IRENA
International Renewable Energy Agency

SUMMARY REPORT OF THE WORKSHOP

"Needs and Gaps on Standardisation for Renewable Energy

Actions to facilitate the best use of standardisation for renewables"

Bonn, Germany

24 October 2012

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1. Introduction

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation dedicated to renewable energy. In accordance with its Statute, the Agency's objective is to "promote the widespread and increased adoption and the sustainable use of all forms of renewable energy". IRENA focuses its efforts on delivering its mandate through leadership along three equally important key pillars. These pillars are for IRENA to serve as a:

- Global voice for renewable energy and technologies;
- Renewable energy and technology advisory resource for countries; and
- Network hub for country, regional and global programmes.

IRENA acknowledges that standardisation plays a relevant role throughout the entire technology life cycle, from R&D stages through to the commercialisation and diffusion of technology. For renewable energy markets, standardisation may provide a number of key benefits, as witnessed in other economic sectors. These benefits include production cost-decreasing effects; reduction of transaction costs through simplified contractual agreements and use of standardised components; common language and understanding of what a particular product or service is and is not; and an increased level of quality and safety for consumers. Taken together these benefits result in higher consumer confidence in, and acceptance of, the technology in question. Nevertheless, when poorly designed, standardisation may inhibit innovative solutions, create administrative burdens, increase costs, and inhibit trade.

The workshop conducted in Bonn, Germany, on 24 October 2012 was organised by IRENA in collaboration with the United Nations Industrial Development Organization (UNIDO) and the International Centre on Trade and Sustainable Development (ICTSD). It brought together a group of experts to discuss the priority needs and gaps concerning standardisation for renewable energy technologies. The objectives of the workshop were:

- To establish a stakeholders' network to discuss the priority needs and gaps related to standardisation focused on renewable energy technologies; and
- To translate these needs and gaps into concrete action items relevant to different stakeholders.

The workshop consisted of five sessions:

1. An introduction to identified needs and gaps from a landscape analysis of current international and regional standards on renewable energy;
2. Keynote presentations on different aspects of standardisation for renewable energy, highlighting the main issues related to each aspect and possible actions to address them;
3. A breakout groups session where participants identified concrete actions to address priority needs in the area of standardisation for renewable energy;

4. A plenary discussion on the outputs of the breakout groups session; and
5. A closing session and wrap-up of the next steps after the workshop.

Prior the workshop IRENA also:

- Distributed a draft version of IRENA's background paper on its analysis of gaps in international standardisation in the field of renewable energy to participants; and
- Prepared and distributed a questionnaire to broader stakeholders enquiring on specific needs concerning renewable energy standards.

IRENA's draft paper and the feedback received from the questionnaire respondents were used as a basis for discussion in the breakout groups session, where participants completed and elaborated on the list of identified needs, before considering actions to address them.

The outcome of the workshop will help define IRENA's rolling action plan in the area of renewable energy standards. It will also provide recommendations to Member Countries and other relevant organisations on possible actions to address their specific needs.

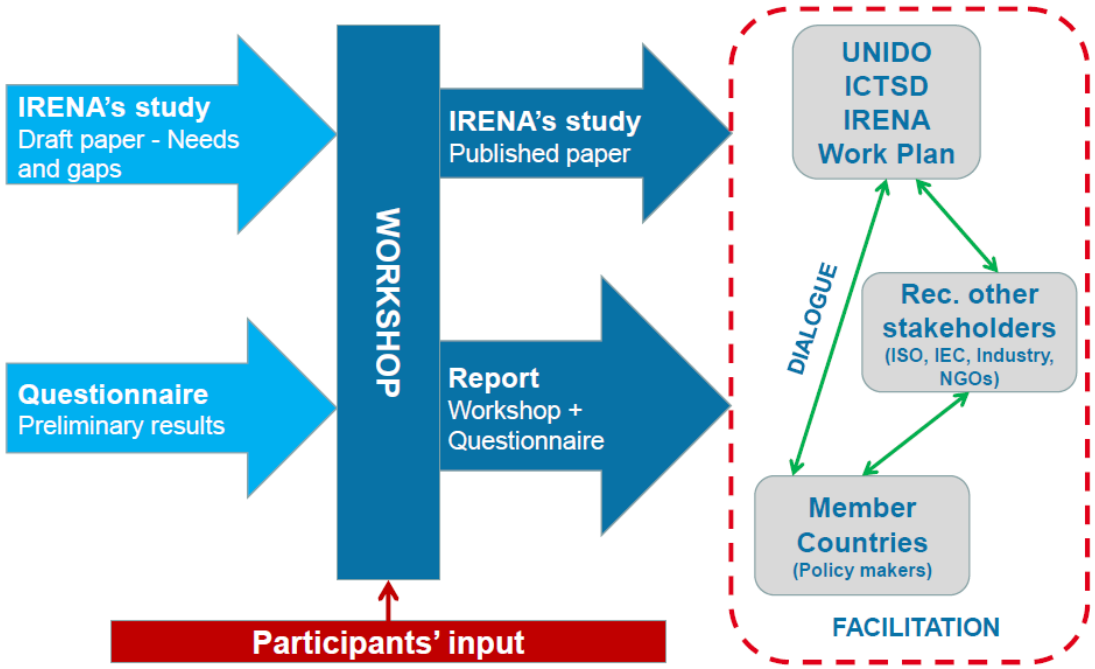

Figure 1: Workshop inputs and outputs

2. Questionnaire

A questionnaire was prepared in order to seek feedback from a broad range of stakeholders in the field of standardisation for renewable energy (including standards developers and users) concerning the priority needs and gaps in this area of work, the required actions to address them, and the best role for IRENA to support such actions.

The questionnaire was organised according to a system of needs categories identified in IRENA's initial draft paper on international standardisation for renewable energy technologies. The following six categories encouraged respondents to think broadly about the needs and gaps in renewable energy standards:

- Trading of renewable energy technology;
- Harmonisation of standards;
- Testing and certification of equipment;
- Incorporation of standards into national regulatory frameworks;
- Participation of developing countries in the development process of international standards; and
- Capacity building and availability of information on standards for renewables.

Questionnaire participants were invited to complete the questionnaire indicating specific needs identified in their area of interest concerning standardisation for renewable energy. They could then indicate suggested actions to address these priority needs.

In total, 22 responses to the questionnaire were received including some collaborative contributions, such as those returned from industrial associations. Responses were received from over 13 countries, as well as several international bodies. The questionnaire surveyed national and international standardisation bodies, industrial associations, research institutes, members of industry, as well as input from an independent expert and an NGO. The figures below depict the composition of responses.

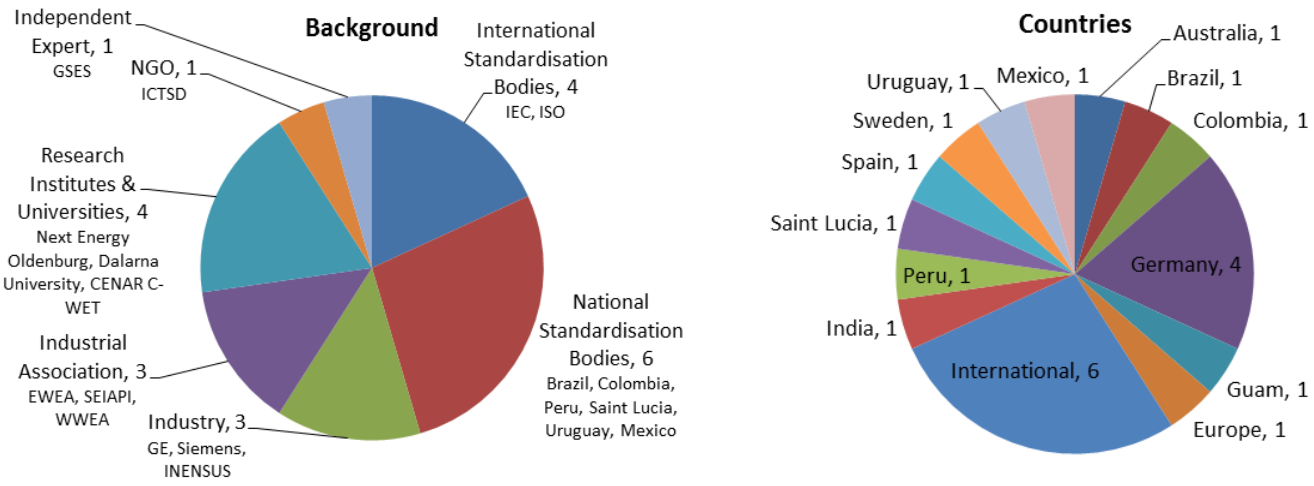

Figure 2: Number of responses received by organisation type and country

In compiling the results, the categories were adjusted to reflect the content of the responses. It was found that although most aspects of standardisation spread across several categories, some are more entwined than others. The responses were therefore grouped into the following five categories:

- Trading and harmonisation;
- Testing and certification;
- Incorporating standards into regulatory frameworks and capacity building;
- Participation of developing countries in the development process; and
- Availability and dissemination of information.

In addition to the above, many comments suggested specific standards that could be developed and these were therefore formed into a sixth category. Some of these suggestions are in fact already published or under development at the appropriate international standardisation body, while others are yet to be developed. The fact that suggestions for new standards were received in areas that already have published standards suggests the importance of dissemination of information. All of the suggestions received are of high relevance to the work programmes being developed by international standardisation bodies.

As mentioned earlier, results from the questionnaire were shared at the workshop and contributed to the discussion during the breakout groups session. The results were compiled and can be found in the table in Annex 3.

3. Outcome of keynote speakers session

Eight keynote speakers provided the following presentations:

- Mr. Gideon Richards, Consulting With Purpose: "*International Standardisation in the Field of Renewable Energy*".
- Mr. Joachim Monkelbaan, International Centre for Trade and Sustainable Development: "*Trading of renewable energy technologies*".
- Mr. Geoff Stapleton, Global Sustainable Energy Solutions: "*Harmonisation of standards for renewable energy systems*".
- Mr. Luis Maria Arribas, CIEMAT: "*Testing and certification for small wind turbines*"
- Mr. Kevin A. McKinley, International Organization for Standardisation: "*How ISO Standards Support Renewable Energy*".
- Mr. Gabriel Barta, International Electrotechnical Commission: "*Helping project developers and policy-makers: standards and development*".
- Ms. Li Yan, China National Institute of Standardisation: "*Incorporation of international standards into national regulatory frameworks*".
- Ms. Müge Dolun and Mr. Mark Draeck, United Nations Industrial Development Organization: "*Standards and Certification in Renewable Energy*".

The following sections summarise the messages conveyed in the keynote presentations. For details of the individual presentations, please refer to the slides available on IRENA's website (www.irena.org) in the "Events Archive" page.

3.1 Balanced participation in the standards development process is crucial

At this session it was explained how standards are based on the consensus reached at the various committees where they are developed, and that different stakeholders have different interests and requirements, as shown in Figure 3 below.

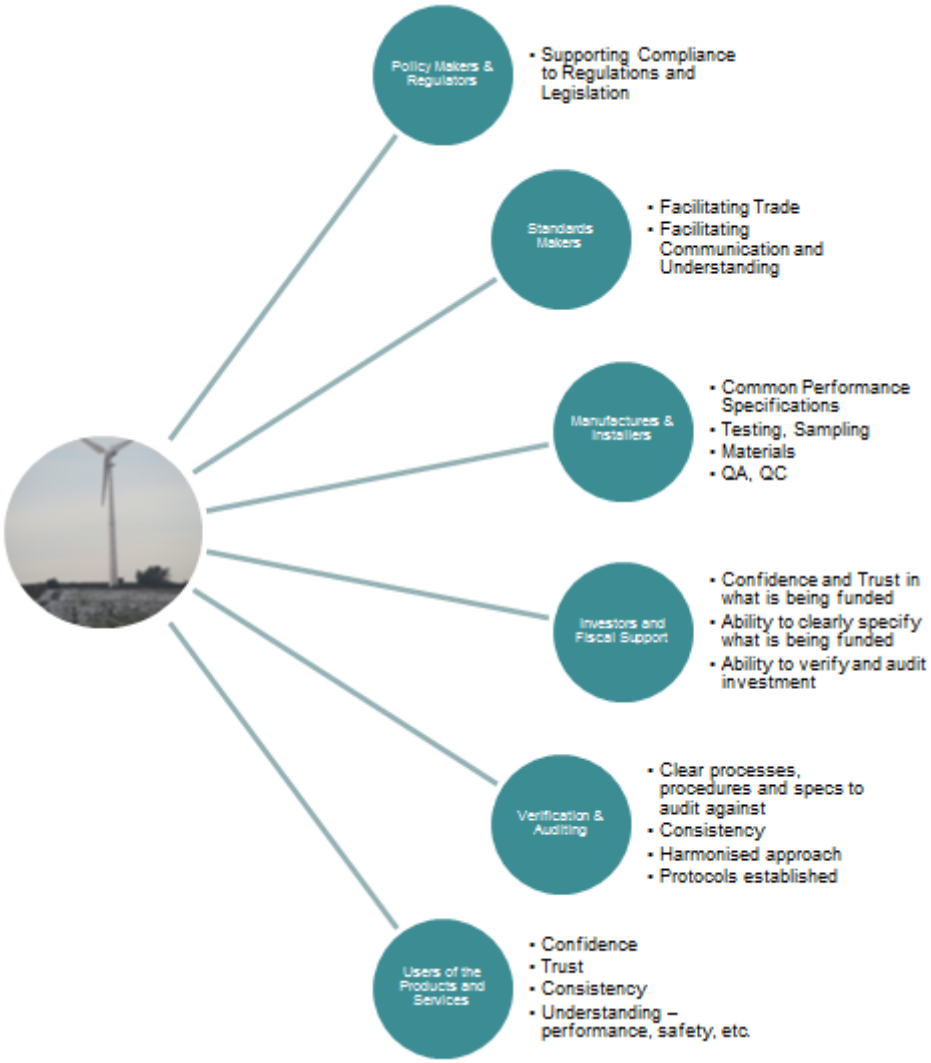

Figure 3: Stakeholders' requirements from standards[1]

This diversity of stakeholders' needs may lead to a mismatch of requirements. Therefore, it is very important that technical committees responsible for standards development have an appropriate balance of active members to ensure an optimal outcome. Balance in technical committees should be sought at all levels, including:

- Technical;
- Demographical; and
- Geographical.

[1]Source: Richards, G. (2012) PowerPoint presentation "Summary of the Report on International standardisation in the field of Renewable Energy", Bonn, Germany.

It was also underlined that the engagement of developing countries in the process of developing international standards for renewable energy is still incipient. This may result in standards that do not take note of the specific circumstances in developing countries (e.g. particular climate conditions); a lack of awareness of international standards already available for certain applications; and the development of national standards, instead of the adoption of international standards. There are already some initiatives working to support the engagement of developing countries, for example ISO–DEVCO or IEC–Affiliate Country Programme. These initiatives aim to facilitate access to international standards from developing countries and the participation of local experts in the standards development process.

3.2 Access to standards is complex and costly

Some presenters indicated the difficulties in obtaining access to standards for renewable energy, which are mainly due to:

- The existence of different sites presenting different degrees of information instead of a common information source (a one-stop-shop) with an uniform and appropriate searching facility; and
- The actual cost of the total number of standards and normative references required for a specific application.

It was mentioned that there are often difficulties in interpreting the information available on the existing sites. When looking for a standard it is important to be able to understand:

- What is the primary role of the standard?
- How to use it?
- Where is it used?
- Which other standards are required in connection with the one being researched?

It was also pointed out during the discussion sessions that the cost of standards can be prohibitive for developing countries. Even when they want to adopt a particular standard people cannot afford to buy the legal version.

3.3 Renewable energy standards are not just ‘product’ standards

Some presentations also highlighted the fact that, when considering renewable energy standards, most of the attention if focussed on equipment, while other aspects of equal importance – including training, installation, operation and maintenance, and management system standards – are sometimes overlooked.

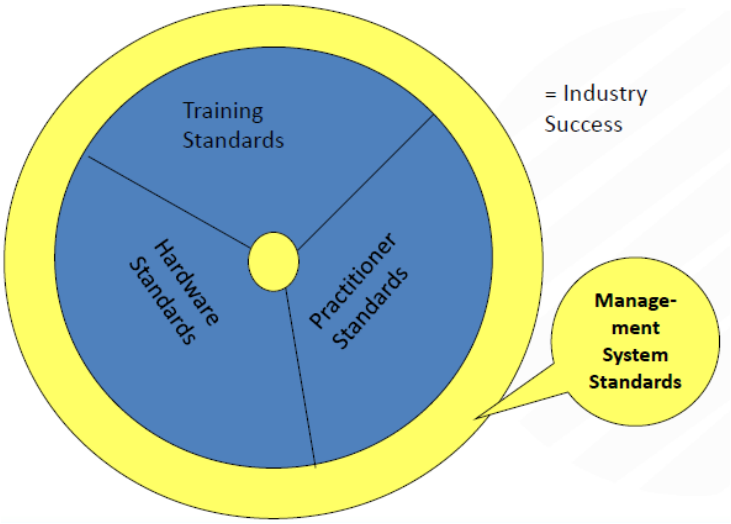

Figure 4: Standards required for a complete renewable energy system[2]

A successful renewable energy system requires not only good components, but also appropriate installation, operation and maintenance, as well as a good integration with other components in the energy system (e.g. the grid, loads in off-grid systems). Not observing all these parts of the system may result in low performance, extra costs and safety issues. There is therefore a need to reinforce the importance of following all the appropriate standards in order to ensure good operation of a renewable energy system, as shown in Figure 4.

3.4 Standards create barriers for trading renewable energy goods when not used well

The role of standards in facilitating the trade in products and services associated with the deployment of renewable energy technologies was also stressed during discussions. However, some presenters highlighted the fact that in some cases, standard-related measures may create unnecessary restrictions to trade. This can be due to, for example: i) a lack of national implementation of international standards for renewable energy; ii) insufficient harmonisation efforts; or iii) a lack of progress in achieving acceptance of equivalence, or mutual recognition, of certification. These issues may result in the creation of non-tariff barriers to the trade for renewable energy goods.

The need to use standards to support governmental programmes and regulations was also discussed, including the use of relevant "international" standards as a basis for technical regulations. It was also considered important to promote mutual recognition of conformity assessments as the basis for accepting equivalence of technical regulations.

[2]Source: Stapleton, G. (2012) PowerPoint presentation "Harmonisation of standards for renewable energy systems", Bonn, Germany.

The lack of available case studies in the field of standardisation in renewable energy was also raised during discussions. Case studies are an important tool, although missing at the moment, to disseminate lessons learnt and best practices concerning use of standards, as well as the implementation of quality assurance schemes.

3.5 Harmonising standards is important but also a major challenge

The fact that non-harmonisation of standards may inhibit the trade and deployment of renewable energy technologies has already been discussed. However, during some presentations it was suggested that achieving real global harmonisation of standards might be extremely difficult due to political and commercial issues, since both country and private sector interests can play a determining role in the development and adoption of standards.

A large number of international, regional and national standards are already available for similar applications. This indicates that having too many standards is not an ideal situation. It was also shown that initiatives aimed at harmonising standards at a regional level might require major efforts, including:

- Having an organisation to manage the harmonisation process (e.g. AFSEC for Africa);
- Performing a thorough analysis of all the standards that exist and identifying priority gaps for specific technologies and applications; and
- Establishing committees charged with reviewing all existing appropriate standards and providing recommendations on how they can be harmonised. Regional level participation from international standardisation bodies (e.g. IEC and ISO) would be beneficial in this process.

A harmonised standard could eventually be produced. However, during the harmonisation process every country where the standard might be applicable should be contacted, in order to determine whether that country would adopt the harmonised standard. Even so, this would not guarantee that the harmonised standards would necessarily be adopted, due to the political and commercial competition reasons already mentioned above.

3.6 Sound quality assurance schemes are critical

At this session the importance of quality assurance schemes, including testing, certification and inspection (collectively known as conformity assessment) was underlined. Quality assurance schemes, when well designed and implemented, give confidence to buyers and customers for quality and safety, while at the same time supporting national technical requirements and facilitating access to markets.

Standards and conformity assessment guidelines can also support the effective dissemination of renewable energy technologies. However, to do so they must cover the full technology value chain including harmonised measurement standards, product-specific standards, and certification of competency of all those involved in the process, such as energy experts, consultants, project developers, installers and auditors. The links between all these parts is depicted in Figure 5 below.

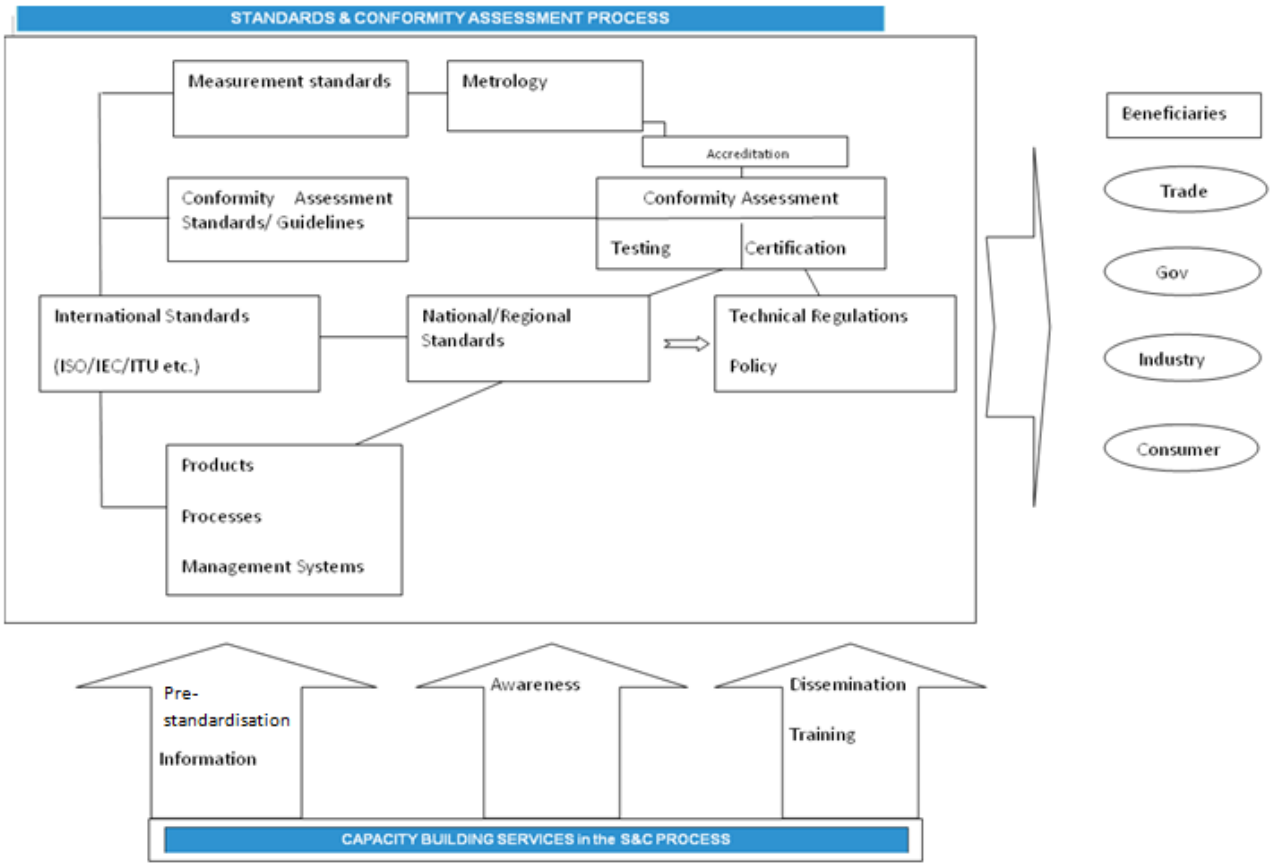

Figure 5: Standards and conformity assessment process[3]

The challenges for the establishment of such quality assurance schemes were also discussed, including:

- The lack of internationally recognised expert training and certification programmes for designers, installers as well as for auditors and assessors;
- The diversity of national approaches for certification of renewable energy systems; and
- Growing concerns over the credibility of certification schemes in some countries.

[3]Source: Adapted from Dolun, M. (2012) PowerPoint presentation "Standards and Certification in Renewable Energy", Bonn, Germany.

The testing and certification of small wind turbines (SWTs) was presented as a case study. It was showed how the absence of quality assurance schemes had already allowed poor quality products to reach the market in some countries. The underperformance and failure of such products have impacted on the perception of the consumers and undermined trust in the whole SWT technology. However, establishing formal quality assurance schemes in developing countries is challenging, due to the lack of capacity and infrastructure as well as the costs related to testing a product and obtaining a certificate for it. It is therefore important to consider alternatives such as having some kind of quality assurance scheme that is reliable, but at the same time affordable in developing countries. The possibility of having a labelling scheme to inform customers on the key characteristics of the product was discussed as a possible first step towards a formal, and global, quality assurance scheme for SWTs.

3.7 International standards may support national regulatory frameworks but the development of required capacity is needed

The session also discussed the importance of using international standards to support national regulatory frameworks. The established benefits of international standards include:

- Providing a detailed technical basis for laws and regulations;
- Supporting public and private tendering processes; and
- Helping fulfil the WTO's Agreement on Technical Barriers to Trades.

Nevertheless, some presentations underlined the fact that countries need to understand how they can benefit from using international standards in their national regulatory frameworks. They also need to develop the capacity to make the best use of these standards, including:

- Becoming active participants in international standards development;
- Having access to information on standard schemes;
- Having competent and trained professionals, such as trainers, consultants, energy experts, assessors and auditors, available to implement quality assurance schemes; and
- Developing national conformity assessment providers.

4. Outcome of breakout groups session

During the afternoons session participants divided into small groups to discuss the actions required to address priority needs and gaps in standardisation for renewable energy. The discussions were structured around five topics.

1. Testing and certification;
2. Harmonisation of standards and trading;
3. Access to standards and related information;
4. Use of standards in national policy frameworks; and
5. Engagement of developing countries in the standardisation process.

Participants were given a draft list of needs for each topic, based on IRENA's draft paper and the inputs from the questionnaire. They first reviewed and completed the list and then drew up a list of key action points required to address priority needs related to each topic. A summary of the actions proposed for each topic is presented in this section. For the complete list of needs and actions, please refer to Annex 3.

4.1 Testing and certification

	ACTION	COMMENT
a.	Bring banks, insurances companies and other capital market participants together to discuss the requirements for certification for renewable energy technologies.	The use of certified components and quality assurance is very relevant for projects seeking access to financing sources. Therefore, a dialogue on, and common understanding of, these requirements is needed.
b.	Disseminate best practice on renewable energy technologies certification and testing.	The sharing of best practices in the field of testing and certification would help governments, national certification authorities and labs avoid past mistakes. However, there is a lack of documented case studies and lessons learnt in this field.
c.	Kick-off activities to structure the certification for off-grid renewable energy technologies products/projects.	A major gap has been observed in this area concerning off-grid renewable energy technologies, e.g. solar home systems, small wind turbines. It would be useful to develop an agenda to establish quality assurance schemes for these applications.

d.	Support the participation of developing countries in the international elaboration of certification and testing methodologies.	As mentioned in the previous section, it is necessary to develop schemes that are robust but at the same time affordable for developing countries. To achieve this, the active participation of developing countries in the whole process is crucial.
e.	Support establishment of a network of laboratories.	A network of laboratories might allow: • Customers to easily find the laboratories that may test their products; and • Identification of technical or geographical areas where testing facilities are missing.

4.2 Harmonisation of standards and trading

	ACTION	COMMENT
a.	Identify overlaps between standards for the same application and the potential solutions for harmonising them.	In order to harmonise standards at a regional level, it is important to first identify available standards and existing overlaps.
b.	Identify harmonisation priority needs for particular technologies and standards and for particular countries.	A committee should be established to review the overlaps identified and prioritise the technologies and applications to be tackled in the region. While doing so, key stakeholders and national officers in the region should be consulted, and there should be investment in awareness-raising and capacity-building. The established committee should then review and endorse the harmonised standards.
c.	Adopting existing international standards with country notes added if needed.	It was suggested that international standards should always strive for full consensus of all countries as part of the standardisation process. Here, further engagement of developing countries should be promoted, as indicated in Section 4.5 of this report. The importance of countries taking the existing opportunity of reviewing and commenting on standards under development or revision at international standards bodies was also stressed. Countries have the opportunity to raise their concerns and propose adjustments or, despite the fact that local requirements should be avoided in international standards, add country notes to the standards if absolutely necessary. This would ensure that international standards are published taking country aspects into consideration and facilitating their adoption across regions.

4.3 Access to standards and related information

	ACTION	COMMENT
a.	International standards bodies should produce best practice guides to clarify difficult technical aspects and publish explanatory documents for standards.	It was noted that there is still a lack of information on how to use standards and how to get the required standards for specific applications, particularly for non-experts on standardisation.
b.	Development of a common standards database for renewable energy technologies.	A web access database for renewable energy standards would be a useful source for facilitating dissemination and access to renewable energy standards. However, creating such a database is a challenge as significant resources are required, not only to develop it, but to maintain it. A Wiki structure may possibly help in that regard, allowing input from many sources to build a profile.
c.	Explore alternatives to reduce or waive the cost of getting standards.	Standardisation bodies very much rely on the income from standards, so they cannot be given away free. Therefore, innovative alternatives to reduce their cost should be explored.

4.4 Use of standards in national policy frameworks

	ACTION	COMMENT
a.	Promote understanding of how standards support public policy objectives.	This could be done through: • Micro-level studies based on ISO methodology (as an example); • Encourage the development of national strategies for renewables with targets and linked to international/regional standards; • Macro/sectorial studies; and • Good policy study at national level or case studies to explain the role of national infrastructure.
b.	Promote good regulatory practices.	Suggested sub-tasks are: • Identify and document best practices; • Show linkages between regulation and standards and provide a list of best practices; • Promote inter-ministerial and/or inter-agency cooperation at national level; and • Outline benefits to country economy. (Macro-economic analysis).

c.	Capacity building and institutional strengthening.	This activity would require the development of: • Check lists or surveys to identify country capabilities and needs; • Guidelines for decision-makers; and • Specific capacity-building exercises and training materials.

4.5 Engagement of developing countries in the standardisation process

	ACTION	COMMENT
a.	Create national committees of experts to participate in the standards development process and establish mechanisms to support them.	Expertise in developing countries for participating in the standards development process should be identified and organised in committees, for example IEC national electrotechnical committees. Financial mechanisms are required to support the work of these committees.
b.	Ensure that the perspective of project developers in developing countries is considered during the standards development process.	The view of project developers is sometimes missing in the standards process, particularly in developing countries where specific circumstances (e.g. extreme climate conditions, available infrastructure) can determine the success of a project.
c.	Stress the importance of considering the whole range of standards, including system design, system installing, monitoring and management.	As previously mentioned in this report, attention should not only be paid to product standards. Standards for trainers, installers and system management are also critical in assuring the good operation of renewable energy systems.
d.	Capacity building and awareness.	The development of the required capacity in developing countries to promote the best use of standards should include: • Awareness in countries of the existing mechanisms to support their participation in the process, e.g. IEC-Affiliate Country Programme and ISO–DEVCO; • Education and training programmes; • Sharing best practices and case studies; and • Promotion of hands-on internships.

5. Conclusions

The workshop achieved its objectives by:

- Establishing a balanced stakeholders' network that discussed the priority needs and gaps related to standardisation for renewable energy technologies; and
- Translating these needs and gaps into action items relevant to different stakeholders.

During the event the high importance of standardisation and quality assurance for accelerating the sustainable deployment of renewable energy was stressed. However, it was also noted that significant efforts are still required to elucidate what standards are, and what they can do for stakeholders, particularly by supporting those policy-makers who are aiming to design sound national regulatory frameworks for renewable energy innovation and deployment. During the workshop, participants identified key areas where work is needed to effectively harness all benefits from sound standardisation and quality assurance schemes for renewable energy, including:

- Engagement in the process of developing international standards by all stakeholders, in both developed and developing countries;
- Access to international standards for renewables and to related information is crucial in ensuring that the role of standards is understood and they are well used;
- Implementation of sound and affordable quality assurance schemes for the whole technology value chain (equipment, installation, O&M, human skills, etc.) is key to supporting renewable energy technology markets and, for project developers, key to obtaining access to financial sources;
- The use of standards in national policy frameworks requires a good understanding of the whole standardisation process as well as the development of required capacity at country level;
- Sharing best practices is important to facilitate an appropriate and wider use of international standards;
- Standardisation should cover all aspects across the whole life cycle of the system, including system design, components, installation, operation and maintenance, decommissioning and competency criteria; and
- Some applications, such as off-grid and small-scale renewable energy systems, still require more attention from international standards bodies.

IRENA has included a number of proposals in its Work Programme for 2013 aimed at providing its Member Countries with useful tools to facilitate the best use of standardisation for the deployment of renewable energy technologies. These proposals, which are based on IRENA's needs and gaps analysis and the feedback received at this workshop, include:

- Commence development of a web information platform, in consultation with relevant stakeholders, that would provide easy access to information on international standards for renewable energy, including existing standards and those under development; the benefits of standardisation; and their development process, use and application;

- Analyse the barriers to the wider use of quality assurance schemes, including the testing and certification of equipment, with a focus on small-scale and off-grid renewable energy technologies. This should be led by a pilot study for one selected type of renewable energy equipment;
- Document relevant case studies on the impact of standardisation and quality assurance for renewable energy technologies, with the aim of facilitating the dissemination of best practices relevant to policy-makers, industries and technology end-users.

The workshop also revealed that, in order to address all the identified issues and materialise the suggested action items, it is important to facilitate continued dialogue between all relevant stakeholders. It was suggested that IRENA is in a very good position to play a role as facilitator, linking countries, standards developers and standards users with the aim of ensuring that they all benefit from the support offered by standards in their efforts to achieve an accelerated deployment of renewable energy at a global level.

ANNEXES

Annex 1 - Workshop Agenda

08.30-09.00	**Registration**	
09.00-09.25	**Introduction**	
	Welcome	*Mr. Frank Wouters* – Deputy Director-General, IRENA
	Introduction to workshop	*Mr. Francisco Boshell* – Analyst, IRENA Innovation and Technology Centre (IITC)
09.25-11.00	**Panel presentations on issues related to standards for renewable energy**	**Moderator:** *Mr. Diego Masera* – Chief of the Renewable and Rural Energy Unit, United Nations Industrial Development Organization (UNIDO)
	Introduction to mapping of international and regional standards on renewable energy: needs and gaps	*Mr. Gideon Richards* – CEO, Consulting with Purpose LTD, ISO SAG-E member
	Standards and trading of renewable energy technologies	*Mr. Joachim Monkelbaan* – Programme Officer Climate Change and Energy, International Centre for Trade and Sustainable Development (ICTSD)
	Harmonisation of standards for renewable energy systems	*Mr. Geoff Stapleton* – Director, Global Sustainable Energy Solutions Pty Ltd, Chairman of the Standards, Training and Accreditation (STA) committee from the Australian Clean Energy Council
	Testing and certification for small wind turbines: challenges and actions to address them	*Mr. Luis Maria Arribas* – Researcher Wind Energy, Energy Research Centre of Spain (CIEMAT)
11.00-11.20	**Coffee Break**	
11.20-13.00	**Panel presentations on issues related to standards for renewable energy (continued)**	**Moderator:** *Mr. Diego Masera* – Chief of the Renewable and Rural Energy Unit, United Nations Industrial Development Organization (UNIDO)
	How Standards Support Renewable Energy	*Mr. Kevin A. McKinley* – Deputy Secretary-General, International Organization for Standardization (ISO)
	Helping project developers and policy-makers: standards and development	*Mr Gabriel Barta* – Head of technical coordination, International Electrotechnical Commission (IEC)
	Incorporation of international standards into national regulatory frameworks	*Ms. Li Yan* – Researcher, China National Institute of Standardisation (CNIS)
	Capacity building and information platform for renewable energy standards	*Ms. Müge Dolun and Mr. Mark Draeck* – United Nations Industrial Development Organization (UNIDO)
13.00-14.00	**Lunch**	
14.00-16.20	**Prioritising needs and defining required actions**	
	Definition of concrete actions to address priority needs concerning standardisation for renewable energy technologies	Breakout group session
16.20-16.40	**Coffee break**	
16.40-18.15	**Plenary discussion**	**Moderator:** *Mr. Dolf Gielen* – Director, IRENA Innovation and Technology Centre (IITC)
18.15-18.30	**Closing session and next steps**	

Annex 2 - Participants list

	Name	Organisation
1	Althaus, Jörg	Director of Global Competence Centre PV Modules – TÜV Rheinland Energie und Umwelt GmbH
2	Arribas, Luis Maria	Researcher – Energy, Environment and Technology Research Centre of Spain (CIEMAT)
3	Barta, Gabriel	Head of Technical Coordination – International Electrotechnical Commission (IEC)
4	Bergmann, Arno	German Commission for Electrical, Electronics and Information Technology of DIN and VDE (DKE)
5	Boshell, Francisco	Analyst – International Renewable Energy Agency (IRENA)
6	Dolun, Müge	Industrial Development Officer – United Nations Industrial Development Organization (UNIDO)
7	Draeck, Mark	Rural & Renewable Energy Unit – United Nations Industrial Development Organization (UNIDO)
8	Eguino, Kory	Executive Secretary – Pan American Standards Commission (COPANT)
9	Gielen, Dolf	Director Innovation and Technology Centre - International Renewable Energy Agency (IRENA)
10	Gsänger, Stefan	Secretary General – World Wind Energy Association (WWEA)
11	Hecl, Vladimir	Programme Officer – United Nations Framework Convention on Climate Change (UNFCCC)
12	Hillner, Ulf	Technical Cooperation – German Institute of Metrology (PTB)
13	Holz, Felix	Vice President, Experten team Greentech – Deutsche Bank

14	Hossain, Jami	World Wind Energy Association (WWEA)
15	Isaka, Mirei	Analyst – International Renewable Energy Agency (IRENA)
16	Jungmittag, Andre	Professor – Frankfurt University of Applied Sciences
17	Konings, Peter	President – Sustainable Energy Industry Association of Pacific Islands (SEIAPI)
18	Kovacs, Peter	Technical Research Institute of Sweden
19	Masera, Diego	Chief of the Renewable and Rural Energy Unit – United Nations Industrial Development Organization (UNIDO)
20	McKinley, Kevin	Deputy Secretary-General – International Organization for Standardization (ISO)
21	Monkelbaan, Joachim	International Centre for Trade and Sustainable Development (ICTSD)
22	Nies, Jacob	Chief Consulting Engineer – Wind Energy Division – General Electric
23	Peters, Holger	CTO – INENSUS
24	Pitteloud, Jean-Daniel	World Wind Energy Association (WWEA)
25	Rauser, Francoise	Affiliate Country Programme Executive Secretary – International Electrotechnical Commission (IEC)
26	Richards, Gideon	CEO – Consulting with Purpose LTD / ISO SAG-E Member
27	Roesch, Roland	Senior Analyst – International Renewable Energy Agency (IRENA)
28	Sanchez, Marcelino	National Renewable Energy Centre of Spain (CENER)
29	Shrestha, Janak	Programme Officer – Standards Setting Unit, United Nations Framework Convention on Climate Change (UNFCCC)
30	Stapleton, Geoff	Director – Global Sustainable Energy Solutions Pty Ltd

31	Struth, Ulrich	Energy Division – Siemens AG
32	Weischer, Lutz	Research Analyst – World Resources Institute (WRI)
33	Werner, Jack	Executive Director – Institute for Sustainable Power, Inc. (ISP) / Co-Chair SE4All Practitioners' Network, Working Group on Standards
34	Wouters, Frank	Deputy Director-General – International Renewable Energy Agency (IRENA)
35	Yan, Li	Researcher – China National Institute of Standardisation (CNIS)

Annex 3 – Complete list of needs and suggested actions

Below are the complete lists of needs and gaps, including the suggested actions to address them, from the questionnaire and workshop discussions.

Trading and harmonisation	
Needs	**Actions**
Countries follow different standards for the same application in the same region, impeding trading and commercialisation of technology.	Advise countries in a region on the benefits of harmonisation and endorsement of international standards. This issue might require addressing political issues.
Addressing harmonisation of standards at international level might be cumbersome due to issues as technology (hardware), lock-in due to historical use of different standards, political reasons to use certain standards, and the time needed to revise international standards.	Development and use of harmonised regional technical guidelines, based on prevailing international standards and adjusted for particular regional circumstances (e.g. climate), to overcome the issue of non-harmonised standards.
There are many national standards that impede trade.	Encourage recognition of international standards and accreditation procedures. Benefits of harmonising should be communicated. Country-specific (protectionism) should be discouraged. Improve standards to include country-specific needs. Clarify motives for deviating from international standards. Investigate which standards could and should be harmonised.
Possible market domination of a few players.	Improve market access Create conditions to reduce monopolised market share.
Many grid codes for small markets.	Support regional organisations to allow greater interoperability.
Higher penetration of renewables without considering demand/supply match.	Schemes should be created to encourage capacity markets. Encourage producers to increase predictability.
Difficulty of power trading with renewable energy due to its variability and unpredictability.	Shorten windows in the power spot market so renewable energy can compete. Reconsider feed-in tariffs Power trading problems should not be identified with renewable energy. Legislation is required to allow connection to grid.

Unfamiliarity with differences between products that meet standards with those that do not.	Communicate the idea that standards should be applied to all imported products and projects.
Quality control with international accepted procedures and quality levels.	Establish an international quality control programme. Define minimum international quality control procedures. Increase use of factory inspection procedures by implementation of ISO 9001.
Transparency in occupational health and safety practices.	Promote adoption of OHSAS 18001.
Transparency in environmental practices.	Promote adoption of ISO 14001 and ISO 50001.
Donor countries use their own standards, leading to mismatch of equipment.	

Testing and Certification	
Needs	**Actions**
Some laboratories lack infrastructure for certification.	Assess laboratory infrastructure needs. Establish a network of laboratories for testing.
Testing and certification is expensive, particularly for small-scale and off-grid system equipment in developing countries.	Assess how to implement certification mechanisms that balance stringency and costs to make them affordable to developing countries and small-scale applications. Design and establish “low-cost” testing facilities in developing countries, using local capacity such as universities and other recognised test centres.
Some stakeholders are unaware of how to certify or test equipment.	Create a list of test centres and what they are able to certify. Establish regional testing laboratories.
Lack of trust in product labelling and certification.	Share best practices and protocol between labs. Strengthen conformity assessment programmes. Improve consultation process. Warranty performance according to label. Label conformity.

	Consumer education.
Some laboratories lack trained staff to certify.	Assess training needs. Disseminate accreditation methods for staff.
Testing and Certification should reflect extreme environmental considerations.	Collaborative research on regional failure mechanisms. Develop test criteria for extreme conditions.
Certifying can be a nuisance to some technology providers.	Allow self-declaration of standards.

Incorporating into national frameworks and capacity building	
Needs	**Actions**
Regulation often does not specify standards.	
National standards are often developed, instead of accepting international standards.	Encourage the acceptance of international standards.
There are many government entities working with the renewable energy industry.	Encourage establishment of a state entity to consolidate the needs of the renewable energy industry.
Impact of higher energy prices on population.	Methods for ensuring least impact.
Some stakeholders do not understand the process of standards development.	
Some stakeholders do not understand the purpose/benefit of applying standards.	Investigate what standards are being applied.

Participation of developing countries in the development of standards	
Needs	**Actions**
Participation in standards development is expensive and complex.	Create a fund for participation of experts from developing countries in technical committees (TCs). TCs to meet using electronic media, e.g. webinars.
There is a lack of awareness of how to participate.	Organising platforms where private sector and governments can provide technical assistance and training to developing countries to improve standards and conformance regimes for renewable energy and understand the standards and specific editions being used.
Motivation to participate is lacking.	Benefits of participation should be identified. Benefits of implementing standards should be identified.
Standards may not take into account specific needs and realities of developing countries.	
It is not clear who should participate.	Key contact people should be identified (e.g. technical, government and utilities). Developing countries should focus on those technologies with potential in their countries.

Access to information and dissemination	
Needs	**Actions**
It is difficult to find relevant standards.	A one-stop-shop with secure funding and operational responsibility is needed. A forum or helpline. Identify contact persons who can advise countries on standards. Strengthen regional and sub-regional databases. Encourage data sharing.
Some stakeholders do not know what standards exist.	Create a web-access database of available standards for renewables, including their interrelation with other standards, and indications of their related costs. Communicate what standards exist.
Purchasing standards can be expensive.	
Consumers do not understand the benefits of standards.	
Lack of information – there is no database that collects all relevant standards for an application.	Establish database of successful projects. Costing for different sources. Encourage data sharing, which requires high-level buy-in and transparency.
The language used in standards is difficult to understand.	Develop guidelines that identify key points in simpler language. Translations of standards.
It is difficult to find local and national requirements for certification.	Create a global repository of local code requirements.
Stakeholders do not know how to apply standards.	Train stakeholders on how to apply existing standards.

Proposals for development of new technical standards
Solar thermal collector performance.
Standards to estimate annual average of energy resource (e.g. solar radiation or wind speed).
General lack of standards for renewable energy technologies, outside wind and solar.
Machine head testing of wind turbines.
Aviation lighting for wind turbines.
Navigation lighting for wind turbines.
Certification of equipment used in biomass.
Improve consistency of biofuel properties.
Certification of hybrid equipment.
Waste to energy standards.
Solar cooking standards.
Resource assessment standards.
Health and safety.
Offshore electrical works.
Develop a renewable energy converter standard.
International grid codes are not harmonised.
The US national standard in development, UL 6141, and the IEC 61400 series are not harmonised.
Second-hand renewable energy equipment (especially for wind and solar).