Zero Energy Infantry Training Bases

6th Jeffrey Cook Workshop In Desert Architecture, Zeroplus Energy Settlements

The Department Of Engineering & Construction, MOD

Professional Authority In Engineering

Executive division – IDF & MOD

Managing 2.6 billion $ a year

Constructing 2.5 million square meters in the next few years

ZEB

Zero Energy
- **Building**
- **Base**
- **Complex**

A complex containing energetically efficient buildings whose annual energy consumption is equal or less than the renewable energy produced within it

Construction & upgrading the Infantry Training Base for the 933 Brigade

Construction of a new Infantry Training Base for 84 Brigade

Sites Position

Infantry Training Base In Numbers

80 Acres
Fenced Area

50,000 SqMt
Built Up Area

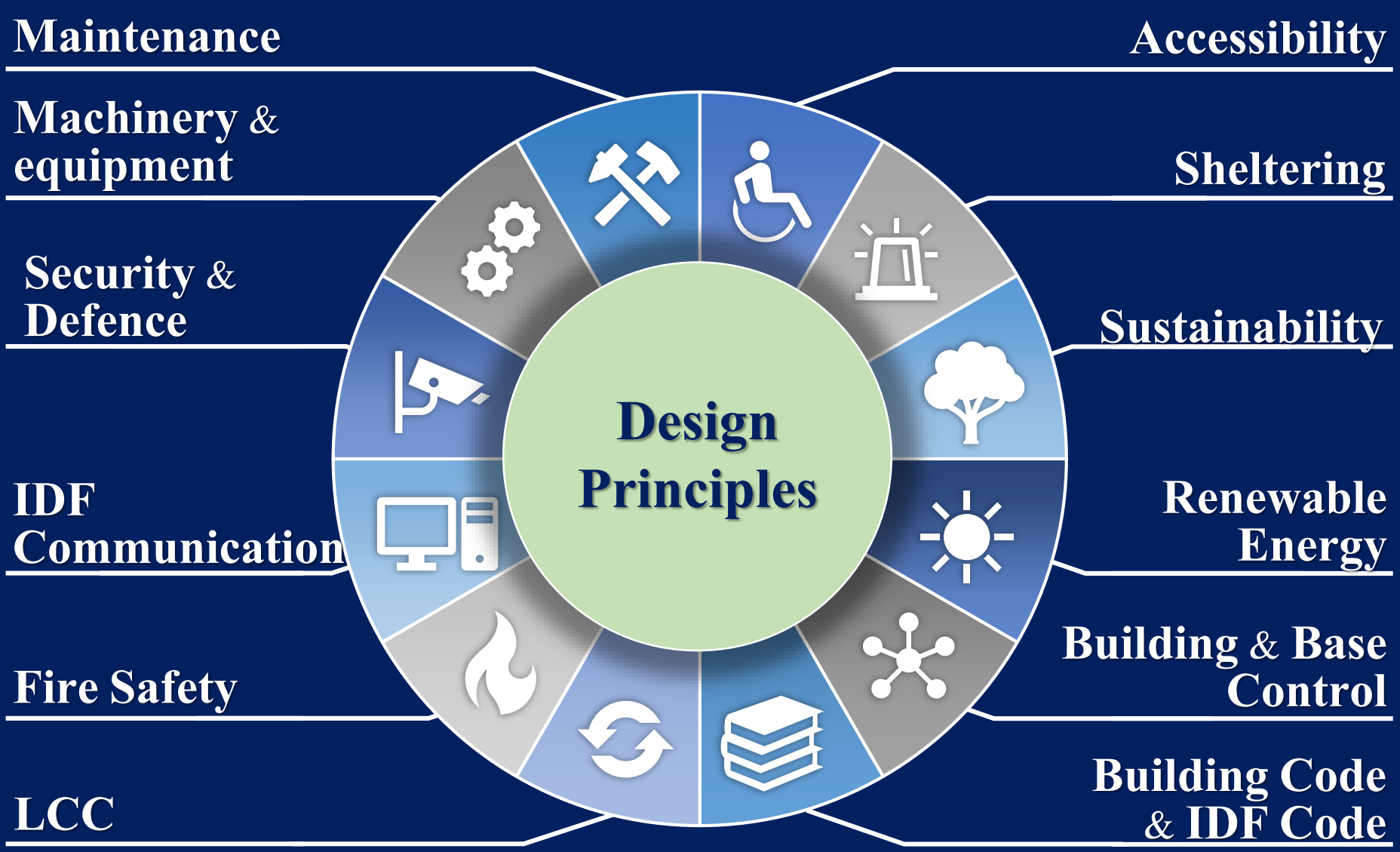
350 Staff

3,000 SqMt
Options

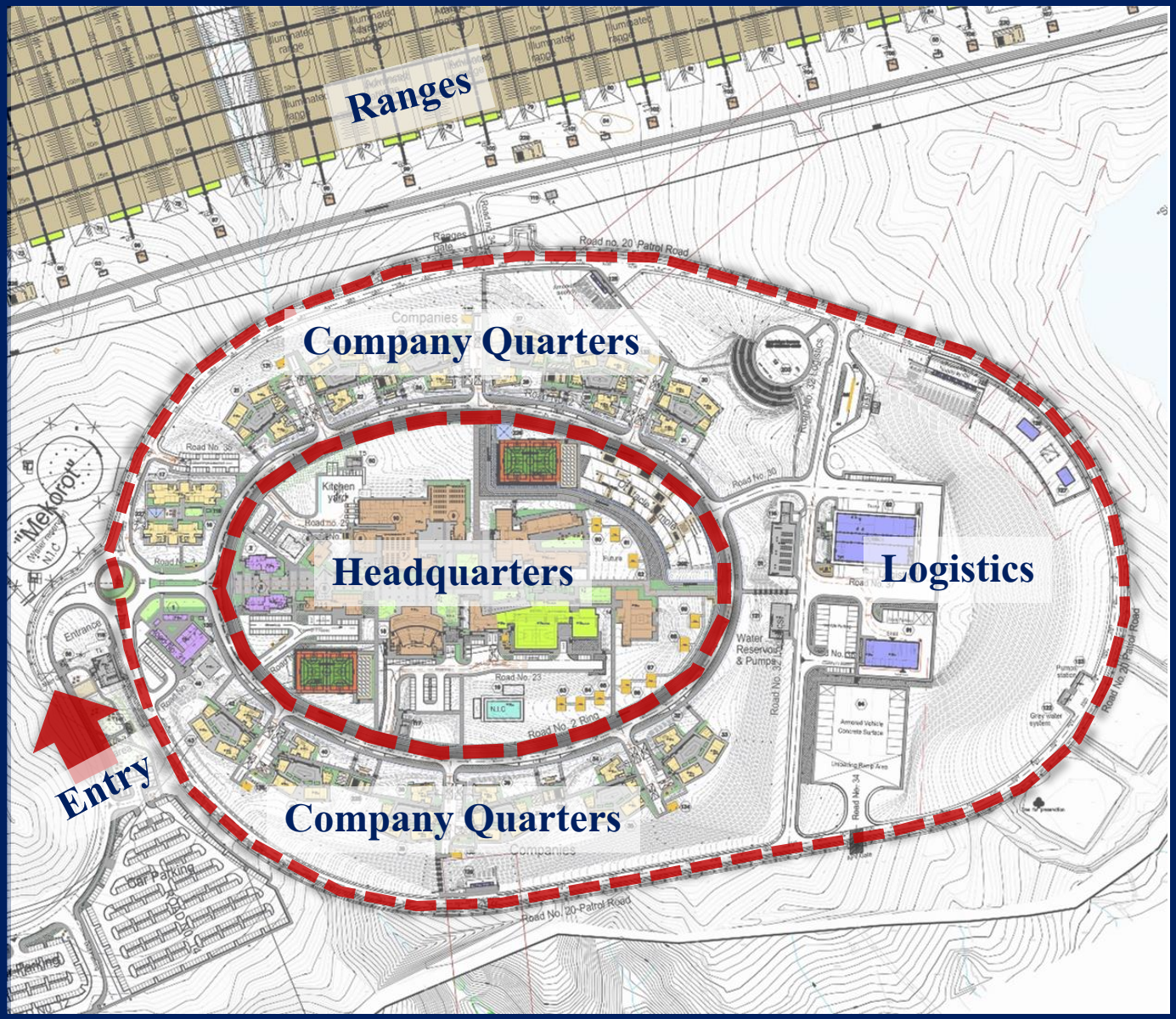
100 Acres
Ranges Area

24 Buildings,
+30
Structures

1700 Recruits


Maintenance
Machinery & equipment
Security & Defence
IDF Communication
Fire Safety
LCC
Accessibility
Sheltering
Sustainability
Renewable Energy
Building & Base Control
Building Code & IDF Code
Design Principles

84 ITB - Masterplan



- Company Quarters
- Staff Quarters
- Offices
- Synagogue
- DFAC
- Infirmary
- Training
- Simulators
- Auditorium
- Physical Training
- Logistics Centre
- Vehicle Maintenance Centre

84 ITB- Simulation

933 ITB- Simulation

Reaching ZEB - Comprehensive vision

Green Building Code

Solar Thermal System

B^2MS

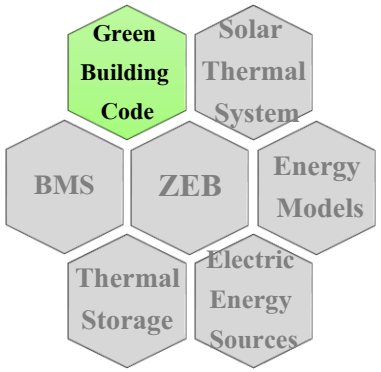
ZEB

Energy Models

Thermal Storage

Electric Energy Sources

Green Building code 5281



1. All buildings are designed to withstand an energetic rating of at least 1 star (there are also 3-star buildings)
2. The rating relates to environmental aspects, electrical installations, lighting, air conditioning, water, building control, green energy production, insulation in all components of the building, waste, recycling and more
3. Is expected to save 25-40% per building in current electricity consumption following compliance with the standard requirements

Green Building code 5281

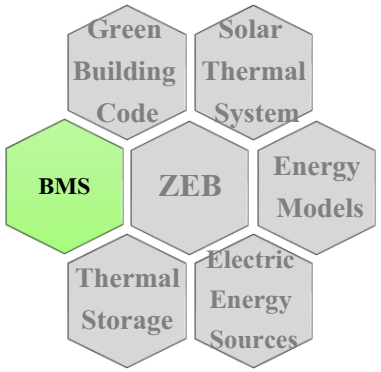
An example of a residential building, companies compunds, approved for a 3-star rating

סעיף	פרק	מגורים	נקוד מרבי	נקוד (מגיש)	נקוד (סוקר) שלב מקדמי	נקוד (סוקר) שלב א'
1	סה"כ פרק אנרגיה		38			
1.1	ביצועים אנרגטיים של הבניין		24	15.00	23.00	2.00
1.2	מערכות הבניין		14	27.50	14.00	8.00
2	קרקע		17	9.00	8.50	2.00
3	מים		13	7.50	9.00	0.00
4	חומרים		8	6.50	6.50	0.00
5	בריאות ורווחה		13	13.00	13.00	0.00
6	פסולת		3	2.00	2.50	1.50
7	תחבורה		4	0.50	0.50	0.50
8	ניהול		4	3.00	3.00	1.50
9	חדשנות			0.00	0.00	0.00
		סה"כ	100	84.00	80.00	15.50

×12

1. LED Lighting
2. BMS
3. PV, Heat Pumps
4. Night ventilation
5. Energy Center, Thermal Storage
6. Controlled outdoor lighting and full cut-off
7. Dosed showers and faucets
8. Extensive vegetation, gray water for irrigation
9. Waste and recycling points

Energy management system in buildings and base - B^2MS

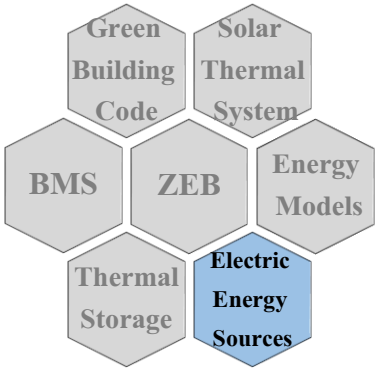


1. The base management system consists of controllers who connect to central systems (electricity, lighting, air conditioning, fuel, fire, water and sewage, irrigation, etc.) and read the data

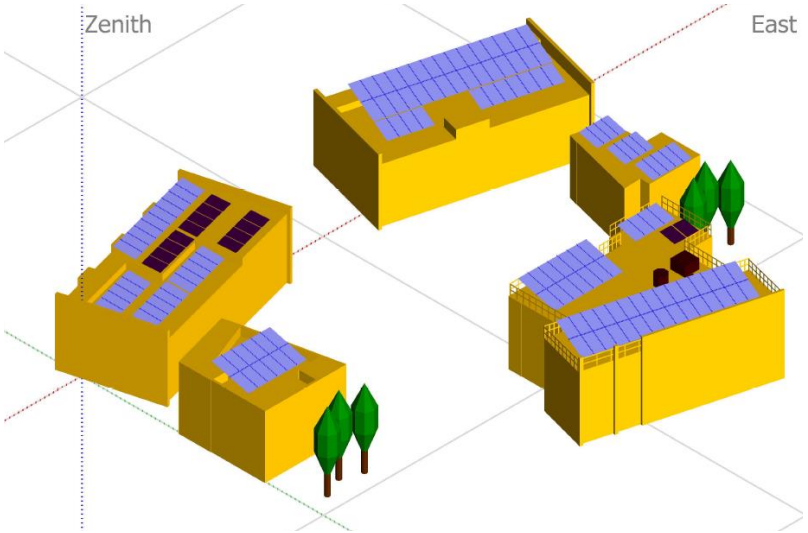
2. The system performs management in each structure including scoring, setting thresholds, bouncing alerts, generating reports, comparing similar structures, etc.

3. Micro Grid: The system performs management of energy sources, PV, generators, storage of electrical energy, thermal storage, gray water, hot water and more

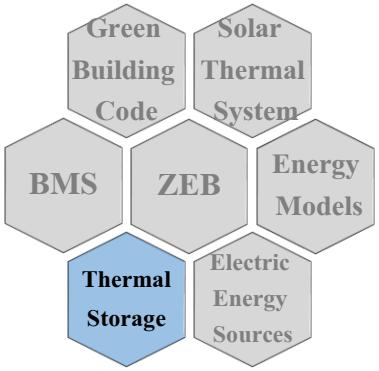
Electric Energy Sources

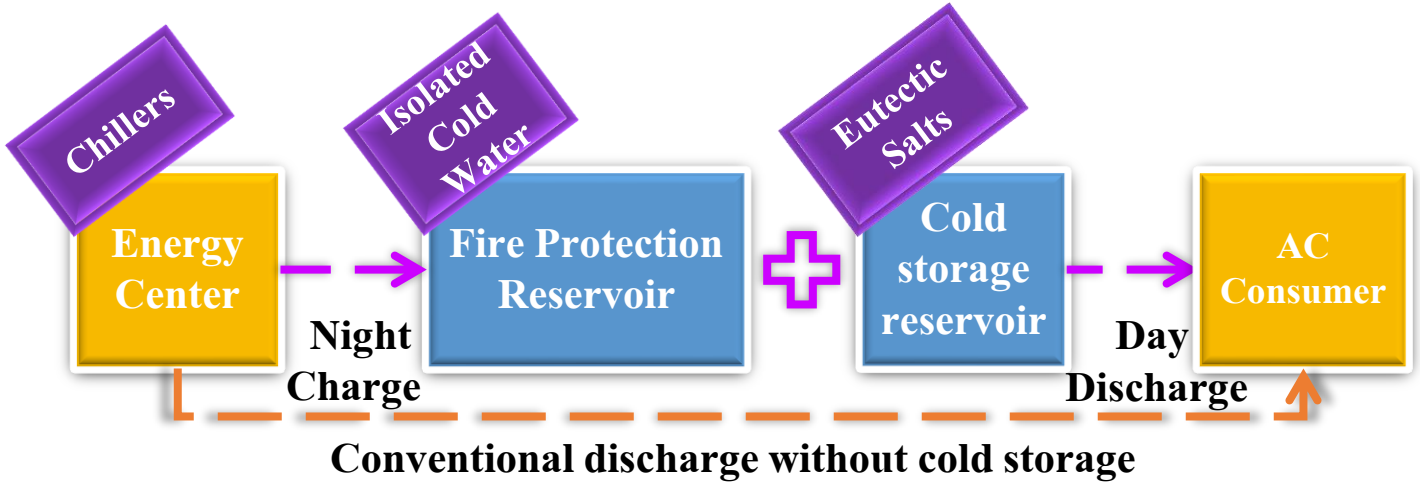


1. Production of electricity from PV installed on all rooftops above 200 square meters.
2. The peak production is about 2 MW (annual production 3,400,000 kWh)
3. An 1800 KVA generator is installed, including a smart loading system as part of the microgrid
4. Purchase of electricity from a private producer - Dorad - High voltage connection



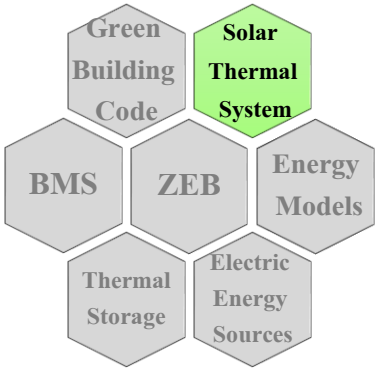
Cold storage facility for saving electricity costs for AC purposes

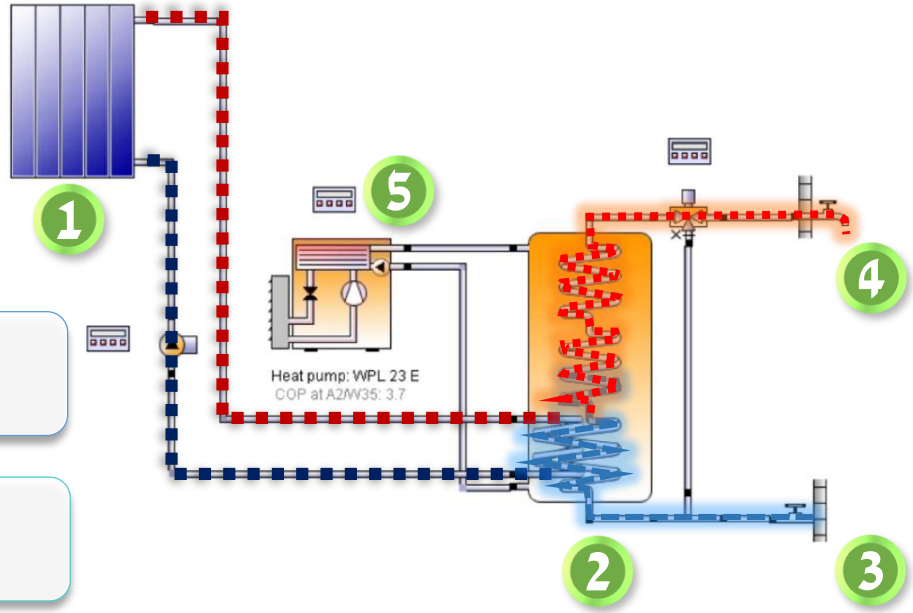




1. Loading the cold reservoir (with eutectic salts) and the fire protection reservoir at night with low cost with 2 chillers, also at weekends and from PV balances
2. Discharge of reservoirs (cold water) to the consumer at peak demand when the price is high for 5 hours or more
3. Energy saving during the high price peak (2000 tons of cooling per day, 400 tons of cooling per hour)
4. Return on investment in 5 years

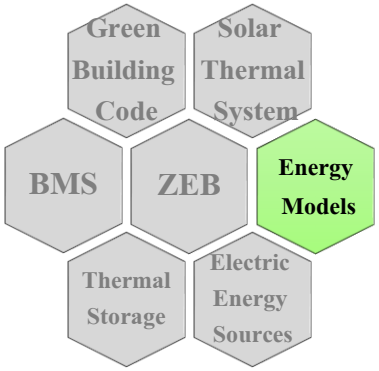
Solar thermal system for hot water (residential and DFAC)

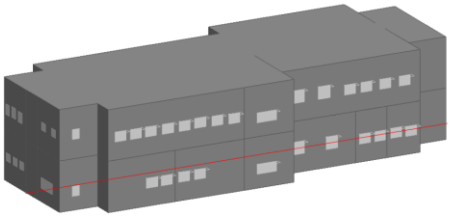


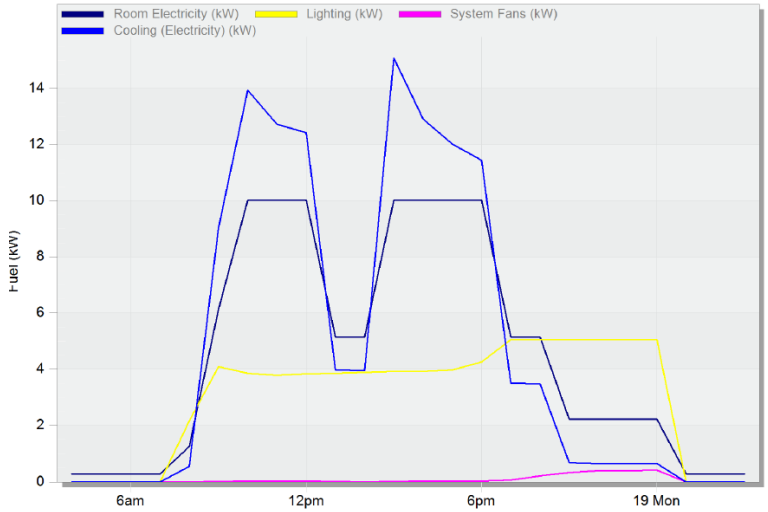


1. Thermal panels absorb sunlight during the day
2. Storage tank is heated through the Liquid which comes from the panels
3. Water for consumption is heated by the tank as a heat exchanger
4. A consumer receives hot water
5. Heat pumps work at night at low price to warm the water for the morning

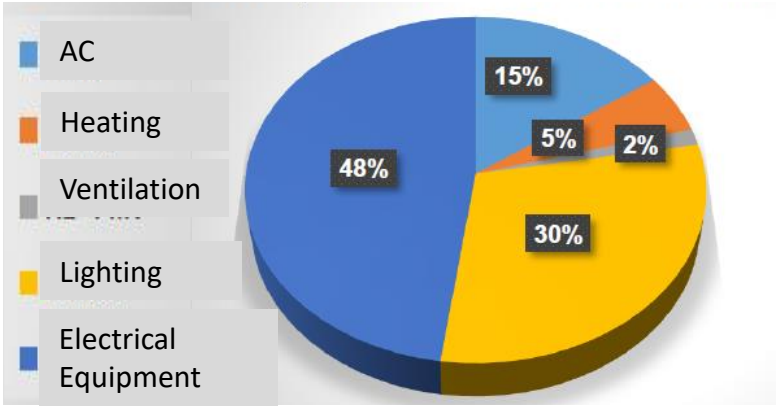
Annual energy consumption prediction models



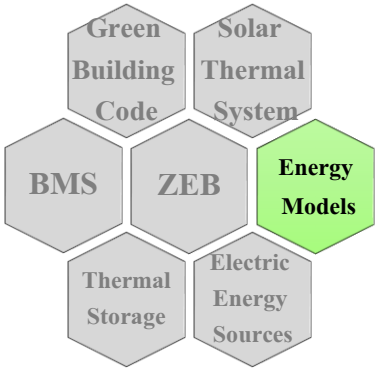


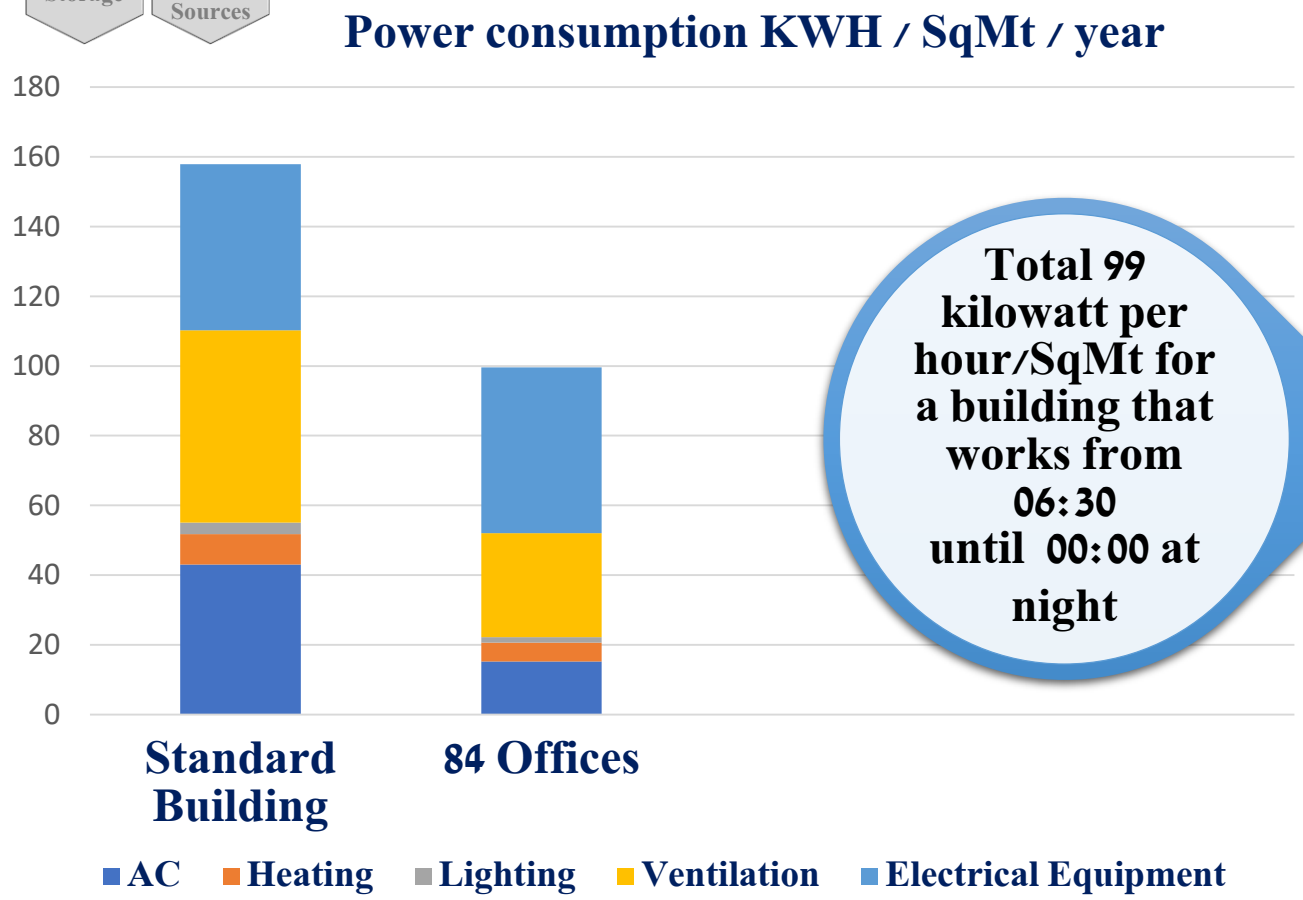


1. Each building will have an electric consumption forecasting model which considers lighting, electricity, air conditioning, fresh air, etc.
2. The model considers location in the country, planned isolation in walls, glazing, aluminium, etc.
3. In cooperation with the client, a daily consumption schedule was built with the distribution of percentages of use of buildings
4. The model predicts the required consumption throughout the year and the result can be compared to the proposed planning



Annual energy consumption prediction models





Total 99 kilowatt per hour/SqMt for a building that works from 06:30 until 00:00 at night

Efficiency of 37% of annual consumption!

84 ITB – Offices Building – general data

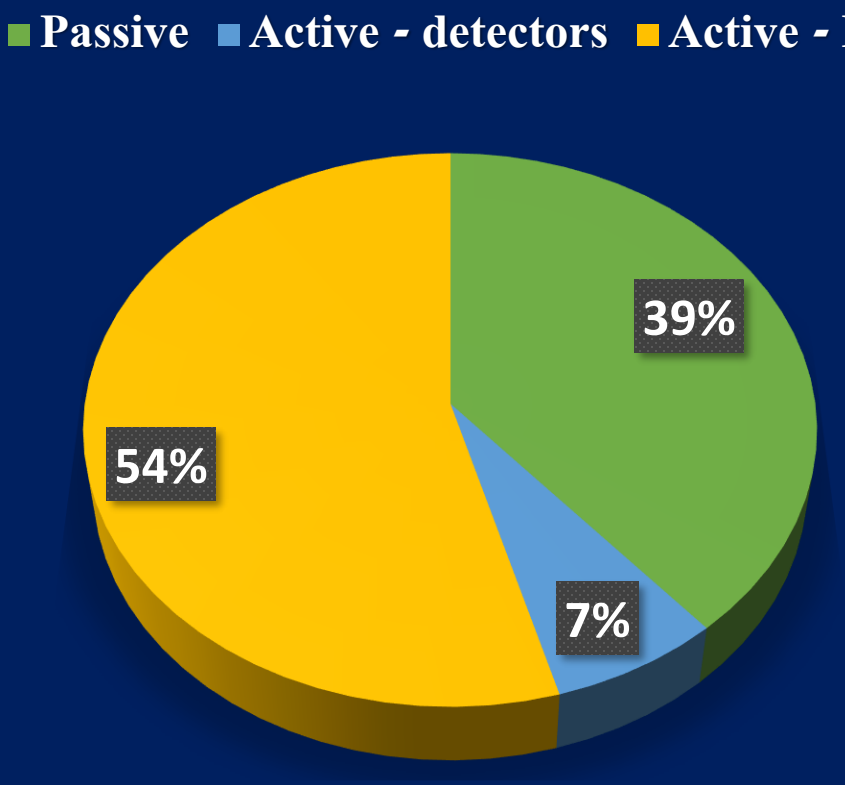
Phase 1

Gross built area (sqm)	Amount of rooms / spaces	Net available roof space (net)	Exterior Wall Area (sqm)
659 (1)	47 (2)	238 (3)	1190 (4)

Phase 2

Capacity on the roof 40.46 kwp	By amount of rooms / spaces	Shadows Insulation of walls Insulation of windows Roof insulation
Active - PV	Active – Presence detectors	Passive

Green Extras Cost Calculation

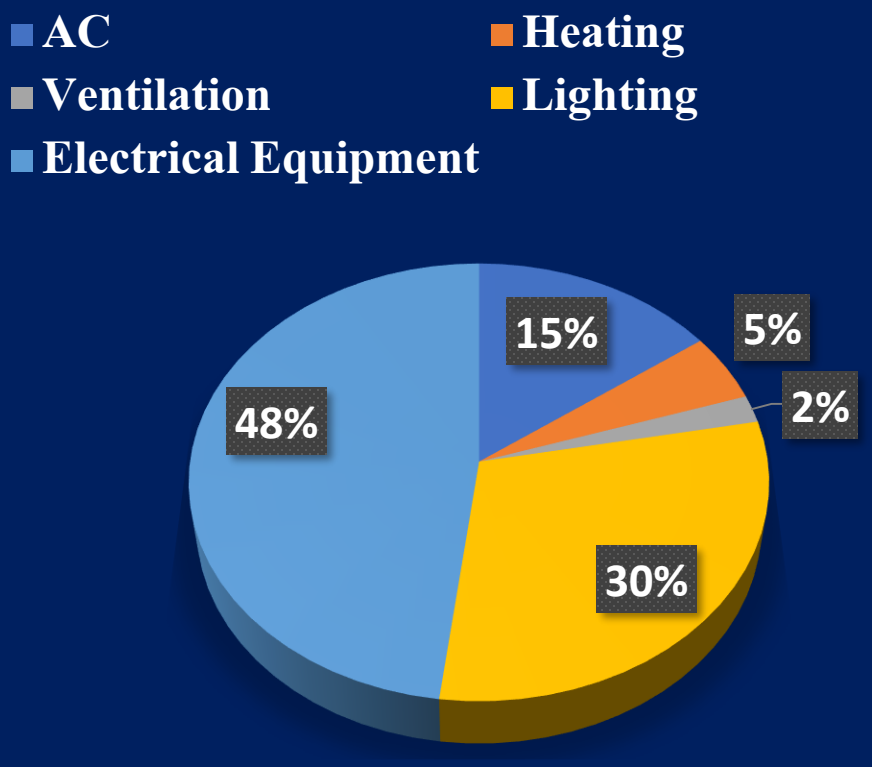


Phase 3

	With PV	Without PV
Total cost of green additions	62.6 K $	28.6 K $
Cost of additions per square meter	84.45 $	38.53 $
Construction cost addition to the MOD price list by 1,485 $ per square meter	5.7%	2.60%

Calculation Of Energy Intake

Annual Consumption Distribution By Systems



Phase 4

	Standard Buil.	Green Buil.
AC	28,348	10,017
Heating	5,741	3,588
Ventilation	2,182	992
Lighting	36,404	19,678
Electrical Equipment	31,365	31,365
Total	KWH/Year 104,041	KWH/Year 65,640

Energy Reset & ROI

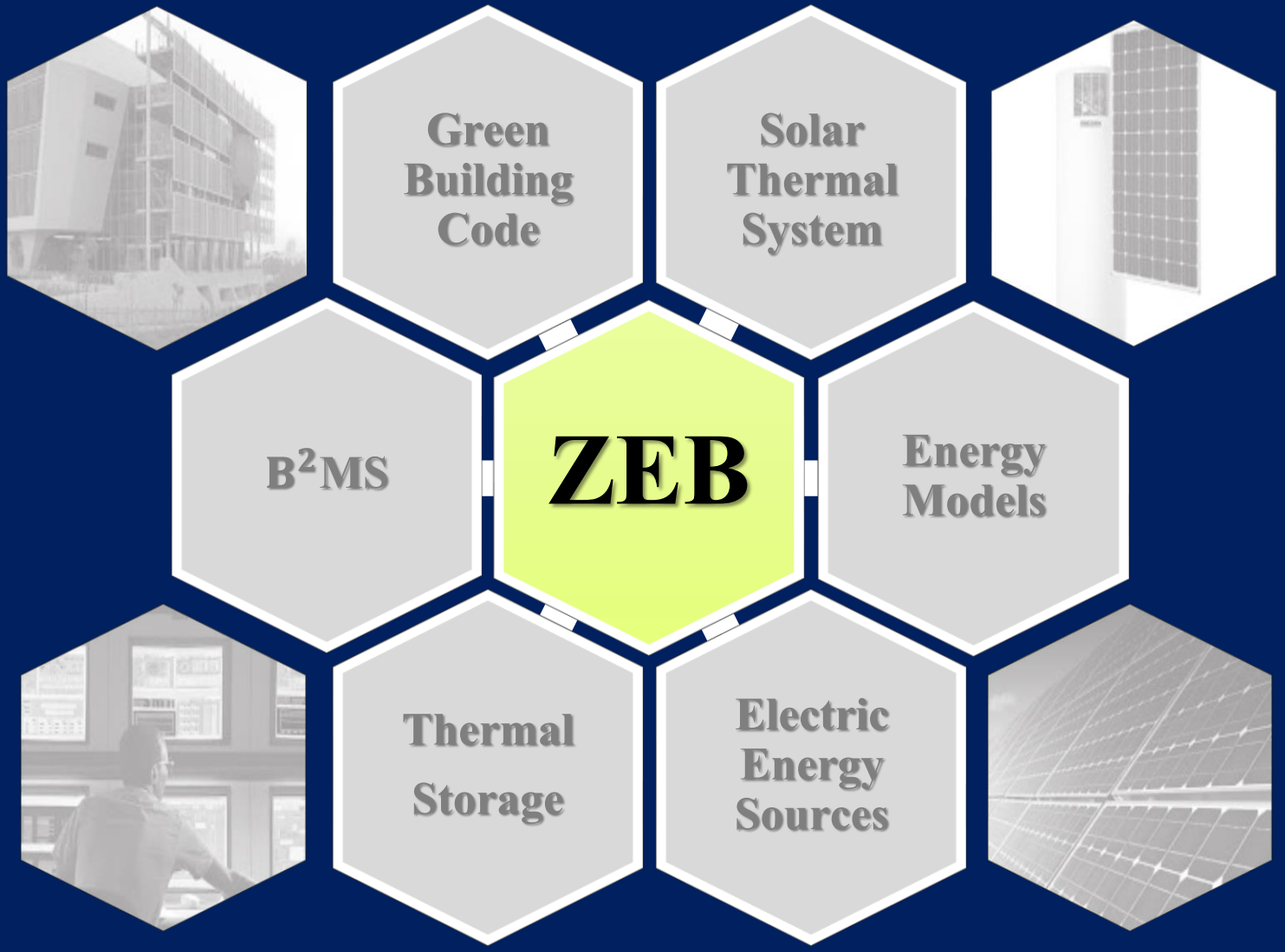
Energy reset percent standard structure - 66%

Energy reset percent green structure - 105%

ROI - 7 years

$$\frac{\text{Cost Of Green Additions}}{\text{(PV Maintenance Cost)-(Elec. Cost+Savings)}}$$

Standard Buil.	Green Buil.
Electricity Cost	
10.4 K $	6.5 K $
Savings	
3.9 K $	
Cost Of Green Additions	
62.6 K $	
Electicity Consumption	
KWH 104,041	KWH 65,040
PV Production	
KWH 68,782	


Green Building Code
Solar Thermal System
B²MS
ZEB
Energy Models
Thermal Storage
Electric Energy Sources

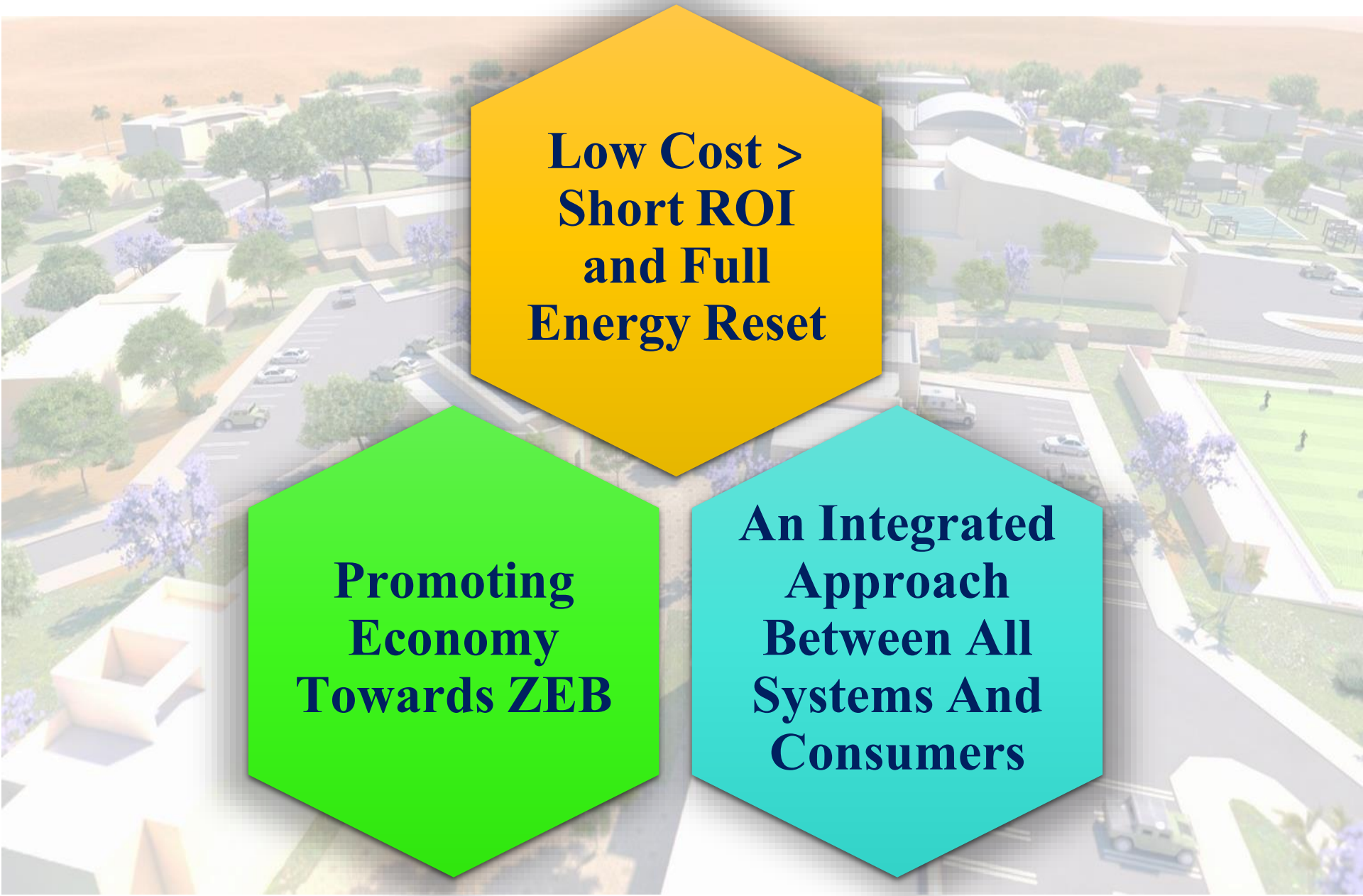
Modeling All Buildings / Interpolation Entire Base

מבנים עיקריים - מעל 200 מ"ר	סה"כ מ"ר לתחום	כמות מבנים	סה"כ מ"ר	עלות פסיבי	עלות גלאים למ"ר	עלות PV למ"ר	סה"כ עלות למ"ר	סה"כ צריכה כולל ציוד שנתי	עלות חשמל שנתית	חיסכון שנתי	ייצור PV	עלות אחזקה שנתי	אחוז איפוס	החזר השקעה בשנים
הנהלה/ כניסה	463	1	463	₪ 55,282	₪ 10,265	₪ 80,794	₪ 146,340	40,957	15,566	9,107	-	-		6
משרדים	574	1	574	₪ 68,536	₪ 12,726	₪ 100,163	₪ 181,424	50,776	19,298	11,291	-	-		6
משרדים	712	1	712	₪ 85,013	₪ 15,785	₪ 124,244	₪ 225,042	62,984	23,937	14,005	-	-		6
מרפאה	705	1	705	₪ 84,177	₪ 15,630	₪ 14,100	₪ 113,907	62,364	23,702	13,867		-		8
בית כנסת	226	1	226	₪ 26,984	₪ 5,010	₪ 4,520	₪ 36,515	19,992	7,598	4,445		-		8
הסעדה	2,992	1	2,992	₪ 357,245	₪ 66,333	₪ 522,104	₪ 945,681	264,672	100,591	58,853	-	-		6
קנטינה, מבנה ספורט ו-GYM	2,900	1	2,900	₪ 346,260	₪ 64,293	₪ 506,050	₪ 916,603	256,534	97,498	57,043	-	-		6
הדרכה	3,500	1	3,500	₪ 417,900	₪ 77,595	₪ 610,750	₪ 1,106,245	309,610	117,670	68,845	-	-		6
סימולטורים	1,500	1	1,500	₪ 179,100	₪ 33,255	₪ 261,750	₪ 474,105	132,690	50,430	29,505	-	-		6
אודיטוריום	2,225	1	2,225	₪ 265,665	₪ 49,328	₪ 388,263	₪ 703,256	196,824	74,805	43,766	-	-		6
מגורי סגל/מפקדה בנות	1,152	1	1,152	₪ 137,549	₪ 25,540	₪ 201,024	₪ 364,113	101,906	38,730	22,660	-	-		6
מגורי סגל/מפקדה בנים	1,746	1	1,746	₪ 208,472	₪ 38,709	₪ 304,677	₪ 551,858	154,451	58,701	34,344	-	-		6
פלוגות	1,549	11	17,039	₪ 2,034,457	₪ 377,755	₪ 2,973,306	₪ 5,385,517	1,507,270	572,851	335,157	-	-		6
מרט"פ	740	1	740	₪ 88,356	₪ 16,406	₪ 129,130	₪ 233,892	65,460	24,879	14,556	-	-		6
לוגיסטיקה	1,970	1	1,970	₪ 235,218	₪ 43,675	₪ 343,765	₪ 622,658	174,266	66,231	38,750	-	-		6
תאורת חוץ						₪ 210,900	₪ 210,900	140,160	42,048	36,792				6
מתקן אגירת קור (תוספת עלות לאחר קיזוז)							₪ 1,420,000			222,526		- 60,000		5
סה"כ	**38,444**	**25**		**4,590,214**	**852,303**	**6,775,539**	**13,638,056**	**3,540,916**	**1,334,535**	**1,015,511**	**3,468,000**	**103,200**	**98%**	**6**

Modeling All Buildings / Interpolation Entire Base

מבנים עיקריים - מעל 200 מ"ר	סה"כ מ"ר לתחום	כמות מבנים	סה"כ עלות	PV ייצור	עלות אחזקה שנתי	אחוז איפוס	החזר השקעה בשנים
הנהלה/ כניסה	463	1			-		6
משרדים	574	1			-		6
משרדים	712	1			-		6
מרפאה	705	1			-		8
בית כנסת	226	1			-		8
הסעדה	2,992	1			-		6
קנטינה, מבנה ספורט ו- GYM	2,900	1			-		6
הדרכה	3,500	1			-		6
סימולטורים	1,500				-		6
אודיטוריום	2,225				-		6
מגורי סגל/מפקדה בנות	1,152				-		6
מגורי סגל/מפקדה בנים	1,746				-		6
פלוגות	1,549				-		6
מרט"פ	740	1			-		6
לוגיסטיקה	1,970	1			-		6
תאורת חוץ							6
מתקן אגירת קור (תוספת עלות לאחר קיזוז)					60,000		5
סה"כ	38,444	25	4,590,214	852,303	75,539		6

Summary


Low Cost > Short ROI and Full Energy Reset
Promoting Economy Towards ZEB
An Integrated Approach Between All Systems And Consumers


THANK YOU