



Smart metering, ToU and automation: regulatory experience in Italy

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London, 06.02.19

Workshop organised by Reading University

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AGENDA

1. Key figures of the Italian power system

Demand and supply

Market structure

2. Smart metering 1st generation

First generation: results over 15 years

ToU: effects of mandatory ToU pricing in default supply regime

3. Smart metering 2nd generation

Empowering «Chain 1» for granularity and throughput time

A tool for customer awareness and automation: «Chain 2»

FINAL USES: electricity demand in Italy

Total demand 2017:

320 TWh/yr

Self-consumption:

30 TWh/yr (estimate)

Prosumers

0,7 Million

System peak: **55-59 GW**

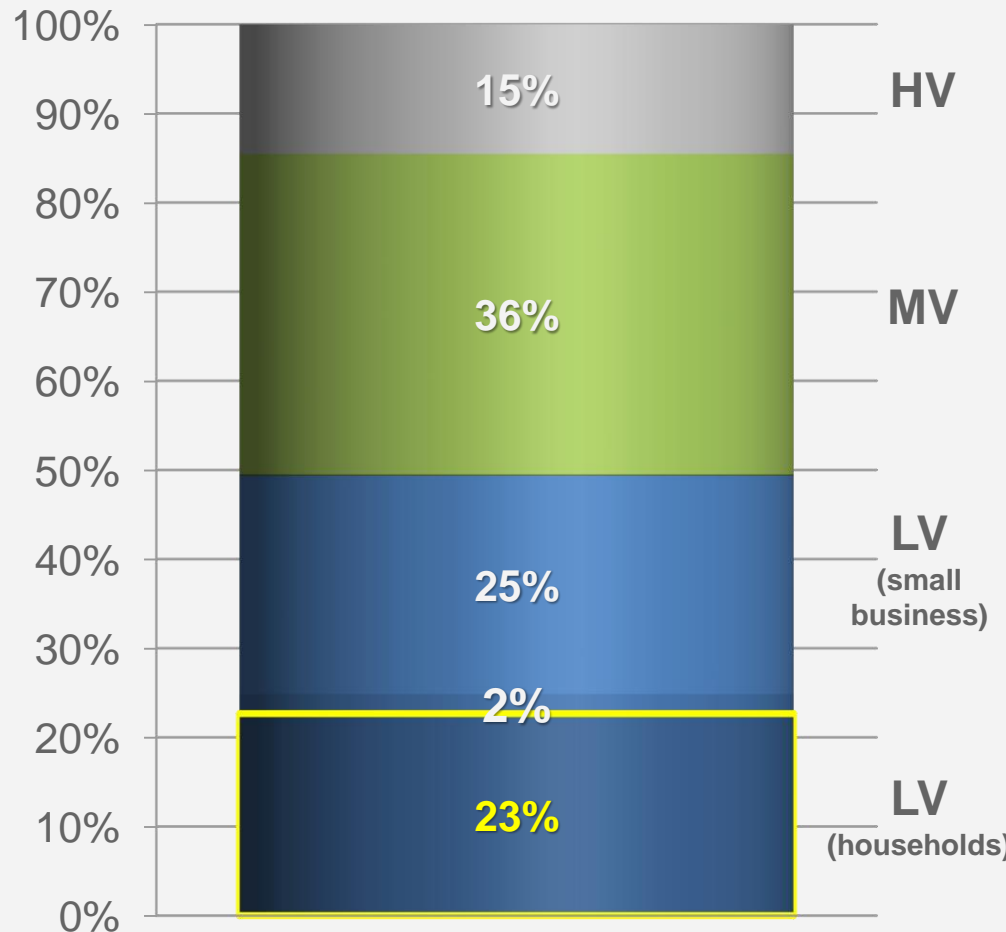
~20 GW min.load night,

~30 GW Sundays, daylight

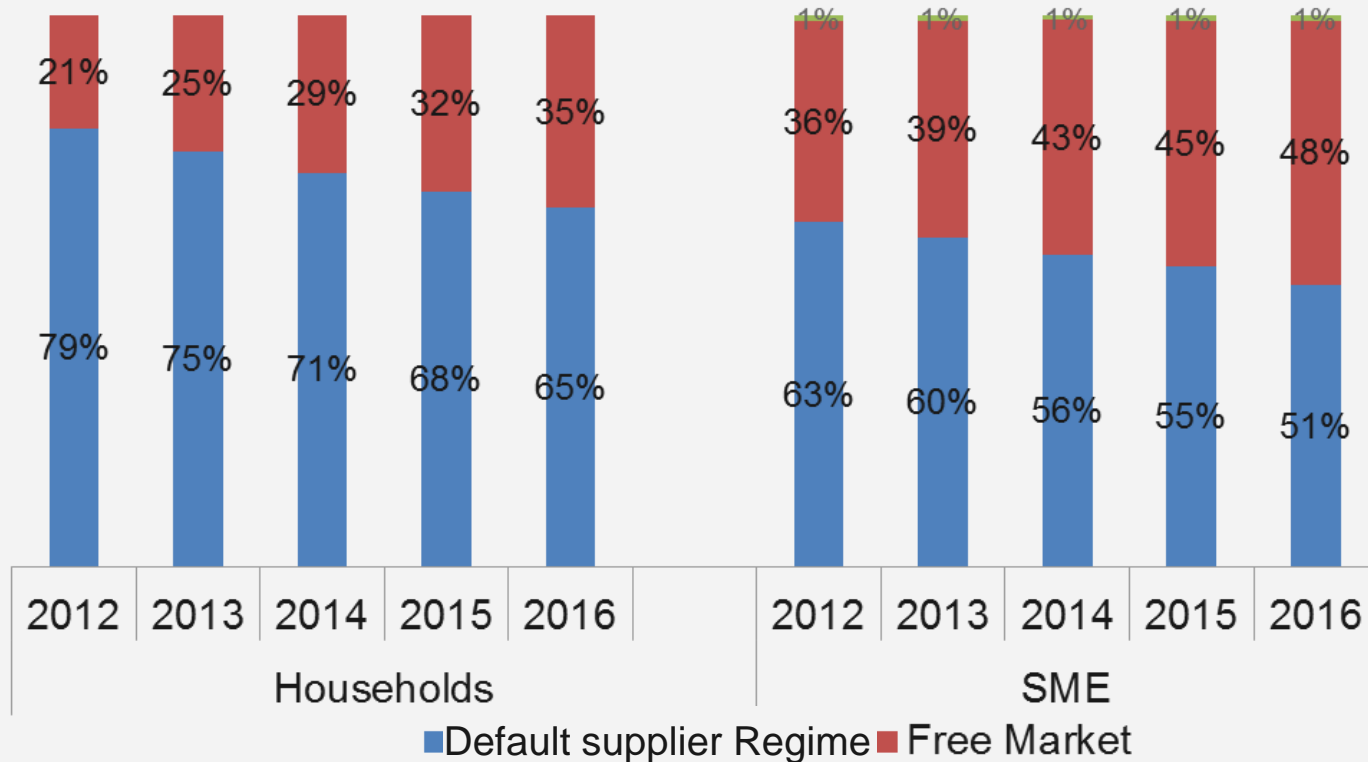
Household consumption

2,100 kWh/user avg/yr

3.3 kW capacity limit



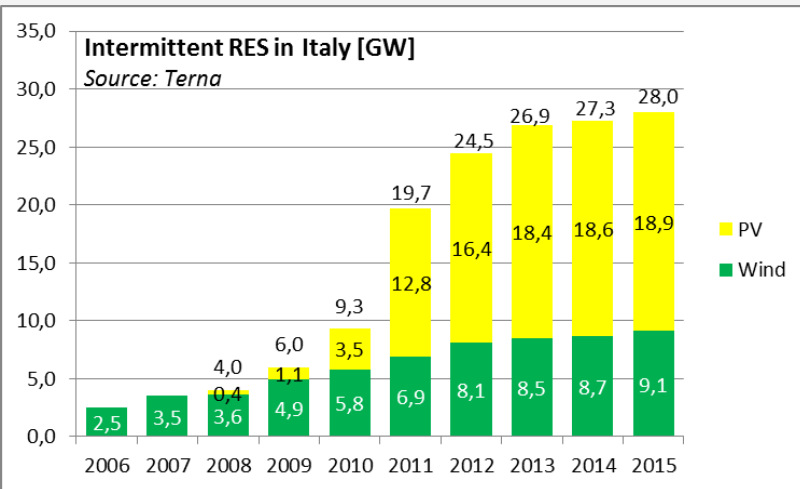
RETAIL SUPPLY: «default supplier» regime vs free market



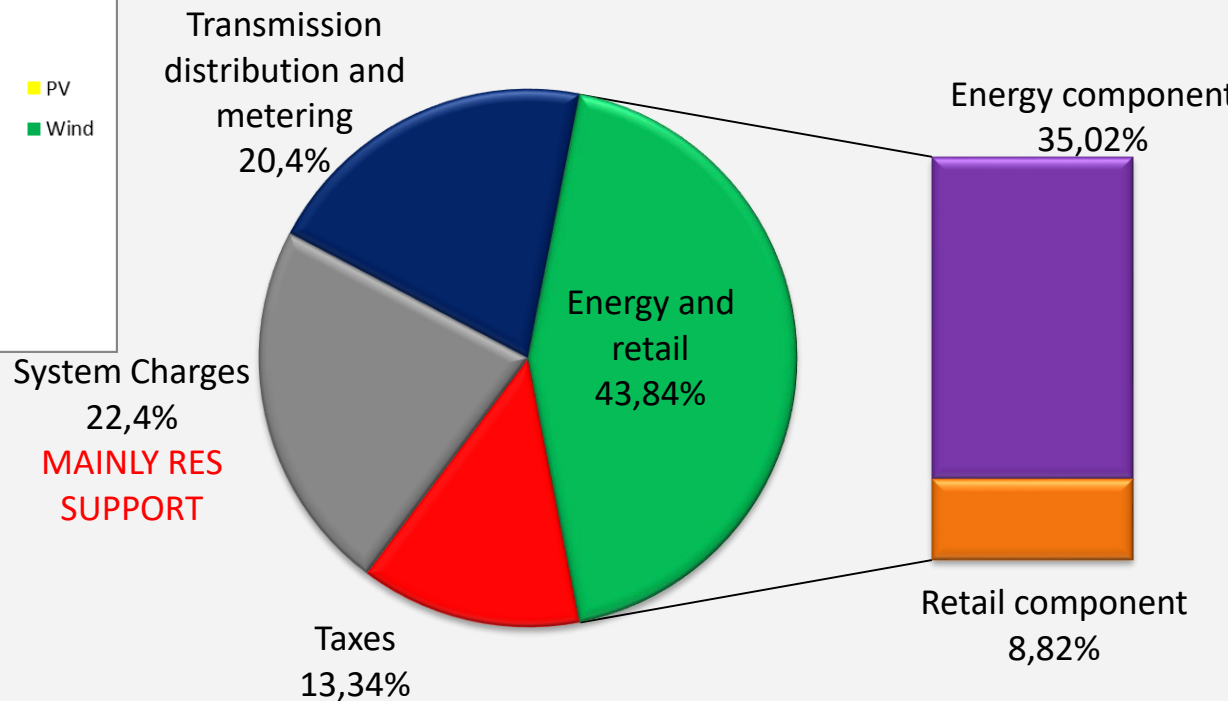
Relatively high number of customers still in the **default supplier regime**
 Law 124/2017 decided to remove this regime from July 2020

RETAIL SUPPLY: pricing

Households: total price = 18,98 eurocent/kWh
(reference user: resident, 3 kW, 2700 kWh/year; 2018 2Q)



The growing impact of RSE has reduced in a first stage wholesale prices levelling differences between peak and off-peak



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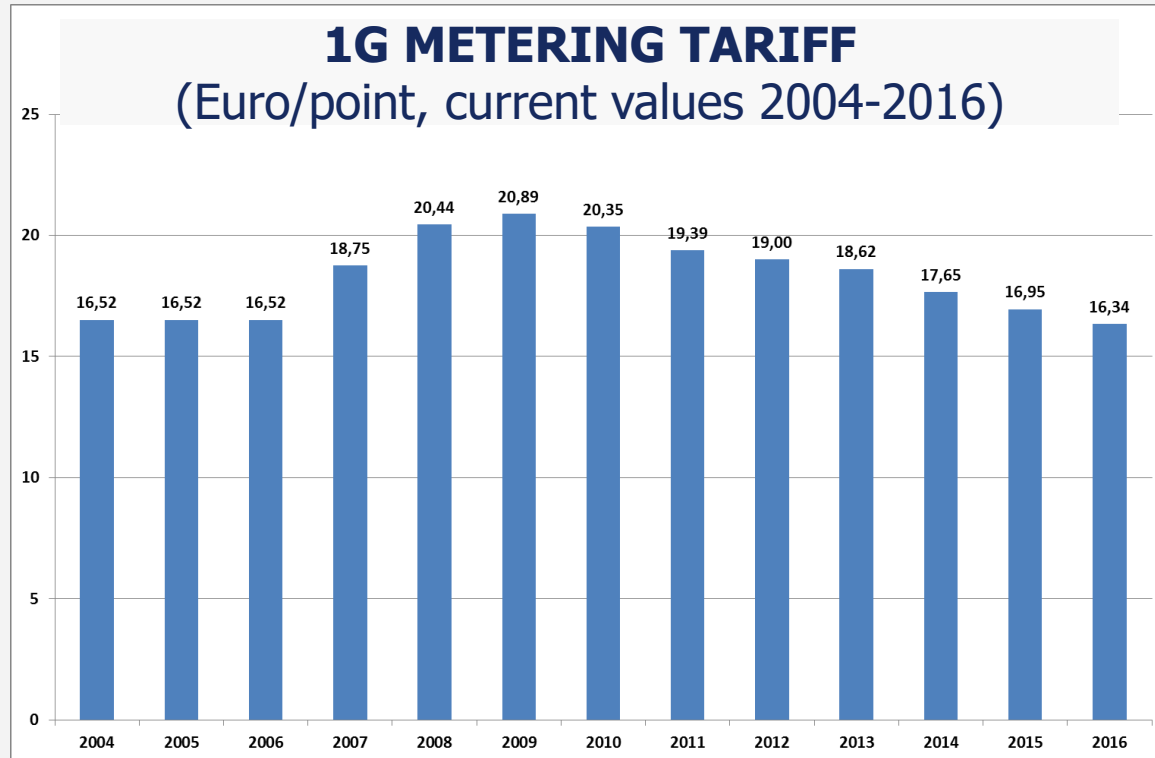
ELECTRICITY SMART METERING: back-ground in Italy

- Metering operated by **DSOs**; extremely relevant difference with UK
- **First generation (1G) started in 2001** voluntarily by Enel DSO, that completed its own customer base in 2006
- Other DSOs compelled by the Regulator (2007-2011)
- **35 M customers** with smart meters; **400 M readings/year**
- Excellent **cost** position: CAPEX 1G around 80 euro/unit
- Regulatory **lifetime** of smart meters: 15 years
- *E-distribuzione* (Enel DSO) engaged in second generation (2G) technical development
- Law mandate to ARERA for functional requirement 2G, defined with decision 87/2016; 2G roll-out started in 2017

ELECTRICITY SMART METERING IN ITALY: benefits

BENEFITS 1G

- Time-of-use energy pricing (mandatory)
- Monthly readings
- Almost no estimated bills
- Easy switch (spot reading)
- Minimum "vital" service
- Better service, e.g. prompt reconnection
- Energy balance in LV networks



References to tariff decisions:

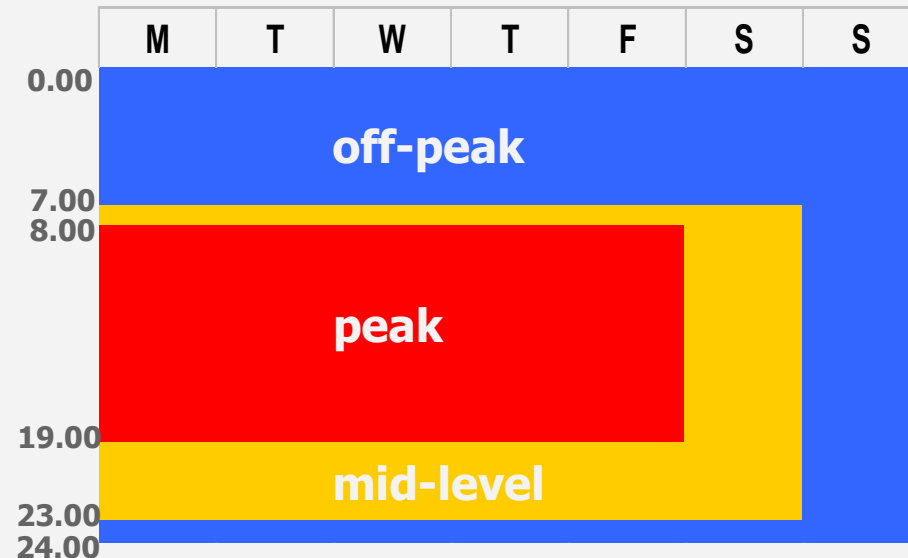
*Del. 5/04; Del. 275/06
Del. 348/07; Del. 199/11
Del. 654/15*

Time-of-Use price (LV customers in Default Supplier Regime)

Default Supplier Regime («maggiore tutela»): Household & Small business customers that **do not choose their own supplier**

DSR energy prices regulated by AEEG are differentiated per time-bands on **mandatory** basis:

- Household: 2 bands
peak vs. (**mid-level**+off-peak)
- Small business: 3 bands
- In the free market customers can be supplied with «flat» prices (no ToU mandatory requirement for energy prices).
- Consumptions are however read separately for timebands even for free market customers (DSO is the metering operator).



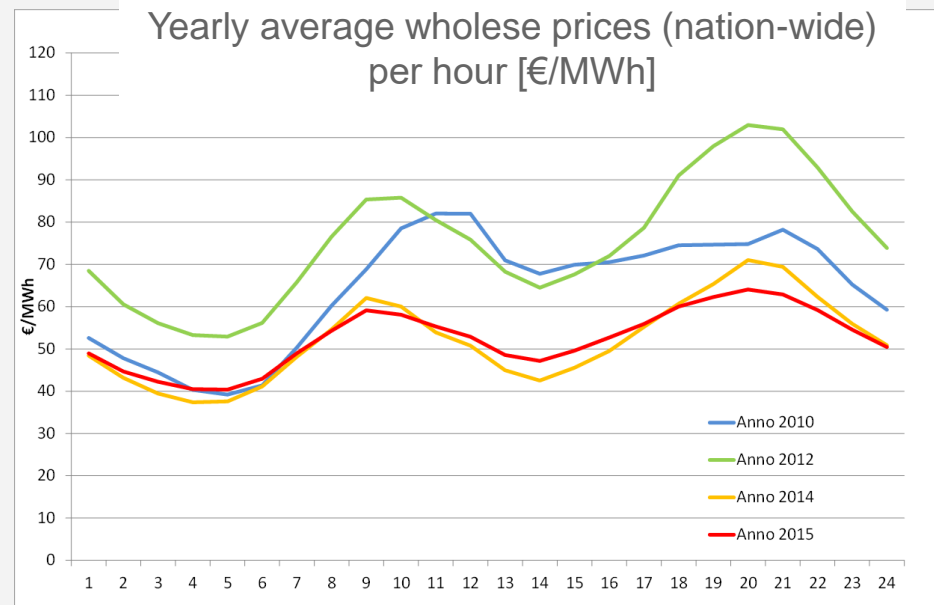
Time-of-Use price (LV customers in Default Supplier Regime)

- **Individual information about separated consumption per band:**
in occasion of the change (2010-11), each involved customer received bills with differentiated consumption (3 bands) at single price for 6 months in advance of the first ToU bill
- A large survey has been conducted on a controlled panel of 8000+ customers in order to make a **fact-based comparison** of consumption behavior **before and after** the introduction of the TOU. Main results:
 - ➔ percentage of customers with at least 2/3 of consumption in low-price timeband: **+5%**
 - ➔ percentage of customers that have moved consumption from higher-price to lower-price timeband: **60.1%**
 - ➔ very limited consumption shift (as absolute values)

Source: Benini, Gallanti, Grattieri, Maggiore, «Impact of a mandatory time-of-use tariff on the Italian residential customers», RSE 2012

Time-of-Use price: customers' preferences

- Although all LV customers are metered according the same rules, ToU pricing is mandatory only for those in default supplier regime (around 21,5 Million household customers)
- Customers supplied in the free market can choose the pricing among different offers: single price, two bands, three bands
- **In the free-market, 2 customers out of 3 prefer an offer without ToU pricing (7.2 Million customers out of 11.5 Million household customers in the free market)**



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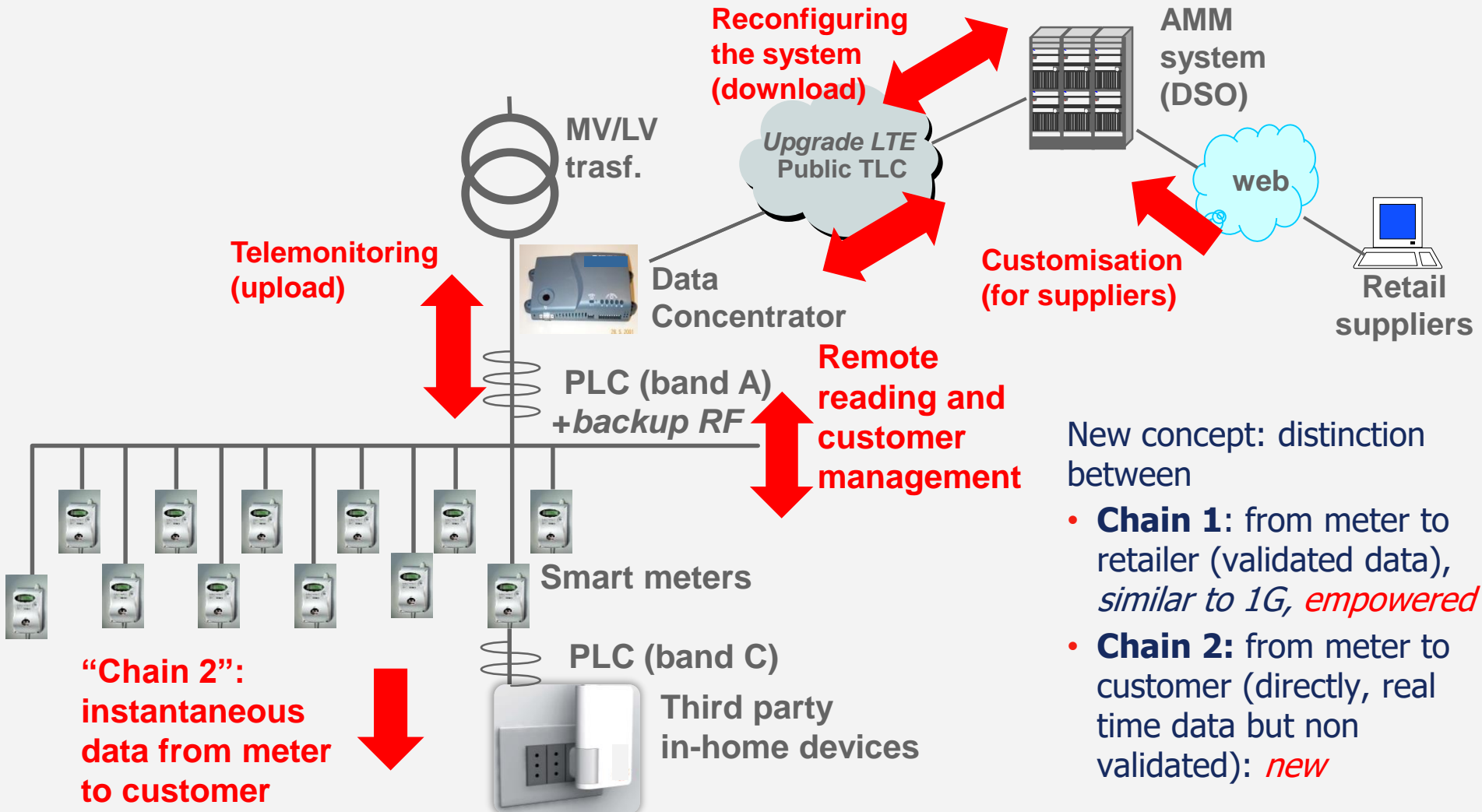
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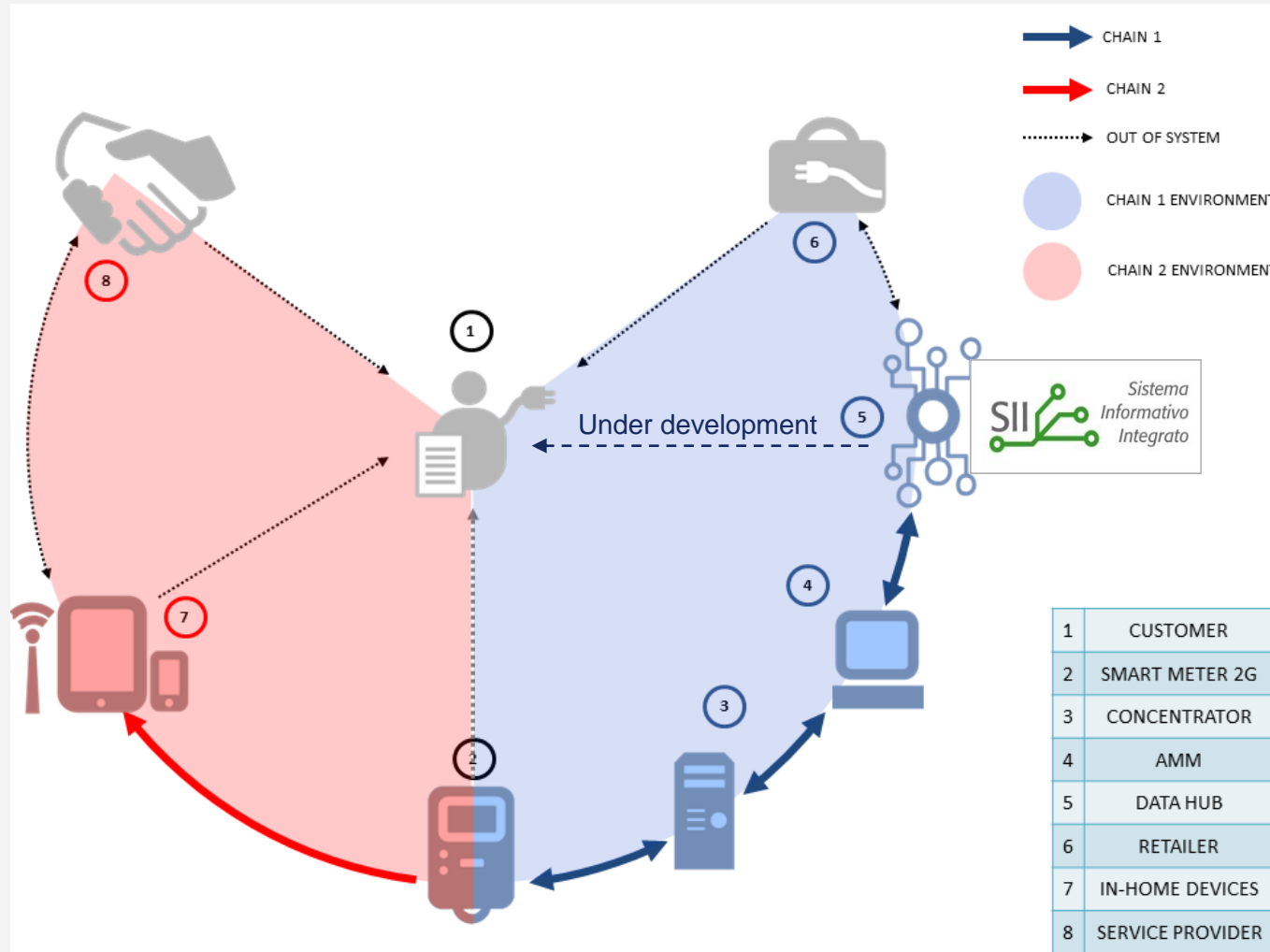
SMART METERING: system architecture from "1G" to "2G"



New concept: distinction between

- **Chain 1:** from meter to retailer (validated data), *similar to 1G, empowered*
- **Chain 2:** from meter to customer (directly, real time data but non validated): *new*

CHAIN 1 & CHAIN 2: concept of 2G (Regul. decision 87/2016)



«Chain 1»

- Purpose: billing and network management
- Validated data, SLA
- Daily collection
- Operated by DSO
- Back-up channel

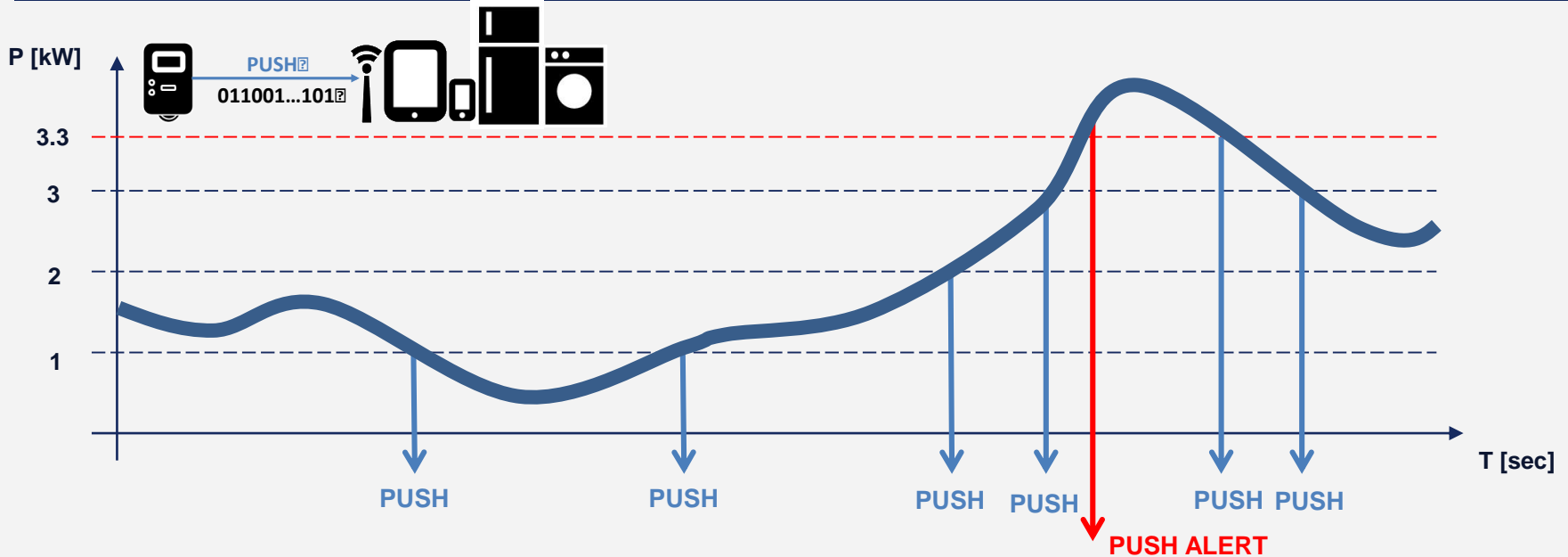
«Chain 2»

- Purposes: customer awareness and value offering for suppliers
- Close to real-time, not validated data
- Continuous flow
- Interoperable with 3rd party IHDS
- No back-up channel

Usefulness of Chain 2

- Different use cases have been investigated: can be grouped in **four** categories:
 - **customer awareness**: e.g. alert for exceeding thresholds
in Italy: power is limited via breaker
 - **home automation**: e.g. load shifting with deferrable loads; peak shaving using “smart” energy management
in Italy: economically relevant because network tariff is largely capacity-based
 - **market participation**: e.g. customer energy flexibility sold directly to the Ancillary Service Market, even through an aggregator
in Italy: trials ongoing
 - **innovation in retail offering**: e.g. new services and “prepayment”
in Italy: never used before
- Meter operator (DSO) can not carry out commercial activity beyond the meter: hence, **interoperability** is necessary

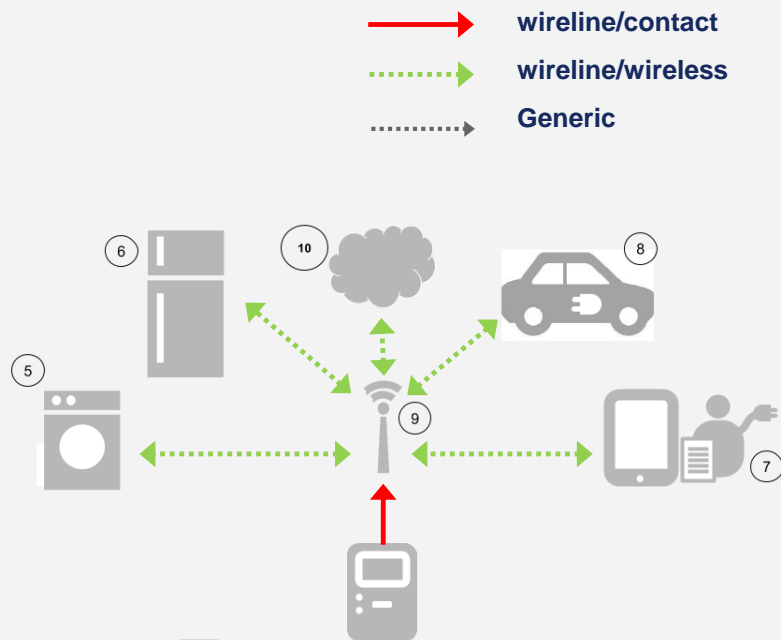
CHAIN 2 (new with 2G): real-time communication



- “frequent asynchronous data”: level of used power capacity changes very rapidly; in order to avoid **disconnection due to limitation of contractual power** an alert can be sent
- Requirements: sampling **up to every 1 second** “frequent asynchronous data” are not to be stored (strong *privacy issues*)

CHAIN 2 (new with 2G): interoperable In-Home Device

- IHDs developed by **third parties** (integrated with home ecosystem)
- **Standard communication protocol** (for both DSO and device provider)
- Developed by CEI (standardisation body) with industry consensus: **July-2017** (CEI TS 13-82/85)
- Physical layer PLC in CLC **"band C"**, further layers under development
- **Monitoring phase** under course, very good performance (end-to-end)
- **Release 2.1**: cooperation with Agcom on further options for chain 2 - *consultation paper* [ARERA n.245/18](#)



	<i>Frequent</i> - 1 retry	<i>Rare</i> - 4 retry
Avg	98,79%	98,23%
5° percentile	97,28%	100 %
1° percentile	50,64%	0 %

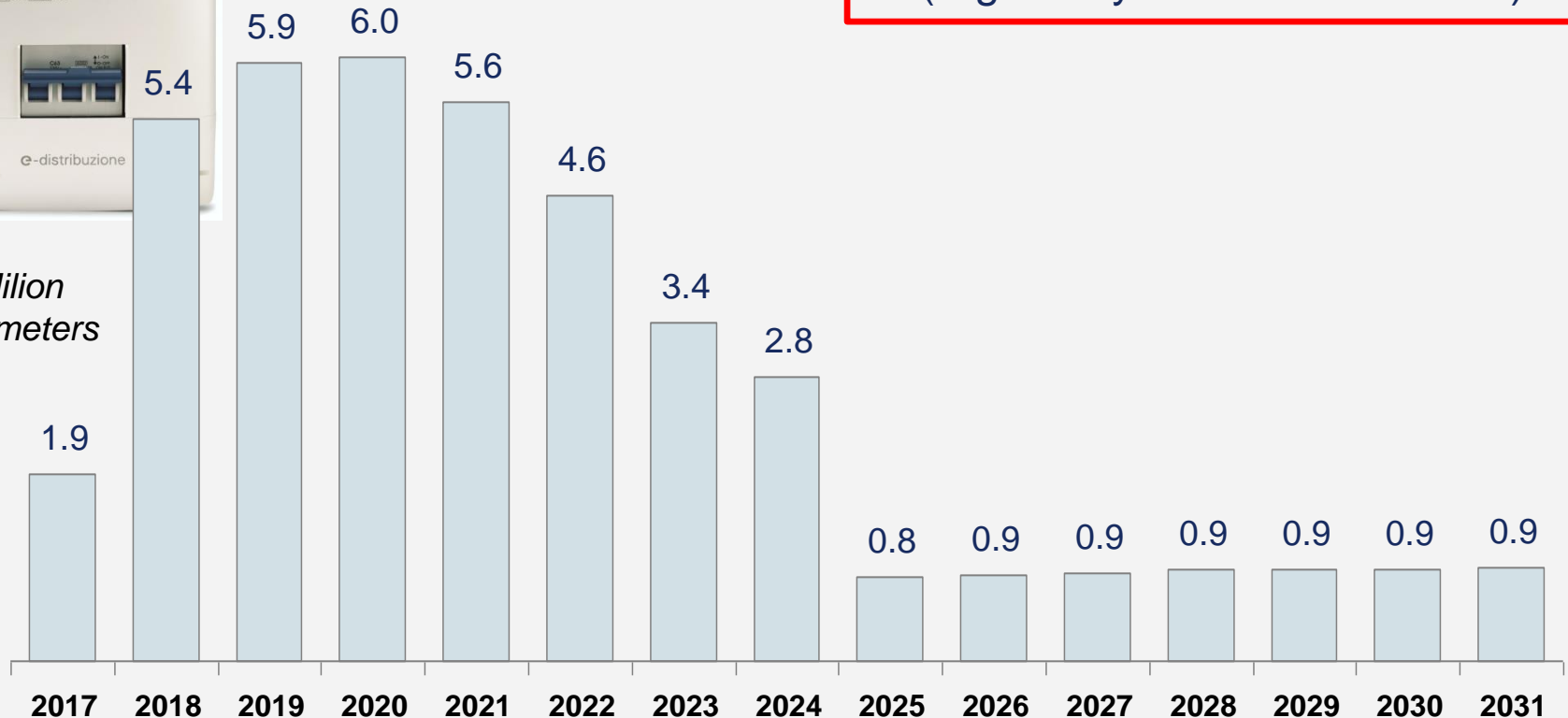
% success rates in daily samples

2G SMART METERING ROLL-OUT PLAN (*e-distribuzione*)



Average cost (over 15 years):
94 € per meter-2G
(regulatory decision 222/2017)

Milioni
2G meters



Please visit:

www.arera.it

Suggested reading on the Italian case (innovation)

CHANGING THE REGULATION FOR REGULATING THE CHANGE

Innovation-driven regulatory developments in Italy

ICER Distinguished regulatory scholar Award 2012

http://www.iern.net/portal/page/portal/IERN_HOME/ICER_HOME/ABOUT_ICER/Distinguished_Scholar_Award_2012

Suggested reading on the Italian case (smart metering)

SMART METERING: AN EVOLUTIONARY PERSPECTIVE

Guidelines and lessons learnt from the Italian regulatory experience

Highly Acknowledged Paper ERRA regulatory research Award 2017

<http://erranet.org/knowledge-base/erra-regulatory-research-award/#winner2017>

Thank you for your attention

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