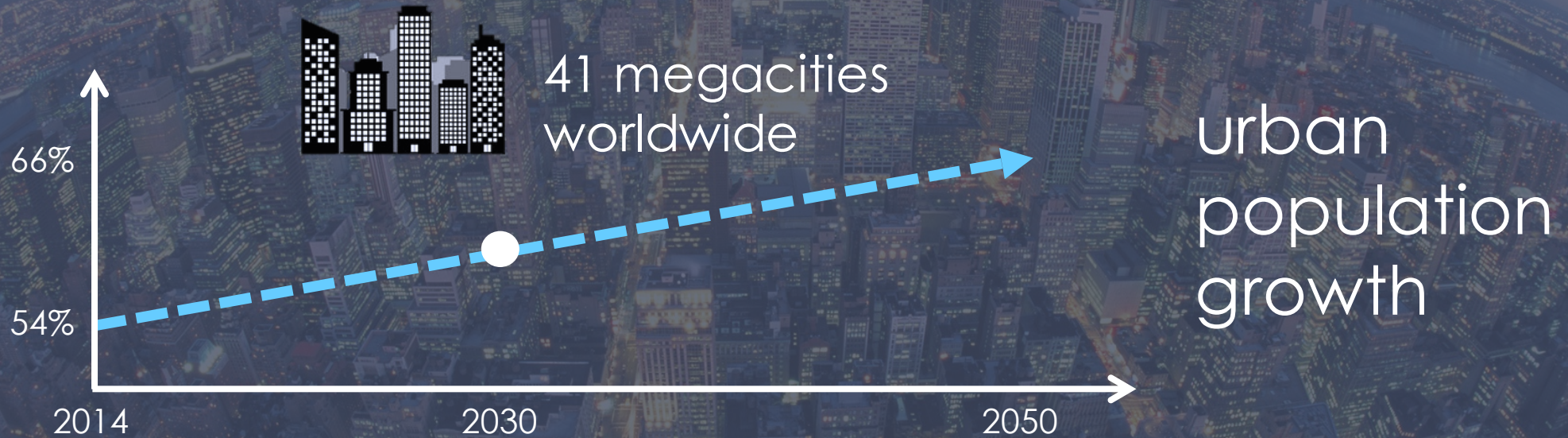




SmartH2O
an integrated platform coupling smart water meters
with ICT and data intensive modeling to
support residential water management

Andrea Cominola, the SmartH2O Consortium

URBAN CONTEXT



Source: United Nations. Department of Economic and Social Affairs. Population Division, 2010

URBAN CONTEXT



URBAN WATER DEMAND MANAGEMENT

URBAN CONTEXT

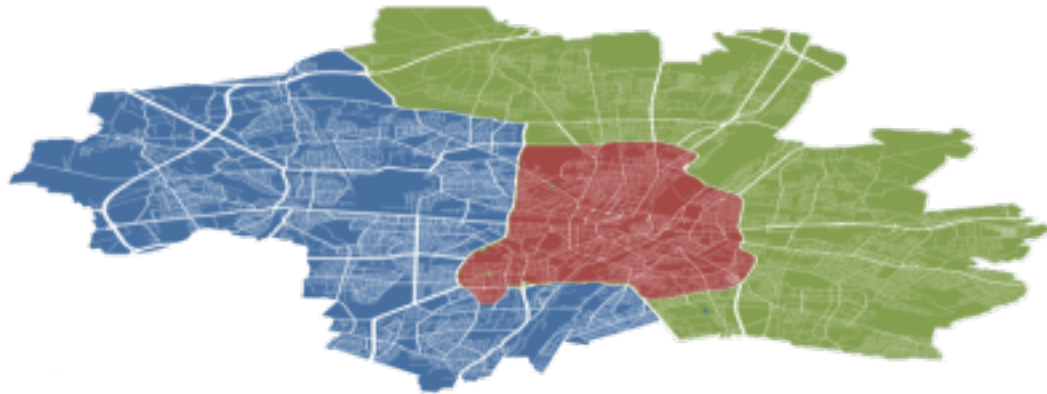
DEMAND MANAGEMENT



available resource

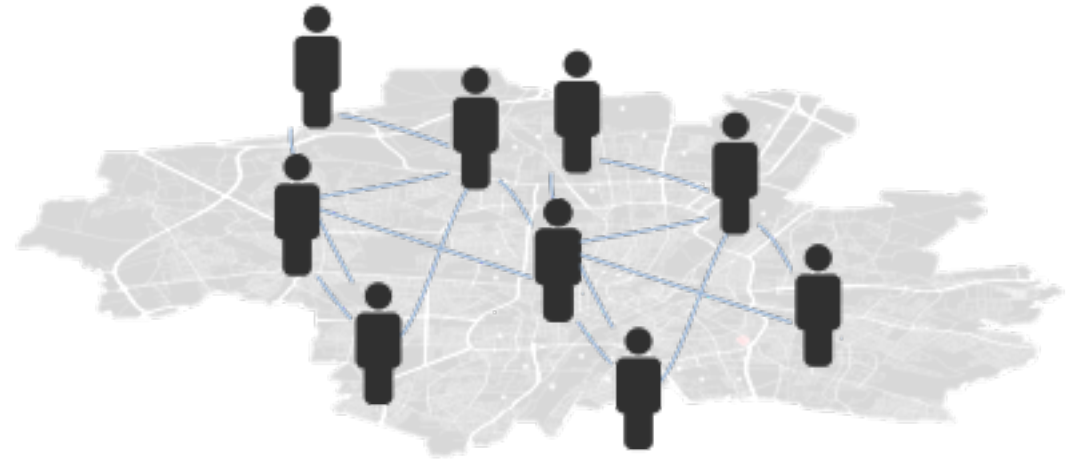
URBAN WATER DEMAND MANAGEMENT

city scale



strategic level
planning

user level



customized management
tailored WDMS



MAIN GOAL

Understanding, modelling and modifying consumers behavior to achieve quantifiable water savings in the residential sector

KEY ELEMENTS



- High-resolution water consumption data
- Interaction with customers for information sharing and socio-psychographic data gathering
- Gamification techniques for users engagement

LEVERAGES FOR WATER DEMAND MANAGEMENT



- Customized feedbacks to water consumers – **RECOMMENDATIONS**



- Rewards (and dynamic pricing) – **BEHAVIOURAL ECONOMICS**

LOCARNO | CH

Società Elettrica Sopracenerina
power supply utility, 80 thousand
customers served

Interested in multi-utility smart metering
(water, energy, gas)

Almost 400 smart water meters installed

LONDON | UK

Thames Water water supply utility
15 million customers served

2.6 GI/day drinking water distributed

Development plan: 3 Million smart meters
installed by 2030

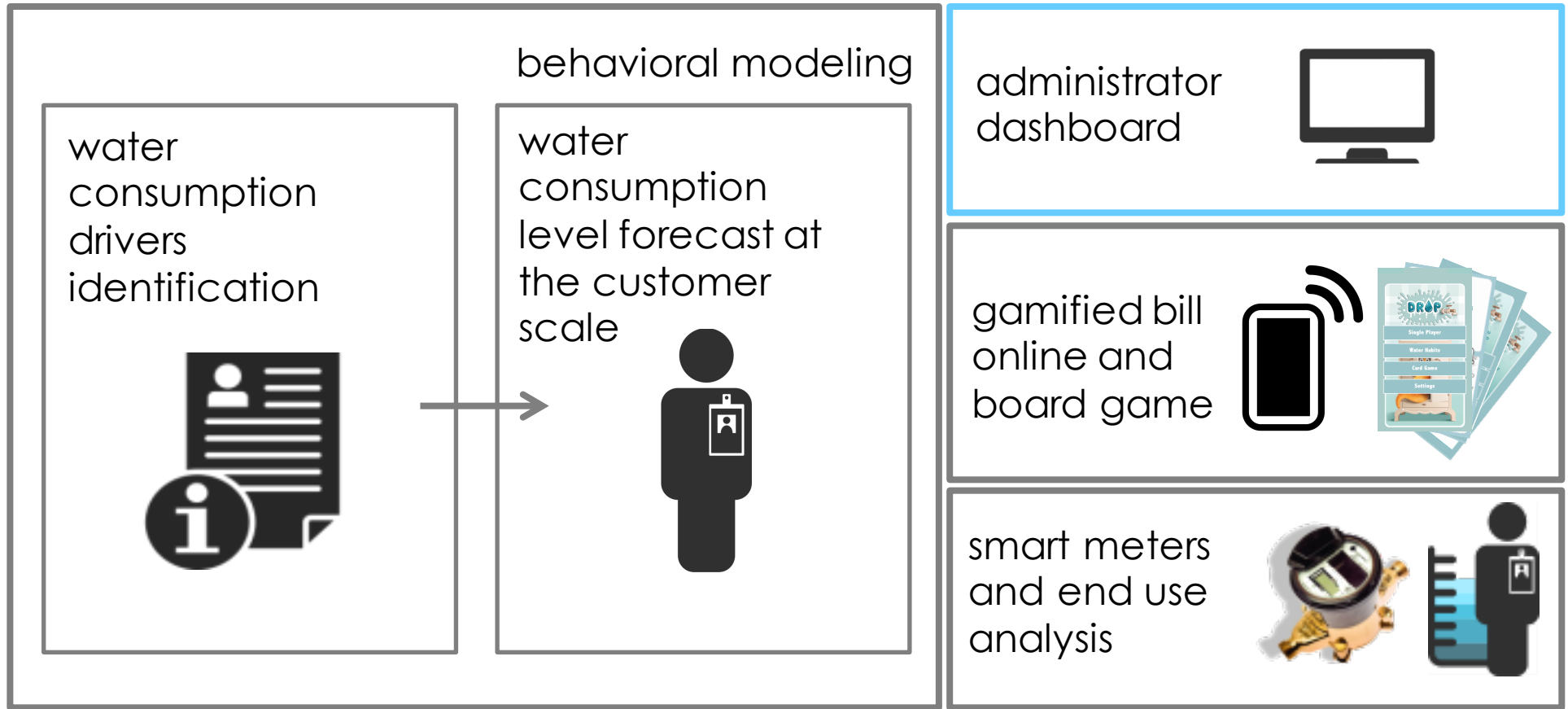
VALENCIA | ES

EMIVASA water supply utility
2 million customers served

490,000 water smart meters currently installed

Development plan: 650,000 water smart meters
installed by end 015.





Response to
WDMS

tailored feedbacks
prescriptive norms
gamified bill
price schemes

This block contains four icons: a document with an information symbol (i), a dollar sign (\$), a smartphone with a signal icon, and a network diagram with three nodes.

sH₂  platform

Technological insights

SMART METERS

1-hour sampling resolution data
400 new smart meters installed in the Swiss case



ONLINE SURVEYS

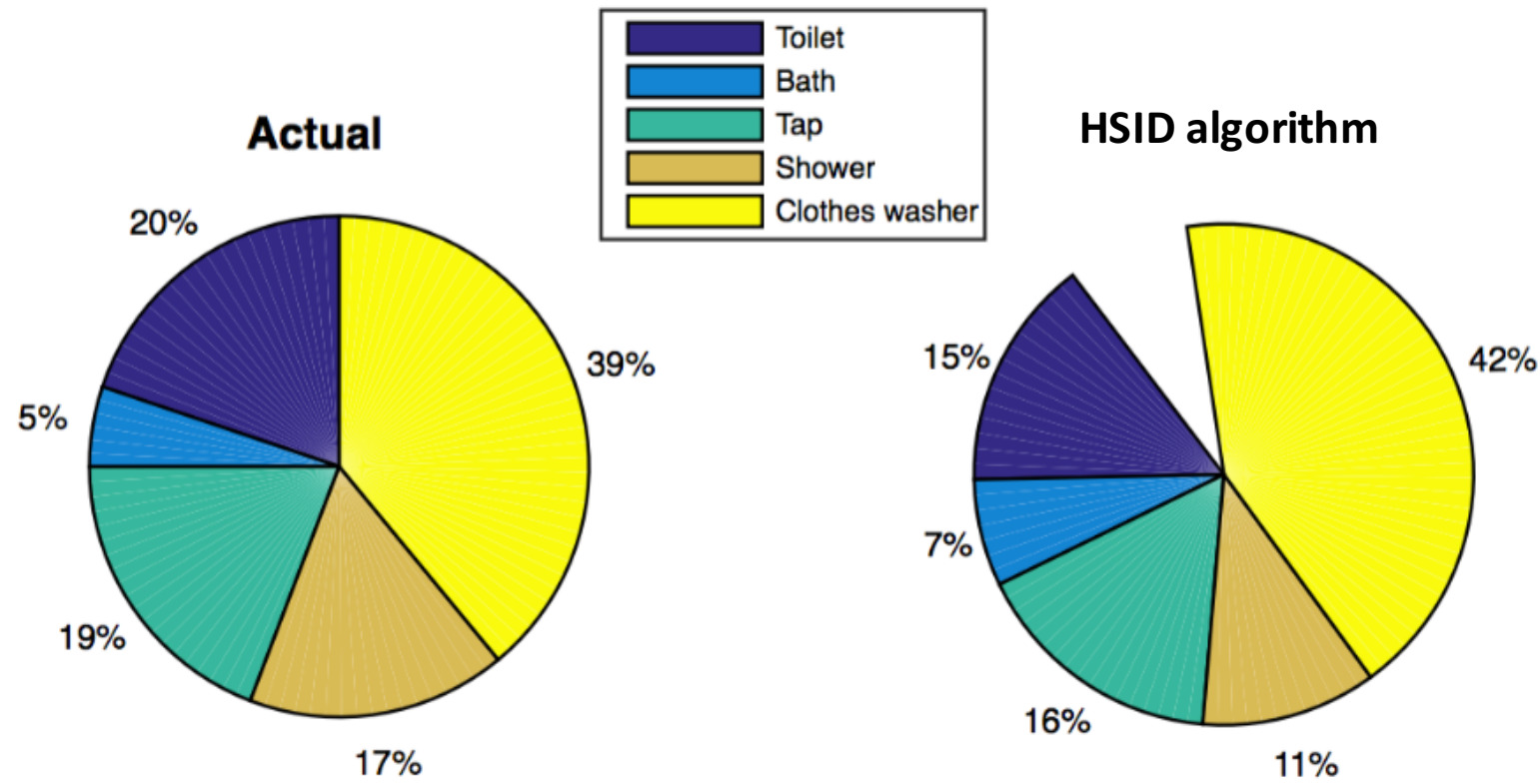


- online surveys are rolled out with the SmartH2O users, in order to collect **users' psycho-sociographic data** (e.g., house characteristics, water consumption devices) and **attitudes** (water saving and consumption attitudes and water price preferences)
- surveys are also developed to get feedbacks from the users on the usability of the SmartH2O platform

END_USE CHARACTERIZATION

A new algorithm to perform household energy and water consumption

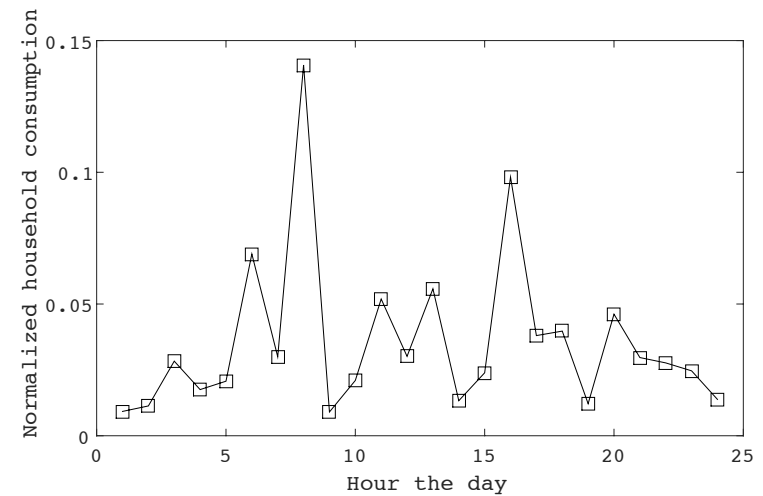
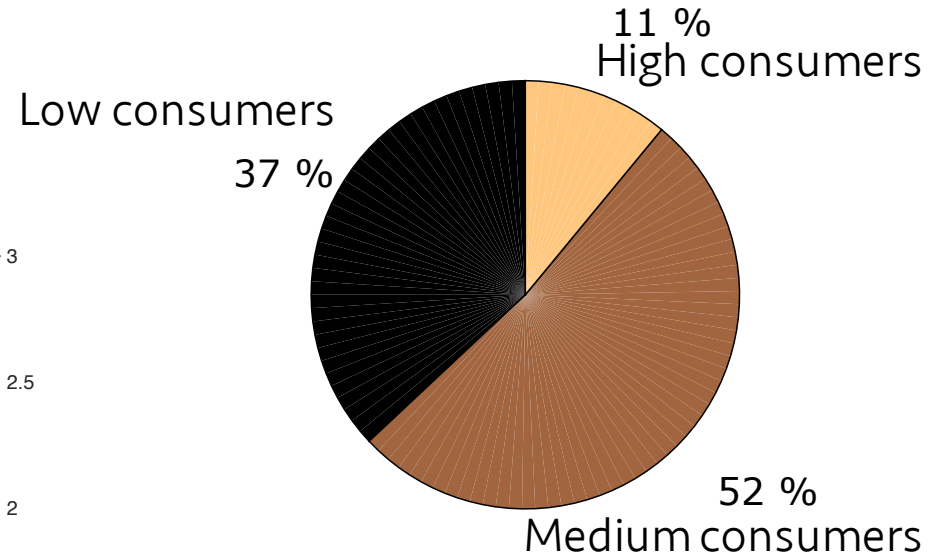
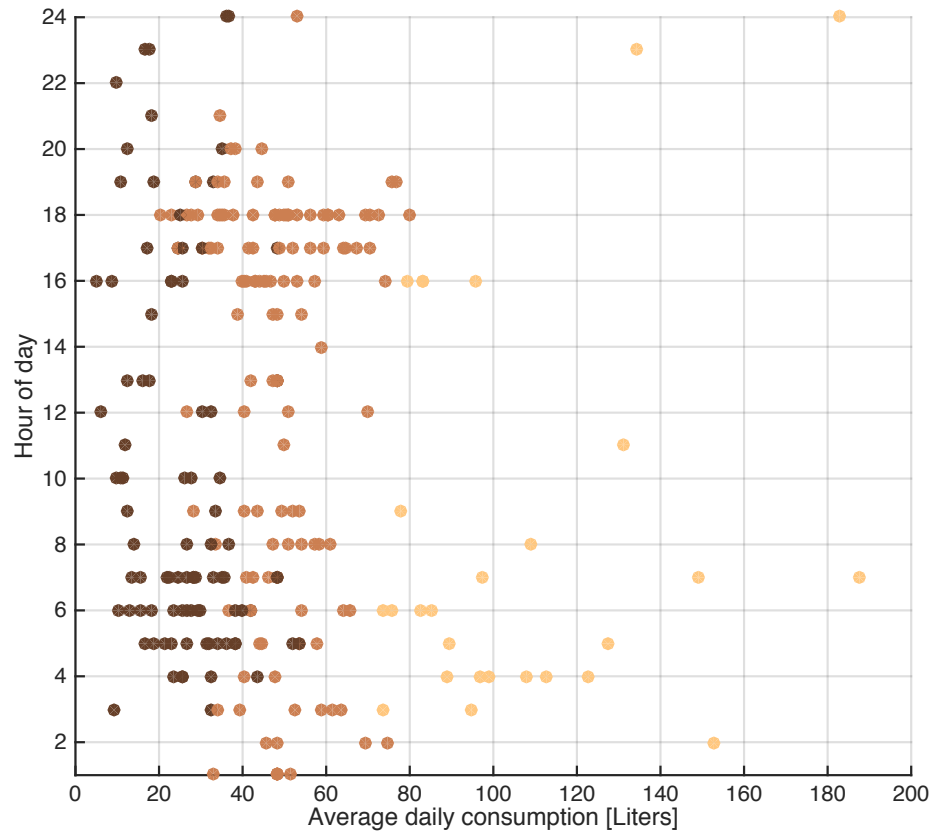
TRACE DISAGGREGATION into end-uses (e.g., washing machine, toilet, tap, etc...) has been developed, with the purpose of profiling users' consumption.



Preliminary experiment:
1 household (New Zealand)
Piecewise constant trajectories on 1 min resolution built from 10s resolution sampling

USER BEHAVIOURAL MODELING

Single user's BEHAVIORAL MODELING through CLUSTERING and CLASSIFICATION techniques.



USER BEHAVIOURAL MODELING

A first prototype of AGENT-BASED MODEL for multi-user modelling

Water consumption

Agent-based model for Water Consumption Simulation in the Swiss city of Tegna

[Show description](#)

Statistics :

Total consumption (lt): 126

Households' level state

Low consumption:127

Medium consumption:106

High consumption:12



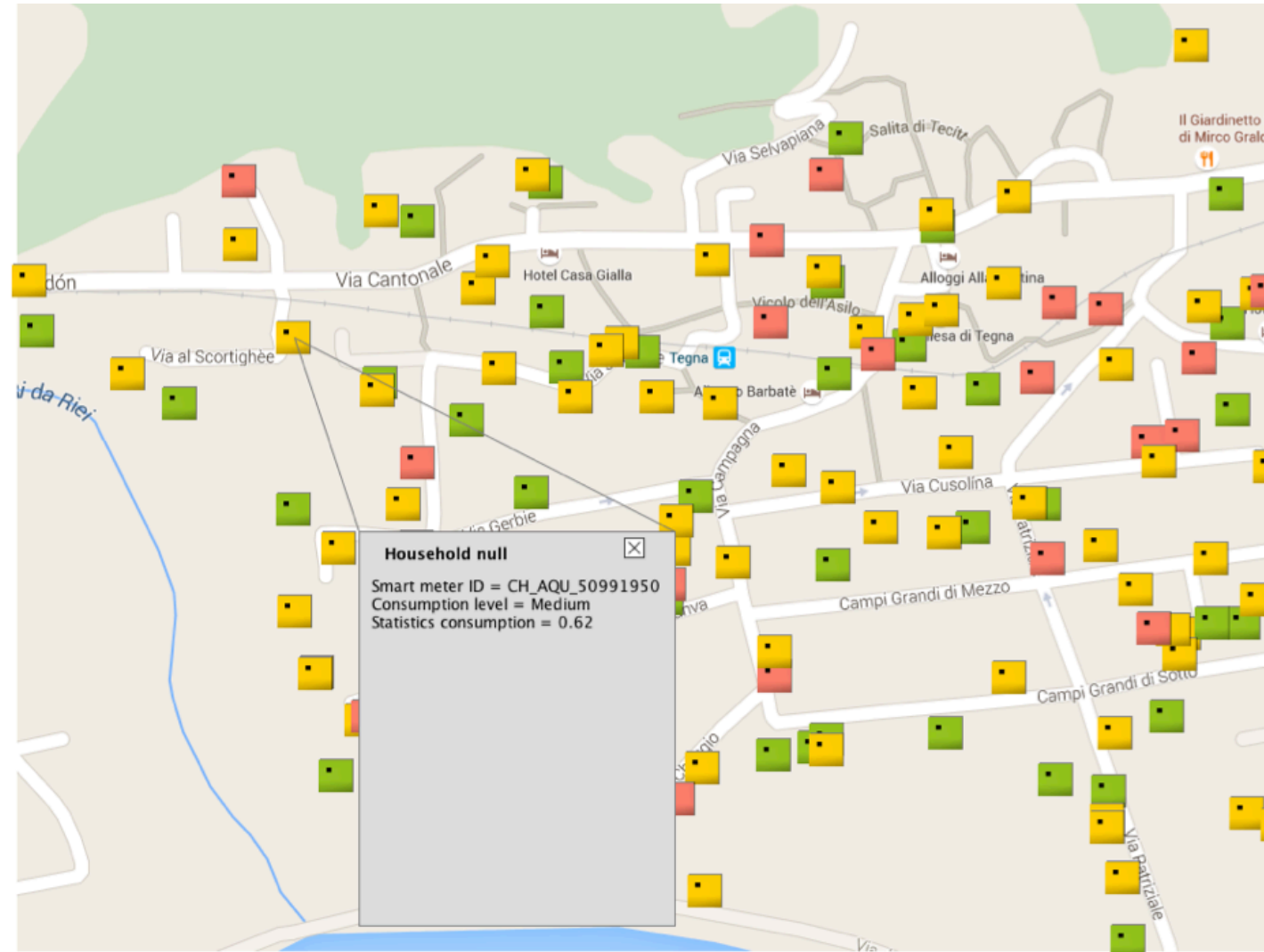
- Low consumption (%): 1.007 (51.8%)
- Medium consumption (%): 0.841 (43.3%)
- High consumption (%): 0.095 (4.9%)

Legend :

Household consumption level

- low
- medium
- high

- Map
- Territory
- None





UK flag | Settings gear | Profile: Emma

Status

Tips

Household profile

Leaderboard

HOUSEHOLD CONSUMPTION Days

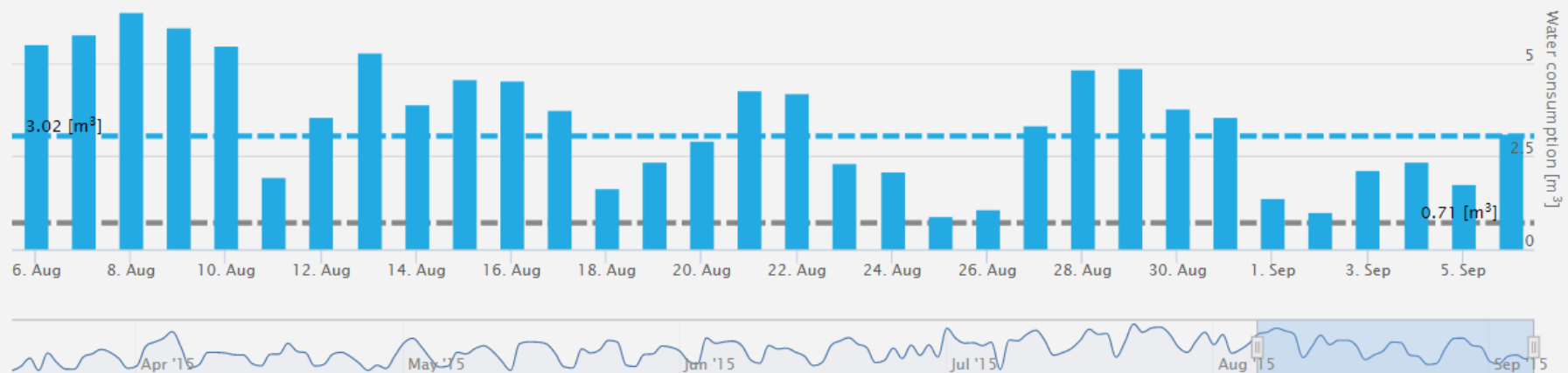
Detailed consumption | Overview

Data updated on 2015-09-06 - Click on bars to see hourly consumption

your daily average neighborhood average

Zoom 1m 3m 6m All

From Aug 6, 2015 To Sep 6, 2015



CUSTOMERS ENGAGEMENT and GAMIFICATION

The screenshot displays the SH2 water utility app interface. At the top, the current meter reading is 186.593 m³. The user's name is Emma. The interface is divided into several sections:

- 7 DAYS LEADERBOARD:**

Rank	Name	Points
1	Luca	400 Points
2	James	400 Points
3	Caleb	400 Points
4	Matthew	350 Points
5	Emma	300 Points
6	Giorgia	50 Points
7	Jacob	50 Points
- OVERALL RANKING:**

Rank	Name	Points
61	Lucas	8,800 Points
62	Grace	8,450 Points
63	Mason	8,400 Points
64	Andrew	8,400 Points
65	Christopher	8,400 Points
66	Zoey	8,350 Points
67	Jayden	8,350 Points
68	Victoria	8,250 Points
69	Daniel	8,150 Points
- Your Achievements:**
 - Total points: 8,100
 - Your past actions: Read a tip (8/27/15 2:47:30 PM) - 100 points
 - Achieved Badges: 3 (represented by icons)
 - Available Rewards: 3 (represented by icons)
- Eager for more points?:**
 - 100 points
 - Read a tip: Learn to save water with our practical tips
 - Go
- Leaderboard:**

Rank	Name	Points
69	Daniel	
70	Emma	
71	Audrey	



sH₂  next steps



SMART

SENSORS

Water consumption

Agent-based model for Water Consumption Simulation in the Swiss city of Tegna

Show description

Statistics :

Total consumption (lit): 126
Households: 126

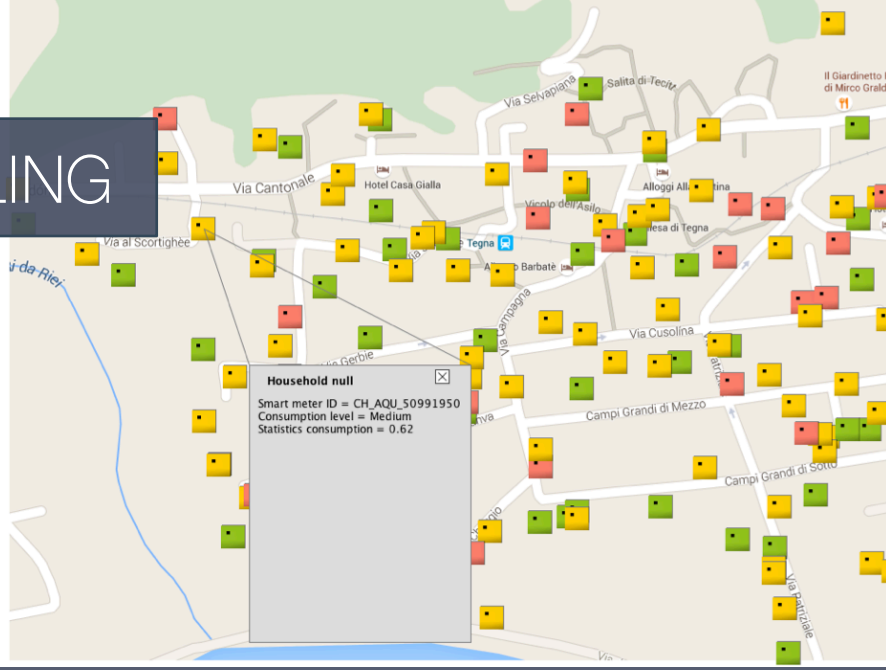
MODELLING



- Low consumption (%): 1.007 (51.8%)
- Medium consumption (%): 0.841 (43.3%)
- High consumption (%): 0.095 (4.9%)

pick random household

- Legend :
- Household consumption level
 - low
 - medium
 - high
 - Map
 - Territory
 - None



SMART SENSORS

Water consumption

Agent-based model for Water Consumption Simulation in the Swiss city of Tegna

Show description

Statistics :

Total consumption (m³): 126
Households: 126

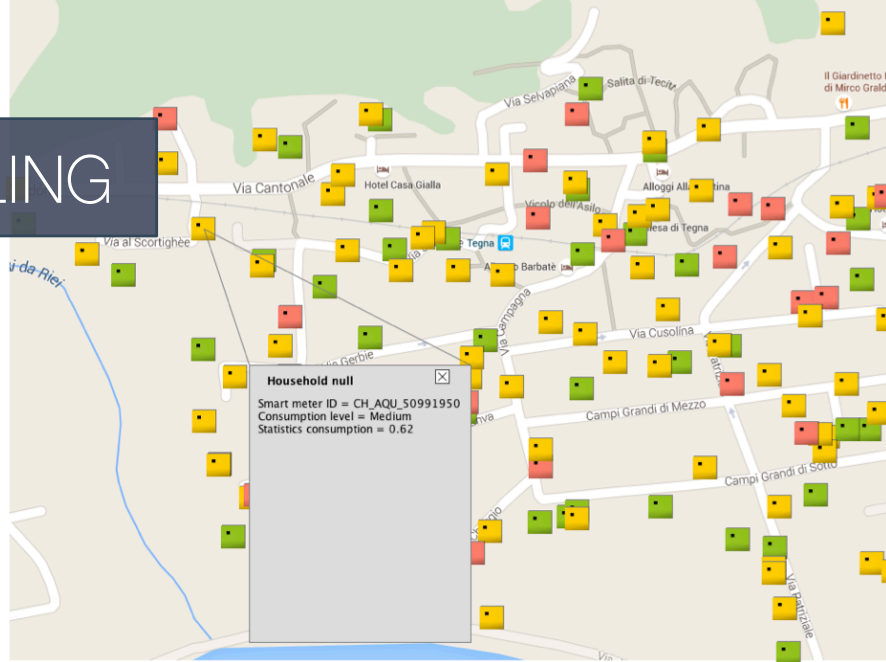
MODELLING



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- Medium consumption (%): 0.841 (43.3%)
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pick random household

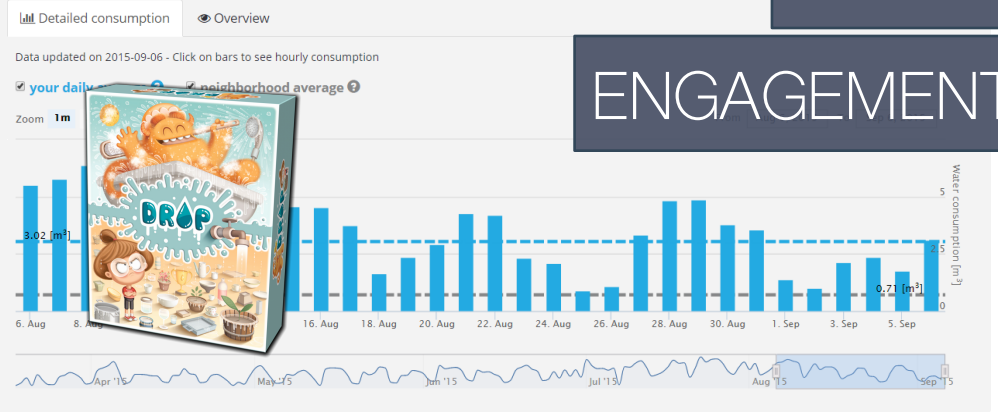
- Legend :
- Household consumption level
 - low
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 - Map
 - Territory
 - None



HOUSEHOLD CONSUMPTION

USERS'

ENGAGEMENT



SMART SENSORS

Water consumption

Agent-based model for Water Consumption Simulation in the Swiss city of Tegna

[Show description](#)

Statistics :

Total consumption (m³): 126

Household consumption (m³): 126

MODELLING

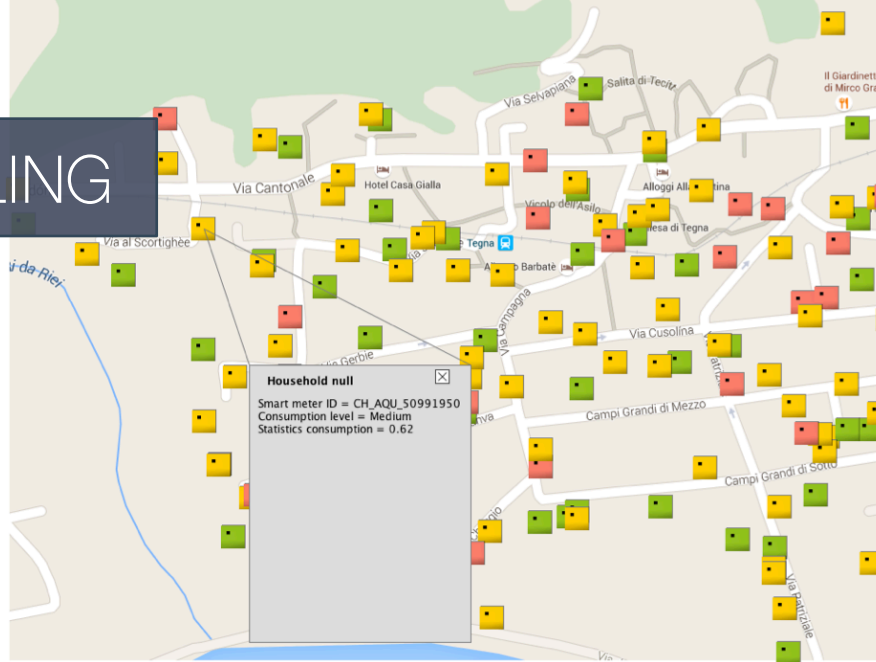


- Low consumption (%): 1.007 (51.8%)
- Medium consumption (%): 0.841 (43.3%)
- High consumption (%): 0.095 (4.9%)

[pick random household](#)

- Legend :
- Household consumption level
 - low
 - medium
 - high

- Map
- Territory
- None



Household null

Smart meter ID = CH_AQU_50991950
Consumption level = Medium
Statistics consumption = 0.62



Status

Tips

Household profile

Leaderboard

HOUSEHOLD CONSUMPTION

Days

USERS'

Detailed consumption

Overview

Data updated on 2015-09-06 - Click on bars to see hourly consumption

your daily consumption

Zoom



3.02 m³

6. Aug

8. Aug

16. Aug

18. Aug

20. Aug

22. Aug

24. Aug

26. Aug

28. Aug

30. Aug

1. Sep

3. Sep

5. Sep

0.21 m³

Apr '15

May '15

Jun '15

Jul '15

Aug '15

Sep '15

ENGAGEMENT



SMART

SENSORS

Closing the loop with the design and implementation of customized water demand management strategies

Water savings monitoring

Scuola universitaria professionale
della Svizzera italiana

SUPSI



POLITECNICO
MILANO 1863



The University of Manchester



UNIVERSITAT
POLITÈCNICA
DE VALÈNCIA

SETMOBILE

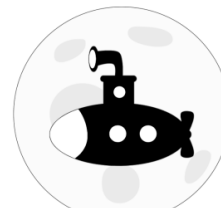


EIPCM

EUROPEAN INSTITUTE FOR
PARTICIPATORY MEDIA



Società Elettrica Sopracenerina



moonsubmarine



emivasa



AJUNTAMENT DE VALÈNCIA



sH₂ 

the smart H₂O project
A European project on water sustainability

<http://www.smarth2o-fp7.eu/>



@smarH2Oproject
#SmarH2O
@AndreaCominola
@NRMPolimi

thank you

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Department of Electronics,
Information and Bioengineering