



WELCOME TO BUDAPEST

20th March 2024

Péter István Vedres

Hungarian Energy and Public Utility Regulatory Authority

Head of department

Sustainable Development Department



Who are we?



Electricity



Natural gas



District Heating



Water utility



Waste

energy efficiency

consumers protection

sustainable development



MEKH

Hungarian Energy and Public Utility Regulatory Authority

independent regulatory authority since 2013

price regulation

energy-statistics

licensing and supervision

Department of Sustainable Development

KEHOP OPERATIVE
PROGRAMME



REGISTER OF VERIFIED
ENERGY SAVINGS



AUDIT CHECKS



REGISTER OF THE
AUDITORS



NATIONAL NETWORK OF
ENERGY COUNSELLORS



LIFE-IP PROJECT



EEOS



RES





Thank you for your attention!

Hungarian Energy and Public Utility Regulatory Authority

Clean energy, sustainable environment



The Hungarian EEOS

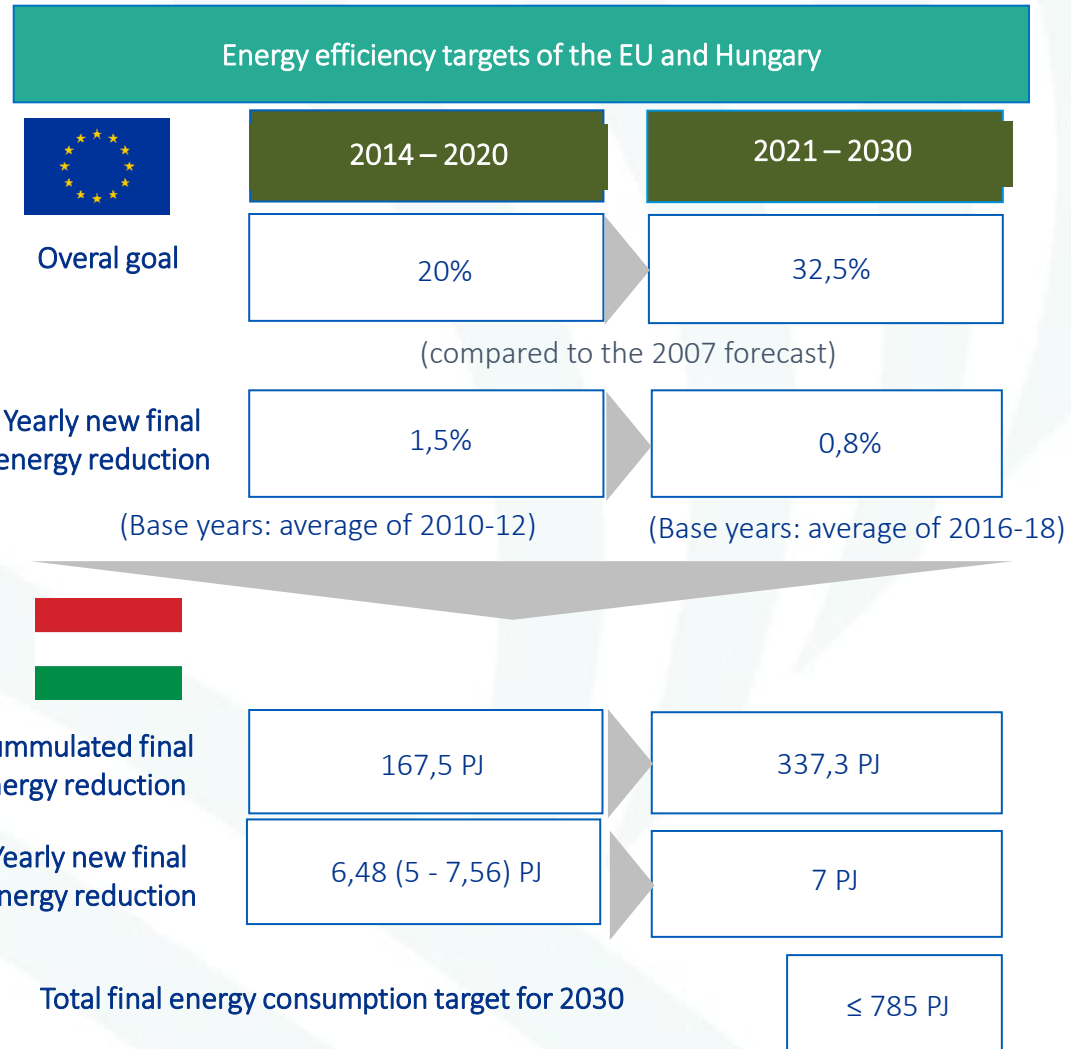
Dr. Johanna Hohmann

20th March 2024

Hungarian Energy and Public Utility Regulatory Authority

Clean energy, sustainable environment

Hungary's energy efficiency targets and legal framework



In 2020 Hungary's final energy consumption was 754 PJ

The EU Energy Efficiency Directive (2012/27/EU)

- sets the energy efficiency targets

Regulation (EU) 2018/1999 on the Governance of the Energy Union and Climate Action

- sets the criteria for the National Energy and Climate Plans (NECP) and for the progress report

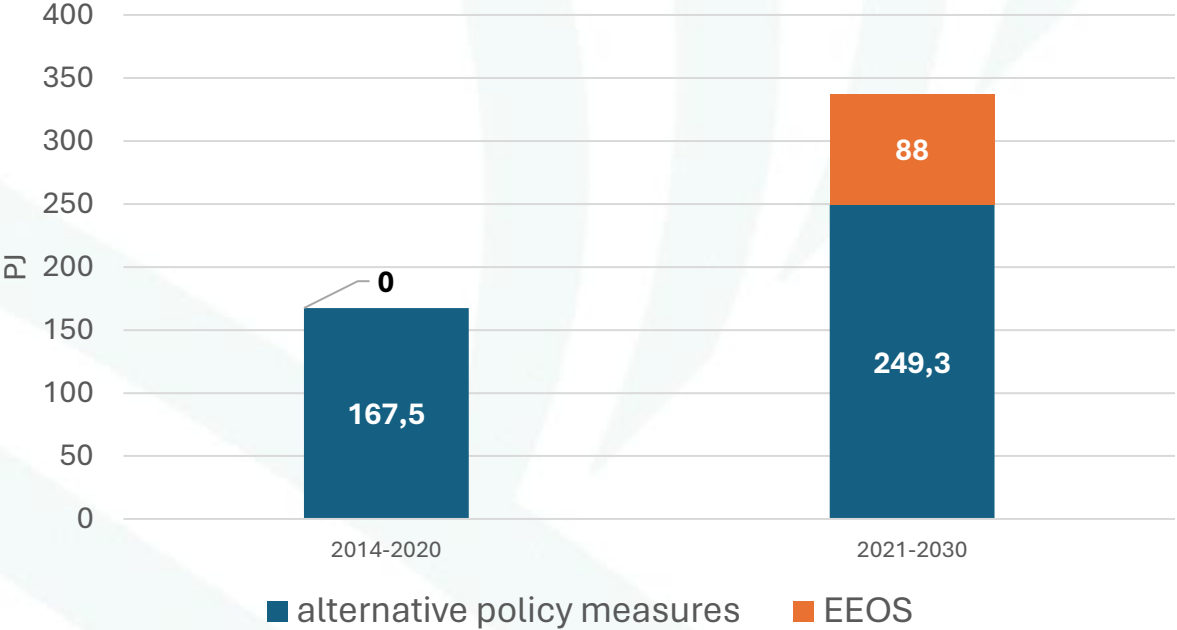
The National Energy Strategy and the Hungarian NECP are setting the energy efficiency targets and the pathway for Hungary

Implementation of the Hungarian energy efficiency targets

Cumulated final energy reduction target (PJ)	
2014-2020	2021-2030
167,5	336,5
	(+169)

122/2015 Government Decree defines the policy measures

Energy savings obligation and policy measures



For the period 2021-2030

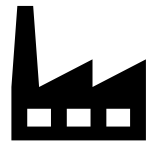
- There are 31 alternative policy measures
- Hungary has decided to introduce **EEOS**, a new policy measure to reach the energy efficiency targets

Share of the EEOS in reaching the 2030 targets

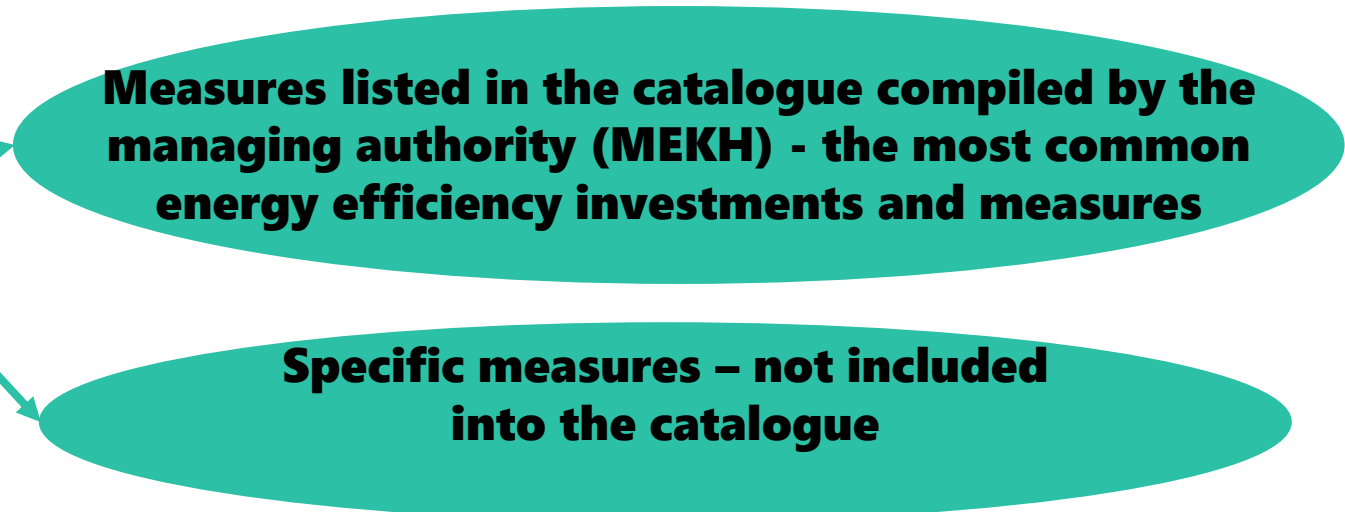
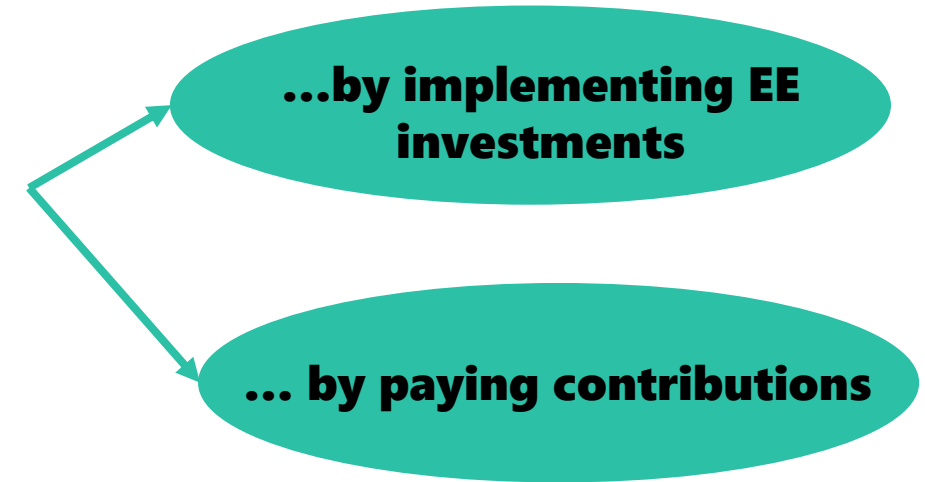
26%

* According to the Government Decree 122/2015

EEOS IN HUNGARY FROM 2021




Under the "*polluter pays principle*", companies involved in energy supply are required to achieve the energy savings targets set for them





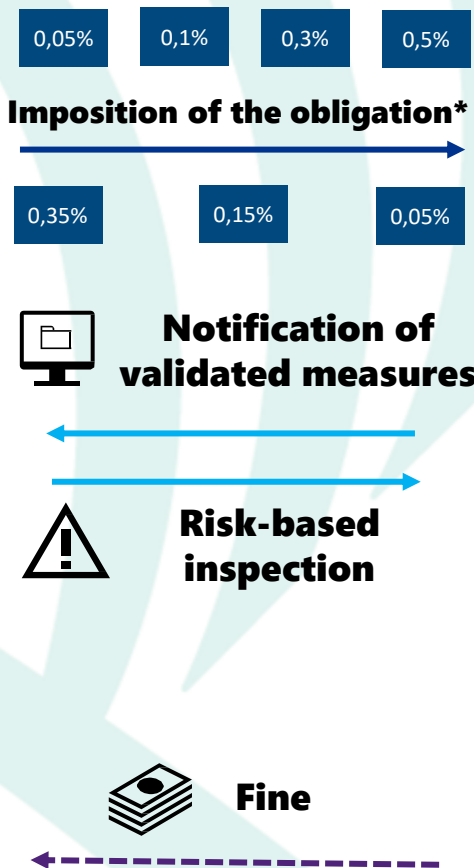
MANAGING AUTHORITY








MEKH
Hungarian Energy and Public Utility Regulatory Authority



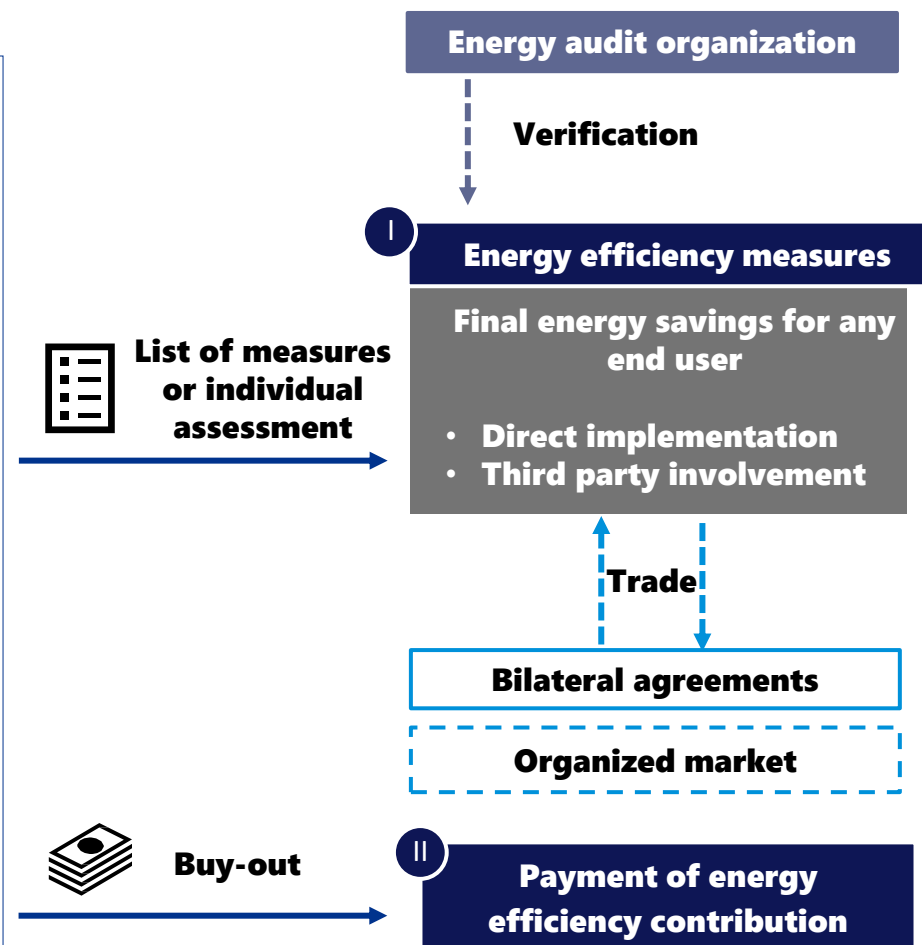
Unit responsible for EEOS



OBLIGED PARTIES

-  **Licensed electricity traders**
-  **Licensed universal electricity providers**
-  **Licensed natural gas traders**
-  **Licensed universal natural gas providers**
-  **Companies selling transport fuel to final consumers**

FULFILLMENT OF OBLIGATION



EEOS results



Obligation

291 TJ/a

396 TJ/a

1 778 TJ/a

Submitted energy savings by obligated parties

961 TJ/a



1482 TJ/a

3486 TJ/a

Nr. of implemented projects

873

1100



2269

Overperformed by 330%

Overperformed by 361%

Overperformed by 196%



Stock exchange on <https://ceegex.hu/en/ekr/about-the-ekr-market>



Thank you for your attention!

Hungarian Energy and Public Utility Regulatory Authority

Clean energy, sustainable environment

 **HUMDA**



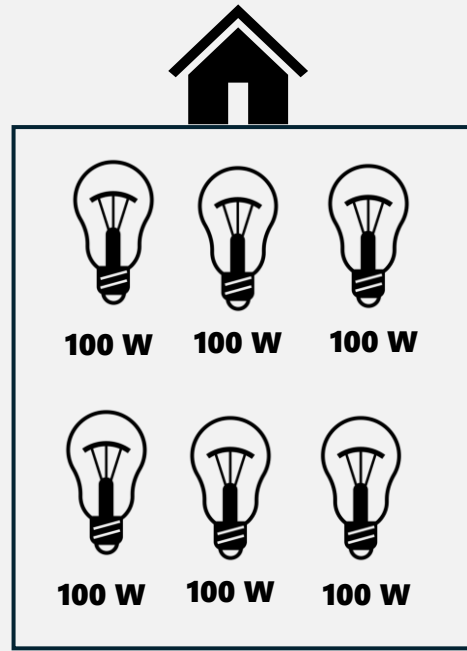
MEMBER OF
SZÉCHENYI
UNIVERSITY GROUP



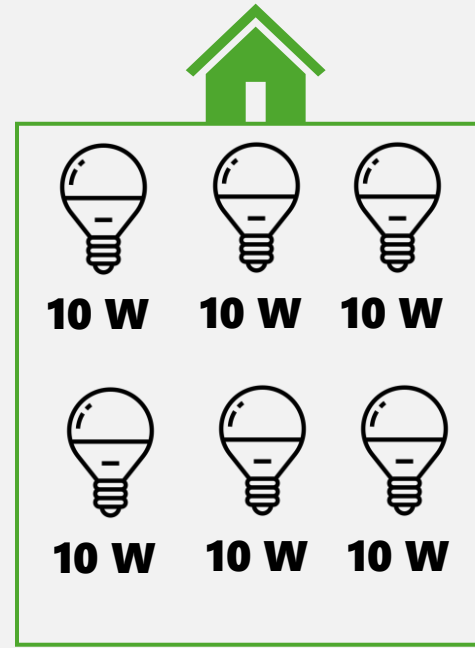
 **ENSMOV** PLUS

Ármin BÖHM
Chief Expert, HUMDA
Project Expert, CEER

WHAT IS MERIT ORDER?



600 W

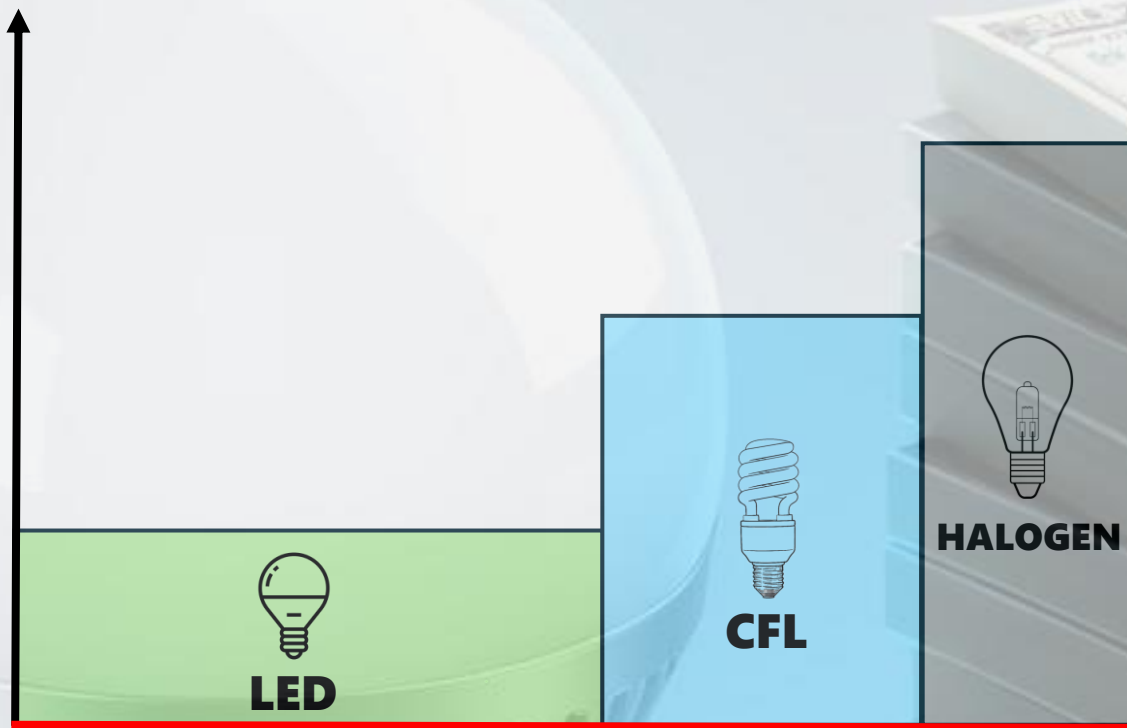


60 W




WHAT IS MERIT ORDER?


UNIT COST



ENERGY SAVING POTENTIAL


 $6 \times \text{Light Bulb} = 600 \text{ W}$
100 W

-540 W
→



 $6 \times \text{Light Bulb} = 60 \text{ W}$
10 W



SOURCES

ERM

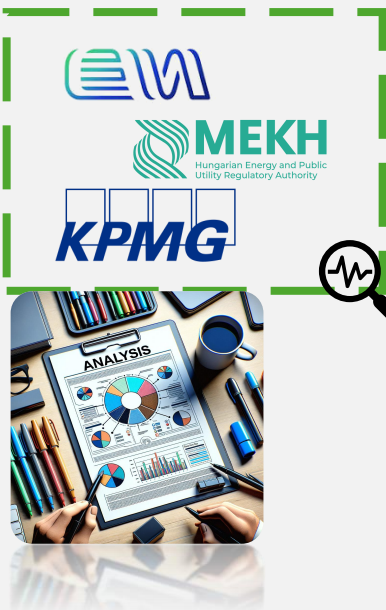
KPMG

MEKH
Hungarian Energy and Public Utility Regulatory Authority





SOURCES



STRUCTURAL REFORM SUPPORT SERVICE (SRSS)

(FROM 2020 DG REFORM)





**STRUCTURAL REFORM
SUPPORT SERVICE
(SRSS)
(FROM 2020 DG REFORM)**



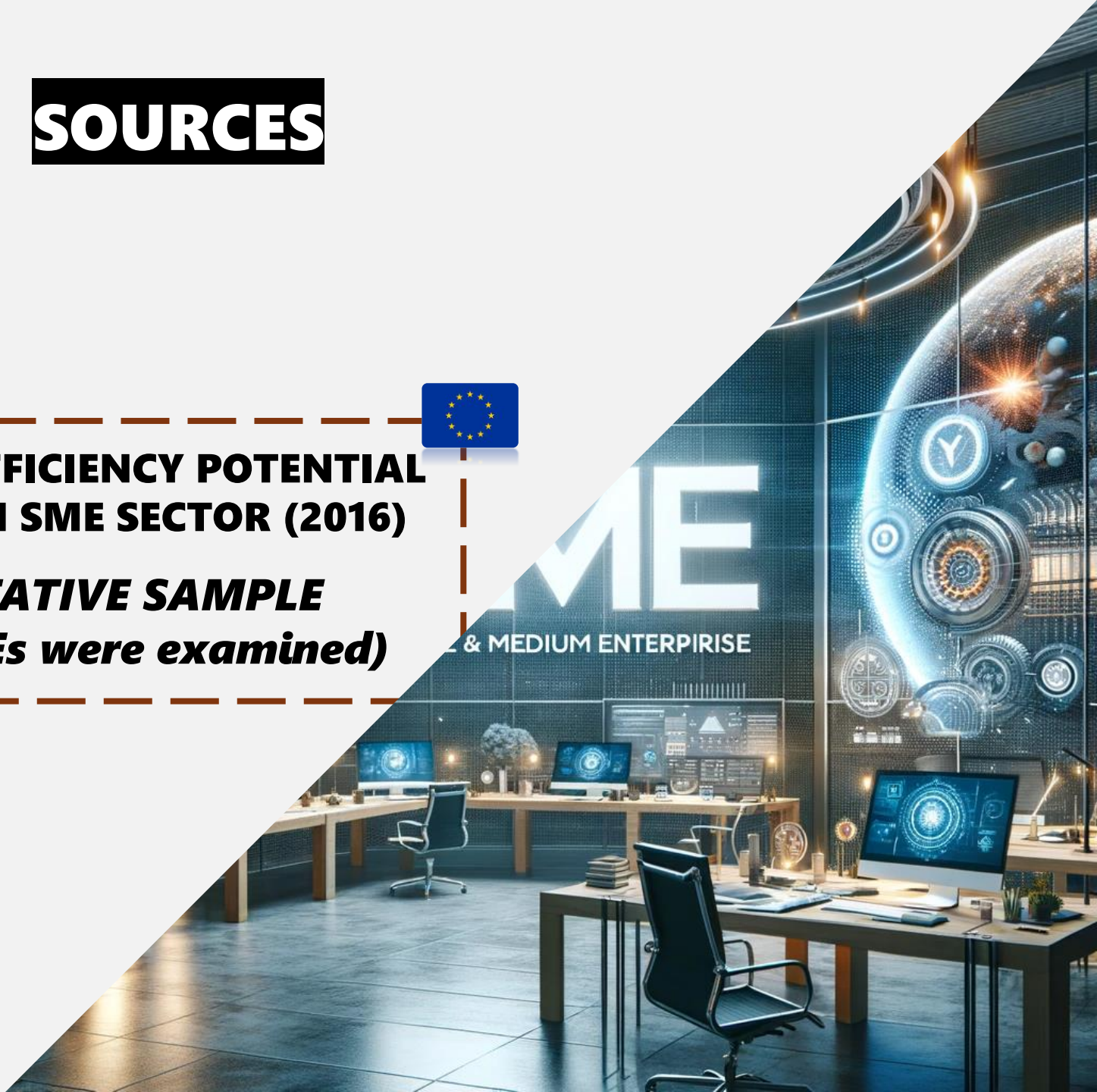
SOURCES

**KEOP ENERGY EFFICIENCY POTENTIAL
ASSESSMENT IN SME SECTOR (2016)**

***REPRESENTATIVE SAMPLE
(~120.000 SMEs were examined)***



**SME
& MEDIUM ENTERPRISE**





**STRUCTURAL REFORM
SUPPORT SERVICE
(SRSS)**
(FROM 2020 DG REFORM)



**KEOP ENERGY EFFICIENCY POTENTIAL
ASSESSMENT IN SME SECTOR (2016)**



REPRESENTATIVE SAMPLE
(~120.000 SMEs were examined)



ENSMOV PLUS

SOURCES

"ENERGY MANAGER"

POLICY MEASURE





**STRUCTURAL REFORM
SUPPORT SERVICE
(SRSS)
(FROM 2020 DG REFORM)**



**"ENERGY MANAGER"
POLICY MEASURE**



**KEOP ENERGY EFFICIENCY POTENTIAL
ASSESSMENT IN SME SECTOR (2016)**

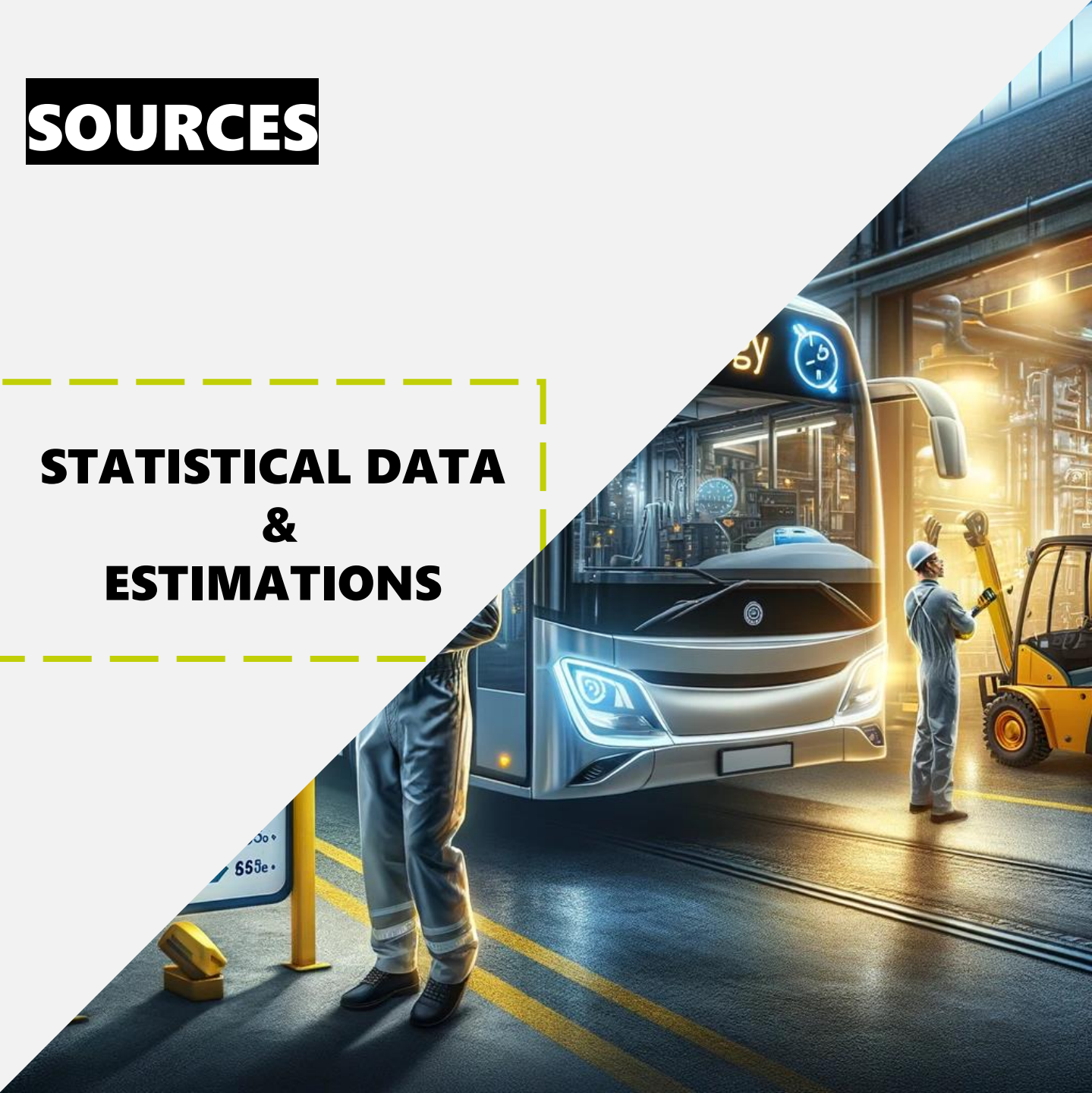


**REPRESENTATIVE SAMPLE
(~120.000 SMEs were examined)**



SOURCES

**STATISTICAL DATA
&
ESTIMATIONS**





SOURCES

EWA
MEKH
Hungarian Energy and Public
Utility Regulatory Authority
KPMG

**STRUCTURAL REFORM
SUPPORT SERVICE
(SRSS)
(FROM 2020 DG REFORM)**

**"ENERGY MANAGER"
POLICY MEASURE**

**KEOP ENERGY EFFICIENCY POTENTIAL
ASSESSMENT IN SME SECTOR (2016)**

**REPRESENTATIVE SAMPLE
(~120.000 SMEs were examined)**

**STATISTICAL DATA
&
ESTIMATIONS**

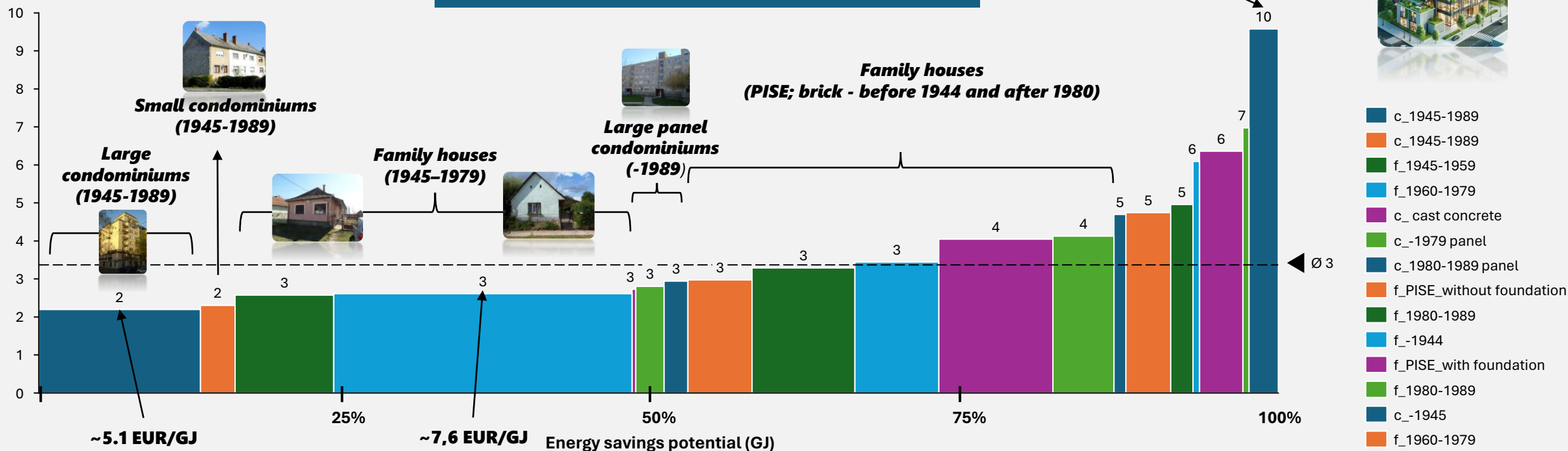
BUILDING ENERGY PERFORMANCE

**STRUCTURAL REFORM
SUPPORT SERVICE
(SRSS)
(FROM 2020 DG REFORM)**



Lifetime investment unit cost
(thousand HUF / GJ)

INSULATION + DOOR & WINDOW (D&W) REPLACEMENT



Total final energy consumption

210 PJ

Total estimated potential

79 PJ

Average investment cost per residence

**3,24 million HUF
(~8 243 EUR)**

Legend

*f: family house
c: condominium*

BUILDING ENERGY PERFORMANCE



Mónika Bene – Antal Ertl – Áron Horváth – Gergely Mónus – Judit Székely

In terms of geographical variables, it is worth highlighting the consumption of real estate in the Northern Hungary and North regions compared to other regions. It can be assumed that the real estate characteristics in these parts of the country are also different from other regions, because the owners explain an average difference of 35 kWh/m²a between the categories.

Condominiums built with panel technology require around 20 kWh/m²a more energy than the average condominium.

The energy demand of homes without hot water supply is higher, reflecting the impact of other factors such as outdoor temperature and neglect. The proportion of dwellings without hot water is around 10% of the total dwelling stock.

The coefficients of the regressions and the standard errors are given in Annex 2.

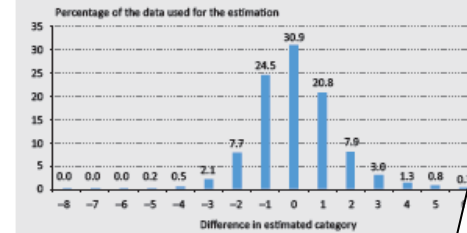
2.3. Fitting a random forest model

Since the aim of our work is to estimate as accurately as possible the energy demand based on the dwelling characteristics, we used a popular model in the field of machine learning, the random forest model, which can capture more flexible relationships in the data than OLS. The model incorporates the interactions between variables.

The algorithm grew 1,000 trees, with a minimum node size of 5 units. The results were tested on both training and test sets. The results of the test set are shown in Figure 3 based on the estimation of categories. The model was wrong in 86 per cent of the cases.

Mónika Bene – Antal Ertl – Áron Horváth – Gergely Mónus – Judit Székely

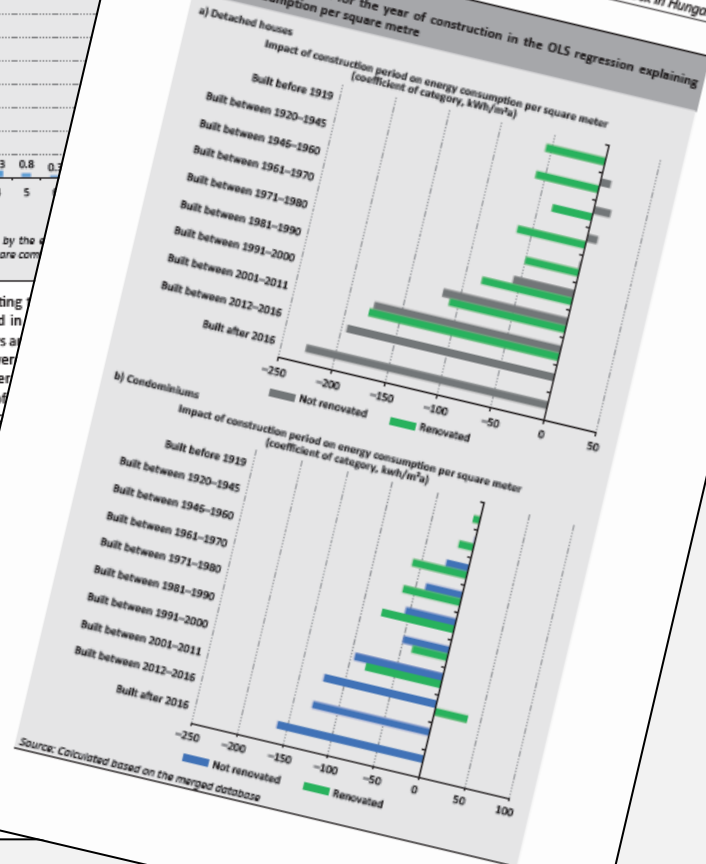
Figure 1
Errors of the OLS regression explaining energy consumption per square metre by category difference



Note: Positive numbers: the energy consumption per square metre predicted by the model is higher than the actual certificate (AA+, AA, AA and BB categories are compared).
Source: Calculated based on the merged database

Beyond the general fitting characteristics, it is worth highlighting some estimated coefficients. In the building typology used in the Renovation Strategy, the period of construction of buildings plays a significant role. The coefficients for the periods defined in the Microcensus were used in our estimation (see Figure 2). The energy consumption per square metre of modern buildings can be up to 200 kWh/m²a lower than that of older buildings. Differences are slightly larger for detached houses than for condominiums. Renovated dwelling units show a 50–100 kWh/m²a lower energy consumption compared to non-renovated units. This estimated impact is statistically almost negligible for buildings built after 2000. For condominiums built after 2000, the impact is significant due to the low number of units.

Figure 2
Estimated coefficients for the year of construction in the OLS regression explaining energy consumption per square metre



Source: Calculated based on the merged database



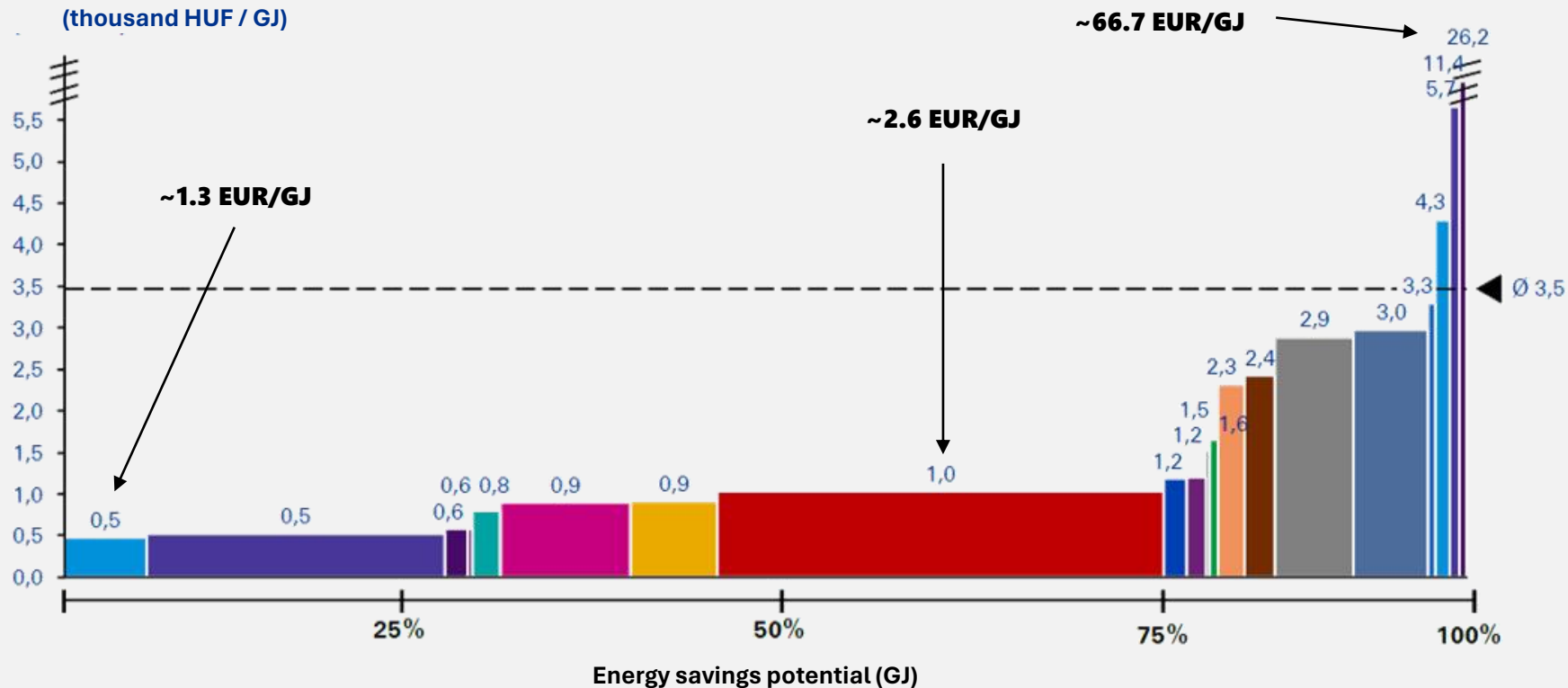
SME

KEOP ENERGY EFFICIENCY POTENTIAL ASSESSMENT IN SME SECTOR (2016)



REPRESENTATIVE SAMPLE
(~120.000 SMEs were examined)

Lifetime investment unit cost
(thousand HUF / GJ)



- Processing industry - Lighting
- Processing industry - Insulation
- Other services - Lighting
- Commerce - Lighting
- Other industry - Insulation
- Processing industry - D&W replacement
- Other services - Insulation
- Processing ind. - Heating sys. modern.
- Commerce - Insulation
- Processing ind. - DHW sys. modernization
- Other industry - Lighting
- Other services - DHW sys. modernization
- Other services - Utilization of RES
- Other services - D&W replacement
- Other industry - Heating sys. modern.
- Processing industry - Utilization of RES
- Other industry - D&W replacement
- Commerce - D&W replacement
- Commerce - Heating sys. Modern.
- Other industry - Heating sys. modern.
- Other industry - DHW sys. Modern.

Total estimated potential

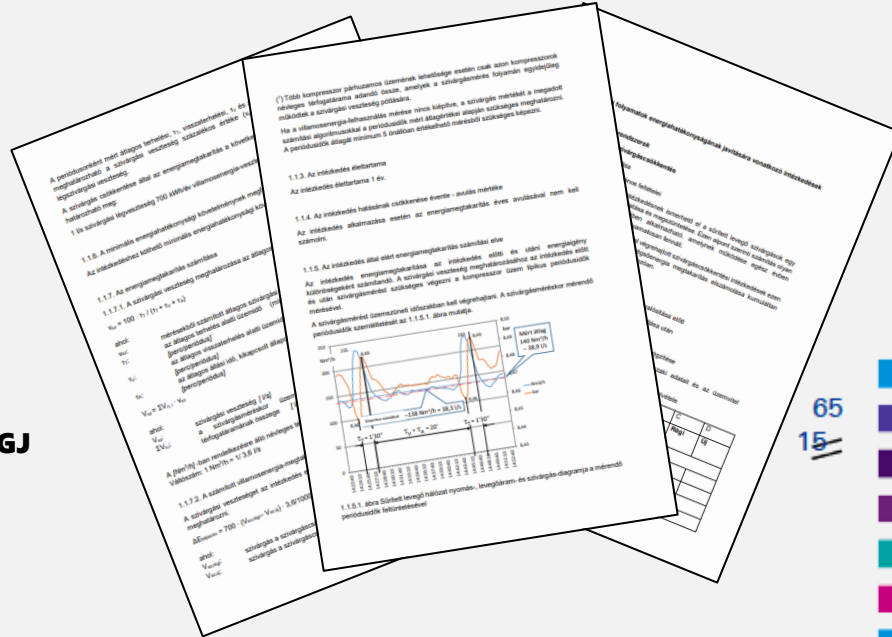
13 PJ



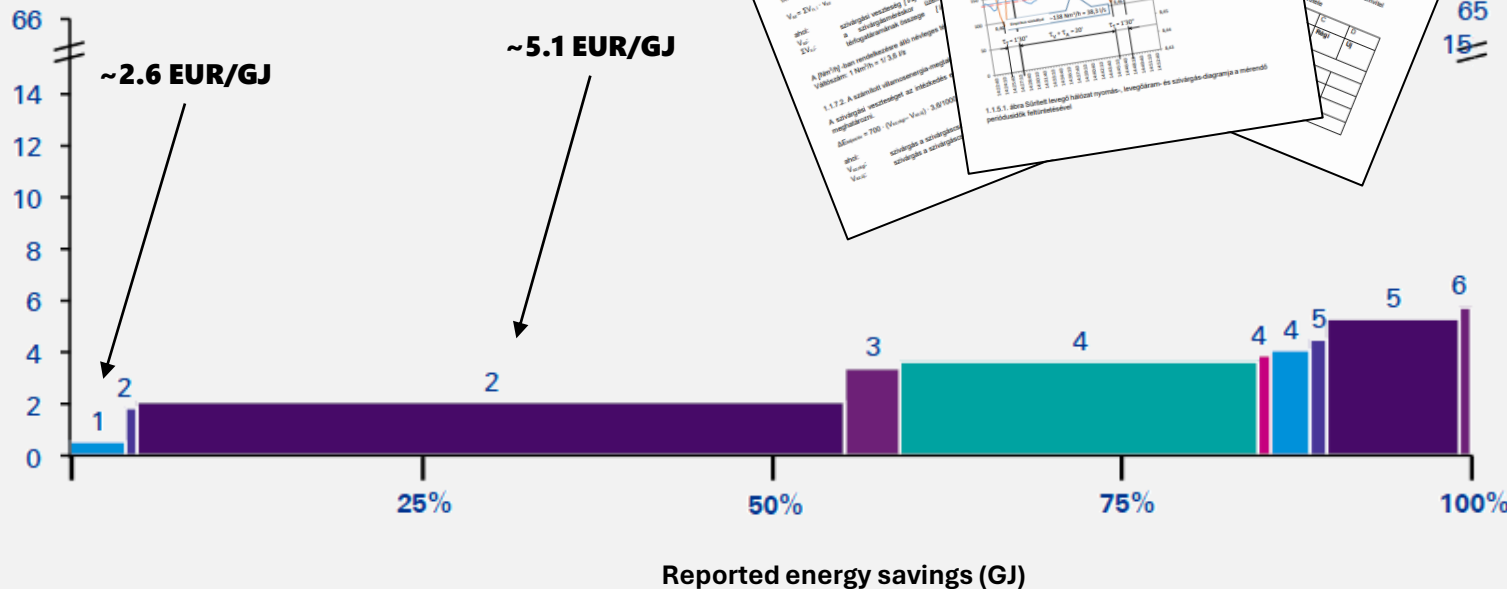
INDUSTRY



"ENERGY MANAGER"
POLICY MEASURE



Median investment cost over lifetime
(thousand HUF / GJ)



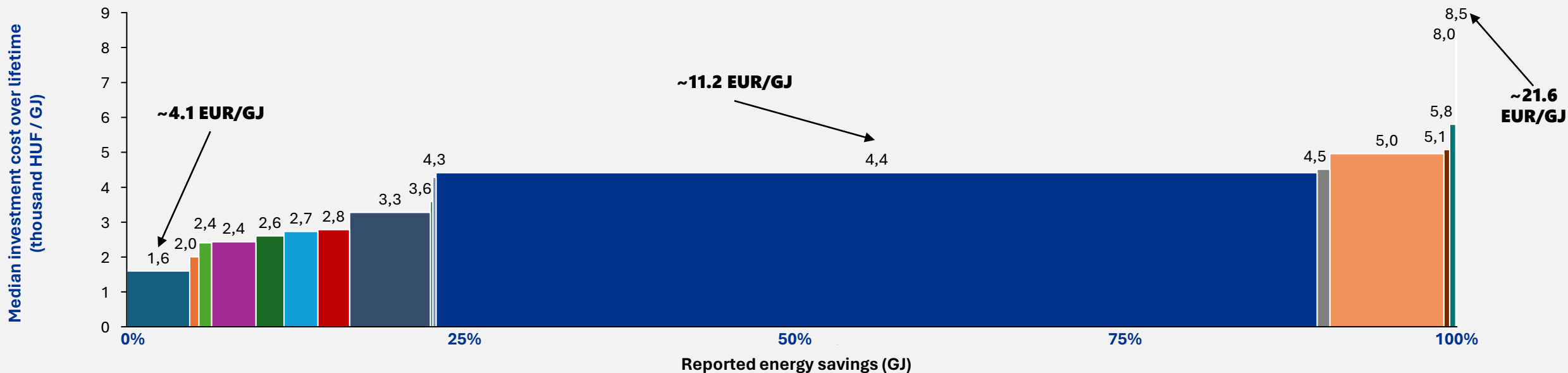
- Industrial Processes - Gas
- Industrial Processes - Compressed air
- Building Services - Heating Sys.& DHW
- Electrical systems - Building Surv. & Lighting
- Industrial Processes - Production
- Building Services - Ventilation
- Building Structures - Renovation
- Building Services - Cooling
- Other
- Renewable Energies - Solar
- Transportation - Freight Transport
- Transportation - Passenger Transport



INDUSTRY (by sector)



"ENERGY MANAGER"
POLICY MEASURE

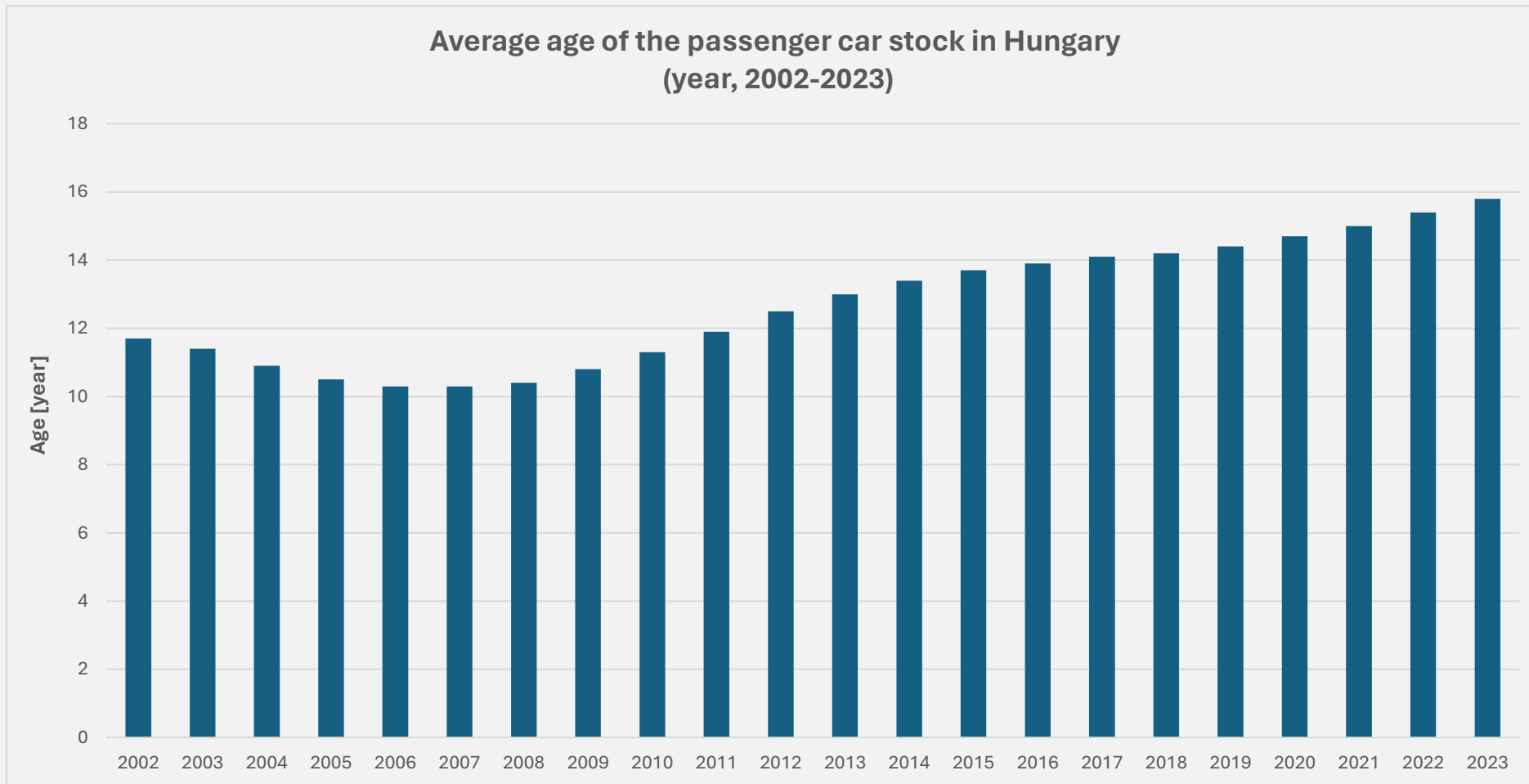


- Coke ovens and oil refineries
- Wood and wood products (except furniture manufacture)
- Paper, pulp & printing
- Electricity and heat production, other - energy sector
- Non-metallic minerals
- Others - industry
- Non-ferrous metal raw materials, basic iron and steel
- Trade and public services
- Transport equipment
- Fisheries, agriculture and forestry
- Machinery
- Pipeline transport, road, rail, domestic water transport, international air transport
- Food, beverages & tobacco
- Mining and quarrying, extraction of petroleum and natural gas
- Chemical and petrochemicals
- Construction
- Textile and leather industry



TRANSPORT

**STATISTICAL DATA
&
ESTIMATIONS**





TRANSPORT

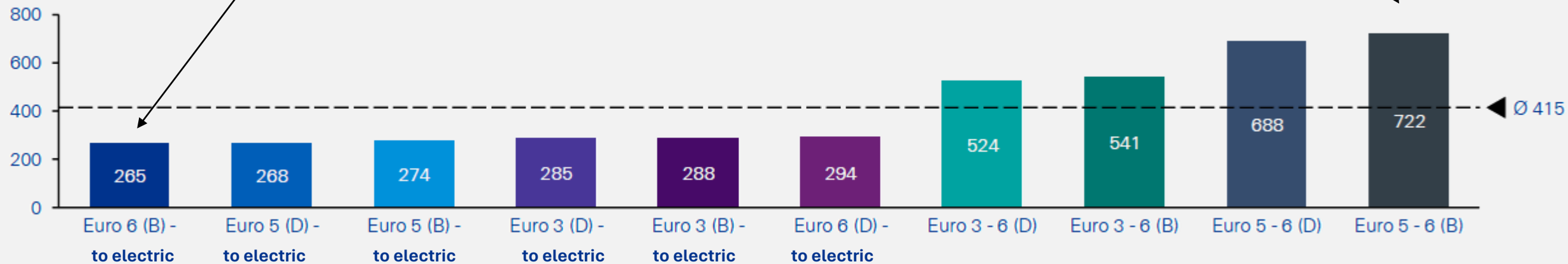
STATISTICAL DATA
&
ESTIMATIONS



~1836.1 EUR/GJ

~673.9 EUR/GJ

Investment unit cost
(thousand HUF / GJ)



Ø 415

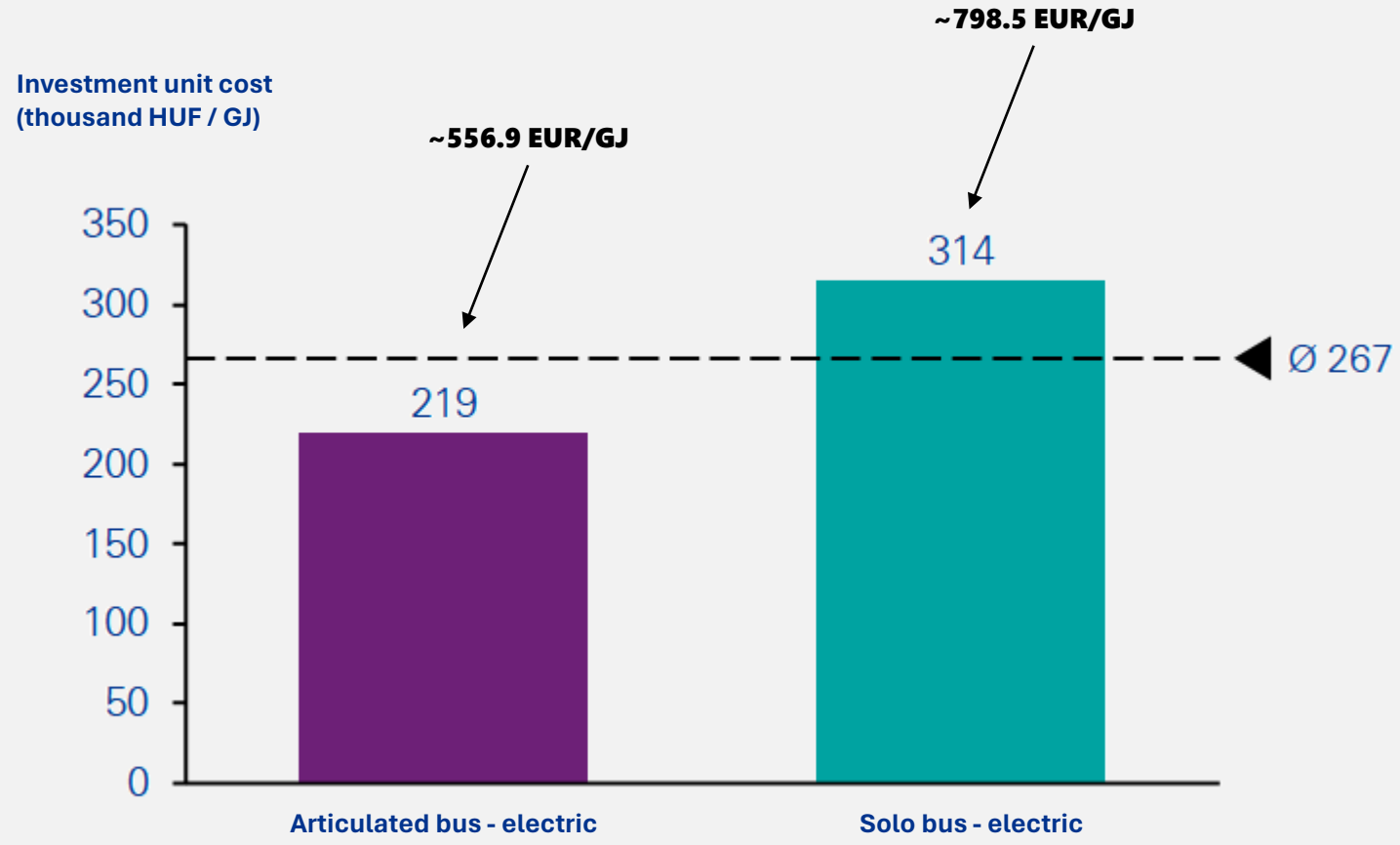
Legend:

D: diesel
B: gasoline



TRANSPORT (buses)

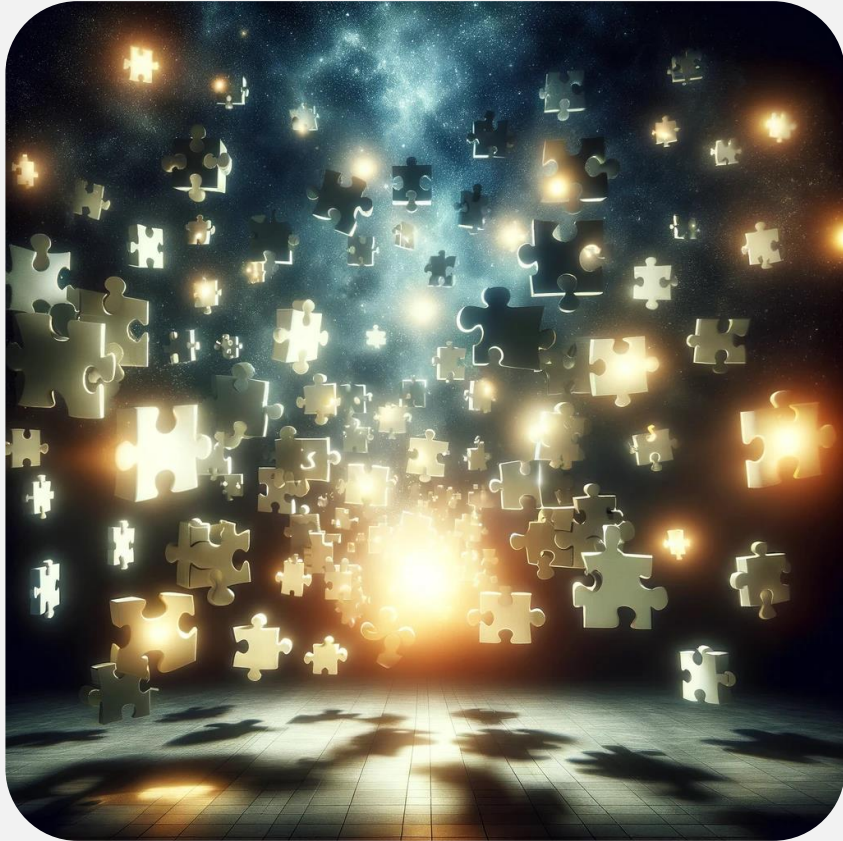
STATISTICAL DATA
&
ESTIMATIONS



GREEN BUS PROGRAMME



FUTURE WORK



 **HUMDA**

 MEMBER OF
SZÉCHENYI
UNIVERSITY GROUP

THANK YOU FOR YOUR ATTENTION!

 **ENSMOV** PLUS

Ármin BÖHM

*Chief Expert, HUMDA
Project Expert, CEER*

armin.bohm@humda.hu