ROYAL DANISH
CONSULATE GENERAL
The Trade Council in Istanbul

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SOLAR ENERGY IN TURKEY

POTENTIAL FOR DANISH STAKEHOLDERS

Prepared by The Trade Council of Denmark in Istanbul

SOLAR ENERGY IN DENMARK

SUMMARY

- Solar electricity capacity has increased substantially in the past decade, growing from 3 MW in 2008 to 921 MW in 2018. We expect capacity to keep increasing over the forecast period, at an average of 5.1% per annum, and to reach 1,171 MWe by 2023.
- Net metering, implemented in 2010, made solar panels more attractive, as households and public institutions could store surplus production, and the government provided subsidies.
- The 2017 decision to make wind and solar projects compete on equal terms in tender auctions for subsidies is also expected to boost the expansion of solar energy.

TURKEY'S RAPID GROWTH & TARGETS

DID YOU KNOW THAT?

- Turkey's energy consumption is increasing **4-6%** every year as an ever growing and industrializing country
- Turkey plans to generate **two-thirds** of its electricity from local and renewable resources by 2023.
- Turkey is one of the fastest growing energy markets among the OECD countries.
- Turkish government has committed to double the capacity of installed solar and wind power by 2027 and to invest around $110 billion in the energy sector.
- The share of renewable energy in total power generation increased from 18.15 percent in September 2018 to 35.45 percent in September 2019. This marks a **41-percent increase** in the power generation from renewable energy sources.
- Solar power generation increased by **145 %**, wind power generation increased by 16.46 percent, and HPP power generation increased by 61 percent.

SOLAR ENERGY SECTOR IN TURKEY & KEY FIGURES

WHY TURKEY?

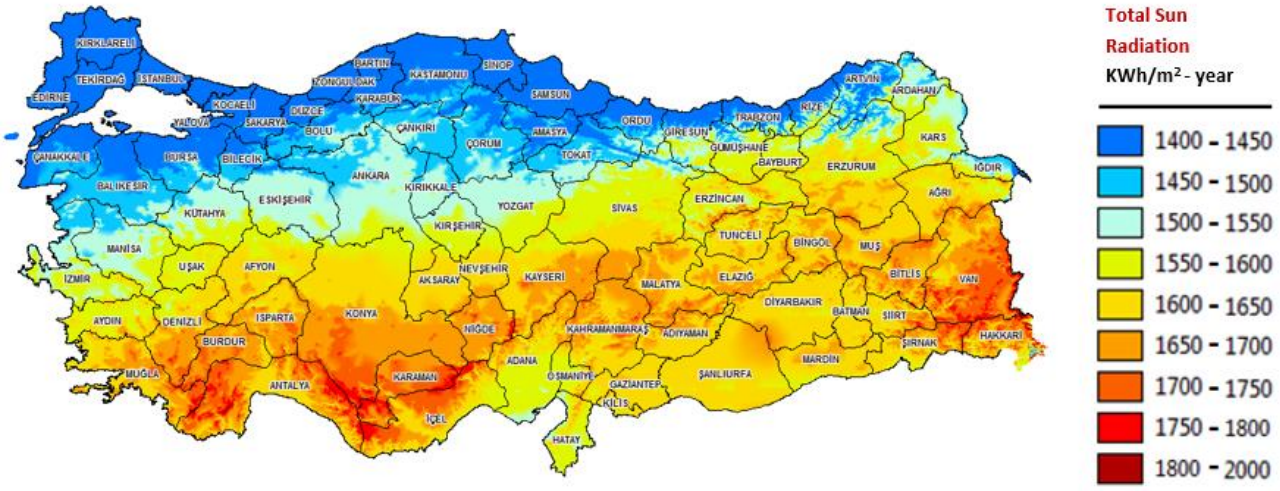
With a population reaching 80 million, Turkey's energy consumption based on primary energy resources are continuing to increase. More than 75% of energy consumption in the country is met by imports. The share of imports continues to grow each year.

Therefore, it is critical to supply its energy demand by using domestic non-renewable and renewable resources. In this regard, Solar energy is one of the most important alternative clean energy resource, which is still relatively untapped in Turkey.

- Average annual solar radiation as **1311 kWh/m²-year (3,6 kWh/m²-day)**
- Solar energy thermal potential is **61 mil.** Toe and electricity potential is **15 mil.** Toe
- The annual average total insolation duration as **2640 hours (7,2 hours/day)**
- The average solar intensity is **3.6 kWh per square**
- **200** sunny days on average

Turkey - Energy report: Renewable energy - EXCEL2						
Renewables capacity and generation						
	2018a	2019a	2020b	2021b	2022b	2023b
Electricity capacity: Hydro (MW)	27,862	28,362	28,862	29,362	29,862	30,362
Electricity generation: Hydro (GWh)	59,755	62,022	64,356	66,758	69,230	71,774
Electricity capacity: Non-hydro renewables (MW)	13,170	14,770	16,480	18,490	20,500	22,910
Electricity generation: Non-hydro renewables (GWh)	34,265	37,115	40,214	44,067	47,825	52,322
Non-hydro renewables						
Electricity capacity: Wind (MW)	7,016	7,606	8,306	9,306	10,306	11,506
Electricity generation: Wind (GWh)	19,882	21,156	22,680	24,957	27,140	29,757
Electricity capacity: Solar (MW)	4,921	5,921	6,921	7,921	8,921	10,121
Electricity generation: Solar (GWh)	7,477	8,997	10,516	12,036	13,556	15,379
Electricity capacity: Other non-hydro renewables (MW)	1,233.0	1,243.0	1,253.0	1,263.0	1,273.0	1,283.0
Electricity generation: Other non-hydro renewables (GWh)	6,905.6	6,961.6	7,017.6	7,073.6	7,129.6	7,185.6
aEconomist Intelligence Unit estimates.bEconomist Intelligence Unit forecasts.						
Sources: The Economist Intelligence Unit; © OECD/IEA 2018 IEA statistics, www.iea.org/statistics, licence: www.iea.org/t&c.						

TURKEY DNI MAP



Source: GEPA (Solar Enerji Potential Map)

MARKET POTENTIAL & TARGETS FOR THE SECTOR:

- Investment in Turkey's solar power accelerated sharply in 2016 and 2017.
- Installed solar-power capacity in Turkey reached **5.9 GW in 2019**, and the target is 15 GW of capacity to be reached by 2027.
- The bulk of current capacity is provided by plants of less than 5 MW each.
- There are also big projects such as Cıngıllı SPP with a 36.4 MWp, the largest licensed solar power plant in Turkey in an area of 520,000 square meters in a single field in Bor, Niğde by Polat Energy.
- Turkish households are preparing to produce solar energy by installing roof-top and facade solar panels with a new legislation adopted in late December 2017 that enables households to install solar panels with a maximum capacity of 10 megawatts with less red tape.
- Solar power capacity is expected to reach 17 GW by 2029, accounting for about 14% of Turkey's total electricity capacity.
- According to the Renewable Energy Strategic Plan for 2018-2029, the following targets have been set for installing solar power:

2018	2019	2029
4.900 MW	5.900MW	17.300 MW

INCENTIVES IN THE SECTOR (YEKDEM)

The Turkish government has an incentive scheme to support investments in the renewable energy sector since 2009. According to the scheme, solar energy is the most supported energy source.

The Ministry of Energy and Natural Resources has determined the baseline feed-in tariff for solar energy at; **13.3 USD cent/ kWh.** The feed-in tariff is valid for 10 years upon obtaining licence.

A total of; **6.7 USD cent/ kWh** (PV) and **9.2 USD cent/ kWh** (CSP) can furthermore be obtained if the following components are manufactured in Turkey:

Type of Plant	Domestic Production	Domestic Contribution (USD Cent/ kWh)
Photovoltaic Solar Power Generation Facility	PV panel integration and production of solar structural mechanics	0,8
	PV modules	1,3
	Cells composing the PV module	3,5
	Inverter	0,6
	Equipment focusing the sunlight on PV module	0,5
	TOTAL	**6,7**
Concentrated Solar Power (CSP) Generation Facility	Radiation collection tube	2,4
	Reflective surface panel	0,6
	Solar tracking system	0,6
	Mechanical equipment for thermal energy storage system	1,3
	Mechanical equipment of steam generation system that accumulates sunlight on the tower	2,4
	Stirling engine	1,3
	Panel integration and structural mechanics of solar panel	0,6
	TOTAL	**9,2**

Maximum Feed-in-Tariff and Local Content Bonus for solar energy:

- **20 USD cent/ kWh** (PV) and **22,5 USD cent/ kWh** (CSP)

SOLAR YEKA (RENEWABLE ENERGY ZONE)

YEKDEM scheme mentioned above encouraged localisation of equipment manufacturing by offering an increase in feed-in tariffs for renewable projects that utilise domestically manufactured equipment.

The YEKA scheme goes one step further by mandating the use of domestically manufactured equipment in projects that are tendered under the YEKA Regulation.

THE FIRST YEKA TENDER (MARCH 2017)

- ✓ Solar YEKA: A consortium of Kalyon and South Korea's Hanwha won an auction to build and operate **a 1-GW solar plant** in Konya province in early 2017 on the basis of a bid of US$6.99 cents per kWh.
- ✓ The winning consortium was required to set up an SPV to build a 1GW solar power plant as well as a vertically integrated **500MW solar module** factory producing the photovoltaic modules required by the power plant.
    - In March 2017, the Integrated **Solar Power Photovoltaic Panel Manufacturing Plant** established in Başkent Organized Industrial Zone (OIZ) by Kalyon Holding.
    - It will be one of the exceptional factories in Europe, and Turkey's first integrated factory in Middle East. Equipment of each cell down to all phases will be manufactured. The factory will create 1,300 jobs.

SOLAR YEKA 2 AND MINI YEKAS

To be launched in 2020.

- ✓ There will be no requirement to establish an equipment manufacturing facility.
- ✓ Differently from the Solar YEKA 1 Tenders, the size of the projects will be considerably smaller, which should make it easier for the winning consortia to finance these projects.
- ✓ It is expected that there will be approximately 40 separate tenders for each so-called "mini YEKA project" with an installed capacity of 10 to 50 MW each in various locations throughout Turkey.

SOLAR THERMAL ENERGY FOR DISTRICT HEATING

- Solar thermal heating is used a lot in Turkey and there is a potential to use solar energy for district heating.
- With nearly 1.9 million m² of collector area newly installed in 2014 (1.33 GWth), Turkey was the second-largest solar thermal market after China.
- The share of vacuum tube collectors had increased significantly over the years but stagnated in 2014 at 44 % of total market volume (Solar Heat Worldwide, 2016 Edition). The annual study Solar Heat Worldwide from Austrian research institute AEE INTEC uses industry-based figures for Turkey.
- According to the latest market surveys on solar thermal industry trends;
  - ✓ multi-family houses were considered as the fastest-growing segment in Turkey´s solar thermal market, as stated by 52% of the survey participants. Another 17% considered single-family houses to be the most important segment, 14% opted for the tourism sector, 10% for the public sector and 7% for industrial process heat.

POTENTIAL FOR DANISH COMPANIES

- Investing in big and small scale projects
- Be a sub supplier to Solar YEKA 1 and YEKA 2 to be held in 2020
- Being a consultant to the current and upcoming projects
- Using solar thermal collectors connected to developing district heating market
- Partnerships with Turkish companies

- SOLAREX İSTANBUL, July 9-11, 2020

Solar Energy and Technologies Fair "Solarex Istanbul" is fair which is comprised of various activities, which visitors will participate in, as well as the symposiums and firm conferences. Sector's leading organizations are illuminating the sector with the seminars during the fair, where seminars are conducted especially in the field of financing, investment and production.

https://solarexistanbul.com/?gclid=CjwKCAjwpqv0BRABEiwA-TySwUCHaohl6jXHIt-pfHwXsjuetsoDkR4SlRnlrdn-YmQu22rzpYiF6hBoCxjYQAvD_BwE

THE TRADE COUNCIL OF DENMARK IN TURKEY

CONTACT:

For further information, please contact The Trade Council in Istanbul:

Name: **Seda Kayrak Bilgen**, Senior Trade Manager & Sector Expert

Direct phone: +90 212 359 1912

E-mail: sedkay@um.dk

Name: **Katya Ginoviç**, Commercial Assistant

Direct phone: +90 212 359 1913

E-mail: katgin@gum.dk

Name: **Anette Snedgaard Galskjøt**, Consul General

Direct phone: +90 212 359 1903

E-mail: anegal@um.dk

UDENRIGSMINISTERIET

Danmarks Generalkonsulat i Istanbul, The Trade Council
Trump Towers, 14th Floor, Büyükdere Cad. 34387
Mecidiyeköy Şişli İstanbul Turkey
Tlf.: +90 212 359 1900
E-mail: isthkt@um.dk

https://tyrkiet.um.dk