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IEA ISGAN Annex I Global Smart Grid Inventory

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Für den Inhalt und die Schlussfolgerungen sind ausschliesslich die Autoren dieses Berichts verantwortlich.

Abstract

The ISGAN Annex 1 Program of Work, adopted October 2011, has three primary tasks. Task 1 entails development and population of a unified ISGAN framework for assessment of national-level motivating drivers and technology priorities for smart grids. Task 2 concerns development of the initial project inventory, including the establishment of criteria for inclusion of projects in the inventory, the formulation of harmonized data fields for submitted data, and the identification of an appropriate repository (or multiple repositories) for submitted data, as well as the collection and analysis of the initial data. Task 2 also includes the development of related data retrieval and analytical tools. Task 3 builds on Task 2 by adding a quantitative layer using key per performance indicators identified by ISGAN Annex 3 (Benefit-Cost Analyses and Toolkits).

Switzerland has brought in knowledge by two key national SmartGrids demonstration projects and the knowledge gained in the collection of European SmartGrids projects (Information knowledge base).

Projektziele

Die Schweiz hat von Anfang an aktiv am Aufbau des IEA Implementing Agreements ISGAN (International SmartGrids Action Network) mitgewirkt.

ISGAN was launched as the International Smart Grid Action Network at the first Clean Energy Ministerial (CEM), a meeting of energy and environment ministers and stakeholders from 23 countries and the European Union held in Washington, D.C on July 19 and 20, 2010. The CEM focuses on high-level attention and commitment to concrete steps—both policies and programs—that accelerate the global transition to clean energy. The Ministerial was an outgrowth of the agreement at the Major Economies Forum on Energy and Climate (MEF) in L'Aquila, Italy in July 2009, where countries agreed to collaborate on advancing clean energy technologies. ISGAN facilitates dynamic knowledge sharing, technical assistance, and project coordination, where appropriate. ISGAN participants report periodically on progress and projects to the Ministers of the Clean Energy Ministerial, in addition to satisfying all IEA Implementing Agreement reporting requirements. Membership in ISGAN is voluntary, and currently includes Australia, Austria, Belgium, Canada, China, Finland, France, Germany, India, Ireland, Italy, Japan, Korea, Mexico, Norway, the Netherlands, Russia, Spain, Sweden, Switzerland, the United Kingdom and the United States.

Die Schweiz setzt sich durch Teilnahme an diesem Annex I der IEA „Global Smart Grid Inventory“ das Ziel, SmartGrids generell und Erfahrungen aus SmartGrids Projekten im speziellen international auszutauschen und gemeinsam voranzutreiben. Das BFE profitiert von intensivierten internationalen Beziehungen und der Zusammenarbeit mit den weiteren IEA Ländern.

Many participating ISGAN countries are already developing, demonstrating, testing, and deploying smart grid technologies and systems, drafting policies and implementing regulations to advance smart grids, assessing current and projected transmission and delivery infrastructure needs, evaluating demand-side practices, and measuring other aspects of smart grids. In addition, many bilateral and regional cooperative efforts have been launched featuring smart grid as a significant or principal focus. The objective of this activity is to identify countries' specific motivating drivers for pursuing smart grids, catalogue the wide range of smart grid activities underway, and collect and organize the wealth of experience being generated into a resource available first to ISGAN Participants and then a global audience.

Durchgeführte Arbeiten und erreichte Ergebnisse

Die Schweiz hat im Jahr 2014 aktiv an Webinars teilgenommen, die im Rahmen des Annex I durchgeführt wurden. Insbesondere wurden Aspekte von Schweizer und Europäischen Schlüsselprojekten im Gebiet SmartGrids eingebracht. Die IEA profitiert auch von der Sammlung europäischer Projekte im sog. SmartGrids-Monitor, welcher ebenfalls vom BFE mitfinanziert ist und welcher mehr als 500 europäische, Grids- und SmartGrids bezogenen Projektbeschreibungen beinhaltet. Annex I wurde bei der Erfassung von Informationen rund um Schlüsselprojekte im Gebiet SmartGrids und der neu geschaffenen Informationsdatenbank IEA ISGAN strategisch und inhaltlich unterstützt.

Folgende Resultate wurden dabei erzielt:

The objective of the ISGAN global smart grid inventory is to help depict a global view of smart grid activities and investments to allow identification of remaining gaps along with opportunities for targeted collaboration or further investment by ISGAN Participants. Development of the inventory followed the ISGAN framework of assessment, during which smart grid drivers and technologies were assessed by each ISGAN Participant based on their respective national-level priorities. Information on ongoing and planned smart grid projects that respond to national-level priorities was then collected

from each Participant as input to the inventory. Cataloguing of the projects in the inventory is presented in a two-part report.

Part 1 organizes smart grid projects by each main application;

Part 2 organizes the inventory projects by their contribution to policy goals.

The “**project main applications**” and “**policy goals**” in the inventory are in close association with the “smart grid technologies” and the “smart grid drivers,” respectively, in the assessment framework. The latter two categories are more granular than their respective former categories; in other words, a main project application and a policy goal could encompass, respectively, a group of smart grid technologies and drivers. Project information presented in the two-part report was drawn from data call responses by the national experts and representatives of the ISGAN Participants, without any changes. 98 smart grid projects from 17 ISGAN Participants have been captured in the inventory:

Number of Smart Grid Projects	ISGAN Participants
11 Each	India, United Kingdom
10 Each	France, Ireland, United States
8	Germany
6	Sweden
5 Each	Belgium, Canada, Korea
4	Japan
3 Each	Austria, Mexico
2 Each	Italy, The Netherlands, Switzerland
1	Spain

Switzerland has entered two of its key SmartGrids projects into the ISGAN Annex analyses: The Swiss2Grid and the GridBox SmartGrids demonstration projects.

The main gathered information/data is as follows:

- **Fields:** UID, Unique Project ID
 - o **Project overview:** Project name, Location(s) of the physical implementation, Start date of the project, Ending date of the project, Contact person (Name, phone, email address), Project website, Leading organization, Leading organization type, Other participants (Names, countries, and organization type), Project main application, Prevaling stage of development - R and D or Demonstration or Deployment or roll-out, Brief project description (Goals and main areas of innovation), Main project results and outcomes, Brief description of how results can be scaled up or replicated, Main obstacles or challenges and lessons learned, Future applications and third party market entries, Regulatory issues or recommendations related to the project
 - o **Project financial information:** Total budget, Contributing organizations and share of contribution, Sources of project financing or funding, Describe the scenario for estimated costs and benefits, Availability of estimated costs, Availability of estimated benefits
 - o **Focus area:** TRANSMISSION LEVEL-Grid architecture, TRANSMISSION LEVEL-Power technologies, TRANSMISSION LEVEL-Network management and control, TRANSMISSION LEVEL-Market simulation techniques, T and D INTERFACE-Coordination between T and D, DISTRIBUTION LEVEL-Smart customers, DISTRIBUTION LEVEL-Smart energy management, DISTRIBUTION LEVEL-Smart integration, DISTRIBUTION LEVEL-Smart distribution network

- o **Policy goals:** Sustainability and integration, Security and quality of supply, Energy efficiency and savings, Coordination and interconnection
- o **Consumer Engagement:** Which aspects of consumer engagement have been addressed, Target sector, What are the main motivational factors used to engage consumers, Number and details of consumers participating in demand response, Number and details of consumers with in-home display tools, Number and details of consumers with smart appliances, How do you rate the participation of the consumers involved, Describe consumer engagement strategy and findings, Main benefits of and obstacles to consumer engagement, Innovative business model proposed or used for engaging consumer, Regulatory aspects to facilitate consumer engagement
- o **Social impact:** UID, Unique Project ID, Has the project addressed the following social aspects, Issues hindering social acceptance addressed by the project,
- o **Privacy, Security, Interoperability:** UID, Unique Project ID, Has the risks to data processing by the system been assessed, Has the project addressed issues of interoperability?

The projects have been categorized along a list of seven smart grid applications (“Project Main Application” categories):

- Smart Network Management
- Integration of DER (Distributed Energy Resources)
- Integration of Large Scale RES (Renewable Energy Systems)
- Aggregation (Demand Response [DR], VPP [Virtual Power Plant])
- Smart Customer and Smart Home
- Electric Vehicles (EV) and Vehicle2Grid (V2G) Applications
- Smart Metering

Further, under each Application heading, projects are further organized by Distribution (D) Level, Transmission (T) Level, and T&D Interface, pertaining to their physical application domains (or shown as the “Smart Grid Area of Focus” in the template).

The seven “Project Main Application” categories relate to the smart grid technologies listed in the survey in the ISGAN Framework of Assessment Report. A few Application categories comprise a group of smart grid technologies in the survey. For example, the Application category “Smart Energy Management” embodies a group of smart grid technologies used in the survey, namely, information and communications technology, distribution management systems and outage management systems, and system wide monitoring, measurement, and control. Also, the Application category “Integration of Large Scale RES” comprises both smart grid technologies of large scale variable RES integration and wind.

Relation to policy goals

Project could indicate specific policy goals such as:

Sustainability and Integration

- Estimated reductions of CO₂ (via reduced energy losses, energy savings, integration of RES)
- Additional RES hosting power in the grid /maximum power load
- Additional DER hosting power input in the grid (incl. EV and storage)/maximum power load
- Additional Demand Side Management power managed in the grid/maximum power load
- Increased number of consumers participating in electricity markets and in energy efficiency measures

Security and Quality of Supply

- Duration and frequency of interruptions (e.g., SAIDI, SAIFI, CAIDI, etc.)

Energy Efficiency and Savings

- Energy savings
- Percentage reduction of electricity losses
- Reduced peak load

Coordination and Interconnection

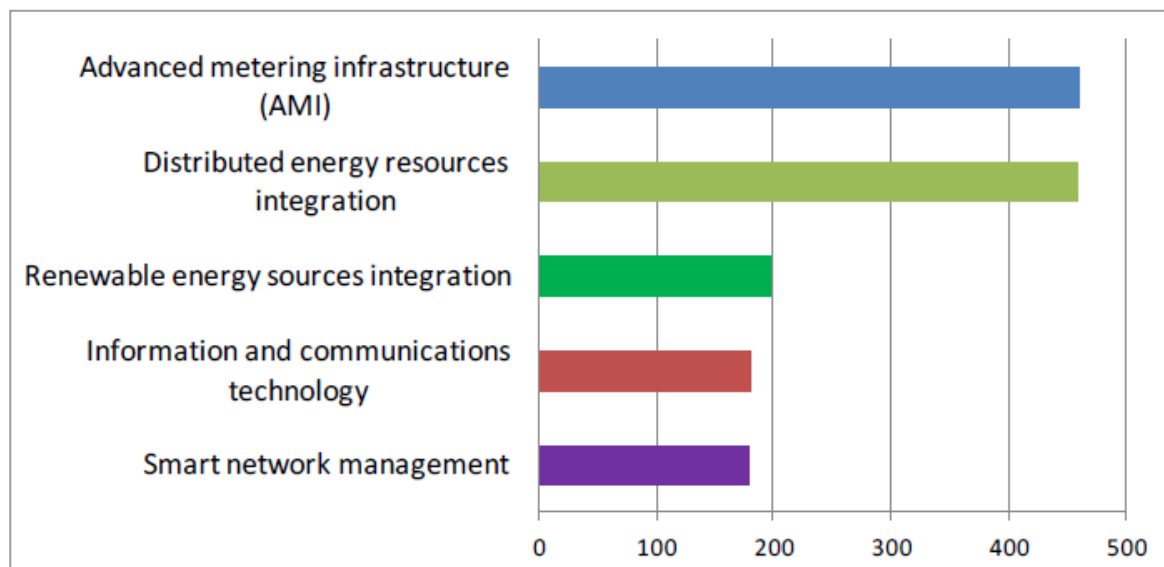
- Additional interconnection capacity (specify HVDC and HVAC)
- Increased internal transfer capacity between TSOs or DSOs

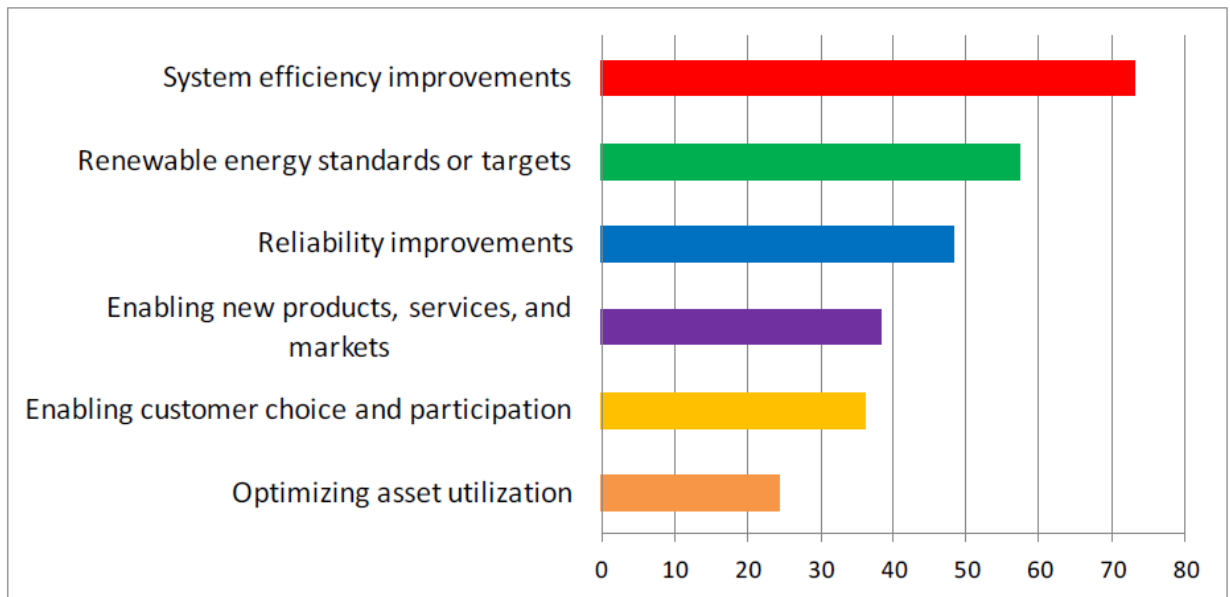
Other policy goals which were not used in the final categorization but mentioned by the participants are:

- Avoid using diesel backup generation,
- Establishment of a low-carbon transportation system,
- Provision of incentives to encourage consumer movement toward a low-carbon society,
- Establishment of regional nano-grids,
- Establishment of EV charging networks,
- Promotion of consumer-oriented energy saving/control systems (smart stores, smart schools, smart houses, energy saving street lights, etc.),
- Establishment of a community energy management system through the promotion of regional energy saving stations,
- Development of environmental learning systems, e-learning systems, etc.,
- Voltage quality:
 - o voltage magnitude within regulatory voltage limits,
 - o reduced phase imbalance,
- Grid protection and monitoring tasks in general,
- Ensuring more ancillary service resources with V2G,
- Ensuring energy security besides fossil fuels,
- Reinforcing system resilience by increasing demand response capability,
- Coordination by local renewable energy company involving prosumers, and Energy efficiency by transparency of energy consumption.

SMART GRID DRIVERS AND TECHNOLOGIES BY COUNTRY, ECONOMIES, AND CONTINENT (update of previous ISGAN Annex I work during 2014)

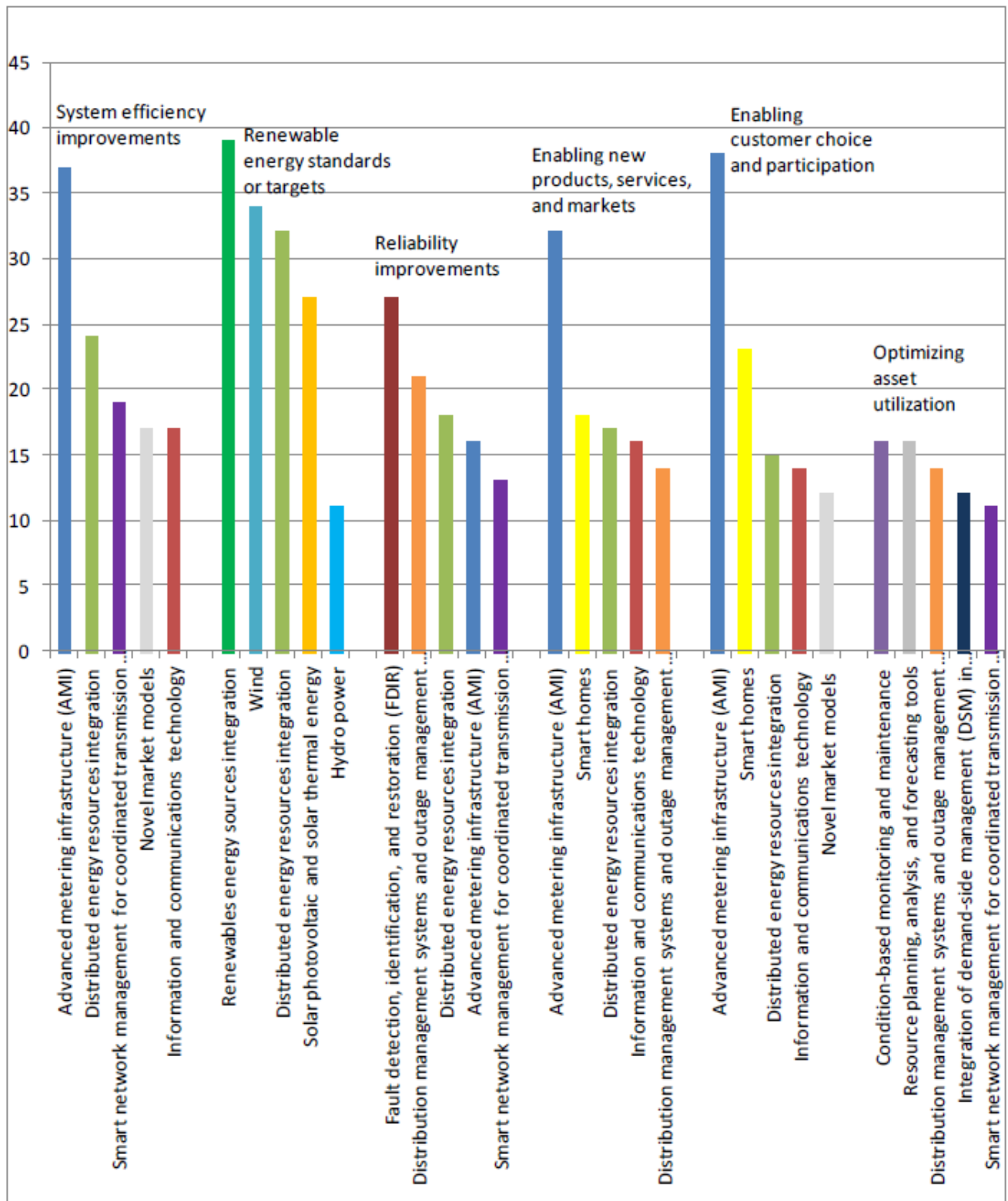
The following figures shows the analysis results for the “top-5 ranked technologies” and the “Top-6 Ranked Motivating Drivers”.



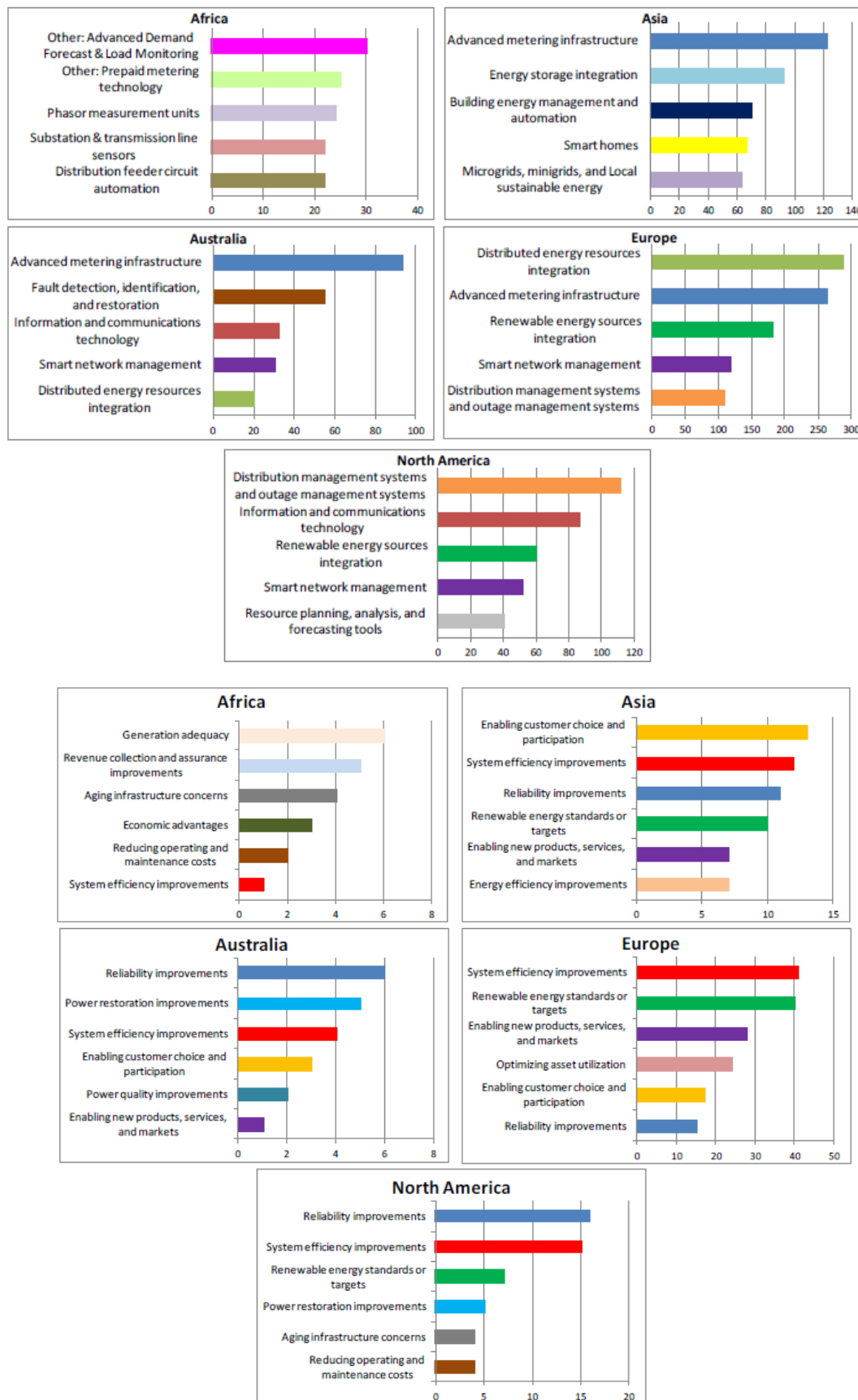


The x-axis scales in the above figures reflects the scores from the clustering analysis.

Zooming into each of the bars of the previous figure yields insights as shown on the next figure. Six groups of technologies are shown in the following figure, and each group consists of the top-5 technologies ranked to support a driver (shown in the label) with technology scores in y-axis and technology names in x-axis. Thus, the figure depicts the prioritized driver-technology pairs from the clustering analysis of the 22 national-level results.



Splitting these figures per continent yields interesting differences:



Common motivating drivers and technologies identified as being of priority to at least three of the five continents are presented in following table. As shown, System efficiency improvements is the only motivating driver of priority to all five continents; the next most common driver, i.e., of priority to four continents, is Reliability improvements. In regard to the common technologies, AMI and Smart network management are of priority to three continents.

To summarize: Motivating Drivers and Technologies Identified as a Priority to Three or More Continents are:

Motivating Driver	Priority to Continents
System efficiency improvements	All
Reliability improvements	Asia, Australia, Europe, North America
Enabling customer choice and participation	Asia, Australia, Europe
Enabling new products, services, and markets	Asia, Australia, Europe
Renewable energy standards or targets	Asia, Europe, North America
Technology	Priority to Continents
Advanced metering infrastructure (AMI)	Asia, Australia, Europe

Nationale Zusammenarbeit

National steht im Rahmen des Annex I vor allem der Kontakt mit Schweizer SmartGrids-Projekten im Vordergrund, welche im ISGAN Annex I SmartGrids Projekt-Inventory aufgeführt werden.

Internationale Zusammenarbeit

Die Arbeiten sind aufgrund des IEA-Charakters stark international ausgerichtet.

Neben der Schweiz haben vor allem aktiv mitgemacht:

Status of Survey Completion and Validation	ISGAN Participants
41 Completed surveys, from 22 nations	Australia, Austria, Belgium, Canada (5), China, Finland (2), France (2), Germany, India, Ireland, Italy (2), Japan (2), Republic of Korea, Mexico (6), Russia, Singapore, South Africa, Spain, Sweden (5), Switzerland, The Netherlands (2), United States (2)
27 Completed and validated surveys, from 18 nations	Australia, Austria, Belgium, Canada (3), Finland (2), France(2), Germany, Ireland, Italy (2), Japan, Republic of Korea, Mexico, Singapore, South Africa, Spain, Sweden (5), Switzerland, The Netherlands
5 Completed but not validated surveys, from 4 nations	China, India, Russia, United States (2)
9 Surveys rejected by countries' primary coordinators	Canada (2), Japan, Mexico (5), The Netherlands

Die interaktive Zusammenarbeit fand im Jahr 2014 vor allem in Form von Webinars statt:

Webinar Date	Smart Grid Project	Project Country (ISGAN Participant)
10 July 2013	Transactive Control	United States
5 December 2013	Salzburg Project	Austria
23 January 2014	Grid4EU Project	Europe-wide
6 March 2014	Jeju Field Trial Project	Republic of Korea
15 May 2014	Smart Community Demonstrate Project in Kita-Kyushu City	Japan
2 July 2014	The PowerShift Atlantic Smart Grid Demonstration of a Virtual Power Plant	Canada
9 October 2014	SmartSacramento	United States
January 2015	Swedish Smart Grid	Sweden

Referenzen

Main Web site: <http://www.iea-isgan.org/>

Dokumente: <http://www.iea-isgan.org/index.php?r=home&c=5/378>