



# The Italian experience from the first compliance period

*17<sup>th</sup> October 2018*

Italian Energy Efficiency Agency (DUEE-SPS-ESE Laboratory)



# Legal Framework D. Lgs. 102/2014

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. Serie Generale n°165 of 18/07/2014)

Art. 8 states who must carry out energy audits:

- Large enterprises (comma 1);
- Energy intensive enterprises (comma 3): only companies that have tax relief on the energy cost of the electric bill

# Statistical data (December 2017)

NACE classification	Number of enterprises	Audited sites	ISO 50001 enterprises	Large enterprises	Large energy-intensive enterprises	Non-large energy-intensive enterprises
A – Agriculture, forestry and fishing	60	99	2	55	1	0
B – Mining and quarrying	37	53	2	22	2	10
C - Manufacturing	4,827	6,793	97	2,490	722	1,528
D - Electricity, gas, steam and air conditioning supply	226	507	8	191	3	6
E - Water supply, sewerage, waste management and remediation activities	302	890	12	245	17 1	4
F - Construction	159	346	9	144	2	1
G - Wholesale and retail trade, repair of motor vehicles and motorcycles	835	2,286	4	728	24	11
H - Transportation and storage	392	942	7	320	27	9
I - Accommodation and food service activities	93	258	2	81	4	0
J - Information and communication	150	596	4	130	4	3
K - Financial and insurance activities	238	684	6	220	2	0
L – Real estate activities	7	95	1	46	2	1
M - Professional, scientific and technical activities	229	472	4	197	3	3
N - Administrative and support service activities	222	471	2	196	5	3
Q - Human health and social work activities	208	451	2	184	12	4
R - Arts, entertainment and recreation	43	118	0	33	4	1
Other	52	93	1	37	2	3
<b>Total</b>	<b>8,130</b>	<b>15,154</b>	<b>163</b>	<b>5,319</b>	<b>836</b>	<b>1,597</b>

# Italian Methodologies

- **Approach for multisite enterprises: clustering (sampling method) for choosing which site must be audited;**
- **Standard report:**
  - **Report Index**
  - **Plant energy framework**
  - **Spreadsheet file with a summary of site energy consumption in the site.**

# Report Index

- 1- Information about auditor**
- 2- Information about enterprise**
- 3- Time period in which energy audit was performed**
- 4- Units of measures**
- 5- Information about data collection**
- 6- Output**
- 7- Raw materials**
- 8- Production processes**
- 9- KPIs**
- 10- Energy Consumption**
- 11- Energy models**
- 12- Comparison between found KPIs and reference KPIs**
- 13- Past efficiency actions put in place**
- 14- Found efficiency actions from energy audit**
- 15- Summary of results**

# Industrial plant energy framework (tree shape)

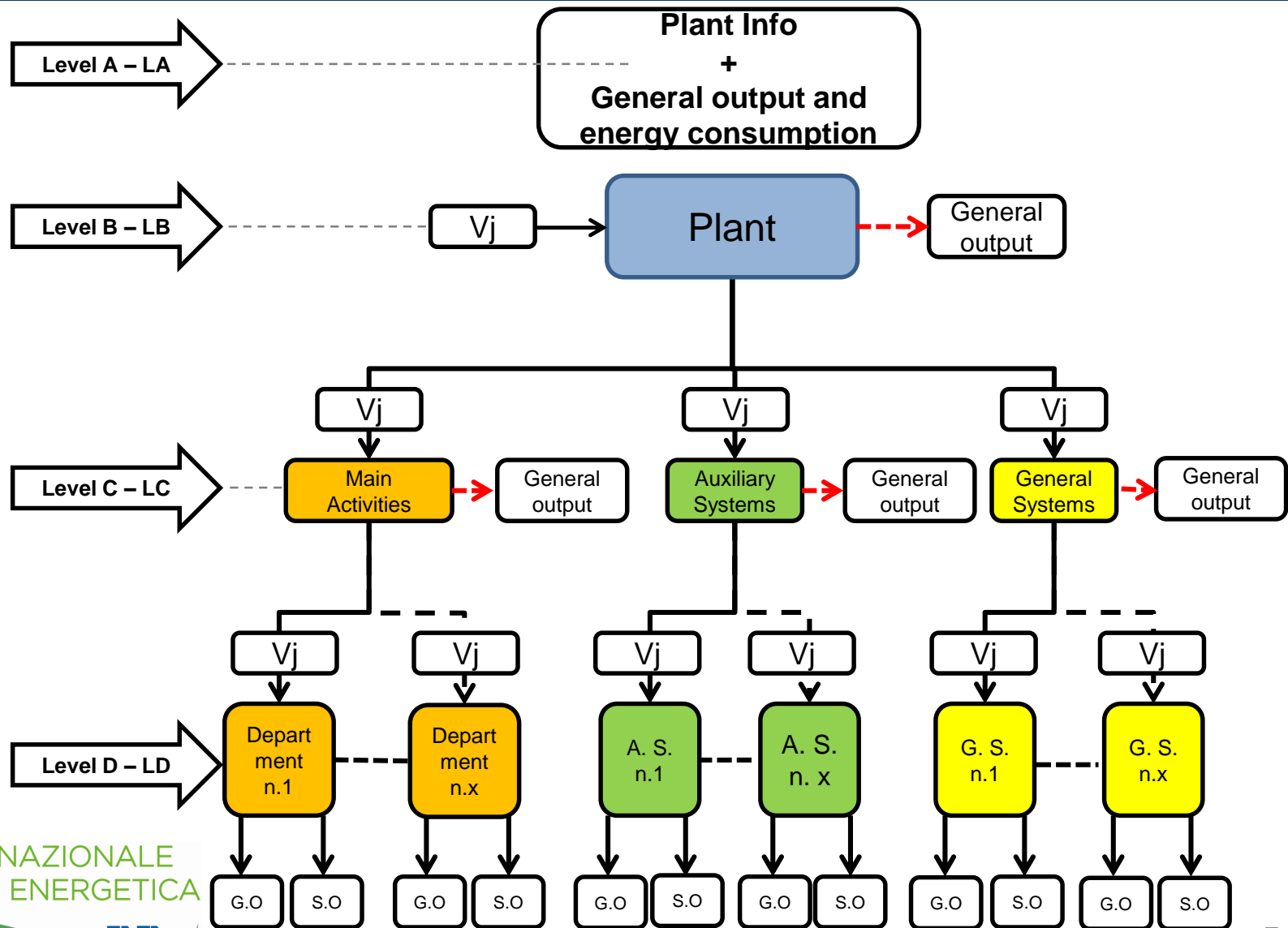
**Plant energy framework (tree shape) allows to summarize the main energy parameters,**

**Plant is divided in three functional areas.**

- 1. Main activities**
- 2. Auxiliary systems**
- 3. General Systems**

**According to that scheme we follow the path of all energy vectors through each area**

# Industrial plant energy framework (tree shape)



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

# Spread sheet

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		$0,187 \times 10^{-3}$			0	0				
			2	Natural Gas	Sm3		$8.250 \times 10^{-7}$	8.250	0						
			3	Heat	kWh		$860/0,9 \times 10^{-7}$		0						
			4	Cold	kWh		$(1/EER) \times 0,187 \times 10^{-3}$		0						
			5	Biomass	t		$PCI \text{ (kcal/kg)} \times 10^{-4}$		0						
			6	Burning oil	t		$PCI \text{ (kcal/kg)} \times 10^{-4}$	9.800	0						
			7	LPG	t		$PCI \text{ (kcal/kg)} \times 10^{-4}$	11.000	0						
			8	Diesel-Gasoline	t		$PCI \text{ (kcal/kg)} \times 10^{-4}$	10.200	0						
	9	Coke	t		$PCI \text{ (kcal/kg)} \times 10^{-4}$	8.300	0								

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



# Spread sheet

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

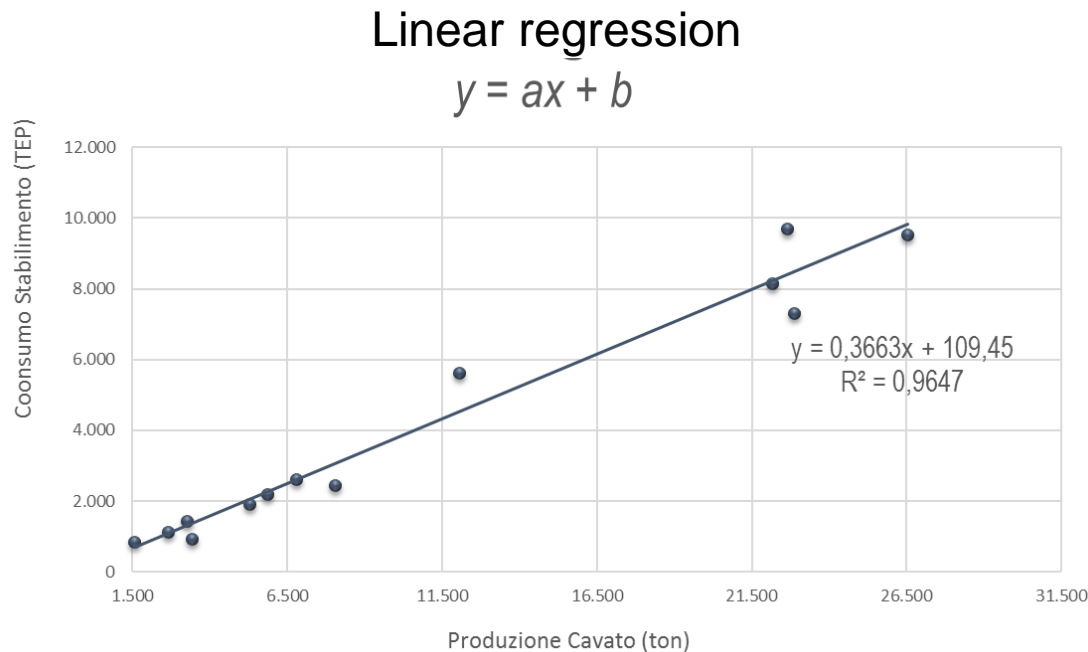
			CONSUMPTION	TOE	General performance index		Specific index		Factory performance index		Reference performance index		
LC	1.1	MAIN ACTIVITIES	0		kind of measure (continuous or estimate)		value	u.m.	kind of measure (continuous or estimate)	value	u.m. [kWh/D.s.]	Value	u.m
LD	1.1.1	Melting furnaces			-								
	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 (continuous 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 (continuous 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

- Find relation between parameters in the scattered graph: energy consumption and output (linear relation in first approach)
- Acceptance criteria



# Building up industry KPIs

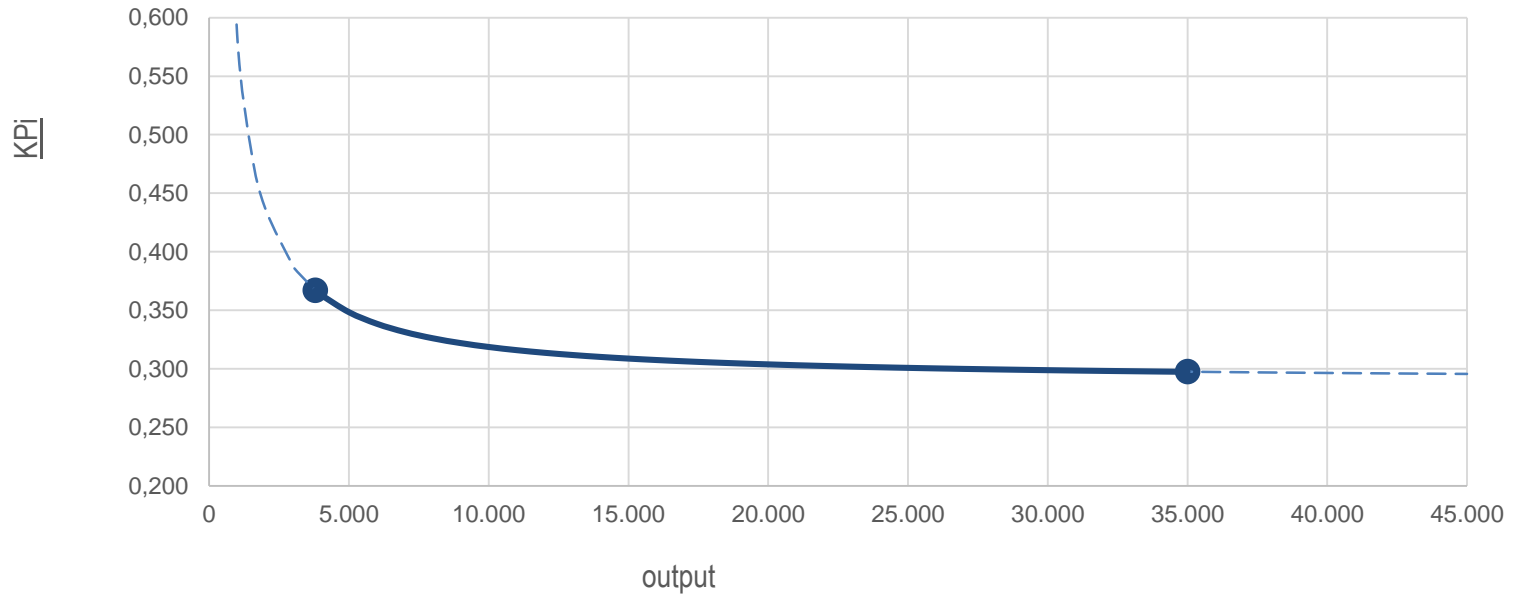
Analytical model

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

**KPI**

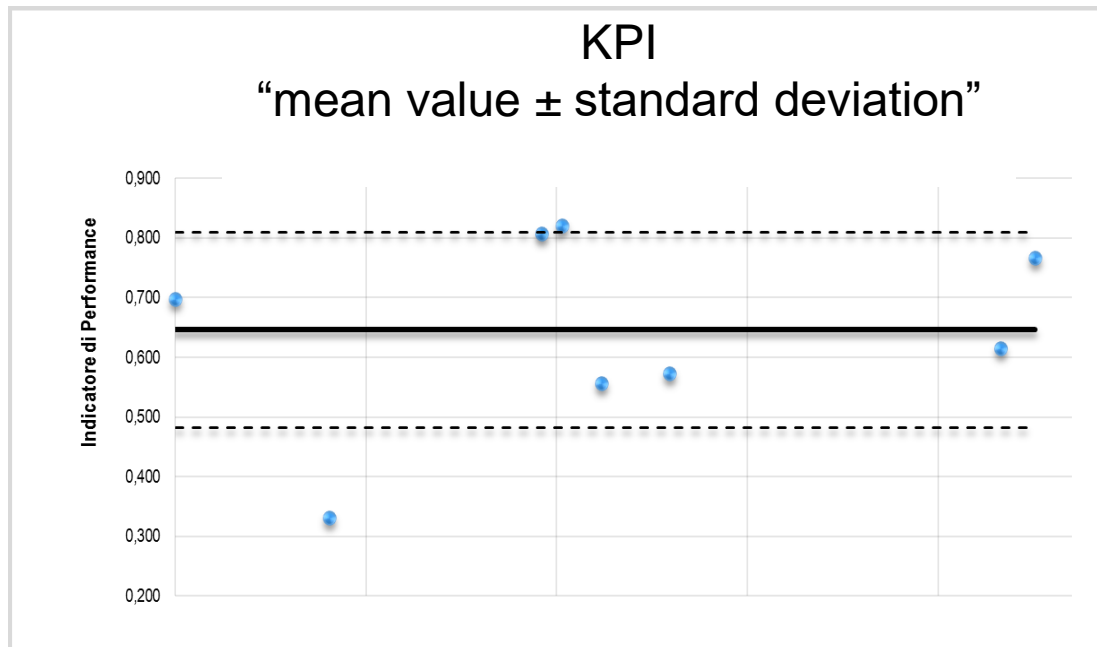
$KPI = f(output)$

$KPI = a + b/x$



# Building up industry KPIs

Statistical model “mean value  $\pm$  standard deviation”



# Building up industry KPIs

## Sectors:

- Pulp and paper
- Ceramics
- Plastics
- Rubber
- Foundries
- Cement
- Glass
- Food
- .
- .
- .
- .

# Guide Line for monitoring

## Guide for implementing a cost effective monitoring system

Implementation of a monitoring depends on the sector each enterprise belongs to (industrial sector or service sector) and on the enterprise production area **(main activities, auxiliary systems and general system)**

# Guide Line for monitoring

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

1. Single site enterprises:

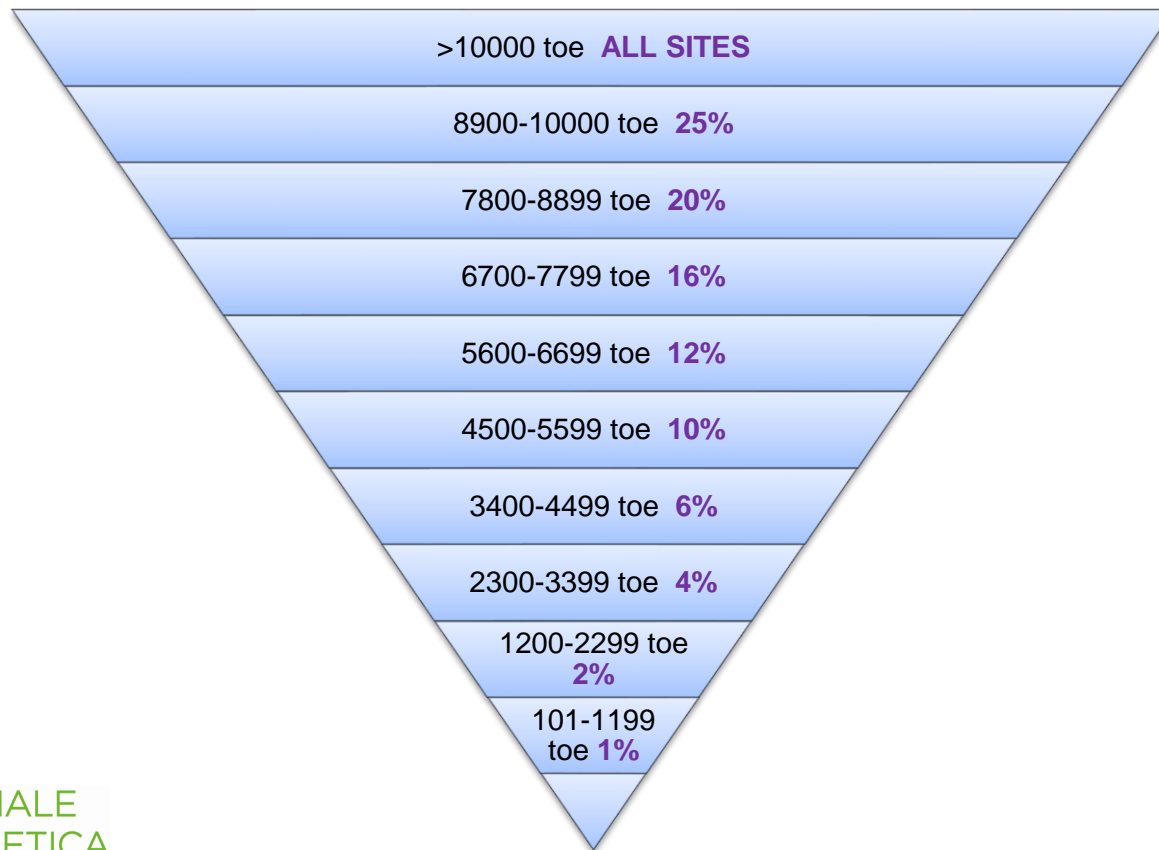
each enterprise with an energy consumption more than 100 toe shall implement a monitoring system

2. Multi site enterprises:

1. Sites with an energy consumption more 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



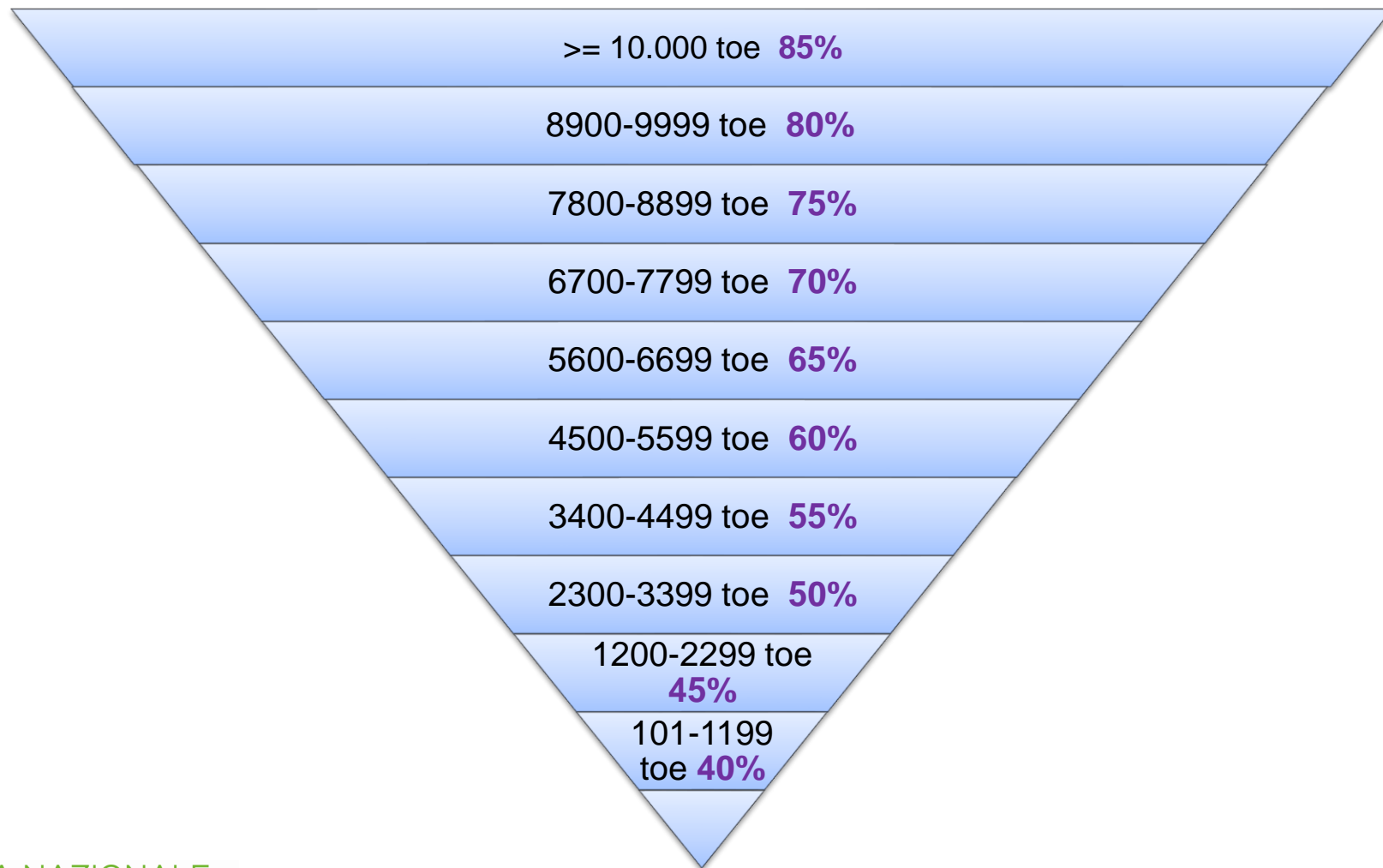


# Level of monitoring coverage for industrial sector

## Industrial sites with energy consumption over 10.000 toe/year

- **85% coverage of reported consumption**, for every 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 every 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 every 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 – «main activities».



# 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%

# Guide Line for monitoring

Monitoring system or monitoring strategy:

- a. Measurement campaign with temporary equipment/instrumentation : life time of a measurement campaign shall choose in order to be representative of the specific process (significance and replicability).;
- b. Set up of lasting equipment/instrumentation

# Expected results form the next compliance period

1. Almost the same amount of energy audits
2. Better quality
3. More confident general KPIs
4. More in depth analysis of specific KPIs

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