ADDRESS

Active **D**istribution network with full integration of **D**emand and distributed energy **RES**ource**S**

Regine BELHOMME, EDF SA
regine.belhomme@edf.fr

http://www.addressfp7.org

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active demand

address
interactive
energy

Project co-funded by the
European Commission within
the 7° Framework Programme

The ADDRESS Project in a Few Numbers

Started June 1st 2008

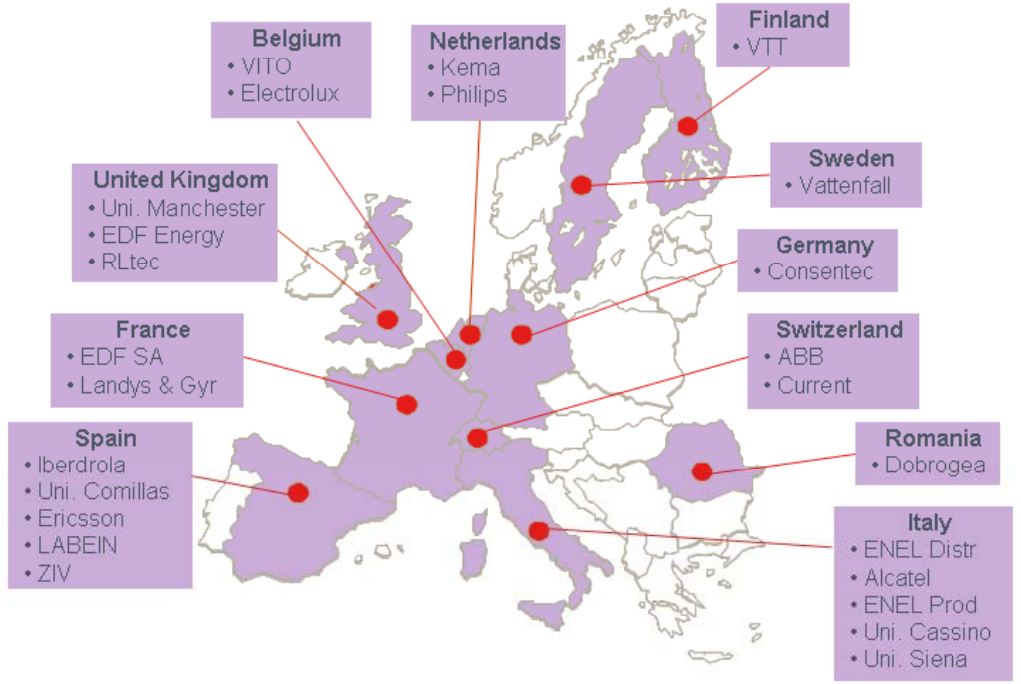
4 years (2008 – 2012)

Enel Distribuzione is Coordinator

EDF SA is Technical Manager

Total budget 16 M€

EC financing 9M€



25 partners, 11 European countries

Research: Uni. Manchester, Uni. Comillas, Uni. Siena, Uni. Cassino, ENEL Prod, VTT, VITO, Labein, KEMA, Consentec;

DSO and TSO: ENEL Distrib., EDF Energy, Iberdrola Distrib., Vattenfall

Energy supply and retail: EDF-SA, ENEL Distributie Dobrogea

Electric equipment : ABB, Landis+Gyr, ZIV

Home appliances & white goods, consultants: Philips, Electrolux, RLtec

Communication and ICT providers: Ericsson España, Alcatel, Current

ADDRESS Target and Objectives

Target

Active Demand (AD): active participation of domestic and small commercial consumers in the power system markets and service provision to the power system participants

Objectives

To enable active demand

- Develop technical solutions at the consumers premises and at the power system level
- Propose recommendations and solutions to remove the possible barriers

To exploit the benefits of active demand

- Identify the potential benefits for the stakeholders
- Develop appropriate markets and contractual mechanisms

Study of accompanying measures to deal with societal, cultural, behavioural aspects

Validation in 3 complementary test sites with different demographic & generation characteristics

Dedicated dissemination activities for the stakeholders

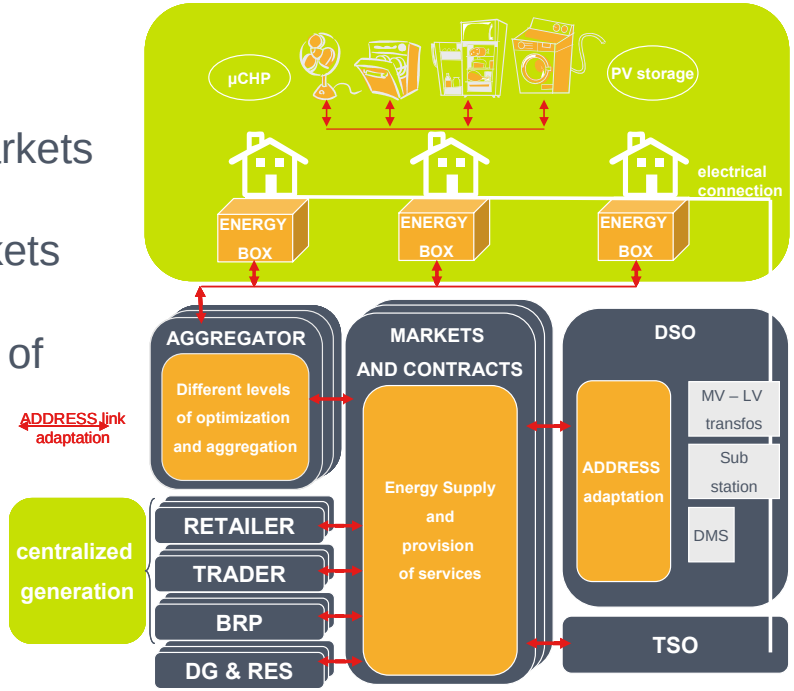
ADDRESS conceptual architecture and concepts

Consumers

- Energy Box: interface with the aggregator
- Optimisation and control of appliances and DER

Aggregators

- Mediator between consumers and markets
- Collects requests &signals from markets and participants
- Gathers flexibilities of consumers



DSO

- Key participant in active grids of the future
- Consumers connected to distribution network
- Enable AD and ensure secure and efficient network operation
- Interaction through markets
- Direct interaction with TSO for system security

Markets & contracts

- Energy supply
- Relief of overload & network congestion
- Balancing services (incl. compensation of RES variability)
- Ancillary services: steady state V control, tertiary reserve
- Load shaping services (e.g. peak shaving)

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Main Concepts

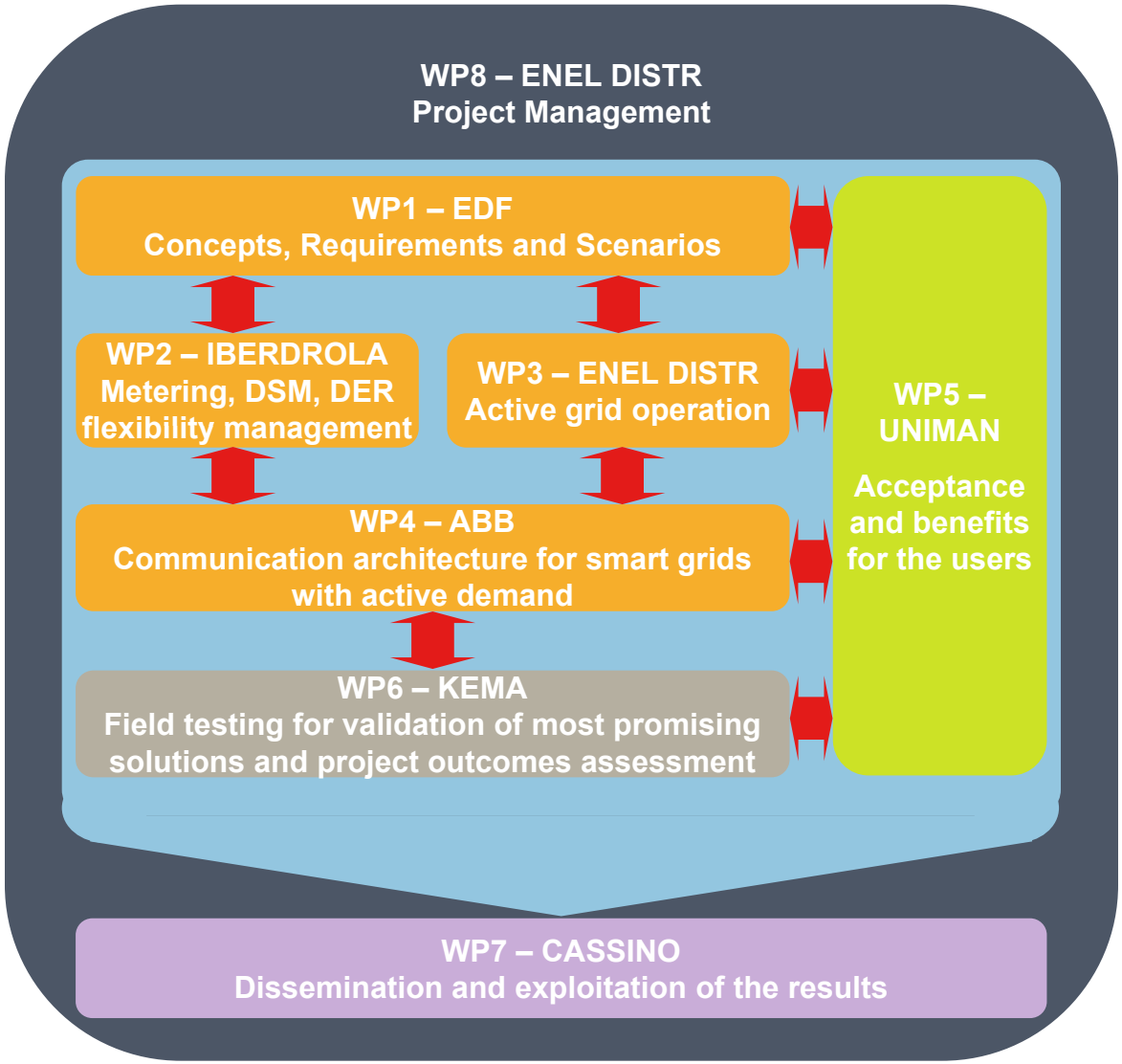
- Interaction based on real-time price and volume (mainly P) signals
- Real-time = 20 to 30 min ahead or longer
- May be modulated by geographical / topological information
- Direct load control by DSO will be not considered

- "Demand" approach (in contrast with "generation" approach)
- consumers not only motivated by purely economic aspects
- not able or not prone to characterize precisely in advance the services and flexibilities that they can provide
  - Services "requested" through appropriate price and/or volume signal mechanisms and provided on a voluntary and contractual basis
  - Development of appropriate technologies at consumers' premises
  - Accompanying measures for societal and behavioural aspects

- Distributed intelligence and local optimisation
- Topologically-dependant services
- Participants optimise real-time response according to the real-time signals

Put the "right amount" of intelligence at the "right place"

ADDRESS Methodology (1/3)



ADDRESS Methodology (2/3)

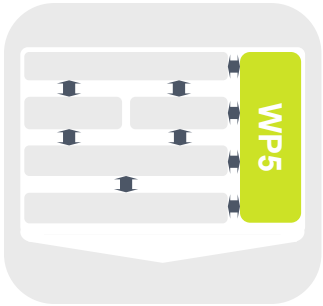
1. Develop
   - the concepts, in particular the mechanisms for the design of price and volume signals
   - ADDRESS technical and commercial architectures along with functional requirements based on the concepts
   - 4 or 5 scenarios representative of European power systems
   - ➢ WP1 (EDF SA)

2. Develop
   - enabling technologies, algorithms and prototypes,
   - test them individually in laboratories.
   - ➢ WP2 (IBERDROLA): for consumers, aggregators and other deregulated market participants
   - ➢ WP3 (ENEL Distr.) for DSOs and TSOs and grid operation
   - ➢ WP4 (ABB) for communication architecture

ADDRESS Methodology (3/3)

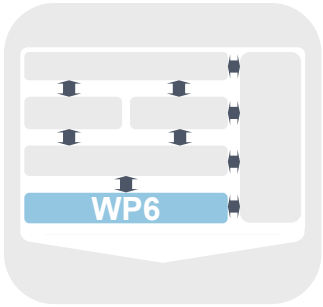
3. Develop
   - contractual, market & regulatory mechanisms for exploitation of the benefits
   - recommendations for accompanying measures for social acceptance

   ➢ WP5 (Uni. Manchester)



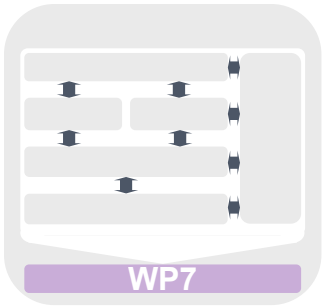
4. Validate and assess
   - Validate the concepts and the solutions developed at 3 different field test sites in Spain, Italy and on a French island
   - Assess the solutions performance and project outcomes (concepts, architectures, …)

   ➢ WP6 (KEMA)



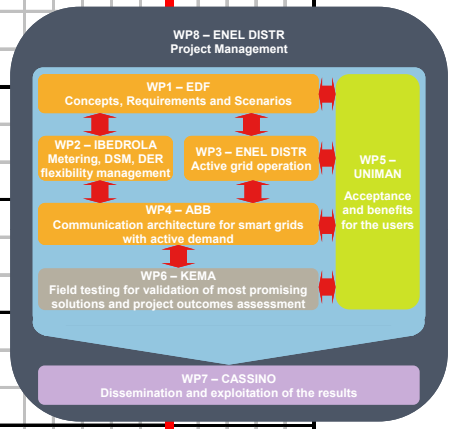
5. Recommendations and dissemination
   - Define recommendations for the different stakeholders: regulators, communities, power system participants, R&D “world”, standardization bodies, …
   - Deploy and communicate the results

   ➢ WP7 (Uni. Cassino)



Work schedule

	2008				2009				2010				2011				2012
	Year 1				Year 2				Year 3				Year 4				
	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	
WP1																	
WP2																	
WP3																	
WP4																	
WP5																	
WP6																	
WP7																	
WP8																	



Main Expected Results

Date	Description	WP	Diss
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PU: public

CO: confidential, restricted to ADDRESS consortium

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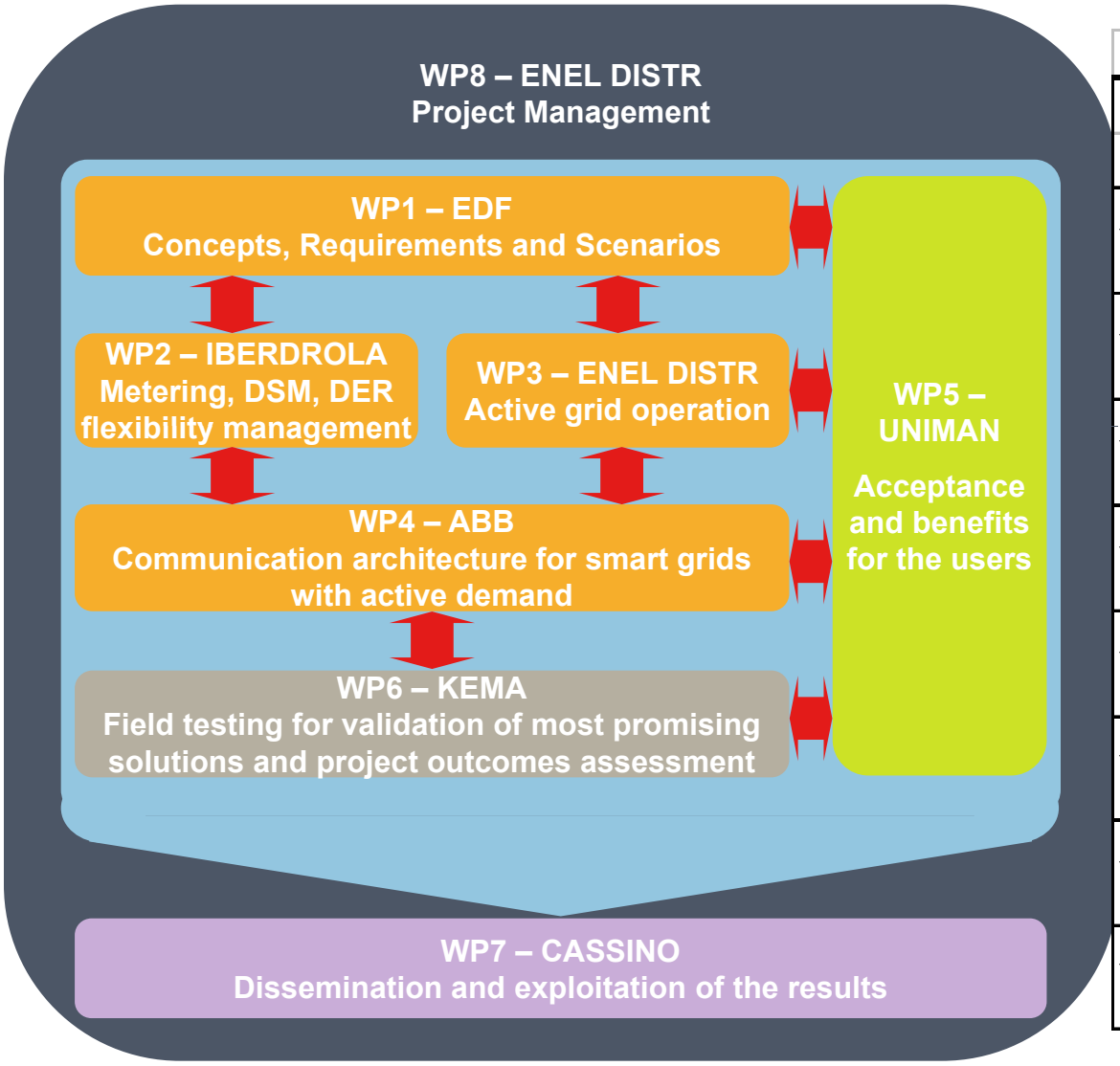
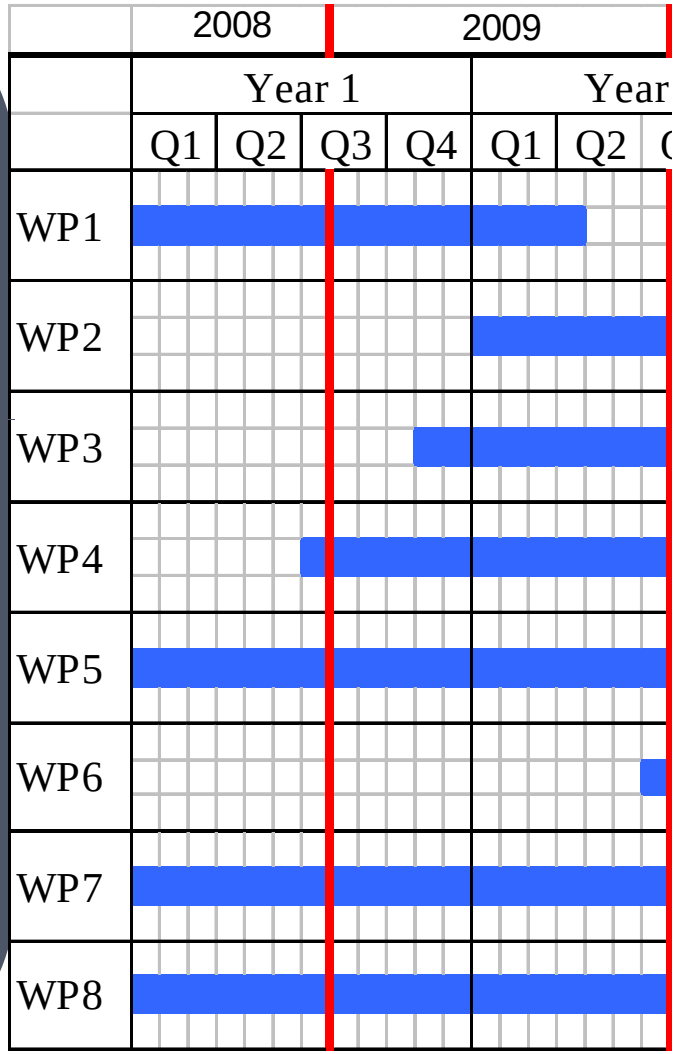
Overview of the work done





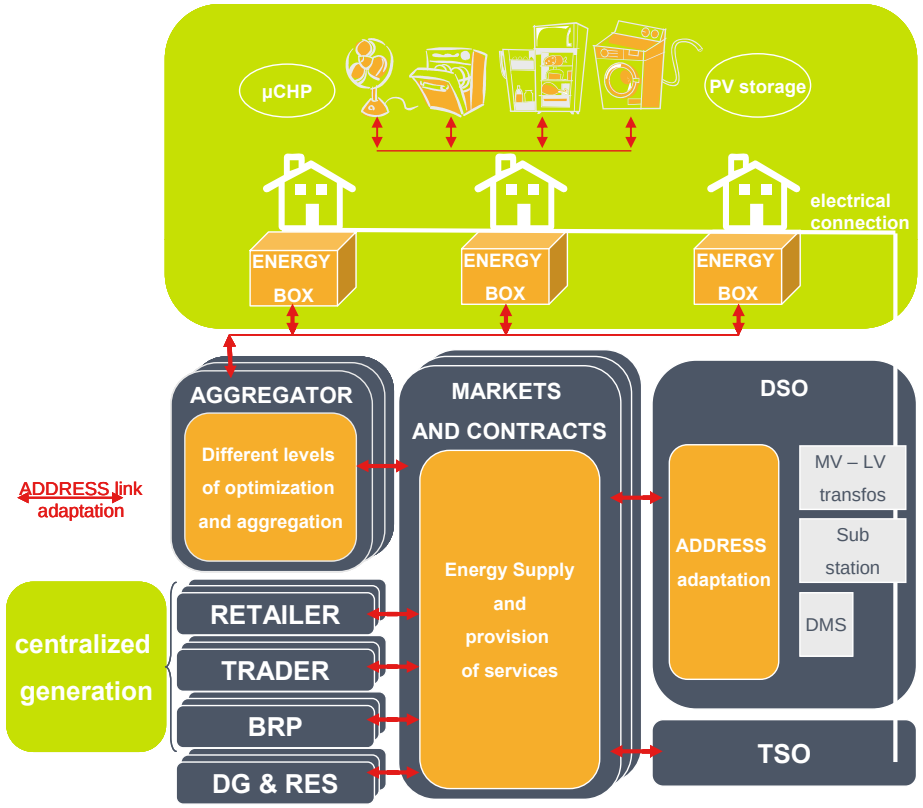
Overview of the work done (and results)

- Discussion of ADDRESS first draft architecture and proposed concepts
- Flexibility of loads, generation and storage at consumers' premises
- Requirements for AD service provision to power system players
- Aggregator of consumers flexibilities
- Toy example on ADDRESS market simulation
- The ADDRESS scenarios approach and first methodology
- Potential benefits of Active Demand (AD)
- Next steps

Discussion of ADDRESS first draft architecture and proposed concepts

Identification of the main issues to be solved, for instance:

- Relationships between aggregator and
  - DSO/TSO (impact on grids, …)
  - Retailers/BRPs (imbalances, …)
  - Consumers (acceptance, …)
- Energy box:
  - Ownership, functions, etc.
  - Interaction with the meter
- Service provision:
  - Characterisation of services
  - Price and volume signals
  - Risk management
  - Markets and contracts
- Monitoring/assessment of
  - Consumers response
  - Service delivery
- Importance of the regulatory framework



Flexibility of loads, generation and storage at consumers premises

Detailed analysis of

- Embedded generation and storage at consumers premises
- Loads and appliances at consumers premises
- Technical (electrical) characteristics, load usage constraints, control capabilities, energy impact of flexibility, services that can be provided, costs, spreading, …

Aggregated flexibility at the consumer level

- Consumers load curves for Spain, Italy, Finland …
- Consumers classification and analysis of flexibility
- Analysis according to periods of the year, week, day, …
- Flexibility indicator

Scenarios for the evolution of consumers' flexibility at the horizon 2020 and a "more aggregated" level:

- From the perspective of the portfolio of an aggregator
- In accordance with the general scenarios approach based on "success factors"

Survey of Energy boxes and local energy management systems – on-going

Technical Challenges to solve to make demand more "active" – starting

Requirements for AD service provision to power system participants (1/5)

Survey and assessment of past and on-going DSI programmes

- Participants involved and their needs addressed in the programme,
- The services provided
- Barriers encountered and the possible solutions implemented,
- Signals exchanged and the way they were designed,
- Outcome and lessons learned

Definition and classification of Electricity system players (~functions or archetypes) to which active demand services could be provided

- Regulated players: **DSOs and TSOs**
- Deregulated players: ~15 players, 9 players to study (apart from ADDRESS "consumers" and "aggregator")
  - **Producers:** central producers, decentralised electricity producer, producer with regulated tariff and obligations (reserve, volume, curtailment, etc.)
  - **Intermediaries:** production aggregators, energy traders, electricity brokers, Balancing Responsible Parties (BRPs), retailers
  - **Consumers:** large consumers

Requirements for AD service provision to power system participants (2/5)

Expectations of deregulated players with respect to AD and possible services

For each of the player:

- Role of the player and main functions in the system,
- Main stakes and contextual constraints,
- **Short-term needs and long-term needs generated by the stakes**
- **How can AD meet these needs**
- Identification of possible services provided by AD and basic requirements (=> many possible services)

Expectations of DSO/TSO with respect to AD and possible services

Similar approach as for deregulated players => mainly three types of services

- Voltage regulation and power flow control (VPRF)
- Tertiary active power reserve
- Smart load reduction to avoid “blind” load-shedding

Requirements for AD service provision to power system participants (3/5)

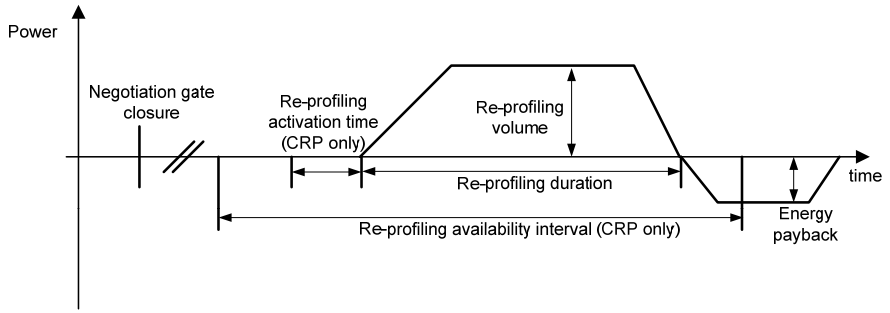
Impacts of AD development on the processes of players and possible issues/barriers against AD development

- AD acceptance by the players (not only consumers)
- Regulatory issues (lack of incentives, volume threshold, obligations, etc.)
- Contractual issues and pricing model
- Conflicting interests of players with respect to AD services
- Verification of service provision
- Management of information (ownership, confidentiality, etc.)
- Risks: uncertainty on AD availability, energy “payback” effect, network topology, etc.

Requirements for AD service provision to power system participants (4/5)

Standardized AD services & products:

- AD service template
  - Atomic
  - Composite
- 2 AD products

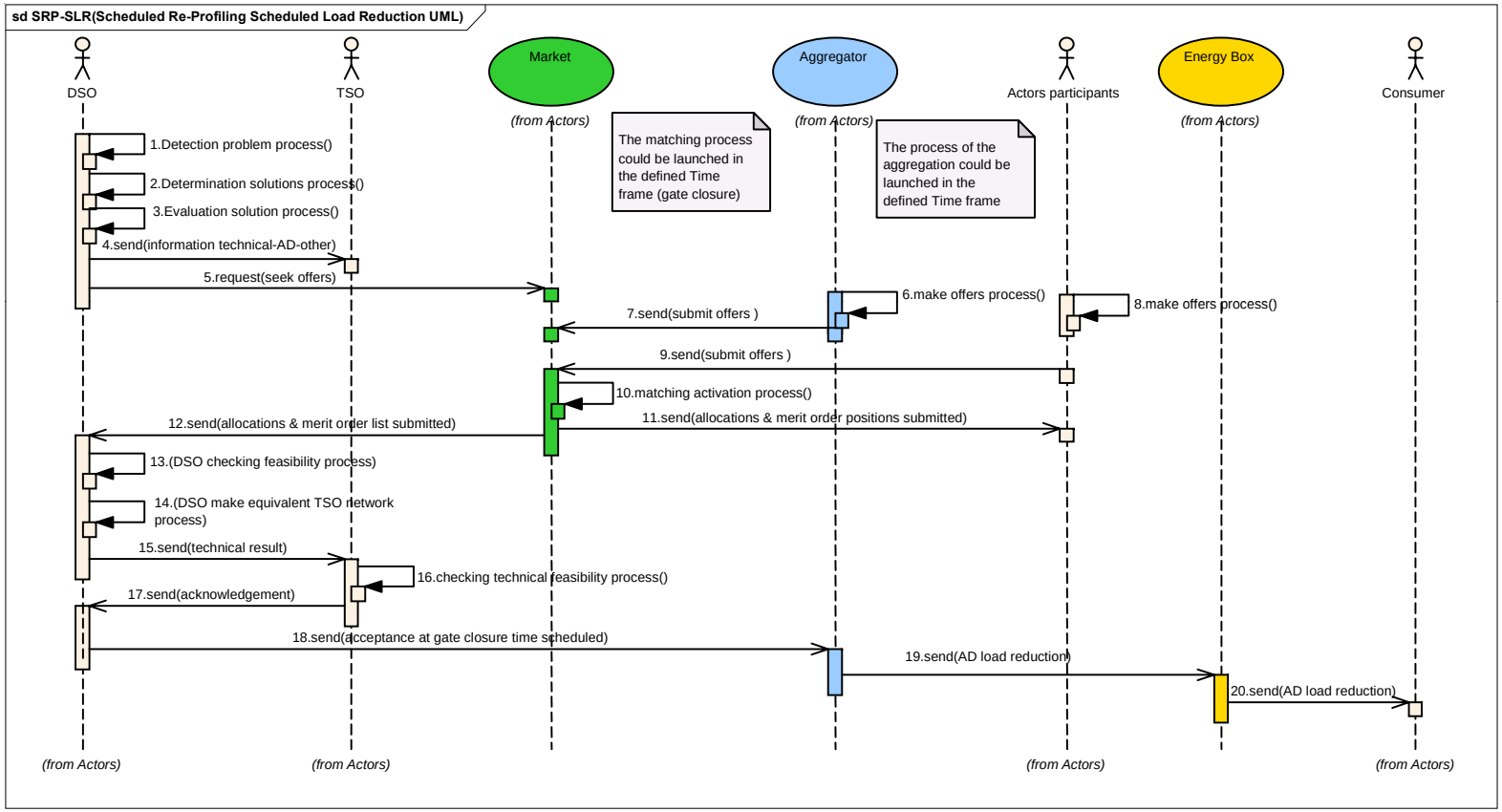


AD Products	Conditionality	Typical example
Scheduled re-profiling (SRP)	Unconditional (obligation)	The aggregator has the obligation to provide *a specified* demand modification (reduction or increase) at a given time to the product buyer.
Conditional re-profiling (CRP)	Conditional (option)	The aggregator must have the capacity to provide *a specified* demand modification during a given period. The delivery is called upon by the buyer (similar to a reserve service)

Bi-directional Conditional Re-Profiling or 2-way CRP (2-CRP): modification in a range, including both demand increase and decrease

Requirements for AD service provision to power system participants (5/5)

Description of “use cases” for the previously identified services



Methodology for the design of price and volume signals – on-going

- Based on the optimization process of the players

Aggregators of consumers flexibility …
… and toy example on market simulation

Overview of "aggregators" in different countries in the world

- Not exhaustive
- To have some hints of the present situation
- USA, Australia, Italy, Germany, France, …

The ADDRESS aggregator (work on-going) - first thoughts on

- Role and main functions,
- Relationships and services provided to power system players
- Activities and internal organization

Integrated toy example on ADDRESS market simulation

- Better understanding, pedagogical purposes, play with "numbers", …
- Provision of services by AD aggregators to retailers and DSO
- One type of products ("Scheduled re-profiling"= scheduled load modification)

ADDRESS scenarios approach & first methodology

Collection and analysis of country specific aspects (contextual elements) based on answers to a questionnaire – factors important for AD implementation

- Players, market organisation, regulation, metering activity, network aspects, …
- Large development of RES expected to increase needs for AD services
- Retailers will probably be key agents for AD deployment and, vice versa, AD business can be a key factor for retailer development
- Smart meters will probably be one of the key enablers for AD development

Guidelines to build ADDRESS scenarios

Horizon: 2020 … and steps to go there

ADDRESS approach: success targets

- Scenarios: 4 European contexts with different probability and level of success with respect to an ADDRESS future
- Focus on success factors and drivers:
  - Climatic factor (heating or cooling dominance)
  - Consumer density (urban vs rural, network aspects, housing style & age, …)
  - Enabling technology (new usages, intelligent appliances, ICT, meters, …)
  - Industry infrastructure (market context, generation mix, environmental issue,…)
- Methodology to assess success based on impacts on all the players' stakes.

Potential benefits of Active Demand (AD)

- Constitution of the Group of Users and Stakeholders (GUS)
- Questionnaire on the potential benefits and perceptions of active demand sent
  - To the GUS members
  - To the ADDRESS consortium members
- On-going: analysis of the results.

Next steps

ADDRESS Vision (WP1):

- Technical and commercial architectures
- Definition of ADDRESS Scenarios
- Application of the architecture to the scenarios

Specifications

- Detailed specifications for exploitation of DDER flexibility and service provision at consumers and aggregator levels (**WP2**)
- Detailed specifications for control and automation of distribution networks with AD (**WP3**)

Communication (WP4)

- Survey on communication requirements
- Continue information model: players and interaction modeling

Acceptance and market (WP5): start work on

- Models of benefits
- Consumers engagement
- Market mechanism and contractual structure

Test sites (WP6)

- Start selection and definition of test objectives

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+ Internal Reports and different kinds of documents

Thank you for your attention !

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