Energy Transition in Turkey

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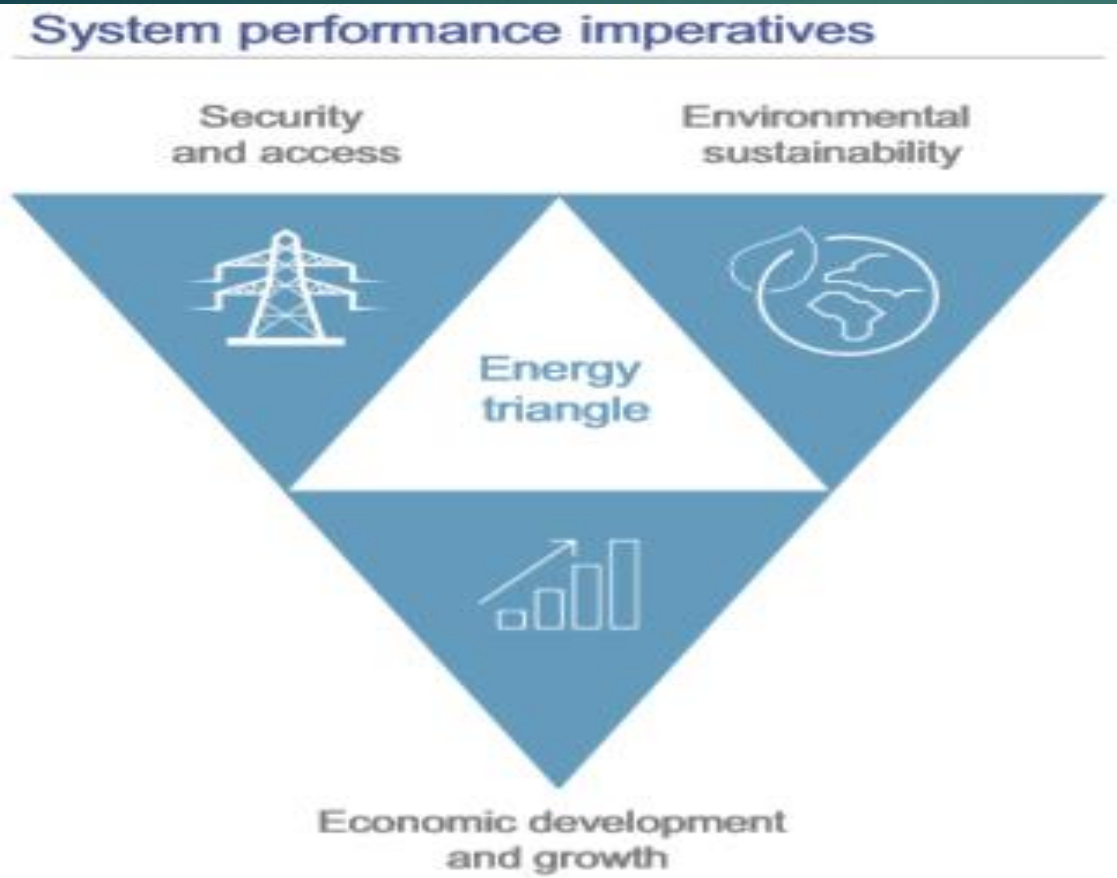
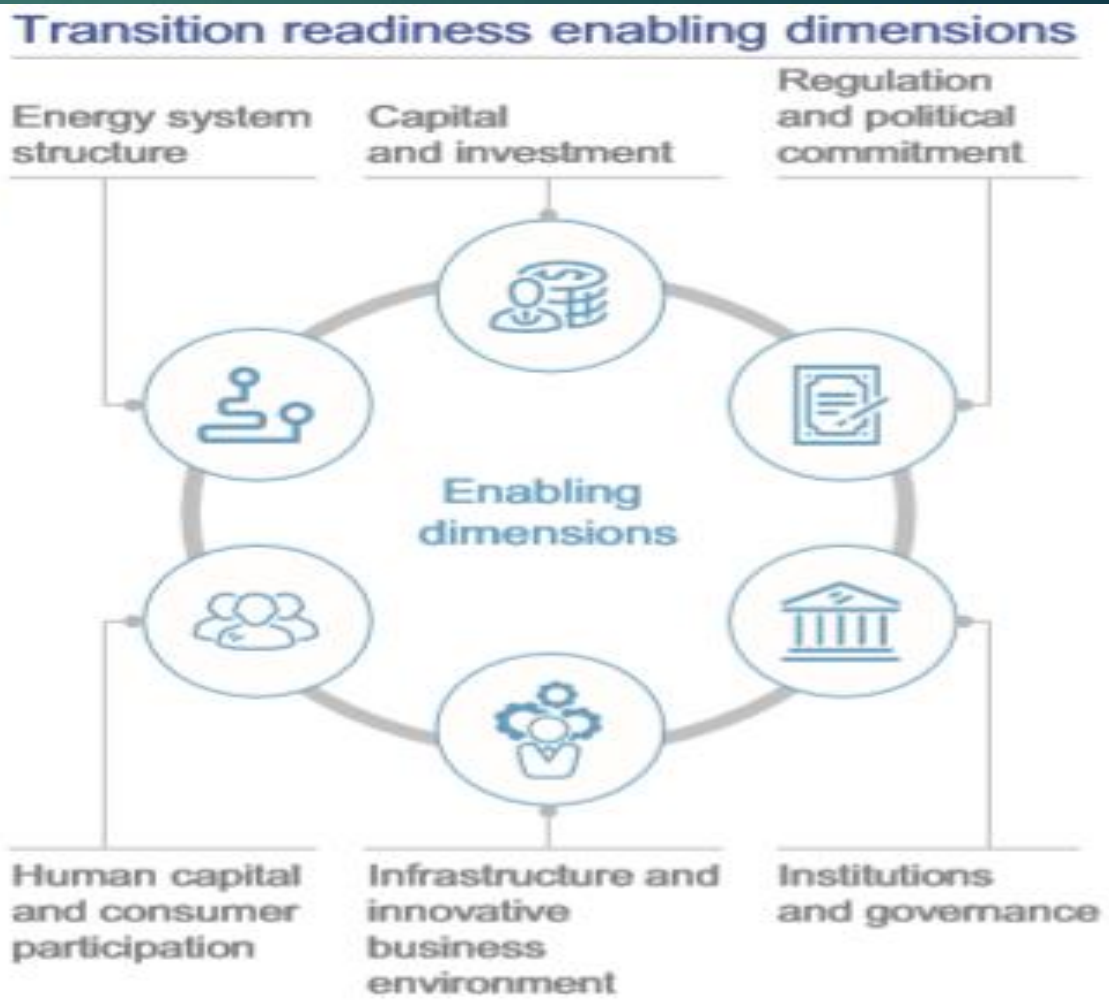
What is Energy Transition?

- "The energy transition is a pathway toward transformation of the global energy sector from fossil-based to zero-carbon by the second half of this century. At its heart is the need to reduce energy-related CO_2emissions to limit climate change. ……. Renewable energy and energy efficiency measures can potentially achieve 90% of the required carbon reductions." Source: IRENA

What is Energy Transition Index?

"The energy transition index benchmarks countries on the performance of their energy system, as well as their readiness for transition to a secure, sustainable and affordable, and reliable energy future." Fostering effective Energy Transition Report 2019, World Economic Forum





Source: WEF

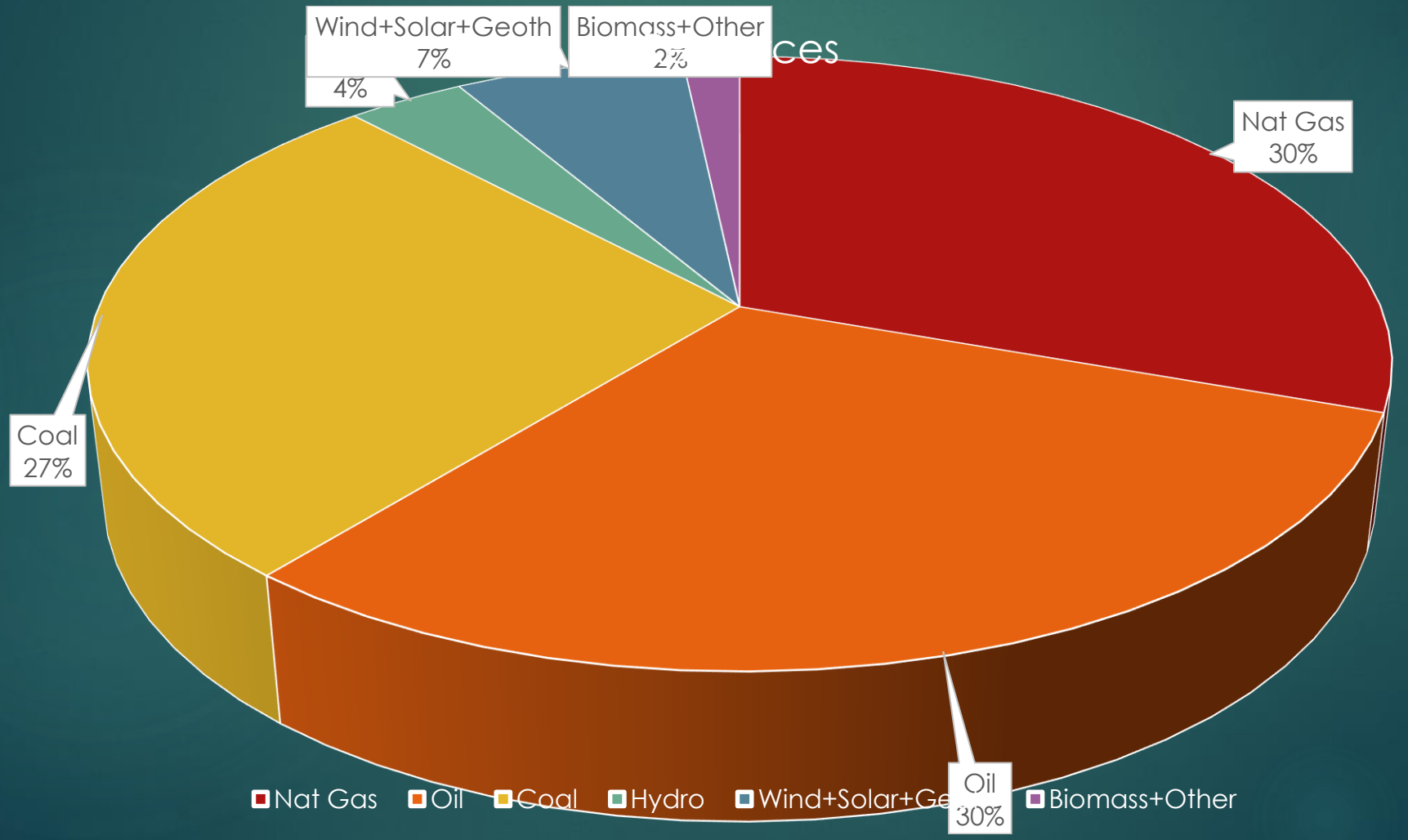
Energy Transition Index 2019

Source: World Economic Forum

2019 (2018) rating	Country	ETI score	System Performance	Transition readiness
1 (1)	Sweden	71%	85%	69%
2 (2)	Switzerland	74%	78%	71%
3 (3)	Norway	73%	82%	66%
4 (4)	Finland	73%	72%	74%
5 (5)	Denmark	72%	72%	73%
6 (8)	Austria	71%	71%	71%
7 (7)	UK	70%	74%	66%
8 (9)	France	69%	77%	60%
9 (6)	Netherlands	69%	71%	66%
10 (10)	Iceland	69%	75%	62%
64(58)	Turkey	55%	60%	49%

Primary Energy Mix of Turkey 2017

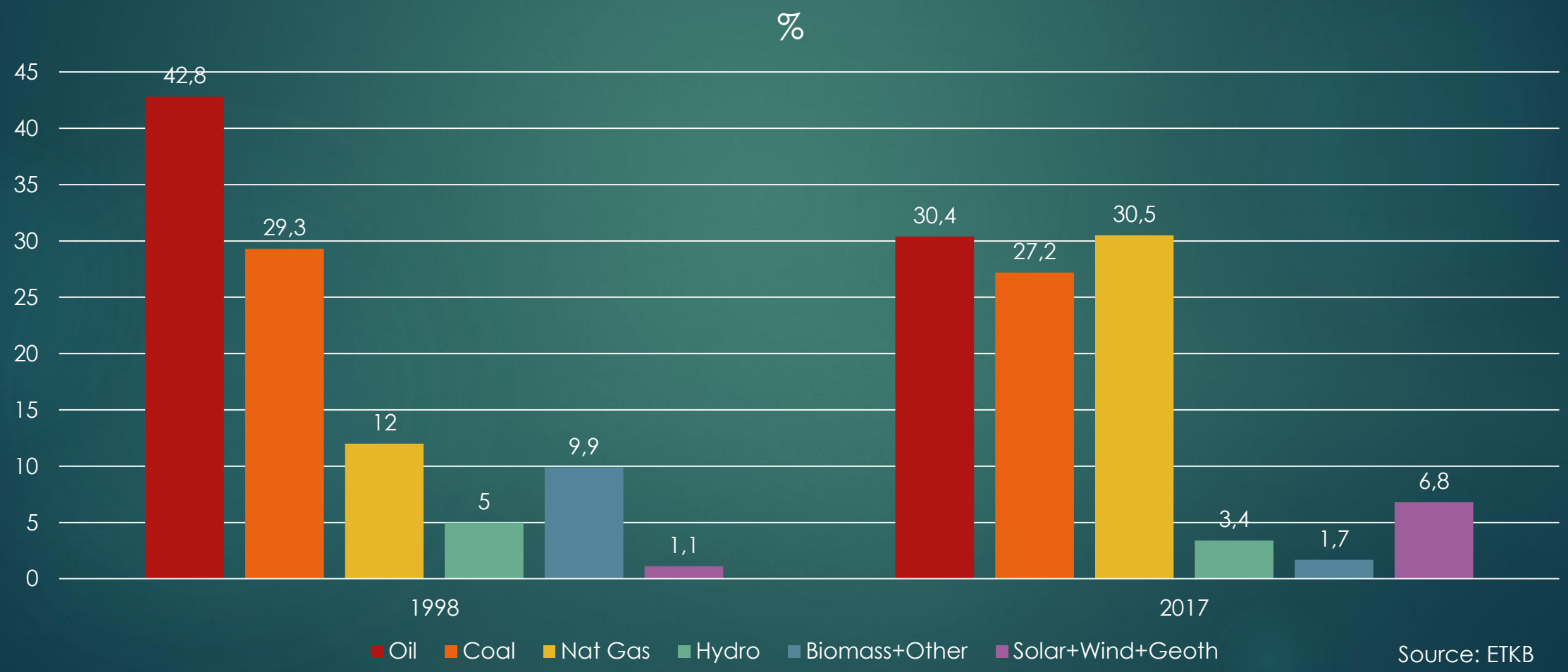
145.3 Mill toe



Source: ETKB

Primary Energy Mix of Turkey

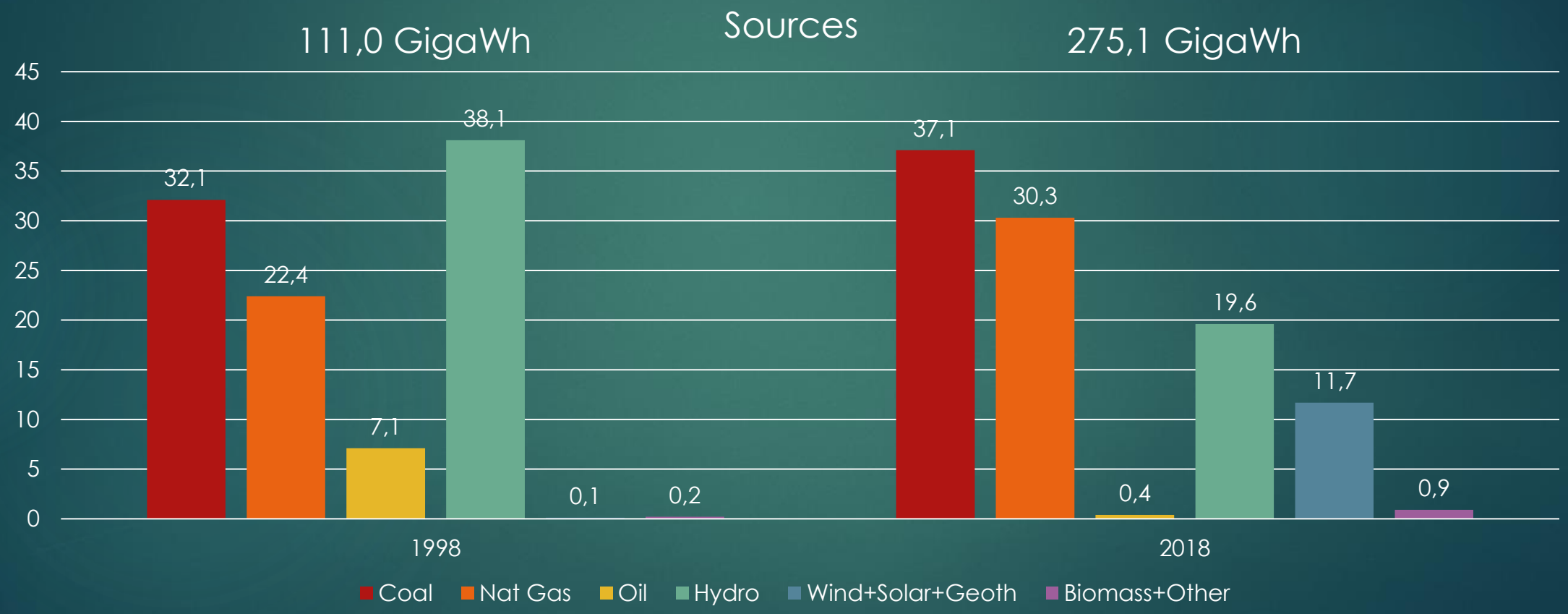
1998:73.3 Mill TOE - 2017: 145.3 Mill TOE



Source: ETKB

ENERGY TRANSITION-ELECTRICITY GENERATION

Source: TEİAŞ



Turkish Energy Strategy 2023 Targets

(released in 2010)

- Utilization of indigenous and renewable energy resources (over 30% share of renewables in electricity generation, full utilization of hydro potential, 20.000 MW wind, 600 Mwe geothermal, no concrete figure for solar)
- Diversification of energy supplying countries
- Reduction of energy intensity by 20%
- Introduction of nuclear energy into the energy mix (5% share in electricity generation)
- Only targets, no action plan

Strategic Plan 2015-2019

- Action plan prepared with stakeholders
- Special focus: Storage capacities
- 2019 targets for renewables

Hydro:	32.000 MW
Wind:	10.000 MW
Solar:	3.000 MW
Geothermal:	1.300 MW
Biomass:	700 MW

THE NATIONAL ENERGY EFFICIENCY ACTION PLAN 2017-2023

Total Investment Required 2017-2023 (m$): 10.928

Cumulative Energy Savings 2017-2023 (ktoe/m$): 23.901/8.365

Cumulative Energy Savings 2017-2033 (ktoe/m$): 86.369/30.228

Energy Efficiency in

- Buildings
- Industry
- Transport

RENEWABLES: Hydro

Source:ETKB, EPDK

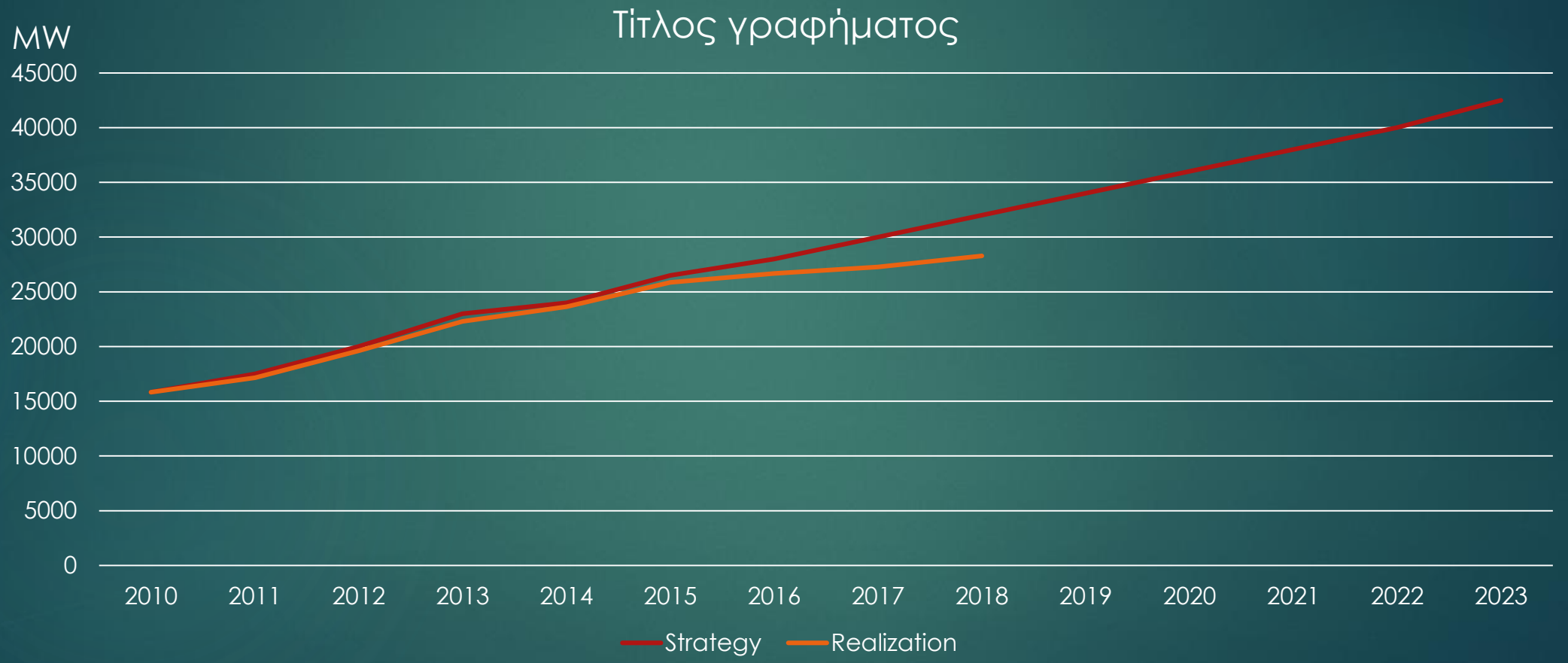
2023 Target: Full utilization of 140 TWh/a potential ~40.000 MW(2010 36% in operation)
Strategic Plan 2019 target: 32.000 MW

2000: 11.175 MW
2005: 12.906 MW

2010: 15.831 MW
2011: 17.137 MW
2012: 19.609 MW
2013: 22.289 MW
2014: 23.643 MW
2015: 25.868 MW
2016: 26.681 MW
2017: 27.273 MW
2018: 28.291 MW

Renewables: Hydro

Installed capacity and 2023 target



Investments slowed down: Strong NGO opposition, Market conditions

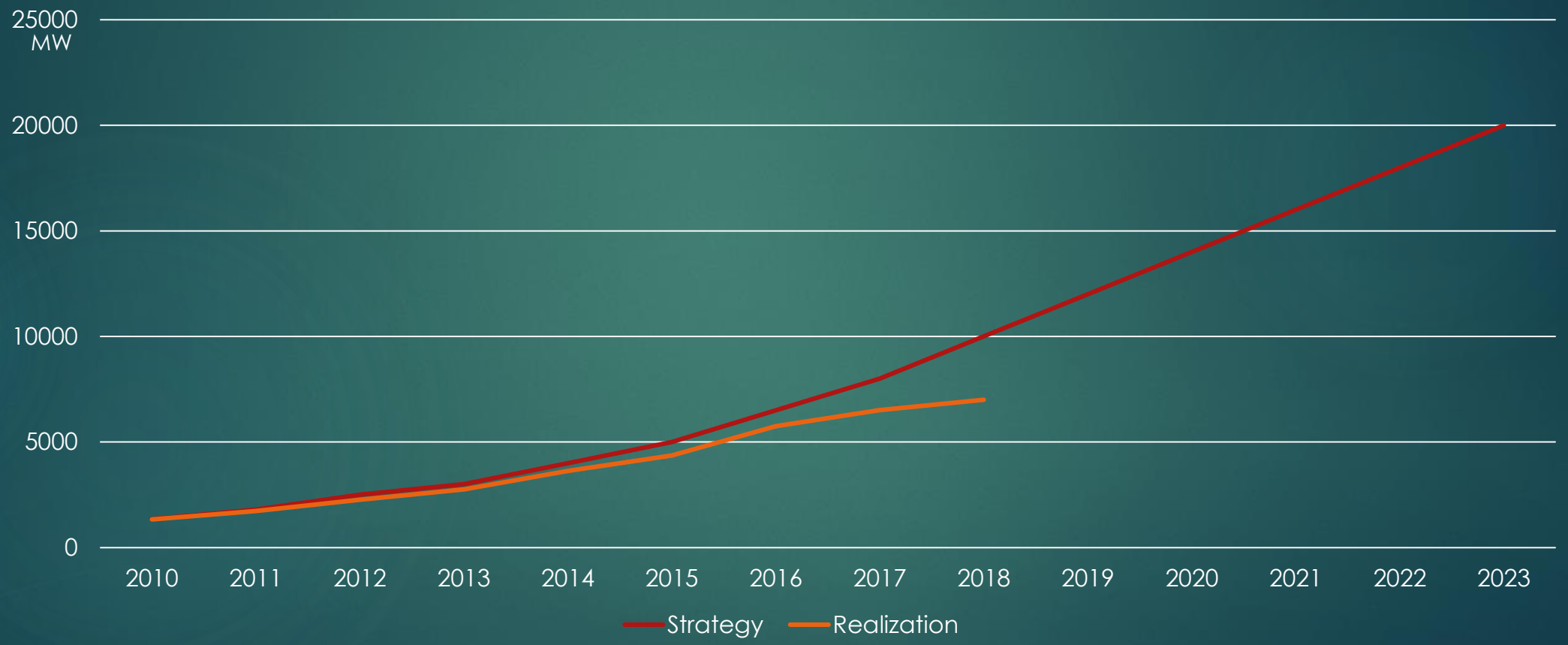
Renewables: Wind

2023 target: 20.000 MW, Strategic Plan 2019 target: 10.000 MW

2007:	27 MW
2008:	433 MW
2009:	800 MW
2010:	1.329 MW
2011:	1.729 MW
2012:	2.261 MW
2013:	2.760 MW
2014:	3.630 MW
2015:	4.365 MW
2016:	5.751 MW
2017:	6.516 MW
2018:	7.005 MW

- August 2017 1000 MW tender: 3,48 $cent/kWh
- May 2019 4 x 250 MW tender: 3,53 / 3,69 / 4,00 / 4,56 $cent/kWh

Renewables: Wind



Investments slowed down: Moderate NGO opposition, Market conditions

Renewables: Geothermal

2023 Target: 600 Mwe, Strategic Plan 2019 Target: 1.300 Mwe

Source:EPDK

2002: 15 MWe

2012: 162,2 Mwe
2013: 310,8 MWe
2014: 404.9 Mwe
2015: 623,9 MWe
2016: 820,9 MWe
2017: 1063,7 Mwe
2018: 1282,5 Mwe

Renewables: Solar

2023 Target: n/a, Strategic Plan 2019 Target: 3000 MW

2014: 40,2 MW
2015: 248,8 MW
2016: 832,5 MW
2017: 3.420,7 MW
2018: 4.662,9 MW

- Auction March 2017 1000 MW: 69,9 $/MWh
- New tenders for 3 regions under preparation

Renewables: Biomass

2023 Target: n/a, Strategic Plan 2019 Target: 700 MW

2007: 43 MW

2008: 60 MW

2009: 87 MW

2010: 108 MW

2011: 127 MW

2012: 160 MW

2013: 237 MW

2016: 363 MW

2017: 450 MW

March 2019:

659 MW

Source: EPDK, Oltan Köleoğlu Enerji

Is Nuclear Part of the Energy Transition?

Source: Rosatom, MENR

Akkuyu Nuclear Power Plant

Technical

Reactor design: NPP 2006 (WER-1200), 4 x 1200 MW
Construction period: 2018- ?

Legal steps

12 May 2010: IGA has been signed
IGA has been ratified in both parliaments
13 Dec 2010: Project company has been formed
12 Dec 2013: Updated site report approved
01 Jan 2014 Environmental impact assesment approved
25 Jun 2015 Preliminary Generation license issued
29 Jun 2015 Contract for off-shore structures signed
09 Feb 2017 Design parameters approved
03 Apr 2018 Erdoğan and Putin launched the construction

Commercial terms

Operating period: 60 years
CAPEX: 20 bill USD
Payback period: 18 years
Contract period: 15 years for 50% of the generated electricity
Fixed price: 12.35 US cents/kWh

DESIGNING A LOW CARBON ENERGY SYSTEM

Alternative sources need to be in place as short-term and long-term back-up to Wind and Solar to ensure electricity supply security.

CO_2 neutral back-up:

- Hydro
- Interconnectors
- Electricity Storage
- Demand-side management

"Low" CO_2 back-up:

- NG fired power plants

NATURAL GAS INFRASTRUCTURE

Domestic Pipeline Network and Entry Points

2018: 15 547 km (Distribution Network: 137 535 KM)

Source: Botaş, GAZBIR

NG Underground Storage

Location	*Capacity (bcm)*	*Injection rate (mcm/d)*	*Withdrawal rate (mcm/d)*
Operational			
Botaş Silivri	2.8	16	25
Botaş Tuz Gölü	1.2	30	40
Projects			
Botaş Silivri Phase III (under implementation)	4.6	40	75
Botaş Tuz Gölü Expansion (under implementation)	5.4	60	80
Toren Tarsus Phase I	0.5		24
Çalık Tuz Gölü	1.0	10	20

NG Infrastructure - LNG Terminals

1. Botaş Marmara Ereğlisi Terminal near Istanbul: 6bcm/a regasification capacity,
18 mcm/d sendout capacity(increase to 27 mcm/d in 2019)

2. Egegaz Aliağa Terminal near Izmir: 6 bcm/a regasification capacity
16.5 mcm/d send out capacity

Floating Storage and Regasification Units

Etki -Aliağa (operational since Dec 2016)
5,3 bcm/a regasification capacity, 20 mcm/d sendout capacity

Botaş -Dörtyol (operational since Feb 2018)
5.3 bcm/a regasification; 20 mcm/d sendout capacity

Botaş -Saroz (investment)

Maks- Izmit Altınova (planning)

ENERGY TRANSITION IN TRANSPORT

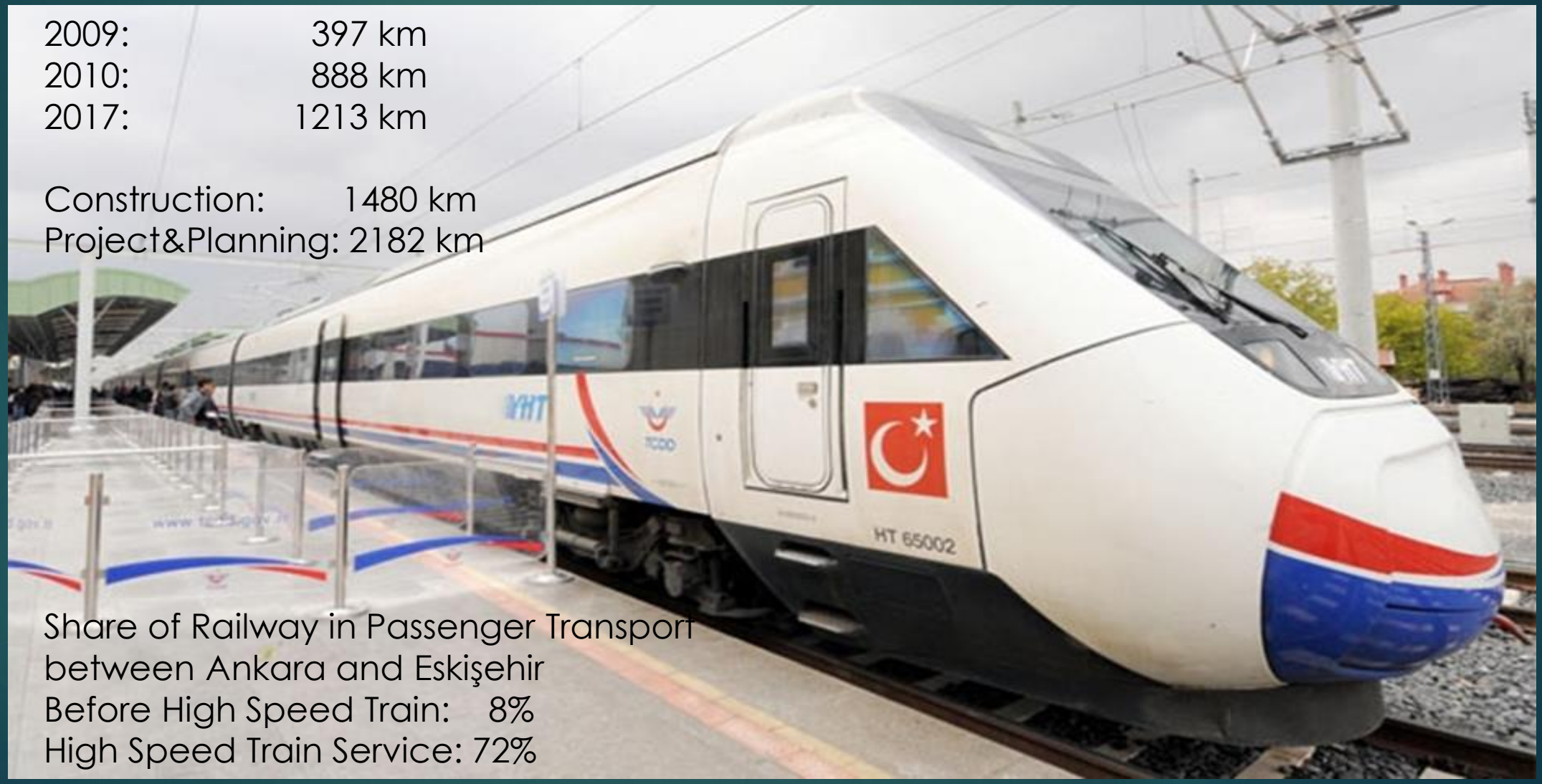
RAILWAY TRANSPORT		
Year	Freight (Mill. T)	Passenger (Mill.)
2003	15.9	76.9
2014	28.7	153.6
2017	28.5	176.1

Source: UDHB

MODAL SPLIT 2014 (%)				
	Freight		Passenger	
	Railway	Road	Railway	Road
Turkey	4.5	89.6	1.6	98.4
Germany	24.9	58.2	8.3	91.7

Source: EU Transport in Figures Statistical Pocketbook 2016
Air and Maritime transportation are excluded.

ENERGY TRANSITION IN TRANSPORT – HIGH SPEED RAİLWAYS



2009: 397 km
2010: 888 km
2017: 1213 km

Construction: 1480 km
Project&Planning: 2182 km

Share of Railway in Passenger Transport between Ankara and Eskişehir
Before High Speed Train: 8%
High Speed Train Service: 72%

ENERGY TRANSITION IN TRANSPORT – RAILBOUND TRANSPORT IN METROPOLITAN AREAS

ISTANBUL: 233 km
IZMIR: 203 km
ANKARA: 118 km
BURSA: 55 km
KONYA: 45 km
ESKIŞEHIR: 37 km
KAYSERI: 35 km
GAZIANTEP: 27 km
ERZINCAN: 23 km
ANTALYA: 19 km
ERZURUM: 19 km
SAMSUN: 16 km
ADANA: 14 km

ENERGY TRANSITION IN TRANSPORT – BUSES IN METROPOLITAN AREAS

CNG Buses: since 2007
ANKARA: 1289 CNG Buses in use:
ISTANBUL, KOCAELI, BURSA, KONYA, KAYSERI……

ELECTRIC BUSES: IZMIR, MANISA, ELAZIĞ, ISTANBUL, AYDIN, KONYA, ESKİŞEHİR….

ISTANBUL plans a fleet of 30% CNG and 25% electric in 2020
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ENERGY TRANSITION IN TRANSPORT- ELECTRIC CAR SALES (Source: TEHAD)

Years	Electric	Hybrid	Total
2015	119	106	225
2016	44	950	994
2017	77	4451	4528
2018	155	3876	4031

Source: wrightcoating.com

ENERGY TRANSITION IN TRANSPORT – ELECTRIC VEHICLE CHARGING STATIONS (excluding private charging Stations)

ENERGY TRANSITION WITHOUT FUNCTIONING MARKET?

EXIST Energy Exchange Istanbul
Established in March 2015
Electricity market operations:
- Day ahead market,
- Intra-day market,
- Balancing market,
- Market registration process,
- Market Settlement

Natural gas market:
- Regulation on Wholesale natural gas market published March 2017
- 1 April 2018: Online testing of the spot natural gas trade system on the energy stock exchange started
- 1 Sept 2018: Organized Natural Gas Market has started

IS TURKEY READY FOR ENERGY TRANSITION?

Renewables: Good investment performance in the last 6-7 years, the potential not utilized

Energy Efficiency: More Investments needed

Electricity Market: Abolish tariffs, more market transparency needed

Natural Infrastructure: More underground storage capacity needed

Natural Gas Market: Still a long way to "Gas to gas competition"

Transport Sector needs a special focus

In conclusion: A lot is done but still a long way to go.

Thank you

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