SOLAR HEATING & COOLING PROGRAMME
INTERNATIONAL ENERGY AGENCY

Task 48

Final Deliverable
Report on Labelling possibilities investigation

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IEA Solar Heating and Cooling Program

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 to reach the goal set in the vision of solar thermal energy meeting 50% of low temperature heating and cooling demand by 2050.*

The member countries 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 for 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 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
- Workshops and conferences
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Executive Summary

The work within the subtask C “Market support measures” is related to create a panel of measures to support the solar cooling market. These measures will use the results of Subtasks A “Quality procedure on component level” and B “Quality procedure on system level” and will above all explore the possibilities to identify, rate and verify the quality and performance of solar cooling solutions. The resulting tools are intended to provide a framework that will enable policy makers to craft suitable interventions (e.g. certificates, label and contracting etc.) that will support solar cooling on a level playing field with other renewable energy technologies. Even if the completion of these tools will not be achieved rapidly, the subtask should permit to initiate all and maybe conclude some of them.

From the past and present experience with labelling of solar systems (e.g. Solar Keymark, Blauer Engel, etc.) or “Green quality” labels such as LEED or Green Building Council tools, within the framework of Activity C5 “Labelling possibilities investigation”, existing labels as well as different standards for solar cooling and sorption heat pumps were investigated to create a Solar cooling label itself or (more probable) a specific Solar cooling extension(s) to the existing labels. This activity has mainly exploratory and firstly make a full state of the art of the labelling process, which could welcome the solar cooling technology on their scope. From these information’s, investigations on how to integrate them or even how to create an independent Solar Cooling Label were investigated and theorized if accurate.

1. Investigation of labelling possibilities

The state of the art of labeling possibilities was explored as well as the adaptation of building codes like LEED, GreenStar, DGNB, etc.

Furthermore, also standards were investigated to explore their usability for the proposed solar cooling labelling approach. In Australia the standard AS 5389 for small-scale standardized solar cooling systems is published based on the CTSS method. In Germany/Europe the EN 12309 for gas fired sorption appliances for heating and/or cooling is available, which could be adapted to solar cooling (using Part 5: Requirements and Part 1: Safety requirements).

A possible approach to develop a solar cooling label is to use the requirements of the EU Solar Keymark, then a minimum standard for solar cooling is defined ("Solar Cooling Keymark"). This approach is a system approach like for SolarCombi Systems.

2. Template structure on labeling possibilities

A template structure on the labeling possibilities (for EU and Australia, eventually USA) has been set up to ensure the quality measures for small (standardized systems) and medium/large (engineered systems). Subsequently two possible options for labelling a solar cooling system will be described in the following.

2.1. Option A: labeling based on components

Option A considers the default to achieve the "Solar Cooling Keymark" by building the soar cooling system with labeled components. The proposal is to rate the system in a certification process like existing labels, for example LEED, Green Star or DGNB. For structuring the certification workflow it is necessary to limit the labels that can be used for choosing the products. Because it concerns to be an international label, the most popular energy labels for technologies of each country or continent should be considered. To create a uniform system for choosing the products, get an overview about prices and the possible rating points of the system part, these data need to summarize in an online system where companies, planning companies and builder-owners can update and inform about the newest products and their performance and energy efficiency.

The rating of the products occurs by the existing testing and verifying methods of the existing labels, like Energy Star, EU Solar Keymark or Blauer Engel. To compare the products the criteria could be, for example, the performance, energy demand, broadly availability the carbon footprint in the manufacturing process and environmental compatibility of the working fuels. For each of this criteria the products get a reasonably amount of points which makes the comparison way easier. A chance for the manufacturers is to combine their products to packages that they know that they can reach an appropriate label.

To award the system could then be set by summarizing the points of each system part (Figure 1). As with certifications for buildings, some system components could get a stronger weighting. With it can be got to incentive to pay attention with certain components to a suitable assessment and to compensate more weakly valued components and to get, nevertheless, a high labelling. Similarly to persisting labeling methods, planners have to send their tables and the certificates of the chosen system parts and their fulfilled specific data to the "Solar Cooling Keymark"-company to get the certificate for the solar cooling system. The company not only proves the accuracy of the tables, they also prove the design of the components. There is no need to do this proving in a complex way. It is sufficient to do it in a rough computing to get a preliminary label. To get the final label the system has to be measured and accredited due the collected the performance of the system will be compared with the performance data of the previous design. Between these two data bases a set difference gives the answer if the solar cooling system keeps the preliminary label or will be lower rated or higher rated than before.

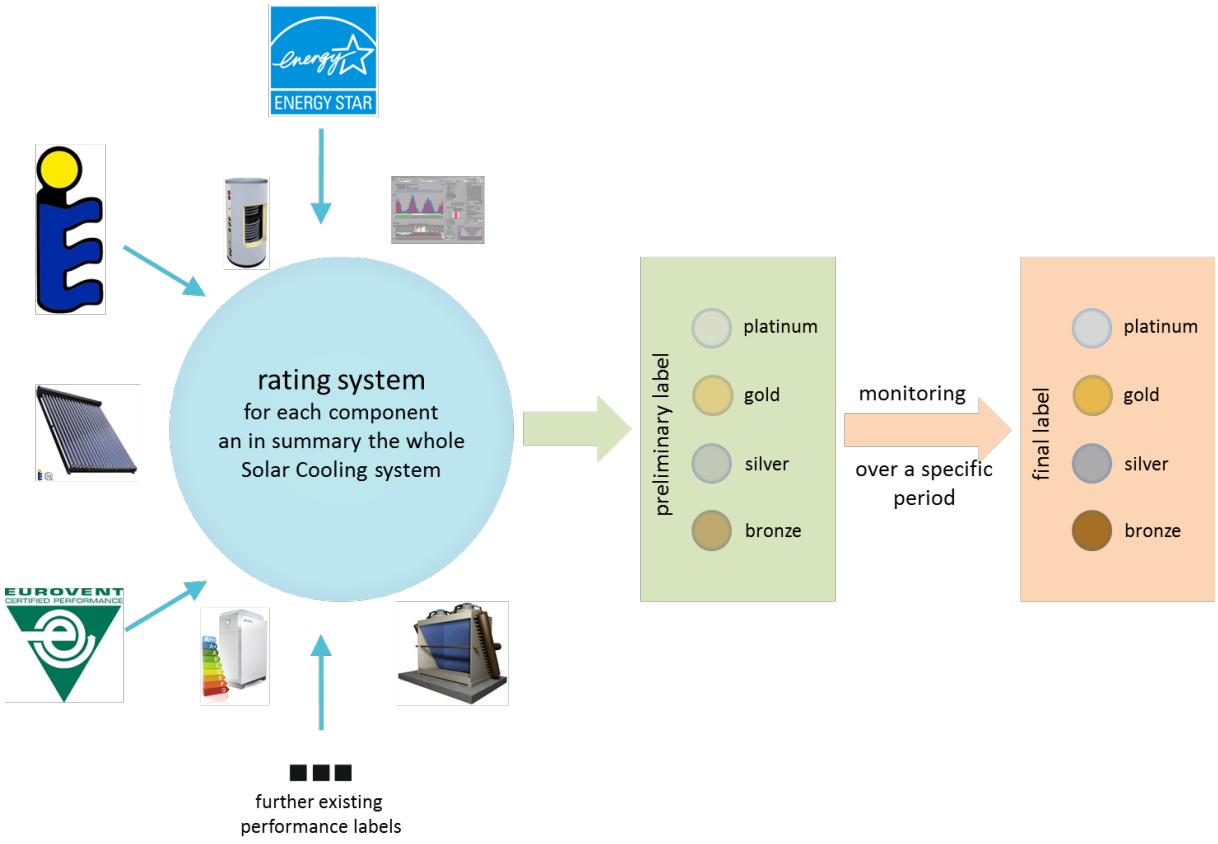

Figure 1: Labelling process of Option A (Source: JER)

2.2. Option B: labeling based on norms

Option B arranges another way to labelling a solar cooling system. Building up on computing methods and standards this way concerns a labelling of the system based on computed or simulated values. In Europe are different standard texts to design and rate HVAC-systems. The gap in these standards is the reference to systems of solar cooling. With the standards only different parts of a HVAC-system can be designed. To be able to apply these norms, nevertheless, to more and more frequently growing Solar Cooling systems a connection between the norms is essential (Figure 2). In reference to the existing European standards it should be possible to link different parts of several norms and prove the compatibility of each other. After that the missing parts that are necessary to design and rate a solar cooling system have to be formulated new.

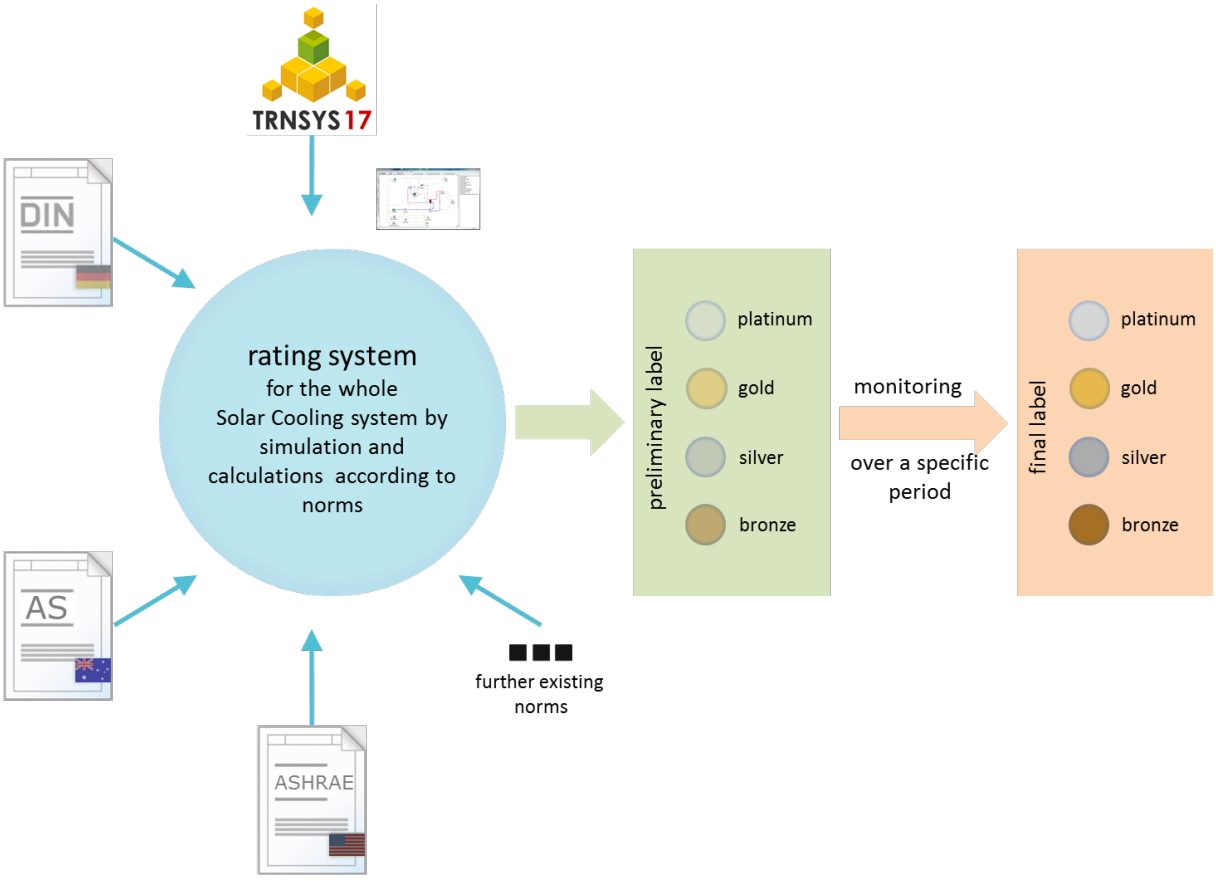

Figure 2: Labelling process of Option B (Source: JER)

The resulting computations can be done with wide spread computer software named TRNSYS in the CTSS (Component Testing System Simulation). This method is written down in the Australian norm AS 4238:2008 to simulate systems with solar water heaters. The approach is to extend this method to a solar cooling system before the installation to get exact information about the energy performance. Further there are a more norms for the method of testing for rating desiccant-based dehumidification

equipment (ANSI/ASHRAE Standard 174-2009), method of testing for rating utilizing heat for the regeneration process (ANSI/ASHRAE Standard 139-2007), Standard for absorption water chilling and water heating packages (ANSI/ARI Standard 560:2000) and desiccant dehumidification components (ARI 940-98). Based on that, this norm could be supplemented by miscellaneous excerpts of other international/European norms.

For it can be consulted German and European norms. The norm DIN V 18599 which handles with the calculation of the benefit, ultimate energy demand and primary energy demand for heating, cooling, airing, domestic hot water and lightning of buildings. It is used to certificate buildings with the EnEV-Label. The possible chapters of this norm are 2, 5 and 7 (Figure 3). Chapter 2 treats with the energy requirement for heating and cooling in building zones, chapter 5 deals with the energy demand of heating systems and chapter 7 engage with the energy demand of space air technology and climate cool systems, including sorption-chilling process. The next step should be to define a new chapter especially for Solar Cooling systems. That doesn't mean to invent the chapter completely new. To simplify the defining process elements of the existing chapters 2, 5 and 7 can be adopted. Additionally elements of the norm EN 12975 can be added. This Euro-norm deals with the design of thermal solar collectors and their components.

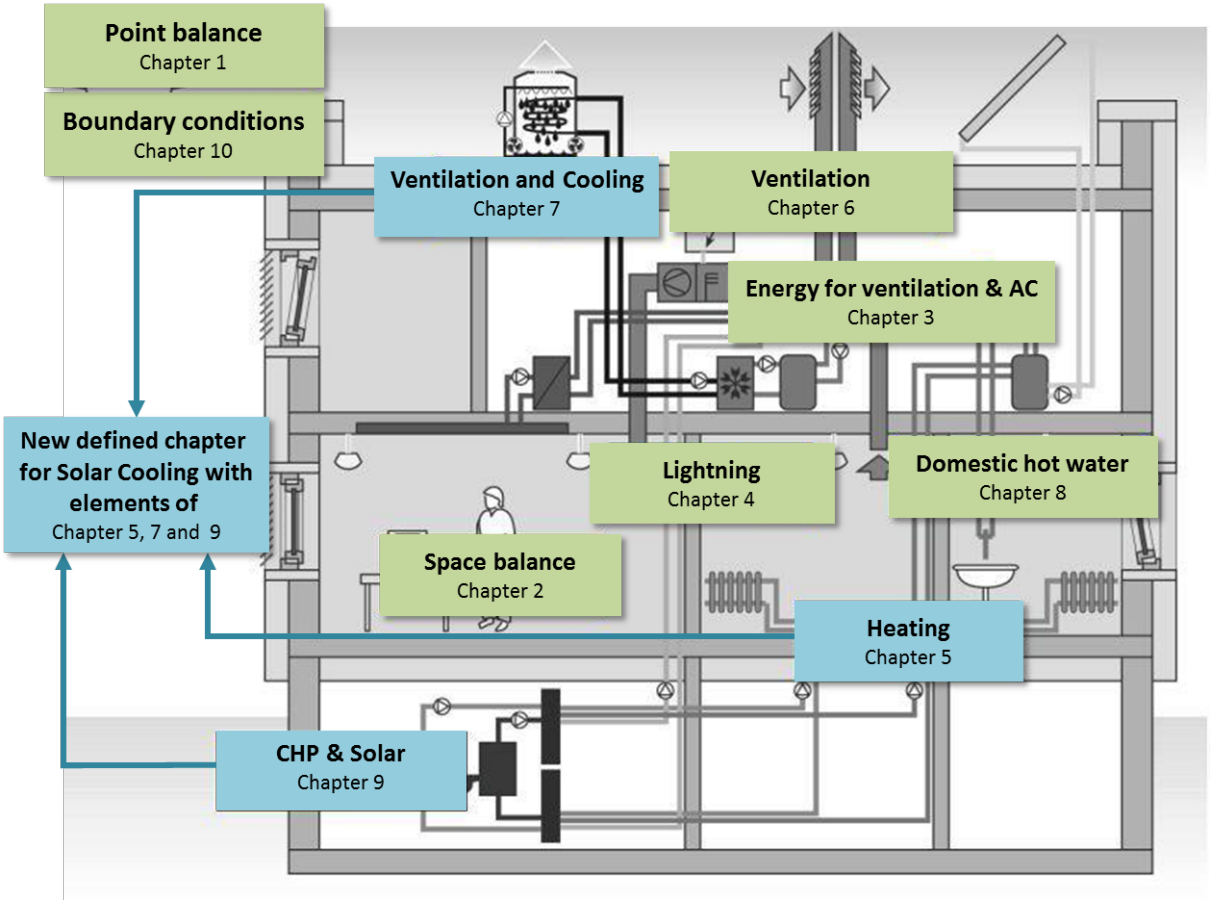

Figure 3: Elements of the DIN V 18599 that can be used for defining a separate chapter for Solar Cooling Systems (Source: DIN / JER)

3. Summary

The two presented options are different approaches to define a system for labelling of solar cooling systems.

Option A is a structured process, which is based on existing labels like:

- EU Solar Keymark
- Eco-design
- Energy Star
- eurovent
- … and further labels for components of Solar Cooling Systems

and use them to rate the different systems components. The results of the rating are summarized in a software program which gives a preliminary label of the system. The final label is given after testing the system by monitoring.

Option B is only based on existing and new defined norms. The content of existing norms can be used to define new chapters which are necessary to create a norm for Solar Cooling Systems. A selection of norms that can be applied are:

- EN 12975
- DIN V 18599
- AS 4238:2008
- … and other international norms

The labelling of option B is therefore adapted on calculations by norms and a given method of simulation the Solar Cooling System with TRNSYS (given by AS 4238:2008).

Bibliography

ANSI	American National Standards Institute
ARI	Air-Conditioning and Refrigeration Institute
AS	Australian Standard
ASHRAE	American Society of Heating, Refrigerating and Air-Conditioning Engineers
CTSS	Component Testing System Simulation
DGNB	Deutsche Gesellschaft für Nachhaltiges Bauen
DIN	Deutsches Institut für Normung
EN	Europäische Norm
Green Star	Rating system for building by the Green Building Council of Australia
HVAC	Heating, Ventilation and Air Conditioning
JER	dr. jakob energy research
LEED	Leadership in Energy and Environmental Design

Acknowledgements

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