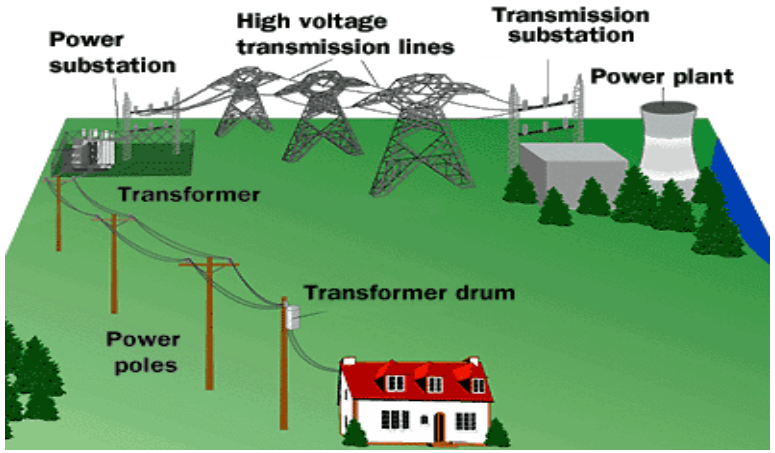
What can Future Internet mean for Smart Energy ?

Mikhail Simonov - simonov@ismb.it – Valencia, 15 April 2010

Carbon Economy

Human being consumes different kinds of energy for living, industry and other activities, causing

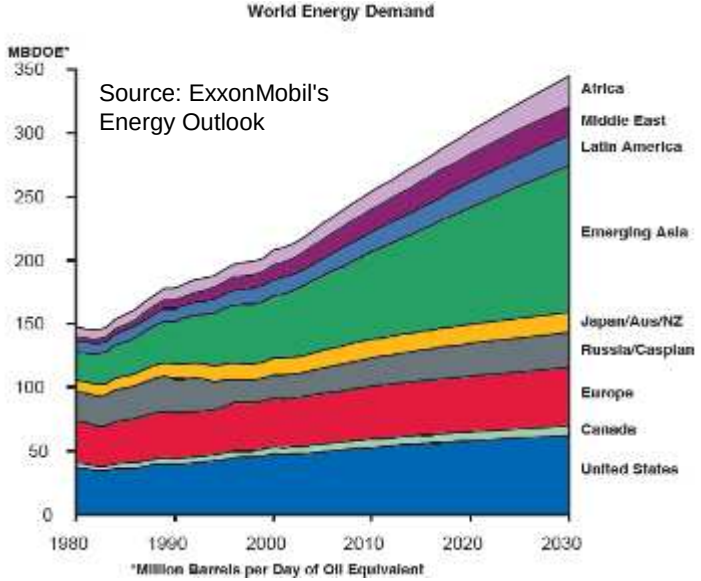
- increased emissions, e.g. carbon footprint
- energy shortage, e.g. load to optimize
- garbage disposal, e.g. renewable sources to prioritize
- unhappiness, e.g. social aspects to privilege
- inadequate services, e.g. need of “smartness”

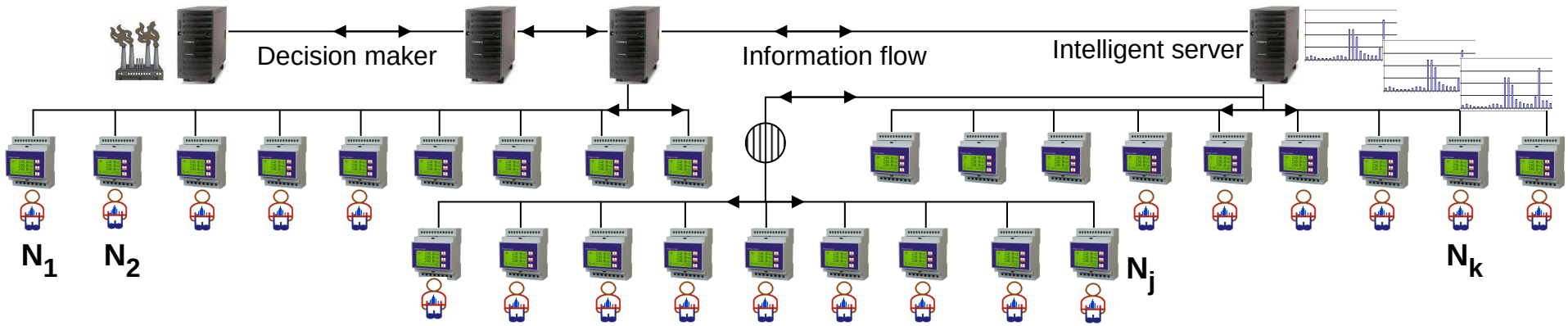


A **low carbon** economy depends on the way we use the energy, transport, and mobility system.

How to achieve a virtually carbon-neutral impact with a level of safety in a 20-30 year time-frame?

CO_2 reduction





Challenges

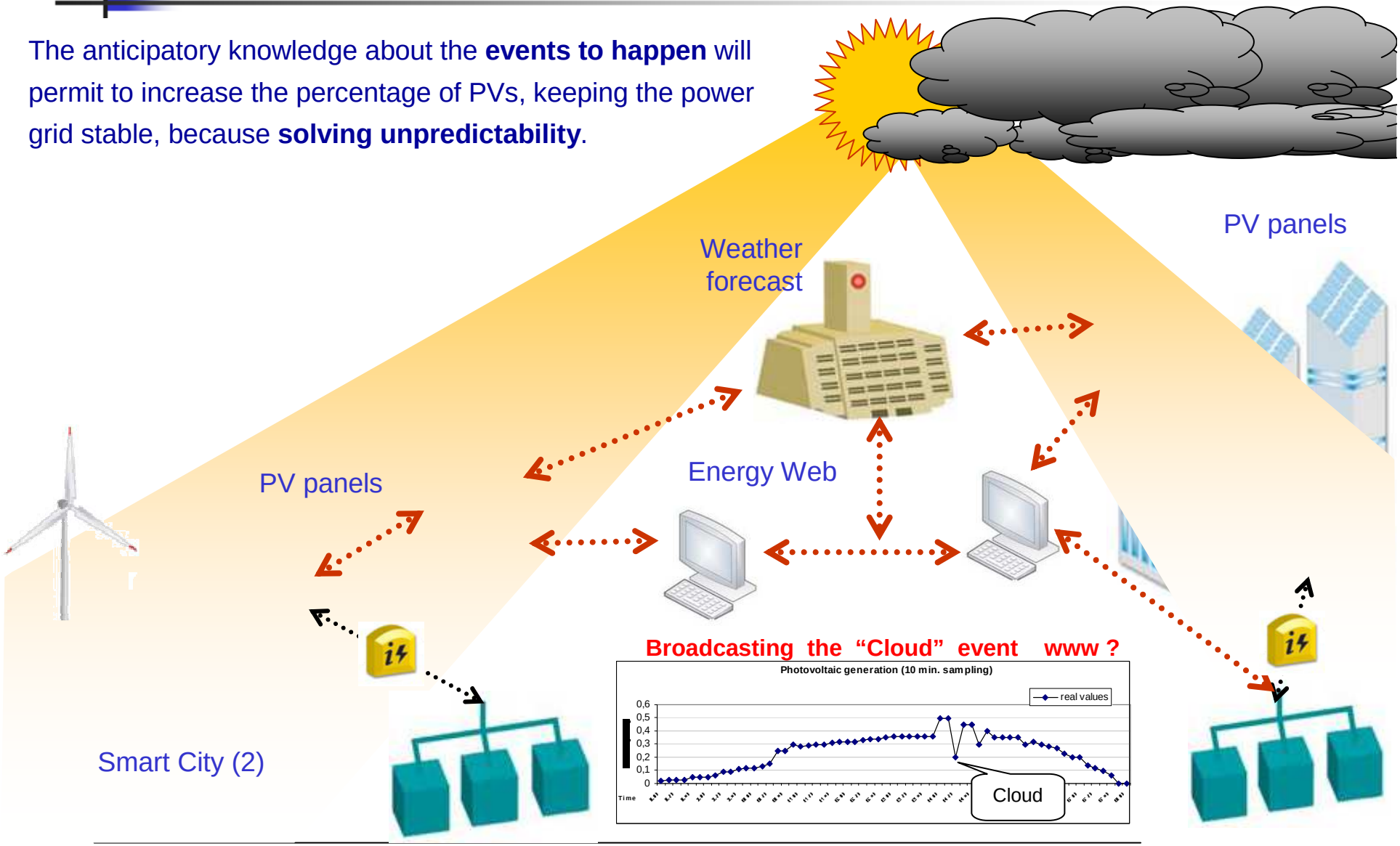
- The portion of **renewable energy is limited** up to 10 – 15% because of the unpredictability.
- The energy consumption is **invisible, seamless process**, not monitored by end-users.
- Energy quality is managed **reactively** (relying on under-frequency), with no anticipatory knowledge

Future Internet (FI) brings:

- Integration of grids in the system-of-system, making interoperable separate fieldbus
- New dynamic nodes abstracting HEVs / HSVs
- Possibility of the e-energy business (online real time energy trading)
- The infrastructure for energy services with new control paradigms permitting to optimize both individual and collective interests
- The anticipatory knowledge about events going to happen (proactiveness)
- Multiplicity of services, working independently and together, to interact with.

Challenge 1: more renewable

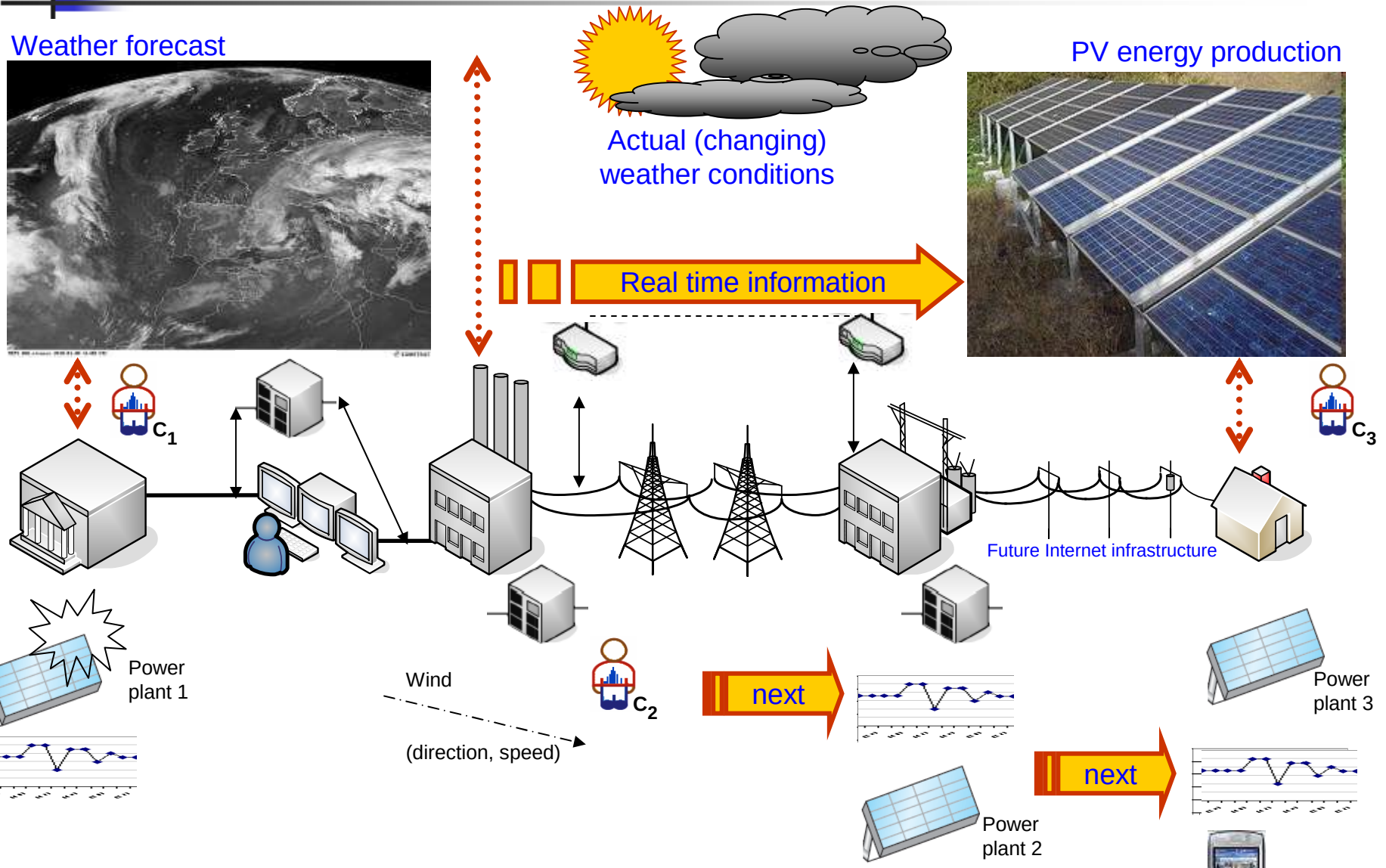
The anticipatory knowledge about the **events to happen** will permit to increase the percentage of PVs, keeping the power grid stable, because **solving unpredictability**.



Istituto Superiore Mario Boella

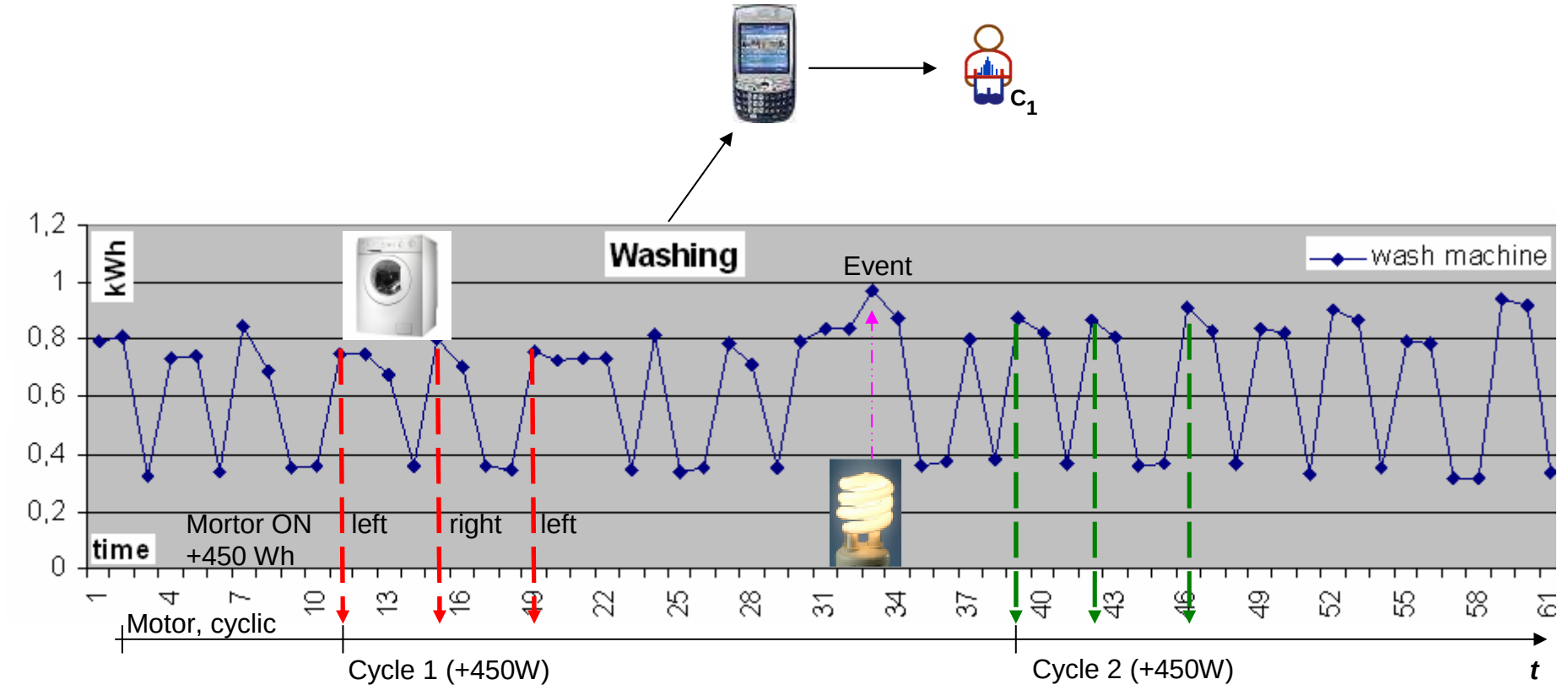
Mikhail Simonov - simonov@ismb.it – Valencia, 15 April 2010

Impact 1: the percentage of renewable beyond 10-15%



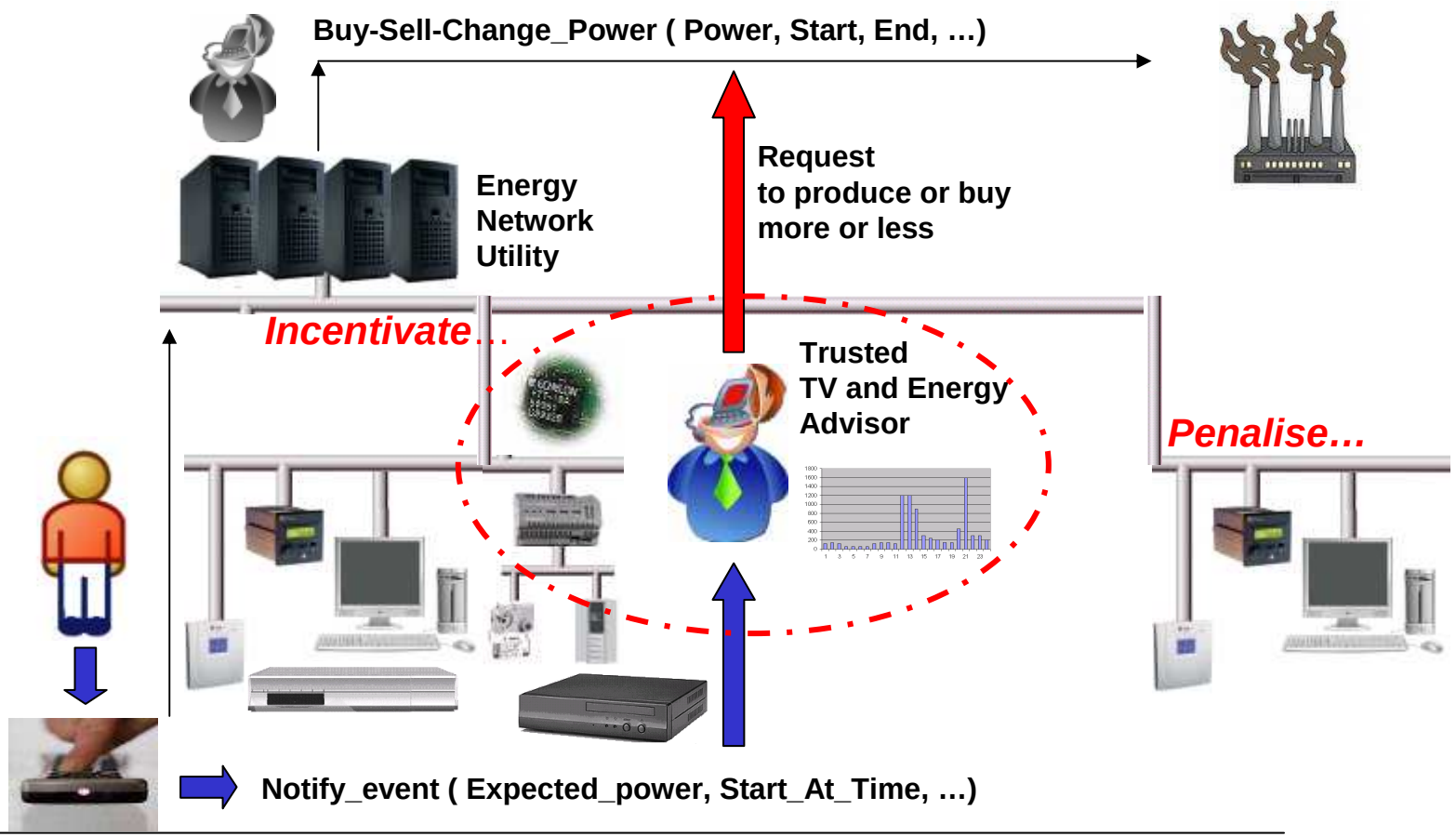
Challenge 2: Awareness and knowledgeable consumption

Using new HMI and smart phones complementing smart meters, permits **awareness raising** about the energy-consuming processes, permitting the knowledgeable use of the energy. It makes visible the seamless dynamics.

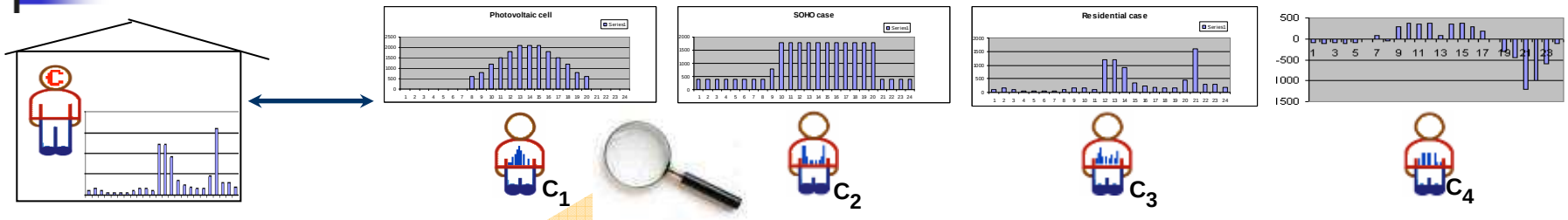


Challenge 3: proactive and not reactive

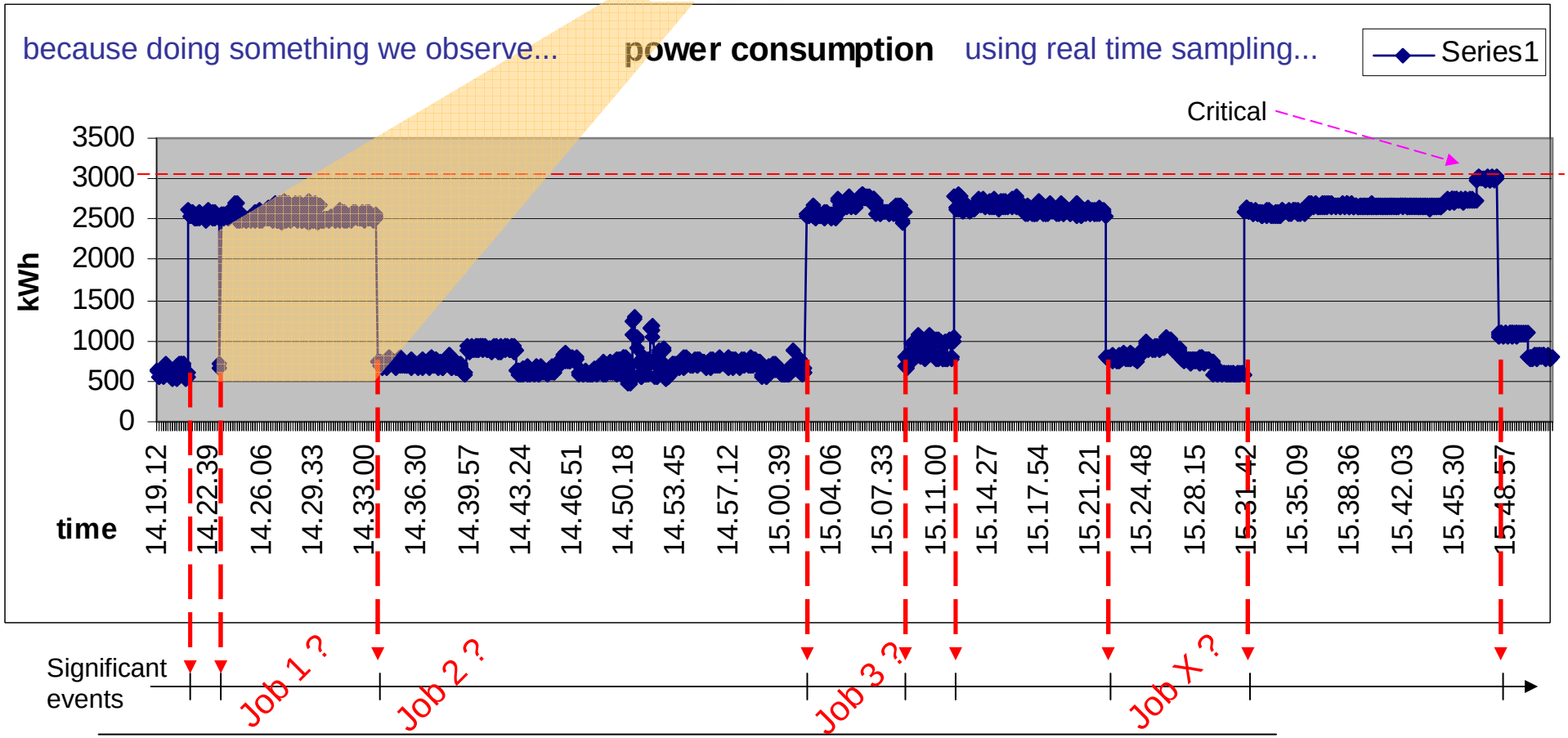
Acquiring in real time the social events and measuring the “digital energy”, it becomes possible **to anticipate** the significant energy consumption variations, enabling the proactive response.



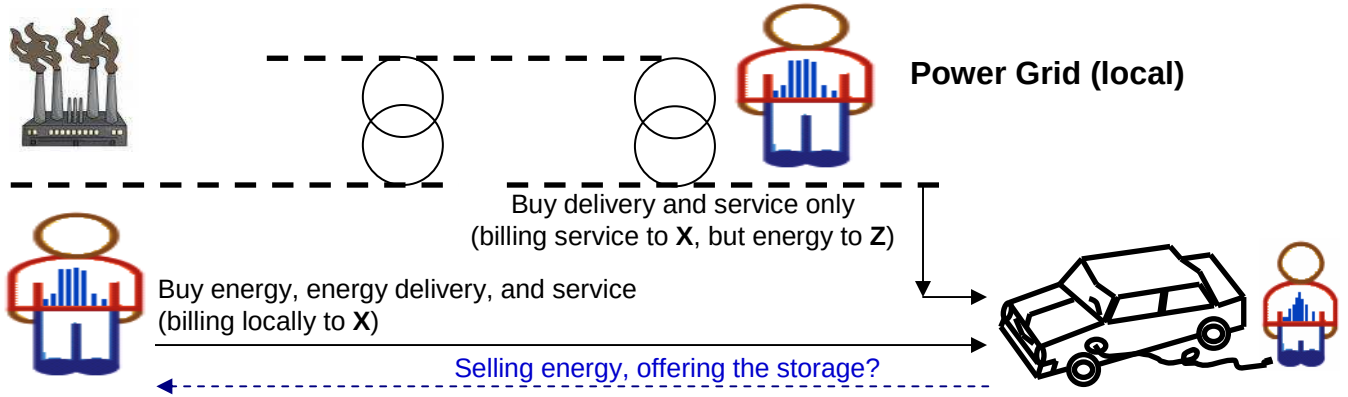
Impact 3: Complete personalisation



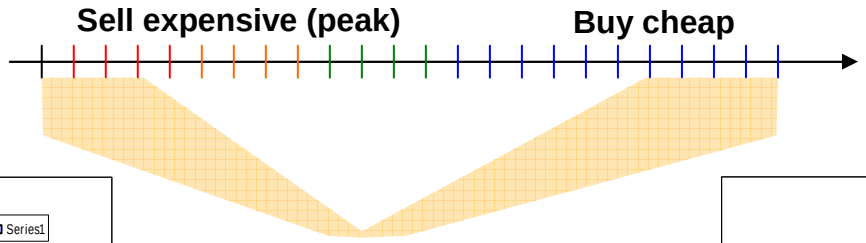
because doing something we observe... **power consumption** using real time sampling...



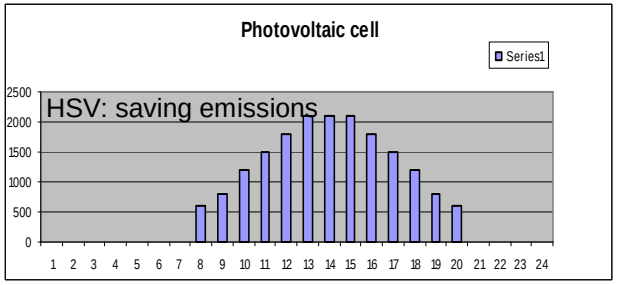
Challenge 4: HEV/HSV brings energy storage

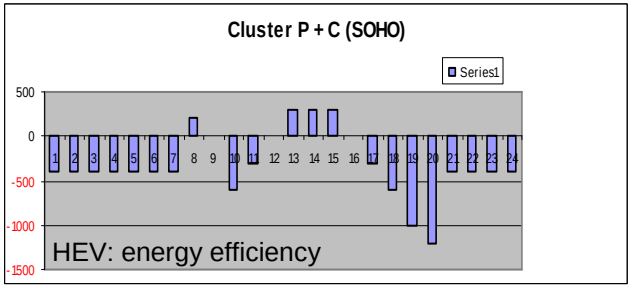


At 7.40 I bring my children in the school, park the car (charging HSV) then.
At 17.30 I travel back, and park the car again. I might need my car in the evening time (advise from mobile), but it is **"online" for more than 20 hours**.

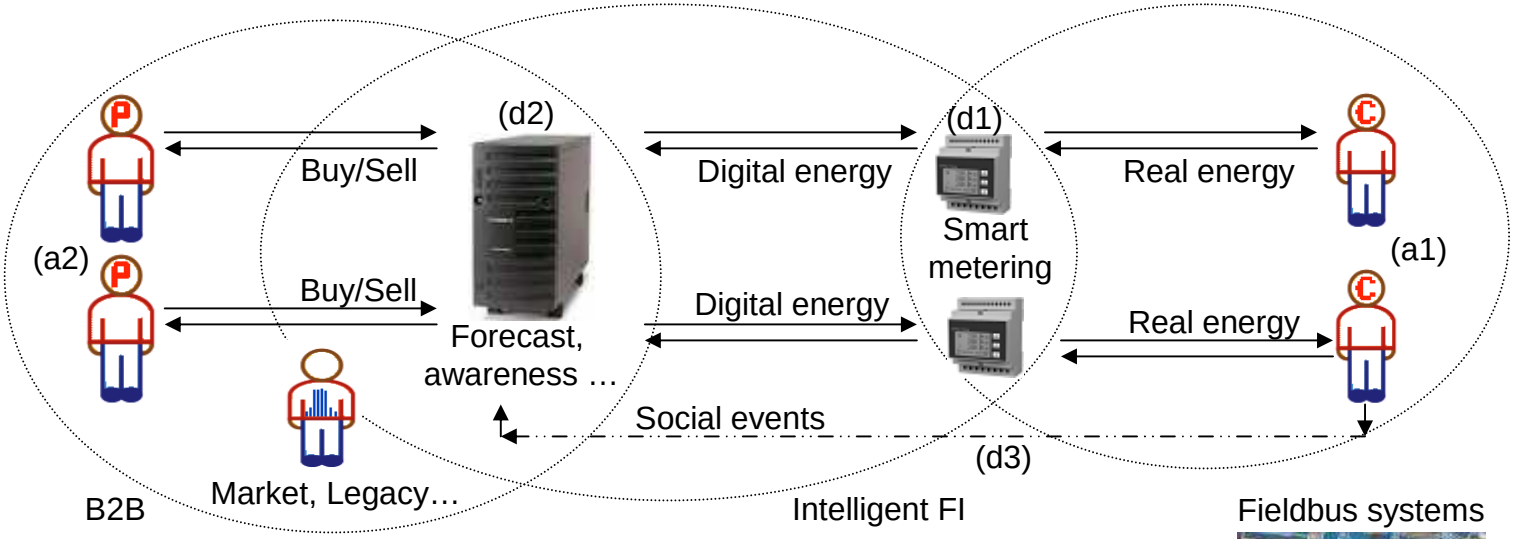


Possible strategy:
- Sell HSV generated (clean) energy.
- Sell "green" certificate.
- Sell 66% (accumulated) while peaks.
- Buy cheaper energy to refill.
- Sell 66% (accumulated) while peaks.
- Buy cheapest night energy to refill.





Impact 4: Future Internet energy services



Possible scenario in 2020?

- People (**Humans**) and artefacts (**Things**) fully **cooperating** communicating entities
- Individuals **sharing the knowledge** to achieve the collective optimisation
- Ecologic Hybrid Electric Vehicles are dynamic networked nodes **bringing renewable** energy
- Batteries of Electric Cars **plugged** into grids bring the energy **storage**
- New e-business with energy, **energy brokers** selling/purchase in **real-time**
- Information and Knowledge (virtual entities) are **new assets** enriching the market
- Global System-of-Systems as a new entity offering **complete safety**
- Bi-directional **event flows**, Dynamic (intermittent) entities, Evolutionary processes …

THANK YOU