies an effect on the already existing income stream of an owner for the short term, which could prove as a barrier in order to move forward with this method.
	Cons / Barriers: - Using a building's existing income is not going to be a popular idea	**Cons / Barriers:** - Why renovate when there is a chance in increase in FAR? - Using existing income when it is a single owner means directly impacting their livelihood	**Cons / Barriers:** - Using owner's existing income stream, particularly for those who don't have a portfolio to lean on, does not sound	**Cons / Barriers:** - Existing infrastructure is not good	**Cons / Barriers:** - No legal precedent to doing this. Existing tenants would need to move out for the duration of the renovation	**Cons / Barriers:** - Lest likely to be adopted because of incurring short term loss for long term gain	
Financing Through Energy Savings	**Pros / Opportunities:** - Does not need political approval if not relying on changing of electricity price - No additional changes needed for electricity costs - Reduction of subsidy is an opportunity to take advnatage of	**Pros / Opportunities:** - This can be done with the removal of the subsidy	**Pros / Opportunities:** - Not incurring additional costs on tenants - The fact that the burden of utility expenses is on the owner of the building makes this more attractive	**Pros / Opportunities:** - If cooperation between private and public entities is possible, then an attractive option - Currently, Kuwait is installing new electrical usage machines to more accurately measure electricity usage in houses	**Pros / Opportunities:** - Good legal justification for this, not changing anything existing	**Pros / Opportunities:** - Most direct impact on energy savings	This is the most logical and simple approach. If possible, getting the desired NPV with energy savings is by far the most attractive way of selling the idea of financing. This method does not rely on any external factors to change in order, and is also attractive because in Kuwait the burden of utilities expenses is on the owner of the building. However, given the current subsidy this financing method is not feasible within 10 years, and is looking at something closer to 30 years for it to become feasible, which is often too long term for it to attract any owner.
	Cons / Barriers: - Relying on the government to change energy savings lead to a lot of inertia - Currently the subsidy does not make it feasible what	**Cons / Barriers:** - Currently subsidy does not make it feasible - At some point reliant on tenant behaviour for maximizing funds	**Cons / Barriers:** - Having to rely on major changes within the energy prices to make this feasible is not likely - At some point reliant on tenant behaviour for maximizing funds	**Cons / Barriers:** - Limited in budget if we are going to have a 0 NPV.	**Cons / Barriers:** - Reliance on the change of electiricy	**Cons / Barriers:** - Unlikely to be adopted due to the	
Financing Through Eneregy Savings and Rent Increase	**Pros / Opportunities:** - Does not need political approval if not relying on changin energy price	**Pros / Opportunities:** - By far the most feasible without incurring a loss on the income of the owners existing income stream - A small increase in rent leads to a large positive change in NPV	**Pros / Opportunities:** - Due to the sensitive nature of the rent, a small change would be needed to make a big difference	**Pros / Opportunities:** - There is more potential for availability in budget to achieve a high end renovation	**Pros / Opportunities:** - a combination of energy savings and rent increase means that there is a flexibility to find the best legal option	**Pros / Opportunities:** - Increased budgetary expenditure possible given that rent can be flexible	Due to the sensitivity of rent on the NPV, a small change in rent can make a big change in the feasibility. This paired with the savings in electricity can make it a more attractive offer. A small increase in rent can make it more possible to rely on smaller changes in elctricity price. However, both this and the previous model depend on changes in electricity price, and there is a huge political barrier to achieving that.
	Cons / Barriers: - Increases in rent can lead to some issues with tenants	**Cons / Barriers:** - Increases in rent unlikely.	**Cons / Barriers:** - Increases in rent could lead to some issues with tenants	**Cons / Barriers:** - Limited to the budget of what a rent increase can allow	**Cons / Barriers:** - Increase in rent could provide a threat from tenants	**Cons / Barriers:** - Limited by the amount that rent can be increased logically	
Financing Through Eneregy Savings and Rent Increase with Islamic / Regular Loan	**Pros / Opportunities:** - Posturing it as an Islamic loan would make it more popular	**Pros / Opportunities:** - By far the most feasible - Fastest Return rate - Highest NPV in the longer run	**Pros / Opportunities:** - The usage of a loan makes it easier to be able to reduce the increase in rent	**Pros / Opportunities:** - Increased NPV means more budget for technological barriers	**Pros / Opportunities:** - The loan allows for more flexibility and reduced need for increasing rent	**Pros / Opportunities:** - Increased budgetary expenditure even more possible because loan improves the NPV	While the issues are similar to the previous ones, the loan with a payback period of 10 years has been found to grealtly improve the feasibility of the renovation, reducing the probability of loss from 47% to 29%. The barrier here is firtly that loans for renovation projects are limited to 70,000KWD maximum for private owners, and that there is no guarantee that the full 70,000 KWD would be granted
	Cons / Barriers: - Increases in rent can lead to some issues with tenants	**Cons / Barriers:** - Reliant on receiving the loan	**Cons / Barriers:** - Reliant on actually receiving the loan - Loan is limited to 70,000 KWD for renovation project from the Central Bank of Kuwait - The uncertainty of whether receiving a loan of 70,000 means lower chances of success	**Cons / Barriers:** - Limited budget as far as what rent increased and changes in electricity price will allow	**Cons / Barriers:** - The risks of attaining a loan	**Cons / Barriers:** - Reliant on receiving a loan - Again limited by the logical increases possible in rent and electricity changes	
Add on Business Model	**Pros / Opportunities:** - This would be the most attractive for owners as an increase in the revenues	**Pros / Opportunities:** - Most potential for revenue increase when feasible - More likely to be attractive when a portfolio level intervention is possible	**Pros / Opportunities:** - Gives an opprotunity to create new building type, and a higher land value	**Pros / Opportunities:** - New additions provide opportunities for better technology not related to existing	**Pros / Opportunities:** - There is legal precedent for renovating and increasing FAR	**Pros / Opportunities:** - New additions can provide potentials for improving the urban environment	This is by far the most attractive in increasing the NPV provided that there is a large portfolio to deal with. There is precedent for entire buildings being demolished for an increase in FAR, and it would not seem unfeasible to suggest an add on.However, from a financial perspective, this is completely unfeasible for a small building because of the very high up front costs in actually building a building, with the case in the project requiring nearly 11 floors of additional space to make up for the costs. In addition to that, there is a huge strucutaral barrier in that the existing infrastructure in Kuwait lacks both reliable data and reliable build quality.
	Cons / Barriers: - Have to rely on municipality giving additional benefits	**Cons / Barriers:** - Up front costs of renovation very high, unfeasible for small projects	**Cons / Barriers:** - Increased build time means building will not have tenants for longer	**Cons / Barriers:** - Severe lack of data and good infrastructure in existing buildings makes this more or less unfeasible on a non portfolio level intervention	**Cons / Barriers:** - There is no legal precedent for renovating and increasing FAR of another project - This could lead to a dangerous precedent	**Cons / Barriers:** - Increased construction waste from additional building	
Using a One Stop Shop	**Pros / Opportunities:** - Does not need cooperation with the public sector - Potential to hook onto existing companies - A precedent for this is set in the "cookie cutter engineering office"	**Pros / Opportunities:** - Expert consultations could lead to best possible NPV	**Pros / Opportunities:** - Provides a soft introduction to renovation, provides everything a consumer needs in one go	**Pros / Opportunities:** - Providing synergy between parties could lead to most cost effective technologies	**Pros / Opportunities:** - No legal barriers to setting up a one stop shop	**Pros / Opportunities:** - Provides a good front for environmental education	A one stop shop is an interesting proposition, and is a good way to softly introduce the idea of renovation into the general public. However, this would not be feasible as there is very interest in it. There is an opportunity in such that there exists the idea of the one stop shop in Kuwait already, which is the engineering office, which supplies all sorts of services in one place without much effort on behalf of the client.
	Cons / Barriers: - The difficulty of it "catching on"	**Cons / Barriers:** - Why renovate when there is a chance in increase in FAR? - Using existing income when it is a single owner means directly impacting their livelihood	**Cons / Barriers:** - Social barrier of people not being cognizant enough of sustainability means	**Cons / Barriers:** - Finding the qualified people is going to be a challenge	**Cons / Barriers:** -	**Cons / Barriers:** - It will be a small movement that will require a lot of work to gain traction	
Using Private Public Partnership	**Pros / Opportunities:** - Public sector actually has a great need to do this for the easing off of the subsidy	**Pros / Opportunities:** - Power of the public sector can provide long term loans for a short period and has a positive impact on NPV - Corona crisis might pave way for Kuwait to be more cognizant of spending of public reserve funds	**Pros / Opportunities:** - Provides a good precedent for different kinds of public private opportunities	**Pros / Opportunities:** - Public funds can be used to host private enterprises for improved funds for innovation	**Pros / Opportunities:** - Can set precedent for a new legal change	**Pros / Opportunities:** - A chance to make the public sector more cognizant of these issues	A Public Private Partnership appears to be the most logical means of achieving renovation. Particularly because the public sector does in fact have a large stake in this considering how much public funds are being spent on the electricity subsidy. Pairing this with the fact that 10 year loans of 70,000 KWD has proven to be very valuable for improviing the likelihood of success in the renovation case, it makes for a compelling case to do so. Unfortunately, this has the largest barrier in which the government both has a lot of inertia in taking action and also that there is no legal precedent for this, especially considering that within Kuwait Law the public sector is always the final owner of a PPP project.
	Cons / Barriers: - Public sector unwilling to admit issue with subsidy	**Cons / Barriers:** - Corona crisis has greatly affected Kuwait's economy and reserve funds	**Cons / Barriers:** - Rampant corruption in general hinders the ability for parties to cooperate	**Cons / Barriers:** - Government generally has a lot of inertia in its action	**Cons / Barriers:** - Unlikely to have a legal change as the Kuwait Law dictates that in all private public partnerships the public sector needs to be the final owner, which does not aid in renovation	**Cons / Barriers:** - Public sector has generally not shown interest in the environment	

PESTLE Analysis - Summary

	SUMMARY / RECOMMENDATIONS
Existing rent	Financing through existing rent has proved to be the most feasible without the need for intervention in changing the price of power. This method also has the highest NPV on the long range, and highest change of NPV before and after change, however this means of financing implies an effect on the already existing income stream of an owner for the short term, which could prove as a barrier in order to move forward with this method.
Financing Through Energy Savings	This is the most logical and simple approach. If possible, getting the desired NPV with energy savings is by far the most attractive way of selling the idea of financing. This method does not rely on any external factors to change in order, and is also attractive because in Kuwait the burden of utilities expenses is on the owner of the building. However, given the current subsidy this financing method is not feasible within 10 years, and is looking at something closer to 30 years for it to become feasible, which is often too long term for it to attract any owner.

PESTLE Analysis - Summary

	SUMMARY / RECOMMENDATIONS
Financing Through Eneregy Savings and Rent Increase	Due to the sensitivity of rent on the NPV, a small change in rent can make a big change in the feasibility. This paired with the savings in electricity can make it a more attractive offer. A small increase in rent can make it more possible to rely on smaller changes in elctricity price. However, both this and the previous model depend on changes in electricity price, and there is a huge political barrier to achieving that.
Financing Through Eneregy Savings and Rent Increase with Islamic / Regular Loan	While the issues are similar to the previous ones, the loan with a payback period of 10 years has been found to grealtly improve the feasibility of the renovation, reducing the probablilty of loss from 47% to 29%. The barrier here is firtly that loans for renovation projects are limited to 70,000KWD maximum for private owners, and that there is no guarantee that the full 70,000 KWD would be granted

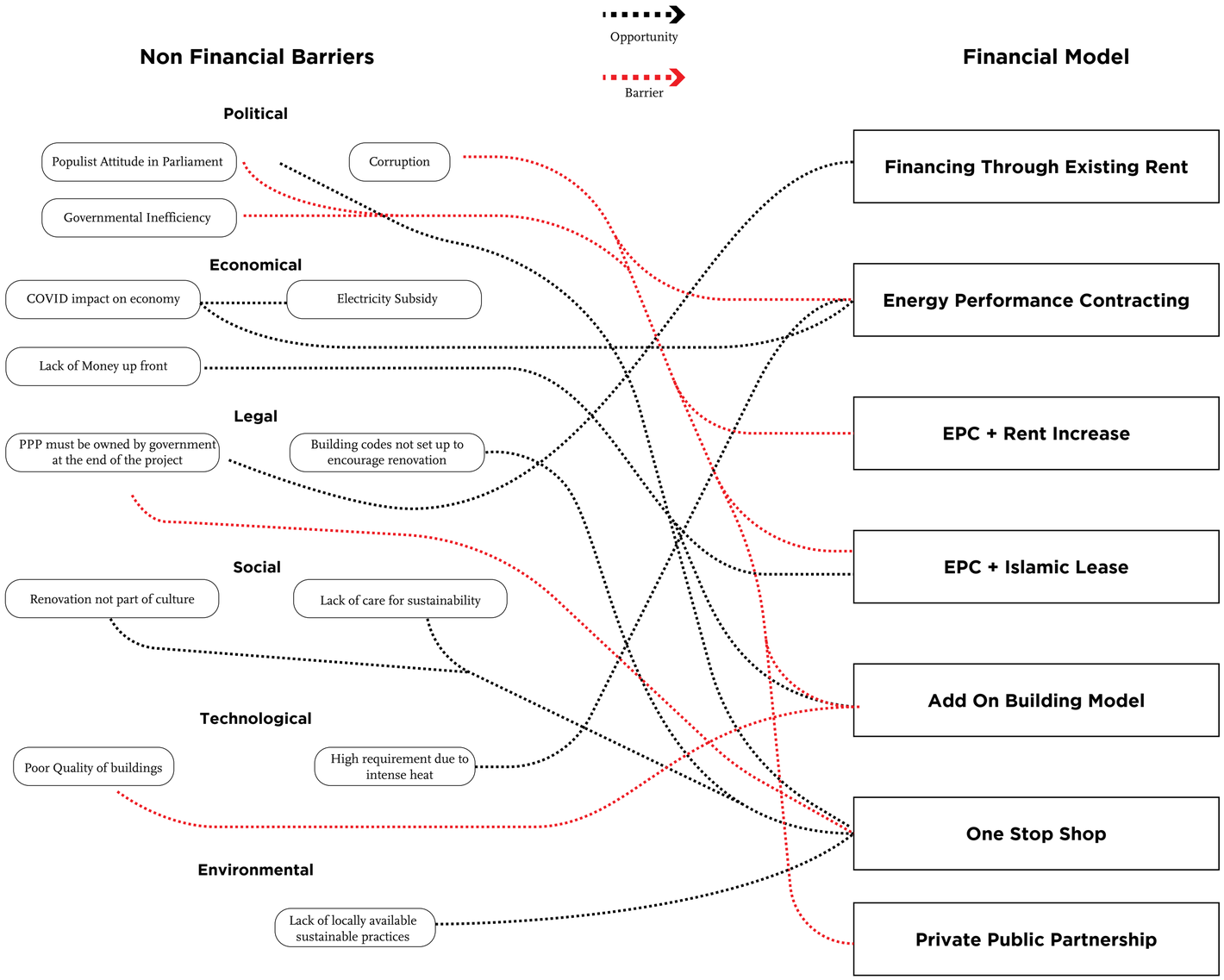
PESTLE Analysis - Summary

	SUMMARY / RECOMMENDATIONS
Add on Business Model	This is by far the most attractive in increasing the NPV provided that there is a large portfolio to deal with. There is precedent for entire buildings being demolished for an increase in FAR, and it would not seem unfeasible to suggest an add on.However, from a financial perspective, this is completely unfeasible for a small building because of the very high up front costs in actually building a building, with the case in the project requiring nearly 11 floors of additional space to make up for the costs. In addition to that, there is a huge strucutaral barrier in that the existing infrastructure in Kuwait lacks both reliable data and reliable build quality.
Using a One Stop Shop	A one stop shop is an interesting proposition, and is a good way to softly introduce the idea of renovation into the general public. However, this would not be feasible as there is very interest in it. There is an opportunity in such that there exists the idea of the one stop shop in Kuwait already, which is the engineering office, which supplies all sorts of services in one place without much effort on behalf of the client.

PESTLE Analysis - Summary

	SUMMARY / RECOMMENDATIONS
Using Private Public Partnership	A Public Private Partnership appears to be the most logical means of achieving renovation. Particularly because the public sector does in fact have a large stake in this considering how much public funds are being spent on the electricity subsidy. Pairing this with the fact that 10 year loans of 70,000 KWD has proven to be very valuable for improviing the likelihood of success in the renovation case, it makes for a compelling case to do so. Unfortunately, this has the largest barrier in which the government both has a lot of inertia in taking action and also that there is no legal precedent for this, especially considering that within Kuwait Law the public sector is always the final owner of a PPP project.

Barrier Web Diagram



Summary

- Financially feasible to implement these models, except for ABM.
- In some cases even more applicable to the Kuwait rather than Europe because burden of utilities is on the building owner
- Broader sociological problems which inhibit changes
- Focus should be on incentivizing through increasing profit, and thus when possible portfolio level interventions are preferred due to constraints of working on the object level
- Financial barriers are doable, the larger problem is the behavioural one, as stated by Herrero and Thornton (2020)

Herrero, M., & Thornton, P. (2020). What can COVID-19 teach us about responding to climate change? The Lancet Planetary Health, 4(5). https://doi.org/10.1016/s2542-5196(20)30085-1

Relevance

- Are European models applicable to this context?
- What should be done next?
- Is it feasible for Kuwait?
- How would this benefit a finance consultant?

Thank you.