Dynamic water prices for promoting a sustainable and efficient use

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Context

KEY TECHNOLOGIES

Smart metering

Real-time monitoring

Improved demand forecast

DRIVERS

Need to improve efficiency, cost recovery and sustainability

Raise of “Open Data”

Demand Side Management

Raise of the DYNAMIC PRICING for…

- *Influence consumption patterns*
- *Generate savings in capital and operating costs*

HOW?

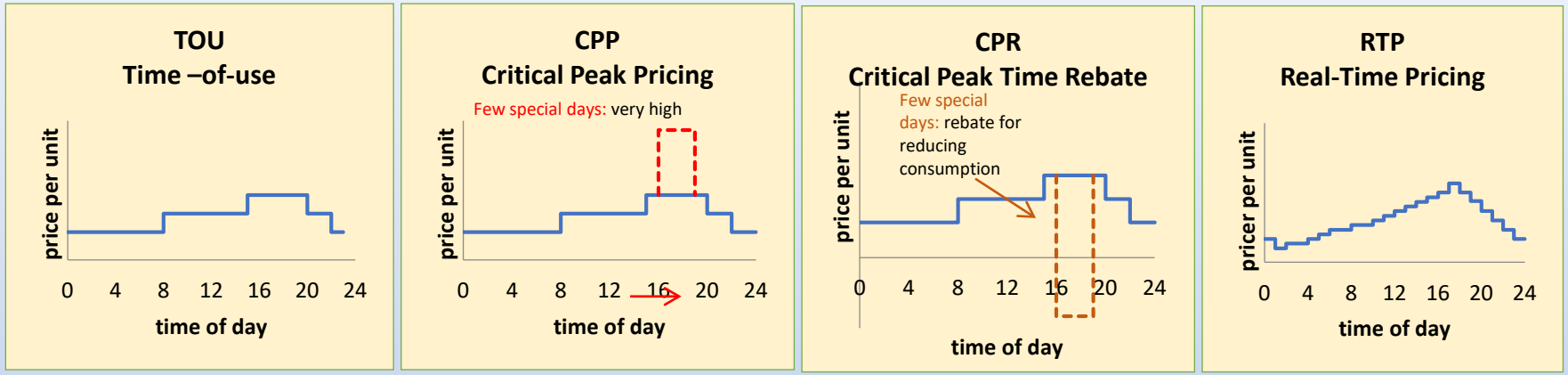
Improving the ACCURACY OF PRICE SIGNALS that consumers face during any timeframe or situation, gives them an incentive to ADJUST THEIR USAGE during high-cost and low-cost periods

- More efficient operation of the system
- Defer the investment in new resources or capacity updates
- Reduce environmental impact
- Energy use efficiency
- Better drought policies

What are dynamic tariffs?

- Dynamic pricing options are a step forward from current constant prices regardless of supply/demand balance or regardless of the underlying costs of supplying the service at different time intervals.
- Their application is spreading through many sectors (electricity, telecommunications, transport, insurance, etc.) as there is the need to find strategies and **solutions that lead to a better recovery of the costs of supply**: as many long-term vision reports affirm (Jones, 2010; Swabey, 2007), “in response to rising constrained supply of some resources and in a desire to more finely tune consumer behavior in a proactive manner, the advent of dynamic pricing models is on the horizon”.
- These innovative models become a reliable option in demand-side management thanks to the use of smart technologies: smart metering, real-time monitoring and improved demand forecast.
- Dynamic tariffs: tariff schemes that **recognize the underlying real time costs of service supply or use**, as opposite to conventional tariffs where this signal is not so inherent

Typical dynamic pricing schemes (electricity, transport or insurance sector)



- The choice of the best pricing scheme depends on the management objective and the technical feasibility

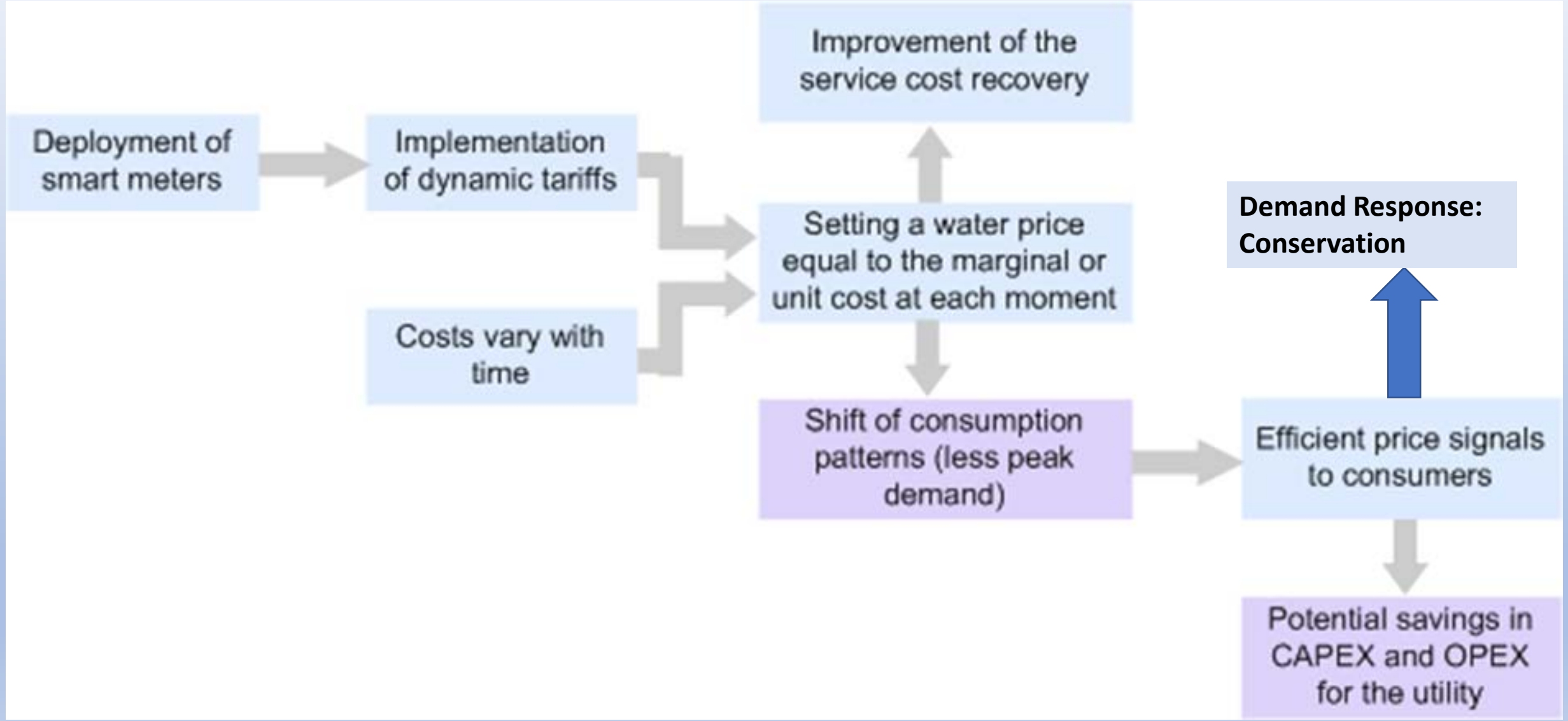
Tariff scheme	Objective	Mechanism
Time of use tariffs (TOU)	Smooth daily demand patterns	Different peak and off peak prices
Critical peak pricing (CPP) and Critical peak rebate (CPR)	Reduce demand drastically during special events	Very high prices during special events
Real time pricing (RT)	Reflect real time costs	Many different pricing periods along the day, prices are updated regularly

With a TOU structure, prices vary within a day and the rate structure is the same on all days. CPP and CPR are similar to TOU tariffs, additionally they provide very large incentives to change consumption during few special events. Each of these tariffs schemes may be useful to give pricing signals on time-related costs of water services

Objectives of Water Dynamic Tariffs

- Better reflecting **time-related costs of water services** and to manage water demand
- To shift water demand to time periods when water services provision or wastewater treatment are less costly so that the utility (and consumers) may save costs. These potential cost saving may contribute to achieving the goal of full cost recovery in a more efficient way.
- Then, a working definition of a dynamic water tariff and a time-varying water pricing scheme refers to **any tariff structure for water services that charges different prices depending on the time of water use.**

Description of how a dynamic tariff can have an impact in potential savings for CAPEX and OPEX and in water demand



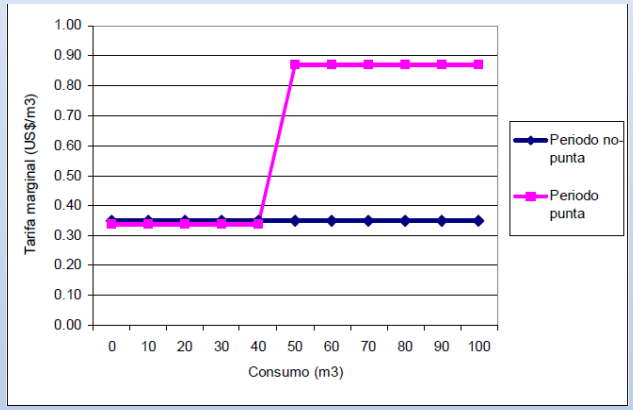
Time-related costs of water services supply and sanitation

- Costs of water services depend on many factors some of which are subject to the time of consumption. For instance, costs of water services provision vary throughout the year, e.g. providing water during dry month may be more costly than during rainy month. Also costs of water provision may vary within a month, within a week or even within a day.
- Some of the aspects that affect costs of water services and that are not constant over time are listed below:
  - **Climate:** temperature, rainfall, droughts, floods
  - **Hydrological aspects**: use of different water sources (Kondili & Kaldellis, 2005) and varying raw water quality affect costs
  - **Water consumption demand**: peak periods with high demand, off-peak periods with low demand
  - **Network operation aspects**: above all energy costs and costs related to network capacity
  - **Costs of sewer system and waste water treatment** also change with the time of water use.

Cases for a Dynamic Water Tariff

- **Seasonal tariff**: higher water service prices in hot months than in cold ones (Ex. Aguas Andinas)

	Tarifa Única	
	Periodo punta	Periodo no punta
Cargo Fijo	0.77	0.77
Cargos variables		
0-40m^3	0.35	0.34
>40m^3	0.35	0.87



- **Drought based tariff**: water tariffs increases during drought periods to reduce water consumption when water is scarce
- **Daily time-of-use tariff**: higher tariffs during daily peak hours than during off-peak hours to smooth daily water consumption patterns

Demand Response: Do dynamic prices alter consumption patterns or not?

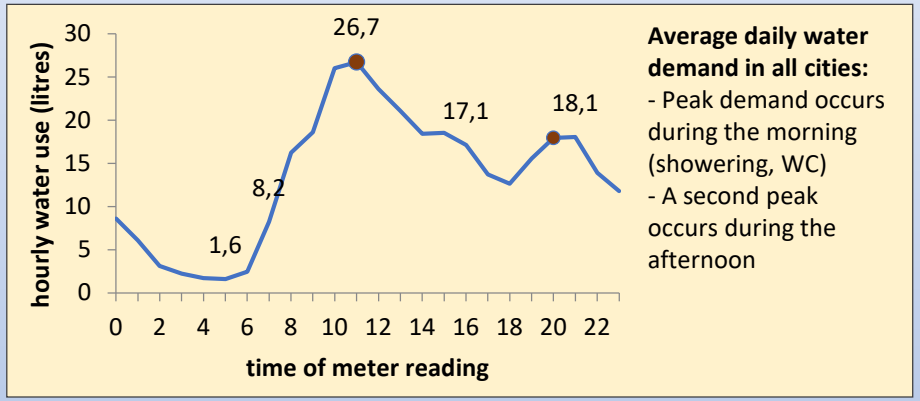
- Demand response during a specific time periods is composed by two effects:
- **Demand shift** describes a change of the time of consumption while the overall amount consumed remains the same.
- **The conservation effect** refers to any reduction in total consumption with respect to some benchmark consumption prior to changes in the tariff design that is attributable to the pricing programme (evidence in electricity)

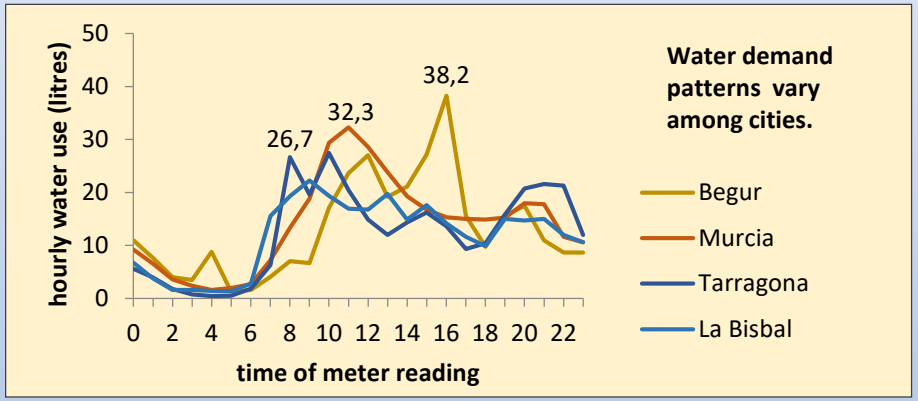
Water Demand Patterns

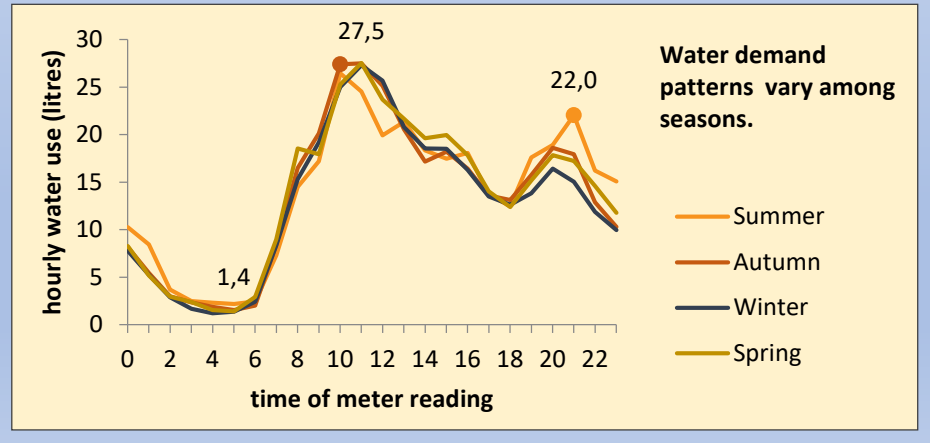
- In order to design a dynamic pricing in water, to carry on a brief analysis of data on hourly water consumption of a sample of water users may help us to define the target.
- Usually, the idea that residential water users show clear peak demand patterns is assumed.
- However, non-residential water users show less generalizable water demand patterns and the existence of peak demand patterns is industry or user-specific.

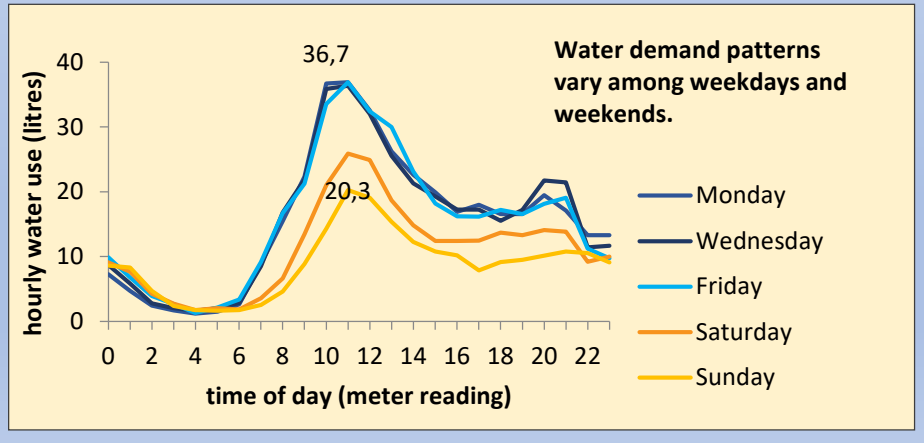
Data evidence: RESIDENTIAL hourly water demand patterns

- Sample: Hourly water consumption of 56 residential water users in Begur, La Bisbal, Tarragona and Murcia; July 2011 to July 2012



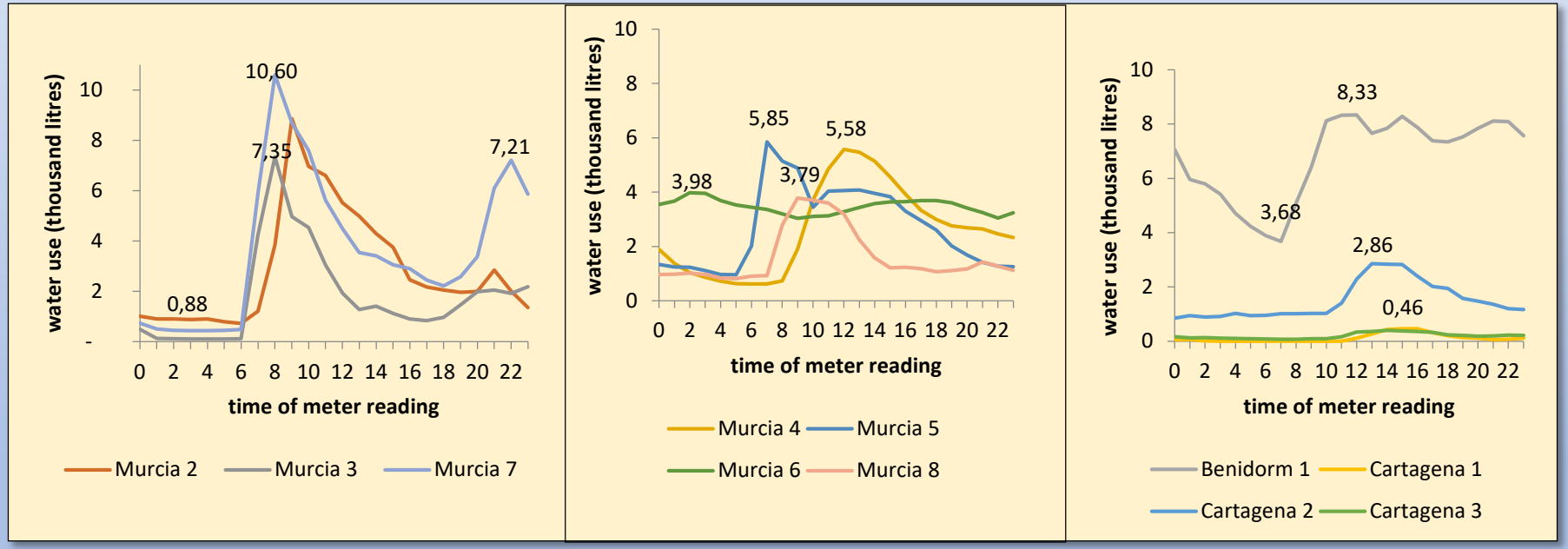






Data evidence: INDUSTRIAL hourly water demand patterns

- Sample: Hourly water consumption of 12 industrial water users in Murcia, Cartagena and Benidorm;
- Water demand of industrial water users does not follow a common peak demand pattern



SURVEY RESULTS: Assesment of Water Demand Patterns (Residential water users)

- **DEMAND SHIFT:**
- According to the survey, a TOU Tariff would trigger a demand shift: **slightly less than 1/3 (one third) of the sample (400) would shift water consumption** from day to night if there was a day/night water rate. Slightly more than 2/3 (two third) would not shift any consumption from day to night if there was such rate.
- Those people who would shift consumption from day to night state that they would shift 37,9% on average.
- The entire sample (including people who would not shift any water consumption) would shift 11,75% of their water use from day to night on average.

- **CONSERVATION EFFECT:**
- As per the respondents, a TOU would trigger a conservation effect: 59% of the respondents state that they would reduce the total daily volume of water used if there were day/night water rates.

SURVEY RESULTS: Assesment of Water Demand Patterns (Industrial water users)

- **DEMAND SHIFT:**
- According to the survey, a TOU Tariff would trigger a **very limited demand shift: 7% of the sample** (54 companies) would shift water consumption from day to night if there was a day/night water rate.
- Those four companies who would shift consumption from day to night state that they would shift 37,9% on average. Their average monthly water consumption is 3.862 m3 and they belong to the following sectors: food and beverage industry, metallurgy and metal products industry, paper industry and a hotel from the service sector.
- 93% of the sample (54 companies) state that they would not shift any consumption from day to night if there was such rate.
- The entire sample (including companies who would and who would not shift any water consumption) would shift between 2,3% and 4% of their water use from day to night on average if there was a day/night water tariff
- **CONSERVATION EFFECT:**
- As per the respondents, a Blue Tariff would trigger a conservation effect: 17% of the respondents (10 companies) state that they would reduce the total daily volume of water used if there were day/night water rates. Of these 10 companies, 4 belong to the industrial sector (representing 12% of the industrial sector and the corresponding subsectors are food and beverage, rubber and plastic, paper, metal and metallurgy industry) and 6 to the service sector (representing 25% of the service sector and the corresponding subsectors are hotels, sport club, hospital and educational services).

SIMULATION ON THE BUSINESS CASE AND ECONOMIC IMPACT

- Owing to the preliminary simulations conducted in order to evaluate the impact of a Blue Tariff on energy costs, we have seen that the software SAPHIR and BioWin make up an effective approach for evaluating the economic implications in the case of a shift in water demands and a shift of wastewater flows respectively.
- The simulation results show **that the energy costs depend on the distribution of the demand or the effluent along the day. Thus a Dynamic Tariff may be an effective tool for generating energy cost savings if it generates the desired modification of the moment of water use and/or discharge.**

Conclusions

- A dynamic tariff for non-residential consumers seems unlikely to generate a sufficient demand response to provoke a noteworthy economic impact on the costs of service operations.
- Even if a TOU Tariff will be implemented for the non-residential consumers, quantities such as
  - the reduction of total daily water consumption
  - the water quantity to be moved in other moments of the day or during the night

will be the key point.

- Application of new schemes depends on the changes in current regulation. Now, prices discrimination in the same water use is not allowed in some countries and technology is not implemented extensively yet. But, all is evolving quickly and innovation and disruptive innovation is leading competitive business.

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- Many Thanks for your attention !!

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