Direção Geral de Energia e Geologia

Directive 2012/27/EU

Article 7

Alternative Policy Measures for Energy Efficiency Obligation Schemes

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December 2013

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2. INTRODUCTION

Pursuant to Article 7(1) of Directive 2012/27/EU of the European Parliament and of the Council on energy efficiency, Member States are required to establish energy efficiency obligation schemes, ensuring that energy distributors and/or retail energy sales companies achieve a **cumulative end-use energy savings target** by 31 December 2020. This target is to be at least equivalent to achieving **new savings each year** from 1 January 2014 to 31 December 2020 of 1.5% of the annual energy sales to end consumers of all energy distributors or all retail energy sales companies, by volume, averaged over the most recent three-year period prior to 1 January 2013. The sales of energy, by volume, used in the transport sector may be partially or fully excluded from this calculation.

As an **alternative** to establishing such schemes, Article 7(9) stipulates that Member States may opt to take **other policy measures** to achieve energy savings among end consumers, provided that the annual quantity of end-use energy savings achieved by such policy measures is equivalent to that stipulated in Article 7(1).

In compliance with the provisions jointly stipulated in Article 7(9) and Annex V(4) of Directive 2012/27/EU, **Portugal**, by means of this report, hereby **notifies the Commission** that it has decided to use the alternative approach set out in Article 7(9) and is providing information on the end-use energy savings targets, measures to be adopted and methodologies used to calculate savings.

3. END-USE ENERGY SAVINGS TARGETS

Pursuant to Article 7(1) of Directive 2012/27/EU, the end-use energy savings target is based on the average value of annual energy sales, by volume, to end consumers of all energy distributors or all retail energy sales companies for the three years prior to 1 January 2013, i.e. 2010, 2011 and 2012.

This data was provided by the Directorate for Planning and Statistics Service of the Directorate-General for Energy and Geology, which is responsible for preparing official energy statistics in Portugal, a competence delegated to it by the National Statistics Institute.

Energy sales for the transport sector have been totally excluded from these calculations and the figures for 2012 are still provisional. As soon as these figures are confirmed as final, the data in the following table will be updated:

Table 1 – Annual energy sales [toe]

Sector	Form of Energy	Year		
		2010	2011	2012P
Industry	**Subtotal**	3 486 699	3 392 237	0
	Petrol	1 012 838	866 242	
	Natural Gas	988 895	1 053 662	
	Electricity	1 430 797	1 396 518	
	Renewables	0	0	0
	Others	54 169	75 815	
Domestic	**Subtotal**	2 511 254	2 328 868	0
	Petrol	679 765	586 880	
	Natural Gas	300 266	259 089	
	Electricity	1 248 873	1 182 947	
	Renewables	282 350	299 952	
	Others	0	0	0
Services	**Subtotal**	1 938 658	1 857 652	0
	Petrol	249 772	180 836	
	Natural Gas	208 962	213 898	
	Electricity	1 479 924	1 462 918	
	Renewables	0	0	0
	Others	0	0	0
Agriculture and Fishing	**Subtotal**	452 202	441 261	0
	Petrol	360 462	352 155	
	Natural Gas	3 511	4 684	
	Electricity	88 164	84 380	
	Renewables	65	42	
	Others	0	0	0
	TOTAL	**8 388 813**	**8 020 018**	**7 707 793**

NOTES:
Unit: toe
Source: DGEG Energy Reports
Others: Industrial waste

Does not include non-energy uses
According to ICESD 2010, just 40% of firewood used in households is purchased. Only 40% of the firewood used will be considered for the domestic sector.
The figures for 2012 are still provisional

Therefore, considering the said data, the average value for the three year period from 2010 to 2012 was calculated to be 8 038 874.7 toe.

The annual volume of energy savings was then determined (x1.5%) based on the average value ascertained for the years 2010, 2011 and 2012.

Moreover, as described in Annex V(2)(e), it is stipulated that each specific energy saving action is to result in savings not just in the year of implementation but also in future years, up to 2020. This is why the required quantity of savings accumulates year upon year.

Table 2 – Overall energy savings targets

Year	% Savings	Savings (toe)						
2014	1.5%	120 583						
2015	1.5%	120 583	120 583					
2016	1.5%	120 583	120 583	120 583				
2017	1.5%	120 583	120 583	120 583	120 583			
2018	1.5%	120 583	120 583	120 583	120 583	120 583		
2019	1.5%	120 583	120 583	120 583	120 583	120 583	120 583	
2020	1.5%	120 583	120 583	120 583	120 583	120 583	120 583	120 583

Thus, as per the calculations described above, it can be seen that the accumulated end-use energy savings target is **3 376 327 toe**.

4. PROPOSED ENERGY SAVINGS: 2016 / 2020

In light of the above, a series of programmes and measures was identified, contained in the National Energy Efficiency Action Plan (PNAEE), in different sectors, so as to achieve the end-use energy savings targets set out in the Directive.

The analysis resulted in the selection of the measures described in this document. Programmes and measures which did not ensure continued energy savings until 2020 were eliminated, as were those in which the level of implementing measures needed to be improved.

Table 3 shows the annual energy savings derived from the implementation of energy efficiency measures in the following sectors:

a) Transport (TRP);
b) Residential and Services (RS);
c) Industry (IND);
d) State (EST).

Table 3 – Annual energy savings

Programme	Results							
	Energy savings (toe)							
	2013	2014	2015	2016	2017	2018	2019	2020
TRP	6 641	19 944	12 396	13 914	13 938	15 101	16 156	17 643
RS	46 765	52 445	53 134	53 834	54 590	55 545	55 340	55 009
IND	34 500	34 500	34 500	34 500	34 500	34 500	34 500	34 500
EST	14 842	15 086	19 831	20 930	22 023	23 115	24 208	25 300
Total	**102 748**	**121 975**	**119 860**	**123 178**	**125 051**	**128 261**	**130 204**	**132 452**

The figures presented above are based on a careful identification of the energy efficiency measures which continue to have an impact in the 2020 time frame, and which make it possible to achieve the following accumulated energy savings:

Table 4 – Accumulated energy savings

Programme	Results							
	Accumulated energy savings (toe)							
	2013	2014	2015	2016	2017	2018	2019	2020
TRP	6 641	33 226	72 207	125 101	191 934	273 868	371 957	487 690
RS	46 765	145 975	298 319	504 497	765 266	1 081 579	1 453 233	1 879 896
IND	34 500	103 500	207 000	345 000	517 500	724 500	966 000	1 242 000
EST	14 842	44 770	94 528	165 217	257 928	373 755	513 789	679 124

Total	**102 748**	**327 471**	**672 054**	**1 139 815**	**1 732 628**	**2 453 702**	**3 304 980**	**4 288 710**

As such, the following targets were established in accordance with the energy savings described above:

a) Interim target (2016): 1 139 815 toe;

b) Final target (2020): 4 288 710 toe.

5. SECTORIAL ANALYSIS

The energy savings proposed in the previous section were based on an exhaustive analysis of measures and programmes from various sectors of activity. A detailed description of each is provided below:

5.1. TRANSPORT

5.1.1. PROPOSED ENERGY SAVINGS

The following table shows the annual savings resulting from each of the measures set out in the different programmes aimed at promoting energy efficiency in the transport sector:

Table 5 – Annual energy savings in the transport sector

Programme	Code	Name	Results							
			Energy saved							
			2013	2014	2015	2016	2017	2018	2019	2010
Eco Car	**Tp1m1**	**Green Taxes**	1 009	1 146	1 264	1 383	1 503	1 623	1 742	1 861
	Tp1m3	**Mobi.E**	174	242	376	625	971	1 390	1 798	2 057
Urban mobility	**Tp2m2-1**	**Mini-bus**	131	175	175	218	218	218	218	218
	Tp2m2-2	**Taxi Management**	3 432	4 061	4 691	5 320	5 949	6 578	7 208	7 837
	Tp2m2-3	**Soft Modes**	506	503	400	397	295	293	194	192
Energy Efficiency System for the Transport sector	**Tp3m2**	**RGCE TRP**	907	7 799	2 000	2 000	2 000	2 000	2 000	2 000
	Tp3m3	**Nitrogen**	483	966	966	1 450	483	483	483	966
	Tp3m4	**Fleet Management**	0	5 052	2 523	2 521	2 518	2 516	2 513	2 511
Total			**6 641**	**19 944**	**12 396**	**13 914**	**13 938**	**15 101**	**16 156**	**17 643**

Table 6 – Accumulated energy savings in the Transport sector

Programme	Code	Name	Results							
			Energy saved (toe) [accumulated]							
			2013	2014	2015	2016	2017	2018	2019	2010
Eco Car	Tp1m1	Green Taxes	1 009	3 165	6 584	11 386	17 692	25 619	35 289	46 821
	Tp1m3	Mobi.E	174	589	1 380	2 796	5 184	8 962	14 537	22 170
Urban mobility	Tp2m2-1	Mini-bus	131	436	916	1 614	2 530	3 665	5 017	6 588
	Tp2m2-2	Taxi Management	3 432	10 925	23 109	40 613	64 066	94 098	131 337	176 413
	Tp2m2-3	Soft Modes	506	1 514	2 923	4 730	6 831	9 225	11 813	14 592
Energy Efficiency System for the Transport sector	Tp3m2	RGCE TRP	907	9 612	20 317	33 023	47 728	64 434	83 139	103 844
	Tp3m3	Nitrogen	483	1 933	4 349	8 215	12564	17 396	22 712	28 994
	Tp3m4	Fleet Management	0	5 052	12 628	22 724	35 339	50 470	68 114	88 269
Total			**6 641**	**33 226**	**72 207**	**125 101**	**191 934**	**273 868**	**371 957**	**487 690**

5.1.2. DESCRIPTION OF THE PROPOSED PROGRAMMES AND MEASURES

A detailed description is given below of each of the programmes and measures proposed for the transport sector, which will make it possible to achieve the targets which have been defined.

Programme Tp1 – Eco Car

This programme consists of 3 measures to improve the private transport segment, encouraging renewal and more efficient use.

Tp1m1 – Green Tax – Review of the tax system for private vehicles

This measure aims to maintain and improve existing conditions with a view to promoting the introduction of vehicles with low CO_2 emissions by means of tools and mechanisms encouraging their expansion in the road transport sector. Some of the tools to achieve this measure relate to vehicle tax reforms, as well as making consumption guides available and publicising energy information on new vehicles.

This measure is in keeping with the EU strategy, which is essentially based on three pillars: i) voluntary commitments by the automobile industry to reduce greenhouse gas emissions; ii) better information for consumers and iii) promoting more energy efficient automobiles, through fiscal measures.

Emissions are linked to the quality of fuels, but largely depend on the efficient use of fuels, particularly by combustion engine technology. This measure aims to encourage the acquisition of private or commercial light vehicles with lower emissions.

Tax incentives are a preferred tool for implementing this measure, including benefits in terms of vehicle tax (ISV) and road tax (IUC) for registered automobile vehicles and motor-bicycles, based on the level of gCO_2/vkm emissions. The ISV calculation also considers CO_2 emissions, in accordance with progressive tables, with a view to encouraging the sale of vehicles with lower emissions. These tools thus also involve disseminating information among consumers since they are an economic incentive associated with a choice that involves lower fuel consumption, which is more rational and hence less polluting.

Tp1m3 - Mobi.E: Promoting the acquisition of electric vehicles

This measure aims to promote demand for and the introduction of electric vehicles (EV) in the market for mixed and passenger light vehicles and electric scooters, making the most of investments which have already been made in terms of developing an intelligent and integrated management platform. One of the possible solutions could include upgrading the existing charging infrastructure, adapting it to public and private covered parking sites, such as by developing solutions for charging vehicles at home. Another aspect of this measure focuses on demonstrating the advantages of using electric vehicles and scooters, highlighting the benefits of this technology in light of the growing costs associated with conventional fuels and the environmental impact.

As with the 'Green Tax' measure, electric vehicles can use benefits which include total exemption from the environmental component of the IUC, while ISV benefits are applicable to acquisitions made within the scope of Article 2(2)(a) of Annex I of the Vehicle Tax Code, approved by Law No 22-A/2007 of 29 June 2007, in its present form.

Programme Tp2 – Urban Mobility

This programme consists of two measures and aims to encourage the use of collective transport and soft modes of transport to the detriment of individual transport, with a particular emphasis on urban areas.

Tp2m2 - Use of more energy efficient transport and mobility solutions

This measure aims to improve energy efficiency by introducing more efficient vehicles for public road transport, as per the following terms:

a) Tp2m2-1 Minibuses and flexible transport services

This measure seeks to encourage the use of fleets of minibuses which contribute, autonomously or as part of conventional bus fleets, towards serving demand better during off-peak hours for urban public transport fleets or in rural areas with low population.

It also aims to implement innovative solutions which can respond to mobility needs by means of flexible public transport services (FPT), including services with variable routes, stops and schedules. These

solutions make it possible to provide public transport solutions that are better suited to demand, improving performance levels (reducing consumption, routes and distances) and reducing the use of individual transport.

b) Tp2m2-2 – Fleet management centres and the automatic attribution of taxi services

Taxis are an intermediate solution between collective transport and private vehicles, making it possible to respond better to specific transport needs.

New solutions have been contemplated to organise and provide taxi services, which can include their integration into FPT services.

This measure also focuses on developing fleet management centres and the automatic attribution of taxi services, which can locate all vehicles and ascertain their availability, encouraging available taxis to wait to be assigned passengers at taxi ranks, significantly reducing the number of taxis hailed while circulating on the roads. The reduction of empty trips will immediately be reflected in a reduction in the respective fuel consumption, traffic congestion, vehicle maintenance expenditure, emissions, etc.

c) Tp2m2-3 Use of bicycles and soft modes of transport

After the preparation of the 'Plan to Promote Bicycles and Other Modes of Soft Transport 2013-2020', a programme was created that aims to develop a strategy and a coherent and articulated set of measures to promote the everyday use of bicycles and adopt sustainable mobility solutions. It also seeks to create better and safer conditions for soft modes of transport and to change behaviour so as to reduce the use of individual motorised transport.

In addition to the leisure and sports aspect, reinforcing the everyday use of bicycles is also associated with a growing number of municipalities which have been implementing bike sharing solutions and building cycle paths (normal streets, cycle lanes and cycle paths). This aims to develop infrastructure to support the 'Plan to Promote Bicycles and Other Modes of Soft Transport 2013-2020' and sports and leisure activities, as well as

infrastructure aimed at using bicycles for everyday life, by connecting residential, employment and service zones and large-scale facilities. It is important to note that a great deal of the existing investment in bicycle paths was due to the initiative of municipalities.

Programme Tp3 - Energy Efficiency System for the Transport sector

This programme consists of four measures and aims to encourage actions which provide passenger railway networks, as well as the energy management of transport fleets.

Tp3m1 – Providing Passenger Railway Transport

This measure was contemplated in the National Plan for Climate Change, approved by Council of Ministers Resolution No 104/2006 of 23 August 2006 (PNAC 2006). It sought to change the services provided by the railway concessionaire (CP-Comboios de Portugal) by reducing the travel time on the Lisbon-Porto, Lisbon-Castelo Branco and Lisbon-Algarve routes. The actions carried out within the scope of this measure relate to operating efficiency, improving the quality of services, reducing travel times and increasing demand.

The impact of this measure can be improved by means of actions promoted in partnership with railway passenger transport operators, highlighting the economic and environmental advantages of using trains as opposed to private vehicles, especially evident in medium and long haul journeys.

Tp3m2 – Regulation to Manage Energy Consumption in the Transport Sector

This measure evaluates the performance of the current Regulation to Manage Energy Consumption in the Transport Sector, approved by Implementing Order (Portaria) No 228/90 of 27 March 1990, amended by Law No 7/2013 of 22 January 2013, and the respective impact on the reduction of energy consumption in the transport sector.

The technical review of the Regulation to Manage Energy Consumption in the Transport Sector is being assessed and could prove to be a new contribution to the transport sector, with an impact on post-2016 goals.

This is a regulatory measure aimed at dedicated operators of transport fleets and company transport fleets which have annual consumption above a reference value (the current regulation encompasses all fleets with an annual consumption of more than 500 toe) and which prepare rationalisation plans, by means of specific audits, with a view to improving energy intensity or reducing specific consumption.

Tp3m3 – Support for installing equipment to fill tyres with nitrogen

This measure essentially aims to promote the installation of nitrogen generating systems in the workshops of passenger and goods transport operators and in the workshops of private fleets (private and municipal companies), with an emphasis on heavy vehicle fleets.

In addition to other consequences (such as safety, comfort and the tyre's working life) using tyres with incorrect pressure represents an increase in the vehicle's consumption and the consequent associated emissions.

One of the ways of effectively ensuring a reduction in the number of vehicles circulating without adequate tyre pressure is to consider the possibility of providing support to the workshops of transporters and company fleets to acquire nitrogen generating systems to fill tyres. A second phase could include public supply outlets and repair and assistance workshops.

In addition to other advantages, filling tyres with nitrogen helps minimise loss in pressure. Regardless of the habit of checking tyre pressure by drivers, the use of nitrogen ensures that the tyre pressure for vehicles on the road remains correct for a longer period of time.

Tp3m4 – Fleet Management System and Promoting Eco-Driving

This measure consists of promoting the adoption of systems by passenger and goods transporters to monitor the performance of professional drivers. This will make it possible to correct unsuitable driving habits, promote best practices and provide tools for the ongoing training of drivers, as well as technological solutions compatible with open operating systems, ensuring interoperability with existing devices on the market, which aid driving and make it possible to gather information on the driving and the vehicle's performance.

The measure will be complemented by training in eco-driving based on the results collected through the fleet management systems, further promoting energy savings in this manner.

5.2. RESIDENTIAL AND SERVICES

5.2.1. PROPOSED ENERGY SAVINGS

The following table shows the annual savings derived from each of the measures stipulated in the different programmes aimed at promoting energy efficiency in the Residential and Services sector:

Table 7 – Annual energy savings in the Residential and Services sector

Programme	Code	Name	Results							
			Energy saved							
			2013	2014	2015	2016	2017	2018	2019	2020
Renew Home & Office	RSp1m1	Efficient Equipment	3 514	3 164	3 044	2 800	2 618	2 636	2 591	2 448
	RSp1m2	Efficient Lighting	8 284	8 284	8 284	8 284	8 284	8 284	8 284	8 284
	RSp1m3	Efficient Windows	122	123	124	124	125	125	126	127
	RSp1m4	Efficient Insulation	93	77	93	108	123	139	170	216
	RSp1m5	Green Heat	15 777	16 092	15 388	14 650	13 875	13 064	11 105	9 061
Energy Efficiency System for Buildings	RSp2m1	Residential Certification	2 763	2 901	3 046	3 351	3 686	4 055	4 460	4 906
	RSp2m2	Services Certification	10 145	11 455	12 765	14 075	15 385	16 695	18 005	19 314
Solar Thermal	RSp3m1	Solar Residential	4 006	7 097	7 125	7 161	7 196	7 232	7 268	7 305
	RSp3m2	Solar Services	2 062	3 252	3 265	3 282	3 298	3 314	3 331	3 348
Total			**46 765**	**52 445**	**53 134**	**53 834**	**54 590**	**55 545**	**55 340**	**55 009**

Table 8 – Accumulated energy savings in the Residential and Services Sector

Programme	Code	Name	Results [accumulated]							
			Energy saved (toe) [accumulated]							
			2013	2014	2015	2016	2017	2018	2019	2020
Renew Home & Office	RSp1m1	Efficient Equipment	3 514	10 191	19 912	32 434	47 573	65 348	85 714	108 529
	RSp1m2	Efficient Lighting	8 284	24 853	49 706	82 843	124 264	173 970	231 959	298 234
	RSp1m3	Efficient Windows	122	367	735	1 228	1 845	2 588	3 457	4 453
	RSp1m4	Efficient Insulation	93	262	525	895	1 389	2 021	2 824	3 842
	RSp1m5	Green Heat	15 777	47 646	94 903	156 810	232 593	321 439	421 390	530 403
Energy Efficiency System for Buildings	RSp2m1	Residential Certification	2 763	8 427	17 137	29 198	44 945	64 747	89 009	118 177
	RSp2m2	Services Certification	10 145	31 745	66 110	114 550	178 375	258 894	357 418	475 256
Solar Thermal	RSp3m1	Solar Residential	4 006	15 108	33 335	58 723	91 307	131 123	178 208	232 597
	RSp3m2	Solar Services	2 062	7 376	15 955	27 816	42 975	61 449	83 253	108 405
Total			**46 765**	**145 975**	**298 319**	**504 497**	**765 266**	**1 081 579**	**1 453 233**	**1 879 896**

5.2.2. DESCRIPTION OF THE PROPOSED PROGRAMMES AND MEASURES

Programme RSp1 - Renew House & Office

This programme aims to promote the substitution of equipment in the Residential Sector and in the Services Sector, so as to make home appliances, electric equipment and lighting more efficient, keeping pace with technological advances promoted by producers and induced by the market's growing requirements in terms of reducing consumption, *viz*. energy consumption.

RSp1m1 – Promoting more efficient equipment

The measure's main objective is to promote the substitution of home appliances and other electric equipment essentially used for domestic purposes, reducing the specific consumption of domestic equipment. Energy labelling, introduced by Council Directive No 92/75/EEC of 22 September 1992, enabled consumers to be clearly informed of the characteristics and performances of the products they intend to acquire. This Directive covers a broad range of equipment with significant energy consumption, considering all consumption in the residential sector, especially electricity consumption.

Directive No 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 (Energy Labelling Directive), revoked said Council Directive No 92/75/EEC of 22 September 1992. It also introduced a new energy label, with new classes (A+++ to D, on most equipment) and new criteria for their attribution. New categories were included for devices, especially televisions. The Energy Labelling Directive, transposed by Decree-Law No 63/2011 of 9 May 2011, is currently the main tool to promote the acquisition and use of more efficient home appliances and other electrical equipment. It is a well known tool and has been accepted well by consumers, since it clearly transmits information on the energy efficiency and performance of equipment available in the market.

RSp1m2 – Efficient Lighting

This measure aims to ensure the adoption of national programmes to promote efficient lighting, by renewing infrastructure and substituting bulbs with poor energy efficiency, so as to phase them out.

Decree-Law No 18/2000 of 29 February 2000 established the rules for the energy labelling of electric bulbs for domestic use, transposing to the national legal system Directive No 98/11/EC of 17 January 1998. As with home appliances, bulbs are classified according to their energy efficiency, enabling consumers to obtain an idea of their consumption, in conformance with envisaged use.

In addition to this information there is also a mechanism to promote the use of more efficient bulbs through the application of a tax on energy inefficient bulbs (Decree-Law No 108/2007 of 12 April 2007), which has contributed significantly towards accelerating the phasing out of incandescent bulbs.

It is important to expand this phasing out to other types of less efficient bulbs based on energy performance classifications, namely by introducing new kinds of bulbs, with a view to including other emerging technologies, such as light-emitting diodes (LED) or efficient halogen, in the respective lighting segment. It is expected that these bulbs will begin to substitute bulbs used for traffic signals and other more common uses of low efficiency incandescent and halogen bulbs.

RSp1m3 – Efficient Windows

This measure is part of a set of measures to overhaul the residential sector and contemplates interventions related to the cladding of buildings. It aims to improve glass surfaces, by using double glazing and thermally sealed window frames as well as the use of efficient (low emissivity) glass.

This measure seeks to promote the replacement of glass surfaces, in conjunction with a product labelling system. Between 750 000 to 800 000 m^2 of efficient glass is expected to be installed by 2016.

The data on installed windows refers to windows sold in the market, distributed by the weighting attributed to renovated buildings, considering all works carried out annually. Forecasts for the evolution of the installation of more efficient

windows have considered the full functioning of the product labelling system from 2013 onwards.

The objective of this system is not just to promote registering of manufacturers and installations of efficient windows but, especially, to provide the market with a tool which can enable suitable comparison of the energy performance of the different equipment.

This measure is being implemented due to the potential which has been identified by means of the improvement measures included in energy certificates as well as specific support aimed at the area of energy efficiency.

RSp1m4 – Efficient Insulation

Just like the previous measure, this measure is also part of the measures to overhaul the residential sector, contemplating work for the cladding of buildings in terms of thermal insulation, applicable to roofs, floors and walls.

In addition to renovating buildings, this measure aims to implement efficient insulation. About 3 million m^2 of efficient insulation material are expected to be installed by 2016 in buildings requiring repairs.

The evolution of the square metres installed, in terms of thermal insulation, has been revised downwards essentially due to the current economic climate. It is expected that these figures could gradually evolve in a more positive manner after 2014.

This measure is being implemented due to the potential which has been identified by means of the improvement measures included in energy certificates as well as specific support aimed at the area of energy efficiency.

RSp1m5 – Green Heat

This measure aims to encourage the use of heat recuperators in residential units, to complement and provide an alternative to traditional means of ambient heating (open fireplaces). Moreover, heat recuperators combine the advantages of using biomass with a system of forced air, enabling them to uniformly distribute the hot air produced in the spaces to be heated.

An associated energy saving of 75% has been estimated due to the use of a renewable source of energy, which represents a reduction of 0.68 toe/dwelling

renovated, based on a survey of consumption in the domestic sector by the Directorate-General for Energy and Geology [*Direção* Geral de Energia e Geologia – DGEG] and by the National Statistics Institute [*Instituto Nacional de Estatística, I.P.* - INE, I.P.] in 2010.

The introduction of this type of equipment in the market is directly related to the evolution of electricity and gas prices, since biomass is considered to be one of the main alternatives. Thus, an annual positive evolution of 2% in the numbers of installed devices has been considered, in keeping with forecasts by manufacturers in this sector.

Certification systems for equipment, installers and biomass are being contemplated in order to implement this measure, so as to ensure a level of quality which promotes trust among consumers and encourages them to adopt this technology. Moreover, promotional campaigns will be conducted involving the State, sector associations and equipment manufacturers, with a view to highlighting the advantages of this heating solution. The campaigns will emphasise the ease of installation and current efficiency as well as the fact that the devices are safe and easy to use, being a low cost and ecological solution.

Programme RSp2 – Energy Efficiency System for Buildings

The Energy Certification Programme aims to improve the energy performance of buildings, by improving the average energy efficiency of buildings, by implementing guidelines which regulate the Energy Certification System for Buildings (SCE), as a result of the transposition to the national legal system of Directive 2010/31/EU, carried out through the publication of Decree-Law No 118/2013 and Law No 58/2013 both of 20 August 2013.

RSp2m1 - SCE Residential Buildings

The SCE requires new buildings or large scale renovations to incorporate minimum quotas of efficient classes (B- to A+). Moreover, mechanisms can be developed by means of specific regulations which promote improvements in the energy class of buildings.

New buildings

The target for this indicator is to certify 268 000 residential units by 2020 with an energy class of B- or higher for new buildings or large scale renovations. This goal was defined on the basis of the evolution seen in the context of the SCE in terms of the number of buildings certified up to 2012, the current scenario for the evolution of the economy and the dynamics of the real estate market.

From 2007 to 2012 the annual average from records for such buildings is 19 300 residential units, of which 7.7% involve large scale renovations.

The forecast for the evolution of certified buildings between 2012 and 2020 contemplated the scenario in 2013, considering the trends of buildings certified in the last two years and the current situation of the real estate sector. A positive evolution in the real estate sector is expected from 2014 onwards, further driven by an increase in the number of existing buildings being remodelled.

The impact of this measure has been determined on the basis of an estimate of Energy Certificates issued within the scope of the SCE for new units as well as large scale renovations, and an impact factor, expressed in toe/dwelling, which reflects the evolution in terms of energy efficiency and requirements underlying the regulatory reviews of the laws on the energy performance of buildings.

The value of the factor for reducing consumption per dwelling for 2011-2012 was ascertained to be 0.203 toe/dwelling, considering the most recent statistical information for improvements in the energy performance of buildings collated from the SCE database. A new factor for reducing consumption per dwelling will be determined after 2013, by applying the new system for the energy certification of buildings. In the meanwhile, using the current ratio of nominal consumption in certificates issued as per the SCE and the real values resulting from ICESD 2010, the value of the factor for reducing consumption per dwelling corresponds to 0.23 toe/dwelling.

Until 2010, the energy certificates issued for residential properties built between the beginning of 2007 and the end of 2010 were included in this measure, since these projects already incorporated the technical requirements for new buildings

even though they might not have a Regulatory Compliance Certificate (DCR) for this phase (owing to the date the SCE came into effect).

Existing buildings

Existing buildings will contribute through the implementation of the improvement measures identified for dwellings which are subject to energy certification. Considering the number of existing buildings certified within the number of total buildings in Portugal and the level of implementation of the said improvement measures, it was decided to consider the individual contribution of each specific measure with regard to other vectors set out in the PNAEE, namely the Solar Thermal, Green Heat, Efficient Windows and Efficient Insulation measures.

RSp2m2 – SCE Service Buildings

The SCE stipulates that new buildings or large scale renovations are required to incorporate minimum quotas of efficient classes (B- to A+). Additionally, mechanisms can be developed by means of specific regulations to improve the energy class of buildings.

The objective is to certify around half of all service buildings to be of an energy class B- or higher by 2020.

In the context of this measure, the useable floor space area of buildings certified since the SCE came into effect and until the end of 2020 was calculated to be 58 563 066 m^2, corresponding to a total of 22 837 certificates for properties within the scope of the Regulations for Climate Control Energy Systems in Buildings (RSECE). In 2011 and 2012, 3 551 services buildings were identified by means of the RCCTE. From 2013 onwards, these buildings will be analysed within the scope of the RSECE and as such, the forecasts for the 2013-2020 period have already considered this factor.

The impact of this measure has been determined on the basis of an estimate of Energy Certificates issued within the scope of the SCE for new dwellings as well as large scale renovations, and an impact factor, expressed in toe/dwelling, which reflects the evolution in terms of energy efficiency and requirements underlying the regulatory reviews of the laws on the energy performance of buildings.

The forecast for buildings certified during the period 2013-2020 was based on the expected increase by means of new legislation (in effect from 2013), which will promote a greater certification of this type of buildings, as well as the evolution of the definition of a large-scale services building (indexed to the area of such buildings).

Programme RSp3 - Solar Thermal

The aim of the programme is to promote the integration of solar thermal systems in existing and future buildings in the domestic and services sector.

RSp3m1 - Residential Solar Thermal

This measure aims to promote the installation of solar thermal systems in existing and future buildings, with a view to creating a sustained market for the residential sector of 100 000 m^2 of solar panels installed per year. This would result in around 800 000 m^2 of panels installed and operational by 2016 and about 1.2 million m^2 by 2020.

This programme also aims to revitalise existing equipment, creating favourable conditions for substitution and/or specialised repair/maintenance.

This measure is being implemented due to the potential identified by means of Building Energy Certification (new buildings and improvement measures included in the energy certificates of existing buildings), leveraged by means of specific support in the area of energy efficiency, including negotiating credit lines aimed essentially at the domestic sector.

RSp3m2 – Services Solar Thermal

This measure seeks to create a sustained market, leading to the installation of 40 000 m^2 of solar panels per year. This will result in around 330 000 m^2 of installed and operational panels by 2016, and around 500 000 m^2 by 2020.

This measure is being implemented due to the potential identified by means of Building Energy Certification (new buildings and improvement measures included in the energy certificates of existing buildings), leveraged by means of specific national and Community support in the area of energy efficiency.

5.3. INDUSTRY

5.3.1. PROPOSED ENERGY SAVINGS

The following table shows the annual savings achieved by each of the measures of the different programmes aimed at promoting energy efficiency in the Industry sector:

Table 9 – Annual energy savings in the Industry sector

Programme	Code	Name	Results							
			Energy saved							
			2013	2014	2015	2016	2017	2018	2019	2020
Intensive Energy Consumption Management System	**Ip1m1**	**Transversal measures**	11 500	11 500	11 500	11 500	11 500	11 500	11 500	11 500
	Ip1m2	**Sectorial measures**	11 500	11 500	11 500	11 500	11 500	11 500	11 500	11 500
	Ip1m3	**Other sectors**	11 500	11 500	11 500	11 500	11 500	11 500	11 500	11 500
Total			**34 500**	**34 500**	**34 500**	**34 500**	**34 500**	**34 500**	**34 500**	**34 500**

Table 10 – Accumulated energy savings in the Industry sector

Programme	Code	Name	Results							
			Energy saved (toe) [accumulated]							
			2013	2014	2015	2016	2017	2018	2019	2020
Intensive Energy Consumption Management System	**Ip1m1**	**Transversal measures**	11 500	34 500	69 000	115 000	172 500	241 500	322 000	414 000
	Ip1m2	**Sectorial measures**	11 500	34 500	69 000	115 000	172 500	241 500	322 000	414 000
	Ip1m3	**Other sectors**	11 500	34 500	69 000	115 000	172 500	241 500	322 000	414 000
Total			**34 500**	**103 500**	**207 000**	**345 000**	**517 500**	**724 500**	**966 000**	**1 242 000**

5.3.2. DESCRIPTION OF THE PROPOSED PROGRAMMES AND MEASURES

Programme Ip1 – Energy Efficiency System for Industry and other sectors

Measures in the industrial sector will continue to focus on the implementation of the Intensive Energy Consumption Management System (SGCIE), namely on the potential for energy savings contained in the PREN plans, resulting from obligatory energy audits. These measures can be categorised in the following manner:

a) Measure Ip1m1 - SGCIE – Transversal Measures
b) Measure Ip1m2 - SGCIE – Specific Measures
c) Measure Ip1m3 - SGCIE – Other Sectors

Considering the implementation and assessment of the SGCIE, it will be reviewed to expand its scope of application, as well as to improve the level of monitoring of energy consumption or incentives to encourage companies to adopt such actions voluntarily. The monitoring of the implementation of the measures and energy efficiency will also be improved by using measurement and verification protocols. This review of the SGCIE also aims to encourage companies to adopt European standards for energy management systems (e.g. ISO 50001).

It is also expected to incorporate the obligations for improving energy efficiency stipulated in Decree-Law No 34/2011 of 8 March 2011, amended by Decree-Law No 25/2013 of 19 February 2013, governing the mini-production system, so that they are framed within the SGCIE regulations.

Ip1m1 - SGCIE Transversal Measures

The transversal measures cover four technological areas:

- Electric engines;
- Production of heat and cold;
- Lighting;
- Other measures to promote energy efficiency in industrial processes.

Table 11 – Transversal Measures

Scope	Measure / Technology
Electric Engines	Optimising engines
	Pump systems
	Ventilation systems
	Compression systems
Production of Heat and Cold	Cogeneration
	Combustion systems
	Heat recovery
	Industrial cooling
Lighting	Efficient lighting
Efficiency of Industrial / Other Processes	Monitoring and controls
	Treatment of effluents
	Process integration
	Maintaining energy consuming equipment
	Thermal insulation
	Transport
	Training and awareness for human resources
	Reduction of reactive energy

These measures have been grouped on the basis of their general applicability in the sectors covered by the regulation.

Ip1m2 - SGCIE Specific Measures

In addition to the transversal measures, a set of specific or sectorial measures have been identified for a significant group of industrial sectors. These involve possible actions that are applicable to the respective production processes.

Table 12 – Specific or Sectorial Measures

Sector	Measure / Technology
Food & Beverages	Optimising sterilisation
	Membrane separation processes
	Changing from horizontal to vertical mills
	Vacuum distillation
Ceramics	Optimising kilns
	Improving driers
	Vapour extrusion
	Hard extrusion

	Optimising the production of powder
	Use of alternative fuels
Cement	Optimising grinding
	Use of alternative fuels (e.g. biomass)
	Reducing the use of clinker in cement
	Use of natural gas (to substitute petroleum coke)
Timber and Timber Products	Mechanical instead of pneumatic transporters
	Using biomass
	Optimising drying chambers and kilns
Metal and electro-mechanics	Submerged combustion for heating baths
	Reusing waste
	Optimising kilns
Metallurgy and Smelting	Improving the quality of anodes and cathodes
	Fusion sector
	Number of castings per cavity
	Efficiency of cast metal
	Reducing wastage rates
	Eliminating dust
	Increasing the cycle rate
	Reducing thicknesses
Paper and Pulp	Gasification / burning of black liquor and other wastes
	Optimising drying
Chemicals, Plastics and Rubber	New separation operations (e.g. membranes)
	Use of new catalysts
	Optimising distillations
Iron & Steel	Improving electric kilns
	Smelting reduction processes
	Simultaneous moulding and forming
Textiles	Optimising bath processes
	Mechanical / IV pre-drying
	Heating water by means of solar panels
	Optimising textile production processes
Garments, Footwear and Hides	Improvements in cleaning / baths
	Cutting and joining technologies
	Heating water by means of solar panels
Glass	Optimisation of kilns
	Recycling used glass

Ip1m3 - SGCIE Other Sectors

This measure identifies the existing potential for savings in the SGCIE for other sectors of activity, in addition to those mentioned in Measure Ip1m2, as well as the potential resulting from new cogeneration projects or other actions which are not directly linked to the implementation of the SGCIE, but which lead to an increase in energy efficiency in the industrial sector.

5.4. STATE

5.4.1. PROPOSED ENERGY SAVINGS

The following table shows the annual savings from each of the measures envisaged in the different programmes aimed at promoting energy efficiency in the State sector:

Table 13 – Annual energy savings in the State sector

Programme	Code	Name	Results							
			Energy saved							
			2013	2014	2015	2016	2017	2018	2019	2020
Energy Efficiency in the State Sector	Ep1m1	Energy Certification for State Buildings and Energy Performance Contracts	10 053	10 502	14 593	15 682	16 772	17 861	18 950	20 039
	Ep1m2	Public Administration Energy Efficiency Action Plans - ECO.AP	2 350	2 115	2 742	2 742	2 742	2 742	2 742	2 742
	Ep1m3	More efficient State sector transport	268	299	326	336	339	343	346	349
	Ep1m4	Efficient Public Lighting	2 170	2 170	2 170	2 170	2 170	2 170	2 170	2 170
Total			**14 842**	**15 086**	**19 831**	**20 930**	**22 023**	**23 115**	**24 208**	**25 300**

Table 14 – Accumulated energy savings in the State sector

Programme	Code	Name	Results [accumulated]							
			Energy saved (toe) [accumulated]							
			2013	2014	2015	2016	2017	2018	2019	2020
Energy Efficiency in the State Sector	Ep1m1	Energy Certification for State Buildings and Energy Performance Contracts	10 053	30 609	65 757	116 588	184 190	269 654	374 067	498 520
	Ep1m2	Public Administration Energy Efficiency Action Plans - ECO.AP	2 350	6 815	14 021	23 969	36 659	52 091	70 265	91 181
	Ep1m3	More efficient State sector transport	268	836	1 730	2 960	4 529	6 440	8 697	11 304
	Ep1m4	Efficient Public Lighting	2 170	6 510	13 020	21 700	32 550	45 570	60 760	78 120
Total			**14 842**	**44 770**	**94 528**	**165 217**	**257 928**	**373 755**	**513 789**	**679 124**

5.4.2. DESCRIPTION OF THE PROPOSED PROGRAMMES AND MEASURES

Programme Ep1 – Energy Efficiency in the State Sector

Cabinet Resolutions Nos 2/2011 of 12 January 2011 and 67/2012 of 9 August 2012, governing the Public Administration Energy Efficiency Programme (ECO.AP Programme), created the necessary conditions for developing an effective energy efficiency policy for the State sector. They envisage achieving a 30% increase in energy efficiency by 2020 as compared to the current consumption figures in state buildings and equipment.

This programme envisages energy savings in four areas: the Energy Certification of Buildings and Energy Performance Contracts, Energy Efficiency Action Plans, Fleet Management and Public Lighting.

The implementation of some of the measures described below are supported by the market for Energy Services Companies (ESE), subject to a system of registration and qualifications, as established in Legislative Order No 15/2012 of 3 July 2012, published in the Official Gazette of the Republic of Portugal, 2nd series, No 127 of 3 July 2012, with a view to ensuring the quality of the services provided. These are the companies which will sign Energy Performance Contracts with the State within the scope of the Eco.AP Programme for the buildings covered therein, promoting the necessary investment and intervention to ensure improvement in their energy performance.

A standardised template has been created to facilitate energy performance contracts being signed in Public Administration, which the respective entities can use for this purpose. This template was published by means of implementing order (*Portaria*) No 60/2013 of 5 February 2013.

Ep1m1 – Energy Certification for State Buildings and Energy Performance Contracts

The ECO.AP Programme introduces a set of initiatives aimed at implementing measures to improve energy efficiency in Public Administration. These are to be implemented in the short, medium and long-term in public services, entities and facilities, with a view to changing behaviour and promoting a rational management of energy services.

The goal established for 2020 envisages that a total of 2 225 State buildings will be subject to certification. Of this total, Energy Performance Contracts will be signed for around 500 buildings within the scope of the ECO.AP Programme. These buildings will include at least 20% of the energy consumption of each ministry. The intervention of the ESEs in such buildings should enable a 30% saving in energy consumption.

The Energy Certification for State Buildings Measure will be leveraged by the implementation of the ECO.AP programme. The ESEs which have been allocated the Energy Performance Contracts will be responsible for ensuring this certification.

Ep1m2 – Energy Efficiency Action Plans for Public Administration - ECO.AP

Energy efficiency action plans can be prepared in the situations set out in Paragraph 2(d) of Council of Ministers Resolution No 2/2011 of 12 January 2011, i.e. for buildings with lower levels of energy consumption and which are not included in the properties identified by each ministry for the Energy Performance Contracts to be signed with ESEs.

Two types of measures – active and passive – are defined in such plans.

As active measures, the intervention consists of introducing more efficient lighting technologies and control systems, substituting climate control equipment with more efficient devices and installing solar thermal panels to produce hot water for high consumption buildings or equipment, such as schools and multipurpose pavilions. This area also focuses on promoting an eco-friendly public procurement policy while purchasing equipment, as well as teleconferencing technologies for meetings.

In terms of passive measures, these focus on solutions for the cladding of buildings, from installing insulation in opaque cladding (walls, floors, roofs) to devices providing shade (inside and outside).

The effects of these measures will be monitored and assessed by means of the Public Administration Energy Efficiency Barometer. This barometer serves to compare and publicly disclose the energy and low carbon performance of the services of each ministry, such as the respective consumption and energy efficiency action plans, implementing Parliament Resolution No 114/2010 of 29 October 2010, which made it compulsory to disclose the Public Administration’s energy bill.

The editions of the Public Administration Energy Efficiency Barometer will be reinforced by the launch of an Energy Efficiency Guide for the Public Administration, as well as prizes to distinguish best practices in the Public Administration.

In addition to incentives to rationalise the respective consumption and energy costs, efforts will be made to establish the Public Administration as an important agent for disseminating energy efficiency and low carbon best practices.

With this in mind, funding mechanisms will be developed to support the implementation of these plans, including studies, monitoring of the implementation and training for the local energy managers set out in Paragraph 3 of Council of Ministers Resolution No 2/2011 of 12 January 2012.

Without prejudice to the different scope of the energy efficiency action plans stipulated in Council of Ministers Resolution No 2/2011 of 12 January 2012 and the low carbon sectorial plans described in Council of Ministers Resolution No 93/2010 of 26 November 2010, the local energy managers will serve as a link between the two plans.

Ep1m3 – More Efficient State Transport

This measure aims to introduce energy efficiency and environmental criteria for transport, namely by renewing the public fleet with low emissions vehicles. This serves to implement the guidelines of the National Strategy for Ecological Public Procurement, phasing out vehicles with higher CO_2 emissions and creating mobility plans for public bodies where this measure is justified.

The implementation of this measure derives from the legislation governing the activities of the Public Administration Shared Services Entity [Entidade de Serviços Partilhados da Administração Pública, I. P. - ESPAP, I.P.]. The scope of ESPAP's competences includes ecological and low energy consumption public procurement for the State.

Ep1m4 – Efficient Public Lighting

In Portugal, Public Lighting (PL) is responsible for 3% of energy consumption. In recent years, there has been a discernable tendency towards expanding the PL network (by about 4% to 5% per year). This implies a set of measures aimed at increasing energy efficiency in the public lighting infrastructure.

Regulations for public lighting are expected to be published, which will include plans, cost-benefit analyses, tenders, monitoring and control of such systems, so as to ensure energy efficiency gains, reduce costs and a suitable level of service, with a view to improving the economic and environmental sustainability of municipalities.

Examples of intervention in public lighting projects include installing luminous flux regulators, substituting inefficient or obsolete light fixtures and ballasts, substituting mercury vapour lamps with more efficient sources of lighting, installing control, management and monitoring technologies for public lighting and substituting light sources in traffic and pedestrian control systems with LED technology.

As in the case of the ECO.AP Programme, the use of ESEs is also a fundamental tool for PL projects and energy performance contracts (EPC) are signed by means of public tenders.

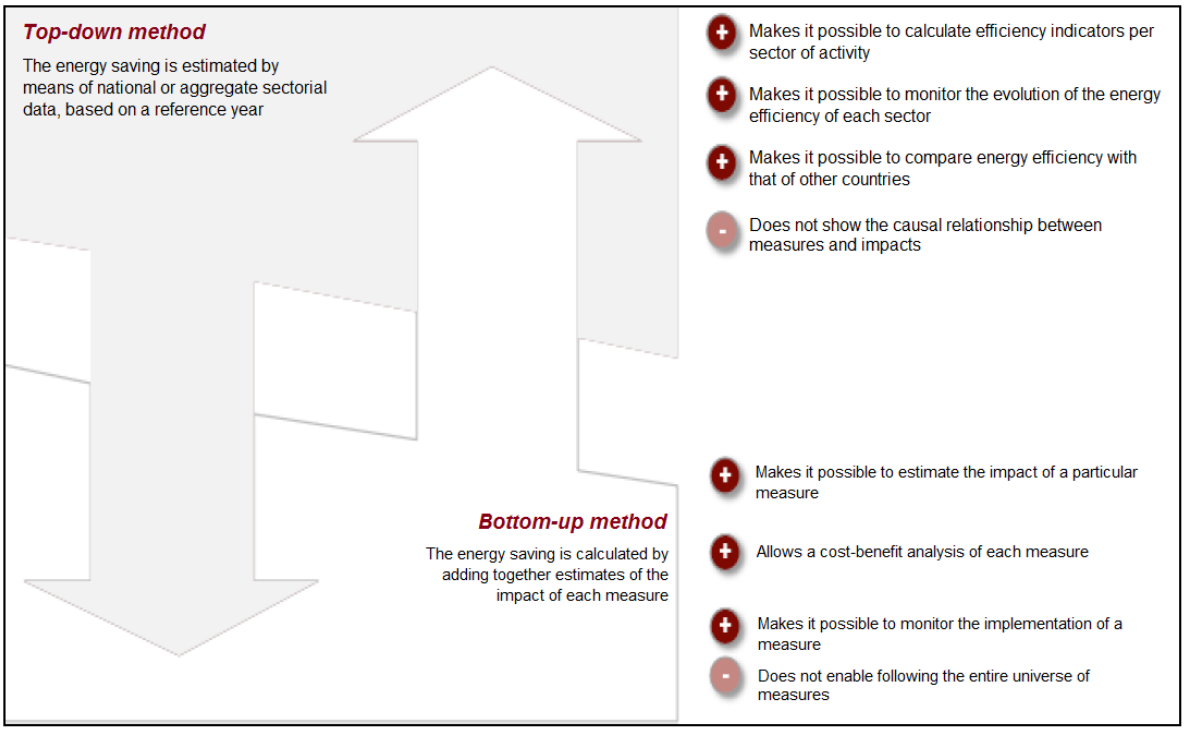
Furthermore, all information on public lighting throughout different public or private entities will be compiled and integrated into a single database, which will guide future public policies for energy efficiency in the area of public lighting.

6. MONITORING

Monitoring involves verifying compliance with the goals defined for energy efficiency savings for each measure, as well as continuous and comparative assessment of the cost-benefit ratio of the different measures. To this end, it is important to ensure that suitable statistical variables are developed, *viz.* quantitative and performance indicators evaluating the measures for the purposes of the top-down and bottom-up monitoring stipulated in the European Union methodology.

The bottom-up method uses specific methodologies for each measure (whenever possible), based on criteria and assumptions which make it possible to estimate the impact on final and primary energy, derived from the implementation of the measure. By showing a causal relationship between measures and impacts, it enables a cost-benefit analysis according to the investment made for the purposes of promoting the measure. It is thus possible to develop and periodically update a merit list of measures which are being implemented. However, the inherent nature of the bottom-up method does not allow it to monitor all measures and the validity of the assumptions for the methodologies developed is liable to undermine the veracity of the impact being monitored.

The top-down method responds to this monitoring shortcoming, by means of a set of energy efficiency indicators which make it possible to monitor savings achieved as compared to a reference year, in a given sub-sector. To this end, these indicators require aggregate information on sub-sector energy consumption as well as the activity indicators with which the consumption is associated, eliminating, as far as possible, effects which are not due to energy efficiency.



Source: Directive 2006/32/EC of the European Parliament and of the Council of 5 April 2006; "Recomendações para uma Estratégia Sustentável de Eficiência Energética e Exploração de Energias Renováveis para Portugal", 2012, A.T. Kearney/INESC Porto

In addition to selecting top-down aggregate indicators, other indicators will also be assessed which could assist the process for monitoring the implementation of the measures.

6.1. TOP-DOWN INDICATORS

6.1.1. TOP-DOWN INDICATORS FOR THE TRANSPORT SECTOR

The following table shows the top-down indicators for the transport sector:

Table 1 - Top-Down Indicators for the Transport Sector

Indicator Code	Description of the indicator	Effects reflected by the indicator
P8	Energy consumption of light vehicles (gep) per passenger-km (pkm)	Reflects technological improvements, behaviour and an increase in the occupancy rate of light passenger vehicles
A1	Energy consumption of light vehicles (l) per 100km covered	Reflects technological improvements and changes in behaviour in passenger cars. The difference as compared to the P8 indicator is due to the variation of the occupancy rate and the structure of diesel/petrol

		consumption.
P9	Energy consumption of cargo vehicles (gep) per tonne-km transported (ton.km)	Reflects technological improvements, fleet management, changes in occupancy rates and a shift to trucks with larger cargo capacities
A2	Energy consumption of cargo vehicles (toe) per vehicle	Reflects technological improvements and the effect of a change in the average size of vehicles. An increase in the occupancy rate or in the cargo capacity of the vehicles may not always translate into savings
P10	Energy consumption of passenger railway transport (gep) per passenger-km transported (pkm)	Reflects technological improvements and changes in the occupancy rate of trains
P11	Energy consumption of railway cargo transport (gep) per tonne-km transported	Reflects technological improvements and changes in the occupancy rates of trains
P12	Share of public transport in the total of passengers-km transported (%)	Reflects a shift to modes of public transport
P13	Share of rail and river transport in the total of tonnes-km transported (%)	Reflects a shift in cargo traffic to railway and river modes
M5	Energy consumption of road vehicles (toe) per equivalent car	Reflects technological improvements, behaviours and a reduction in the distance covered by road transport
M6	Energy consumption of railway transport (gep) per tonne-km equivalent transported	Reflects technological improvements and changes in the occupancy rates of trains (passenger and goods trains)
M7	Energy consumption of river transport per tonne-km equivalent transported (gep/tkm)	Reflects technological improvements and changes in the occupancy rates of river transport

6.1.2. TOP-DOWN INDICATORS FOR THE RESIDENTIAL AND SERVICES SECTOR

The following table shows the top-down indicators for the Residential and Services sector:

Table 16 – Top-Down Indicators for the Residential and Services Sector

Indicator Code	Description of the indicator	Effects reflected by the indicator
P1	Energy consumption to heat space per m^2 adjusted to climate conditions (kgep/m^2)	Reflects the impact of the regulation of construction, renovation of building stock, the efficiency of heating equipment and behaviour in terms of energy consumption for heating spaces
P2	Energy consumption to cool space per m^2 adjusted to climate conditions (kgep/m^2)	Reflects the impact of the regulation of construction, renovation of building stock, the efficiency of air conditioning equipment and behaviour in terms of energy consumption for cooling spaces
P3	Energy consumption to heat water per inhabitant (toe/inhabitant)	Reflects the technological improvement of equipment and the introduction of solar thermal energy in energy consumption to heat water
P4-1	Electricity consumption (kWh) per refrigerator (kWh/unit)	Reflects technological improvements and behavioural changes in the use of refrigerators
P4-2	Electricity consumption (kWh) per washing machine (kWh/un)	Reflects technological improvements and behavioural changes in the use of washing machines
P4-3	Insert more equipment	
P5	Electricity consumption (kWh) for lighting per dwelling	Reflects technological improvements, an increase in the number of bulbs or the number of usage hours for lighting
M1	Non-electric energy consumption per dwelling adjusted to climate conditions (toe/dwelling)	Reflects a wide range of improvements in the consumption of non-electric energy
M2	Electric energy consumption (kWh) per dwelling (kWh/dwelling)	Reflects a wide range of improvements in the consumption of electric energy

6.1.3. TOP-DOWN INDICATORS FOR THE INDUSTRIAL SECTOR

The following table shows the top-down indicators for the Industrial sector:

Table 2 – Top-Down Indicators for the Industrial Sector

Indicator Code	Description of the indicator	Effects reflected by the indicator
P14	Energy consumption (Mtoe) per unit of production	Reflects a wide range of improvements but can also incorporate changes in the production mix
M8	Energy consumption per unit of value addition (gep/euro)	Reflects improvements but incorporates various effects which are not due to energy efficiency (changes in profits, the product mix or quality, for example)
P14	Energy consumption (Mtoe) per unit of production	Reflects improvements but incorporates various effects which are not due to energy efficiency (changes in profits, the product mix or quality, for example)
M8	Energy consumption per unit of value addition (gep/euro)	Reflects improvements but incorporates various effects which are not due to energy efficiency (changes in profits, the product mix or quality, for example)

6.1.4. TOP-DOWN INDICATORS FOR THE STATE SECTOR

The following table shows the top-down indicators for the State sector:

Table 3 – Top-Down Indicators for the State Sector

Indicator Code	Description of the indicator	Effects reflected by the indicator
P6	Non-electric energy consumption in public services per m^2 adjusted to climate conditions (toe/ m^2)	Reflects renovations of the building stock and boilers or the installation of solar panels, as well as a change in consumption from non-electric consumption to electricity
P7	Electric energy consumption in public services per m^2 (kWh/ m^2)	Reflects technological improvements in equipment and lighting
M3	Non-electric energy consumption in public services per employee equivalent adjusted to climate conditions (toe/employee)	Reflects a wide range of improvements in non-electric energy consumption
M4	Electric energy consumption in public services per employee equivalent (kWh/employee)	Reflects a wide range of improvements in electric energy consumption

6.2. BOTTOM-UP INDICATORS

The following paragraphs summarise the bottom-up method applied to measures for which they are suitable.

6.2.1. BOTTOM-UP INDICATORS FOR THE TRANSPORT SECTOR

No bottom-up method was considered for the transport sector.

6.2.2. BOTTOM-UP INDICATORS FOR THE RESIDENTIAL AND SERVICES SECTOR

The following table shows the bottom-up indicators for a set of measures in the Residential and Services sector:

RSp1m1 – Promoting more efficient equipment

Table 19 – Variables considered in the bottom-up methodology for the RSp1m1 measure

Variables (V) and assumptions (P) for the calculation methodology		Name	Unit
V	Equipment in operation	P	Unit
V	Total consumption	E	toe
V	Specific consumption	---	toe/un
P	Factor for converting electric energy to final energy	---	toe/GWh
P	Factor for converting electric energy to primary energy	---	toe/GWh

The calculation formula is:

$$EE\ (ano\ t) = \left(\frac{E\_(t-1)}{P\_(t-1)} - \frac{E\_t}{P\_t}\right) \times P\_t$$

RSp1m2 – Efficient Lighting

Table 20 – Variables considered in the bottom-up methodology for the RSp1m2 measure

	Variables (V) and assumptions (P) for the calculation methodology	Name	Unit
V	No of bulbs acquired voluntarily	N1	Unit
V	No of bulbs distributed via incentives	N2	Unit
V	Average power of bulbs in use	P.conv.	W
V	Average power of economical bulbs	P.incent.	W
V	No of hours of lighting equipment in use	nh	
V	Final unitary energy savings	UFES	kWh/un
P	Correction factor which considers that part of the bulbs sold will not substitute existing bulbs	Frep	Non-dimensional
P	Factor for converting electric energy to final energy	Fce	toe/GWh
P	Factor for converting electric energy to primary energy	Fce2	toe/GWh

The calculation formula is:

$$EE = (P_{convencional} - P_{incentivadas}) \times nh \times \left(\frac{Frep}{1000}\right) \times (N1 + N2) \times Fce$$

RSp1m3 – Efficient Windows

Table 41 – Variables considered in the bottom-up methodology for the RSp1m3 measure

	Variables (V) and assumptions (P) for the calculation methodology	Name	Unit
V	Thermal transmission coefficient of the substituted windows	U_inicial (initial)	W/ m^2 /K
V	Thermal transmission coefficient of the efficient windows	U_novo (new)	W/m^2/K
V	No of degrees-day of heating/cooling	GDA	K*days/year
V	Final unitary energy savings	UFES	kWh/m^2
V	Area of windows installed with double or triple glazing	A	m^2
V	% of heating /cooling by electric sources	---	%
V	% of heating/ cooling by fossil sources	---	%
P	Coefficient "a": Correction factor depending on the building's climatic zone. a=1 if there is no national data for the calculation	a	Non-dimensional
P	Coefficient "b": Correction factor depending on the average efficiency of the heating system	b	Non-dimensional
P	Coefficient "c": Intermittence coefficient depending on the operational continuity of the heating system. c=0.5 if there is no national data for the calculation	c	Non-dimensional
P	Factor for converting electric energy to final energy	Fce	toe/GWh
P	Factor for converting electric energy to primary energy	---	toe/GWh

The calculation formula is:

$$EE = \frac{(U_{inicial} - U_{novo}) \times GDA \times 24h \times a \times \left(\frac{c}{b}\right)}{1000} \times A \times \left(\frac{Fce}{1 \times 10^6}\right)$$

RSp1m4 – Efficient Insulation

Table 22 – Variables considered in the bottom-up methodology for the RSp1m4 measure

Variables (V) and assumptions (P) for the calculation methodology		Name	Unit
V	Thermal transmission coefficient of the substituted element with insulation	U_inicial (initial)	W/m^2/K
V	Thermal transmission coefficient of the element with efficient insulation	U_novo (new)	W/m^2/K
V	No of degrees-day of heating/cooling	GDA	K*days/year
V	Final unitary energy savings	UFES	kWh/m^2
V	Area of thermal insulation applied in buildings	A	m^2
V	% of heating /cooling by electric sources	---	%
P	Coefficient "a": Correction factor depending on the building's climatic zone. a=1 if there is no national data for the calculation	a	Non-dimensional
P	Coefficient "b": Correction factor depending on the average efficiency of the heating system	b	Non-dimensional
P	Coefficient "c": Intermittence coefficient depending on the operational continuity of the heating system. c=0.5 if there is no national data for the calculation	c	Non-dimensional
P	Factor for converting electric energy to final energy	Fce	toe/GWh
P	Factor for converting electric energy to primary energy	---	toe/GWh

The calculation formula is:

$$EE = \frac{(U\_inicial - U\_novo) \times GDA \times 24h \times a \times (\frac{c}{b})}{1000} \times A \times (\frac{Fce}{1 \times 10^6})$$

RSp1m5 – Green Heat

Table 23 – Variables considered in the bottom-up methodology for the RSp1m5 measure

Variables (V) and assumptions (P) for the calculation methodology		Name	Unit
V	No of heat recuperators sold		Un.
V	% of heat recuperators installed which substitute fireplaces in existing buildings, including apartments and houses	%Subs	Un.
P	Domestic consumption of a heat recuperator	Ce	toe/dwelling
P	% of reduction of consumption due to the installation of a heat recuperator	%red	%

The calculation formula is:

$$EE = N \times \%Subs \times Ce \times \%red$$

RSp2m1 – SCE Residential Buildings

Table 24 – Variables considered in the bottom-up methodology for the RSp2m1 measure

Variables (V) and assumptions (P) for the calculation methodology		Name	Unit
V	Number of residential dwellings with Energy Certification built between the beginning of 2007 and the end of this year	---	Dwellings
P	% of final energy saved derived from electricity	---	%

The calculation formula is:

Savings achieved on the basis of the information in the energy certificates in the SCE database.

RSp2m2 – SCE Services Buildings

Table 25 – Variables considered in the bottom-up methodology for the RSp2m2 measure

Variables (V) and assumptions (P) for the calculation methodology		Name	Unit
V	Service units with Energy Certificates issued	---	Dwellings
V	Area of service units with Energy certificates issued	---	m^2
P	% of final energy saved derived from electricity	---	%

The calculation formula is:

Savings achieved on the basis of the information in the energy certificates in the SCE database.

RSp3m1 – Solar Thermal Residential

Table 26 – Variables considered in the bottom-up methodology for the RSp3m1 measure

Variables (V) and assumptions (P) for the calculation methodology		Name	Unit
V	Area installed per year	A	m^2
V	Thermal production	USAVE	toe/m^2
V	Specific final energy savings	UFES	toe/m^2
P	Output of the stock of heaters	η	%

The calculation formula is:

$$EE = \frac{USAVE}{\eta} \times A$$

RSp3m2 – Solar Thermal Services

Table 27 – Variables considered in the bottom-up methodology for the RSp3m2 measure

Variables (V) and assumptions (P) for the calculation methodology		Name	Unit
V	Area installed per year	A	m^2
V	Thermal production	USAVE	toe/m^2
V	Specific final energy savings	UFES	toe/m^2
P	Output of the stock of heaters	η	%

The calculation formula is:

$$EE = \frac{USAVE}{\eta} \times A$$

6.2.3. BOTTOM-UP INDICATORS FOR THE INDUSTRIAL SECTOR

The following are the bottom-up indicators for a set of measures for the Industrial sector:

Ip1m1 – SGCIE Transversal measures

Table 28 – Variables considered in the bottom-up methodology for the Ip1m1 measure

Variables (V) and assumptions (P) for the calculation methodology		Name	Unit
V	Energy Savings for Electric Engines (final energy)	---	toe
V	-- Of which: Electricity	---	toe
V	Energy Savings while Producing Heat and Cold (final energy)	---	toe
V	-- Of which: Electricity	---	toe
V	Energy Savings for Lighting (final energy)	---	toe
V	-- Of which: Electricity	---	toe
V	Energy Savings due to the Efficiency of Industrial and Other Processes (final energy)	---	toe
V	-- Of which: Electricity	---	toe

The calculation formula is:

Savings achieved on the basis of the information from energy audits and rationalisation plans in the SGCIE database.

Ip1m2 – SGCIE Specific Measures

Table 29 – Variables considered in the bottom-up methodology for the Ip1m2 measure

Variables (V) and assumptions (P) for the calculation methodology		Name	Unit
V	Final energy savings	---	toe
V	Food, beverages and tobacco	---	toe
V	Textiles	---	toe
V	Paper and Pulp	---	toe
V	Chemicals, plastics and rubber	---	toe
V	Ceramics	---	toe
V	Metallurgy and smelting	---	toe
V	Glass	---	toe
V	Cement	---	toe
V	Garments, footwear and hides	---	toe
V	Iron and steel	---	toe
V	Timber and timber articles	---	toe
V	Metal and electro-mechanics	---	toe
P	Factor for converting electric energy to final energy	Fce	toe/GWh
P	Factor for converting electric energy to primary energy	---	toe/GWh

The calculation formula is:

Savings achieved on the basis of the information from energy audits and rationalisation plans in the SGCIE database.

Ip1m3 – SGCIE Other Sectors

Table 30 – Variables considered in the bottom-up methodology for the Ip1m3 measure

Variables (V) and assumptions (P) for the calculation methodology		Name	Unit
V	Savings in other sectors of activity (c/s SGCIE). Includes SGCIE and Cogeneration	---	toe

The calculation formula is:

Savings achieved on the basis of the information from energy audits and rationalisation plans in the SGCIE database.

6.2.4. BOTTOM-UP INDICATORS FOR THE STATE SECTOR

The following are the bottom-up indicators for a set of measures for the State sector:

Ep1m1 – Energy Certification for State Buildings and Energy Performance Contracts

Table 31 – Variables considered in the bottom-up methodology for the Ep1m1 measure

Variables (V) and assumptions (P) for the calculation methodology		Name	Unit
V	Buildings with improved energy classification	---	Buildings
V	Area of buildings	---	m^2
P	% of final energy saved derived from electricity	---	%
P	Factor for converting electric energy to final energy	---	toe/GWh
P	Factor for converting electric energy to primary energy	---	toe/GWh

The calculation formula is:

Savings achieved on the basis of information in the energy certificates in the SCE database and the results of the implementation of projects within the scope of the ECO.AP programme.

Ep1m2 – Public Administration Energy Efficiency Action Plans - ECO.AP

Table 32 – Variables considered in the bottom-up methodology for the Ep1m2 measure

Variables (V) and assumptions (P) for the calculation methodology		Name	Unit
V	Buildings with improved energy classification	---	Buildings
V	Area of buildings	---	m^2
P	% of final energy saved derived from electricity	---	%
P	Factor for converting electric energy to final energy	---	toe/GWh
P	Factor for converting electric energy to primary energy	---	toe/GWh

The calculation formula is:

Savings achieved on the basis of information in the energy certificates in the SCE database and the results of the implementation of projects within the scope of the ECO.AP programme.

Ep1m3 – More efficient State Transport

Table 5 – Variables considered in the bottom-up methodology for the Ep1m3 measure

Variables (V) and assumptions (P) for the calculation methodology		Name	Unit
V	Number of new light vehicles with diesel propulsion	N1	Vehicles
V	Number of new light vehicles with petrol propulsion	N2	Vehicles
V	Average CO_2 emissions factor of new vehicles with diesel propulsion	E1	gCO_2/vkm
V	Average CO_2 emissions factor of new vehicles with petrol propulsion	E2	gCO_2/vkm
V	Number of km covered	D	km
P	Average CO_2 emissions factor of substituted vehicles	Eref	gCO_2/vkm
P	Factor to convert grams of CO_2 into energy (petrol)	Fce2	$kgCO_2/toe$
P	Factor to convert grams of CO_2 into energy (diesel)	Fce1	$kgCO_2/toe$

The calculation formula is:

$$EE = \frac{N1 \times D \times \left(\frac{Eref - E1}{Fce1}\right)}{1000} + \frac{N2 \times D \times \left(\frac{Eref - E2}{Fce2}\right)}{1000}$$