Content

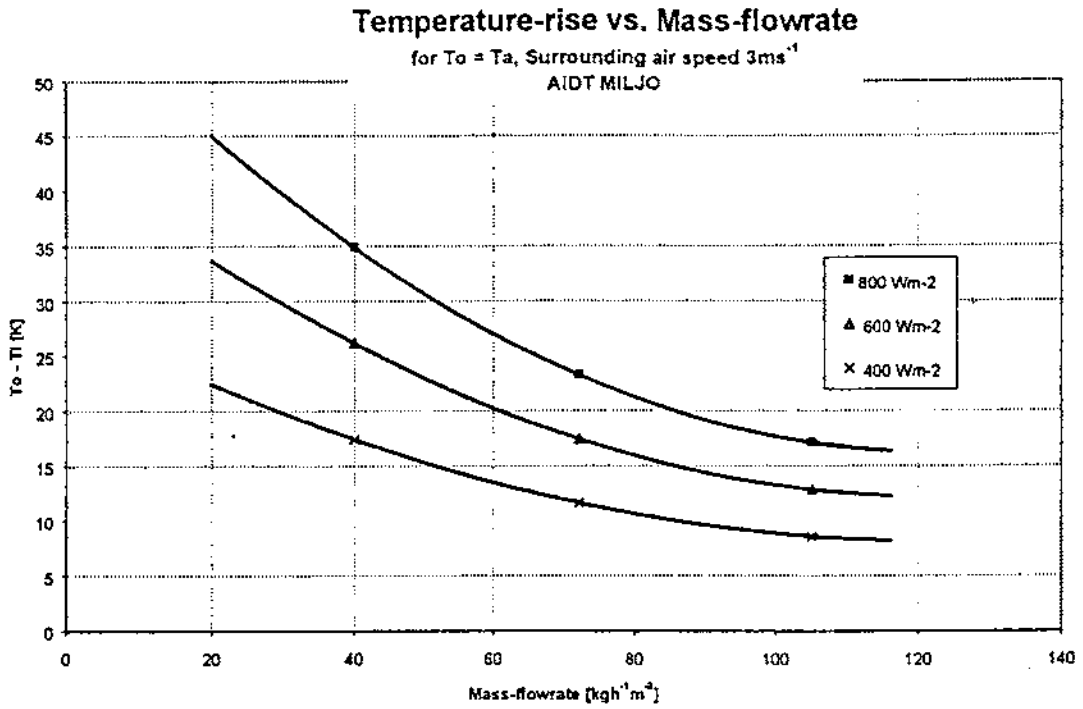
---

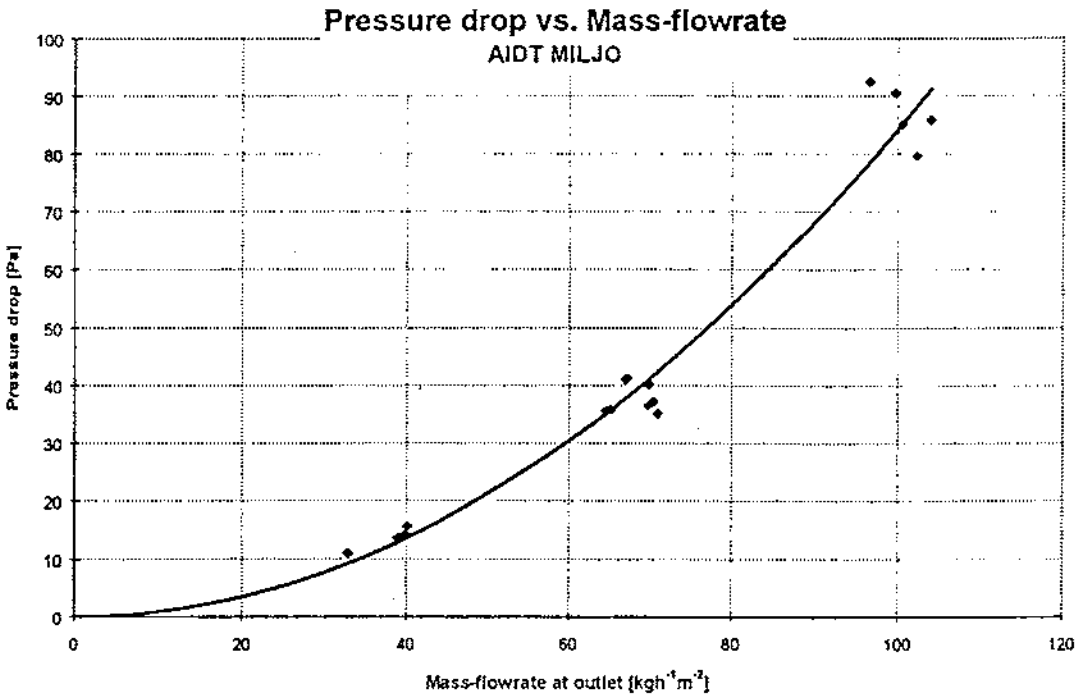
arsenal
research

ARSENAL RESEARCH- the Austrian Centre for Research and Testing is a research centre owned by the Republic of Austria. With its about 220 employees in 4 specialised divisions Arsenal Research takes an interdisciplinary approach to projects on energy, environmental protection, construction engineering, traffic engineering and microelectronics.
The Department of Renewable Energies has been working in the fields of solar thermal energy for more than 20 years. Closely Connected to these working fields are air-conditioning, building technology and space heating, as well as photovoltaics.
ARSENAL is the only institution for testing and certification of solar thermal applications according to national Standards. Beside testing, Arsenal gives support to the industry during the developing process of solar collectors and components. Projects concerning dissemination of solar energy are also content of the work. Arsenal is also accredited for calibration of electrical quantities, pressure and temperature.

Symbols and Units

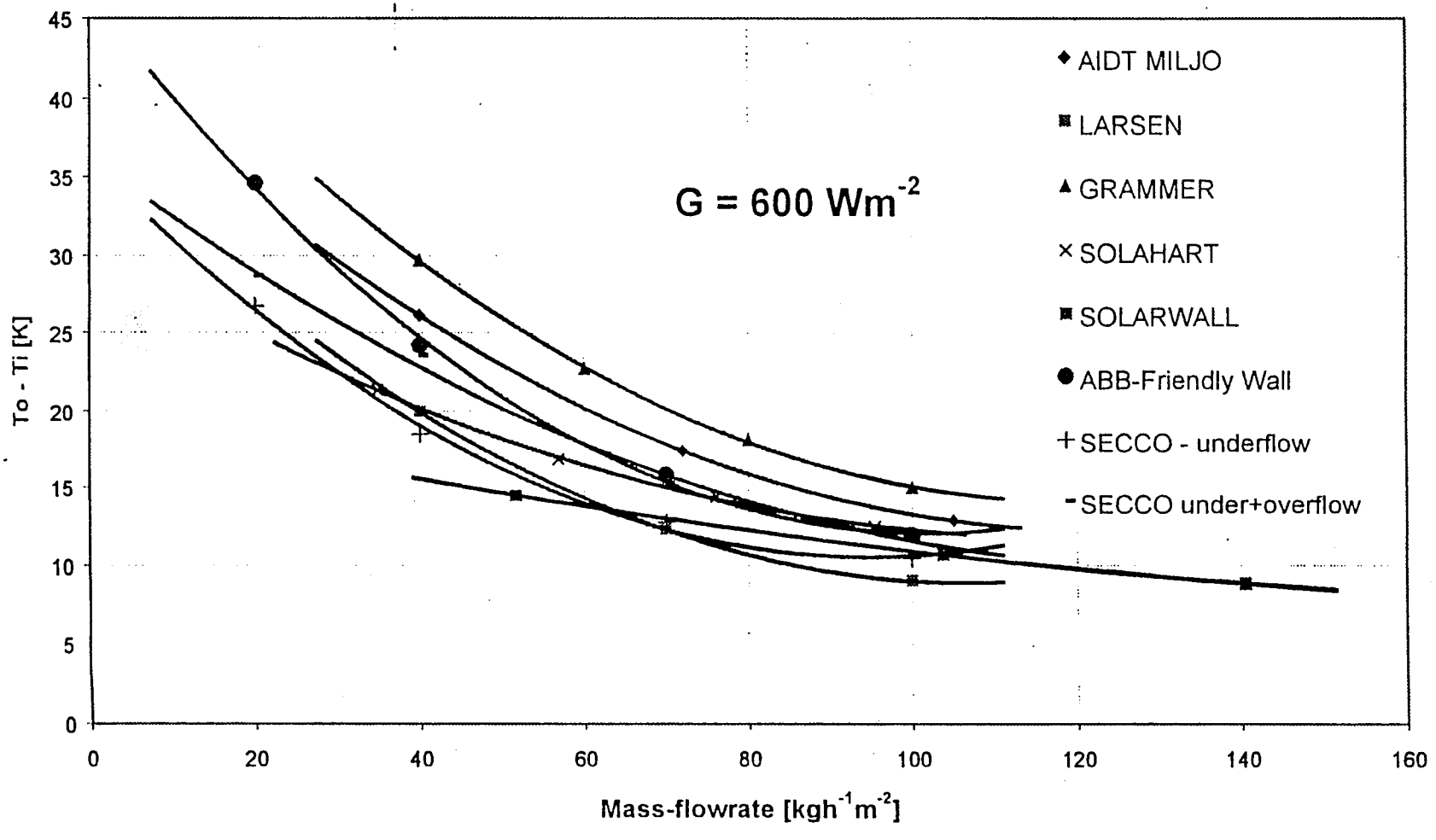
A_C	Collector reference area (normally: aperture area) [m^2]
C_p	Specific heat [$Jkg^{-1}K^{-1}$]
Eta, η	Efficiency
G_T	Global solar irradiance on tilted surface (further on only G) [Wm^{-2}]
G	Global solar irradiance [Wm^{-2}]
K	Kelvin
$\dot{m}$	Mass flow rate [kgh^{-1}]
Qsol	Solar performance of the sun at the collector reference area [W]
Q_u	Useful gain of the collector [W]
Ta	Ambient temperature [°C]
T_{am}	Measured absorber temperature [°C]
Ti	Inlet temperature [°C]
Tk	Collector temperature (physical collector-mean-temperatur) [°C]
Tm	Mean Collector temperature (arithmetic mean value between inlet and outlet temperature) [°C]
To	Outlet temperature [°C]
W	Watt
α	solar absorptance
ΔT	temperature difference To-Ti [K]
ε	hemispherical emittance
ρ	density of heat transfer fluid air [kgm^{-3}]
τ	transmittance
ξ	airflow-resistance


Temperature-rise vs. Mass-flowrate
for To = Ta, Surrounding air speed 3ms-1
AIDT MILJO
To - Ti [K]
Mass-flowrate [kgh-1m-2]
800 Wm-2
600 Wm-2
400 Wm-2
0
5
10
15
20
25
30
35
40
45
50
0
20
40
60
80
100
120
140

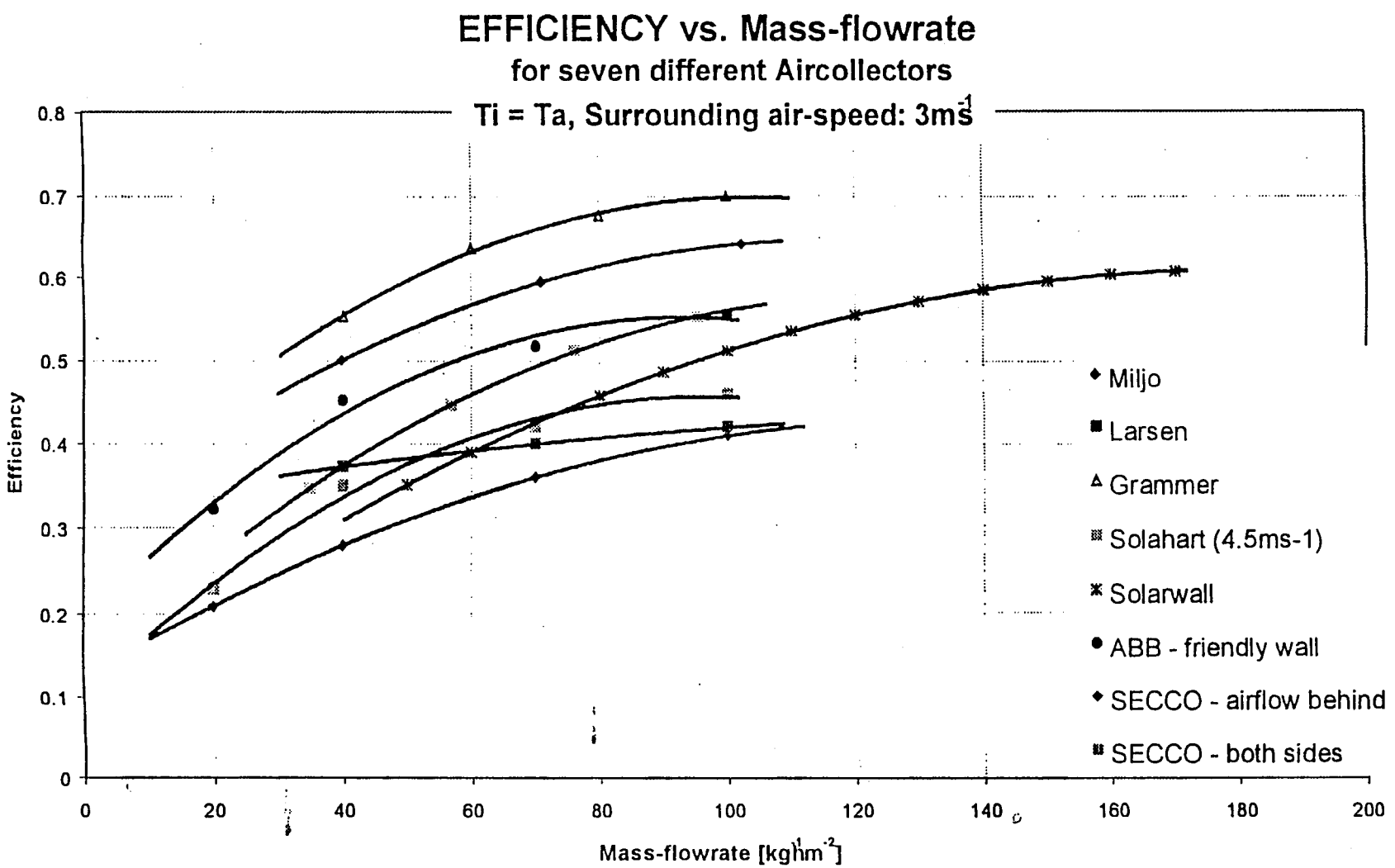

Pressure drop vs. Mass-flowrate
AIDT MILJO
Pressure drop [Pa]
Mass-flowrate at outlet [kgh-1m-2]
0
10
20
30
40
50
60
70
80
90
100
0
20
40
60
80
100
120

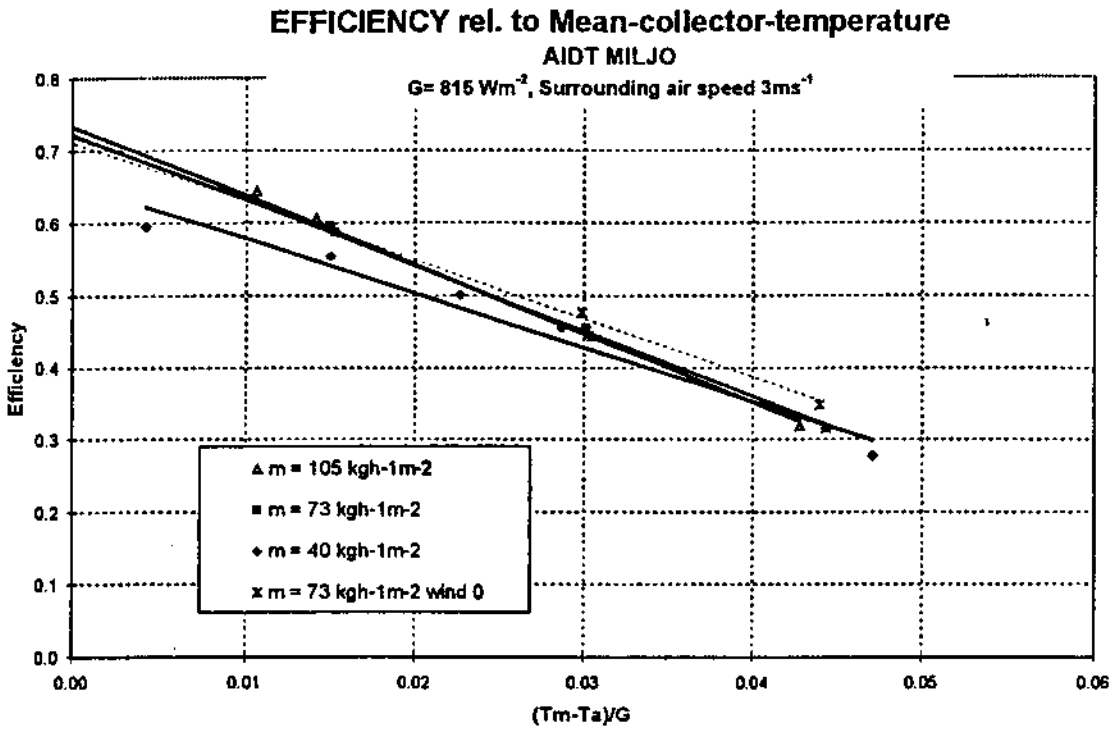
Temperature-rise vs. Mass-flowrate

Surrounding air speed 3ms^{-1}

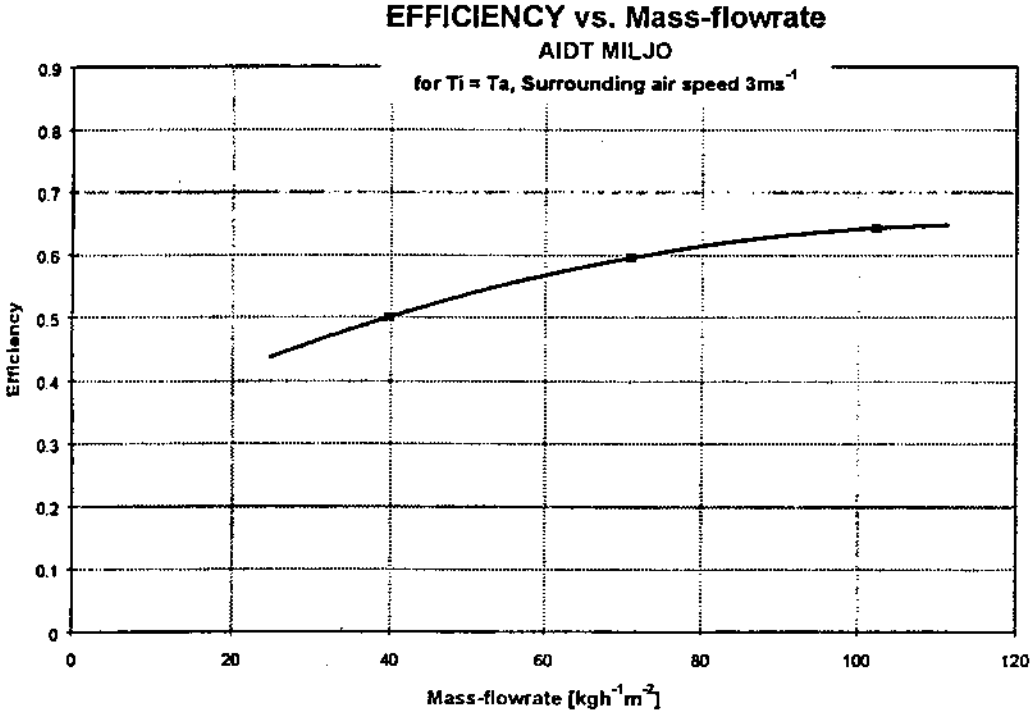


Common presentation of the efficiency curves for all tested collectors:



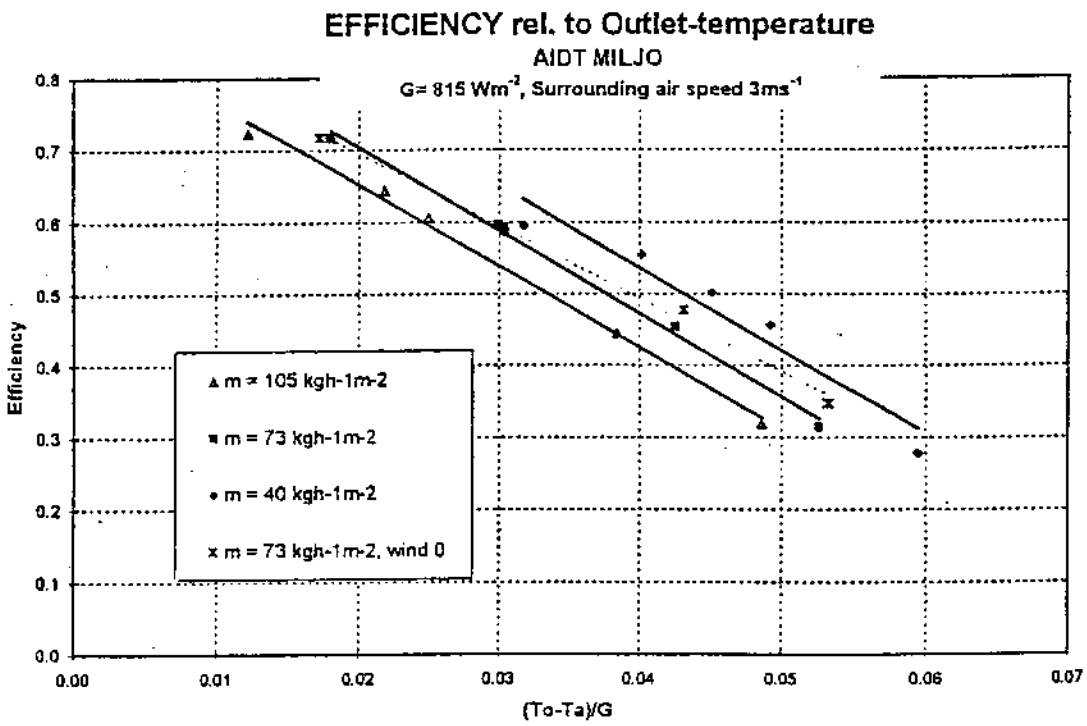


This collector is usually operating with Ti=Ta, therefore the following presentation is important as well:



AIDT MILJØ
Kongravensbrovej, Aidt, DK-8881 Thorsø
Phone: +45 86 96 67 00 Fax: +45 86 96 69 55, email: aidt@email.dk, http://www.aidt.dk

- **Reference area:** 1.24m^2 (gross dimensions: 1986mm*720mm)
- **Air-flow:** penetrating through a black porous felt absorbing mat
- **Glazing:** 6mm channelled sheet made of polycarbonate
- **Casing:** Aluminium
- **Absorber:** black porous felt absorbing mat
- **Insulation:** 30 mm mineral wool
- **Tilt angle for testing:** 45°
- **Tested at mass flowrates:** 40, 73, 105 kgh^{-1}m^{-2} (50, 90, 130kgh^{-1})



Note: At this diagramm, you can see as mentioned in chapter 3, that due to the penetration of the air through the black porous absorber felt, very high heat transfer rates are obtained. Therefore in this case the presentation of the efficiency curve using the arithmetic mean temperature between inlet and outlet would be better suited.