Winning End Users Active Support to Demand Side Response

José Osório, [1] Ana Estanqueiro [2]

[1] REN – Rede Elétrica Nacional, Av. Estados Unidos da América, 55, Lisbon, Portugal. e-mail: jose.osorio@ren.pt

[2] LNEG – Laboratório Nacional de Energia e Geologia, I.P., Estrada do Paco do Lumiar, 22, Lisbon, Portugal. e-mail: ana.estanqueiro@ineti.pt

Abstract-- While objectives proposed for Smart Grids and Smart metering may seem to be able to win easily end user's supports, a considerable amount of studies on social behavior concerning energy efficiency and sustainability show the gap between the values people would like to fulfill and their real life performance. As TSOs envision here a source of System Ancillary Services, measures to make the source really dependable, so that an adequate market design may really work are pointed out.

***Index Terms*—Smart Grids, Smart metering, System Ancillary Services, Sustainable Development**

I. Introduction

THE European Commission's Recommendation on roll-out of smart metering [14] envisions Smart grids for goals which could be expected to win strong support from electric networks end users. However, there is a considerable amount of studies on social behavior concerning energy efficiency and sustainability which show the gap between the values people would like to fulfill and their real life performance.

What TSO (Transmission System Operators) expect is that the important changes that Power Systems are going through, as wind power and other variable energy sources increase their share, will include receiving a significant contribution in System Ancillary Services from network systems end users either by displaying demand flexibility or by offering resources from Distributed Generation (DG) as they acknowledge system availabilities or requirements through adequately designed communications. Such responses duly aggregated at predefined levels designed to fetch them from end users' sources of ancillary services that will replace bulk generation (that "traditionally" provided them) are becoming mandatory for the TSO pursuing a global network technical management.

In this paper measures that could promote such end user active participation are discussed. An adequately designed System Services' market would appeal bathed motivations. However, the lumping mechanisms that will fill in the gap between its granular composition and bulk system requirements poses a number of questions and the answer to these will be key to a real end users empowerment drawing from their knowledgeable participation. The following will rank high among such questions:

- Solutions at end user installation are expected to lie quite far away from the "one fits all" paradigm. How to achieve efficiently the degree of tailor made retrofitting that will be required?
- How to reach the depth of involvement at end user installations that will allow the required consumption pattern re-engineering?
- How to assure end users about the reliability of this system architecture innovation and that the privacy of their personal data (specific consumption patterns included) will be preserved as required by [14]

Field experiences in Demand Side Management (DSM) and co-related work in Smart Grids (SG) and Smart Metering (SM) are analyzed together with experience gathered in end user energy efficiency. The aim is to extract lessons to apply in the inflowing work and simultaneously point out further sociological field research or other interventions that may be required.

The case study will be based on the examination of the Portuguese National Regulatory Authority's proposals for SM roll-out, recently published [1]. At a later stage the whole Iberian MIBEL power market may be envisaged.

II. European Energy Policy

The Portuguese TSO, REN's Electricity Transmission System Planning Directorate is permanently concerned with the medium and long term vectors that form a resilient and firm guidance of its activity. Recent Communication from the Commission on Renewable Energy [2], insists on the importance of large scale integration of renewable energy in Europe and of the private sector investment to achieve these goals and that this "in turn relies on the stability of renewable energy policy". Investment requirements form a complex interwoven tissue. Besides a rigorous implementation and enforcement of the Renewable Energy Directive, a clear longer term policy is needed to ensure it is set up.

The largest share of energy supply in 2050 will come from renewable energy, since growth in renewables will be a 'no regrets' option. As stated in this EC document, investment policies should favour a level field for renewables and fossil fuel subsidies should be dismantled: "The complementarity of climate and renewable energy policies requires an adequate carbon market and energy taxes to give investors strong incentives to invest in low carbon technologies."

The document proposes a truly integrated market to enable producers of renewable energy to participate fully and to progressively take on the same responsibilities as conventional generators, including balancing. Returns should cover investment costs for new generation to maintain system adequacy (ensuring adequate investment to guarantee uninterrupted electricity supplies). How to cope with the downward pressure on wholesale electricity prices due to the rise of wind and solar power (with near zero marginal costs)? The market should be able to reduce supply for low prices and increase it when prices are high: "Changes in market prices need to encourage flexibility, including storage facilities, flexible generation, DSM (as consumers respond to changing price patterns)."

It continues saying that the energy infrastructure package and the internal energy market directives, through measures to better coordinate infrastructure planning, development and operation and to roll-out smart meters pave the way towards integrated European energy infrastructure: "The creation of the single market, new technologies, new market players, new ancillary service providers – all hinge on the need for new infrastructure."

It is said also that transforming infrastructure includes the development of smart grids, with producers, even new micro-producers, consumers and grid operators all having to communicate to ensure optimal demand supply matching. Appropriate standards and new market and regulatory models will be needed.

Under section 5, "Empowering consumers", one can read about consumer's choice being enhanced by and further upgraded into smart savings capability as smart metering will allow him to profit from real time or near real time market prices allowing DSM to render peak shaving capabilities into a much higher public acceptance of RES.: "The greatest benefits should come with the combination of "smart metering" and micro generation."

And in its last paragraph the document leaves an appeal towards the maintenance of the European research and industrial leadership globally for a cost effective competitiveness and job opportunities.

III. REN, THE ELECTRIC TRANSMISSION SYSTEM OPERATOR: THE CONCERNS

REN is one of the 41 members of the European Network of Transmission System Operators for Electricity (ENTSO-E), established by the EU 3rd Internal Energy Market Package [3].

Within this organization, European TSOs are currently developing a Demand Connection Grid Code, through a highly participated process which includes public consultations and open stakeholder oriented workshops. This is one among other Grid Codes for which ENTSO-E was supplied "Framework Guidelines" by the Agency for the Cooperation of Energy Regulators (ACER) wherein "significant grid users" are defined "on the basis of their impact on the cross border system performance via influence on the control area's security of supply, including provision of ancillary services"; and it is required that network code(s) shall provide for regular re-assessment of the "significance test" and cost-benefit analysis (CBA) to cope with evolving system requirements including penetration of RES, DG, Smart grids and household DSR and set out minimum standards and requirements to enable demand response and/or participation of consumption units in other grid services, on a contractually-agreed basis.

Previously, following the adoption of the 3rd legislative package for the European Internal Market in Energy [3], European Commission (EC) invited the European Regulators' Group for Electricity and Gas (ERGEG) to progress as far as possible in the preparatory work for the above "Framework Guidelines" since ACER would not be fully operational before March 2011. Thus the first step taken resulted in an Initial Impact Assessment document [5], referred to the expected important role that Demand Response involving large industrial consumers with modulating capabilities as well as the domestic and Small to Medium Enterprises (SME) segment, subject to massive smart meters roll out and intermediating Balance Responsible Parties (BRP), would play. These BRP could be commercial suppliers aggregating capabilities of scores of end users and even managing them in real time.

Expectations in this document pointed out "…the present need to support achievement of the 2020 targets and even more, to balance the future massive intermittent generation, active demand side participation in the market appears to be unavoidable."

Attention is also given to specificities of the demand response grid users that "need to be addressed, including coordination, organization and market related issues.

Moreover, transparency in the connection requirements for demand response is essential for the SOs to be able to manage and integrate the demand response services in the network operations, most notable in relation to balancing of intermittent generation."

On ENTSO-E's webpage a description of the process that followed is given [6]: last January ENTSO-E received an EC mandate to develop a Demand Connection Code (a set of rules) (DCC) under the above mentioned ACER's document [4]; several bilateral discussions with stakeholders, public stakeholder workshops and the resulting exchange of viewpoints led to the draft DCC [7] now made available through this webpage with a request for further input. Now the concept of "significant grid users" has been replaced by "significant demand facility" which is defined as either a demand facility, connected directly to the Transmission System, or a Demand Facility with Demand Side Response (DSR) with the only exception of DSR responding to System Frequency Control (SFC) requirements. This results in a higher status being recognized to any consumer willing to let any part of his load participate in DSR: the exception is intended only for those appliances which will in the near future automatically react to System Frequency deviations, through some built-in device of which the end user will in general be unaware and will thus require no decision from its user for participation in DSR.

This important status is clearly stated in [7] when referring the change in the historical role of generation to move towards demand to supply SAS: "…with robustness to face disturbances and to help to prevent any large disturbance or to facilitate restoration of the system after a collapse" being fundamental prerequisites."

This is also stated in an explanatory note [8] published together with the draft DCC, in its section "1.3 Options to Increase RES Penetration in the System". In Table 2: Overview of options to increase RES integration compares pros and cons of several alternatives for the sourcing of System Services like Load-Generation Balancing, Voltage profile management, SFC. The conclusion reported from comparing the sourcing of these System Services from persisting conventional generation, or from innovative devices built into RES generators or from investing in grid devices for extensive storage or for voltage management (reactive compensation) or from DSR points to a mix where the advantages of the DSR option prevail over the other options besides the advantages expected from consumers' active participation and their resulting empowerment.

As part of the consultation process on the draft DCC [7] launched on its publishing date, the 27th June 2012, an open workshop was held on the 5th July, at the premises of ERSE, the Portuguese National Regulatory Authority, to collect stakeholder input. When comments from the floor were requested, the first question raised referred the conclusion from the pros and cons table mentioned in the previous paragraph to ask what architecture was being prepared so as to reach the required volume of System Services to be sourced from DSR. Motivation of end users as well as of intermediating parties such as traders (who could serve as aggregators) were the explicit concerns. Although ERSE's representative considered it a million dollar question, the subsequent discussion revealed that these matters were yet in a rather embryonic stage.

On the 6th July 2012, at a panel held by REN in Lisboa, on "Challenges and opportunities towards a sustainable energy future" the keynote speaker [15] after stressing the importance of integrating larger volumes of renewable energy went on to remark on the importance of DSR for this objective. DSR, he said, would not be as useful and smart as could be without massive roll-out of smart meters [15]. Another panelist recommended that the development of Renewable Energy utilization should continue and that a revolution in the use of Information and Communications Technologies (ICT) for their smooth integration would be required: it would help develop namely DSR and Smart Grids for a smart management of RES [16].

IV. ERSE's Study on Smart Meters for Electricity and for Gas [1]

ERSE presents the study on SM for electricity and gas as aiming to comply with its legal obligation to evaluate economically all the costs and benefits for the market, namely for grid operators, traders and consumers and then make the economically most rational proposal including its time schedule.

ERGEG's recommendations of good practice on Smart Metering [citation in 1] are tabled: data privacy and security, level of customer servicing, scope of CBA and same opportunities for all along the roll-out process. In these recommendations the top ten functionalities most valued as a result of the CBA so far engaged in Europe are referenced: data recording and appliance control for energy saving; secure two-ways communications for data transfer as often as suitable for consumers as well as for operators, for meter maintenance and control (fraud detection, supply cut-off and restoring, eventually with some change in the supply conditions, all included), for remote tariff changes and with multiple record storage for this purpose; metering of two-ways active and reactive flows to support micro-generation.

Several experiences already carried out in Portugal as well as worldwide are reviewed in [1]:

- The French NRA decided there would be consumer oriented communication and education programs put together by a partnership to include permitting authorities, local communities, suppliers and consumers' associations. In relation to gas smart meters some functional restrictions were imposed for safety reasons ;
- Their most compact gas network led Holland to the so called multi-utility approach: an integrated smart metering that should serve both, electricity and gas supplies. A mandatory roll-out was refused by the parliament on grounds of the right to consumer information privacy: a voluntary approach was decided except for new housings where it became mandatory. Correct consumption metering and billing, ease of supplier change, more efficient market operations and the promotion of energy efficiency were the main objectives. Studies carried out showed that in order to induce energy savings it was important to supply near real time consumption information, provide tips and objectives for saving energy and specify consumption per appliance, compare current consumption with historical values as well as with similar consumers.
- In the UK the main objectives are energy savings, peak shaving, improved trading service and competition in the relevant markets, while ensuring adequate data protection and an appropriate infrastructure for smart grids. A dedicated Data Communications Company will be set up and consumers will have to decide whether to make their consumption data available and on its use. In-house displays (IHD) for real time consumption data were deemed necessary.
- In Ireland a high level design of electricity smart metering roll-out for public consultation included cost-benefit analyses, pilot projects, submitting traders and grid operators to independent audits and consumer behavior tests statistically considered quite sizable, thus yielding important information on the smart meters impact on consumers. A multi-utility approach to include gas

supply was suggested as well as well as the mandatory use of IHD. Consumption data security and protection requirements are defined.

- In the Australian State of Victoria a smarter and more efficient Electricity System operation is expected with new services for customers including monitoring supply quality and improved energy efficiency, while it is provided for minimum consumption data protection.
- Referenced benefits from Smart Metering include improvements in Electricity System Planning, postponing investment, facilitating distributed generation, electric vehicles deployment. In all analyzed international experiences consumption data is proprietary and the consumer decides who may access it and he may retrieve it either from the bill or from the meter's local interface. In Holland and in the UK there is an organization in charge of smart meter reading and data processing.

For its own CBA on the Portuguese case ERSE uses a discount rate of 10% closely related to the rate of return on the regulated assets on the grid owing to current Portuguese financing difficulties and current CO_2 market prices (8.51 €/ton maximum) until 2014 and thence estimates from EC's "Impact Assessment – A Roadmap for moving to a competitive low carbon economy in 2050". Furthermore, this document claims that only CO2 reductions from higher energy efficiency will be taken into account as it is considered that emissions base cost is already internalized in the price of electricity [10]!

The "standard" set of functionalities includes minimum requirements from EU directives and national objectives with due regard to the obsolescence of technology. An important functionality included in the standard pack is the temporary reduction of maximum supply power, as this brings about a more significant self-limitation of demand. It was also thought sensible to avoid parting from generalized international practice as too customized functionalities could prove very expensive given the size of the Portuguese market and the departure from the benefits of scaling and of the learning curve.

While considering several types of feed-back to the consumer, on his own consumption, estimates of the energy saving and peak shaving that could result from them do not indicate on what research they are supported. Even in the accompanying ACB report [10] to this study [1] and made available with it this cannot be found. However the report on Portuguese field experiences [11] also accompanying the main ERSE study [1] describes in project Inovgrid one Portuguese field experience that includes a consumers' study case where some values presented in the main ERSE study and in the ACB document [10] were obtained. Report [11] clarifies also that all this is relative to over 15000 domestic clients and some notes on customers' behavior changes noticed in SME are referred.

Back to main study [1], data security and privacy are considered together with consumers' access to his own consumption data. Consumers' time spent on requirement of the installing crew is valued at €3/hour, either for IHD, or for smart meters. However, IHD devices are regarded as consumer's option to be installed at his own cost: this option is different from the one considered in the UK or in Australia ([10] for, even if at the end of the day the whole bill will be paid by the consumer, the front investor should have proper financing resources and the capability to stand its initial impacts.

ACB report [10] summarizes benefits (reduced cost-to-serve, energy savings, improvement of retail market functioning, better distribution grid service and promotion of smart grids for "smarter use of the energy infrastructure, new energy services", higher DG penetration or Electric vehicles deployment) and costs (new meters –including stranded costs of the replaced ones, ICT, project management). Roll-out management costs, including consumer education costs, are presented as non-negligible: but no further grounding is presented for the displayed figure. In this document, energy savings made possible at consumers' installations are pointed as reducing asset efficiency along the value chain. This same efficiency reduction along the value chain is referred with respect to demand time-of-use flexibility. Benefits resulting from reduced or postponed investments due to energy savings and time-of-use flexibility and similar benefits related to investments in distribution and transmission grid assets are mentioned. However, a healthier attitude can be noticed: higher competition between traders is reported as a benefit to consumers meaning less revenue to traders, but here it is immediately pointed out that higher efficiency in trading is expected to overcome this revenue reduction. In this context it is also mentioned that the ease in getting real time consumption metering would help competition as trader switching becomes easier.

The results shown in study [1], section 6.5.2, neatly set aside gas smart metering when considered alone. The same conclusion is arrived at in section 6.5.3 where joint electricity and gas smart metering is considered.

Thus only electricity smart metering roll-out has a positive assessment [10, section 6.5.1] and the most valued scenario extends linearly from 2014 to 2016, features the above mentioned "standard" set of functionalities, detailed monthly billing of real consumption with energy saving tips and 85% PLC communications - as in highly dispersed consumers' areas GPRS will have to be used and these are deemed to reach 15% [10, pg. 44, 50, 51]. As mentioned earlier IHD are optional but the possibility of connecting them is included in the standard set of smart meter functionalities. This scenario was submitted to sensitivity analyses and conclusions along sections 6.6 and 6.7 show evidence of the robustness of its high value.

V. Smart Metering as a tool towards Sustainable Development

The two Directives concerning the internal market (in electricity and in gas) [3] require each in its own Annex 1, section 2, that Member States (MS) "shall ensure the implementation of intelligent metering systems that shall assist the active participation of consumers in the electricity supply market" or "in the gas supply market", respectively. Furthermore the

"implementation of those metering systems may be subject to an economic assessment of all the long-term costs and benefits to the market and the individual consumer or which form of intelligent metering is economically reasonable and cost-effective and which timeframe is feasible for their distribution."
Subsequently a time-table shall be prepared for the full roll-out which in the case of electricity should be complete by no later than 2022.
The rationale developed by EC, namely in Communication [2] comprehensively examined in section I above, establishes two important goals for the Smart Grids:

- End users empowerment through DSM capabilities which allow them a better grip of understanding on underlying technical characteristics of the power system. This provides for a more democratic participation in policy definition towards energy sustainability.
- Further integration of RES in the Power System, as it is upgraded to source ancillary system services from end users' DSM, as well as of Distributed Generation (DG) capabilities.

Study [1] published by ERSE reaches positive conclusions for the roll-out of smart meters. Although it may have been restricted by the current situation of the Portuguese economy, future reassessments are promised, which will possibly run under more clarified conditions.
It is important that a strategic definition of priorities ranking important measures and cost-benefit based ranking of priorities has to be carried out with these two goals at the very kernel of properly designed policies. Rather than listing requirements, highly motivating promotions of required policies should be carried out on one hand, while on the other hand consumer education should be aimed. Good practices and required functionalities should be defined in due regard to the more strategic objective of end user participated energy services management.
Electricity TSOs' concerns as explained in section II above are at the joint of the two goals above. Procuring ancillary system services in the bulk volumes required for a smooth operation of Power Systems makes dependable sources absolutely needful. As the generation mix gets higher and higher shares of RES generation where wind and solar power will be largely dominant, their variable generation requires larger balancing flexibility and their technical features are known to require higher supplies of other system services to the Power Grid concerning voltage and frequency regulation. Moreover, collecting RES power is requiring significant extension of HVDC links (although not yet in Portugal) and balancing RES has led to the introduction of variable speed hydro pumps and both these technologies are responsible for added difficulties in system frequency control.
As also mentioned previously, Demand Response is expected to become a very advantageous source of system services. Making it dependable will of course be highly correlated to the real empowerment that the end user might experience participating in a smart power system management and thus making energy services from the grid more affordable than they would be otherwise: an example are dynamic pricing programs, made possible through smart meters, which will help load-supply balance through the flexibility achieved from displacing load from more costly hours to lower cost hours in sizeable aggregated volumes. Automation could lead this service into a higher level comparable to secondary regulation.
Realizing the uncertainty in decision makers' minds about smart metering potential, capability of lasting effectiveness, reliability of pilot results, cost-effectiveness of the programs, desirable feedback contents and format, European Smart Metering Industry Group (ESMIG) decided to fund an independent study to compare a large number of pilot studies to point out repeated and consistent results [9]. VaasaETT, that was selected to conduct this study, presents itself as a Global Energy Think-Tank [17], and an expert in "Customer Behaviour and Demand Response in energy markets". Their "Empower Demand" report [9] is an impressive piece of work which compares about 100 pilots involving 450000 residential customers. These pilots were chosen setting aside those with less detailed reports or less comparable for any other reason.
Owing to constructive differences between the pilots and their reporting, conclusions do but indicate which variables influence results rather than any exact percentage figure. Fifteen different aspects or variables were defined to describe the structure of the pilots (feedback contents and format, whether combined with pricing, tariffing, education during pilot, pricing alerts, pilot size, duration and uptake, etc.) and 7 other variables described the involving market (climate and season, regionalized differences, average yearly consumption, meter and data ownership, etc.)
Two main types of smart metering based Demand Empowerment programs were considered: Feedback programs (through IHD, Ambient Displays, websites or informative billing) and Dynamic Pricing programs (through TOU pricing, CPP, CPR or RTP, while insufficient data led to set aside pricing programs like those based on pre-payment or increasing tariff blocks). An excellent explanation of these programs can be found in [9]. Along the report it is stressed that technology is an enabler of successful DSM which rather depends on five decisive factors: "socioeconomic factors, consumer consumption patterns, program content/structure, supportive technology, and household load sources" which are the building blocks to meeting consumers' needs and thence their engagement. Program uptake is a central concern in this report, and one that is shared with TSOs in that these operators seek sizable and dependable sourcing of system services, a need arising from deeper penetrations of RES in Power Systems as already stated.
In respect to this, regionalized differences noticed in uptake rates of different types of programs gave rise to hints to improve their cultural fit by region. Longer lasting pilots seem to have higher potential of improving uptake due to users' learning cycles (TOU results, however, do not appear to run in the same direction): keeping initial interest alive and developing it will be the challenge here and for this one possible

way would be to introduce more sophisticated aspects of the program at later stages. While dynamic pricing pilots do not seem to suffer with large number of participants more than one thousand participants in a feed-back pilot shows a trend to declined results: either dynamic pricing is easier to communicate while effective feedback for larger populations requires proper segmentation or this is the consequence of the noticed trend towards simpler and less informative feedback in the larger pilots. This suggests further research on large pilots which will also allow appropriate customer segmentation during and after the rollout, from the analysis of reactions to the program as it evolves. This can then frame directed marketing and education.

In general customer education seems to improve program results. Researching how to make the most of it is important e.g. to be able to use the potential of one program type to prepare end-users for a more advanced program type or to properly segment education programs. Education also helps overcome some negative side effects in dynamic pricing programs where sometimes demand driven to off-peak hours results in higher over-all energy consumption, particularly in the case of automated loads. Other forms of interaction between program organizers and its participants may include questionnaires, interviews and meetings and they tend to improve results. Interaction taking place (e.g. an extra education campaign) after a program has been launched may even increase the cycle of learning and consumer interest. Although technology is very important as is the case of IHD for feedback or of load automation for real time or near real time response to system emergencies, what indeed is in question is "the current tendency to emphasize technological development over and above all other factors in European pilot schemes while comparatively little funding is provided to studying the best messages to deliver to consumers, their cycles of learning through program layering or the impact of surrounding socioeconomic and cultural factors." [9]

Thus it seems that if we are really committed to sourcing sizable volumes of ancillary system services from grid end-users based on a dependable smart grids architecture it would be best to set-up some kind of organization with the enterprise of linking energy system services requirements with end-users' needs in a permanent win-win strategy. The main goal would be to keep alive a vivid interest of end-users in participating in the management of the energy system accompanying the profound energy system evolution expected in the coming decades. It would provide specialized employment to energy managers who would follow energy services utilization in industrial units, residential districts or blocks or may be even within a building in permanent personal contact. Actually these have been referred to as possible "energy ambassadors" [12] [13]. This approach would require preparing properly designed education campaigns, including adequate segmentation, as well as all other useful interactions with end-users, helping them understand how to do the best use of energy services they need, the context of the wider energy system management, data security and protection issues, and promoting procedural justice. Transparency would be a key to the success of this organization and that would call for some form of end-user participation in its management too. Report [13] concerns field work carried out with an aim, among others, to help the Portuguese Energy Agency which is an organization similar to the one proposed here but with its target set on the promotion of energy efficiency. The proposal being presented here has additionally an aim related to SAS supply to the Power Grid. This SAS procuring organization should develop its work aiming a strategy of mutual support with ADENE and the Municipal Energy Agencies.

Having in mind the main goal of this organization, for drafting its initial activity guidelines, lecture [12] and report [13] could be very helpful as they have the advantage of a more holistic approach on energy services intermediation towards end-users. Furthermore it is based on a vast field experience of the Portuguese energy culture from a sociological viewpoint. Main roadblocks to be overcome include poor and confusing knowledge about energy items exhibiting gaps between scholarly acquired knowledge and day by day professional or domestic practice, lack of trust in procedural justice, poor institutional communication, financial difficulty in initial investments and social disregard for saving attitudes, with tips on how to overcome them: performing a protective role against any abuses attempted against end-users, improving educative, motivational an informative communication, progressive incentives offered as energy management improves, profiting from the unavoidable increase in energy costs, supporting required equipment acquisition and needed works, profiting from young ones' knowledge received at school to reach their homes, promote development of energy-efficient goods with easy interfaces, promote energy-efficient attitudes at work, etc. [12] [13]. An important wealth of aspects of energy culture (behavior, beliefs or knowledge) can be found on [12] and on [13]. Tips for proper segmentation of communication contents are also given on both.

This organization would have to develop specialized skills: for example receiving visits from the mentioned energy ambassadors may be regarded as somewhat intrusive [12] and one tip to overcome it would be offering expert visits for on-site help on a voluntary basis. Also letting a utility command through remote action appliances may similarly seem intrusive, even when the end-user can over-ride this remote action, while letting the end-user choose if and how much he will react to such a signal looks much less intrusive and this is seen to result in no lower response [9]. In case enhancing dependable sourcing is aimed one could use the above suggested tips as a start to allow a certain period in which end-users would get acquainted with the situation and as they got confident a contract could be proposed by a trader requiring some mandatory cooperation. But retail traders are in Portugal another population who does not seem very keen on these subjects: on July 10th 2012 at a conference on "Electricity and Gas Markets

Liberalization", organized in Lisboa by "Associação Portuguesa da Energia" [18], the Portuguese representative of World Energy Council, a panel with several retail traders failed to mention smart metering until a question from the floor made them consider the item and even then they failed to develop it beyond mere declarations of platonic interest.

Fairness should be yet another of the organization's concerns: an example would be assessing the consequences of dynamic pricing programs on low-income consumers or on people retained at home (sick or elderly people or very young children) [9] [12] [13]. According to results of such an assessment some adaptation of the programs may be required so as to make them usable by all while complying with fairness requirements. Developing this line of activity and communication would probably prove very beneficial if presented in its link to sustainability which should be skillfully linked also with the importance that Portuguese society gives to Renewable Energy, especially Wind Power as an edge towards energy sustainability [12] [13].

Once the main objective of sourcing dependably significant volumes of SAS is defined, win-win situations should be tabled coupling SAS / (supplying end-user type) pairs so as to strategically create segmented targets and trying to scan the whole population: e.g. small industrial and commercial customers may be of higher potential than perceived at first glance. Combining feedback and dynamic pricing proves to lead to highest performance. Early media involvement raises the reach of communication campaigns and prevents negative publicity. These suggestions for the organization's early work are adapted from a larger list in [9]

Of course this organization will not come without a price. But while carrying out ACB long term costs of energy systems will have to be equated, and among these a carbon price that really pays its heavy externalities, so as to keep them along an optimized path towards energy sustainability. The central mission of this SAS procuring organization of calling for a democratic participation of the citizens in a transparent management of the energy system and creating long-term employment for highly qualified people must be taken into account.

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VI. Synthesis and Conclusion

The need of further integration of renewable energy in the Power System and the need to promote end users empowerment through Demand Side Management allowing them a better grip of understanding on underlying technical characteristics of the power system are two unavoidable factors to be included in Cost Benefit Analyses of smart grids and smart metering developments.

Rather than listing requirements, highly motivating promotions of required policies should be carried out on one hand, while on the other hand consumer education should be aimed. Good practices and required functionalities should be defined in due regard to the more strategic objective of end user participated energy services management.

It seems that if we are really committed to sourcing sizable volumes of ancillary system services from grid end-users based on a dependable smart grids architecture it would be more adequate to set-up some type of organization with the enterprise of linking energy system services requirements with end-users' needs in a permanent win-win strategy. The main goal would be to keep alive a vivid interest of end-users in participating in the management of the energy system accompanying the profound energy system evolution expected in the coming decades.

VII. Glossary

ACER	Agency for the Cooperation of Energy Regulators
ADENE	Portuguese Energy Agency
BRP	Balance Responsible Party
CBA	Cost Benefit Analysis
CPP	Critical Peak Pricing
CPR	Critical Peak Rebate
DCC	Set of mandatory rules (Code) for Demand Connection
DG	Distributed Generation
DSO	Distribution System Operator
DSM	Demand Side Management
DSR	Demand Side Response
EC	European Commission
ENTSO-E	European Network of TSO for Electricity
ERGEG	European Regulators' Group for Electricity and Gas
ERSE	Portuguese NRA for Electricity and Gas
ESMIG	European Smart Metering Industry Group
HVDC	High Voltage Direct Current
ICT	Information and Communication Technology
IHD	In-house displays which hang on a wall or sit on a counter.[9] pg. 83
MS	Member State
NRA	National Regulatory Authority
REN	Portuguese TSO for Electricity as well as for Gas
RES	Renewable Energy Sources
RTP	Real Time Pricing
SAS	System Ancillary Services
SFC	System Frequency Control
SG	Smart grids
SME	Small to Medium Sized Enterprises
SO	System Operator
TOU	Time-of-use pricing
TSO	Transmission System Operator

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IX. Biographies

José Osório is a senior engineer at REN who received both his Electrical Engineering (Power Systems) degree in 1978 and his MSc in Electrical and Computing Engineering in 1995 from Instituto Superior Técnico Technical University of Lisbon (TUL). Currently he researches under the Climate Change and Sustainable Development Policies Program jointly run by TUL, the New University of Lisbon and the Lisbon University, on Demand Response supported Power Balancing Markets. Since 2006 he has been working in the field of large scale integration of RES and CHP and participated in the EU FP6 research project "Wind on the Grid". From 2000 to 2005, he worked in Energy Trading, for REN, at the very launch of the Iberian Power Market, with emissions trading and OTC contracts included. From 1989 to 1999 he worked in short to medium term Operations Planning. Previously he was a Control Room Engineer at National Dispatch Centre, which included short term operations planning.

Ana I. Estanqueiro was born in Coimbra, Portugal. She received her Power Engineer degree from the Technical University of Lisbon (TUL) in 1986 where she also did her M.Sc and PhD in Mechanical Engineering - Energy, respectively in 1991 and 1997. She works as a Wind Energy research scientist at the Portuguese National Laboratory for Energy and Geology, LNEG (former INETI) since 1987, being responsible for the Wind R,D&D Research area as well as an invited professor at FCUL – Sciences Faculty of University of Lisbon. Her research interests are broad within wind energy including planning methodologies for sustainable wind deployment, offshore wind, micro wind turbines with a special focus on dynamic models for large system integration assessment, benefiting from her electrical and mechanical background. She was chair of the International Energy Agency - IEA Wind Agreement from 2007 - 2009 and is President of the PT IEP-IEC CTE 88 Wind Turbines since 1995. Ana Estanqueiro represents Portugal in several international and European organizations as the IEA Wind implementing agreement, the TP-Wind Mirror Group, the SetPlan European Industrial Initiative – Wind and EERA Wind. She is a member of the IEA Experts Group for Science and Energy (ESGE) and several professional organisations as IEEE and OE – Ordem dos Engenheiros.