

SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

UTILISATION OF ISO9806:2013 IN GLOBAL SOLAR CERTIFICATION

A REPORT FOR IEA SHC TASK 43 SOLAR RATING AND CERTIFICATION



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EnergyAE

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Summary

ISO 9806 *Solar energy - Solar thermal collectors - Test methods*, the international standard for testing solar thermal collectors, was first published in 1994. Since that time there have been advances in technology, resulting in a need for the standard to be updated. This update was completed in 2013. The thirty three member nations of the European Committee for Standardisation (CEN) have adopted ISO 9806:2013.

This study investigates the likelihood that ISO 9806:2013 will be adopted in other countries around the world. To determine this, a survey which received 63 responses from 30 countries was conducted. Respondents were asked how likely their countries were to adopt the standard and what, if any changes could be made to the standard to improve it.

Sixteen countries outside of the CEN membership were identified as having reasonably large solar market size and were targeted by this study as they are large contributors to the world's solar market. Responses were received from thirteen of these countries, many of which suggested alterations to ISO 9806 in order to increase the likelihood of adoption in their country.

These results will be used to inform the next revision of ISO 9806.

Table 1 – Summary of results collected on the sixteen target countries

Country	TOTAL ¹ [MW _{th}]	World Market share [%]	ISO TC180	SHC	Contact on TC180 list?	Contact through SHC	Contact on solar heat world wide list	Changes recommend	Questionnaire responses received	Likely uptake
China	40320	83.89%	P	Y	Y	Y			3	50%
Brazil	721	1.50%		N					2	50%
India	707	1.47%	P	N		Y			1	
Australia	702	1.46%	P	Y	Y	Y		Clearer description to avoid misinterpretation, and stagnation temperature	4	33%
United States	672	1.40%	P	Y	Y	Y		Clearer description to avoid misinterpretation	1	100%
Israel	261	0.54%	P	N		Y		Some additional tests or requirements needed	3	100%
Mexico	189	0.39%	O	Y	Y	Y			0	
Japan	117	0.24%	O	N		Y		Similar to another standard	4	50%
South Africa	91	0.19%	P	Y	Y	Y			1	
Canada	89	0.19%	P	Y	Y	Y		Air Collectors, Editorial Corrections & Clearer description to avoid misinterpretation	3	50%
Taiwan	78	0.16%		N					1	
Tunisia	51	0.11%	P	N		Y			3	100%
Jordan	48	0.10%		N					1	
Lebanon	42	0.09%		N					0	
Korea, South	38	0.08%	O	N		Y			0	
Barbados	?	?	P	N		Y			2	100%

¹ From Solar Heat Worldwide, Weiss and Mauthner 2014

IEA Solar Heating and Cooling Programme

The Solar Heating and Cooling Programme was founded in 1977 as one of the first multilateral technology initiatives ("Implementing Agreements") of the International Energy Agency. Its mission is

*To enhance **collective knowledge** and **application** of solar heating and cooling through **international collaboration**.*

The members of the Programme collaborate on projects (referred to as "Tasks") in the field of research, development, demonstration (RD&D), and test methods for solar thermal energy and solar buildings.

A total of 53 such projects have been initiated to-date, 39 of which have been completed. Research topics include:

- ⤴ Solar Space Heating and Water Heating (Tasks 14, 19, 26, 44)
- ⤴ Solar Cooling (Tasks 25, 38, 48, 53)
- ⤴ Solar Heat or Industrial or Agricultural Processes (Tasks 29, 33, 49)
- ⤴ Solar District Heating (Tasks 7, 45)
- ⤴ Solar Buildings/Architecture/Urban Planning (Tasks 8, 11, 12, 13, 20, 22, 23, 28, 37, 40, 41, 47, 51, 52)
- ⤴ Solar Thermal & PV (Tasks 16, 35)
- ⤴ Daylighting/Lighting (Tasks 21, 31, 50)
- ⤴ Materials/Components for Solar Heating and Cooling (Tasks 2, 3, 6, 10, 18, 27, 39)
- ⤴ Standards, Certification, and Test Methods (Tasks 14, 24, 34, 43)
- ⤴ Resource Assessment (Tasks 1, 4, 5, 9, 17, 36, 46)
- ⤴ Storage of Solar Heat (Tasks 7, 32, 42)

In addition to the project work, there are a number of special activities:

- SHC International Conference on Solar Heating and Cooling for Buildings and Industry
- Solar Heat Worldwide – annual statistics publication
- Memorandum of Understanding with solar thermal trade organizations

Members

Australia	Italy
Austria	Mexico
Belgium	Netherlands
China	Norway
Canada	Portugal
Denmark	RCREEE - <i>Sponsor</i>
ECREEE - <i>Sponsor</i>	Singapore
European Copper Institute - <i>Sponsor</i>	South Africa
European Commission	Spain
Germany	Sweden
Gulf Organization for Research and Development - <i>Sponsor</i>	Switzerland
Finland	United Kingdom
France	United States

Further information:

For up to date information on the IEA SHC work, including many free publications, please visit www.iea-shc.org.

Background

The adoption of an international standard for the testing of performance and quality is desirable as it can enable new products to reach a global market without duplicating testing in each individual country. This lowers the barrier to entry and enables more innovative, lower cost options to grow the industry to be competitive with other technologies (Ping, 2011). In 1994, ISO 9806 was published to provide a common method for testing of the most common solar heating collectors at the time. This was adopted in part or whole by many countries but did not include many of the durability and reliability tests required in many national standards. Since then, there have been many advances in technology, and testing experience, and therefore the new ISO 9806 was published in November 2013 to include these innovations.

This study presents the results from a survey to determine the likelihood of adoption of this new standard in the main global markets. Beyond the adoption of the standard, a Global Certification program that certifies compliance to the new standard has been proposed by IEA SHC's Task 43 (Neilsen, 2014).

The European Committee for Standardisation (CEN) is the only regional standards body that has confirmed it will adopt the standard in full at this stage. If ISO 9806:2013 *Solar energy - Solar thermal collectors - Test methods* is to be the basis of Global Certification it requires countries with significant market size to adopt it. A target list of 16 countries that have a reasonable market size and the option to adopt the standard was developed. As the CEN member countries are all required to adopt ISO 9806 these countries are not included in the target list. The CEN member list includes the 28 European Union Countries, the Former Yugoslav Republic of Macedonia, and Turkey plus three countries of the European Free Trade Association (Iceland, Norway and Switzerland) (European Committee for Standardization, 2014).

A questionnaire was developed for global survey of suitable persons to answer the following research questions

1. Is it likely that countries outside Europe will take up the new standard?
2. Are there any improvements required for countries to take adopt it?
3. Are there any other improvements that may be necessary or desired to improve the Standard?
This question was relevant for all countries including European countries.

The questionnaire

A questionnaire was developed to ask 19 questions covering general information such as, their identity, qualifications to represent their country, status of their standards body, testing laboratories, certification companies, and more specifically their understanding of the intention of their country's standards body to adopt the standard, and any changes needed to the new standard.

The survey was opened on 23 July 2014 and closed at the end of August 2014 receiving a total of 63 responses.

A list of the questions is shown below. The exact format and presentation of questions as well as potential answers appears in appendix 1.

1. Are you able to comment on behalf of your country about the possible adoption of ISO 9806-2013 Solar thermal collectors - Test methods?
2. Can you suggest another person within your country who could be contacted about this matter?
3. Does your country have a Mirror Committee for ISO Standards Committee TC180 and/or a National Standards committee that provides Solar Heating testing Standards
4. Are you a member of that committee?
5. Can you provide a Contact for the Committee?
6. Does your country currently have any National standard for solar heating collector test methodology?
7. Does it incorporate the same methods as international standards such as EN 12975 or ISO 9806?
8. Does your country currently recognize other solar heating collector test methodologies such as EN 12975 or ISO 9806?
9. Is it likely that your country will take up ISO 9806:2013 as a National Standard or recognize it for purposes such as Regulations and/or Certification?
10. What changes would need to be made in order for your country to adopt ISO 9806-2013 as its standard solar heating collector test methodology?
11. Are there any changes to ISO 9806 that you consider would improve that Standard?
12. Please outline the changes? (If insufficient space, email additional information to ken.guthrie@setransformation.com.au)
13. Please outline the changes? Answer broken into categories 10 when given from LG
14. Does your Country have a certification system for solar collectors?
15. Please provide a contact or a website for further information on the certification system
16. Is there a solar heating industry trade association in your country? If so, please identify and give contact details.
17. And website address for the Trade Association?
18. Are there test laboratories in your country that test solar collectors? If so, please provide contact details or website address?
19. Please add any other comments.
20. Your contact details?

Target Countries

The survey was distributed through the mailing list for ISO TC180 "Solar Energy", and list of data providers to Solar Heat Worldwide (Weiss and Mauthner 2014). It was intended that the industry leaders on these lists would pass the survey to all relevant contacts in their country. Given the number of responses, this seemed effective in distributing the survey.

Of particular interest were countries that may adopt ISO 9806 and have a reasonable share of the world's solar market. The list of target countries then comprised of the 16 countries next largest solar market share. These countries in order of market share are;

- China
- Brazil
- India
- Australia
- United States
- Israel
- Mexico
- Japan
- South Africa
- Canada
- Taiwan
- Tunisia
- Jordan
- Lebanon
- Korea, South
- Barbados

Results

The survey had 63 valid respondents from a total of 30 countries responding, including 13 of the 16 "target countries". Of the target countries, only Mexico, Lebanon and South Korea were not represented in responses. Responses represented over 90% of the world's market (Weiss and Mauthner, 2014).

While some of the responses were incomplete in some sections, the majority of responses were completed and many findings can be drawn from the results. There were a number of multiple entries and invalid results due to erroneous entries, these were removed. A number of the respondents did not include their country of origin, only 38 out of 63 valid responses gave their country. For other countries, the IP address of the respondent was used to geo-locate where the form was completed **Error! Reference source not found.** below shows the proportion of countries that respondents to the survey are based, while figure 2 shows the location of each country that received responses

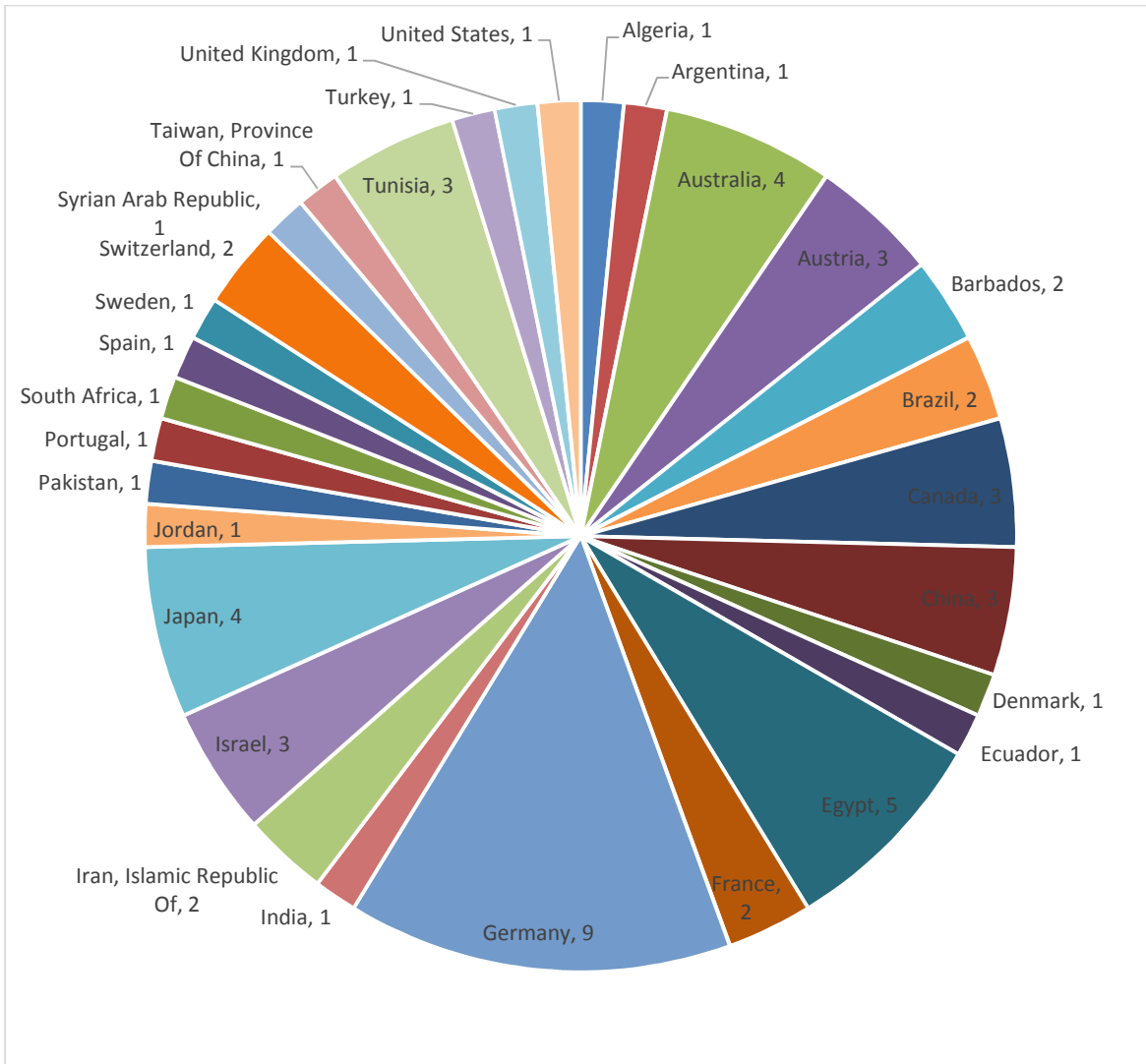


Figure 1 - Number of responses in each country



Figure 2 - Countries with responses

Likelihood of uptake

One of the key results expected of the survey is to develop an understanding of how likely it is that ISO 9806:2013 will be adopted in countries outside of the CEN. Of particular importance are the countries identified earlier as "target countries" which have a reasonable market share.

To calculate the likelihood of uptake respondents were asked *"Is it likely that your country will take up ISO 9806:2013 as a National Standard or recognize it for purposes such as Regulations and/or Certification?"*. Respondents were given four options to answer, "Yes", "No", "Not sure" or "Don't know". "Yes" was given a weighting of 1, "No" a weighting of 0, "Not sure", 0.5 and "Don't know" responses were removed from the analysis. Once the results were tallied a weighted average was calculated for each country.

Figure 3 shows the likelihood of uptake for all of the countries with respondents, while figure 4 shows the likelihood of uptake for only the respondents of target countries.

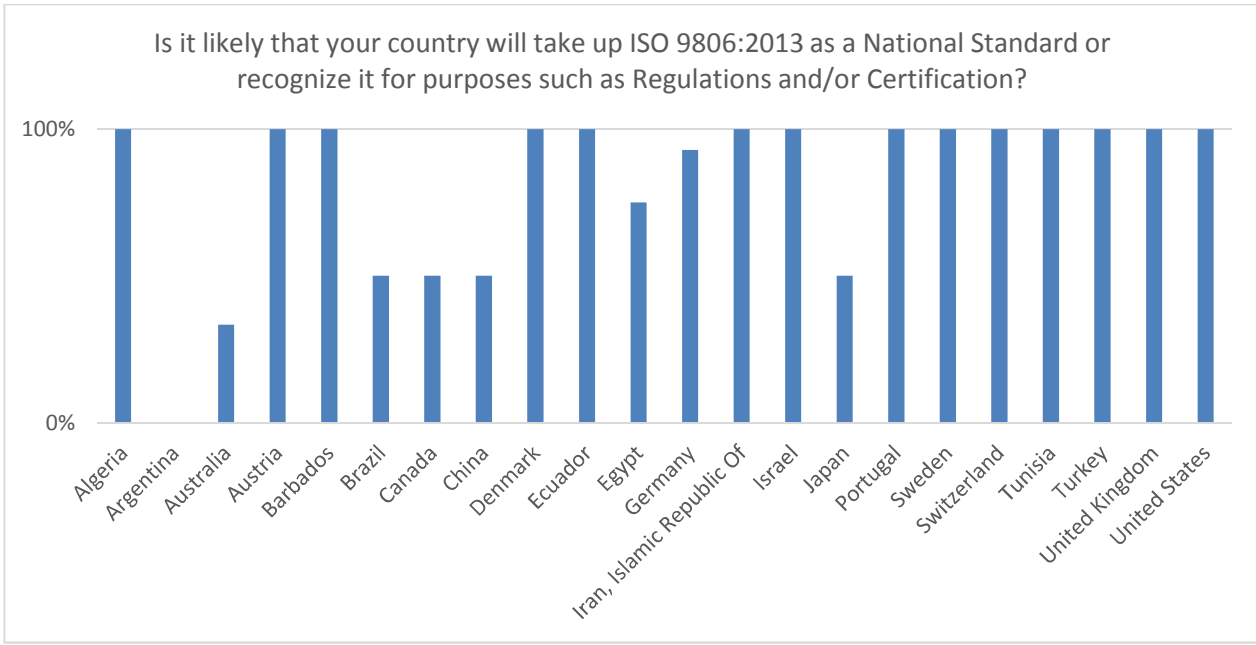


Figure 3 - The percentage likelihood that ISO 9860 will be adopted in each country with responses.

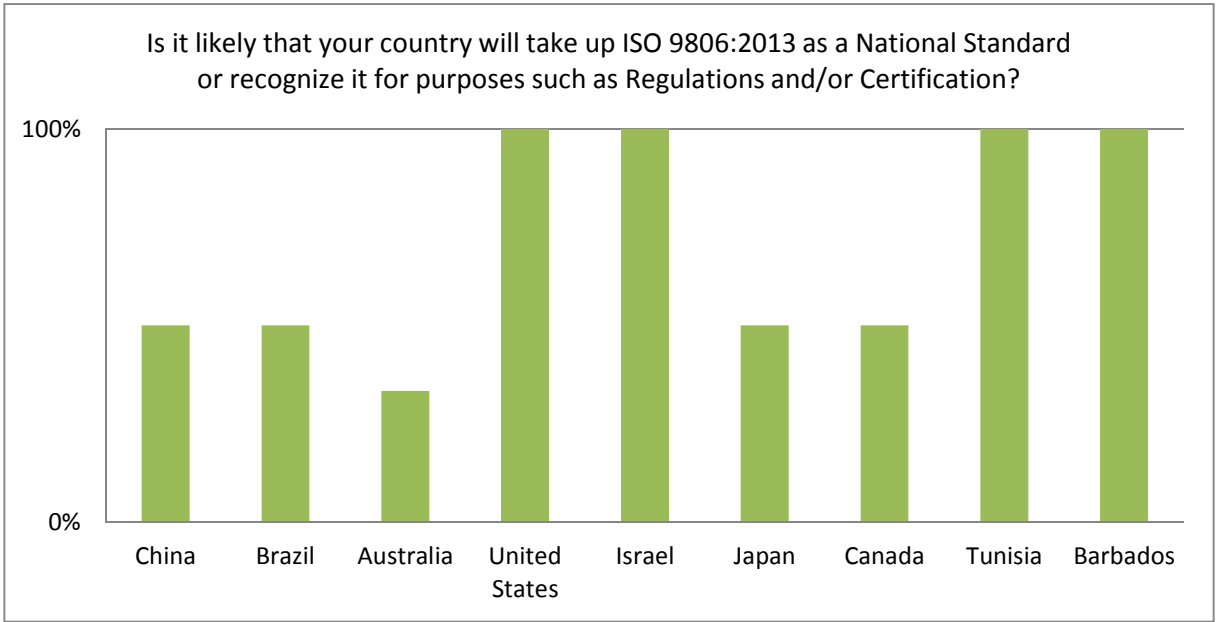


Figure 4 - The percentage likelihood that ISO 9860 will be adopted in each targeted country with responses to this question.

Figure 4 shows that in four out of nine of the targeted countries, that had respondents to this question, 100% of respondents consider it likely that ISO 9806 will be taken up. While China and three other of the target countries 50% of the respondents think that it likely and 50% consider it unlikely. Australia is the only one of the target countries that most respondents believe it is unlikely that ISO 9806 will be adopted.

Improvements required

Another key result from the survey is what improvements the respondents believe can be made to ISO 9806 or what changes they believe are needed in order for ISO 9806 to be taken up in their country. There was two questions where respondents were asked to answer these questions;

- Question 10. What changes would need to be made in order for your country to adopt ISO 9806:2013 as its standard solar heating collector test methodology?
 - Changes to the current document?
 - Changes with your Country's standards or certification processes?
 - Other (please specify)
 - This response then opened a box for an open ended response
- Question 11. Are there any changes to ISO 9806 that you consider would improve that Standard?
 - Yes
 - This response allowed the respondents to complete question 12, an open ended response that asked "Please outline the changes?"
 - No

Please note a copy of the full survey can be found in Appendix 1.

Appendix 2 features a list of all the open ended responses to questions ten and twelve.

Figure 5 shows the responses from respondents based in target countries.

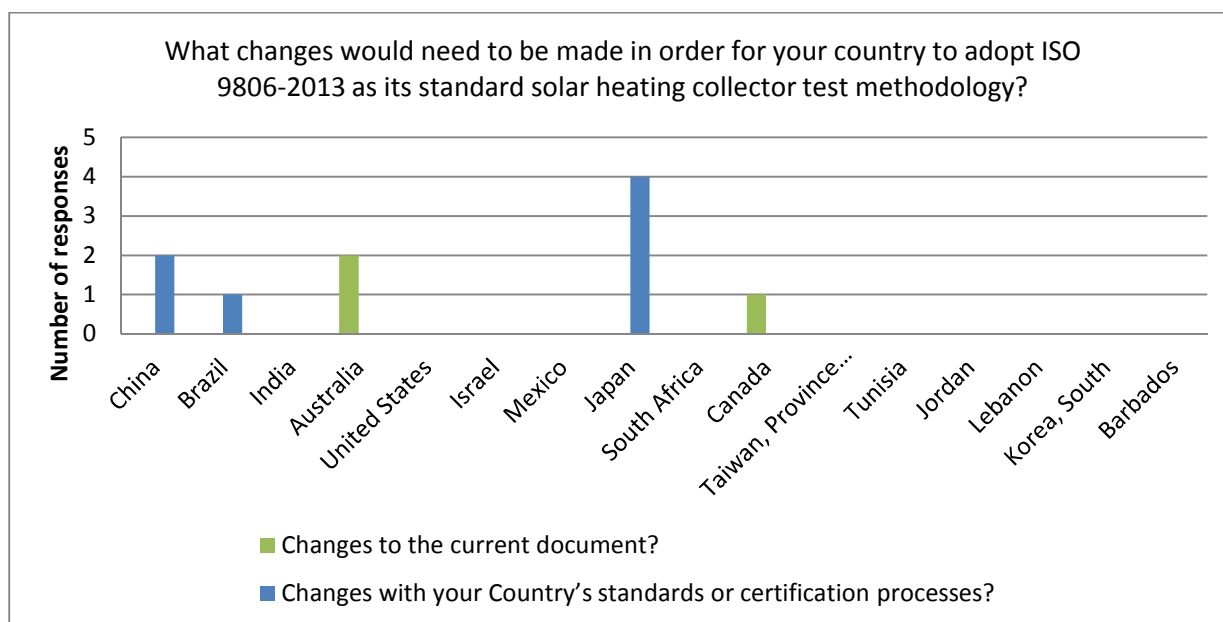


Figure 5 - Response from target countries for the question "What changes would need to be made in order for your country to adopt ISO 9806:2013 as its standard solar heating collector test methodology?"

Figure 5 shows that the targeted countries with responses to the question "What changes would need to be made in order for your country to adopt ISO 9806:2013 as its standard solar heating collector test methodology?". China, Brazil and Japan believed that changes to their Country's standards or certification processes were needed in order for ISO 9806 to be adopted. However, Australia and Canada believed that there needed to be changes to ISO 9806 in order for it to be adopted in their country.

In order to aid analysis, the responses to question twelve, specifying a "yes" answer to the question "Are there any changes to ISO 9806 that you consider would improve that Standard?" were categorised into six broad themes and responses recorded against them. If a respondent mentioned more than one theme in their response, all themes mentioned were recorded. If respondents did not specify the changes, a response of "Not specified" was recorded. These results were compiled along with the "no" responses to create Figure 6 and Figure 7 which show these results for all the countries and for only target countries respectively.

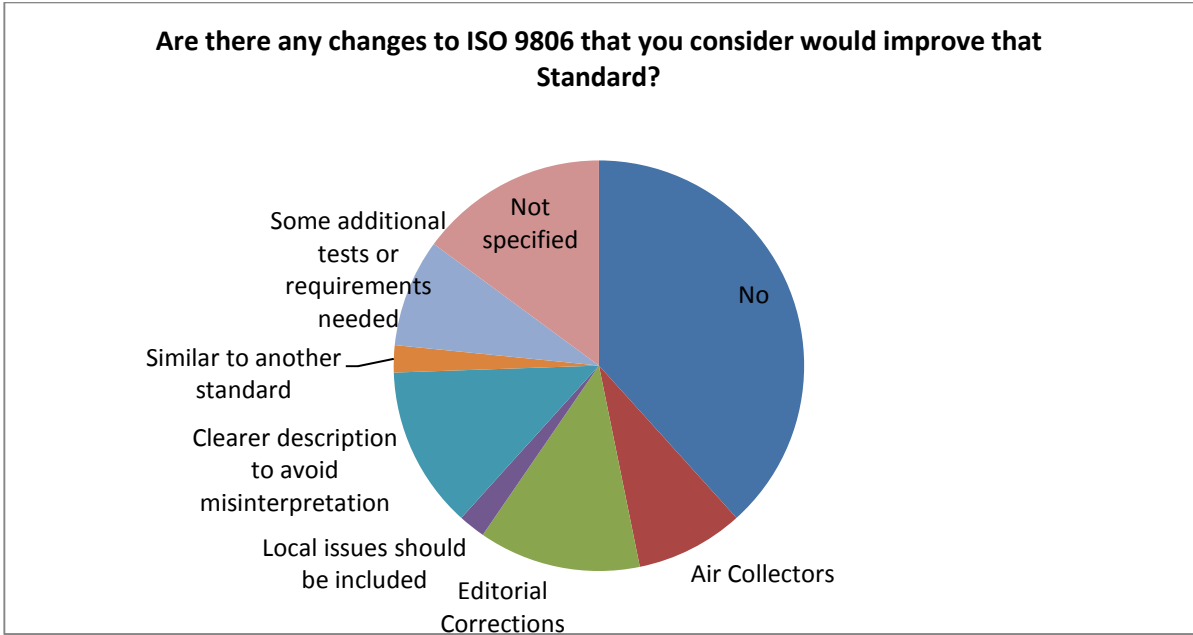


Figure 6 - Changes that would improve ISO 9806 summarised for all countries with responses.

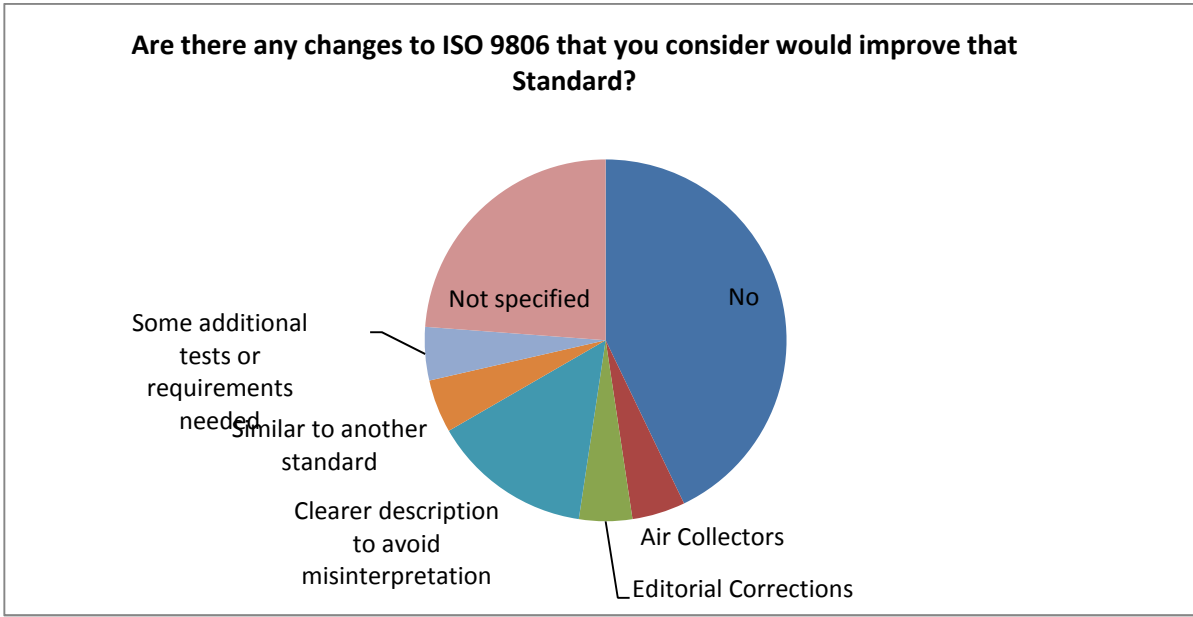


Figure 7 - Changes that would improve ISO 9806 summarised for only targeted countries with responses.

As is shown the main changes required from the respondents in both all countries and targeted countries are clearer descriptions.

The responses from the target countries have been gathered in Table 2. Table 2 compares the responses with the same respondents believes of whether ISO 9806 will be adopted by their country and their country.

**Table 2 - Responses to how ISO 9806 needs to be improved from only targeted countries.
(Please note that a full list of responses can be seen in Appendix 2)**

Responses to Question 10. <i>What changes would need to be made in order for your country to adopt ISO 9806:2013 as its standard solar heating collector test methodology?</i>	Country	Will ISO 9806 be adopted in your country?
Stagnation testing is not adequate for Australian conditions.	Australia	No
Since the Canadian test methods for air-heating collectors currently in CSA-F378.2 were adapted into ISO 9806:2013, we are now closer than ever to being harmonized with ISO 9806:2013. Having said that, there are a number of edits that should be made to the existing ISO 9806:2013 to correct some things that we ran out of time to process before 9806:2013 was published.	Canada	Not sure
Responses to Question 12. <i>Please outline the changes? (Are there any changes to ISO 9806 that you consider would improve that Standard?)</i>	Country	Will ISO 9806 be adopted in your country?
The document needs to be written in a clearer fashion so that requirements and test methods are more rigorously specified.	Australia	No
The difference between ISO9806 and JIS A4112:2011 Solar thermal collectors™ is currently, examined. The results will be reported within two or three months. (JIS™ is Japanese Industrial Standards)	Japan	Not sure
We will send the proposed changes in a separate email as noted above.	Canada	Not sure
Main national deviations: - Organic collectors (UV degradation tests) - specific structural requirements - Minimum energy efficiency requirement (43%)	Israel	Yes

Other information Gathered

Several other questions also show interesting results which can aid our understanding of the current situation regarding adoption of the standard in each country. This information will be able to assist in help us understand which countries need most assistance in developing standardised procedures. The responses from each country were collated, when contradicting answers from two different respondents from the same country were given, the results were analysed and the most likely answer was included.

These results have been recorded and shown in Table 3.

Table 3 – Summarised responses for each country with responses to the survey showing other information gathered by the survey

Please note:

An answer of "unknown" denotes either a response of "Don't know" or the question being left blank

^ indicates that there were multiple responses but a Yes or No was favoured over a Don't know.

* indicates a European Country that responded something other than Yes/Yes, this answer has been changed as there is a regional standard

+ indicates that there were multiple responses but a response from a member of a standards committee has been favoured

Country	Question 14. <i>Does your Country have a certification system for solar collectors?</i>	Question 6. <i>Does your country currently have any National standard for solar heating collector test methodology?</i> Question 7. <i>Does it incorporate the same methods as international standards such as EN 12975 or ISO 9806?</i>	Question 3. <i>Does your country have a Mirror Committee for ISO Standards Committee TC180 and/or a National Standards committee that provides Solar Heating testing Standards</i>
Algeria	No	Yes/Yes	Yes
Argentina	Yes	Yes/Yes	Yes
Australia	Yes	Yes/Yes	Yes
Austria	N/A	No	Yes
Barbados	No	Yes/No	No
Brazil	Yes	Yes/Yes	No
Canada	Yes	Yes/Yes	No
China	Yes	Yes/Yes+	Yes
Denmark	No	Yes/Yes	Unknown
Ecuador	Unknown	No	No
Egypt	No	N/A	N/A
France	Yes	Yes/Yes*	Yes
Germany	Yes	Yes/Yes*	Yes
India	Unknown	Yes/Yes	Yes
Iran	Unknown	Yes/Yes	Yes
Israel	Yes	N/A	Yes
Japan	N/A	Yes/No	N/A

Jordan	Unknown	Unknown	Unknown
Pakistan	Unknown	Yes/Yes	Unknown
Portugal	No	Yes/Yes*	Yes
South Africa	No	Unknown	Unknown
Spain	Unknown	Yes/Yes*	Yes
Sweden	Yes	Yes/Yes*	No
Switzerland	Yes^	Yes/Yes	Yes
Syria	Unknown	Unknown	Yes
Taiwan	Unknown	Unknown	Yes
Tunisia	No	Yes/No	Yes
Turkey	Yes	Yes/Yes	Unknown
UK	Yes	Yes/Yes	Yes
USA	Yes	No	Yes

Also considered of interest was the responses to question fifteen through to eighteen, asking respondent if there were trade associations and test laboratories in their countries and to provide details of each. Lists of trade associations and test laboratories have been compiled and can be seen in appendix 3 and 4 respectively.

Discussion

Respondents from nine out of the sixteen target countries gave responses regarding the likelihood that ISO 9806:2013 would be taken up in their country. From this information we can categorise the targeted countries into three sections, those with 100% of respondents thinking uptake was likely, those with 50% and those with 33%.

The USA, Israel, Tunisia and Barbados all had 100% of respondent answers that they thought it was likely that their country would take up ISO 9806:2013. One respondent from the USA and one from Israel thought that changes could be made to improve ISO 9806:2013, these changes requested greater clarity and the addition of some tests.

China, Brazil, Japan and Canada all had 50% of respondent answers that they thought it was likely that their country would take up ISO 9806:2013. Of these, Brazil, Japan and Canada had 100% of respondents unsure if ISO 9806 would be taken up, while China had one respondent answer "yes" and one answer "no". China is the most important of any country featured in this survey as they have 83% of the world's total solar collector market. China and Brazil both believed that the main barriers to the adoption of ISO 9806 was with their own countries procedures. Respondents from Canada on the other hand believed that changes needed to be made to ISO 9806 before it could be adopted by Canada, suggesting that there needed to be changes to air collector test procedures, there needed to be clearer description to avoid misinterpretation and that some editorial corrections were needed.

Japanese respondents showed somewhat contradictory results with all four respondents suggesting that the main barrier to adopting ISO 9806:2013 lay within their own countries procedures, but also believing changes were required to ISO 9806:2013. These seemingly contradictory opinions are likely because Japan has a similar standard, JIS A4112:2011 which is currently under review and is difficult to comment of the likelihood of ISO 9806:2013 being adopted until this review is completed.

Only one of the three respondents from Australia believed that it was likely Australia would adopt ISO 9806:2013. Responses suggest that this is largely due to Australian conditions being different to the most of the world, particularly Europe, which result in different requirements for testing, in particular the stagnation test. Australia also has a very good base with testing methodologies that incorporate many aspects of ISO 9806:2013 already in place, as well as a standards committee, trade association and multiple testing labs. These different conditions and good standards base as well as the opinion that the new standard is more open to misinterpretation, are likely the reasons that Australian respondents think it is unlikely ISO 9806:2013 will be adopted in its present form.

This survey information can be used to guide the future development of the standard, and the certification program. The contact details collected should be used to build relationships with the target countries.

Building an awareness of the standard and certification program in countries without any national standards, or certification program should become a focus. At present, we have focused on the target countries as these present the immediate use, however by incorporating the suggested alterations, other countries may also be more likely to adopt ISO 9806:2013 in the future.

Recent developments

ISO TC180 "Solar Energy" and the European Standards Committee CEN TC312 have decided to work together to revise the current standard to take into account the comments gathered in this questionnaire so that it will be more likely that the test standard will be adopted widely and be suitable to become the basis for a Global Solar Certification system.

The work will be undertaken as a joint project lead by CEN TC312.

Conclusion

In order for a Global Solar Collector Certification scheme to be realised it needs to be based on a widely adopted International Standard. The recently published standard ISO 9806:2013 *Solar energy - Solar thermal collectors - Test methods* could become the basis of a global scheme.

From this survey it appears that there needs to be some changes to ISO 9806:2013 to encourage wider adoption in some major international markets. The major changes required include some additional test methods, especially for air collectors and also additional clarity of test methodology to avoid misinterpretation by testing laboratories and certification bodies.

Work is beginning in the revision of ISO 9806:2013 to incorporate the comments and changes found through this survey.

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ISO 9806:2013 *Solar energy - Solar thermal collectors - Test methods*

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The Authors would like to thank the Australian PV Institute for making available the survey application.

Appendix 1 Survey Questions

Adoption of ISO 9806:2013 Solar Collector Test Methods

***1. Are you able to comment on behalf of your country about the possible adoption of ISO 9806-2013 “Solar energy – Solar thermal collectors - Test methods” ?**

Yes

No

2. Can you suggest another person within your country who could be contacted about this matter?

Name:

Company:

Country:

Email Address:

3. Does your country have a Mirror Committee for ISO Standards Committee TC180 and/or a National Standards committee that provides Solar Heating testing Standards

Yes

No

I don't know

4. Are you a member of that committee?

Yes

No

5. Can you provide a Contact for the Committee?

Name:

Company:

Country:

Email Address:

6. Does your country currently have any National standard for solar heating collector test methodology?

Yes

No

7. Does it incorporate the same methods as international standards such as EN 12975 or ISO 9806?

Yes

No

Adoption of ISO 9806:2013 Solar Collector Test Methods

8. Does your country currently recognize other solar heating collector test methodologies such as EN 12975 or ISO 9806?

- Yes
- No

9. Is it likely that your country will take up ISO 9806:2013 as a National Standard or recognize it for purposes such as Regulations and/or Certification

- Yes
- No
- Not sure
- Don't know

10. What changes would need to be made in order for your country to adopt ISO 9806-2013 as its standard solar heating collector test methodology?

- Changes to the current document?
- Changes with your Country's standards or certification processes?

Other (please specify)

11. Are there any changes to ISO 9806 that you consider would improve that Standard?

- Yes
- No

12. Please outline the changes?

(If insufficient space, email additional information to ken.guthrie@setransformation.com.au)

13. Does your Country have a certification system for solar collectors?

- Yes
- No
- Don't know

14. Please provide a contact or a website for further information on the certification system

15. Is there a solar heating industry trade association in your country? If so, please identify and give contact details.

Name:

Company:

Country:

Email Address:

16. And website address for the Trade Association?

17. Are there test laboratories in your country that test solar collectors? If so, please provide contact details or website address?

18. Please add any other comments.

***19. Your contact details?**

Name:

Company:

Country:

Email Address:

Appendix 2

Actual worded responses outlining changes

Table A2 - Responses to how ISO 9806 needs to be improved from all respondents.

Responses to Question 10. *What changes would need to be made in order for your country to adopt ISO 9806:2013 as its standard solar heating collector test methodology?*

All the requirements of the standard should be in a separated regulation. One for thermal efficiency, other for pressure resistance, etc. Also, instruments requirements should be adapted to national availability and calibration infrastructure.

Stagnation testing is not adequate for Australian conditions.

Since the Canadian test methods for air-heating collectors currently in CSA-F378.2 were adapted into ISO 9806:2013, we are now closer than ever to being harmonized with ISO 9806:2013. Having said that, there are a number of edits that should be made to the existing ISO 9806:2013 to correct some things that we ran out of time to process before 9806:2013 was published.

Responses to Question 12. *Please outline the changes? (Are there any changes to ISO 9806 that you consider would improve that Standard?)*

'- Separation of air collectors into an new standard. - I am Convenor of SK285 : There are many technical issues to be discused in the forthcoming revision. Regards Andreas

The certification of the standard should be local and not imported.

No specific suggestions at the moment

Will send e-mail

The document needs to be written in a clearer fashion so that requirements and test methods are more rigorously specified.

The difference between ISO9806 and JIS A4112:2011 "Solar thermal collectors" is currently, examined. The results will be reported within two or three months. ("JIS" is Japanese Industrial Standards.)

more detailed instructions for PVT

test methods part must be improved to avoid differences on values of labratories.

There are minor editorial changes needed. I will send e-mail.

Main national deviations: - Organic collectors (UV degradation tests) - specific structural requirements - Minimum energy efficiency requirement (43%)

We will send the proposed changes in a separate email as noted above.

1- rupture or collapse test (air heating collectors only)clause 8 2- standard stagnation temperature of liquid heating collectors

I would say there's more to do on air collectors as well as on PVTs but hopefully what is there already is good enough to support the entry of these two Technologies into the market. If they turn out to be doing good progress, new issues that need attention will come up, but I Believe there should be some significant market pull before you refine further. For the standard as a whole, I am afraid there are plenty of small mistakes that need to be corrected, but it is hopefully not too much work.

mechanical load test for tubular collectors

- mistakes at some equations for unglazed collectors - new definition instead of unglazed - Footnote d

Table 1: the rain penetration test shall be carried out for all collectors using insulation materials - reference irradiation $G=1000\text{W/m}^2$ for all kin

Appendix 3

Lists of Trade Associations

Table A3 – List of Trade Associations

Country	Trade Association	Website
Australia	Clean Energy Council	www.cleanenergycouncil.org.au
Austria	Austria Solar	www.solarwaerme.at/
Brazil	ABRAVA	www.abrava.com.br
Canada	CanSIA	www.cansia.ca
China	China Solar Industry Fedration	www.cstif.com
Denmark	Dansk Solvarme Forening	www.dansksolvarmeforening.dk
Ecuador	Servicio Ecuatoriano de Normalización	www.tramitesciudadanos.gob.ec/
France	ENERPLAN	www.enerplan.asso.fr
Germany	Bundesverband Solarwirtschaft	www.solarwirtschaft.de/
Japan	Japan Solar System Development Association	www.ssda.or.jp
Portugal	APISOLAR	www.apisolar.pt/
South Africa	SESSA	www.sessa.org.za/
Sweden	Solar Energy Association of Sweden	www.svensksolenergi.se/
Switzerland	Swissolar	www.swissolar.ch
Tunisia	Chambre Syndicale Nationale des Energies Renouvelables (CSNER)	www.csner-tn.com/
Turkey	Gunder	www.gunder.org.tr
UK	Solar Trade Association	www.solar-trade.org.uk/
USA	Solar Energy Industry Association	www.seia.org

Appendix 4

List of Test laboratories

Table A4 - List of Test laboratories

Test Lab	Country	Website
CDER	Algeria	www.cder.dz
INTI	Argentina	www.inti.gob.ar/
Laboratorio de Estudios Sobre Energia Solar	Argentina	untsolar@gmail.com
UNLU	Argentina	anahi_lanson@hotmail.com
UNRC	Argentina	www.ing.unrc.edu.ar
ANTL	Australia	www.antl.com.au/
Mech Lab Uni NSW	Australia	www2.mech.unsw.edu.au/content/labs_computing/Mechlab.cfm?ss=5
Uni South Australia	Australia	www.unisa.edu.au/Research/Barbara-Hardy-Institute/Testing-and-evaluation1/SEISC/
Vipac	Australia	www.vipac.com.au/
AIT (Austrian Institut of Technology)	Austria	www.ait.ac.at/
ASIC Austria Solar Innovation Center	Austria	http://www.asic.at/
Green Solar	Brazil	www.pucminas.br/green
IPT Instituto de Pesquisa Tecnologicas	Brazil	www.ipt.br
Exova	Canada	www.exova.com
HuBei Research Institute of Products Quality Supervision and Inspection	China	www.hbjzj.org.cn
Intertek Guangzhou	China	www.intertek.com/
National solar water heater testing center (Beijing)	China	he.tao@ymail.com
SDQI	China	www.sdqi.com.cn
Solar Testing	China	www.solar-testing.org
TÜV Rheinland - Shanghai	China	www.tuv.com/cn/greater_china/home.jsp
	China	zjymsh@163.com
AELab - Applied Energy Laboratory	Cyprus	www.mcit.gov.cy/
ITC 1004	Czech Republic	
Danish Technical University, Section for Building Physics	Denmark	www.bfi.byg.dtu.dk/english
National research centre	Egypt	www.nrc.sci.eg/
New & renewable energy authority	Egypt	www.nrea.gov.eg
Belenos	France	www.belenos.pro/
Centre Scientifique et Technique du Bâtiment (CSTB)	France	www.cstb.fr/
Fraunhofer-ISE	Germany	www.collectortest.com
ISFH	Germany	www.isfh.de/
		www.itw.uni-stuttgart.de/institut/abteilungen/tzs/
ITW-TZS	Germany	

IZES	Germany	www.izes.de/
TUV-Rheinland	Germany	www.tuv.com/de/deutschland/gk/anlagen_maschinen/klima_umweltschutz/umweltschutz.html
TZSB	Germany	www.izes.de/tzsb/
Demokritos	Greece	www.solar.demokritos.gr/
Albarubens	Italy	www.albarubens.it/
ENEA	Italy	www.trisaia.enea.it/componentisolari.htm
Eurofins	Italy	www.eurofins.it/
Istituto Giordano	Italy	www.giordano.it/
National Energy Research Center	Jordan	www.rss.io/page/753
CTCV	Portugal	www.ctcv.pt/
LNEG	Portugal	www.lneg.pt
TSU Piestany	Slovak Republic	www.tsu.sk/
CENER	Spain	www.cener.com/es/index.asp
INTA	Spain	www.inta.es/
ITC	Spain	www.itccanarias.org/web/
SP	Sweden	www.sp.se/en/Sidor/default.aspx
Hochschule fur Technik (HSR)	Switzerland	www.hsr.ch/
Institut fur Solartechnik (SPF)	Switzerland	www.spf.ch
CTMCCV	Tunisia	www.ctmccv.ind.tn
Research and Technology Centre of Energy	Tunisia	www.crlen.rnrt.tn/Accueil.php
Atlas	USA	www.atlas-mts.com
Florida Solar Energy Centre	USA	www.fsec.ucf.edu/
Intertek	USA	www.intertek.com/
LabTest Certification	USA	www.labtestcert.com/
NC Clean Energy Technology Center	USA	www.nccleantech.ncsu.edu/
TUV Rheinland - PTL	USA	www.tuvptl.com/