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TWINNING

State Agency on Energy Efficiency and Energy Saving of Ukraine

ELECTRICITY FROM SOLAR ENERGY FOR YOUR FAMILY

PHOTOVOLTAIC SOLAR ENERGY FOR YOUR FAMILY

Do you want to save on utility bills? Do you dream of being independent of your electricity providers?

With your own solar power station (SPS), this is quite real. In other countries, such household installations have been a common and profitable business for households for a long time now.

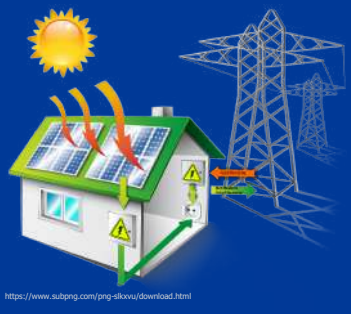
The benefits of solar power stations offer an opportunity to:

- independently provide your household and community with clean electricity
- decrease dependence on the import of traditional energy resources
- save on electricity bills
- be autonomous (if you install a storage equipment or combine different renewable energy technologies)
- develop modern clean technologies instead of spending money on the maintenance of outdated equipment at CHPs and NPPs
- support local businesses in related industries
- improve the quality and stability of electricity supply
- become energy efficient for the benefit of the family budget and comfort: to analyse energy consumption, conduct energy audits of the house, use electrical appliances with energy efficiency of class A and higher, carry out thermal modernization, replace lighting systems with energy-saving ones and introduce other state-of-the-art smart technologies.

This brochure was produced with the financial support of the European Union. Its contents are the sole responsibility of the State Agency on Energy Efficiency and Energy Savings of Ukraine, EURAC research and the Environment Agency Austria and do not necessarily reflect the views of the European Union.

RESOURCES DESCRIPTION

Solar energy is environmentally-friendly. It can be produced as long as the sun is shining. It is expedient and possible in the entire territory of Ukraine to use solar radiation to generate electric and thermal energy.



> *A solar power station produces electricity throughout the whole year, even in winter and cloudy weather, but its capacity is the highest in summer, provided there are direct sun rays and no direct shadows.*

A brief description of the operating principles of the technology

Solar panels transform the solar energy into electrical energy to be consumed (a network power station) or with the possibility to accumulate it in storage batteries (hybrid, standby or autonomous stations). In particular, an inverter converts the received DC power into AC power (220V, 50 Hz) which is compatible with any electrical and lighting appliances.

WHAT ARE THE OPTIONS OF POWER STATIONS EXPLOITATION FOR PRIVATE HOUSEHOLDS?

Option 1

A solar power station for self-consumption

Such an SPS consists of grid-tie inverters and generating devices to prevent the flow of energy to the grid (a smart meter).

In the daytime when there is power consumption and solar activity, a smart meter reads the power consumption information of the facility, transmits this information to the inverter, which in its turn increases or decreases its power output to provide the required amount of energy that the facility needs now.

ADVANTAGES

A low cost of the equipment (i.e. the cost of 1 kW of the capacity) as well as a possibility to use clean energy in everyday life.

DISADVANTAGES

Inability to ensure power supply to facilities by such an SPS when the power in the central grid goes off, since the inverter goes into standby mode.

Option 2

A solar power station for self-consumption with an opportunity to sell excess electricity to the grid

It has the same functionality as the SPS for self-consumption. In addition, there is an opportunity to sell electricity to the grid at a green tariff which shall be valid in Ukraine until 2030. Due to this, investments into SPS will be paid back within 4-6 years.

ADVANTAGES

A short payback period and possibility to receive further profit.

DISADVANTAGES

An SPS can switch off if power in the central gird goes off; you can only sell excess electricity to the grid (part of the electricity will be consumed by the facility).

Option 3

A solar power station for autonomous electricity supply for a facility

It is expedient to use such an SPS if there is no electricity in a house at all or it occasionally goes off. In the daytime, photomodules generate electricity that charges storage batteries (usually lithium ones as they are more cost-effective for solar installations) as well as cover the daytime consumption of the facility. In the evening, the energy from batteries is converted by an inverter and feeds the power as long as there is residual charge in the batteries.

ADVANTAGES

Full autonomy and continuity, reliability of power supply.

DISADVANTAGES

More expensive than the first two types of SPS; longer payback periods.

ENERGY PRODUCTION POTENTIAL IN REGIONS OF UKRAINE

The data below were provided by the Solar Energy Association of Ukraine supported by "Atmosphere" Company

Potential electricity production by an SPS in a household (per 1 kW of the capacity*) is given in the table below.

Generation of energy by a 1 kW solar panel
(a 35-degree angle, south orientation) monthly, kWh

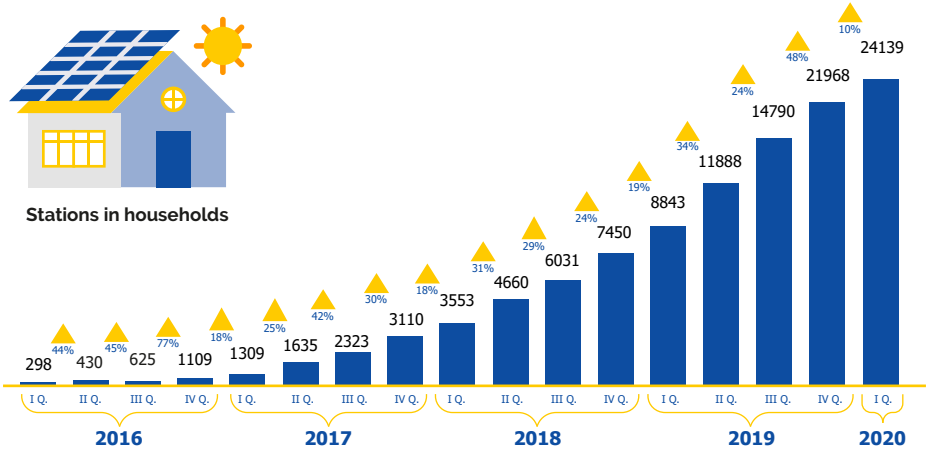
Oblast	Latitude	January	February	March	April	May	June	July	August	September	October	November	December	Per hour, kWh
		Generation of energy by a 1 kW solar panel (35-degree angle, south orientation) monthly, kWh												
Autonomous Republic of Crimea	44°	58,9	74,1	122	141	167	159	167	165	137	112	78,4	52,8	1434,2
Cherkasy	49°	31,8	55,5	110	140	162	159	159	154	116	83,3	34,6	24,3	1229,5
Chernihiv	51°	30,1	51,8	105	129	157	153	152	140	104	69,7	28,4	20,8	1140,8
Chernivtsi	48°	42,2	56,9	110	130	147	140	150	142	112	89,1	47,5	34,2	1200,9
Dnipropetrovsk	48°	36,3	59,5	110	133	154	154	159	154	119	89,1	44,6	27,7	1240,2
Donetsk	48°	41,2	60,4	111	136	164	161	168	163	131	39,8	50,8	28,2	1254,4
Ivano-Frankivsk	48°	38,9	52,9	105	129	143	134	142	137	106	83,8	45,9	33,1	1150,6
Kharkiv	50°	36,6	61	110	129	155	156	155	148	111	77,1	37,6	23,8	1200,1
Kherson	46°	51,9	77,6	129	151	170	165	176	171	140	111	61,6	43,9	1448
Khmelnytskyi	49°	33,7	46,2	105	129	154	148	148	143	110	83,3	38,9	24,9	1164
Kirovograd	48°	40,3	63,6	115	138	161	161	167	162	125	95,5	45,6	32,1	1306,1
Kyiv	50°	33,3	53,5	110	133	159	153	154	142	108	76,4	30,1	22,3	1174,6
Luhansk	48°	41,8	62,1	110	136	166	161	165	161	128	89,9	47,9	26,3	1295
Lviv	49°	37,1	51,1	106	131	144	139	142	139	106	80,9	40,9	31,1	1148,1
Mykolaiv	46°	47,3	72,9	129	152	174	166	175	170	136	109	59,5	42,2	1432,9
Odessa	46°	47,4	72,8	127	151	175	165	171	168	133	107	56,7	42,7	1416,6
Poltava	49°	36	59,4	111	134	158	158	158	154	115	83,2	38	27	1231,6
Rivne	48°	29,7	45,4	103	130	149	144	143	139	104	77,8	36,1	22,8	1123,8
Sumy	50°	30	55	104	129	156	153	150	141	103	70,6	30	21,3	1142,9
Ternopil	49°	34,2	49,1	107	131	149	144	147	140	109	83,5	40,1	26,9	1160,8
Transcarpathian	48°	35,6	55,9	116	137	150	148	152	154	117	89,6	47,6	25,4	1228,1
Vinnytsia	49°	37	49,4	106	131	158	152	153	146	110	84	38	26,1	1190,5
Volyn	50°	31,1	44,7	105	132	148	140	144	140	105	78,4	37,6	24,7	1130,5
Zaporizhian	47°	43,4	66,2	122	144	170	165	170	165	130	99,6	51,7	33,1	1360
Zhytomyr	50°	33,8	50,6	104	131	155	148	149	140	104	77,2	32	24,8	1149,4

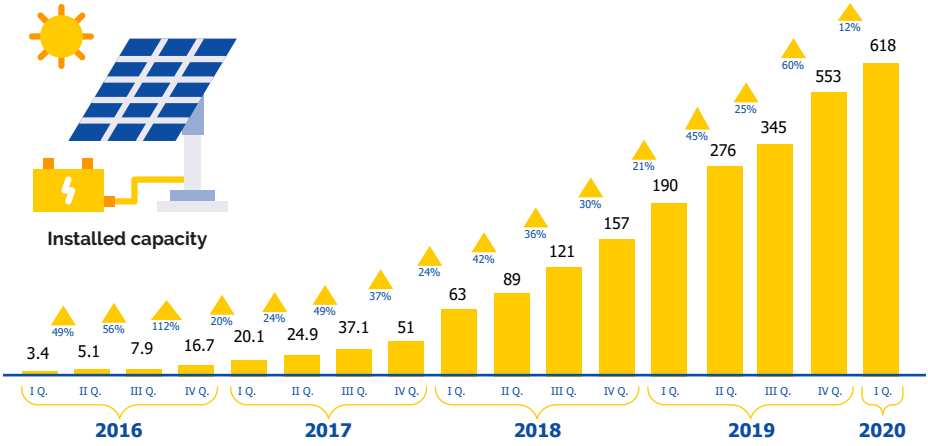
** the potential of electricity generation may be higher due to the development of solar panels production technologies*

INSTALLATION DYNAMICS OF SOLAR POWER STATIONS IN HOUSEHOLDS IN UKRAINE

According to the data of State Agency on Energy Efficiency and Energy Saving of Ukraine (SAEE), **about 24,000 solar stations** in private households with a total capacity of **more than 600 MW** are operating under the green tariff in Ukraine, as of 01.04.2020.

Installation dynamics of solar power





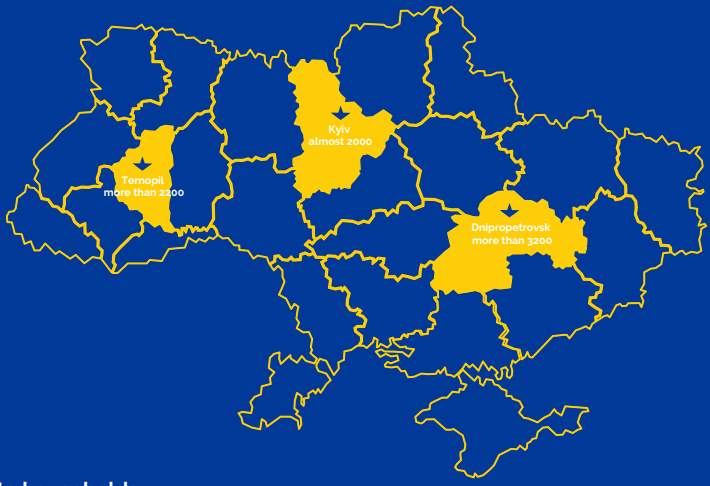
** The statistics is quarterly updated by the 25th day the month following the reporting quarter.*

Check the official web-site of SAEE for updated information on the number of SPS in households in Ukraine: https://saee.gov.ua/uk/content/informatsiyni-materialy

UKRAINIAN FAMILIES HAVE INVESTED MORE THAN 500 MILLION EURO INTO SOLAR INSTALLATION PROJECTS.

Top three oblasts, where the largest number of SPS in private households is recorded, includes:

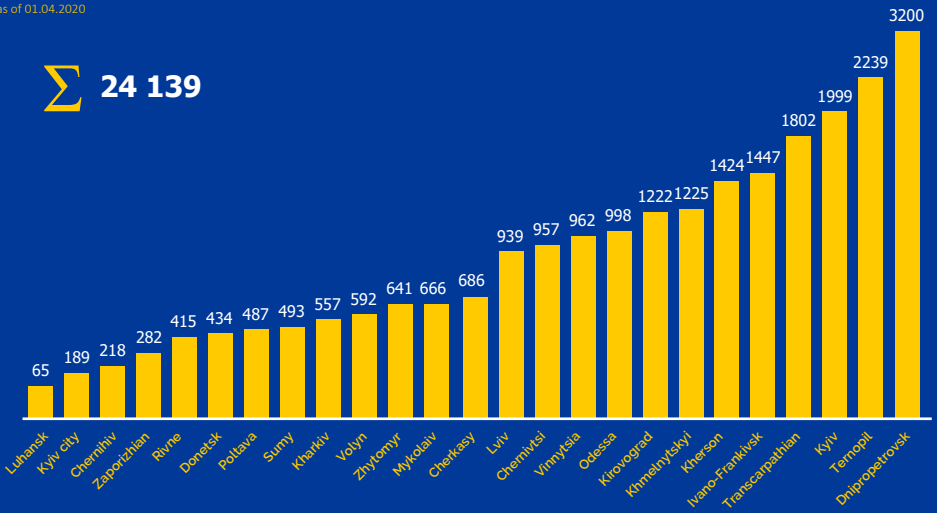
- Dnipropetrovsk more than 3200
- Ternopil more than 2200
- Kyiv almost 2000



Number of SPS in private households

as of 01.04.2020

Σ 24 139



As we can see, more and more citizens start producing clean energy. It is important that it is small-scale energy generation that makes self-consumption possible as well as leads the owners to rational use of energy and energy efficiency measures.

Yurii Shafarenko
Deputy Head of the State Agency on Energy Efficiency and Energy Saving of Ukraine

Let us take a look at the usage of SPS for a typical private **house of 150 m²** with a monthly electricity demand of **250 kWh** in Kyiv:

OPTION 1
is for self-consumption only

OPTION 2
is both for self-consumption and for the opportunity to sell electricity to the grid at the green tariff

OPTION 3
is for autonomous electricity supply of a house

INDICATORS	OPTION 1	OPTION 2	OPTION 3
Technical parameters of the technology:			
• installed capacity (kW)	2	30	5-10
• production amount (kWh/year)	2 560	38 400	6 400-12 800
• amount of self-consumption (kWh/year)	3 000	3 000	3 000
Economic parameters for the year:			
Total cost of installation, UAH:	51 700	587 000	282 000-465 000
• the cost of a solar power plant	42 300	517 000-540 000	161 000-322 000
• the cost of the storage battery	n/a	n/a	100 000 UAH.
• the cost of connection to the grid	n/a	depends on a region	n/a
• the cost of assembly	10% of equipment cost	10% of equipment cost	10-12% of equipment cost
Electricity tariff:			
• average tariff for electricity consumption, UAH/kWh	1,60	—	1,60
• green tariff (18% + 1.5% tax incl.)	n/a	3,41	n/a
• income (profit/ savings), UAH/year	saving 4 096	earning 130 944	saving 4 800
• payback period, years	from 12	4-6	—

** - the above-mentioned comparison of the use of equipment is for informational purposes only and should not be considered as an economic justification. The technical and economic parameters may differ from the actual operating conditions of the equipment.*

PROCEDURE FOR SPS INSTALLATION IN A HOUSEHOLD

No authorization documents or licenses are required for the installation of an SPS.

The procedure for sale, accounting and payment for electricity produced by SPS of private households is regulated by the NEURC Resolution No. 170 dated 27.02.2014, registered at the Ministry of Justice of Ukraine on May 26, 2014 under No. 539/25316.

SPS installation procedure consists of the following steps:

01

Consulting with engineers of a service company on SPS installation in households:

- estimation of the house power system parameters;
- the design of the roof of the house, the size, type, angle of the roof; in case of installation on the ground – presence of facilities, trees and other objects that would create shadows for the solar station;
- choice of SPS installation options (self-consumption; self-consumption and selling to the grid at the green tariff; autonomy) *(capacity calculation, choice of equipment, approximate cost).*

02

To further receive the green tariff, it is necessary to contact the Distribution System Operator (Oblenergo) to clarify the following questions:

- capacity allowed under the agreement on the electricity use;
- conditions of capacity increase (up to 30 kW) (costs and terms of connection in case of capacity increase).

03

Increasing the capacity envisaged by the contract with Distribution System Operator (Oblenergo) on electricity use - signing a new contract (if necessary)

04

Concluding a Contract with a service company for the installation and commissioning of the SPS, incl. supply of necessary equipment and supplements *(purchase and installation of SPS equipment can be done independently but we recommend contacting a specialized service company);*

05

A specialized company performs installation and commissioning of the SPS on the site.

Background information:

Installation of an SPS in a private household is carried out in accordance with the recommendations of the manufacturers of the equipment as defined in the technical documentation (passports of electrical equipment), and in compliance with the rules of setting up electrical installations. Equipment that allows parallel operation with the power system should not impair the electricity quality parameters of the electricity supplier.

By Ukrainian law it is allowed to install a solar power station with the capacity of **up to 30 kW** in private households **to receive the green tariff**. A solar station can be located on the roof and/or facade of a house, or on the ground within the household area. The green tariff for electricity produced by an SPS, which was commissioned from 01.01.2020 to 31.12.2024, constitutes 16.26 €ct/kWh *(the green tariff is established in the national currency (pegged to euro) and is subject to quarterly revision)*

A private household sells electricity produced by the SPS to the electricity supplier at the green tariff in amount which exceeds the monthly electricity consumption of the private household.

Reference:

If a household consumption exceeds the electricity produced by SPS

- *A household consumed 300 kWh for a month.*
- *A solar power station produced 200 kWh.*
- *Electricity consumption tariff - UAH 0.9/kWh (including VAT)*

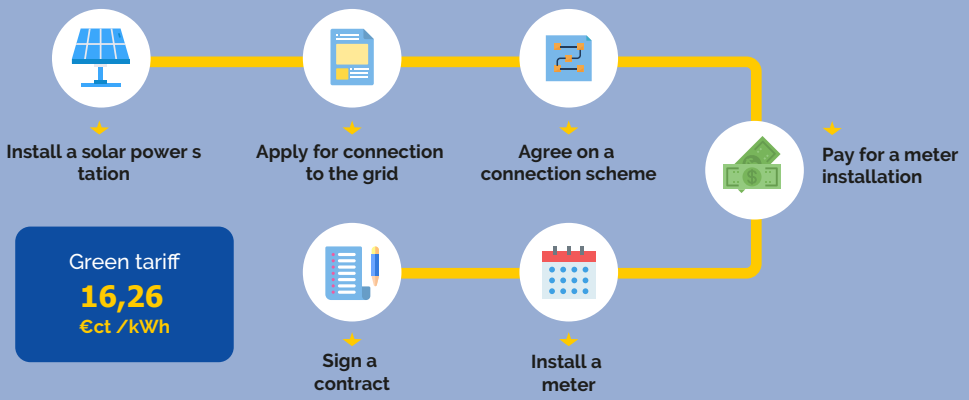
*The household will pay electricity supplier for electricity consumption (300 kWh – 200 kWh)*0.9 =* ***90 UAH.***

If the electricity generation by SPS exceeds a household consumption

- *A household consumed 300 kWh for a month.*
- *A solar power station has produced 500 kWh.*
- *Green tariff for SPS commissioned from 01.01.2020 to 31.12.2024 - 16,26 €ct/kWh (excluding VAT)*

*The electricity supplier will pay the household for the electricity generated by its SPS and fed to the grid (500 kWh - 300 kWh)*16,26/100 =* ***32,52 € (≈921 UAH)***

How to get the green tariff?



06

In order to receive income under the green tariff, it is necessary to open a current account at a bank to receive funds the funds, and submit the following documents to the Distribution System Operator (Oblenergo):

- application notifying about the SPS installation - one-line connection scheme with information on equipment elements installed, their nominal capacity and the installation location;

07

Oblenergo verifies the information (3 working days) and provides the customer with an invoice to pay for the services of a metering unit installation (3 working days).

08

Oblenergo installs the metering unit (3-5 days from the date of the payment)

09

Oblenergo (within 3-5 working days) transfers information on the installation of the SPS in the household to the Universal Services Provider.

10

The Universal Services Provider and the consumer conclude a Contract on the purchase and sale of electricity at the green tariff, which is Annex 2 to the Contract on the supply of electricity by the Universal Services Provider.

The date when the SPS is commissioned is fixed in the application notifying Oblenergo about the SPS installation in a household.

Payments to the household for excess electricity produced by the SPS and sold at the green tariff are made from the date of the conclusion of the Contract on the purchase and sale of electricity at the green tariff.

It should also be noted that the greatest effect from the use of renewable energy sources can be achieved undertaking energy efficiency measures.

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CO-FUNDING PROGRAMS FOR SOLAR POWER STATIONS

Incentive programs for SPS installed in households have been implemented in various regions of Ukraine. Under these programs, partial reimbursement of costs or a loan for the SPS installation may be obtained.

Does this program work in your city, district or region? Learn the details:

IN OBLAST STATE ADMINISTRATIONS

ON THE MAP OF LOCAL PROGRAMS

In addition, some banks in Ukraine also offer financial support for energy-efficient equipment and RES technologies, including SPS.

Pay attention to relevant programs at Ukrgasbank, Oshchadbank and other institutions, which offer special conditions for granting loans for the construction of your own SPS.

Oles Shtefchuk
from Kharkiv region:

"The life philosophy of our family is that our children deserve the planet in the state no worse that in which we "received" it. Therefore, we try to protect nature and consume wisely. Solar panels help us conserve non-renewable natural resources and provide for ourselves by means of the sun. For two years, our solar station has allowed us to reach the "energy surplus" – we feed into the central grid more than we consume per year. Thus, we also help to improve the ecological balance at the state level and promote energy independence.

Also, due to the solar station, our monthly electricity consumption has decreased by 100-350 kW in winter months, and during the heating season we sell excess energy to the state at the green tariff. Our household does not consume anything externally, we have our own water supply and sewage system, and we rejected gas use at the design stage of our house. So, the final annual balance for utilities has completely turned out to be negative for us meaning that we are significantly paid extra now!

To sum up, spare money, make profit and save the earth!"

Olha Moiseyeva
from Lviv region:

«We installed a 9.2 kW SPS on the ground near our house.
Solar panels are environmentally friendly. Such projects lead to energy independence, reduction of air pollution, and enable us to sell excess electricity at the green tariff – doesn't it sound profitable?

To reimburse the costs of installing the station, we used the IQ energy program (the IQ energy program was developed by the European Bank for Reconstruction and Development, which aims at improving the residential energy efficiency in Ukraine).

Since the cost of other energy sources is likely to gradually increase and the extraction of traditional fuels is detrimental to the environment, one can be sure that the future lies with renewable energy!»

USEFUL SOURCES OF INFORMATION

State Agency on Energy Efficiency and Energy Saving of Ukraine

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We are in social media: https://www.facebook.com/saeeUA
https://twitter.com/SAEE_Ukraine
https://t.me/SAEE_UA

UA MAP

an Interactive Investment Map of Renewable Energy and Energy Efficiency Projects in Ukraine

uamap@saee.gov.ua

- Contacts of regional state administrations for the information on clean energy

  http://saee.gov.ua/uk/content/regional-contacts

- Renewables Association of Ukraine

  +38 (044) 379 12 95 https://uare.com.ua

  info@uare.com.ua

- The National Commission for State Regulation of Energy and Public Utilities of Ukraine

  https://www.nerc.gov.ua box@nerc.gov.ua

  www.facebook.com/nerc.gov.ua

- Solar Energy Association of Ukraine

  http://aseu.org.ua

  https://www.facebook.com/aseuofficial

- Institute of Renewable Energy of National Academy Science of Ukraine

  +38 (044) 206-28-09 renewable@ukr.net

  http://www.ive.org.ua info@ive.org.ua

- Organization of «Global 100% RE Ukraine»

  https://100re.org.ua info@100re.org.ua

  https://www.facebook.com/100REUA

There are numerous portals on the Internet where you can also find relevant information, such as:

- Profit Calculator for a Solar Power Station:

  https://life.pravda.com.ua/projects/solar/2018/10/24/233639

- Up-to-date news on clean energy sources on the Eco Town website:

  https://ecotown.com.ua

- Directory of service companies for the sale and installation of solar power station equipment in households

  https://joule.ua

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