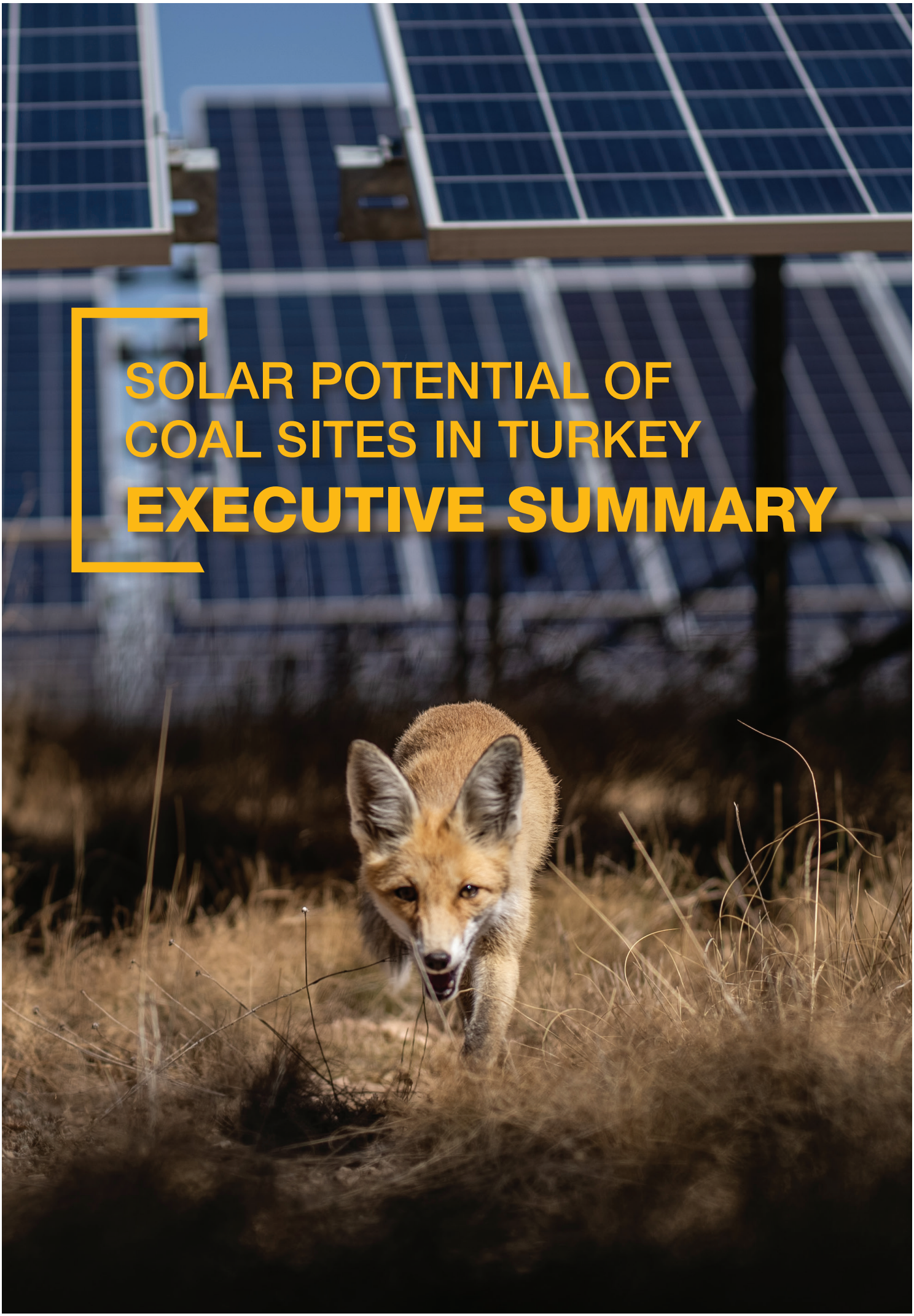

SOLAR POTENTIAL OF COAL SITES IN TURKEY

EXECUTIVE SUMMARY

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Solar3GW for Europe Beyond Coal, Climate Action Network (CAN) Europe, Ekosfer, WWF-Turkey (World Wide Fund for Nature), Greenpeace Mediterranean, 350.org, Climate Change Policy and Research Association, and Yuva Association.

Date: March 2022

Photos by Barbaros Kayan - Europe Beyond Coal

PREFACE

By ratifying the UN Paris Climate Agreement, Turkey has joined the ranks of countries that have made a commitment to limit the rise of global warming to 1.5°C. Turkey has also announced that it aims to achieve net zero emissions by 2053. With these targets in mind, it is critical that the country urgently begins planning the decarbonisation of its economy. Coal is the fossil fuel with the highest emission intensity, so Turkey needs to start planning its coal exit in order to achieve its climate targets.

This will have co-benefits in the form of reduced threats to public health, and less damage to the environment through air and water pollution and soil contamination. A coal phase-out would also have economic benefits, as public funding is currently wasted on coal subsidies and on incentives for the coal industry to stay operational, despite renewable energy technologies offering a cheaper, healthier, fossil-free alternative. A switch away from coal to more sustainable, renewable energy sources, such as solar power, would be a symbol of technological progress, creating jobs, and boosting Turkey's energy independence.

In the context of its decarbonisation target, Turkey should increase the share of solar power in its energy mix. The areas occupied by open-pit mining sites that feed coal-fired thermal power plants are suitable for solar installations because they are large open spaces that are prime for repurposing, and have a cost advantage in transition from coal to solar power as they are already connected to substation hubs and transmission lines. These solar installations can provide opportunities to attract new investors and manufacturing industries, and to create new jobs, minimising any economic hit to these regions because of the closure of the coal mines.

Before the solar potential of an individual mining site can be established, it must first be ascertained whether the site was formally classified as forest, agricultural or pasture land. Sites that were, should, where possible, be rehabilitated and returned to their previous status. Similarly, in cases where land for the mining was expropriated from local people, the sites should be rehabilitated and returned to their rightful owners. In cases where the conversion from coal mine to solar installation is a suitable option, every effort should be made to incorporate wildlife corridors, and limit impacts on neighbouring agricultural or pasture land. Community ownership schemes should also be prioritised, so that local people can benefit from the introduction of the new solar schemes.

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METHODOLOGY

The coordinates of the sites used in this study were obtained from the Energy Market Regulatory Authority (EPDK) of Turkey, and the areas constituting coal mines were determined by verifying them on Google Earth. Since some of the coal mines are very close to, or intersect one another, those examples were evaluated together as one site. These cases have been highlighted as such in the report. When determining which sites are suitable to transition from coal to solar power, sites facing south with more than 20% inclination, facing north with more than 5% inclination, or with bodies of water (such as flooding or backwater) were eliminated from the scope of the report. Approximately half of the total area (249.5 million m2) determined as mining sites were excluded from the calculation for these reasons. The value used in the study for the efficiency of photovoltaic modules is 22%. Approximately 10 acres of land was used for 1 megawatt peak (MWp) installation. After determining the size of the total area, the total production potential was calculated by performing PVSyst simulation, according to the geographical location of the area.

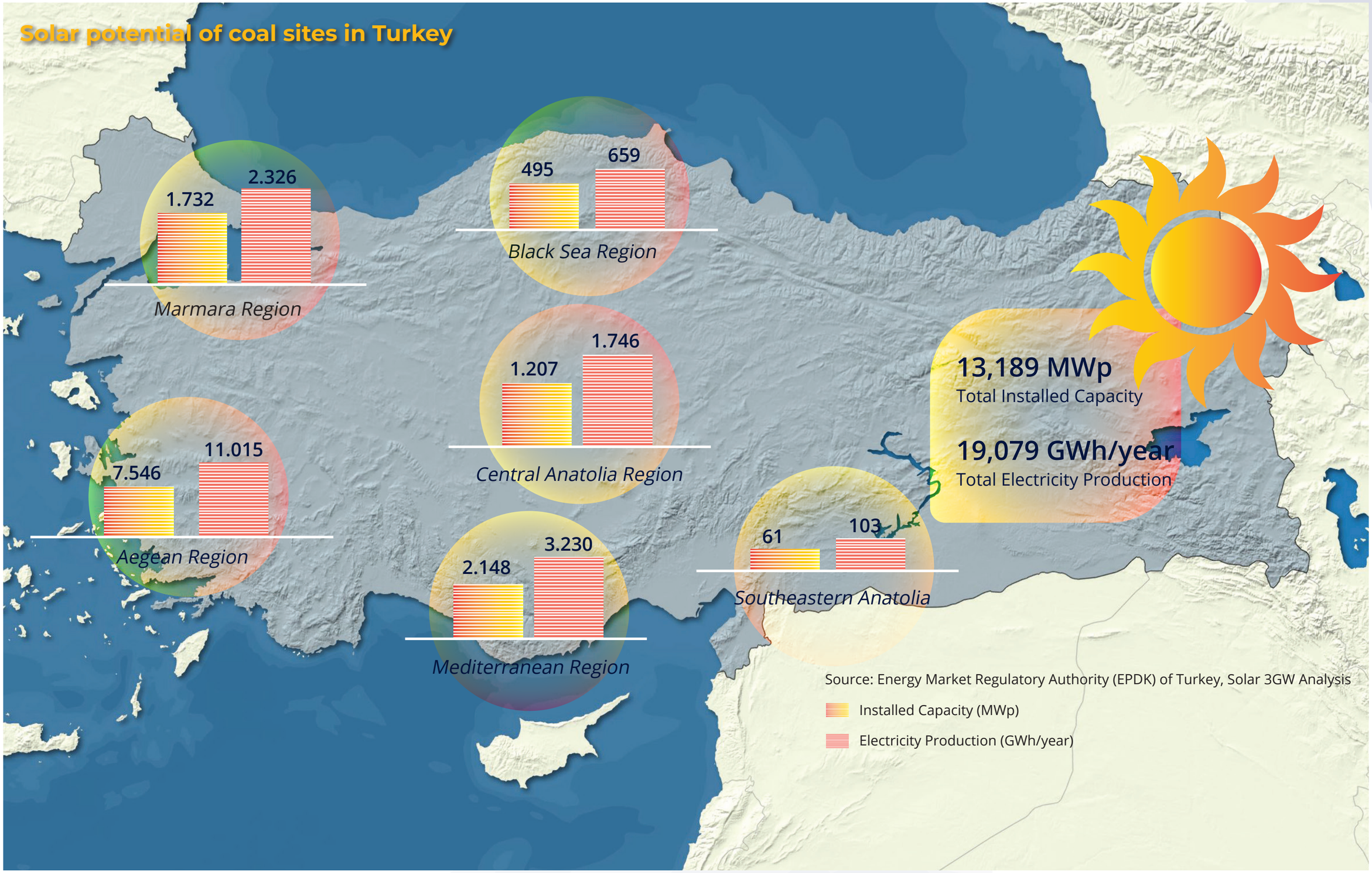
In addition to considering the installation of solar production on mining sites of coal-fired power plants, the study also considered 4-hour and 16-hour integrated battery storage facilities as options to, at least partially, replace these coal-fired power plants. The 4-hour storage system is widely used around the globe in conjunction with solar energy, as it is a system that moderates the rapid voltage drops and spikes caused by the abrupt appearance of clouds, providing a reliable source of power without creating tension in the grid. On the other hand, the 16-hour storage system can provide power to the grid outside of sunlight hours while also having the same advantages as the 4-hour storage system. The simulation was calculated for a 20 MW plant as this is the maximum size that can be analysed using PVSyst. The electricity generation data was calculated according to this value, taking into account the number of panels that can be installed on each coal site. The reason for the lower production in storage plants compared to non-storage plants (i.e. generating plants) is the loss of efficiency that occurs in charging and discharging the battery.

The mining sites included in this report are as follows:

Çan, Çan 2, Bolu-Göynük, Kangal, Seyitömer, Çayırhan, Orhaneli, Çatalağzı, Soma-B, Soma, Soma-Kolin, Polat, Tufanbeyli, Tunçbilek, Yatağan, Yeniköy, Yeniköy-Kemerköy, Çumra Termik, Çumra, Afşin-Elbistan A, Afşin Elbistan B, Silopi.

SOLAR POTENTIAL OF COAL SITES IN TURKEY

Solar potential of coal sites in Turkey



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CONCLUSION AND RECOMMENDATIONS

Solar Potential of Coal Mining Sites

Number of Plants Included in the Calculation	22
Total Installed Capacity of Coal-Fired Thermal Power Plants on the Sites	10.495 MW
Total Installed Capacity upon Transition to Solar Installations	13.189 MWp
Total Electricity Production upon Transition to Solar Installations	19.079 GWh/year
Projection of Total Investments to be Made	
Non-Storage	$5.9 Billion
4-Hour Storage	$8.8 Billion
16-Hour Storage	$13.6 Billion

Values by household

Electricity production potential from solar power in the covered sites	19,079 GWh/year
Number of households that can be fully powered by solar power	6.9 million households/year
Carbon dioxide emissions prevented	12.4 million tons CO2/year

Annual electricity needed per household: 2760 kWh
Amount of CO2 emission to be prevented: 0.6482 tCO2/MWh

Within the scope of the study, the open-pit coal mines that provide coal to 22 coal-fired thermal power plants with a total installed capacity of 10,495 MW were included in the calculation. Solar power with a total installed capacity of 13,189 MW can be built in areas that are suitable for a transition from coal mining sites to solar power (the breakdown per power plant can be found in the report's Appendix). A total of 19,079 GWh/year electricity would be produced from these solar installations, which can meet the annual electricity needs of 6.9 million households. If the areas occupied by coal mining sites are instead equipped with solar power, 12.4 million tonnes of CO2 emissions per year can be prevented.

This study demonstrates that open-pit coal mining sites in Turkey have a high potential to be converted to solar electricity production. Making use of this potential by prioritising the involvement of local people in the decision-making processes, as well as the protection of ecosystems, will facilitate Turkey's achievement of its goal to reach carbon neutrality by 2053. Some suggestions as to what can be done to take advantage of this potential are as follows:

- Turkey should establish a coal exit plan in line with the UN Paris Climate Agreement's objective (to which it is a party) of limiting global temperature increase to below 1.5°C, and a closure schedule should be determined for existing coal-fired power plants.
- In locations where grid balance is considered critical, building solar installations with storage units should be considered, and regional grid investment plans should be examined.
- Support for solar installations with battery storage to replace coal-fired thermal power plants should be prioritised, using tools such as Value Added Tax exemptions or investment incentive certificates, instead of purchasing guarantees.
- Solar power production, installation and investments should be supported while prioritising the needs of local people and ecosystems, in order to take advantage of the opportunities created by solar energy technologies in the suitable coal mining sites.

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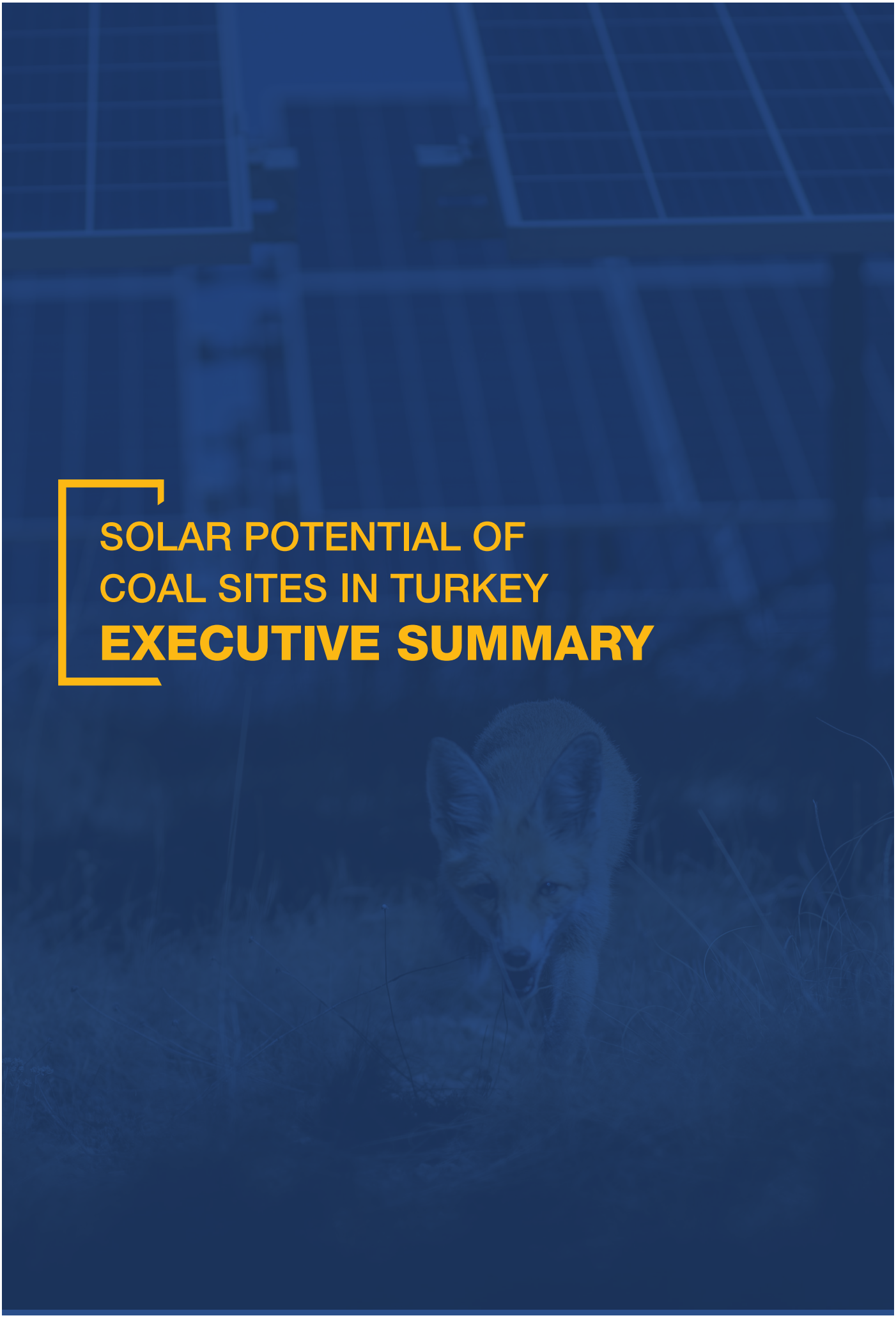

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