Covenant of Mayors East for Climate & Energy

Energy Efficiency in the Buildings

Identification of the project

Existing buildings & Energy monitoring

Training: “Sectorial Areas of SEAP Implementation”

Tbilisi

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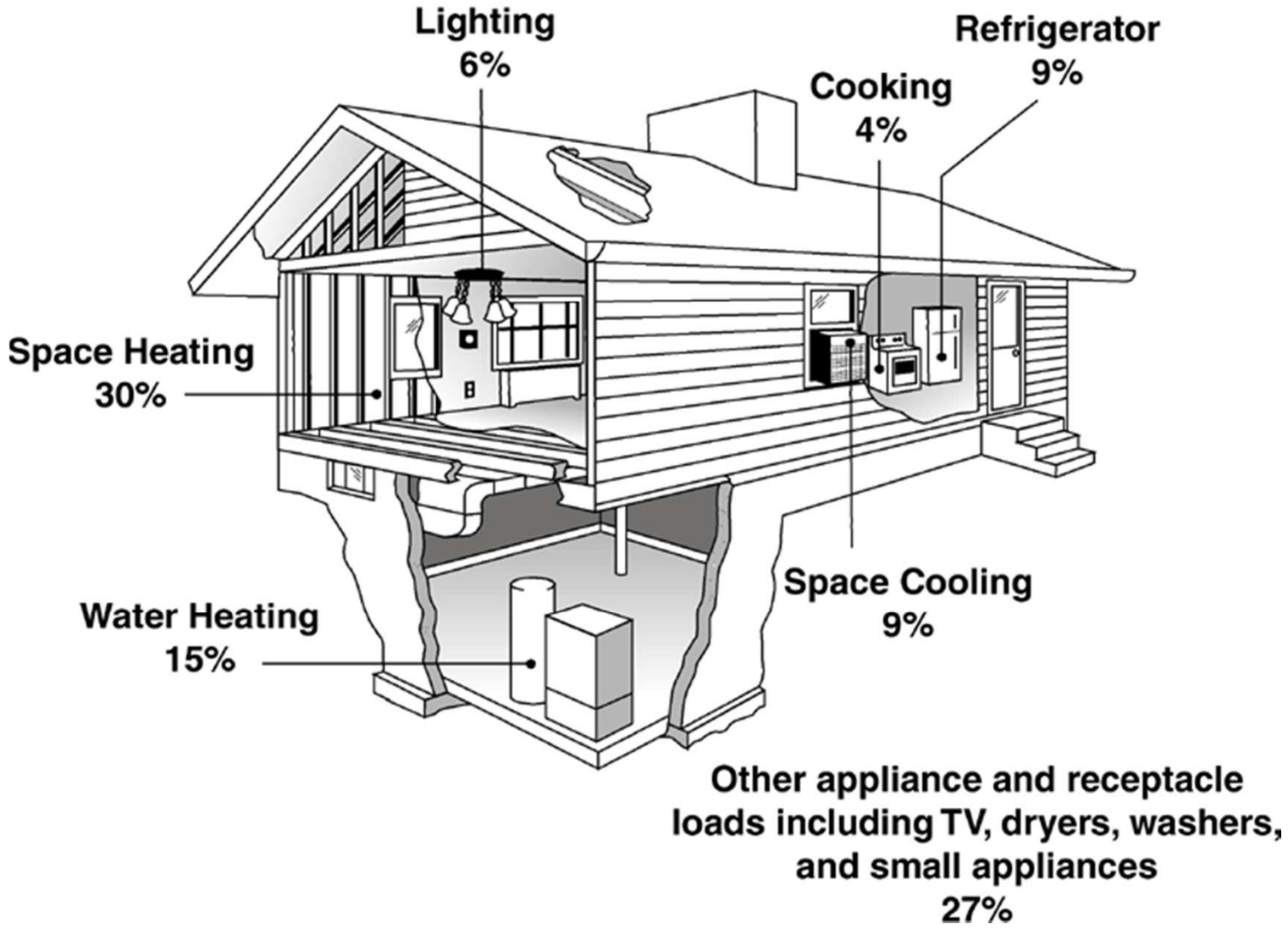
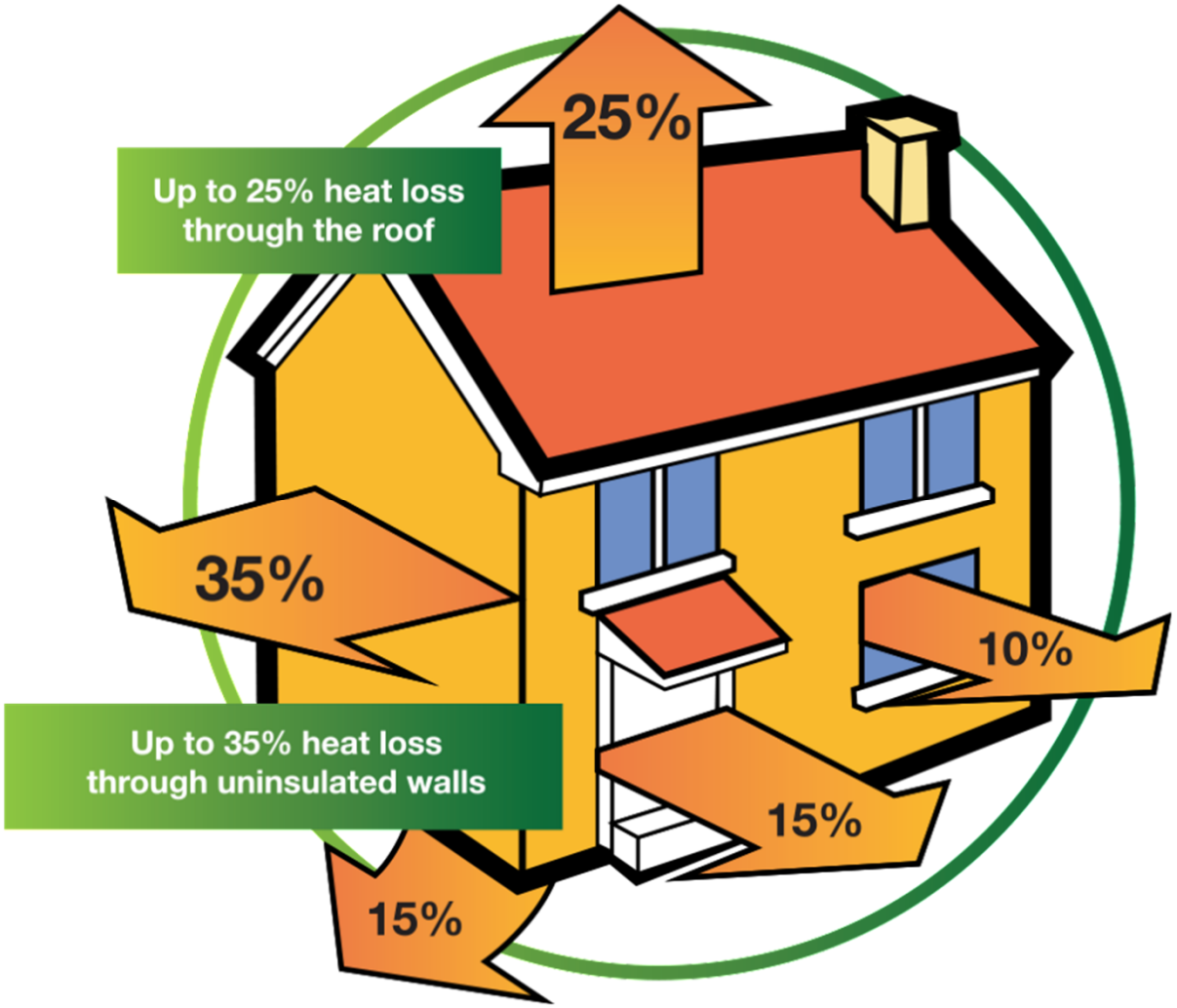
What is Energy Efficiency?

Efficient energy use, sometimes simply called **energy efficiency**, is the goal to reduce the amount of energy required to provide products and services. For example, insulating a home allows a building to use less heating and cooling energy to achieve and maintain a comfortable temperature.

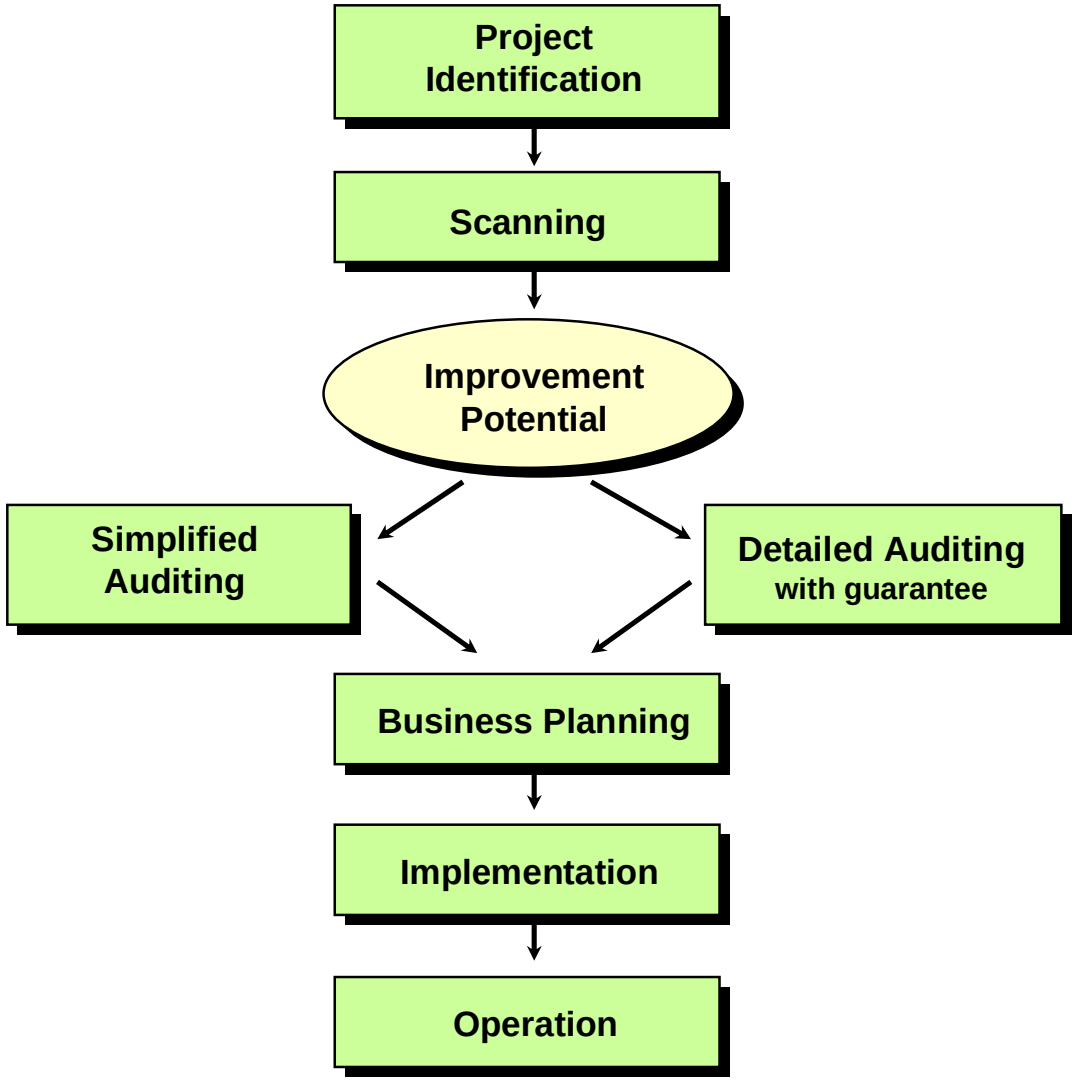
Energy Use in Typical Houses



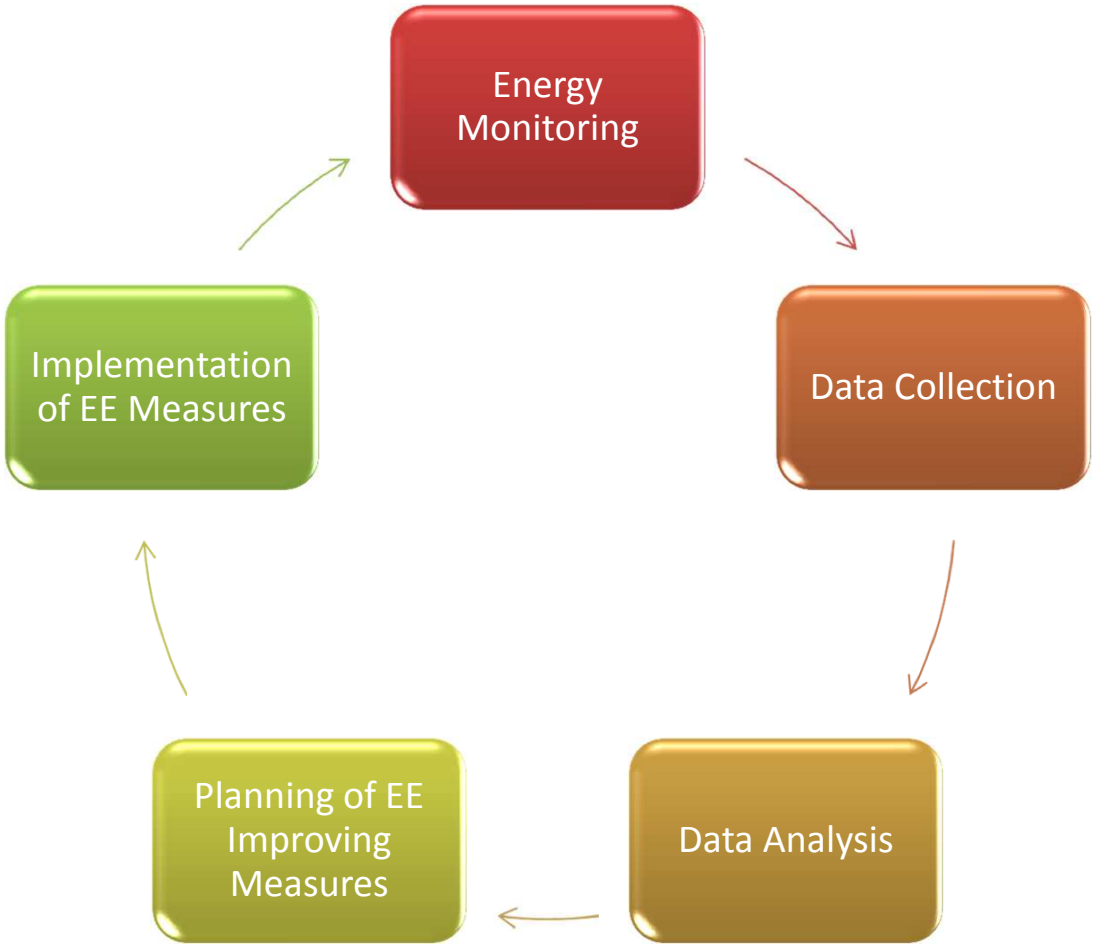
Heat Losses from Building Envelope



Project Development Process



Energy Management



Collecting data

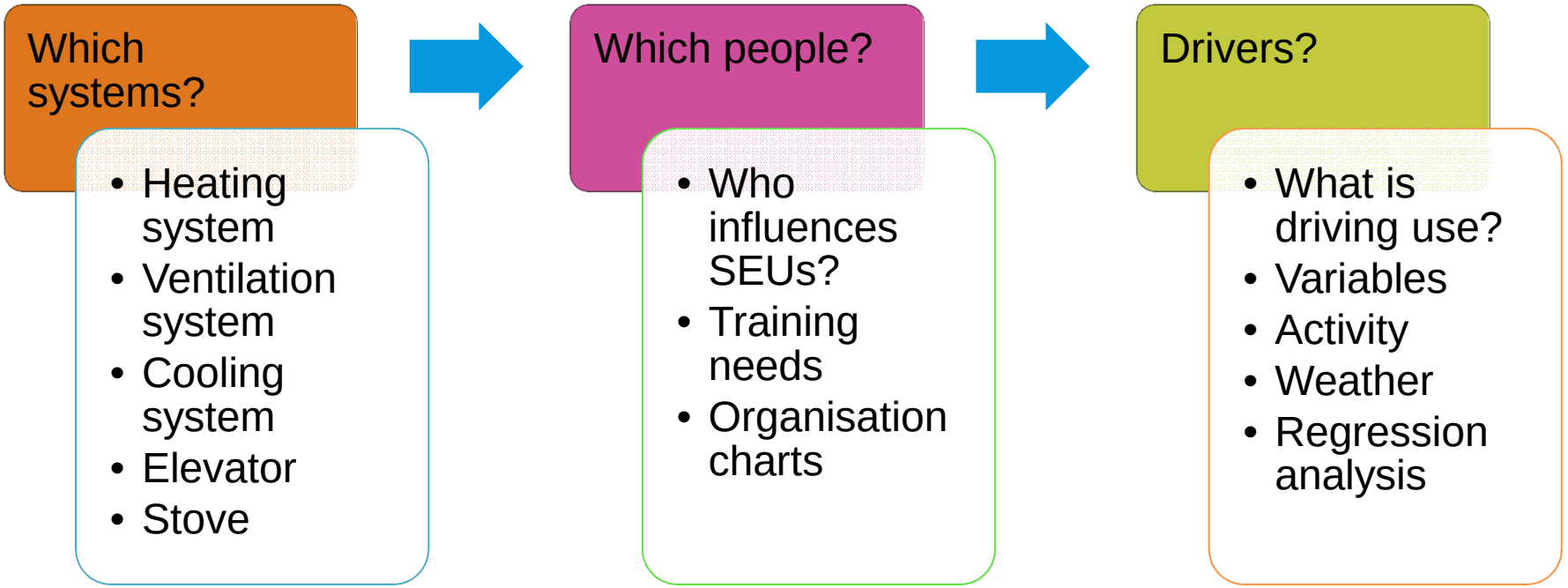
- What data do we have?
- What data do we need?
- Building energy sources? Electrical, natural gas, propane, etc..?
- What facilities, systems or equipment are using energy?
- Building total heating area [m^2]?
- Building total heating volume [m^3]?
- Year of Construction [general condition of the building]?
- Location [climate zone - degree days]

- How much energy are we consuming?
- How much did we consume in the past?
- What are energy consumption trends for the future?

Analyze Energy Use & Consumption

- **Collect past and current monthly consumption** data at the facility level (energy bills).
- Determine **what other data** may be **available**.
  - Sub-meter data
  - Interval data
  - Equipment information
  - Other data
- Analyze **past** and **current** annual **consumptions**

Significant energy uses

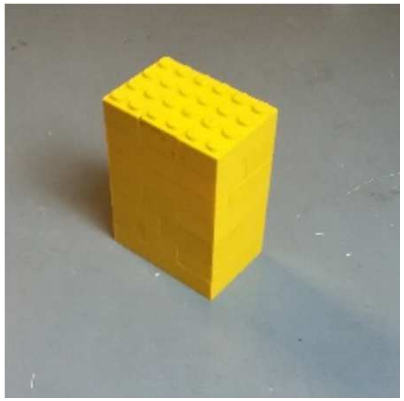
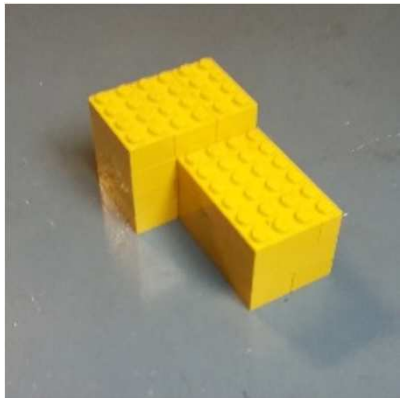
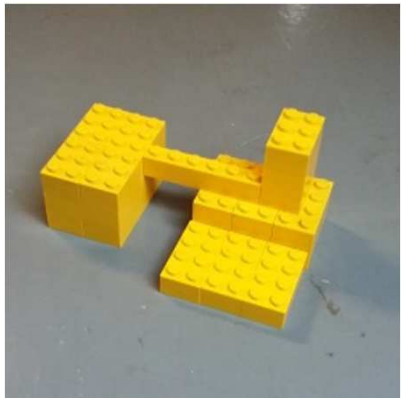
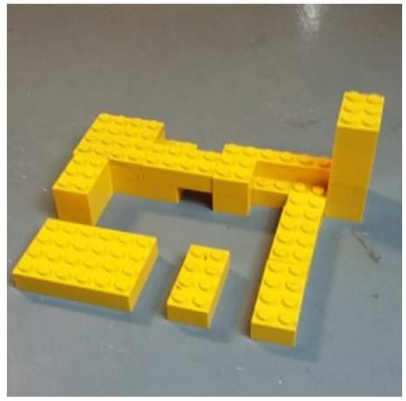


Main indicators of building energy performance

- Specific Energy Consumption by area [kWh/m^2]
- Specific Energy Consumption by users [kWh/person]
- Quantity of Beneficiaries [number of workers, staff, inhabitants, visitors, etc..]
- Specific Hot Water Consumption by area [L/m^2]
- Specific Hot Water Consumption by person [L/person]

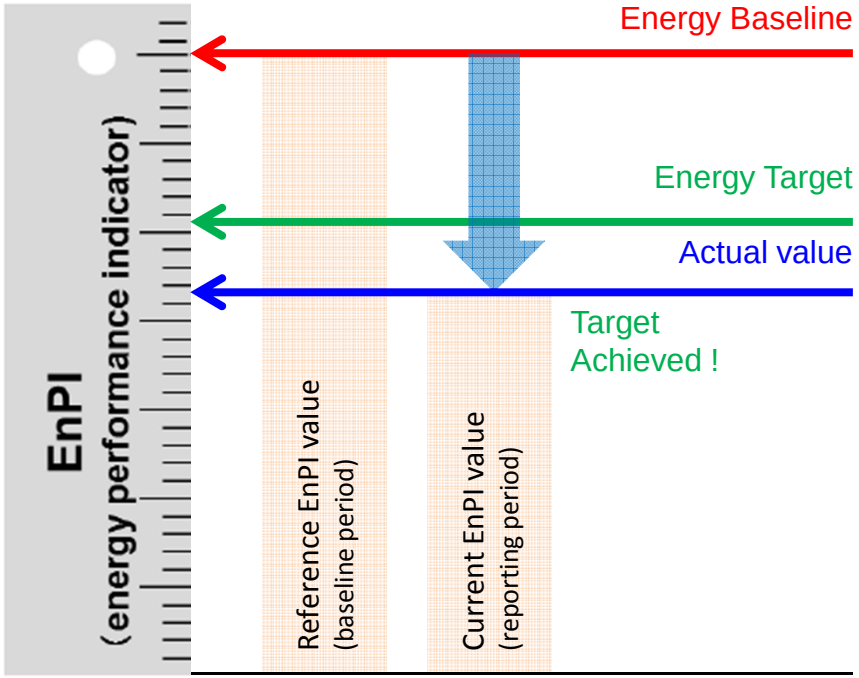
Energy per m^2?

- Same volumes
- Same floor area
- Different functionality
- Very different energy needs!

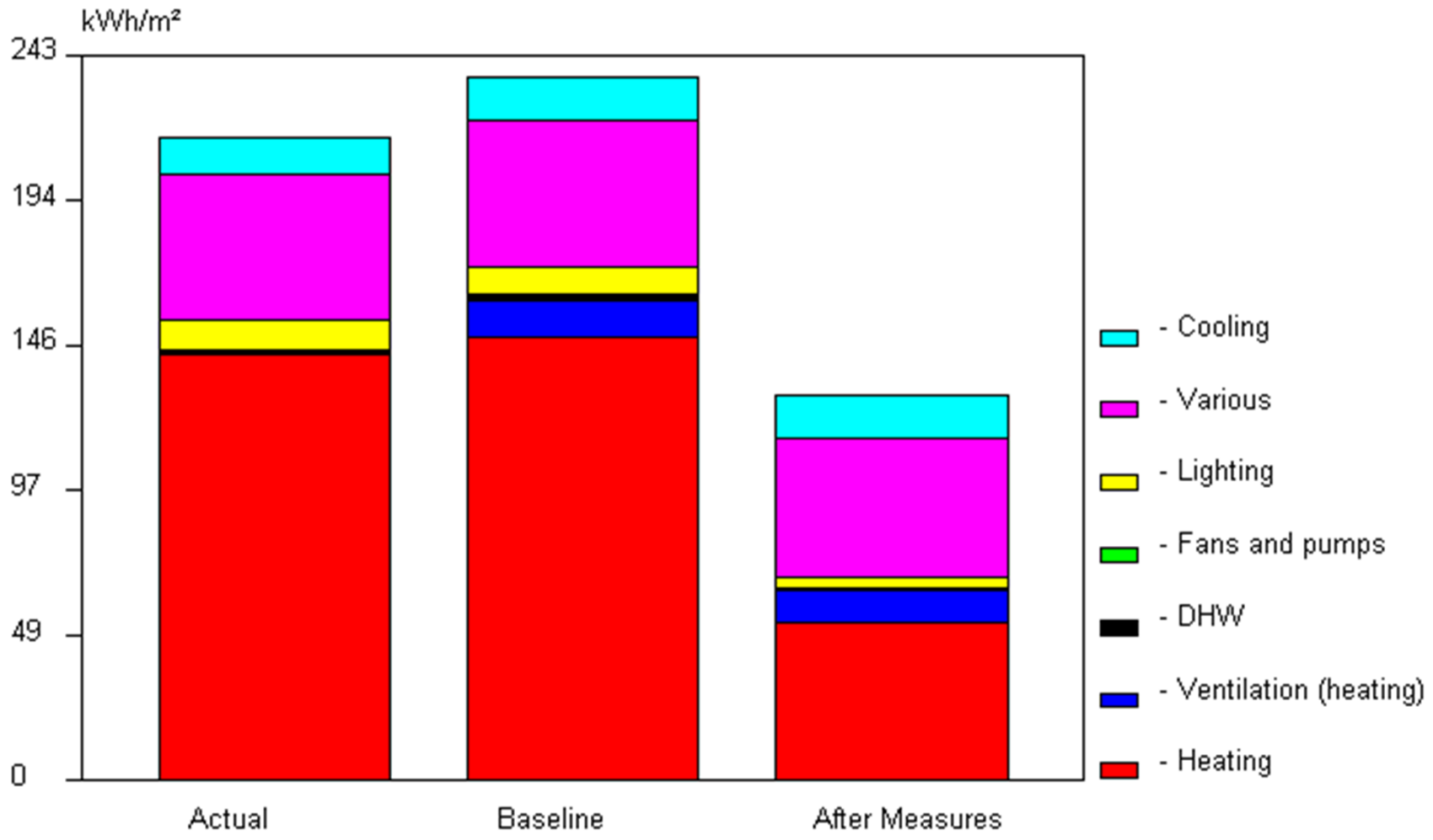





Basic terminology

- **Energy performance indicator**
- **Energy Baseline**
- **Energy Target**
- **Energy Improvement**



Example: Annual Energy Consumptions
[kWh/m²]



Example EP requirements in EU countries

Country	Residential	Public and other	Residential	Public and other
	Current norms	Current norms	Limits for NZEB in force from 2019/2021	Limits for NZEB in force from 2019/2021
	kWh/m²	*kWh/m²*	*kWh/m²*	*kWh/m²*
Slovakia	112	190	43	66
Bulgaria (Reg. No7)	168	260	48	80
France (RT2012)	50	90	0	0
Denmark (BR15)	31	42	20	25
Italy Zone E	88	76	n.a	n.a
Georgia (average)	**>250**	**200**	**n.a**	**n.a**

Average specific energy consumptions

Building Type	Building quantity	Average specific energy consumption
	pcs.	kWh/m^2
ministrative	2	253
ndergarten	158	200
ort School	3	86
useum	2	46
rary	1	170

Summary table for Kindergartens

	< Baseline	*Low*	*Average*	*High*
ps by Consumption /m²]	**0-100**	**100-200**	**200-300**	**300-518**
tity	11	61	58	28
Share of Building	7%	39%	37%	18%
umption [kWh]	1,439,810	17,854,931	18,986,473	8,334,306
Savings [%]	-38%	57%	60%	64%
Savings [kWh]	-539,929	10,152,693	11,391,884	5,327,928
ge Savings per	-49,084	166,438	19,6412	190,283

Total consumptions for all buildings

Type of Energy	2013		2014		2015		2016	
	Consumption	Bill [GEL]	Consumption	Bill [GEL]	Consumption	Bill [GEL]	Consumption	Bill [GEL]
Electricity [kWh]	5106112	964809	5412085	1022366	10670842	1696799	3140501	334124
Natural gas [m3]	1630717	1223038	2646779	1985084	4238441	3178201	161211	121103
Liquid fuel [L]	0	0	0	0	0	0	0	0
Solid Fuel [kg]	0	0	0	0	0	0	0	0
Other energy source	0	0	0	0	0	0	0	0
Water [T]	300003	1335413	339645	1494437	503290	2213020	22208	97725
		3523260		4501887		7088019		552952

Example: Kindergarten #117

t of energy efficiency measures

Deep retrofit measures:

- Reparation of existing and Installation of additional solar water heating system;
- Installation of grid connected PV system.

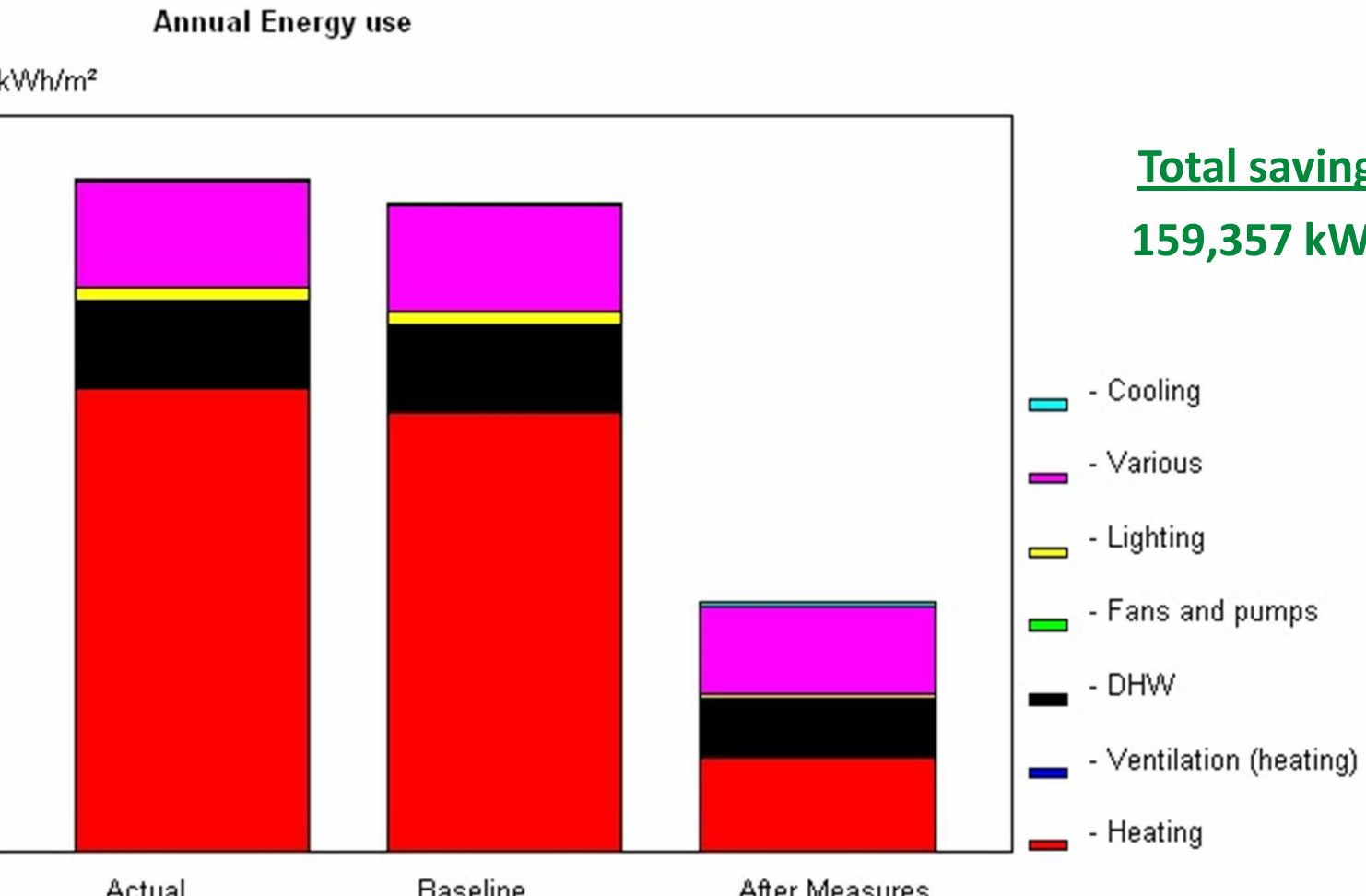
Cost-optimal retrofit measures:

- Replacement of incandescent and fluorescent bulbs with LED luminaries;
- Thermal insulation of roof;
- Thermal insulation of floor;
- Thermal insulation of wall.

Must-do retrofit measures:

- Installation of ventilation system;

Example: Kindergarten #117



Total saving:

159,357 kWh

Example: Sport Hall “Lilo”

t of energy efficiency measures

Deep retrofit measures:

- Installation of solar water heating system;
- Installation of grid connected PV system.

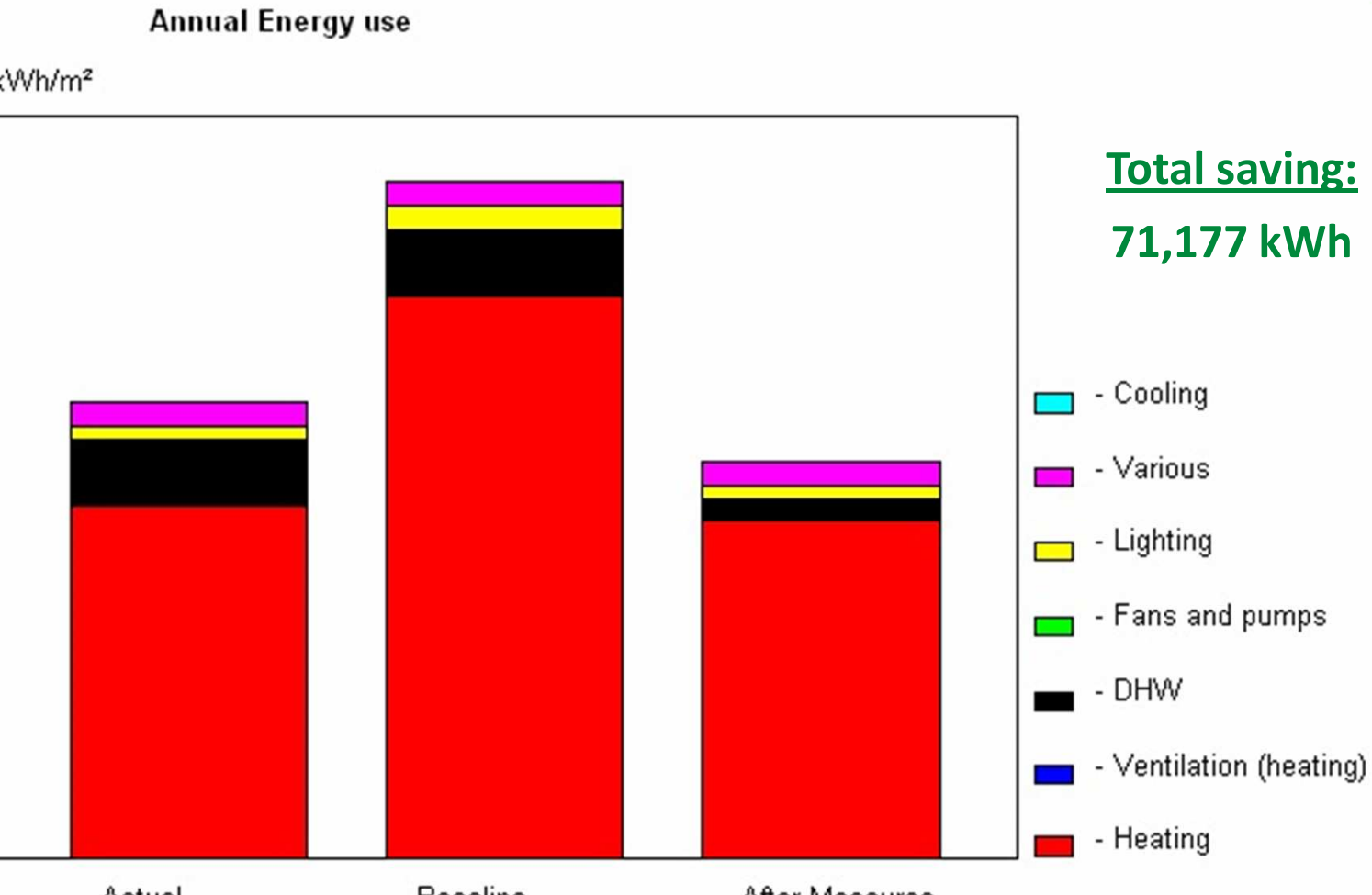
Cost-optimal retrofit measures:

- Replacement of incandescent and fluorescent bulbs with LED luminaries;
- Thermal insulation of roof;
- Thermal insulation of wall.

Must-do retrofit measures:

- Replacement of halogen projectors with LED projectors;
- Installation of ventilation system.

Example: Example: Sport Hall “Lilo”



Total saving:

71,177 kWh

xample: Ilia Chavchavadze House Museum

t of energy efficiency measures

Deep retrofit measures:

- Installation of grid connected PV system.

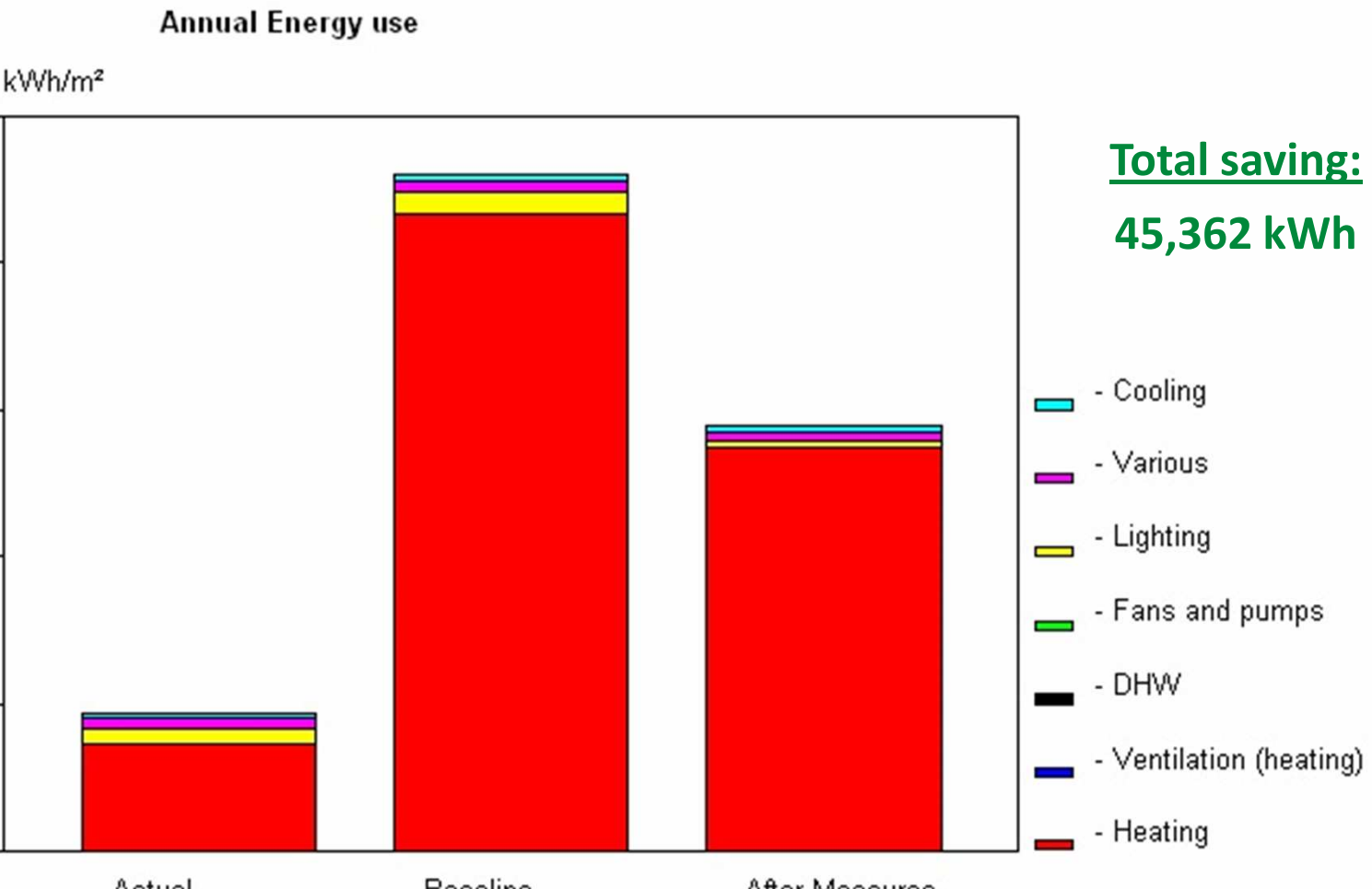
Cost-optimal retrofit measures:

- Replacement of incandescent and fluorescent bulbs with LED luminaries;
- Replacement of outdoor incandescent bulbs with LED luminaries;
- Thermal insulation of roof;
- Installation of PVC windows.

Must-do retrofit measures:

- Installation of Central heating and hot water preparation system

xample: Ilia Chavchavadze House Museum



Total saving:

45,362 kWh

Common issues of existing buildings

- Building envelope without thermal insulation
- Absence of active ventilation system
- Irregular indoor temperatures
- Inefficient lighting system (incandescent bulbs)
- Inefficent use of energy applications
- Absence of hot water metering
- Lack of energy management

Thank you!