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# Aspects of the Combined Systems, Advantages of Their Application

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**Annotation.** This work presents the types of combined devices, their appearance, methods of use, directions of use, and advantages in use. In addition, the analysis of the differences and advantages of solar energy devices from each other is given.

**Key words:** energy, solar flux, power, installation, combined system, photo module, modular type, collectors.

One of trends of last years is constant growth of volumes of gained energy at the expense of use of renewed sources on the basis of solar, wind and other installations. It along with obvious advantages has also the basic deficiency connected with variability of the produced electric power (a night-time, absence of a wind or too strong wind, etc.). This deficiency can be successfully compensated by creation of the combined power installations where, along with renewed energy sources fuel cells and accumulators are used. Thus hydrogen for work of fuel cells can be gained in the electrolyze, in the most effective work RES, can be reserved in special capacities, and if necessary to be used for an electric power generating.
The basic advantages of application of the combined power installations:

- Economy of means for the power installation maintenance
- The Fuel economy
- Low level of emissions of harmful substances in a circumambient
- Low noise level of power installation

In difference not only from traditional power stations and boiler-houses, but also from the installations converting renewed energy sources (windmill-electric generating plants, geothermal, tidal, water-power developments), it is possible to install the combined solar systems of a heat supply in immediate proximity from a user. They can be installed directly in the center of densely populated cities on roofs of buildings for maintenance with the electric power of municipal sector and the industrial factories.

It is defined that the combined installations considerably surpass in all power parameters flat and Parabola the cylindrical solar steam-turbine plants applied separately.

Fig. 1. Modular installations of solar power station Solar Energy Generating Systems, California (USA).

As of 2020г. The most powerful thermal solar power station (354 MW) was Solar Energy Generating Systems, California (USA) (fig. 1.) [7]. The design developed by company Luz International, represents system from nine solar power stations which have been had in desert Mohave in California. From them five

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two have power 30 MW everyone, on 80 MW and two more 14 MW. At power station creation it has been used 936384 parabolic-cylindrical the concentrator which are had on the square 6,5 км$^2$. In 2018 power of existing solar heating systems increased by 21 %, attaining level nearby 180 GW a heat rating.

In-process [5] the concept of creation of the combined photo thermodynamic power installations which efficiency is in more details observed in [5] is put forward formulated in ENIN of G.M.Krzhizhanovsky. The circuit design of the combined solar power installation matches to its basic idea - a combination in one installation of photo-electric and thermodynamic methods of transformation of energy. This combination is based on application of a steam power cycle for salvaging of heat which is taken away from the photo-electric battery.

At station there is a field parabolic-cylindrical mirror-image concentrators in which focuses linear receivers of a solar radiation - photo batteries from one or several rows of photocells the surplus heat from which is taken away in the steam-turbine power installation are had. The electric power from photo batteries through inverters arrives in system of delivery of power where the electric power from the steam-turbine plant oscillator moves also. Sampling of such configuration is proved by successful experience of creation and maintenance of solar thermodynamic power stations with parabolic-cylindrical concentrators of firm of Billiard pockets and firm ORMAT power modules on low-boiling working mediums.

Advantage of the double-circuit circuit design is that important condition that in the first contour there is no gauge pressure. Solar radiation concentrators are during the day twirled on support-rotary devices for orientation to the sun that demands presence of flexible joints in system of heat removal from photo batteries. Performance of such joints in the absence of an essential gauge pressure in a contour easier, than at a gauge pressure. At the same time, a deficiency of the double-circuit circuit design is tank circuit presence that has an inevitable consequence additional exegetical losses at a heat transport from the photo battery to a working medium. For the one-circuit circuit design, on the contrary, an energy loss is minimum, but tap of warmth from the photo battery is under a gauge pressure. Besides, as photo-electric modules are simultaneously steam plants, in channels of cooling of photo batteries circulates opaque two-phase vapor-liquid a mix that expels application of more effective obverse cooling.

In the most important parameter influencing both on EFFICIENCY of photo converters, and on electric EFFICIENCY of a thermodynamic part of power installation, the operating temperature of photo-electric converters If is. Its value will be defined also by a settlement way of physical and economic optimization.

Not smaller value, than sampling of an aspect of the concentrator has also sampling of the circuit design of its twirl for orientation to the sun. As a matter of fact, concentrating system should be observed in unity of its basic parts what the concentrator and the support-rotary device orienting the concentrator on the sun are actually. Sampling of this or that constructive circuit design of concentrating system causes the certain circuit design of its twirl.

The detailed analysis of efficiency of various constructive circuit designs of the combined installations from the point of view of the quantity, arriving solar radiation is resulted in [3]. There it is shown that sampling of the constructive circuit design depends also on features of "a solar climate" in this or that point and from its geographical latitude. In the combined solar power installations of independent application it is necessary to use the circuit design of twirl concerning two axes - vertical and horizontal. Thus, the combined solar power installation of independent application will consist of the equal modules containing параболоцилиндрический the concentrator of a solar radiation, the support-rotary device providing twirl of the concentrator concerning two axes, and the receiver of the concentrated solar radiation with photo converters and system of heat removal from them.

For the combined solar power installation integrated into a power supply system, is accepted in the capacity of an initial point that it should have uniaxial system of twirl of the concentrator. Thus the axis of its twirl should be horizontal and oriented in a direction the north-south.

For the solar combined power station with the one-circuit thermal circuit design and an uniaxial attitude control system the most suitable working medium is the water providing the best characteristics of a convective heat exchange in the chilling channel of the receiver at moderated (to 15 bar) pressures. At negative temperatures of air for lack of solar radiation it is required to merge water in a memory warmed forecastle.

For independent station with the double-circuit thermal circuit design are suitable normal hexane, cyclopentane and methanol as they have high enough critical pressures and allow to design the effective

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turbine of low power. In our calculations in the capacity of a working medium it was used N-hexane, thermodynamic and thermo physical which properties were defined by a known technique [4].

Creation of the similar combined power installations with use of renewed energy sources, is unconditional, actual and for our country.

Separate regions of the country are power scarce - fuel in them deliver from the outside that brings up a question on regional power safety. All these arguments can serve as a necessity substantiation to develop small distributive power engineering on the basis of alternative energy sources and new power effective production engineering.

Besides provision of energy of the users which have appeared «behind a board» the centralized networks, the small distributive power engineering (DPE) is necessary and, for example, for maintenance of an emergency reserve for power sensitive and strategically important installations: reserve power supplies for Central Bank system, for telecommunication knots, for a covering of peak loads of separate substations of a power supply system of Uzbekistan.

The majority of installations work still on rock gas. However more and more conversations and forecasts it is audible about use in small distributive power engineering of renewed energy sources (RES).

The volume of world investments in RES grew on 32 % in 2020 - to record 211 bln. dollars (in comparison with 150 bln. dollars in 2019 and 30 bln. dollars in 2014). In particular, considerable investments are carried out in wind-power engineering sector in China and solar installations of a small size in Europe. Besides, according to International Finance corporation, the volume of investments into new oscillating powers on the basis of RES last years exceeds 50 % of total amount of global investments into new oscillating powers.

In Uzbekistan though fathom value of sped up heading RES, but there are also the opponents oriented more on further use of hydrocarbons.

The core of arguments of opponents of sped up heading RES are high capital outlays on power installations of this kind. However these expenses really decrease every year - for example, solar panels already stand below 1500 dollars / kw.

RES are good also that at their installations completely are absent margin expenses for a power production, and also volatility risk cost prices. Also that is important - RES give non-polluting and safety energy that reduces emissions of hotbed gases.

Every year about solar power engineering even more often speak as about the real energy source worldwide. Many European countries referred to to idea of development of solar power engineering seriously. In particular, experience of Germany shows that during the period with 2000 for 2007 the multiplicative effect of use of solar energy made for economy 5,4 euros at expenses less than 1,5 euros a month counting on a household.

The world "solar" branch for 25 years of development also attained quite good results - the prices for photo-electric installations decreased in 20 times.

According to forecasts European Photovoltaic Association (EPIA), by 2030 solar power stations will make worldwide 200-400 ГВт that allows to fulfil requirements for the electric power of 14 % of the population of the Earth.

In Uzbekistan there are huge preconditions of development of solar power engineering. To them it is possible to refer to essential scientifically-technological potential of Uzbekistan, high level of a solar radiation (insolation) on greater parts of territory of Uzbekistan. Besides, solar generation will participate in replacement of out-of-date power powers during forthcoming modernization of fixed capital of domestic electric power industry. The potential of considerable multiplicative effect in economy at the expense of development of contiguous hi-tech, innovative branches is very high: microelectronics, semiconductors, manufacture of stores of energy, intellectual networks.

It is important to stimulate development of solar power engineering in Uzbekistan right now as it gives the chance uses of the high technologies at the given stage of their rough development when the technological transfer is still possible. After achievement of competitiveness of solar power engineering with traditional aspects of generation development of domestic potential in this area will be extremely inconvenient.

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