EU Enrironmental Technology
Verification pilot programme

Le progrès, une passion à partager

Statement of Verification

Environmental Technology Verification

Technology	ENERGETIC SYSTEM LI-MITHRA
Registration number	VN20170029
Identification number LNE	33786
Emission Date	18/12/2017

Organisme de vérification		Proposant	
Name	Laboratoire national de métrologie et d'essais	Name	Li Mithra
Contact	M. Emmanuel Rébuffat	Contact	M. Guy Torrent
Address	1 rue Gaston Boissier 75015 Paris	Address	5, impasse du stade 88390 Uxegney
Telephone	+33 (0) 1 40 43 37 40	Telephone	+33 (0) 3.29.81.44.60
E-mail	etv@lne.fr	E-mail	g.torrent@li-mithra.fr
Internet	http://www.lne.fr	Internet	https://www.li-mithra.fr/

Warning : this translation is made for information purpose only. Only the French version shall be valid

Cette vérification est disponible sur le site http://iet.jrc.ec.europa.eu/etv/

The ETV verification program allows to independently verifying the performance of innovative environmental technologies.

This document is the statement of verification. It certifies performances that have been verified according to the procedure described in the general verification protocol prepared by the European commission[2].

I. Technology description

Li-Mithra energy system is producing a quantity of heat energy at a temperature of service defined, production of domestic hot water or for the heating of the premises; It is associated with photovoltaic solar panels that are not developed by Li-Mithra.

The technology consists of a heat pump specific (variable speed with control advanced compressor) coupled to photovoltaic panels fitted with a 3 mm thickness heat thermal aluminum exchangers/absorber positioned on the panel back face (against the backsheet/electrical isolator). The exchanger is linked to the backface panel by mechanical specific springs.

The absorber/exchanger is a fine multichannel plate traversed by a fridge liquid which, on the face in contact with the backsheet collects the solar irradiating energy or the thermal effect of the rain or from the wind (thermal booster).

The technology provide:

Cooling down the photovoltaic panel in order to maintain or improve the electrical production

Increase the heat pump cold source in order to improve the coefficient of performance (COP).

II. Applications

II.1 Matrix

The environmental matrix considered by the direct solar energy technology (irradiation) as the indirect sun effect (environmental ambient air temperature, wind and ground convection).

II.2 Purposes

Set the cold water temperature to usage temperature, with the maximum renewable energy. In the other hand, get the maximum photovoltaic solar panel efficiency.

1 – Plus d'information sur le programme ETV sur les sites http://iet.jrc.ec.europa.eu/etv/ et http://www.verification-etv.fr/

2 – Le General Verification Protocol (GVP) est disponible à l'adresse http://iet.jrc.ec.europa.eu/etv/reference-documents

II.3 Operational conditions implementation

Using a system to collect sun irradiation (hybrid panel) connected to a heat pump.

II.4 Performance parameters summary

The performance parameters are defined following the below standards:

Photovoltaic modules: NF EN 61215, NF EN 61646

Solar hybrid absorber : ISO 9806

Permise heating heat pump : NF EN 14511

DHW heat pump: NF EN 16147

The main determining installation performances is the efficiency coefficient (COP) calculated with produced power and consumed, in immediate mode or on period. The energy power are:

Thermal power provided by the heat pump

Electrical global system consumption

Electrical power provided by the hybrid panel

Those powers are determined by mathematic equations from the specified previous norms.

III. Test and analysis design

III.1 Existing and new data

The existing data presented during the ETV proposal phase were not acceptable because they did not follow the GPV requirements: the used method to provide those data did not follow the requirements of the NF EN ISO 17025 standard (e.g. equipment calibration inexistent, or incomplete; lack of method or procedure regarding meteorological tractability).

Additional test have been realized in accordance with the method purposed in the verification protocol in the ETV framework.

III.2 Laboratory or field conditions

The used models to determine the system performance have been powered by measure made on the existing system.

The test on the performing coefficient providing the electrical consumption to ensure installation heating needs has been made on site.

Test made on:

Performance coefficient of the solar collector.

Photovoltaic power

Insolation quality of the solar collector

Mechanical load resistances with a positive or in depression have done in a laboratory.

III.3 Matrix composition

The environmental matrix considered has been the direct solar irradiation and the indirect irradiation (environmental temperature, wind blowing speed and the ground convection).

III.4 Tests parameters analysis

The performance parameters are the one that define the Li-Mithra technology installation performance coefficient.

- Thermodynamic system cold source temperature on evaporator inlet of the heat pump, this, dependent of the solar panel temperature outlet, according to the solar collector model, solar collecting surface as the direction condition, gradient, external temperature, wind power and solar irradiation.
- Effective thermal power of the heat pump: provided power at the heat pump condenser for temperature couple points “cold source/hot source” defined in the protocol.
- Electrical power consumption of the heat pump: electrical heat pump power consumption following the determination conditions of the thermal effective heat pump.
- The electrical power consumption of the circulation pump of the system.
- Electrical power furnished by the hybrid panels: photovoltaic electric power measured beyond the inverter (DC power converted in AC power) this, independently of the photocell temperature and independently of the refrigerant liquid temperature going into the solar panel absorber.

The performance coefficient (COP) is represented by Li-Mithra under 4 types:

- COP of the heat pump avoiding auxiliary consumption (circulation pump and electronic)
- COPLM: as above but taking into account auxiliary such circulation pump and electronic.
- COPLM-PV same as above but reduced by the photovoltaic panel production.
- SPF: COPLM-PV integrated on a period of heating.

The operational verified parameters are:

- Performance coefficient allowing defining electrical consumption to ensure the thermal heating needs.
- The thermal performances coefficients of the solar collectors
- The electrical power of the solar collectors
- The insulation quality of the solar collectors
- The mechanical resistance with positive pressure or depressure

III.5 Summary of the analysis method and test used

On the solar collector circuit

Modelisation has been realized to determine the glycol temperature at the evaporator inlet. This mathematical model is done from accredited laboratory test results.

- Thermal performances according to ISO 9606 norm (optical efficiency of the collector h0 and thermal looses bu, b1 and b2).
- Photovoltaic performances according to EN 61215 norm (pic power MPP under 1000 w/m² at 25° C temperature)

For the thermodynamic heat pump circuit

The heat pump performance have been modeled on its functioning envelop represented 9 temperature level condition of the glycol liquid evaporator inlet on a scale (-15° C; +25° C) and 7 level of the condenser temperature gradually on the scale +35° c up to 65° C)

III.6 Measured parameters

The following parameters have been verified:

- Global solar irradiation on the hybrid panel level
- External ambient temperature (° C) under ventilated shelter with anti-irradiation screen
- Humid temperature (° C) or relative humidity rate
- External air flow speed (m/s) at the level of the hybrid collectors with a mini threshold of 0.5 m/s
- Glycol temperature hybrid panel inlet
- Glycol temperature hybrid panel outlet
- Voltaic cell frame temperature (° C)
- Glycol flow rate in the hybrid panel (m³/s)
- Inlet and outlet glycol temperature at heat pump evaporator.
- Flow rate on the condenser (DHW or heating mode) in m³/s
- Inlet and outlet temperature on the heat pump condenser(° C=
- Electrical power consumed by the heat pump (kWh)
- Electrical power consumed by the circulation pump on solar circuit (kWh)
- Electrical power furnished by the PV panels (kWh)
- Functioning duration of the solar circuit circulation pump (h)

IV. Verification results

IV.1 Performance parameters

The seasonal performance factor of the system is SPF. This taking into account PV panel production as heat pump production, defined during the yearly model on Strasbourg latitude. It reach a value **of 6.6 +/- 1.2.** This value taking into account the incertitude linked to the revendicated value of 5.

The SPF calculation for other systems can be determined by calculation using incertitude of +/- 16% (+/- 11% without PV panels) b using the following data:

The climatic condition of the system installation location (yearly means average data hourly timing sample in order to be in accordance with the energetic performances calculation of the European regulation.

The normative framework test of the hybrid solar collector presented in the test report for the thermal and photovoltaic portion.

System thermic loses calculation

The collecting loop regulation and heat pump mathematic model realized and submitted in the test report.

IV.2 Operational parameters

The operational parameters are listed below:

Energetic Li Mithra system	
Test	**Résults**
Thermal performances coefficient of the solar collector (in regard to the gross solar collector surface)	$\eta_{0,hem}$: 0,470 b_u : 0,032 s/m b_1 : 20,435 W/m²K b_2 : 2,179 W.s/m³.K
Solar collector Photovoltaic power	P_{MPP} : 252,1 W (T°:24,7 °C / G_0 : 1000,3 W/m²)
Solar collector Electrical insolation	Conform
Mechanical load of the solar collector. To be positive or negative	Conform

Results table of the operational test parameters issued by the report CESPPV-FRF201703234 and certisolis 20170101-001

IV.3 Environmentals parameters

N/A

IV.4 Supplementary parameters

N/A

V. Additional information's

N/A

VI. Quality insurance and controlled deviation

As verification institution, the LNE is accredited according to the norm ISO 17020 to realize the verification following the ETV protocol. The scope of this accreditation includes the technical energetic field.

The tests carried out on the performance coefficient have been realized by Li-Mithra company.

Those tests have been audited two times.

The first audit has shown deviation that has been corrected for the second audit realized at the final test and gives valid results.

The whole verification overriding has been realized by the environmental department and information security of the certification direction as from the LNE training which is in charge of ETV activity and who is an accredited institution for inspection according to the norm ISO 17020 for the above description.

The quality insurance is described in the below table

Organisme	LNE / DCF		LNE / Quality direction	Bélénos (CETIAT)	Li Mithra	CETIAT	CESP	CERTISOLIS
Relevant actors	ERE	VDE	Internal Auditor	ELE	CLA	MMT	JBB	JBE
Verification protocol	Examen		Internal Auditor	Rédaction		Examen		
Test plan	Examen			Examen	Rédaction			
Test system perform and Quality management system of de the test structure				Audit ISO 17025	Responsible			
Test performs				Technical audit	Responsible		Responsible	Responsible
Report test				Examen	Rédaction		Redaction	Redaction
Verification report	Examen		Internal auditor	Redaction		Examen		
Declaration of verification	Redaction	Examen						

The relevant actors are the following :
CLA : Clément Lamblé, Li Mithra
ELE : Emmanuel Léger, Bélénos then CETIAT
ERE : Emmanuel Rébuffat, LNE
VDE : Virginie Desbordes, LNE
MMT : Michèle Mondot, CETIAT
JBB : Jean-Baptiste BEYSSAC, CESP
JBE : Jérôme BECCAVIN, Certisolis