# Intelen

## ENGAGING PEOPLE TO RETH!NK

# Behavioral Demand Response (BDR) based on Digital Consumer Engagement & smart meters in Crete

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Intelen is a technology and engagement software provider focusing on the energy utility sector.

Intelen focuses on energy and utility market of USA and Europe.

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ENGAGING PEOPLE TO RETH!NK

The science behind

COLLECTING

PROCESSING

DELIVERING

Alter human behaviors

Energy management

Education about sustainability

Energy efficiency

⚡ Energy data
Behavioral data
👤 Demographic data
♡ Psychographic data

Data mining techniques

Pattern detection algorithms

Real time analytics

Event-based actions
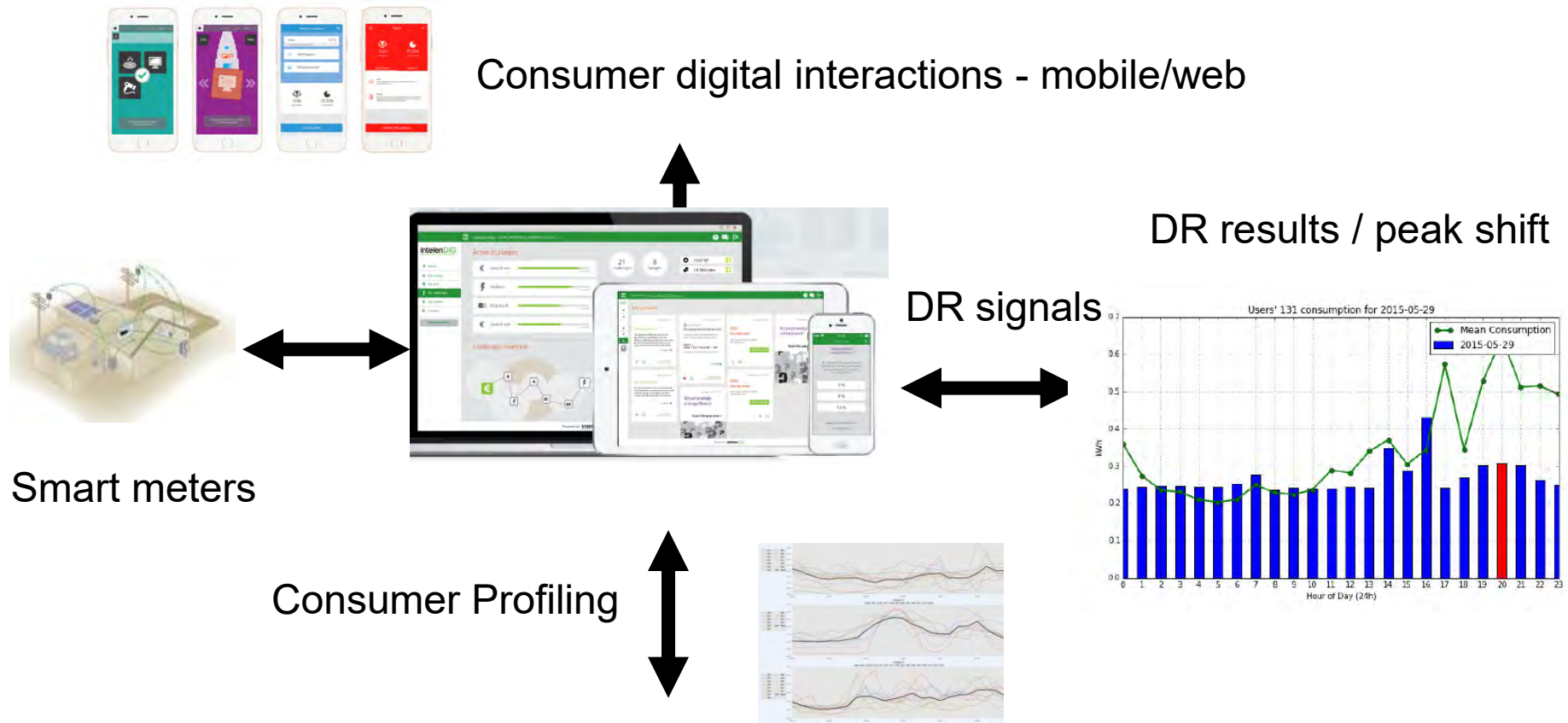
Gamification

Social Interaction
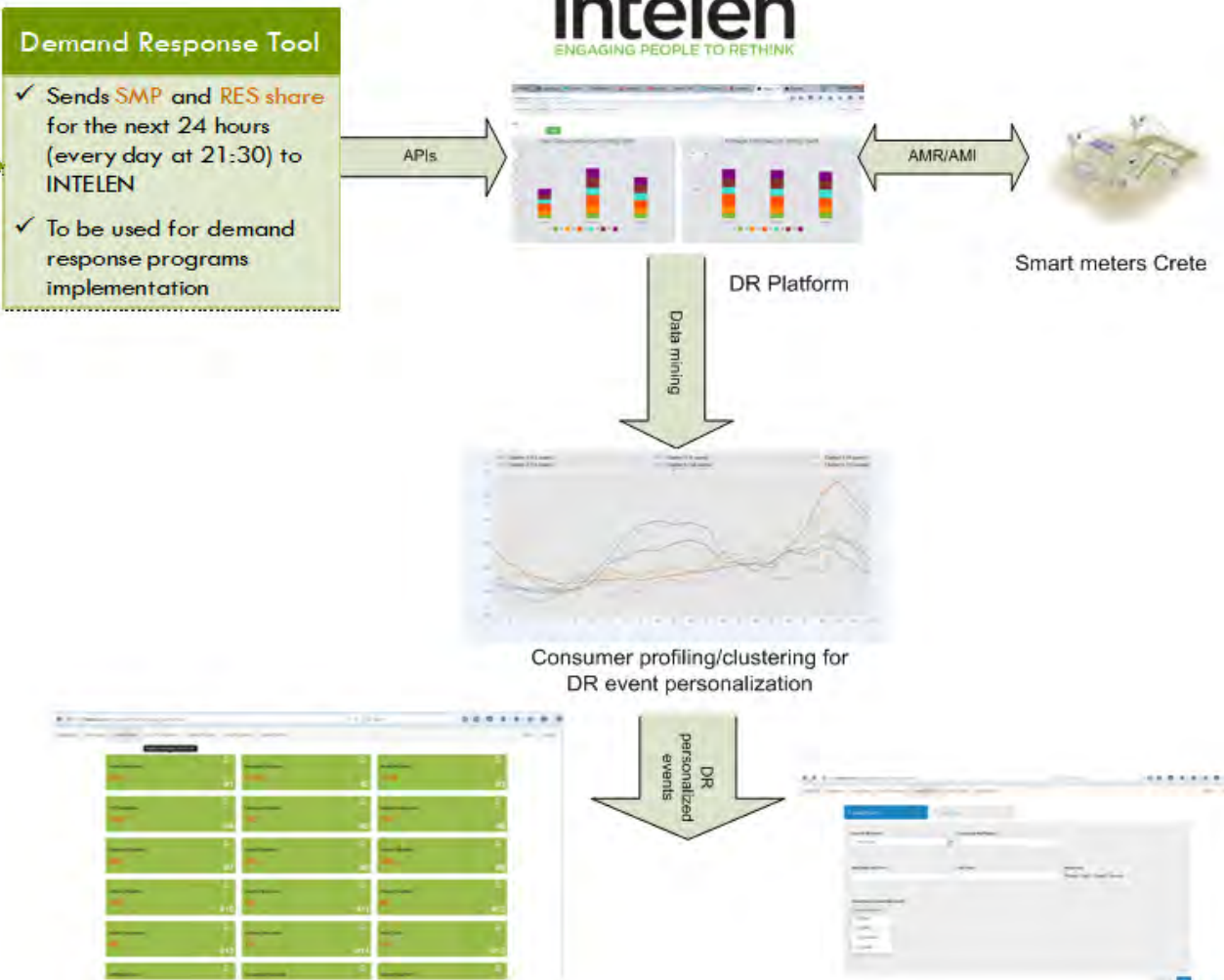
Customization

# Crete Behavioural DR case



- Smart meter installations to 100 home consumers in Heraklion
- Initial surveys and consumer details entry (demographics, etc)
- Daily SMP and Energy Mix details input from HEDNO and AUTH
- Users had access to specific web platform
- Users had access to email and smartphone enabled messaging
- DR events lasted for approx 6 months, Q3 & Q4 2015
- The project/services will scale up to the whole Greece, through DSO and/or retailers

# Crete Behavioural DR case



Consumer digital interactions - mobile/web

DR results / peak shift

DR signals

Smart meters

Consumer Profiling

**DR events:** combining ToU & Behavioral events

# Methodology



**Demand Response Tool**
- ✓ Sends SMP and RES share for the next 24 hours (every day at 21:30) to INTELEN
- ✓ To be used for demand response programs implementation

APIs

DR Platform

Data mining

Smart meters Crete

AMR/AMI

Consumer profiling/clustering for DR event personalization

DR personalized events

**Receive ToU pricing & Energy Mix**

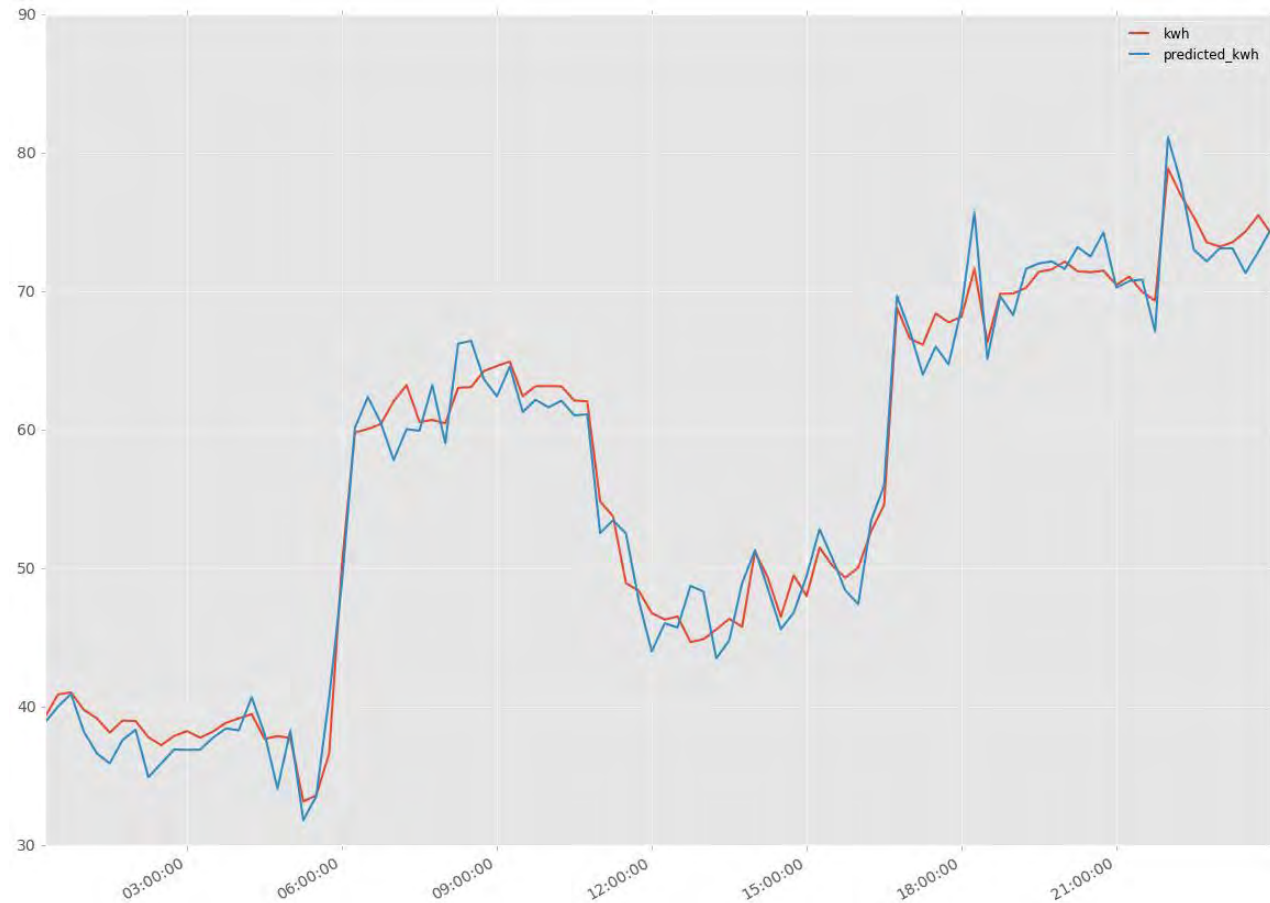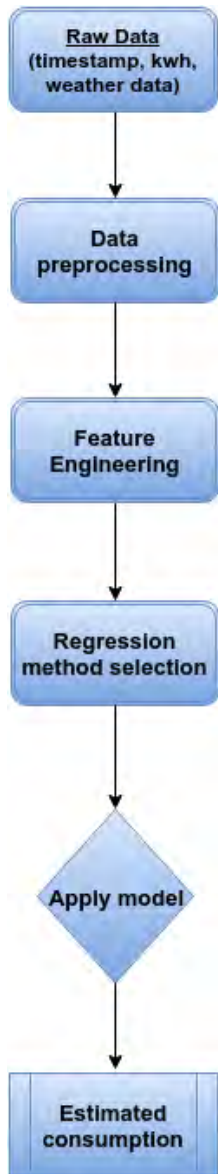**Analyze consumer profile clusters**

**Create DR message event**

**Send events to specific clusters**

**Apply M&V verification**

# Consumers profiling/forecasting
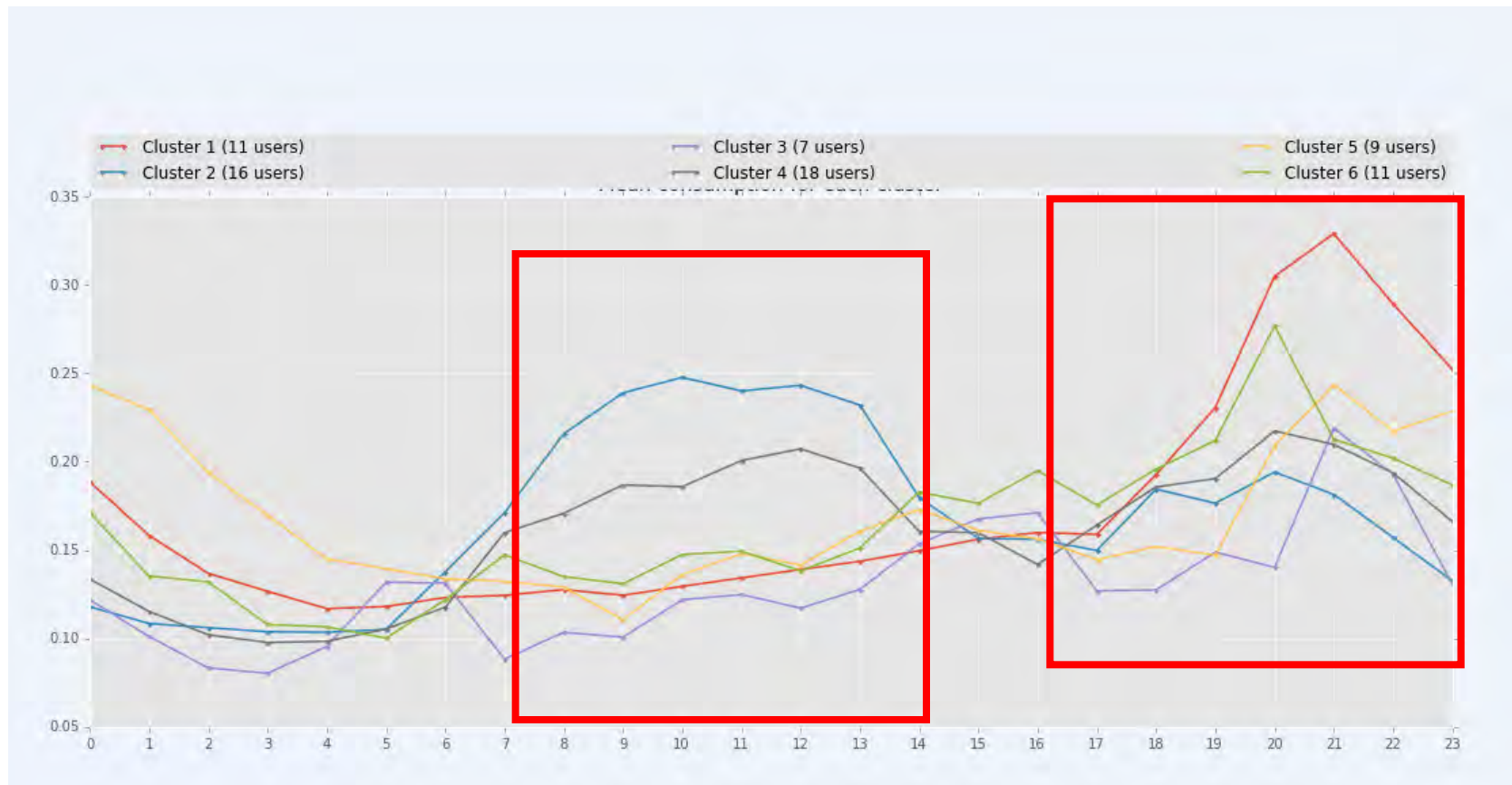
Consumers profiling/forecasting

# DR events

| DR Event | Date | Start time | End time | Scope | Invitation content[1] |
|---|---|---|---|---|---|
| DR Event 1 | 29/05/2015 | 20:00 | 21:00 | Energy Reduction | Simple message |
| DR Event 2 | 04/06/2015 | 19:00 | 20:00 | Energy Reduction | Simple message |
| DR Event 3 | 09/06/2015 | 20:00 | 22:00 | Energy Reduction | Simple message |
| DR Event 4 | 15/06/2015 | 21:00 | 00:00 | Energy Reduction | Simple message |
| DR Event 5 | 25/06/2015 | 12:00 | 17:00 | Energy Reduction | Simple message |
| DR Event 6 | 01/07/2015 | 00:00 | 02:00 | Energy Increase | Simple message |
| DR Event 7 | 02/07/2015 | 14:00 | 18:00 | Energy Increase | Simple message |
| DR Event 8 | 09/07/2015 | 20:00 | 22:00 | Energy Reduction | Simple message |
| DR Event 9 | 15/07/2015 | 21:00 | 22:00 | Energy Reduction | User-friendly message |
| DR Event 10 | 20/07/2015 | 19:00 | 22:00 | Energy Reduction | User-friendly message |

# Results

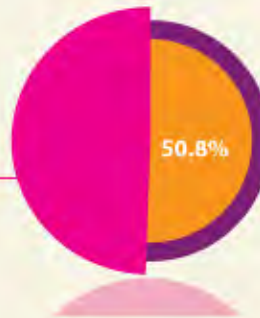# Results



Consumption per participant - 1st DR event
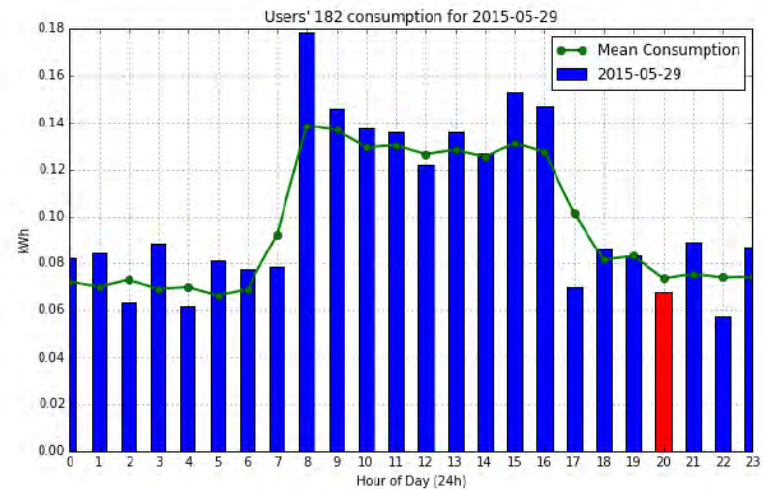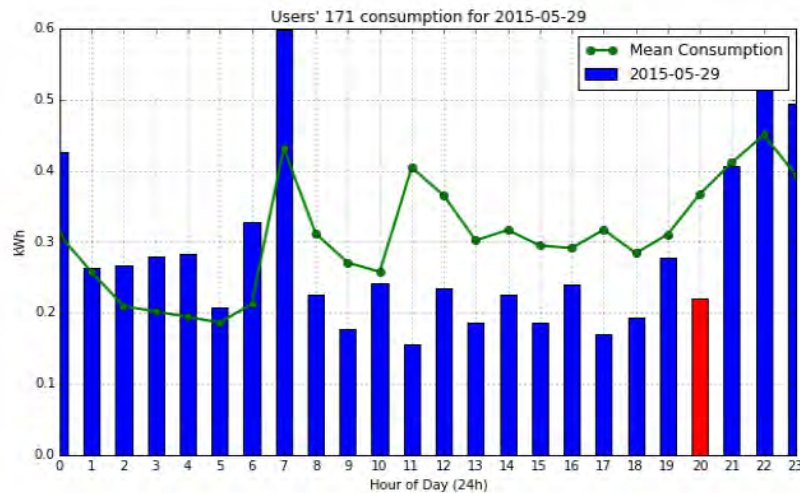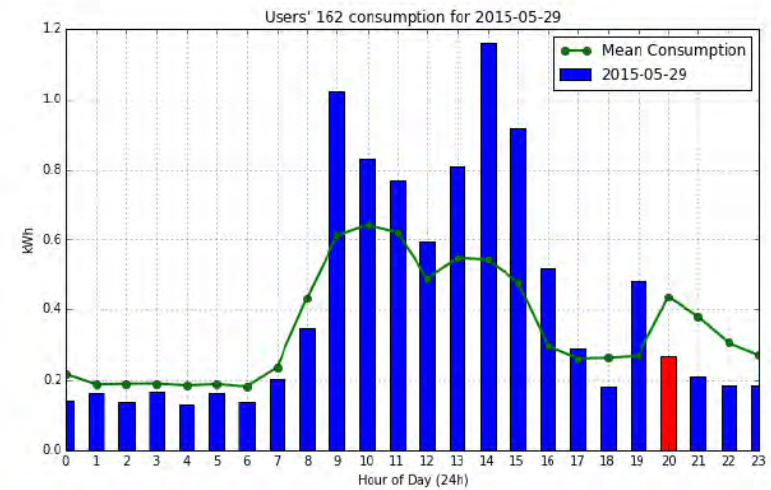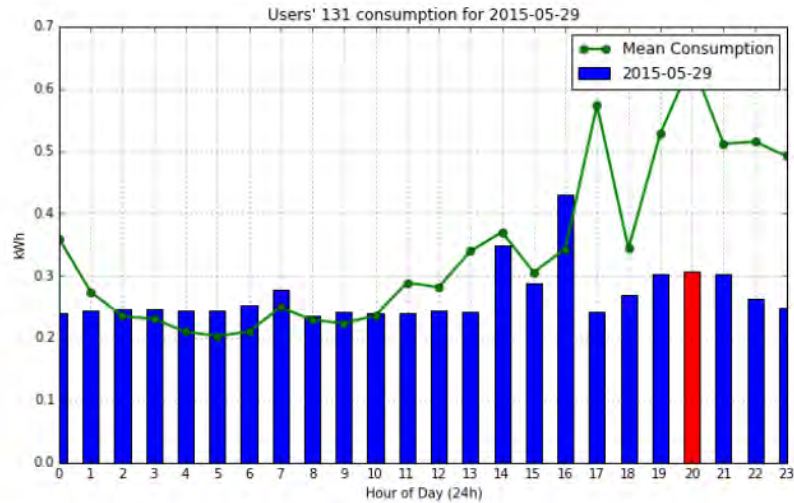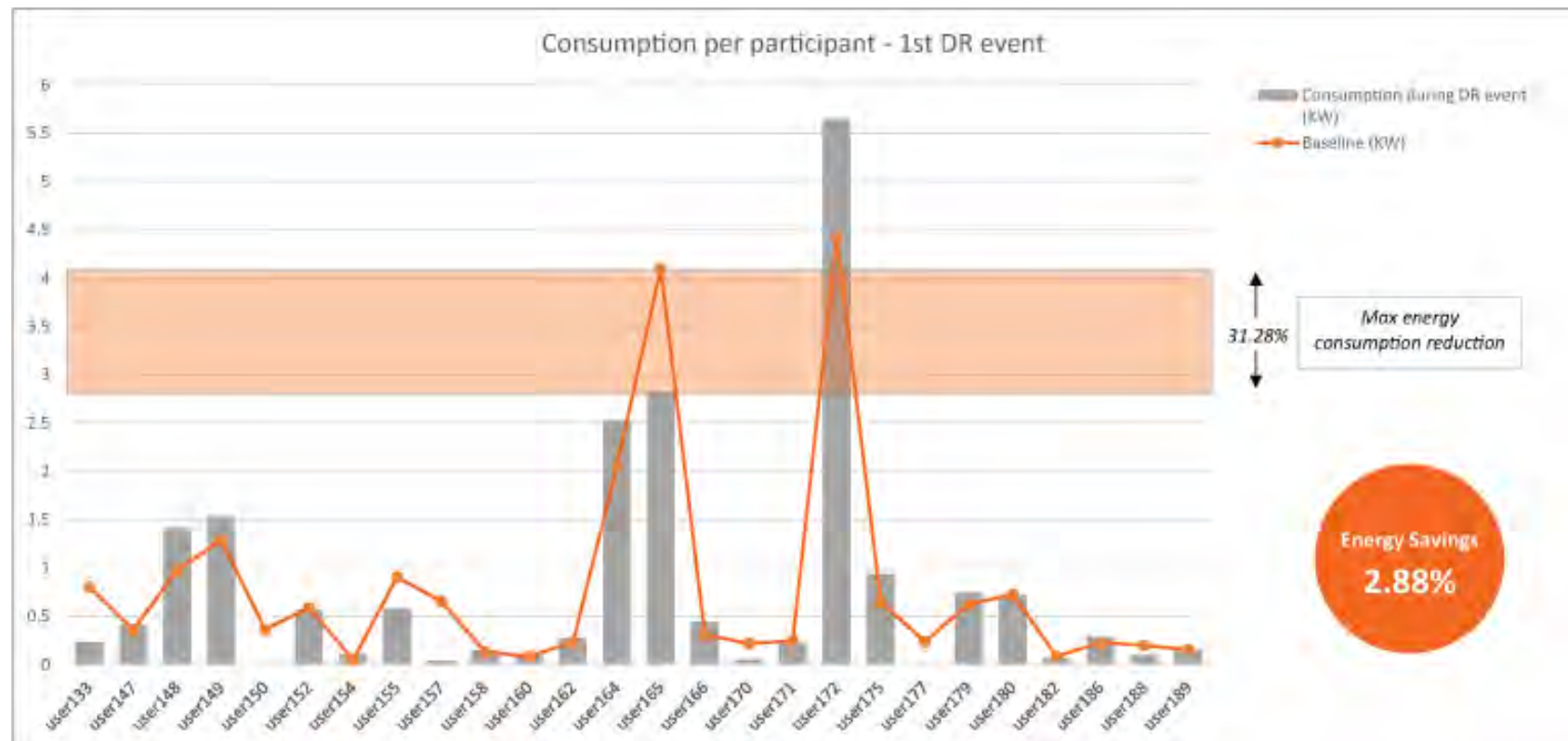
# Results



**Engaged Participants 02**

Engaged participants indicated consistency with reducing or increasing their energy consumption when requested, in most of the times (over 50%).

50.8%

**Highly Engaged Participants 01**

This group of users reduced energy **every time** requested and respectively increased energy consumption when the objective of DR event was energy increase.

6.8%

23.7%

18.7%
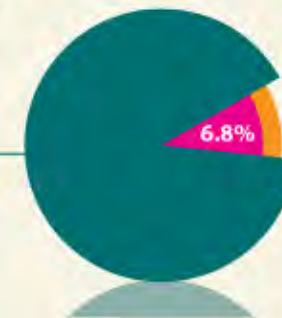
**Low Engaged Participants 03**

Participants with low engagemenent were those who reciprocated to what DR events' objective was suggesting at a frequency lower than 50% but higher than 20%.
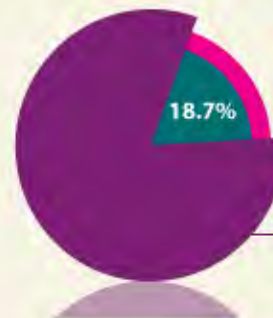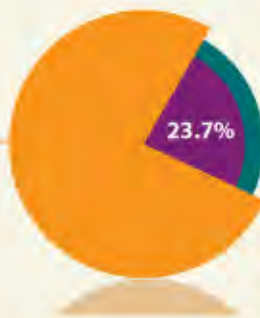
**Not at all Engaged Participants 04**

As "not at all engaged" were classified the participants that failed to meet DR events' goal resulting in exactly the opposite than the desired outcome, either all the times or at a higher than 90% of the times.

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# Personalization in DR

| DR Event | Day of Event | Time of Event | Motivational factor | Control Group | Condition Group |
|----------|--------------|---------------|---------------------|---------------|-----------------|
| 1 | 10/09/2015 | 20:00-21:00 | Personalization | 15 invitees | 15 invitees |
| 2 | 24/09/2015 | 20:00-21:00 | Notice in advanced | 15 invitees | 15 invitees |
| 3 | 01/10/2015 | 21:00-22:00 | Competition | 15 invitees | 15 invitees |
| 4 | 13/10/2015 | 21:00-22:00 | Feedback (without savings) | 15 invitees | 15 invitees |
| 5 | 15/10/2015 | 21:00-22:00 | | | |
| 6 | 30/10/2015 | 20:00-21:00 | Feedback (with savings) | 15 invitees | 15 invitees |
| 7 | 04/11/2015 | 20:00-21:00 | | | |
| 8 | 26/11/2015 | 20:00-21:00 | Set a certain goal for savings | 15 invitees | 15 invitees |

# Results from Personalization
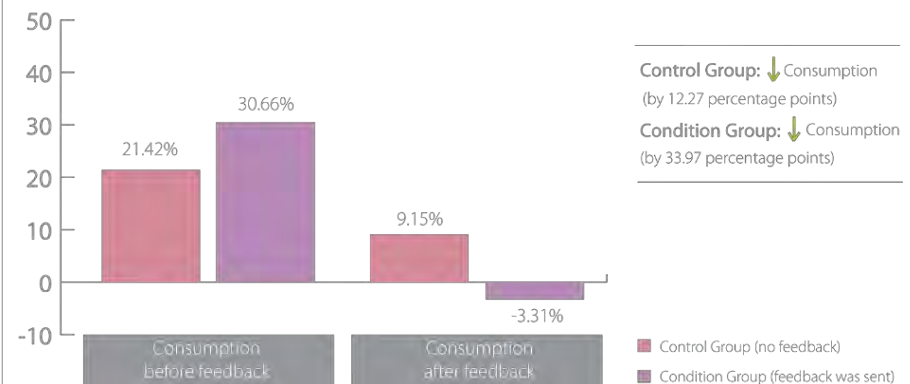


Energy consumption before feedback

Energy consumption after feedback

Difference of Average Consumption (%)

Difference of Average Consumption compared to the baseline (%)

# Conclusions

- Various DR signals and approaches were tested/deployed/measured
- Personalization can increase DR efficiency and savings
- Customer profiling is important at the beginning
- Energy mix and ToU pricing based on SMP increases overall visibility and strategy for the utilities/DSOs
- DR efficiency on people follow the Pareto principle 80/20
- Predictive analytics algorithms help a lot the M&V for DR
- Behavioral M&V can prove savings
- If we add **storage we have Prosumer DR !**

# Further study

- Evaluate DR effectiveness when monetary incentives are provided
- Evaluate DR effectiveness when social effects are presented
- Evaluate DR effectiveness when training through suitable content has been preceded
- Evaluate DR effectiveness using more advanced baseline models that predict participant's consumption by also considering temperature changes
- Utilize profiling techniques based on demographics and other data sources in order to build models for predicting savings
- **Behavioral DR is a HOT market !**
- **Storage is changing the DR space !**
- **Prosumer models will rise**

# Thank you !

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