# Focus: Italy

- **Energy Policy for Industries and Enterprises**
- **Energy Audits policy implementation**

Enrico Biele, ENEA

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Funded by the European Union

# About ENEA


ENEA is the Italian *National Agency for New Technologies, Energy and Sustainable Economic Development.* It is a public Research and Technology Organization operating in the fields of energy, environment and new technologies to support Country's competitiveness and sustainable development.

ENEA's *Agency for Energy Efficiency* offers technical and scientific support to companies, supports the Public Administration in the preparation, implementation and control of national energy policies, and promotes training and information campaigns for the dissemination of energy efficiency culture.

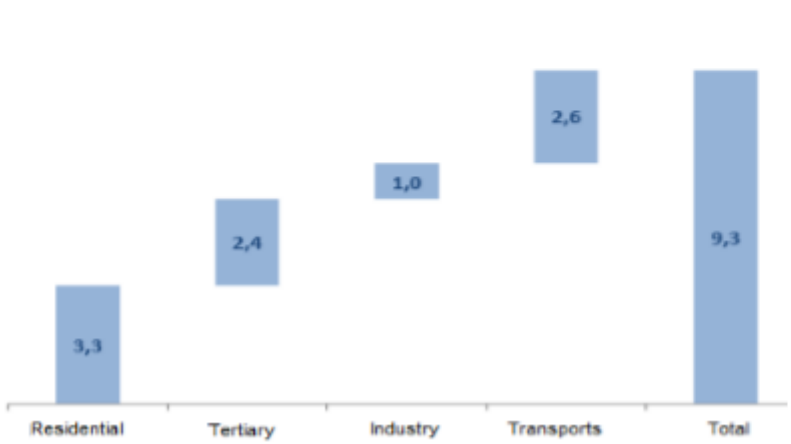
# Government's priorities and R&D

Government's priorities for the Industrial Sector: Italy's Energy Strategy 2017 (Ministry of Economic Development)

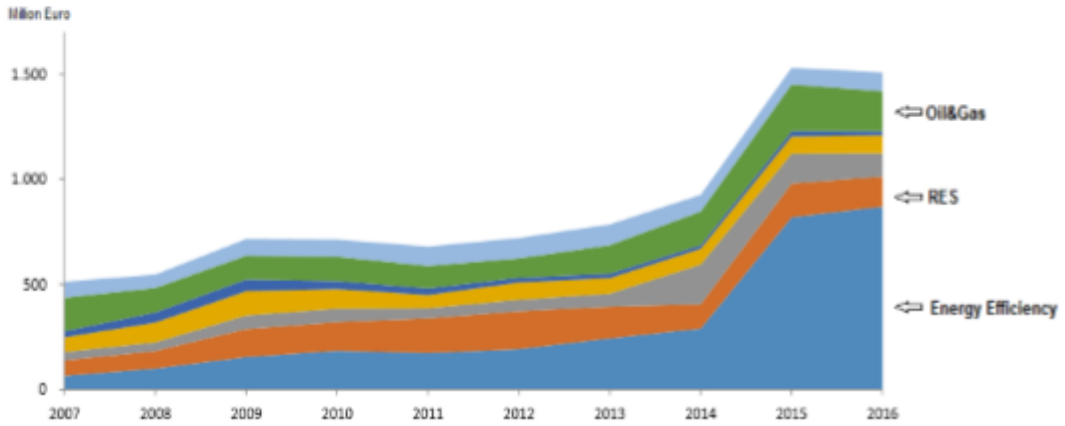
1) Strengthening and streamlining the white certificates scheme.

2) Promoting the energy efficiency of SMEs, by renewing schemes for co-funding energy audits and EMS.

Final energy consumption reduction goals (Mtoe) 2021-2030, NECP draft, 2019




R&D expenditure in the Energy sector, National Energy Situation Report 2019

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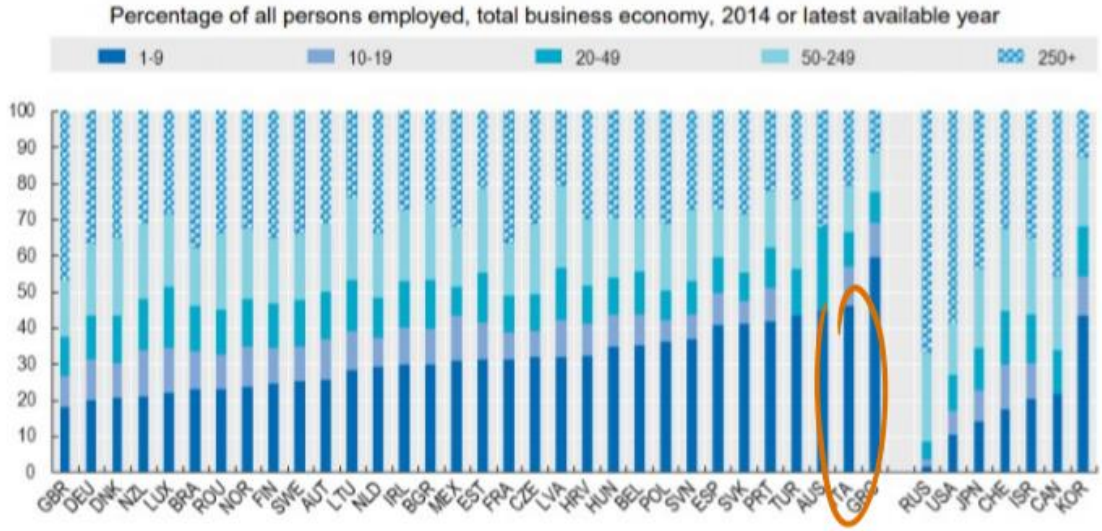
# SMEs

According to our new Energy Strategy towards 2030, one of the key-points in the energy efficiency policy development in industry will be “Promoting the energy efficiency of SMEs, by renewing schemes for co-funding energy audits and energy management systems”.

ITALY’S NATIONAL ENERGY STRATEGY 2017




Source: Oecd, Enhancing the contributions of smes in a global and digitalised economy, 2017.

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# Innovative startups programme

| INDICATORS | 30/09/2014 | 30/09/2015 | 30/09/2016 | 30/06/2017 |
|---|---|---|---|---|
| No. of startups | 2.630 | 4.704 | 6.363 | 7.398 |
| No. of employees | 2.607 | 5.351 | 9.042 | 10.262 |
| Average value of production (€) | 131.451 | 131.127 | 151.884,00 | 164.000 |
| Total value of production (€) | 183.768.452 | 349.192.469 | 585.211.807 | 773.170.993 |

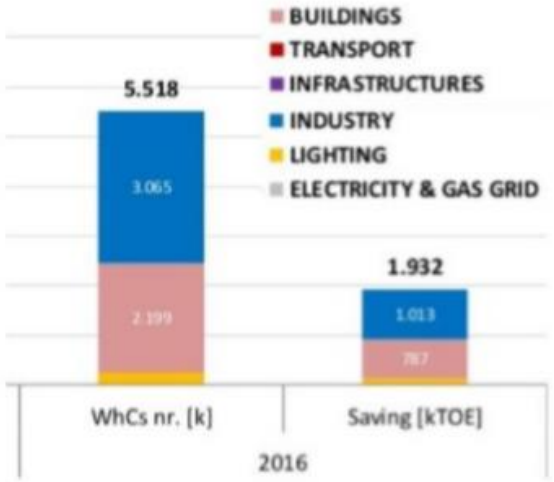
**Source: Infocamere**

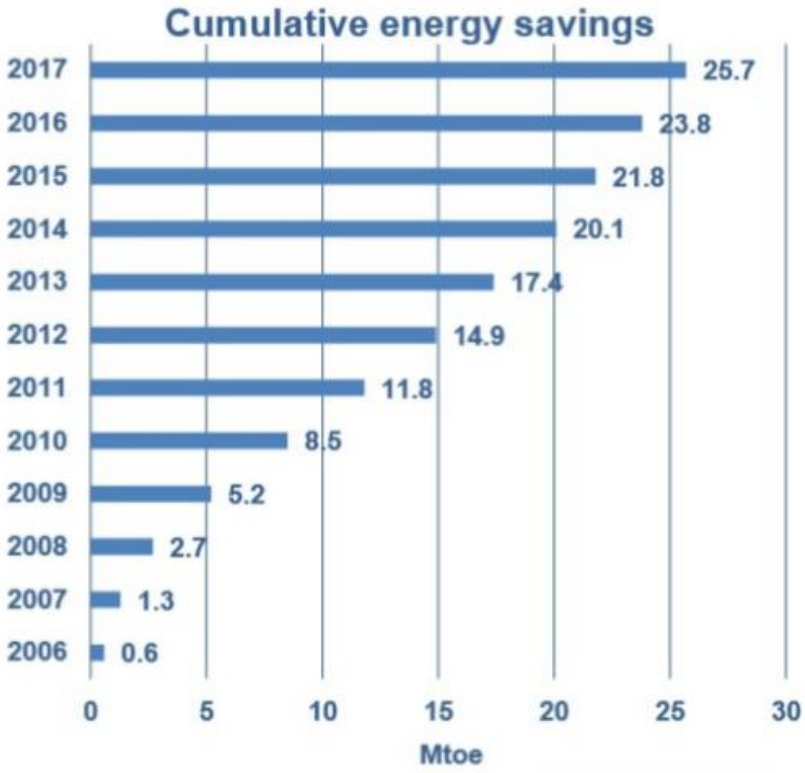
On 30 June 2017, 1,195 clean tech energy startups, whose value of production is more than 120M€.

Most of these companies operate in the Research and Development sector, particularly in the field of natural sciences and engineering (66.9% of all clean tech startups), and in biotechnologies (20%).

# Energy Efficiency Obligation Schemes: White Certificates in Italy

Obligation for electricity and gas distributors with more than 50,000 end users to generate each year a certain amount of savings or, alternatively, to purchase an equivalent amount of certificates from non-obliged parties (such ESCOs or ISO 50001 certified parties).




Source: GSE

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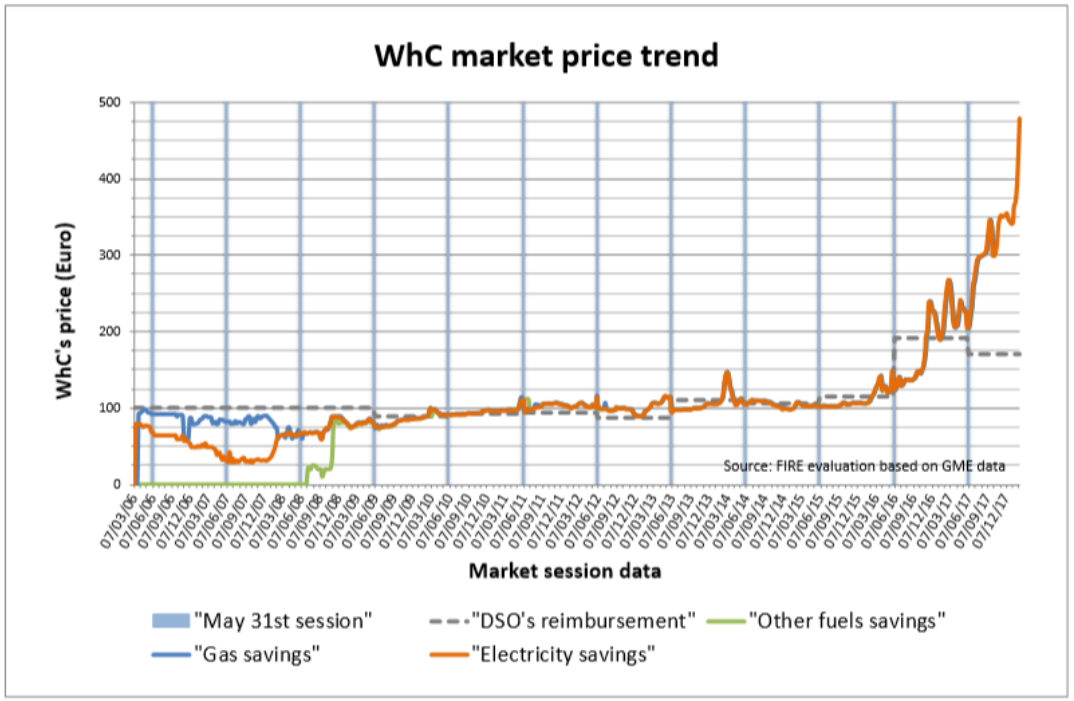
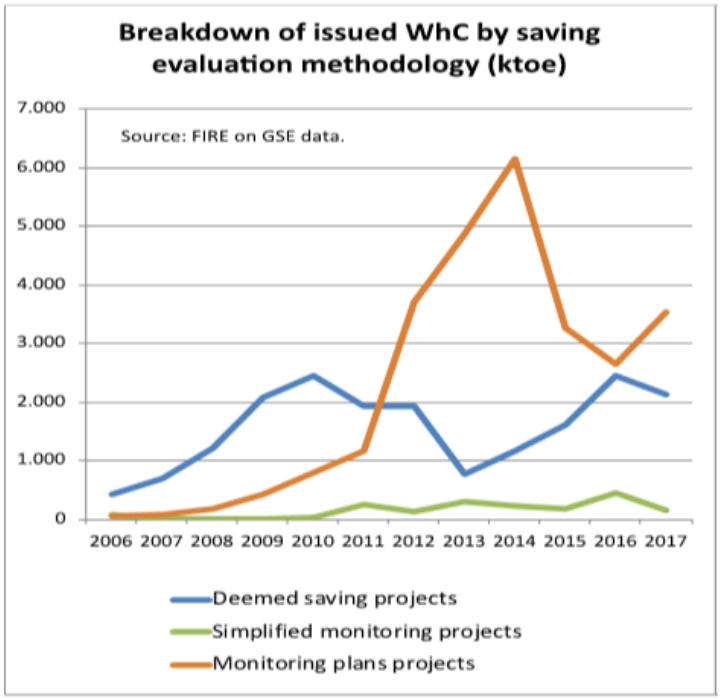
# White Certificates prices

Source: D. Di Santo, L. De Chicchis, E. Biele, (FIRE- Italian Federation for Energy Efficiency), White certificates in Italy: lessons learnt over 12 years of evaluation, IEPPEC International Conference, Wien 2018

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# Building and maintaining an Energy Efficiency Obligation Scheme

## Why EEOs and some important points to be taken into account

Within the Member States is emerging a growing tendency in choosing an Energy efficiency obligation scheme.

- Difficulties in achieving energy savings targets with existing policies.
- New solutions in energy markets, which are difficult to be covered by traditional policies.
- Lack of public finances, which gives power to the market to look for alternative financing tools.

## Efforts required to implement and maintain an EEO scheme

- Monitoring, verification, control and compliance.
- Interaction and possible overlapping with other policies.
- Industry is hard to manage but contains a huge cost/effective potential.
- Provide and allocate an adequate budget for training and dissemination activities, market analysis, and for periodic meetings among obliged parties, voluntary parties and managing Institutions.
- Encourage the use of ISO 50001 Energy management systems and if possible incentivize the participation of certified ESCOs and professionals.

# Energy audits policy implementation

Italy has transposed the Energy Efficiency Directive (2012/27/EU) into national law by issuing the Lgs. Decree n°102 of 4 July 2014 (G.U. n°165 of the18/07/2014)

Art. 8 defines the following parties subjected to the energy audit obligation:

- Large enterprises;
- Energy intensive enterprises: companies that apply for a tax relief on the energy cost of the electric bill under Ministry of Economic Development Decree 21st December 2017.

I

(Legislative acts)

DIRECTIVES

DIRECTIVE 2012/27/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL

of 25 October 2012

on energy efficiency, amending Directives 2009/125/EC and 2010/30/EU and repealing Directives 2004/8/EC and 2006/32/EC

(Text with EEA relevance)

EUROPEAN PARLIAMENT AND THE COUNCIL OF THE PEAN UNION,

ng regard to the Treaty on the Functioning of the European , and in particular Article 194(2) thereof,

ng regard to the proposal from the European Commission,

transmission of the draft legislative act to the national ments,

ng regard to the opinion of the European Economic and Committee (1),

Shifting to a more energy-efficient economy should also accelerate the spread of innovative technological solutions and improve the competitiveness of industry in the Union, boosting economic growth and creating high quality jobs in several sectors related to energy efficiency

(2) The Conclusions of the European Council of 8 and 9 March 2007 emphasised the need to increase energy efficiency in the Union to achieve the objective of saving 20 % of the Union's primary energy consumption by 2020 compared to projections. The conclusions of the European Council of 4 February 2011 emphasised that the 2020 20 % energy efficiency target as agreed by the June 2010 European Council, which is presently not on track, must be delivered. Projections made in 2007 showed a primary energy consumption in 2020 of 1 842 Mtoe + 20 % reduction results in 1 474 Mtoe or

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# Legal Framework D. Lgs. 102/2014

In Italy an organization qualifies as Large enterprise if it shows:

1. A number of employees ≥ 250 and an annual turnover > € 50 million and an annual budget > € 43 million

Or

2. A number of employees ≥ 250 and an annual turnover > € 50 million

Or

3. A number of employees ≥ 250 and an annual budget > € 43 million

Under Italy's article 8 implementation, the size of the company must be calculated only on Italian sites both of the company itself and of its associated/related companies.
Energy Intensive Enterprises are the ones with large energy consumptions applying for a tax relief on part of the purchased energy.

# Legal Framework  D. Lgs. 102/2014

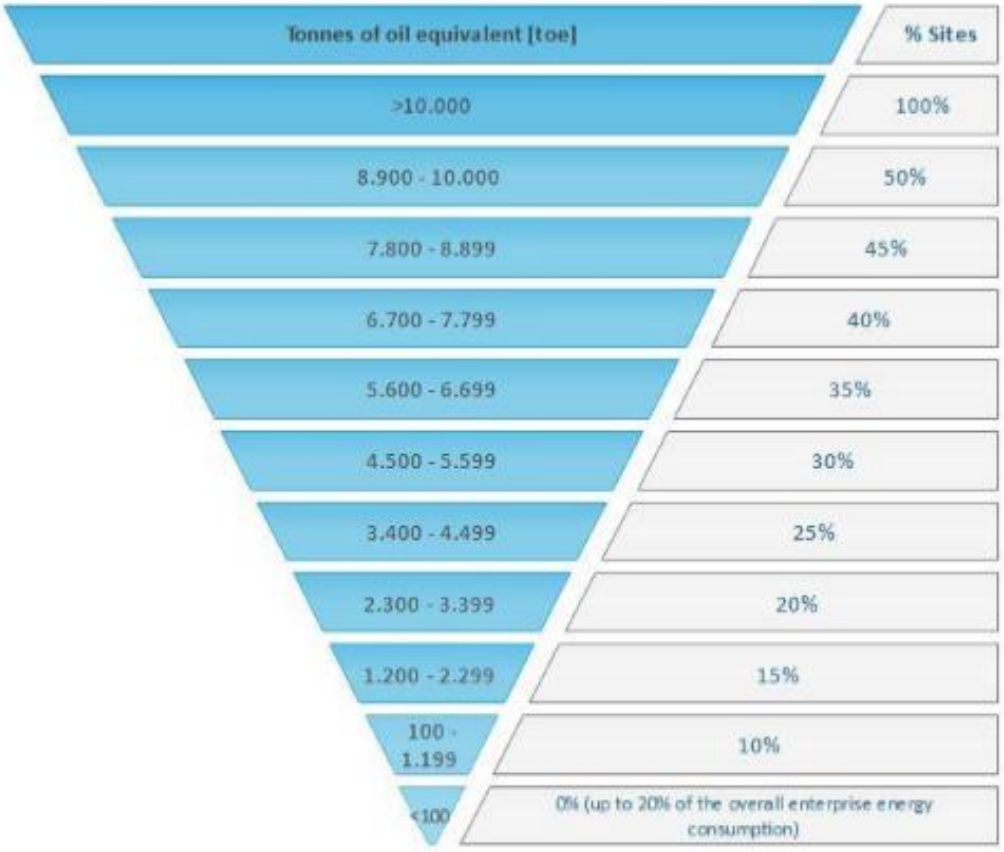
Obliged Enterprises that will not carry out an energy audit observing Annex II of the EED within the above deadlines, are subject to administrative monetary penalties. The penalty does not exempt obliged enterprises from carrying out the audit, with its submission to ENEA within six months from the sanction imposition by the Ministry of Economic Development.

Pursuant to article 8 of Italian Legislative Decree 102/2014 implementing the Energy Efficiency Directive, as at 31 December 2018 ENEA received 16,105 energy audits of production sites relating to 8,870 companies.

Over 45% of the audits were carried out on sites related to the manufacturing sector and over 15% in trade.

# Sampling process for multisites enterprises

A company is obligated to carry out the energy audit on the energy consumption of year n -1 on every single site owned in year n.




cluster of sampling for industries

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# The Energy Audit report

An energy audit report shall incorporate at least the following contents:

**1- Details of the expert carrying out the energy audit**: this section should be filled with detailed data on the energy audit expert, specifying if he/she is an internal or external qualified professional and his/her professional qualification. Within the Italian transposition of article 8 are entitled to carry out an energy audit only: Energy Management Experts according to the National standard UNI CEI 11339; Energy Service Companies according to the National standard UNI CEI 11352; Energy auditors.

**2- Obligated party details**: general data useful to identify the obligated enterprise, such as number of employees, sector, NACE code, turnover and balance sheet. Where applicable, details shall be provided on the full or partial ownership of other companies' shares; where applicable details shall be provided on the parent companies and third parties owning shares in the enterprise itself.

**3- Reference period** of the energy auditing process.

**4- Units of measure and reference values**, including correction and normalization parameters whenever adopted (such external temperature or Heating Day Degrees).

# The Energy Audit report

**5- Data collection procedure**: a list of the type of measurements (spot or continuous, direct or indirect) shall be provided. For the enterprises falling into the first obligation period, it has not been considered compulsory to have been implemented a dedicated measurement system, while a utility meter has been considered enough for the purposes of article 8 implementation. For solid or liquid fuels the purchasing invoices have been considered satisfying. It is also required to provide detailed information on the employed meters, including the typology, the accuracy and the calibration procedure. For the new energy audit session (2019) it will be necessary to implement a more detailed energy management measurement procedure.

**6- Products**: it is requested a detailed description and identification of delivered products, including semi-finished ones. For each product shall be provided at least the annual quantity with the associated unit of measure.

**7- Raw materials**: a list of type and quantities of the materials employed in the process.

**8- Production process**: description of the production process, flowchart including all the energy vectors and all the process phases.

# The Energy Audit report

**9- KPIs**: for the process under consideration a set of reference KPIs shall be listed in detail. KPIs can be found in technical literature, international and national standards (for each document detailed information such the year of publication shall be included). If any information about KPIs is not available, any assumption shall be explained in detail. Anyway, at least general KPI shall be listed based on the total output and total consumption for each energy vector on a three years base.

**10- Energy consumption**: the consumption of the below listed energy vectors shall be listed, taking in account that total consumption shall include also the amount of energy self-produced and used in the plant:

- total consumption
  i. power meter
  ii. detailed power consumption and related bill (3 years if possible)
  iii. gas meter
  iv. detailed gas consumption and related bill (3 years if possible)
  v. Other fuels and energy vectors

# The Energy Audit report

**11- Energy models**: development of models for energy vector entering the plant.

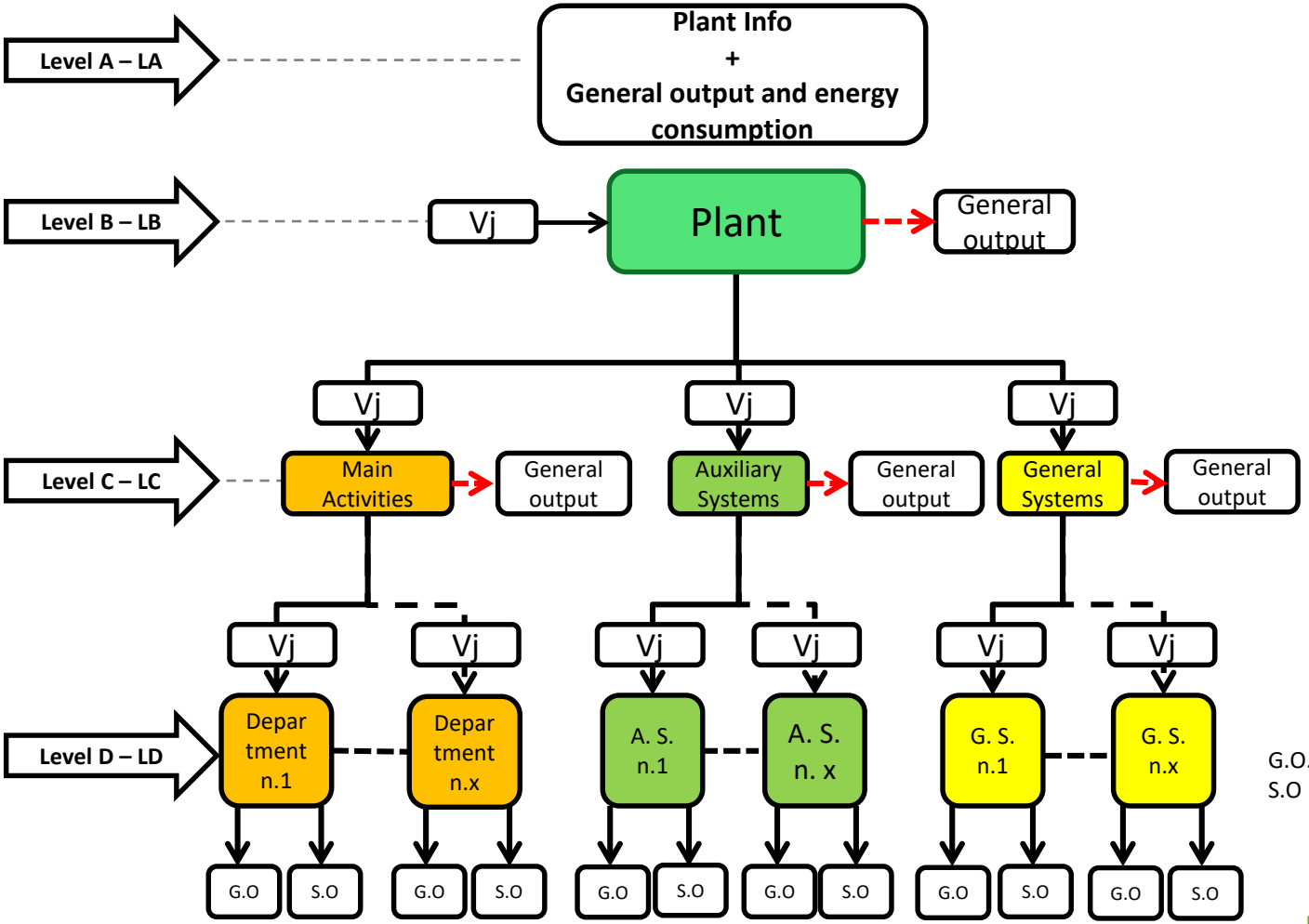
**12- Determination of actual KPIs** and comparison with reference KPIs.

**13- EMOs implemented in the past**: the most relevant EMOs implemented in the past shall be listed including any local and state incentive.

**14- List of EMOs:** for each EMO the following information shall be reported:
a. detailed technical description, as far as possible and where applicable, including documentation relating to the component, system, process interested by the EMO itself; b. cost benefit analysis based on NPV/I;
c. planning of measures and assessments to verify the energy savings obtained by the implanted EMOs; for each measure the relevant instrumentation shall be listed;
d. opportunity to obtain local and state incentives.

**15- Summary of the found EMOs**: for each EMO the following data shall be listed according to NPV/I ratio: investment, cash flows, savings, payback period, Internal Rate of Return, NPV, NPV/I.

# Industrial plant energy framework (tree shape)




G.O. General output
S.O Specific output.

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# Spreadsheet

| | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LA | BUSINESS DATA | NAME | | ADDRESS | | VAT NUMBER | INDUSTRY CODE | YEAR | PRODUCTION | | |
| | | | | | | | | | Gross (Value) | Net (Value) | [u.m.] |
| | | | | | | | 24.51 | 2014 | | | tons |
| | PROCESS CHARACTERIZATION | Kind of furnace | | Kind of moulding | | | | | | | |
| | | Kind of production | | Kind of casting | | | | | | | |
| | CONSUMPTIONS | CODE | VECTOR | u.m. | VALUE | TEP CONVERSION FACTOR | LOWER HEATING VALUE | TEP | Vtot [tep] | | |
| | | 1 | Electricity | kWh | | 0,187 x 10^-3 | | 0 | 0 | | |
| | | 2 | Natural Gas | Sm3 | | 8.250 x 10 ^-7 | 8.250 | 0 | | | |
| | | 3 | Heat | kWh | | 860/0,9 x 10^-7 | | 0 | | | |
| | | 4 | Cold | kWh | | (1/ EER) x 0,187 x 10^-3 | | 0 | | | |
| | | 5 | Biomass | t | | PCI (kcal/kg) x 10^-4 | | 0 | | | |
| | | 6 | Burning oil | t | | PCI (kcal/kg) x 10^-4 | 9.800 | 0 | | | |
| | | 7 | LPG | t | | PCI (kcal/kg) x 10^-4 | 11.000 | 0 | | | |
| | | 8 | Diesel-Gasoline | t | | PCI (kcal/kg) x 10^-4 | 10.200 | 0 | | | |
| | | 9 | Coke | t | | PCI (kcal/kg) x 10^-4 | 8.300 | 0 | | | |

| | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LA.1 | INTERNAL TRASFORMATIONS | CODE | ENERGY CARRIER | u.m. | Balance | Cogeneration | Trigeneration | Photovoltaics | Wind | Other | Total | TEP | Vtot [tep] | |
| | | 1 | Electricity | kWh | Production | | | | | | 0 | 0 | Use for internal trasformation | 0 |
| | | | | | Internal consumption | | | | | | 0 | 0 | | |
| | | | | | Exportation | | | | | | 0 | 0 | Production | 0 |
| | | 2 | Natural gas | Sm3 | Use | | | | | | 0 | 0 | | |
| | | 3 | Heat | kWh | Production | | | | | | 0 | 0 | Exportation | 0 |
| | | | | | Internal consumption | | | | | | 0 | 0 | | |
| | | | | | Exportation | | | | | | 0 | 0 | Internal consumption | 0 |
| | | 4 | Cold | kWh | Production | | | | | | 0 | | | |
| | | | | | Internal consumption | | | | | | 0 | | **Total consumptions** (Consumi LA - Internal consumption + Production - Exportation) | **0** |
| | | | | | Exportation | | | | | | 0 | | | |
| | | .... | Other | | ... | | | | | | | | | |

# Spreadsheet

| ELECTRICITY | | | CONSUMPTION | TOE | General performance index | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | kWh | TOE | kind of measure (continous or estimate) | - | Measured consumption | Non measured consumption | % measured | It's necessary a more detailed study |
| LB | j=1 | ELECTRICITY | | | | | | | | |

| | | | CONSUMPTION | TOE | General performance index | | Specific index | | Factory perfromance index | | | Reference performance index | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LC | 1.1 | MAIN ACTIVITIES | 0 | | kind of measure (continous or estimate) | | value | u.m. | kind of measure (continous or estimate) | value | u.m. [kWh/D.s.] | Value | u.m |
| LD | 1.1.1 | Melting furnaces | | | | - | | | | | | | |
| | 1.1.2 | Melt maintenance furnaces | | | | - | | | | | | | |
| | 1.1.3 | Core making | | | | - | | | | | | | |
| | 1.1.4 | Moulding | | | | - | | | | | | | |
| | 1.1.5 | Casting | | | | - | | | | | | | |
| | 1.1.6 | Thermal treatment | | | | - | | | | | | | |
| | 1.1.7 | Shake-out / Take-out | | | | - | | | | | | | |
| | 1.1.8 | Finishing works | | | | - | | | | | | | |
| | 1.1.9 | Painting | | | | - | | | | | | | |
| | 1.1.10 | Other | | | | - | | | | | | | |
| | 1.1.11 | | | | | - | | | | | | | |

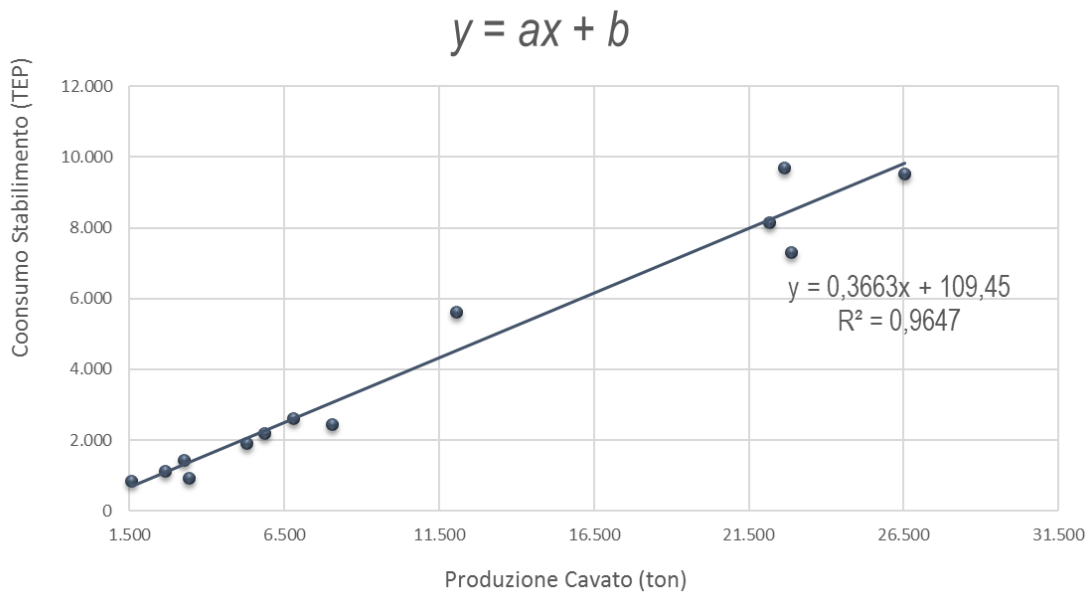
| LC | 1.2 | AUXILIARY SERVICES | 0 | | | | value | u.m. | kind of measure (continous or estimate) | value | u.m. [kWh/D.s.] | Value | u.m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD | 1.2.1 | Compressed air plants | | | | - | | | | | | | |
| | 1.2.2 | Aspiration plants | | | | - | | | | | | | |
| | 1.2.3 | Material carriers | | | | - | | | | | | | |
| | 1.2.4 | Other… | | | | - | | | | | | | |

| LC | 1.3 | GENERAL SERVICES | 0 | | | | value | u.m. | kind of measure (continous or estimate) | value | u.m. [kWh/D.s.] | Value | u.m |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| LD | 1.3.1 | Heating and domestic hot water | | | | - | | | | | | | |
| | 1.3.2 | Conditioning | | | | - | | | | | | | |
| | 1.3.3 | Lighting | | | | - | | | | | | | |
| | 1.3.4 | Other… | | | | - | | | | | | | |
| | 1.3.5 | | | | | - | | | | | | | |

# Building up industry KPIs

- Finding a relation between parameters in the scattered graph: energy consumption and output (linear relation in first approach)
- Evaluate acceptance criteria

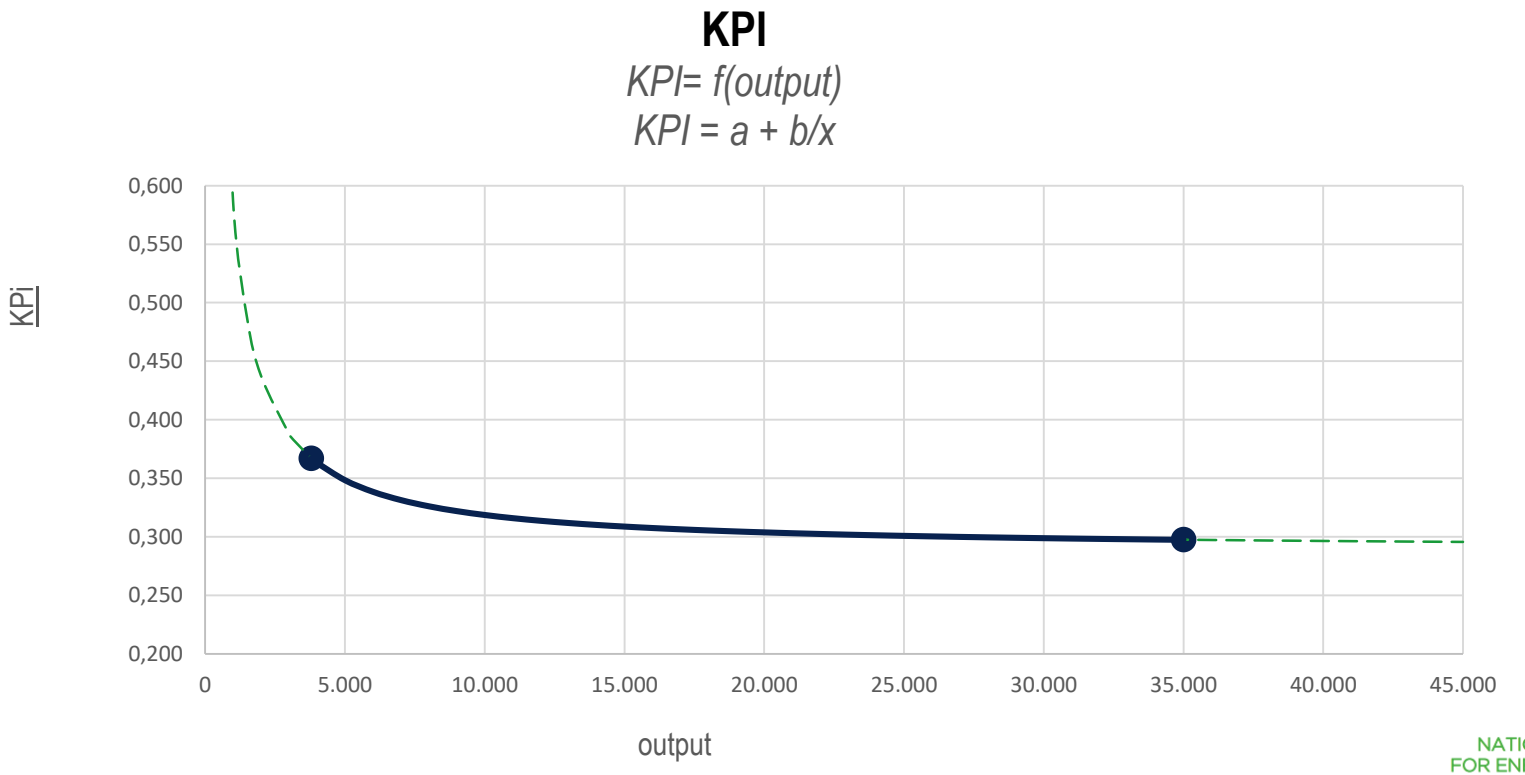
Linear regression



# Building up industry KPIs

Analytical model

$$KPI\ (t) = 0{,}315864 + \frac{396{,}78}{output(t)}$$

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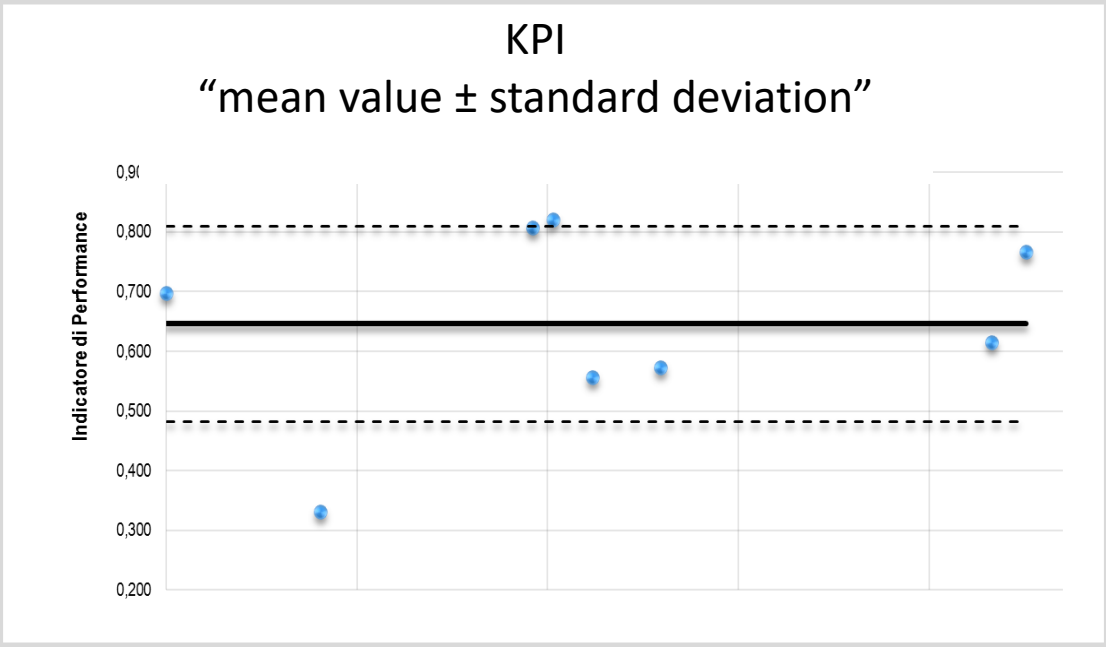
# Building up industry KPIs

Statistical model "mean value ± standard deviation"

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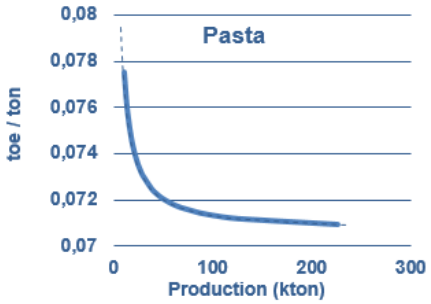
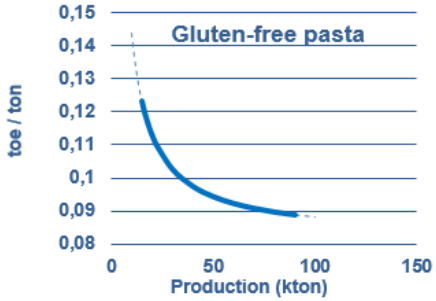
# Building up industry KPIs

Sectors:

- Pulp and paper
- Ceramics
- Plastics
- Rubber
- Foundries
- Cement
- Glass
- Food
- 2019: Offices, private healthcare etc.




- ABI Lab per le banche
- AIDEPI
- AITEC-CEMENTO
- AGENS-Trasporto pubblico locale
- ASSOCARTA
- ASSOFOND
- ASSOIMMOBILIARE
- ASSOTELECOMUNICAZIONI-ASSTEL
- ASSOVETRO
- CONFINDUSTRIA Ceramica
- FEDERACCIAI
- FEDERAZIONE GOMMA PLASTICA
- FEDERDISTRIBUZIONE
- UNIONE PETROLIFERA
- UTILITALIA e altre associazioni (SII, Rifiuti, Produzione Elettrica, TLR)
- SANITA' PRIVATA

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# Guidelines for monitoring

Implementation of a monitoring system depends on specific enterprise according to the following criteria.

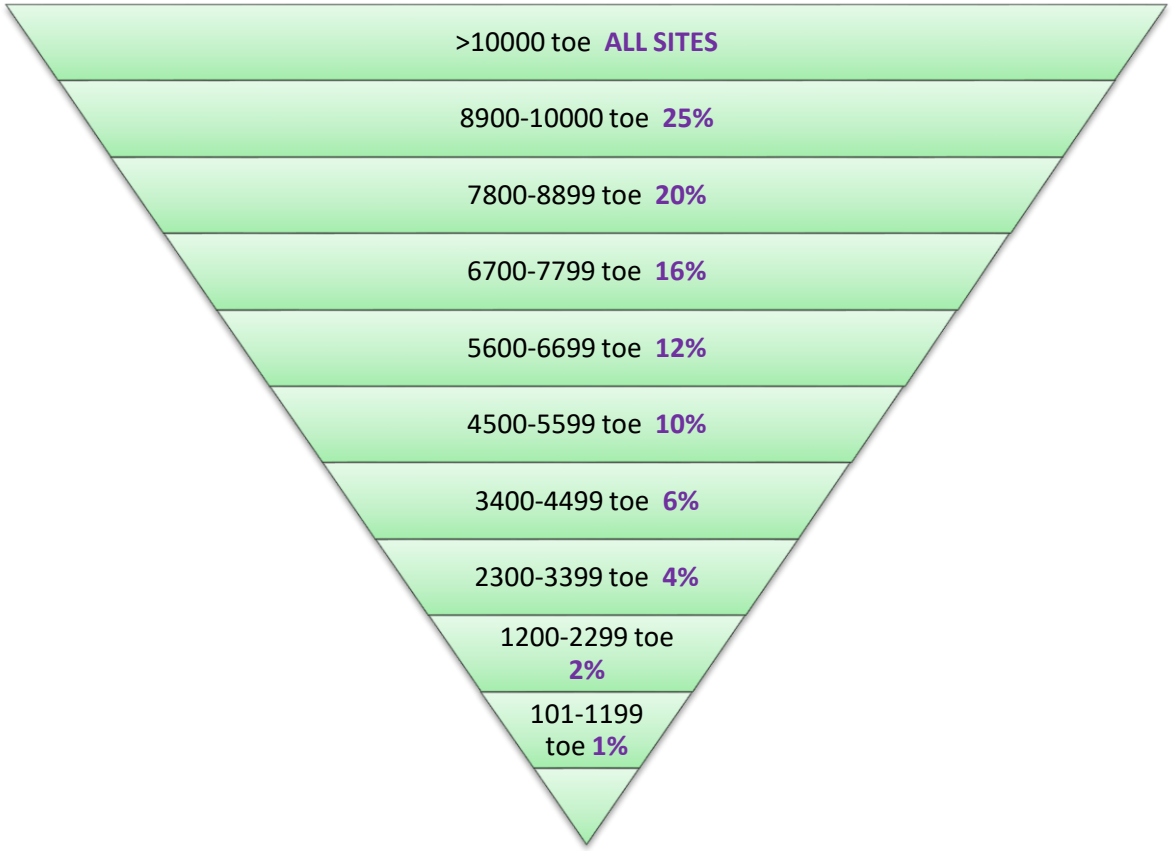
1. Single site enterprises:

   each enterprise with an energy consumption more than 100 toe shall implement a monitoring system

2. Multi site enterprises:
   1. Sites with an energy consumption higher than 10.000 toe shall implement a monitoring system
   2. Sites with an energy consumption less than 100 toe are allowed to not implement a monitoring system
   3. Sites with an energy consumption between 100 and 10000 toe shall apply sampling method

# Monitoring clustering

Monitoring clustering for industrial sites according to the energy consumption in the reference year: number of sites that shall implement monitoring system

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# Level of monitoring coverage for industrial sector

Industrial sites with energy consumption above 10.000 toe/year

- 85% coverage of reported consumption, for each energy vector related to general consumption in the reference year (as metered by main plant meter – Level A) for “main activities" (Level C)
- 50% coverage of reported consumption, for each energy vector related to general consumption in the reference year (as metered by main plant meter– Level A) for “auxiliary systems” (Level C)
- 20% coverage of reported consumption, for each energy vector related to general consumption in the reference year (as metered by main plant meter– Level A) for “general systems(Level C) )

# Level of monitoring coverage for industrial sector

| Energy consumption in the reference year (toe/year) | | Main Activities | Auxiliary systems | General Systems |
|---|---|---|---|---|
| > 10.000 | | 85% | 50% | 20% |
| 8900 | 10000 | 80% | 45% | 20% |
| 7800 | 8899 | 75% | 40% | 20% |
| 6700 | 7799 | 70% | 35% | 20% |
| 5600 | 6699 | 65% | 30% | 20% |
| 4500 | 5599 | 60% | 25% | 10% |
| 3400 | 4499 | 55% | 20% | 10% |
| 2300 | 3399 | 50% | 15% | 10% |
| 1200 | 2299 | 45% | 10% | 5% |
| 100 | 1199 | 40% | 5% | 5% |

# How to measure

**Measurement methods**

Measurements can be made using the following methodologies:

- Measurement campaigns: the duration of the metering campaign must be chosen (in terms of significance, reproducibility and time validity) according to the type of process of the plant. The minimum timespan of the campaign should be properly justified by the energy auditor. It will also be necessary to record the production data related to the period of interest.

- Typologies of meters allowed:
-- existing meters;
-- new meters (portable, remote, with monitoring software including data recording and display functions).

Measurements should comply with national and international reference standards (such as **ISO, UNI, IPMVP Protocol**). In case of indirect measurements, the use of widely consolidated calculation methods available in technical literature is allowed.

# Energy audits policy implementation results

| ATECO sector | Number of enterprises | Audited sites | Projects with payback time less than 3 years | Potential savings (ktoe) | Necessary investments (M€) |
|---|---|---|---|---|---|
| A - Agriculture, forestry and fishing | 61 | 108 | 59 | 2.5 | 2.2 |
| B - Mining and quarrying | 40 | 75 | 31 | 5.7 | 3.5 |
| C - Manufacturing | 5,131 | 7,032 | 5,271 | 595.3 | 491.4 |
| D - Electricity, gas, steam and air conditioning supply | 232 | 492 | 194 | 38.1 | 32.2 |
| E - Water supply, sewerage, waste management and remediation activities | 324 | 921 | 276 | 24.3 | 18.7 |
| F - Construction | 175 | 323 | 97 | 10.1 | 6.9 |
| G - Wholesale and retail trade; repair of motor vehicles and motorcycles | 892 | 2,433 | 896 | 24.2 | 21.2 |
| H - Transportation and storage | 416 | 934 | 272 | 27.7 | 18.1 |
| I - Accommodation and food service activities | 110 | 309 | 112 | 2.6 | 3.1 |
| J - Information and communication | 160 | 664 | 255 | 19.6 | 20.6 |
| K - Financial and insurance activities | 244 | 597 | 151 | 2.4 | 2.3 |
| L - Real estate activities | 59 | 114 | 52 | 2.2 | 2.2 |
| M - Professional, scientific and technical activities | 255 | 316 | 66 | 1.4 | 1.0 |
| N - Administrative and support service activities | 250 | 449 | 62 | 1.0 | 0.8 |
| Other | 337 | 693 | 570 | 22.5 | 22 |
| **Total** | **8,686** | **15,460** | **8,364** | **779.6** | **646** |

Source: ENEA, 2017

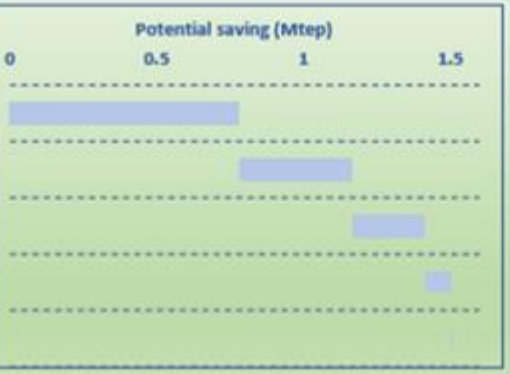
# Energy audits policy implementation results

- Sectoral breakdown: almost 45% of them was performed on site in the manufacturing branch and more than 10% in trade, where energy consumption of Mass Retail Channel has a relevant share.

- The potential saving may be roughly 1.5 Mtoe, more than 1.1 Mtoe of which could be achieved by around 14,000 interventions associated to investments with payback time equal or lower than 5 years.

– Interventions, investments (€) and savings (toe) of energy efficiency interventions identified in energy audits performed according to article 8 of Lgs. D. 102/2014 by payback time, cumulated values

| Payback (years) | Interventions | Investments (€) | Savings (tep) |
|---|---|---|---|
| ≤ 3 | 8,364 | 646,335,323 | 779,560 |
| ≤ 5 | 14,193 | 1,631,881,852 | 1,168,814 |
| ≤ 10 | 21,923 | 2,657,662,287 | 1,414,719 |
| ≤ 20 | 25,698 | 3,341,674,298 | 1,501,881 |
| ≤ 30 | 26,284 | 3,449,551,432 | 1,509,606 |




Source: ENEA

# Expected results form the next compliance period

1. Better overall quality of the energy audit reports
2. Increased share of monitored consumptions VS estimated consumptions
3. More confident general KPIs
4. More in depth analysis of specific KPIs

# Questions

# Thanks for your kind attention

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