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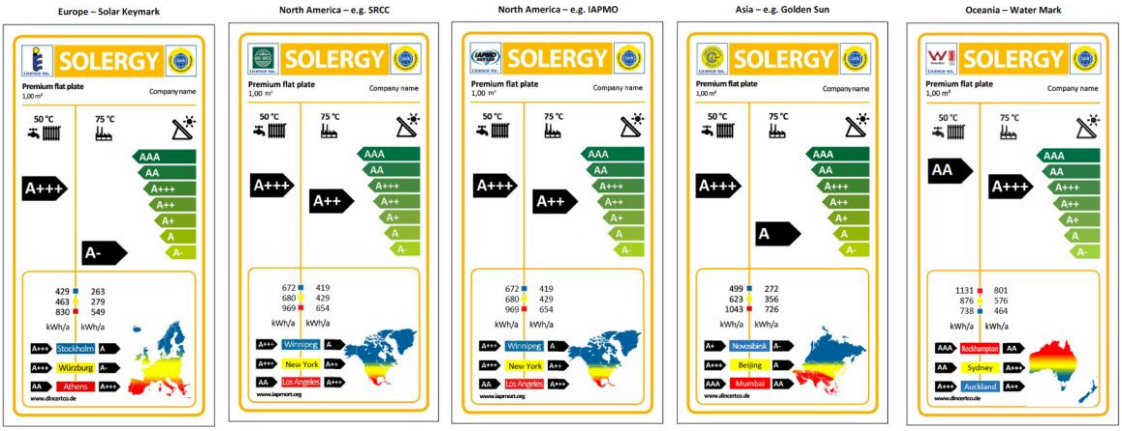

Certification Scheme

Collector Label SOLERGY

in cooperation with

Global Solar Certification Network (GSCN)

(2023-01-01)

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Foreword

There are many energy efficiency labels around nowadays. They tell the consumers how much energy products like refrigerators, washing machines, light bulbs, boilers and heat pumps use, or – in the best case scenario – how little. In Europe and other countires the ErP label for "energy related products", with categories ranging from green A to a red G, is one of the most well known.

Note: Classes from A+ to A+++ introduced in the meantime have already been or will be abolished again for the remaining product categories probably by 2026 at the latest by 2030.

The main objective is to save primary energy, thus reducing carbon emissions and costs. Since solar collectors are a different kind of heat generators because they consume practically no primary energy, they fall outside the typical energy labelling scheme. For the solar thermal industry, this meant no opportunity to show consumers that solar collectors are able to produce heat very efficiently without emitting CO_2.

Members of the solar thermal industry identified this threat and joined forces through the Solar Heating Initiative (SHI) to develop the collector label SOLERGY. It was launched in 2016 when DIN CERTCO adopted the voluntary scheme and issued the first labels in Europe. Since then, more and more well-known manufacturers have been applying for the SOLERGY label. In 2021, the Solar Heating Initiative (SHI) and the Global Solar Certification Network (GSCN) started an alliance to promote the SOLERGY label worldwide.

The SOLERGY label rates solar collectors according to how much heat is generated per collector area, differentiated according to different temperature levels and climate zones. Due to their special environmental and climate friendliness compared to the conventional primary energy-dependent heat devices, the scale of SOLERGY ranges from A- to AAA. The available space should be used in the best possible way. Therefore, the SOLERGY label classifies the area efficiency for a climate zone and also indicates the heat yield for a reference. Therefore, collectors with high specific yields receive better ratings.

The SOLERGY label increases transparency and consumer confidence in solar thermal collectors because it is linked to a valid collector certificate scheme such as Solar KEYMARK in Europe. This means that a neutral and competent body has carefully examined and assessed the product based on test criteria. Besides, third-party monitoring of the on-going production process, ensures that the quality of the product is maintained.

SOLERGY is a tool to make the potential contribution of solar collectors to an environmentally friendly and sustainably cost-effective heating supply more visible. This empowers consumers to make better choices based on transparent information. It also encourages manufacturers to continually improve their products to strengthen their competitiveness.

Collectors shall receive the SOLERGY label on meeting the requirements listed under Section 2 according to the procedure described in this certification scheme.

All label holders can be viewed on the regularly up-dated website of the Certification Body responsible for the registration or the website of https://solar-heating-initiative.com/solergy.

Start of validity

This certification scheme comes into effect on 2023-01-01.

Amendments

This certification scheme differs from the certification scheme “Collector Label SOLERGY” (2021-12) as follows:

a) Global SOLERGY collector label created, to include North America, Asia, Oceania in addition to Europe

b) Additional label design for single low temperature level: 25 °C – swimming pool

c) Additional label design for two temperature levels: 25 °C – swimming pool and mixed temperature level 25/50 °C – low temperature space heating and water heating

d) Updated label design for single temperature level 50 °C now for two temperature levels: mixed temperature level 25/50 °C – low temperature space heating and water heating (planned for use in revised EU legislation) and 50 °C – medium temperature space heating and water heating

e) PVT label combining low temperature space heating/ water heating and electricity application mixed temperature level 25/50 °C – low temperature space heating and water heating electricity

f) Editorial changes

Previous Editions

Certification scheme “Collector Label SOLERGY” (2021-12)
Certification scheme “Collector output label” (2016-06)
Certification scheme “Collector output label” (2016-02)

CONTENTS

1 Scope

This certification scheme is applicable to solar thermal collectors certified on the basis of an ISO 9806 test along with the testing and registration specifications mentioned below, and meets all of the requirements for awarding the SOLERGY collector label.

The SOLERGY collector label applies to all continents of the world based on the local acknowledged certification scheme (see Annex F to Annex K). Only empowered Certification Bodies of the corresponding local certification scheme are authorized to issue the SOLERGY collector label under the condition of membership in the Global Solar Certification Network (GSCN, www.gscn.solar).

2 Testing and registration specifications

The following referenced documents are the basis for testing and SOLERGY registration. For dated references, only the edition citied applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

– ISO 9806:2017 “Solar energy – Solar thermal collectors – Test methods”
– This certification scheme
– The General Terms and Conditions of issuing Certification Body
– The respective schedule of issuing Certification Body

3 Testing (general Information)

For the performance of the tests required as the basis for the conformity assessment and registration of the products, the issuing Certification Body avails itself only ISO/IEC 17025 accredited testing laboratories for solar collectors to which it has awarded recognition. The involved testing laboratory should be member of GSCN.

4 Requirements for Certification Bodies (general information)

The registration is carried out by Certification Bodies, which have

– To be accredited according to ISO/IEC 17065, at least with the scope of solar collectors.
– To be member of GSCN as a Certification Body.
– To have issued valid product certificates for solar collectors according to a certification scheme (system 5 certification including on-site inspection) recognized by GSCN and utilizing testing in accordance with the ISO 9806 standard.
– To be signatory of a contract with DIN CERTCO as the owner of this certification scheme for granting the collector label SOLERGY according to this certification scheme and the specific continent.

The Certification Body is only allowed to grant the collector label SOLERGY which are certified by himself and for those continents where its own product certificate and certification scheme is valid for. For example a European Certification Body can only grant the SOLERGY label for Europe and based on a valid Solar KEYMARK certificate issued by himself.

For continents, where no certification scheme exists which is recognized by GSCN or if there is no Certification Body fulfilling the requirements mentioned above, other of those Certification Bodies can carry out the registration also for those products which they have not certified.

5 Registration

5.1 Application for registration

The applicant must submit the following documents to the issuing Certification Body of the specific continent:

– Application form for registration of the collector label SOLERGY in the original complete with legally binding signature.
– Valid Solar KEYMARK certificate, SRCC certificate or any other collector certificate based on a certification scheme acknowledged by GSCN.
– Filled Excel spreadsheet (template of Certification Body) for the collector certificate.

The applicant will receive from Certification Body, following receipt of the application, a confirmation of order with a process number and notes regarding the further course of the procedure and, as applicable, queries concerning any missing documents.

5.2 Conformity assessment

On the basis of the submitted documents, the issuing Certification Body conducts the conformity examination. To this end, an assessment is made with the check the energy output data with ScenoCalc and the registration with the output class.

Conformity examinations are based on a valid collector certificate, an error-free, acknowledged data sheet, and an error-free completed Excel spreadsheet. Should errors be detected, the applicant has to povide new corrected data sheets or Exel spreadsheets.

Conformity document per collector certificate on condition that at least the lowest performance class for the respective temperature level is achieved under the average climatic conditions of the continent:

– Collector yield data sheet for colder, medium and warmer climates of the respective continent for all applicable temperature levels including yield class of collector, specific yield per m^2 gross area, module yield, and annual efficiency.

– Two versions of the label with different temperature levels if applicable displaying: the continent, yield classes and label scale for applicable temperature level/application at average climate, the yield classes for the 3 climate zones, and the module yield for the 3 climate zones.

Additional Label versions with other temperature levels can be ordered if covered by the collector yield data sheet.

5.3 The registration and the right to use the label

After successful testing and conformity assessment of the submitted documents, the Certifcation Body conducts a registration and awards the right to use the collector label in conjunction with a corresponding registration number for the requested continent.

Furthermore, the Certification Body will create 2 labels by default according to the assignment in Annex C for the applicant.

5.4 Publication of the SOLERGY registration and rating

All label holders can be viewed on the regularly up-dated website of the Certification Body responsible for the registration or the website of https://solar-heating-initiative.com/solergy. Manufacturers, users and consumers use this research possibility for obtaining information on registered collectors.

5.5 Validity and alterations/amendments

The SOLERGY registration is granted for an unlimited period. Its validity is linked to the validity of the acknowledged collector certificate and the respective datasheet and ongoing compliance with the requrierments of the SOLERGY certification scheme (see also Sections 5.6 and 5.7).

The label holder is obliged to inform the Certification Body of all alterations to the product using the application form. Where the alterations result in changes to the technical specifications to the collector certification, the Certification Body shall also update the associated SOLERGY collector label. Fees may be assessed where changes to the SOLERGY label are necessary.

5.6 Suspension

The Certification Body may suspend the registration under specific circumstances (see also Section 5.7) for a limited period of time. The manufacturer will be informed in written form. During this time the manufacturer is not allowed to use the collector label.

5.7 Expiry

The right to use the SOLERGY collector label can expire if:

– The acknowledged collector certificate is withdrawn,

– Withdrawal of the SOLERGY label registration is requested by the manufacturer,

– The collector label is misused by the certificate holder,

– The requirements laid down in the SOLERGY certification scheme or its accompanying documents are not fulfilled,

– The certification or license fees are not paid on the due date,

– The prerequisites for the right to use the collector label are no longer fulfilled.

5.8 Liabilty

The SOLERGY label is issued and registered exclusively by Certification Bodies fulfilling the requirements of Section 4. A liability in any form is excluded by the author Stefan Abrecht and Solar-Experience GmbH.

Annex A General principles of the “SOLERGY” collector label

A 1 Calculation basis

a. Thermal efficiency

The criterion according to which the thermal efficiency of collectors is evaluated for the collector label is the annual thermal efficiency $\eta_{a,th}$. It is a performance parameter that indicates which share of the annual hemispherical irradiation sum H_{hem} in collector plane at a defined mean temperature level ϑ_m can be supplied as maximum thermal energy by a Solar Thermal (ST) collector for a specific climate zone (see paper “Annual efficiency- Easy understanding of collector performance”). Based on the calculations of the specific annual Gross Thermal Yield (GTY formerly called ACO = Annual Collector Output) with the simulation tool ScenoCalc the annual efficiency is determined using the following formula:

$$\eta_{a,th}(\vartheta_m) = \frac{GTY_{spec,a}(\vartheta_m)}{H_{hem}}$$

ScenoCalc stands for Solar Collector Energy Output Calculator. This free to use tool is a spreadsheet-based program for the calculation of annual solar collector energy yield. In the European Solar KEYMARK certification scheme both Gross Thermal Yield and annual efficiency η_a are reported in the datasheets.

b. Electrical efficiency

The criterion according to which the electrical efficiency of collectors is evaluated for the collector label is the annual electrical efficiency $\eta_{a,el}$. It is a performance parameter that indicates which share of the annual hemispherical irradiation sum H_{hem} in collector plane at a defined mean temperature level ϑ_m can be supplied as maximum electrical energy by a Photovoltaic Thermal (PVT) collector for a specific climate zone. Based on further developed and simplified calculations of the specific annual Gross Electric Yield (GEY) the annual electrical efficiency is determined using the following formula:

$$\eta_{a,el}(\boldsymbol{\vartheta_m}) = \frac{\boldsymbol{GEY_{spec,a}(\vartheta_m)}}{\boldsymbol{H_{hem}}}$$

According to the definition of GEY in EN 12975 and further simplifications, the annual electrical efficiency can be calculated to a good approximation independent of irradiation only as a function of the mean collector temperature and 3 collector parameters simplified as constant.

$$\eta_{a,el} = \frac{GEY_a(\boldsymbol{\vartheta_m})}{A_G \cdot H_{hem}} = \frac{P_{max}}{A_G \cdot 1000\frac{W}{m^2}} \cdot (K(50°) - 0{,}01) \cdot [1 + \delta \cdot (\upsilon_m + \Delta\upsilon_{cell} - 25°C)]$$

If the specific parameter values for the product to be labelled are not available, the following default values shall be used:

- Incidence angle modifier at 50°: K(50°) = 0,95
- Temperature compensation: δ = -0,005/K
- PV cell overtemperature: $\Delta\vartheta c_{ell}$ = 10 K

This results in the simplified equation, where P_{max} is the maximum power rating in W at STC:

$$\eta_{a,el} = \frac{P_{max}}{A_G \cdot 1000\frac{W}{m^2}} \cdot 0{,}94 \cdot [1 - 0{,}005 \cdot (\upsilon_m - 15\ K)]$$

Generally the value of the annual efficiency is calculated in % and rounded to the nearest integer.

A 2 Classification and denomination

The classification was set at 7 classes, analogue to the EU energy label. Due to the fact that solar collectors do not consume primary energy, it was decided by the Initiative Solar Heating that there should only be variations of the A class (AAA, AA-, A+++, A++, A+, A, A-). This provides a clear distinction from primary energy consuming appliances with classes A to G, as defined within EU Regulations. The width of the class levels was made relative to the width of the class levels of the EU Regulation of 2013 for heat generators, as they are also very suitable for differentiating between different technology levels for solar collectors (e.g. higher absorption and lower emissivity of absorbers, higher transmittance of glazing, better insulation etc.).

For the temperature levels from 25 °C up to 50 °C, the scale for low-temperature heat pumps was used, and for 75 °C the scale for heat generators such as gas boilers was used. To achieve the highest rating of AAA the benchmark of the annual efficiency value was set to 52 % for temperatures up to 50 °C and for 75 °C it was set lower to 45 % as the exergetic value is higher. In the average reference climate of Europe these values can be achieved for medium and high temperatures only with highest performing collectors with very good optical efficiency and typically vacuum insulation.

In warmer climates they can be achieved also without vacuum insulation. Thus the label gives a clear indication and distinction about the efficiency of different collector types at different temperature levels in different climate zones and assistance for customers but also indication for manufacturers.

The electrical efficiency rating followed the same procedure, with the highest class AAA set at 26 %. This is a value that will be achieved in the future by further improving silicon PV cells, and thus follows the idea of only awarding the AAA rating to products whose efficiency is close to the technical optimum. Currently (2022), the best PV modules are expected to just achieve a AA rating at ϑ_m = 25 °C.

Note: A more detailed derivation of the class division can be found in Annex L

Annex B Classification of solar collectors into label classes according their annual efficiency and its labelling requirements

Table 0-1 Thermal label classes of solar collectors at lower (25 °C) mixed (25/50 °C) and medium temperatures (50 °C)

Label class	Annual thermal efficiency $\eta_{a,th}$ in %
AAA	$\eta_a \geq 52$
AA	$45 \leq \eta_a < 52$
A+++	$37 \leq \eta_a < 45$
A++	$34 \leq \eta_a < 37$
A+	$32 \leq \eta_a < 34$
A	$30 \leq \eta_a < 32$
A-	$18 \leq \eta_a < 30$

Table 0-2 Thermal label classes of solar collectors at higher temperatures (75 °C)

Label class	Annual thermal efficiency $\eta_{a,th}$ in %
AAA	$\eta_a \geq 45$
AA	$37 \leq \eta_a < 45$
A+++	$29 \leq \eta_a < 37$
A++	$27 \leq \eta_a < 29$
A+	$25 \leq \eta_a < 27$
A	$23 \leq \eta_a < 25$
A-	$11 \leq \eta_a < 23$

Table 0-3 Electrical label classes of PVT collectors generally for all temperature levels

Label class	Annual electrical efficiency $\eta_{a,el}$ in %
AAA	$\eta_a \geq 26$
AA	$22 \leq \eta_a < 26$
A+++	$19 \leq \eta_a < 22$
A++	$17 \leq \eta_a < 19$
A+	$16 \leq \eta_a < 17$
A	$15 \leq \eta_a < 16$
A-	$9 \leq \eta_a < 15$

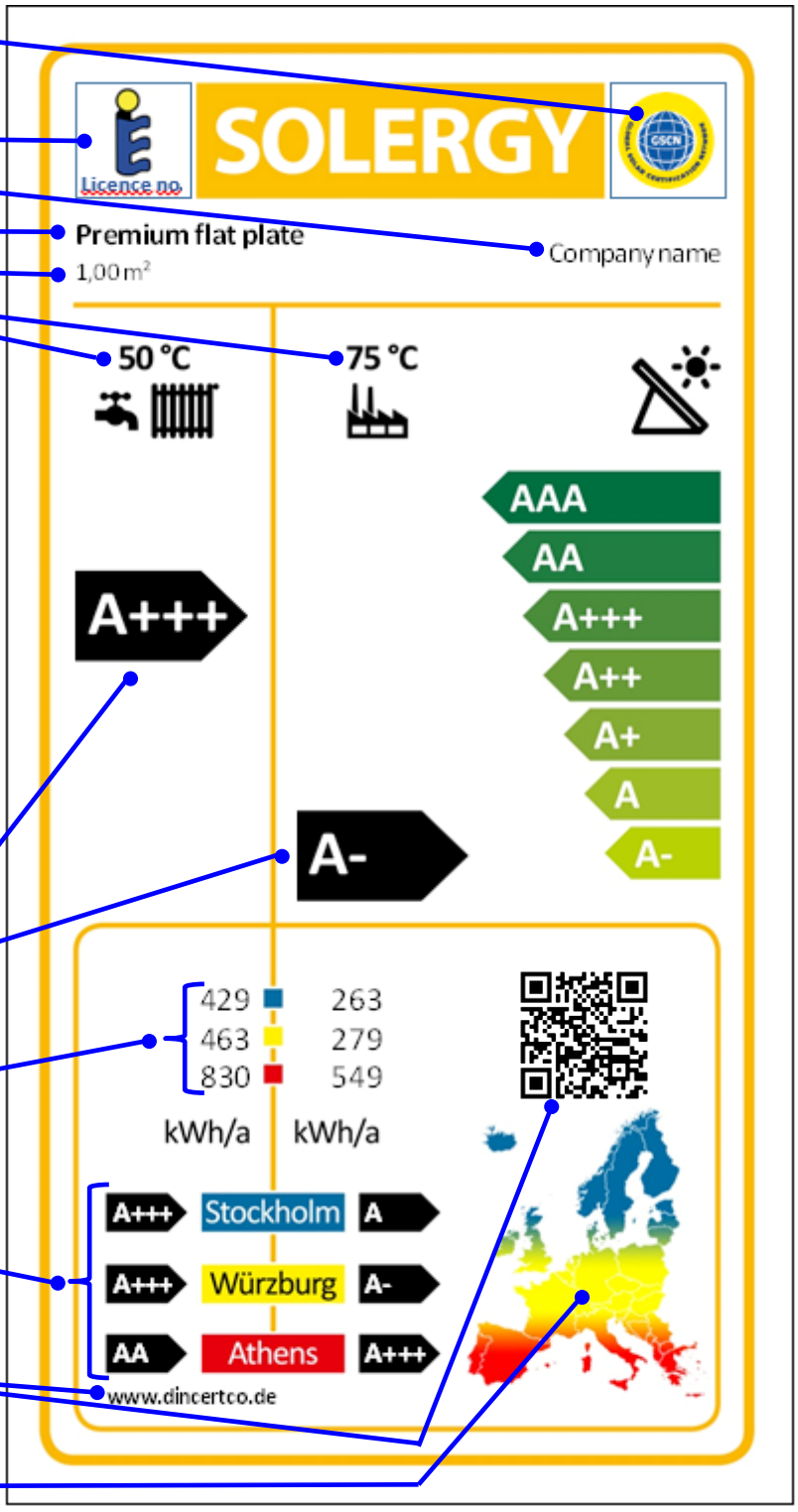
Requirements:
ST and PVT Collectors can only be labelled in a category if they achieve at least the lowest label class in the average climate zone. If under this condition no label class is achieved in another climate zone (e.g. colder climate), a classification for this category in this zone is omitted and only the yield value is presented.

Annex C General Design of the "SOLERGY" collector label

- Logo of Gobal Solar Certification Network
- Logo of Certification Body and license number
- Supplier´s name or trade mark
- Supplier´s model identifier
- Gross area of the collector module
- Designated temperature(s)
  25 °C, mix 25/50°C, 50°C, 75 °C
  and electricity (PVT only)
  + Icons of possible applications

- Swimming pool (25 °C)
- Low temperature space heating (< 35 °C)
- Medium temperature space heating (< 50 °C)
- Water heating (50 °C)
- Process heat (75 °C)
- Electricity (PVT only)

- Label classes at average climate for displayed temperature(s)
- Annual collector thermal yield GTY each at colder, average, and warmer climate for displayed temperature(s) and electric yield GEY (PVT only)
- Reference locations for the 3 zones and related label classes for displayed temperature(s) and electric yield GEY (PVT only)
- Website and QR code where the data base is to be found
- Map of continent displaying three indicative global solar irradiance zones



Annex D Collector label assignment

Most solar collectors are designed for specific temperature levels and applications. Therefore, up to 2 label types are assigned to the different collector types as standard, which are also issued if the respective minimum requirements are met. If the collector type is also intended for other additional applications and fulfils the requirements for classification, these labels can also be ordered for a fee. Permissible results are displayed on the yield data sheets in any case.

Table D-1 Standard and additional labels

Collector type	Label version/no. of categories										
	1x	2 x (combined)									
	25 °C	25 °C	25/50 °C	25/50 °C	50 °C	50 °C	75 °C	25 °C		25/50 °C	
Wind and infrared sensitive collectors (WISC)	x	(x)		-		-		-		-	
Flat plate collectors (FPC) and evacuated tube collectors (ETC)	(+)	(+)		x		x		-		-	
Photovoltaic thermal collectors (PVT)	-	-		(+)		(+)		x		x	

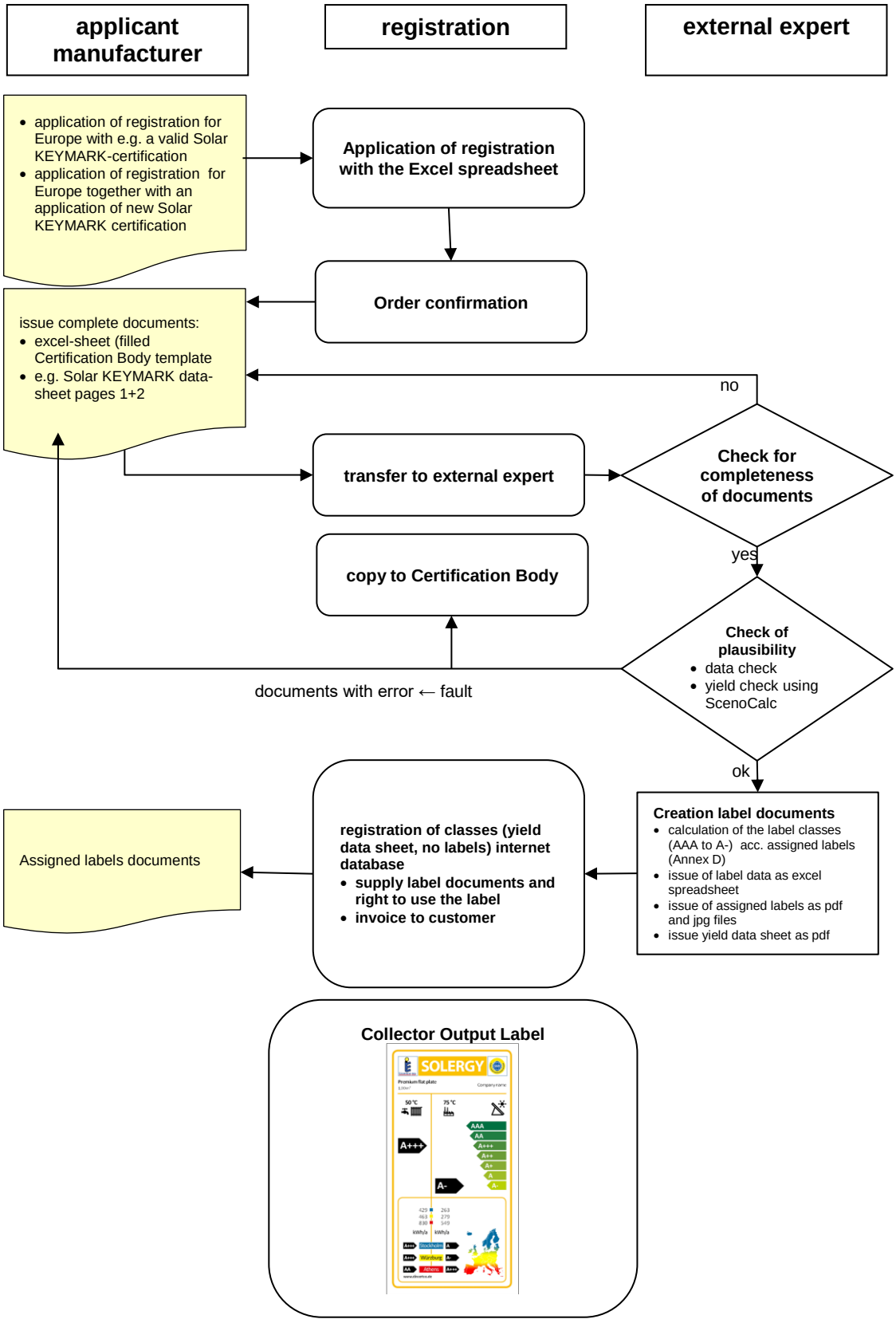
Key:

x = standard label assignment

(x) = standard label assignment if applicable

(+)= additional labels can be ordered at extra charge if applicable

Annex E Flow chart for registration with the Collector label



Annex F Design principles for the label "SOLERGY" Europe

Weather data	**Europe**		
Data file	SOLERGY-weatherdata-world_V.1.0.xls		
Source	(from Solar KEYMARK certification)		
Climate zone	colder	average	warmer
Spreadsheet	_Stockholm	_Würzburg	_Athens
Reference location	Stockholm	Würzburg	Athens
Latitude	59,4°	49,8°	38,0°
Longitude	-18,1°	-10,0°	-23,7°
Global irradiation G	979 kWh/m²	1095 kWh/m²	1607 kWh/m²
Annual average ambient temperature	Ø 7,5 °C	Ø 9,0 °C	Ø 18,5 °C
Collector tilt – fixed non tracking	45°	35°	25°
Hem. Irradiation fixed tilt	1166 kWh/m²	1244 kWh/m²	1765 kWh/m²
Hem. Irradiation E-W axis tracking	1268 kWh/m²	1318 kWh/m²	1955 kWh/m²
Hem. Irradiation N-S axis tracking	1408 kWh/m²	1444 kWh/m²	2386 kWh/m²
Hem. Irradiation - 45° tilt vertical axis tracking	1565 kWh/m²	1572 kWh/m²	2444 kWh/m²
Hem. Irradiation 2-axis tracking	1634 kWh/m²	1625 kWh/m²	2609 kWh/m²

Annex G Design principles for the label "SOLERGY" North America

Weather data	**North America**		
Data file	SOLERGY-weatherdata-world_V.1.0.xls		
Source	Meteonorm V. 7.3		
Climate zone	colder	average	warmer
Spreadsheet	_Winnipeg	_New York	_Los Angeles
Reference location	Winnipeg	New York	Los Angeles
Latitude	49,9°	40,7°	33,9°
Longitude	97,2°	73,8°	118,4°
Global irradiation G	1378 kWh/m²	1430 kWh/m²	1824 kWh/m²
Annual average ambient temperature	Ø 3,4 °C	Ø 12,2 °C	Ø 16,7 °C
Collector tilt – fixed non tracking	35°	25°	25°
Hem. Irradiation fixed tilt	1724 kWh/m²	1605 kWh/m²	2017 kWh/m²
Hem. Irradiation E-W axis tracking	1886 kWh/m²	1721 kWh/m²	2163 kWh/m²
Hem. Irradiation N-S axis tracking	1989 kWh/m²	1883 kWh/m²	2452 kWh/m²
Hem. Irradiation - 45° tilt vertical axis tracking	2262 kWh/m²	2032 kWh/m²	2598 kWh/m²
Hem. Irradiation 2-axis tracking	2388 kWh/m²	2113 kWh/m²	2715 kWh/m²

Annex H Design principles for the label "SOLERGY" South America

Weather data	**South America**		
Data file	SOLERGY-weatherdata-world_V.1.0.xls		
Source			
Climate zone	colder	average	warmer
Spreadsheet	in process	in process	in process
Reference location	in process	in process	in process
Latitude	in process	in process	in process
Longitude	in process	in process	in process
Global irradiation G	in process	in process	in process
Annual average ambient temperature	in process	in process	in process
Collector tilt – fixed non tracking	in process	in process	in process
Hem. Irradiation fixed tilt	in process	in process	in process
Hem. Irradiation E-W axis tracking	in process	in process	in process
Hem. Irradiation N-S axis tracking	in process	in process	in process
Hem. Irradiation - 45° tilt vertical axis tracking	in process	in process	in process
Hem. Irradiation 2-axis tracking	in process	in process	in process

Annex I Design principles for the label "SOLERGY" Asia

Weather data	**Asia**		
Data file	SOLERGY-weatherdata-world_V.1.0.xls		
Source	Meteonorm V. 7.3		
Climate zone	colder	average	warmer
Spreadsheet	_Novosibirsk	_Beijing	_Mumbai
Reference location	Novosibirsk	Beijing	Mumbai
Latitude	55,1°	40,0°	19,1°
Longitude	-83,1°	-116,3°	-72,9°
Global irradiation G	1160 kWh/m²	1369 kWh/m²	1839 kWh/m²
Annual average ambient temperature	Ø 3,4 °C	Ø 12,2 °C	Ø 27,4 °C
Collector tilt – fixed non tracking	40°	25°	25°
Hem. Irradiation fixed tilt	1516 kWh/m²	1540 kWh/m²	1936 kWh/m²
Hem. Irradiation E-W axis tracking	1669 kWh/m²	1634 kWh/m²	2033 kWh/m²
Hem. Irradiation N-S axis tracking	1694 kWh/m²	1664 kWh/m²	2265 kWh/m²
Hem. Irradiation - 45° tilt vertical axis tracking	1969 kWh/m²	1827 kWh/m²	2322 kWh/m²
Hem. Irradiation 2-axis tracking	2094 kWh/m²	1885 kWh/m²	2417 kWh/m²

Annex J Design principles for the label "SOLERGY" Africa

Weather data	**Africa**		
Data file	SOLERGY-weatherdata-world_V.1.0.xls		
Source			
Climate zone	colder	average	warmer
Spreadsheet	in process	in process	in process
Reference location	in process	in process	in process
Latitude	in process	in process	in process
Longitude	in process	in process	in process
Global irradiation G	in process	in process	in process
Annual average ambient temperature	in process	in process	in process
Collector tilt – fixed non tracking	in process	in process	in process
Hem. Irradiation fixed tilt	in process	in process	in process
Hem. Irradiation E-W axis tracking	in process	in process	in process
Hem. Irradiation N-S axis tracking	in process	in process	in process
Hem. Irradiation - 45° tilt vertical axis tracking	in process	in process	in process
Hem. Irradiation 2-axis tracking	in process	in process	in process

Annex K Design principles for the label "SOLERGY" Oceania

Weather data	**Oceania**		
Data file	SOLERGY-weatherdata-world_V.1.0.xls		
Source	Meteonorm V. 7.3		
Climate zone	colder	average	warmer
Spreadsheet	Auckland	Sydney	Rockhampton
Reference location	Auckland	Sydney	Rockhampton
Latitude	-37,0°	-33,9°	-23,4°
Longitude	-174,8°	-151,2°	-150,5°
Global irradiation G	1549 kWh/m²	1675 kWh/m²	2022 kWh/m²
Annual average ambient temperature	Ø 15,2 °C	Ø 18,1 °C	Ø 22,4 °C
Collector tilt – fixed non tracking	25°	25°	25°
Hem. Irradiation fixed tilt	1709 kWh/m²	1851 kWh/m²	2139 kWh/m²
Hem. Irradiation E-W axis tracking	1827 kWh/m²	1981 kWh/m²	2286 kWh/m²
Hem. Irradiation N-S axis tracking	2028 kWh/m²	2189 kWh/m²	2630 kWh/m²
Hem. Irradiation - 45° tilt vertical axis tracking	2157 kWh/m²	2328 kWh/m²	2705 kWh/m²
Hem. Irradiation 2-axis tracking	2247 kWh/m²	2428 kWh/m²	2830 kWh/m²

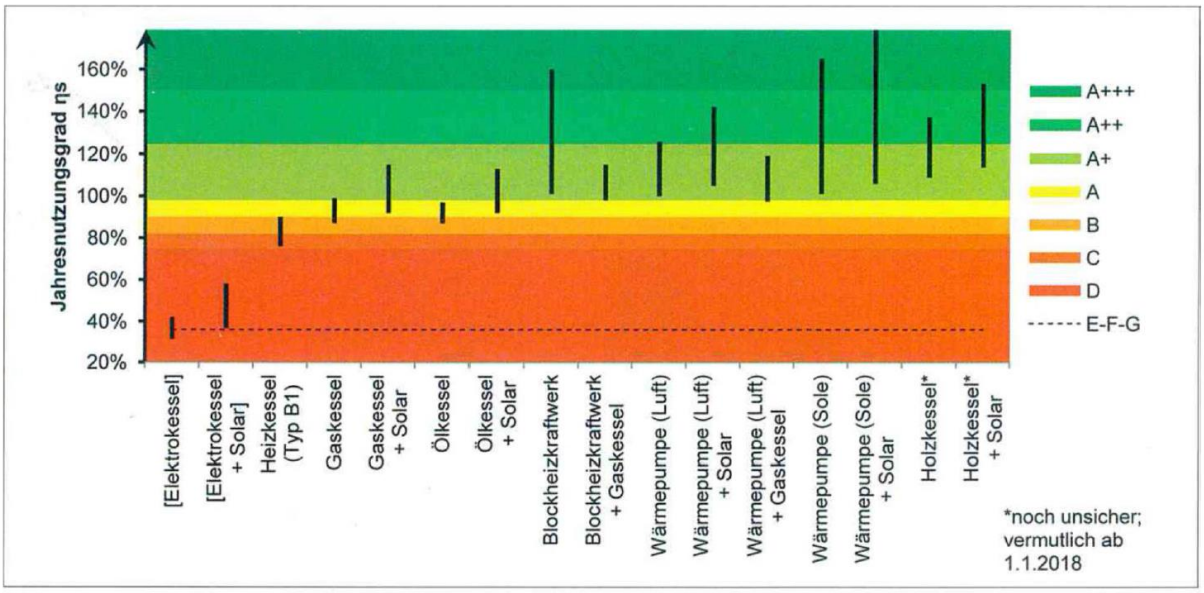
Annex L Historical roots of the SOLERGY collector label

L 1 Background

In September 2013 the European Union (EU) released a delegated regulation for Eco-Design and Labelling of space and water heaters which came into force in September 2015. In this regulations on product labeling only "primary energy consuming equipment" is taken into account so far. As basis for the classification of heat generators for space heating a so-called seasonal space heating energy efficiency (annual efficiency) is defined based on the ratio "provided useful heat" to "primary energy consumption”.

The primary energy is either the GCV of fossil fuels used (e.g. for oil or gas boilers) or electricity as final energy (e.g. for heat pumps), multiplied by a factor for primary energy of 2.5. For example a low-temperature heat pump with a COP of 4.5 has an energy efficiency of 4.5 / 2.5 = 180 % and thus achieves an A+++ (from 09/2019).

In principle collectors could also be considered as heat pumps, but collectors need only about 1 kWh of electricity for an output of 100 kWh heat (COP coll = 100). This means a primary energy consumption of 2.5 kWh and thus an energy efficiency of 100 / 2.5 = 4,000 %. Hence, solar collectors would have blown the scale and were probably not explicitly included in the classification of energy efficiency classes. This might have been one of the reasons why solar thermal collectors did not get a label but were considered only as an almost irrelevant add on to conventional heat generators.



Erwartete Einstufung von Heizgeräten in die Energieverbrauchskennzeichnung nach Verordnung 2013/811/EU als Verbundanlage ab 26.9.2015. Bild: UBA

Figure 1 Classification of heaters as package and product label (source: magazine IKZ-Fachplaner July 2013)

Since the classification indicated on energy labels is perceived by manufacturers and consumers as a sign of quality, collectors cannot afford not to be labelled. By excluding solar collectors from product labelling, they are noted as not being independent energy efficient products. Furthermore, this can mislead consumers when evaluating heat generators. Without product labelling, the CO_2-free contribution of solar thermal to the energy transition in the heating sector is completely neglected and its role is only be to be added to the main products of the package label (boilers, heat pumps or CHP heaters) to make them look a little bit better.

Having this in mind, Stefan Abrecht, developed a method to label solar collectors following closely the EU classification of heat pumps. The result was an accurate, clear and market-oriented method for labelling solar collectors based on the specific yield per collector area. The Solar Heating Initiative (SHI), which was founded to overcome this labelling discrimination, supported the idea to create a voluntary collector label. Joining forces the Certification Body DIN CERTCO and SHI introduced this label in August 2015, in parallel with the entry into force of the EU regulations.

L 2 Mathematical basis

In regulation 811/2013 the instruction for the assessment of heat pumps (= categories heaters without low temperature heat pumps) and low-temperature heat pumps are described in detail. For each type there is a separate classification scheme. For heaters without low-temperature heat pumps (normal heat pump) the A+++ level starts already at 150 % (see table 1, yellow array), for low-temperature heat pumps it starts only at 175 % (see table 1 blue array).

Table L-1 Classification scheme for energy efficiency of conventional heaters and output classes for solar collectors

	Output classes "SOLERGY"	B	A---	A--	A-	A	A+	A++	A+++	AA	AAA
	Energy efficiency classes ErP	G	F	E	D	C	B	A	A^{+}	A^{++}	A^{+++}
Heaters without low-temperature heat pump	seasonal space heating efficiency	0%	30%	34%	36%	75%	82%	90%	98%	125%	150%
	relative efficiency A+++ =100%	0%	20%	23%	24%	50%	55%	60%	65%	83%	100%
Collectors for higher temperatures (75 °C)	Annual efficiency η_a at 75 °C annual output/irradiation	0%	9%	10%	11%	23%	25%	27%	29%	37%	45%
	relative efficiency AAA =100%	0%	20%	22%	24%	51%	56%	60%	64%	82%	100%
Low-temperature heat pump	seasonal space heating efficiency	0%	55%	59%	61%	100%	107%	115%	123%	150%	175%
	relative efficiency A+++ =100%	0%	31%	34%	35%	57%	61%	66%	70%	86%	100%
Collectors for medium temperatures (50 °C)	Annual efficiency η_a at50 °C annual output/irradiation	0%	16%	17%	18%	30%	32%	34%	37%	45%	52%
	relative efficiency AAA =100%	0%	31%	33%	35%	58%	62%	65%	71%	87%	100%

The different classification schemes are related to the higher exergy provision of the normal heat pump, which can achieve higher flow temperatures. Accordingly, two scales were introduced for collectors too which depend on whether higher temperatures (75 °C) or medium and lower temperatures (50 °C/25 °C) are provided.

Since unrealistic simplifications are used in the Regulation 811/2013 for the calculation of the package label when solar devices are included and assessed (e.g. for space heating a fictive collector efficiency at an irradiance of 1000 W/m² and a temperature difference of 40 K are used), a so called annual efficiency η_a has been introduced in the collector label (see Annex A). This simple and understandable parameter is the basis to assess collectors and then further simplified by setting benchmarks for classes to achieve acceptance and easy understanding by the consumer. Mathematically, the scales for the annual efficiency were set analogously to the relative efficiencies for low and medium temperature heat pumps/other heat generators.

L 3 Determination of the classification

At first, solar collectors of an AAA class collector efficiency was fixed to 52 % (see table 1, green array). The conversion factor for the other classes is determined by the ratio of this value to the A+++ value of the low-temperature heat pump. The adjustment can be seen by the fact that the relative characteristic curves of low-temperature heat pump and solar collectors at 50 °C are the same (figure 2, yellow line in accordance with blue).

The output classes for higher temperatures (75 °C) are based on the classification of the heaters without low temperature heat pump. Again the annual efficiencies are adjusted so that the characteristic curve matches the respective curve for heaters (figure 2, red line in accordance with green). Basically output classes for low temperatures (25 °C) can be determined too. Practically, the same classification as for medium temperatures can be applied.

The standardized efficiency classes shown (= relative efficiency with A +++ = 100 %) also point out how the EU has designed the classification. It is clearly visible that intended technological leaps (different slope of the graphical curve in figure 2) are represented by a strong change in the relative efficiency. Correctly, the first leap is applied during the transition from category D (A-) to C (A), because the worse classes E (A--) to G (B) will be excluded from 2019 on.

Products which do not have reached the class D (A-) by then must be taken off the market in accordance with the EU Regulation 811. If a product has made the leap to class C (A), it can be shifted to class A+ (A+++) by steady minor improvements.

Then there is a second technological leap to A++ (AA). This can be achieved almost only by new improved technology. Getting to A+++ (AAA) is only possible by again significantly increased technological efforts. An analysis of the market for solar collectors shows that today virtually no collectors are available in the 3 lowest classes. Therefore, the rule of the EU Regulations for 2019 to skip these classes is already implemented in this guideline as there is no need to introduce them.

Hence, for the SOLERGY label remain 7 classes ranging from A- to AAA. They reflect the available various technological stages of solar collectors on the market in a differentiated and proper manner.

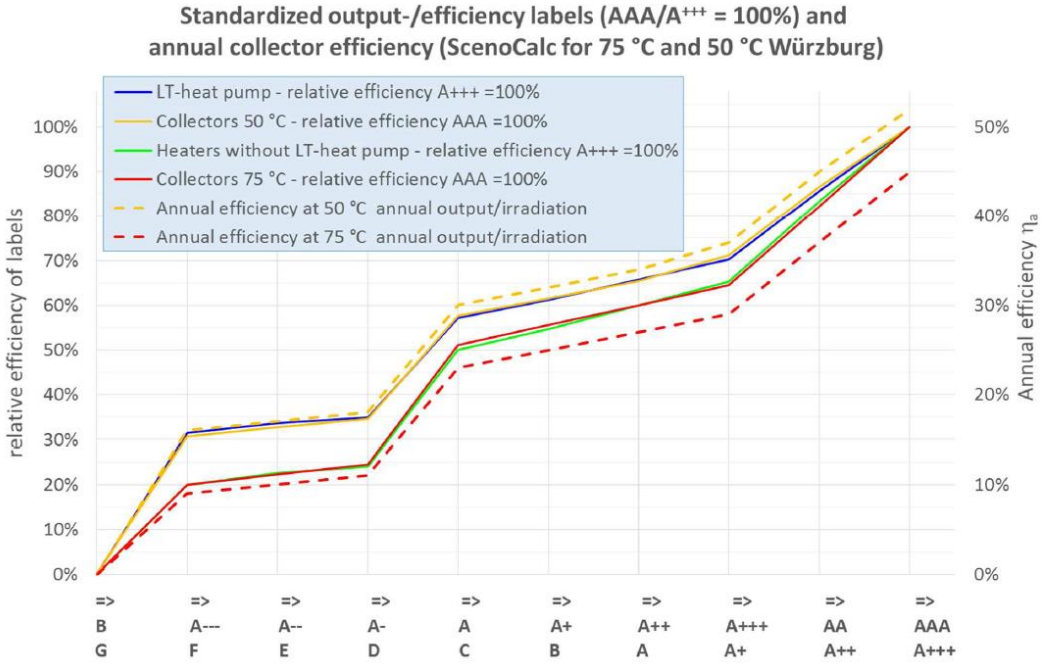


Figure 2 Standardized efficiency / label classes

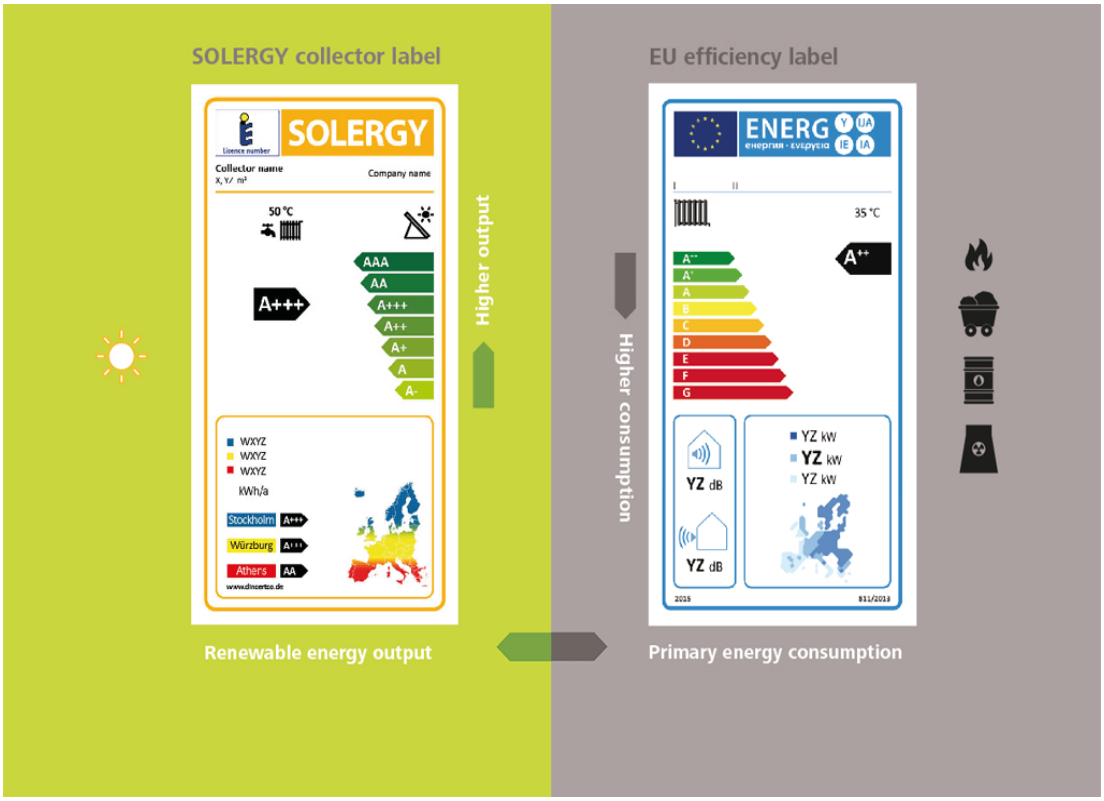
Subsequently, a possible labelling scheme for solar collectors could be presented in accordance to Regulation 811/2013 and 812/2013. As previously described, label classes are determined for solar collectors for both higher temperatures (process heat) as well as for medium temperatures (DHW) and also lower temperatures (swimming pools) see Annex B. In most cases it is obvious which marking is appropriate and therefore an automatic assignment of the labels is made (see Annex D) Anyway the manufacturer is free to ask for an additional label in a different category if it applies.

In addition to the output classes of the collector on the labels, the Gross Thermal Yield (GTY) per module is specified in kWh/a explicitly for colder, medium and warmer locations of each continent. They are shown on the label explicitly beside the belonging reference locations. The yield data are taken directly from Solar KEYMARK datasheet or calculated by ScenoCalc. The climate data is given in Annex F to Annex K. On the label itself the logo of the Certification Body, the license number of the collector model and the reference to the website and the database via QR-code are declared. The collector output label SOLERGY is issued by the relevant Certification Body and delivered as image file. The data of the labels of all participating companies are presented in a registered database published in the internet.

Important:
A label for a certain temperature level can principally only be issued, if the collector at all reference locations achieves at least the lowest class which is granted!

L 4 Legal issues SOLERGY Label vs. EU-Label

Due to the fact, that the EU-classification scale (A+++ to G and the color gradient from green to red of the arrows leading to the right) is legally protected and may not be used in voluntary labels, a different scale had to be used. The EU scale compares different types of heaters only according to their efficiency related to primary energy consumption. But practically it is not possible to distinguish between them by type of heater. Only products, which use ambient heat or cogeneration are able to reach classes higher than A.
Note: With the new revision of the regulations (coming into force approx. 2025/2026) the old classes A-G will be reintroduced and all A+ (++) classes will be dropped



The SOLERGY collector output label has been designed to show the consumer the differentiation related to specific energy output and to primary energy relevance. It has been developed using a scale based on the letter A. The relative classification of the scale has been adapted the way that flat plate collectors of the comfort and premium class, which actually dominate the market, are technologically comparable to the best conventional heat generators, determined by the EU to be heat pumps. Additionally, they are superior from the ecological perspective, which makes it imperative to label them with A++ or A+++ especially from the point of view of the consumer.

Both upper classes (AA and AAA) contain collectors with extra high specific energy output. They can provide heat also under difficult conditions like high solar fractions, smaller areas and higher temperatures as they have special technical features e.g. double glazing, vacuum isolation and reflectors. The marking of the lowest class A- shows that these products are close to the limit where such products make sense related to heat production. Reasons for such a low class are outdated technologies (e.g. non selective absorber) or not enough solar active area (e.g. vacuum tubes with big spacing). A proof for this fact is, that powerful PV modules can reach this class as well but deliver more high-grade electricity.