Solar Thermal Systems

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Dubai American University 25.06.2008

"Green Building Conference“
Dubai LEED requirements and solutions

Viessmann Group

Founded 1917, €1.4 Billion turnover in 2007, 8200 employees

www.viessmann.com

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Viessmann is one of the leading boiler and renewable energy manufacturers of Europe

Boilers from 1,5 – 20000 kW with efficiencies up to 109 % for gas, oil and bio-fuels

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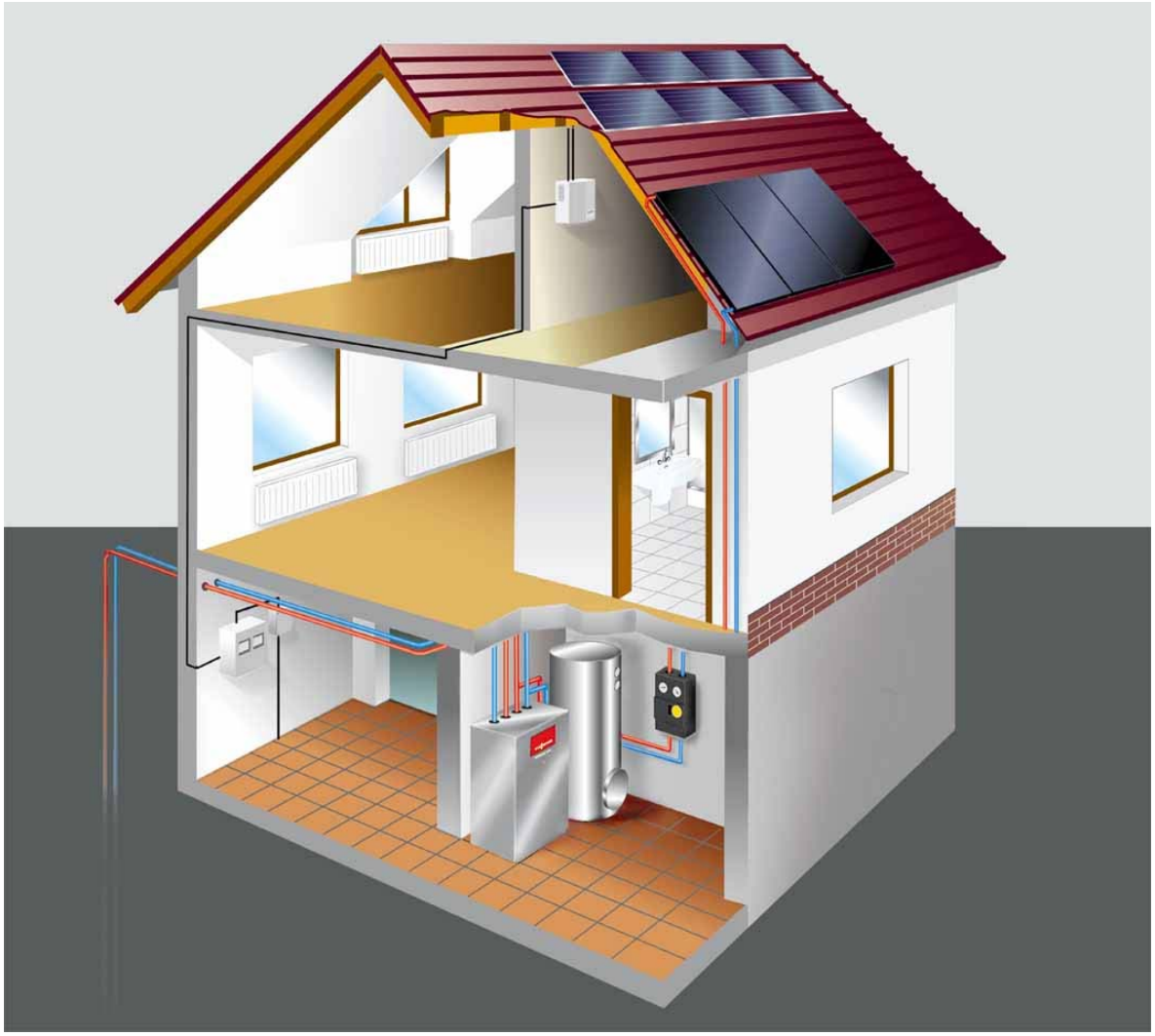
Viessmann has system solutions for heating, hot water and solar energy applications in housing and commercial projects



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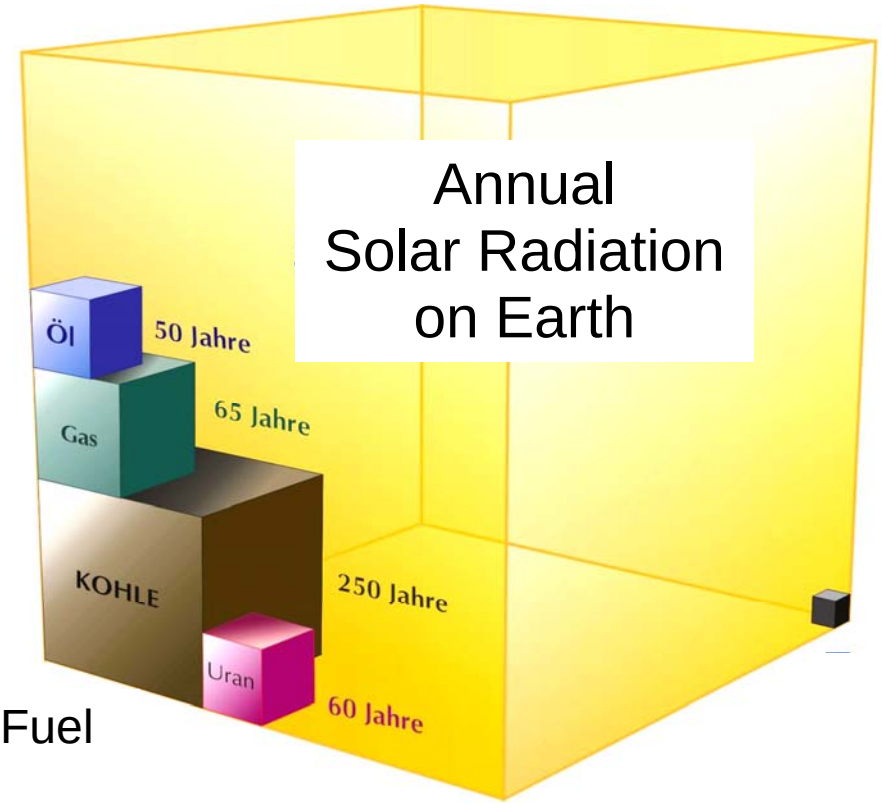
Solar Energy – The power source of the earth

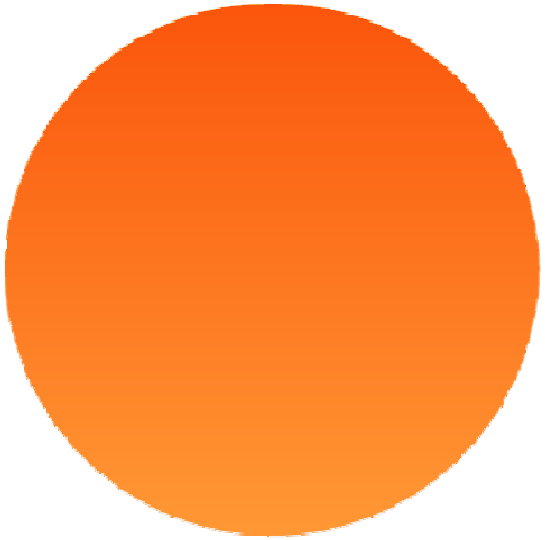
In **less than four hours** the sun radiates the **annual energy demand of the world's population** to the earth.



Estimated Fossil Fuel Sources

Annual Energy Consumption on Earth

Solar energy



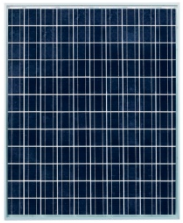
Annual Energy amount (Europe) : Ø 1000 kWh/m²*a

Annual Energy amount (UAE) : Ø 2000 kWh/m²*a

Solar Energy related to buildings

→ Heat

→
Electricity
(direct with PV)



→ Solar lighting

→
Concentrated
Solar Power

→ Bio Fuels

Photovoltaic : Electricity through light
Viessmann Vitovolt PV Systems

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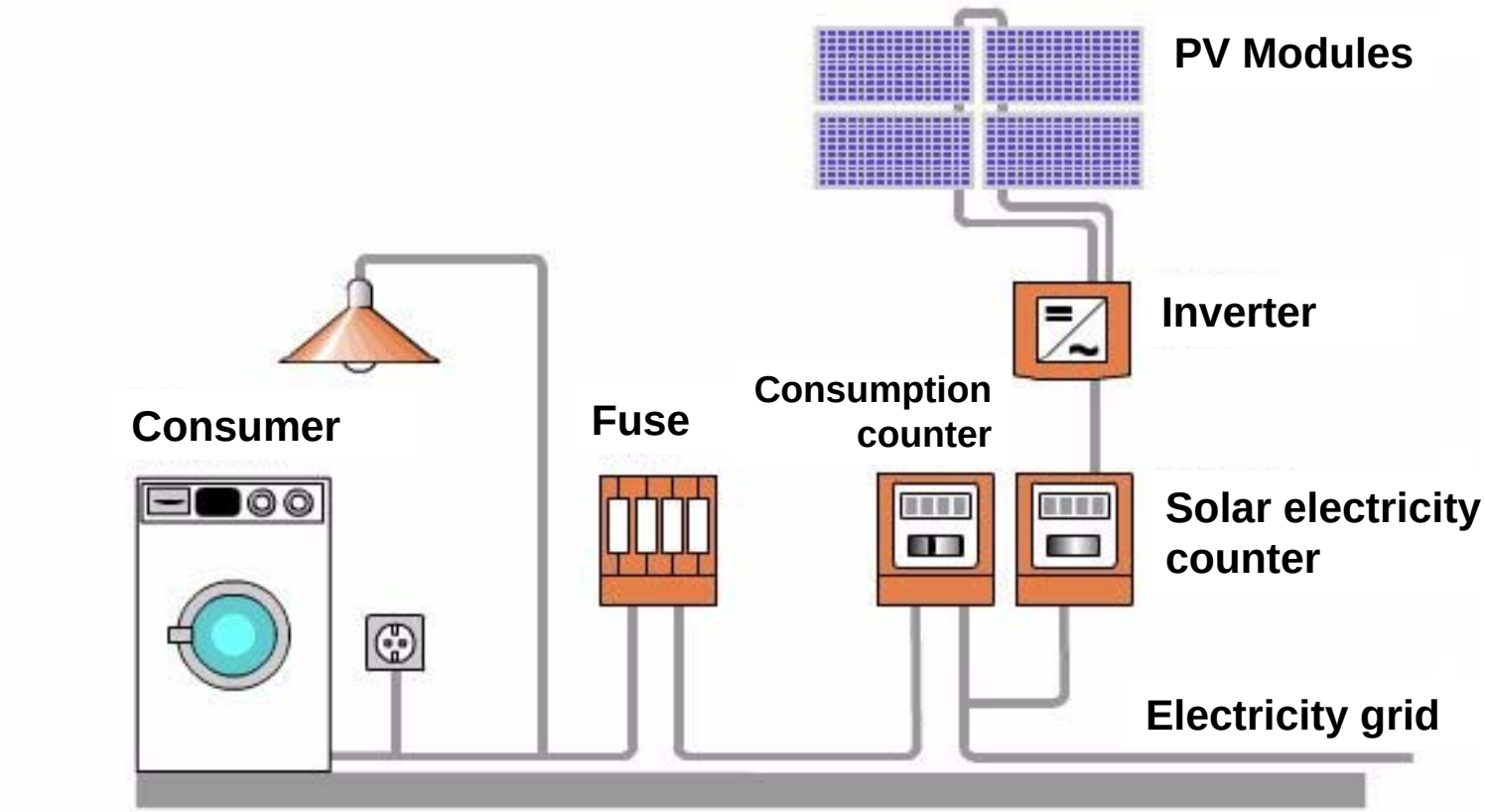
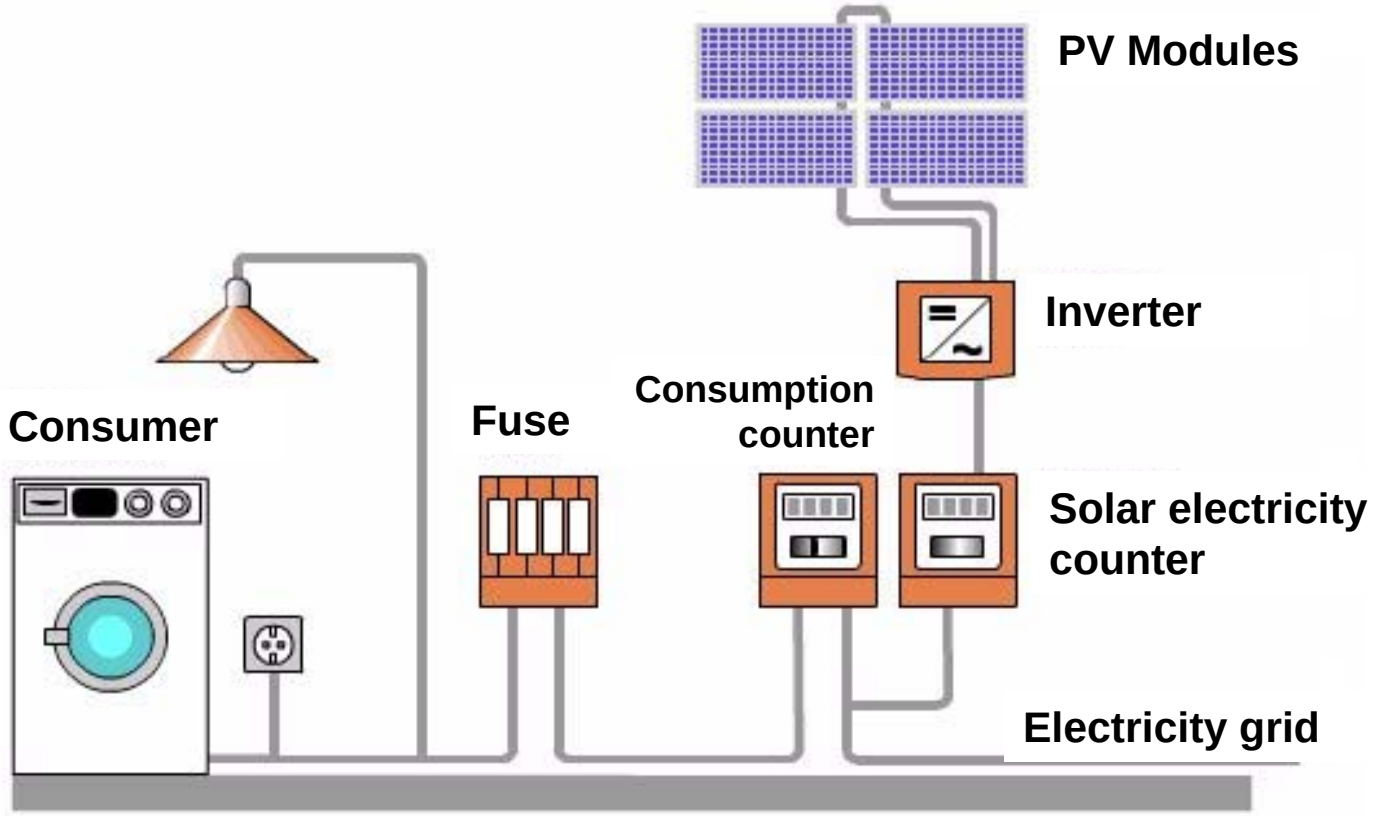
Grid connected systems vs. Battery backed up systems



ADVANTAGES:

- **No need for battery backup, <u>maintenance free, allmost "0" operation costs</u>**
- **No transfer losses compared to power plants. Electricity is generated at the "field"**
- **100 % of solar electricity is used at home or at the grid**
- **Every house/building can be utilised as a "mini power plant"**

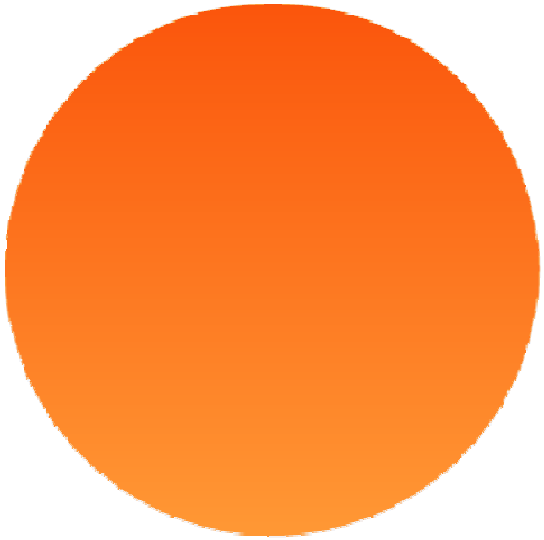
German Enery Supply Law (EEG) supports the investment of Photovoltaic: Grid connected systems



- Germany has now a world market share of over 50 % (Annually installed PV systems)
-Electricity from the grid ~ 0,2 USD /kWh
-Payback for privat persons from their mini PV plant ~ 0,8 USD /kWh
- Germany has annual world market share of 50 %

Installations of PV

Solar energy



→ **Heat**

What can we do with heat ?

- **Domestic hot water**
- **Pool heating**
- **Heating support in cold climates**
- **Process heat**
- **Solar cooling with absorption chillers**

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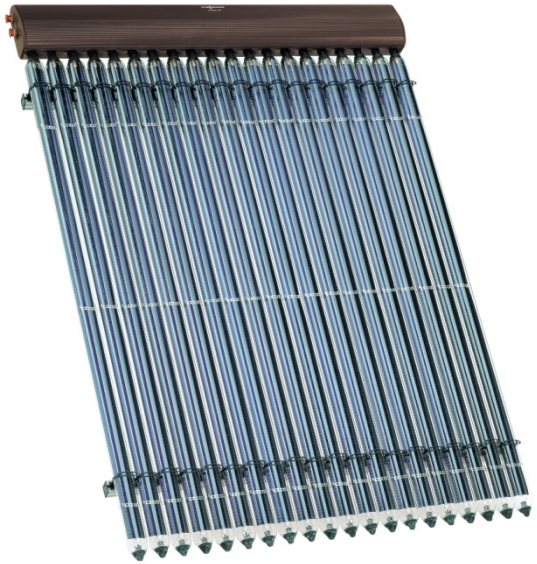
Solar-thermal: Heat through sunshine

Vitosol 100

Vitosol 200



Vitosol 300

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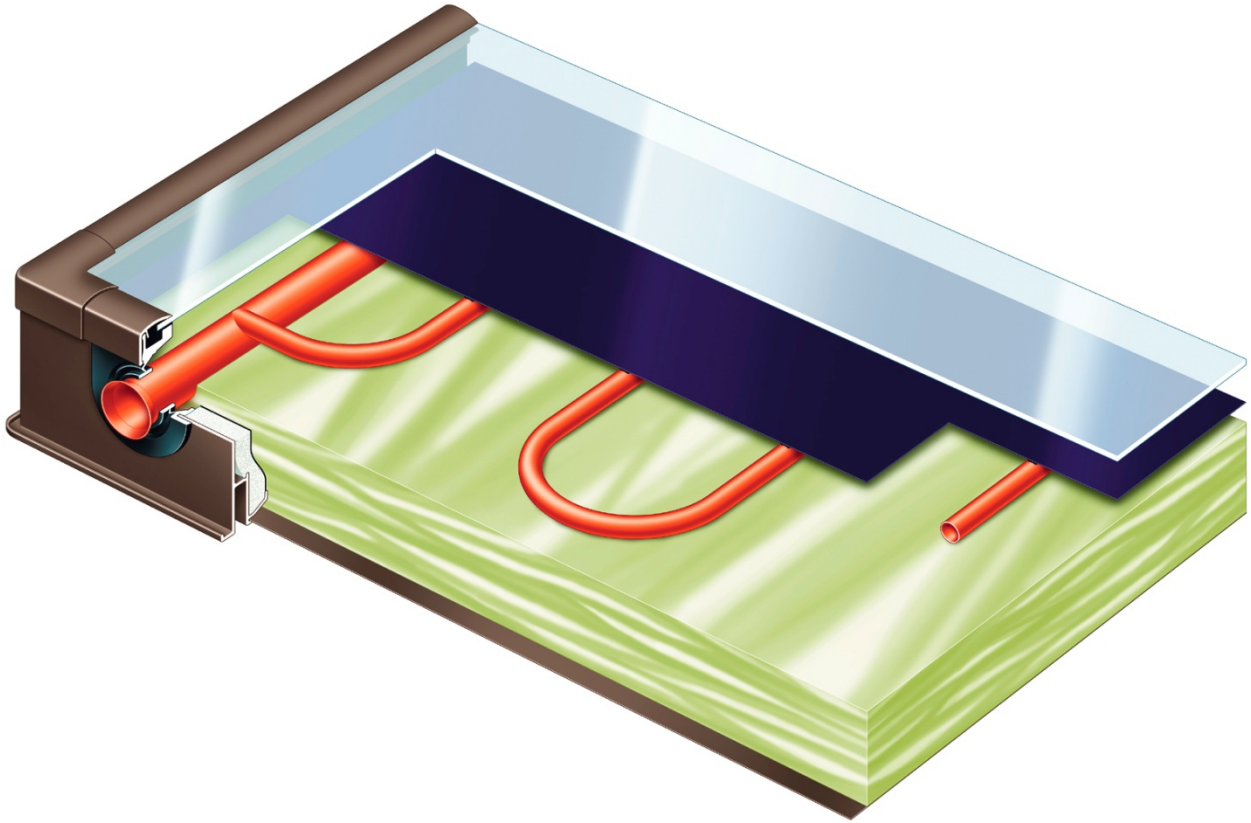
Vitosol 100
Flat collectors



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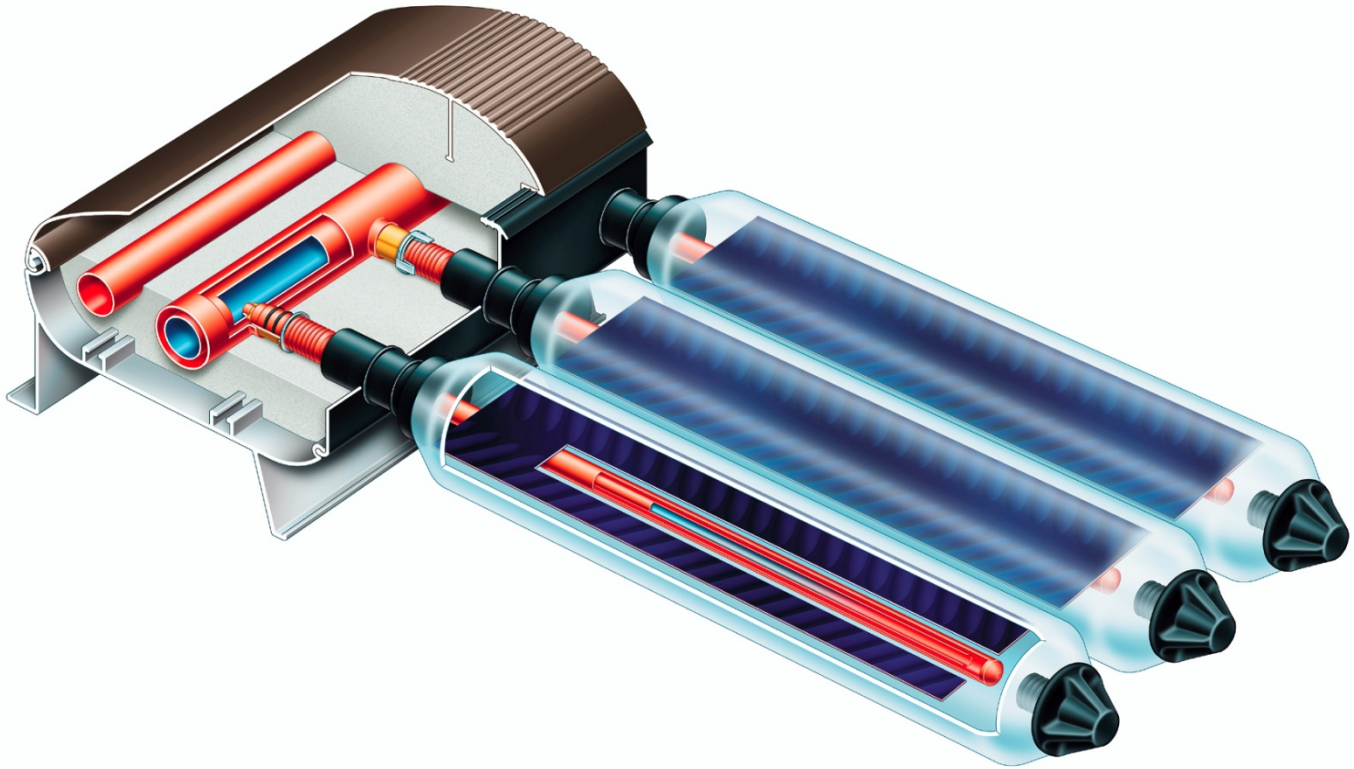
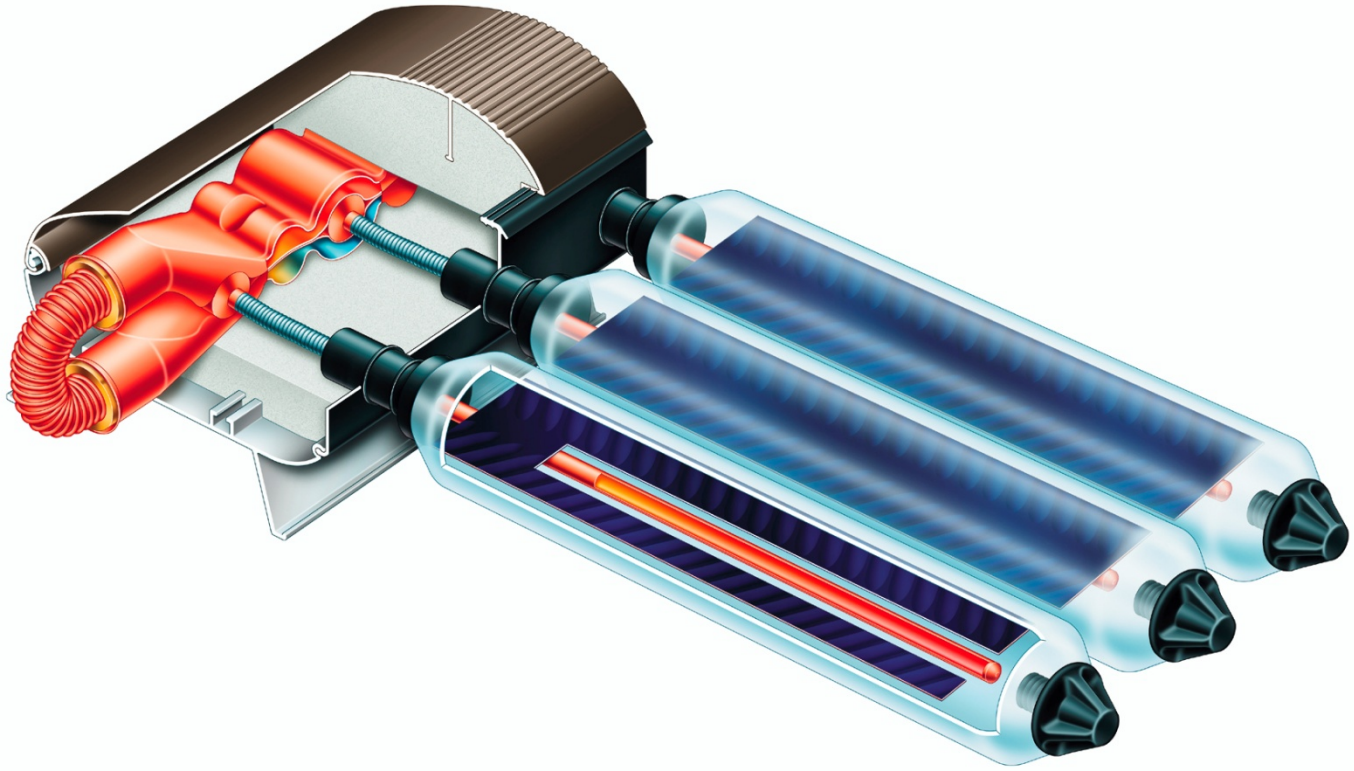
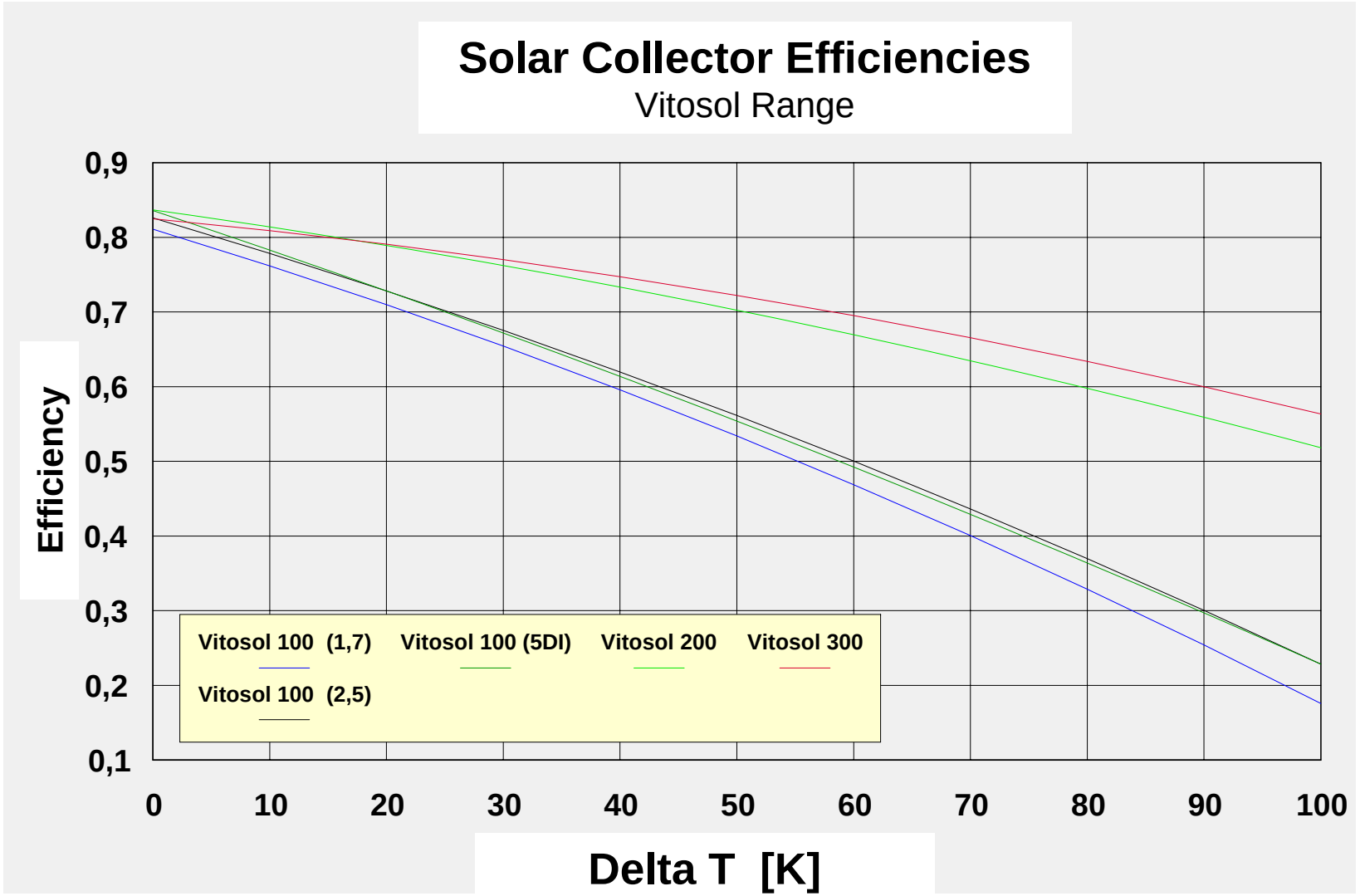
Vitosol 200
Evacuated tube collector with copper absorber, direct flow



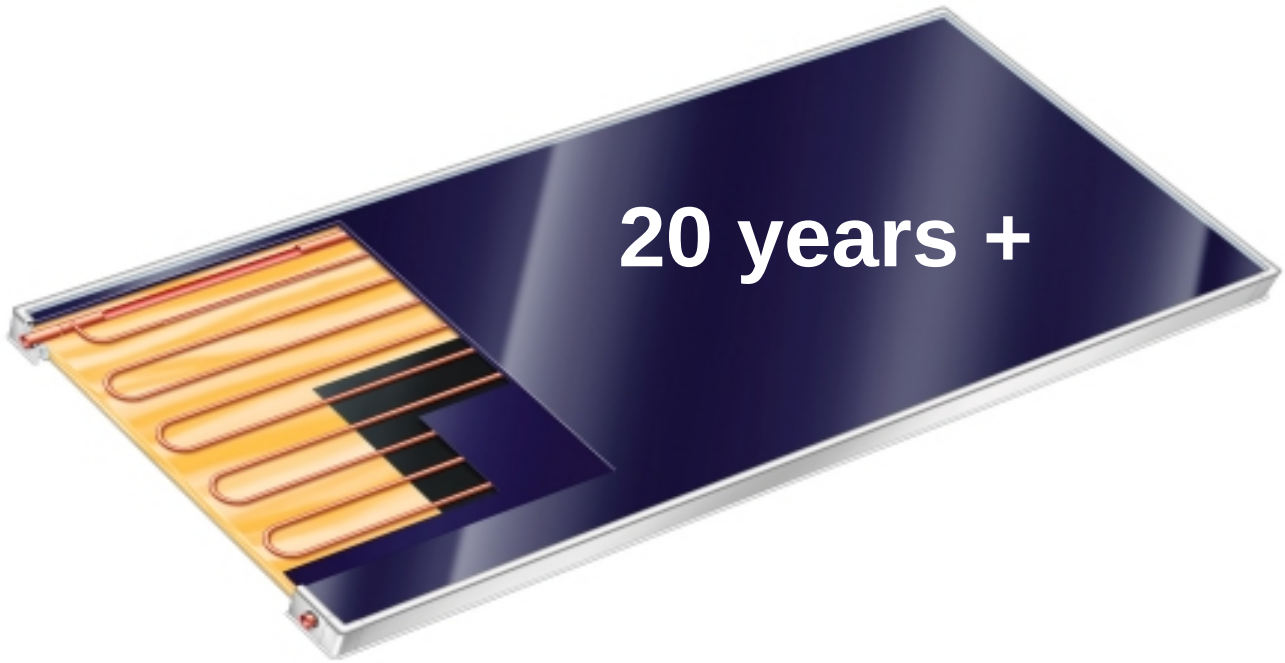
Vitosol 300
Evacuated tube collector with copper absorber, heat pipe technology



Efficiency curve



Life expectations of solar collectors

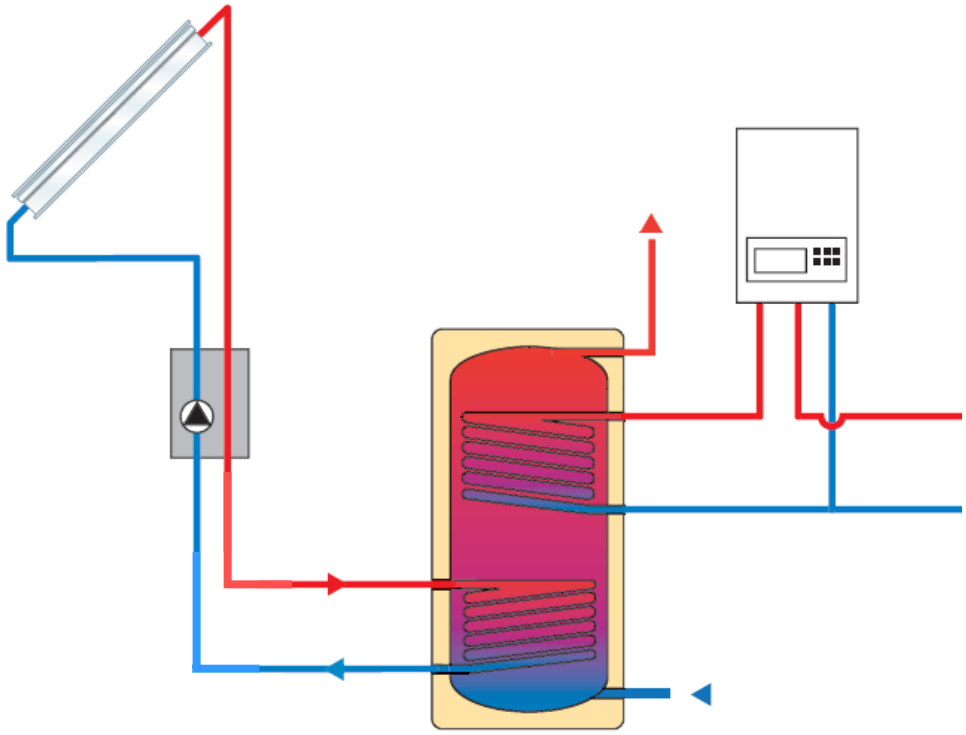


Life expactations of solar collectors

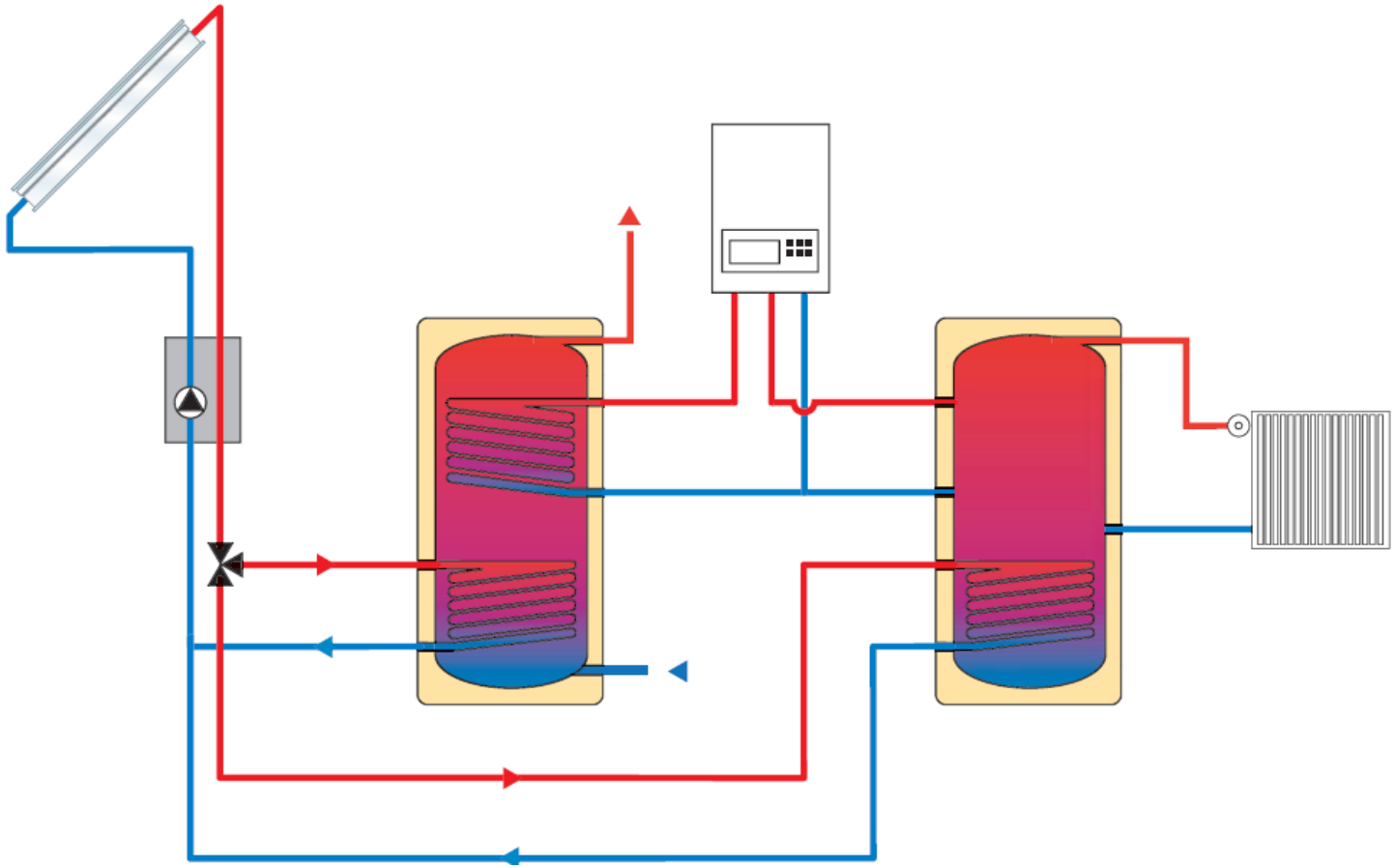
30 years

35 years

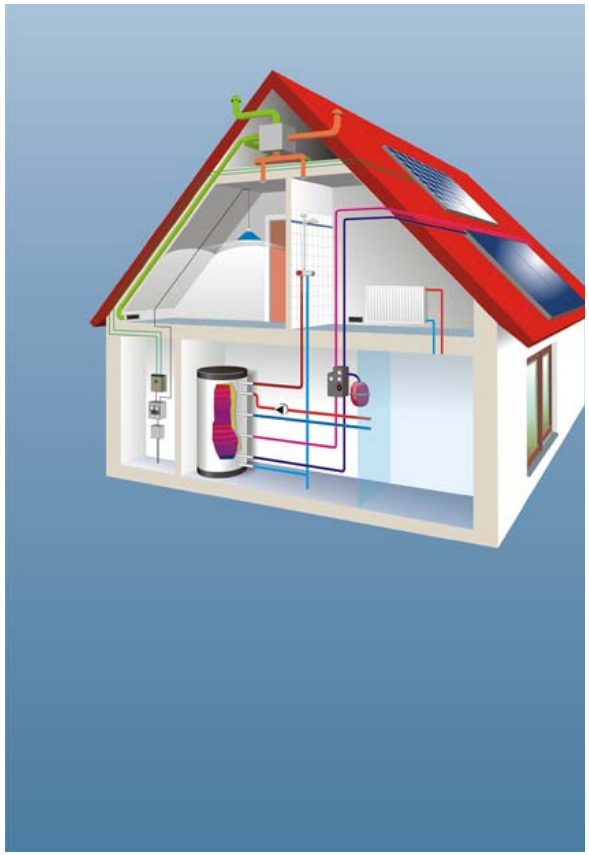
Solar hot water generation



Solar hot water generation and combination systems



Efficiency of the total system



Instead of using individual electric water heaters a central hot water system has lower losses. The electric load of the building is highly reduced.

60-70 % of the hot water can be generated through solar. Remaining is covered by the backup system

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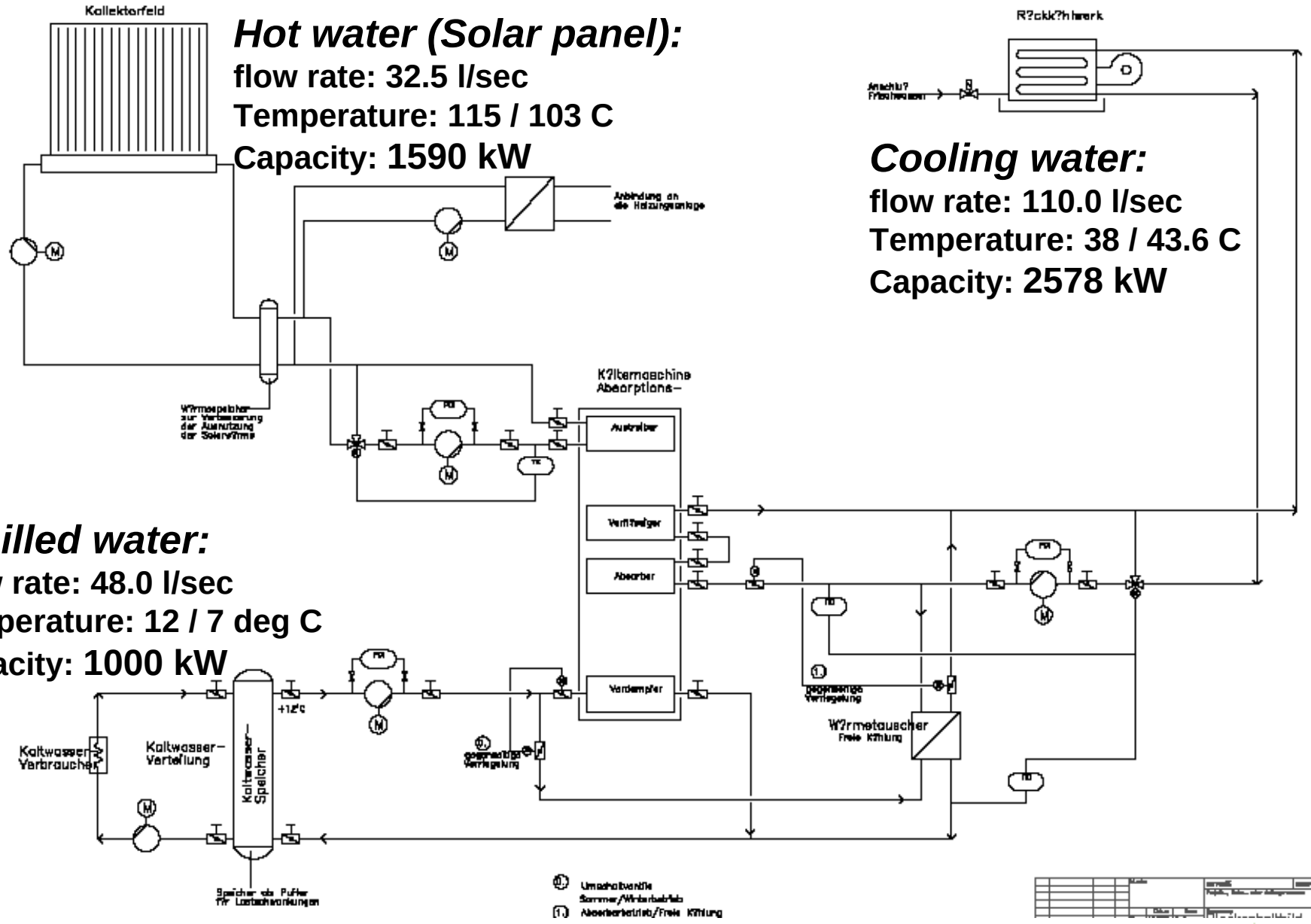
Example: Selection of a Solar cooling system in Dubai



Hot water (Solar panel):

flow rate: 32.5 l/sec
Temperature: 115 / 103 C
Capacity: 1590 kW

Cooling water:

flow rate: 110.0 l/sec
Temperature: 38 / 43.6 C
Capacity: 2578 kW

Chilled water:

Flow rate: 48.0 l/sec
Temperature: 12 / 7 deg C
Capacity: 1000 kW

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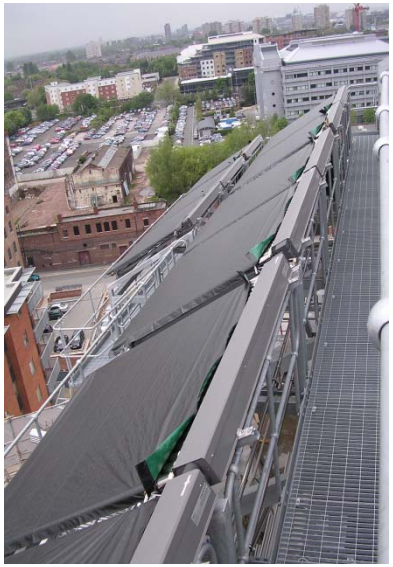
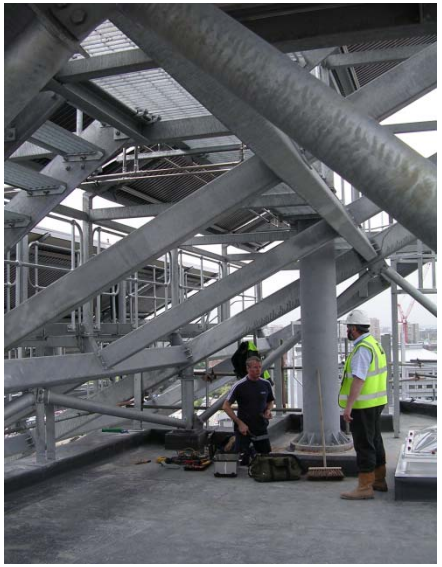
Installation examples

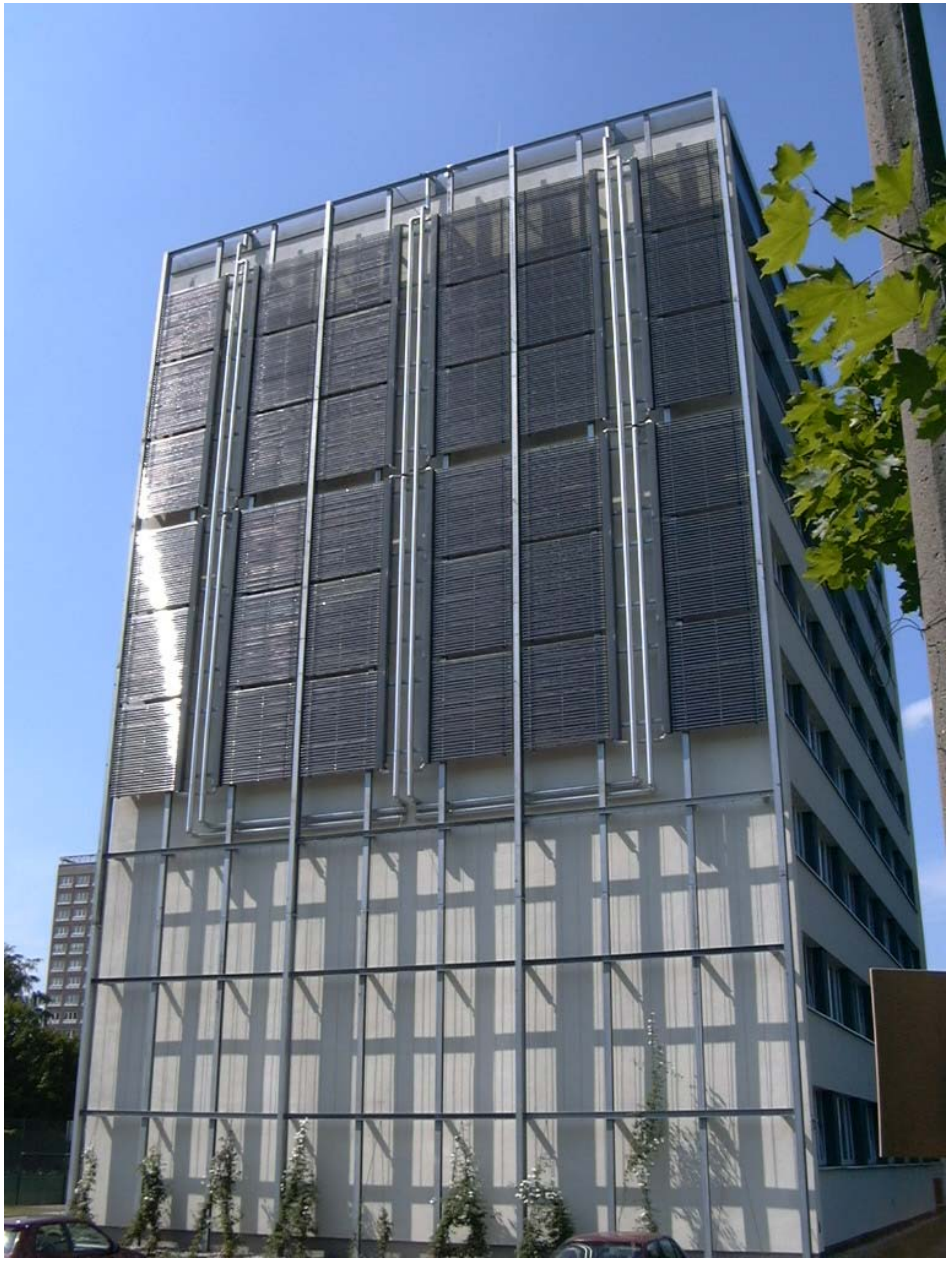
Case study –
Green Building, Manchester





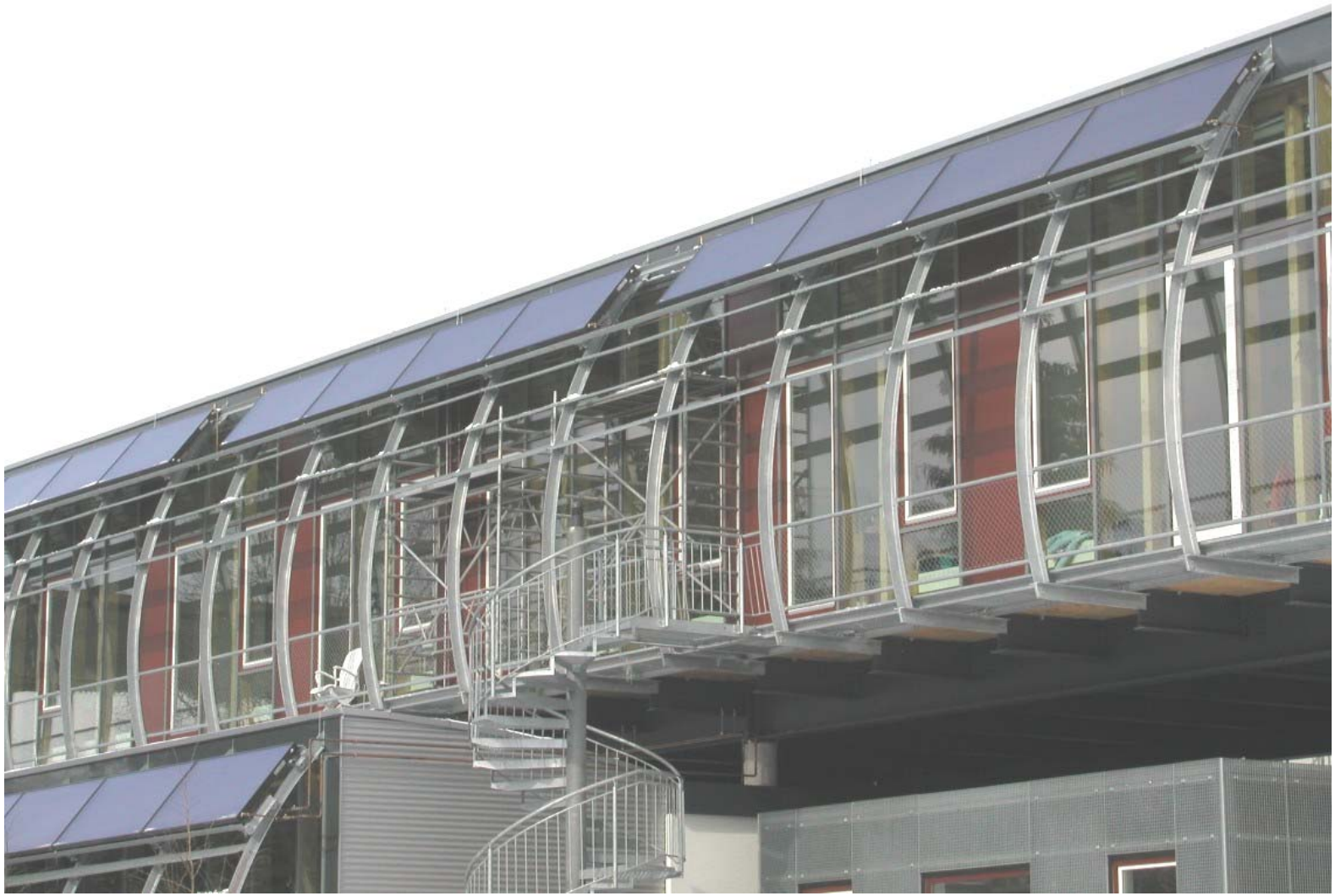
Installation examples

Installation examples



Vacuum tube collectors on a vertical surface

Installation examples



Installation examples in UAE
Jebel Ali Process heating system

Solar Absorber gross surface area : 296.1 m^2

Energy produced by collectors : 376,4 MWh/year

Diesel savings : 48,1 m^3/year.

CO_2 emissions avoided : 132500 kg

Application0 : Process heat for hot water loop at manufacturing plant

Installed by Value Addition FZE

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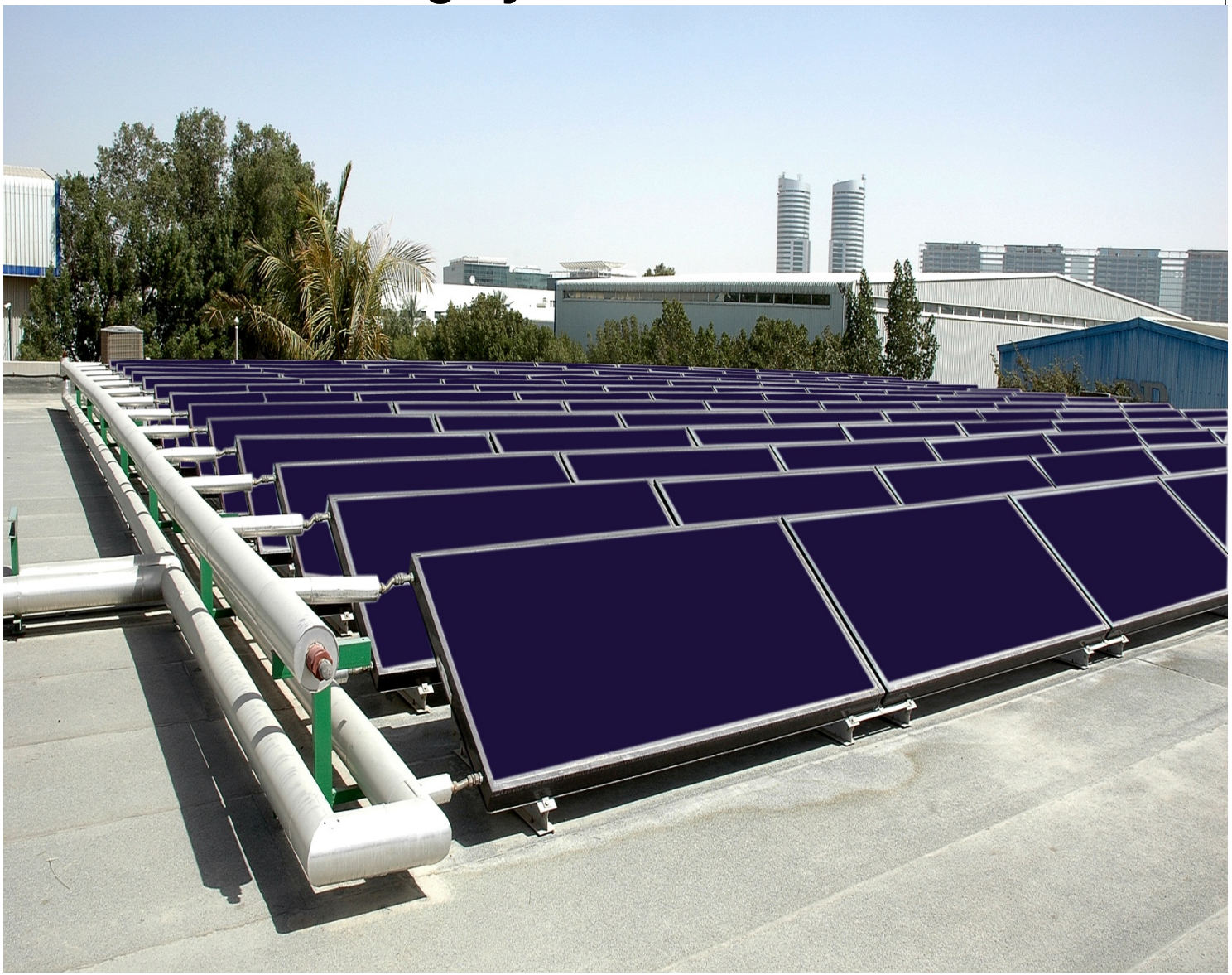
Installation examples in UAE
Jebel Ali Process heating system



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Installation examples in UAE
Palm Jumeirah Residential buildings solar hot water system

Solar Absorber gross surface area :

14 x 200 m^2 (2800 m^2)

Energy produced by collectors : 3805 MWh/year

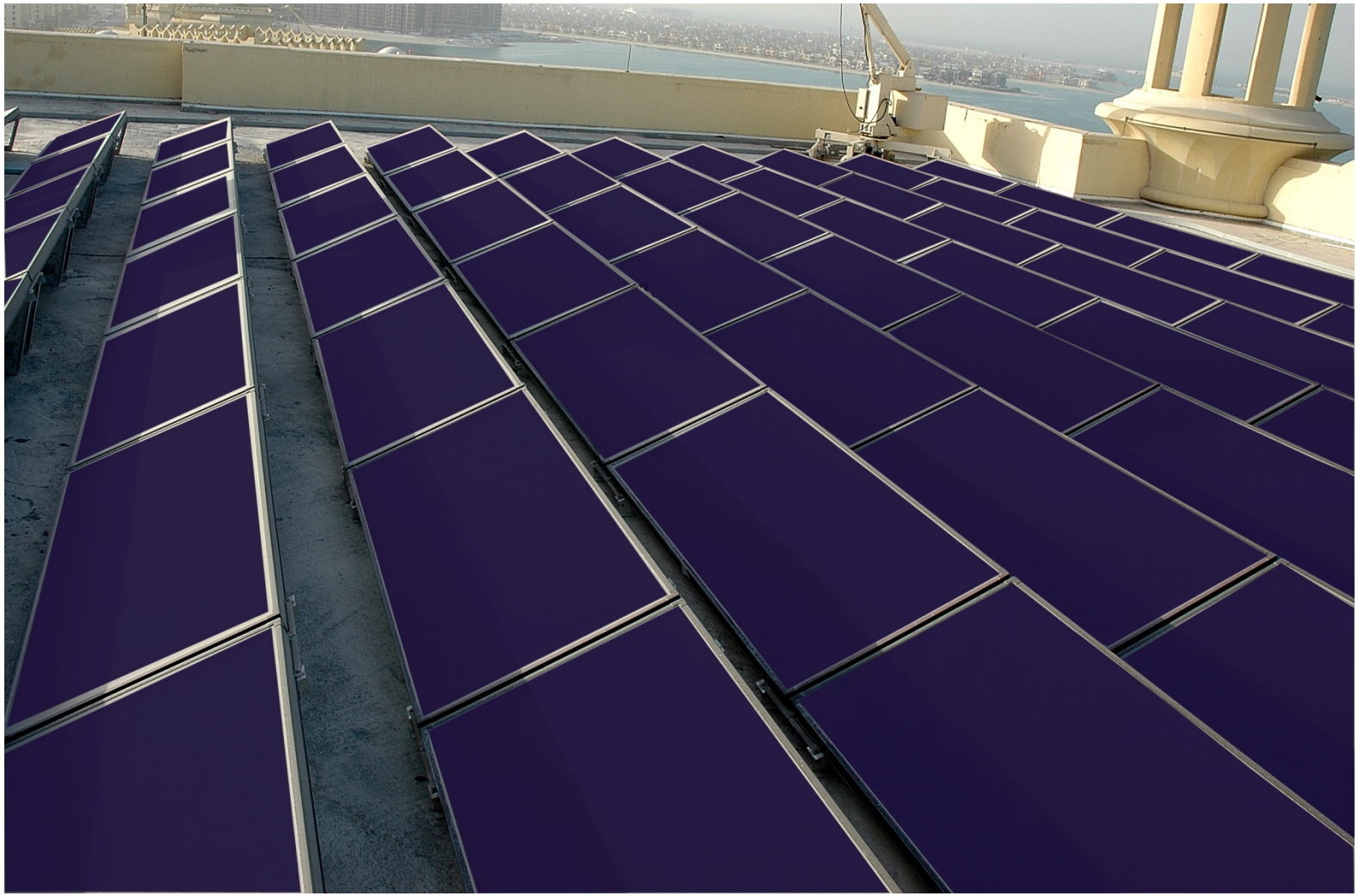
Natural gas savings : 471000 m^3/year.

CO_2 emissions avoided : 1 070 000 kg

Backup system Gas fired wall hung condensing boilers

Installed by Value Addition FZE

Installation examples in UAE
Palm Jumeirah Solar Energy System



Viessmann Flat Solar Thermal Panels with original support system and connection pipes

Installation examples in UAE
Palm Jumeirah Solar Energy System

Viessmann Domestic Hot Water cylinders

Viessmann Gas condensing boilers for the backup of the system (109 % efficiency)

Installation examples in UAE
Solar Energy System for villa's in Jumeirah

Solar hot water system with electric backup

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Installation examples in UAE
Al Quoz Solar Energy System labour camp

Operational since 2000

Photovoltaic or Solar Thermal ?

Based on simulations for Dubai:

1 m² Solar Thermal

Investment ~ 800 -1000 Euro

Gain 1300 kWh/a **heat**

CO_2 savings 932 kg/a

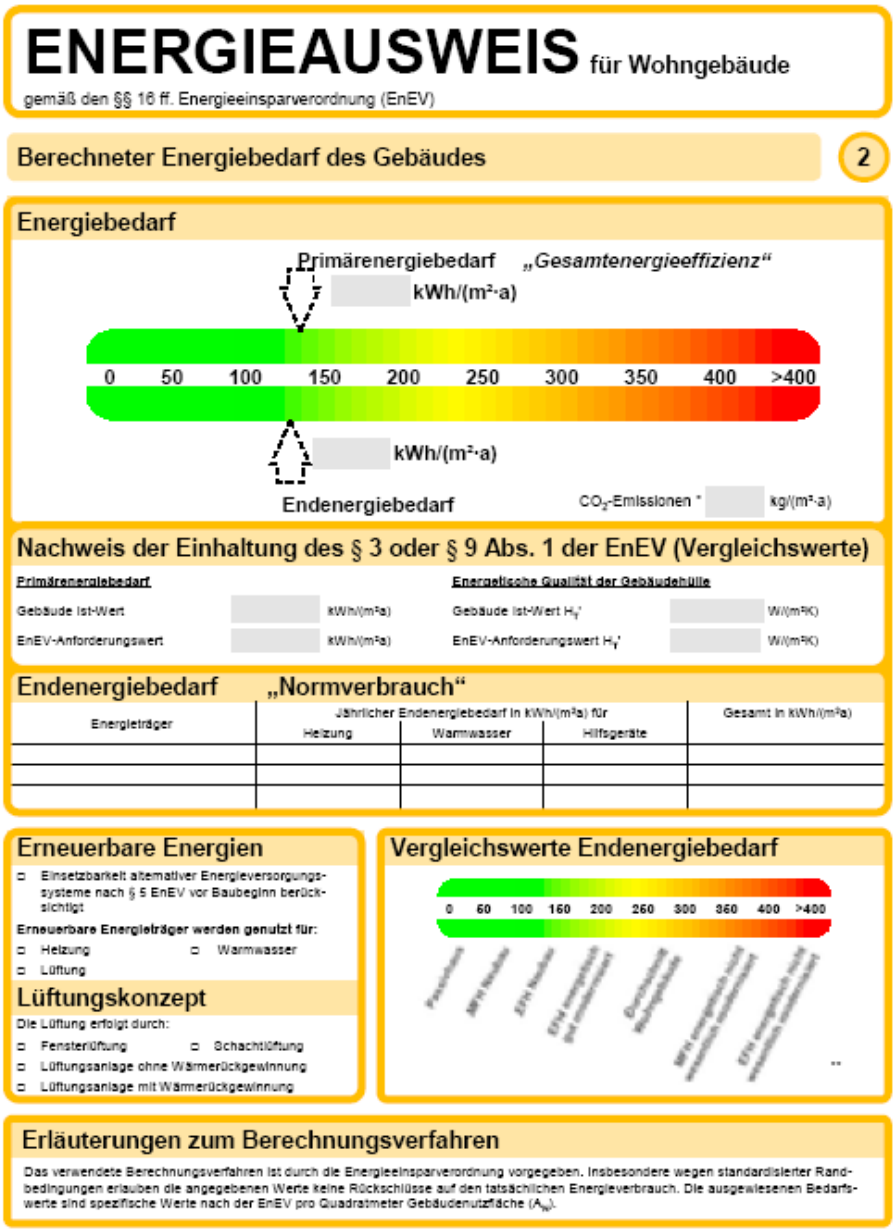
1 m² PV system

Investment ~ 1500 Euro

Gain 208 kWh/a **electric**

CO_2 savings 184 kg/a

European Energy Performance of Buildings Directive 2002 /91/EC



ENERGIEAUSWEIS für Wohngebäude

gemäß den §§ 16 ff. Energieeinsparverordnung (EnEV)

Berechneter Energiebedarf des Gebäudes — 2

Energiebedarf

Primärenergiebedarf „*Gesamtenergieeffizienz*“ kWh/(m²·a)

0 50 100 150 200 250 300 350 400 >400

kWh/(m²·a)

Endenergiebedarf

CO_2-Emissionen * kg/(m²·a)

Nachweis der Einhaltung des § 3 oder § 9 Abs. 1 der EnEV (Vergleichswerte)

Primärenergiebedarf			Energetische Qualität der Gebäudehülle		
Gebäude Ist-Wert		kWh/(m²a)	Gebäude Ist-Wert H_T'		W/(m²K)
EnEV-Anforderungswert		kWh/(m²a)	EnEV-Anforderungswert H_T'		W/(m²K)

Endenergiebedarf „Normverbrauch“

Energieträger	Jährlicher Endenergiebedarf in kWh/(m²a) für Heizung	Warmwasser	Hilfsgeräte	Gesamt in kWh/(m²a)

Erneuerbare Energien

- Einsetzbarkeit alternativer Energieversorgungssysteme nach § 5 EnEV vor Baubeginn berücksichtigt

Erneuerbare Energieträger werden genutzt für:

- Heizung
- Warmwasser
- Lüftung

Lüftungskonzept

Die Lüftung erfolgt durch:

- Fensterlüftung
- Schachtlüftung
- Lüftungsanlage ohne Wärmerückgewinnung
- Lüftungsanlage mit Wärmerückgewinnung

Vergleichswerte Endenergiebedarf

0 60 100 160 200 260 300 360 400 >400

Erläuterungen zum Berechnungsverfahren

Das verwendete Berechnungsverfahren ist durch die Energieeinsparverordnung vorgegeben. Insbesondere wegen standardisierter Randbedingungen erlauben die angegebenen Werte keine Rückschlüsse auf den tatsächlichen Energieverbrauch. Die ausgewiesenen Bedarfswerte sind spezifische Werte nach der EnEV pro Quadratmeter Gebäudenutzfläche (A_N).

Limitation of the primary energy demand of buildings

Example Germany:

- Existing building 130-210 kWh/m².year
- Low energy house 70 kWh/m².year
- Energy efficient house 40 kWh/m².year

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Solar energy needs
good engineering design
and installation
to reach the goal !

Questions ?

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