

Energy Efficiency at local level

Estonian Thermal Power Engineers Association (ETPEA)

Centro de Informação Urbana de Lisboa

9th September 2013

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www.lisboaenova.org

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LISBOA E-NOVA

LISBON'S MUNICIPAL ENERGY AND ENVIRONMENTAL AGENCY

Non-profit organization operating under private Law, which seeks the sustainable development of the city of Lisbon

MISSION

- Energy demand management
- Energy efficiency
- Endogenous energy resources management
- Environmental management
- Best practices in Urban Planning and Construction
- Sustainable mobility



LISBOA E-NOVA

AREAS OF EXPERTISE

Energy and
Environmental
Strategy

Energy
Efficiency and
Renewable
Energy

Water

Sustainable
Mobility

Smart Cities

Urban
Planning

Biodiversity

Environmental
Awareness

COMMUNICATION

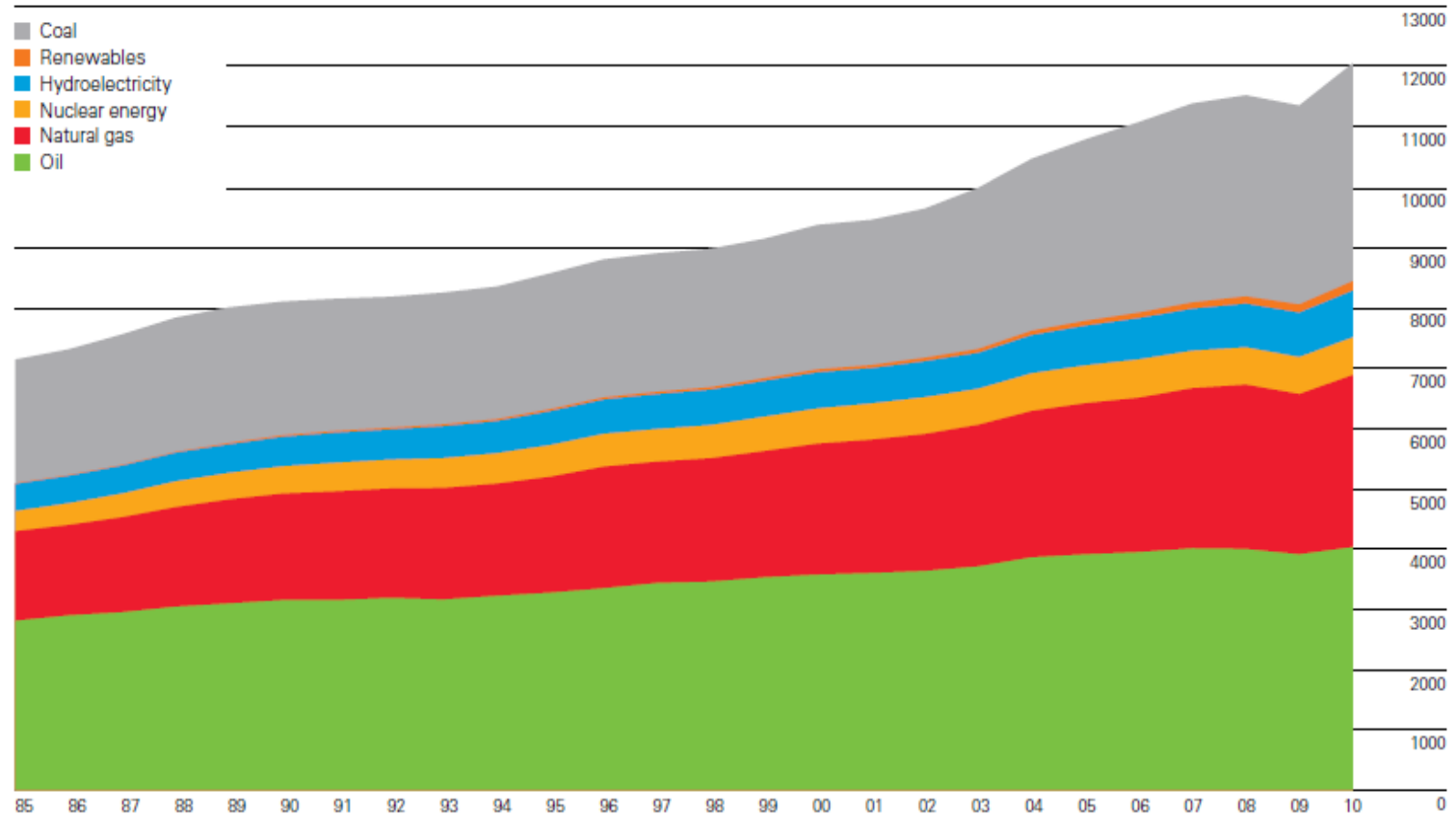
AFFILIATES



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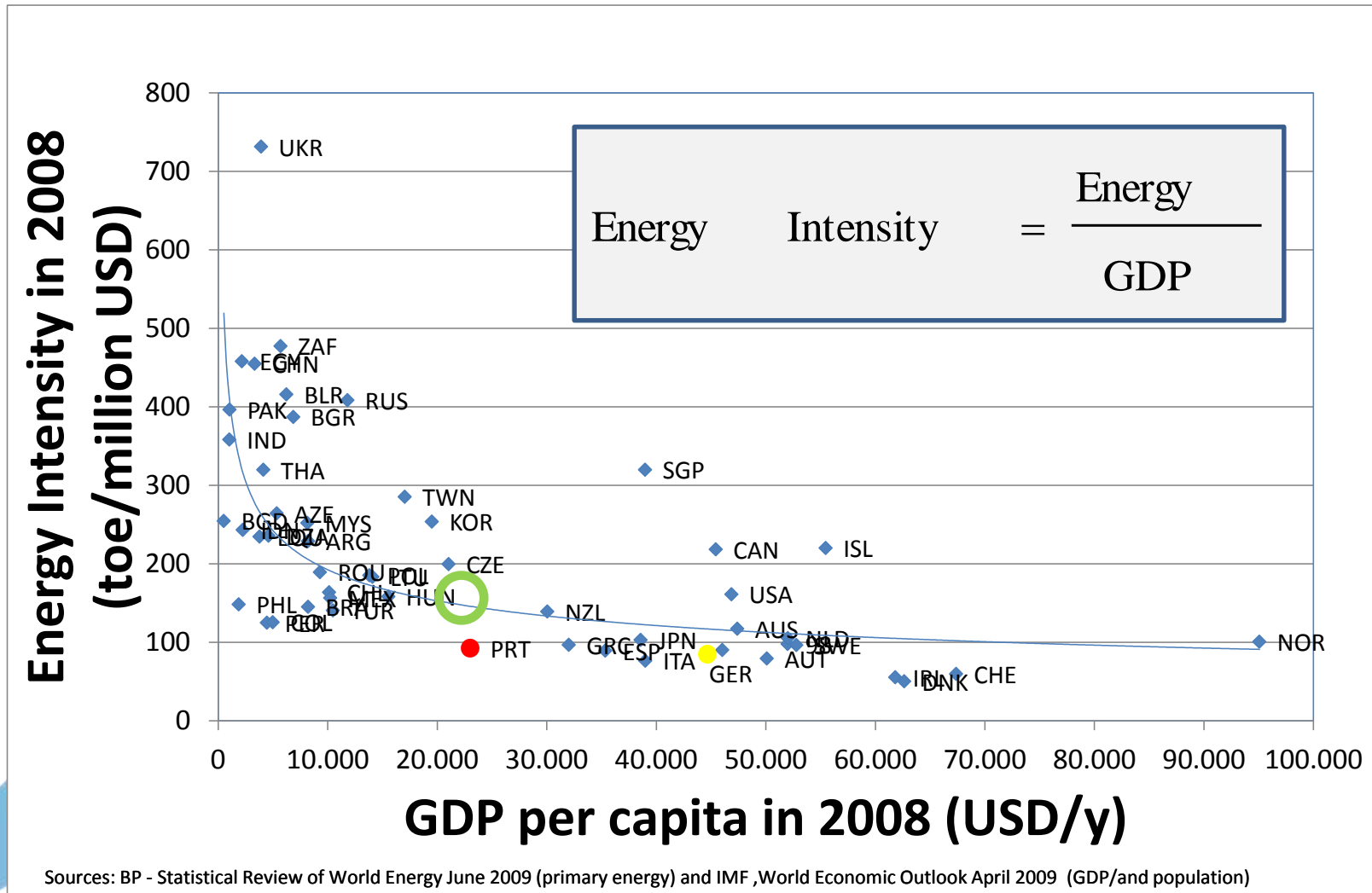
ENERGY CONTEXT WORLD

WORLD ENERGY CONSUMPTION



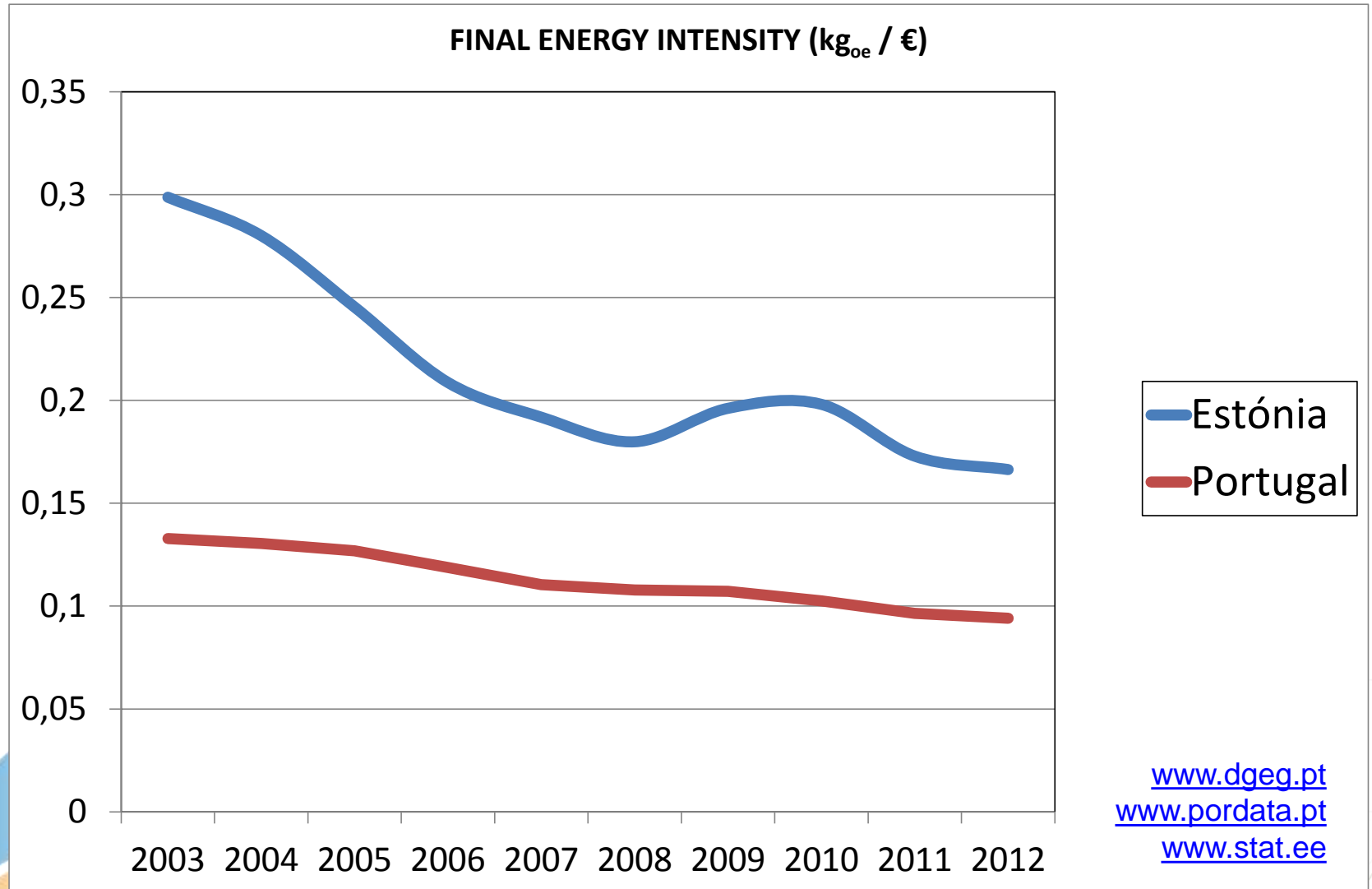
Source: BP- Statistical Review of World Energy 2011

ECONOMIC STRUCTURE



Sources: BP - Statistical Review of World Energy June 2009 (primary energy) and IMF, World Economic Outlook April 2009 (GDP and population)

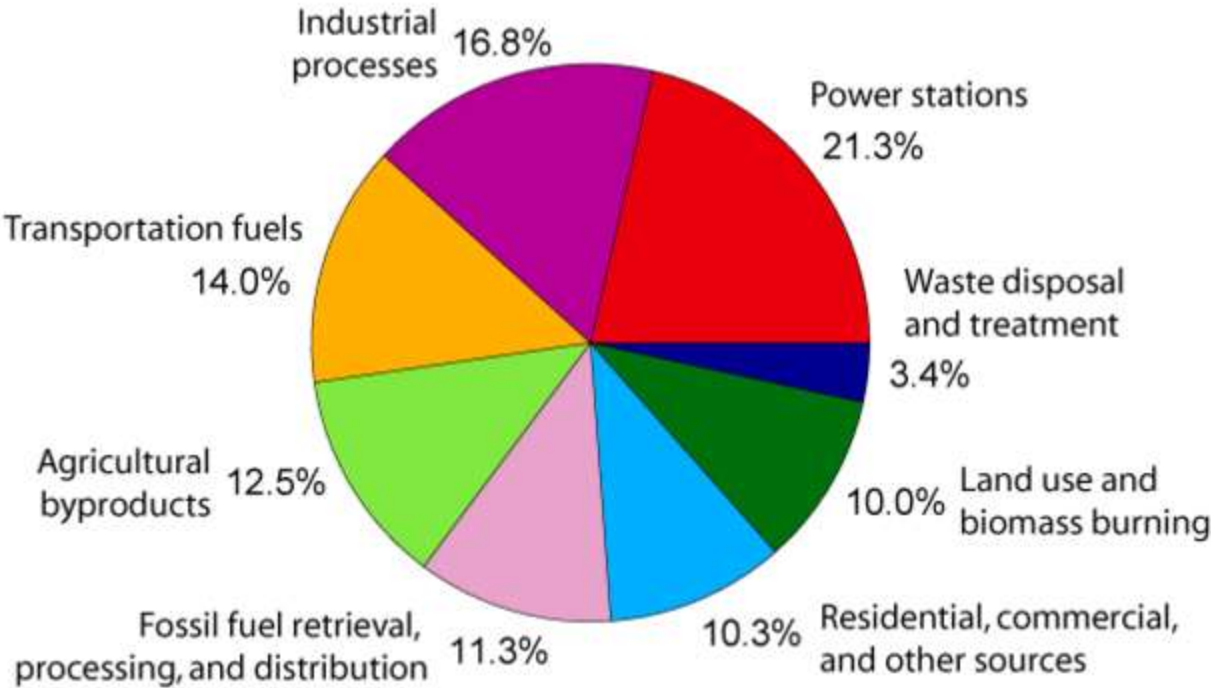
ECONOMIC STRUCTURE



CO₂

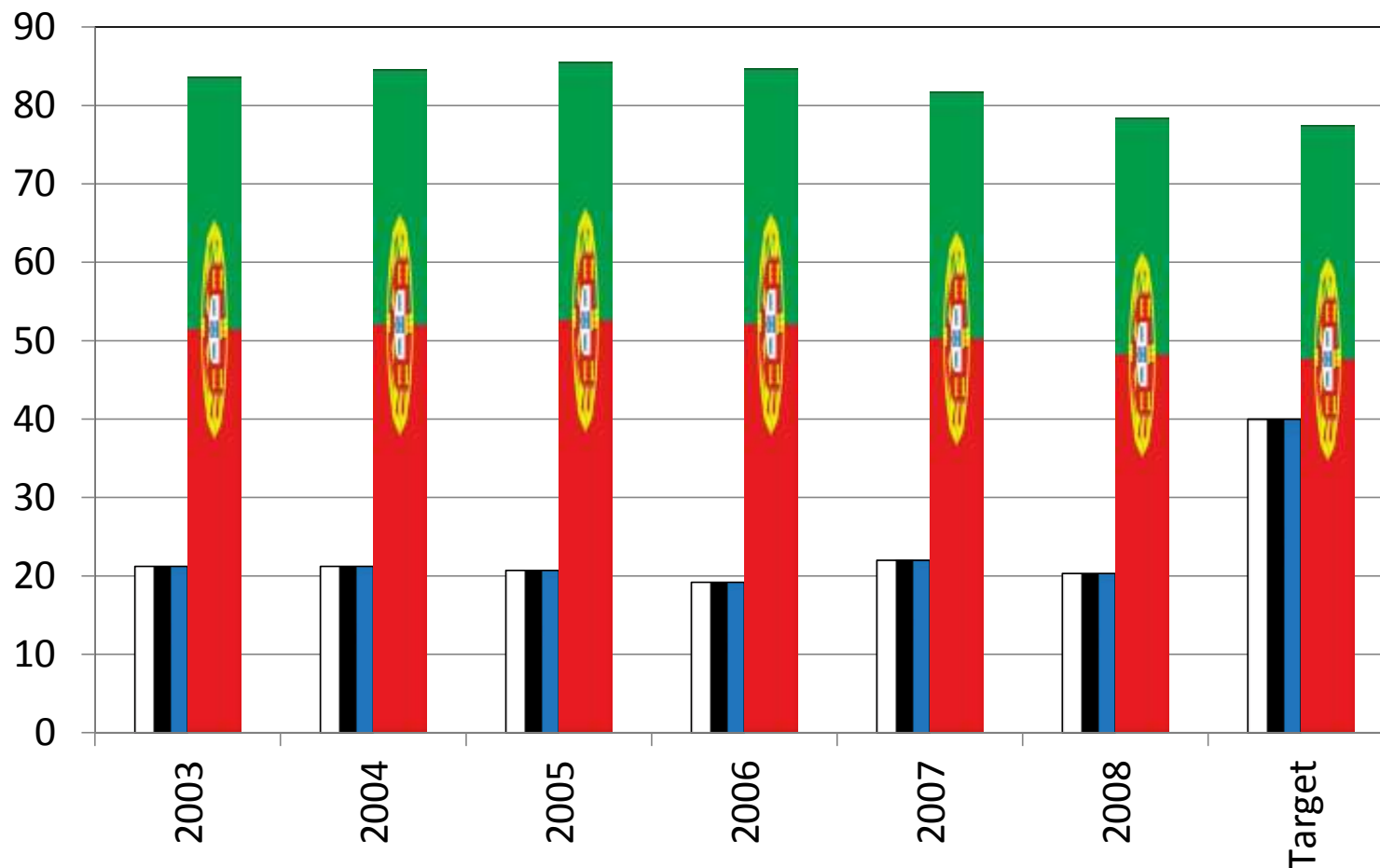
$$\text{CO}_2 \text{ emissions} = \text{Popul.} \times \frac{\text{Production}}{\text{Population}} \times \frac{\text{Energy}}{\text{Production}} \times \frac{\text{CO}_2}{\text{Energy}}$$

Annual Greenhouse Gas Emissions by Sector



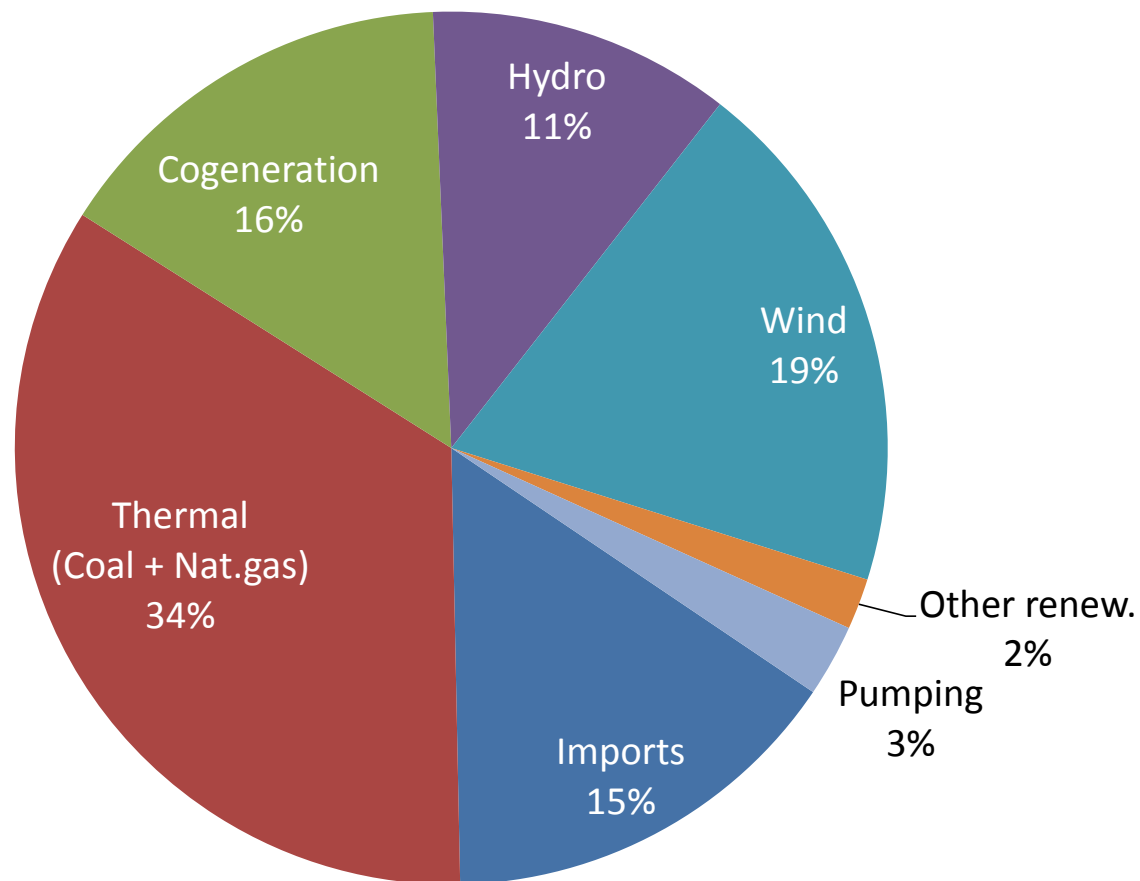
Source: Wikipedia

CO₂ EMISSIONS (MTon/y)

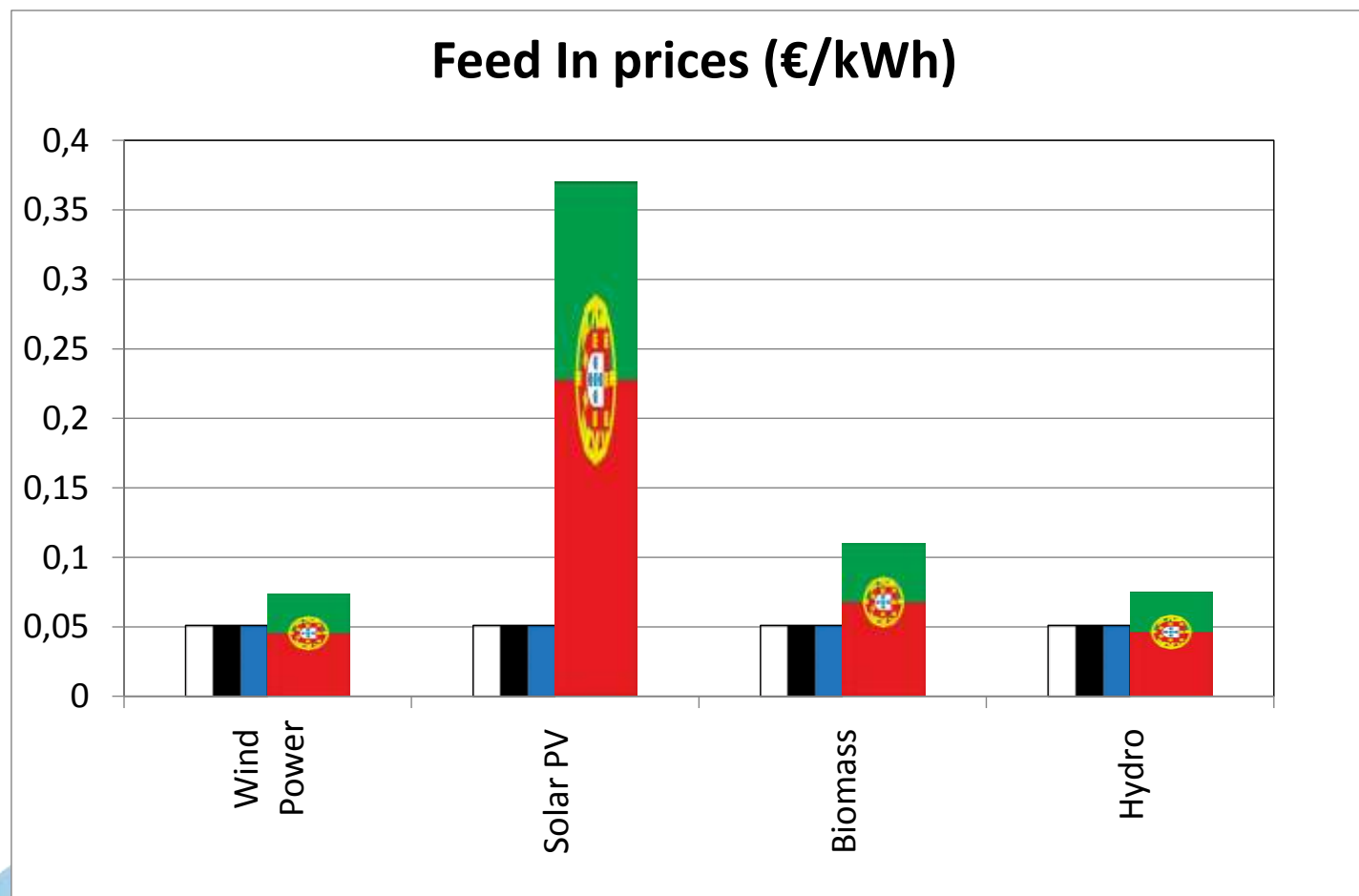


ENERGY CONTEXT PORTUGAL

PORTUGUESE ELECTRICITY PRODUCTION (2012)

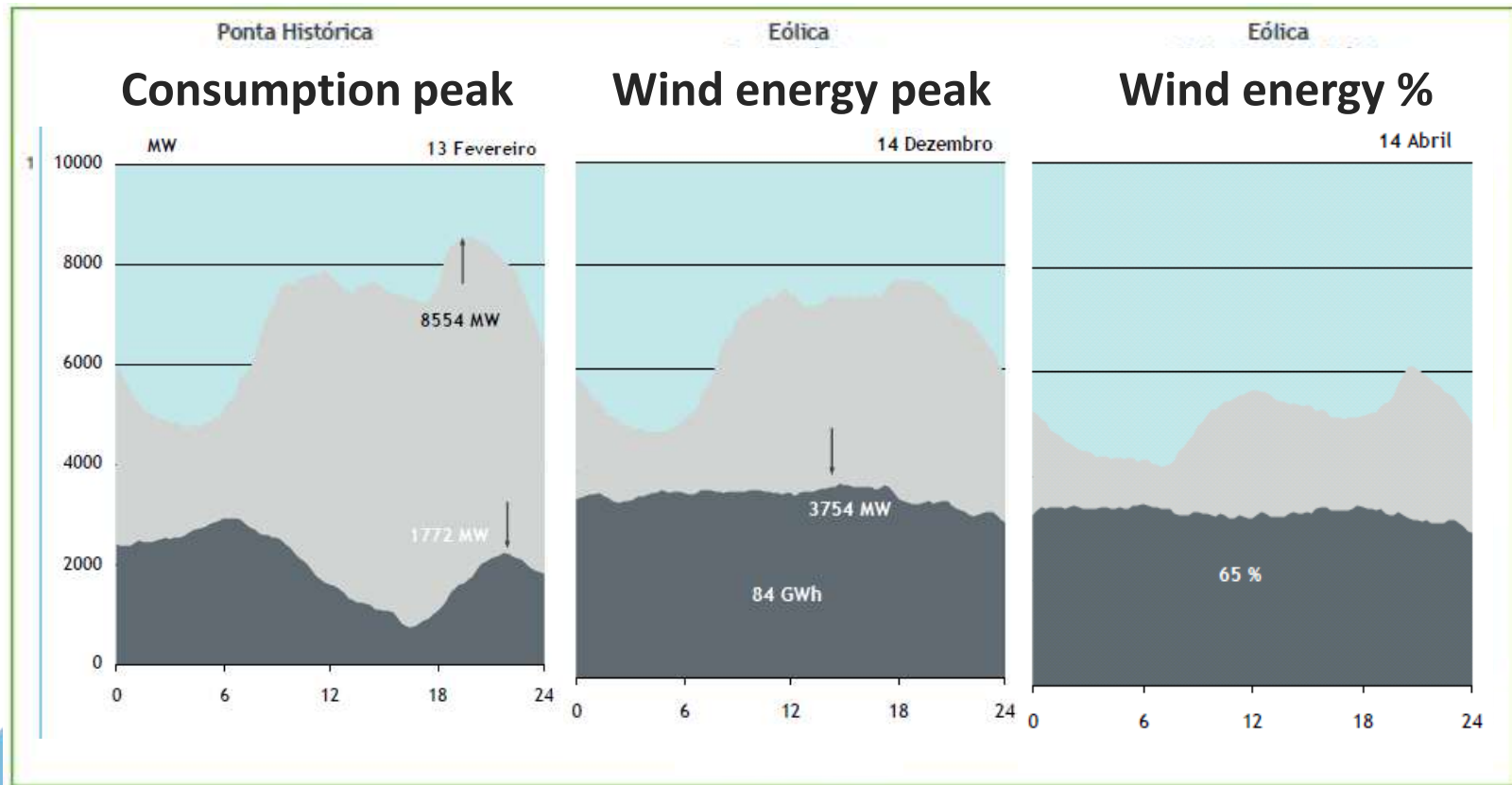


Source: REN (www.ren.pt)



ELECTRICITY

Wind energy production in 2012

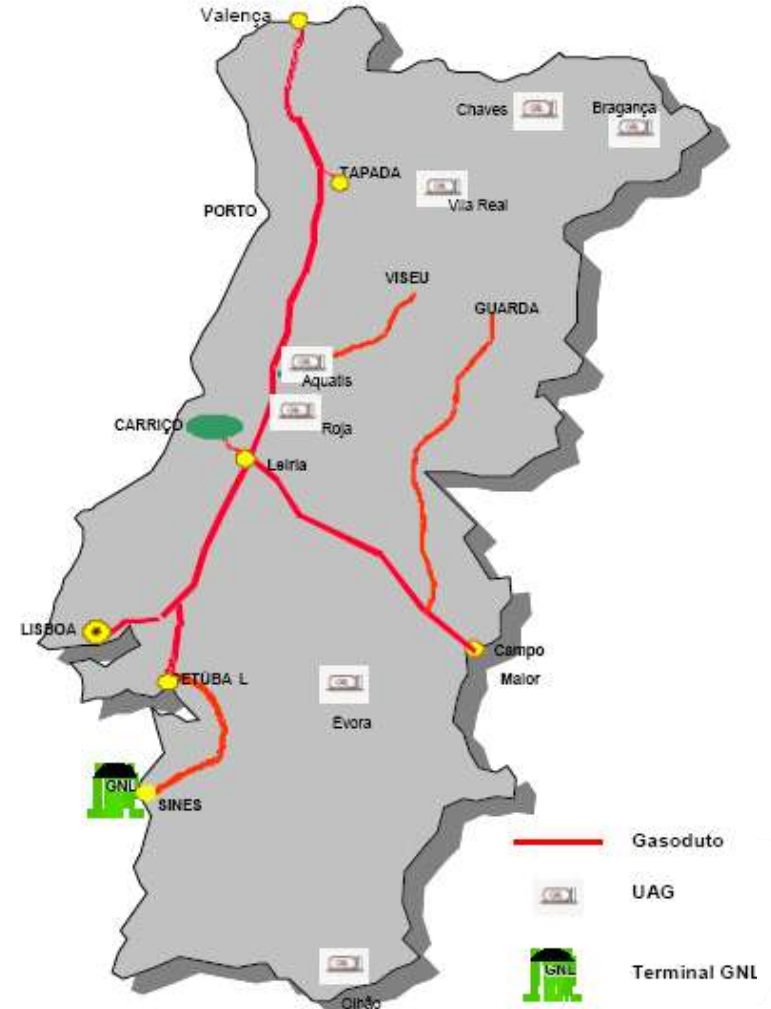


Source: REN (www.ren.pt)

NATURAL GAS

- 44%: By pipeline, entering at Campo Maior (from Argelia)
- 56%: By LNG, at Sines (from Nigeria)

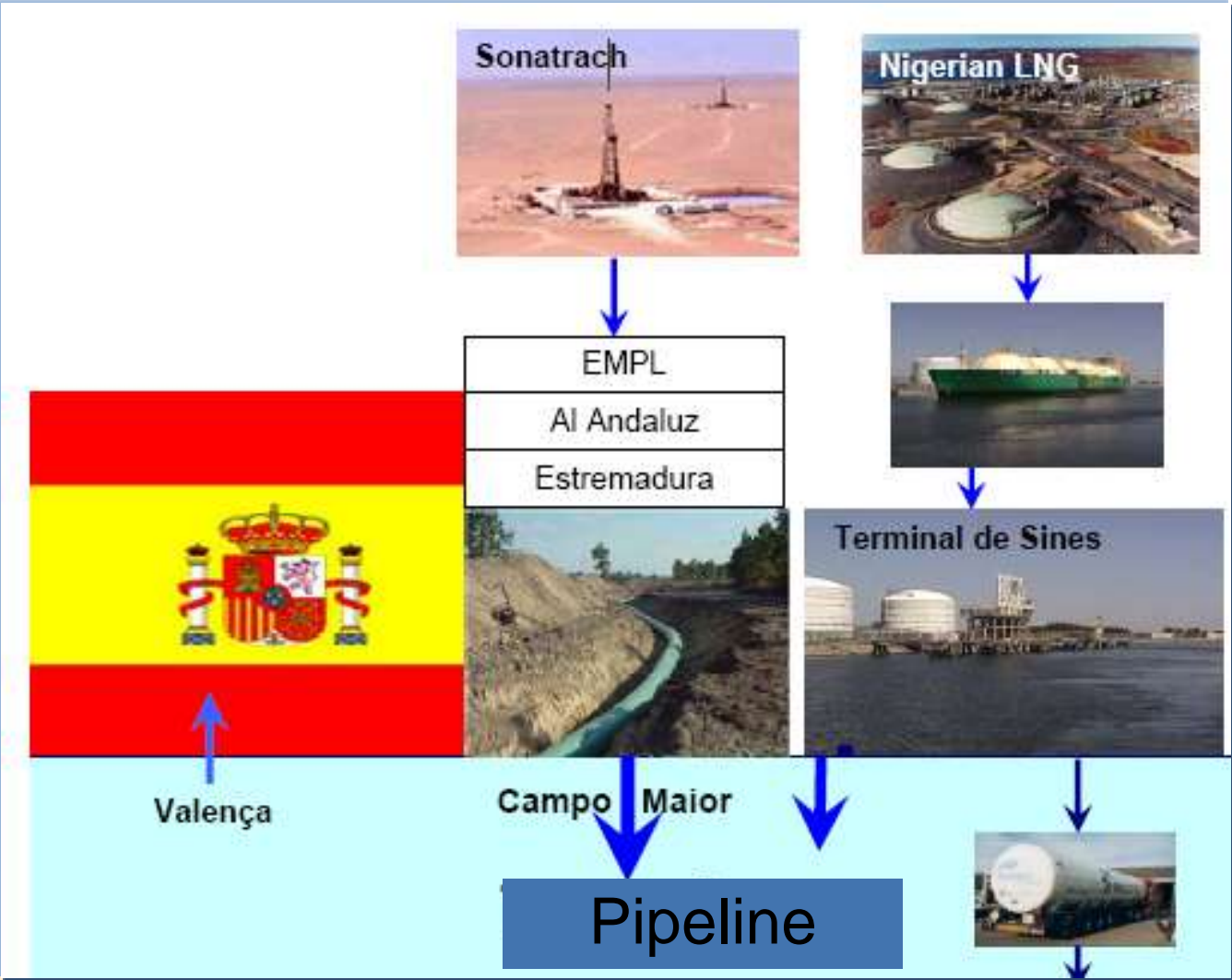
(2010)



Source: REN (www.ren.pt)

Fonte: Transgás

NATURAL GAS



NATURAL GAS

Natural gas is almost Methane (CH₄),
depending on it's origin

Teor médio dos componentes (% molar)	Badajoz		Sines	
	2004	2005 <i>(1ºsem)</i>	2004	2005 <i>(1ºsem)</i>
Metano	85,271	88,258	92,009	92,301
Etano	9,318	7,829	4,872	4,869
Propano	1,815	1,317	2,190	2,064
i-Butano	0,161	0,101	0,365	0,327
n-Butano	0,238	0,146	0,455	0,348
i-Pentano	0,027	0,020	0,029	0,012
n-Pentano	0,024	0,016	0,005	0,002
C₆⁺	0,020	0,019	0,000	0,000
N₂	1,675	1,052	0,075	0,077
CO₂	1,454	1,241	0,000	0,000

NATURAL GAS

HHV (High Heat Value) is the main chemical property of NG.

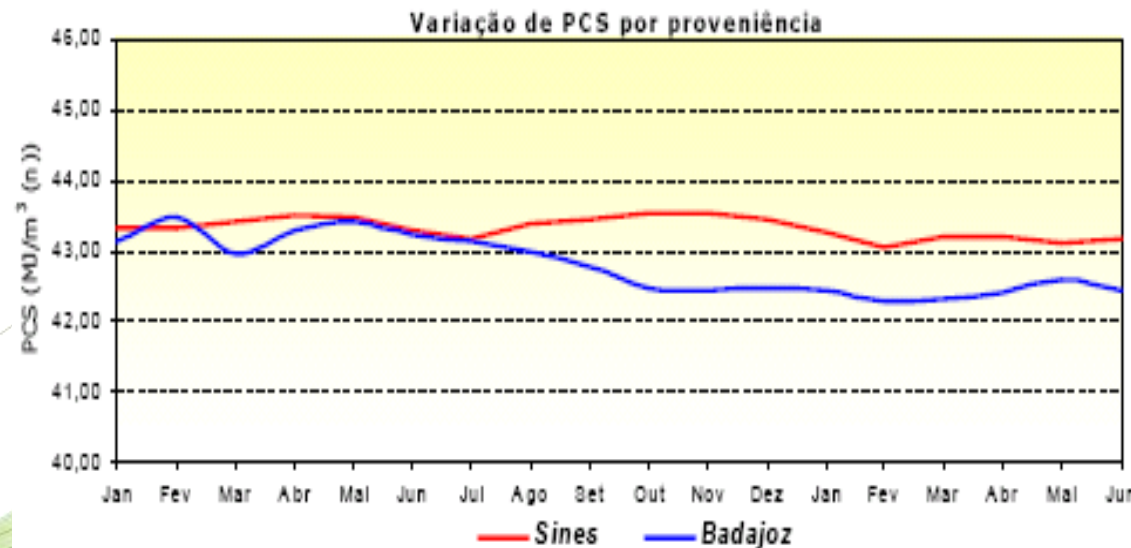
It's value, in Portugal, depends of the location (due to IGN) and time along the year

Valores médios do PCS

(MJ/m³(n))

Badajoz		Sines	
2004	2005 (1 ^ª sem)	2004	2005 (1 ^ª sem)
42,98	42,41	43,40	43,17

[15°C; (0°C; 1,01325 bar(a



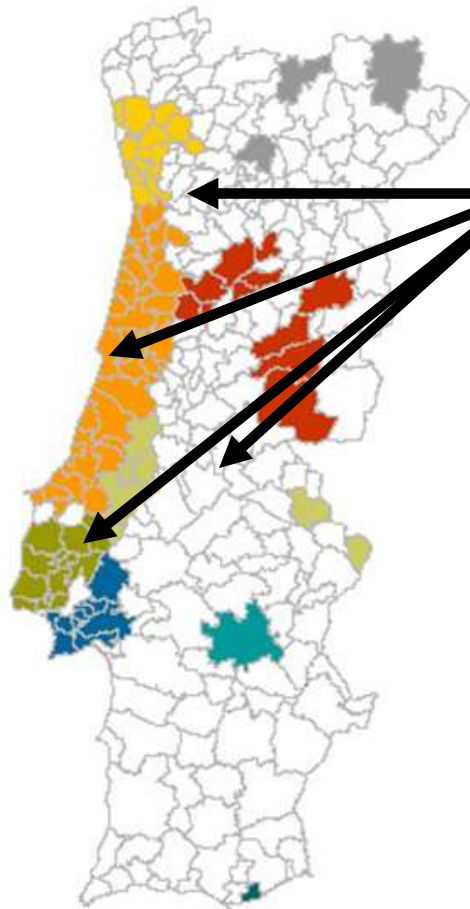
NATURAL GAS

NATURAL GAS INTERFACE

NGI is the interface between NG from Sines and NG from Argelia. It's location is usually in the zone Lisboa-Leiria



NATURAL GAS



NATIONAL CONSUMPTION (FORECAST 2011/12) (GWh/y)		
Combined cycles	27.462	40%
Direct clients	15.445	23%
Distributors	25.446	37%
TOTAL	68.353	

Lusitaniagás	8.610	34%
Portgás	6.782	27%
Lisboagás	6.308	25%
Setgás	1.952	8%
Others	1.794	7%

Source: ERSE (www.erse.pt)

ENERGY CONTEXT LISBON

POPULATION

Reduction of population in favor of the Region of Lisbon (NUTS II)

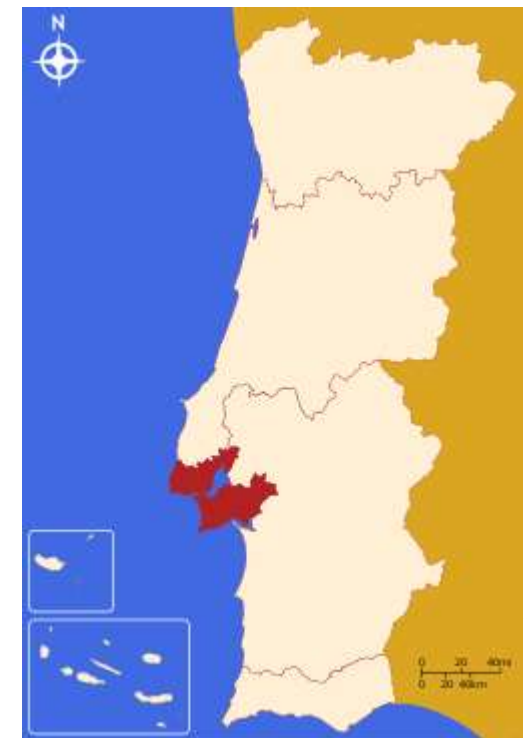
	1981	2010
City	808.786	469.509
Region	2.494.179	2.839.908

Source: www.pordata.pt

$$\left(\frac{\text{Lisbon Municipality}}{\text{Lisbon Region (NUTS - II)}} \right)_{\text{Popul.}}$$


Source: Presidência da República (www.presidencia.pt)

NUTS II - LISBON



ECONOMY

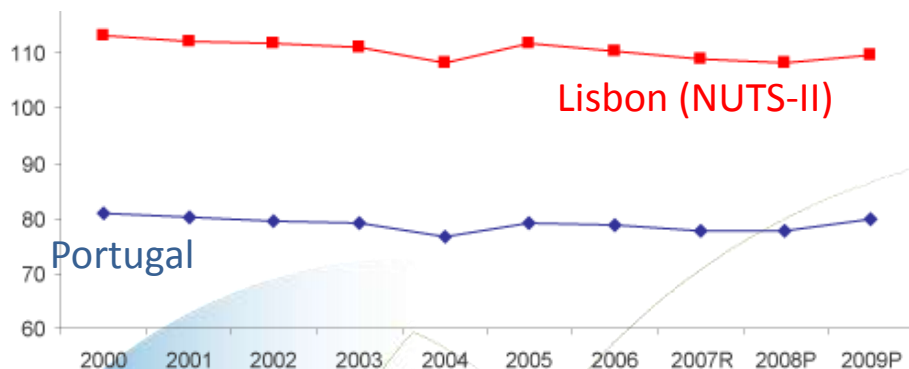
Lisbon concentrates the economy activity

ANNUAL SALES (Non-financial activities)

	2009 (M€)	% of National
City	84.415	25%
Regional	160.301	48%
National	335.887	100%

Source: www.pordata.pt

GDP₂₀₀₉/cap in PPP (EU27 = 100)



Source: AICEP (www.portugalglobal.pt)

GDP

	2009 (M€/y)	% of National
Regional	61.486	37%
National	168.046	

Source: AICEP (www.portugalglobal.pt)

ENERGY CONSUMPTION

Electricity

National final consumption of 49 TWh/y
Lisbon City represents ~ 7%

Gasoline and gasoil

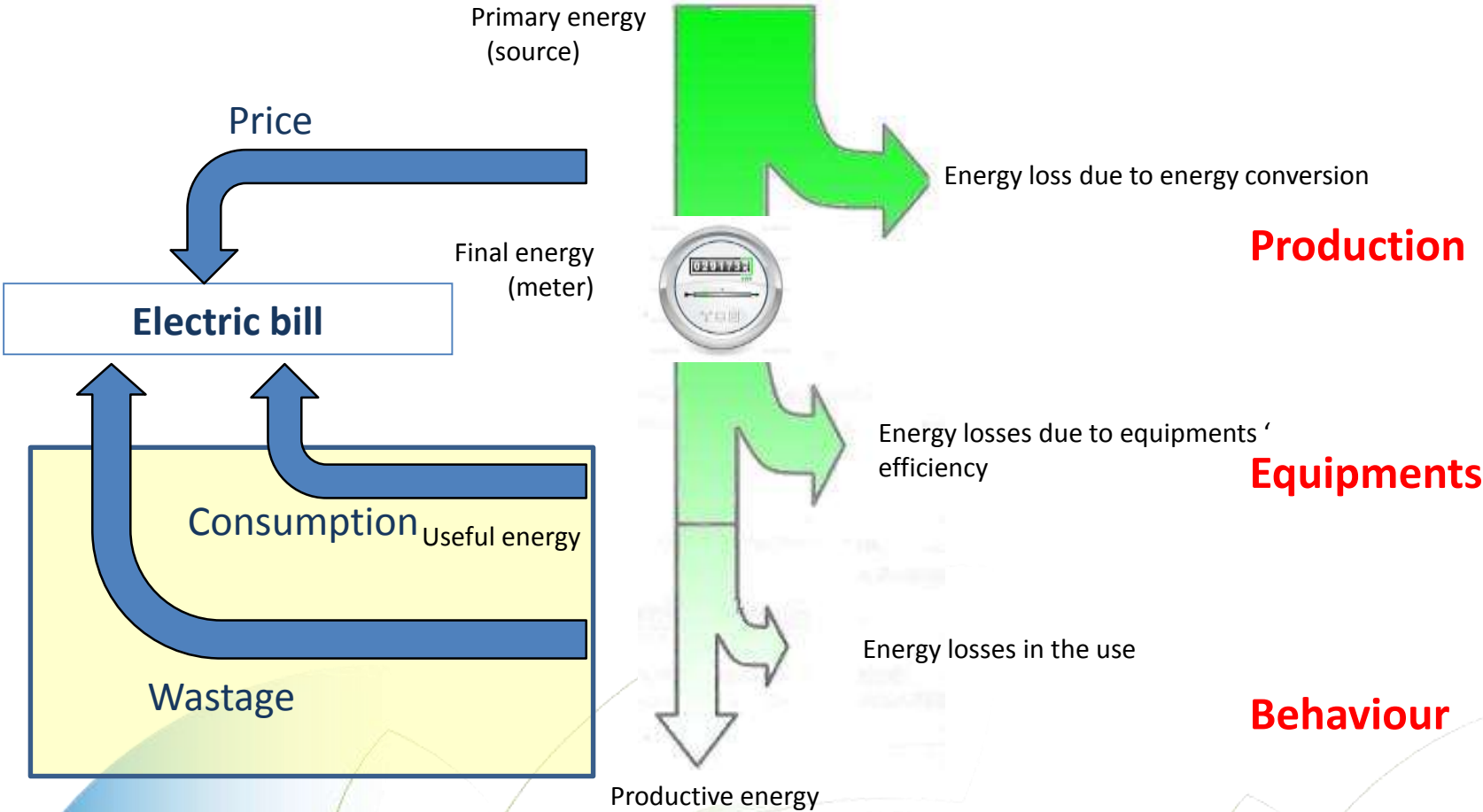
National final consumption of 6 M ton/y (71 TWh/y)
Lisbon City represents ~ 5%

Natural gas

National final consumption of 3,4 bcm/y (41 TWh/y)
Lisbon City represents ~ 8%

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BACKGROUND



Águas, M (2013)

LED IN TRAFFIC LIGHTS

- Replacement of 4000 bulbs for LED in the last 3 years (15%)
- Reduction of 1300 MWh in energy consumption
- Less 48 ton CO₂/year
- Less 130.000 Euros/year in the energy bill of the Municipality



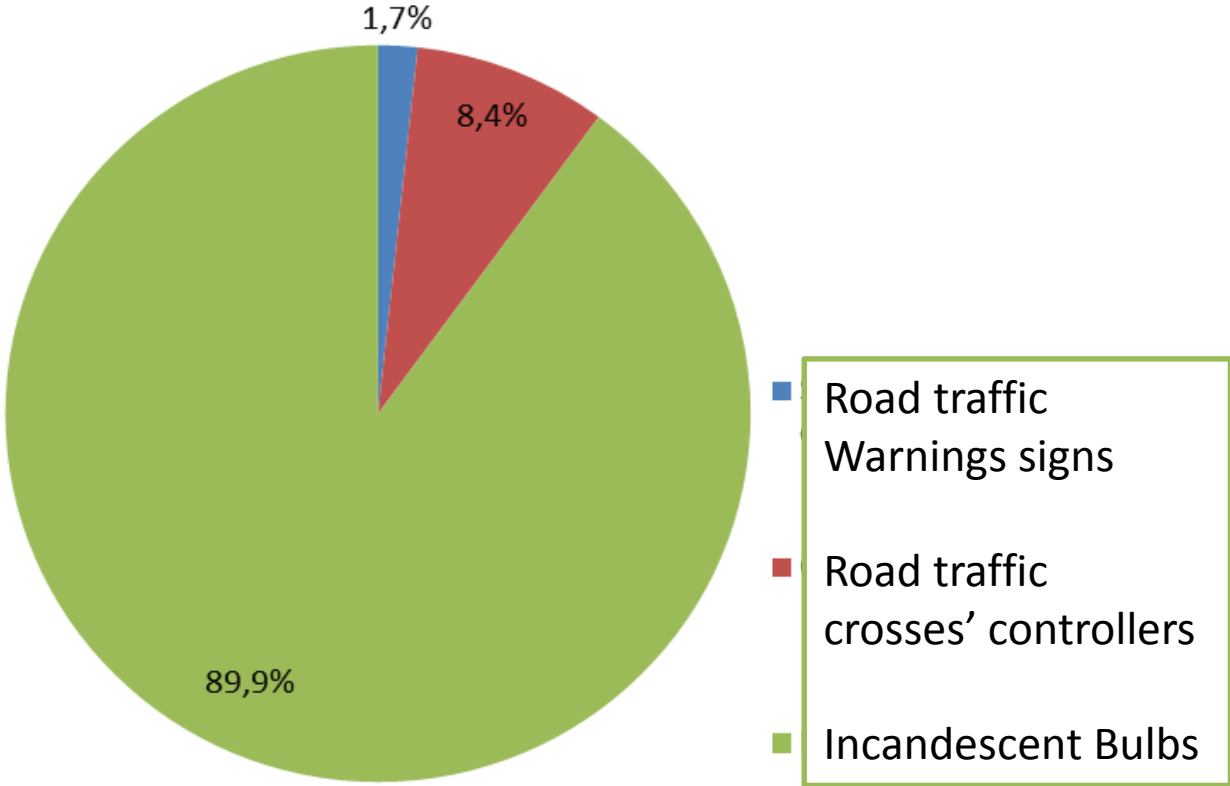
EPC IN TRAFFIC LIGHTS

- Replacement of 22500 bulbs for LED during 2013
- Reduction of 6,2 GWh in energy consumption/year
- Less 230 ton CO₂/year
- Less 700 k Euros/year in the energy bill of the Municipality

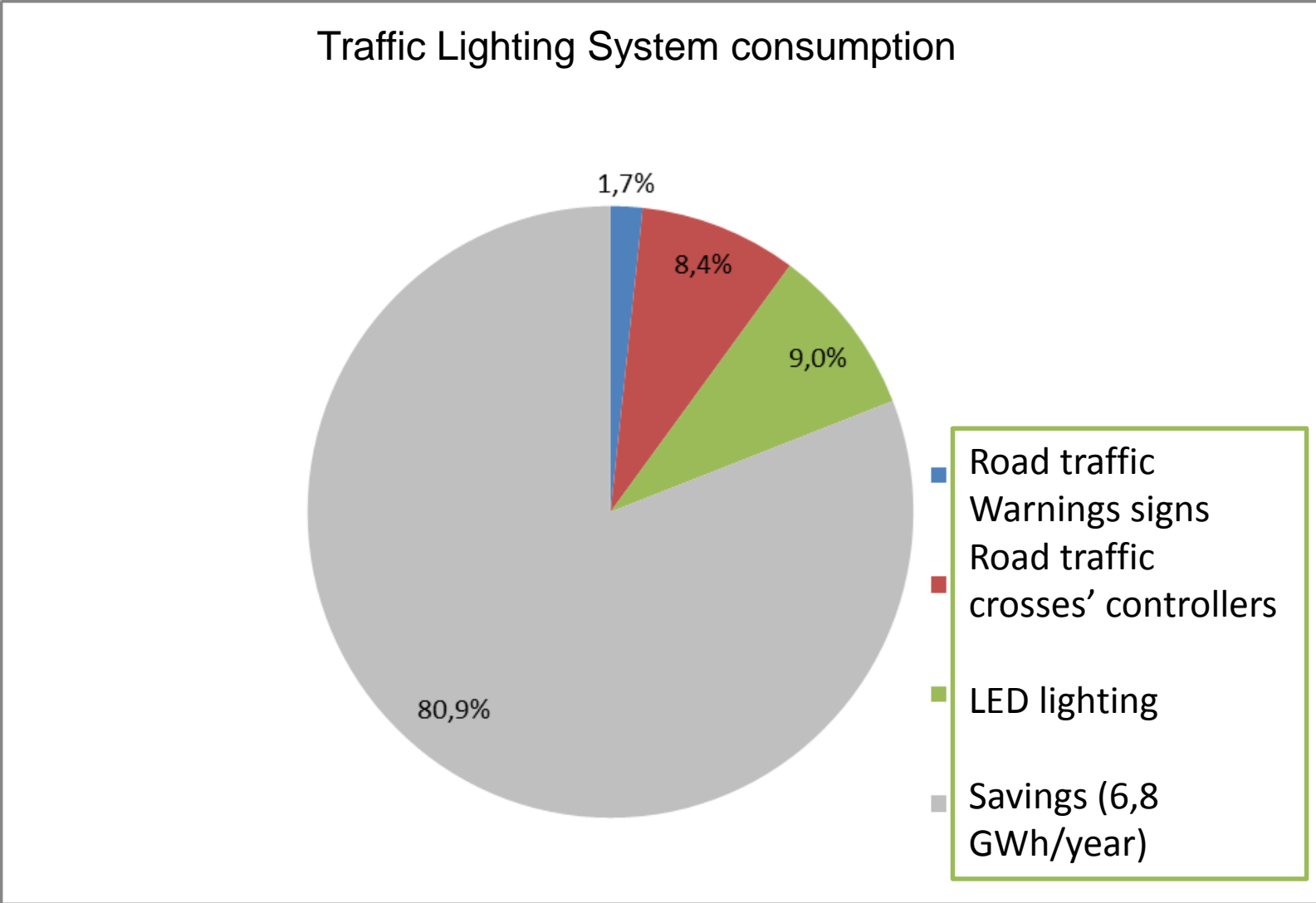


EPC IN TRAFFIC LIGHTS

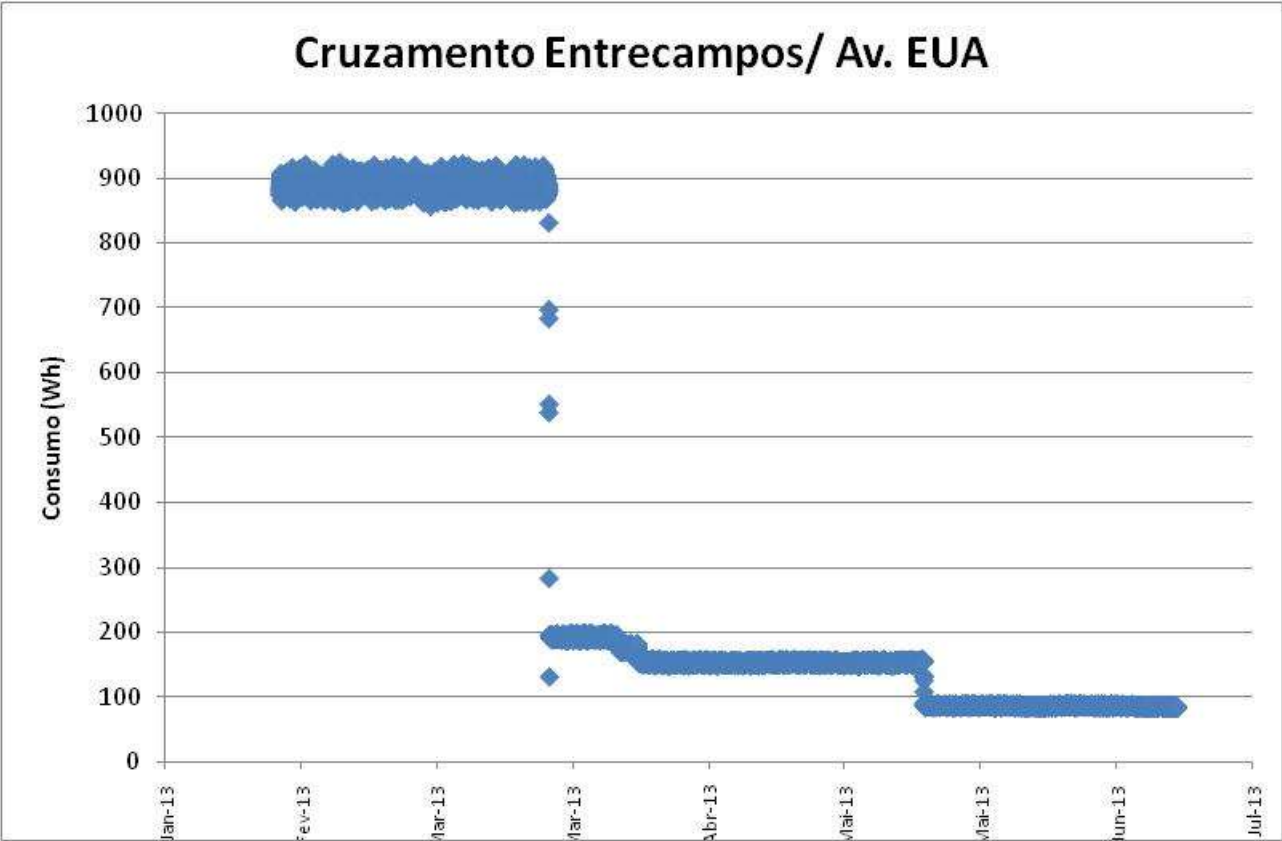
Traffic Lighting System consumption



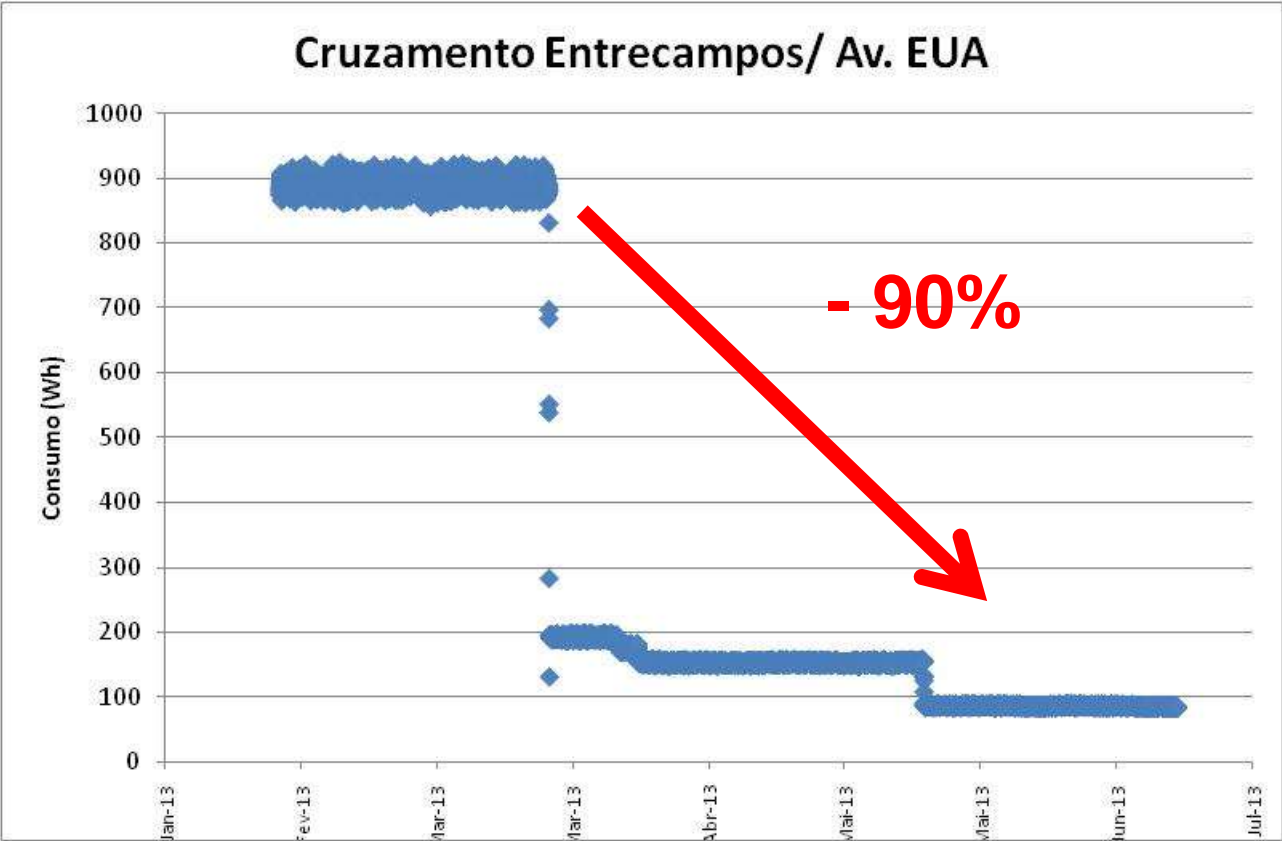
EPC IN TRAFFIC LIGHTS



EPC IN TRAFFIC LIGHTS: SAVINGS POTENTIAL



EPC IN TRAFFIC LIGHTS: SAVINGS POTENTIAL



PUBLIC LIGHTING

3 levels of action:

PPEC – Energy Efficiency Promotion Plan (NRA)

- Equipping existing 250 W (HP Sodium-vapor lamps) luminaires with electronic ballasts (light flux reduction and less energy consumption) and remote-management.
- Historical buildings efficient lighting
- Energy consumption reduction - 791 MWh.

Enable

Time based

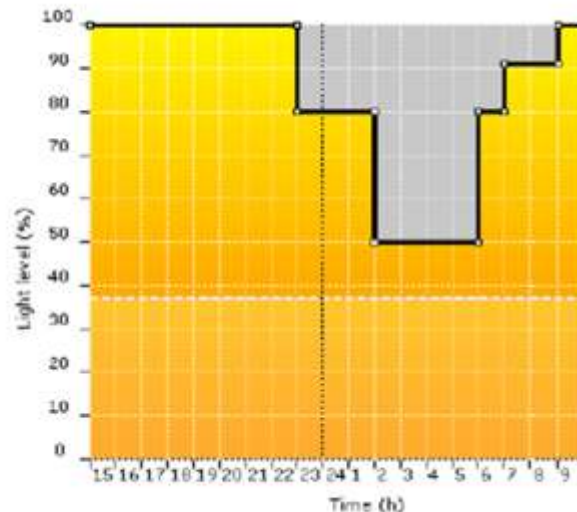
Location

No boston

Custom...

Schedule

Time (hh:mm)	Light level (%)	Fade time (s)
23:00	80	180
02:00	50	180
06:00	80	0
07:00	91	0
09:00	100	0



PUBLIC LIGHTING

EPC in Public Lighting

Preparing an entire District for more efficient lighting under an EPC procedure

LED piloting

Piloting LED technology in several streets of Lisbon



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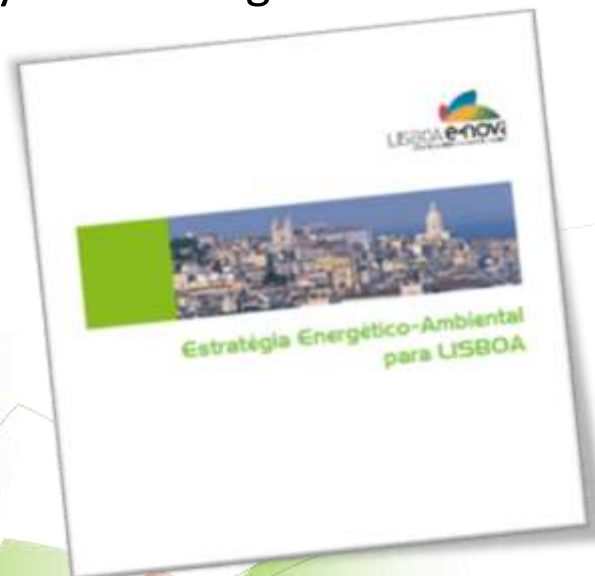
LISBOA e-nova
AGÊNCIA MUNICIPAL DE ENERGIA E AMBIENTE

LISBON'S ENERGY AND ENVIRONMENT STRATEGY

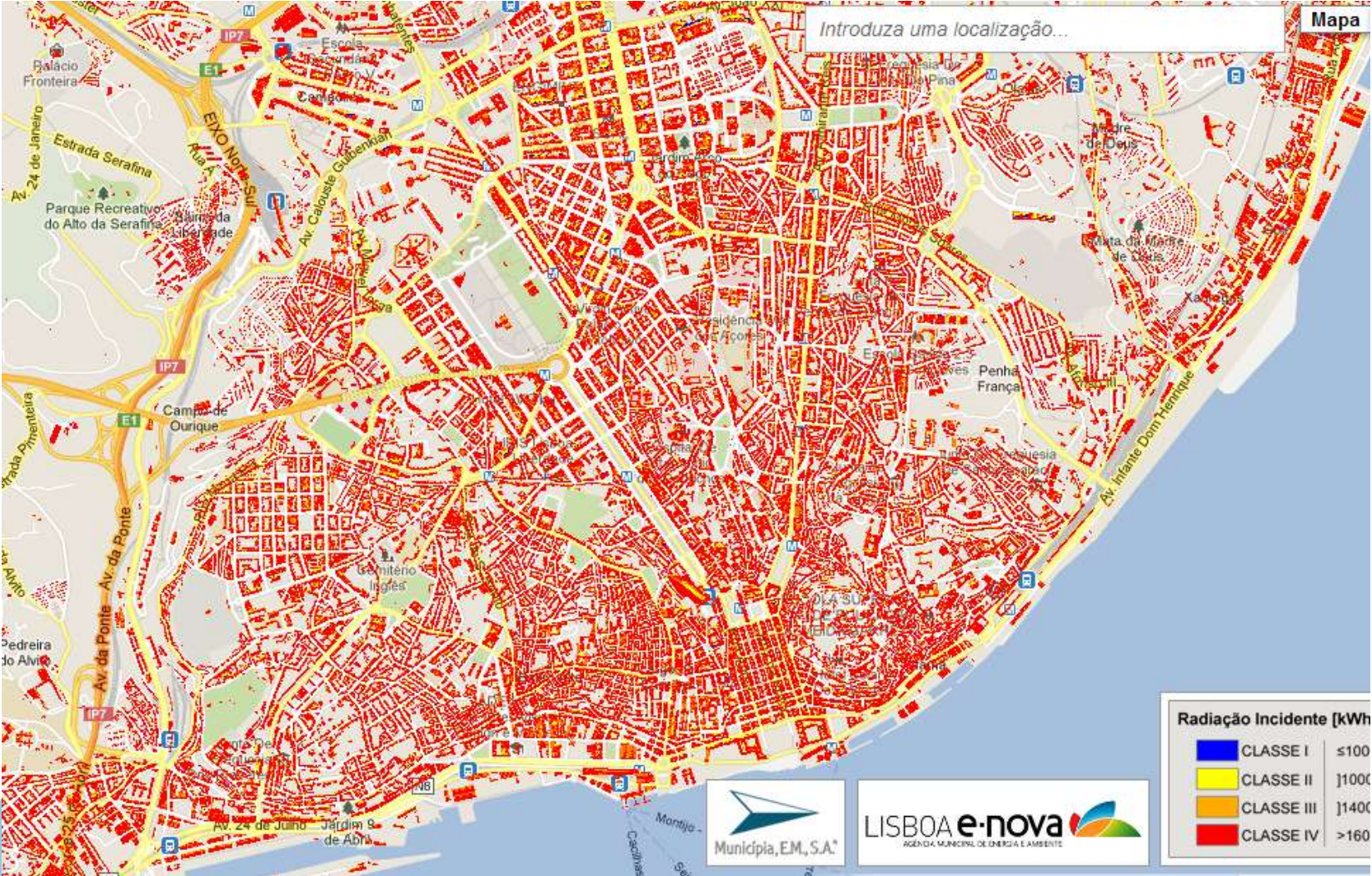
Defined goals to accomplish between 2009-2013 (political mandate) in the sectors: energy; water and materials

COVENANT OF MAYORS

Lisbon undersigned this Document in 2009 and Lisboa E-Nova was responsible for the definition of Lisbon's methodology for the Sustainable Energy Action Plan, and is currently monitoring it.

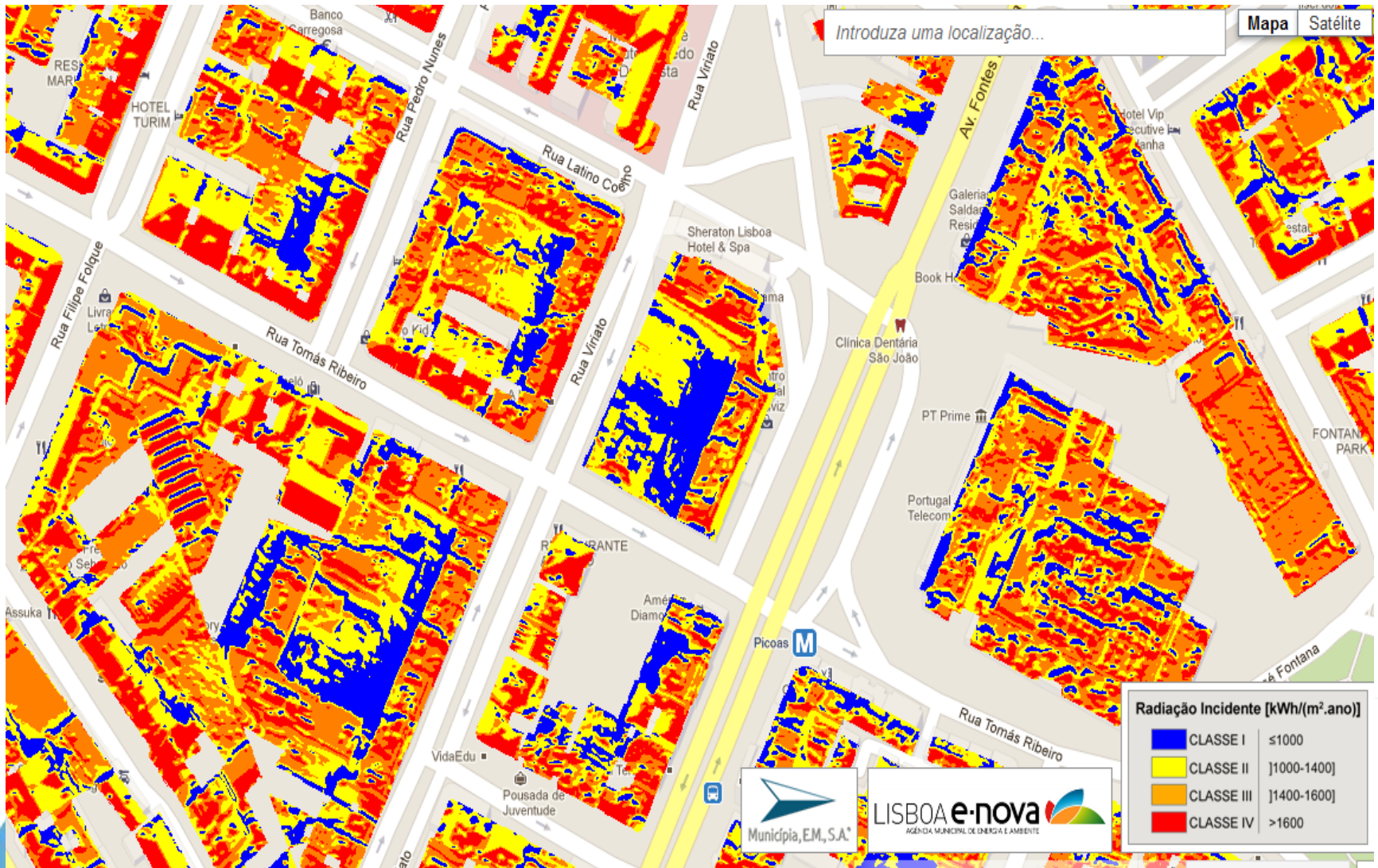


LISBON'S SOLAR POTENTIAL CHART



www.lisboanov.org/cartasolarlisboa

LISBON'S SOLAR POTENTIAL CHART



LISBON'S SOLAR POTENTIAL CHART





URBANSOL PLUS UrbanSol+

Solar Thermal in Major Renovations and Protected Urban Areas



Intents to promote the adoption of solar thermal systems in multi-family buildings and classified areas.

Lisbon will share it's experience regarding the adoption of solar thermal in classified areas and focus on the promotion of collective solar thermal systems in multi-familiar buildings requalification's.

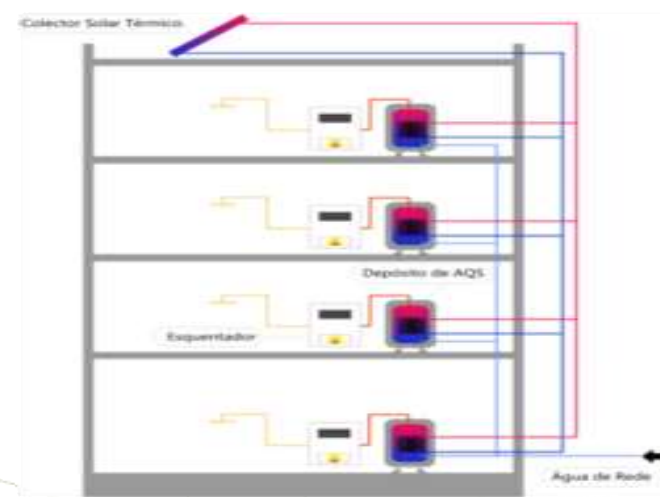
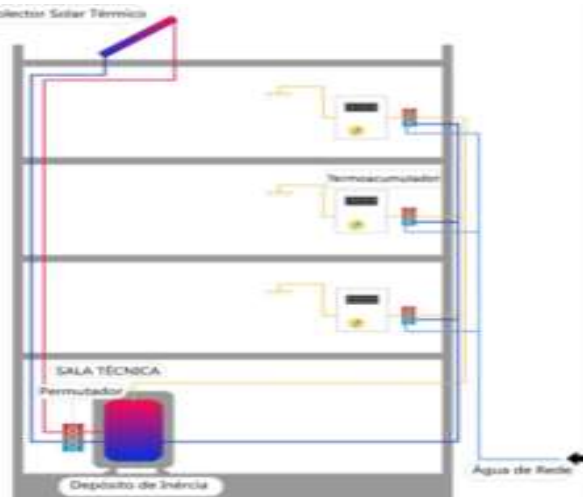
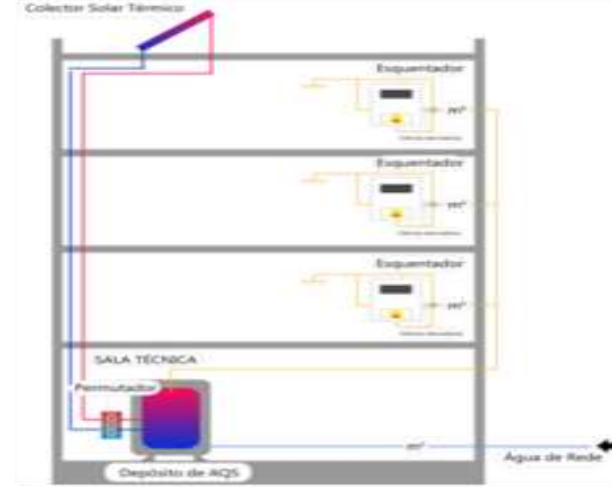
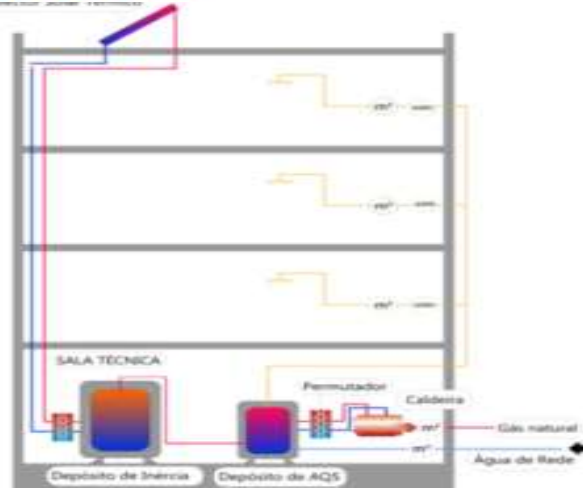


URBANSOL PLUS



Steps

1. Building identification
2. Solar potential
3. Existing DHW systems
4. Common areas and space availability
5. Results – technical and economical analysis

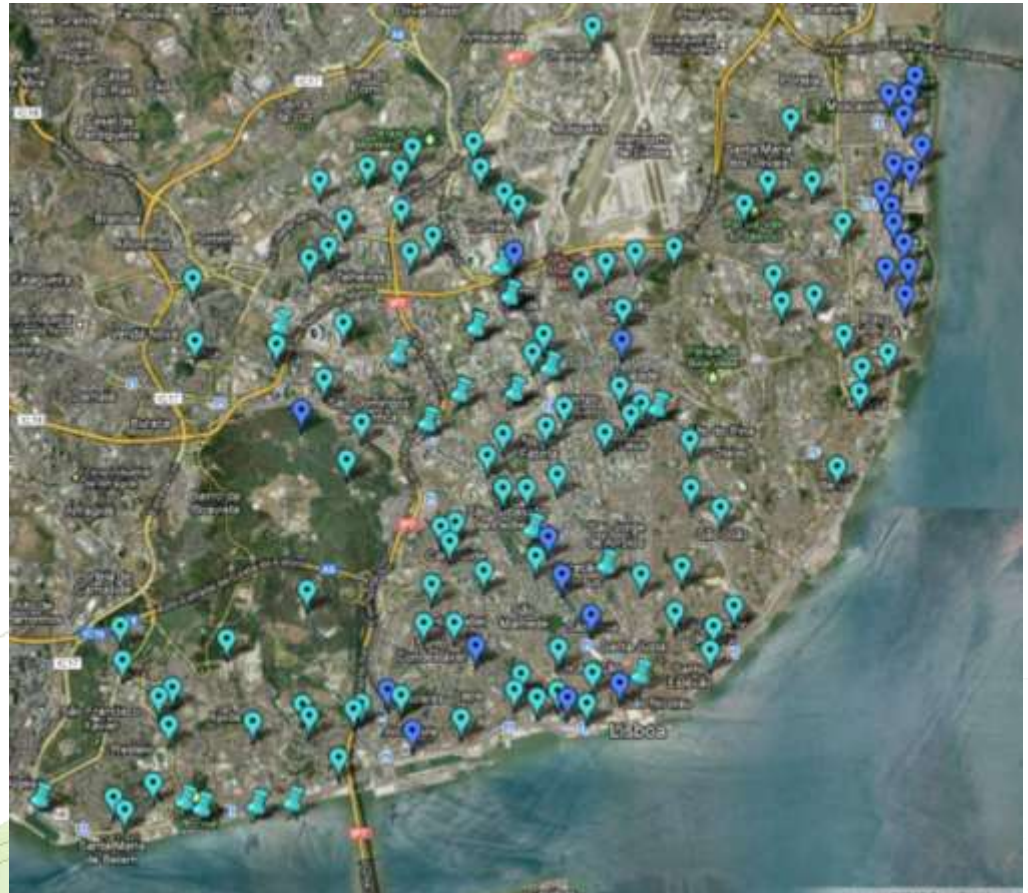


MOBI-E: ELECTRIC MOBILITY IN LISBON

Project coordination of the location of 514 slow charging points for electric cars in the city of Lisbon.

During 2012 will be installed:

- 30 slow charging points for electric motorcycles/ bicycles
- 9 fast charging points



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LISBOA E-NOVA DEVELOPPED DIFERENT ENERGY EFFICIENCY SOLUTIONS BASED IN ICT AND BEHAVIOURAL CHANGE

- For residential or companies consumers
- Diferent investment in metering

	No investment	With investment
Dwellings	Competition	Smartmeter
Service buildings	Remote Manager Tool	Online electrical Disaggregation



LISBOA E-NOVA DEVELOPPED DIFERENT ENERGY EFFICIENCY SOLUTIONS BASED IN ICT AND BEHAVIOURAL CHANGE

- For residential or companies consumers
- Diferent investment in metering

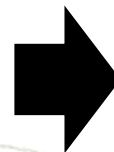
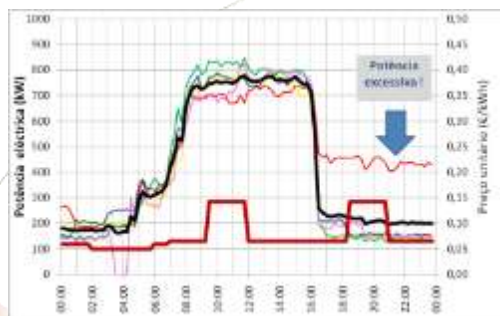
	No investment	With investment
Dwellings	Competition	Smartmeter
Service buildings	Remote Manager Tool	Online electrical Disaggregation

ENERGY Remote management TOOL

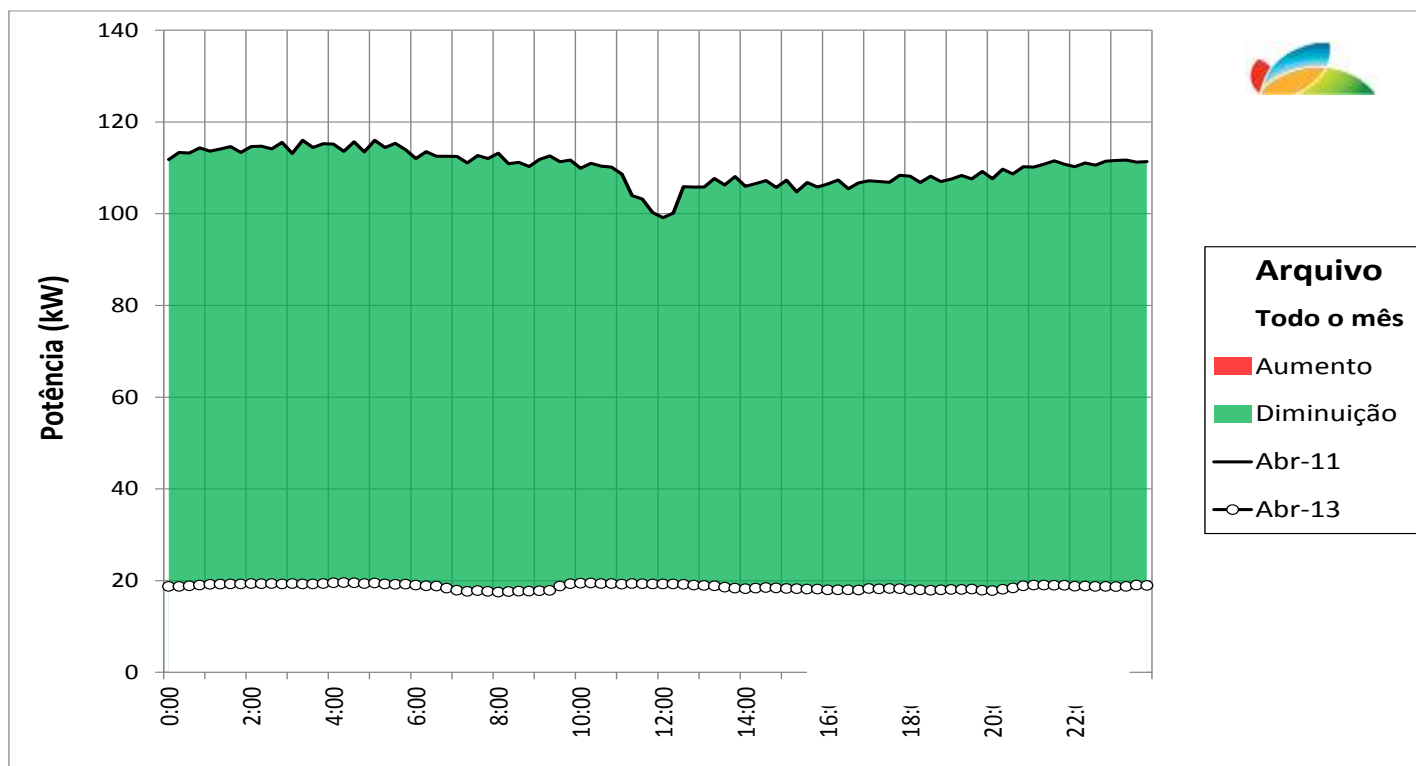
In Municipal buildings and buildings from Lisboa E-Nova Affiliates, Lisboa E-Nova offers the remote manager tool.

Goal: to present energy efficient solutions based on:

- Uses the telemetry system installed by the DSO (near real time data)
- Team work: (Lisboa E-Nova) + (Maintenance and Costs control departments)
- 1 in each 37 kWh consumed in medium (or high) voltage in Lisbon is already analyzed by Lisboa E-Nova.
- For the current pipeline, real/potential savings with low pay-back is up to 15%



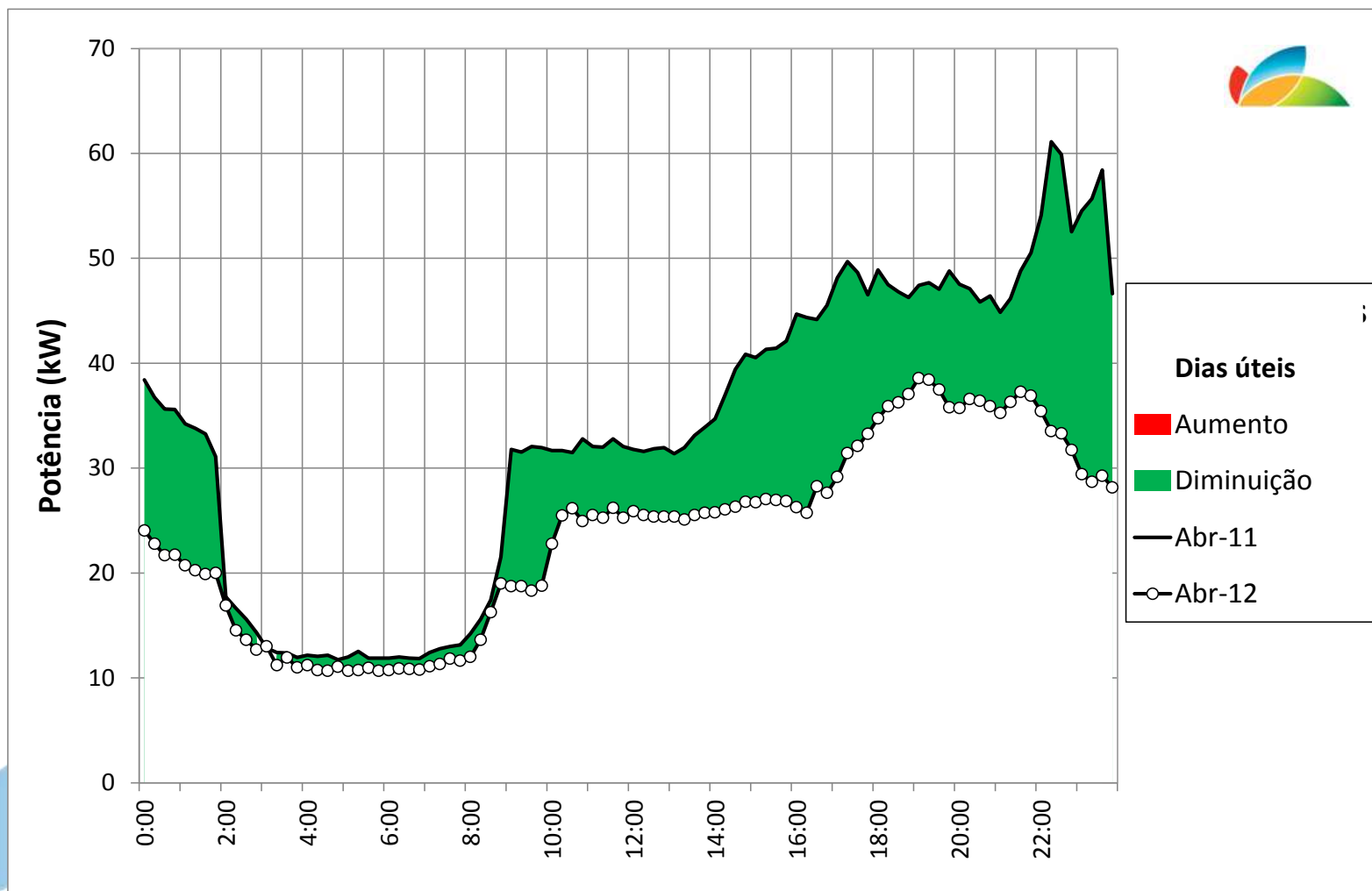
CASE STUDY 1: - 736 000 kWh/year Savings: 72%



Arquivo	Consumo (kWh/ano)	Factura c/IVA(€/ano)
Mai-10 a Abr-11	1.023.664	108.010
Mai-12 a Abr-13	287.746	56.104
Poupança	-735.918	-80.951
	-72%	-75%

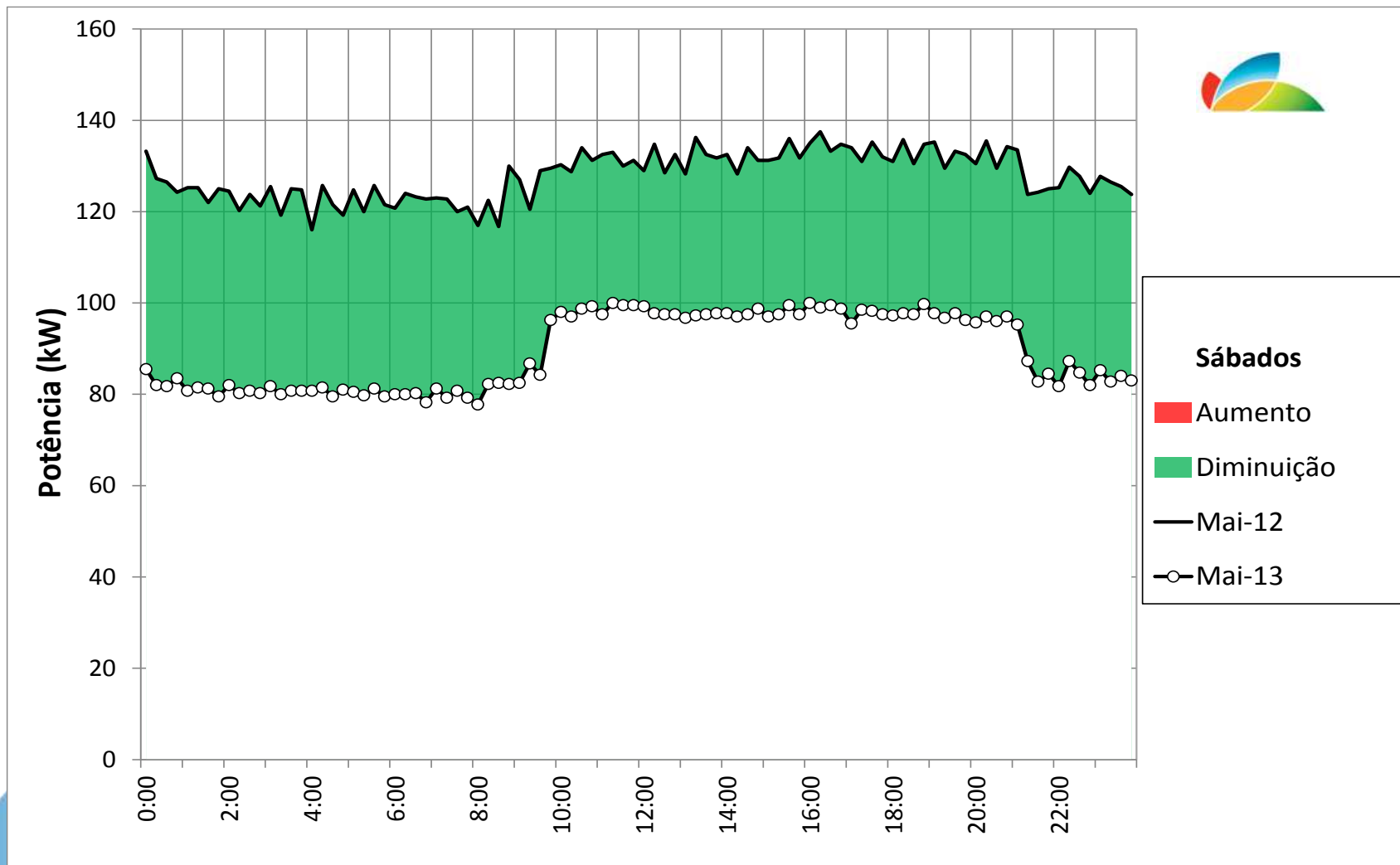
A poupança na factura foi calculada considerando o preço actual só da componente de energia (0,11 €/kWh)

CASE STUDY 2: - 300 000 kWh/year Savings: 28%





CASE STUDY 3: - 150 000 kWh/ano Savings: 12%



DWELLINGS – RESIDENTIAL BUILDINGS

Energy efficiency based in smart metering and feedback mechanisms (user empowerment through information and behaviour change)

Promote energy efficiency and behaviour change through the use of smart meters and practical accompaniment towards the adoption of more energy efficient actions and empowered and skilled households to manage and save energy

Annual savings: 0,4 – 0,8 GWh/y

Total investment: 250.000 €



Empowered consumer

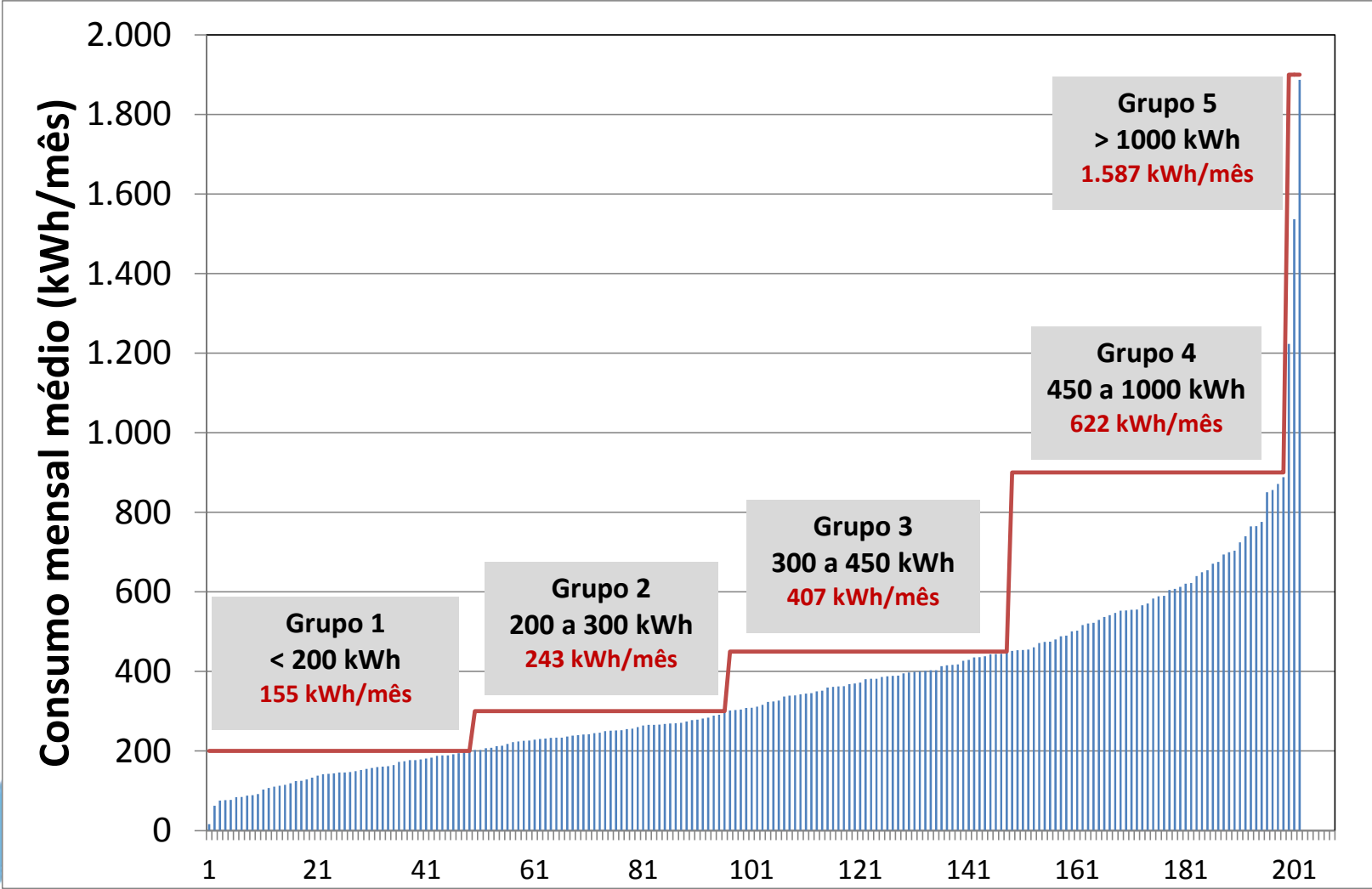
- **ICT**
- **Information** (Informative billing)
- **Continuous motivation**
- **Results** (Energy savings and decreasing energy costs)



USERS' CONSUMPTION RANGE

Grupo	Consumo mensal (kWh/mês)	Número de Participantes	Consumo médio (kWh/mês)
1	Menor que 200	35	155
2	De 200 a 300	40	243
3	De 300 a 450	49	407
4	De 450 a 900	39	622
5	Mais de 900	3	1587
	Sub-Total	166	386
	Não disponível	84	
	Total	250	

USERS' CONSUMPTION RANGE



PERSONAL FEEDBACK GIVEN

- Facebook group for knowledge and experience sharing;
- Monthly workshops with users;
- Permanent and individual technical support;
- COOPETITION;
- Monthly graphical reports.

Contadores Inteligentes para Decisões Eficientes PROGRAMA "COOPETIR"

Evolução da sua classificação de Março/2013 para Abril/2013:

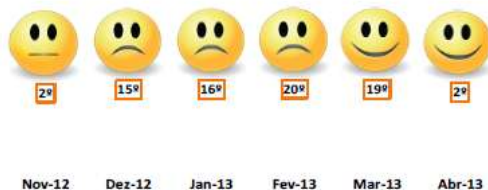
↑ Em Abril-13 subiu da 19ª para a 2ª posição.

A sua classificação de eficiência eléctrica no Grupo 2

A expressão do smile indica a sua evolução em relação ao mês anterior.

Legenda:

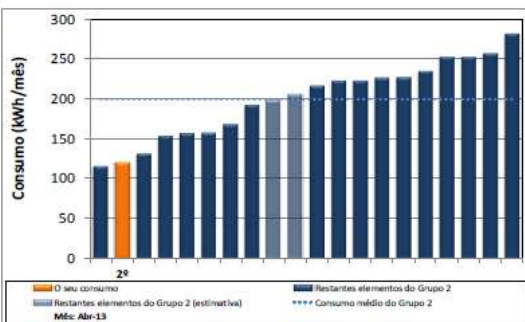
- 😊 Subiu de posição
- 😐 Manteve a posição
- 😞 Desceu de posição



Consumos em Abril de 2013 Grupo 2

Note em destaque a representação do seu consumo.

As barras de cor transparente correspondem a participantes que apresentam dados incompletos, cujos consumos foram reconstruídos por estimativa.



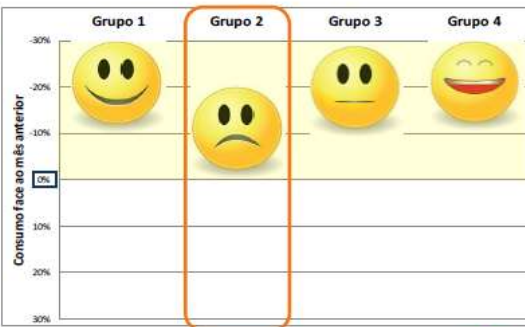
Dinâmica de poupança eléctrica entre Grupos

Legenda:

- 😊 Maior poupança
- 😐 2ª maior poupança
- 😞 3ª maior poupança
- 😄 Menor poupança

Grupos - critérios:

- Grupo 1: até 200 kWh/mês
- Grupo 2: 200-300 kWh/mês
- Grupo 3: 300-450 kWh/mês
- Grupo 4: 450 kWh/mês ou mais



Behavioural sheet of the participant with best performance in Group 2

Contadores Inteligentes para Decisões Eficientes PROGRAMA "COOPETIR"

Evolução da sua classificação de Fevereiro/2013 para Março/2013:

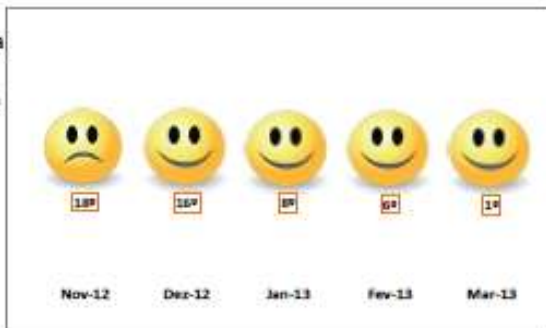
✓ Parabéns, em Março-13 subiu da 6ª para a 1ª posição.

A sua classificação de eficiência eléctrica no Grupo 3

A expressão do smile indica a sua evolução em relação ao mês anterior.

Legenda:

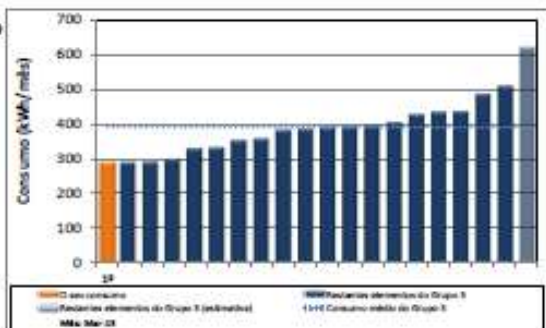
- 😊 Subiu de posição
- 😐 Mantive a posição
- 😞 Desceu de posição



Consumos em Março de 2013 Grupo 3

Note em destaque a representação do seu consumo.

As barras de cor transparente correspondem a participantes que apresentem dados incompletos, cujo consumo foi reconstruído por estimativa.



Dinâmica de poupança eléctrica entre Grupos

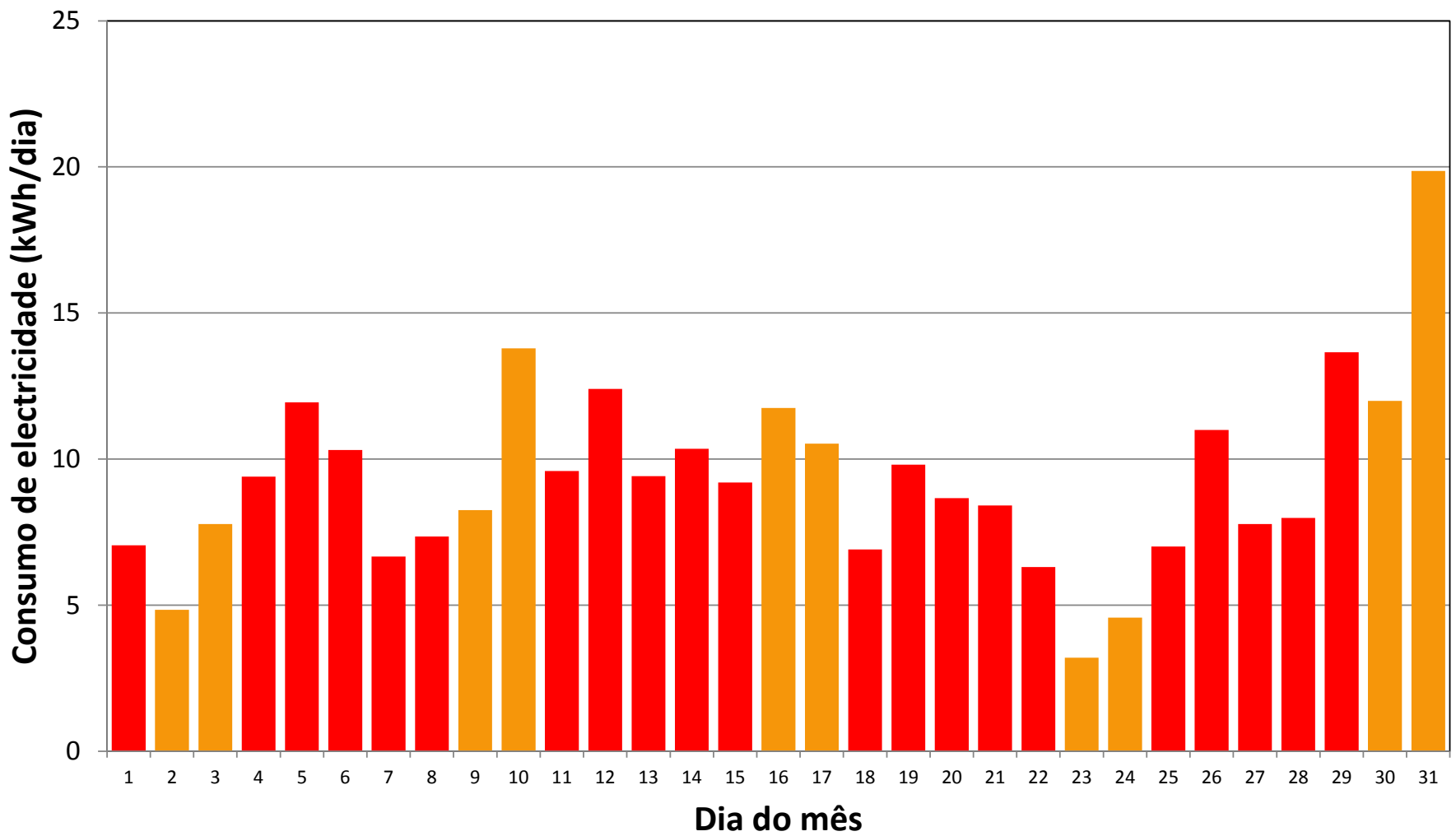
Legenda:

- 😊 Melhor poupança
- 😐 2ª melhor poupança
- 😞 3ª melhor poupança
- 😞 Menor poupança

Grupos - critérios:
Grupo 1: até 200 kWh/m²
Grupo 2: 200-300 kWh/m²
Grupo 3: 300-450 kWh/m²
Grupo 4: 450 kWh/m² ou mais



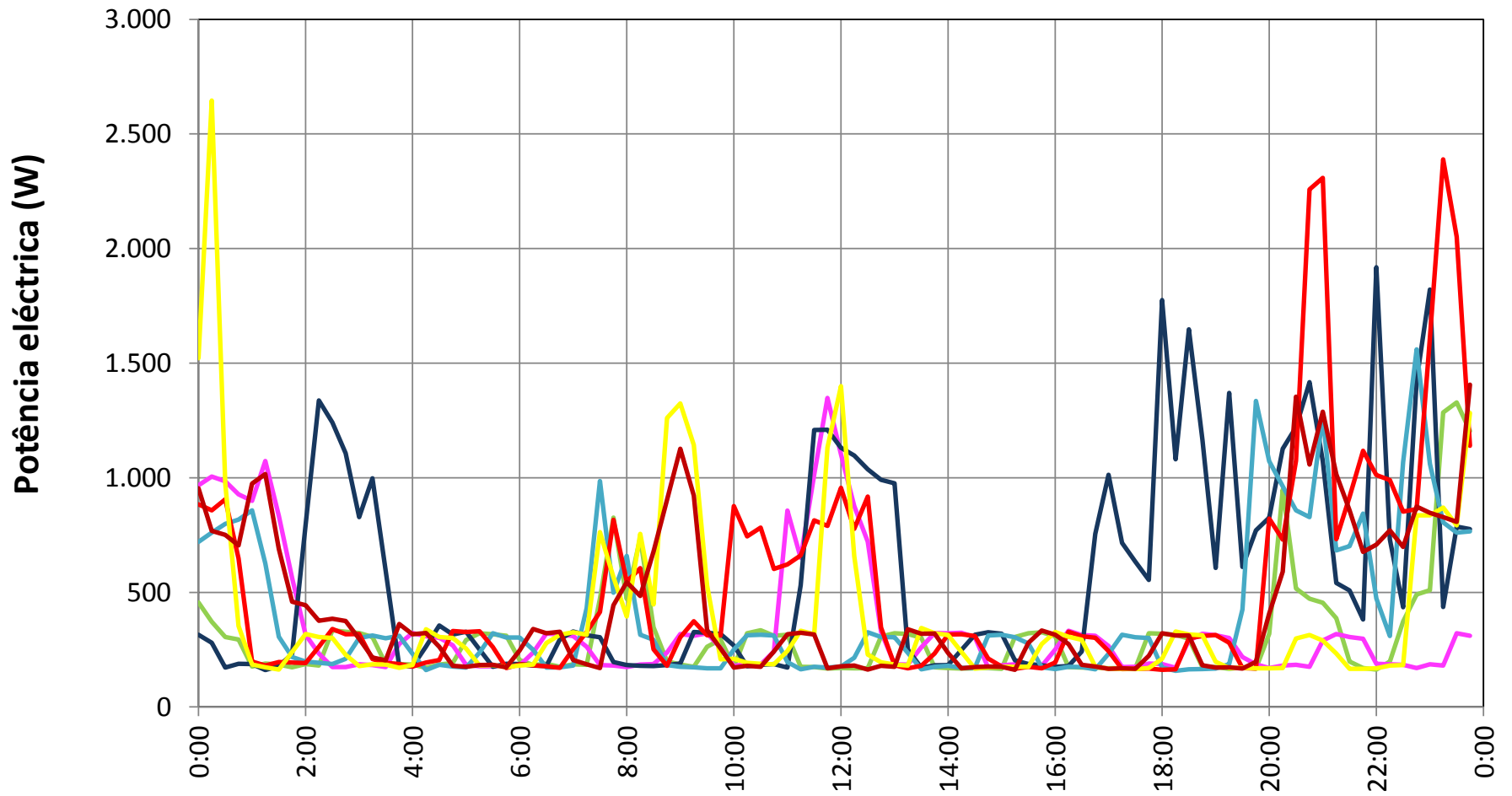
Behavioural sheet
of the participant
with best
performance in
Group 3



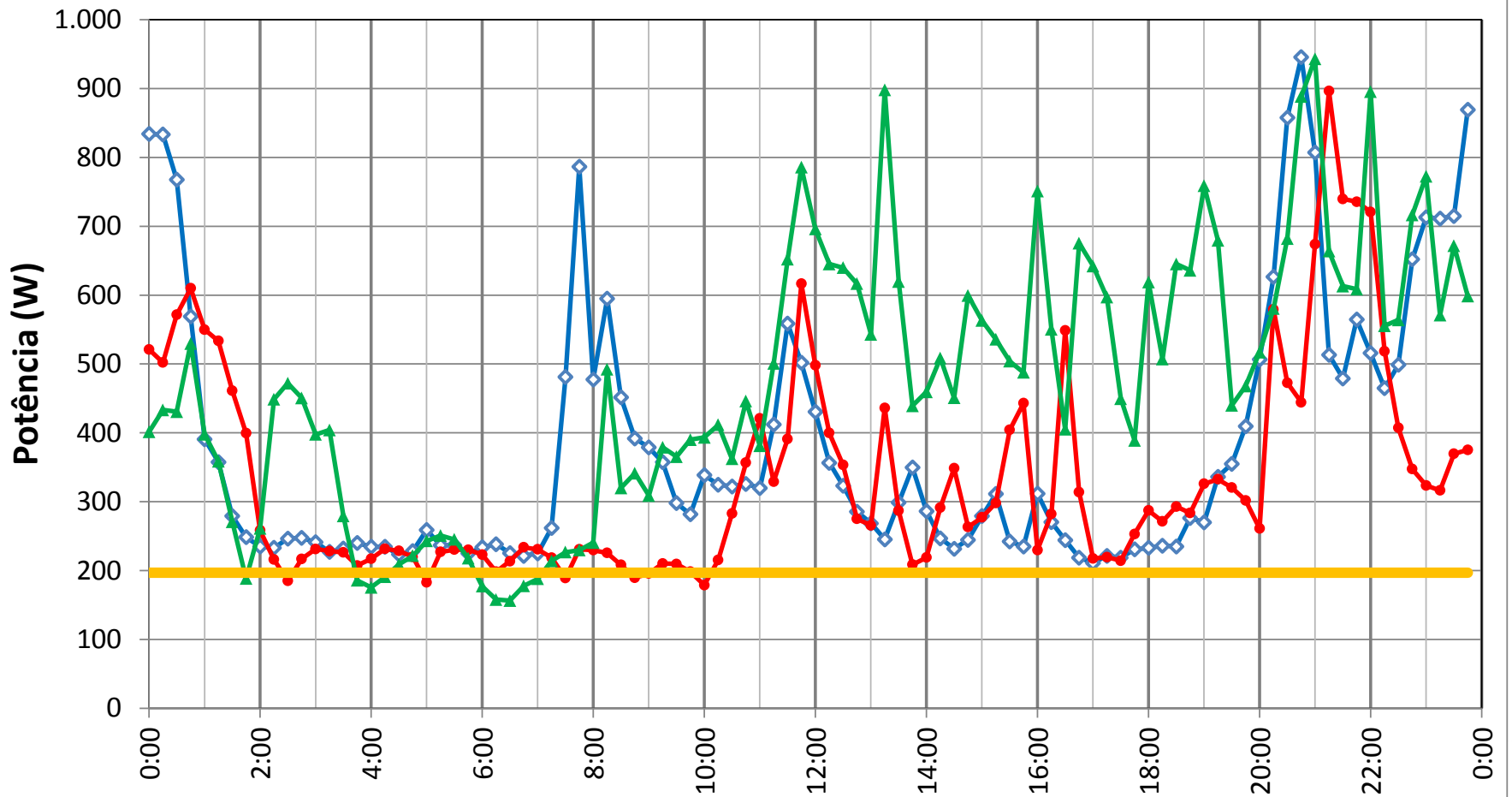
Mar-13

■ Dia útil

■ Fim de semana



— 08/Mar (Sex) — 09/Mar (Sáb) — 10/Mar (Dom) — 11/Mar (Seg) — 12/Mar (Ter) — 13/Mar (Qua) — 14/Mar (Qui)



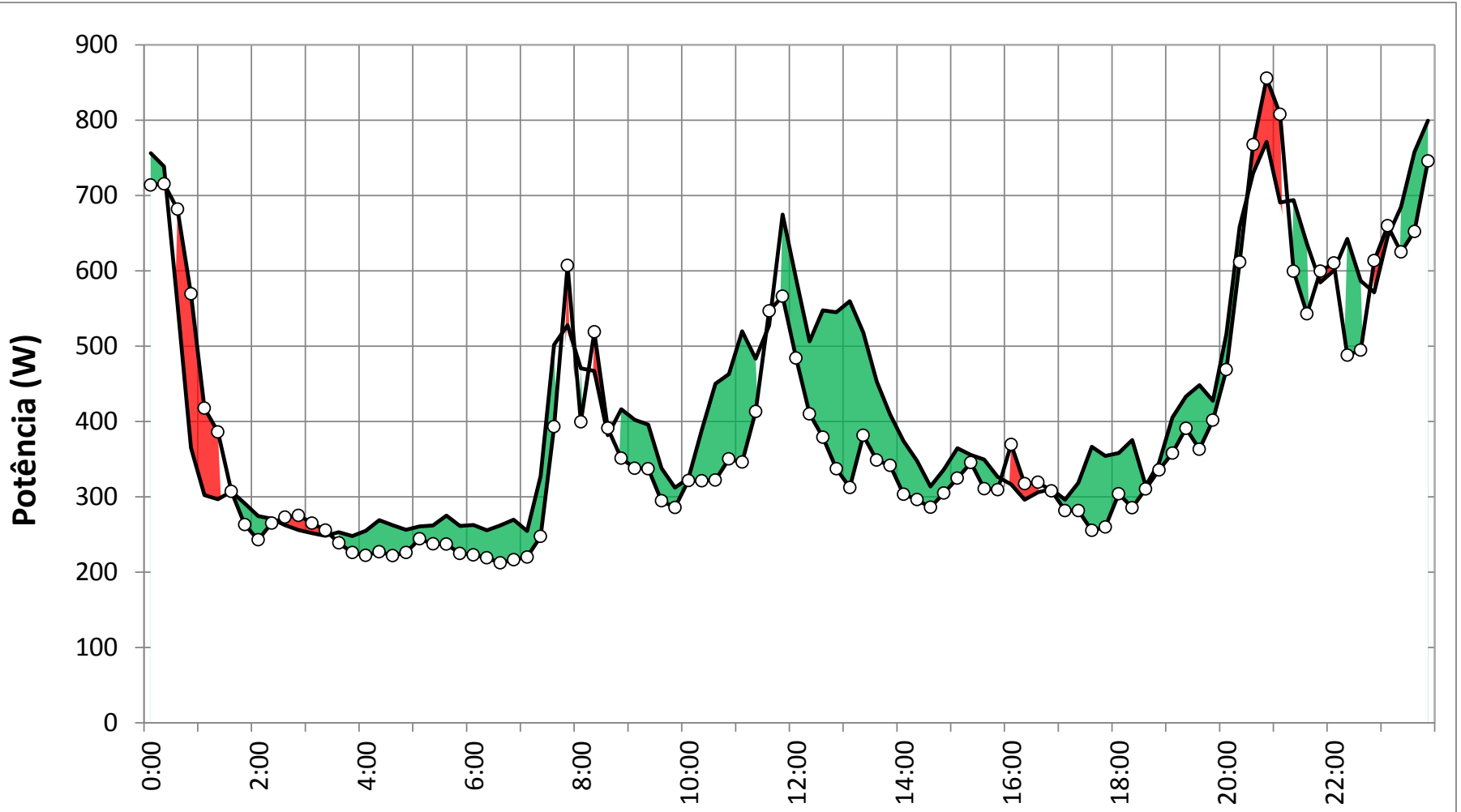
◆ Dias úteis (21)

● Sábados (5)

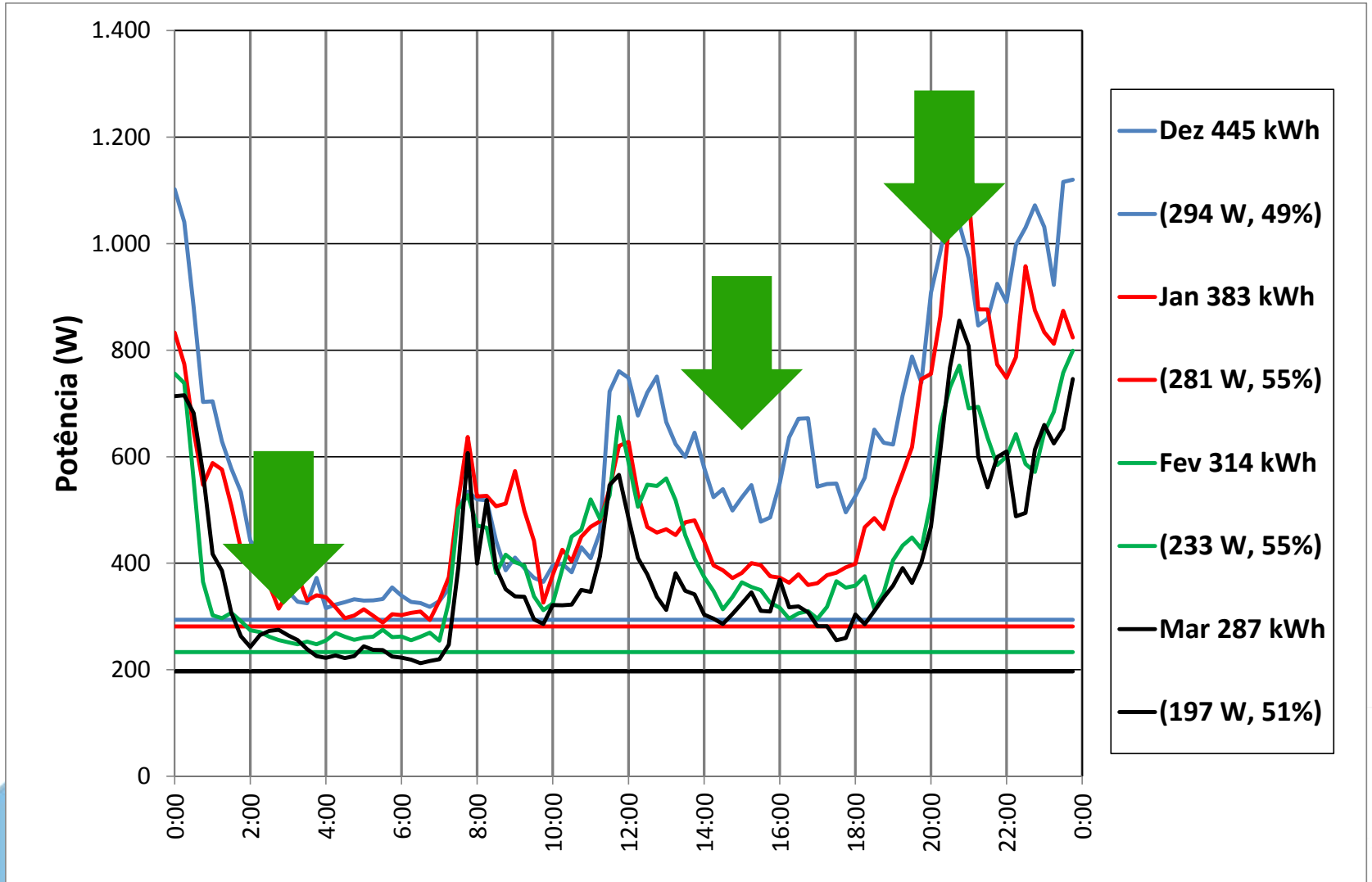
▲ Domingos (5)

— Mínimo (197 W, 51%)

Mar-13



CONSUMPTION PROFILE: Best practice case



SOME RESULTS:

- Minimal power:
 - Individually, 41% of the total consumption;
 - Consumption groups, 66% of the total consumption;
- Average power between 0h-7h is 85% of the average power between 7h-24h
- Average consumption ~ 400 kWh or ~ 70 €

ACTIONS – BEHAVIOURAL CHANGE

- Standby reduction
 - Turning off modems, boxes, etc.
 - Use of stand-by killers
- Smart plug programming
- Temperature control
 - Heating system
 - Water heater
- Contracted power reduction
- Lighting technology changing

THANK YOU!



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