



# Analysis of Data from Energy Audits Reports of Large Enterprises



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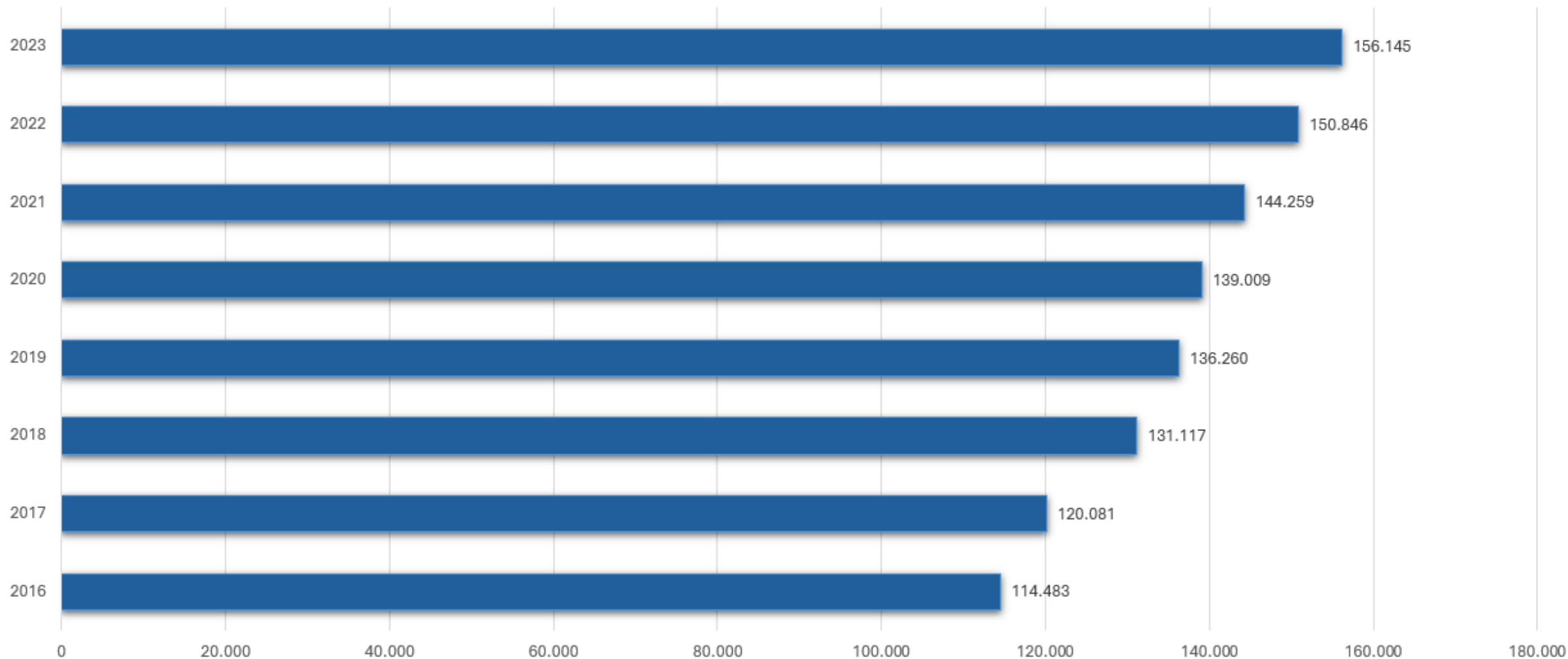
# Large enterprises obligations

- **Large companies** - trading companies that employ an average of at least 250 people during the business year and meet one of the other two conditions for classifying a company in the category of a large company **in accordance with the law regulating the accounting of entrepreneurs**
- Large companies are required to prepare an independent energy audit for large companies **every four years**
- Large companies that introduce **an energy or environmental management system**, which includes an obligation to regularly carry out energy audits, based on a certificate issued by an accredited independent body according to relevant European or international standards, are not required to prepare an energy audit.

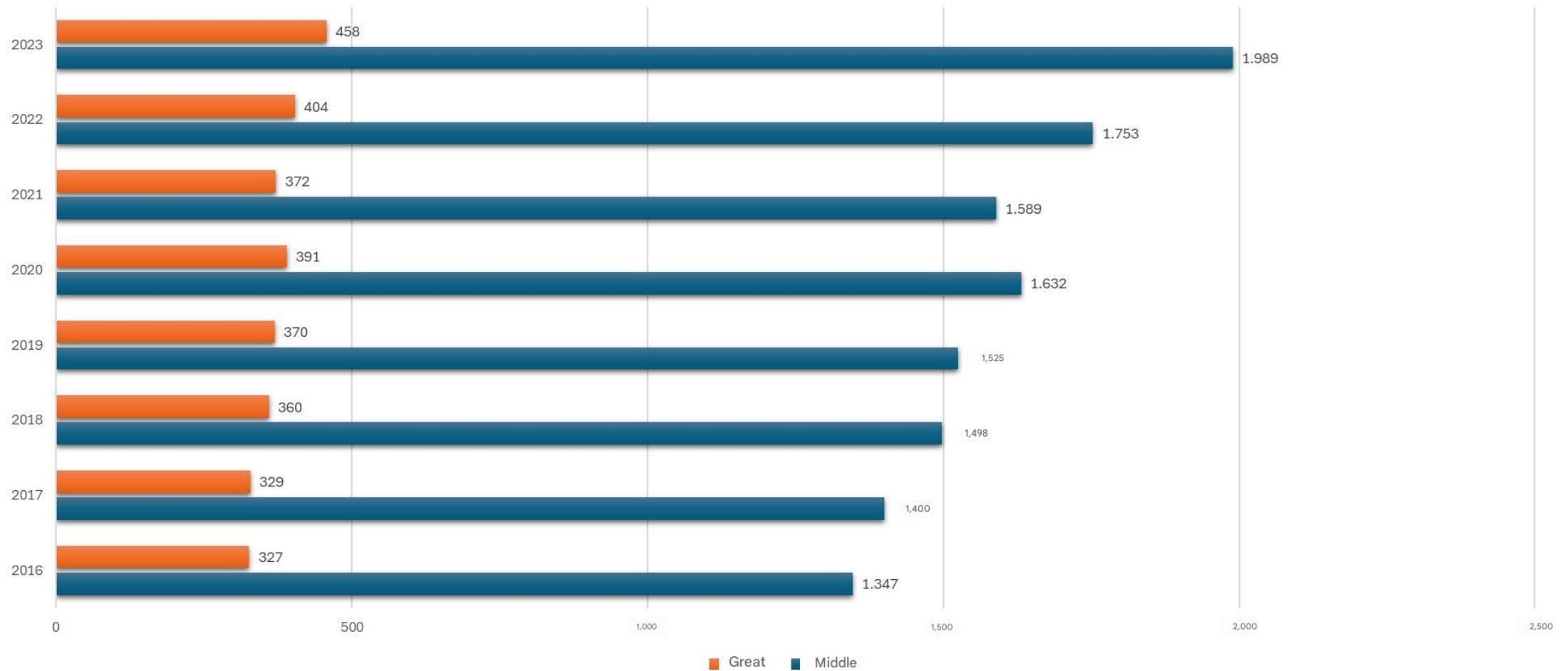
# Large enterprises obligations

- Large enterprises are obliged to **provide the Ministry with proof**, or a certificate of the introduced energy or environmental management system, which includes the obligation to regularly carry out energy audits issued by an accredited independent body according to relevant European or international standards **and a report on the energy audit made as part of that system**.
- **Rulebook on energy audit for large enterprises** - prescribes the conditions for issuing and revoking authorization for energy audits for large companies, the content of the report and the manner of keeping the register.

# Total number of companies in the Republic of Croatia (2016 – 2023)



# Medium and large companies (2016 – 2023)



# Analysis of reports on energy audits of large companies

- In 2023, **458 large companies are registered** in the Republic of Croatia
- **219** large companies implemented the first EPVP (Energy Audit for Large Enterprises) in the period from 2016 to 2024 (04/2024)
- **63** large companies conducted the first and second EPVP (04/2024)
- The analysis included **63 large companies** that prepared the first and second energy audits, i.e. **126 EPVP reports**

# Analysis of reports on energy audits of large companies

- Structure analysis and integrity of the data in the EPVP report is carried out with goal to identify the opportunities for quality improvements and recommendations for standardization reports and harmonization with reporting requirements from Article 11 of the EnU Directive (EED 2023)
- Activities :
  - *Establishment of the EPVP Register*
  - *Analysis of companies in the Register according to economic areas activities*
  - *Analysis of the **consumption data** energy and water*
  - *Analysis of the **EEMs status***
  - *Identification of non-compliance and incompleteness of data*
  - *General recommendations for improving the quality*

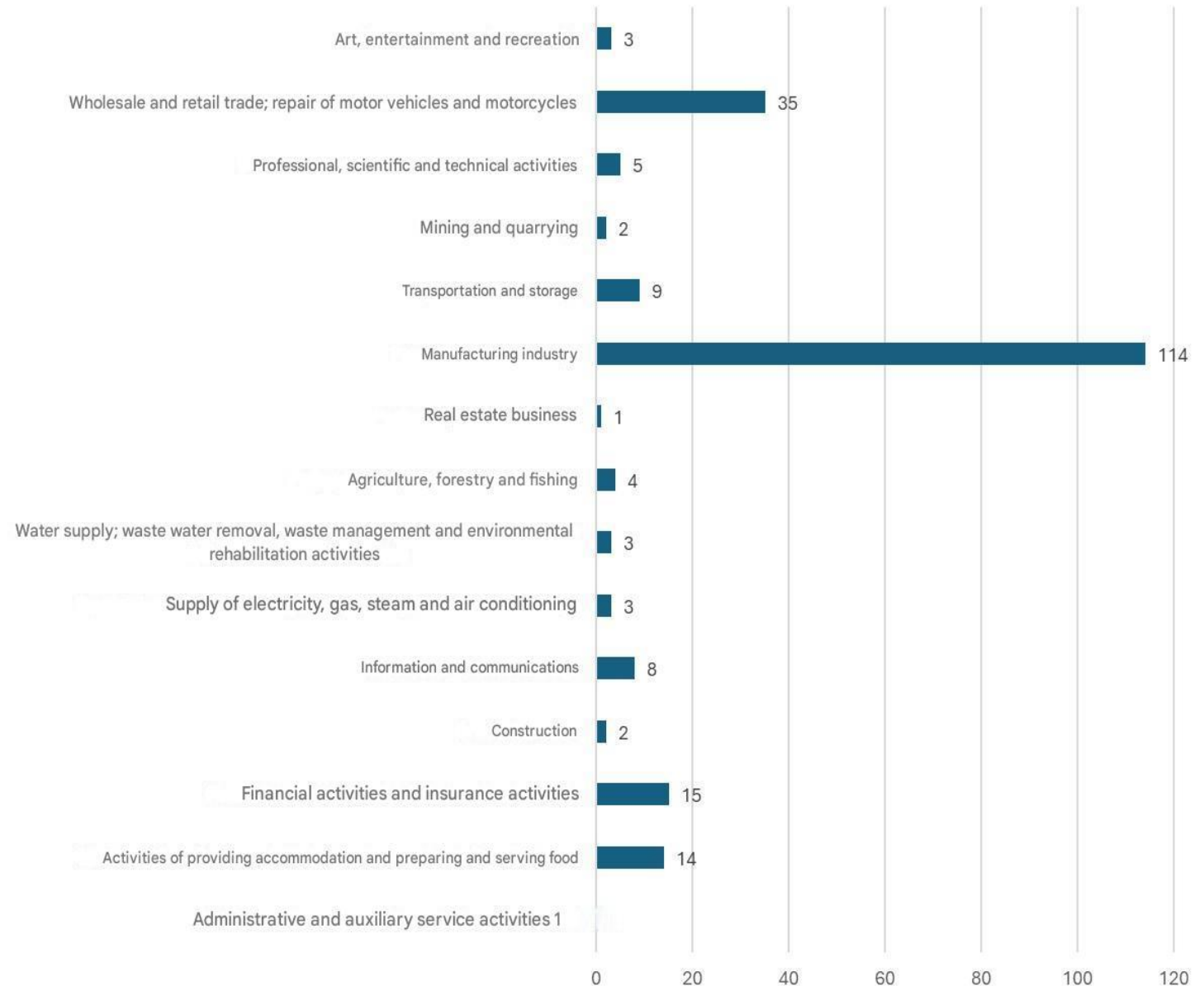


# EPVP Register

NKD area	Company number
Administrative and auxiliary service activities	1
Activities of providing accommodation and preparing and serving food	14
Financial activities and insurance activities	15
Construction	2
Information and communications	8
Supply of electricity, gas, steam and air conditioning	3
Water supply; waste water removal, waste management and environmental rehabilitation activities	3
Agriculture, forestry and fishing	4
Real estate business	1
Manufacturing industry	114
Transportation and storage	9
Mining and quarrying	2
Professional, scientific and technical activities	5
Wholesale and retail trade; repair of motor vehicles and motorcycles	35
Art, entertainment and recreation	3
<b>TOTAL</b>	<b>219</b>

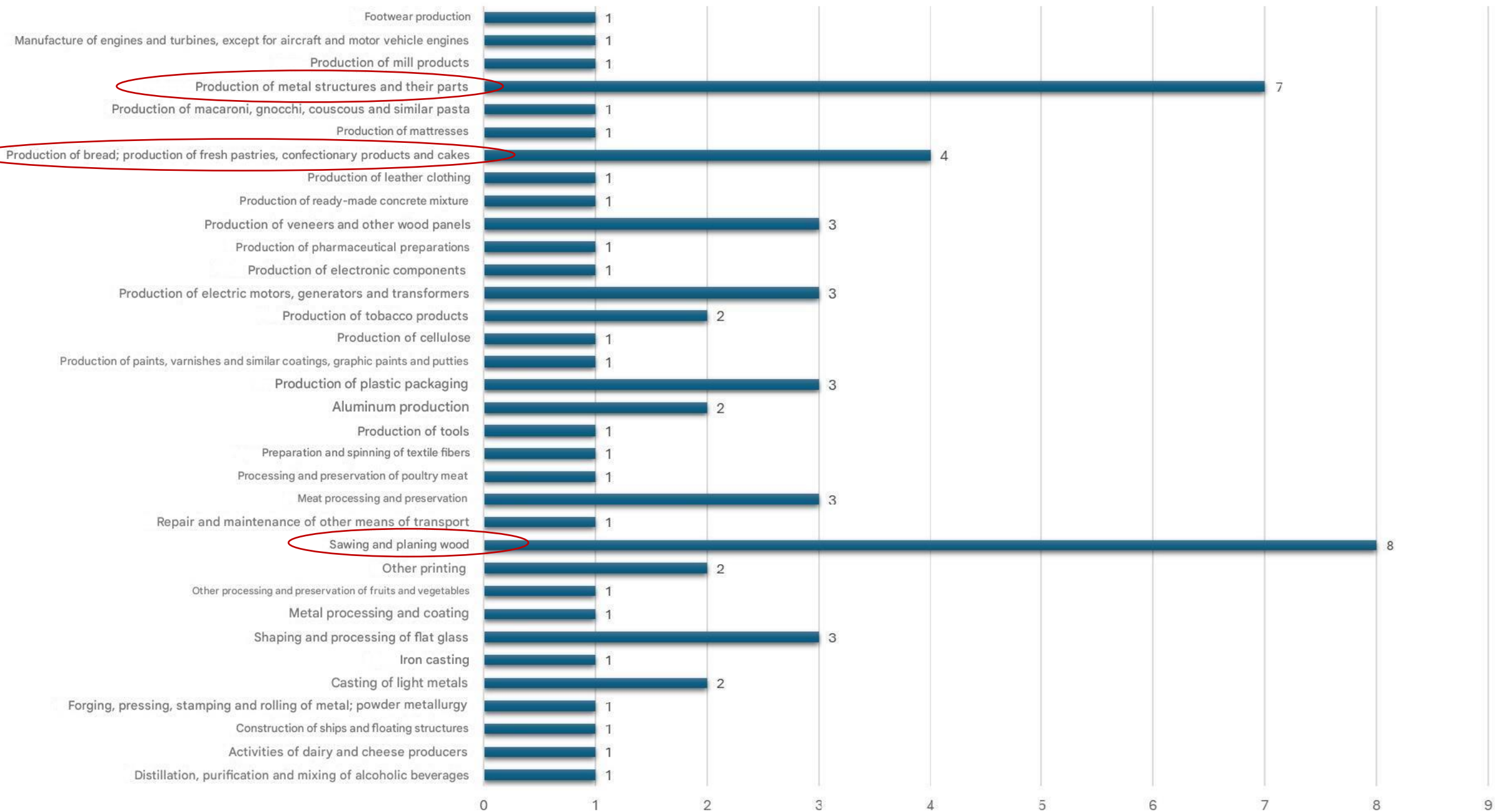


Number of companies by NKD area

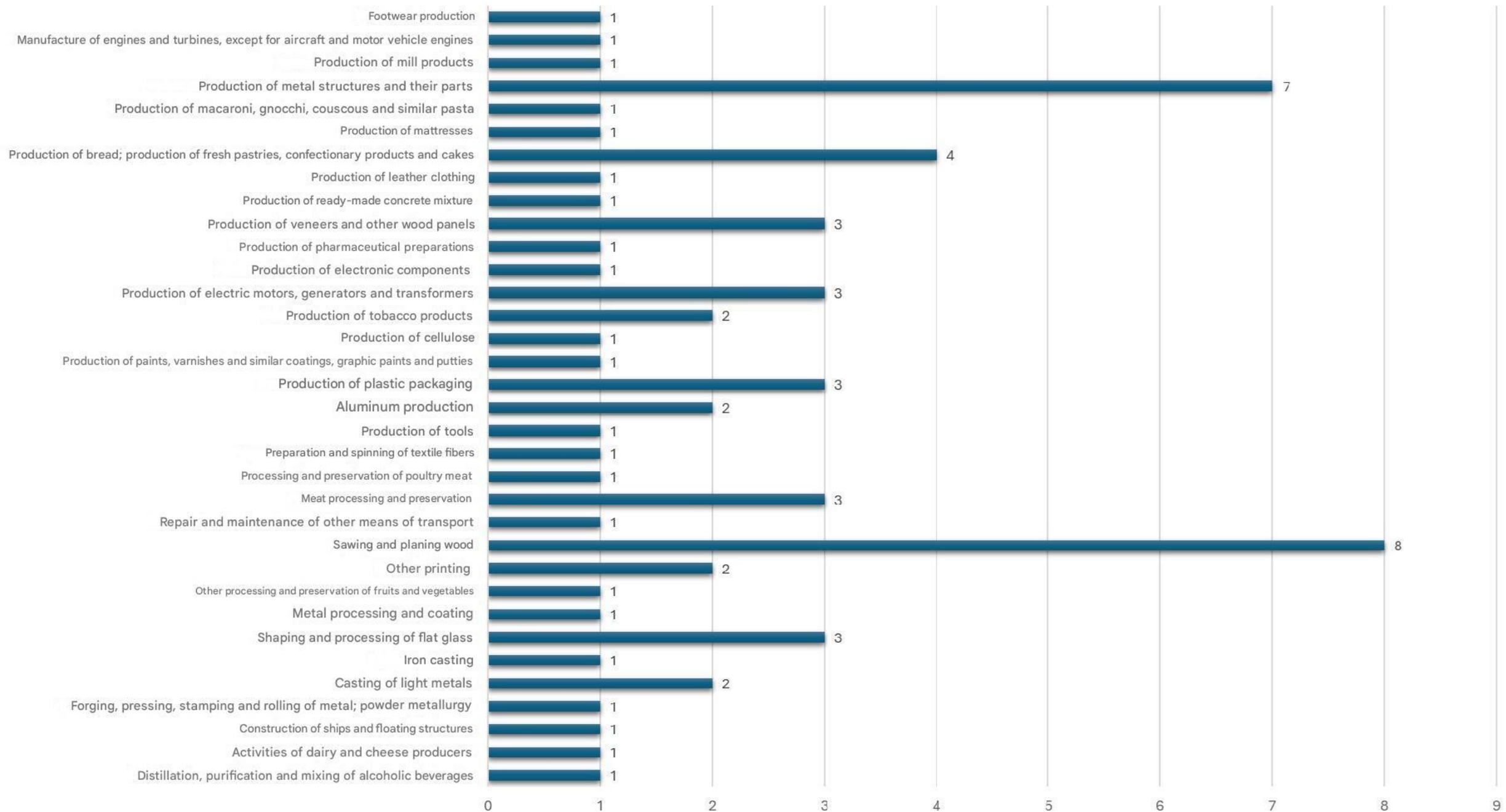




## Structure of companies in the EPVP Register in the processing industry



## Structure of companies in the EPVP Register in the processing industry



# Analysis of consumption data

- Structure data on consumption in EPVP reports often varies what reduces reliability and comprehensiveness analysis.
- Data are presented in different formats (for the previous a year; for the previous three years; the average of the previous three years; incomplete annual consumption; in some cases no specification on the type of energy source etc.).
- In companies with large number of locations and buildings sometimes lacks summary data for the entire company (e.g. shown separately by individual location), which makes analysis difficult at the level of the entire organization.
- In companies that conducted two energy audits (if different companies conducted audits), often there is a difference in structure (e.g. they are not covered all energy sources) and scope (e.g. all locations/buildings are not covered) of the analyzes so data are not comparable.

# Analysis of data on the proposed and implemented EEMs

- **766** EEMs are identified for 63 companies who are spent first and the second EPVP in the period from 2016 to 2024
- Analysis is not covered EEMs like energy management system implementation and change behavior but only investment EEMs.
- **136** EEMs which are in 2nd EPVP report repeated from the first EPVP reports were registered
- **24** EEMs are described (in 2nd EPVP) as implemented. It is important to note that this data is only from the sample of the reports and the data do not represent the total and final number of measures implemented in large companies or in sector.
- It is necessary to establish a system of continuous monitoring and recording of implemented EEMs and their impact in companies.

# Analysis of data on the proposed and implemented EEMs

- Data structure on EEMs is generally uniform and in the majority cases whole.
- Relevant indicators like potential cost savings efficiency and reduction CO<sub>2</sub> emissions are shown practically in all Reports .
- In some reports for some standard EEMs are displayed only descriptive, without calculation effect (savings in kWh and EUR, reduction of CO<sub>2</sub>, simple payback period). That should be corrected in the future reports, since the calculation savings for standard EEMs according to the SMIV Rulebook (national regulation/methodology) is simple .

# Analysis of data on the proposed and implemented EEMs

- Specific measures, especially in the *Processes* sector, are often stated only in the form of descriptions, without quantitative assessments.
- Given the specificity of some measures, it is understandable that savings estimates are more difficult to obtain without the involvement of experts with narrow specialist knowledge.
- It is necessary to identify the challenges that arise when recommending EEMs in industrial processes, since most recommended EEMs are mostly standard measures for buildings.

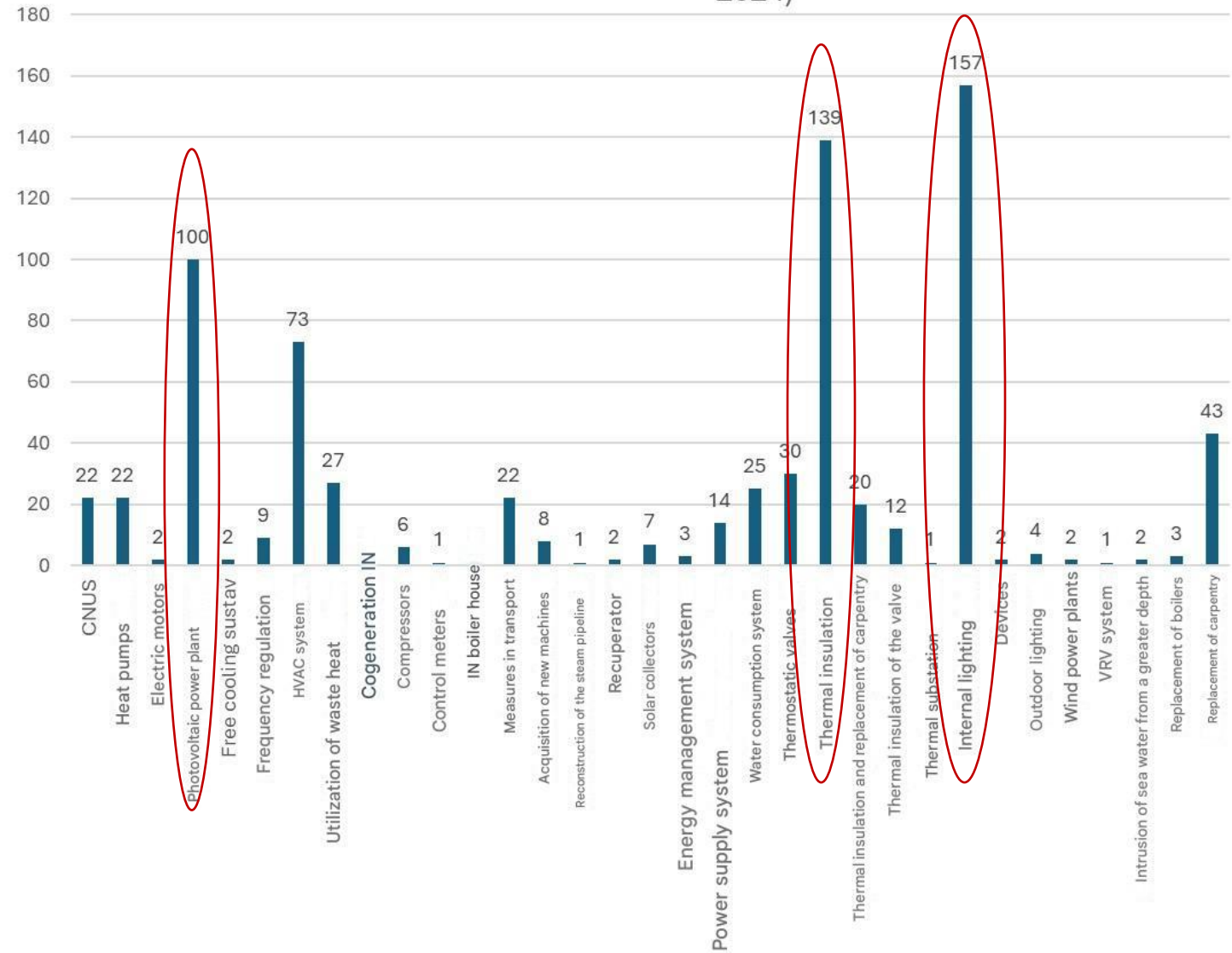
# Analysis of data on the proposed and implemented EEMs

- Energy savings estimations, which arise from behavioral changes, are often overestimated, as they often are expressed as certain percentage of the total consumption energy, what it can result with unrealistic assessments in companies with large energy intensity.
- In some cases, there is a lack of precise indication of the type of energy to which the effect of a certain EEMs applies.
- In the 2nd Report there are rarely comparison of the status of the EEMs implementation proposed in the 1st Report. The analysis of the implemented EEMs should definitely be performed as part of the energy audits in order to enable the monitoring and evaluation of the success of the implementation of the proposed EEMs over time, which would ensure better analysis and further decision-making.



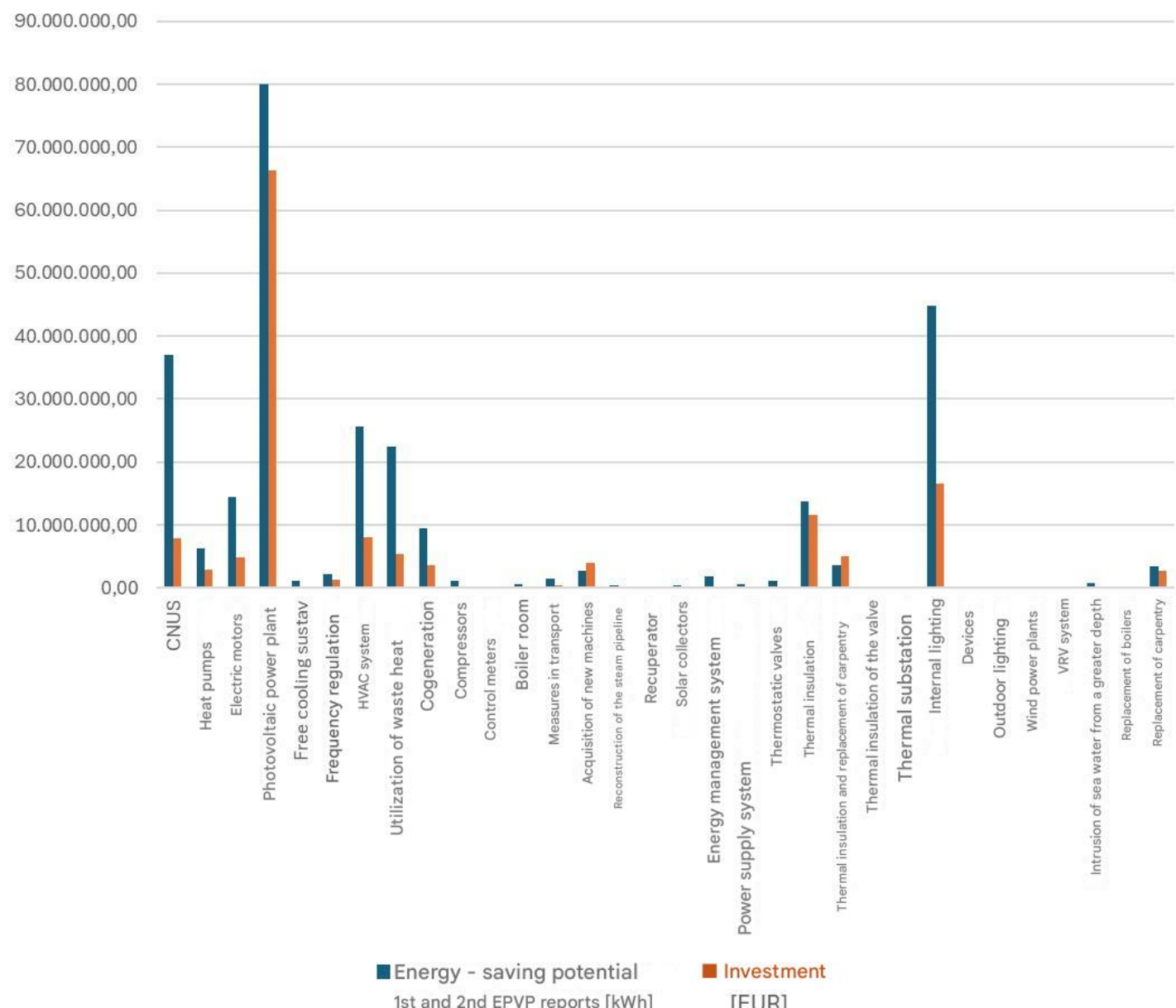
# Data on the proposed EEMs

Number of all proposed measures EnU 1st and 2nd EPVP report (2016 - 2024)



Type of measure	Number of all proposed measures EnU 1st and 2nd EPVP report (2016 - 2024)
CNUS	22
Heat pumps	22
Electric motors	2
Photovoltaic power plant	100
Free cooling system	2
Frequency regulation	9
HVAC system	73
Utilization of waste heat	27
Cogeneration	2
Compressors	6
Control meters	1
Boiler room	2
Measures in transport	22
Acquisition of new machines	8
Reconstruction of the steam pipeline	1
Recuperator	2
Solar collectors	7
Energy management system	3
Power supply system	14
Water consumption system	25
Thermostatic valves	30
Thermal insulation	139
Thermal insulation and replacement of carpentry	20
Thermal insulation of the valve	12
Thermal substation	1
Internal lighting	157
Devices	2
Outdoor lighting	4
Wind power plants	2
VRV system	1
Intrusion of sea water from a greater depth	2
Replacement of boilers	3
Replacement of carpentry	43
TOTAL:	766

# Data on the proposed EEMs



Type of measure	Energy - savings potential 1st and 2nd report EPVP [kWh]	Investment [EUR]
CNUS	37,100,273.16	7,937,443.63
Heat pumps	6,280,828.17	2,960,533.56
Electric motors	14,472,047.24	4,852,855.32
Photovoltaic power plant	80,066,523.03	66,395,071.15
Free cooling system	1,202,423.96	2,654.46
Frequency regulation	2,155,888.67	1,354,959.85
HVAC system	25,680,620.33	8,141,997.04
Utilization of waste heat	22,528,269.73	5,461,854.01
Cogeneration	9,425,000.00	3,637,666.73
Compressors	1,170,973.26	249,963.97
Control meters	73,847.27	3,981.68
Boiler room	558,464.48	150,810.86
Measures in transport	1,551,337.48	485,580.86
Acquisition of new machines	2,706,039.56	3,974,027.71
Reconstruction of the steam pipeline	475,528.00	103,523.79
Recuperator	139,242.00	6,954.68
Solar collectors	372,383.90	176,889.01
Energy management system	1,834,912.38	236,269.83
Power supply system	592,803.59	114,706.35
Thermostatic valves	1,212,241.03	167,515.16
Thermal insulation	13,744,015.13	11,571,245.37
Thermal insulation and replacement of carpentry	3,694,932.20	5,096,366.89
Thermal insulation of the valve	335,355.47	21,355.10
Thermal substation	119,816.29	8,494.26
Internal lighting	44,747,454.78	16,618,973.60
Devices	20,976.00	1,651.07
Outdoor lighting	65,245.20	21,635.65
Wind power plants	28,308.00	0.00
VRV system	9,866.27	36,962.64
Intrusion of sea water from a greater depth	859,774.20	146,231.34
Replacement of boilers	207,585.00	92,294.78
Replacement of carpentry	3,528,833.92	2,704,598.55
TOTAL:	276,961,809.70	142,735,068.86

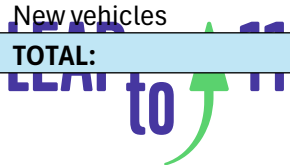
# Data on the proposed EEMs by sectors

Sector	Number of EnU measures
Buildings	722
Processes	25
Transport	19
<b>TOTAL:</b>	<b>766</b>

Processes - EnU measure	Savings [kWh]
Electric motors	14,472,047.24
Utilization of waste heat	3,228,128.00
Compressors	665,737.20
Acquisition of new machines	630,497.70
Power supply system	-
Thermal insulation	158,027.00
Intrusion of sea water from a greater depth	859,774.20
Replacement of boilers	110,000.00
<b>TOTAL:</b>	<b>20,124,211.34</b>

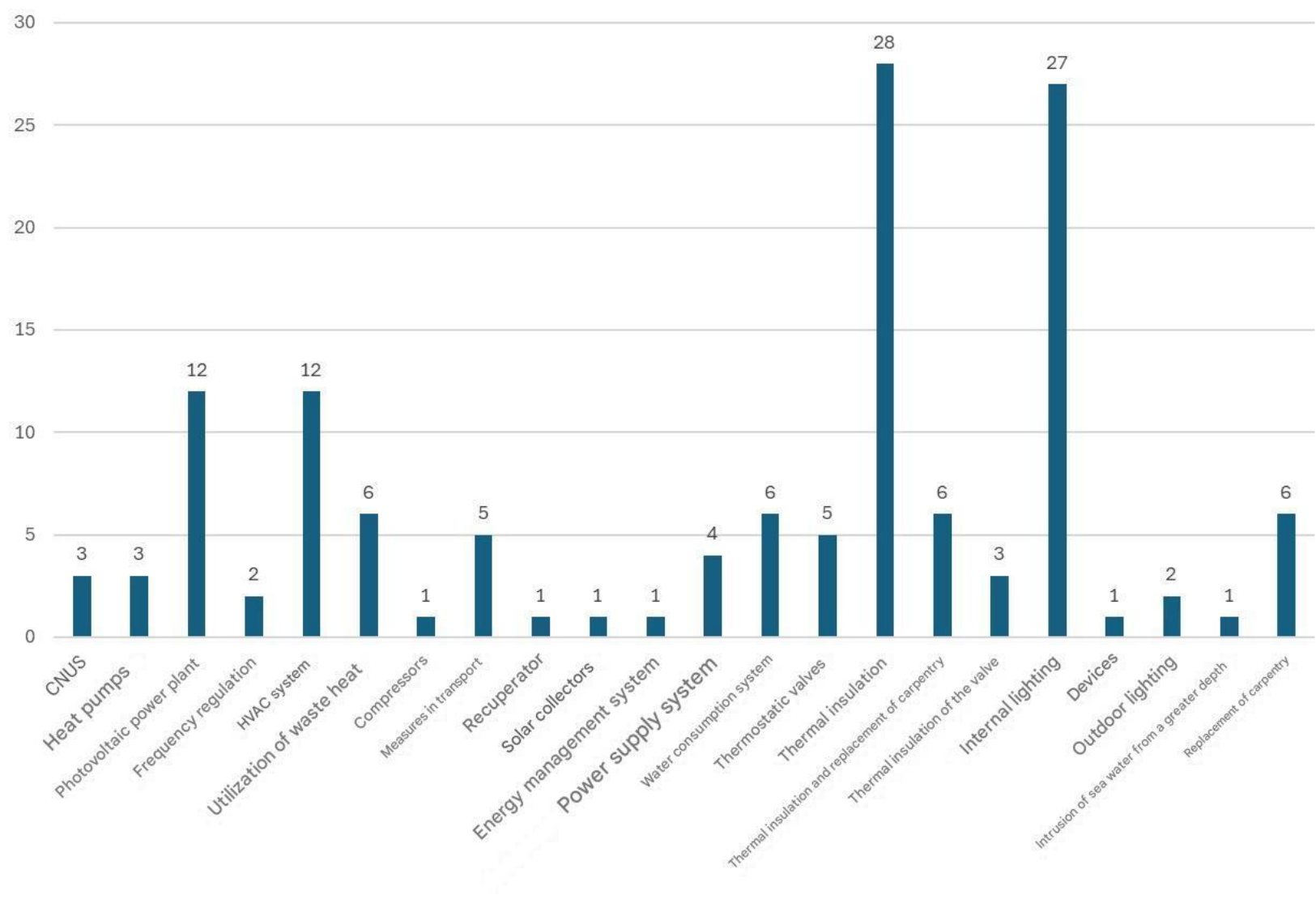
Transportation - EnU measure	Savings [kWh]
Car tires	1,022,501.00
Eco driving	384,806.53
New vehicles	134,004.70
<b>TOTAL:</b>	<b>1,541,312.23</b>

Buildings - EnU measure	255.296.286.13
CNUS	37,100,273.16
Heat pumps	6,280,828.17
Photovoltaic power plant	80,066,523.03
Free cooling system	1,202,423.96
Frequency regulation	2,155,888.67
HVAC system	25,680,620.33
Utilization of waste heat	19,300,141.73
Cogeneration	9,425,000.00
Compressors	505,236.06
Control meters	73,847.27
Boiler room	558,464.48
Acquisition of new machines	2,075,541.86
New vehicles	10,025.25
Reconstruction of the steam pipeline	475,528.00
Recuperator	139,242.00
Solar collectors	372,383.90
Energy management system	1,834,912.38
Power supply system	592,803.59
Thermostatic valves	1,212,241.03
Thermal insulation	13,585,988.13
Thermal insulation and replacement of carpentry	3,694,932.20
Thermal insulation of the valve	335,355.47
Thermal substation	119,816.29
Internal lighting	44,747,454.78
Devices	20,976.00
Outdoor lighting	65,245.20
Wind power plants	28,308.00
VRV system	9,866.27
Replacement of boilers	97,585.00
Replacement of carpentry	3,528,833.92
<b>TOTAL:</b>	<b>255.296.286.13</b>



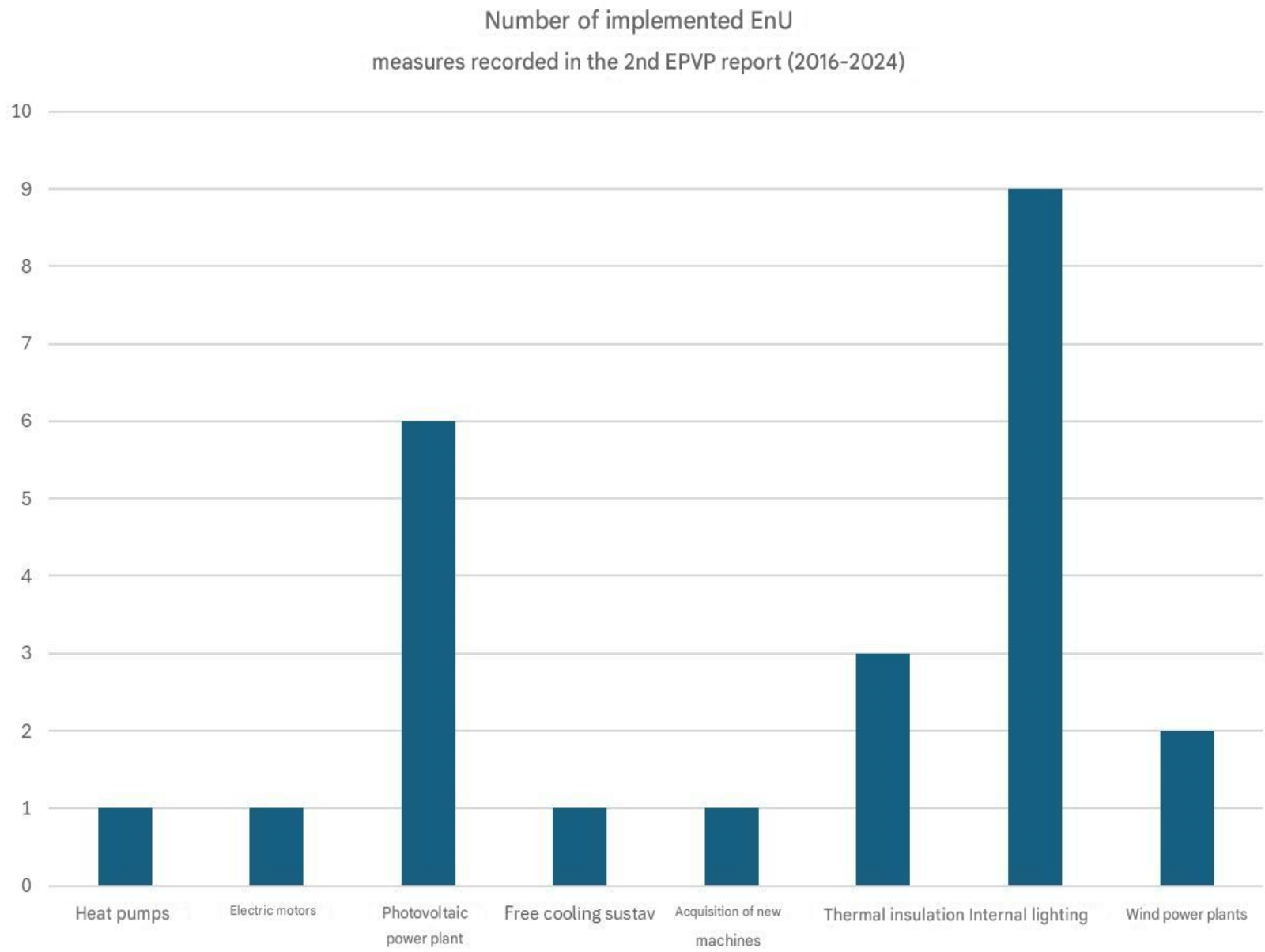
# Data on repeated EEMs

EnU measures in the 2nd EPVP report (2016 - 2024)



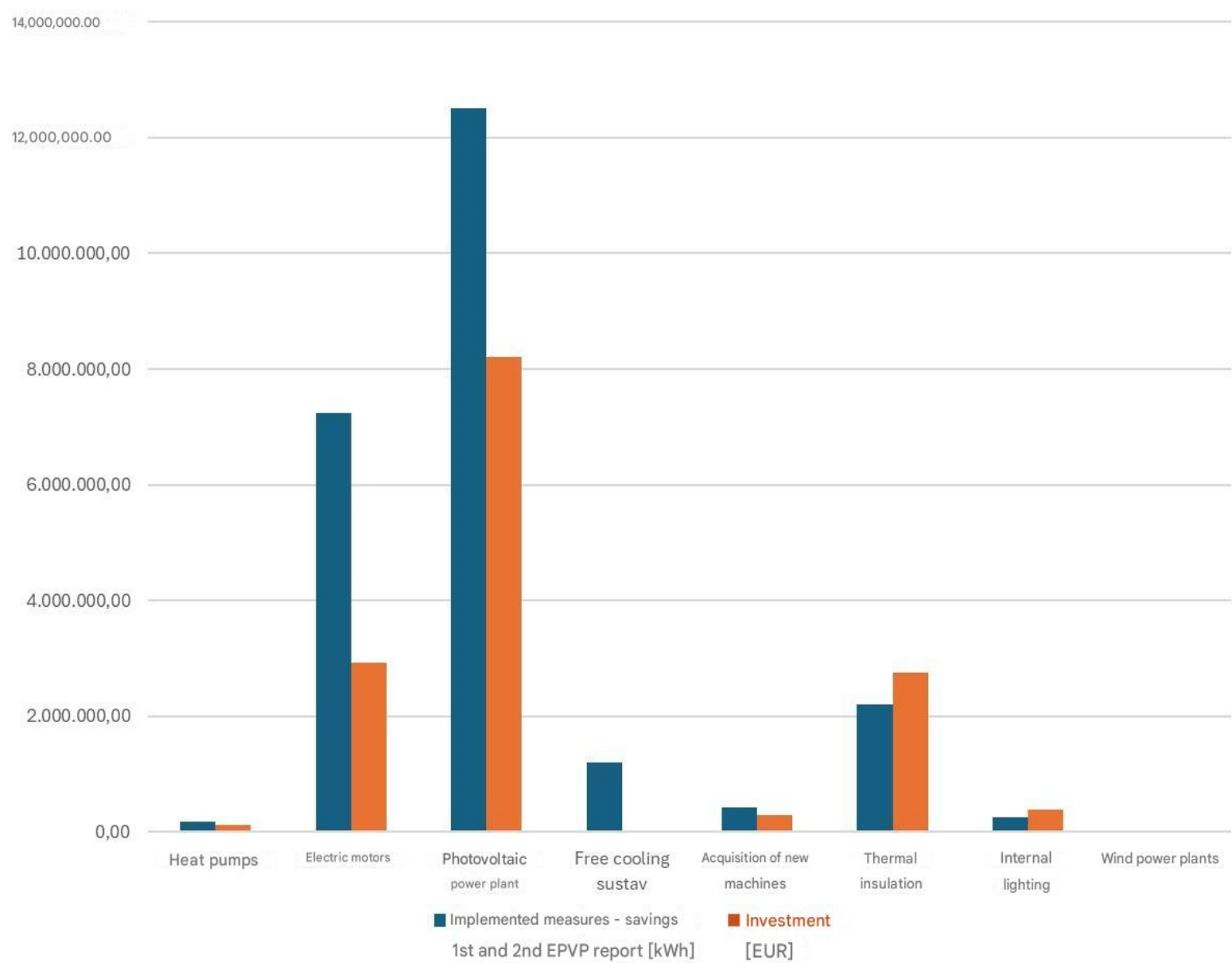
Type of measure	Number of repeated EnU measures in the 2nd EPVP report (2016 - 2024)
CNUS	3
Heat pumps	3
Photovoltaic power plant	12
Frequency regulation	2
HVAC system	12
Utilization of waste heat	6
Compressors	1
Measures in transport	5
Recuperator	1
Solar collectors	1
Energy management system	1
Power supply system	4
Water consumption system	6
Thermostatic valves	5
Thermal insulation	28
Thermal insulation and replacement of carpentry	6
Thermal insulation of the valve	3
Internal lighting	27
Devices	1
Outdoor lighting	2
Intrusion of sea water from a greater depth	1
Replacement of carpentry	6
TOTAL	126

# Data on the implemented EEMs



Type of measure	The number of implemented EnU measures recorded in the 2nd EPVP report (2016 - 2024)
Heat pumps	1
Electric motors	1
Photovoltaic power plant	6
Free cooling system	1
Acquisition of new machines	1
Thermal insulation	3
Internal lighting	9
Wind power plants	2
TOTAL:	24

# Data on the implemented EEMs



Type of measure	Implemented measures - savings 1st and 2nd EPVP report [kWh]	Investment [EUR]
Heat pumps	163,000.00	111,487.16
Electric motors	7,236,023.62	2,917,056.00
Photovoltaic power plant	12,502,760.43	8,206,640.37
Free cooling system	1,200,000.00	1,327.23
Acquisition of new machines	419,000.00	289,481.72
Thermal insulation	2,206,000.00	2,757,979.96
Internal lighting	240,791.96	374,570.31
Wind power plants	28,308.00	0.00
TOTAL:	23,995,884.01	14,658,542.74

# Improvement of the data structure for monitoring EE in the business sector

- It is recommended to use uniform forms for recording data on energy consumption, recommended and implemented EEMs, thus ensuring consistency and comparability of data.
- All relevant data on energy consumption should be included in the forms, including the type of energy source, annual consumption, and consumption by sector (buildings, processes, transport) if applicable.
- It is desirable to keep consumption data at the level of related companies, locations, ETCs or buildings.
- It is desirable to keep consumption data at the level of a large company - summarized for all related companies, locations, ETCs or buildings.



# Improvement of the data structure for monitoring EE in the business sector

- The record of EEMs should contain detailed information on each implemented measure.
- Minimum data requirements for EEMs: description of the measure, estimated savings (in kWh, EUR and CO2 reduction), implementation cost, and payback period.
- It is necessary to track the implementation status of EEMs from previous energy audits, in order to monitor long-term effectiveness.
- It is important to clearly indicate the status of each EEMs in the form – new EEM, ongoing EEMs, implemented EEM, and to update this information regularly in digital platform.
- It is desirable to establish monitoring of actual energy savings (based on the metering) after the implementation of EEMs, which would allow comparison with estimates and more accurate analysis.

# Thank you for your attention



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