Solar Thermal System Solutions

Powering the Planet – Every Day

Sacramento Metropolitan Air Quality Management District

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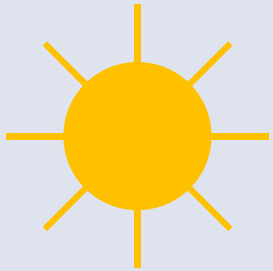
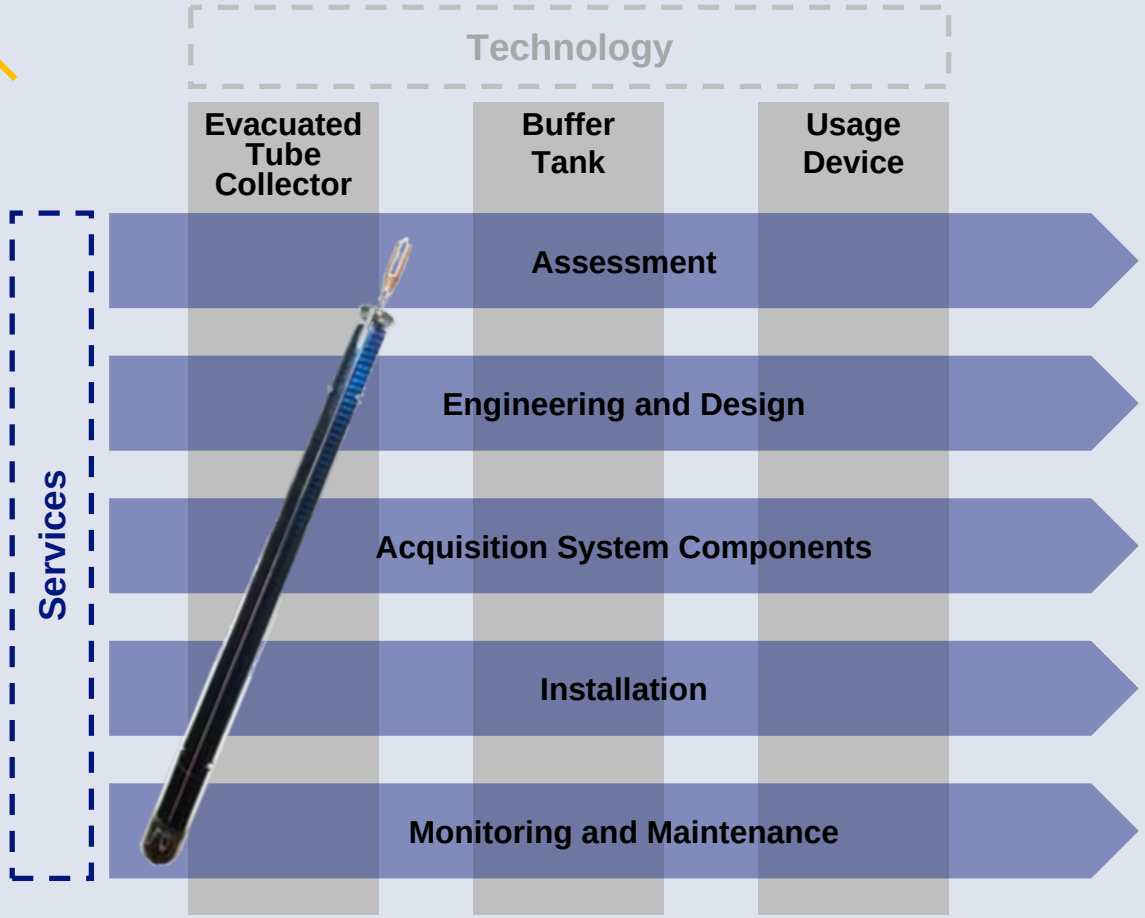
- **Company Presentation**
- Solar Thermal Market Potential
- Solar Thermal Technologies
- Solar Thermal Applications

ergSol is a U.S. based provider of complete and customized solar thermal system solutions

ergSol's Technology and Services





- Cooling
- Water Heating
- Process Heat
- Space Heating

ergSol can help to attain the quality of life we seek

ergSol

Providing complete and customized solar thermal solutions utilizing highly efficient ETC technology

- **Predictable Energy Cost**
- **Reduced Greenhouse Gas Emissions**
- **Provide Energy Independence**

Sustainability

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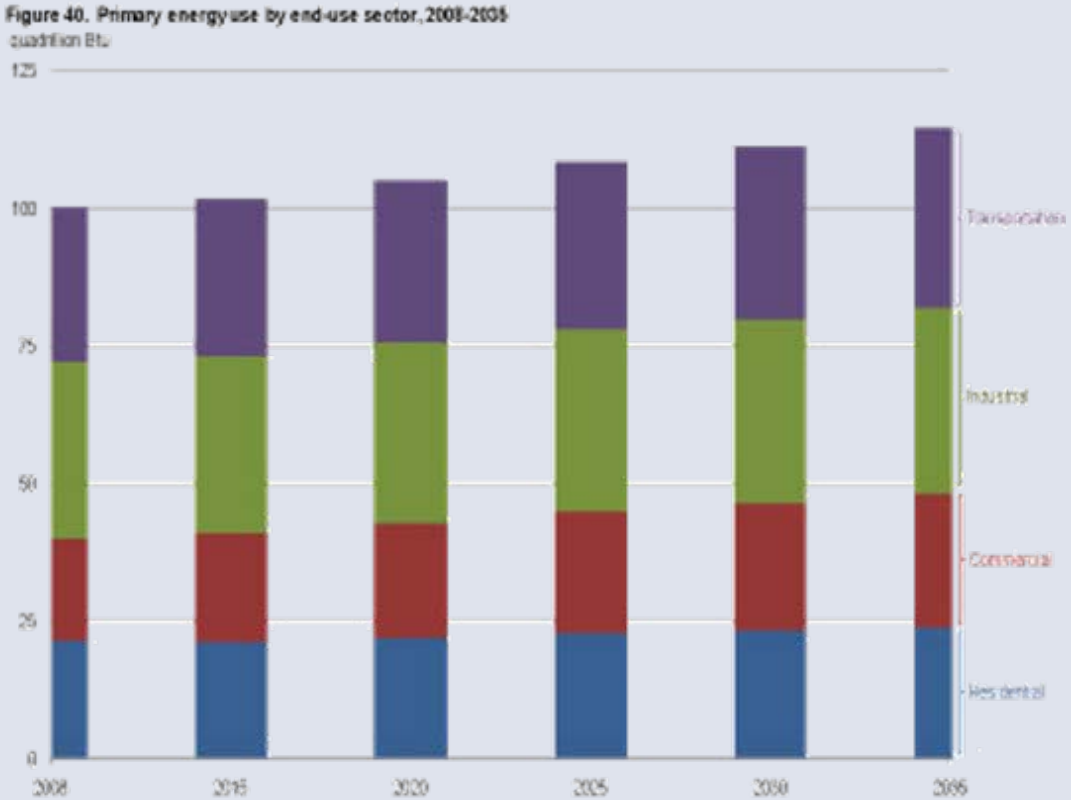
Solar Thermal can meet and exceed the demands of our energy- reliant society

Concerns and solutions

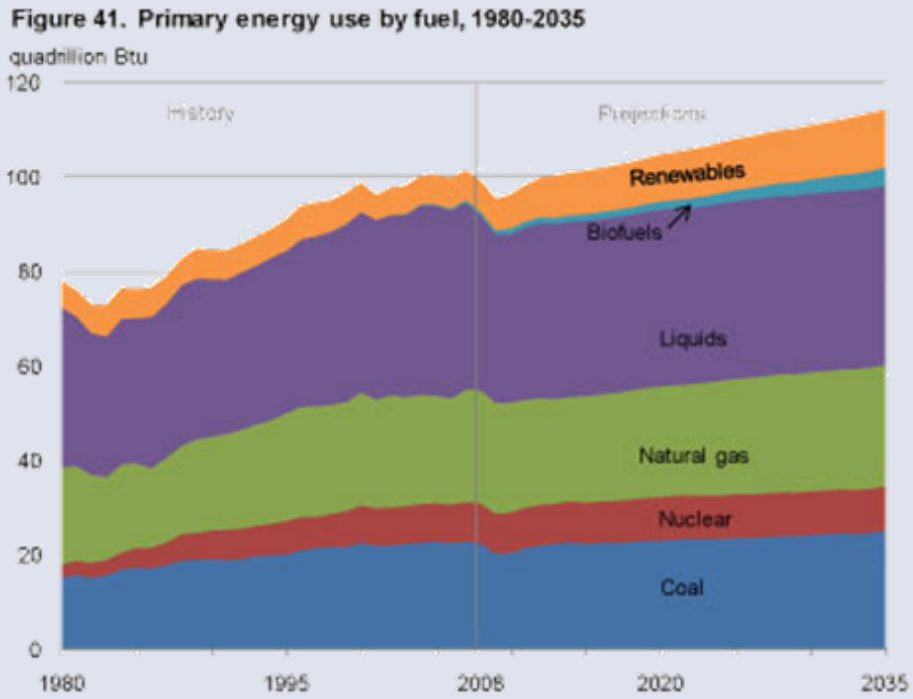
Industry concerns	Solar Thermal Solutions
Fossil fuels	• Fossil fuel supply is diminishing • Sunlight is readily available → **Independence from fossil fuels**
Fluctuating energy costs	• Reliance on global natural resources triggers cost fluctuation • Solar Thermal technology relies on the “free” sun light → **Predictable energy costs**
Emissions	• Greenhouse gas emissions are an issue • Governmental mandates on reduction • Development of “cap and trade” systems → **Reduction of carbon footprints**

The projections focus on the factors that shape the U.S. energy markets in the long term

Moderate Energy Consumption Growth and Greater Use of Renewables



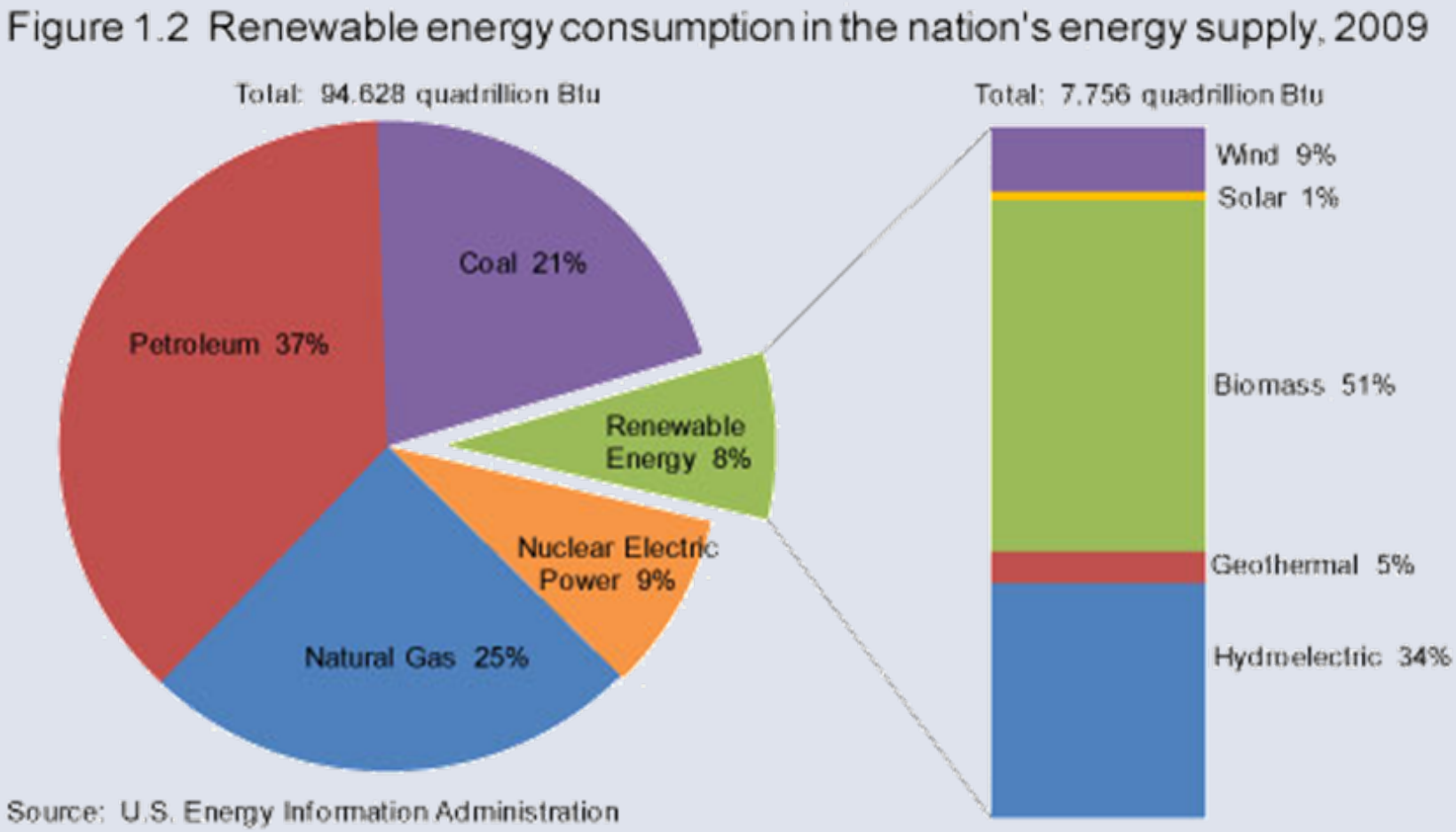
Source: EIA Annual Energy Outlook 2010



Source: EIA Annual Energy Outlook 2010

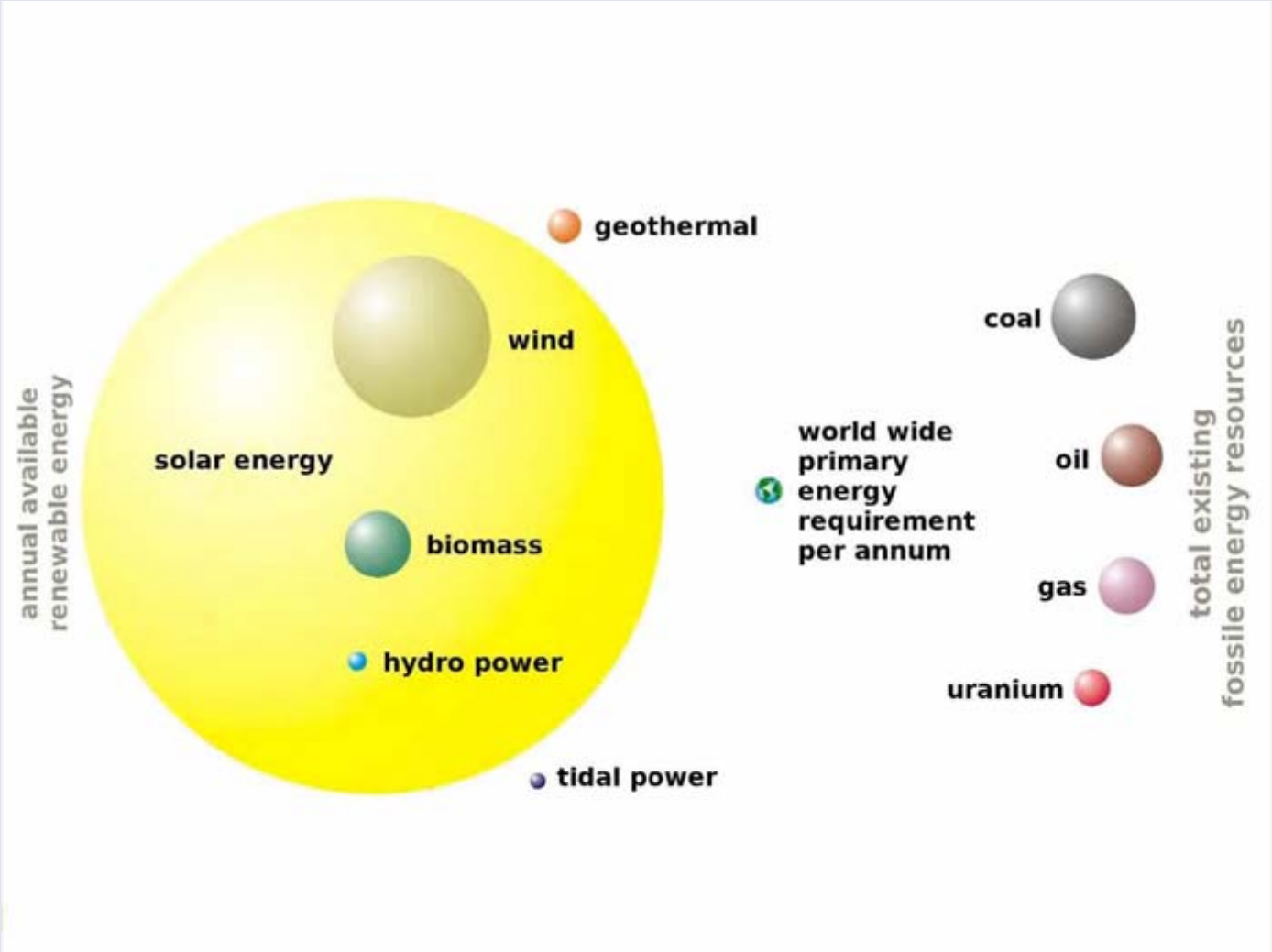
The U.S. renewable energy consumption increased in 2009 to 7.8 quadrillion Btu's

U.S. Renewable Energy Consumption



Energy resources worldwide

All Renewables



Source: Koldehoff 2009 (Prof. Volker Quaschning, FHTW Berlin/ Reference Year 2007)

The sun is the optimal solution to our growing energy challenge

Sunlight delivers more energy in one hour than the Earth uses in one year

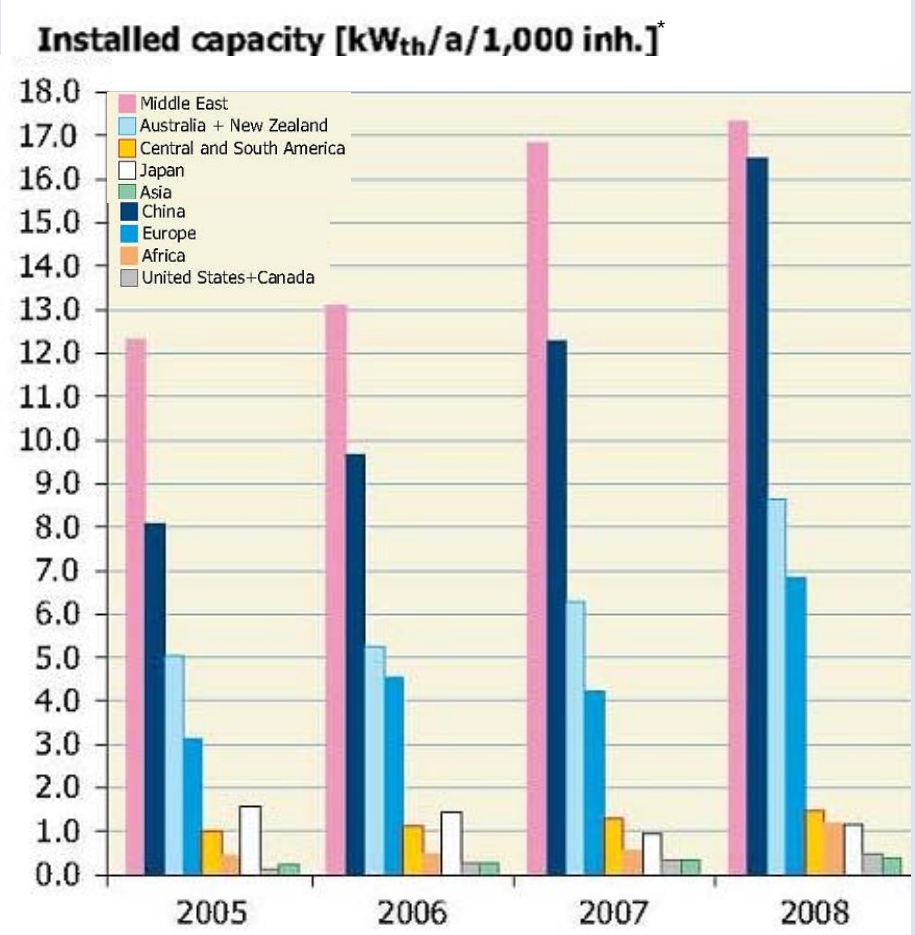
Solar Thermal Technology

Solar thermal technology is the process of capturing the sun's natural energy to produce thermal energy

- Solar thermal energy describes **heat** rather than electricity
- Solar thermal systems have the proven potential to deliver and utilize more of the sun's energy than conventional solar panel systems
- Solar thermal technology is an elegant solution that can be **customized** and optimized for many applications including **water heating, space heating, process heat and cooling**

Global market developments indicate a significant growth opportunity for the U.S. solar thermal industry

Market Potential for Solar Systems



Middle East: Israel, Jordan
Africa: Namibia, South Africa, Tunisia, Zimbabwe
Central & South America: Barbados, Brazil, Chile, Mexico, Uruguay
Asia: India, South Korea, Taiwan, Thailand
Europe: EU 27, Albania, Macedonia, Norway, Overseas Dep. of France, Switzerland, Turkey

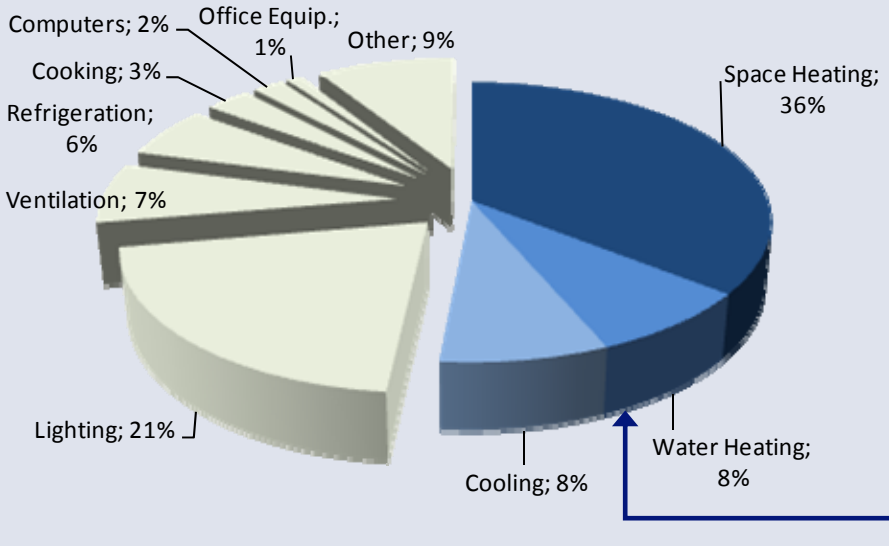
- Increasing energy demands are unable to be met by existing means
- Recent **boom** in solar system installations in the Middle East and China
- The **U.S. lags behind** the rest of the world

* Source: iea-shc Solar Heat_Worldwide 2010

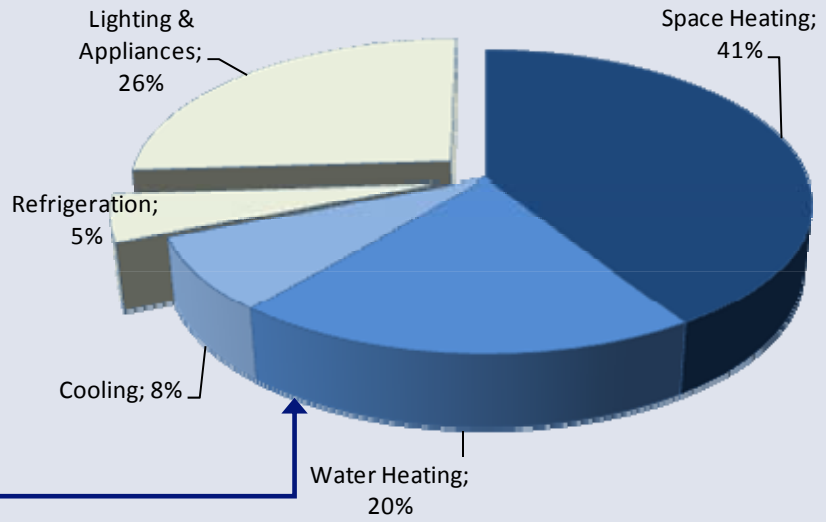
Given the great potential, now is the time to tap into the U.S. energy market place with solar thermal technology

Substantial Applications for Solar Thermal Technology

Commercial Energy Consumption (2003) [1]



Residential Energy Consumption (2005) [2]



3

- Annual primary **energy savings**: 1quad = 293,071 GWh
- Annual **CO2 emissions reduction** : 50-75 million metric tons
- Annual retail energy **cost savings**: $ 8 billion

1) Source: EIA, 2003 Commercial Buildings Energy Consumption Survey
2) EIA, 2005
3) Source: NREL, March 2007; The Technical Potential for Solar Water Heating to Reduce Fossil Fuel Use and Greenhouse Gas Emissions in the U.S.

A substantial share of industrial process heat could be provided by solar thermal technologies

Hot Water, Solar Space Heating, Solar Cooling, Process Heat, Waste Water Treatment

Categories

- **Fruit and Vegetable Processing Industry**
- **Dairy Processor**
- **Manufacturing**

Applications for Significant CO_2 Reductions

- Energy costs in 2002: $370 million for purchased electricity; $440 million for purchased fuels
- Vegetable canneries: 80% natural gas as boiler fuels; 20% electricity
- Around one half of electricity use was for machine drives; one quarter was for process cooling and refrigeration

- Energy consumption: 80% by combustion of fossil fuel; 20% by electricity
- Energy consumed depends on the range of products being produced, level of automation, age and scale of a plant
- Fuel consumption: milk powder 19.53 MBtu/ton product; cheese 4.11MBtu/ton product

- Industrial energy consumption 38% of total U.S. energy consumption in 1997
- Manufacturing processes consume about 5.2 quadrillion Btu (17%)
- Fossil fuel combustion accounts for 92% of this energy, electricity for 8%
- Commonly operations include: fluid heating, calcining, drying, metal heat treating, metal heating, smelting, metal melting, non-metal melting

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Concentrating Solar Power

Utility Scale Solar Power

Source: Brightsource – Power Tower

Source: Abengoa – Dish Sterling Technology

Source: Abengoa – Power Technology

Concentrating Solar Power

Utility Scale Solar Power

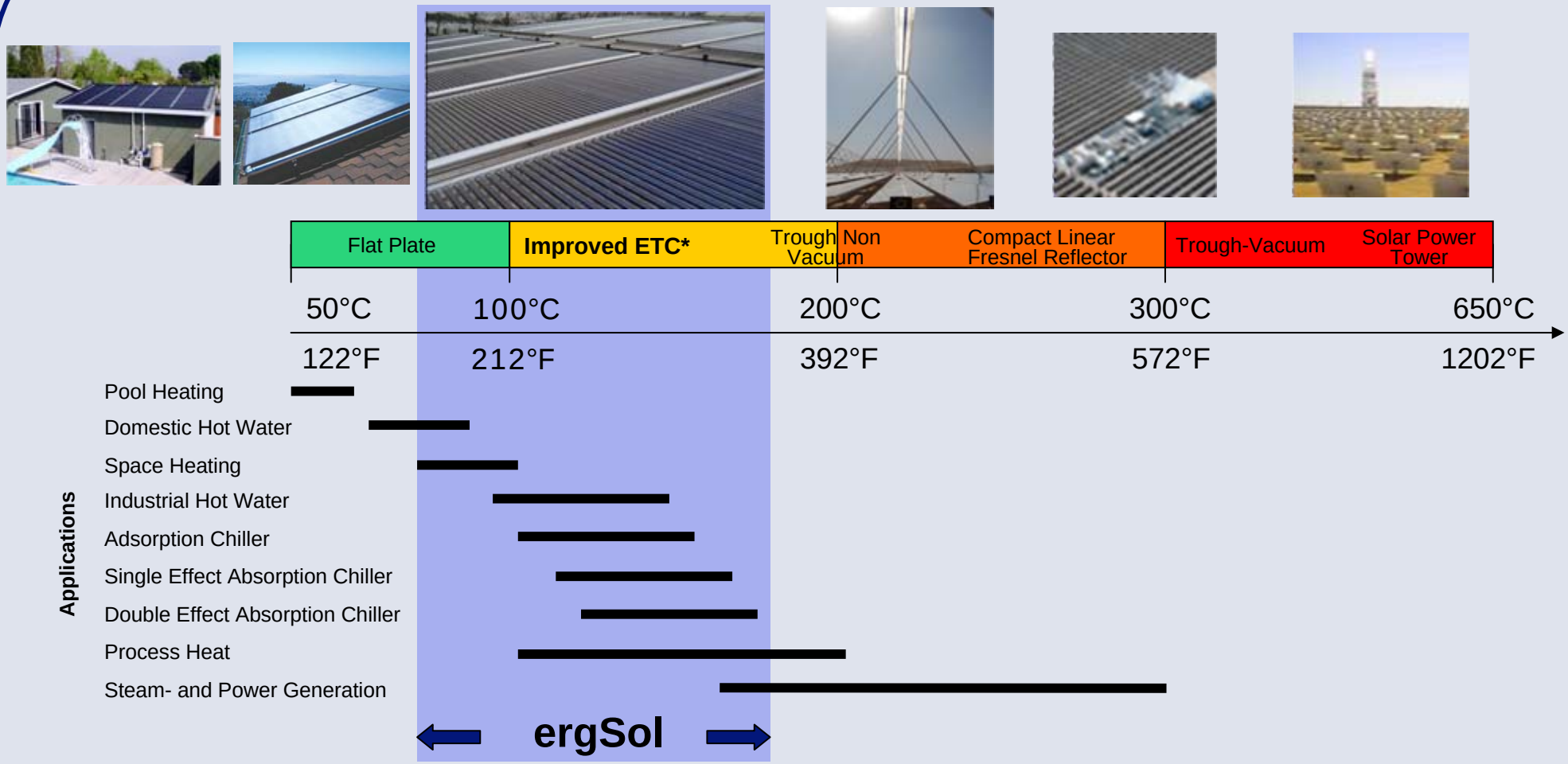
Source: Solar Millennium

Source: Solar Millennium – Parabolic Trough

Source: Ausra – Compact Linear Fresnel Reflector

Solar thermal systems have a wide range of application depending on the required temperatures

Solar Thermal Technologies



Because the ETCs are able to reach such a high temperature, they are able to provide many otherwise unattainable applications

* ETC = Evacuated Tube Collector

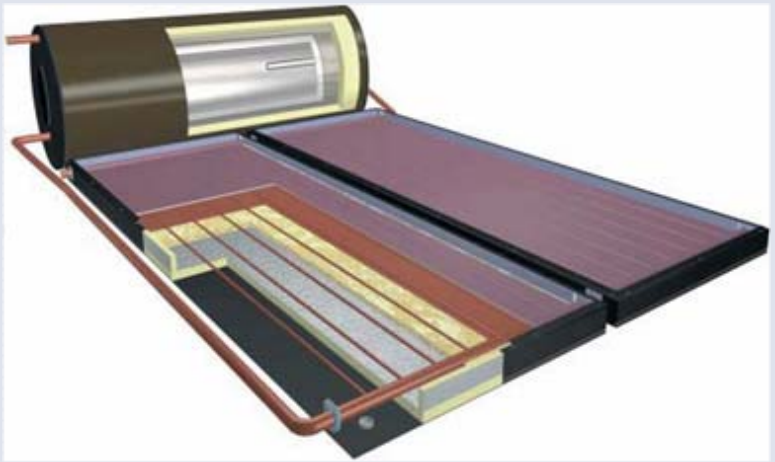
Various collector types

Lower End of Temperature Spectrum

Unglazed Solar Pool Collector

Source: Pool Solare Expert

Thermosyphon Systems

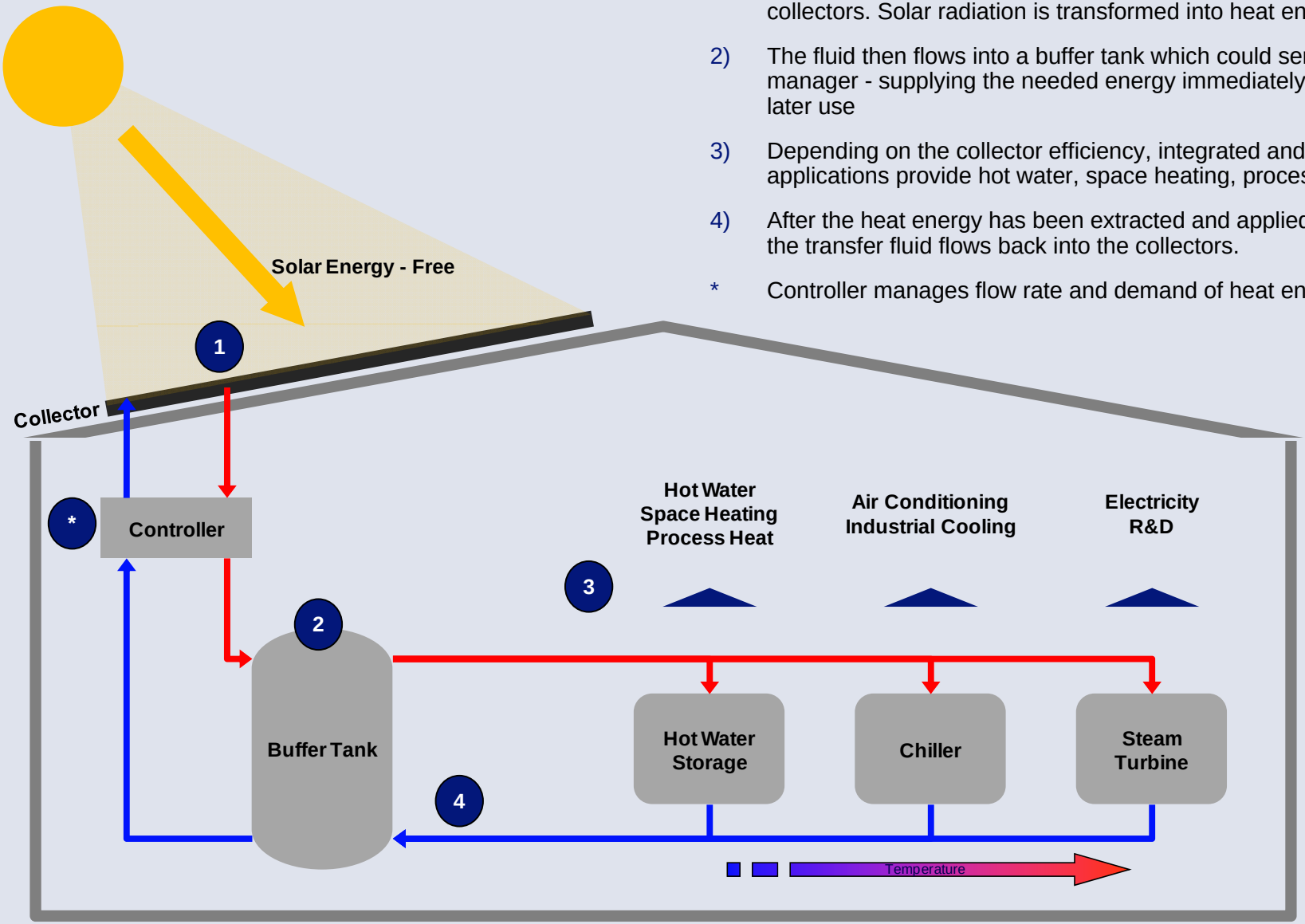


Source: SunEarth

Source: CleanTech

Solar thermal technology harnesses the natural energy to deliver clean, affordable and reliable power

Solar Thermal System



1) Energy from the sun heats up a transfer fluid inside the solar thermal collectors. Solar radiation is transformed into heat energy within the fluid.

2) The fluid then flows into a buffer tank which could serve as a 24/7 energy manager - supplying the needed energy immediately and storing the rest for later use

3) Depending on the collector efficiency, integrated and customized applications provide hot water, space heating, process heat and cooling.

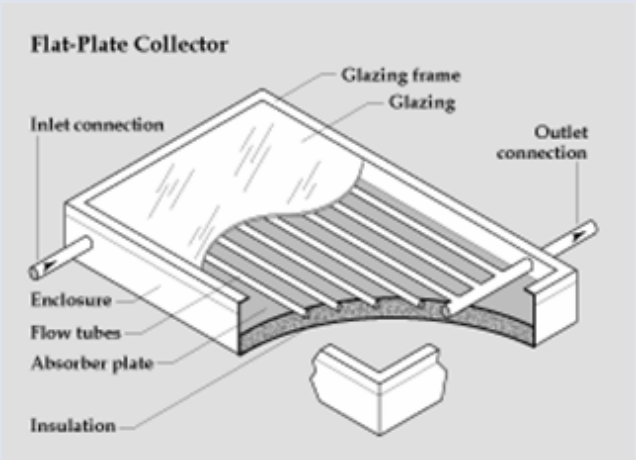
4) After the heat energy has been extracted and applied by the usage devices, the transfer fluid flows back into the collectors.

* Controller manages flow rate and demand of heat energy

Glazed flat-plate collectors

Characteristics

Source: Vaillant



Source: EERE

Source: Sunwater

Glazed flat plate collectors

Characteristics

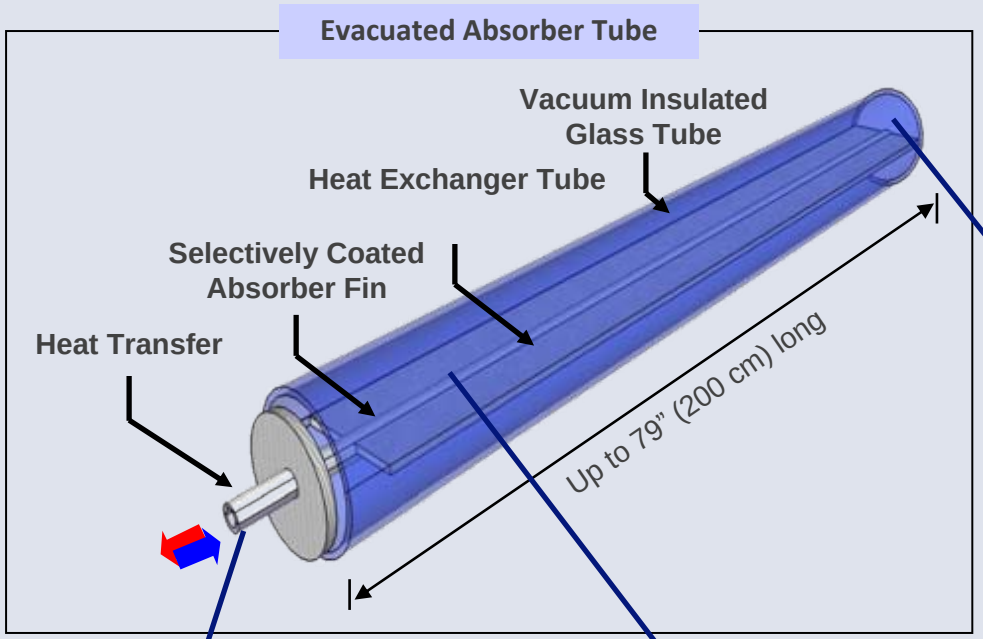
Source: Flat_plate_solar_collector

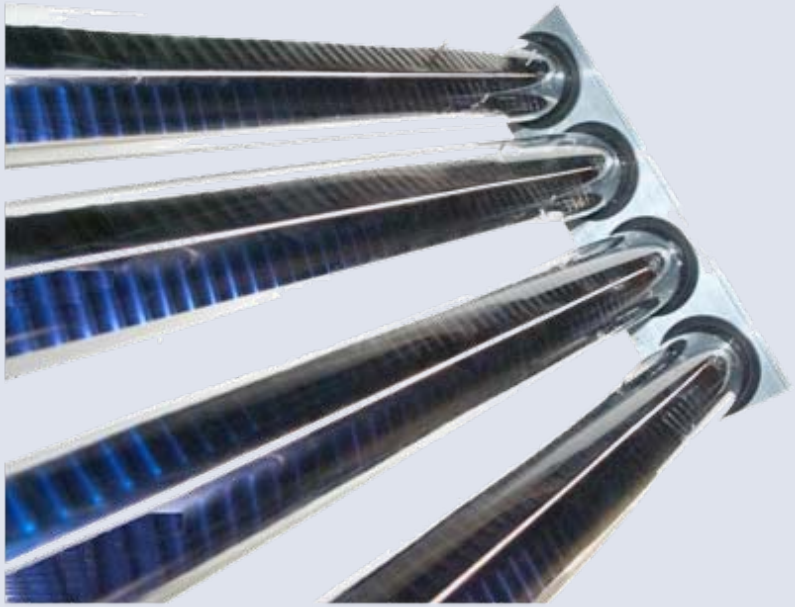
Glazed Flat Plate Collectors

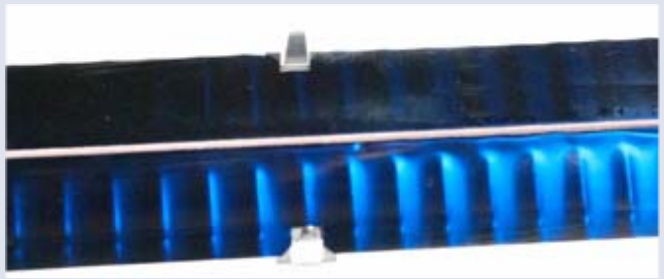
- Proven Technology
- Durable and reliable
- Should a problem occur, entire collector must be replaced
- Do perform best when installed facing south at the proper tilt
- Standard flat plate collectors operate up to 176ºF
- Capture direct and diffuse light
- Applicable in all climates
- Proper installation distance to avoid shading
- Efficiency is decreasing due to heat loss
- Application limited due to varied efficiency
- New constructions and retrofits
- Lifetime >25 years

Highly advanced evacuated tube technology takes solar thermal energy to a new level

ergSol's Evacuated Tube







Evacuated tube collectors

Characteristics

ergSol's Evacuated Tube Collector

- Proven technology
- Achieve high temperatures (350ºF) with high efficiency
- Vacuum eliminates conductive and convective heat loss
- Capture both direct and diffuse insolation
- Space, cost and energy efficient
- Applicable in all climates
- Residential, commercial, and industrial applications
- Applications for water heating, space conditioning, cooling, industrial processes
- Mounting options: horizontal, vertical, flat, pitched, building integrated
- Should a problem occur, single tubes can easily be replaced
- No moving parts
- Expected lifetime: >25 years

ETCs are designed and installed to combine functionality and aesthetics

ETC Installations Suitable for New and Existing Buildings

Building Types

- Commercial
- Industrial
- Residential
- Multi-Family/ Dorms
- Government

ETC Mounting Options

- Horizontal and Vertical Installation
  - Flat roof
  - Pitched roof
  - Building integrated

ETCs are designed and installed to combine functionality and aesthetics

ETC Installations Suitable for New and Existing Buildings

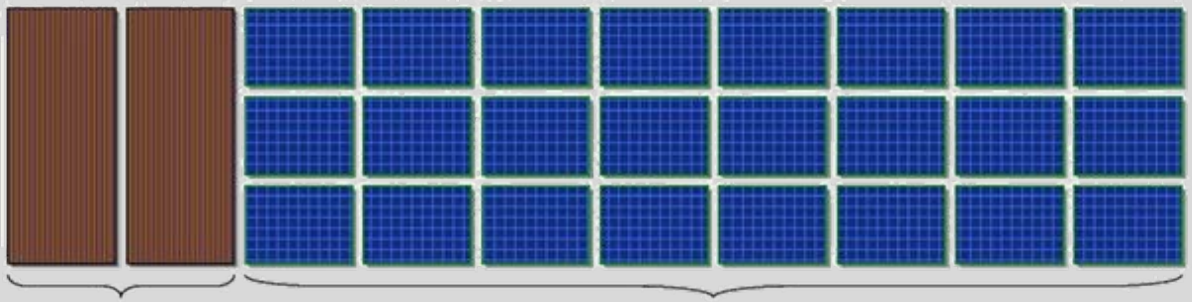
Solar Thermal is a space, cost and energy efficient solution

Sunlight delivers more energy in one hour than the Earth uses in one year

Solar Thermal Technology

Solar thermal technology is the process of capturing the sun's natural energy to produce thermal energy

- Solar thermal (ST) systems have the proven potential to **deliver and utilize more of the sun's energy** than conventional Photovoltaic (PV) systems - **80% vs. 14% efficiency**



ST (upper standard FP-Collector)			PV (Shell SQ 165-PC)	
Output/day[1]:	22.7 kWh_{th}	=	Output/day[2]:	22.3 kWh
Area:	80 ft^2	1 to 7	Area:	456 ft2
Installed cost:	$7,000		Installed cost:	$51,480
Tax credit (CA):	$2,000		Tax credit (CA):	$15,444

1: Peak output based on SRCC Category C Clear Sky for ST (Equivalent kWh derived using 3,414 Btu/kWh)
2: Manufacturers spec sheet for PV at standard test conditions (5.28 kW array rating x 5.8 peak sun-hrs/day)

Source: Koldehoff 2009

Linear Fresnel collectors

Characteristics

Source: Mirroxx

Linear Fresnel Collector

- Individually tracked mirror rows
- Concentrating direct sunlight
- Achieve high temperatures (392ºF) with pressurized water; higher temperatures can be realized with thermal oil
- Simple power control
- Optimized stow positions for various weather conditions
- Self-cleaning position in rain
- Easy maintenance access
- Commercial, and industrial applications
- Applications for water heating, space conditioning, cooling, industrial processes
- Mounting options: on flat roofs (width 25 ft, length 13 ft, receiver height 13 ft.

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Solar Thermal systems power business, industry and homes using clean, dynamic energy

Versatile and Proven Applications

Commercial, Industrial, Agricultural, Multi-family Housing, Residential	
Industry / Commercial Sector	**Processes**
Food and Beverages	Drying, Washing, Pasteurizing, Boiling, Sterilizing, Heat Treatment, Cooling
Textile Industry	Washing, Bleaching, Dyeing, Cooling
Chemical Industry	Boiling, Distilling, Various chem. Processes, Cooling
Agricultural Products, Dairies, Poultries	Drying, Washing, Cooling, Sterilizing
Manufacturing	Washing, Refrigeration, Heating, Cooling
Desalination, Waste Water Treatment Plants	Boiling, Distilling
Various other sectors, such as: Hospitals, Hotels, Retirement Homes, Schools, Gyms, Wineries, Breweries, Prisons, Restaurants, Car Wash Multi-Family Housing/District Heating and Cooling	Pre-heating of Boiler, Feed-water, Washing Clothes, Dishes, Shower, Heating and Cooling of Production Halls/ Office Space

Solar Thermal has clear benefits

Solar Thermal

Providing complete and customized solutions

- **Proven, reliable technologies**
- **Applicable in all climates**
- **Highly diversified range of applications**

Sustainability

Thank you very much for your attention.