Role of the smart technology in the energy efficiency improvement

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Warsaw, March 4, 2011

Capacity Building for Sustainable Energy Regulation in Eastern Europe and Central Asia

ENERGY COOPERATION BETWEEN THE EU, THE LITTORAL STATES OF THE BLACK & CASPIAN SEAS AND THEIR NEIGHBOURING COUNTRIES

Agenda

- General rules of the customer behaviour changing
- Areas of the possible improvement of energy efficiency
  - on the customer side
  - on the operator side
  - on the supplier side
- Available tools/signals for behaviour changing of the market participants
- Smart grid as a solution

General rules of the customer behaviour changing

▶ Objects

▶ Competence to change the behaviour

▶ Signal for the change available just in time

▶ Motivation for the change

▶ Simplicity of the settlement as the effect of the change

General rules of the customer behaviour changing

► Objects:

◆ Total energy consumption:

  ◆ Heating:

    ❖ Building efficiency

    ❖ Behavioural scheme (open windows, 25^0C vs 18^0C in-home temperature, etc.)

  ◆ Transport

    ❖ The level of needs

    ❖ Type of vehicle

  ◆ Electric equipment

    ❖ In-home equipment saturation

    ❖ The use of the equipment

General rules of
the customer behaviour changing

▶ Object – electricity:

    ◆ Energy consumption level

    ◆ Load curve shape (Power consumption shape)

General rules of the customer behaviour changing

- Competence to change the object
    - customer independent
    - customer dependent:
        - time related
        - cost related

| | - high efficient |
| | - medium efficient |
| | - low efficient |

Kind of solutions matrix		Cost	
		low	high
Time to effect	short	(green)	(yellow)
	long	(yellow)	(red)

General rules of the customer behaviour changing

► Motivation to the change:

  ◆ economic (costs or income perspective)

  ◆ non-economic (ambition, comparison to the neighbours, welfare vision etc.)

  ◆ perspectives of new useful services

General rules of the customer behaviour changing

► Signal for the change available just in time
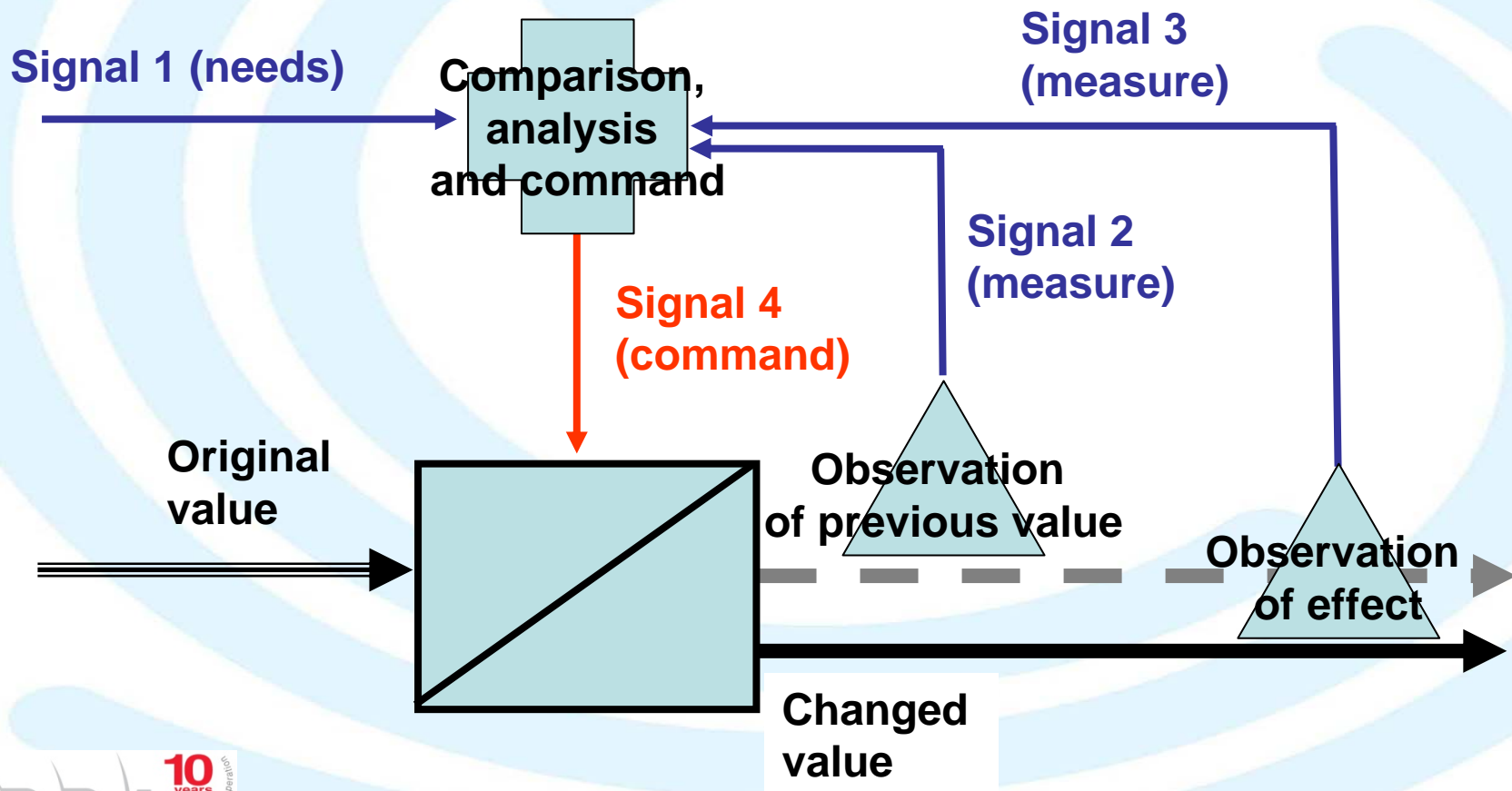
General rules of the customer behaviour changing

► Simplicity of the settlement as the effect of the change

- ◆ direct effects (e.g.: costs reduction)
  - ◆ short time loop of answer
  - ◆ long time loop of answer
- ◆ indirect effects (e.g.: satisfaction)
  - ◆ soft correlation

Areas of the possible improvement of energy efficiency

▶ On the customer side:

- ◆ Energy consumption reduction by soft change of behaviour

- ◆ Power consumption reduction by soft change of behaviour

- ◆ Energy and/or power consumption reduction by the replacement of equipment (hard change)

Areas of the possible improvement of energy efficiency

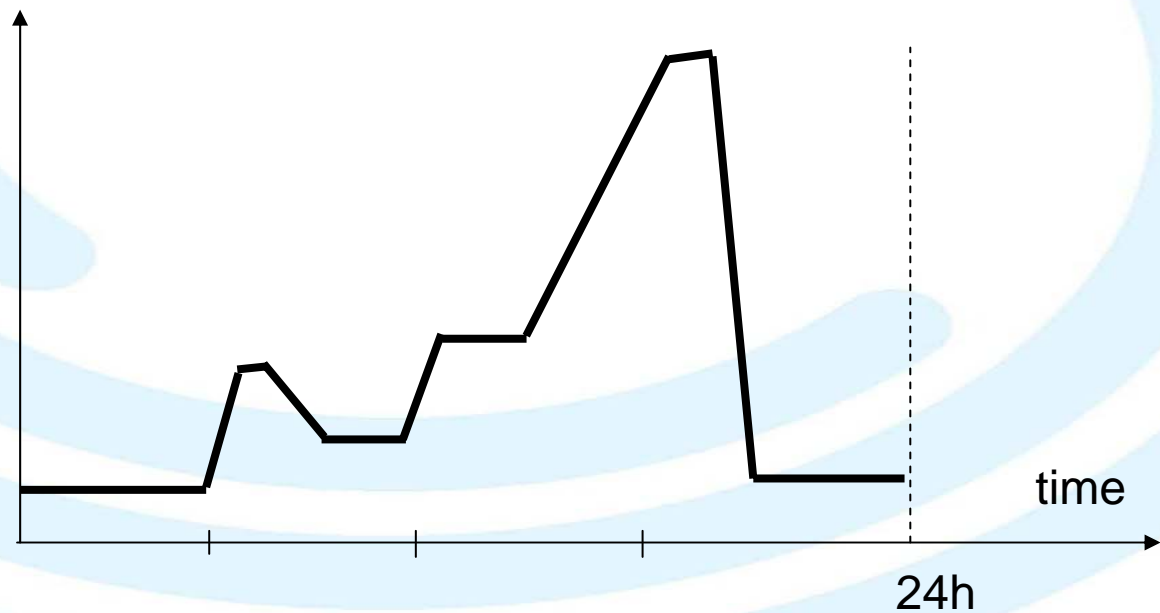► Energy consumption reduction by soft change of behaviour

  ◆ e.g.: iron use style:

    ● to prepare the huge part of laundry without breaks or

    ● to switch on the iron for each shirt separately, or to make many breaks during the work

Areas of the possible improvement of energy efficiency
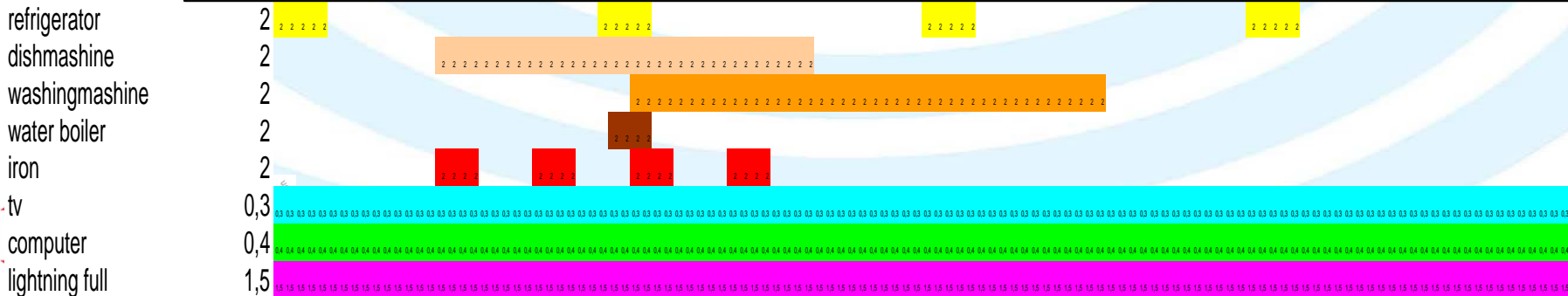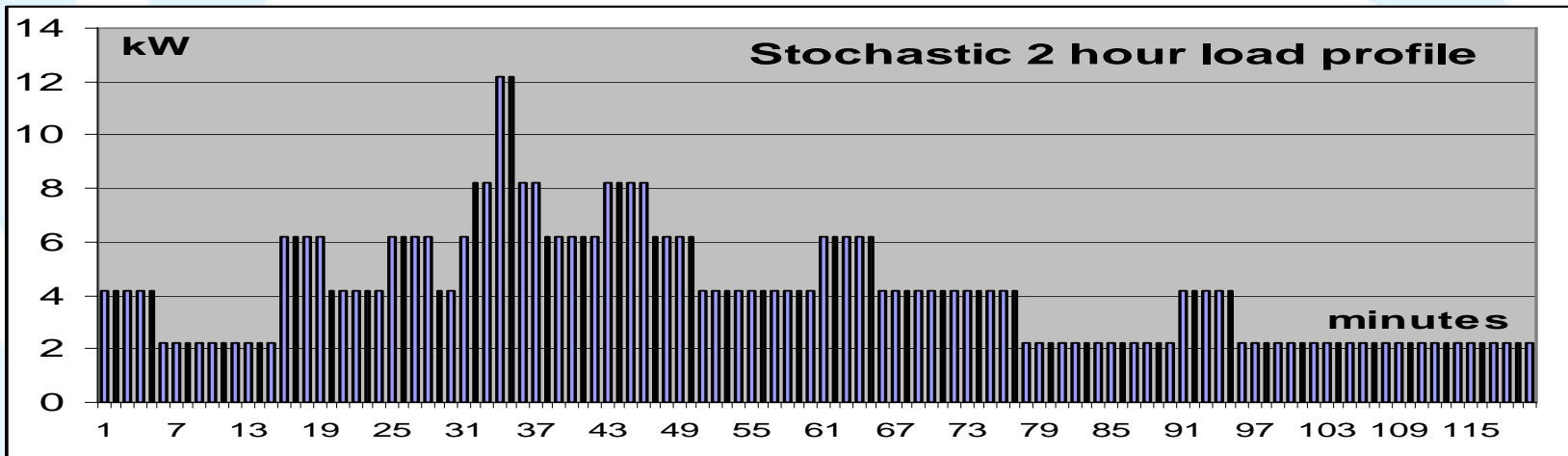
▶ Power consumption reduction by soft change of behaviour

Typical shape of load curve of household group :

time

24h

Areas of the possible improvement of energy efficiency

▶ Power consumption reduction by soft change of behaviour

Individual shape of household consumer :

Areas of the possible improvement of energy efficiency

▶ Power consumption reduction by soft change of behaviour
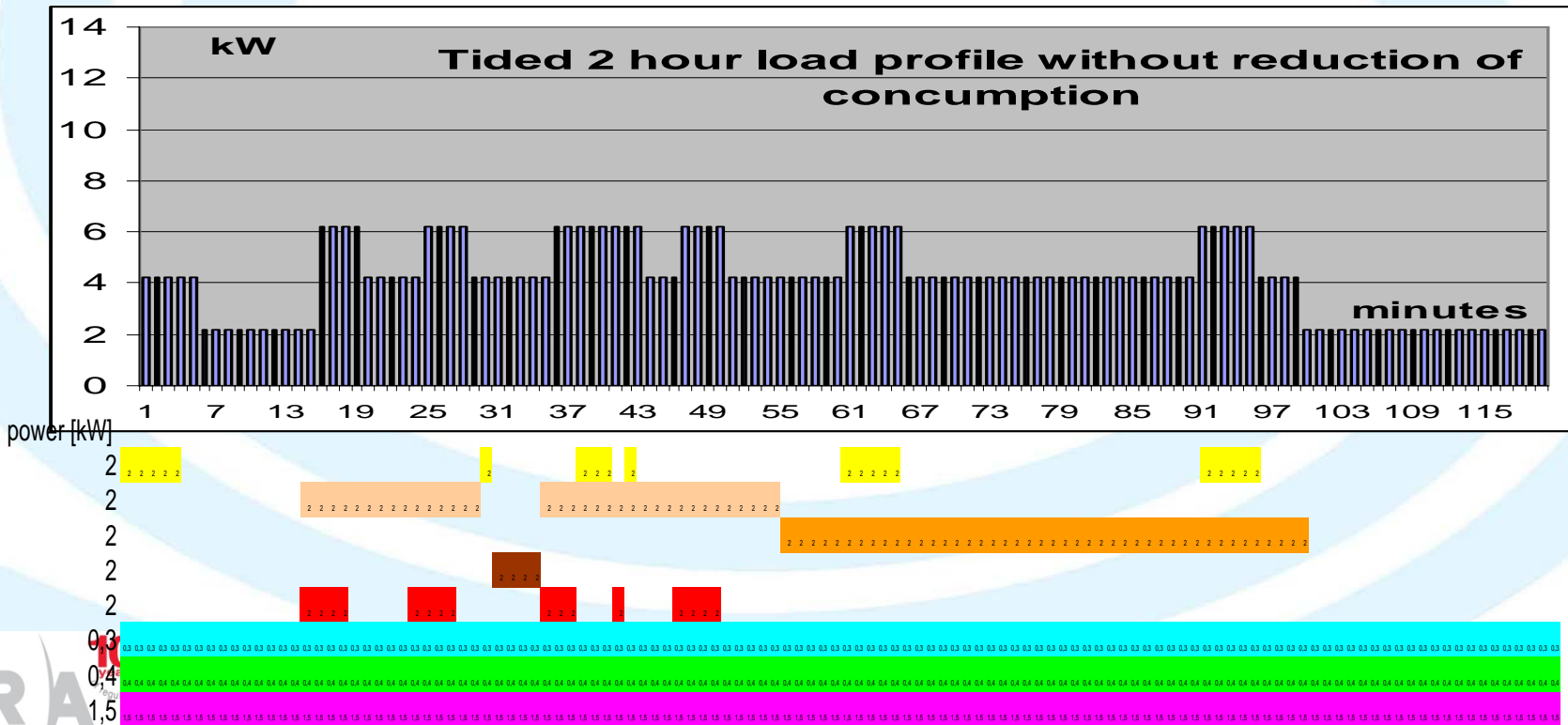
Individual shape of household consumer :

Areas of the possible improvement of energy efficiency

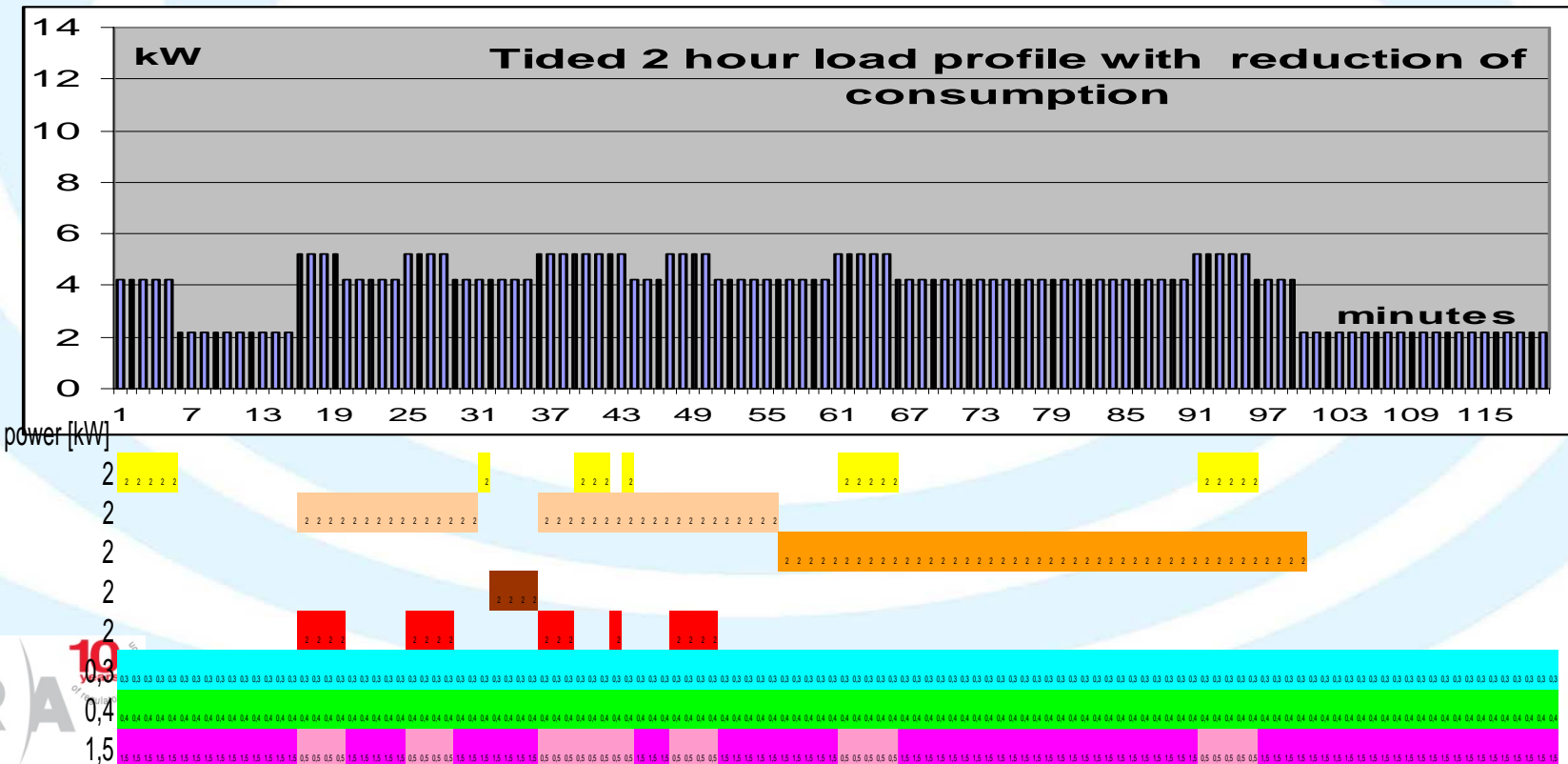▶ Power consumption reduction by soft change of behaviour

Individual shape of household consumer :

Areas of the possible improvement of energy efficiency

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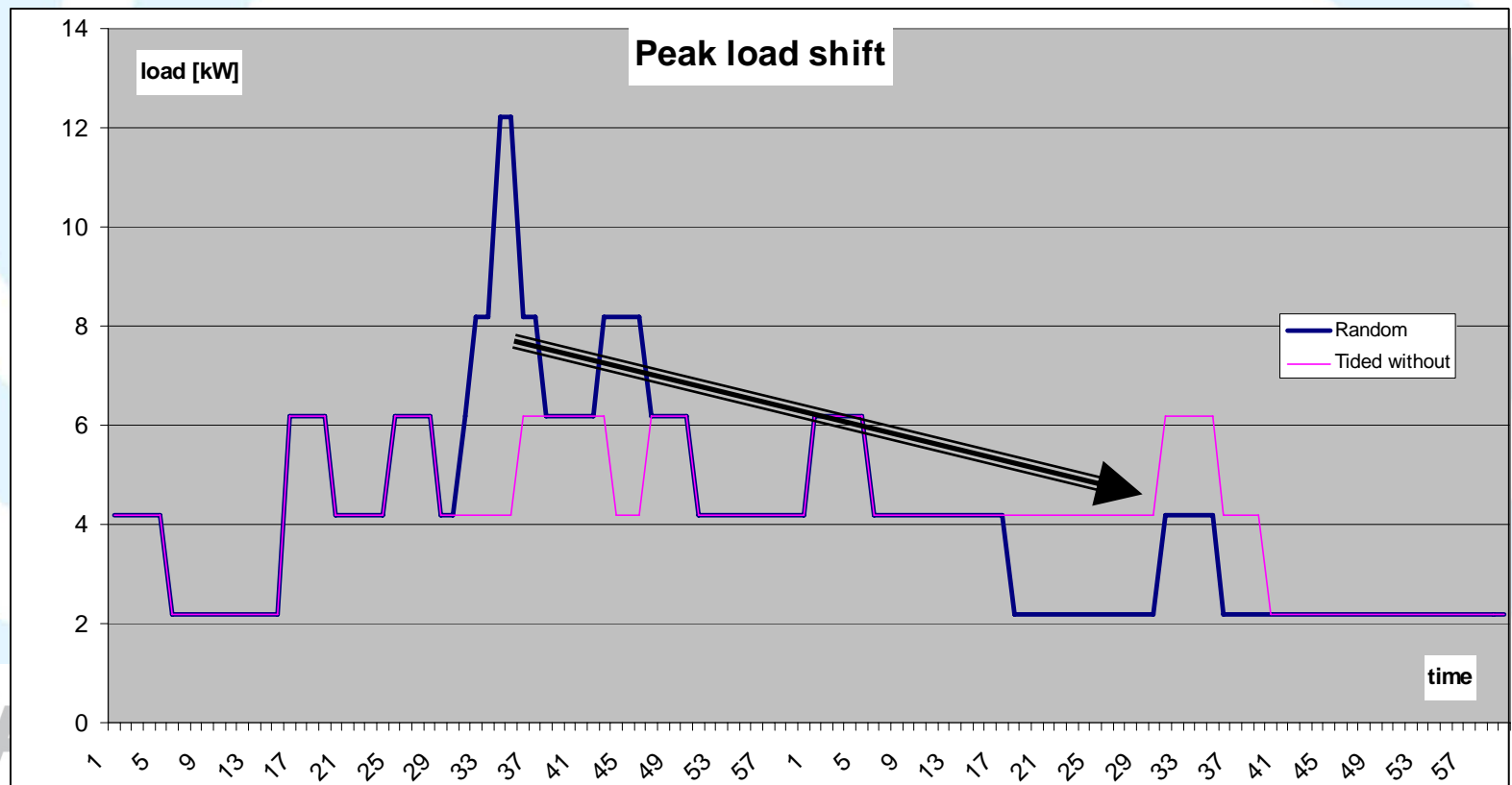
Individual shape of household consumer :

Areas of the possible improvement of energy efficiency

▶ On the operator side

- ◆ current technical losses optimization
- ◆ maintenance costs optimization
- ◆ investment optimization

Areas of the possible improvement of energy efficiency

▶ On the supplier side

◆ mainly, the supplier is motivated to maximise of the sale

but

◆ in certain conditions he has interest to reduce demand level

Available tools/signals for behaviour changing of the market participants

► For the customer:

- ◆ energy price (just) time related
- ◆ energy price whole market energy price related
- ◆ energy price current system situation related
- ◆ power price customer localisation related
- ◆ educational campaign
- ◆ neighbour relationship („competition")
- ◆ income perspective (e.g. prosumer's)
- ◆ non-energy added value

Available tools/signals for behaviour changing of the market actors

► For the DSO:

  ◆ Proper current observation of customer behaviour

  ◆ Proper current observation of network state

  ◆ Proper current observation of distributed generation state

Available tools/signals for behaviour changing of the market actors

▶ For the supplier:

- ◆ Wholesale market price dynamics
- ◆ Current demand dynamics
- ◆ Price flexibility of demand of certain groups of customers
- ◆ Current network state (risk of damages) and congestions management range

Smart grid as a solution

- What is the „ Smart Grid" (from point of view of this approach)?
- Who and why is a „target" of SG solutions?
- SG as a tool for direct observation of customer behaviour
- SG as a communication platform
- SG as a tool for distributed generation development
- SG as a tool for self-observation of customer

Smart grid as a solution

▶ What is the „ Smart Grid" (from point of view of this approach)?

◆ the source of information for all market participants

◆ the communication platform for all signals (information and commands)

◆ the friendly platform for distributed generation (additional income source)

◆ the friendly platform for non-energy added value for customers

Smart grid as a solution

▶ Who and why is a „target" of SG solutions?

◆ Who:

 ◆ Distributed and dissiminated (scattered) customers (less them 40kW of power demand, and even less them 1 MWh/year of energy consumption)

 ◆ The rest of customers („by the way")
 ◆ Network operators

Smart grid as a solution

- Who and why is a „target" of SG solutions?
  - Why:
    - This segment of the market (25% of total consumption) is response on the highest level of load curve
      - ❖ the load shift of this one kind of demand is the most important
      - ❖ the load shift of this one kind of demand is very difficult because of logistical reasons, but it could be more efficient than the industrial demand shift (from certain customer point of view)
    - Distributed investment on the RES is more effective then centralised
      - ❖ because of local heat market, important for all CHP
      - ❖ because of limited scale of renewable primary energy resources

Smart grid as a solution

▶ SG as a tool for direct observation of customer behaviour

▶ Measurement device:
  ◆ with current position register
  ◆ with broader measurements range
  ◆ with „semi - on line" transfer of information to the market partners (one time per day instead of one time per few month to the market partners, one time per every 15 min to the customer)

▶ It means current observation of customer reactions, practically

Smart grid as a solution

► SG as a communication platform

► The levels of information exchange:
- ◆ supplier
- ◆ DSO (TSO)
- ◆ End user's (customer's) Measurement device
- ◆ HAN devices
- ◆ another (non electricity) functionalities

► Efficient links between all a.m. levels

Smart grid as a solution

▶ SG as a tool for distributed generation development

◆ Direct communication tool to each end-user

◆ Indication and measurement of reverse flow of energy (if occurs) from each of end-user

◆ No additional technical barriers for agreement of connection conditions for new small energy source located inside customer property

Smart grid as a solution

► SG as a tool for self-observation of customer

- ◆ Closed loop of information between certain behaviour and its effect
- ◆ Possibility of current observations of effects of certain modes of using of certain HAN devices – the open way to learn more effective behaviour
- ◆ Possibility of limited automation of reactions on the market signals – free of permanent meaning solutions

Conclusions

► It is true, that is possible to improve energy efficiency without SG solutions,

but:

► SG implementation is a crucial condition for EE improvement much easier and much effective

because:

♦ SG infrastructure could be a source of all important signals,

♦ SG infrastructure could be an efficient platform for all important information exchange.

Thank You for Your Attention !

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