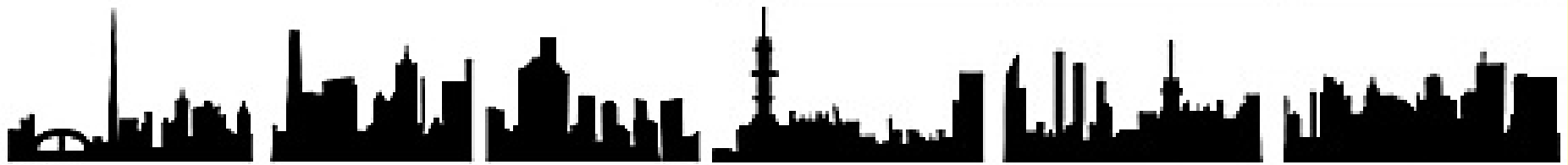


2015 BP Madrid Forum on Energy & Sustainability

30th September 2015

**THE HUMAN FACTOR IN ENERGY USE:
THE ROLE OF INFORMATION
(ANALYSIS THROUGH ECONOMICAL EXPERIMENTS)**



**Enrique Belenguer
Universitat Jaume I
Energy Efficiency Foundation**

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1

CONTEXT



MISSION:

To promote a more rational and efficient use of energy through training, advising and dissemination of good energy practices to citizens, public organizations and companies.

ACTIVITIES:

- Industrial sector
- Public sector
- Residential sector

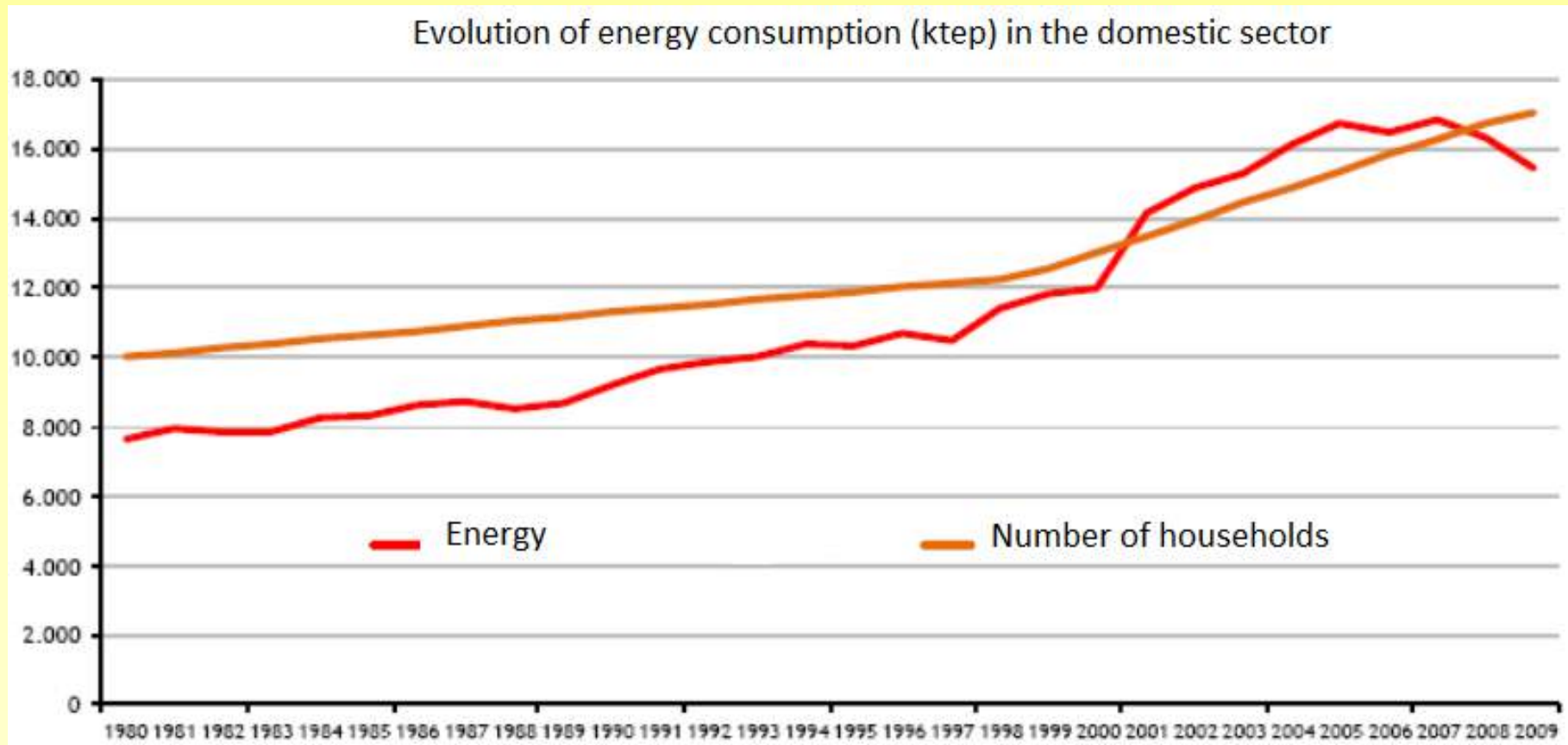


1

CONTEXT

Evolution of the Spanish energy consumption in the domestic sector:

- Today → 25 % of the total electrical energy and 17 % of the secondary energy.



1

CONTEXT

- Methods to increase energy efficiency in the domestic sector:
 - Economic methods.
 - Informational methods: training, advices, energy labels, energy use campaigns, ...
 - Feedback mechanisms (inform about the result of an action): smart meters, peer comparison, enhanced billing, ...

 - Barriers to increase energy efficiency in the domestic sector:
 - Inadequate information or lack of information.
 - Economic cost of the measures.
 - Social costs.
 - Living conditions.
-

1

CONTEXT

| Intervention | Range of energy savings |
|--|-------------------------|
| Direct feedback (including smart meters) | 5-15 % |
| Indirect feedback (e.g. enhanced billing) | 2-10 % |
| Feedback and target setting | 5-15 % |
| Energy audits | 5-20 % |
| Community-based initiatives | 5-20 % |
| Combination interventions (of more than one) | 5-20 % |

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THE HUMAN FACTOR IN ENERGY USE

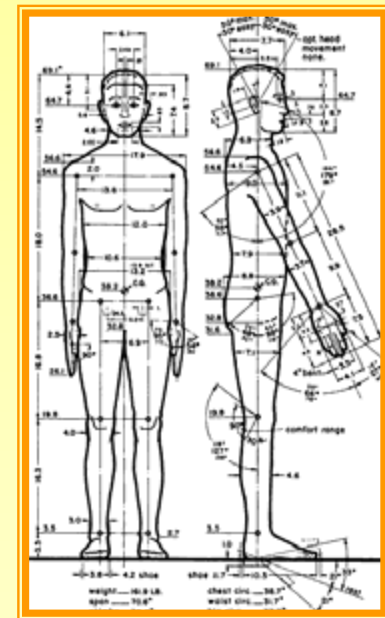
RESEARCH PROJECT: “Evaluation of energy management and saving treatments in the domestic environment through the development of economic experiments”

BASIS:

- Human behavior consists of rational and irrational (emotional) decisions.
- The detailed knowledge of energy-consuming behavior is paramount for the development and implementation of new technologies, services and even policies that could result in a more rational use of energy.

METHODOLOGY:

- Development of economic experiments in two levels:
 1. Experimental economics laboratory.
 2. Real homes with real energy use conditions.

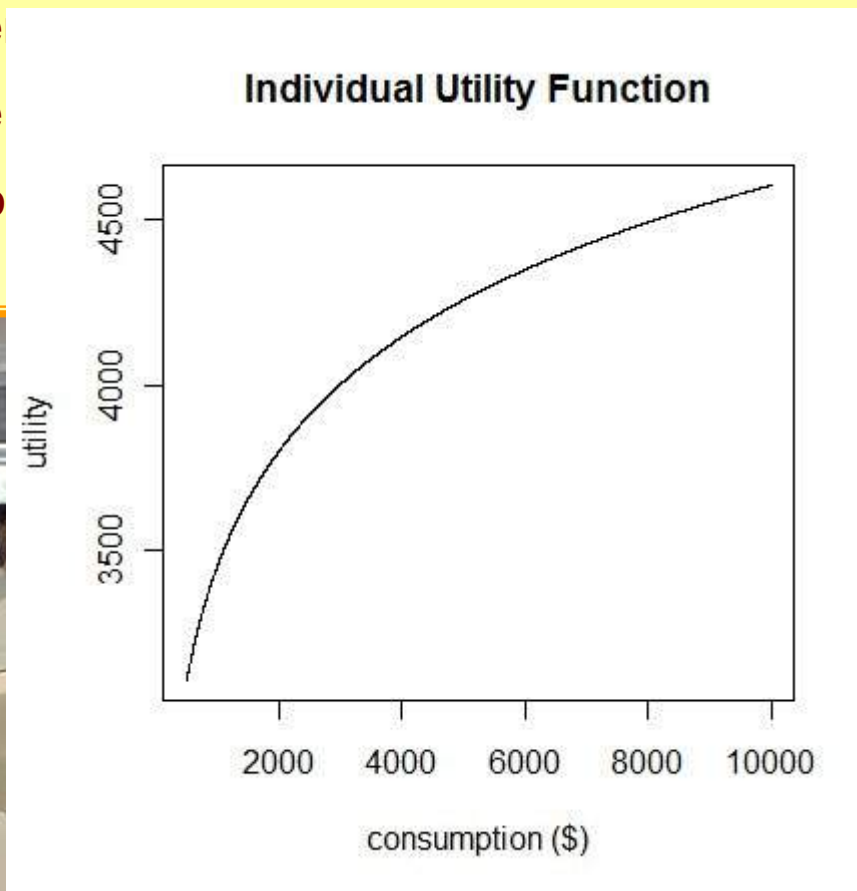


2

THE HUMAN FACTOR IN ENERGY USE

EVALUATION OF TREATMENTS IN THE LABORATORY (LEVEL 1):

- Study of behavior by human subjects acting in controlled decision making e
- Compute
- Evaluatio



2 THE HUMAN FACTOR IN ENERGY USE

EVALUATION OF TREATMENTS IN THE LABORATORY (LEVEL 1):

Quedan 54 segundos...

Tipo día: DÍA DE INVIERNO

COCINA

- Iluminación** Utilidad 262.71 ¢€
- Horno** Utilidad 140.0 ¢€
- Microondas** Utilidad 266.78 ¢€
- Vitrocerámica** Utilidad 260.0 ¢€
- Tostadora** Utilidad 100.0 ¢€
- Frigorífico** Utilidad 435.66 ¢€
- Lavadora** Utilidad 109.0 ¢€
 - Algodón 60° Ut 164.0 ¢€
 - Sintético 40° Ut 109.0 ¢€
 - Lavado en frío Ut 112.0 ¢€
 - Stand-by Ut 10.14 ¢€
 - Apagado total Ut 0 ¢€
- Lavaplatos** Utilidad 949.46 ¢€
 - Modo ECO (1h30') Ut 824.57 ¢€
 - Modo rápido (30') Ut 646.14 ¢€
 - Stand-by Ut 24.89 ¢€
 - Apagado total Ut 0 ¢€
- Plancha** Utilidad 67.0 ¢€

SALÓN

- Iluminación** Utilidad 1036.05 ¢€
- Televisión** Utilidad 593.67 ¢€
 - Stand-by Ut 23.38 ¢€
 - Apagado total Ut 0 ¢€
- Minicadena** Utilidad 63.79 ¢€
 - Stand-by Ut 32.68 ¢€
 - Apagado total Ut 0 ¢€
- Ordenador** Utilidad 270.67 ¢€
 - Stand-by Ut 164.67 ¢€
 - Apagado total Ut 0 ¢€
- Router** Utilidad 79.3 ¢€

BAÑO

- Calefactor** Utilidad 642.0 ¢€
- Higiene personal**
 - Ducha tipo 1 Ut 475.78 ¢€
 - Ducha tipo 2 Ut 1101.42 ¢€
 - Baño Ut 1633.89 ¢€

CALEFACCIÓN

- Calefacción** Utilidad 2542.25 ¢€

HABITACIÓN 1

- Iluminación** Utilidad 621.05 ¢€
- Ordenador fijo** Utilidad 596.47 ¢€

HABITACIÓN 2

- Iluminación** Utilidad 169.6 ¢€

Siguiente

2 THE HUMAN FACTOR IN ENERGY USE

EVALUATION OF TREATMENTS IN THE LABORATORY (LEVEL 1):

Quedan 181 segundos Tipo día: DÍA DE INVIERNO

COCINA

- Iluminación Utilidad 380.43 ¢€
- Horno Utilidad 140.0 ¢€
- Microondas Utilidad 85.09 ¢€
- Vitrocerámica Utilidad 244.29 ¢€
- Tostadora Utilidad 100.0 ¢€
- Frigorífico Utilidad 435.66 ¢€
- Lavadora Utilidad 141.36 ¢€
 - Algodón 60° Ut 123.0 ¢€
 - Sintético 40° Ut 81.75 ¢€
 - Lavado en frío Ut 84.0 ¢€
 - Stand by Ut 19.36 ¢€
 - Apagado total Ut 0 ¢€
- Lavaplatos Utilidad 591.97 ¢€
 - Modo ECO (1h30') Ut 565.71 ¢€
 - Modo rápido (30') Ut 464.43 ¢€
 - Stand-by Ut 26.26 ¢€
 - Apagado total Ut 0 ¢€
- Plancha Utilidad 67.0 ¢€

SALÓN

- Iluminación Utilidad 0.0 ¢€
- Televisión Utilidad 442.23 ¢€
 - Stand by Ut 26.13 ¢€
 - Apagado total Ut 0 ¢€
- Minicadena Utilidad 91.54 ¢€
 - Stand by Ut 43.54 ¢€
 - Apagado total Ut 0 ¢€
- Ordenador Utilidad 270.67 ¢€
 - Stand by Ut 164.67 ¢€
 - Apagado total Ut 0 ¢€
- Router Utilidad 79.3 ¢€

HABITACIÓN 1

- Iluminación Utilidad 0 ¢€
- Ordenador fijo Utilidad 403.2 ¢€

HABITACIÓN 2

- Iluminación Utilidad 489.68 ¢€

CONTADOR

761.0 KWh

BAÑO

- Calefactor Utilidad 458.57 ¢€
- Higiene personal
 - Ducha tipo 1 Ut 304.63 ¢€
 - Ducha tipo 2 Ut 670.27 ¢€
 - Baño Ut 1633.89 ¢€

CALEFACCIÓN

- Calefacción Utilidad 1393.92 ¢€

Horas en uso: 18, 15, 23, 15

Siguiente

2 THE HUMAN FACTOR IN ENERGY USE

EVALUATION OF TREATMENTS IN THE LABORATORY (LEVEL 1):

Tipo día: DÍA DE INVIERNO

COCINA

Iluminación Utilidad 0 c€

Horno Utilidad 0 c€

Microondas Utilidad 0 c€

Vitrocerámica Utilidad 0 c€

Tostadora Utilidad 0 c€

Frigorífico Utilidad 435,66 c€

Lavadora Utilidad 0 c€

Algodón 60° Ut 0 c€

Sintético 40° Ut 0 c€

Lavado en frío Ut 0 c€

Stand-by Ut 0 c€

Apagado total Ut 0 c€

Lavaplatos Utilidad 0 c€

Modo ECO (1h30') Ut 0 c€

Modo rápido (30') Ut 0 c€

Stand-by Ut 0 c€

Apagado total Ut 0 c€

Plancha Utilidad 0 c€

SALÓN

Iluminación Utilidad 0 c€

Televisión Utilidad 0 c€

Stand-by Ut 0 c€

Apagado total Ut 0 c€

Minicadena Utilidad 0 c€

Stand-by Ut 0 c€

Apagado total Ut 0 c€

Ordenador Utilidad 0 c€

Stand-by Ut 0 c€

Apagado total Ut 0 c€

Router Utilidad 79,3 c€

CONSEJOS

1. No dejes en stand-by los equipos cuando no los utilices: apágalos totalmente

Siguiente consejo

HABITACIÓN 1

Iluminación Utilidad 0 c€

Ordenador fijo Utilidad 0 c€

HABITACIÓN 2

Iluminación Utilidad 0 c€

BAÑO

Calefactor Utilidad 0 c€

Higiene personal

Ducha tipo 1 Ut 0 c€

Ducha tipo 2 Ut 0 c€

Baño Ut 0 c€

CALEFACCIÓN

Calefacción Utilidad 0 c€

Horas en uso

| | | | | | | | | |
|----|---|----|---|----|---|----|---|----|
| 7 | + | 15 | + | 15 | + | 15 | + | 15 |
| 8 | + | 15 | + | 15 | + | 15 | + | 15 |
| 9 | + | 15 | + | 15 | + | 15 | + | 15 |
| 10 | + | 15 | + | 15 | + | 15 | + | 15 |
| 11 | + | 15 | + | 15 | + | 15 | + | 15 |
| 12 | - | 15 | - | 15 | - | 15 | - | 15 |

2 THE HUMAN FACTOR IN ENERGY USE

EVALUATION OF TREATMENTS IN THE LABORATORY (LEVEL 1):



2 THE HUMAN FACTOR IN ENERGY USE

EVALUATION OF TREATMENTS IN THE LABORATORY (LEVEL 1):

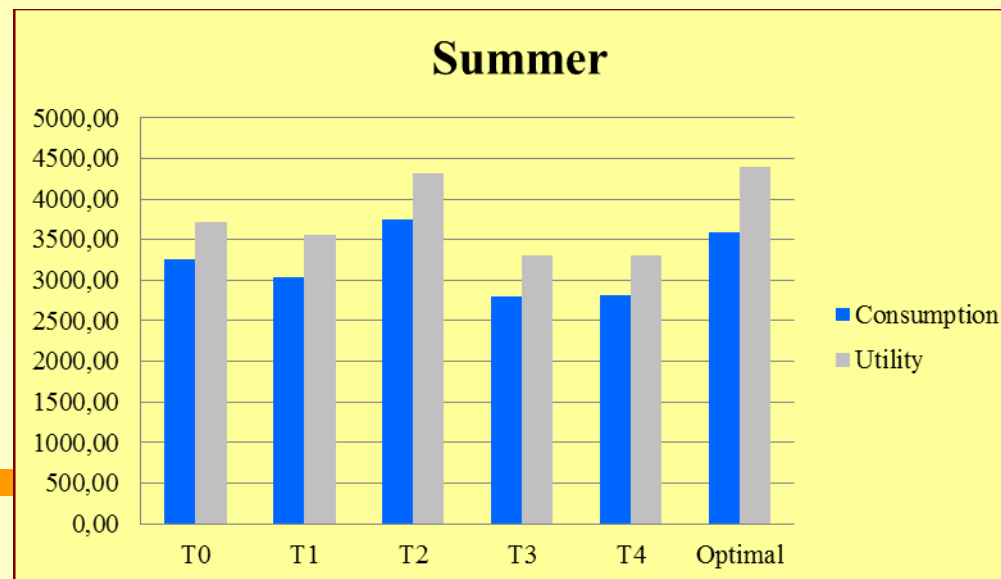
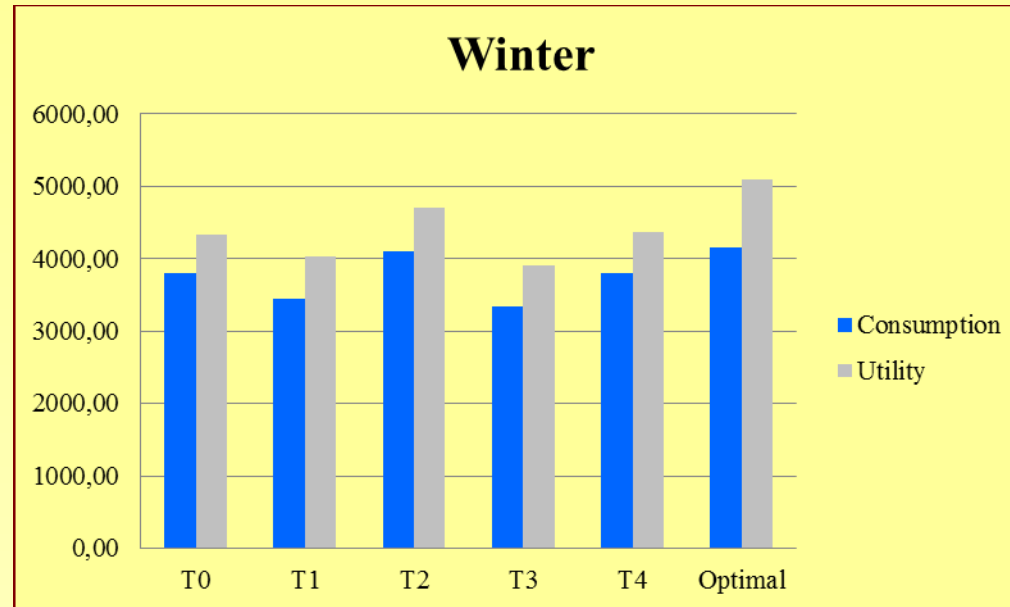


EVALUATION OF TREATMENTS IN THE LABORATORY (LEVEL 1):

- T0. No treatment.
 - T1. Implementation of a real time energy and cost measuring system.
 - T2. Implementation of a real time measuring system with information for each appliance.
 - T3. Implementation of an information sharing system between consumers.
 - T4. Consumers' training in better energy practices.
-

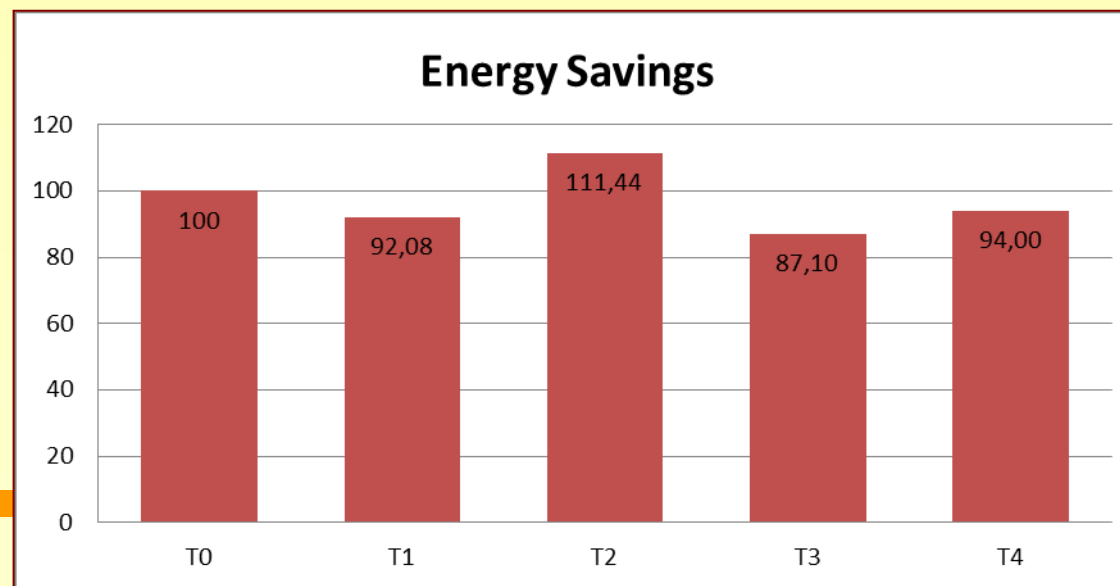
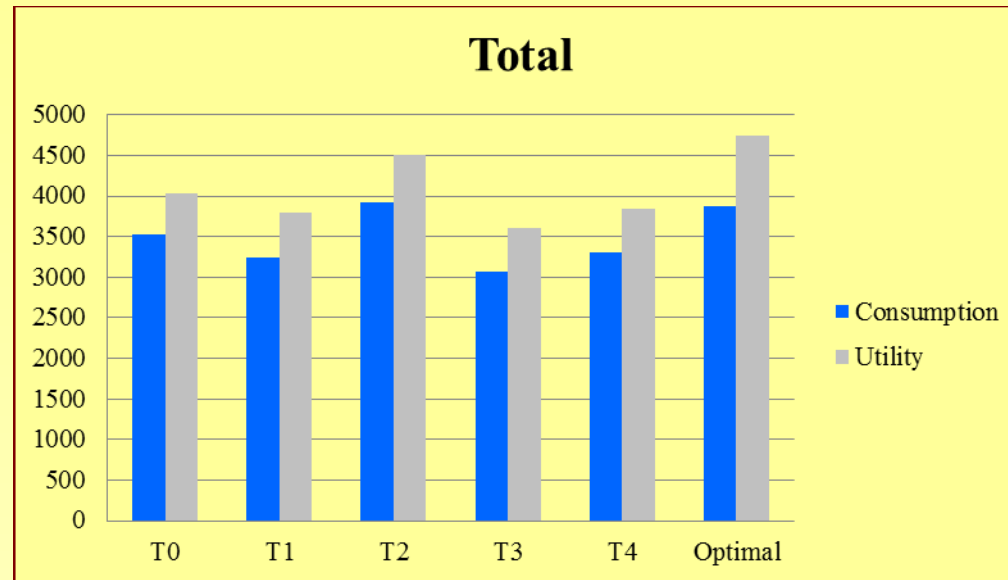
2 THE HUMAN FACTOR IN ENERGY USE

RESULTS:



2 THE HUMAN FACTOR IN ENERGY USE

RESULTS:



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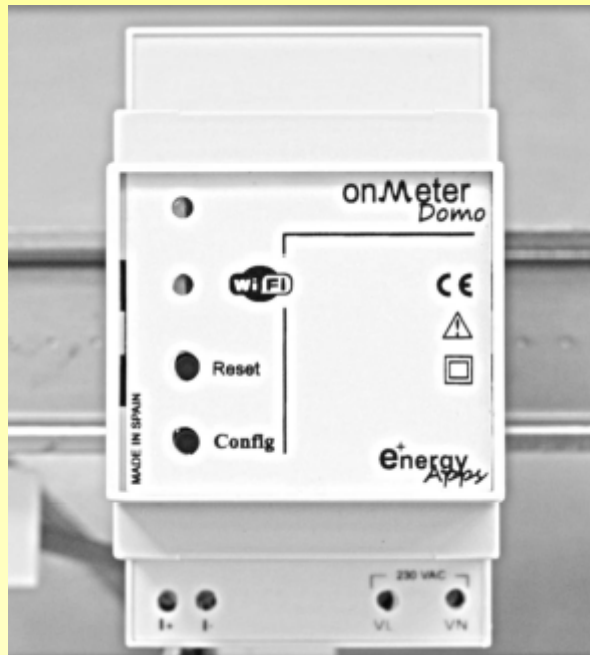
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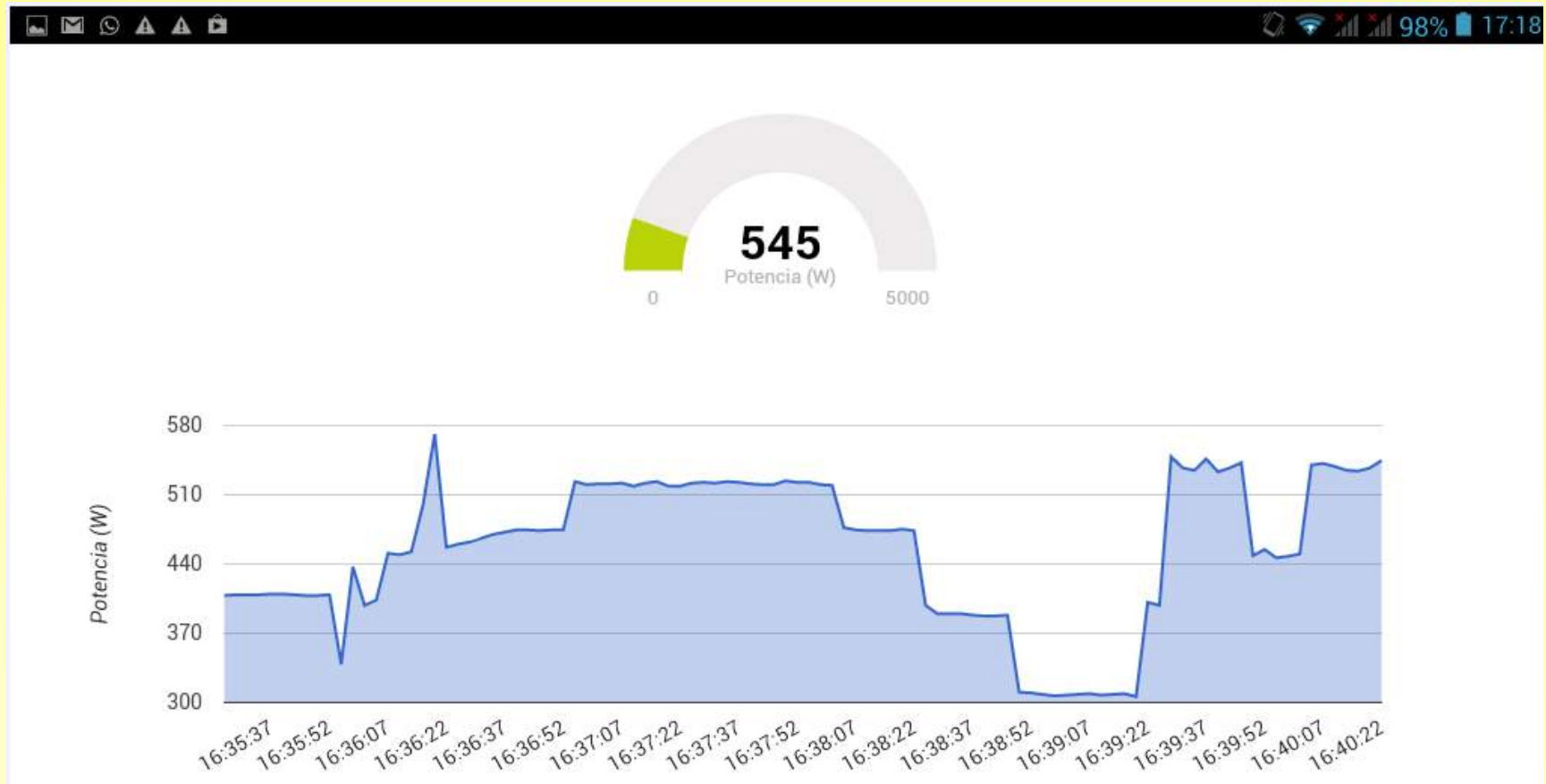
CONCLUSIONS

1. The understanding of human behavior is paramount to achieve a more rational use of the energy (at least in the domestic sector).
 2. The product “ENERGY” is barely understood by the people.
 3. Direct feedback and information sharing is a good way to reduce energy consumption at home.
 4. Political support for the implementation of individual metering (easy and free access to data) is necessary.
 5. The new technologies allow the development and implementation of a new class of products and services:
 - Smart Meters.
 - Energy apps.
-

3 CONCLUSIONS



3 CONCLUSIONS



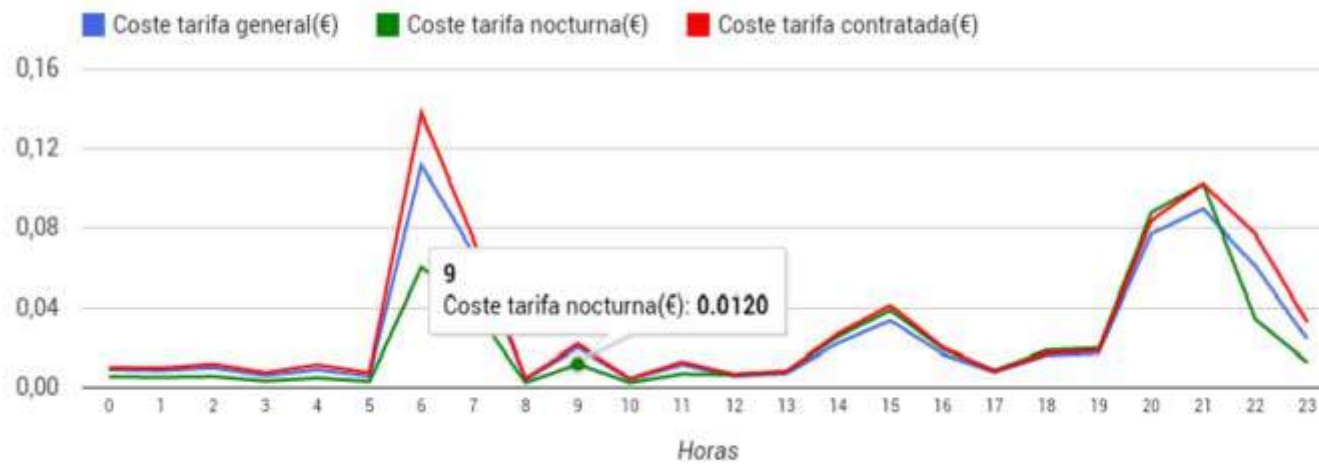
3 CONCLUSIONS



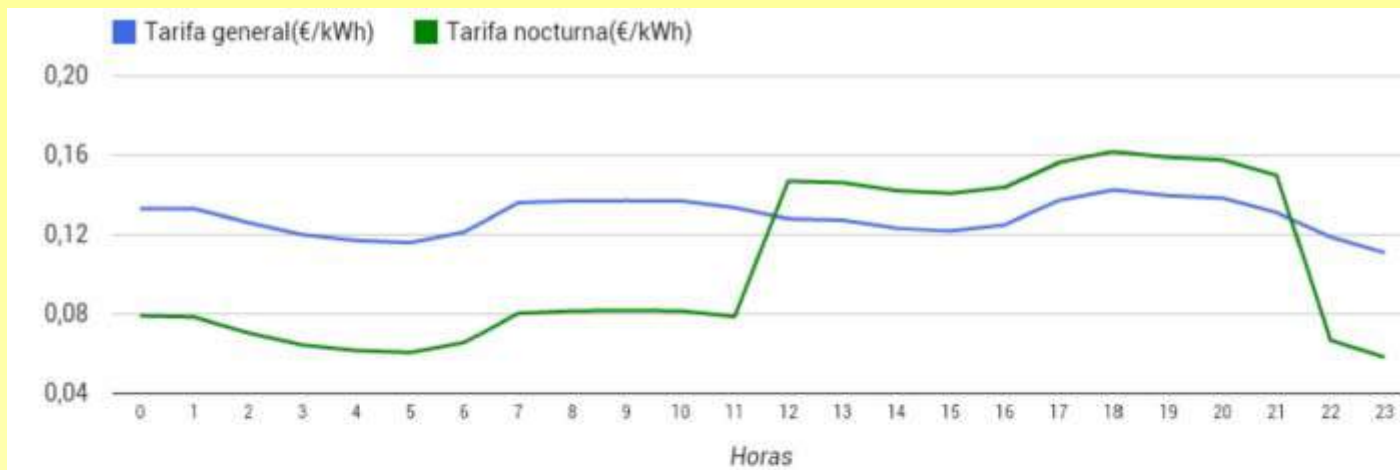
3 CONCLUSIONS

Consumo para el martes, 18 de noviembre de 2014

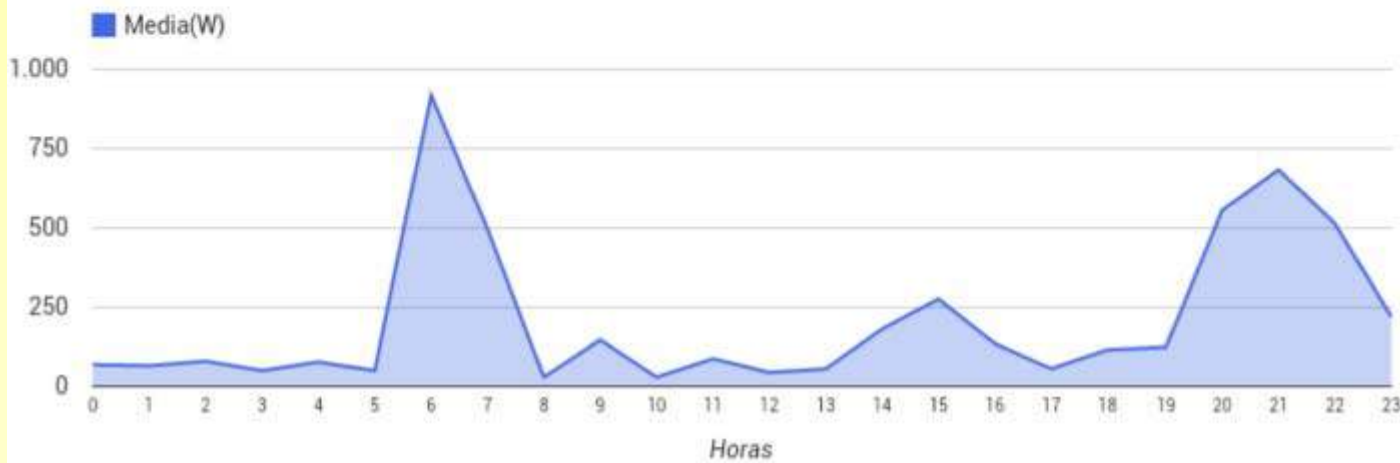
| Coste tarifa general PVPC | Coste tarifa nocturna PVPC | Coste tarifa plana |
|---------------------------|----------------------------|--------------------|
| 0.65 € | 0.53 € | 0.76 € |



3 CONCLUSIONS



Consumo registrado el martes, 18 de noviembre de 2014



The screenshot shows a mobile application interface for an energy audit. At the top, there is a blue header with 'Inicio' on the left, 'Auditoría energética' in the center, and 'Menú' on the right. Below the header, the section is titled 'Potencia máxima consumida.' and contains a table with three rows of power-related data. A note below the table advises comparing the maximum consumed power with the contracted power level. The next section is titled 'Precio medio al que paga la energía con diferentes tarifas.' and contains a table comparing three different tariffs: general PVPC, nocturnal PVPC, and flat rate. A note below this table explains that the most economical option depends on consumption habits. The final section is titled 'Consumo de base.' and contains a single row of data representing the minimum daily consumption. A note below this section explains that this value is the minimum consumed during the day and can be reduced by disconnecting standby devices.

Potencia máxima consumida.

| | |
|---|---------|
| Potencia contratada | 4.60 kW |
| Rango inferior de potencia | 3.30 kW |
| Valor máximo consumido en los últimos 2 meses | 5.38 kW |

* Compare el máximo consumido con su nivel de potencia contratado. Si es inferior considere un contrato con una potencia contratada menor a la actual.

Precio medio al que paga la energía con diferentes tarifas.

| Tarifa general PVPC | Tarifa nocturna PVPC | Tarifa plana |
|---------------------|----------------------|--------------|
| 0.119€/kWh | 0.091 €/kWh | 0.150 €/kWh |

*En función de sus hábitos de consumo le será más rentable utilizar la tarifa general, la tarifa nocturna o una tarifa contratada de coste fijo sobre la energía consumida. Elija con su comercializadora el contrato que le resulte más económico.

Consumo de base.

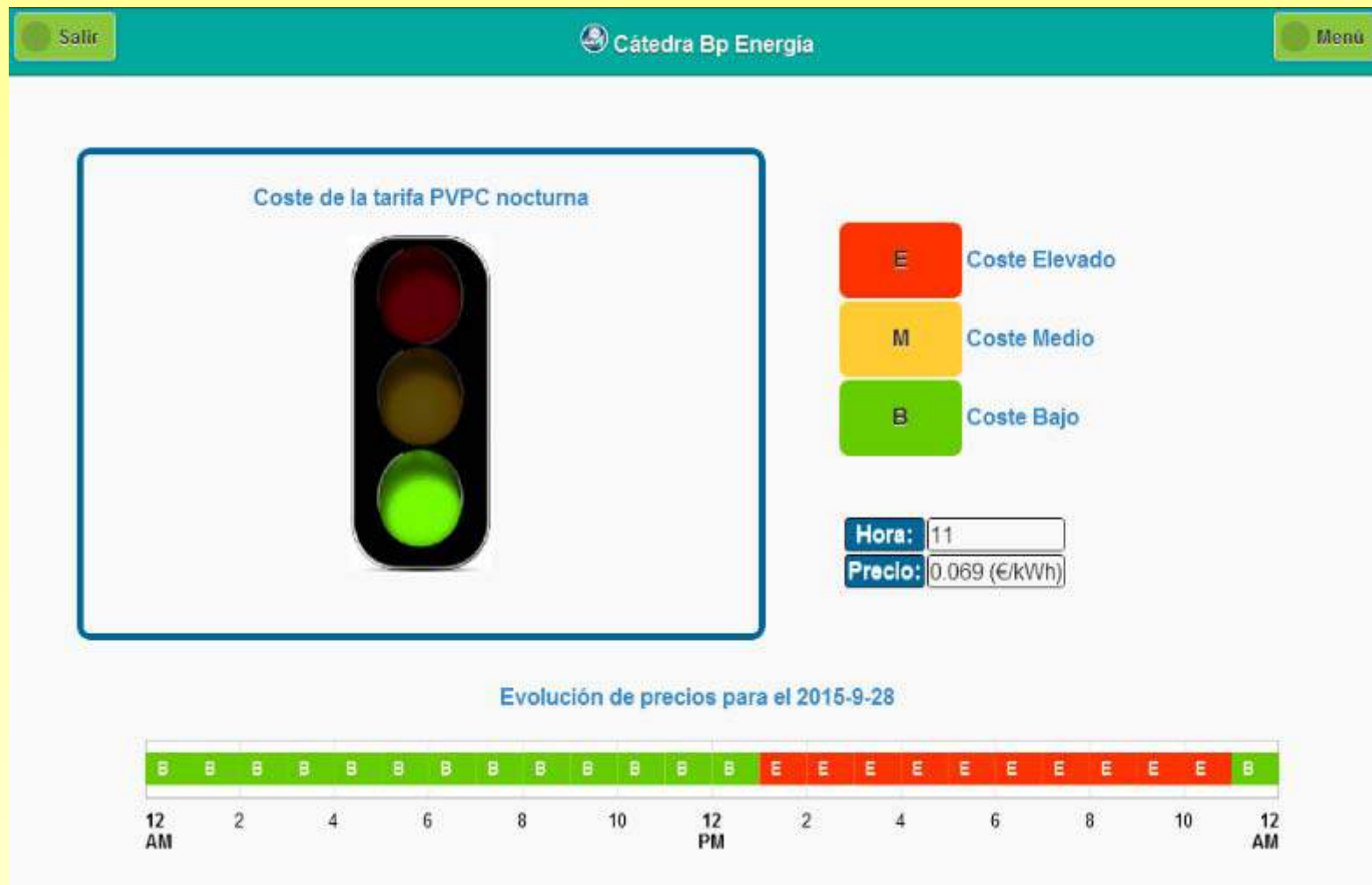
| | |
|-----------------------------|--------|
| Valor mínimo del día de hoy | 71.92W |
|-----------------------------|--------|

*Este valor es el mínimo consumido a lo largo del día de hoy. Trate de reducirlo al máximo desconectando consumos de standby innecesarios o utilizando ciclos económicos en neveras, aires acondicionados, calefacciones, etc...

3 CONCLUSIONS



3 CONCLUSIONS



3 CONCLUSIONS

Salir Cátedra Bp Energía Menú

Conoce el coste de las tarifas PVPC

PVPC para el miércoles, 16 de septiembre de 2015

— Precio máximo — Precio mínimo

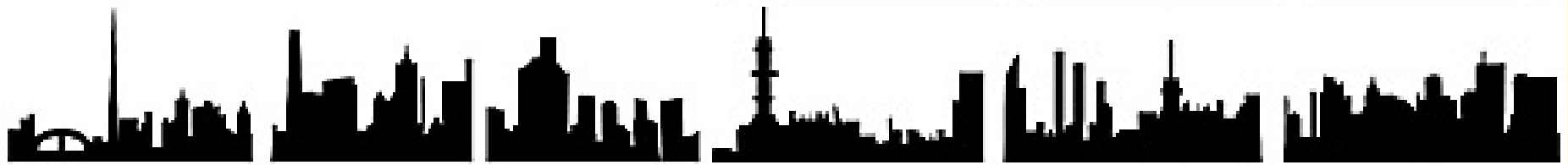
0.25
0.20
0.15
0.10
0.05
0.00

00:00 01:00 02:00 03:00 04:00 05:00 06:00 07:00 08:00 09:00 10:00 11:00 12:00 13:00 14:00 15:00 16:00 17:00 18:00 19:00 20:00 21:00 22:00 23:00 24:00

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