

SUN & WIND ENERGY



Old friends and new companions

PHOTOVOLTAICS

Advanced process control in PV industry

WIND ENERGY

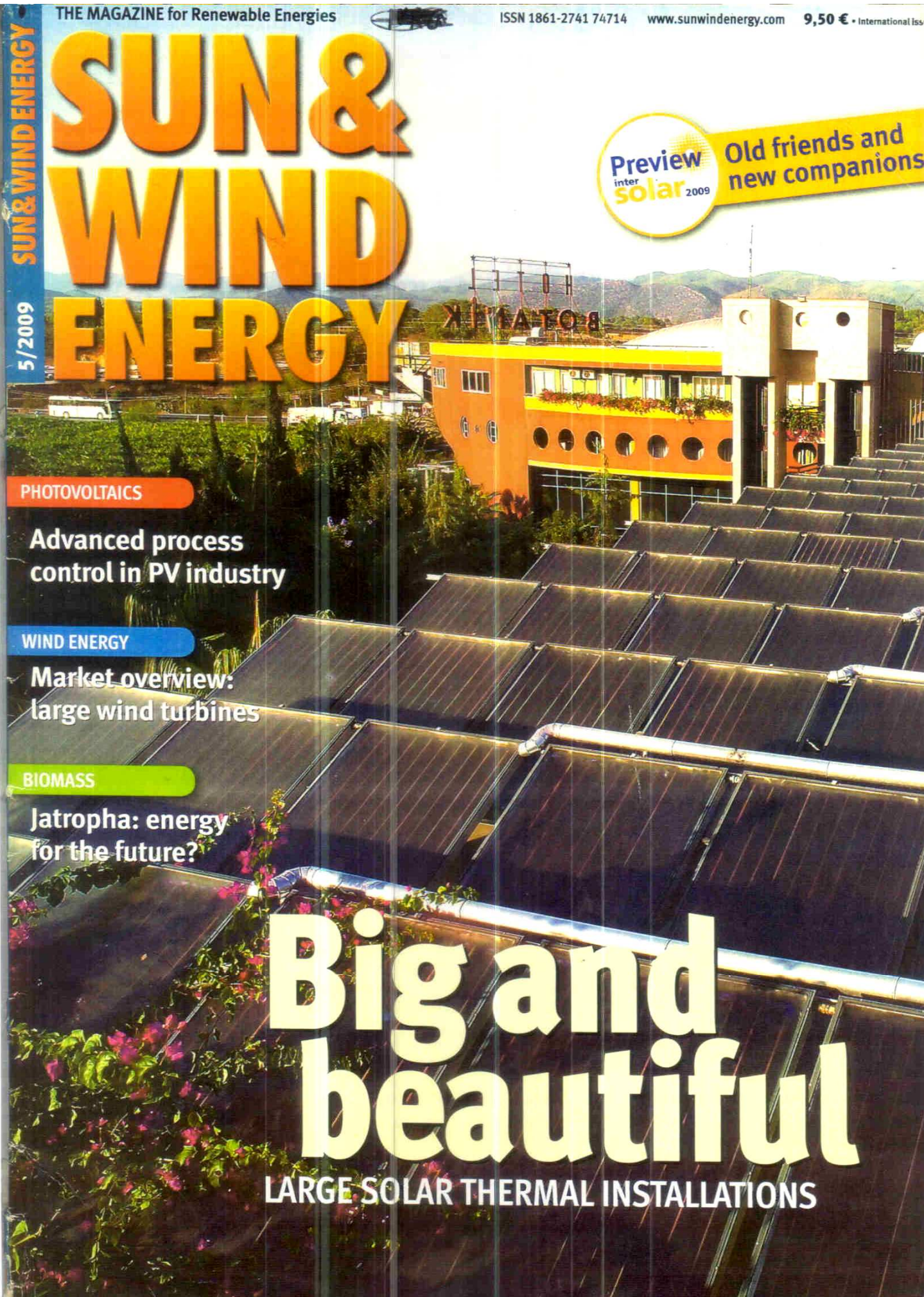
Market overview: large wind turbines

BIOMASS

Jatropha: energy for the future?

Big and beautiful

LARGE SOLAR THERMAL INSTALLATIONS



Sample projects with 50 to 500 m² of collectors

Collector manufacturer	Planning company / installing company	Location	Start of operation	Type of plant	Type of solar system	Kind of system	Collector area [m ²]	Volume of storage [litre]	Solar coverage	Project specials
Ariston Thermo Group, Italy	n/a	Lanzarote (Canary Islands) / Spain	2008	sports halls	DHW and pool heating	pumped	375	3,000	70 %	3 swimming pools heated by solar system
Baymak, Turkey	Baymak after sales service	Turkey	2005	hotel	DHW	pumped	70	5,000	100 %	
Buderus (Bosch Thermotechnik), Germany	n/a	Wiehl / Germany	2008	2 multi-family houses	DHW and solar space heating	pumped	57	2,600	13 %	solar system SAT-WZ midi with remote monitoring and remote parametrization
Chiryu Heater, Japan	Chiryu Heater	Komagane / Japan	2007	care home	DHW and solar space heating	pumped	92	1,000 (hot water) 18,000 (storage for heating)	50 %	roof-integrated collectors
Chromagen, Israel	Chromagen	Israel	2004	multi-family house	DHW	pumped	294	22,050	75 %	7 buildings, each with 21 apartments
CitrinSolar, Germany	CitrinSolar / Willi Mayer, Toarmina (Sicily)	Catania (Sicily), Italy	2008	hotel	DHW	pumped	126	6,000	85 %	
Elco (Ariston Thermo Group), Germany	Ralf Petersen	Kiel / Germany	2008	hotel / 80 rooms	DHW and solar space heating	pumped	110	4,000	35 %	two heat pumps and two condensing boilers as backup
Elcora, Cyprus	Elcora	Limasol / Cyprus	2006	hotel	DHW	pumped	140	7,000	80 %	
EnerWorks, Canada	Glenbarra Energy	Pickering (Ontario) / Canada	2008	apartment building	DHW	pumped	218	2,724	18 %	uses the pre-packaged EnerWorks Solar Energy Unit
Ezinç, Turkey	Ezinç / Erciyes University	Kayseri / Turkey	2002	Erciyes University	DHW and solar space heating	pumped	334	12,280	100 %	facilities save 90,000 kg oil per year
Hellomex, Mexico	Rydia	León / Mexico	2009	hospital	DHW	pumped	100	8,000	60 %	
Heliotek, Brazil	Heliotek	Sao Paulo / Brazil	2008	hotel	DHW	pumped	300	30,000	70 %	high efficiency flat plate collector
Jehin, Korea	Jehin	Seoul / Korea	2000	sports halls	DHW	drain back	500	22,000	60 %	
Kloben, Italy	Kloben	Salerno / Italy	n/a	hotel and restaurant	DHW, solar space heating and cooling	pumped	145	12,000	70 %	
Módulo Solar, Mexico	Módulo Solar	Mexico City	1997	sports hall, Pumas soccer	DHW	pumped	300	17,000	85 %	
NRG Technologists, India	NRG Technologists	Jamnagar (Gujarat) / India	1998	5 star hotel	DHW	pumped	500	30,000	85 %	composite intelligent control for all operations including recirculation, gas boiler, pressurized and forced flow
Ouraset, Turkey	Solar-GE	Bodrum / Turkey	2008	hotel	DHW	pumped	78	4 x 1,000	45 %	
Siko Solar, Austria	Office A3 Innsbruck, Austria	Telfs (Tyrol) / Austria	2006	multi-family house	DHW	pumped	420	9,000	60 %	collectors adjusted on the curved balcony fronts
Solahart, Australia	Accomandita	Sicily / Italy	2006	hotel	DHW	thermosiphonic	220	15,600	70 %	
Solar Dynamics, Barbados	Solar Dynamics	St. Michael / Barbados	1974	military complex	DHW	thermosiphonic	164	12,718	90 %	
Sunerg, Italy	n/a	Iesi / Italy	2006	sports hall	DHW	pumped	200	n/a	n/a	
Sunrain, China	Sunrain	Lianyungang City (Jiangsu Province) / China	2008	hotel	DHW	pumped	420	24,000	65 %	
Tisun, Austria	Assyce Ingenieros	Granada / Spain	2007	hotel, 171 beds	DHW, solar space heating and pool heating	pumped	400	4 x 5,000	40 %	savings of 143,746 kg CO ₂ per year
Transsen, Brazil	Transsen	Salvador / Brazil	2006	hotel	DHW	pumped	400	45,000	70 %	pre-heating system
Tuma, Brazil	Kempen & Kempen	Porto Seguro / Brazil	2002	hotel	DHW	thermosiphonic	140	21,000	75 %	7 independent thermosiphonic systems (3,000 liters each)
Vaillant, Germany	Vaillant gave planning support to the local installer	near San Diego (California) / USA	2007	multi-family house	DHW and solar space heating	pumped	87	6,000	70 %	in combination with an air/water heat pump additional pool heating and floor heating
Wagner & Co., Germany	Solartronic, Witzenhausen, Germany	Burg Ludwigstein / Germany	2007	youth hotel	DHW	pumped	54	3,000	40 %	system with buffer tanks and instantaneous hot water preparation

DHW = domestic hot water; large flat plate collectors and stratified storage tank Pro-Clean with spherical exchanger; 42 per building; plus 175 for space heating

for example, installed a system with 1,500 m² of solar collectors for the sports centre of the Spanish city of Haro. The flat flow-through, unglazed solar collectors provide hot water to the visitors of both the



Over the past five years, Transsen has built more than 250 large-scale systems in Brazil, Chile, Peru, Argentina and Bolivia. The majority of those systems were used in hotels and multi-family homes.

Photo: Transsen

sports hall and fitness centre and also heat several swimming pools. Around 1,000 guests visit the sport centre every day. One noteworthy aspect: this is one of the biggest roof-integrated solar power systems anywhere in Europe.

"The architect M. Samaniego designed a smoothly-curved solar roof. He has succeeded in combining the functionality of a solar thermal system with architecture that is aesthetically appealing. The modular solar panels are perfectly integrated into the building and no compromises were made in terms of design, dimensions or shape", explains Bernard Thissen of Energie Solaire. The solar roof replaces the tiles and slates of a conventional roof with a series of unglazed collector panels connected by sealed joints. "Although less efficient than glazed solar panels at high temperatures, these panels have a lower capital cost and are therefore the preferable choice for many applications", Thissen continues. The AS type absorber used by Energie Solaire is made of two sheets of

The majority of medium-sized solar thermal systems were built for hotels or multi-family homes.

Source: company information



Aesthetics combined with solar thermal energy: Siko succeeded in seamlessly integrating these solar collectors into balconies in Innsbruck, Austria. Photo: Siko Solar

Sample projects with over 500 m² of collectors

Collector manufacturer	Planning company / installing company	Location	Start of operation	Type of plant	Type of solar system	Kind of system
Baymak, Turkey	Baymak	Turkey	2007	hotel	DHW	pumped
Buderus, Germany	n/a	Berlin / Germany	2006	multi-family house	DHW and solar space heating	pumped
Chromagen, Israel	CUEX	Havana / Cuba	2008	hotel	DHW	pumped
Derya, Turkey	Derya	Antalya City / Turkey	2009	hotel	DHW	pumped
Emmvee Solar, India	Tirumala Tirupathi Devasthanams	Tirumala (Andra Pradesh) / India	2003	hotel/lodge for pilgrims	domestic bathing, cooking	pumped and thermosiphonic
EnerWorks, Canada	Enermodal/Hurst	Okotoks (Alberta) / Canada	2005	district heating system for 54 individual homes	solar space heating ²	pumped
Eziñç, Turkey	Eziñç	Alanya (Antalya) / Turkey	2005	hotel	DHW	pumped
Kloben, Italy	n/a	Khartoum / Sudan	2007	hospital	heating and cooling system	pumped
Jehin, Korea	Jehin	Kwangju / Korea	2000	dormitory	DHW	pumped
Módulo Solar, Mexico	Módulo Solar	Cancún / Mexico	2005	hotel Cancún Palace	DHW	pumped
NRG Technologists, India	NRG Technologists	Idar (Gujarat) / India	1991	industrial, preheating	hot water at 85 °C for feeding to the boiler	pumped
Ouraset, Turkey	Tansug Engineering	Alanya / Turkey	2006	multi-family house	DHW	pumped
Siko Solar, Austria	Klimatherm, Zirl (Austria)	Innsbruck / Austria	2008	multi-family house	DHW	pumped
Sunrain, China	local installation company	Henan Province / China	2008	multi-family house	DHW	pumped
Tisun, Austria	planner: TGA Consulting / ZAE Bayern Energieforscher; installer: Lausser	Munich / Germany	1999	multi-family house (district heating)	DHW and solar space heating	pumped
Transsen, Brazil	Transsen Brazil and Transsen Peru	Tacna / Peru	2008	sports hall	DHW	pumped
Tuma, Brazil	Tuma	Belo Horizonte / Brazil	1994	hotel	DHW	pumped
Wagner & Co., Germany	planning: PKI, Stuttgart (Germany)	Eggenstein / Germany	2008	sports halls, school and indoor pool (district heating)	DHW and solar space heating	pumped

DHW = domestic hot water; ¹ homes have individual small solar water heating appliances; ² solar roof, three collector fields

selectively coated stainless steel. The solar liquid flows through a pattern of offset metal pads. The solar collector array in Haro is capable of achieving an energy yield of around 500 kWh/m²a.

Stainless steel absorbers are not the only components suitable for swimming pool heating. The Brazilian company Aquecedor Solar Transsen Ltda. (Transsen) installed a solar thermal system for heating an indoor swimming pool in the Peruvian city of Tacna. Heat is supplied by unglazed swimming pool absorbers that are made of plastic and comprise 1,080 m² of surface area. "This is the biggest system for pools in South America", says Newton Koeke,

International Trade Manager of Transsen.

The Italian company Kloben (Turco Group S.r.l.) specialises in systems that provide heat for solar cooling. In 2007 the company installed almost 1,000 m² of vacuum tube collectors in a hospital in Khartoum, the capital of Sudan, for air-conditioning purposes. The solar heat is transferred at a temperature of up to 95 °C to a 50 m³ storage tank. If there is insufficient heat to run the refrigeration machine with 95 °C hot water, then a boiler will be used for reheating. The refrigeration machine produces cold water at a temperature of 7 °C. Recooling occurs once the temperature reaches 45 °C.

Collector area [m ²]	Volume of storage [litre]	Solar coverage	Project specials
520	16,500	100 %	
570	n/a	n/a	solar system SAT-WZ midj with remote monitoring and remote parametrization
1,510	120,000	n/a	21 buildings – 1,308 rooms
550	40,000	n/a	selective collector, galvanized boiler
2,000	125,000	30 %	Auto DTC connected to electrical backup
2,300	240,000	91 % for space heating, 60 % for hot water	short term heat is stored in large water tank, long term storage in borehole storage system
1,174	50,000	100 %	hotel saves 150,907 kg LPG per year
950	50,000	95 %	
1,000	40,000	70 %	
1,000	55,000	60 %	
500	20,000	85 %	one of the first systems of this size at 85 °C in India, first boiler feed water system in India
800	40,000	70 %	
1,360	28,000	60 %	at the moment Europe's biggest multi-family passive house
576	30,000	60 %	
3,000	5,700,000	50 %	for 27,000 m ² housing space, collectors replace the roof
1,080	Olympic pool	90 %	the biggest system for pools in South America
804	60,000	75 %	4 storage tanks (15,000 liters each) made by stainless steel
1,600 ²	4,500,000	35 to 40 %	seasonal storage of solar energy with a gravel/water storage, energetic reconstruction of all buildings

Hotel systems also dominated in the area of large-scale solar thermal systems.

Source: company information

In Mexico, Heliomex has built two large-scale systems for solar process heat.

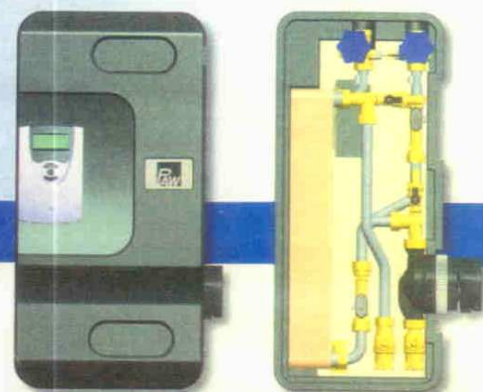
Photo: Heliomex



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