Global Certification for Solar Thermal Products

Co-writers:

Jaime Fernández (AENOR, Spain)

Stephan Fischer (ITW, Germany)

Jim Huggins (SRCC, United States)

Jan Erik Nielsen (SolarKey Int, Denmark)

Foreword

AENOR has based a great part of its growth on the joint work targeted to develop competitive solutions for industries. Two of our main activities are the production of standards and the certification of products in all fields, which are developed with complete independence. Both count with the collaboration of external advisory, well balanced, technical committees. We know very well that a key element of the professional growth of our multi disciplinary technical team lies in the continuous contact with the various industrial and service sectors that we work with. Cooperation and collaboration are words that are embedded deeply in our DNA. We are members of many international entities like CEN or ISO, and we have also chosen to belong to many alliances like the IQNET or the Keymark. These alliances are profitable for all parties involved. In this project different entities from different parts of the world have worked together with a joint objective for the benefit of our societies. In today's global world this is a model of cooperation we should encourage. We should be thankful to the members of industrial associations, laboratories and certification bodies that have participated in this exercise. They are offering an interesting proposal that can be beneficial to all stakeholders in the solar thermal business and we should strongly support it for the future.

Avelino Brito, Chief Executive Officer AENOR

The Solar Rating & Certification Corporation (SRCC®) is an American non-profit organization whose primary purpose is to provide authoritative performance ratings, certifications and standards for solar thermal products, with the intention of protecting and providing guidance to consumers, incentive providers, government, and the industry.

In the 1970's there was little consistency between each state's testing requirements and approach to rating solar equipment in the United States. Such programs soon became an impediment to manufacturers who marketed in more than one state. It became evident that there was a need for a single, national program that would allow manufacturers to rate and test the efficiency of their equipment. This would also benefit consumers by providing a uniform, national approach for rating and comparing solar equipment. In an unprecedented move, the trade association for the solar energy industry and a national consortium of state energy offices and regulatory bodies collaborated to lay the groundwork for such a program, which would soon lead to the founding of the Solar Rating & Certification Corporation.

If necessity is the mother of invention, then harmonization was the mother of the SRCC. We are honored to be a part of the global cooperation to further benefit the solar heating and cooling industry worldwide

Eileen Prado, Executive Director Solar Rating & Certification Corporation®

Executive Summary

The Solar Keymark for solar collectors according to EN 12975 and systems according to EN 12976 has been a success story in Europe. This Quality Mark was born in 2003 in order to help companies throughout Europe get their tests and inspections recognized easily by administration and subsidy bodies without repeating the works in each country and therefore facilitating exports within the EU. ESTIF (European Solar Thermal Industry Federation) holds the Secretariat of a group called the Solar Keymark Network that has the duty of continuously updating the scheme rules, harmonizing the activities of all operators and in general resolving any problems related to the certification and testing of solar thermal products. The SKN meets twice a year and is formed by representatives of Industry, Laboratories, Certification Bodies of Europe and also invites observers from around the world.

In Europe, all countries that are members of CEN have the obligation of adapting EN standards. This means for example that when EN 12975 was approved back in 2000, all CEN members had to withdraw any national standards for collectors and only one standard was used in Europe. However this does not happen with ISO standards and ISO members. ISO 8906 is an international standard for testing collectors, but that does not mean that all countries must necessarily withdraw their national collector testing standards. As harmonization efforts are undertaken, the next revision of ISO 9806 will be accepted by CEN, and the EN 12975-2 (testing method for collectors) will be withdrawn and reconverted into the new version of EN ISO 9806. Therefore a chance for **a unique worldwide testing method for collectors may give way to a unique global certification system.**

During the Solar Keymark Network Meeting of October 2011 it was agreed that there was a strong interest in deeply analyzing the possibility of the European Solar Keymark becoming a global Mark with the birth of a EN ISO 9806 standard for testing collectors. A working group for Global Certification was set up and the Solar Certification Fund awarded it with a fund for a project in March 2012.

The objective of the 1 year project was to make a rational study of all the elements involved in the decision process and conclude on the steps needed to be taken towards globalization. This document is a result of all the research activities of the co-writers and all the meetings held within the working group. Once the document is finished, members of the Solar Keymark Network will be on a more equal level of knowledge as to which the best decision to make is and what the best steps to follow are. The document has been written thinking also about other professionals outside Europe that may be interested in the possibilities of Global Certification for their business.

In **chapter 2 we describe two global certification schemes with the purpose of learning from their experience** and finding inspiration for solving problems we may find along the road. In both cases they have started as European schemes and turned global. We were especially interested in their infrastructure from a technical and legal point of view, and also the efforts done to assure harmonization of the different operators.

The most interesting conclusions drawn from studying the Global G.A.P (Agricultural Products) and the IECEE (low voltage electric products) international certification schemes are:

- There is a strong interest in harmonization among the certification bodies and laboratories. Both international schemes ask for accreditation of the certification bodies and laboratories, but both consider that this is not enough. There are extra activities like peer auditing or direct auditing from the owner of the scheme. In the case of Global G.A.P there are also working groups set up with accreditation bodies to assure harmonization in accreditation activities.
- In both cases there is a well-defined and full time infrastructure of working groups for continuous development and improvement of documents.
- In both cases there is a Secretariat working full time for the global scheme.
- In the case of Global G.A.P, the Secretariat is a private company that goes one step further than certification activities and also provides the sector with tools for improvement like e-learning.
- Global G.A.P uses a 'Think Global, act local' philosophy with national working groups that work to prepare guidelines for the implementation of rules.
- There are different methods for ownership of the Mark, but the Mark is always registered and resources are dedicated to protecting from its misuse.

Chapter 3 offers a first glance at certification systems across the world and what standards they are using for testing. It is a necessary condition for global certification to be successful that the future revision of ISO 9806 standard is used worldwide. So the main purpose of this chapter is to find an answer to that question. The conclusion reached is that most countries that have test laboratories are using testing methods based on either the ISO or EN standard, and since these are merging into one, then it seems likely there will indeed be a common worldwide testing method. However there is not a clear answer as to whether any other national standards will be used for testing at the same time. (Belonging to ISO does not mean that there is an obligation to withdraw any other national standards, so it is allowed to have another national testing method for collectors) Therefore it is concluded that an effort could be made in communicating with Standardization bodies worldwide to assure that the new revision will be the only valid method used in each country.

We also wanted to start discovering who could be our partners in a Global Certification Scheme and if it would benefit all operators. Finding out which countries have subsidy programs or have legal requirements for incorporating solar thermal products into buildings is also important since these normally rely on certified products to assure quality and declared values.

This is a summary of what we have discovered:

NORTH AMERICA:

Canada has had some incentive programs that kick started the solar thermal industry in the period 2008 to 2001. It has its own CSA standards and the certification body is the CSA and there are two laboratories in the country. It is not clear if they will use the new revision of ISO 9806.

USA has had many incentive programs since the 1980's, some years with more intensity than others. There are also certain codes that act as legal requirements for solar thermal products in new buildings. A big difference when comparing with Europe where the EN standards are used in all countries for solar thermal products, the US has different levels of types of standards and standardization bodies. The ASHRAE and SRCC standards are the oldest and most used. As a certification body, SRCC is basing their tests on the ISO 9806 standard, so it is expected to adapt completely to the new revision of ISO 9806. IAPMO is another certification body that is developing its own standards but is also expected to test with the new ISO 9806 revision. There are 5 laboratories in the country

CENTRAL AND SOUTH AMERICA*:*

Mexico has a program called PROCASOL with the target of developing a favorable regulatory environment and there are subsides through the Hipoteca Verde program. There is one laboratory called Mexolab used by the certification body ONMCEE. There is no information on the relationship between the NORMEX standards and how similar they are to ISO 9806 standards.

Brazil has the largest market in South America with a certification scheme run by Inmetro that is becoming mandatory between 2012 and 2014. There are two laboratories working in the country. The actual ABNT standards are based on EN standards and they are expected to therefore assimilate the future revision of ISO 9806.

Barbados is a small country, an island in the Caribbean, but it has an interesting story regarding solar water heating. It places 5th in the world when measuring installed capacity per inhabitant and has reduced its external energy dependence drastically by encouraging the use of solar thermal products.

Chile has a subsidy program managed by an organism called SEC (Superintendencia de Electricidad y Combustible). There is a registered list for certified solar thermal products that are eligible for subsidies and also a procedure for accepting certification bodies and laboratories. There is one laboratory and a certification body called ICOMCER in the country. Their INN standards are based on EN standards so it is expected for them to use the new revision of ISO 9806.

ASIA*:*

China has the biggest market worldwide and a strong growth rate. There is a state law of Renewable energy since 2006. There are 5 certification bodies and 8 laboratories. There are many national GB standards but there is no information as to their similarities with ISO 9806 or the use of its future revision.

India has a certification body for solar thermal products, which is the same as its standardization body (Bureau of Indian Standards, BIS). There are 8 laboratories for testing solar thermal products, although there is no information as to whether they will be using the future revision of ISO 9806 for testing. There are subsidies for collectors and systems and many projects and initiatives to promote renewable energy.

Japan has no certification bodies or laboratories, but there are plans to build a first laboratory in 2015 through funding by the METI (Ministry of Economy, Trade and Industry). There are some local government subsidies. The JISC (Japanese Industrial Standards Committee) has issued some standards but there is no information as to their similarities with ISO 9806.

South Korea counts with government subsidies and legal requirements for new buildings to use solar thermal products. Subsidies are based on certified products. KEMCO issues the standards and there are two laboratories working but there is no information on the test similarities of their test methods.

NORTHERN AFRICA AND THE MIDDLE EAST:

At the end of 2012 a new international certification scheme called SHAMCI for the Arab countries in Northern Africa and the Middle East was created. It is very similar to the Solar Keymark Scheme and it is expected that the testing methods will be those of the future revision of ISO 9806. Palestine, Jordan and Syria have the largest installed capacity in this region of the world.

AUSTRALIA:

Australia has a subsidy scheme called the Small-scale Renewable Energy Scheme. It creates a financial incentive for owners to install eligible small-scale installations such as solar water heaters, heat pumps, solar panel systems, small-scale wind systems, or small-scale hydro systems. It does this by legislating demand for Small-scale Technology Certificates (STCs). STCs are created for these installations according to the amount of electricity they produce or displace. There are AS/NZS national standards and also Keymark certificates are accepted as long as they have other national requirements. The new revision of 9806 is expected to be used but there is yet no information on whether other requirements will be asked for in the subsidy scheme.

EUROPE:

There are many subsidy schemes and legal requirements for use of solar thermal products in new buildings across different countries in Europe. The Solar Keymark has been successful in being accepted as testing method for subsidies throughout Europe with some extra minor requirements in some countries. All European members of CEN have the obligation of withdrawing any standards that fall under the same scope as EN standards, therefore all laboratories use the same testing methods. EN 12975-2 describes the testing method for collectors and it will be withdrawn and turned into EN ISO 9806 in its future revision. There are 11 empowered certification bodies in Europe that grant the Solar Keymark and also their own private marks. There are 21 laboratories in Europe.

Chapter 4 is of special importance since the conclusions found will guide us in pinpointing where to we should concentrate our efforts. For any reader in this industrial sector it is also of interest of course.

Based on Solar Heat World Wide 2010 (published in May 2012) and other sources the conclusion is, that the most promising markets for <u>glazed solar collectors outside Europe</u> are:

- China
- Turkey
- Brazil
- India
- South Africa
- (Mexico)
- (Mena Region – low market but strong growth)

The most promising markets for un-glazed collectors outside Europe are:

- US
- Australia
- Brazil
- South Africa

New promising markets for solar collectors glazed in Europe are:

- Poland
- Denmark (large systems)

Besides all the research and investigation which is important, we also wanted part of the project to show some practical work. So **the purpose of chapter 5 is to offer a practical approach by comparing the US SRCC and the European Solar Keymark Certification schemes.** Emphasis has been made on the certification of collectors, since it is the first product to expect a common ISO EN testing standard.

The comparison has been structured in the following way:

- **Similar terms.** Sometimes we found ourselves in meetings and after a while we realized it was necessary to rewind and go back to explaining what we understood by the term we were using. The cultural gap and the fact that English is a second language sometimes slows down progress. It is also quite didactic to study the different infrastructure of stakeholders like standardization bodies or accreditation bodies. Terms analyzed are: standards, accreditation, collector with and without storage, system, manufacturer, private label, OEM, similar model, families and types and subtypes
- **Certification rules.** Both systems rely on documents and concepts like granting the certificate, follow up, inspection visit, certificate, data base, mark ownership, license holder
- **Requirements on products and operators**. Both systems have requirements on the products, on certification bodies, laboratories and inspection bodies based on accreditation standards.
- **Legislation and subsidies**. They exist on both US and Europe but are different.

After comparing the certification system of SRCC in the US, and the Solar Keymark certification system used by European Certification bodies, the conclusions are:

- The biggest difference and obstacle towards harmonization is a different testing method and this will be resolved with the new revision of ISO 9806.
- The certification schemes are similar:
- Initial visit and tests in external laboratories for granting the certificate
- Yearly inspection visits and product testing within the factory while the certificate is valid
- Certificates are similar but differ in some technical data and the way they are stored in web page.
- Harmonization of both certification schemes seems a possibility in the future; however a more and deeper comparison will be needed.

- Certification bodies in Europe have reached the conclusion that they all do the same things but with different styles. After working with the US the feeling was similar. As meetings are held and colleagues share working methods a mutual and solid confidence is created. The key to success in the future seems to be simply working together with an open mind.

Conclusions

The European EN 12975-2 that defines the testing methods for solar collectors will be withdrawn and merged into the new revision of the standard ISO 9806 by the end of 2013 or in 2014 at the latest. Having a common world wide testing method, makes it seem like **the time is right** for the successful European Solar Keymark to lead the creation of a Global Certification for solar thermal products.

The research of this project has not proven this hypothesis to be wrong. Many certification schemes around the world are based on either the EN or ISO standard, so when they merge there will indeed be a unique testing method. However for ISO member standardization bodies there is no obligation to withdraw any other national standards that share the same scope as ISO standards. What this means that it is perfectly legal to have another national testing method for collectors besides ISO 9806. Therefore it is concluded that an effort could be made in communicating with Standardization bodies worldwide to assure that the new revision will be the only valid method used in each country.

The Solar Keymark has a sound infrastructure that has proven successful. However the research based on already existing global schemes has pinpointed very clearly **what needs to be improved or created for a global Mark**:

- A lot of work towards harmonization of the operators (certification bodies, laboratories and inspection bodies) must be done.
- There must also be a new infrastructure or framework for more operators to participate in an efficient manner.
- The 'think Global, Act Local' philosophy of Global G.A.P. seems very inspirational.
- The ownership of the Mark and the governance of its bodies must be worked out as the next steps.

The performance parameters of collectors are hard to evaluate by consumers (Whether administration, construction company or the final consumer). Certification by an independent third party of these performance parameters gives confidence to the consumer that there is really an adequate level of quality and helps the industry by setting fair playing rules for manufacturers. The research has shown that in many countries there are subsidy programs or legal requirements that set these rules through certification. Therefore certification in the solar thermal industry is common throughout the world. It seems very obvious that common testing methods and harmonized certification requirements will have a positive effect on industry and consumer.

However when we have discussed openly the question: **Who is interested in a Global Mark?** The answer is not so obvious. A very interesting point was set by the General Secretariat of ESTIF at the last SKN meeting when he declared that there is not really a true Global Market for solar collectors. There may be one or two global players yes, but markets are mostly locally driven. Let's not forget that the success of the Keymark was based on the need of a true European Market for tests being accepted and not repeated in every country.

It is clear for all that any steps in harmonizing testing and certification activities in a growing market should help improve the growth of industry. The situation in every country regarding subsidies, legal requirements or even the conditions of the market may vary significantly. Globalization may sometimes harm some companies/markets and help others. Whereas many companies are for harmonizing testing methods in order for everyone to 'speak' in the same technical language, it is not clear that all companies will want only one global Mark. There must be therefore a way for national quality marks or national legal requirements to live in harmony with one unique international quality mark. There is an important market growth in many parts of the world that seem to assure success for a global mark, as many companies grow and reach markets across frontiers. Having a real global market seems a real possibility in the near future. It is however in everyone's main interest that there is a **harmonization** in testing and certification procedures, and this **must be achieved in a way that does not harm the status quo**. A first step may be to create a global Mark, which can be called an "**Umbrella mark"**. In order to grant this mark, there must be a minimum of harmonized requirements to be fulfilled.

By harmonizing the test methods and certification procedures, manufacturers could reduce costs by several thousands of dollars and be assured that, once completed, the same test results used for the global certification mark would be honored by local certification organizations for their own marks.

With this idea we have set a calendar for a one year work plan that is meant to finish in March 2014 with the creation of a global network of operators with the goal of harmonizing testing and certification activities and that will recognize each other's work under an "Umbrella Mark".

Summary

1. INRODUCTION

The Keymark is a Quality Mark owned by CEN (European Committee for Standardization) and CENELEC (European Committee for Electrotechnical Standardization). The Keymark is based on an ISO 5 System for certification, which means that audits and tests are run for granting the certificate and are also repeated every year while the certificate is valid.

The Solar Keymark for solar collectors according to EN 12975 and systems according to EN 12976 has been a success story in Europe. It was born in 2003 in order to help companies throughout Europe get their tests and inspections recognized easily by administration and subsidy bodies without repeating the works in each country and therefore facilitating exports within the EU. ESTIF (European Solar Thermal Industry Federation) holds the Secretariat of a group called the Solar Keymark Network that has the duty of continuously updating the scheme rules, harmonizing the activities of all operators and in general resolving any problems related to the certification and testing of solar thermal products. The SKN meets twice a year and is formed by representatives of Industry, Laboratories, Certification Bodies of Europe and also invites observers from around the world.

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The project consisted in preparing this document in a period of approximately one year. The objective was to make a rational study of all the elements involved in the decision process and conclude on the steps needed to be taken towards globalization. This document is a result of all the research activities of the co-writers and all the meetings held within the working group. Once the document is finished, members of the Solar Keymark Network will be on a more equal level of knowledge as to which the best decision to make is and what the best steps to follow are. The document has been written thinking also about other professionals outside Europe that may be interested in the possibilities of Global Certification for their business.

The SKN Working Group for Global Certification is composed by: François Xavier Ball, Harald Drück, Jan Erik Nielsen, Mark Witt, Ralf Koebbermann-Rangers, Sören Scholz, Stefan Mehnert, Stephan Fischer, Jaime Fernández (Chair), Jim Huggins, Hoang Liaw, Les Nelson, Sussane Hansson, Vinod Kumar, Tomas Koenig, Eileen Prado. The co-writers are Jaime Fernández, Stephan Fischer, Jim Huggins and Jan Erik Nielsen.

2. DESCRIPTION OF INTERNATIONAL CERTIFICATION SCHEMES ON DIFFERENT PRODUCTS

In this chapter we describe two global certification schemes with the purpose of learning from their experience and finding inspiration for solving problems we may find along the road. In both cases they have started as European schemes and turned global. We were especially interested in their infrastructure from a technical and legal point of view, and also the efforts done to assure harmonization of the different operators.

2.1. SUMMARY AND CONCLUSIONS ON CHAPTER 2

The first clause *(*2.2*)* refers to the agricultural sector and to a certification scheme called Global G.A.P .The next 4 clauses *(*2.3 to 2.5*)* refer to the sector of low voltage electric products. Here we explain first the European mutual recognition agreements that started in the 1970s and turned global in the 2000s. Therefore it is interesting to read in order, although the global scheme *(*IECEE*)* is not explained until the last clause *(*2.5*).*

The most interesting conclusions drawn from studying the Global G.A.P and the IECEE international certification schemes are*:*

- There is a strong interest in harmonization among the certification bodies and laboratories. Both international schemes ask for accreditation of the certification bodies and laboratories, but both consider that this is not enough. There are extra activities like peer auditing or direct auditing from the owner of the scheme. In the case of Global G.A.P there are also working groups set up with accreditation bodies to assure harmonization in accreditation activities.
- In both cases there is a well-defined and full time infrastructure of working groups for continuous development and improvement of documents.
- In both cases there is a Secretariat working full time for the global scheme.
- In the case of Global G.A.P, the Secretariat is a private company that goes one step further than certification activities and also provides the sector with tools for improvement like e-learning.
- Global G.A.P uses a 'Think Global, act local' philosophy with national working groups that work to prepare guidelines for the implementation of rules.
- There are different methods for ownership of the Mark, but the Mark is always registered and resources are dedicated to protecting from its misuse.

2.2. DESCRIPTION OF GLOBAL G.AP

2.2.1. Description of products certified and brief description of the market of Global G.A.P

Global G.A.P. stands for good agricultural practice. It is actually food producers that are certified, falling into the categories of crops, aquaculture, and livestock.

At this moment there are over 112.600 producers certified in over 100 countries.

2.2.2. General Structure of certification scheme of Global G.A.P

2.2.2.1. Ownership of Mark, infrastructure of group and parties involved in Global G.A.P

There is a private nonprofit company called FoodPLUS GmbH, based in Cologne, Germany that acts as a single management platform for GLOBAL G.A.P. The financial and legal ownership and responsibility for FoodPLUS GmbH are held by the EHI Retail Institute via its 100% subsidiary EHI-Verwaltungsgesellschaft mbH.

The brand itself, the standards, and all the procedures are privately owned by Global G.A.P. This is a big difference with respect to other certification schemes that use EN or ISO standards, which are owned by CEN or ISO.

A quick look at its history helps explain its actual infrastructure and working methods. Back in 1997 Global G.A.P was born in Europe under the name of EUREP G.A.P. This was a result of retailers across Europe harmonizing their standards and procedures and developing an independent certification system for Good Agricultural Practice (G.A.P.). The EUREP GAP standards helped producers comply with Europe-wide accepted criteria for food safety, sustainable production methods, worker and animal welfare, and responsible use of water, compound feed, and plant propagation materials. Harmonized certification also meant savings for producers, as they would no longer need to undergo several audits against different criteria every year. Retailers and producers throughout the world joined in and in 2007 the name was changed to Global G.A.P.

There exists a Global G.A.P. membership which is divided into three categories: Producers & Suppliers, Retailers & Food Service, and Associates. The main reason for membership is to help create a network that harmonizes good agricultural practice throughout the world. Besides other benefits, membership allows working in a number of committees. The rules are all documented and may be downloaded from the website.

The Global G.A.P. Board is made up of an equal number of elected producer and retailer representatives. It will rely on the Secretariat that is based in Cologne for implementing all policies and procedures. In order to do this, the Secretariat has a staff of around 50 people. Their job is to give support to a large number of different committees.

There are three technical committees composed of members (crops, aquaculture, and livestock) that will take care of developing and keeping standards and procedures up to date. There are also stakeholder committees that will develop very specific issues and resend documents to the technical committees for approval. There are also national working groups that will concentrate on the development of national guidelines to implement the standards. This is a result of “think Global-act local” commitment.

There are also a committee of certification bodies and an Integrity Surveillance committee that receive support of this Secretariat for their meetings. See annex 3 for a diagram of infrastructure.

A lot of effort is also put into the database by the Secretariat. The moment a certificate is granted it goes on the database immediately, the idea is that if you are not there, you are not certified. Since 2005, this database is checked daily by traders and retailers worldwide.

The Secretariat has also prepared many training programs. Many e-learning tutorials help all parties improve their knowledge in many fields.

The different groups will meet on a monthly or yearly basis, and usually there is a summit every two years. The last one was held in Madrid in November 2012.

2.2.2.2. Requirements of Global G.A.P on*:*

2.2.2.2.1. Certification bodies and the integrity program in Global G.A.P

At this moment there are over 140 certification bodies that are recognized to work with Global G.A.P. They must be accredited and sign a Memorandum of Understanding with GLOBAL G.A.P, which will oblige them to comply with the Certification Integrity Program *(*CIPRO*)*. This will include certain audits that are explained bellow on point 2.5.2.3

2.2.2.2.2. Laboratories of Global G.A.P

Laboratories are required to be accredited but they do not play a direct role in certification commonly seen in other certification schemes. In the Global G.A.P. scheme, the producers send samples directly to the laboratories but the laboratories do not do the certifications. The laboratories forward test results to the certification bodies.

2.2.2.2.3. Inspection bodies of Global G.A.P

The certification bodies set the requirements for inspections. At this moment there are over 1400 recognized inspectors that follow the main requirements set by the certification bodies..

2.2.2.3. Certification body auditing and the Integrity Program of Global G.A.P

There is no peer auditing like there is in other international certification schemes, but all certification bodies receive audits following the CIPRO. The certification bodies are audited by members of the Secretariat. There are two different parts to this audit. One is an audit at the office of the certification body where the procedures for granting and maintaining the certificates are checked. The second involves an additional inspection at a producer that has already been inspected by the certification body. Both inspections are compared.

Since the certification bodies are also audited by the accreditation bodies, the idea is for these to be complementary activities. In order to assure this, the Secretariat holds meetings with the accreditation bodies to compare audits and any issues that help harmonization. Last year's meeting was attended by 27 different accreditation bodies.

There is a warning system for certification bodies, consisting of two levels a yellow card and red card, before the cancellation of the contract. Certification bodies with inadequate behavior will be forwarded to the ICS (Integrity Surveillance Committee).

2.2.3. Legislation and subsidies of Global G.A.P

There are no subsidies and legislation varies from country to country.

2.2.4. Success and market implementation of Global G.A.P Mark

So far, it has been a very successful scheme. It is basically a business to business brand that is not well known by the general public. Taking a quick look at numbers throughout the years:

- 2004: 18.000 producers → 2011: 112.600 producers
- 142 certification bodies in 112 countries
- 1.400 inspectors

2.3. <u>CENELEC CERTIFICATION AGREEMENT (CCA)</u>

The next 4 clauses refer to the same sector of low voltage products. Since they are all linked, we start with the European agreements that began in the 1970s and end with the global agreement that was developed in the 2000s.

2.3.1. Description of products certified and brief description of market of CCA

This mutual recognition agreement, the CCA from now on, applies to low voltage products (excluding cables) under EN standards. The main categories of products are: luminaires, IT equipment, electronic appliances, household appliances, and installation materials. At first it only applied to products manufactured in Europe, but now it is open to any production plants in the world. More information can be found on annex A.

2.3.2. General Structure of Agreement of CCA

2.3.2.1. Members of Agreement, infrastructure of group and parties involved in CCA

The CCA is signed by 25 European Certification Bodies representing 22 countries. By this agreement, there is a compulsory recognition of initial tests and voluntary recognition of inspection agreements.

The CCA works in the following way: A Certification Body will grant a Product Certificate to a Manufacturing Plant. This means an initial inspection and testing has taken place and that there will be follow up inspections and tests every year from there on. This Product Certificate will allow the company to use a Quality Mark on its products. Then the Certification Body will issue a Notification of Test Result (NTR). This NTR is the document that must be accepted by the signers of the CCA for their own Product Certification systems or Quality Marks.

Every NTR has a common format. There is also a common format for inspection reports. It is only compulsory to recognize the NTR, but in practice the certification bodies will have bilateral agreements to accept each other's inspections on common clients, using always a harmonized format.

The CCA members and laboratories have an organized infrastructure to deal with all internal procedures and assure harmonization. The meetings take place once a year in a three day period together with the ENEC and HAR meetings. There is a Committee called ECS that has many working groups called OSM (Operational Staff Meetings). See diagram in annex 2.

2.3.2.2. Requirements of CCA on :

2.3.2.2.1. Certification bodies of CCA

Only European certification bodies sign the CCA. They must be accredited under EN 45011 by an accreditation body signer of the MLA agreement and will also receive peer audits.

2.3.2.2.2. Laboratories of CCA

Laboratories worldwide may be used but under the following rule: each laboratory must work with only one certification body. It is a requirement to be accredited under EN 17025 by an accreditation body signer of the MLA agreement and also to receive peer audits.

2.3.2.2.3. Inspection bodies of CCA

Most inspection bodies will be part of a certification body, and therefore will fall under their accreditation scope.

2.3.2.3. Peer auditing or expert groups of CCA

There is a system for peer auditing that affects the CCA. It is described in point 2.4.2.3 but it is advisable to read first the rest of agreements and schemes regarding electrical products since they are all interrelated.

2.3.3. Legislation and Subsidies of CCA

There are no subsidies involved in these products. They are affected by the Low Voltage Directive (LVD) and the Electromagnetic Compatibility Directive (EMCD). These require only self-declaration by the manufacturers, so they are not affected by testing under the CCA.

2.3.4. Success and market implementation of CCA Mark

Having existed since 1973, the CCA is the oldest agreement for electrical products in Europe. Therefore it can be considered a success. However if we look at the following table of NTRs issued in the last years we can see a decreasing trend. The reason is that in the recent years this agreement seems to be losing importance to the more international agreement explained in section 2.4.

Year	1996	2001	2006	2011
NTRs issued	5723	3594	2101	824

2.4. ENEC

2.4.1. Description of products certified and brief description of market of ENEC

In general, the products affected are the same as those under the CCA (low voltage products except for cables). More information can be found in annex A.

2.4.2. General Structure of Certification Scheme of ENEC

2.4.2.1. Ownership of Mark, infrastructure of group and parties involved in ENEC

ENEC is a European Quality Mark, so it is meant to go a step further than the CCA. In practice, the certification bodies will actually grant both the ENEC Mark and their own Quality Mark at the same time. There is an agreement signed by European Certification bodies to comply with ENEC rules.

In every country, there is one certification body that is the owner of the ENEC Mark in that country. The owner is responsible for protecting the proper use of the mark in its country, and therefore also for granting the certificates. In case more than one certification body operates in a single country, an agreement must be reached and there is a specific committee dedicated to resolving conflicts if agreements are not reached.

The rules will be slightly different depending on the product categories, but there are common inspection reports and tests. The certification system will consist of initial inspection and testing, followed by annual inspections and tests.

The ENEC members and laboratories have an organized infrastructure to deal with all internal procedures and assure harmonization. The meetings take place in a three day period together with the ENEC and HAR meetings. See diagram in annex 2.

2.4.2.2. Requirements of ENEC on :

2.4.2.2.1. Certification bodies, laboratories and Inspection bodies of ENEC

Same as CCA.

2.4.2.3. Peer auditing or expert groups of ENEC

Same as CCA, it is explained in 2.4.2.3 after the entire electrical sector is explained.

2.4.3. Legislation and Subsidies of ENEC

Same as CCA.

2.4.4. Success and market implementation of ENEC Mark

It can be considered successful, enjoying a slow but steady growth.

Year	2006	2011
Number of certificates	13.757	16.539

2.5. HAR

2.5.1. Description of products certified and brief description of market of HAR

The products affected are low voltage cables, up to 750 V. It is a rather steady market, with no great changes in recent years. More information can be found in annex A.

2.5.2. General Structure of Certification Scheme of HAR

2.5.2.1. Ownership of Mark, infrastructure of group and parties involved in HAR

There is an agreement signed between 18 European certification bodies representing 18 countries.

The certification system requires initial inspection and testing, being ISO 9001 certification compulsory. During follow up, there are 4 inspections a year and tests are done on a large number of samples (50 to 150 samples per year).

In every country there is an owner of the Mark, and in every country the Mark has two names. The first name is that of the certification body, and the second name is HAR. For example in Germany it is VDE HAR and in Spain it is AENOR HAR. The owner in every country is responsible for protecting the mark, and globally the group has commissioned VDE to act as international protector of all Marks.

A very important issue is the principle of reciprocity. It is written clearly in every certificate that all HAR Marks are recognized by all certification bodies involved. This means that all certification bodies must accept, protect, and defend any HAR certificate that is granted.

In some specific cases, there may be bilateral agreements between certification bodies that may share clients selling different products in both countries.

The HAR members and laboratories have an organized infrastructure to deal with all internal procedures and assure harmonization. The meetings take place in a three day period together with the ENEC and CCA meetings. There is a HAR Committee called HAR AC that will itself be divided into working groups called OSM. See diagram in Annex 2.

2.5.2.2. Requirements of HAR on :

2.5.2.2.1. Certification bodies of HAR

All certification bodies and manufacturers are European. There are many specific procedures that all certification bodies must follow. Certification bodies must be accredited under EN 45011 by an accreditation body signer of the MLA and follow peer audits.

2.5.2.2.2. Laboratories of HAR

Laboratories must be accredited to ISO 17025 by an accreditation body signer of the MLA and follow peer auditing.

2.5.2.2.3. Inspection Bodies of HAR

They normally fall under the scope of certification bodies.

2.5.2.3. Peer auditing or expert groups of HAR

Same as CCA, it is explained in 2.4.2.3 after the entire electrical sector is explained

2.5.3. Legislation and Subsidies of HAR

There are no subsidies involved in these products. They are affected by the Low Voltage Directive (LVD) and the Electromagnetic Compatibility Directive (EMCD). These require only self-declaration by the manufacturers, so they are not affected by testing under the CCA. In the future these products may be affected by the Construction Products Regulation (CPR)

2.5.4. Success and market implementation of HAR Mark

The Mark exists since the early 1970s and is very well known in a market that is very stable. Most of the manufacturers are certified.

Year	**2001**	**2011**
Valid Licenses	1305	1385
Number of firms	218	198

2.6. <u>IECCEE</u>

2.6.1. Description of products certified and brief description of market of IECEE

This can be considered the European CCA agreement going global. This agreement affects low voltage products worldwide that fall under the scope of IEC standards. Therefore the IECEE uses international standards (IEC) versus the European standards (EN) used in CCA. These international standards tend to be very similar to European standards. More information can be found in Annex A.

2.6.2. General Structure of Agreement and how it used by the rest

2.6.2.1. Ownership of Mark, infrastructure of group and parties involved in IECEE

The signers of the IECCEE will accept and recognize each other's CB certificates. These are certificates granted after an initial inspection and test. It is actually possible to recognize a CB, a CB + NTR or even a CB+ NTR+Product Certificate.

IEC manages the internal meetings between all parties for all agreements and marks. There is an annual 2 day meeting of the Certification Management Meeting (CMC). Members of this group are one member per country plus the certification body. CMC will propose any new documents to the Conformity Assessment Board of IEC, which acts as the highest level for all different certification systems in IEC.

The CMC will have a Committee of Testing Laboratories (CTL) that organizes a program for testing among laboratories. There will also be different task forces by product categories called ETFs. See diagram in annex 2.

2.6.2.2. Requirements of IECEE on :

2.6.2.2.1. Certification bodies of IECEE

Certification bodies must be accredited to EN 45011 by an accreditation body signer of the MLA and follow peer audits.

2.6.2.2.2. Laboratories of IECEE

Laboratories must be accredited to ISO 17025 by an accreditation body signer of the MLA and they are obliged to work with only one certification body in each product category in which they test. Laboratories will also follow peer audits.

2.6.2.2.3. Inspection bodies of IECEE

Inspection bodies will usually fall in the direct scope of the certification body's accreditation.

2.6.2.3. Peer auditing or expert groups of IECEE

IEC, in coordination with EEPCA, is responsible for managing peer assessment for all agreements, so this will affect the CCA, ENEC Mark and HAR Mark that have been explained up to now. This will affect certification bodies, inspection bodies and laboratories.

An initial audit will take place with 2 or 3 auditors. Normally, there is a mix of one European plus another non-European in the auditor's team. The follow up audit takes place every three years when the body is accredited, and if not accredited it will take place every year. (Non-accreditation may be allowed under certain conditions.)

It is compulsory for all signers of the agreement to have at least one auditor for each of the product categories in which they work.

There are specific training sessions for the auditors (they are referred to as assessors) and these are located around the world. There is one in Europe, one in Asia and one in America. After the training sessions, the assessors must pass an exam. According to their experience and knowledge, there will be lead assessors and technical assessors.

The audits take place throughout the year and there is a peer assessment group that evaluates the results of the audits and manages the corrective actions. The result of these audits is open for anyone in the agreement to see.

There is an annual fee to be paid per agreement by the certification bodies, and afterwards every three years. When the audits are passed, there will be a fee for the peer assessment that will include the cost of the audit.

2.6.3. Legislation and Subsidies of IECEE

There is really no global or common legislation, and it will be different worldwide. Recently many developing countries will rely on CBTR to prove their own legislation requirements. *(*In these cases, the certificates may be issued by a local certification body that accepts a CBTR.*)*

2.6.4. Success and market implementation of IECEE Mark

This agreement is quite successful and may be overtaking the CCA agreement.

Year	2006	2011
CBs Issued	50.241	69.180

3. STUDY OF WORLD MARKETS REGARDING NATIONAL CERTIFICATION SCHEMES FOR SOLAR THERMAL PRODUCTS

This chapter has proven the most difficult one of the project and it has shown us the important task that lies ahead. There is a lot of information published on the internet, but the interpretation of what is published and the reality of each situation needs direct and personal contact. We tried our best to gather information but found it difficult to hold personal interviews with colleagues we have never met. Therefore before considering the information on this chapter the bibliography should be checked to see where the information comes from. Reading this chapter may also seem very didactic since in some cases there is interesting information as to how standardization bodies work in different countries.

3.1 SUMMARY AND CONCLUSIONS OF WORLD MARKETS REGARDING CERTIFICATION SCHEMES

This chapter offers a first glance at certification systems across the world and what standards they are using for testing. It is a necessary condition for global certification to be successful that the future revision of ISO 9806 standard is used worldwide. So the main purpose of this chapter is to find an answer to that question. The conclusion reached is that most countries that have test laboratories are using testing methods based on either the ISO or EN standard, and since these are merging into one, then it seems likely there will indeed be a common worldwide testing method. However there is not a clear answer as to whether any other national standards will be used for testing at the same time. *(*Belonging to ISO does not mean that there is an obligation to withdraw any other national standards, so it is allowed to have another national testing method for collectors*)* Therefore it is concluded that an effort could be made in communicating with Standardization bodies worldwide to assure that the new revision will be the only valid method used in each country.

We also wanted to start discovering who could be our partners in a Global Certification Scheme and if it would benefit all operators. Finding out which countries have subsidy programs or have legal requirements for incorporating solar thermal products into buildings is also important since these normally rely on certified products to assure quality and declared values.

So gathering information to the best of our abilities, this is a summary of what we have discovered*:*

North America*:*

Canada has had some incentive programs that kick started the solar thermal industry in the period 2008 to 2001. It has its own CSA standards and the certification body is the CSA and there are two laboratories in the country. It is not clear if they will use the new revision of ISO 9806.

USA has had many incentive programs since the 1980's, some years with more intensity than others. There are also certain codes that act as legal requirements for solar thermal products in new buildings. A big difference when comparing with Europe where the EN standards are used in all countries for solar thermal products, the US has different levels of types of standards and standardization bodies. The ASHRAE and SRCC standards are the oldest and most used. As a certification body, SRCC is basing their tests on the ISO 9806 standard, so it is expected to adapt completely to the new revision of ISO 9806. IAPMO is another certification body that is developing its own standards but is also expected to test with the new ISO 9806 revision. There are 5 laboratories in the country

Central and South America:

Mexico has a program called PROCASOL with the target of developing a favorable regulatory environment and there are subsides through the Hipoteca Verde program. There is one laboratory called Mexolab used by the certification body ONMCEE. There is no information on the relationship between the NORMEX standards and how similar they are to ISO 9806 standards.

Brazil has the largest market in South America with a certification scheme run by Inmetro that is becoming mandatory between 2012 and 2014. There are two laboratories working in the country. The actual ABNT standards are based on EN standards and they are expected to therefore assimilate the future revision of ISO 9806.

Barbados is a small country, an island in the Caribbean, but it has an interesting story regarding solar water heating. It places 5th in the world when measuring installed capacity per inhabitant and has reduced its external energy dependence drastically by encouraging the use of solar thermal products.

Chile has a subsidy program managed by an organism called SEC (Superintendencia de Electricidad y Combustible). There is a registered list for certified solar thermal products that are eligible for subsidies and also a procedure for accepting certification bodies and laboratories. There is one laboratory and a certification body called ICOMCER in the country. Their INN standards are based on EN standards so it is expected for them to use the new revision of ISO 9806.

Asia:

China has the biggest market worldwide and a strong growth rate. There is a state law of Renewable energy since 2006. There are 5 certification bodies and 8 laboratories. There are many national GB standards but there is no information as to their similarities with ISO 9806 or the use of its future revision.

India has a certification body for solar thermal products, which is the same as its standardization body (Bureau of Indian Standards, BIS). There are 8 laboratories for testing solar thermal products, although there is no information as to whether they will be using the future revision of ISO 9806 for testing. There are subsidies for collectors and systems and many projects and initiatives to promote renewable energy.

Japan has no certification bodies or laboratories, but there are plans to build a first laboratory in 2015 through funding by the METI (Ministry of Economy, Trade and Industry). There are some local government subsidies. The JISC (Japanese Industrial Standards Committee) has issued some standards but there is no information as to their similarities with ISO 9806.

South Korea counts with government subsidies and legal requirements for new buildings to use solar thermal products. Subsidies are based on certified products. KEMCO issues the standards and there are two laboratories working but there is no information on the test similarities of their test methods.

Northern Africa and the middle East:

At the end of 2012 a new international certification scheme called SHAMCI for the Arab countries in Northern Africa and the Middle East was created. It is very similar to the Solar Keymark Scheme and it is expected that the testing methods will be those of the future revision of ISO 9806. Palestine, Jordan and Syria have the largest installed capacity in this region of the world.

Australia:

Australia has a subsidy scheme called the Small-scale Renewable Energy Scheme. It creates a financial incentive for owners to install eligible small-scale installations such as solar water heaters, heat pumps, solar panel systems, small-scale wind systems, or small-scale hydro systems. It does this by legislating demand for Small-scale Technology Certificates (STCs). STCs are created for these installations according to the amount of electricity they produce or displace. There are AS/NZS national standards and also Keymark certificates are accepted as long as they have other national requirements. The new revision of 9806 is expected to be used but there is yet no information on whether other requirements will be asked for in the subsidy scheme.

Europe:

There are many subsidy schemes and legal requirements for use of solar thermal products in new buildings across different countries in Europe. The Solar Keymark has been successful in being accepted as testing method for subsidies throughout Europe with some extra minor requirements in some countries. All European members of CEN have the obligation of withdrawing any standards that fall under the same scope as EN standards, therefore all laboratories use the same testing methods. EN 12975-2 describes the testing method for collectors and it will be withdrawn and turned into EN ISO 9806 in its future revision. There are 11 empowered certification bodies in Europe that grant the Solar Keymark and also their own private marks. There are 21 laboratories in Europe.

3.2 NORTH AMERICA

3.2.1 United States of America

3.2.1.1 Description of the Market in U.S.A

The solar heating & cooling industry comprises a few distinct markets: solar water heating (SWH), solar space heating (SSH), solar pool heating (SPH) and solar space cooling (SSC). In general, rebates and tax credits are only available for SWH and sometimes SSH projects, but generally not for SPH systems. This makes tracking installations of the latter two technologies quite difficult. SSC is still being developed commercially and does not yet receive targeted deployment incentives.

The SWH market was immensely popular in the early 1980s. Energy prices were high, government incentives were generous, and manufacturers and installers struggled to keep up with demand. When incentives expired in the mid-1980s, the industry consolidated dramatically. The SPH market in the U.S. is largely tied to the housing and pool construction markets. Shipment data suggests that this market hit its peak in 2006 and has declined sharply since due to the weak economy. SSH is still emerging as an energy technology but has begun to carve out a niche.

In 2011, at least 635,760 square feet (sq. ft.) of SWH collectors were installed in the U.S. Residential installations accounted for 72 percent of installed capacity, with a total of 448,930 sq. ft. installed. Nonresidential (commercial, government, non-profit) installations totaled 316,138 sq. ft. These figures are based on rebated systems and known large installations as reported by installers and are not comprehensive for all systems installed in the U.S. The three market leaders in 2011 were Arizona, Hawaii, and California. All three states have ample solar resources and offer incentives for SWH projects. Florida, which is not listed due to a lack of rebate information, would also likely be a market leader with these three states. Collector shipment information suggests an 8 percent year-over-year decline in the Florida market from 2010 to 2011, though the overall installed capacity cannot be discerned.

For residential installations, the square footage of a SWH project is largely determined by a home's hot water usage and geographic location. For example, in Arizona, fewer and/or smaller collectors are required to heat the same amount of water compared to a system in the Northeast U.S. Non-residential installations are affected by the same factors as residential systems, along with an added element: the maximum rebate available. In Delaware, the rebate is only $10,000, so a large non-residential SWH system typically does not make financial sense. In California, however, the maximum incentive is $500,000, which lends itself to the development of larger projects.

Comprehensive manufacturing data is difficult to compile or even estimate for the domestic SWH industry. Unlike in the PV industry, where manufacturers freely share production figures in an effort to display the strength of their company and the industry as a whole, most SHC companies are typically hesitant to share any information whatsoever.

Without a doubt, the U.S. SWH market grew in 2011 compared to 2010. An overall figure is difficult to tabulate, but the data points that are available, in conjunction with installer and manufacturer surveys, suggest a growth rate of about 5 percent. With the advent of third-party financing in the non-residential SWH space, this particular market shows the most promise in the near term, especially in states where systems can generate Solar Renewable Energy Credits. However, the traditional cash-sale SWH market, particularly on the residential side, is severely hampered by the low price of natural gas. Without generous state or utility rebates, the slow payback on residential systems with natural gas backup makes for a challenging value proposition. Residential SWH adoption increased from 2004 to 2008, when there was a spike in natural gas prices. However, the market dwindled in 2009 when natural gas prices plummeted. Should natural gas prices remain low, the value proposition for small-scale SWH is greatly diminished. In markets with electric or oil-fired hot water heaters, demand can be expected to rise incrementally.

3.2.1.2 Legislation and Subsidies in U.S.A.

Similar to solar photovoltaics (PV), SWH demand is largely stimulated by the availability of incentives. Rebates for SWH systems are available in 30 states. Rebates are offered by a variety of entities, including utilities, cities and counties, and via statewide initiatives. These rebates are in addition to the 30-percent Federal Investment Tax Credit (ITC). Additionally, 14 states allow solar water heating to help meet renewable portfolio standards (RPS), and SHC can even generate tradable solar renewable energy credits (SRECs) in a select few markets. (SEIA/GTM Research, 2012)

Detailed information on incentives is available from the Database of State Incentives for Renewables & Efficiency (DSIRE) website: http://www.dsireusa.org/

Codes

Codes are different from Standards in that they give legal requirements for the construction/installation of products. Codes often reference or require testing in accordance with specified standards. The sections of US codes that apply to solar water heating include plumbing, mechanical, residential, and energy conservation. Solar water heating is not usually mentioned specifically, with the one significant exception listed below.

International Code Council (ICC) (www.iccsafe.org)

The International Code Council is a member-focused association dedicated to helping the building safety community and construction industry provide safe, sustainable and affordable construction through the development of codes and standards used in the design, build and compliance process. Most U.S. communities and many global markets choose the International Codes.

The International Codes, or I-Codes, published by ICC, provide minimum safeguards for people at home, at school, and in the workplace. The I-Codes are a complete set of comprehensive, coordinated building safety and fire prevention codes. Building codes benefit public safety and support the industry's need for one set of codes without regional limitations.

Fifty states and the District of Columbia have adopted the I-Codes at the state or jurisdictional level. Federal agencies including the Architect of the Capitol, General Services Administration, National Park Service, Department of State, U.S. Forest Service and the Veterans Administration also enforce the I-Codes. The Department of Defense references the International Building Code for constructing military facilities, including those that house U.S. troops, domestically and abroad. Puerto Rico and the U.S. Virgin Islands enforce one or more of the I-Codes.

The ICC codes that specifically mention solar water heating are the International Residential Code (Chapter 23) and the International Mechanical Code (Chapter 14).

International Association of Plumbing and Mechanical Officials (IAPMO) (http://www.iapmo.org/pages/default.aspx)

The International Association of Plumbing and Mechanical Officials has been protecting the public's health and safety for more than eighty five years by working in concert with government and industry to implement comprehensive plumbing and mechanical systems around the world.

As a membership-based association, IAPMO utilizes an open consensus process in the development of its flagship Uniform Plumbing Code® and Uniform Mechanical Code®. These codes are established through scientific research, debate, and analysis.

The IAPMO code that specifically mentions solar water heating is the Uniform Solar Energy Code.

3.2.1.3 Standardization Bodies and standards in U.S.A

American National Standards Institute (ANSI) (www.ANSI.org)

ANSI is the national standards body for the United States. It oversees the creation, promulgation and use of thousands of norms and guidelines that directly impact businesses in nearly every sector: from acoustical devices to construction equipment, from dairy and livestock production to energy distribution, and many more. ANSI is also actively engaged in accrediting programs that assess conformance to standards. ANSI facilitates the development of American National Standards (ANS) by accrediting the procedures of standards developing organizations (SDOs). These groups work cooperatively to develop voluntary national consensus standards. It is estimated that in the U.S. today there are hundreds of “traditional” standards developing organizations - with the 20 largest SDOs producing 90% of the standards - and hundreds more “non-traditional” standards development bodies, such as consortia. This means that the level of U.S. participation is quite expansive as the groups themselves are comprised of individual committees made up of experts addressing the technical requirements of standards within their specific area of expertise.

The ANSI standards regarding solar water heating are three test methods:
ASHRAE 93 - Methods of Testing to Determine the Thermal Performance of Solar Collectors. This standard was the predecessor to ISO 9806 and EN 12975.
ASHRAE 96 - Methods of Testing to Determine the Thermal Performance of Unglazed Flat-Plate Liquid-Type Solar Collectors
ASHRAE 109 - Methods of Testing to Determine the Thermal Performance of Flat Plate Solar Collectors containing a Boiling Liquid

Solar Rating & Certification Corp (SRCC®) (www.solar-rating.org)

The SRCC depends on the participation of subject matter experts as volunteers to work through a consensus process based on integrity and balance for all interested stakeholders. The SRCC is committed to its standards being implemented as broadly as possible in the marketplace, with the integrity of the created work upheld, so that all interested parties can make the appropriate use of the standards they need.

The SRCC standards regarding solar water heating are:
SRCC Standard 100 "Minimum Standards for Solar Thermal Collectors"
SRCC Standard 300 "Minimum Standards for Solar Water Heating Systems"
SRCC Standard 600 "Minimum Standards for Solar Thermal Concentrating Collectors"
SRCC TM-1 "Solar Domestic Water Heating Component Test and Analysis Protocol"

International Association of Plumbing and Mechanical Officials (IAPMO) (http://www.iapmostandards.org/Pages/default.aspx)
For over 30 years, IAPMO's standards-development, an ANSI approved process, has primarily focused on plumbing product standards. Recently, IAPMO's efforts have broadened to include standards for mechanical products covering heating, ventilation, cooling and refrigeration system products. IAPMO also publishes standards covering products used in the Recreational Vehicle and Manufactured Housing Industry called IAPMO Trailer Standards.

Very recently, IAPMO has begun development of solar water heating standards.

ASTM International (www.astm.org)

ASTM International, formerly known as the American Society for Testing and Materials (ASTM), is a globally recognized leader in the development and delivery of international voluntary consensus standards. Today, some 12,000 ASTM standards are used around the world to improve product quality, enhance safety, facilitate market access and trade, and build consumer confidence.

ASTM's leadership in international standards development is driven by the contributions of its members: more than 30,000 of the world's top technical experts and business professionals representing 150 countries. Working in an open and transparent process and using ASTM's advanced electronic infrastructure, ASTM members deliver the test methods, specifications, guides, and practices that support industries and governments worldwide.

There are at least twenty ASTM standards regarding solar water heating (http://www.astm.org/Standard/committees/E44.html). The most significant are:

E424 - Standard Test Methods for Solar Energy Transmittance and Reflectance (Terrestrial) of Sheet Materials

E905 - Standard Test Method for Determining Thermal Performance of Tracking Concentrating Solar Collectors

Underwriters Laboratories (UL) (www.UL.com)

Established in 1894, UL is a global independent safety science company with expertise innovating safety solutions from the public adoption of electricity to new breakthroughs in sustainability, renewable energy and nanotechnology. Dedicated to promoting safe living and working environments, UL helps safeguard people, products and places. UL certifies, validates tests, inspects, audits, and advises and educates. All electrically operated equipment installed in the US must be listed to a UL Standard.

The two UL standards most applicable to solar water heating are:
UL 174 – Household Electric Storage Tank Water Heaters
UL 1279 – Outline of Investigation for Solar Collectors

3.2.1.4 Certification Bodies and requirements of certification Schemes in U.S.A

Solar Rating & Certification Corp. (SRCC) (www.solar-rating.org)
In 1980, the SRCC was incorporated as a non-profit organization whose primary purpose is to provide authoritative performance ratings, certifications and standards for solar thermal products, with the intention of protecting and providing guidance to consumers, incentive providers, government, and the industry. The corporation is an independent third-party certification entity. It is unique in that it is the only national certification program established solely for solar thermal products. It is also the only national certification organization whose programs are the direct result of the combined efforts of state organizations and an industry association involved in the administration of standards. Equipment that has been certified and rated by the SRCC is required to bear the SRCC certification seal, which shows the performance rating for that product. In addition, each certified product is published by the SRCC in a directory. Each product's directory listing contains information on the product's material and specifications, as well as the certified thermal performance rating. SRCC is accredited by the American National Standards Institute.

Collector Certification (http://www.solar-rating.org/guidelines/index.html)
Collectors must be tested in accordance with ISO 9806. The collector design and test report are reviewed to verify compliance with SRCC Standard 100. This standard covers required test methods and collector design requirements. Collector certifications expire twelve years from the date of the lab report and require bi-annual factory inspections.

System Certification
Systems must use an SRCC certified collector and specify the other components in the system. The system design and the installation / operation manual are reviewed to verify compliance with SRCC Standard 300. This Standard covers design, reliability/durability, safety, operation/servicing, installation, and manuals.System certifications require full review before recertification every five years.

International Association of Plumbing and Mechanical Officials (IAPMO)
(http://www.iapmort.org/Pages/SolarCertification.aspx)
IAPMO R&T is a North American plumbing and mechanical product certification agency. It is accredited by the American National Standards Institute and Standards Council of Canada. IAPMO currently lists solar collectors and systems to the SRCC standards mentioned above as well as to their Uniform Solar Energy Code. (http://pld.iapmo.org/default.asp)

3.2.1.5 Laboratories in U.S.A.

SRCC's certification program operating guidelines, test methods and minimum standards, and rating methodologies require the performance of nationally accepted equipment tests on solar equipment by independent labs which are approved by SRCC. SRCC approved laboratories have ISO 17025 accreditation. Following is a list of laboratories currently participating in the SRCC Test Lab Program:

Atlas Material Testing (http://www.atlas-mts.com)
Solar collector testing is conducted outdoors by the DSET Laboratories division of Atlas. DSET Laboratories is located in Phoenix, Arizona.

TUV Rheinland PTL (http://www.tuvptl.com)
TUV Rheinland PTL conducts solar collector testing outdoors at its facility in Tempe, Arizona.

Intertek Testing Services North America (http://www.intertek.com)
Intertek Testing Services NA conducts solar collector testing outdoors at its facility in Plano, Texas.

Florida Solar Energy Center (FSEC) (http://www.fsec.ucf.edu)
FSEC conducts solar collector testing outdoors at its facility in Cocoa, Florida.

Pacific Energy Testing (http://www.pacificenergytesting.com)
Pacific Energy Testing conducts solar collector testing outdoors at its facility in Menlo Park, California.

Exova Canada (http://www.exova.com)
Exova conducts solar collector testing at its indoor facility in Mississauga, Ontario.

LabTest Certification (http://www.labtestcert.com)
LabTest conducts solar collector testing outdoors at its facility in Richmond, British Columbia.

3.2.2 Canada

3.2.2.1 Study of the market in Canada

During the period 2008 to 2011, the introduction of the Government of Canada ecoENERGY for Renewable Heat programs and a number of complimentary programs at the provincial level, kick-started Canada's Solar Thermal Industry:

- Average market activity grew annually by an estimated 40 – 50% by collector area.
- Market activity for Solar Thermal Air surged from an average of over 30 MW per year between 2000 and 2007 to an estimated 120 MW per year between 2008 and 2011, comprising almost 50% of the market in 2010 and potentially surpassing liquid in 2011.

Market milestones achieved during this period included:

- In 2010, Canada surpassed 1,000,000 m2 of cumulative Solar Thermal systems in operation.
- By the end of 2011, Canada will have surpassed 1 GW (1,000 MW in operation)

3.2.2.2 Legislation and Subsidies in Canada

Federal incentives appear to have expired in March 2012. The following provinces had/have programs for Solar Heating and Cooling:

British Columbia: SolarBC - Under the Public Sector Energy Conservation Agreement (PSECA) the BC Government worked alongside SolarBC to fund solar thermal water and air heating systems in provincial public sector buildings, including 10 university and college buildings and 5 hospitals.

Manitoba: Earth Powered Loans - Borrow up to $7,500 per residence; minimum loan is $500 and no down payment is required. Maximum term is 15 years. Interest rate is 4.9% (for the initial 5-year fixed term).

New Brunswick: - Efficiency NB - Through the Residential Energy Efficiency Program Efficiency NB provides advice on energy efficiency and financial incentives to help offset the costs of energy efficient upgrades. Rebates up to $2,500 per home are available for solar water heating systems certified to CSA standards.

Northwest Territories: - Alternative Energy Technologies Program (AETP) - is designed to promote the use of renewable energy sources in the NWT. The funding is split into three sections:
Community Renewable Energy Fund (CREF);
Medium Renewable Energy Fund (MREF);
Small Renewable Energy Fund (SREF).

The Community Renewable Energy Fund is available to Aboriginal and community governments, GNWT departments, boards and agencies and non-profit organizations. The program assists community-based installations of alternative energy systems, or the conversion of an existing conventional energy system to alternative energy technology. The objective of this fund is to promote projects that advance the knowledge and effectiveness of new clean energy technologies in northern environments. Funding of up to one-half of the project cost is available, to a maximum of $50,000 per year.

The Medium Renewable Energy Fund is available to assist commercial businesses, including off-grid camps and lodges that want to incorporate commercially available alternative energy technologies into their operations. The objective of this fund is to reduce fuel use in remote locations where fuel prices are extremely high due to added transportation costs. Funding of up to one-third of the cost of qualified alternative energy systems is available. The maximum amount that will be provided to any recipient is $15,000 per year.

The Small Renewable Energy Fund is available to assist NWT residents to integrate commercially available, clean energy technologies on their property, building or other assets for the purpose of reducing fuel usage. Funding of up to one-third of the cost of qualified alternative energy systems is available. The maximum amount that will be provided to any recipient is $5,000 per year.

Nova Scotia: Nova Scotia has a commercial and a residential program:

Commercial/Industrial Solar Hot Water & Solar Hot Air Rebate
Conserve Nova Scotia provides a 15% rebate of the installed cost of a solar water heating system for institutional, industrial, or commercial use. The maximum provincial rebate is $20,000. Also, Conserve Nova Scotia provides a 15% rebate of the installed cost of a solar air heating system for institutional, industrial, or commercial use. The maximum provincial rebate is $20,000.

Residential Solar Hot Water Heating Program
Homeowners that take part in this program will have opportunity to receive a 15% rebate up to $20,000. There is also an opportunity to be eligible for Federal solar incentives under this program.

Ontario: Home Energy Savings Program - To help homeowners save energy, save money and help reduce greenhouse gas emissions, the Ontario government has created the Ontario Home Energy Savings Program. More than $2500 in Federal and Provincial incentives is available for the installation of a solar domestic hot water system.

Prince Edward Island: Sales Tax Exemption - There is a Provincial Sales Tax (PST) exemption on small-scale renewable energy equipment. Items which are exempt from provincial sales tax include solar thermal and solar photovoltaic systems.

Saskatchewan: Energy Star Rebate for New Homes - Saskatchewan residents who build or purchase a newly constructed ENERGY STAR qualified or R-2000 home between after April 1, 2007 are now eligible to receive a number of rebates, including a $1,000 rebate for the installation of a solar domestic hot water heating system.

Solar Heating Initiative for Today (SHIFT) - The SHIFT program provides funding for new solar water heating systems to large, non-residential consumers of hot water in Saskatchewan. The program is available for businesses, industries, multiple-unit residential buildings over three stories, public institutions such as hospitals and schools, and municipal and provincial facilities. The SHIFT incentive matches the ecoENERGY for Renewable Heat incentive level combining to provide up to $80,000 on eligible project costs.

Yukon: Good Energy Program - The Government of Yukon offers energy efficiency incentives and offers a $500 rebate for the installation of a qualified solar hot water heating system through its Good Energy Program. This program is also tied to the Federal ecoEnergy Retrofit Program.

3.2.2.3 Standardization Bodies and standards in Canada

The Standards Council of Canada (SCC) (http://www.scc.ca/) is a federal Crown corporation. It has its mandate to promote efficient and effective standardization in Canada. The Standards Council of Canada (SCC) does not develop standards itself, but it plays the important role of coordinating standards work in Canada and ensuring Canada's input on standards issues in international standards organizations. The SCC accredits Canadian standards development organizations (SDOs) and also approves Canadian standards as National Standards of Canada based on a specific set of requirements.

CSA Group (http://www.csa.ca/cm/ca/en/about-csa)

CSA Group is a not-for-profit membership-based association serving business, industry, government and consumers in Canada and the global marketplace. As a solutions-oriented organization, it works in Canada and around the world to develop standards that address real needs, such as enhancing public safety and health, advancing the quality of life, helping to preserve the environment, and facilitating trade.

The CSA standards regarding solar water heating are:

- CSA-F378 - Solar collectors
- CSA-F379 - Packaged solar domestic hot water systems (liquid-to-liquid heat transfer
- CSA-F383-08 - Installation of packaged solar domestic hot water systems

3.2.2.4 Certification Bodies and requirements of certification Schemes in Canada

CSA Group is a not-for-profit, membership-based association serving business, industry, government and consumers in Canada and the global marketplace. CSA Group offers collector certification to CSA F378 (http://directories.csa-international.org/cert_rec_srch.asp?txtDir=*&Submit=Search&txtCustomer=&txtProvState=&txtCountry=&txtFile=&txtMajorClass=8854&txtMinorClass=01&txtClassDesc=&txtKeyword=) and system certification to CSA F379 (http://www.solarbc.ca/learn/systems).

3.2.2.5 Laboratories in Canada

Exova Canada (http://www.exova.com)
Exova conducts solar collector testing at its indoor facility in Mississauga, Ontario

LabTest Certification (http://www.labtestcert.com)
LabTest conducts solar collector testing outdoors at its facility in Richmond, British Columbia

3.3 CENTRAL AND SOUTH AMERICA

3.3.1 Mexico

3.3.1.1 Description of the Market in Mexico

By cooperating with and supporting the PROCALSOL, the country program will develop a favorable regulatory environment and help increase market demand and strengthen the supply chain in order to achieve a total capacity of 2, 500,000 m^2 of solar hot water installed in Mexico by the end of 2013. Is expected to reach the target continued growth of 23.5 million m^2 of total installed capacity of solar hot water by 2020 and this corresponds approximately to a cumulative reduction potential of greenhouse gases over 27 million tons of CO2 by 2020. The program will focus on: a) increase the awareness of key stakeholders on the use of solar hot water, b) support the establishment of a favorable regulatory environment for sustainable development market in Mexico, including voluntary quality control and certification of solar hot water, c) strengthen the capacity of the supply chain, and d) support the establishment of financial mechanisms attractive to consumers in cooperation with local financial institutions.
Source: http://www.undp.org.mx/spip.php?page=proyecto&id_article=1272

3.3.1.2 Legislation and subsidies in Mexico

Hipoteca Verde (Green Mortgage) The commissioning of the 25,000 project solar roofs is the product of joint collaboration of the German cooperation to development (GIZ) and Infonavit, with the financial support of the Ministry Federal German of the environment nature conservation and Nuclear Safety (BMU, by its acronym in German) that generates this initiative resources through the emissions trading scheme (ETS).

3.3.1.3 Standardization bodies and standards in Mexico

NMX-ES-001 NORMEX-2005:
Solar power, thermal efficiency and functionality of solar collectors for water heating. Methods of testing and labeling. Mexico: The Mexican society of standardization and certification S.C. (NORMEX), 2005.

NMX-ES-004-NORMEX – 2010: partial match with ISO 9459-2:1995
Solar energy. Thermal evaluation of solar energy systems for water heating. Test method: the Mexican society of standardization and certification S.C. (NORMEX), 2010.

SOLAR THERMAL TECHNICAL OPINION ON HOUSING.
National Commission for the efficient use of energy (CONUEE). 2011.

3.3.1.4 Certification bodies and requirements of certification schemes in Mexico

- ANCE Asociacion de Normalizacion y Certificacion A.C. http://www.ance.org.mx/Index900.htm
- NORMEX the Mexican society of standardization and certification S.C. http://www.normex.com.mx/
- ONMCCE El Organismo Nacional de Normalización y Certificación de la Construcción http://www.onncce.org.mx/

3.3.1.5 Laboratories in Mexico

Mexolab http://www.mexolab.com/laboratorio/servicios-especializados

MEXOLAB® is a laboratory created in 2011, with capacity to test different thermo hydraulic and physical integrity systems and solar water heaters, as well as research, technological development and innovation in thermal applications of solar energy.

3.3.2 Brazil

3.3.2.1 Description of the market in Brazil

Brazil has the largest and most evolved market for solar water heaters in South America. It has a total installed area of over 7 millionm^2 that has been gradually increasing since 2005 and is expected to continue its growth. In the year 2011, over 1million m^2 were installed.

This market development can be explained by looking back at its recent history. The oil crisis in the 1970s got many companies started but it was not until the 1980s that the first standards were created in the ABNT (Brazilian Association for Technical Standards). This helped the sector improve its quality and the first companies dedicated exclusively to solar water heaters emerged. The 1990s saw the birth of the first voluntary certification system by an agreement between INMETRO, PROCEL and ABRAVA. The blackout in 2001 pushed a federal law for energy efficiency that powered renewal energies, resulting in the creation of the first laboratory with a solar simulator. At this moment, the Inmetro certification Program is becoming mandatory, starting in 2012 and with a two year transition period. There are around 150 manufacturers of solar collectors and tanks that will be affected.

3.3.2.2 Legislation and subsidies in Brazil

Since 2012, the INMETRO Certification program is mandatory in Brazil.

3.3.2.3 Standardization bodies and standards in Brazil

For collectors the standards used in Brazil are prepared by the ABNT:

- ABNT NBR 1547-1: Thermal Solar Systems and components – solar collectors- Part 1: General Requirements (it is based on EN 12975-1)
- ABNT NBR 1547-2: Thermal Solar Systems and components – solar collectors- Part 1: Test methods (it is based on EN 12975-2)

With the actual revision of these standards, the tests being done are internal pressure, exposure, external thermal shock and thermal performance. With the next revision of the standard, they are expected to incorporate also the other tests in the European standard (high temperature test, internal thermal shock, rain penetration, freeze resistance, mechanical load and impact resistance)

For coupled system the ISO 9459-2 Domestic water heating systems- Part 2: Outdoor test methods for system performance characterization and yearly performance prediction of solar-only systems is being used.

3.3.2.4 Certification bodies and requirements of certification schemes in Brazil

There is a mandatory certification scheme organized and owned by Inmetro. In this scheme there are certification bodies and laboratories involved for the assessment activities. Besides the initial tests, the certified company must have also an ISO 9001 certification scheme audited by the certification body.

3.3.2.5 Laboratories in Brazil

There are two laboratories in Brazil, both accredited:

- Grupo de Estudos em Energia (Green) at the Pontifica Universidade Católica de Minas Gerais.
- The institute for Technological Research (Instituto de Pesquisas Tecnológicas, IPT) IN Sao Paulo .

3.3.3 Chile

3.3.3.1 Legislation and subsidies in Chile

According to the law 20365 of 19th August 2009 there is a subsidy for the solar water heater system and its installation in new residential buildings. It is granted to construction companies through tax deductions. The subsidies will depend on the value of the residential building:

- Under a value of 96.170 US $, 100% is covered
- Between 96.170 US $ and 144.255 US$, 40% is covered
- Between 144.255 US$ and 216.385 US, 20% is covered

The organism in charge of the subsidies is called SEC (Superintendencia de Electricidad y Combustible). There is an official list of accepted and certified solar thermal products and also a procedure for accepting certification bodies and laboratories.

3.3.3.2 Standardization bodies and standards in Chile

The standardization body in Chile is called INN, Instituto Nacional de Normalización (http://www.inn.cl) and they have based their standards on EN (European) and ISO (International) standards.

3.3.3.3 Certification bodies and requirements of certification schemes in Chile

The certification body working in Chile and accepted by the SEC is ICOMCER (http://www.icomcer.cl/) and they are currently certifying collectors, systems and storage tanks according to EN standards.

3.3.3.4 Laboratories in Chile

There is one laboratory working in Chile called Servicios de ingenería y laboratorio S.A (SILAB) and recognized by the SEC according to http://www.minenergia.cl/archivos_bajar/SEC_R_1999.pdf . However at the time of writing this document the web page of the laboratory does not offer much information about testing solar thermal products (http://www.silab.cl/)

3.3.4 Barbados

3.3.4.1 Description of the market in Barbados

Barbados is a country of 270.000 inhabitants in the Caribbean. According to the Wikipedia, Barbados is one of the Caribbean's leading tourist destinations and is one of the most developed islands in the region. In 2011, Barbados ranked 2nd in the Americas (16th globally) on Transparency International's Corruption Perception Index, behind Canada.

Being an island of over 400 km^2 it might not seem a first class player in the Solar Water Heating industry, however it held in 2008 an outstanding 5th place in the world when measuring the total capacity installed per 1000 habitants, that is 202.7 Kw $_{th}$/1000 inhabitants.

Since the 1970s, over 50.000 solar water heaters have been installed in Barbados. Making an estimation that the average energy consumed by a family for water heating purposes is 3.7 barrels of oil, it is assumed that the country has saved around 505 M US $.

3.3.4.2 Standardization bodies and standards in Barbados

Standards are developed by the Barbados National Standards Institution (BNSI). (http://www.bnsi.bb/) Looking through its catalogue the following standard is found on solar collectors, but due to the date is may not be in active use:

- BNS 147:1983Method of thermal testing of flat plate solar collectors
  - Test methods for thermal performance - thermal loss, collector
  Time constant and thermal efficiency.

3.3.4.3 Certification bodies and requirements of certification schemes in Barbados

The BNSI is authorized to act as a certification body, but there is no evidence of solar collectors or system certification.

3.3.4.4 Laboratories in Barbados

There are no laboratories working in Barbados.

3.4 EUROPE

3.4.1 Certification Scheme in Europe

Solar Keymark is a voluntary certification scheme based on the European standards for solar thermal products. In some countries, Solar Keymark certification is required in subsidy schemes.

Solar Keymark is a 3rd party certification scheme with the following basic elements:

- Initial inspection of production line
- Sampling of product for initial type testing
- Initial type testing
- Annual inspection of production line
- Biannual surveillance test (in fact a detailed product inspection)

3.4.2 Standards in Europe

For collectors, the EN standards EN 12975-1 “Requirements” and EN 12975-2 “Test methods” are used. Both are at the moment being revised:

- The new EN 12975-1 will be a harmonized (obligatory) standard, which will be basis for CE marking related to the Construction Product Directive/Regulation. Additional requirements with respect to fire safety and "dangerous substances" will be included.
- EN/ISO 9806 will, when approved, replace EN 12975-2.

3.4.3 Market and other numbers in Europe

1600 collectors / collector families from 700 different brands are listed in the Solar Keymark collector database.

Accumulated installed collector area in EU27 including CH by end 2011 ("ESTIF"): 37.5 million m^2.

Newly installed collector area in 2011 ("ESTIF"): 3.7 million m^2.

3.5 ASIA

3.5.1 China

3.5.1.1 Certification Schemes in China

In China being the largest market worldwide several certification schemes are in place. Table 1 gives an overview.

Name	**Certification body**	**Affiliation**	**First Publication**
Golden Sun	China General Certification (CGC)	China National Institute of Metrology	03.2006
Kang-Ju	Kang-Ju Construction Parts Certification Center (KCPC)	The Center for Housing Industrialization, Ministry of Construction	02.2007
Ten Rings	China Environment Certification Center (CEC)	National Environment Protection Agency	09.2007
CQC	China Quality Certification Center (CQC)	National Certification Body	10.2007
CABR	Certification Center of China Academy of Building Research (CABR)	China Academy of Building Research	12.2011

Table 1: Chinese certification schemes and bodies

The Golden Sun certification being the most important one includes factory inspection of the production site and a third party test of the product according to the relevant Chinese standards.

3.5.1.2 Standards in China

In China has a large variety of standards are available for solar thermal products, see Table 2.

No	Standard Code	Standard Name
1	GB/T 4271-2007	Test methods for thermal performance of solar collectors
2	GB/T 6424-2007	Flat plate solar collectors
3	GB/T 12936-2007	Solar energy – Thermal application – Terminology
4	GB/T 14890-1994	Calibration of field pyrheliometers
5	GB/T 15405-2006	Thermal specifications and testing method for passive solar houses
6	GB/T 15513-1995	Solar water heaters – Elastomeric materials for absorbers, connecting pipes and fittings – Methods of assessment
7	GB/T 17049-2005	All-glass evacuated solar collector tubes
8	GB/T 17581-2007	Evacuated tube solar collectors
9	GB/T 17683.1-1999	Solar energy – Reference solar spectral irradiance at the ground at different receiving conditions Part 1: Direct normal and hemispherical solar irradiance for air mass 1.5
10	GB/T 18708-2002	Test methods for thermal performance of domestic solar water heating systems
11	GB/T 18713-2002	Solar water heating systems - Design, installation and engineering acceptance
12	GB/T 19141-2011	Specification of domestic solar water heating systems
13	GB/T 19775-2005	Glass-metal sealed heat-pipe evacuated solar collector tubes
14	GB/T 20095-2006	Assessment code for performance of solar water heating systems
15	GB/T 23888-2009	Controller for domestic solar water heating systems
16	GB/T 23889-2009	Specification for domestic solar water heating systems with air-source heat-pump
17	GB/T 24767-2009	Gravity heat-pipe for solar application
18	GB/T 24798-2009	Rubber sealing parts used for solar water heating systems
19	GB/T 25965-2010	Test methods for normal emittance of materials and hemispherical emittance of all-glass evacuated collector tubes

20	GB/T 25966-2010	Specification for domestic solar water heating systems with electrical auxiliary heat source
21	GB/T 25967-2010	Test methods for thermal performance of domestic solar-plus-supplementary water heating systems
22	GB/T 25968-2010	Test methods of solar transmittance and solar absorptance of materials by using spectrophotometer
23	GB/T 25969-2010	General specification for material selection of main components of domestic solar water heating system
24	GB/T 26709-2011	Rigid polyurethane plastic foam used for solar water heaters
25	GB 26969-2011	Minimum allowable values of energy efficiency and energy efficiency grades for domestic solar water heating systems
26	GB/T 26970-2011	Specification for remote-storage double-loop domestic solar water heating system
27	GB/T 26971-2011	Test methods for remote-storage double-loop domestic solar water heating system
28	GB/T 26972-2011	Terminology for concentrating solar thermal power generation
29	GB/T 26973-2011	Specification for solar water heating systems (tank volume over 0.6m3) with air-source heat-pump
30	GB/T 26974-2011	Specification for absorbers of flat-plate solar collector
31	GB/T 26975-2011	All-glass heat-pipe evacuated solar collector tubes
32	GB/T 26976-2011	Specification for solar air collectors
33	GB/T 26977-2011	Test methods for thermal performance of solar air collectors
34	GB/T 28745-2012	Specification for storage tanks of domestic solar water heating system
35	GB/T 28746-2012	Test methods for storage tanks of domestic solar water heating system
36	GB/T 29159-2012	Glass tubes used for all-glass evacuated solar collector tubes
37	GB 50364-2005	Technical code for solar water heating system of civil buildings
38	GB 50495-2009	Technical code for solar heating system
39	GB/T 50604-2010	Evaluation standard for solar water heating system of civil buildings
40	GB 50787-2012	Technical code for solar air-conditioning system of civil buildings

Table 2: Chinese standards on solar thermal products

3.5.1.3 Test laboratories in China

The test laboratories in China are divided in national test centers (see table 3) and provincial test centers (see table 4).

No	Name	Affiliation
1	National Center for Quality Supervision and Testing of Solar Water Heating Systems (Beijing)	China Academy of Building Research
2	National Center for Quality Supervision and Testing of Solar Water Heating Systems (Wuhan)	Hubei Provincial Supervision and Inspection Institute of Product Quality
3	National Center for Quality Supervision and Testing of Solar Water Heating Systems (Kunming)	Yunnan Normal University

Table 3: Chinese national test centers

No	Name	Location
1	Jiangsu Provincial Supervision and Inspection Institute of Product Quality	Nanjing
2	Shandong Provincial Supervision and Inspection Institute of Product Quality	Jinan
3	Zhejiang Provincial Supervision and Inspection Institute of Product Quality	Hangzhou
4	Henan Provincial Supervision and Inspection Institute of Product Quality	Zhengzhou
5	Anhui Provincial Supervision and Inspection Institute of Product Quality	Hefei

Table 4: Chinese provincial test centers

3.5.1.4 Market and other numbers in China

Since the 1980s, the Chinese Government has carried out a plan to strengthen the development and to popularize the application of solar water heaters in China. With the awareness of energy conservation, environment protection and climate change rising, China gives more priority to the development of the solar water heater industry.

The State Law of Renewable Energy was issued in 28 February 2005, and has been implemented since 1 January 2006. The implementation of the State Law provides a legal insurance to the renewable energy utilization and tremendously facilitates the development of solar thermal industry and application in China.

The Chinese solar water heater (SWH) industry has been developing rapidly for past 20 years. There are about 2,800 manufacturers of SWH throughout the country. The Chinese SWH market is developing with an annual increasing rate of about 25%.

In 2011, annual production of SWH reached 57.6 million m^2, installed capacity reached 193.6 million m^2. In 2012, annual production of SWH reached 63.9 million m^2, installed capacity reached 257.7 million m^2. At present, China is the largest country in production and application of SWH in the world.

The majority of collectors and solar thermal systems are using evacuated tubes, however more and more flat plate collectors enter the market especially in the south of the country.

China is making great efforts to expand solar thermal application, such as solar space heating, solar drying, solar air-conditioning, solar industrial process heating, solar thermal power generation, etc.

3.5.2 India

3.5.2.1 Certification Scheme in India

In India both the standardization and certification of solar thermal products is done by the Bureau of Indian Standards (BIS).

3.5.2.2 Standards in India

In India are a few standards available for solar thermal products, see Table 1.

No	Standard Code	Standard Name
1	ISO 12933 Part 1-3, Part 5-2003	Solar Flat Plate Collector - Part 1 : Requirements; Part 2: Components; Part 3: Measuring Instruments; Part 4: inactivate; Part 5: Test Methods
2	IS/ISO 9488-1999	Solar Energy - Vocabulary
3	IS 12976-1990	Solar water heating systems- Code of practice
4	IS 13129 : Part 1-4, 1991	Solar heating - Domestic water heating system: Part 1 Performance rating procedure using indoor test methods; Part 2 Procedure for system performance characterization and yearly performance predication; Part 3 Procedure for system component characterization and predication for yearly performance using component performance data; Part 4 Determination of durability and reliability
5	IS 13429 : Part 1	Solar Cooker - Box Type - Part 1 : Requirements; Part 2 : Components; Part 3 : Test Method
6	IE61725-1997	Analytical Expression For Daily Solar Profiles

Table 1: Indian standards on solar thermal products

More information under:
http://www.bis.org.in/
http://www.standardsbis.in/

3.5.2.3 Test Laboratories in India

The test laboratories in India are divided in regional and one national (Solar Test Centre, Dehli) test centres (see table 2). Most of them are situated in Universities.

No	Name	Location
1	Centre of Energy Studies and Research, Devi Ahilya Vishwavidyalaya Khandwa Road Campus http://www.sees.dauniv.ac.in/	Indore
2	Department of Physics, School of Energy Studies, University of Poona http://www.unipune.ac.in/snc/school_of_energy_studies/	Pune
3	School of Energy Environment and Natural Rescources, Madurai Kamaraj University http://www.mkuniversity.org/sub_link_pg.php?id=s4	Madurai
4	Sardar Patel Renewable Energy Research Institute http://www.spreri.org/	Vallabh Vidyanagar
5	Deenbandhu Chhotu Ram University of Science and Technology http://www.dcrustm.ac.in	Sonepat (Haryana)
6	School of Energy Studies, Jadavpur University http://www.jaduniv.edu.in/view_department.php?deptid=137	Calcutta
7	Energy Research Centre, Punjab University http://erc.puchd.ac.in/	Chandigarh
8	Solar Energy Centre, Drevrsastry Government of India http://www.mnre.gov.in/centers/about-sec-2/	Delhi

Table 2: Indian test centres found at http://www.indiasolar.com/testcentr.htm

3.5.2.4 Market and other numbers in India

The role of new and renewable energy has been assuming increasing significance in recent times with the growing concern for the country's energy security and after the sudden increase in the price of oil after the 1970s. Finally it led to the establishment of the Commission for Additional Sources of Energy in the Department of Science & Technology (CASE) in March 1981. The Commission was charged with the responsibility of formulating policies and their implementation, programmes for development of new and renewable energy apart from coordinating and intensifying R&D in the sector. In 1982, a new department, i.e. Department of Non-conventional Energy Sources (DNES), that incorporated CASE, was created in the then Ministry of Energy. In October 2006, the Ministry was re-christened as the Ministry of New and Renewable Energy. http://www.mnre.gov.in/

India is endowed with abundant of solar radiation. The country receives solar radiation equivalent to more than 5.000 trillion kWh/year with most parts receiving 4-7 kWh per m^2 per day, which is far more than its total annual energy requirement. Solar thermal technologies have already found ready acceptance for a variety of decentralized applications in domestic, industrial and commercial sectors of the country. The most widely acceptable application is the solar water heating technology. However, solar steam generating and air heating technologies and energy efficient solar buildings are also attracting attention in urban and industrial areas. In fact in India solar water heaters are the most popular of all renewable energy devices. There are 60 BIS approved manufacturers of Solar Flat Plate Collectors and 44 MNRE approved evacuated tubular collector based solar water heating suppliers.

Most popular in India are the box type solar cookers with a single reflecting mirror being promoted by the Ministry of Non-conventional Energy Sources since 1982. These cookers are manufactured mainly by small industries to a set of specifications developed by MNES, later approved by Bureau of Indian Standards. There is an estimated potential demand of 10 million solar cookers in this country. In India a major portion of the market is covered by box type cooker and a small portion of the market share is taken up by community type box cooker/parabolic type cooker. There are about 40 manufacturers whose combined annual production capacity is 75000 solar cookers.

There are various projects and initiatives to promote renewable Energy in India. For example the Jawaharlal Nehru National Solar Mission (JNNSM) which is a major initiative of the Government of India. JNNSM was launched in January 2010. The mission targets include 20mio m^2 solar thermal collector area, to create favorable conditions for developing solar manufacturing capability in the country and a lot more. Under Phase II of JNNSM (2013- 2017), target for deployment of 25000 solar pumps by the end of 2017 has been envisaged.

Various projects with concentrated solar power which are suitable for cooking food for large number of people in community kitchen have already been promoted and realized.

In the end of March 2013 there are 7 Mio. m^2 solar thermal collector area installed. 2022 it is expected to achieve 20 million m^2 solar thermal collector area.

In order to have detailed solar resource information, the following initiatives have further been taken by the Solar Energy Centre (SEC):

- The Handbook "Solar Radiant Energy over India" containing various meteorological data is available on MNRE website (http://mnre.gov.in/centers/about-sec-2/hand-book-on-energy-conscious-buildings/)

- The solar maps containing monthly and annual Direct Normal Irradiance (DNI) and Global Horizontal Irradiance (GHI) data have been developed from hourly satellite data spanning from January 2002 to December 2008. These maps cover the entire country at 10 km x10km spatial resolution. Final Solar Maps (DNI & GHI) are available on MNRE website (http://www.mnre.gov.in/sec/solar-resources.htm) and also available in NREL website (http://www.nrel.gov/international/ra_india.html)

The **Government** provides **subsidy** to the extent of 30 to 60% to different category of users and States subject to certain benchmarks as per below:

- General category states for all types of beneficiaries: 30% capital subsidy or loan at 5% interest on 80% of the benchmark cost
- Special category states for domestic & non commercial categories (not availing accelerated depreciation): 60% capital subsidy or loan at 5% interest on 80% of the benchmark cost
- Special category states for commercial users category (availing accelerated depreciation): 30% capital subsidy or loan at 5% interest on 80% of the benchmark cost

Benchmark Cost : ETC based systems : Rs. 10,000/ m^2.

FPC based systems : Rs. 11,000/ m^2.

Solar thermal systems/devices	Capital subsidy (Rs./ m2 of collector area) or 30% of project cost whichever is less*	Euro/m^2 of collector area
Solar water heating & air heating systems, box cookers based on following type of collectors		
Evacuated Tube Collectors (ETCs)	3000	40,50
Flat Plate Collectors (FPC) with liquid as the working fluid	3300	44,50
Flat Plate Collectors with air as the working fluid	2400	32,40
Solar collector system for direct heating Applications	3600	48,55
Dish solar cookers & steam generating systems based on following type of collectors		
Concentrators with manual tracking	2100	28,30
Non- imaging concentrators	3600	48,55
Concentrators with single axis tracking	5400	72,80
Concentrators with double axis tracking	6000	80,90

Table 3: Subsidy pattern for solar thermal systems/devices

* Besides capital subsidy, soft loan at 5% for balance cost of system excluding beneficiary share of 20% may also be available. Also for special category states, this subsidy will be double limited to 60% of project cost. In un-electrified rural areas, subsidy for solar thermal power plants will be 60% in all categories of states.

3.5.3 Japan

3.5.3.1 Certification Scheme in Japan

Currently, there are no official certification bodies and requirements for certification schemes. At present the Japan Solar Platform Forum (non-government groups) has been lobbying. As a result, they can receive federal funding from Ministry of Economy, Trade and Industry (METI), the first laboratory will be built at Nagoya University in 2015 with the funding. The requirements of certification schemes are under consideration.

There is no legislation related to Solar Thermal. Only the local government provides the subsidies. http://www.ssda.or.jp/assist/index.html this webpage shows the local government's subsidies information – it's only in Japanese.

3.5.3.2 Standards in Japan

Following national standards related to solar thermal products are available in Japan which are issued by Japanese Industrial Standards Committee (JISC) http://www.jisc.go.jp/eng/index.html:

- JIS A 4112-2011: Solar collectors
- JIS A 4111-2011: Solar water heater
- JIS A 4113-2011 solar storage tanks

3.5.3.3 Test laboratories in Japan

At present no official test centers are in place in Japan, however Japan Fine Ceramics Center(JFCC) (http://www.jfcc.or.jp/en/), Dr. Tatsuya Kodama in Niigata University has been working on this field (mainly high temperature), http://researchers.adm.niigata-u.ac.jp/R/staff/?userId=1114&lang=en

3.5.3.4 Market and other numbers in Japan

The solar thermal market in Japan has not profited significantly from the energy crisis after Fukushima in March 2011. The latest statistics of the Japanese Solar System Development Association (SSDA) show that the number of newly installed collector area in 2011 was only slightly higher than in 2010. In fact, the 2011 market volume of 136,600 m^2 was merely 5 % above the previous year (129,839 m^2).

Source: SSDA

Japan is still a market dominated by thermosiphon systems. They made up 73 % of total market volume in 2011. The Solar System Development Association (SSDA) does not differentiate between flat plate and vacuum tube collectors in this segment.

The share of residential pumped systems, on the other hand, differs from year to year, with no clear upward trend. The systems have gained no acceptance on the market because of their higher price. Usually, the SSDA does not show thermosiphon systems based on collector area, but on units. Over the last years, however, the association has always stated the average collector area to add up to 3.2 m^2/unit, so this conversion factor is also used in the chart above. Vacuum tube collectors have not had a substantial influence on the Japanese market yet. Only between 500 and 700 m^2 have been incorporated into smaller pumped or larger solar heating systems over the last years.

The solar thermal market has been more or less stagnant during the last three years. Little support by the government, still relatively high prices and the financial crisis which hit Japan in the second half of 2009 are said to be impeding any further growth. Only 2008 showed a slightly higher sales volume of 160,000 m^2, caused by the rapidly increasing oil price in the first half of 2008 and the start of the Tokyo Metropolitan Government's solar thermal promotion campaign.

This year's outlook does not seem much better, according to a statement by Eijiro Kawai, Sales Manager at Chiryu Heater Co., one of the oldest collector manufacturers in Japan. "We expected the solar thermal market to spike after Fukushima, because people started to have a close look at sustainable energies. But it turned out to be a push for solar power generation, caused by the feed-in tariff." Kawai expects this year's market to stay as it is - stagnant.

More information:

www.chiryuheater.jp/en

www.ssda.or.jp

http://solarthermalworld.org/content/japan-stagnating-market-despite-renewables-image-boost

3.5.4 Korea

3.5.4.1 Certification Scheme in Korea

In Korea solar thermal products are certified by the certification body. KEMPO (www.kemco.or.kr/new_eng/main/main.asp). The products need to pass a performance test and a factory inspection by technical standards. 50 % of the test fees are granted by the government in case of a positive result. Only certified products can enter the domestic market which support by the government.

Subsidies:

- Government subsidy is about 50% of installation cost.
- All new public building larger than 1000㎡must be installed renewable energy system of 10% of total energy load without subsidy → Mandatory installaton of renewable system
- Demonstration pilot project for new and renewable system : Max 80% of installation cost support by government

3.5.4.2 Standards in Korea

In Korea standards are issued by KEMCO(Korea Energy Management coperation). Standards available are :

- solar collector test standard for certification of new & renewable facilities
- solar hot water heater test standard for certification of new & renewable facilities

3.5.4.3 Test laboratories in Korea

At present two test centers are in place in Korea:

- KIER(Korea Institute of Energy Research) → main test laboratory for solar thermal products www.kier.re.kr/eng/
- KTL(Korea Testing Laboratory) www.ktl.re.kr/eng/

3.5.4.4 Market and other numbers in Korea

The Korean market of solar thermal products is small the current figures are:

- domestic hot water heater approx. 2,200 m^2
- Space heating and hot water heater for residential house approx. 31,000 m^2
- hot water heating system for sport facilities, welfare facilities, dormitory, etc. approx. 28,000 m^2

3.6 NORTHERN AFRICA AND MIDDLE EAST

3.6.1 Certification Scheme

At the very end of 2012, a new regional certification scheme for the Arab countries in Northern Africa and the Middle East was established: SHAMCI.

The countries participating are:

- Algeria
- Bahrain
- Egypt
- Iraq
- Jordan
- Lebanon
- Libya
- Morocco
- Palestine
- Sudan
- Syria

- Tunisia
- Yemen

SHAMCI is a voluntary certification scheme based on the Arab and European standards for solar thermal products. SHAMCI is a 3rd party certification scheme (inspired by - and close to - Solar Keymark) with the following basic elements:

- Initial inspection of production line
- Sampling of product for initial type testing
- Initial type testing
- Annual inspection of production line
- Biannual surveillance test (in fact a detailed product inspection)

The detailed requirements are close the requirements in the present EN 12975-1.

3.6.2 Standards

EN/ISO 9806 will be used for collector testing.

3.6.3 Market and other numbers

As the certification scheme has just been established, no certificates have been issued yet.

Accumulated installed collector area in the 13 countries in 2011 (rough estimation): 5 million m^2. Palestine, Jordan and Syria are the countries with the largest part.

Newly installed collector area in 2011 (rough estimation): 0.5 million m^2.

3.7 SOUTH AFRICA

3.7.1 Certification Scheme in South Africa

The South African National Accreditation System (SANAS) is recognised by the South African Government as the single National Accreditation Body that gives formal recognition that Laboratories, Certification Bodies, Inspection Bodies, Proficiency Testing Scheme Providers and Good Laboratory Practice (GLP) test facilities are competent to carry out specific tasks in terms of the Accreditation for Conformity Assessment, Calibration and Good Laboratory Practice Act (Act 19 of 2006).

The South African Bureau of Standards (SABS) product service offers a Qualification Scheme for the Solar Water Heating Industry. This Scheme provides the Solar Water Heating components industry with an independent qualification service that enables them to demonstrate compliance through a qualification certificate.

The SABS Product Certification Scheme (SABS Mark) aims at providing third party guarantee of quality, safety and reliability of products to the consumer. It operates in an impartial, non discriminatory and transparent manner monitored by SANAS. Further, it is essentially voluntary in nature, and is largely based on ISO Guide 65, which provides general rules for third party certification system of determining conformity with product standards through initial testing. To maintain SABS Mark approval acceptance, manufacturers have to submit samples for subsequent testing to demonstrate ongoing acceptance and conformance to the relevant specifications.

SABS approval for solar water heating systems is not currently common in South Africa but it is being pursued and more suppliers are expected to become SABS Mark holders.

For more information:

https://www.sabs.co.za/Sectors-and-Services/Sectors/Solar/solar_ac.asp

3.7.2 Standards in South Africa

No	Standard Code	Standard Name
1	SANS 6211-1	Domestic solar water heaters, Part 1: Thermal performance using an outdoor test method
2	SANS 6211-2	Domestic solar water heaters, Part 2: Thermal performance using an indoor test method
3	SANS 6210	Domestic solar water heaters – Mechanical qualification test
4	SANS 10106	The installation, maintenance, repair and replacement of domestic solar water heating systems
5	SANS 9459-2	Solar heating – Domestic water heating systems, Part 2: Outdoor test methods for systems performance characterization and yearly performance prediction of solar-only systems.
6	SANS 1307	Domestic storage solar water heating systems
7	SANS 9488	Solar energy - Vocabulary
8	SANS 151	Hot water storage tank Tests

Table 1: Related Standards and Publications (Source: https://www.sabs.co.za/Sectors-and-Services/Sectors/Solar/solar_sp.asp)

No	Standard Code	Standard Name
1	ISO 9059:1990	Solar Energy – Calibration of field pyrheliometers by comparison to a reference pyrheliometer
2	ISO 9060:1990	Solar Energy – Specification and classification of instruments for measuring hemispherical solar and direct solar radiation
3	ISO 9488:1999	Solar energy - Vocabulary
4	ISO 9847:1992	Solar Energy – Calibration of field pyranometers by comparison to a reference pyranometer
5	ISO 9459-2:1995	Solar heating – Domestic water heating systems, Part 2: Outdoor test methods for systems performance characterization and yearly performance prediction of solar-only systems.
6	ISO 9806-1:1994	Test methods for solar collectors, Part 1: Thermal performance of glazed liquid heating collectors including pressure drop
7	ISO 9846:1993	Solar energy – Calibration of a pyranometer using a pyrheliometer
8	ISO 9459-1:1993	Solar heating – Domestic water heating systems, Part 1: Performance rating procedure using indoor test methods

9	ISO 9808:1990	Solar water heaters - Elastomeric materials for absorbers connection pipes and fittings – Method of assessment
10	ISO/TR 10217:1989	Solar Energy – Water heating systems – Guide to material selection with regard to internal corrosion
11	ISO 9806-3:1995	Test methods for solar collectors, Part 3: Thermal performance of unglazed liquid heating collectors (sensible heat transfer only) including pressure drop
12	ISO/TR 9901:1990	Solar Energy – Field pyranometers – Recommended practice for use
13	ISO 9553:1997	Solar Energy – Methods of testing preformed rubber seals and sealing compounds used in collectors
14	ISO 9845-1:1992	Solar Energy – Reference solar spectral irradiance at the ground at different receiving conditions – Part 1: Direct normal and hemispherical solar irradiance for air mass 15
15	ISO 9806-2:1995	Test methods for solar collectors, Part 2: Qualification test procedures
16	ISO 9459-5:2007	Solar Heating – Domestic water heating systems – Part 5: System performance characterization by means of whole-system tests and computer simulation

Table 2: Solar Water Heating Certification & Assessment – Related Certification (Source: https://www.sabs.co.za/Sectors-and-Services/Sectors/Solar/solar_ac.asp)

3.7.3 Laboratories in South Africa

There are only a few test laboratories for solar thermal in South Africa (see Table 3 below).

No	Name	Affiliation/Location	IP adress
1	SABS - South African Bureau of Standards	Pretoria	www.sabs.co.za
2	CRSES - Centre for Renewable and Sustainable Energy Studies; STERG – Solar Thermal Energy Research Group, affiliated with CRSES	University of Stellenbosch, Stellenbosch	www.sun.ac.za
3	Technical University of Tshwane (TUT)	Pretoria	www.tut.ac.za

Table 3: Test Laboratories in South Africa

3.7.4 Market and other numbers in South Africa

Although the Solar Thermal Market in South Africa is in the early stages, the solar and environmental conditions in SA are indeed ideal for SWHs. Most areas in South Africa average more than 2,500 hours of sunshine per year, and average solar-radiation levels range between 4.5 and 6.5 kWh/m² in one day. The annual global solar radiation average is about 1800 – 2200 kWh/m²a for South Africa, compared with about 1000 kWh/m²a for Europe and the United Kingdom. This makes South Africa's local resource one of the highest in the world. But the SWH market does not reflect this. Even though South Africa was a world leader during the early phases of SWH development a combination of lacking awareness, lacking sustained government initiatives, vested interests, lacking standardisation and cost effective test procedures, as well as the lack of industry cooperation in promotion and training led to the situation where the glazed SWH market stagnated. Besides it has been found that, in general, access to hot water in low-income households is a secondary requirement, after the requirement for additional space within the home.

In fact the South African solar water heating market has considerable potential for electricity savings, to increase employment opportunities, improve electricity demand management and reduce greenhouse gas emissions.

In recent times there started various projects (SOLTRAIN, CSP-Projects ESKOM) to attempt an integrated market transformation in South Africa.
- SOLTRAIN: The overall goal of this three-year southern African regional project (ended in 2016) is to contribute to the switch from a fossil fuel based energy supply to a sustainable energy supply system based on renewable energies. Southern African Solar Thermal Training and Demonstration Initiative (SOLTRAIN) is currently facilitating knowledge transfer and promoting the adoption of this technology within the country. Furthermore, it is the aim of the project to create new jobs at small and medium enterprises and to initiate and/or to strengthen political support mechanisms for solar thermal systems. 50 demonstration systems for social institutions will be installed during this project.
- The Solar Water Heating (SWH) Program which requires renewable energy to replace 10,000 GWh of electricity by 2013. The Department of Energy estimates that 23 % of this target can be met through solar water heating and Eskom is therefore actively encouraging consumers to switch to solar water heating. The aim of the project is to install and subsidise 500 solar water heaters in low-, medium- and high-income urban households. A second phase of the market transformation will enable commercial installation of 9 000 solar water heaters over a period of five years, with the goal being to bridge affordability gaps and make the benefits of solar water heating available to low-income households.

Further, South Africa's solar water heating market has expanded from a mere 20 suppliers in 1997 to more than 400 suppliers in 2011. From an industry of only 10 suppliers they now have a total of 122 accredited suppliers, 351 registered distributors and 180 registered independent installers. Currently 48 of these suppliers are supplying products that have the SABS Mark Approval and 29 are in the process of obtaining it. A total of 45 suppliers are selling both mark approved products and non-mark approved products.

Subsidies:

Each system tested by the SABS receives a system rating (Q-factor), which indicates the kilowatt-hours (kWh) of electricity it is expected to save on a typical day (as determined by the SABS test). All solar water heating systems included in the program have a SABS thermal test report indicating the system's ability to produce hot water. The rebate is calculated based on these test results – but it also takes into account the affordability of systems and attempts to provide consumers with a five year payback period. Rebates currently range from R3,280 up to R8,964 (250 up to 680€) depending on the system purchased. Costs of solar water heaters vary between R7,000 and R35,000 (530 up to 2600 €) depending on the size, type and source, i.e. imported or locally manufactured.
The Standard Bank of South Africa has developed a financing plan for the purchase of solar thermal systems for domestic use for clients of their insurance department and a Standard Bank Low Pressure Solar Water Heater Program for South Africa.

Legislation:

The South African Ministry of Mines and Energy (DME) has developed a new solar strategy and the associated implementation plan. The strategy looks to 2014 before the installation of one million solar thermal systems (300,000 systems by now). By 2020, the water supply of a total of 50% of households will be achieved by solar thermal energy. The implementation of the program seeks to create new jobs in the manufacturing sector.

Furthermore solar water heating is now obligatory for most new buildings under the Energy Efficiency Building Regulations. A minimum of 50 % by volume of the annual average hot water heating requirement shall be provided by means other than electrical resistance heating, including, but not limited to, solar heating, heat pumps, heat recovery from other systems or processes.

Moreover the Department of Trade and Industry (DTI) ensures that legislation is enacted to make it compulsory to install a SWH when an existing geyseris replaced.

Solar power is also increasingly being used for water-pumping through the rural water-provision and sanitation program of the Department of Water Affairs and Forestry. But only six per cent of total energy consumption of South Africa is based on renewable energy. The Integrated Resource Plan (IRP) lays the foundation for the country's energy mix up to 2030, and seeks to find an appropriate balance between the expectations of different stakeholders considering a number of key constraints and risks. It provides for a diversified energy mix, in terms of new generation capacity, that will comprise renewable energy carriers, which include hydro at 6,1%, wind at 19,7%, concentrated solar power at 2,4% and photovoltaic at 19,7%.

Collector Numbers:

Country	**Water Collectors**			**Air Collectors**		**TOTAL [MW]**
	unglazed	**FPC**	**ETC**	**unglazed**	**Glazed**	
South Africa	572.5	251.2	45.7	-	-	869.3
Germany	428.1	9,107.6	1,174.0	-	22.6	10,732.2
China	-	10,351.2	141,828.8	-	-	152,180.0

Table 4: Total capacity in operation by the end of 2011

Country	**Water Collectors**			**Air Collectors**		**TOTAL [m²]**
	unglazed	**FPC**	**ETC**	**unglazed**	**Glazed**	
South Africa	817,803	358,868	65,253	-	-	1,241,924
Germany	611,530	13,010,880	1,677,120	-	32,256	15,331,786
China	-	14,787,370	202,612,630	-	-	217,400,000

Table 5: Total installed collector area in operation by the end of 2011 [m²]

For more information: "Solar Heat Worldwide" IEA report 2011.

For detailed information to the total installed capacity of 1,240,000 m² see Table 6 below.
Reference Climate: Johannesburg, South Africa (Horizontal Irradiation 2.075 [kWh/m²], Inclined Irradiation 2,232 [kWh/m²], Average Outside Air Temp. 15.6 [°C]

	Collector area (gross area) for single system [m²]	**Total collector area 2011 [m²]**	**Total number of systems unglazed 2011 [-]**	**Share of DHW-SFH [%]**	**Type of system [-]**
Solar thermal swimming pool heating reference systems with unglazed water collectors and the total collector area in operation by the end of 2011	200	817,803	4,089	-	-
Domestic hot water reference systems for single family houses and the total collector area in operation by the end of 2011 (SFH)	4 (for single system)	377,468	94,367	89.0%	TS (thermo-syphon)
Domestic hot water reference systems for multifamily houses, hotels and district heating and the total collector area in operation in 2011 (MFH)	50 (for single system)	46,653	933	11.0%	PS (power station)

Table 6: Current installed capacity of Solar Thermal Systems 2011

Furthermore the newly installed collector area in 2011 is 130,000 m² which is equal to 91.2 MW/a.

3.8 AUSTRALIA

3.8.1 Certification Scheme in Australia

The Small-scale Renewable Energy Scheme creates a financial incentive for owners to install eligible small-scale installations such as solar water heaters, heat pumps, solar panel systems, small-scale wind systems, or small-scale hydro systems. It does this by legislating demand for Small-scale Technology Certificates (STCs). STCs are created for these installations according to the amount of electricity they produce or displace.

Each system configuration is registered with a certain number of certificates corresponding to the estimated output of the system (in 4 different climate zones).

Requirements for registration:

- AS/NZS 2712 test report for collectors
- Alternative Solar Keymark collector certification plus the following additional requirements of AS/ NZS 2712

  - 10 days stagnation test (12 hours per day) including a post stagnation performance test
  - Rain penetration test differs from current EN approach, but close to new EN/ISO draft
  - Impact resistance test either with 25.4 mm steel ball or 25 mm ice ball

- Detailed description of the system
- Documented calculation of output of system configurations

Declaration that systems sold are same as systems tested, described and calculated

3.8.2 Standards in Australia

As mentioned the AS/NZS 2712 collector standard is used for testing. It is expected that the new ISO 9806 will be adapted (maybe with some national amendments?).

3.8.3 Market and other numbers in Australia

94 brands have systems in the "Register of solar water heaters" for capacity (tank volume) < 700 liters).

All together 6340 different system configurations are listed the "Register of solar water heaters"!

A typical subsidy level for a small SWH could be maybe 400 - 600 AU$ (depending very much on system and climate zone).

Accumulated installed collector area by end 2010 ("Solar Heat Worldwide"): 2.9 million m^2

Newly installed collector area in 2010 ("Solar Heat Worldwide"): 0.28 million m^2

4. STUDY OF WORD MARKETS REGARDING GROWTH OF MARKET BASED ON IEA-SHC " SOLAR HEAT WORLD WIDE"

This chapter is of special importance since the conclusions found will guide us in pinpointing where to we should concentrate our efforts. For any reader in the industrial sector it is also of interest of course.

4.1 SUMMARY AND CONCLUSION OF CHAPTER 4

Based on Solar Heat World Wide 2010 (published in May 2012) and other sources the conclusion is, that the most promising markets for glazed solar collectors outside Europe are:

- China
- Turkey
- Brazil
- India
- South Africa
- (Mexico)
- (Mena Region – low market but strong growth)

The most promising markets for un-glazed collectors outside Europe are:

- US
- Australia
- Brazil
- South Africa

New promising markets for solar collectors glazed in Europe are:

- Poland
- Denmark (large systems)

The following pages show extracts from different sources giving information that is more detailed on the world markets for solar collectors.

4.2 "SOLAR HEAT WORLD WIDE 2010" FROM MAY 2012

4.2.1 Total installed capacity

Total installed capacity by end **of 2010** in 55 countries worldwide 2010: (196 GW / 300 mio m²)

4.2.1.1 Distribution by location

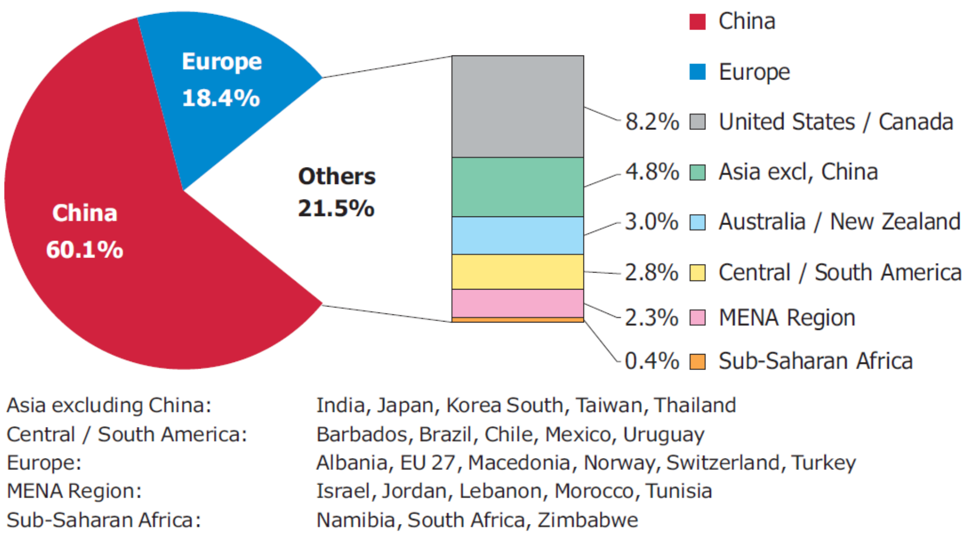


Figure 3: Share of the total installed capacity in operation (glazed and unglazed water and air collectors) by economic regions at the end of 2010

The above fig. 3 from [1] shows that China has almost 2/3 of all installed solar thermal capacity

4.2.1.2 Distribution by country and collector type

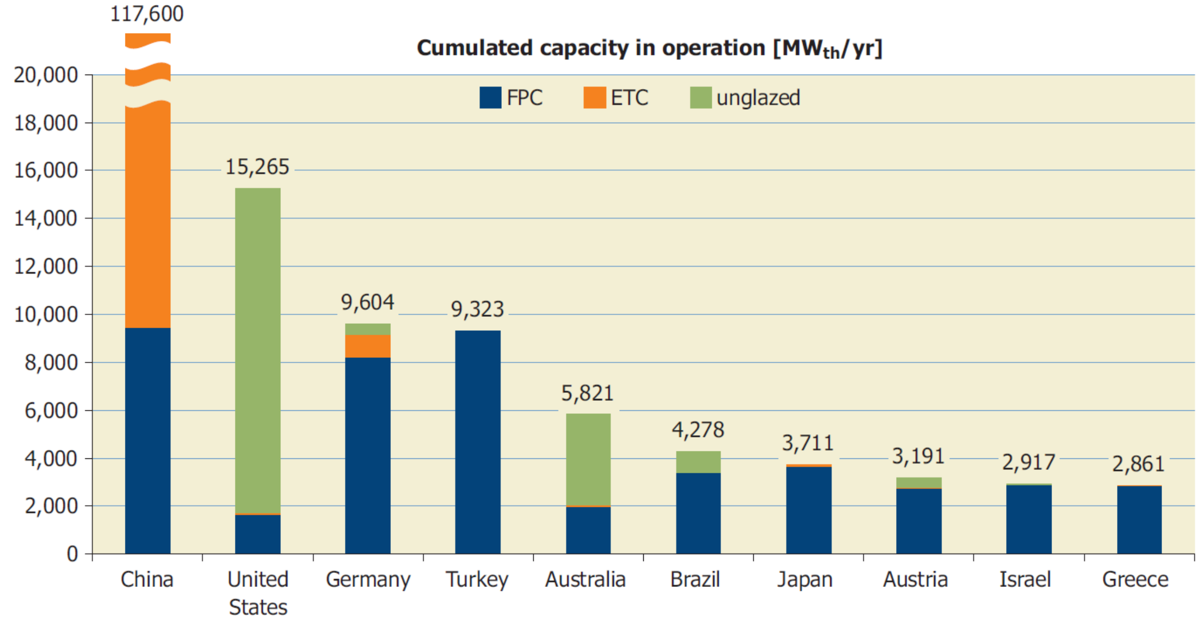


Figure 5: Total installed capacity of unglazed and glazed water collectors in operation in the 10 leading countries by the end of 2010

The above fig. 5 from *[1]* shows that in China by far most of the installed capacity is evacuated tubes *(ETC)*, in US and Australia it is mostly unglazed collectors – elsewhere it is mostly glazed flat palate collectors *(FPC)*.

4.2.2 Newly installed capacity

Newly installed capacity in 2010: (42 GW / 60 mio m²) … 25 % of total installed in 2009

4.2.2.1 Distribution by location

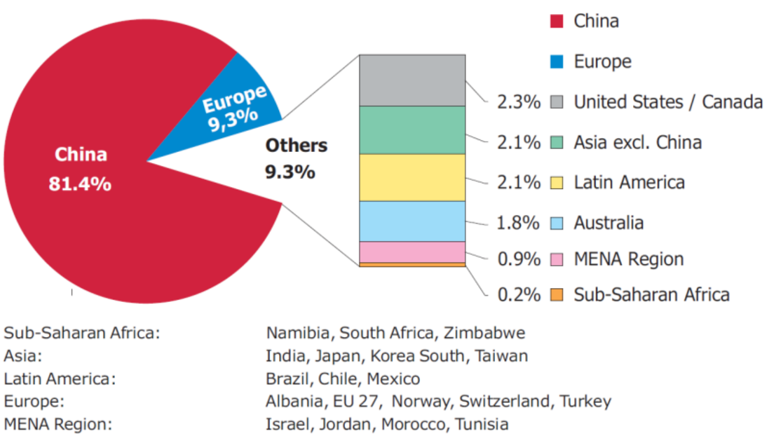


Figure 15: Share of the newly installed capacity (glazed and unglazed water and air collectors) by economic regions in 2010

The above fig. 15 from *[1]* shows that more than 80 % of the solar collector market is in China.

4.2.2.2 Historical development

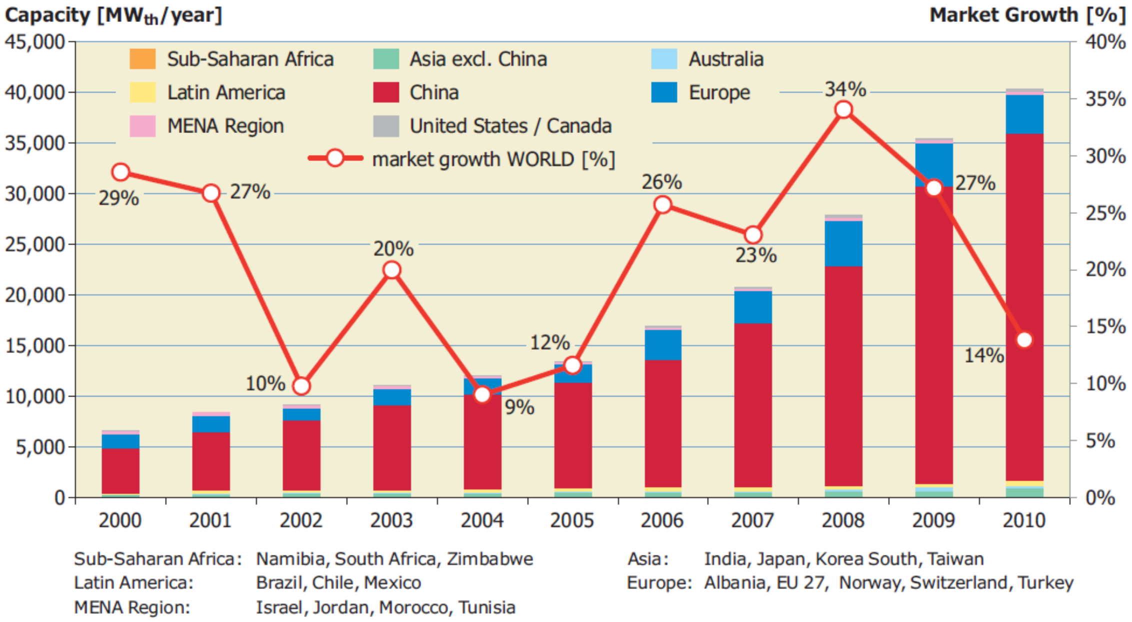


Figure 20: Annual installed capacity of flat plate and evacuated tube collectors from 2000 to 2010

Again, it is seen in the above fig. 20 from *[1]* that the most important market is China – also the most steady growth is seen in China.

4.2.2.3 Distribution by country and collector type

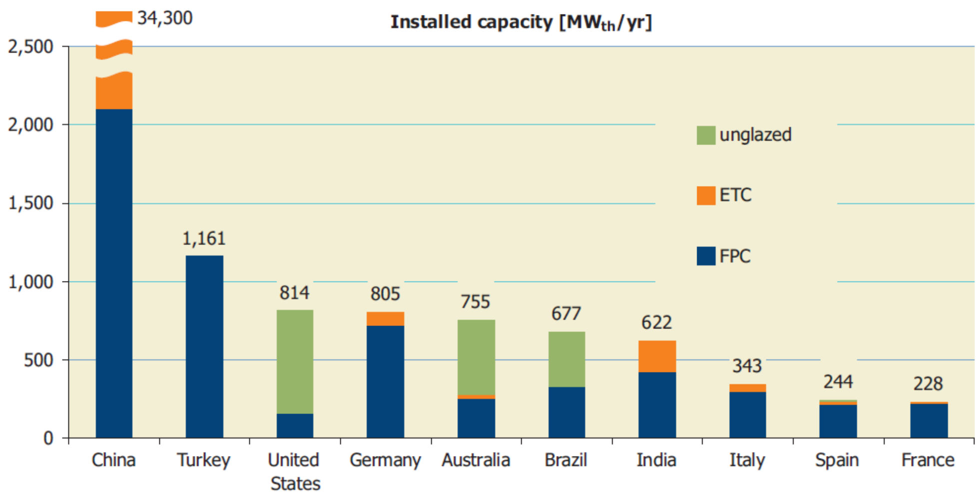


Figure 17: Total capacity of newly installed glazed and unglazed water collectors in the 10 leading countries in 2010

From fig. 17 in *[1]* it is seen that after China, the biggest markets are in Turkey, US, Germany, Australia, Brazil and India – however each these markets are only 2 – 3 % of the Chinese market.

4.2.2.4 Where is the growth?

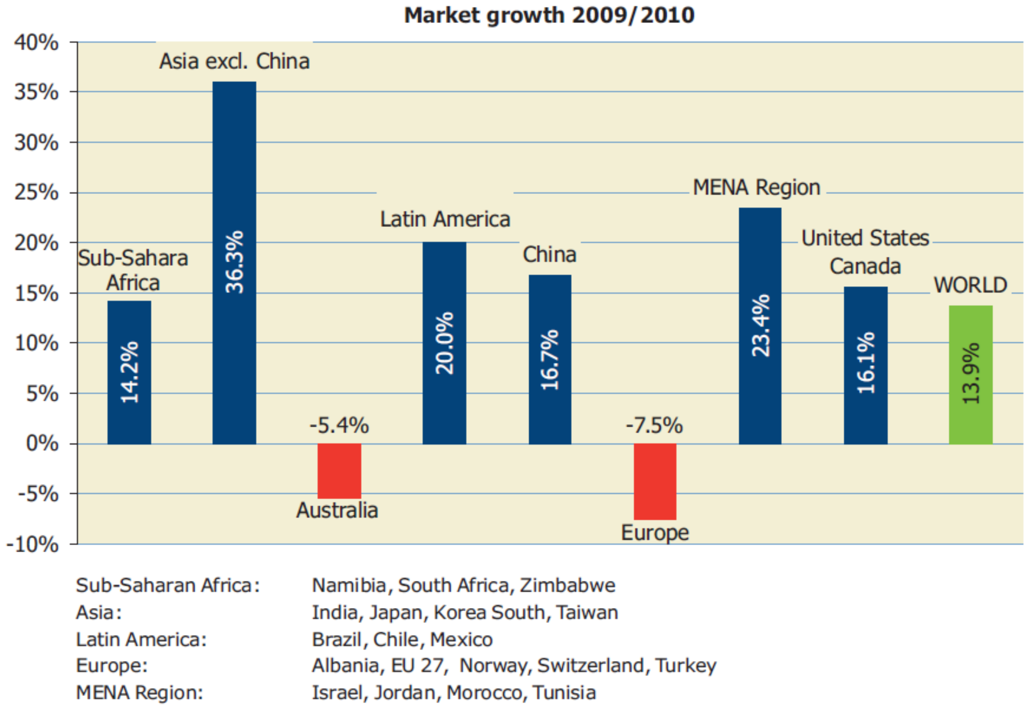


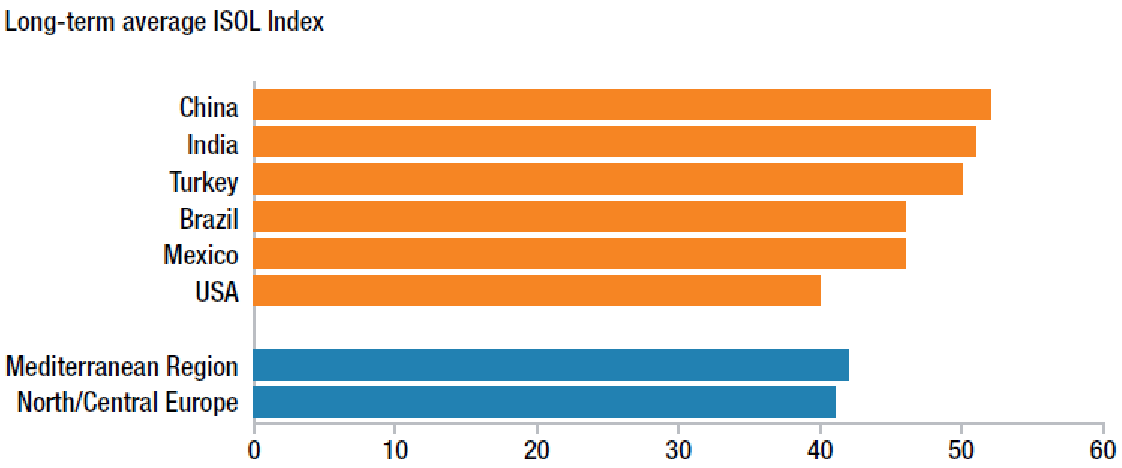
Figure 14: Market development of the newly installed capacity between 2009 and 2010 by economic region

According to the above figure 14 from *[1]* the growth in 2009/2010 is indeed happening outside Europe.

4.3 ISOL INDEX, SOLDRICO(B.EPP) 2012

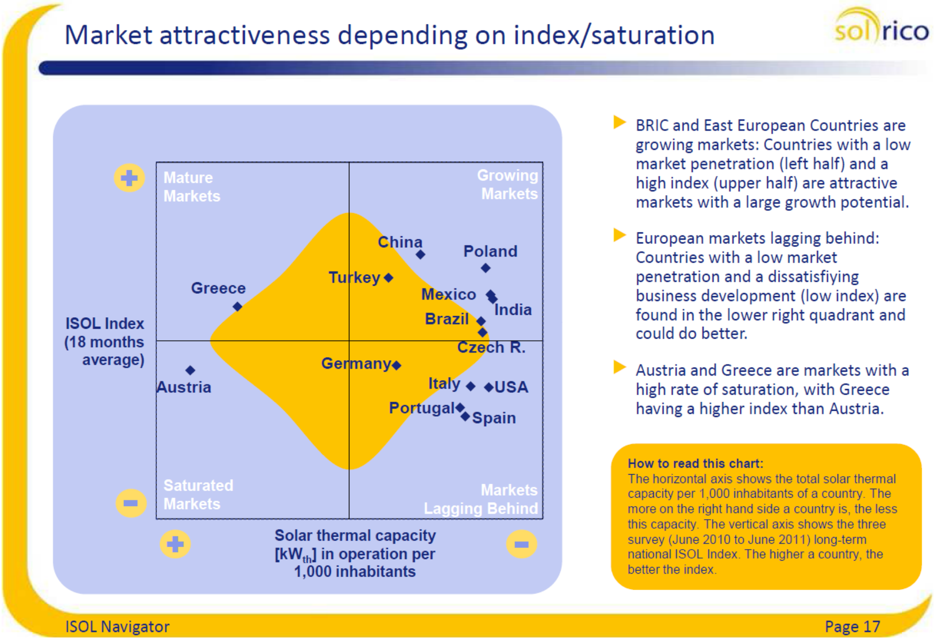
The ISOL index gives the "degree of industry expectations".

4.3.1 Long term index



It is seen that the industry outside Europe in general is more optimistic than the European industry with regard to the "market of tomorrow", *[2]*.

4.3.2 Market attractiveness



The growing/promising markets in the upper right quadrant are here defined as the markets with high industry expectation index and still only little market penetration, - so still big potential in "big old markets" like China and Turkey – and big potential in Poland, Mexico, India and Brazil, *[2]*.

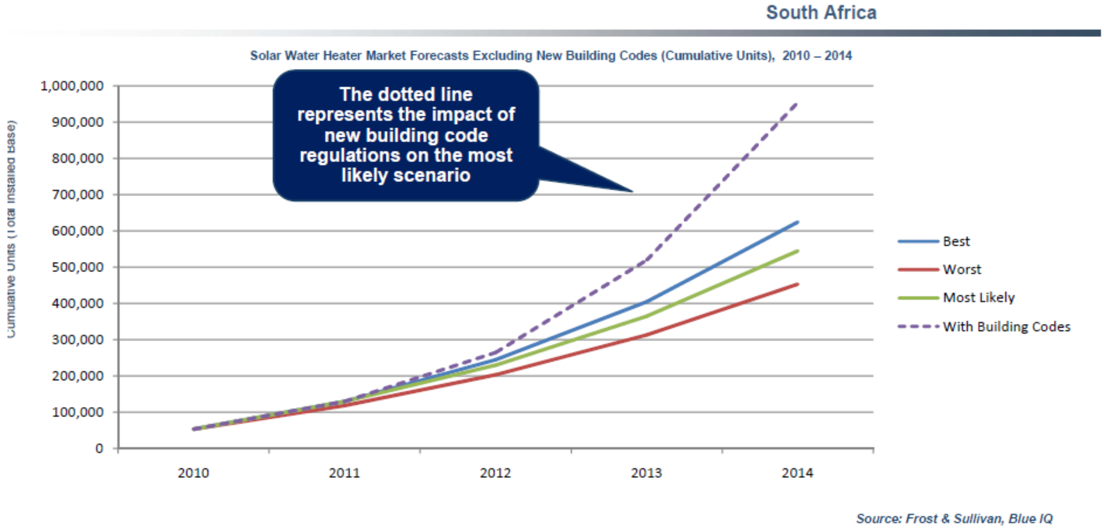
4.3.3 Updated 2011 figures for some overseas markets

Country	Newly installed collector area 2011	Newly installed capacity 2011	Growth rate 2011/2010
Brazil	517 517 m²	362 MW_{th}	9%
China	57 000 000 m²	29 900 MW_{th}	16%
India	600 000 m²	364 MW_{th}	n/a
Mexico	180 000 m²	126 MW_{th}	0%
Turkey	1 805 675 m²	1 264 MW_{th}	9%

This table gives the updated 2011 figures for some overseas markets, *[2]*.

4.4 SOUTH AFRICA

4.4.1 Perspectives from "Frost and Sullivan"



4.4.2 Some indicators for a promising market in South Africa

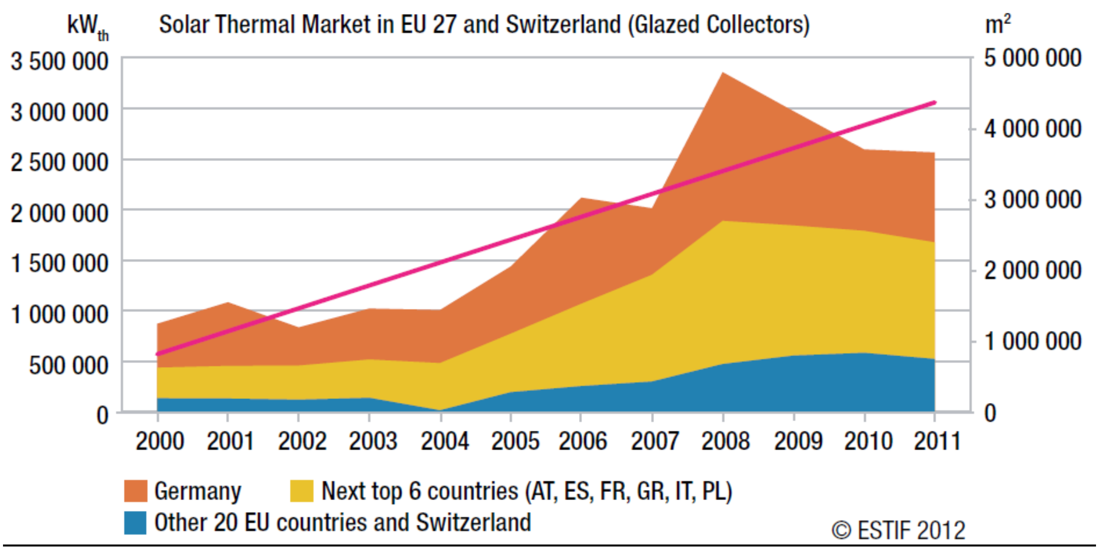
- Building code with solar obligation on its way and will potentially have a very positive influence on the market
- Large ESKOM subsidy programme 766 mio Rand spent in 10/11 – 3 000- 9 000 per SWH *(could be 150 000 units?)*

From *[3]*.

4.5 SOLAR THERMAL MARKETS IN EUROPE TRENDS AND MARKET STATISTICS 2011, ESTIF JUNE 2012

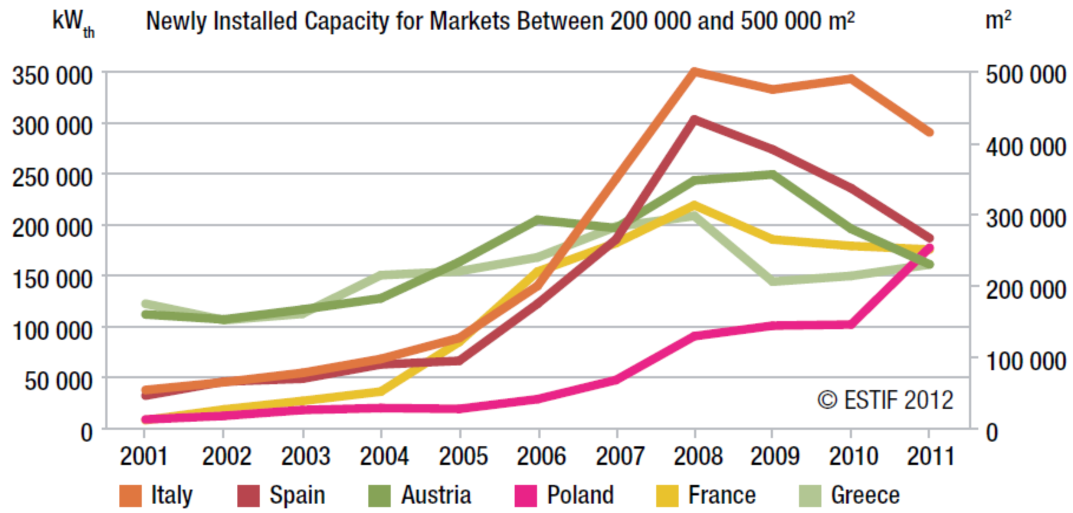
4.5.1 Historical development

4.5.1.1 Whole Europe



The European market is growing – but not very stable, *[4]*

4.5.1.2 Selected European countries



The influence of the economic crisis *(2008 - ?)* on the collector market is clearly seen for Italy and Spain*:* Strong growth has turned into falling markets, *[4]*.

5. FIRST STEP TOWARDS GLOBAL MARK: COMPARING US SRCC RULES WITH EUROPE KEYMARK RULES

Besides all the research and investigation which is important, we also wanted part of the project to show some practical work. So the purpose of this chapter is to offer a practical approach by comparing the US SRCC and the European Solar Keymark Certification schemes. Emphasis has been made on the certification of collectors, since it is the first product to expect a common ISO EN testing standard.

5.1. SUMMARY AND CONCLUSIONS ON CHAPTER 5

The comparison has been structured in the following way:

- **Similar terms.** Sometimes we found ourselves in meetings and after a while we realized it was necessary to rewind and go back de explaining what we understood by the term we were using. The cultural gap and the fact that English is a second language sometimes slows down progress. It is also quite didactic to study the different infrastructure of stakeholders like standardization bodies or accreditation bodies. Terms analyzed are: standards, accreditation, collector with and without storage, system, manufacturer, private label, OEM, similar model, families and types and subtypes
- **Certification rules.** Both systems rely on documents and concepts like granting the certificate, follow up, inspection visit, certificate, data base, mark ownership, license holder
- **Requirements on products and operators**. Both systems have requirements on the products, on certification bodies, laboratories and inspection bodies based on accreditation standards.
- **Legislation and subsidies**. They exist on both US and Europe but are different.

After comparing the certification system of SRCC in the US, and the Solar Keymark certification system used by European Certification bodies, the conclusions are:

- The biggest difference and obstacle towards harmonization is a different testing method and this will be resolved with the new revision of ISO 9806.
- The certification schemes are similar:
  - Initial visit and tests in external laboratories for granting the certificate
  - Yearly inspection visits and product testing within the factory while the certificate is valid
- Certificates are similar but differ in some technical data and the way they are stored in web page.
- Harmonization of both certification schemes seems a possibility in the future; however a more and deeper comparison will be needed.
- Certification bodies in Europe have reached the conclusion that they all do the same things but with different styles. After working with the US the feeling was similar. As meetings are held and colleagues share working methods a mutual and solid confidence is created. The key to success in the future seems to be simply working together with an open mind.

5.2. COMMON TERMS THAT MAY HAVE SLIGHTLY DIFFERENT MEANINGS IN US AND EUROPE

English is the language used in meetings and in written documents in the SKN and it will be the language used for communication within operators of a Global Certification Scheme. In any country, the language may differ from region to region. English will be the mother tongue for US members but for most European members English is their second language. So added to the difficulty of using a second language, there is also a cultural gap that affects communication. We had realized that sometimes after a long discussion, we would have to rewind and make sure that a term we were both using had the same meaning for both of us. So we decided to start by revising the meaning of basic terms that we had realized were not used in exactly the same way. Besides the meaning of the words themselves, it was interesting also to analyze the structure on both sides of the Atlantic for certain stakeholders that affect certification like standardization bodies or accreditation bodies.

Once we got started, we also reviewed some basic concepts that are referred to with different names, like Private label vs OEM.

5.2.1. Standards

Both European and American members will define the term standard in a similar way. We all understand that there can be different types of standards at different levels. However the infrastructure underlying standards in US and Europe is slightly different.

US	**Europe**
Standards may have different levels: Company standard, consortium standard, industry standard, government standard, voluntary consensus standard.	CEN is the European Standardization body and will elaborate standards through its standardization committees with open participation to all its members. CEN standards are named with the prefix EN.
SRCC standards are privately owned by SRCC. They have been the recognized industry standards for over 30 years and are recognized by numerous federal, state, and local authorities. They are the basis of most incentive programs in the US. Since there is no standard mandated by the federal government, there could be in the future other industry standards for collectors in the US.	Each country will have its own and unique standardization body. For example France has AFNOR, Germany has DIN, and Spain has AENOR. Each national standardization body will elaborate its own standards through its own national standardization committees. However because they are CEN members, there may not be national and European standards under the same scope. For this reason, EN 12795 was adopted by all CEN members and any national standards for collectors that existed were withdrawn. Every country will vote on the European standard and once it is approved the standards will be translated into each country.
ISO is the international standardization body. The American National Standards Institute (ANSI) is the US national standards body. Some ISO standards are adopted by ANSI.	**ISO** is the international standardization body. Many ISO standards will be adopted by CEN. A well-known example is the ISO EN 9001 standard. However there is not an obligation for CEN to adopt every ISO standard.
There are many Standards Development Organizations (SDO) in the US. Most engineering societies (ASHRAE, ASME, etc.) and code bodies (ICC, etc.) are SDO's. There are also many private SDO's, including private companies, the American Society for Testing Materials (ASTM), National Sanitation Foundation (NSF), etc. Any SDO may develop a standard for submittal to ANSI as a US national standard. Many standards developed by SDO's and all standards developed by non-SDO's are not submitted to ANSI, but are used extensively both within a company or group of companies and also by entire industries. The future revision of ISO 9806 may be adopted by ANSI if it proves to be acceptable in its final form.	The future revision of ISO 9806 Standard will be adopted by CEN (that will be the future EN 12975-2) and this is the first step towards global certification. The certification bodies involved in the SKN are used to primarily working with EN or national standards, which are the ones used normally by the Industry in Europe.

5.2.2. Accreditation

Accreditation is a term that may be used indicating different types of approval in different areas of work. For those who are not familiar with the technical meaning of 'accreditation', it is often used to simply indicate 'approval'.

SRCC	SOLAR KEYMARK
The term **accreditation** has the same meaning as in Europe Certification bodies are accredited under the ISO 17065 standard and laboratories are accredited under the ISO 17025 standard.	Certification bodies and laboratories understand **accreditation** as the act of being evaluated against an accreditation standard by a third party. If compliance is achieved, then an accreditation certificate is awarded. Certification bodies will be accredited under the EN 45011 (which is being replaced by ISO EN 17065) standard and laboratories will be accredited under the ISO EN 17025 standard.
In the US it is possible to choose the accreditation body. For example, for laboratories there are about five accreditation bodies from which to choose. All of the laboratory accreditation bodies must be signatories to the Mutual Recognition Agreement (MRA) of the International Laboratory Accreditation Cooperation (ILAC). Certification bodies also have several accreditation bodies from which to choose.	In most countries there is only one accreditation body and this strongly affects the relationships. For example in Spain there is only ENAC, in France there is only COFRAC, whereas in Germany there is more than one (DKSS and....?) Accreditation bodies undergo peer auditing in the MLA.

5.2.3. Collectors and Systems

There is one case when we were using the terms collectors and systems for the same product!

SRCC	SOLAR KEYMARK
Collectors without storage are tested according to ISO 9806.	Collectors according to definition of EN 12975-1 and tested according to EN 12975-2
Collectors with storage (ICS and non-separable thermosiphon) are tested according to SRCC TM-1.	Systems according to definition of EN 12976-1 and tested according to EN 12976-2

5.2.4. Manufacturer, Collector class, Private labeling, OEM

SRCC	SOLAR KEYMARK
According to definitions in OG-100: **A manufacturer** is any corporation or division, any firm or person which performs at least one of the following functions with respect to solar collectors: 1-principle design of the product 2-producing in whole or part, including any substantial processing or assembling operation 3-continuously selling, in the open market under its own trade name in reasonable volume, a solar collector. Manufacturer also may mean a company that assembles, fabricates, and/or sells a solar collector that has been certified by another collector Collector class- collectors of similar design....examples are glazed flat plate, tubular, ICS **Private label** – a solar collector which has been SRCC certified and rated as produced by one manufacturer may also be sold by another manufacturer acting as licensee/private label manufacturer. A manufacturer can also private label themselves to sell their product under different brand names. Participant – the owner of the certificate. Is not necessarily a manufacturer. Test results from one model may be used to certify a **similar model** if all materials, part designs, and construction techniques are identical and the only difference is the size of the collector. Certain rules apply, but generally a tested flat plate collector can be sized down to one half or up to twice the tested size. Tubular collectors can be sized beyond these limits.	Although there is no definition of **manufacturer,** it will be used as the end producer of the collector. This means a manufacturer may receive certain parts already assembled, but is considered so when assembling the end product. **OEM-** A company different than the original manufacturer may be the license holder of a SKN certificate under its own name. There is a working group preparing a document to explain all possibilities. **License holder-** the owner of the certificate. Is not necessarily a manufacturer. **A family of collectors:** is defined by a group of collectors that have the same design but different sizes. Families and how they are tested is described in the Scheme rules. **Types and subtypes:** a term that is used mostly for feeing purposes. Different families are different subtypes.

5.3. COMPARISON OF CERTIFICATION SCHEME AND RULES

Here we compare the most important aspects of our certification schemes.

5.3.1. Main Procedure for Certification

SRCC	SOLAR KEYMARK
Explained in document: SRCC document OG-100 Operating Guidelines for Certifying Solar Collectors **Granting of Certificate:** During a first visit to the manufacturing site an inspection of the quality management system is conducted. Samples to be tested are selected by the SRCC approved test laboratory using either a physical visit or a remote process. Tests are conducted in accordance with SRCC Standard 100. SRCC reviews the test results and ensures resolution of all deficiencies. SRCC grants the certificate when all steps have been completed. **Follow up of certificate:** An inspection takes place every 2 years. This is a physical inspection of the collector along with the quality management processes related to production of that collector	**Explained in document:** Specific CEN Keymark Scheme Rules for Solar Thermal Products **Granting of certificate:** A first inspection visit to the manufacturing site. Samples are chosen by the inspector and sent to an SKN laboratory for testing. There is also a written procedure in the Scheme Rules for remote sampling, but it does not exclude the personal inspection visit from taking place. If all certification activities comply with the requirements the certificate is granted. **Follow up of Certificate:** An inspection takes place every year except if the company is ISO 9001 Certified, in which case it takes place every two years. Every two years, during inspection a physical inspection of product takes place. The procedure is documented in Annex A1, A2 and A3

5.3.2. Tests

SRCC	SOLAR KEYMARK
Collectors are tested according to ISO 9806 -1 (glazed collectors),-2 (some parts, applies to both types of collectors) and -3 (unglazed collectors). ASHRAE 93 is used for air heating collectors. (In the new version of ISO 9806 standard all of these tests are all put together in one part) SRCC Standard 300 for systems (a privately owned standard of SRCC)	Collectors are tested according to EN 12975-2 (The next version of this standard will be the same as the next version of ISO 9806.). Systems are tested according to d EN 12976-2.

5.3.3. Visits

SRCC	SOLAR KEYMARK
Inspections include both quality management system and physical inspections. The first visit is more ISO 9001. It establishes the capabilities of a manufacturer based on an assessment of its quality management system. The follow up visits are more product inspection visits, focusing on product conformity, identifying non-conformances, and evaluating complaint handling. Aspects of the quality management system relevant to the collector being inspected are also inspected.	Manufacturers must have a factory control system that can be defined as a quality system based on the ISO 9001 standard that covers their production line. Requirements are the same for initial and follow up visits. The requirements are described in Annex E of the Scheme Rules. The physical inspection test that takes place every two years is a detailed study of the components of the product to assure no changes have taken place. (Annex A2 of Scheme Rules) There is a common inspection report that must be used by all Certification Bodies. (Annex A1 of Scheme Rules) In practice, some certification bodies may carry out or have more stringent requirements for their own certification systems.

5.3.4. Certificate, Data base and Mark Ownership

SRCC	SOLAR KEYMARK
A product certificate is granted showing the certificate owner, company information, expiration date and a broad range of technical information, including the energy output under 15 operating conditions. It is 1 to 3 pages, depending on type of collector.	A product certificate is granted that will show the licensee (company owner of the certificate) and the production site. All certificates will explain briefly the certification procedure. As an annex to this certificate there is a data sheet containing technical information of the collector and calculated annual power output of four cities. This data sheet is common and defined in annex B1. Some certification bodies will annex the data sheet to the certificate, while others make a reference to numbered data sheet.
Certificates may be downloaded from SRCC website. The PDF shown on the screen is actually created from the SRCC database each time one is requested online.	The SKN has a database that is updated as the certification bodies send their data sheets (pdf files) to the SKN Secretariat.
Ownership of Mark: The owner of SRCC marks is SRCC. There are separate marks for the corporation, SRCC OG-100 certification, and SRCC OG-300 certification.	**Ownership of the Keymark:** The owner of the Keymark is CEN. Most certification bodies will also grant in parallel their own private marks.
Use of the SRCC mark by the license holder: Once SRCC certification is granted under SRCC OG-100 or SRCC OG-300 guidelines, the certification holder is granted the use the SRCC certification mark based on SRCC policies. Licenses must be renewed each year.	**Use of Mark by license holder**: The license holder may use the Keymark logo on the certified collectors (although not compulsory) and in commercial documentation.

5.4. COMPARISON OF REQUIREMENTS ON PRODUCTS

For both cases, basically the collector has to pass the tests and comply with follow up inspections.

5.5. COMPARISON OF REQUIREMENTS ON:

A global certification scheme will have to set minimum requirements on all of its operators. Therefore it is important to study these on both cases to see how different they may be.

5.5.1. Certification bodies

SRCC	SOLAR KEYMARK
SRCC is the only certification body that awards SRCC certification. SRCC's accredited to to ISO Guide 65 (which is being replaced by ISO EN 17065)	Certification bodies must be accredited by their accreditation body and submit the application to CEN. Accreditation must be according to EN 45011(this standard is being replaced by ISO EN 17065). The CEN Certification Board (CCB) will then study each case and award empowerment. Certification Bodies are then empowered bodies and may grant Keymark Certificates. CEN only empowers European Certification Bodies. Certification bodies must regularly attend SKN meetings.

5.5.2. Laboratories

For both cases, laboratories must be accredited to ISO 17025

SRCC	SOLAR KEYMARK
SRCC always carries out a first inspection of the laboratory. These inspections are performed by SRCC in accordance with the SRCC Testing Program Approval policy. Based on the lab visit, a recommendation is made to the SRCC Laboratory Approval Committee, who makes the final decision for granting approval.	All certification bodies will have a contract with laboratories. In some cases certification bodies may have some type of initial visit to the lab or certain requirements. The laboratories that are accredited and therefore may be recognized by any Certification Body are found on the SK Web page. Laboratories must attend the SKN meetings regularly.

5.5.3. Inspectors and inspector bodies

SRCC	SOLAR KEYMARK
Inspector body must be accredited to ISO 17021. There will be a contract with each inspection body. SRCC maintains oversight over the inspection process. A formal documentation package is provided to the inspection body. The inspector reports to SRCC who makes decisions about granting new, or maintaining existing, certifications based on the SRCC inspection policy and conformance requirements for certification.	Every certification body may differ a little bit. Inspection bodies will be accredited ISO 17021 or be involved directly in the EN 45011 accreditation of the certification body. Inspectors may be subcontracted. All certification bodies have requirements on the qualification of inspectors, but the procedures may vary. A working group for inspectors has been established within the SKN and they meet once a year but there is no obligation of attendance.

5.6. COMPARISON OF LEGISLATION AND SUBSIDIES

SRCC	**SOLAR KEYMARK**
There is a 30% federal tax credit and a federal Energy Star certification that require SRCC certification. Many states, cities, and utility companies (power suppliers) have incentive programs or installation requirements. Most of them require SRCC certification. Some require SRCC OG-300 system certification and some require just SRCC OG-100 collector certification.	Every country in Europe will have its own subsidy system and many countries have legal requirements for the use of solar thermal products. Some accept Keymark and some don't. Spain can be used as an example: The subsidy body requires a test done according to EN standard but also an ISO 9001 audit. At the same time the Spanish Technical Building Code requires for all new buildings to use solar energy in a determined percentage for heating water.

6. CONCLUSIONS

The European EN 12975-2 that defines the testing methods for solar collectors will be withdrawn and merged into the new revision of the standard ISO 9806 by the end of 2013 or in 2014 at the latest. Having a common world wide testing method, makes it seem like **the time is right** for the successful European Solar Keymark to lead the creation of a Global Certification for solar thermal products.

The research of this project has not proven this hypothesis to be wrong. Many certification schemes around the world are based on either the EN or ISO standard, so when they merge there will indeed be a unique testing method. However for ISO member standardization bodies there is no obligation to withdraw any other national standards that share the same scope as ISO standards. What this means that it is perfectly legal to have another national testing method for collectors besides ISO 9806. Therefore it is concluded that an effort could be made in communicating with Standardization bodies worldwide to assure that the new revision will be the only valid method used in each country.

The Solar Keymark has a sound infrastructure that has proven successful. However the research based on already existing global schemes has pinpointed very clearly **what needs to be improved or created for a global Mark**:

- A lot of work towards harmonization of the operators (certification bodies, laboratories and inspection bodies) must be done.
- There must also be a new infrastructure or framework for more operators to participate in an efficient manner.
- The 'think Global, Act Local' philosophy of Global G.A.P. seems very inspirational.
- The ownership of the Mark and the governance of its bodies must be worked out as the next steps.

The performance parameters of collectors are hard to evaluate by consumers (Whether administration, construction company or the final consumer). Certification by an independent third party of these performance parameters gives confidence to the consumer that there is really an adequate level of quality and helps the industry by setting fair playing rules for manufacturers. The research has shown that in many countries there are subsidy programs or legal requirements that set these rules through certification. Therefore certification in the solar thermal industry is common throughout the world. It seems very obvious that common testing methods and harmonized certification requirements will have a positive effect on industry and consumer.

However when we have discussed openly the question, **Who is interested in a Global Mark?** The answer is not so obvious. A very interesting point was set by the General Secretariat of ESTIF at the last SKN meeting when he declared that there is not really a true Global Market for solar collectors. There may be one or two global players yes, but markets are mostly locally driven. Let's not forget that the success of the Keymark was based on the need of a true European Market for tests being accepted and not repeated in every country.

It is clear for all that any steps in harmonizing testing and certification activities in a growing market should help improve the growth of industry. The situation in every country regarding subsidies, legal requirements or even the conditions of the market may vary significantly. Globalization may sometimes harm some companies/markets and help others. Whereas many companies are for harmonizing testing methods in order for everyone to 'speak' in the same technical language, it is not clear that all companies will want only one global Mark. There must be therefore a way for national quality marks or national legal requirements to live in harmony with one unique international quality mark. There is an important market growth in many parts of the world that seem to assure success for a global mark, as many companies grow and reach markets across frontiers. Having a real global market seems a real possibility in the near future. It is however in everyone's main interest that there is a **harmonization** in testing and certification procedures, and this **must be achieved in a way that does not harm the status quo**. A first step may be to create a global Mark, which can be called an "**Umbrella mark"**. In order to grant this mark, there must be a minimum of harmonized requirements to be fulfilled.

By harmonizing the test methods and certification procedures, manufacturers could reduce costs by several thousands of dollars and be assured that, once completed, the same test results used for the global certification mark would be honored by local certification organizations for their own marks.

With this idea we have set a calendar for a one year work plan that is meant to finish in March 2014 with the creation of a global network of operators with the goal of harmonizing testing and certification activities and that will recognize each other's work under an "Umbrella Mark".

7. PROPOSED COURSE OF ACTION

Taking into account all the conclusions and the work done by the working group, this is the proposed calendar of work for the next year

Step 1: March – June 2013

Make work plan for Task 43 extension:

Formulate work plan for IEA-SHC Task 43 extension "Solar rating and certification – focus on global collector certification" / JE - inputs from: Global Group (GG): Representatives from interested IEA-SHC countries + SKN WG + ESTIF

Approval of work plan for IEA-SHC Task 43 extension "Solar rating and certification – focus on global collector certification" / ExCo

Step 2: June – August 2013

Preparing for Kick-off meeting 30/9 in Berlin:

- Make initial draft proposal for **Organization Framework** for a global solar collector certification scheme / JE – inputs from GG
- Make initial draft proposal for **Internal Working Rules** for "Global Solar Certification Network" / JE – inputs from GG
- Make initial draft proposal for **Certification Scheme Rules** for a global solar collector certification scheme / JE – inputs from GG
- Call for candidates for board members, chairman and secretariat of the " GSN - Global Solar Certification Network"

Step 3: September 2013

Kick-off meeting 30/9* in Berlin:

- Discuss draft proposal for **Organization Framework** for a global solar collector certification scheme
- Discuss draft proposal for **Internal Working Rules** for "Global Solar Certification Network"
- Discuss draft proposal for **Certification Scheme Rules** for a global solar collector certification scheme
- Establish (informally) **"Solar Certification Network", (SCN)** – board of directors, chairman, secretariat
- Establish relevant work groups on
    - Certification mark name and logo
    - Economy / fund raising (UN, IRENA, ...)

  - Legal matters (establishing formally a legal entity, copyright on mark)
  - Web site
  - Mission of SCN
  - Plan for promotion and implementation of global mark

- Decide on date and place for next meeting (March?)

*) *The date* 30/9 2013 *is proposed because it is just in between the ISO TC* 180 *meeting in Freiburg* 26-27/9 *and SKN meeting in Berlin* 1-2/10 *(and the international SHC*2013 *conference is in Freiburg* 23-25/9*).*

Step 4: October 2013 – March 2014

Finalize documents and work in work groups:

Finalize draft proposals for Internal Working Rules and Certification Scheme Rules

Make final draft proposal for mark name and logo

Raise money for at least registration of a legal entity and copyright on mark

Be ready for registration of legal entity and mark

Final draft of mission of SCN

Draft action plan for promotion and implementation

Publish draft website

Step 5: March 2014

2nd meeting of SCF May be combined with the next SKN meeting

Approve Internal Working Rules and Certification Scheme Rules

Approve mark name and logo

Approve registration of legal entity and mark

Approve mission of SCN

Discuss/revise first action plan for promotion and implementation

Step 6: March 2014 -

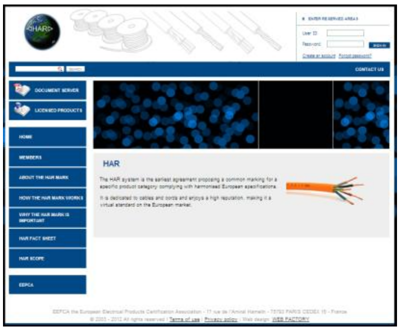
Focus on promotion and implementation.

ANNEX 1
LINKS FOR MORE INFORMATION ON CCA, ENEC, HAR AND

For more information on the CCA, please visit: http://www.eepca.eu/dev/page.php?p=3

For more information on ENEC, please visit: http://www.enec.com/dev/page.php?p=2

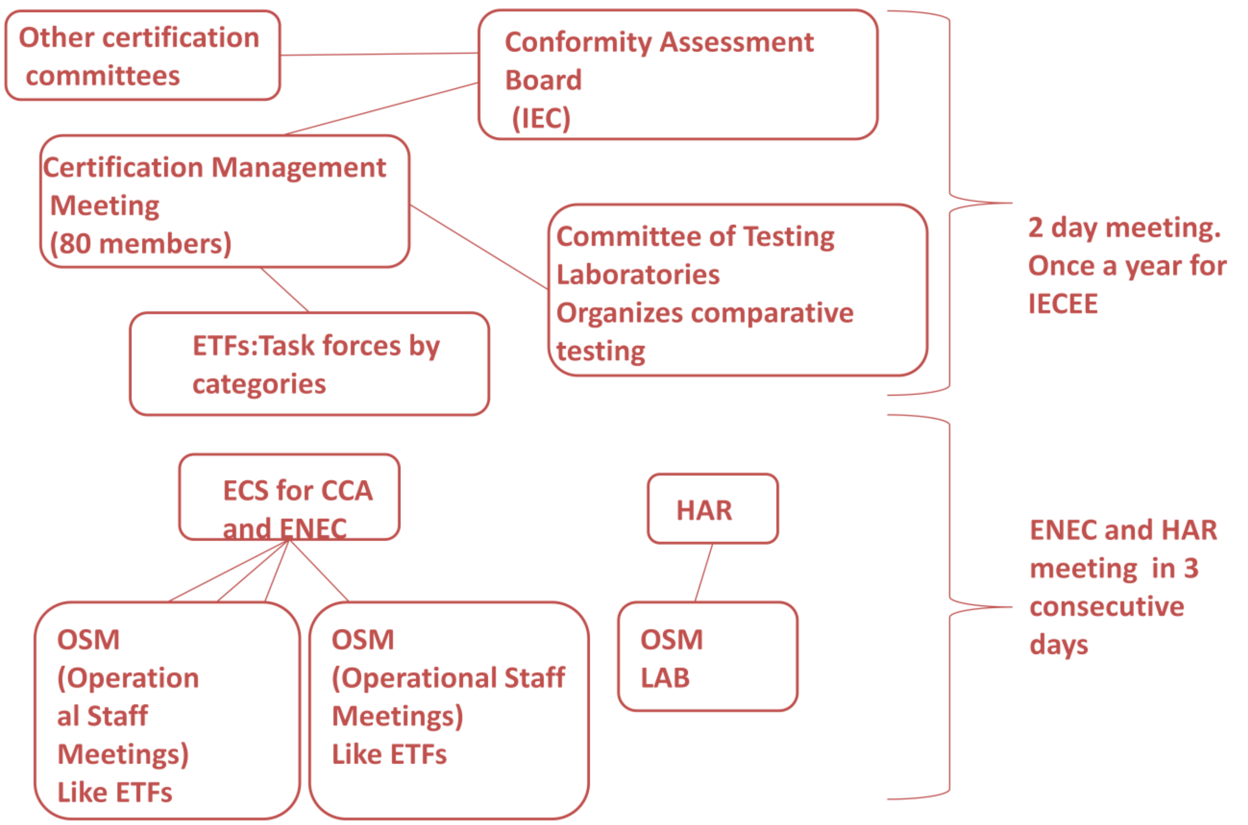
For more information on HAR, please visit: http://www.eepca.eu/dev/page.php?p=6



For more information on IECEE, please visit: http://www.iecee.org/

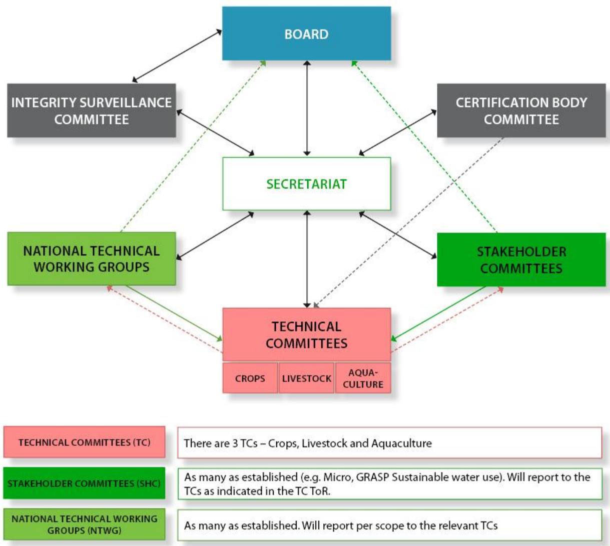
ANNEX 2

INFRASTRUCTURE OF GROUPS FOR CCA, ENEC, HAR AND IECEE



ANNEX 3

INFRASTRUCTURE OF GLOBAL G.A.P



Board is formed by 8 members, elected suppliers and retalires. Works closelv to Secretariat

Secretariat gives support to all committees and activities: 6 to 8 people committed to database (if you are not there, you are not certified), Integrity Program, training, meetings, translation of documents etc...Based in Cologne with freelance professionals throughout globe

Technical Committees develop standards and documents. Have to be a member to participate.

National Technical Working Groups. Think Global-Act Local attitude: national committees that

Stakeholder Committees develop very specific issues. Experts that will develop and resend documents to TCs for approval. Have to be a member to participate

Certification Body Committee

Integrity Surveillance Committee

More information can be found at:

- General web information: www.globalgap.org

ANNEX 4

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