STARGRID Workshop
"A point of view of Industry on Smart Grid Standardization: summary of results from the STARGRID survey"

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- Objective and Context
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Main Objective of the Survey

"in-field" survey of
opinions/concerns/suggestions
by Industry
regarding standardization aspects
of the Smart Grid

Finalization of the survey activities

- To check the awareness level of Industry regarding standardization and std-related initiatives and the existing Standards on Smart Grids
- To assess the importance and the expected impact of the standardization works against the benefits expected by the Industry
- To identify the standardization requirements of the stakeholders and the lacks of existing standards against the selected Areas of Interest: DER Integration and Grid control; Demand-Response Management e Smart Metering
- To identify good practices, as well as technological and non-technological solutions to be considered in the standardization process

Interconnection with the other STARGRID WPs

WP2: Mapping on the std activities and Industry initiatives

WP3: Definition of Stakeholder's requirements. Analysis of pertinent documents

WP4: «in-field» assessment of Smartgrids Industry feedback regarding:

- Standards and Std Org. initiatives
- Regulations
- Industry initiatives

Relevant aspects

- Expectations and Maturity
- Constraints & Barriers
- Gaps
- Retrofit/Research/Development needs
- Opposition, Requirements & good solutions/practices

WP5: Summary & Recommendations

Deliverable D4.2

Survey Method

Questionnaire Format

Section 1	Section 2	Section 3	Section 4	Section 5
General infos on the Organization and its involvement in STD process	**Core SG Standards**	Priority Topic 1: **DER Integration and Grid Control**	Priority Topic 2: **Demand – Response Management**	Priority Topic 3: **Smart Metering**
		General **STD requirements**		
		Gaps and required actions		
		Standardization initiatives awareness		

Interviews Check List Format (supported by the questionnaire)

Level	Subject
Level 1	Relevance of the raised **technical topics**
Level 2	Participation in the **STD process**
Level 3	Specific **requirements** in Standards
Level 4	Awareness/Assessment of STARGRID initiative

Smart Grid Core Standards

Required Assessment: RELEVANCE & FUTURE IMPACT to the represented Organization Score: 1-5	Nr of valid answers	IEC 60870-5 Telecontrol equipment and systems Part 5: Transmission protocols (including parts 101/104)	IEC 60870-6 - Tase.2 Telecontrol equipment and systems - Part 6: Telecontrol protocols compatible with ISO standards and ITU-T	IEC 61850 - Power Utility Automation Communication networks and systems in substations	IEC 61968 - CIM for Distribution Application integration at electric utilities - System interfaces for distribution management	IEC 61970 - CIM for Energy Management Energy management system application program interface (EMS-API)	IEC 62325 - CIM for Market Communication Framework for energy market communications	IEC 62351 - Security Power systems management and associated information exchange - Data and communications security	IEC 62056 - DLMS / COSEM Electricity metering - Data exchange for meter reading, tariff and load control	IEC/TR 62357 - Service Oriented Architecture (SOA) Power system control and associated communications - Reference architecture for object models, services and	IEC PAS 62559 - Methodology IntelliGrid methodology for developing requirements for energy systems	IEC 62488-1 - Power line communication systems for power utility applications - Part 1: Planning of analogue and digital power line carrier systems operating over EHV/HV/MV	AVERAGE
OVERALL	64	3,14	2,81	3,54	3,16	3,13	2,70	3,11	3,31	3,00	2,60	2,60	**3,01**
ITALY	25	2,80	2,68	3,23	2,75	2,92	2,25	2,72	2,41	2,91	2,54	2,40	**2,69**
SPAIN	9	4,00	2,78	3,33	2,44	2,44	2,11	2,78	4,56	2,67	2,44	3,11	**2,97**
GERMANY	5	3,60	2,60	4,80	4,00	3,60	3,40	4,40	2,80	3,40	2,25	1,80	**3,33**
ROMANIA	6	3,67	3,83	4,00	3,20	3,33	3,33	3,33	3,17	3,50	3,17	3,33	**3,44**
MANUFACTURERS	14	2,93	2,36	3,20	2,77	3,08	2,38	2,79	3,31	2,85	2,69	2,62	**2,81**
RESEARCH	13	2,31	1,92	3,08	2,85	2,46	2,15	2,54	2,92	2,25	2,38	2,62	**2,50**
ICT	9	3,44	2,78	4,11	4,22	3,78	3,22	3,89	3,89	3,78	3,11	2,11	**3,48**
DSO	6	3,83	3,50	3,50	3,00	3,00	2,83	3,50	3,83	2,83	2,67	3,17	**3,24**
CONSULTING	10	3,60	3,30	4,10	3,50	3,50	3,10	3,50	3,30	3,00	2,44	3,00	**3,30**

Requirements (ex: DER Integration)

Required Assessment: PRIORITY for the represented Organization Score: 1-5		Grid management (Configuration and re-configuration; fault diagnosis, self-healing, island operation)	Safety (of the Grid and of the DER); protection schemes	Safety of the personnel	Seamless communication between control centers, substations and DER installations	EMC compatibility	Forecasting of power and loads	Electrical Connection of DER to the grid and disconnection	Remote control of DER	Integration into legacy grid control systems	DER Monitoring and Sensors	Support Quality of Supply (Continuity, Voltage and Frequency stability, FRT capability) - Ancillary Services	Provision of flexibility by DERs (control aspects)	Market Connection procedures	Aggregation of power and loads	Non- discriminatory Power Market access	Services Market (operation/flexibility conditions; revenue of the service)	Information and data exchange (definition of the information and data models)	Compliance Testing and certification specifications (incl. e.g. simulation models requirements)	Objective and non-discriminatory data access rules for service providers (like aggregators).	Access to the intl electric and energy market (including procurement)	Security of data and protection of the information	Harmonized and stable technical interconnection rules at national and EU level	AVERAGE
OVERALL	PRIORITY	4,10	4,00	3,46	4,00	3,49	3,87	4,03	4,00	3,66	3,75	3,82	3,73	3,33	3,60	3,40	3,21	3,83	3,78	3,46	3,18	4,02	3,87	**3,71**
ITALY		4,04	3,96	3,52	3,71	3,26	3,96	4,08	3,88	3,61	3,38	3,73	3,59	3,41	3,77	3,57	3,50	3,74	3,38	3,61	3,27	3,70	4,00	**3,67**
SPAIN		4,63	4,13	3,88	4,63	4,13	3,63	3,75	3,63	3,88	3,75	3,57	3,13	2,50	2,50	3,25	2,38	2,75	3,75	3,25	3,13	3,50	3,88	**3,53**
GERMANY		3,80	3,60	2,00	4,75	2,20	2,80	3,40	5,00	3,80	4,40	4,25	4,20	3,80	3,40	3,25	3,25	4,60	4,20	3,20	2,75	5,00	5,00	**3,76**
ROMANIA		3,80	3,80	3,80	3,80	4,20	4,00	4,00	3,80	3,80	4,00	4,20	4,25	2,75	3,75	3,50	3,00	4,50	4,00	3,25	3,50	4,00	3,75	**3,79**
MANUFACTURERS	PRIORITY	4,36	3,64	3,27	3,91	3,36	3,60	4,18	3,91	4,18	3,55	4,00	3,00	3,30	3,33	3,56	2,89	2,89	3,67	2,89	3,56	3,33	4,18	**3,57**
RESEARCH		3,87	3,80	2,79	3,73	3,07	3,93	4,13	3,87	3,13	3,67	3,67	3,73	2,73	3,47	2,64	2,60	3,40	3,57	2,93	2,67	3,73	3,67	**3,40**
ICT		4,50	4,44	3,75	4,44	4,00	3,78	4,25	4,33	3,88	4,22	4,00	4,25	4,00	3,75	3,63	3,88	4,56	4,50	4,00	3,25	4,56	3,56	**4,07**
DSO		3,80	4,40	3,80	4,20	2,60	4,40	4,00	4,40	3,20	4,00	4,00	3,40	3,00	3,00	4,00	3,50	3,80	3,80	3,80	3,50	4,00	3,60	**3,74**
CONSULTING		4,70	4,50	4,10	4,56	4,00	4,30	4,00	4,20	4,40	4,10	4,50	4,20	4,50	4,50	4,11	4,00	4,40	4,00	4,30	3,60	4,60	4,60	**4,28**

Gaps & Required Actions (ex: DER Integration)

AGREEMENT & RELEVANCE

		Increased automation in the distribution grid, to ensure higher efficiency of operation, security, control and quality. Faults detectors will enhance operation and reduce shutdown times	Electrical connections and operation rules of DERs should be harmonized within Europe.	Too strict connection requirements may have financial impact and slow down the implementation of DER	New EMC requirements will arise from the development of the grid, requiring reviewing of the Standards	Available standards provide a sufficient level of cyber security to protect process control and business.	Installation rules of DER should be adapted to allow for new ways of operating grids, such as microgrid. Safety issues have to be covered for all kind of operation and plant technology	Ripple control technology offers sufficient means for the grid operator and service providers to control distributed energy resources.	Mature communication protocols for the control of distributed energy resources do exist already.	A single communication protocol for the remote control of DERs should be imposed in interconnection rules, to ensure interoperability.	Communication protocols as well as information data models for control center <-> DER communication have to be harmonized	New connection requirements may impact the design, the life time and the sizing of machines and equipment	Standards for auxiliary power systems are missing (low voltage DC networks): AC/DC converters, DC management systems, DC protection.	A centralized data access platform is necessary (e.g. containing information on the type of generators, capacity and location).	The current EU electricity wholesale market model (the so-called 'target model') has to be adapted for optimised market integration of DERs.	A capacity mechanism could support the market integration of DERs.	Tender requirements for ancillary grid services should be adapted to allow for participation of DERs (availability, minimum offer sizes, aggregation, etc).	AVERAGE
OVERALL	AGREEMENT	4,46	4,16	3,25	3,43	2,56	3,98	2,92	3,24	3,71	3,95	3,71	3,54	3,56	3,48	3,38	3,76	**3,57**
ITALY		4,32	4,22	3,59	3,33	2,73	4,05	3,13	3,58	3,56	3,88	3,68	3,44	3,90	3,65	3,50	3,74	**3,64**
SPAIN		4,75	4,25	2,88	4,13	2,29	4,00	3,00	3,25	5,00	3,88	3,71	3,86	3,29	2,86	3,14	3,50	**3,61**
GERMANY		4,40	4,20	2,40	2,00	1,80	3,00	2,40	2,80	0,00	4,40	3,40	2,80	2,60	3,20	2,50	3,50	**2,84**
ROMANIA		5,00	4,20	3,40	4,00	3,40	4,40	4,00	3,40	0,00	4,40	4,60	3,80	4,40	3,60	3,60	4,00	**3,76**
OVERALL	RELEVANCE	4,26	3,93	3,16	3,48	3,59	3,76	2,98	3,60	3,62	3,82	3,44	3,19	3,52	3,22	3,18	3,35	**3,51**
ITALY		3,95	4,13	3,27	3,30	3,38	3,71	3,06	3,57	3,67	3,83	3,52	3,30	3,84	3,33	3,21	3,53	**3,54**
SPAIN		4,75	4,38	3,63	4,50	3,88	3,71	2,67	3,38	3,00	3,63	3,71	3,43	3,57	3,00	2,67	3,00	**3,56**
GERMANY		4,40	3,60	1,20	1,50	3,80	3,20	2,75	4,50	0,00	4,20	3,20	2,00	2,40	2,20	2,50	1,75	**2,70**
ROMANIA		4,60	4,20	3,20	4,20	3,25	4,60	4,00	4,00	0,00	4,00	3,60	3,80	4,20	3,40	3,50	3,60	**3,63**
MANUFACTURERS	AGREEMENT	4,58	4,50	2,92	3,50	2,45	3,70	3,25	3,08	4,50	3,83	3,67	3,64	3,73	3,64	3,50	3,25	**3,61**
RESEARCH		4,07	4,00	3,29	3,29	2,50	4,00	3,08	3,07	4,00	3,71	4,00	3,50	3,38	2,83	3,00	3,73	**3,47**
ICT		4,50	4,25	3,38	3,50	2,88	4,63	3,00	3,44	2,50	3,78	3,56	3,25	3,38	4,00	3,86	4,00	**3,62**
DSO		4,60	4,00	3,20	3,00	2,25	3,40	2,50	2,60	0,00	4,40	4,20	4,20	3,40	3,20	3,75	4,25	**3,31**
CONSULTING		4,56	4,11	3,44	3,67	2,11	4,22	2,67	3,56	4,50	4,67	3,67	3,38	4,11	4,11	3,78	4,00	**3,78**
MANUFACTURERS	RELEVANCE	4,00	4,17	3,08	3,42	3,18	3,50	2,63	3,50	5,00	3,82	3,36	2,90	3,70	3,30	3,11	3,00	**3,48**
RESEARCH		4,14	3,93	3,29	3,54	3,00	4,00	3,18	3,69	3,80	3,46	3,33	3,08	3,33	2,83	2,83	3,00	**3,40**
ICT		4,25	4,13	2,88	3,50	4,25	3,38	2,50	3,56	3,00	3,67	3,33	3,00	3,38	3,50	3,50	3,50	**3,46**
DSO		4,20	3,80	3,40	3,25	3,80	3,40	3,33	3,50	0,00	4,40	4,40	4,00	3,80	3,40	3,33	4,25	**3,52**
CONSULTING		4,78	3,89	3,11	3,44	4,00	4,22	3,67	3,78	4,00	4,33	3,78	3,33	3,78	3,44	3,56	3,33	**3,78**

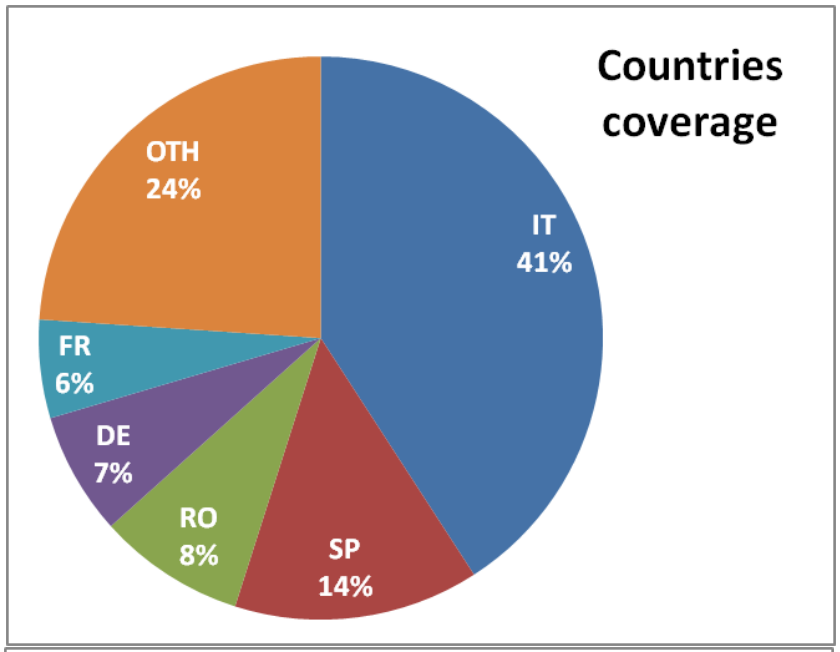
Standardization related initiatives (ex: DER Integration)

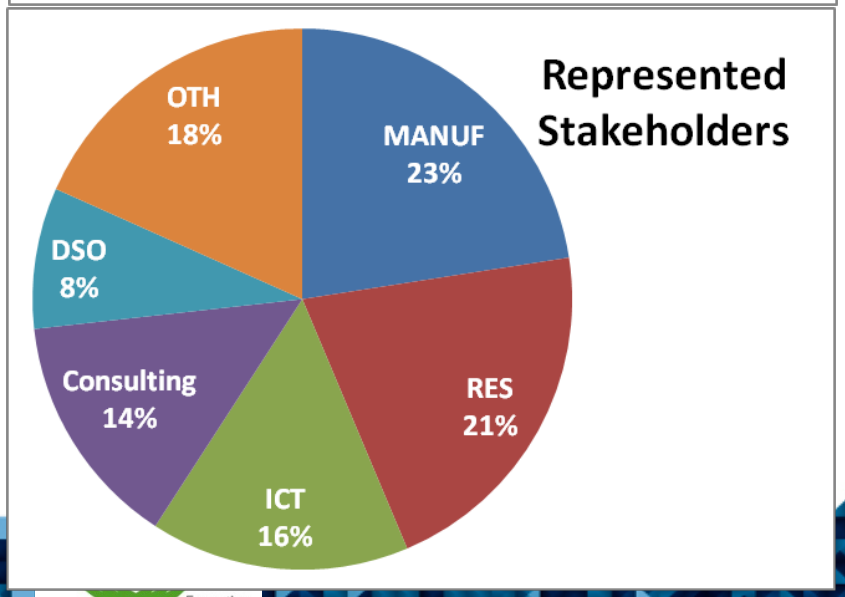
Required Assessment:

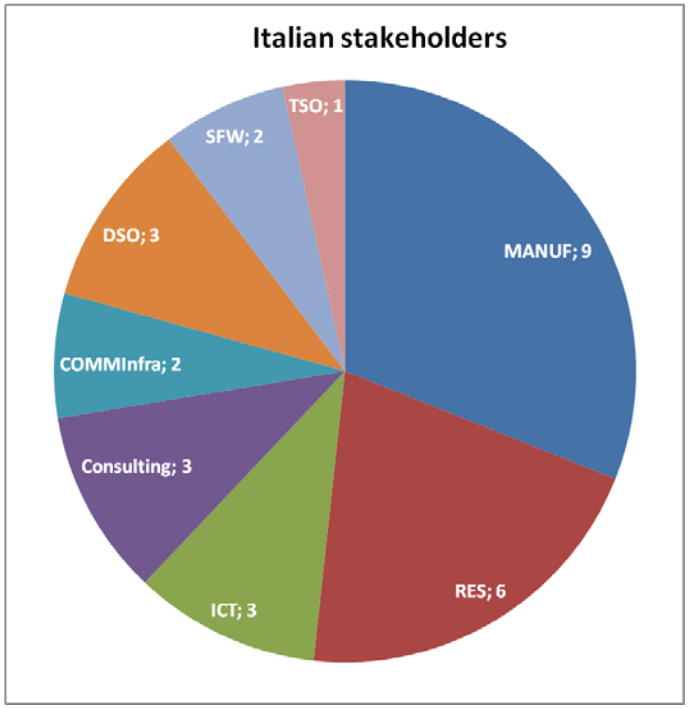
FAMILIARITY & RELEVANCE

		pr IEC 62689 Ed. 1.0 Current and Voltage sensors or detectors, to be used for fault passage indication purposes - Part 1: System aspects; Part 2: General principles and requirements; Part 3: Communica	ENTSO-E Network Codes: RfG: Requirements for Grid Connection; DCC: Demand Connection Code; OS: operational Security; etc.	prEN 50438:2013 (DER operation system) Requirements for the connection of micro-generators to LV distribution networks (CLC TC8X WG3)	FprTS EN 50549:2012 (DER operation system) Requirements for the connection of generators above 16A to LV and MV distribution networks (CLC TC8X WG3)	Pr IEC 61000-X: Electromagnetic Compatibility (EMC) (TC 77)	IEC 62786 Ed. 1.0 Smart Grid User Interface: Demand Side Energy Sources Interconnection with the Grid (TC 8)	IEC/TS 62351-8 Ed. 1.0 Power systems management and associated information exchange - Data and communications security - Part 8: Role-based access control (TC 57 WG 15)	CLC HD 60364-1 Rules for the design, erection, and verification of electrical installations: safety of persons, livestock and property (CLC TC 64)	IEC 61850-90-X Communication networks and systems for power utility automation (e.g. IEC 61850-90-14 for FACTS (Flexible AC Transmission Systems))	IEC 61968 - Common Information Model (CIM) / Distribution Management. Part 8: Interface Standard For Customer Support	IEC 62361-X Harmonization of Quality Codes across TC 57 (TC 57 WG 19)	National interconnection rules please specify in comments1	AVERAGE
OVERALL	AWARENESS	2,15	2,79	2,38	2,22	2,88	2,62	2,77	1,96	3,17	3,22	2,40	2,67	**2,60**
ITALY	AWARENESS	2,26	2,47	2,33	2,24	2,67	2,94	2,72	1,94	3,00	2,89	1,94	2,83	**2,52**
SPAIN	AWARENESS	2,88	2,63	2,50	2,25	3,00	2,25	2,50	2,14	3,25	3,00	1,86	2,50	**2,56**
GERMANY	AWARENESS	1,00	3,80	1,40	1,40	1,80	2,00	3,80	1,20	4,00	4,00	3,80	3,00	**2,60**
ROMANIA	AWARENESS	2,80	3,00	4,00	2,50	3,80	2,75	2,80	3,00	4,00	3,60	2,25	3,25	**3,15**
OVERALL	RELEVANCE	3,02	3,45	3,13	3,02	3,31	3,40	3,50	2,72	3,61	3,59	2,98	3,13	**3,24**
ITALY	RELEVANCE	3,19	3,25	3,33	3,25	3,19	3,44	3,24	2,63	3,59	3,33	2,50	3,08	**3,17**
SPAIN	RELEVANCE	3,80	3,33	3,00	2,60	3,83	2,83	3,17	2,80	3,33	3,17	2,60	3,14	**3,13**
GERMANY	RELEVANCE	2,00	3,80	2,20	2,40	1,80	2,80	4,40	2,20	4,60	4,60	4,20	3,67	**3,22**
ROMANIA	RELEVANCE	3,60	3,75	3,50	3,50	4,20	3,50	3,25	3,60	3,60	3,25	3,00	3,25	**3,50**
MANUFACTURERS	AWARENESS	2,45	2,27	2,10	2,11	3,40	2,30	2,70	2,22	3,20	2,40	1,90	2,56	**2,47**
RESEARCH	AWARENESS	2,00	2,75	2,67	2,67	2,83	2,33	2,00	2,08	2,92	3,33	2,58	2,38	**2,55**
ICT	AWARENESS	1,75	2,71	1,57	1,29	2,25	1,86	3,25	1,29	3,75	4,00	2,00	2,00	**2,31**
DSO	AWARENESS	2,00	3,00	2,00	2,25	2,00	3,20	3,00	1,75	3,20	3,80	3,50	2,00	**2,64**
CONSULTING	AWARENESS	2,33	3,22	3,11	2,33	3,22	3,22	3,22	2,11	3,38	3,33	2,89	3,43	**2,98**
MANUFACTURERS	RELEVANCE	3,38	3,25	3,25	3,43	3,63	3,38	3,38	3,00	3,88	3,00	2,63	2,67	**3,24**
RESEARCH	RELEVANCE	2,89	3,50	3,00	3,20	3,36	3,10	2,91	2,64	3,36	3,45	2,60	2,78	**3,07**
ICT	RELEVANCE	2,88	3,57	2,86	2,29	3,25	3,43	3,75	2,38	4,00	4,29	2,75	2,83	**3,19**
DSO	RELEVANCE	1,67	3,75	2,67	3,00	2,33	3,75	4,50	2,33	3,50	4,50	4,33	2,67	**3,25**
CONSULTING	RELEVANCE	3,67	3,44	3,44	3,44	3,00	3,56	3,89	3,11	4,00	3,89	3,56	3,75	**3,56**

Survey Statistics: feedbacks





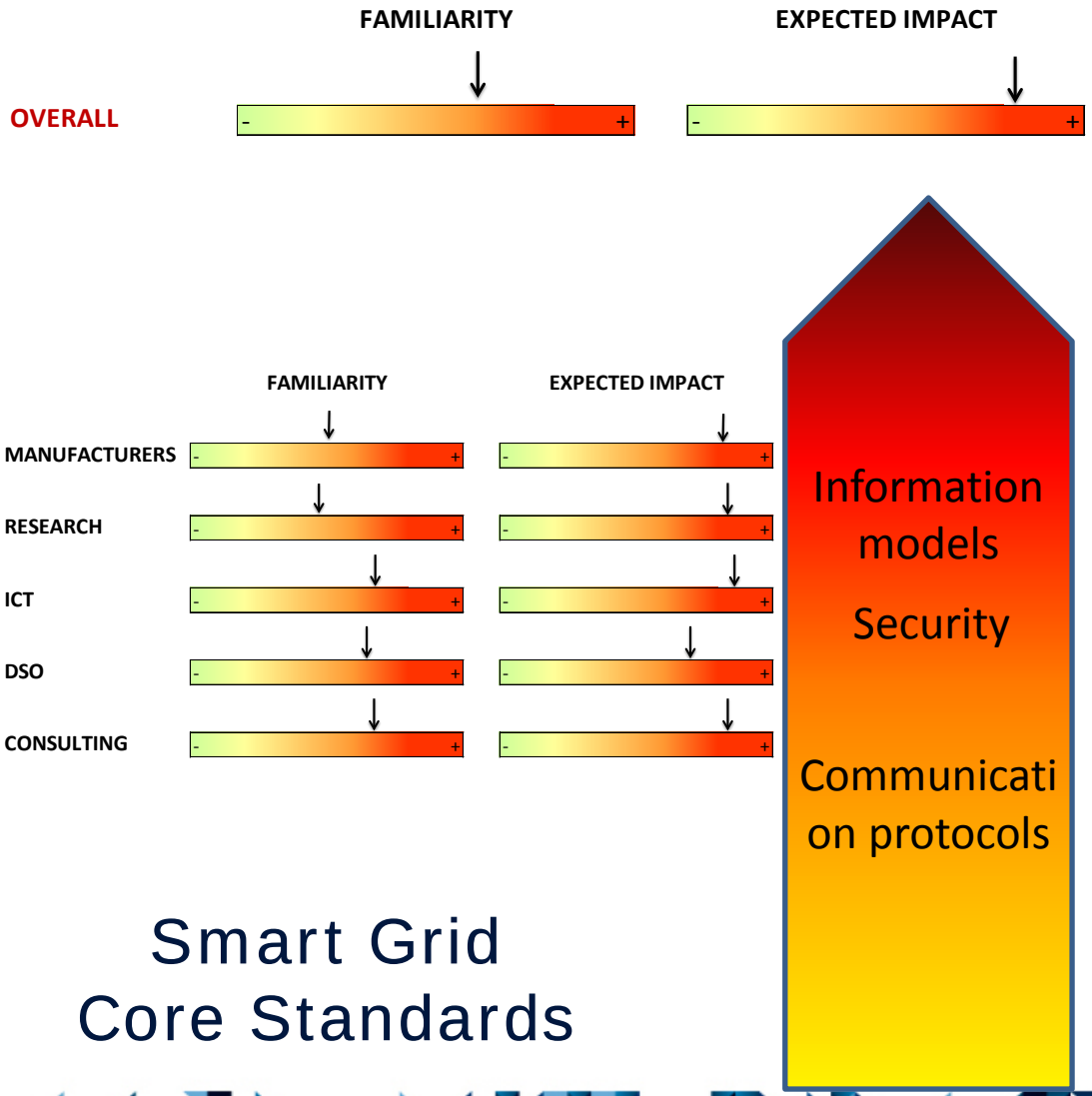


STAKEHOLDERS:

- **MANUFacturers**
- **ICT & SoFtWare providers COMMunication**
- **DSO & Utilities**
- **TSO & Bulk Gen Owners**
- **CONSulting**
- **CONSUMers**

Roundup of the outcomes: synthesis of the questionnaires results

STANDARD	OVERALL
IEC 61850 - Power Utility Automation Communication networks and systems in substations	2,76
IEC 62351 - Security Power systems management and associated information exchange - Data and communications security	2,75
IEC 61968 - CIM for Distribution Application integration at electric utilities - System interfaces for distribution management	2,64
IEC 61970 - CIM for Energy Management Energy management system application program interface (EMS-API)	2,59
IEC 62056 - DLMS / COSEM Electricity metering - Data exchange for meter reading, tariff and load control	2,54
IEC 62325 - CIM for Market Communication Framework for energy market communications	2,50
IEC/TR 62357 - Service Oriented Architecture (SOA) Power system control and associated communications - Reference architecture for object models, services and protocols	2,44
IEC PAS 62559 - Methodology IntelliGrid methodology for developing requirements for energy systems	2,38
IEC 60870-5 Telecontrol equipment and systems Part 5: Transmission protocols (including parts 101/104)	2,27
IEC 62488-1 - Power line communication systems for power utility applications - Part 1: Planning of analogue and digital power line carrier systems operating over EHV/HV/MV electricity grids	2,24
IEC 60870-6 - Tase.2 Telecontrol equipment and systems - Part 6: Telecontrol protocols compatible with ISO standards and ITU-T recommendations	2,20
AVERAGE SCORE	2,48



Smart Grid Core Standards

DER Integration: REQUIREMENTS priority

REQUIREMENTS	OVERALL	MAN	ICT	DSO	CONS	RES	COMM	TSO
Grid management (Configuration and re-configuration; fault diagnosis, self-healing, island operation)	4,10	4,40	4,09	4,25	4,50	3,87	3,00	5,00
Electrical Connection of DER to the grid and disconnection	4,03	4,30	4,09	4,25	3,50	4,07	5,00	3,00
Security of data and protection of the information	4,02	3,38	4,17	4,00	4,50	3,80	4,50	5,00
Safety (of the Grid and of the DER); protection schemes	4,00	3,70	4,08	4,38	4,38	3,80	3,00	5,00
Seamless communication between control centers, substations and DER installations	4,00	4,00	4,08	4,38	4,00	3,73	5,00	4,00
Remote control of DER	4,00	4,00	4,25	4,38	3,75	3,80	4,50	3,00
Forecasting of power and loads	3,87	3,60	3,82	4,38	3,75	3,93	3,50	5,00
Harmonized and stable technical interconnection rules at national and EU level	3,87	4,20	3,67	3,13	4,50	3,80	4,00	5,00
Information and data exchange (definition of the information and data models)	3,83	3,00	4,42	3,63	4,25	3,47	4,50	5,00
Support Quality of Supply (Continuity, Voltage and Frequency stability, FRT capability) - Ancillary Services	3,82	4,25	3,64	3,63	4,25	3,80	2,00	5,00
Compliance Testing and certification specifications (incl. e.g. simulation models requirements)	3,78	3,63	4,18	4,13	3,57	3,43	4,00	3,00
DER Monitoring and Sensors	3,75	3,60	4,08	4,13	3,63	3,60	4,00	3,00
Provision of flexibility by DERs (control aspects)	3,73	3,00	4,09	4,13	3,75	3,67	5,00	4,00
Integration into legacy grid control systems	3,66	4,20	3,73	3,75	4,13	3,07	3,00	4,00
Aggregation of power and loads	3,60	3,38	3,82	3,63	4,00	3,40	4,00	2,00
EMC compatibility	3,49	3,50	3,70	3,50	3,75	3,20	3,50	3,00
Safety of the personnel	3,46	3,40	3,50	4,38	3,88	2,71	3,00	5,00
Objective and non-discriminatory data access rules for service providers (like aggregators).	3,46	3,00	3,83	3,50	4,00	3,07	4,50	2,00
Non- discriminatory Power Market access	3,40	3,63	3,73	3,63	3,86	2,71	3,50	2,00
Market Connection procedures	3,33	3,33	3,82	3,38	4,00	2,73	4,00	2,00
Services Market (operation/flexibility conditions; revenue of the service)	3,21	3,00	3,82	3,50	3,50	2,53	3,50	2,00
Access to the intl electric and energy market (including procurement)	3,18	3,75	3,18	3,25	3,25	2,73	3,50	2,00
AVERAGE SCORE	**3,71**	3,65	3,90	3,88	3,94	3,41	3,84	3,59

DER Integration: GAPS priority

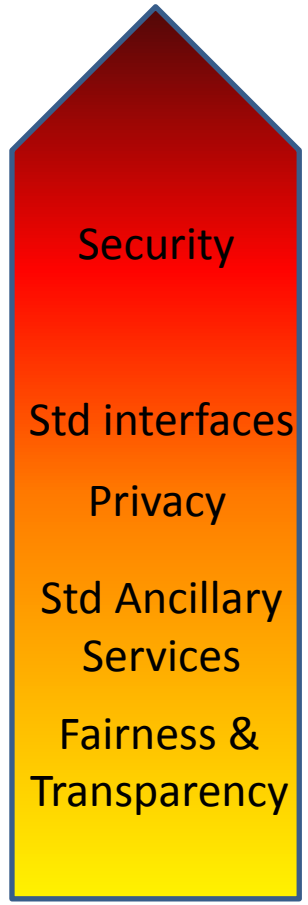
GAPS & Required Actions	OVERALL	MAN	ICT	DSO	CONS	RES	COMM	TSO
Smart Grids request increased automation levels of the distribution grid, to ensure higher efficiency of operation, security, control and quality. Faults detectors will enhance operation and reduce shutdown times	4,26	4,00	4,27	4,50	4,71	4,21	4,00	3,00
Electrical connections and operation rules of DERs should be harmonized within Europe.	3,93	4,18	3,91	4,00	3,43	3,93	4,00	4,00
Communication protocols as well as information data models for control center <-> DER communication have to be harmonized	3,82	4,00	3,42	4,13	4,00	3,46	5,00	4,00
Installation rules of DER should be adapted to allow for new ways of operating grids, such as microgrid. E.g. safety issues have to be covered for all kind of operation and plant technology	3,76	3,56	3,36	3,63	3,86	4,08	4,50	5,00
A single communication protocol for the remote control of DERs should be imposed in interconnection rules, to ensure interoperability.	3,62	5,00	3,00		4,00	3,33	5,00	
Mature communication protocols for the control of distributed energy resources do exist already.	3,60	3,55	3,58	3,75	3,00	3,77	4,50	2,00
Available standards provide a sufficient level of cyber security to protect process control and business.	3,59	3,20	4,00	3,75	3,50	3,23	5,00	2,00
A centralized data access platform is necessary (e.g. containing information on the type of generators, capacity and location).	3,52	3,67	3,30	3,88	3,29	3,50	5,00	4,00
New EMC requirements will arise from the development of the grid, requiring reviewing of the Standards	3,48	3,36	3,40	3,75	3,00	3,62	5,00	2,00
New connection requirements may impact the design, the life time and the sizing of machines and equipment	3,44	3,50	3,18	4,13	3,29	3,25	4,00	2,00
Tender requirements for ancillary grid services should be adapted to allow for participation of DERs (availability, minimum offer sizes, aggregation, etc).	3,35	3,13	3,45	3,88	2,71	3,09	4,50	4,00
The current EU electricity wholesale market model (the so-called 'target model') has to be adapted for optimised market integration of DERs.	3,22	3,33	3,45	3,38	3,14	2,83	4,50	2,00
Standards for auxiliary power systems are missing (low voltage DC networks): AC/DC converters, DC management systems, DC protection)	3,19	3,00	2,82	3,86	2,86	3,25	2,00	5,00
A capacity mechanism could support the market integration of DERs.	3,18	3,00	3,64	3,43	3,00	2,75	4,00	2,00
Too strict connection requirements may have financial impact and slow down the implementation of DER	3,16	3,09	2,91	4,13	2,71	3,21	4,00	2,00
Ripple control technology offers sufficient means for the grid operator and service providers to control distributed energy resources.	2,98	2,57	2,60	3,29	3,14	3,00	3,00	3,00
AVERAGE SCORE	**3,51**	3,51	3,39	3,59	3,35	3,41	4,25	2,88

DER Integration: Relevance of STD initiatives

Standardization related initiatives	OVERALL	MAN	ICT	DSO	CONS	RES	COMM	TSO
IEC 61850-90-X Communication networks and systems for power utility automation (e.g. IEC 61850-90-14 for FACTS (Flexible AC Transmission Systems))	3,61	3,71	4,00	3,29	3,43	3,36	3,50	5,00
IEC 61968 - Common Information Model (CIM) / Distribution Management. Part 8: Interface Standard For Customer Support	3,59	2,86	4,10	4,14	3,29	3,36	4,00	3,00
IEC/TS 62351-8 Ed. 1.0 Power systems management and associated information exchange - Data and communications security - Part 8: Role-based access control (TC 57 WG 15)	3,50	3,43	3,60	4,29	3,50	2,82	4,00	3,00
ENTSO-E Network Codes: RfG: Requirements for Grid Connection; DCC: Demand Connection Code; OS: operational Security; etc.	3,45	3,00	3,67	4,14	2,86	3,50	3,00	5,00
IEC 62786 Ed. 1.0 Smart Grid User Interface: Demand Side Energy Sources Interconnection with the Grid (TC 8)	3,40	3,14	3,56	3,86	2,86	3,20	5,00	3,00
Pr IEC 61000-X: Electromagnetic Compatibility (EMC) (TC 77)	3,31	3,71	3,20	3,33	2,43	3,55	4,00	3,00
prEN 50438:2013 (DER operation system) Requirements for the connection of micro-generators to LV distribution networks (CLC TC8X WG3)	3,13	3,00	3,11	3,33	2,86	3,30	4,00	3,00
National interconnection rules	3,13	2,40	3,00	3,00	3,50	3,11	2,00	5,00
pr IEC 62689 Ed. 1.0 Current and Voltage sensors or detectors, to be used for fault passage indication purposes - Part 1: System aspects; Part 2: General principles and requirements; Part 3: Communica	3,02	3,14	3,10	3,17	2,86	2,89	3,00	3,00
FprTS EN 50549:2012 (DER operation system) Requirements for the connection of generators above 16A to LV and MV distribution networks (CLC TC8X WG3)	3,02	3,17	2,67	3,29	2,86	3,00	3,50	3,00
IEC 62361-X Harmonization of Quality Codes across TC 57 (TC 57 WG 19)	2,98	2,57	2,80	3,80	2,86	2,73	3,00	3,00
CLC HD 60364-1 Rules for the design, erection, and verification of electrical installations: safety of persons, livestock and property (CLC TC 64)	2,72	2,86	2,60	3,17	2,43	2,55	1,00	3,00
AVERAGE SCORE	**3,24**	3,08	3,28	3,57	2,98	3,11	3,33	3,50

Demand Response & customer energy management: REQUIREMENTS priority

REQUIREMENTS	OVERALL	MAN	ICT	DSO	CONS	RES
Security: authentication and encryption	4,05	3,67	4,33	4,60	4,50	3,40
Information Security	4,00	3,29	4,40	4,20	4,50	3,55
Support for Active/Reactive Power Control (load or generation remotely adaptable by the relevant network operator for re-/active power control)	3,98	4,00	3,67	3,80	4,17	4,18
Scalability	3,96	3,86	4,20	4,60	4,50	3,36
Support for multiple and upcoming communication technologies	3,91	3,17	4,20	4,40	4,33	3,56
Data visualisation (e.g. operating schedules, tariff, weather forecasts)	3,89	3,83	3,90	4,20	4,33	3,55
Modular architecture	3,86	3,83	4,30	4,40	4,17	3,18
Simple handling of devices and software	3,77	3,50	3,89	4,60	4,67	3,27
Standard communication interface: CEMS <-> grid operator	3,77	3,67	3,70	3,40	4,50	3,90
Bidirectional communications, feedback from the customer installation to grid or market operator	3,74	3,67	3,78	3,60	4,33	3,60
Interface between customer energy management infrastructure and the advanced metering infrastructure (AMI)	3,74	3,60	3,67	4,20	4,17	3,30
Incentives based load control	3,72	3,60	3,78	4,40	4,33	3,18
Data privacy	3,71	3,33	4,10	4,20	4,00	3,36
Standard communication interface: grid operator <-> market	3,71	3,67	3,67	3,60	4,33	3,56
Standardised protocol translation (gateway functionality)	3,67	3,40	4,00	3,40	4,67	3,00
Standard communication interface: customer energy mangement system (CEMS) <-> market	3,67	3,83	3,80	3,20	4,67	3,27
Direct remote load control	3,64	3,33	3,50	4,40	4,00	3,64

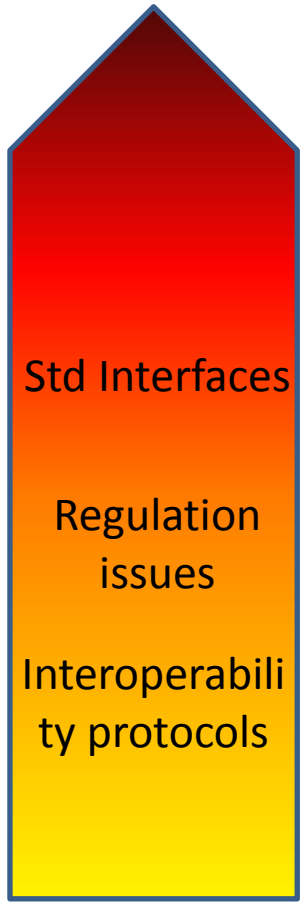


Demand Response & customer energy management: GAPS priority

GAPS & Required Actions	OVERALL	MAN	ICT	DSO	CONS	RES
There is an urgent market need (in Europe) for a Demand Response standard, defining the communication between service providers (e.g. utilities or aggregators) and end customers	3,78	3,80	3,71	3,25	3,83	3,91
A Demand Response standard must be compatible with the Common Information Model (IEC 61970, 61968, 62325)	3,60	3,40	3,25	4,25	3,50	3,64
The wide-scale introduction of variable tariffs could boost Demand Side measures uptake in Europe	3,49	3,50	3,50	3,50	3,33	3,73
The definition of an abstraction layer, i.e. an abstract data model that can be mapped to different information layer standards is a suitable approach to handle the problem of incompatible protocols.	3,48	3,40	3,63	3,00	3,33	3,40
The variety of home automation protocols in use hinders the spread of home automation and energy management systems.	3,37	3,20	3,75	4,00	3,17	3,00
Aggregation of loads and small generation units should be allowed when bidding into electricity markets.	3,33	3,75	3,50	3,00	3,17	3,55
A standardised runtime environment for energy management applications at the customer premises is required	3,24	4,20	3,33	3,00	2,80	2,82
A standardised protocol converter for energy management applications at the customer premises is required	3,21	3,40	3,44	2,75	3,50	2,82
If a Smart Meter Gateway (SMG) is available in a building, the access to controllable loads within the building for external service providers should mandatorily be channeled through the existing (possibly regulated with regard to security measures) connection via the SMG.	3,20	3,50	3,25	3,25	2,67	3,18
The current EU electricity wholesale market model (the so-called 'target model') has to be adapted to allow for market participation of Demand Response providers	3,18	3,00	3,43	3,25	3,17	3,20
Tender requirements in ancillary markets, like minimum offer size and minimum durations, should be lowered to allow for Demand Response participation.	3,16	3,75	3,00	3,33	3,00	3,09

Demand Response & customer energy management: Relevance of STD initiatives

Standardization related initiatives	OVERALL	MAN	ICT	DSO	CONS	RES
IEC 61850-7-420 ed. 2 [current IEC/TR 61850-90-X] Distributed energy resources logical nodes (TC 57 WG 17)	3,39	3,80	3,88	3,50	2,67	3,18
IEC 62746 System interfaces and communication protocol profiles relevant for systems connected to the Smart Grid (TC 57 WG 21)	3,18	3,40	3,88	3,50	2,33	3,00
IEC PC 118 Smart Grid user interface	2,94	2,80	3,00	3,33	2,17	3,13
OpenADR 2.0 Open Automated Demand Response	2,93	3,20	3,63	3,00	2,00	2,64
ENTSO-E Demand Connection Code	2,82	3,40	2,00	4,00	2,17	2,75
prEN 501-12 General requirements for Home and Building Electronic Systems (HBES) and Building Automation and Control Systems (BACS) - Part 12: Smart grid - Application specification - Interface and framework for customer Energy Management (CLC TC 205 WG 18)	2,74	3,80	3,17	2,00	2,50	2,13
ZigBee Smart Energy Profile (SEP) 2.0	2,64	2,80	3,00	2,75	2,00	2,22
Energy@Home	2,56	3,20	1,86	3,33	2,00	2,33
ZigBee Home Automation Profile	2,55	2,80	2,67	3,25	2,17	2,00
ZigBee Smart Energy Profile (SEP) 1.x	2,53	2,60	3,17	2,50	2,00	2,10
OGEMA Open Gateway Energy Management Alliance	2,43	3,60	2,00	2,00	2,00	2,33
Facility Smart Grid Information Model (FSGIM)	2,39	3,00	2,60	2,00	2,17	2,00
EEBus	2,25	3,20	1,67	2,00	2,00	2,11
AVERAGE SCORE	**2,72**	3,20	2,81	2,86	2,17	2,46

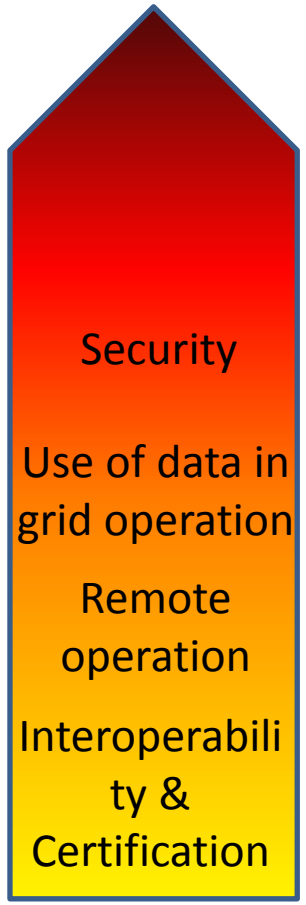


Smart Metering: REQUIREMENTS priority

REQUIREMENTS	OVERALL	MAN	ICT	DSO	CONS	RES
Interoperability	4,60	4,40	4,90	5,00	4,80	4,36
Security	4,49	4,60	4,44	4,60	5,00	4,00
Remote meter reading and management	4,44	4,00	4,67	4,60	4,20	4,55
High availability	4,30	4,40	4,33	4,40	4,80	4,18
Mandatory security provisions (authentication and encryption, data management)	4,29	4,40	4,33	4,40	4,60	4,11
Standardised interfaces and data exchange formats	4,26	4,20	4,44	4,40	4,60	4,00
Load profile data	4,21	4,40	4,11	4,40	4,20	4,27
Secure communications (ensuring data integrity & confidentiality)	4,21	3,80	4,44	4,40	4,40	4,00
Remote connection/disconnection	4,16	4,00	4,56	4,20	3,80	3,91
Bidirectional communications	4,16	4,20	4,44	4,20	3,80	4,18
Data privacy	4,16	3,80	4,20	4,40	4,60	4,18
Scalability	4,14	4,40	4,20	4,40	4,40	3,73
Billing based on actual consumption	4,14	4,20	4,22	4,20	4,40	4,00
Support for multiple and upcoming communication technologies	4,14	4,00	4,60	4,20	4,40	3,73
On-demand meter data access	4,12	4,00	4,22	4,40	3,60	4,27
Quality of Supply control	4,07	4,40	4,11	4,40	3,60	4,00
Standardised data profiles	4,07	3,80	4,20	4,60	4,00	3,91
Provision of data from the AMI for grid control purposes (e.g. voltage and phase measurements)	4,05	4,20	3,89	4,40	3,80	4,18
Data visualisation (consumption and billing information)	4,05	4,00	3,80	4,40	4,00	4,00

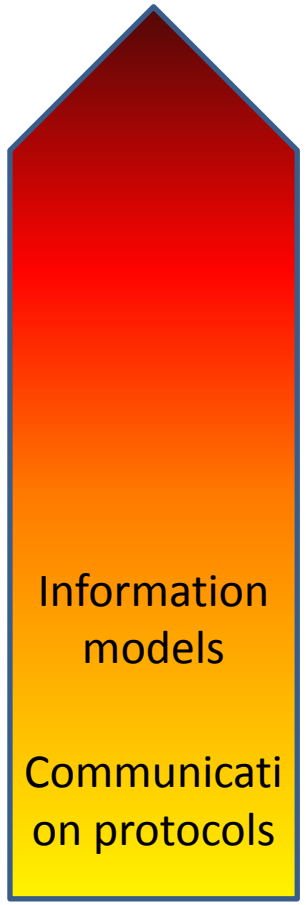
Smart Metering: GAPS priority

GAPS & Required Actions	OVERALL	MAN	ICT	DSO	CONS	RES
Strong security mechanisms (encryption & authentication) should be mandatory for the WAN communication of the SMG	3,87	3,67	4,30	4,40	4,00	3,27
Grid operators should get full access to grid related Smart Meter data at the customer connection point, like voltage, current and cos φ.	3,74	4,17	4,13	4,00	3,00	3,82
A pragmatic approach to security is to deploy the smart meters and implement security measures progressively, as needed.	3,62	4,00	4,10	3,60	3,00	3,00
Smart meters have the potential to be the gateway by which electricity supply can be controlled remotely (entire supply or individual appliances). This possibility must be exploited and become a standard functionality of the smart meter for home devices control	3,59	3,83	3,78	4,60	2,60	3,09
Concerning the smart meter certification (non-metrology aspects), the process is still too unclear (lack of harmonised standards/procedures, list of tests, etc.)	3,43	3,50	3,50	3,20	2,80	4,00
The regulatory differences on smart metering between Member States can be barriers for efficient deployment and cost reductions	3,42	4,17	3,33	3,00	3,60	3,00
Many different standards are being used in the smart meter deployments and are deemed to coexist. The current approach of achieving interoperability at the data model level (for example, using DLMS/COSEM) seems to be efficient and sufficient.	3,39	4,00	3,40	3,00	3,00	3,27
A standardised communication profile for the connection of controllable loads or an energy management system to the Smart Meter Gateway is missing.	3,23	3,50	3,44	3,40	2,60	2,91
In the smart meter certification process it is distinguished between "conformance" (one meter in lab conditions) and "performance" (meter in the entire system, with many meters operating): a) There is a gap in the "conformance" testing	3,00	2,60	2,67	3,40	2,60	3,56
b) There is a gap in the "performance" testing	3,03	2,60	2,83	3,40	2,60	3,50
AVERAGE SCORE	**3,43**	3,60	3,55	3,60	2,98	3,34



Smart Metering: Relevance of STD initiatives

Standardization related initiatives	OVERALL	MAN	ICT	DSO	CONS	RES
IEC 62056 Series (incl. DLMS/COSEM) Electricity Metering Data Exchange (TC 13)	3,55	3,80	4,00	4,00	2,40	3,60
IEC 61968-9 - CIM for Distribution Application integration at electric utilities - System interfaces for distribution management Part 9: Interface Standard for Meter Reading & Control (TC 57 WG 14)	3,25	2,60	3,67	3,60	2,40	3,56
IEC 62056-6-9 Mapping between the Common Information Model CIM (IEC 61968-9) and DLMS/COSEM (IEC 62056) data models and message profiles (TC 13)	3,15	3,00	3,56	3,60	2,40	3,22
IEC 61334 - DLMS (PLC) Distribution automation using distribution line carrier systems (TC 57 WG 9)	3,13	3,00	3,33	3,80	2,40	3,40
prTS 50567-1 (PRIME) Meter data exchange over power lines – Part 1: Lower layer profile using OFDM modulation Type 1 (CLC TC 13)	3,13	3,00	3,38	3,25	2,60	3,40
TR 50572 (SMCG) Functional reference architecture for communication in smart metering systems	3,10	3,00	3,50	3,50	2,60	2,90
ETSI GS OSG 001 Open Smart Grid Protocol (OSGP)	3,08	3,20	3,50	2,75	2,20	3,20
prTS 50567-2 (G3-PLC) Meter exchange over power lines – Part 2: Lower layer profile using OFDM modulation Type 2 (CLC TC 13)	3,03	3,00	3,14	3,25	2,60	3,20
ETSI M2M Machine to machine communication	2,89	3,20	2,57	4,00	2,00	2,67
prTS 50568-5 (Meters & More) "Electricity metering data exchange – The Smart Metering Information Tables and Protocols (SMITP) suite" (CLC TC 13)	2,87	3,60	2,86	2,20	2,20	3,20
ZigBee Smart Energy Profile (SEP) 2.0	2,73	2,80	2,43	3,75	2,00	2,67
M-Bus (EN 13757-2,3), wM-Bus (EN 13757-4)	2,70	2,60	3,00	3,00	1,80	2,56
Energy@Home	2,65	3,20	2,00	3,33	1,80	2,57
ZigBee Smart Energy Profile (SEP) 1.x	2,60	2,75	2,29	3,75	2,00	2,25
ANSI C12 / IEEE 170x Series "Smart Grid Meter Package"	2,46	2,20	2,25	2,50	2,00	3,00
SyM^2 specification Synchronous Modular Meter	2,38	2,75	1,86	2,75	1,80	2,63
AVERAGE SCORE	**2,92**	2,98	2,96	3,31	2,20	3,00



Summary of hints from interviews on Smart Grid Standardization (and Regulation) issues

Summary of Industry hints - 1

Topic	Ref Standard - Document	Industry hints
Interoperability & Conformance	General	Interoperability Testing methods to be developed and standardized to guarantee full automation. Std conformance tests are not enough. Interoperability requirements should not limit the potential for innovation and differentiation. Open standards is a basic condition but not sufficient to reach real interoperability. Standards should cover specifications for interoperability tests for the complete functionalities
Security	IEC 62351 IEC 62443	The complexity of the system highly increases the risk of aimed attacks and makes ineffective the old security scheme. A new scheme is necessary based on the anti-intrusion rules. Interoperability and harmonization of data models as pre-req.
Privacy and data protection	IEC 62056 IEC 62351 M/441	Requirements on security/privacy and information models are not clear and agreed enough. Consumer/customer data protection is the pre-requisite for his participation in the business and the realisation of forecast benefits. Measures for personal data protection should be harmonized. Rules to access data and use them are still missing in EU. Remote control of supply only possible with express consent of the consumer.

Summary of Industry hints - 2

Topic	Ref Standard - Document	Industry hints
Safety	HD 60364	The probability of uncontrolled islanding and the risk of damages for equipment and personnel will increase. Anti-islanding defence actions may differ according to the operational criteria and protection schemes. A scrutiny of present prescription set by each national regulatory authority at national level might be appropriate.
Communication & Info exchange	IEC 60870 IEC 61850 IEC 62325 IEC 61968 IEC 62488 IEC 62746 ...	Information flows need to be harmonized in different domains. Semantic interoperability should be guaranteed to allow devices being automatically connected. Technology is on the shelf. OpenADR, CIM, are sufficiently mature solutions. Appropriate communication infrastructures have to be fixed for the different applications, especially for the remote control of DER (at LV). Reliability of Internet and PLC is questioned; fiber glass is unavailable and expensive. GSM/GPRS solution (CEI 0-16) is a compromise.
Costs	General	Lack of harmonization leads to increased adaptation costs. Standards should pursue minimum costs/ maximum benefits objectives. Provisions of STD should be modulated in relation to the functionality requirements; these latter should be related to the plant power, to guarantee scale economy.

Summary of Industry hints - 3

Topic	Ref Standard - Document	Industry hints
Services & Revenue Metering	EN 62056 IEC 61968 IEC 61850-7 IEC 61850-90	Smart Business Models and other metering equipment have to be developed that turn available data into business opportunities. Standardized connection/ measurement schemes are necessary, compatible with incentives, supporting transparent methods for the analysis and the quantification of the trade-off and, in general, sustaining the new business models. Mandatory measures incompatible with open market
Regulations	ENTSO-E RfG & DCC TS 50549-1/2 EN 50438	Connection codes can lead to increased costs and lengthier procedures, but may have positive impact on DERs integration. DSOs should have full access to the communication devices. Harmonization of std and rules across EU facilitate the deployment of DERs. Capacity market revealed very effective in US.
Standardization process	EN-IEC-IEEE	International approach (i.e. constant ref to IEC-IEEE) is necessary to guarantee open access to market. Use ICT tools to expand participation of industry.
Other issues	General	Research (use EU funded projects), education, awareness, constant connection to policy makers

Conclusions

- A methodology to investigate industry point of view on Smart Grid regulations and standards has been developed
- Questionnaires, coupled with interviews, have provided:
  - Bottom-up prioritization of requirements and gaps of the Smart Grid Standardization process in the three Areas of Interest (DER integration; Demand Response; Smart Metering)
  - Indications on the awareness level of industry (not only) on the progress standardization related initiatives
- Hints (suggestions, recommendations, concerns and opinions) about general and specific issues on standardization were derived from both questionnaires and interviews

Thank you
of your attention

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