THE CHALLENGES OF MODERNIZATION OF BUILDINGS IN KHARKIV

UNECE 2022

LEGISLATIVE PREREQUISITES

- Laws of Ukraine "On energy efficiency of the buildings» and "On energy Efficiency" and a number of regulatory acts are the basis for the legislative basis
- The legislation is effective under business as usual scenario
- More ambitious aims for deep energy modernisation of buildings should be set by Ukraine under proposed future project scenario
- Factors causing necessity to establish tougher aims than in the legislation: expected establishing market based prices for energy sources 6 months after the war, extremely high prices for fossil fuels as a main source of energy, high energy intensity of building, low salary, deficit of working places, low expected motivation to live and work in Ukraine
- Focus should be on economic affordability of accommodations and low energy demand

ENERGY RETROFITTING FOCUS POINTS

- **Energy Demand**

This represent the thermal energy and electricity demand together. Current practice in Ukraine is addressing the thermal energy only

- **Energy Supply**

This includes energy infrastructure like electricity grid, district heating system, cooling system, gas pipelines, biomass or other renewable distribution network. Even Zero Energy Buildings will have the option to sell/buy energy at certain time via infrastructure

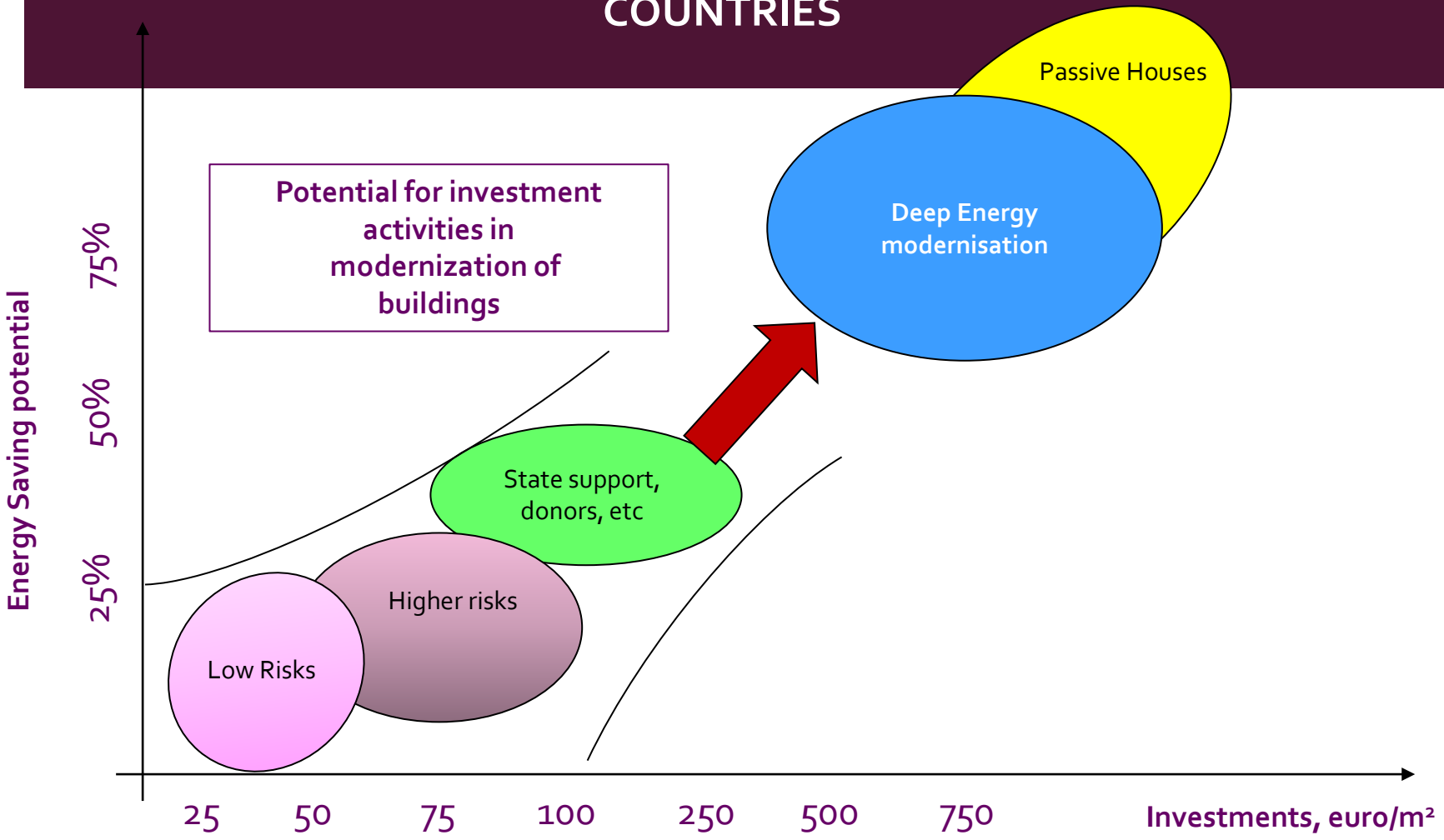
- **Renewable Energy**

Renewable energy can be generated in excess by buildings or needed to be purchased on distinguish base from the grid

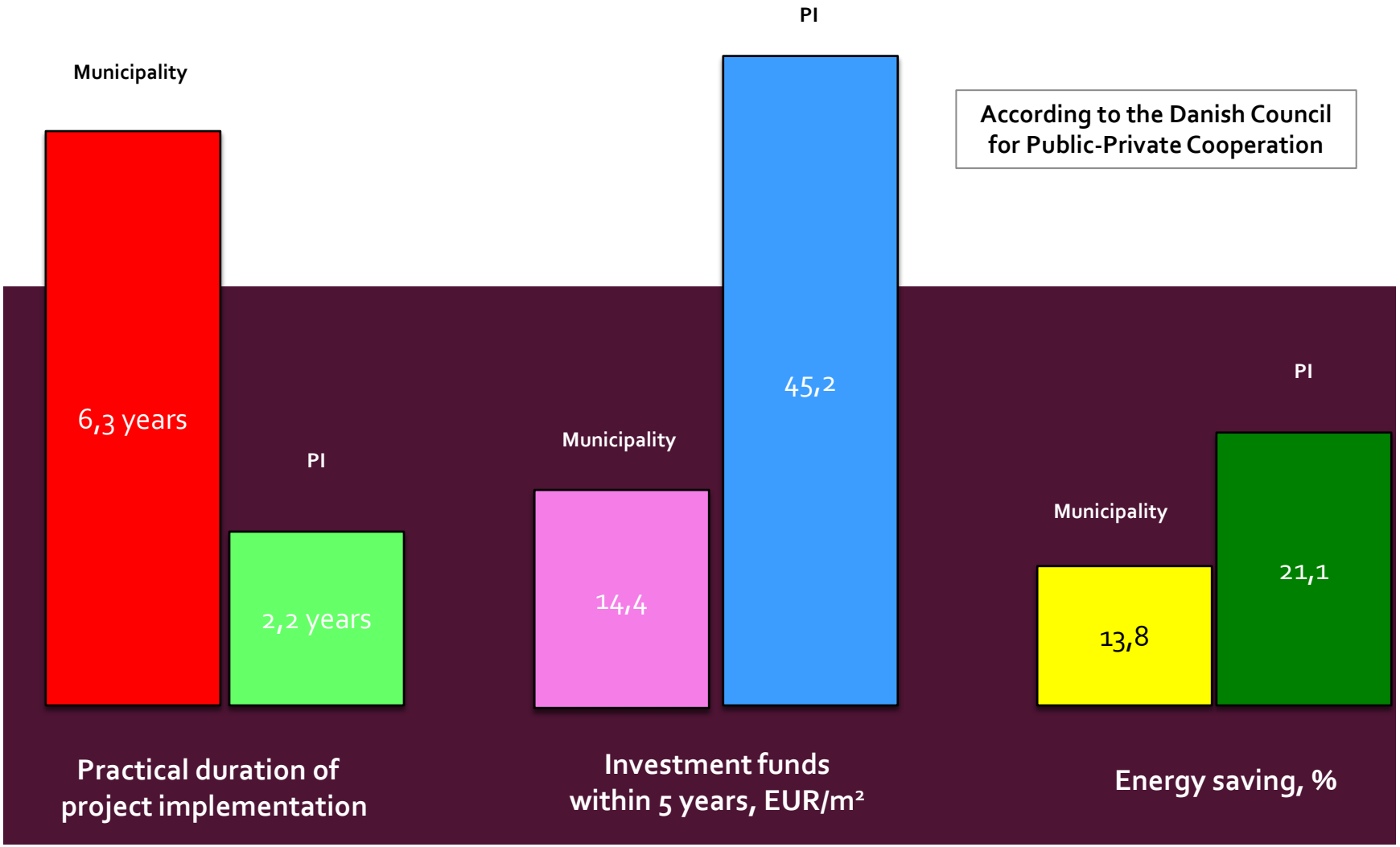
DYNAMICS OF ENERGY INTENSITY INDEX OF BUILDINGS OVER THE PAST 30 YEARS IN INDIVIDUAL EU MEMBER STATES

Country	Indicator of energy intensity of buildings before 1980	Indicator of energy intensity according to the current national standard
Denmark	Residential premises -167 kWh/m²/year	Residential premises - 52.5 kWh/m²/year+1650 KWh Office premises - 71.3 kWh/m²/year+1,650 kWh
Germany	Office premises - 71.3 kWh/m²/year+1650 kWh Schools - 210 kWh/m²/year	Thermal modernization of existing buildings - reduction of more than 40% Residential premises - 50-60 KWh/m²/year New/thermally modernized schools - 80-125 kWh/m²/year
Austria	Maximum U-values	Heating of residential buildings - max. 87.5 kWh/m² Non-residential buildings - max. 30 kWh/m²

RISK REDUCTION AND SUPPORT FROM THE STATE IS THE WAY TO INCREASE ENERGY EFFICIENCY, FOLLOWING THE EXAMPLE OF EU COUNTRIES



ADVANTAGES OF PI IN ENERGY SAVING PROJECTS



VALUE OF PRIVATE INVESTMENTS

- The value of investments can be in the best way described by the equity risk premium, that can be computed using capital asset pricing model (CAPM):

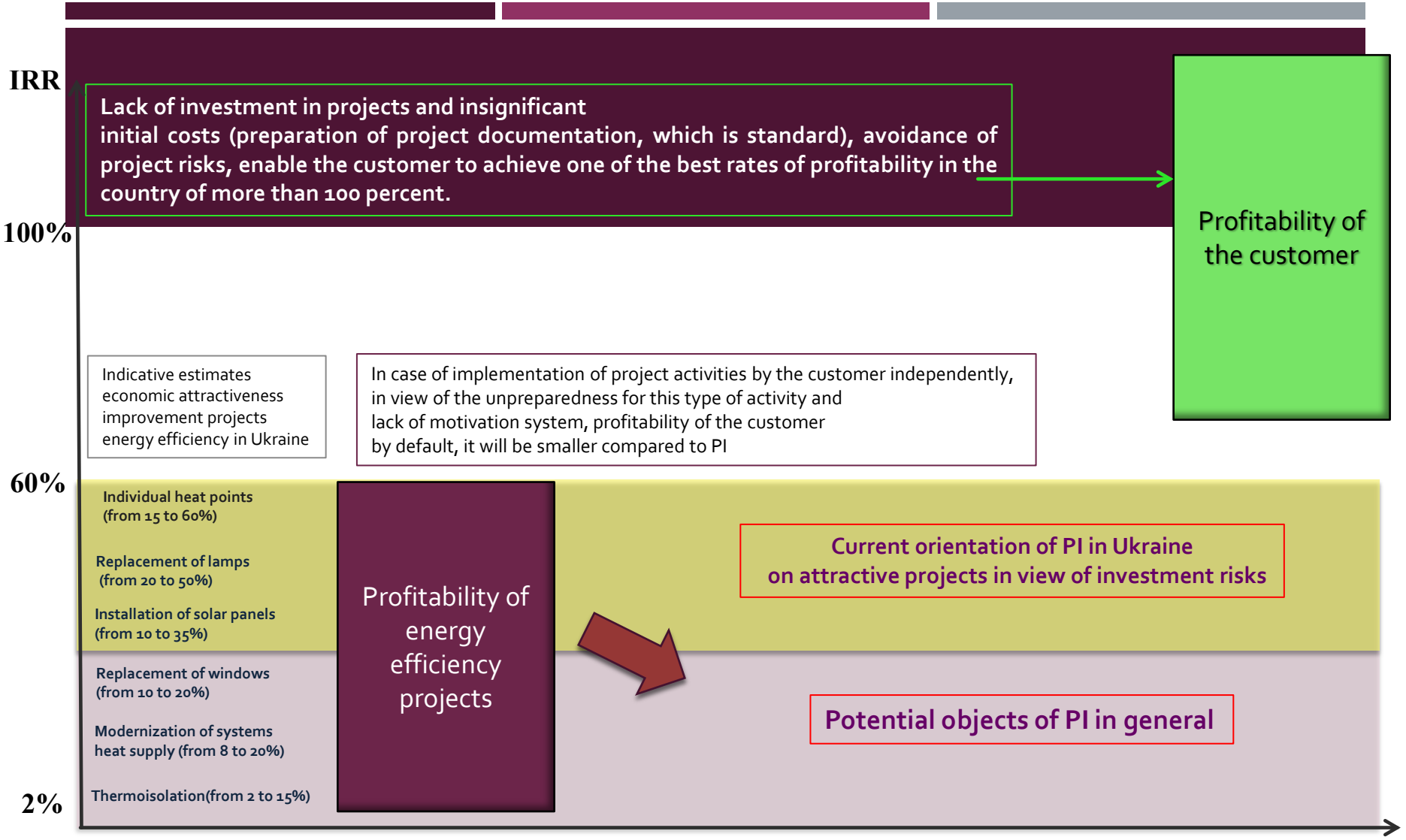
$$\textbf{CAPM (Cost of equity)} = R_f + \beta(R_m - R_f)$$

where:

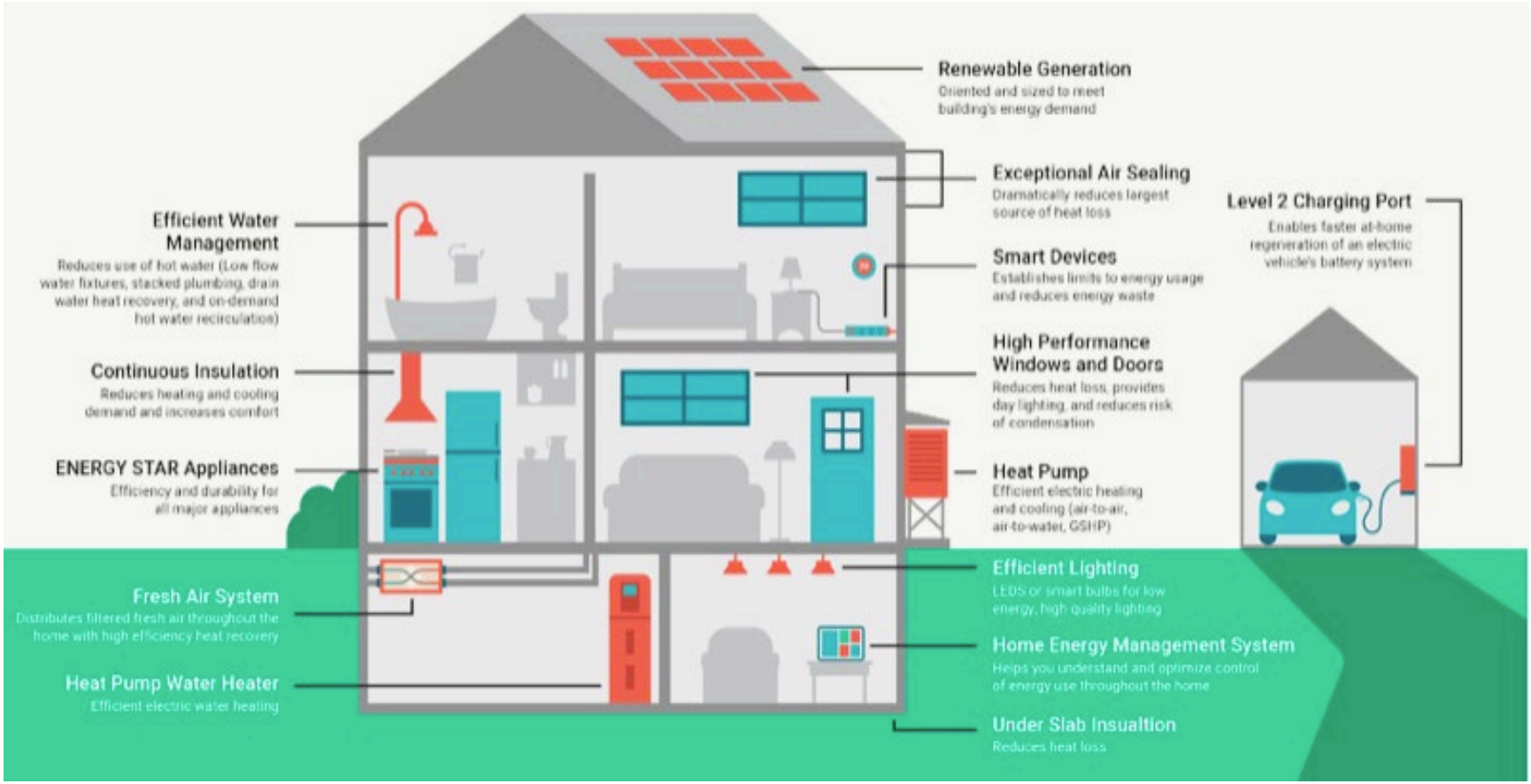
- R_f=Risk free rate of return
- β=Beta coefficient for the stock market
- $R_m - R_f$=Excess return expected from the market

- CAPM for Ukraine is in average **10,67%** as of beginning of 2022
- Private investments can be attracted only at higher rate of return.

PI ENERGY SAVINGS OPTIONS

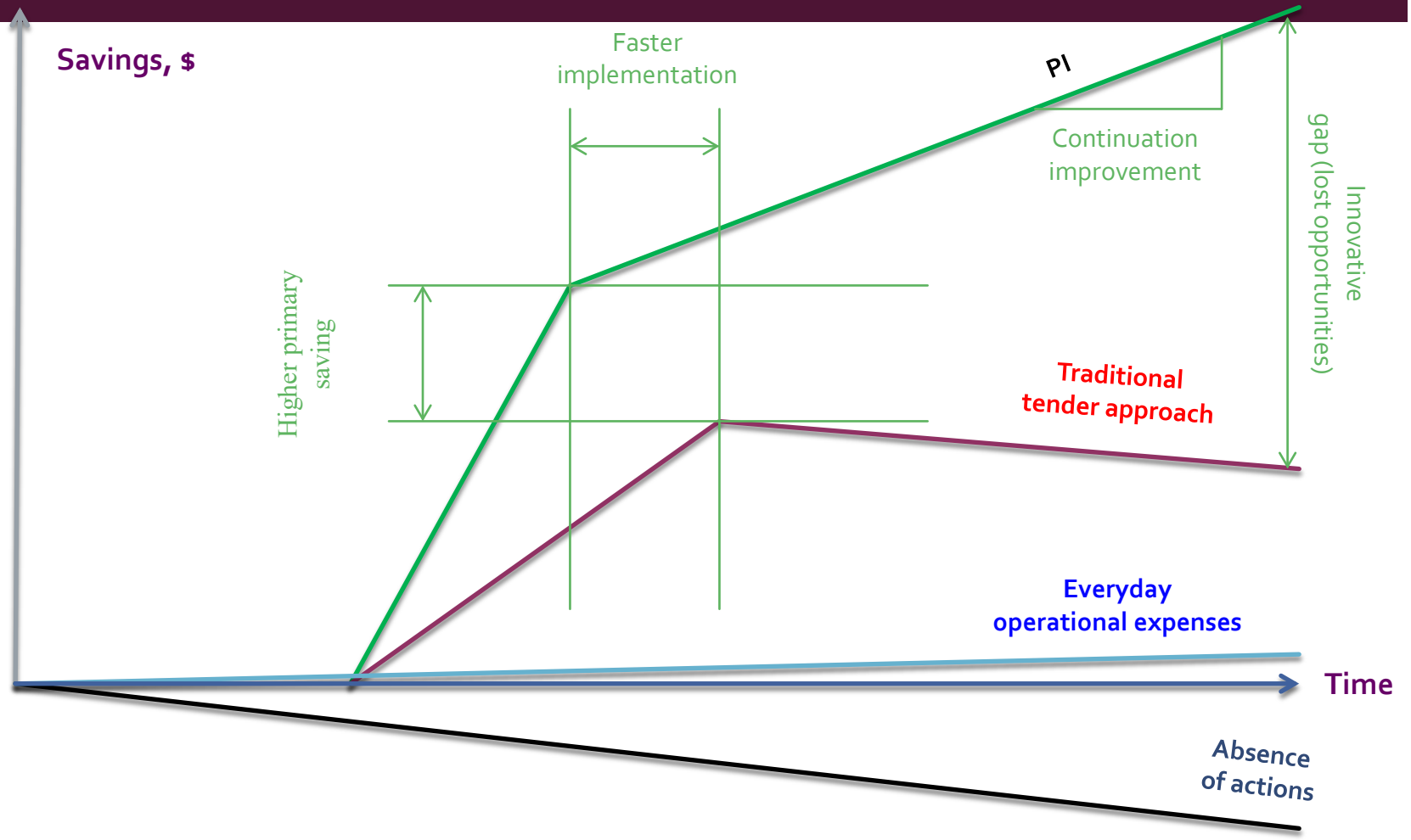


STANDARD FURTHER RECOMMENDATIONS FOR TRANSFORMING INTO ZEB



Source: Efficiency Vermont

ILLUSTRATIVE ADVANTAGES OF PRIVATE INVESTMENTS IN ENERGY SAVING PROJECTS



INDIRECT EFFECTS OF INCREASING THE ENERGY EFFICIENCY OF BUILDINGS

Direct and indirect cost reduction factors when modernizing buildings and saving 50% of primary energy (as a benchmark or target)	Impact
Maintenance costs	9-15% ↓
Professional satisfaction	27-76% ↑
Premium for rent	2-17% ↑
Employment bonus	3-18% ↑
Price premium of real estate	11-26% ↑
Employee productivity	1-10% ↑
Reduction of sick days	0-40% ↑

Source: Rocky Mountain Institute

ANALYSIS OF ENERGY EFFICIENCY IMPROVEMENT SCENARIOS FOR PUBLIC BUILDINGS ON THE EXAMPLE OF STUDIES IN THE EU

	Baseline scenario (simple thermal modernization)	New modern houses	Targetted consumption reduction by 50%	Passive houses
Reduction of consumption of primary energy resources	34%	60%	54%	70%
Economy of thermal energy	33%	68%	60%	83%
The achieved level of reduction in thermal energy consumption, KWh/m2/year	150	72	89	38
Additional investments to achieve primary energy reduction (€/m²)	200- 230	300- 330	280- 310	380- 430
Investment delta compared to the base scenario (€/m²)	-	100- 110	80- 100	180- 200
Cost reduction delta compared to the baseline scenario (€/m²yr)	-	10	7- 10	10- 14
Payback compared to the baseline scenario	-	10	10-11	14-18

Source: Oak Ridge National Laboratory

Comparison for office space with consumption of thermal energy at the level of 224 KWh/m2/year

STAGES TO PLAN ENERGY MODERNISATION OF BUILDINGS

1

Carry out a comprehensive assessment of the energy saving potential of buildings

- It requires the involvement of specialized companies to conduct such an assessment
- Measures to achieve different levels of energy consumption reductions, for example 30, 50 and 75%, should be identified

2

Estimate the cost of own and borrowed capital

- The current level for Ukraine of equity investment valuation is 10.67% in USD

3

Sort the identified projects according to the level of profitability and draw up a comprehensive plan for deep thermal modernization

- The first category of projects should include those with an IRR of more than 10.67% in USD
- Projects with lower IRR levels belong to the second and third categories

4

Involve specialised companies for the implementation of priority projects

- High-income projects with a high level of IRR should be a priority
- Customer's benefits will be maximized
- Tender procedures are needed

5

For projects with a low level of IRR, carry out an assessment of indirect benefits and avoided costs

- Evaluate reduction of CO_2, improvement of comfort in buildings, reduction of morbidity, improvement of functionality, avoidance of costs from replacing equipment, etc.

6

Develop a scheme of in-depth public-private partnership

- To form and allocate budget financing for the implementation of projects with a lower level of IRR

7

Attract donor or preferential funding from international institutions, as well as private funds

- To form mechanisms for working with funds in the direction of project implementation

8

Implement a scheme of in-depth public-private partnership

- To involve specialised companies in the implementation of long-term profitable projects with state and donor funding