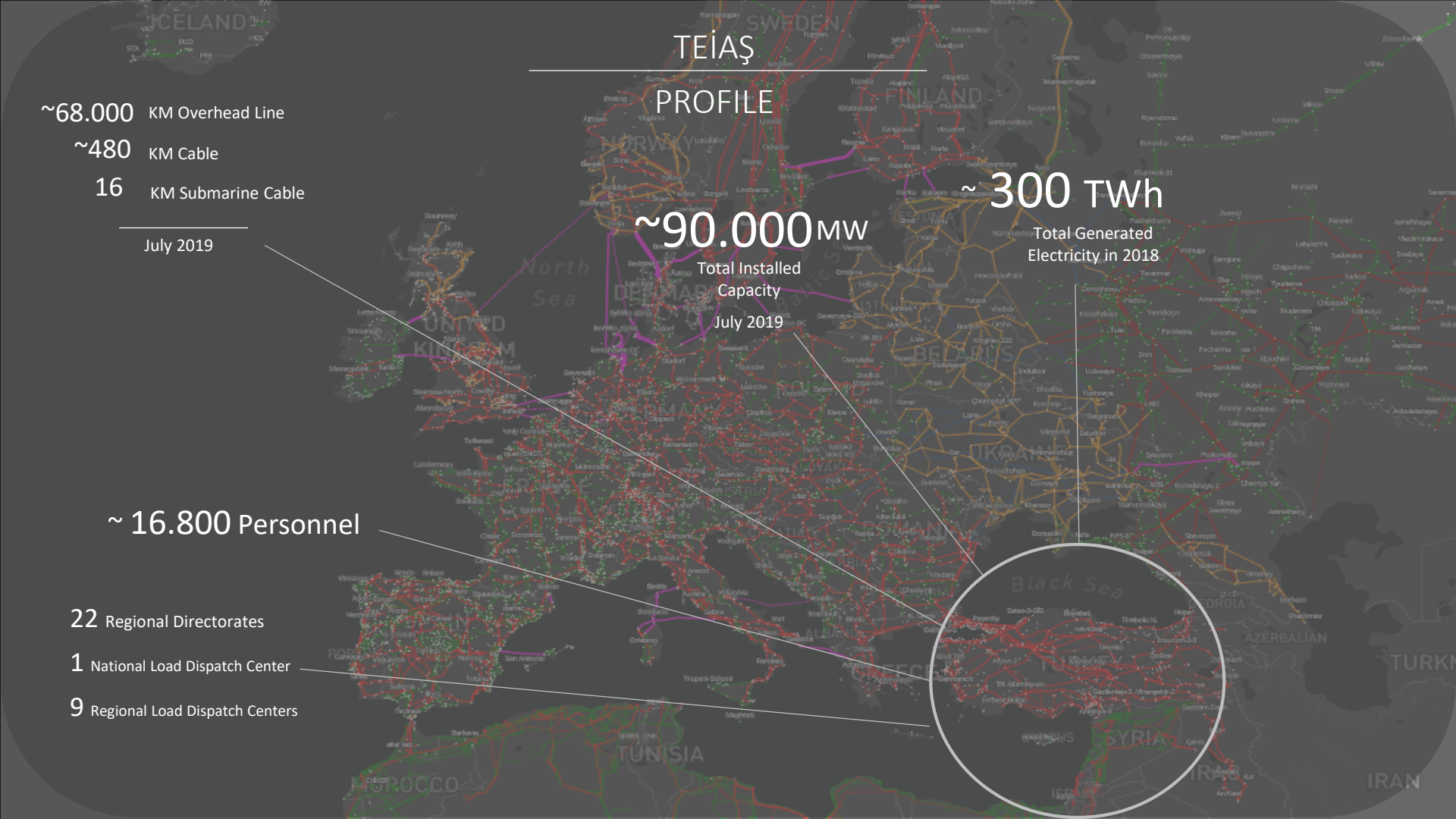
TEİAŞ

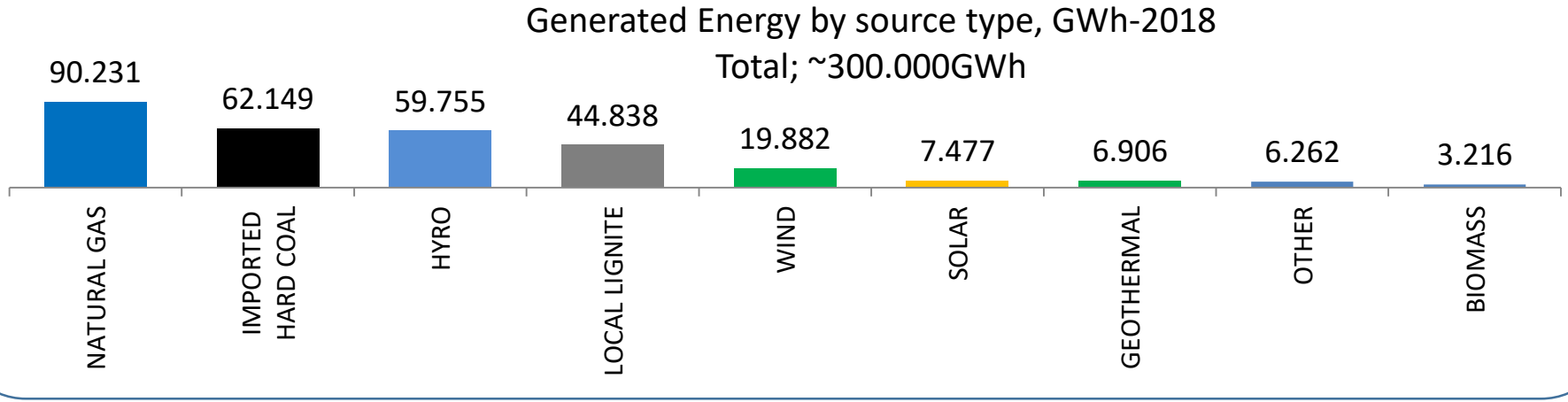
Türkiye Elektrik İletim A.Ş/Turkish Electricity Transmission Corporation
Transmission System Operator and Owner
State Owned Enterprise

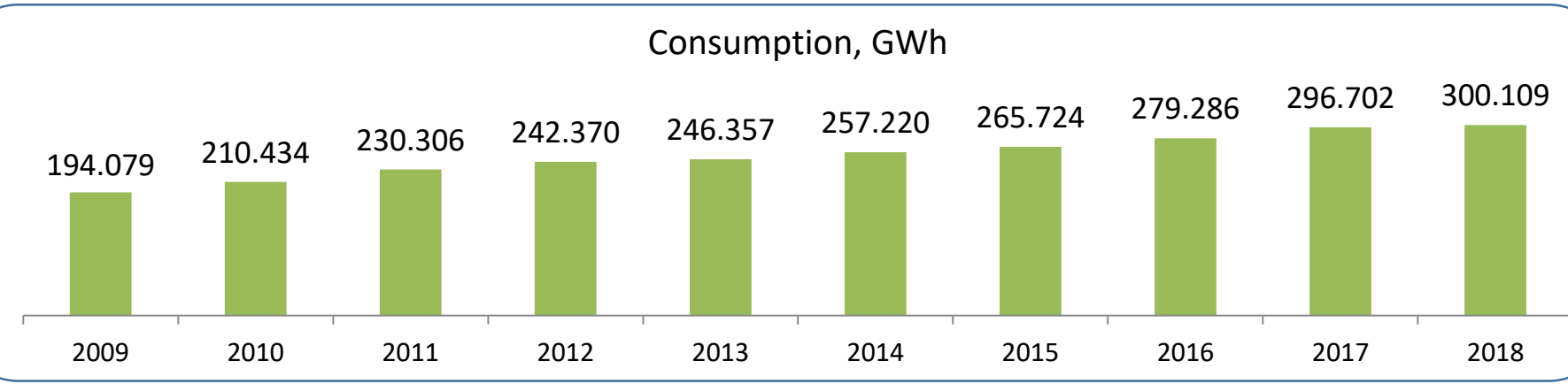
Mevlüt AKDENİZ
Planning department/mevlut.akdeniz@teias.gov.tr

Energy-Climate National Strategies 2030 and Challenges for the Electric Power Sector
Bosnia and Herzegovina October 2019


TEİAŞ
PROFILE
~68.000 KM Overhead Line
~480 KM Cable
16 KM Submarine Cable
July 2019
~90.000MW
Total Installed Capacity
July 2019
~ 300 TWh
Total Generated Electricity in 2018
~ 16.800 Personnel
22 Regional Directorates
1 National Load Dispatch Center
9 Regional Load Dispatch Centers

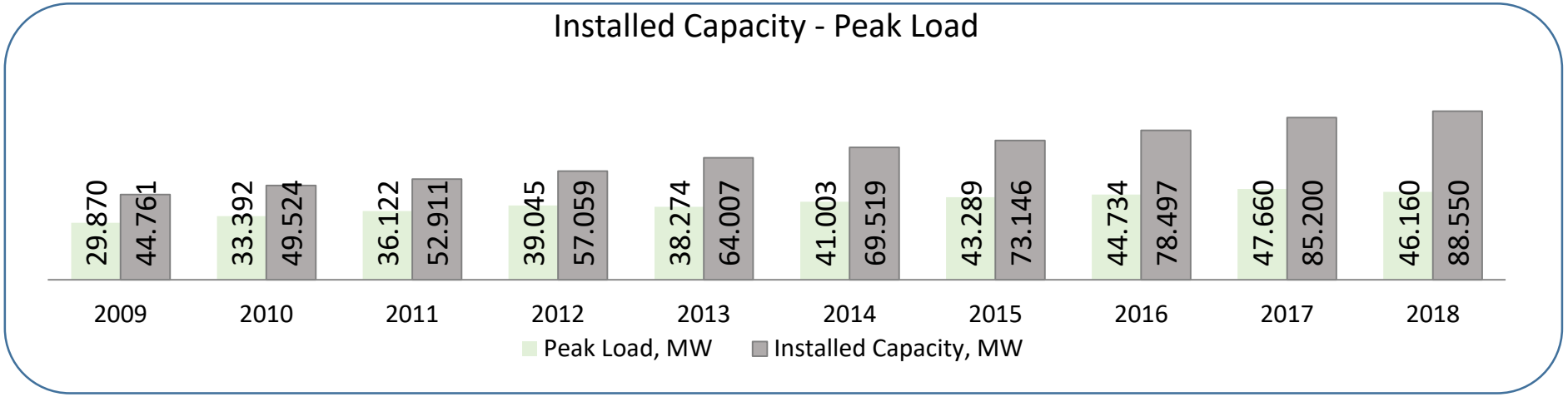
Generation by Source - Consumption



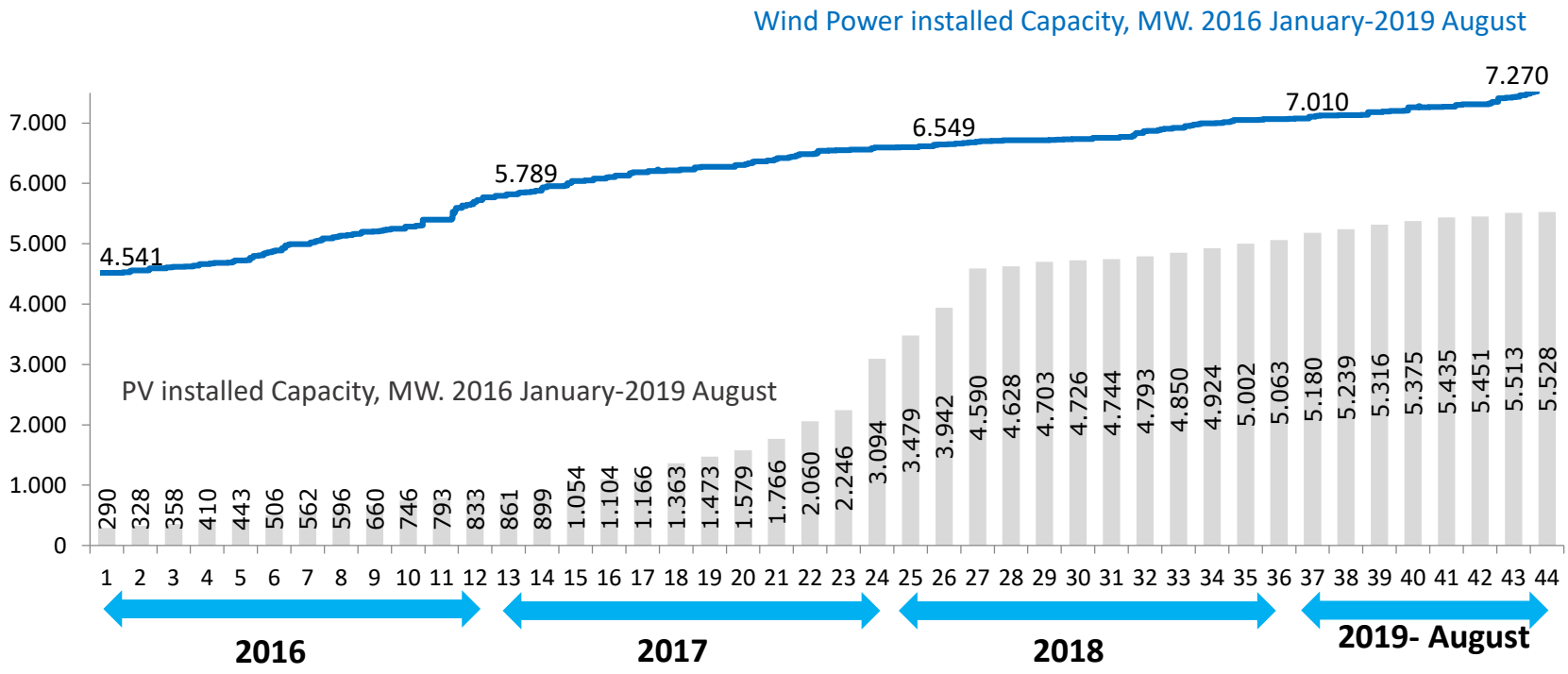


*Import-Export Balance is negligible,Consumption is practically equal to generation

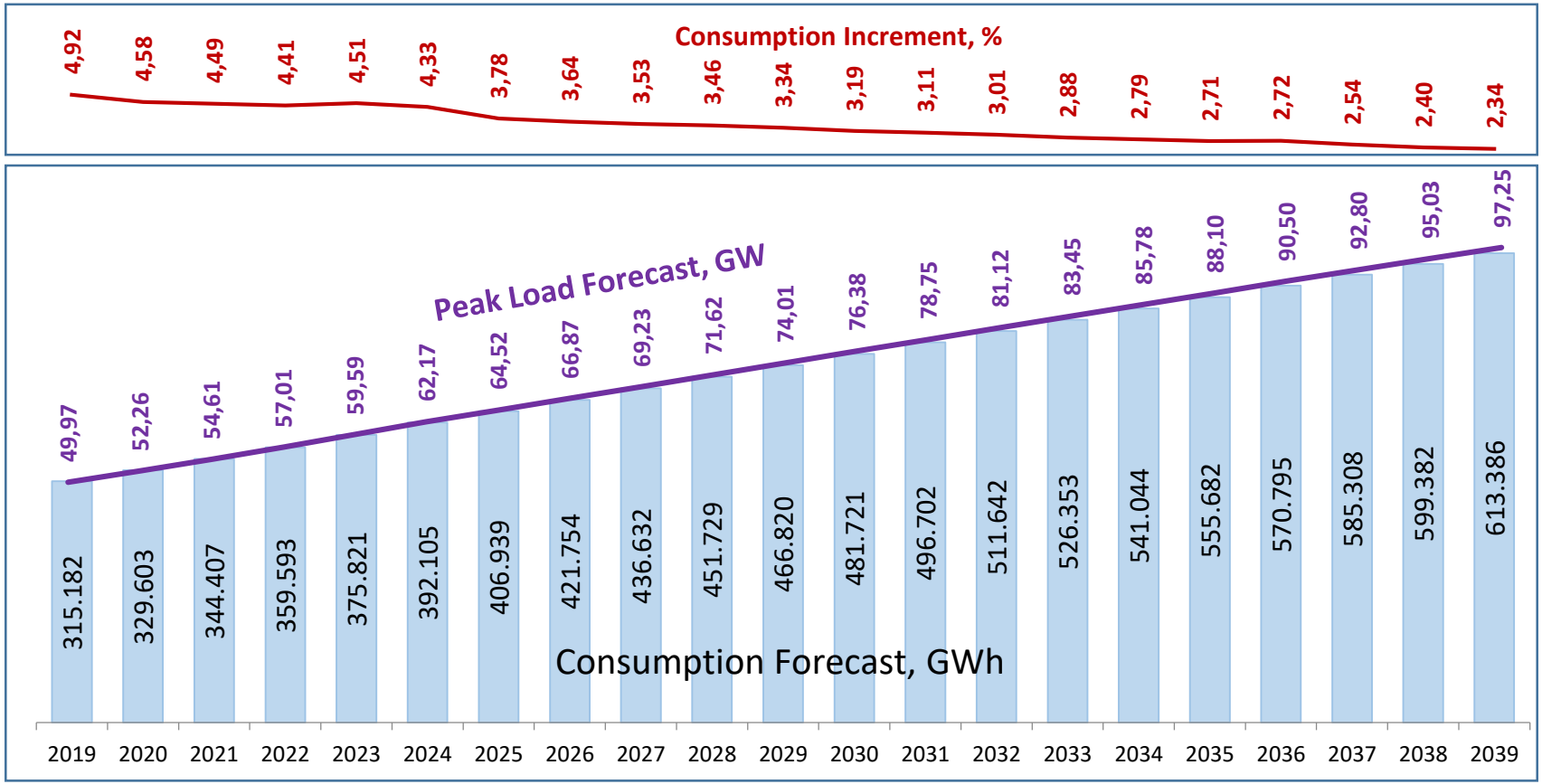
Installed Capacity - Peak Load



Installed Capacity: WPP-PV

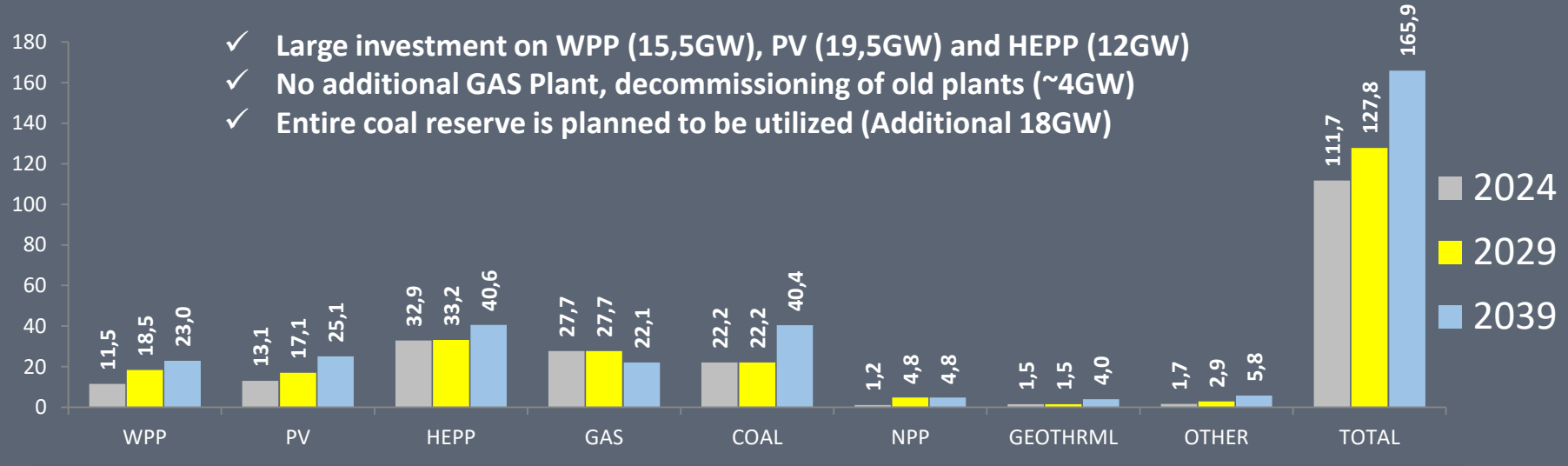


Forecast 2019-2039: Consumption-Peak Load Base Scenario



Next 20 Years: 2020-2039

- ✓ Large investment on WPP (15,5GW), PV (19,5GW) and HEPP (12GW)
- ✓ No additional GAS Plant, decommissioning of old plants (~4GW)
- ✓ Entire coal reserve is planned to be utilized (Additional 18GW)



7,4	5,6	28,5	26	20,5	0	1,3	1,4	90,7

2019 Figures, GW

TEİAŞ

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Table 1. Greenhouse gas reduction targets of the ten largest emitters (based on 2016) emissions and IEA member countries

Ten highest emitting Parties *(as per IEA estimates of CO_2 emissions from fuel combustion in 2016)*	1990	2005	2017	2020 GHG target	Base year level	2017 level	% change to 2017	(I)NDC GHG target[1]
China (incl. Hong Kong)	2 122	5 448	9 302	emissions/GDP 40-45% below 2005	0.72 $kgCO_2$ / 2010 USD PPP	0.44 $kgCO_2$ / 2010 USD PPP	-39%	Reduce CO_2 per unit of GDP by 60-65% below 2005
United States[2]	4 803	5 703	4 761	17% below 2005	5 703 Mt	4 761 Mt	-15%	26-28% reduction by 2025 below 2005 levels
European Union	4 027	3 922	3 209	20% below 1990[3]	4 027 Mt	3 209 Mt	-20%	40% reduction compared to 1990 levels
India	529	1 073	2 161	emissions/GDP 20-25% below 2005[4]	0.30$kgCO_2$ / 2010 USD PPP	0.26 $kgCO_2$ / 2010 USD PPP	-15%	Emissions/GDP 33-35% below 2005 levels[5]
Russian Federation	2 163	1 482	1 536	15-25% below 1990	2 164 Mt	1 536 Mt	-30%	25-30% below 1990 levels[6]
Japan	1 037	1 166	1 132	3.8% below 2005	1 164 Mt	1 147 Mt	-6%	26% below 2013 levels[7]
Republic of Korea (Korea)	232	458	600	*None*[8]		600 Mt		37% below BAU emissions of 850.6 $MtCO_2e$ in 2030[9]
Islamic Republic of Iran (Iran)	171	418	567	*None*		*x*		4% below BAU of 1540 Mt CO_2 in 2030; 12% with international support[10]
Canada	420	540	548	17% below 2005	540 Mt	548 Mt	+1%	30% below 2005 levels
Saudi Arabia	151	298	532	*None*		*X*		Annual GHG-emission abatement of up to 130 $MtCO_2e$

Other IEA member countries

	1990	2005	2017	2020 GHG target	base year level	2017 level	change % to 2017	
	$MtCO_2$							
Australia	260	365	385	5% below 2000 levels	335 Mt	385 Mt	+5%	26-28% below 2005 levels
New Zealand	22	34	33	5% below 1990 levels	34 Mt	33 Mt	%	30% below 2005 levels
Norway	27	35	35	40% below 1990[11]	27 Mt	35 Mt	+29%	40% below 1990 levels
Switzerland	41	44	37	20% below 1990[12]	41 Mt	37 Mt	-9%	50% below 1990 levels. 35% anticipated reduction by 2025
Turkey	129	216	378	*None*				21% emission reduction below BAU of 1175 $MtCO_2e$[13]
Mexico	257	412	446	30% below BAU scenario.	906 $MtCO_2e$ (2020 BAU)	446 Mt		22% below BAU[14]

IEA: CO_2 EMISSIONS FROM FUEL COMBUSTION: OVERVIEW (2019 edition)

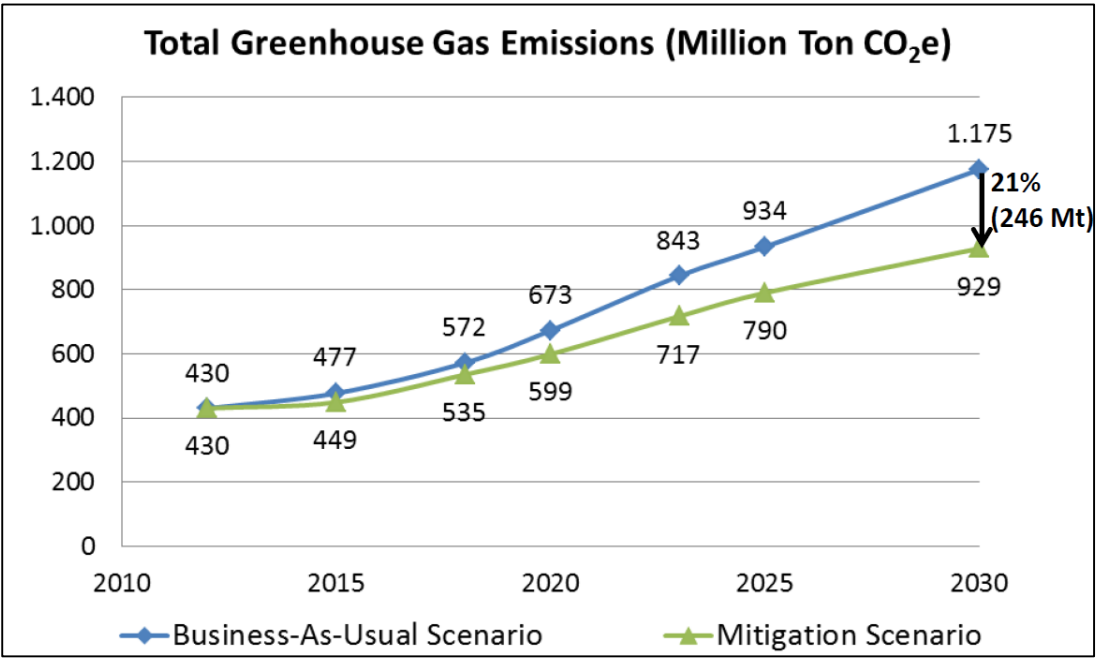
378MtCO2 by fuel combustion, 2017
153 Mtoe of primary consumption, 2018

Consumption*

Million tonnes oil equivalent	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Growth rate per annum 2018	2007-17	Share 2018
Canada	321.5	304.9	312.0	327.2	324.7	337.0	341.8	339.0	338.2	343.7	**344.4**	0.2%	0.7%	2.5%
Mexico	170.8	169.5	174.6	183.1	184.2	185.0	184.1	184.0	186.4	189.3	**186.9**	-1.3%	1.2%	1.3%
US	2258.6	2148.7	2223.3	2204.1	2148.5	2208.0	2232.9	2213.2	2212.7	2222.5	**2300.6**	3.5%	-0.4%	16.6%
Total North America	2751.0	2623.1	2709.8	2714.4	2657.4	2730.1	2758.9	2736.2	2737.2	2755.5	**2832.0**	2.8%	-0.2%	20.4%
Argentina	74.7	73.3	77.2	78.7	81.0	84.5	84.1	86.1	85.9	86.1	**85.1**	-1.2%	1.6%	0.6%
Brazil	239.9	238.6	263.1	275.8	281.3	292.4	299.4	295.9	289.4	293.9	**297.6**	1.3%	2.5%	2.1%
Chile	32.2	31.5	31.7	34.5	35.3	35.7	35.1	35.9	37.7	38.3	**40.1**	4.7%	1.7%	0.3%
Colombia	33.3	31.8	34.1	35.7	38.3	38.9	41.0	41.3	44.2	45.5	**46.9**	3.2%	4.0%	0.3%
Ecuador	12.1	11.9	13.2	14.0	14.8	15.3	16.1	16.1	16.0	16.7	**17.6**	5.8%	3.9%	0.1%
Peru	16.6	17.0	18.8	20.9	21.3	21.9	22.6	24.2	25.5	25.4	**27.0**	6.3%	5.2%	0.2%
Trinidad & Tobago	15.9	16.0	17.5	17.6	16.7	17.2	16.8	16.9	15.4	15.2	**15.3**	0.1%	-0.7%	0.1%
Venezuela	84.6	84.4	79.7	83.4	86.9	84.9	82.1	79.3	72.3	73.6	**64.6**	-12.2%	-1.0%	0.5%
Other S. & Cent. America	91.6	89.6	91.8	94.6	95.1	95.1	95.7	99.5	104.6	105.1	**107.8**	2.6%	1.3%	0.8%
Total S. & Cent. America	600.8	594.2	627.1	655.3	670.9	685.9	692.9	695.3	691.1	699.8	**702.0**	0.3%	1.8%	5.1%
Austria	35.4	34.3	35.6	33.3	35.0	34.7	33.3	33.4	34.6	35.5	**35.0**	-1.5%	0.2%	0.3%
Belgium	67.7	63.4	67.5	63.0	60.7	62.2	58.2	59.1	63.9	64.1	**62.2**	-3.0%	-0.4%	0.4%
Czech Republic	43.9	42.2	44.0	43.0	42.8	42.1	41.2	40.5	39.9	41.8	**42.1**	0.9%	-0.7%	0.3%
Finland	31.4	29.3	31.9	29.7	28.8	29.1	28.1	28.0	28.8	28.1	**29.3**	4.2%	-1.5%	0.2%
France	261.9	248.0	256.0	246.9	247.3	250.1	240.4	241.9	238.4	237.5	**242.6**	2.2%	-0.9%	1.7%
Germany	335.5	315.1	327.9	316.1	320.5	329.8	316.4	322.5	328.1	333.9	**323.9**	-3.0%	0.1%	2.3%
Greece	35.3	34.2	32.5	31.7	30.0	28.5	26.8	27.0	26.6	28.0	**28.3**	1.0%	-2.6%	0.2%
Hungary	25.3	23.2	23.8	23.6	21.9	20.5	21.0	22.4	23.5	23.7	**23.7**	0.8%	-0.9%	0.2%
Italy	181.0	169.2	174.4	170.5	165.8	158.2	149.7	153.1	154.7	156.3	**154.5**	-1.1%	-1.6%	1.1%
Netherlands	93.8	92.4	97.8	93.7	90.6	87.9	83.1	84.1	85.7	84.5	**84.8**	0.3%	-1.2%	0.6%
Norway	46.4	43.1	41.6	42.4	47.3	44.3	45.7	46.5	47.2	47.6	**47.4**	-0.5%	0.5%	0.3%
Poland	97.4	93.9	100.0	100.5	97.5	97.8	94.2	95.2	99.4	103.4	**105.2**	1.7%	0.8%	0.8%
Portugal	24.4	24.5	25.8	24.7	22.6	24.7	24.9	24.8	26.2	25.8	**26.0**	0.8%	0.2%	0.2%
Romania	38.6	33.8	34.0	34.9	33.6	31.4	32.7	32.8	32.8	33.4	**33.4**	0.1%	-1.4%	0.2%
Spain	154.5	143.4	146.5	143.9	143.2	135.9	133.5	135.4	136.9	138.8	**141.4**	1.8%	-0.3%	1.0%
Sweden	53.0	48.7	51.8	51.4	54.7	51.5	51.5	53.3	52.6	54.4	**53.6**	-1.4%	0.1%	0.4%
Switzerland	29.9	29.9	29.2	27.8	29.4	30.3	29.0	28.4	26.8	26.9	**27.8**	3.5%	-0.7%	0.2%
Turkey	100.8	102.2	107.6	115.1	122.3	121.5	125.4	137.2	144.6	152.7	**153.5**	0.5%	4.3%	1.1%
Ukraine	133.5	113.4	121.5	126.3	123.1	117.3	103.2	85.7	89.8	83.4	**84.0**	0.8%	-4.7%	0.6%
United Kingdom	220.0	209.4	214.6	202.2	204.8	204.1	192.5	195.1	193.5	193.2	**192.3**	-0.5%	-1.4%	1.4%
Other Europe	163.5	154.9	160.6	156.9	150.3	152.3	147.4	150.8	154.7	157.3	**159.8**	1.6%	-0.3%	1.2%
Total Europe	2173.3	2048.4	2124.6	2077.7	2072.3	2054.7	1978.3	1996.8	2027.5	2050.0	**2050.7**	*	-0.6%	14.8%
Azerbaijan	12.8	11.3	11.2	12.5	12.8	13.2	13.5	14.7	14.6	14.3	**14.4**	0.6%	1.2%	0.1%
Belarus	25.9	24.5	26.0	25.9	28.0	24.7	25.5	23.2	23.0	23.4	**24.6**	5.0%	-0.9%	0.2%
Kazakhstan	56.4	50.8	54.9	60.5	62.7	63.5	64.4	63.7	64.7	67.6	**76.4**	13.0%	2.3%	0.6%
Russian Federation	676.6	643.2	669.3	691.8	693.8	685.5	688.3	675.4	690.5	694.3	**720.7**	3.8%	0.3%	5.2%
Turkmenistan	12.2	19.9	21.5	23.8	26.0	23.1	23.9	28.6	27.5	28.7	**31.5**	9.8%	6.8%	0.2%
Uzbekistan	44.6	44.8	44.4	46.6	45.5	45.2	47.1	44.9	43.6	45.0	**43.9**	-2.4%	-0.5%	0.3%
Other CIS	16.2	15.6	15.9	17.0	18.0	17.1	17.5	17.4	17.5	18.0	**19.0**	5.9%	0.7%	0.1%
Total CIS	844.7	810.2	843.2	878.0	886.7	872.1	880.3	867.9	881.5	891.2	**930.5**	4.4%	0.5%	6.7%
Iran	205.8	212.7	213.4	224.9	226.2	237.9	249.0	249.2	257.2	272.0	**285.7**	5.0%	3.2%	2.1%
Iraq	29.2	32.6	34.7	36.7	39.0	42.0	40.2	40.1	46.2	47.1	**53.7**	14.1%	5.3%	0.4%
Israel	23.3	22.3	23.7	24.2	25.3	23.5	23.1	24.4	24.8	25.6	**25.6**	0.2%	1.1%	0.2%
Kuwait	29.7	31.1	33.5	33.6	37.3	38.7	35.4	38.5	38.9	38.7	**39.0**	0.7%	3.5%	0.3%
Oman	17.5	17.6	20.6	22.5	24.5	27.4	27.3	28.8	29.0	29.3	**30.7**	4.6%	7.0%	0.2%
Qatar	24.6	24.8	28.3	33.4	37.9	40.8	43.9	48.2	47.6	48.9	**48.3**	-1.2%	8.2%	0.3%
Saudi Arabia	184.3	194.3	213.0	219.8	233.1	234.0	250.8	259.0	262.2	262.8	**259.2**	-1.4%	4.5%	1.9%
United Arab Emirates	81.0	80.0	83.8	88.4	92.8	97.8	97.4	107.1	111.1	109.0	**112.2**	3.0%	4.4%	0.8%
Other Middle East	58.3	58.5	58.2	54.7	51.1	50.3	50.1	48.4	48.0	48.0	**47.9**	-0.2%	-1.6%	0.3%
Total Middle East	653.7	673.8	709.8	738.4	767.3	792.5	817.2	843.7	864.9	881.4	**902.3**	2.4%	3.8%	6.5%
Algeria	36.4	38.6	37.6	39.9	43.6	46.2	50.4	53.1	53.0	53.1	**56.7**	6.7%	4.5%	0.4%
Egypt	71.7	74.6	78.4	79.7	83.8	83.2	83.0	85.3	89.9	92.6	**94.5**	2.1%	3.2%	0.7%
Morocco	15.4	15.0	16.7	17.5	17.8	18.3	18.6	18.9	19.1	20.0	**21.0**	4.9%	3.7%	0.2%
South Africa	125.4	125.1	126.3	124.6	122.7	123.2	124.8	121.9	123.9	121.8	**121.5**	-0.2%	0.4%	0.9%
Other Africa	116.5	118.7	124.8	123.6	131.3	138.9	145.9	150.9	153.5	161.0	**167.8**	4.2%	3.8%	1.2%
Total Africa	365.4	372.0	383.8	385.3	399.2	409.7	422.6	430.1	439.4	448.6	**461.5**	2.9%	2.7%	3.3%
Australia	132.3	131.4	131.9	136.4	134.6	135.3	137.5	139.2	142.1	140.5	**144.3**	2.7%	0.8%	1.0%
Bangladesh	18.8	20.6	21.6	23.0	25.0	25.5	27.0	31.3	31.8	33.0	**35.8**	8.6%	6.4%	0.3%
China	2230.4	2330.1	2491.6	2690.5	2799.5	2907.5	2974.7	3009.6	3047.1	3139.0	**3273.5**	4.3%	3.9%	23.6%
China Hong Kong SAR	24.3	26.6	27.6	28.3	29.3	30.9	33.1	34.9	38.3	41.8	**45.7**	9.3%	5.4%	0.3%
India	477.9	514.3	539.2	571.4	601.0	624.5	667.5	689.8	719.3	750.1	**809.2**	7.9%	5.2%	5.8%
Indonesia	132.7	137.6	151.1	164.6	173.4	178.2	167.2	165.7	170.2	176.9	**185.5**	4.9%	2.8%	1.3%
Japan	517.8	473.1	504.7	479.1	475.7	472.3	460.3	453.3	450.8	455.2	**454.1**	-0.2%	-1.4%	3.3%
Malaysia	80.0	77.7	80.1	82.9	89.0	93.1	93.6	95.1	96.6	96.7	**99.3**	2.7%	2.3%	0.7%
New Zealand	19.3	19.2	19.9	19.7	20.0	20.2	21.2	21.4	21.6	22.2	**21.7**	-1.9%	1.4%	0.2%
Pakistan	62.4	63.2	63.4	63.5	64.1	64.9	66.9	70.4	76.6	81.0	**85.0**	5.0%	2.7%	0.6%
Philippines	28.0	28.3	29.3	29.5	30.9	33.1	34.9	38.3	41.8	45.7	**47.0**	2.9%	5.4%	0.3%
Singapore	59.3	63.8	68.6	71.3	71.6	73.6	75.8	80.6	83.8	86.5	**87.6**	1.2%	4.5%	0.6%
South Korea	241.4	242.6	261.3	273.4	276.3	276.7	279.5	285.3	292.2	297.1	**301.0**	1.3%	2.3%	2.2%
Sri Lanka	5.1	5.3	5.7	5.9	6.0	6.1	5.5	7.0	7.5	7.8	**8.1**	3.3%	3.7%	0.1%
Taiwan	106.6	104.7	110.9	109.3	109.1	111.1	113.8	112.9	115.0	117.0	**118.4**	1.2%	0.4%	0.9%

BP Statistical Review of World Energy 2019 | 68th edition

Turkey's '' *INTENDED NATIONALLY DETERMINED CONTRIBUTION'' submitted on 2015 Sept.*



Greenhouse gases included in the national inventory:

- Carbon dioxide (CO2);
- Methane (CH4);
- Nitrous oxide (N2O);
- Hydrofluorocarbons (HFCs);
- Perfluorocarbons (PFCs);
- Sulfur hexafluoride (SF6);
- Nitrous trifluoride (NF3).

Source: https://unfccc.int/

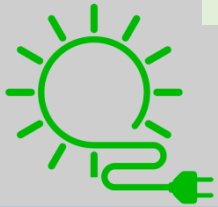
United Nations Framework Convention on Climate Change (UNFCCC)

Plans and policies to be implemented for this INDC

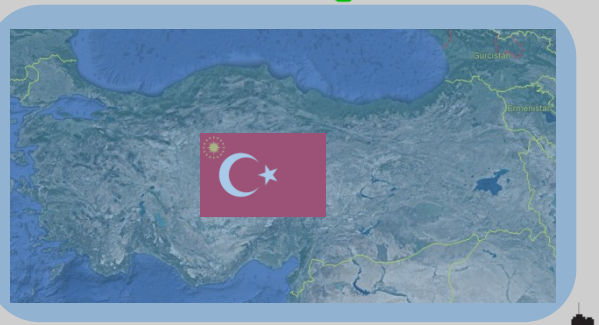
- ❑ Elec. Vehicle
- ❑ High Spd. Railway
- ❑ Scrapping old vehicles
- ❑ Green port-airport

Transport

Energy



- ❑ PV-WPP-HEPP-NPP
- ❑ Loss Reduction



Industry

- ❑ Emission Reduction
- ❑ Efficiency
- ❑ Alternative fuel

- ❑ Land rehabilitation
- ❑ Efficient agriculture

Agriculture

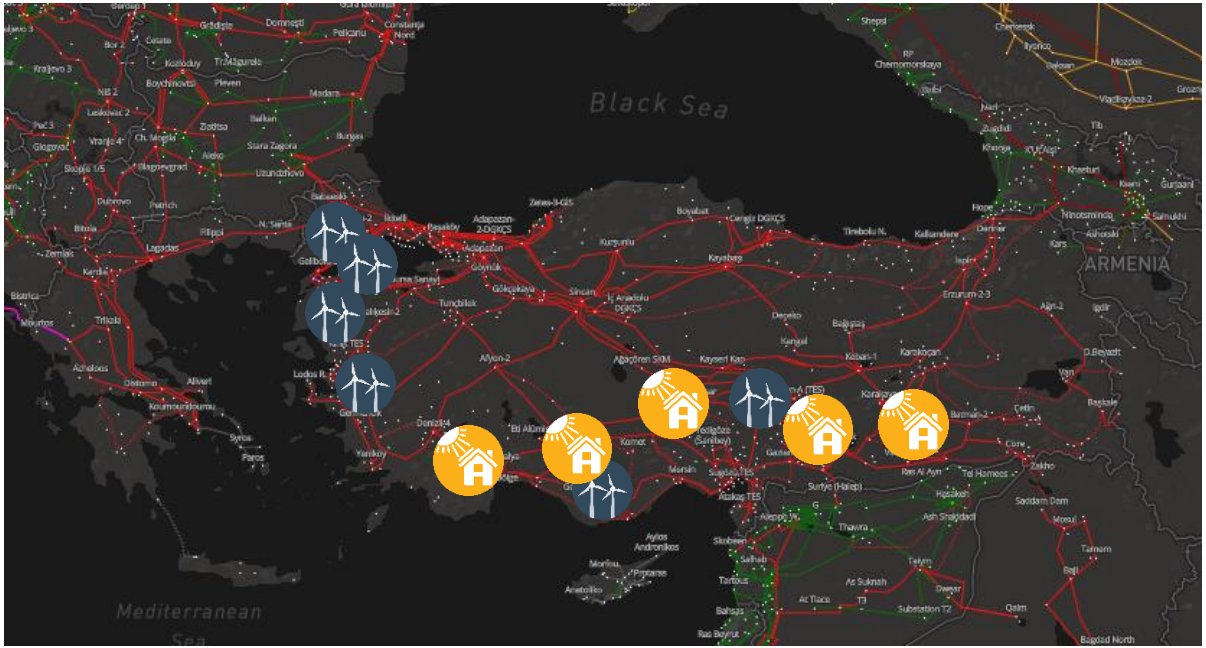
Waste

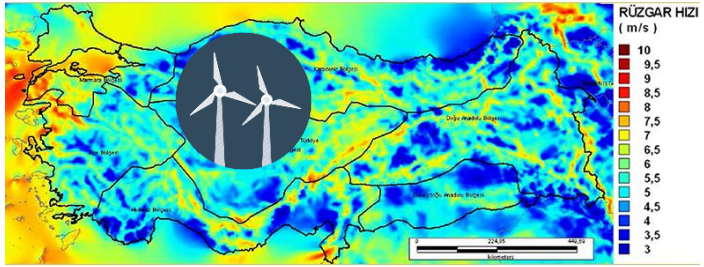
- ❑ Recycle process
- ❑ Waste energy

Buildings and Urban Transformation

- ❑ Energy efficient buildings
- ❑ Certification

Grid Infrastructure development/Resource location

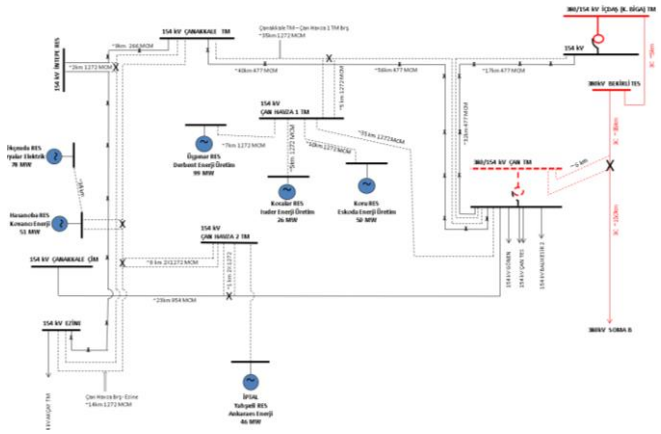


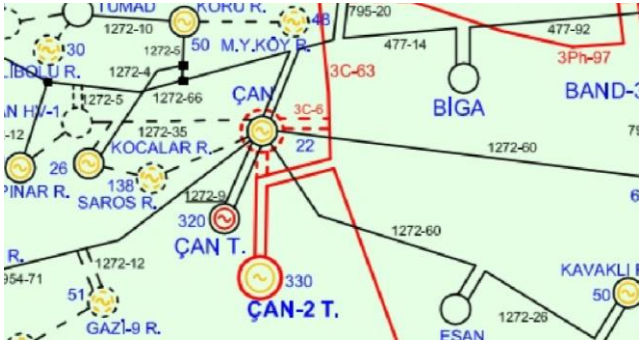


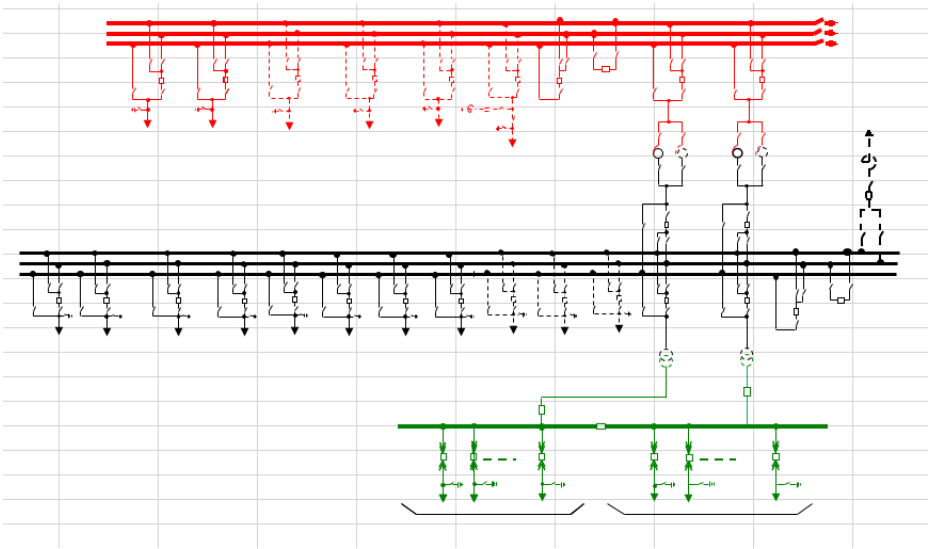
Grid Infrastructure development: WPP connection

Typical Grid Integration for WPP: Connection to 154kV. Collected at 400kV main grid

154kV
400kV
MV

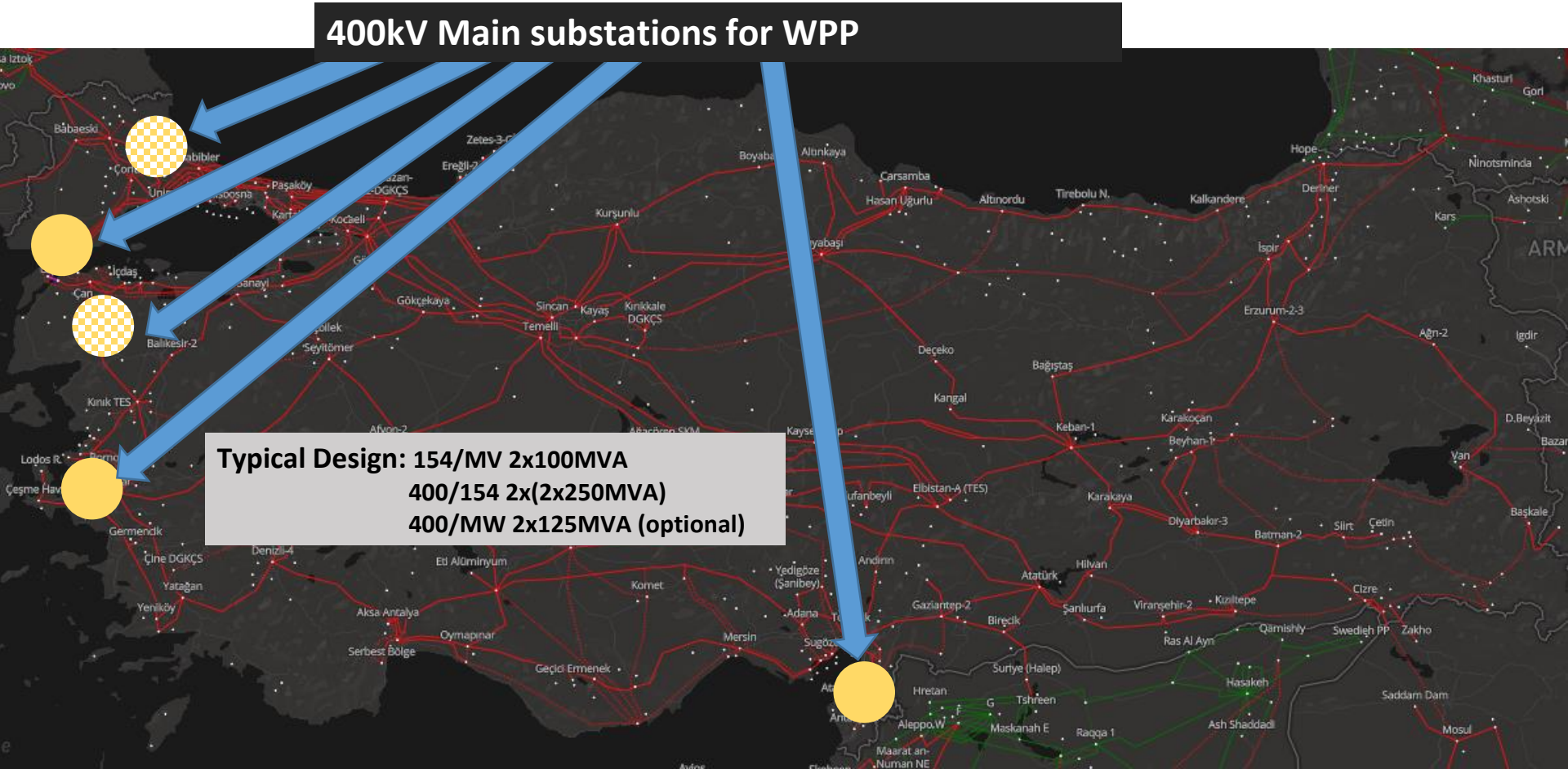






WPPs Capacity Ranging 5MW-10MW to 100MW-150MW
Grid Substation: 154/MV 2x100MWA
400/154kV 2x(2x250MVA)

Grid Infrastructure development: WPP connection

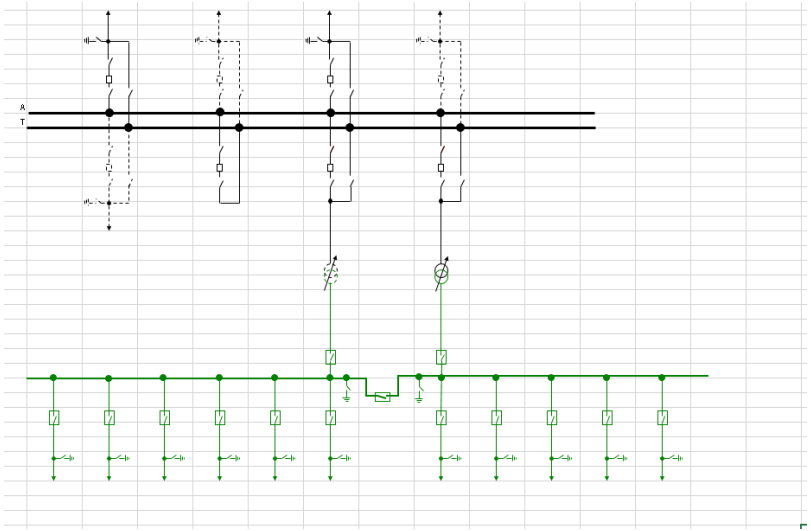


Grid Infrastructure development: PV connection

Typical Grid Integration for PV: Connection to MV.

154kV

MV



PV Plant Capacity Ranging to few MWs
Connected to existing MV network or with a capacity increment in substation. Spread over large land

Grid Infrastructure development: Projects with priority (WPP-PV)

Some Projects developed by Ministry under particular law

- Land selection
- Capacity definition
- Material-technology-local manufacturing requirement
- Incentive declared for definite horizon
- Call for international bid

QUESTIONS/DISCUSSION