TURKEY'S GEOTHERMAL JOURNEY

12.05.2023

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Content

I. Renewable Energy - Geothermal Energy

II. Geothermal Energy Installed Capacity

III. Overview of Geothermal Energy in Turkey

IV. Zorlu Energy

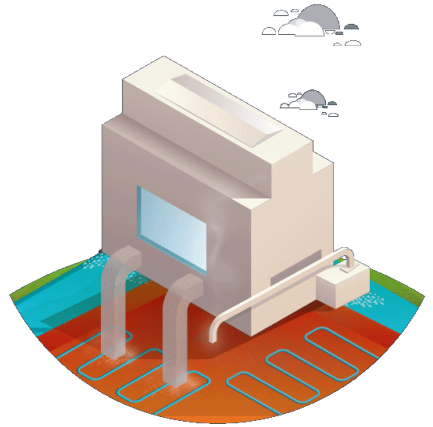
Renewable Energy

Solar

Wind

Hydroelectric

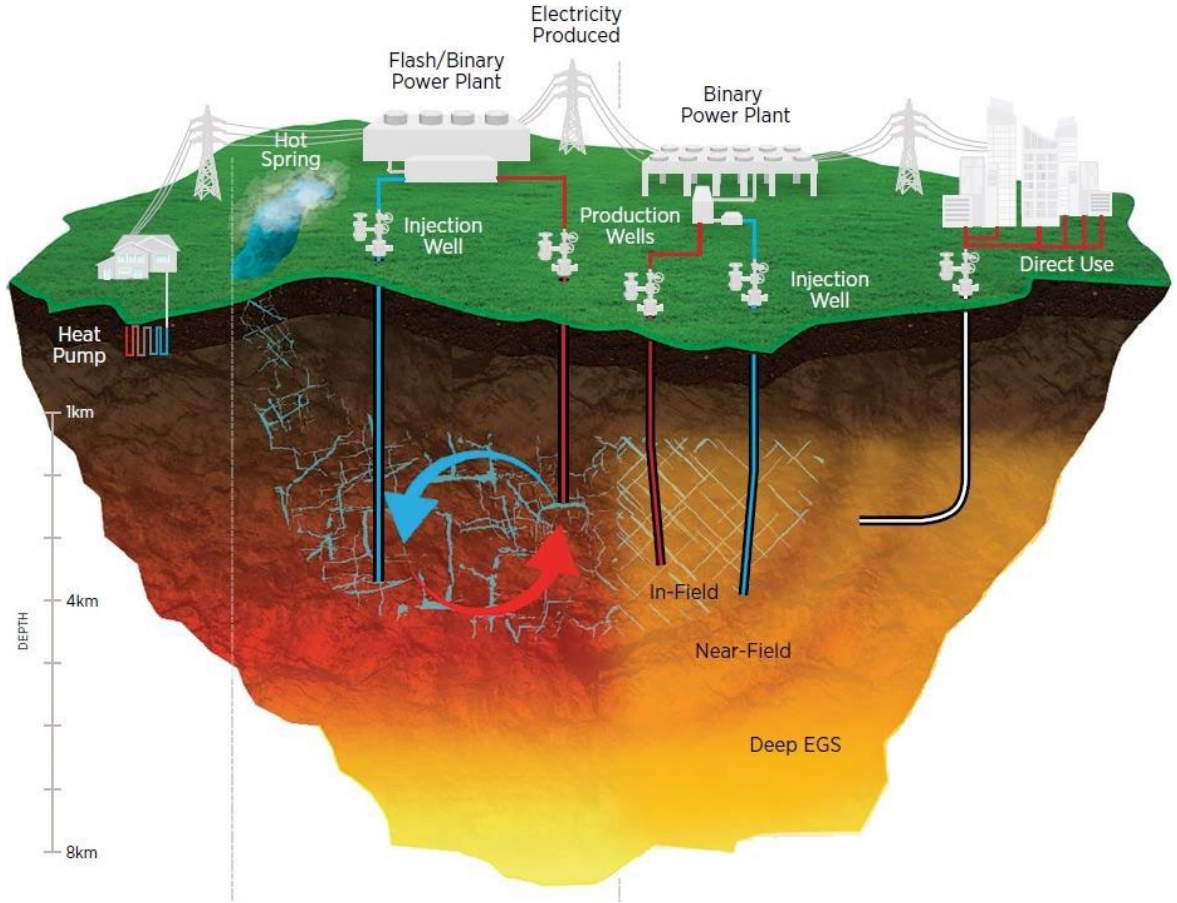
Geothermal

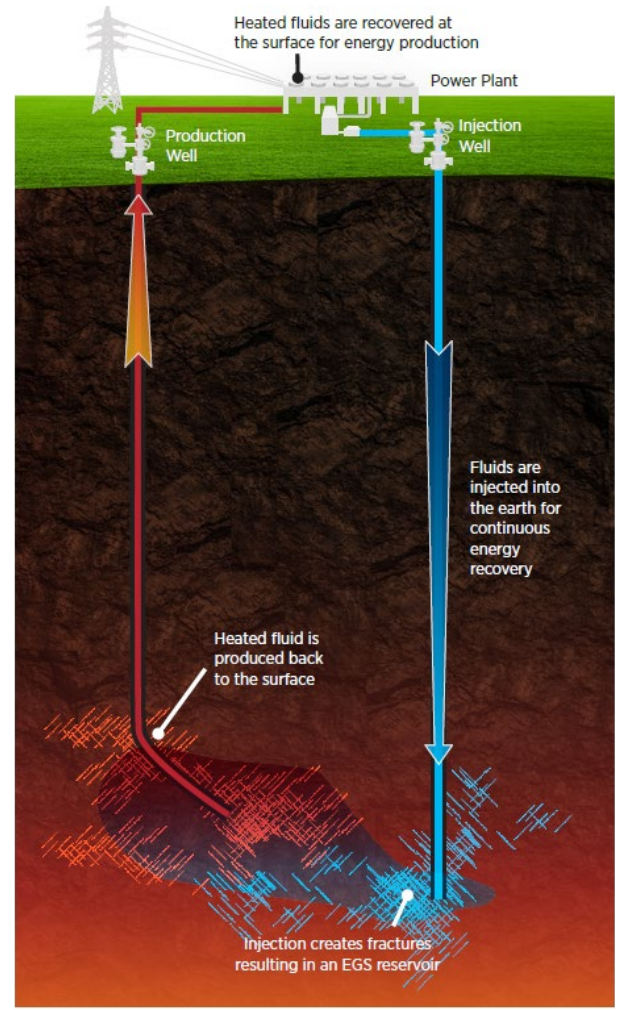


Energy that is collected from renewable sources such as sunlight, wind, rain, geothermal heat that is naturally replenished over the human time scale.

Geothermal Energy

Geothermal power generation; groundwater is heated by a magma reservoir to high-temperature, high-pressure steam that is used to power a turbine to generate electricity.





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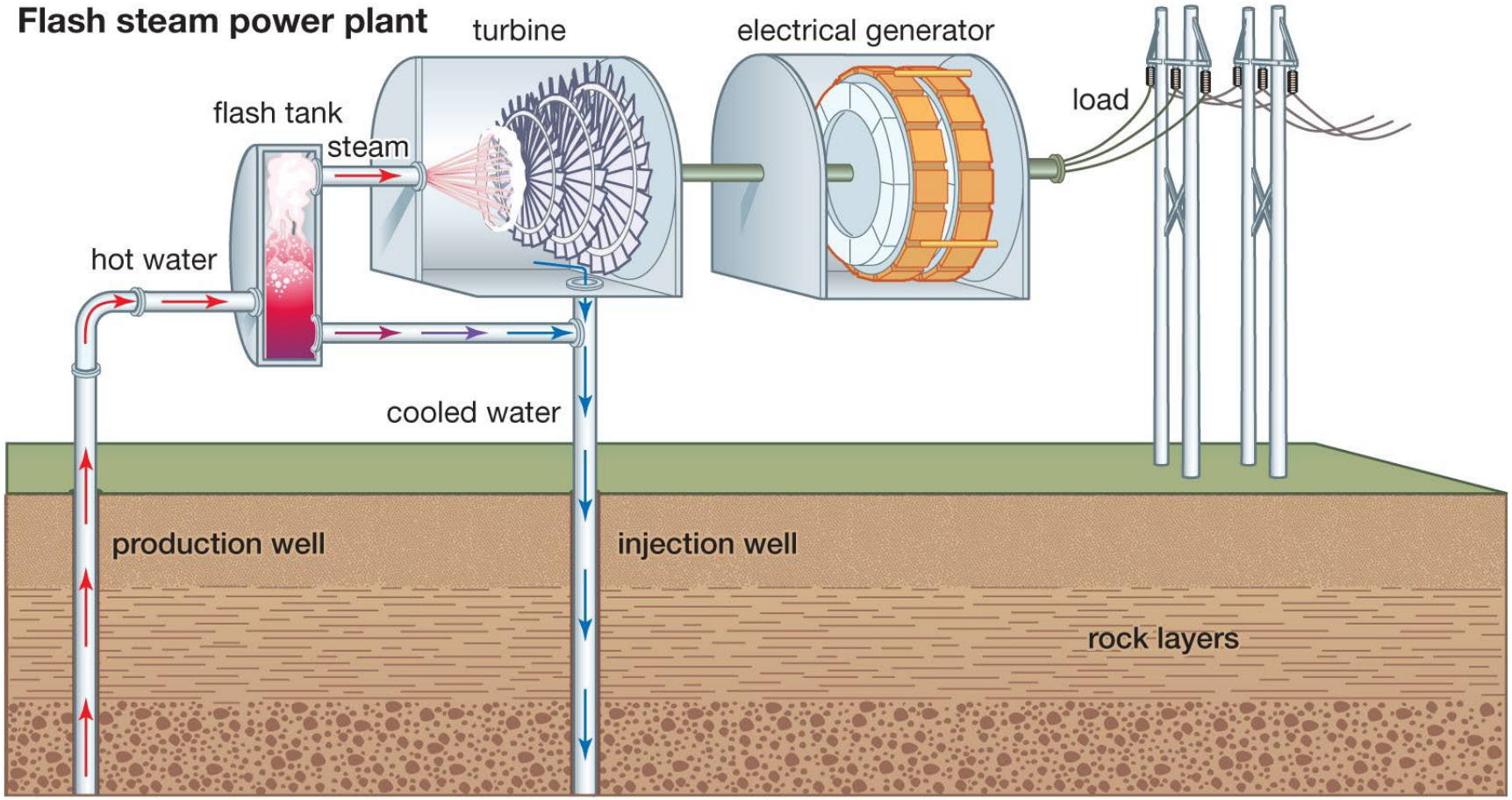
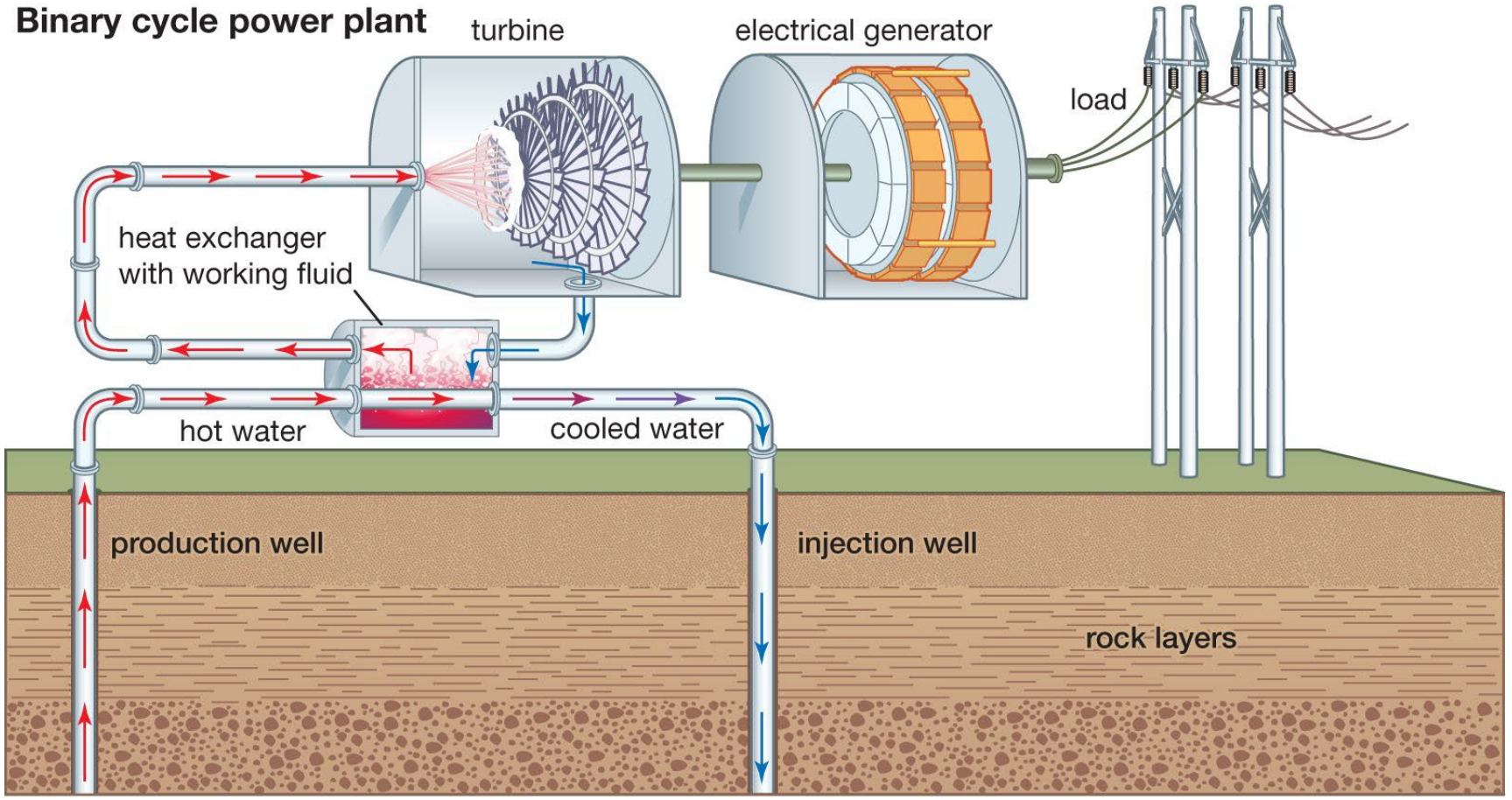
Flash System Geothermal Energy Power Plants



Geothermal fluid is led to the separator, and the separated steam is used to rotate the turbine. If the hot water temperature is sufficiently high (>180°C), a more effective double-flash or triple-flash system is employed.

Binary System Geothermal Energy Power Plants



When the temperature of the geothermal fluid is too low (<180°C) to obtain a sufficient amount of steam, this system utilizes working fluid with a low boiling temperature to drive the turbine.

Geothermal Integrated Usage

INTEGRATED USAGE OF GEOTHERMAL ENERGY

Electricity Production

Renewable Energy sources

Base load

Food Drying

It provides hygienic, high-quality food production.

Heating - Cooling

It reduces foreign dependency on gas and coal with residential and building heating and cooling.

It ends the dependency on external emission generating sources such as coal and natural gas.

Thermal Tourism

It provides points of interest for tourists such as natural exits and spas.

Greenhouse

Quality and continuous production with good agriculture for 12 months of the year with greenhouse heating.

Mining

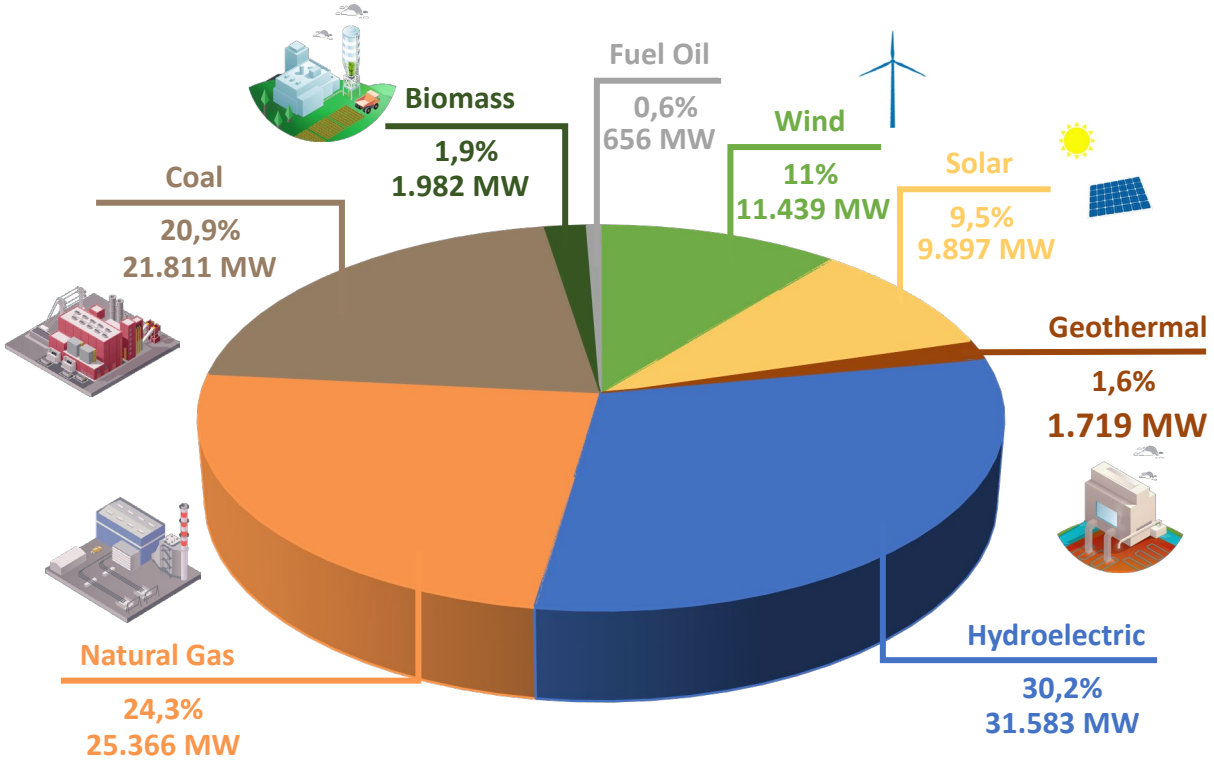
Precious metals, especially lithium, can be obtained with geothermal power.

Geothermal Energy Installed Capacity

Installed Capacity & Electricity Generation in Turkey

Total Installed Capacity - 2023

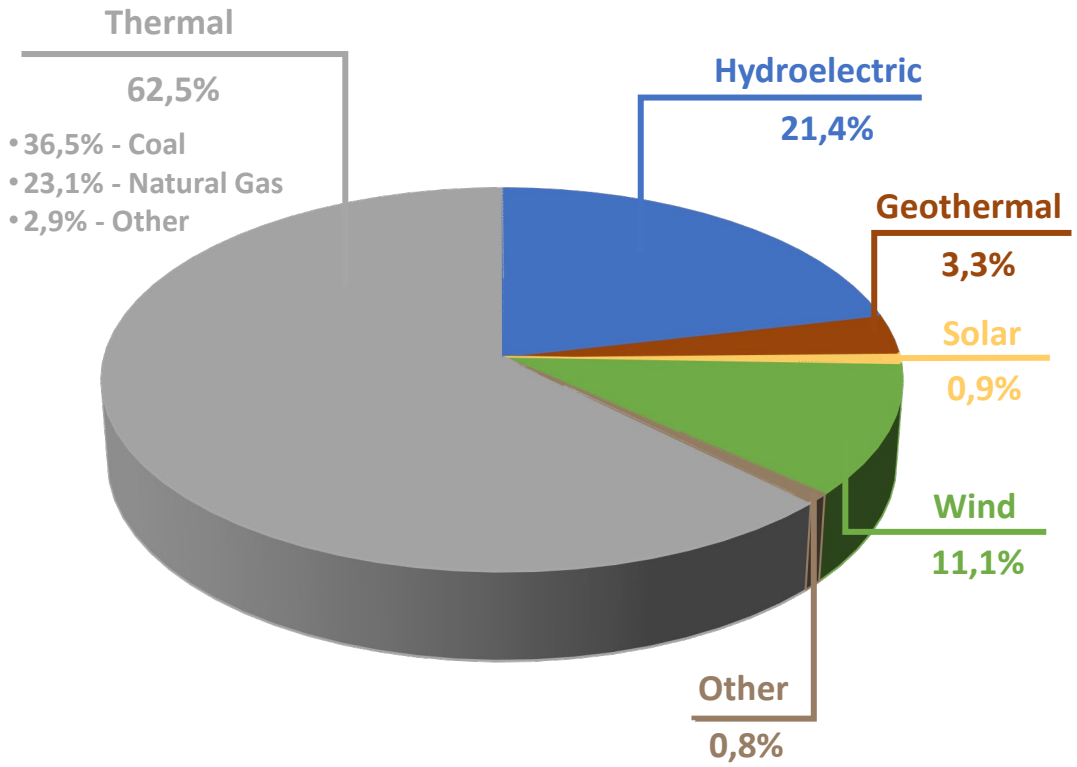
104.453 MW



Source: TEİAŞ (April 2023)

Total Electricity Generation - 2022

311.163 GWh



Source: EPİAŞ

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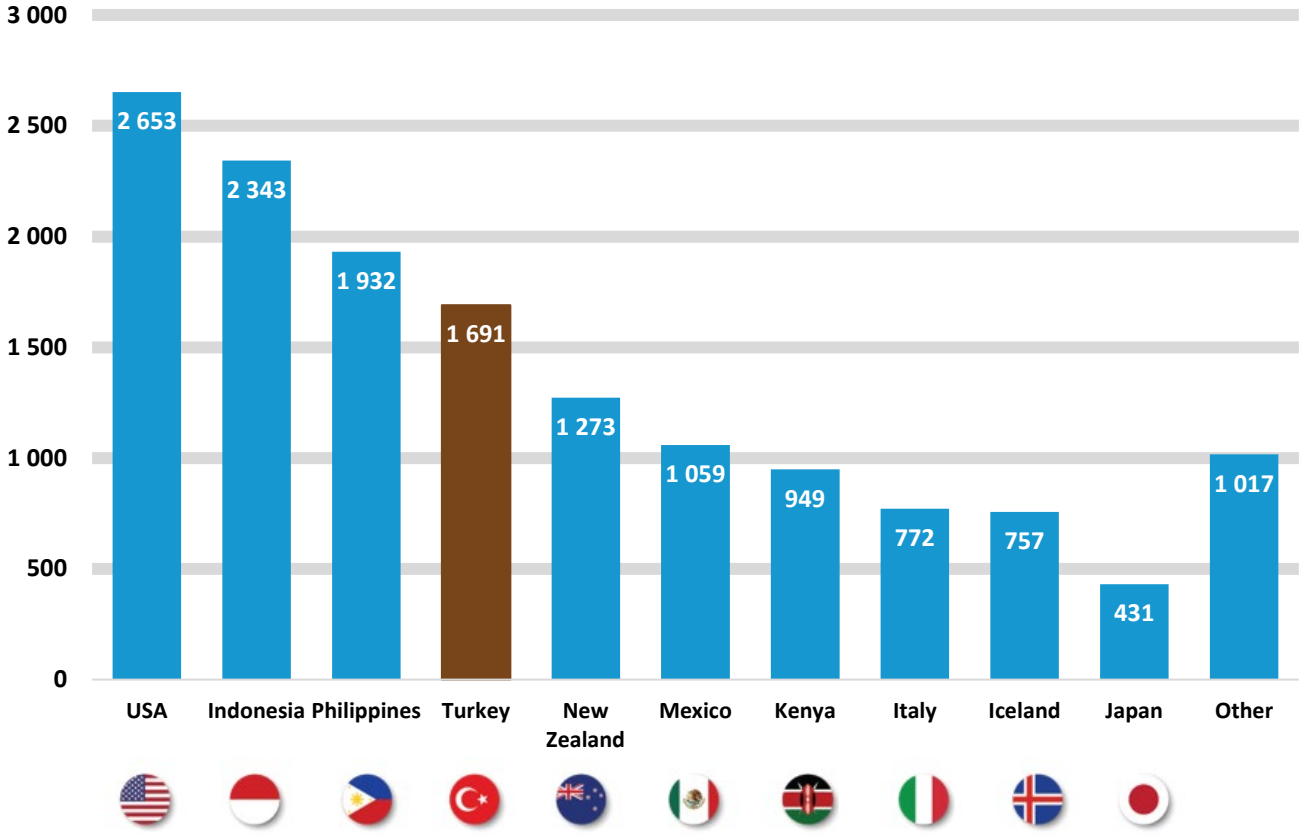
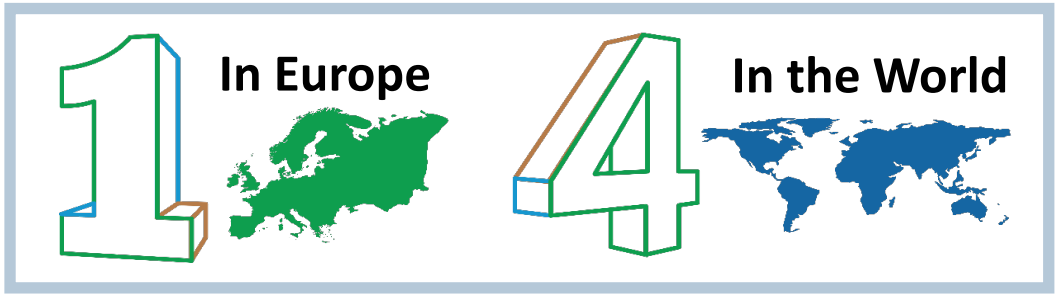
Geothermal Energy Installed Capacity in the World

Total Installed Capacity **14.877 MW (2022)**





11% of the World Installed Power is in Turkey

Turkish Miracle

Source: IRENA 2023

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Geothermal Energy in Turkey

Geothermal Potential in Turkey

DISCOVERED GEOTHERMAL HEAT CAPACITY 62.000 MWt

Geothermal Power Plant

Greenhouse

Residential Heating

1.719 MWe

5.000 MWe

4.350 Acres

25.000 Acres

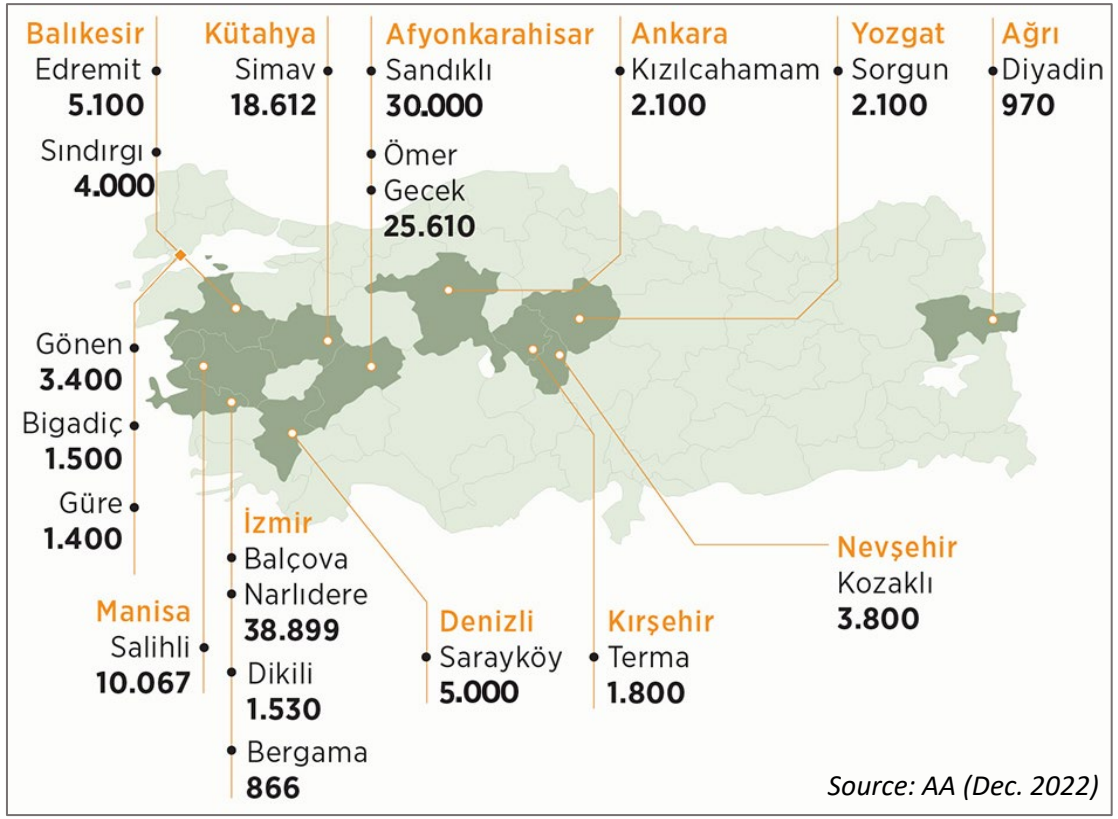
150.000 Residence

5 Million Residence

62.000 MWt Energy equivalent of potential

~50 Billion m³ of natural gas/year

Number of residences with geothermal heating in Turkey



Source: AA (Dec. 2022)

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Geothermal Energy Chronology in Turkey

1984 — Commissioning of first Geothermal Power Plant supported by World bank

May 2005 — Announcement of Feed-in-tariff mechanism
- **5,5 Cent€/kWh** (for all type of Renewables)

June 2007 — Publication of Geothermal Resources Law and Relevant Regulations

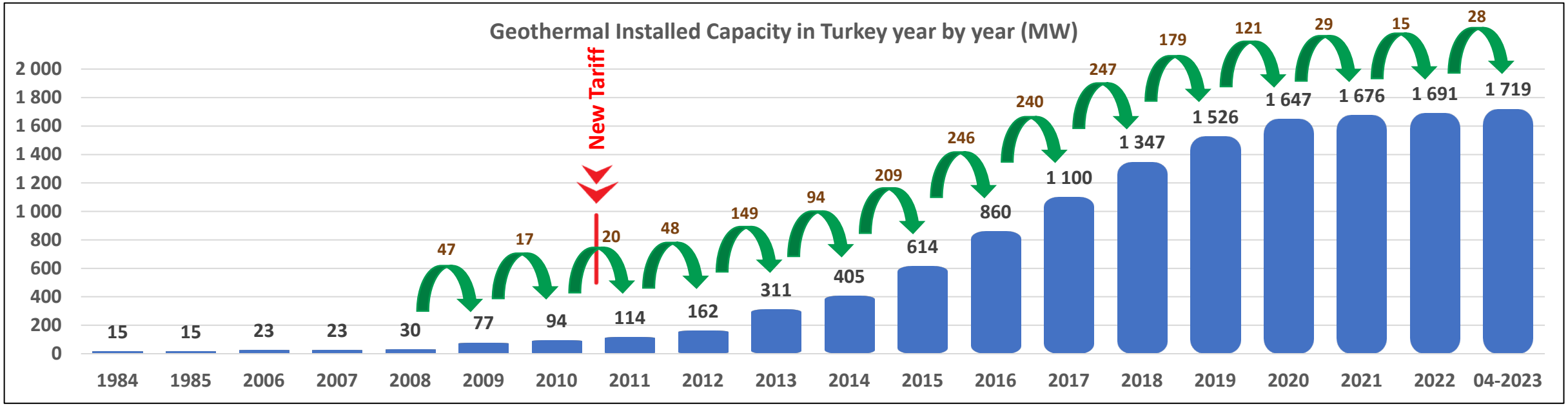
2009 – 2010 — Feed-in-tariff Revision
- Geothermal: **10.5 cent$/kWh**
- Wind : **7.3 cent$/kWh**
- Hydroelectric: **7.3 cent$/kWh**
- Solar: **13.3 cent$/kWh**

2014 — Operational Licenses hold by General Directorate of Mineral Exploration and Research (MTA) released to investors.

June 2015 — Extension of Feed-in-tariff mechanism

June 2021 — End of Feed-in-tariff mechanism

May 2023 — Announcement of new Feed-in-tariff mechanism for plants installed between **2021-2030**



YEKDEM: Renewable Energy Resources Support Mechanism

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Zorlu Energy

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CONSTRUCTION OF POWER PLANTS

Power plant engineering, procurement and construction (EPC)

- 2.323 MW Project Capacity
- 4 Billion USD Project Budget

MAINTENANCE, REPAIR, AND OPERATION SERVICES

Zorlu O&M Energy Facilities Operation and Maintenance Services (Zorlu O&M)

Serving over **2.500 MW** Installed Capacity at almost 30 Power Plants

EV CHARGING STATIONS

<Electrip Global>

- 1.860 Locations
- 3.468 EV Socket Capacity

ELECTRICITY DISTRIBUTION

6.9 TWh through 1.9 M Subscribers
Covering 5 provinces

ELECTRICITY SALES AND TRADING

Zorlu Electricity

8.6 TWh

R&D Innovation

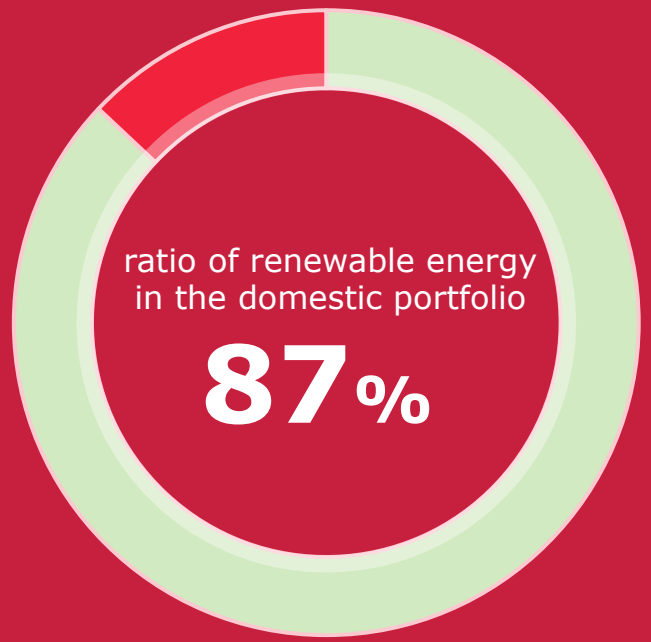
38 R&D and Innovation Project

8 Horizon 2020
1 Eurogia 2020
1 Horizon Europe
2 Era-NET
26 EMRA

NATURAL GAS DISTRIBUTION TRADING

2.2 bcm
through 825k subscribers
covering 5 provinces

TOTAL INSTALLED CAPACITY OF ZORLU ENERGY



996 MW

648 MW in Turkey, 56 MW in Pakistan, 290 MW in Israel (25% share in Dorad Natural Gas Cogeneration Power Plant of 840 MW; 42% share in Ashdod Natural Gas Cogeneration Power Plant of 64.5 MW; 42% share in Ramat Negev Natural Gas Cogeneration Power Plant of 126.4 MW), 1.5 MW in Palestine

5	**NATURAL GAS POWER PLANT** 2 IN TURKEY – 3 IN ISRAEL	**373 MW**
7	**HYDRO POWER PLANTS** 7 IN TURKEY	**118 MW**
4	**GEOTHERMAL POWER PLANTS** 4 IN TURKEY	**305 MW**
2	**WIND POWER PLANTS** 1 IN TURKEY – 1 IN PAKISTAN	**191 MW**
3	**SOLAR POWER PLANT** 1 IN PALESTINE, 2 IN TURKEY AS HYBRID PROJECT	**6,2 MW**

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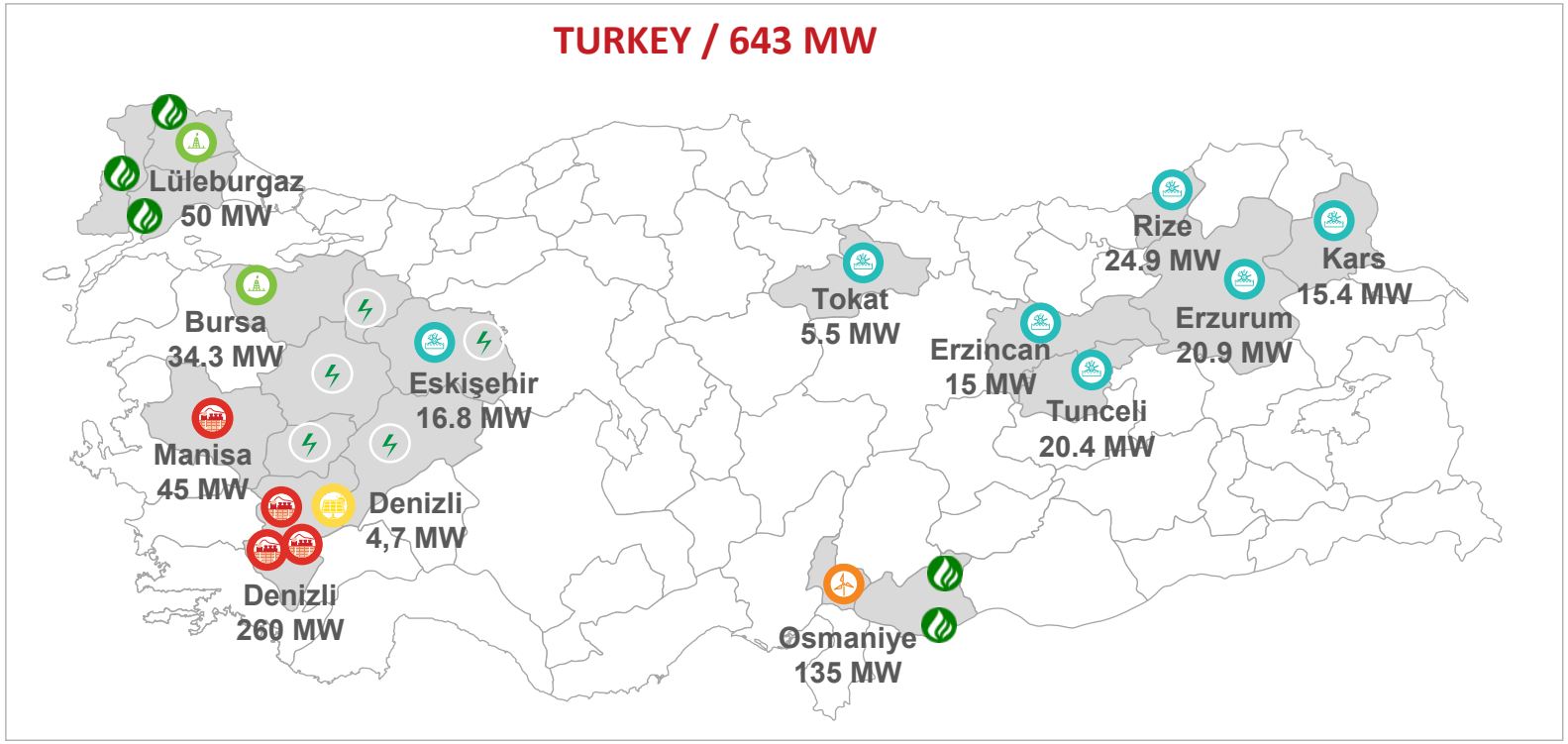
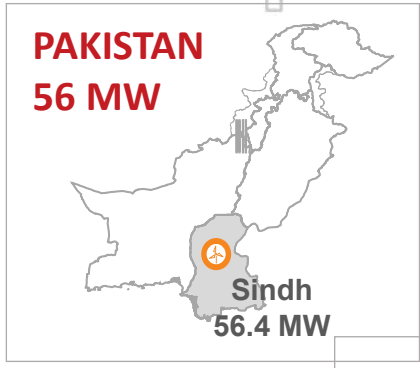
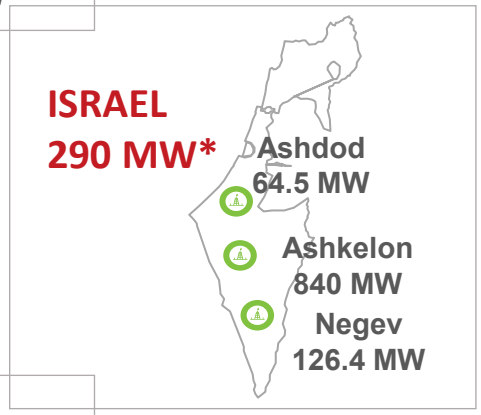
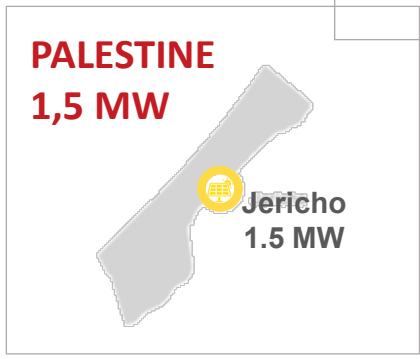
Zorlu Energy Investments









Natural Gas PP (84.3 MW)

Hydro PP (119 MW)

Geothermal PP (305 MW)

Wind PP (135 MW)

Electricity Distribution

Gas Distribution

Solar PP (6,2 MW)

* Stake adjusted

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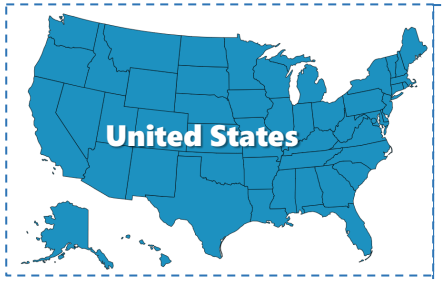
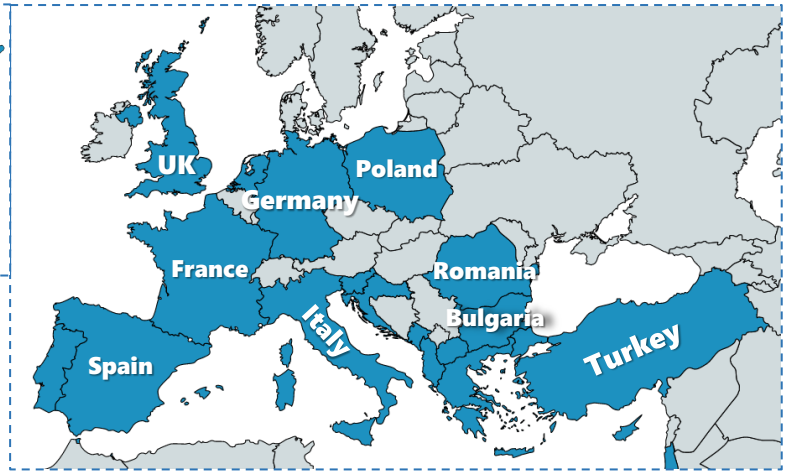
ELECTRIP GLOBAL

THE NEW, CLEAN & FAST ENERGY OF THE ROADS

3.468 ACTIVE CHARGING POINTS

With our new brand ZES, now electrip, which became active in 2018, we are targeting to ease the journeys of the electrical car owners and speed up the electrical car revolution in our country with the help of the quick charge stations implemented by ZES within the city and on intercity highways. We are working to make the electrical cars accessible and usable across the country thanks to these charging stations.





2018

ZES Zorlu Energy Solutions

launched in August 2018

(Now in Europe & USA as **electrip**)

2020

Fastest DC Charger (180 kW) Installed

ZES in Israel
1.000 stations sold

All 81 cities of Turkey covered.

ZES BV launched in Jul. 2020

2021

Incorporations **in Italy, Bulgaria, Greece, Croatia, Montenegro, Poland, Slovenia, Israel**

1000th socket installed in Turkey

2022

Expand activities to **15 countries in Europe & Israel**

New in-house **platform on live globally.**
SHA Agreement with **WH**

2025

80.000 public socket **target**

+ 50% in **Turkey**
+ 10% in **Italy**
+ 40% in **Eastern Europe**
+ 7% in **Rest of Europe**
3% in **USA**

2030

Sustain market share on public networks

w/ **350.000+ sockets**

Private charger sales to **%5+ of sold EVs**

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Zorlu Energy – Geothermal Investments

1984

First Step in Turkey

First GPP in Turkey commissioned in 1984.

2008

15 MWe Kızıldere I GPP

Turkey's first GPP power plant, and the geothermal field license of 70 km^2 were transferred to Zorlu Energy with the privatization tender held in 2008.

2013

80 MWe Kızıldere II GPP

Triple Flash + Binary Combined Cycle

2015

45 MWe Alaşehir I GPP

Double Flash + Binary Combined Cycle

2017-18

165 MWe Kızıldere III GPP

First Unit (99,5 MWe) commissioned in August 2017

Second Unit (65,5 MWe) commissioned in March 2018

Triple Flash + Binary Combined Cycle

Present

Projects on Development

Alaşehir III - 15 MWe

Kızıldere IV - 60 MWe

Kızıldere V - 50 MWe

Nemrut - 300 MWe

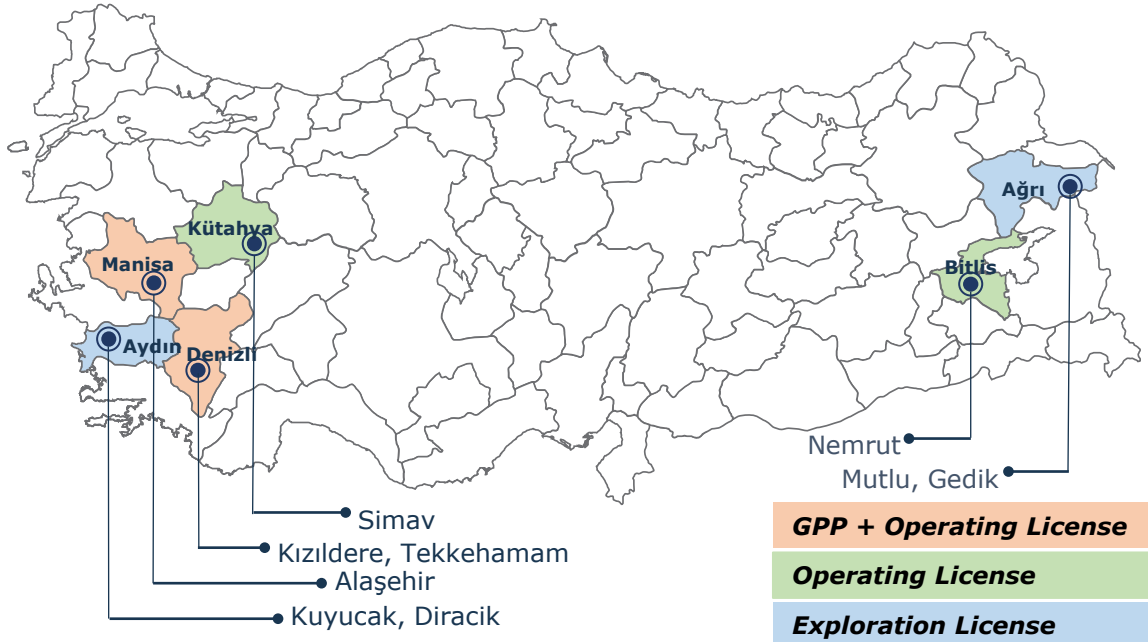
Simav - 50 MWe

Drilling Works Completed

Alaşehir II - 18,6 MWe

Drilling Works Ongoing

Tekkehamam - 35 MWe



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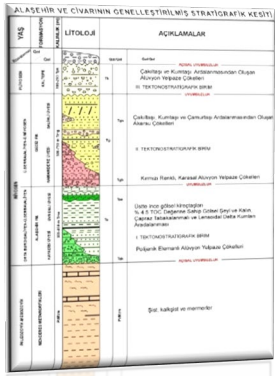
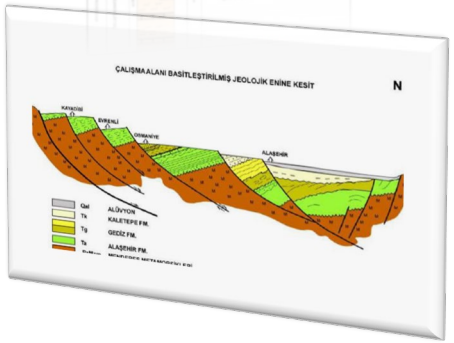
Preliminary Exploration Stage

Surface Geology

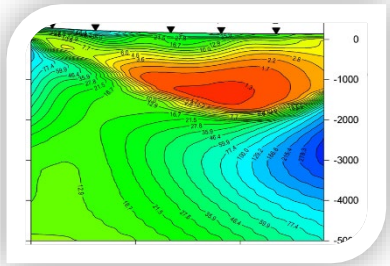


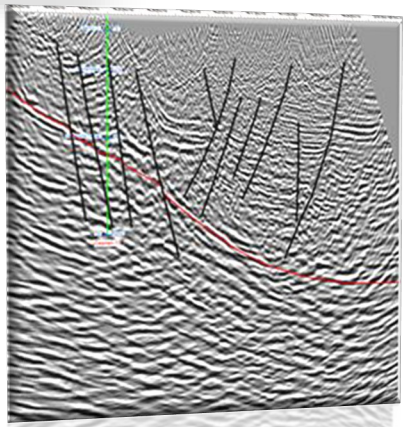


Sample Gathering and Geochemical Studies

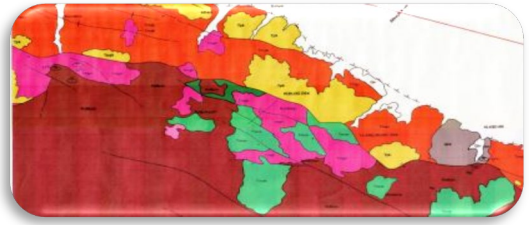
Geophysical Studies

- MT
- Resistivity
- Gravity
- Seismic Studies





Hydrogeology



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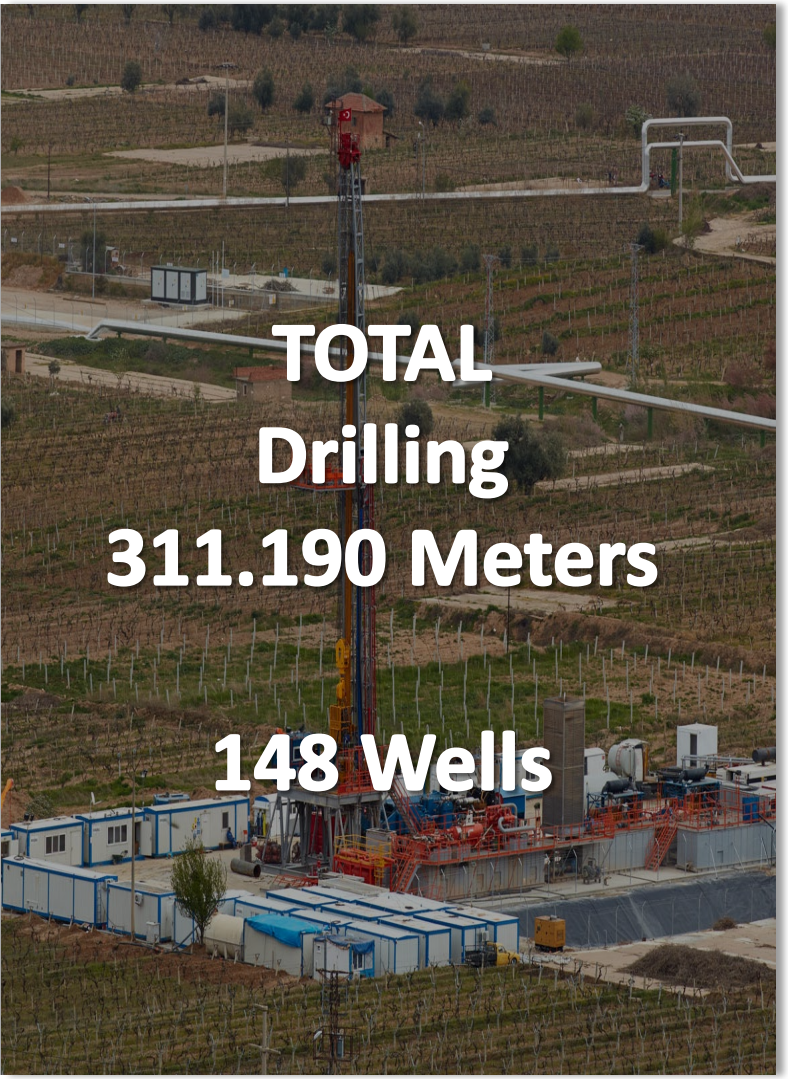
Reservoir Drilling



ALAŞEHİR FIELD

23 wells
34.452 meters — **Phase I**

13 wells
31.661 meters — **Phase II**

TEKKEHAMAM FIELD

2 wells
8.242 meters — **Phase I**

KIZILDERE FIELD

Phase II — **33** wells
72.581 meters

Phase III (U1 + U2) — **59** wells
157.152 meters

Phase IV — **2** wells
7.366 meters

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Zorlu Energy – Geothermal Power Plants

KIZILDERE 1 GEOTHERMAL POWER PLANT	
Installed Capacity	15 MWe
Wells	9 production + Re-injection (integrated to KZD-2)
Cycle Type	Single Flash
Net Annual Production	120 GWh
COD	1984

KIZILDERE 2 GEOTHERMAL POWER PLANT	
Installed Capacity	80 MWe
Wells	18 production + 13 re-injection
Cycle Type	Triple Flash + Binary Combined
Net Annual Production	450 GWh
COD	2013

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Zorlu Energy – Geothermal Power Plants

KIZILDERE 3 GEOTHERMAL POWER PLANT	
Installed Capacity	165 MWe (U1 + U2)
Wells	35 production + 17 re-injection
Cycle Type	Triple Flash + Binary Combined
Net Annual Production	1.000 GWh
COD	2017 (U1) , 2018 (U2)

ALAŞEHİR GEOTHERMAL POWER PLANT	
Installed Capacity	45 MWe
Wells	12 production + 9 re-injection
Cycle Type	Double Flash + Binary Combined
Net Annual Production	250 GWh
COD	2015

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All in One Facility

Thermal Tourism

Thermal water is provided to
2 different hotels in the region.

Electricity Production

1.400 GWh Energy Production
470K Households Electricity Consumption

Household Heating

5.000 Household Heating = Approximately 5 Million m^3 of natural gas

Greenhouse Heating

It is planned to produce 15 thousand tons of vegetables annually by heating a 500 decare vegetable greenhouse.

Dry Ice Production

The release of 110 thousand tons of CO_2 gas into the atmosphere is prevented by production of dry ice.

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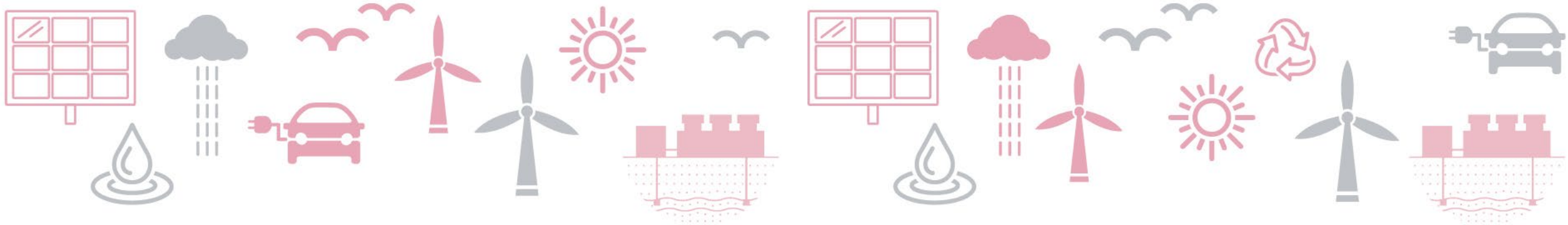

Thank You.

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