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Introduction of Big Solar Furnace and Green Technologies and Materials Development

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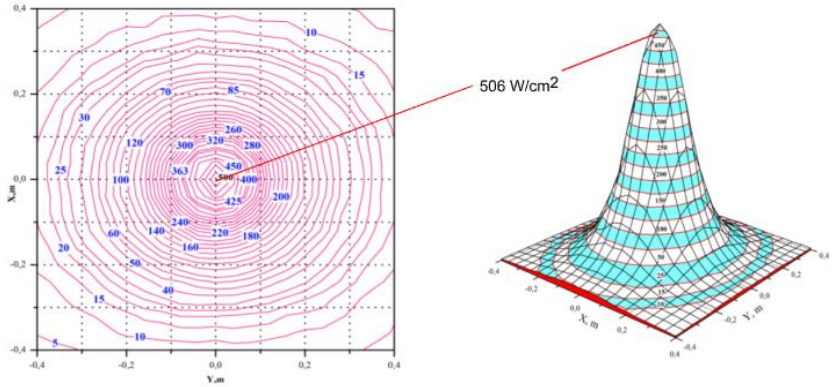
Why Solar Energy?

Uzbekistan is a sunny country

- Number of Sunny days – **280**
- The gross solar energy potential of Uzbekistan is estimated at **50.9 billion tons** of oil equivalent
- The only unique **Big Solar Furnace** in Asia is located here

Big Solar Furnace (BSF)



Distribution of energy density in the focal zone of the BSF

Big Solar Furnace
Concentrator:
Height – 42 m; Width – 54 m
Reflective surface -2140 m^2
Temperature in focus – up to **3000 °C**
Heliostats field:
Number of heliostats – 62
Reflective surface 3022 m^2

Small Solar Furnace:
The diameter of the concentrator 3 m.
Number of heliostats – 1
T= 2800 °C
P= 200 kWt/sm^2
The size of the focal spot is 3 cm

Why Green Technologies?

TODAY

TOMORROW

Nanocomposite film with thermoregulation effect

A technology of the production of a polymer-ceramic composite film has been developed. the film does not pass UV radiation. Visible and infrared photons pass through. Ceramic nanoparticles are given the property of transmitting photons with a **temperature of 24-27 ºC**. In summer the greenhouse is cooled, in winter it is heated without the use of external sources.

Energy consumption 60%

Irrigation water consumption 50%.
In case of using hydrogels 70-90%

Yield growth 30-50%

Increasing the area for agricultural crops

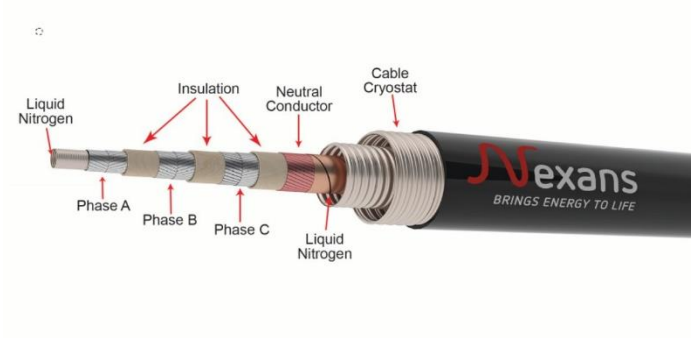
Seed germination 98%

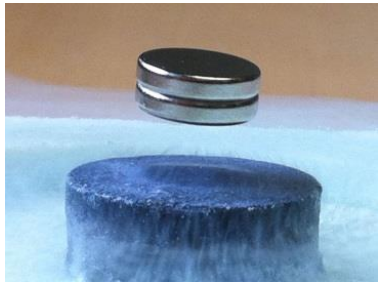
USING DESERT AREA FOR GREENHOUSES

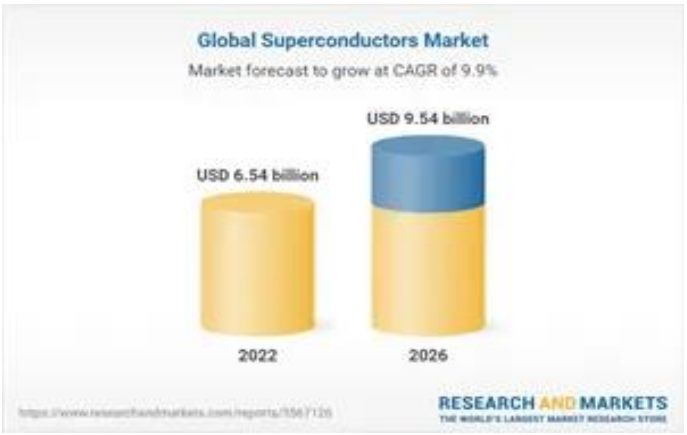
Time	Outside T	Ordinary film	Composite film
6.00	-4 ºC	4,3 ºC	5,8 ºC
7.00	-3 ºC	5,1 ºC	6,0 ºC
8.00	-2 ºC	6,0 ºC	6,9 ºC
10.00	-2 ºC	5,7 ºC	6,8 ºC
12.00	-2 ºC	5,1 ºC	9,0 ºC
14.00	-2 ºC	4,8 ºC	11,5 ºC
15.00	-1 ºC	8,3 ºC	10,4 ºC
16.00	-1 ºC	7,9 ºC	9,1 ºC
17.00	-1 ºC	6,8 ºC	12,0 ºC
18.00	-1 ºC	6,0 ºC	10,0 ºC
20.00	-2 ºC	5,4 ºC	6,5 ºC

Synthesis of Superconducting materials

One of the biggest problems of the energy sector is the transmission of generated electrical energy without losses. But, despite all modern solutions, **losses** amount to **more than 20%.**
If we are manage to avoid losses in energy transmission, we will achieve a reduction in CO_2 emissions.





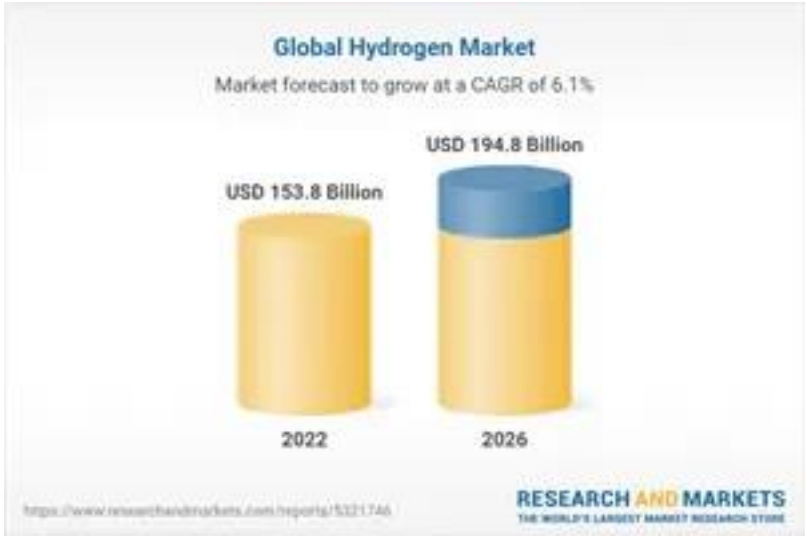


The global superconductors market is expected to grow from $5.37 billion in 2021 to $6.54 billion in 2022 at a compound annual growth rate (CAGR) of 21.8%. The market is expected to reach $9.54 billion in 2026 at a CAGR of 9.9%.

A unique technology has been developed for the production of nanostructured long-term stable Bi/Pb **superconductors** with T=110-120K (-160 °C) and room-temperature phases T=295K (+21 °C) at the Big Solar Furnace (Parkent).

23 kg of superconducting precursors were obtained.

Hydrogen technologies & materials



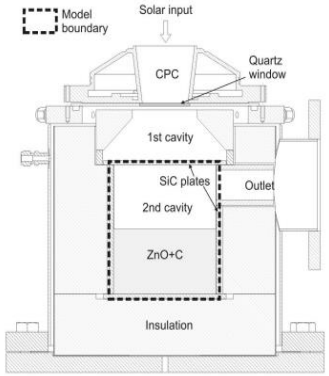
The global hydrogen market is expected to record a value of US$194.8 billion in 2026, progressing at a CAGR of 6.09%, over the period 2022-2026

The market experienced growth accruing to several factors such as rising consumption of agricultural fertilizers, escalating demand in metallurgical industries, mounting concerns regarding carbon emissions worldwide, surging demand for electricity generation and upswing in margarine demand.

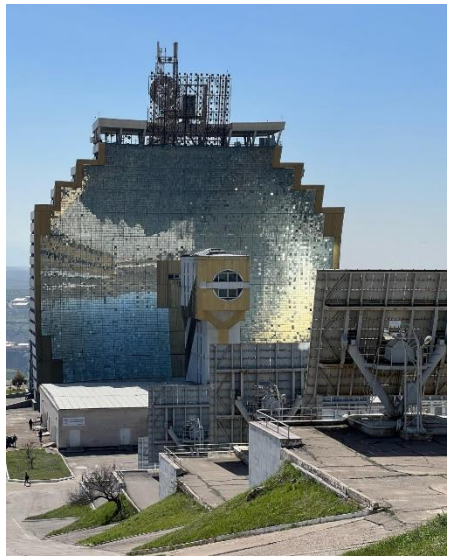
However, the market growth would be challenged by **high cost** of hydrogen production & **transportation**, **storage** of hydrogen and health effects of hydrogen

High cost of hydrogen

- ✓ using **concentrated solar radiation** to water splitting (≈ 2000 ^{o}C)
- ✓ use **catalysts** to lower the water splitting temperature (≈ 800-1000 ^{o}C)



Thermochemical reactors SOLZINC



Extraction of metals from techno-made waste by a concentrated stream of solar radiation

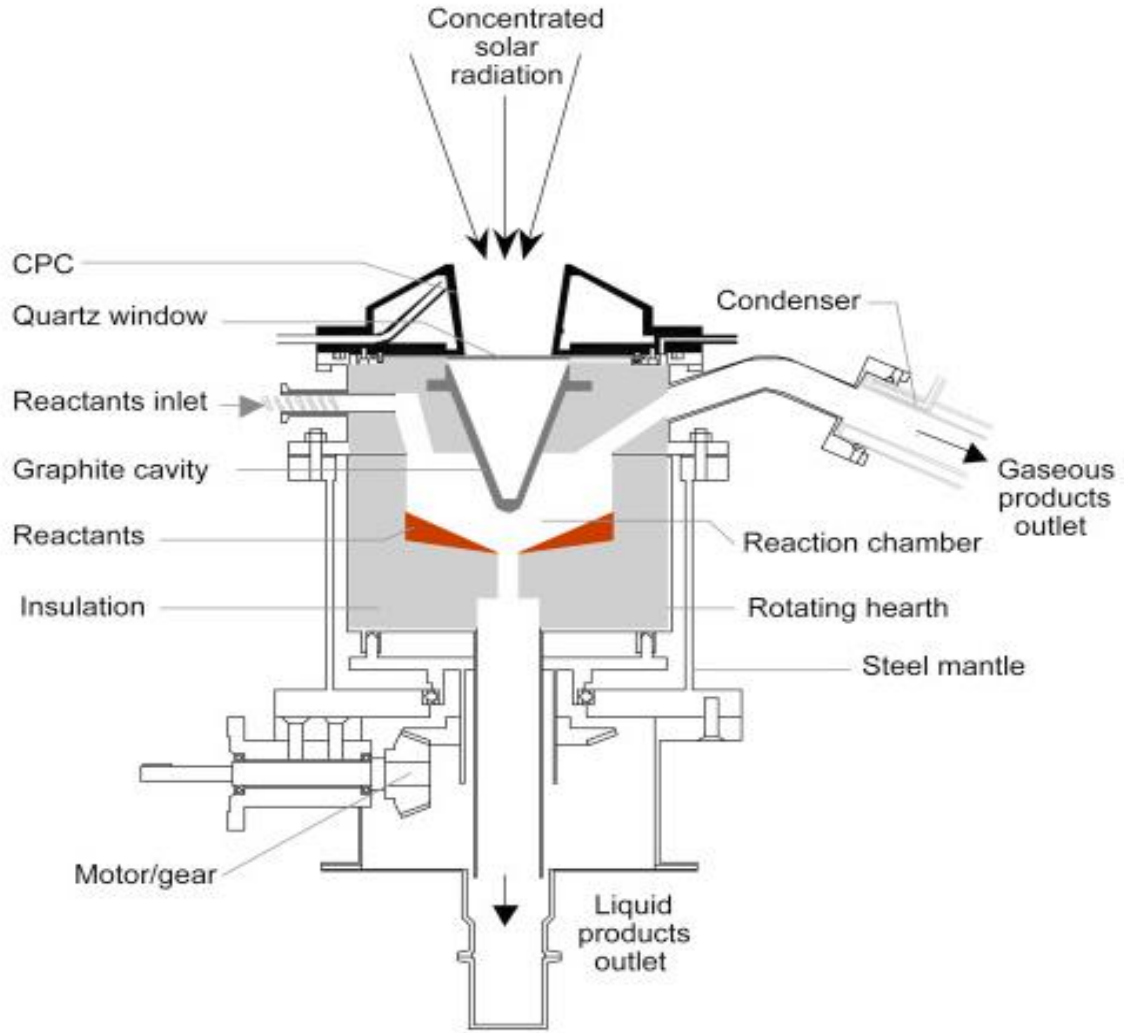
Technogenic waste of Almalik Mining Company was melted on a Big Solar Furnace. Up to 25% metal-containing melt was obtained. At the same time, up to 70% of the molten metal consists of iron, up to 15% of copper and 15% of other metals

-T/wastes - 5 кг;
-10% (500 gr.) CaO + 7% Coal (350 gr.);
-Graphite crucible;
-T = 1750 °C;
-Flow density ≈ 100 Wt/м^2
-Solar radiation E=760 Wt/м^2

T/waste	Quantity (gr/tonn)	Quantity (25% melt)	Quantity (gr/tonn)
Fe	38,57	52.3%	13.1
Si	52,24	10.05%	2,5
Al	1,77	3.25%	0,81
Mo	0,22	0.4%	0,1
Cu	**6.746**	**20.65%**	**4,1**
Zn	9.847	1.68%	0,25

Such a composition of man-made waste is characterized by a low melting point, which is T = 1750 °C with a material dispersion of 74 microns. The process of processing techno-made waste in a solar furnace consisted in melting the material and quenching the fused material into water. Analysis of the chemical composition of the fused material showed the presence of metallic substances (alloy 22 wt.% FeCu) and ceramic (71 wt% CaMaSi2O6) compositions separately.

Extraction of metals from techno-made waste by a concentrated stream of solar radiation



Effectiveness:
Waste recycling: 3,200 tons/year
Molten iron **792** t/year
Copper: **158** t/year
158 $ 7800* = $ 1 232 400

***(LME.Copper)**

Synthesis of materials by using concentrated solar radiation

Corundum

Corundum is a crystalline form of aluminium oxide (Al_2O_3)

Because of corundum's hardness (pure corundum is defined to have 9.0 on the Mohs scale), it can scratch almost all other minerals. It is commonly used as an abrasive on sandpaper and on large tools used in machining metals, plastics, and wood.

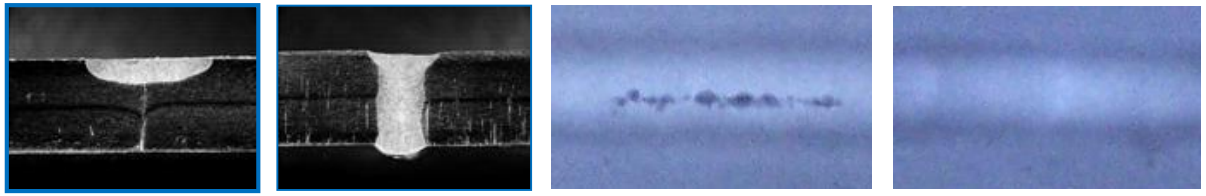
Melting point of corundum – **2050** ^{o}C

Highly effective resource - saving welding materials

Special fluxes (12 types) for ARC welding in inert gases (TIG, MIG, laser, etc.) of Aluminum Alloys, Magnesium Alloys, Carbon, Low Alloyed and Stainless Steels, Titanium Alloys and Nickel Alloys are developed.

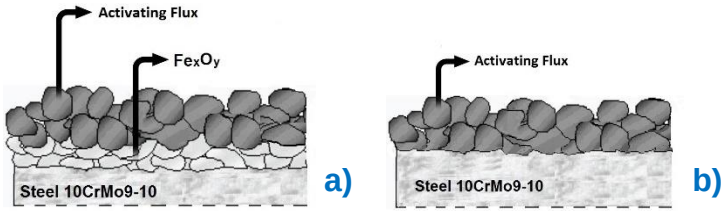
TIG welding

Stainless steel 316L (X18H9) **6 мм.**



Without Flux **With Flux** **Without Flux** **With Flux**

Activating Flux



Efficiencies of Fluxes (for 1 m. of welding seam)

Materials	Saving money $	Saving Time (%)
Aluminum Alloys	15,6	65
Carbon Steel	13,6	67
Stainless steel	19,8	70

When using the activation flux applied to the initial surface of the plate formed two layers consisting of oxide film and flux (a). These two layers are during of A-TIG welding interact with each other and form an activating layer consisting of a mixture of flux and oxides (Fe_xO_y). On a plate from a surface to which the surface oxide film has been removed, there is only a layer of the activating flux (b).

Amaranth oil & SQUALENE

Amaranth oil is a solid benefit for the whole body. It is used with great success in cosmetology and medicine.

It has been proven that amaranth oil has medicinal properties, is used to prevent and treat various diseases, normalizes metabolism and serves as an excellent means to maintain the youth of the body.

Oil mainly (99.9%) consists of fats. The composition can be represented by the following list: fats (including omega-3, omega-6); Vitamin E; **squalene**.

Squalen is a natural hydrocarbon that is found in shark liver, as well as in some types of vegetable oils. Squalene is an excellent building material for cells, which normalizes metabolism.