Towards the next generation of standards for solar thermal systems

J.E. Nielsen, SolarKey Int., ESTIF Technical Consultant

NEGST WP4 - pre-normative work

- *suggestions for improvement of existing standards*
- *basis for new standards*

NEGST InterSolar Work Shop, Freiburg, June 2007

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Why always revise / re-new standards?

- To remove market barriers for new (and better) products -> growing solar thermal market.
- By nature, standards are always developed with a certain time delay compared with developments of products and systems. This delay may be a barrier for the new products to enter the market, as no testing and certification is possible - or existing standards do not express the benefits of the new products.

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Subjects treated?

1. Collectors & collector components
2. Stores
3. Controllers
4. Combisystems (DHW+SH)
5. Solar cooling
6. Solar desalination
7. Fluids
8. LCA – Life Cycle Assessment
9. Conversion m^2 -> power & energy

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Deliverables

1. Proposals for revisions of EN's
2. Resource documents
3. Indications of "further work needed"

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Deliverables

Official proposals to CEN TC312:

- CEN/TC 312 resolves to proceed on the creation of a new WI consisting of the revision of EN12975-1 and -2 once the financing is available for the implementation of M/369. In this revision the following topics will be considered:
  a. clarification of the application of the present standards to **tracking and/or concentrating collectors**
  b. unglazed collectors: refined performance test conditions and prediction, improved sky temperature measurement
  c. collector components **- requirements and test methods**
  d. quality tests for evacuated tubes
  e. improved exposure - **accelerated ageing test of collectors**
  f. (annual collector energy output)

RESOLUTION 10, CEN/TC 312 - GRAN CANARIA, SPAIN, 2006-04-03 & 04

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NEGST
New Generation of Solar Thermal System

1. Collectors & collector components

Resource document, guidelines	**Characterisation of incidence angle dependencies for tracking and concentrating collectors (guidelines recommended to be included in EN12975 – clarification of the EN12975)**
Recommendations for revisions	**Un-covered collectors - refined performance test conditions and prediction: more strict limits on long wave irradiation; improved sky temp. measurement; ...**
Proposal for new standard / inclusion in EN12975 Resource documents (IEA-SHC)	**Quality test of solar absorbers Quality test of polymeric materials in collectors Quality test of reflector materials and anti-reflextive coatings**
Recommendations for revisions	**Qualification tests for vacuum tubes: exposure, mech. load, reflector durabillity, impact resistance, freezing, glass/metal seal durability**
Draft test procedure	**Improved exposure / accellerated agening test of collectors (AU method with hot oil – to be further evaluated)**
Resource document(s) / propossal for revision of EN12975 (Work shop in Austria autumn 2007 – arsenal research)	Air collectors: - recommendations for requirements - recommendations for test methods (based on survey of existing methods) - survey of products in the market and interested companies in development of this type of collectors
Ressource document	Improved performance accuracy (flat plate collectors)

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2. Stores

Draft test procedure	Test methods for stores with external heat exchangers
Draft revised test procedure	Improvement of parameter identification test methods incl. aspect of verification
Ressource document	Basic principles/concepts to be applied in the development of store test methods

This work is partly used in TC312 / WG3 ”Custom built systems” prEN 12977-3 ”Storages”

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3. Controllers

Draft test procedure	Test method for ”variable flow controllers” (e.g. constant temperature control.)
Draft test procedure	Simple test method for energy consumption of pumps and controllers
Draft test procedure	Test method for ”total controllers” (integrated control of the whole heat production)

This work is partly used in TC312 / WG3 ”Custom built systems” prCEN/TS 12977-5 ”Controllers”

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4. Combi-systems

Ressource document	Testing systems (stores) with integrated burner - "Experience on tests for combi-systems with and without integrated burner"
Draft calculation method	Updated/new method for calculating performance of combi-systems
Draft test procedure	Updated Direct Characterisation (DC) test method
Ressource document	Comparison of different performance test methods; CTSS, AC, DC (Round Robin)

This work is partly used in TC312 / WG3 ”Custom built systems” prCEN/TS 12977-4 ”Combi-systems”

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5. Cooling

Ressource document	Survey on existing software for simulations of solar assisted air conditioning systems
Ressource document	Survey of existing test methods and standards for A/C systems components and the need to consider its association with solar - survey on test methods for A/C system components - possibility of reference in CEN/TS 12977

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7. Desalination

Proposal for TR/TS	Guidelines for materials compatibility (corrosion issues)
Proposal for TR/TS	Guidelines for performance testing of solar systems with desalination units

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8. Fluids

Proposal for new CEN TC312 work item	"Standards for solar thermal fluids" - Recommendation for the use of standards for the determination of solar-fluid parameters - Recommended work plan for the elaboration of requirements and testing methods for fluid lifetime / deterioration

Very nice basis for developing EN-standard for solar fluids – so far nobody wanted to take the lead ...

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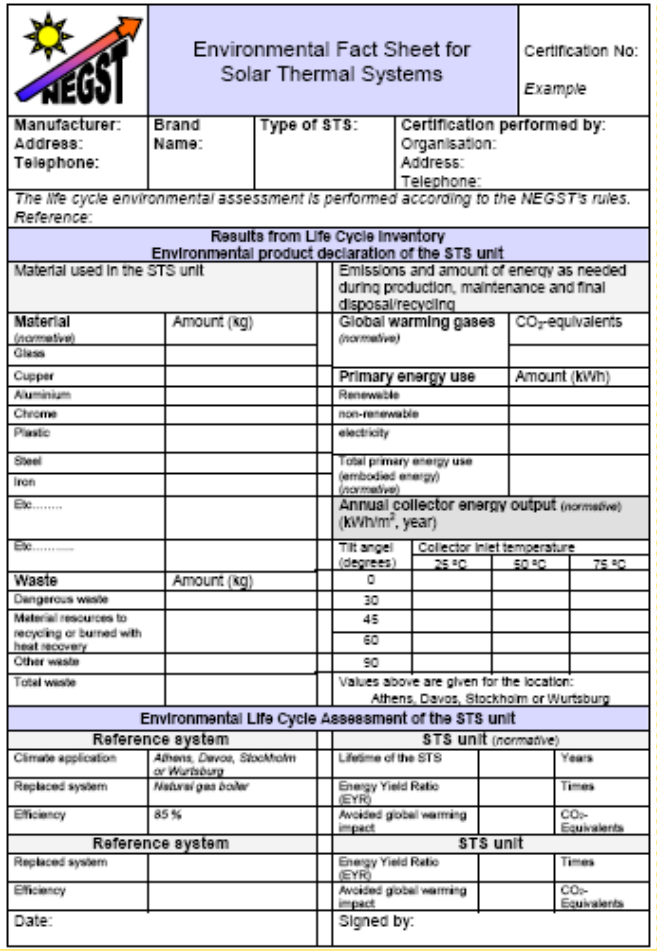
9. Life Cycle Assessment, LCA

Proposal for TS/TR	Method for determination of environmental fact sheet including energy payback time for solar collectors (final decision on subject(s) to be taken)



Environmental Fact Sheet for Solar Thermal Systems

Certification No: *Example*

Manufacturer: Address: Telephone:	Brand Name:	Type of STS:	Certification performed by: Organisation: Address: Telephone:

The life cycle environmental assessment is performed according to the NEGST's rules. Reference:

Results from Life Cycle Inventory
Environmental product declaration of the STS unit

Material used in the STS unit

Material (normative)	Amount (kg)
Glass	
Copper	
Aluminium	
Chrome	
Plastic	
Steel	
Iron	
Etc.....	
Etc.....	
Waste	Amount (kg)
Dangerous waste	
Material resources to recycling or burned with heat recovery	
Other waste	
Total waste	

Emissions and amount of energy as needed during production, maintenance and final disposal/recycling

Global warming gases (normative)	CO_2-equivalents

Primary energy use	Amount (kWh)
Renewable	
non-renewable	
electricity	
Total primary energy use (embodied energy) (normative)	

Annual collector energy output (normative) (kWh/m², year)

Tilt angel (degrees)	Collector inlet temperature 25 °C	50 °C	75 °C
0			
30			
45			
60			
90			

Values above are given for the location: Athens, Davos, Stockholm or Wurtsburg

Environmental Life Cycle Assessment of the STS unit

Reference system		STS unit (normative)		
Climate application	Athens, Davos, Stockholm or Wurtsburg	Lifetime of the STS		Years
Replaced system	Natural gas boiler	Energy Yield Ratio (EYR)		Times
Efficiency	85 %	Avoided global warming impact		CO_2-Equivalents

Reference system		STS unit		
Replaced system		Energy Yield Ratio (EYR)		Times
Efficiency		Avoided global warming impact		CO_2-Equivalents

Date: Signed by:

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10. m² -> power & energy

Resource document (now generally accepted procedure)	Method for ”Conversion of m² to power”
Resource documents	Methods for ”Conversion of m² and power to energy”

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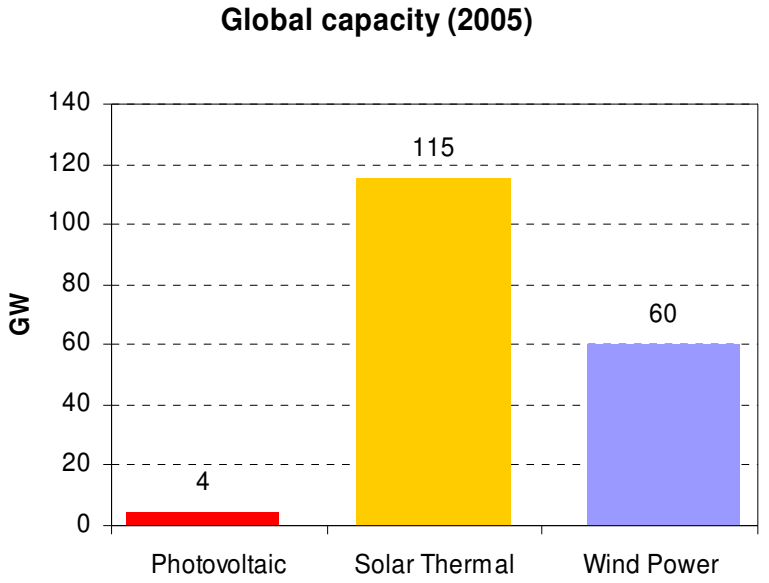
10a. m² -> power

Conversion of m² to power capacity:

P = 0.7 kW/m²

Generally accepted !



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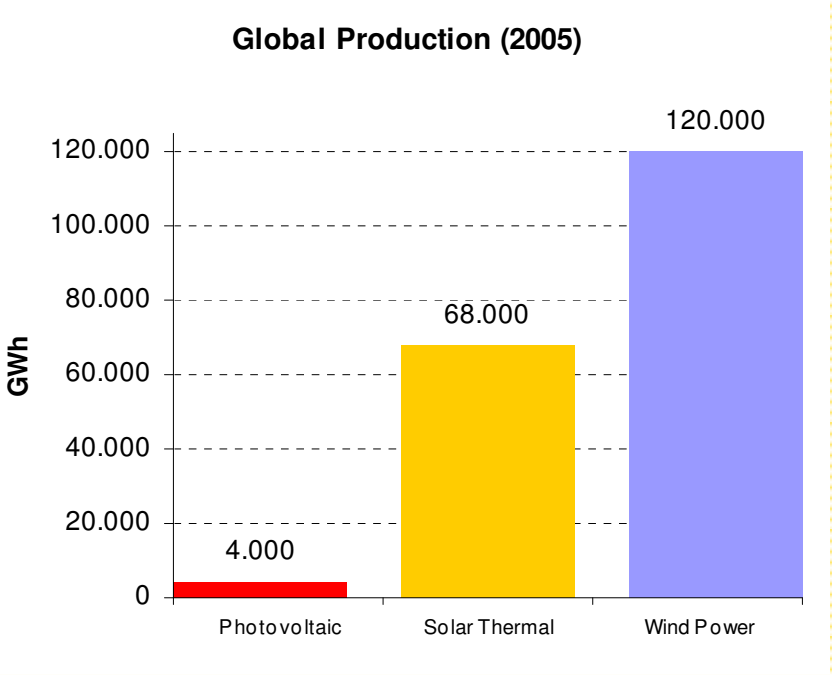
10b. power -> energy

Conversion of power capacity to annual energy production



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10b. power -> energy

IEA-SHC World statistics – main EU markets:

Very good correlation of annual collector energy production (glazed collectors) and **global horizontal irradiation**:

$Q = 0.6 * G_0 * P$

Equivalent full load hours: $0.6 * G_0$

$Q = 0.42 * G_0 * A$

Efficiency: 42% related to **global horizontal radiation**

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10b. power -> energy

Overall Europe:

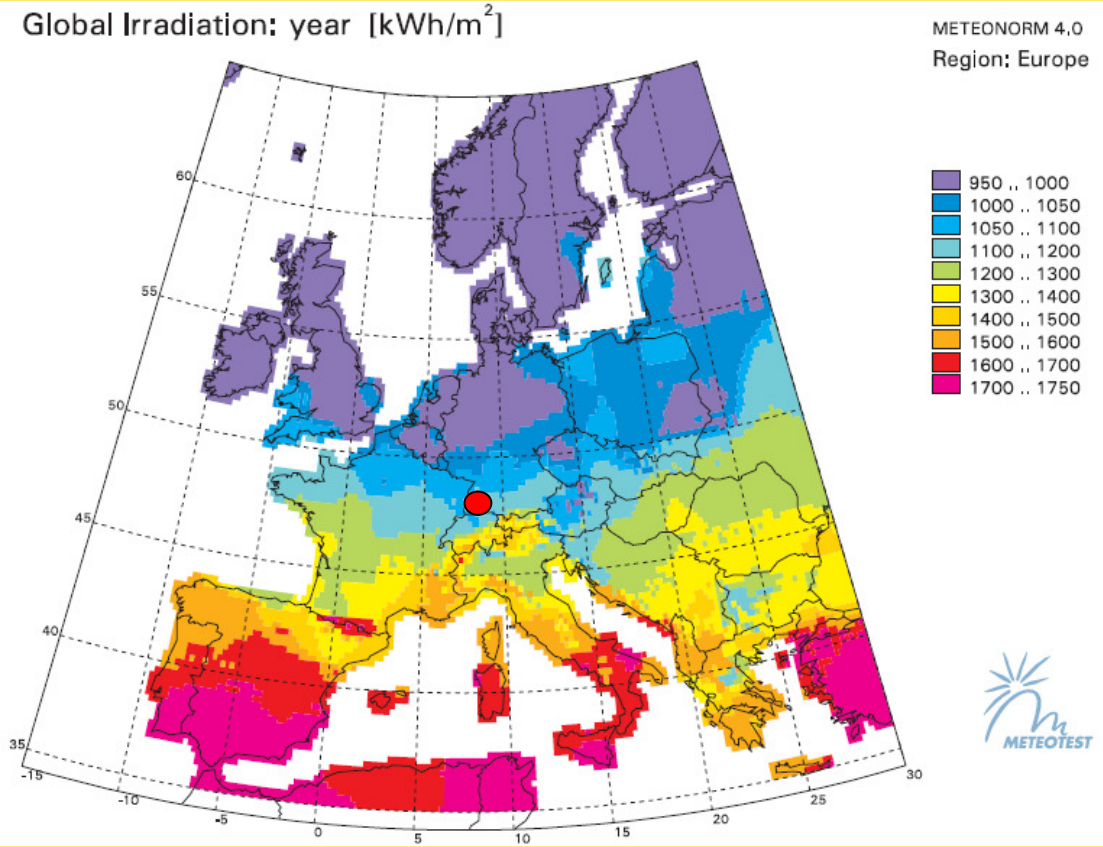
Freiburg: $G_0 \approx 1200$ W/m²

Equivalent full load hours:

0.6 * 1200 = 720 Hours

Q = 720 kWh/kW

Q = 720 * 0.7 ≈ 500 kWh/m²



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Next generation of solar thermal standards

Further info:
www.swt-technologie.de/html/negst.html
www.solarkey.dk/negst-wp4-web/wp4.html

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Thank you for your attention !

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