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## EU4Energy Governance:

Support in development of the Long-term Strategy for Mobilizing Investment in the Renovation of the National Stock of Buildings for the period 2019-2030 in Ukraine

Presented by:

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EECG, 11 March 2020, Vienna, Austria



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# Objectives of the assignment

Provide technical assistance for development of the **Long-term Strategy for Mobilizing Investment in the Renovation of the National Stock of residential and commercial buildings**, both public and private for the period 2019-2030

Fully align with Directive 2012/27/EU on Energy Efficiency and new European standards.

Take into account the national EE targets until 2020 and until 2030 for Ukraine calculated with support of the EU4Energy Governance Project and be updated every 3 years starting with 2021.

# Overview of the Tasks

Task 1

- Overview of national buildings stock

Task 2

- Description of planned policies and measures

Task 3

- Identification of solutions for renovation

Task 4

- Overview of RES and nZEB share in buildings

Task 5

- Objectives and targets-summary of financial decisions

Task 6

- Drafting of LT Strategy for buildings renovation

Task 7

- Roadmap for LT strategy

# Overview of the National Building Stock

## Categorisation – residential

### Categories – Residential Building Sector

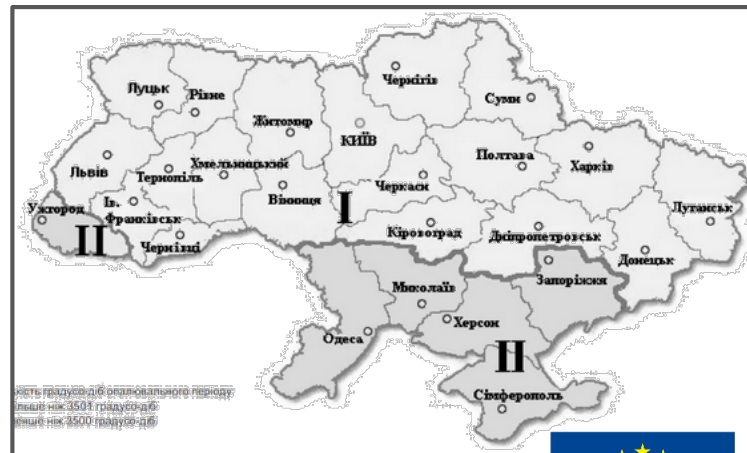
#### 1<sup>st</sup> Categorization – Building Regulation Standards of Construction

Before 2002	2003 - 2015	2015 - 2019
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#### 2<sup>nd</sup> Categorization – Building type

1-2 storey	3-5 storey	6-8 storey	9-12 storey	13-15 storey	16 storey & above
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#### 3<sup>rd</sup> Categorization – Climate Zone



# Overview of the National Building Stock

## Categorisation-public

### Public & Commercial Building Sector

#### *Specific Areas Indicators*

*Average indoor areas per building (m<sup>2</sup>)*

Kindergartens (Pre-school)	Schools	Healthcare	Other
2,088	5,073	4,000	900

#### Notes

- For pre-school and school categories the figures are average areas in the sample of ESCO projects
- The average area for healthcare is an assumption and is considered to represent an average medium sized healthcare building.
- For the category “other” the specific figure is considered as an average governmental administration building (office) and has been also considered within a bottom up approach in view of resulting to overall energy consumption of the group at levels approximately close to the figure reported within NEEAP

# Overview of the National Building Stock

## Building Stock – data requested

### Questionnaires

Data acquisition on existing national building stock and analysis.

- Building type and location
- Age and dimensions
- List of energy consuming systems
- Characteristics of electromechanical equipment
- Historical data on energy consumption
- Maintenance and other documents
- Renovations performed
- Climatic and other support information

N	Name	Address	Building type	Construction date	Number of floors	Size of floors [m x m]	Heating surface [m <sup>2</sup> ]	Heating volume [m <sup>3</sup> ]	Roof area [m <sup>2</sup> ] <small>(in case there are no building layouts)</small>	Need for structural reinforcement Yes/No	Energy consumption				Available technical documents (optional)									
											Boilers		Electricity [ kWh / y ]		Thermal energy (GJ)/6 or Nm <sup>3</sup> /y		Building layout		HVAC mounting plans		Electrical mounting plans			
											Capacity (kW)	Year of installation	2017	2018	2017	2018	C/(I)/M/4	(P)/ES	C/(I)/(M)/E	(P)	C/(I)/(M)/E	(P)/E		
1																								
2																								
3																								
4																								
5																								
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Mailed to: MRD, city administrations of Kyiv

Replies received: Kyiv CA

# Overview of the National Building Stock

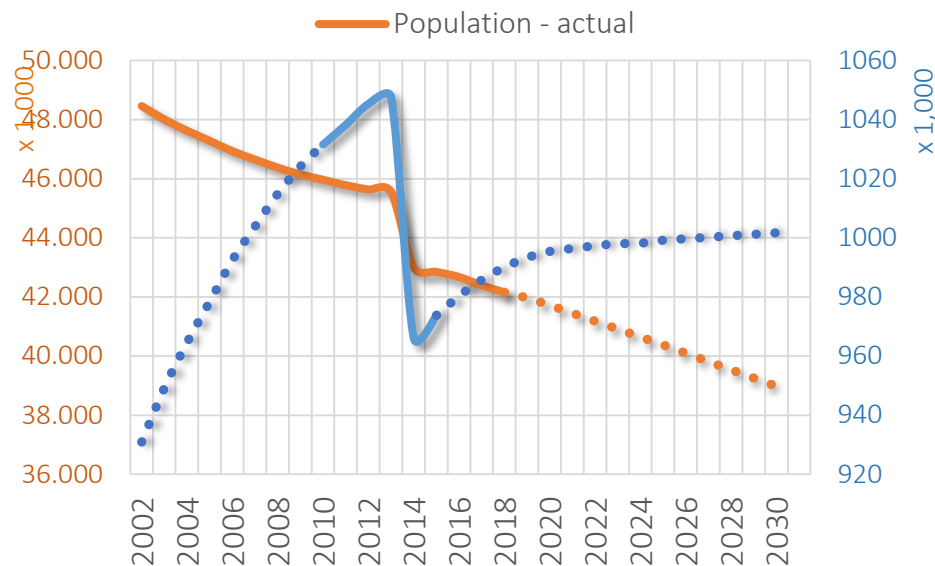
## Building Stock-Residential

### Data inputs

Analytical data on the buildings stock allocated per region, building type, temperature zone and year of construction

- Basic data for Oblasts (Population) [3]
- Ukraine population and projections [4]
- Distribution of new completed residential buildings in 2010 & 2015 by storeys and region (Number of Units) [5]
- Distribution of new completed residential buildings in 2010 & 2015 and their total floor area, by number of storeys, by regions (th.sq.m.) [5]
- Housing Stock by region (th.sq.m) [5]
- Number of residential buildings as of January 1, 2016 [6]
- Housing stock as of January 1, 2019 [7]
- Number of residential buildings as of January 1, 2019 [7]
- Energy Consumption Indicators per Climate Zone [8]

Housing Stock Vs. Population



Total Building Number	10,272,485	-
Total Building Area	989,325	th. sq. m.
Total Electricity Consumption	27,080	GWh
Total Thermal Energy Consumption	172,929	GWh

### Sources:

- [3] wikipedia.org
- [4] worldpopulationreview.com
- [5] State Statistics Service of Ukraine (2016). Residential Construction in Ukraine, 2010-2015. Kyiv, 2016
- [6] Державна служба статистики України (2016). Житловий фонд України у 2015 році. Статистичний бюлетень. Київ – 2016
- [7] Official Ukraine Statistics: ukrstat.gov.ua/
- [8] NDI BK residential specific indicators en



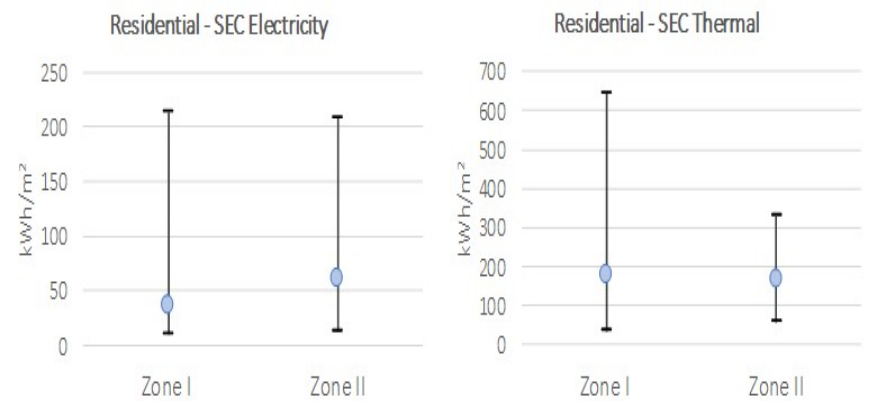
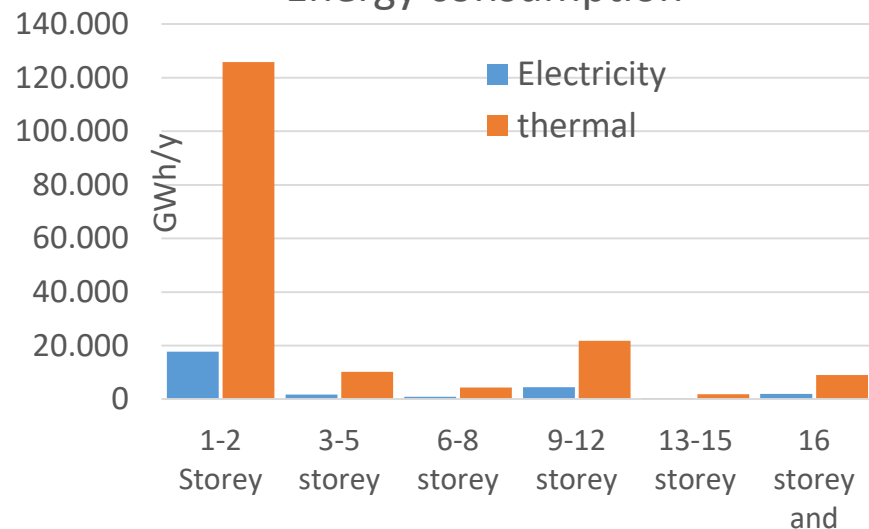
## Building Stock-RESIDENTIAL

### Data analysis

Data categorised and calculated where needed, focusing on: number of buildings, buildings areas, categorisation and energy consumption.

- Projections- total areas 2002-2030
- Total areas of buildings-2002-2019
- Number and areas of buildings per region & type& climatic zone
- Total number of buildings 2002 – 2019
- Split building stock in three categories according to the year of construction based on building regulation standards for construction
- Number and area per region & type and period of construction
- Calculate energy consumption from SEC and thermal energy allocation indicators

Energy consumption



	Electricity		Thermal	
	Zone I	Zone II	Zone I	Zone II
Min	11	13	34	59
Average	36	61	178	165
Max	214	209	645	328



# Overview of the National Building Stock

## Building Stock-PUBLIC

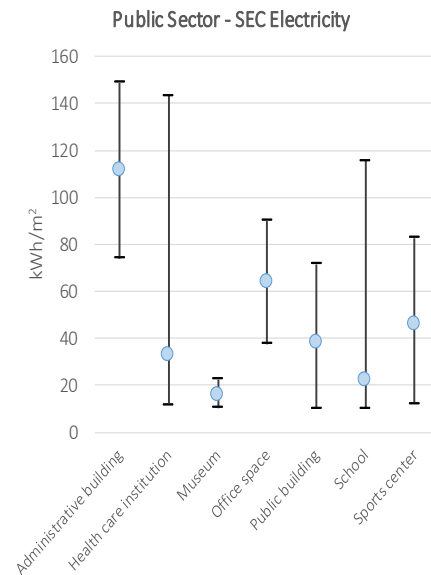
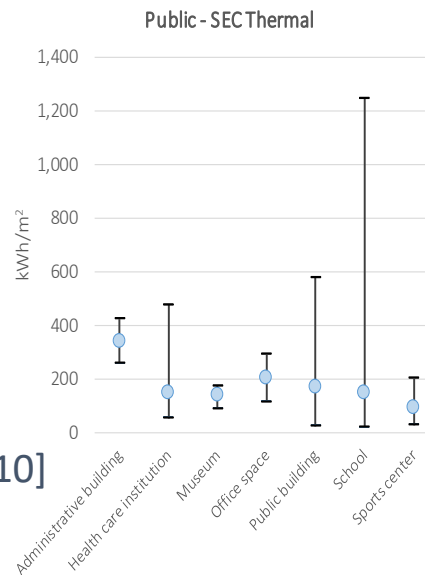
### Data input

For **public buildings only**- data on the buildings stock allocated per region, and building type

- Number of total public buildings (“Public” and “Municipal” buildings) per oblast [9]
- Number of public educational institutions [7]
- Number of public health care institutions [7]
- List of Ukrainian oblasts and territories by population [10]
- Energy statistics of 181 indicative public buildings [11] (areas-energy-educational)
- Total energy consumption of Ukraine Public Sector Buildings [7]

*Due to lack of sufficient baseline inputs the techno-economic analysis did not consider commercial buildings and categories of the tertiary sector*

Total Building Number	255,940	
Total Building Area	322,964	th. sq. m.
Total Electricity Consumption	13,385	GWh
Total Thermal Energy Consumption	39,104	GWh



Electricity							
	Administrative building	Health care institution	Museum	Office space	Public building	School	Sports center
Min	74	12	10	38	10	10	12
Average	111	33	16	64	38	22	46
Max	149	143	22	90	72	116	83

Thermal							
	Administrative building	Health care institution	Museum	Office space	Public building	School	Sports center
Min	259	53	89	115	23	22	28
Average	341	148	141	204	167	150	91
Max	424	476	176	292	578	1246	205

### Sources:

- [7] Official Ukraine Statistics: ukrstat.gov.ua/
- [9] USAID - Ukraine (2012). National Energy Efficiency Action Plan – Buildings (NEEAP-Bs). Kyiv, Ukraine
- [10] Wikipedia – List of Ukrainian oblasts and territories by population
- [11] 181 ESCO Contracts, Energy statistics of 181 indicative public buildings



# Overview of the National Building Stock

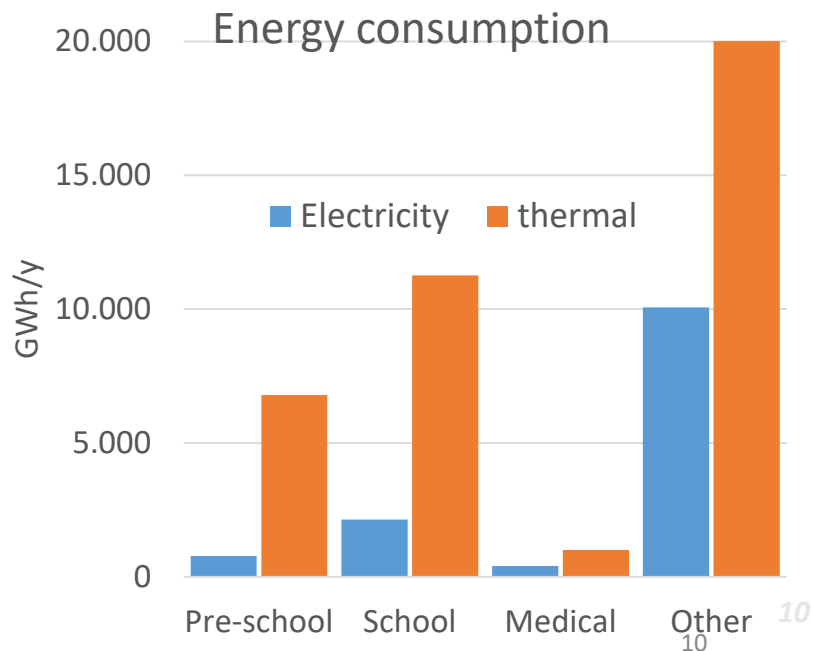
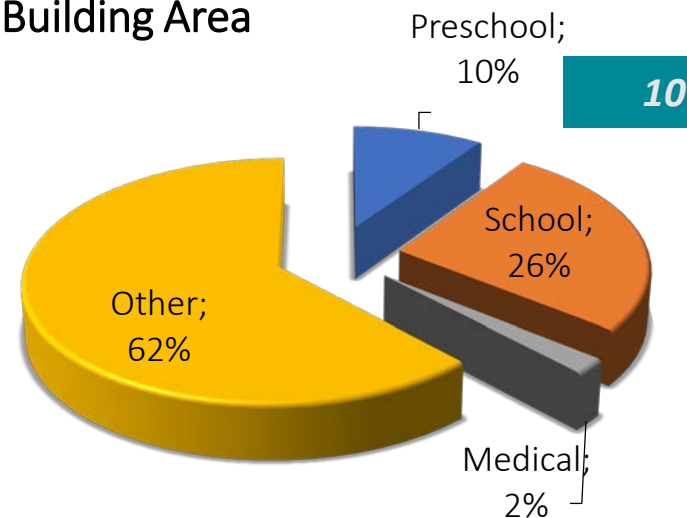
## Building Stock-Public

### Data Analysis

*Based on collected statistical information, data was categorised and calculated where needed, focusing on number of buildings, buildings areas, categorisation and energy consumption.*

- *Number of Public buildings per category and oblast*
- *Total building area per category and region*
- *Thermal energy consumption per public building category and oblast*
- *Electrical energy consumption per public building category and oblast*
- *Public buildings thermal energy consumption per fuel type and oblast*

Building Area



# Buildings Energy Consumption Baseline and Forecasting (based on draft 2<sup>nd</sup> NEEAP)

Estimate of energy consumption	KToe 2021 (baseline)	ktoe – 2021 (with NEEAP measures)	ktoe – 2030 (with NEEAP Measures)	BAU Change (% from 2021 baseline)	EE Target (2021) ktoe	EE Target (2030) ktoe	2030 EE Target (%) from 2021 baseline
Total primary energy consumption	102,658	88,983	91,468	-10.90%	13,675	26,307	25.6%
Total final energy consumption	53,411	49,254	50,447	-5.55%	4,157	10,440	19.5%
FEC – Services		4,784	19,799	313.86%	623	745	15.57%
FEC– Households		16,195	10,294	-36.44%	2,937	2,758	17.03%

## EE Target Setting (within 2<sup>nd</sup> NEEAP context)

**NEEAP 2030 "Buildings", Public Sector and Building-related Horizontal measures add up to 5 Mtoe of the total FE Savings, or 0.5 Mtoe per year in annual target.**

**Buildings sector to be tasked with 50% of the nationwide annual target  
Sufficient to deliver Ukraine's obligation under DIRECTIVE 2012/27/EU**



# Description of planned policies and measures

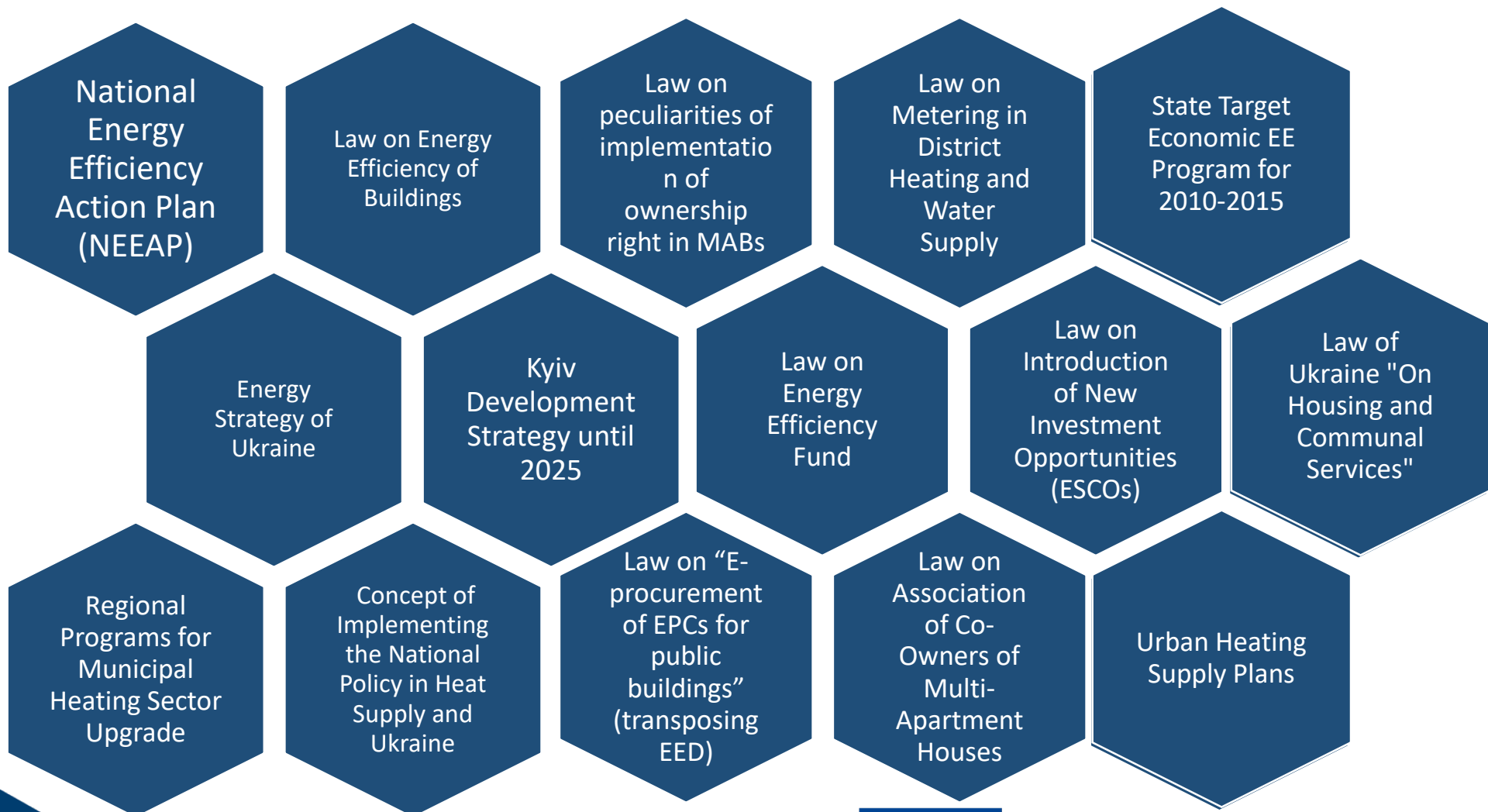
Review of existing regulatory framework and policies based on aggregated set of questions from the Energy Community EE Stocktaking Assessment and the World Bank ESMAP Regulatory Indicators for Sustainable Energy (RISE)

EE INDICATORS	Score
Indicator 1: National EE policy & planning	
Indicator 2: Energy efficiency entities	
Indicator 3: Consumption-based billing	
Indicator 4: EE incentives embedded in tariff	
Indicator 5: Incentives & mandates: large consumers	
Indicator 6: Incentives & mandates: public sector	
Indicator 7: Incentives & mandates: utilities	
Indicator 8: Financing mechanisms for EE	
Indicator 9: Minimum energy performance standards	
Indicator 10: Energy labeling systems	
Indicator 11: Building energy codes	
Indicator 12: Carbon Pricing	
Indicator 13: Energy Statistics	
EE development tools	
Education/capacity development	
Public awareness	



# Existing regulatory framework and policies – Assessment of barriers and hurdles

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## EU/EnC Approximation Requirements

- Directive 2012/27/EU of 25 October 2012 on energy efficiency (EED)
- Directive 2010/31/EU of 19 May 2010 on the energy performance of buildings (EPBD)
- Directive 2010/30/EU of 19 May 2010 on the indication by labelling and standard product information of the consumption of energy and other resources by energy-related products
- Regulation (EU) 2017/1369 of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU
- Directive 2001/80/EC of 23 October 2001 on the limitation of emissions of certain pollutants into the air from large combustion plants

## National Legislation

- Law on EE in Buildings (transposing EPBD)
- 1st NEEAP, EE Target for 2020
- 2nd NEEAP pending adoption in 2020 (transposing EED, A.24)
- NZEB Concept & Action Plan (transposing of Article 9 of 2010/31/EC)
- Ukraine 2050 Low Emission Development Strategy (LEDS)
- Law on Metering in District Heating and Water Supply
- Law on EE Fund, (transposing EED, A.20)
- Law on Association of Co-Owners of Multi-Apartment Houses
- Law on Housing and Communal Services
- Law on Introduction of New Investment Opportunities (ESCOs), (transposing EED)
- Law on E-procurement of EPCs for public buildings (transposing EED)
- Energy Strategy for the period up to 2035

## Secondary legislation

- Concept of Implementing the National Policy in Heat Supply and Ukraine
- Urban Heating Supply Plans
- Municipal Energy Plans (MEPs)/ Sustainable Energy (and Climate) Action Plans (SEAPs/SECAPs)
- Resolution "On Approval of the Plan of Measures for the Implementation of Energy Management Systems at Budgetary Institutions" (transposing EED, A.8)
- Resolutions of Cabinet of Ministers regulating:
  - *Housing Subsidies to the Population,*
  - *Heat metering units,*
  - *Payment procedure for co-owners of multiapartment buildings,*
  - *Housing management and managers,*
  - *Model agreements,*
  - *Energy service contracts,*
  - *Certification of buildings*
  - *Energy performance contracts*
  - *Eco-design and energy labeling of appliances*
  - *Assessment of building energy performance*
  - *Energy management in budget institutions*

# Summary of Barriers



# Legal – Regulatory Barriers

Barriers	Potential Solutions
Ownership of Multi-apartment buildings require consent from large number of residents	Continued and completed reform in multi-apartment housing legislation, establishment and registration of HOAs in all MABs, passportization of buildings and formal registration of all common assets (basements, attics, etc.), consideration of the possibility to use common assets as credit risk security.
Ownership of public buildings by many public agencies and split incentives	Elimination of split incentives, registration of property rights for public buildings, designation of a responsible agency for nationwide public building energy management program and adoption of energy saving targets, development of agency-based bundles of service-building portfolios for EE investments (e.g. Ministry of Education, Ministry of Health), implementation, monitoring and reporting of EE-integrated renovations in services buildings.



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# Market Barriers and Lack of Incentives: Residential Consumers

Barriers	Potential Solutions
Customers cannot access real time feedback on energy usage	Gradual transition on real-time energy measurement and consumption-based billing
Most customers have no ability to manage energy usage levels remotely (through apps or other technology mediums that can track real time usage, directly affecting their bills)	Promote introduction of demand-side management : <ul style="list-style-type: none"> <li>• Plan and implement 100% block-metering and billing on building level in the short-term</li> <li>• Plan and implement 100% metering and billing on sub-station level in the medium-term</li> <li>• Plan and implement 100% and on an apartment level in the long-term</li> </ul> Creating incentives for energy conservation, temperature regulation, hydraulic balancing of heating points, leak detection in heat mains, building thermal loss reduction, etc.
Low Utility Affordability and Continuing Energy Subsidies	Gradual elimination of energy subsidies replacing them with targeted low-income energy efficiency programs
Tariffs not adjusted according to seasons, peaks, real-time, variable peaks	Transition to marginal-cost based pricing to promote energy conservation through tariffs with locked-in demand-side management incentives

# EE Information and Incentives: Large Energy Consumers

Barriers	Potential Solutions	18
No incentives/mandatory targets for EE for large energy consumers	<ul style="list-style-type: none"> <li>Gradual introduction of mandatory energy audits by third parties, buildings certification, energy management and timed improvement of energy performance to achieve norm-compliance to be verified by third parties;</li> <li>Additional regulatory and enforcement efforts on building energy certification tied to the sale or lease of assets.</li> <li>Mandatory energy audits for large energy consuming buildings, defining a regressive threshold for building size benchmark, mandatory development of energy management plan and EE actions; Develop energy audits and investment packages for priority EE retrofitting of priority public buildings (e.g. schools, kindergartens, central government buildings) based on the availability of funds for capital investments;</li> </ul>	
Partial introduction of mandatory energy audits		
Energy performance reporting slowly being introduced, only small share of consumers covered		
No wide application of energy-management systems mandated for large consumers		
No penalties for non-compliance with codes for large consumers		
No measurement and verification program in place (and not by third party)	measurement and verification in 3-year cycles, application of incentives or sanctions to ensure compliance	
No tax incentives for large consumers to invest in EE	Tax incentives for EE investments , if corruption-proof models applicable (voluntary agreements, white certificates)	
No program to publicly recognize large-scale users that have achieved significant energy savings measures	<p>Annual benchmarking and rewarding of best energy performers</p> <p>Use of public funding to leverage additional private-sector investment or address specific market failures (loan schemes, public co-financing of investments, low-income housing EE grants, grants to cover technical assistance, energy auditing, energy performance contracting; EE Funds);</p> <p>Penalties for worst performing large energy consumers</p> <p>in the long-run) mandatory EE action plans for large buildings with commitment to implement EE improvement actions for improved class of building energy performance (e.g. for &gt;1000m<sup>2</sup>; from “D” to “C”)</p>	
Energy savings and/or financial savings not publicized		

# EE Information and Incentives: Public Buildings

<b>Barriers</b>	<b>Potential Solutions</b>
Some country-wide assistance program (from a government or independent entity) to large-scale users to identify energy savings investments opportunities (IFI-supported programs only)	Continued support to state and IFI programs aimed at large energy consumers with mandatory introduction of repayment for sovereign-backed loans in parts related to energy efficiency revenues
Partial uptake of binding energy savings obligations for public buildings (SEAPs/SECAPs, donor-supported programs in limited building scope)	Development of a Nation-wider Public Building Energy Management Program, with designated official agencies/institutions responsible for data generation, benchmarking, planning, financial architecture, reporting
Energy savings from efficiency activities at public buildings not tracked (either in-house or by a third party) for SEAP/SECAPs/CoM	Continued support to Municipal Sustainable Energy Planning, Implementation, Monitoring and Reporting, preferably through unified digitized database allowing for country-wide monitoring, benchmarking and decision-making
No binding energy savings obligations for other public facilities (may include water supply, external lighting, and heat supply)	Mandatory EE performance and procurement requirements, and reporting for public service utilities
Energy savings from efficiency activities at other public facilities tracked only by CoM signatories	Amending laws and regulations with requirements to buildings with nearly zero energy consumption (NZEB). Carrying out research on efficient use of such buildings Creating guidelines and procedures for procurement of energy-consuming devices and energy services to ensure energy efficiency in public procurement of goods and services

# Financing mechanisms in Residential Sector

Barriers	Potential Solutions
Limited engagement of ESCOs in residential EE investments	Implementation of legal reform, demonstration projects and publicity on utilization of ESCO services in residential buildings, development of crowd-funding platforms for residential EE investments, especially for low-income households
No green bonds available for EE investments	Consider utilization of green bonds for financing HOA / housing EE investments
No partial risk guarantees available for EE investments	Gradual transition of grant subsidies for loans with partial credit guarantees, revolving schemes and near-commercial lending terms, with grants only used to support technical assistance and project preparation.
The financing mechanisms available for EE investments limited to IQ Energy, which is phasing out	Continued grant incentives to compensate for high interest rates (in the short-run) to eliminate market barriers. Development of EE financing program for single-family houses.
No commercial, market-driven financing mechanisms viable without any government approval, subsidy, authorization or other mediation	Gradual elimination of subsidies to cost-recovery levels and near commercial financing
High interest rates	Continued interest rate subsidies
Low energy prices making deep renovations less financially attractive	Incentives for deep renovations, and production of associated local materials (insulation, windows, DSM equipment, etc.), on-job trainings / vocational education for generation of properly trained labor-force for expedited façade insulation assignments.

# Financing mechanisms in Services sector

Barriers	Potential Solutions
No tax incentives available for EE investments	Tax incentives for Commercial Buildings, mortgage funds, refinancing, on-tax financing, on-bill financing,
No on-bill financing/re-payment available for EE investments	Utility-based on-bill financing of EE upgrades as EE Obligation scheme for Services Buildings
No green bonds available for EE investments	Consider utilization of green bonds
No partial risk guarantees available for EE investments	Gradual transition from grant incentives to credit guarantees
	Project standardization and/or use of IT-based benchmarking of projects, generation of de-risking databases of EE based on evidence

# Building energy codes

Barriers	Potential Solutions
No designated energy codes for renovated buildings	Introduce energy performance requirements for renovated buildings
	Phase out worst performing buildings Develop PPP schemes for generation of commercially attractive investment projects for in-depth building renovation (e.g. development of new real-estate to finance renovations on building level, such as mansards / top floors for commercial sale or state procurement for special groups (low-income, military, refugee, etc.)) to achieve code compliance (energy, structural and accessibility codes combined)
	Introduce property tax incentives for code-compliant, renovated buildings



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# Building stock & Energy information

Barriers	Potential Solutions
Emerging mandatory standardized rating or labeling system for the energy performance of existing buildings, very limited coverage	Building stock investigation, generation of building database, regular updating Extend technical assistance and capacity building for acceleration of building energy certification and quality assurance
Commercial and residential buildings not required to disclose property energy usage at the point of sale or when leased	Make energy certification mandatory for commercial property sale or lease
Large commercial and residential buildings not required to disclose property energy usage annually	Introduce large energy consumers' annual reporting on energy companies
No proper of monitoring of NEEAP	Establish a regular monitoring routine for NEEAP targets, activities and results, on national level, as well as local plans
No proper building stock statistics with detail on typology, age, purpose, energy performance	Establish a routine and detailed statistical reporting on building stock

# NZEB

Barriers	Potential Solutions
NZEB regulatory process in early stage of development ( concept adopted), regulations still to be developed	Provide state leadership by all newly constructed public buildings as NZEB after 2025 , at least one NZEB until 2025.
No incentives for NZEB construction	Provide tax incentives (e.g. property tax cuts from local govt) for developers and buyers of NZEB commercial real estate.



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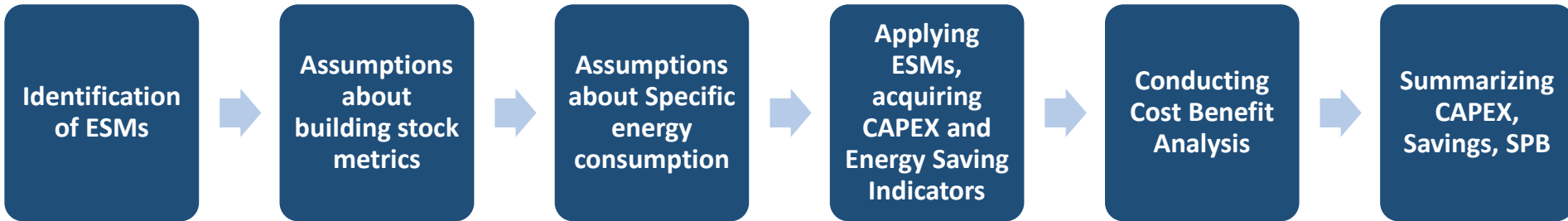


# EE Development Tools

Barriers	Potential Solutions
ESCO sector still evolving, not reached its full potential, particularly due to legal barriers in residential sector	Continued Utilization of ESCO/Energy Performance Services in all sectors through availability of commercial lending for ESCO financing Development of provisions for commercial banks to use state budget payments as repayment security on public building energy performance contracts for ESCO financing (e.g. through factoring)
Limited application of energy management	Introduction of ISO 50001 for large energy consumers
Partial coverage of communities in local energy planning through 274 SEAPs/SECAPs	Adoption of Municipal Energy Planning as Mandatory Requirement of National Legislation with Supporting Municipal Funding for Staff and Activities ; Development and financing of local renovation strategies with building thermal modernization and full commercialization of heat supply service (heating points, buildings, apartments)

Barriers	Potential Solutions
Limited Efforts in Education/ capacity development	Capacity Building and Training Campaigns; Introduction of a system of accreditation of independent experts on energy certification of buildings
	Mandatory energy management for all public bodies with trained staff and network of EE specialist
	One-stop-Shops, Resource Centers
Limited Public awareness	Communication Campaign
	Scale up EE Education Program (e.g.EE Schools Program by MDI/USAID/MHRP) to routinely introduce students to behavioral aspects of EE
	Promote not only implementation but also Publicity around demonstration projects encouraging in-depth renovation

# Identification of solutions for renovation: step by step



Inputs- Determination of EE Investments

## Eligible Energy Saving Measures

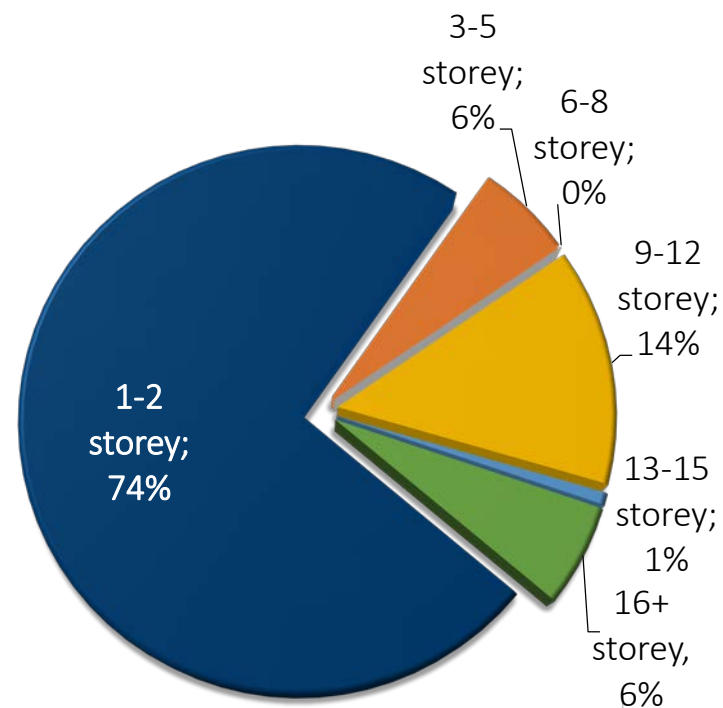
Code	Measure	Residential	Public
ESM 1	Wall insulation (e.g. EPS or Mineral Wool (MW))	✓	✓
ESM 2	Roof insulation	✓	✓
ESM 3	Basement insulation	✓	✓
ESM 4	Energy efficient openings	✓	✓
ESM 5	Energy efficient lighting	✗	✓
ESM 6	Solar PV	✗	✓
ESM 7	Solar thermal for DHW	✗	✓
ESM 8	EE in boilers	✓	✓
ESM 9	EE in DH substations	✓	✓
ESM 10	Rehabilitation of indoor heating networks	✓	✓
ESM 11	Rehabilitation of ventilation systems	✗	✓



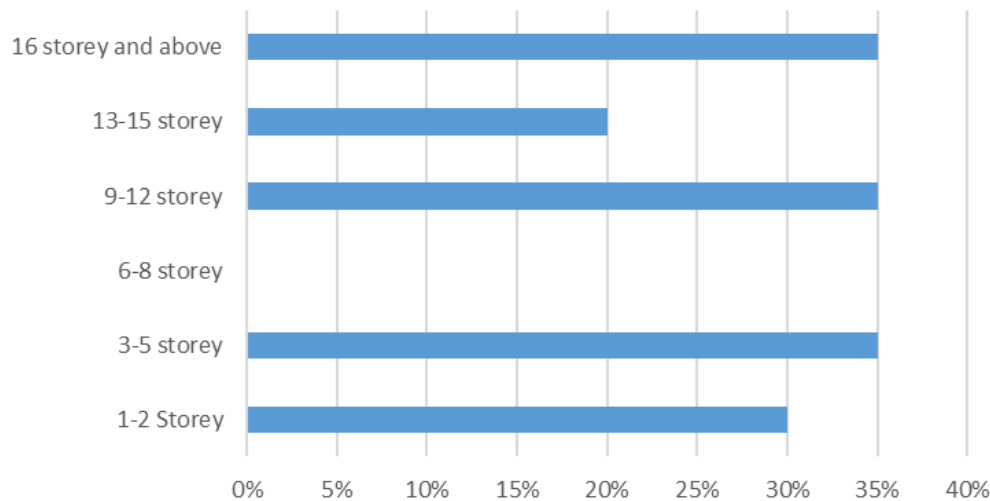
# Identification of solutions for renovation

## Results-RESIDENTIAL BUILDINGS

	CAPEX (k€)	Savings k€	SPB yrs
1-2 storey	21,800,423	1,028,234	21.2
3-5 storey	1,691,627	115,197	14.7
6-8 storey	0	0	0.0
9-12 storey	4,155,123	316,655	13.1
13-15 storey	206,482	16,110	12.8
16+ storey	1,757,779	136,580	12.9
<b>Total</b>	<b>29,611,434</b>	<b>1,612,775</b>	<b>18.4</b>

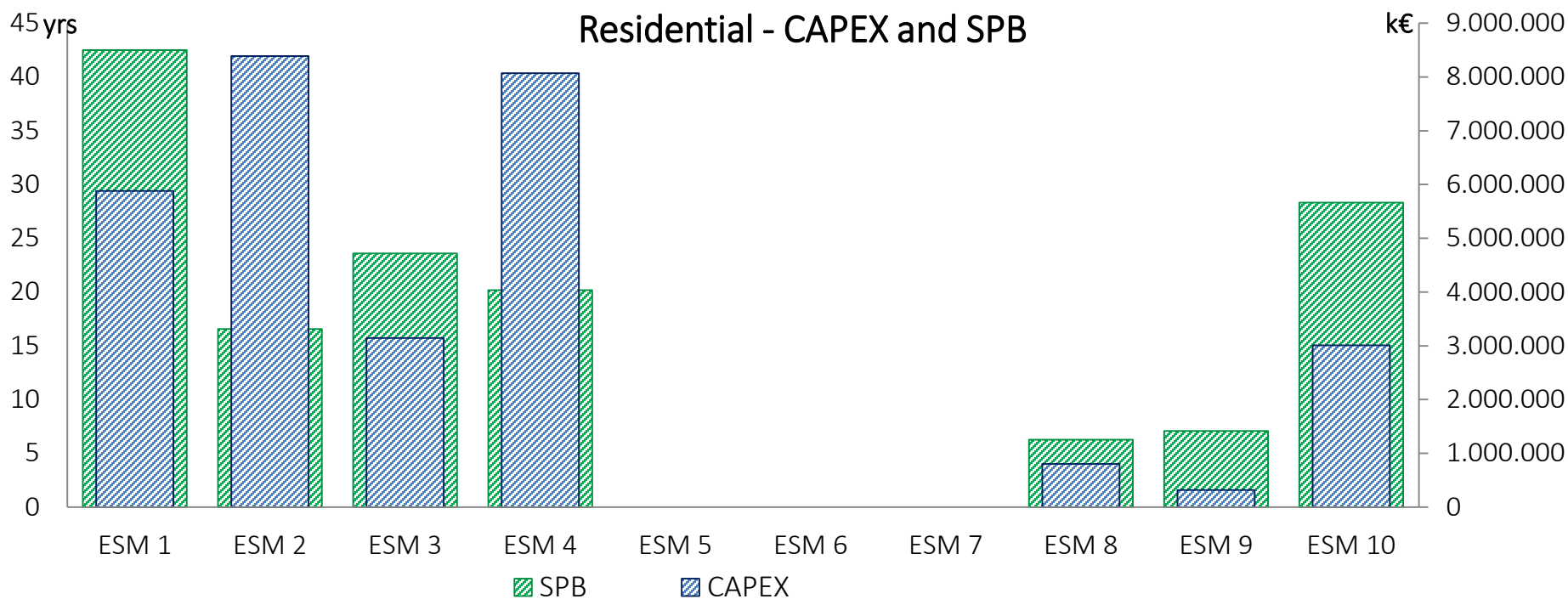


Assumed % rehabilitation per category



# Identification of solutions for renovation

## Results-RESIDENTIAL BUILDINGS



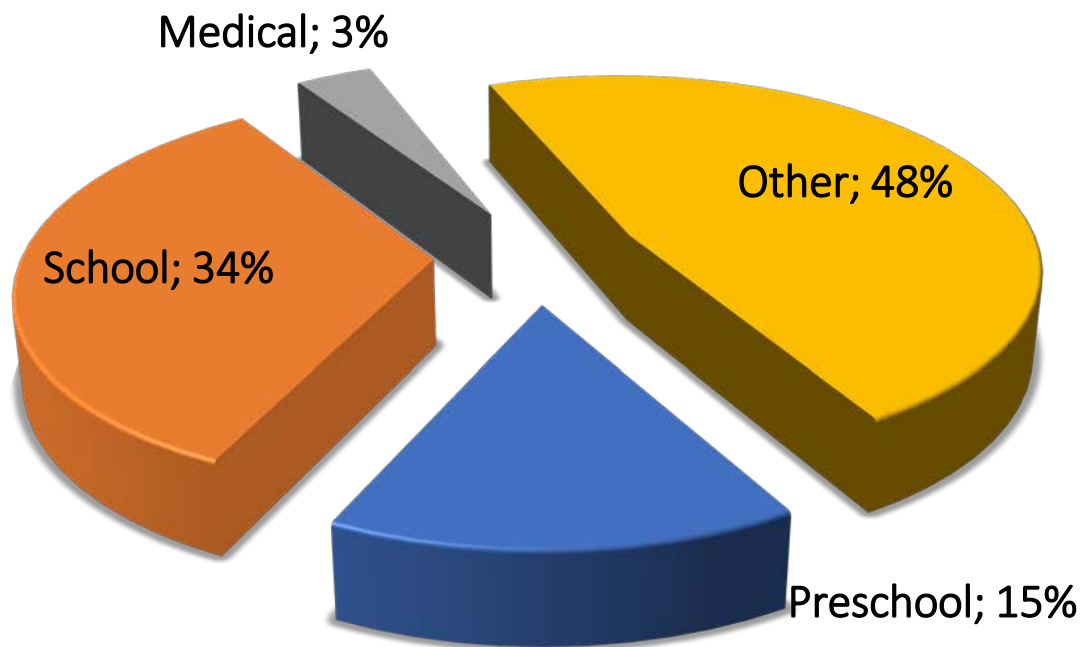
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ESM 2	Roof insulation	ESM 7	Solar thermal for DHW
ESM 3	Basement insulation	ESM 8	EE in boilers
ESM 4	Energy efficient openings	ESM 9	EE in DH substations
ESM 5	Energy efficient lighting	ESM 10	Rehabilitation of indoor heating networks



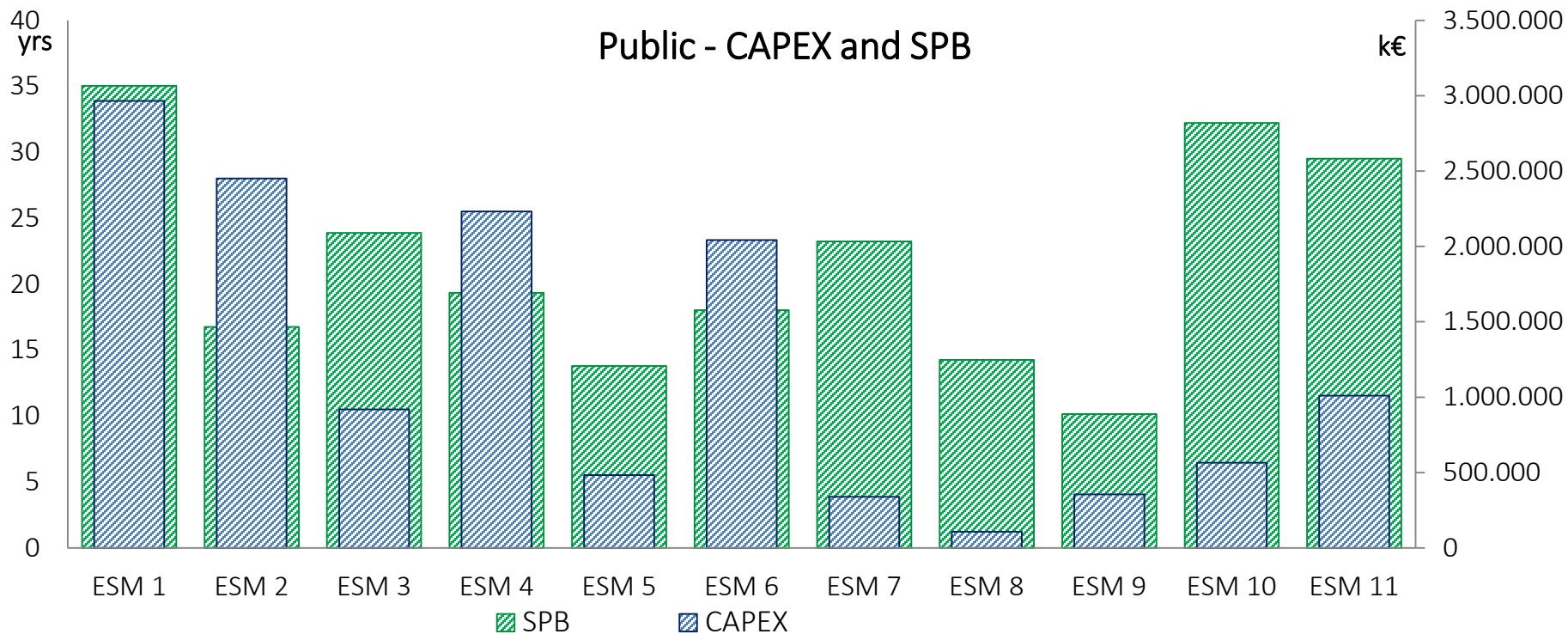
# Identification of solutions for renovation

## Results-PUBLIC BUILDINGS

	CAPEX (k€)	Savings k€	SPB yrs
Preschool	2,059,273	93,711	22.0
School	4,535,844	207,002	21.9
Medical	469,660	18,539	0.0
Other	6,406,341	322,961	19.8
<b>Total</b>	<b>13,471,117</b>	<b>642,213</b>	<b>21.0</b>



# Results-PUBLIC BUILDINGS



ESM 1	Wall insulation (e.g. EPS or Mineral Wool (MW))	ESM 6	Solar PV
ESM 2	Roof insulation	ESM 7	Solar thermal for DHW
ESM 3	Basement insulation	ESM 8	EE in boilers
ESM 4	Energy efficient openings	ESM 9	EE in DH substations
ESM 5	Energy efficient lighting	ESM 10	Rehabilitation of indoor heating networks



Savings per type

### Residential Building Sector

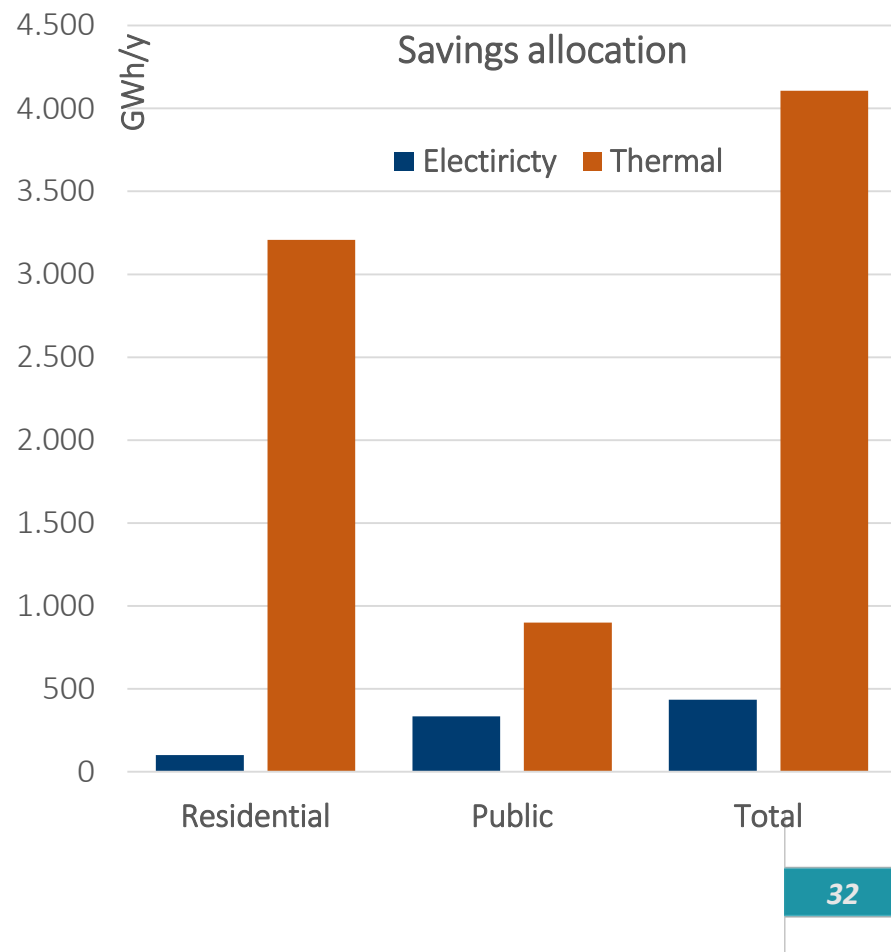
Storey:	1-2	3-5	6-8	9-12	13-15	16 +
Rehabilitated until 2030	30%	35%	-	35%	20%	35%

Number of buildings	3,082,844	-
Total Building Area	300,601	th. sq. m.
CAPEX	29,611,434	kEur
Savings – Electrical	1,000	GWh/r
Savings – Thermal	32,069	GWh/r
Savings – PES	38,277	GWh/r
Cost Savings	1,612,775	kEur/y

### Public & Commercial Building Sector

Type:	Pre-school	School	Medical	Other
Rehabilitated until 2030	40%	40%	50%	30%

Number of buildings	81,747	-
Total Building Area	112,897	th. sq. m.
CAPEX	13,471,117	kEur
Savings – Electrical	3,335	GWh/r
Savings – Thermal	8,999	GWh/r
Savings – PES	19,904	GWh/r
Cost Savings	642,213	kEur/y



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# Results - Benchmarks

## Specific Energy Consumption Indicators

### Following actions

- Confirmation of assumptions
- Confirmation of mix of target groups
- Fine tuning-cost optimal
- Yearly allocation
- Political decision on targets

### SEC Before (for total building stock)

	Electrical	Thermal	Total
<b>Residential Buildings</b>			
1-2	27.7	196.9	224.6
3-5	28.2	165.7	193.9
6-8	26.3	133.3	159.6
9-12	26.2	129.2	155.4
13-15	27.0	124.1	151.1
16+	27.0	123.2	150.2
<b>Total</b>	<b>27.4</b>	<b>174.8</b>	<b>202.2</b>
<b>Public Buildings</b>			
Pre-school	25.1	220.0	245.2
School	25.1	132.7	157.8
Medical	60.3	149.5	209.8
Other	50.2	100.0	150.2
<b>Total</b>	<b>41.4</b>	<b>121.1</b>	<b>162.5</b>

### SEC After (for refurbished buildings)

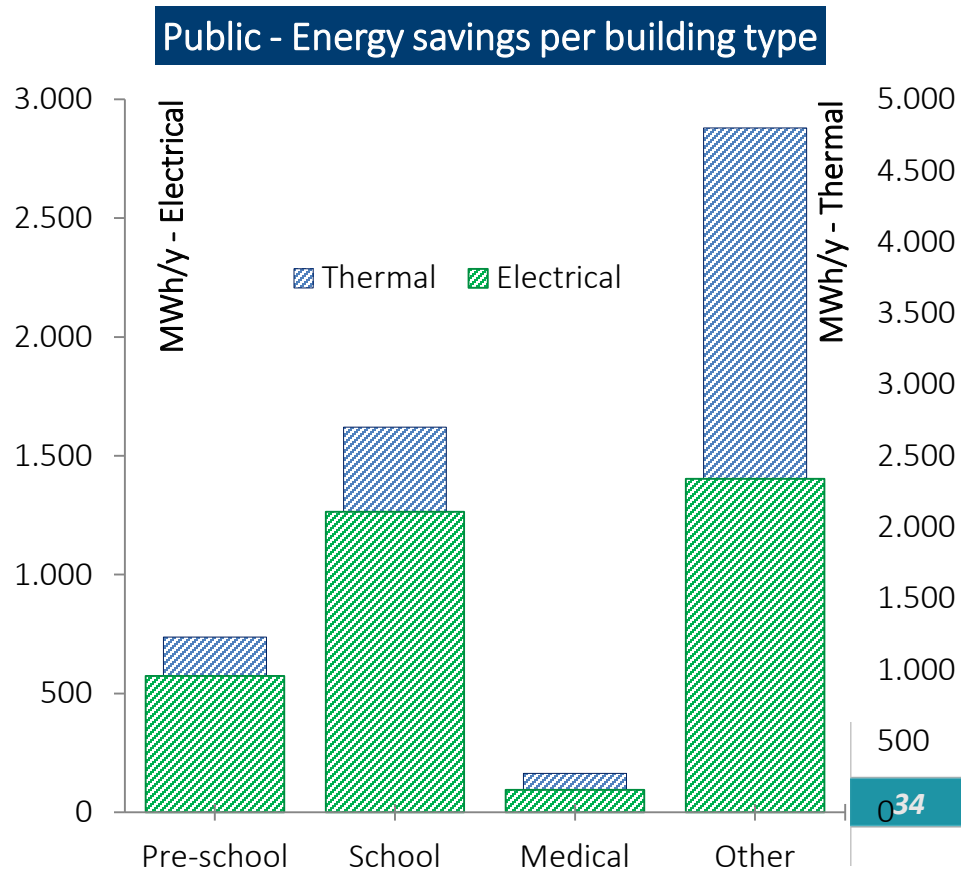
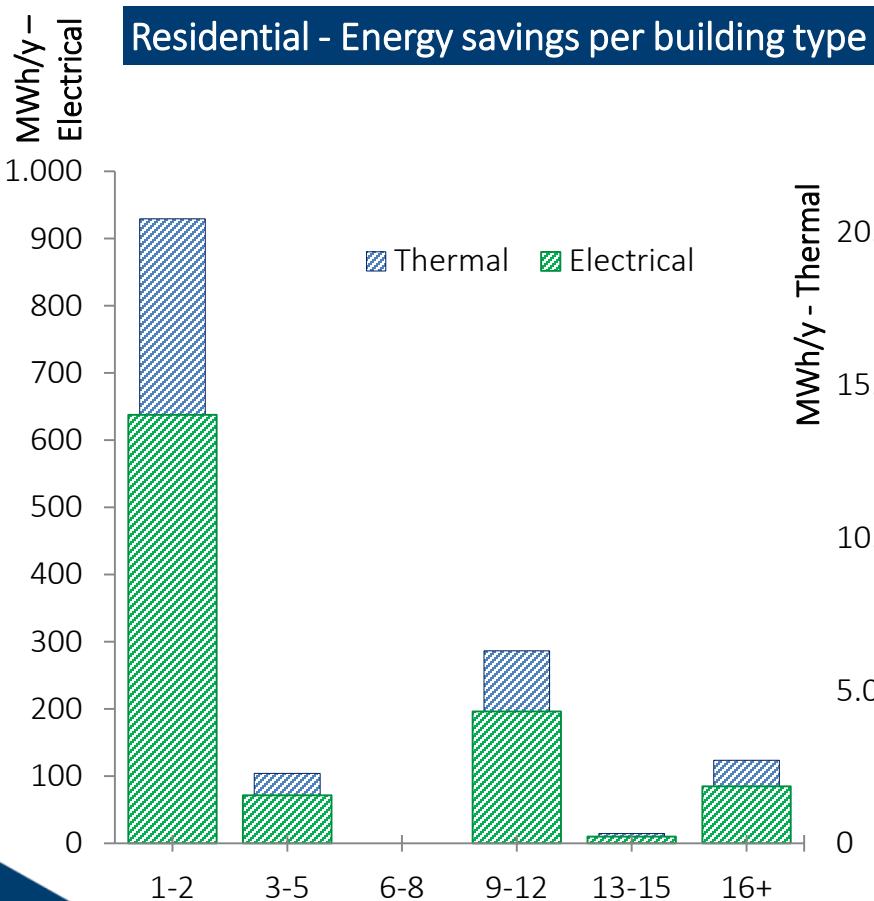
	Electrical	Thermal	Total
<b>Residential Buildings</b>			
1-2	24.4	90.2	114.6
3-5	24.9	59.0	83.9
6-8	26.3	133.3	159.6
9-12	22.9	22.5	45.4
13-15	23.7	17.4	41.0
16+	23.6	16.5	40.2
<b>Total</b>	<b>24.1</b>	<b>67.7</b>	<b>91.8</b>
<b>Public Buildings</b>			
Pre-school	15.7	140.4	156.0
School	15.7	53.2	68.8
Medical	50.9	68.8	119.6
Other	40.8	20.2	61.0
<b>Total</b>	<b>30.1</b>	<b>67.3</b>	<b>97.4</b>

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# Identification of solutions for renovation

## Results summary

### Savings per building type



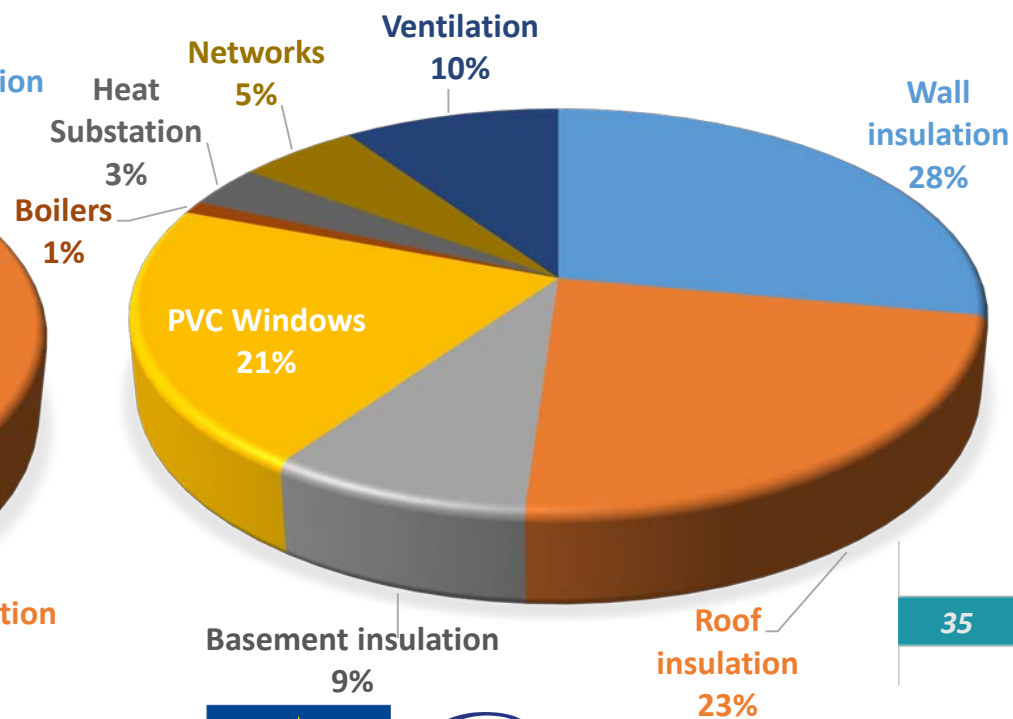
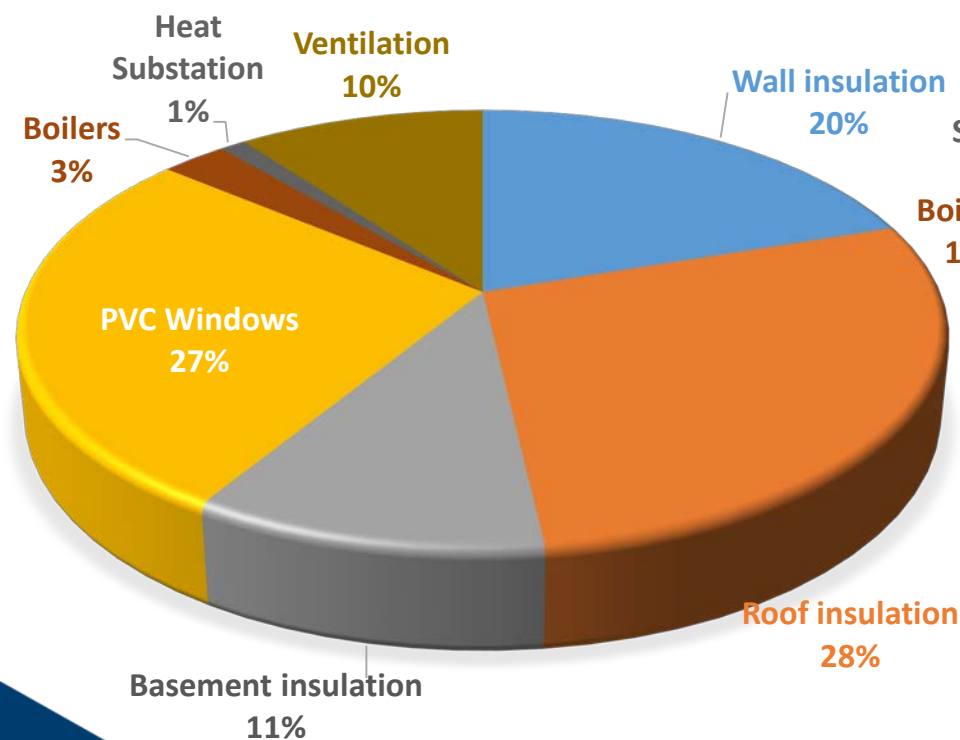
# Results summary

## CAPEX Allocation



### RESIDENTIAL BUILDINGS - CAPEX ALLOCATION

### PUBLIC BUILDINGS - CAPEX ALLOCATION



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# Pending next steps- Roadmap for the Long-term Strategy

- Finalize the Strategy and a detail roadmap for the implementation of the Strategy highlighting:
  - Policy and regulatory measures
  - Responsible bodies (ministries, agencies, municipalities)
  - Financial incentives - funding sources
  - Institutional activities
  - Capacity building recommendations
  - Awareness and dissemination actions
  - Other supporting measures





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## EU4Energy Governance:

Support in development of the Long-term Strategy for Mobilizing Investment in the Renovation of the National Stock of Buildings for the period 2019-2030 in Ukraine

Thank you!!!!

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