VISUAL ANALYSIS OF GLOBAL GREENHOUSE GAS EMISSIONS FROM ELECTRICITY GENERATION SYSTEMS

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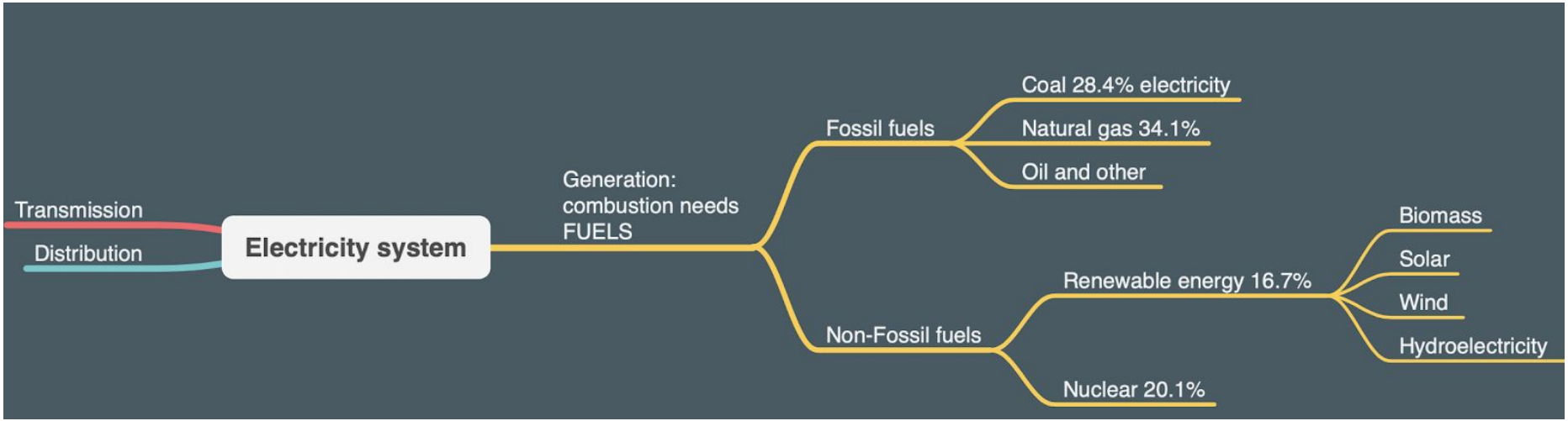
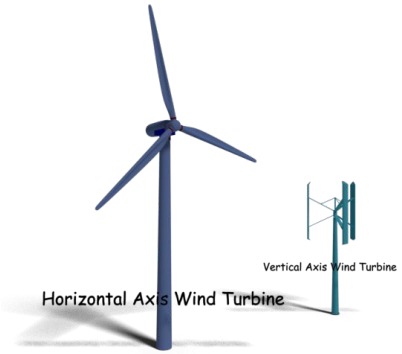
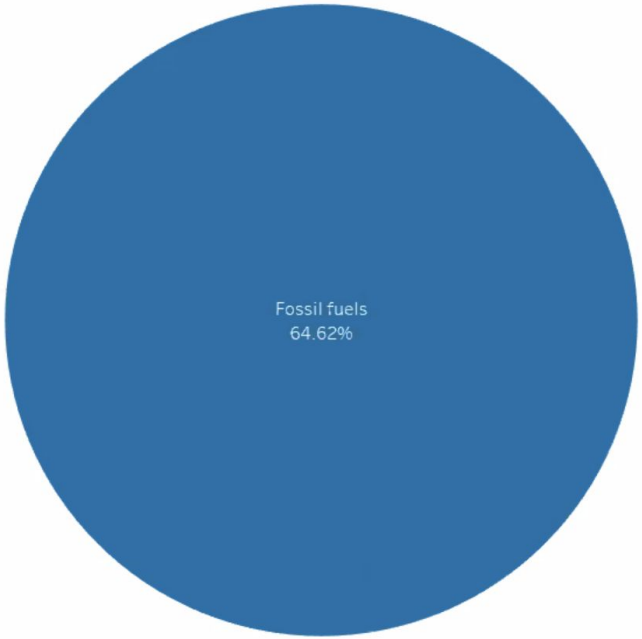


United States in 2018 as an example

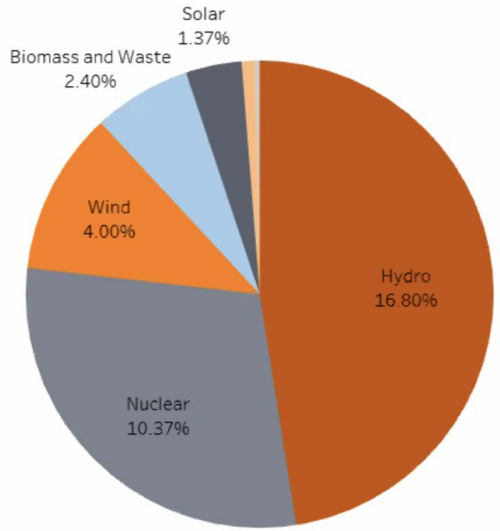


Global Energy Generation in 2016

Fossil Fuel Energy



Clean Energy



Methods:

Original Datasets For Electricity Generation Sources and Greenhouse gases emissions

	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
World											
Generation (billion kWh)	11303.64	11543.24	11624.26	11897.08	12173.54	12607.92	12990.55	13316.9	13669.91	14010.25	14656.88
Nuclear (billion kWh)	1908.807	1996.14	2015.603	2081.626	2125.16	2210.046	2291.533	2271.307	2316.009	2393.132	2449.89
Fossil fuels (billion kWh)	7136.26	7238.183	7281.34	7359.417	7560.903	7787.477	8047.731	8326.582	8616.803	8824.303	9339.857
Renewables (billion kWh)	2278.517	2327.984	2345.25	2475.982	2506.94	2631.962	2674.509	2744.922	2762.072	2819.103	2894.642
Hydroelectricity (billion kWh)	2144.498	2183.127	2188.171	2313.527	2336.504	2453.207	2489.662	2545.822	2551.095	2592.418	2623.042
Non-hydroelectric renewables (billion kWh)	134.0189	144.8571	157.0787	162.4554	170.4361	178.7552	184.8469	199.0998	210.9778	226.6848	271.6001
Geothermal (billion kWh)	35.82027	37.06144	38.19696	39.17257	39.02645	38.25226	40.68968	42.1271	44.70592	47.88301	51.56316
Solar, tide, wave, fuel cell (billion kWh)	1.039468	1.146035	1.124622	1.186389	1.239949	1.292358	1.33731	1.411188	1.511204	1.601491	22.90407
Tide and wave (billion kWh)	0.601	0.614	0.608	0.586	0.592	0.598	0.577	0.6	0.62	0.61	21.701
Solar (billion kWh)	0.405087	0.494765	0.47564	0.555452	0.597622	0.636821	0.694205	0.737168	0.807473	0.894082	1.092575
Wind (billion kWh)	3.5356	4.096951	4.611523	5.557827	7.285109	7.936253	9.289069	12.13504	16.1087	21.242	31.36426
Biomass and waste (billion kWh)	93.65693	102.59	113.1866	116.5836	122.9349	131.3319	133.5969	143.5005	148.7357	156.0557	165.8791
Hydroelectric pumped storage (billion kWh)	-19.9397	-19.0674	-17.9316	-19.9476	-19.4608	-21.5701	-23.2211	-25.9139	-24.9723	-26.2919	-27.5069
Afghanistan											
Generation (billion kWh)	1.098	0.989	0.685	0.677	0.669	0.608	0.549	0.499	0.46	0.455	0.467
Nuclear (billion kWh)	0	0	0	0	0	0	0	0	0	0	0
Fossil fuels (billion kWh)	0.342	0.306	0.212	0.207	0.202	0.196	0.188	0.177	0.16	0.155	0.155
Renewables (billion kWh)	0.756	0.683	0.473	0.47	0.467	0.412	0.361	0.322	0.3	0.3	0.312
Hydroelectricity (billion kWh)	0.756	0.683	0.473	0.47	0.467	0.412	0.361	0.322	0.3	0.3	0.312
Non-hydroelectric renewables (billion kWh)	0	0	0	0	0	0	0	0	0	0	0
Geothermal (billion kWh)	0	0	0	0	0	0	0	0	0	0	0
Solar, tide, wave, fuel cell (billion kWh)	0	0	0	0	0	0	0	0	0	0	0
Tide and wave (billion kWh)	0	0	0	0	0	0	0	0	0	0	0
Solar (billion kWh)	0	0	0	0	0	0	0	0	0	0	0
Wind (billion kWh)	0	0	0	0	0	0	0	0	0	0	0
Biomass and waste (billion kWh)	0	0	0	0	0	0	0	0	0	0	0
Hydroelectric pumped storage (billion kWh)	0	0	0	0	0	0	0	0	0	0	0

Electricity Generation Sources

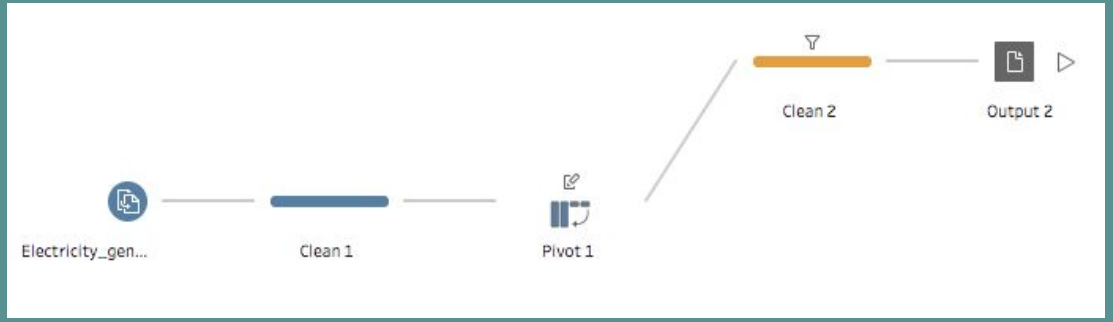
Country	Data sourc	Sector	Gas	Unit	2016	2015	2014	2013	2012	2011	2010
World	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	15005.3	15020.5	15226.5	15292.5	15018.9	14720.5	14140.3
China	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	4644.1	4586.2	4641.5	4747.8	4455.4	4328.3	3841.7
United Sta	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	2145.5	2234	2376.2	2378.5	2360.2	2488.7	2609.6
European	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	1157.5	1177.5	1154.1	1223.9	1289.8	1308.9	1332.4
India	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	1111.3	1101.8	1117	1004.7	995.1	866.3	821
Russia	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	840	879.8	907.5	969.3	1007.7	1015.2	955.9
Japan	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	610.2	606.4	625.1	648.8	628.3	578.4	524.1
South Kore	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	356.6	351.4	343.6	345.9	350.7	346.6	322.9
Germany	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	345.9	346.3	350.3	369.9	364.6	354.2	361.6
South Afric	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	279.9	273.4	292.7	279.5	281.6	272.9	286.3
Saudi Arab	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	274.7	272.7	249	227.2	222.4	208.3	197.7
Australia	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	235.7	223	217.8	227.1	235.4	238.4	245
Canada	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	213.4	211.2	210.2	210.5	209	207.9	211.2
Indonesia	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	206.6	195.5	193.8	168.2	168.8	168.8	152
Mexico	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	196.1	193.7	192	201.5	212.4	204.5	195.4
Iran	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	195.1	192.4	191.1	187.3	177.7	171	163.9
Poland	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	157.9	158.1	155.4	165	164.5	169.5	168.9
Turkey	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	146.5	133.9	138.7	121	126.9	123.1	112.7
Kazakhstai	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	141.3	135.6	141.4	142.2	131.2	126.5	123.7
United Kin	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	125.2	150.7	170.8	196	211.5	197.3	209.1
Malaysia	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	118.5	123.5	119.2	113.8	108.9	110.5	106.5
Italy	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	118.1	120.9	113.7	122.6	144	152.1	153.1
Thailand	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	110.1	110.3	113.4	114.8	106.1	97.6	98.1
Ukraine	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	105.2	94.7	116	135.3	140.2	137.7	129.8
Egypt	CAIT	Electricity/Heat	All GHG	MtCOâ‚‚e	100.4	97.8	92.4	88.2	87.7	81.4	77.8

GHG Emissions

Prepared Dataset

Tableau Prep:

- **Connect Datasets**
- **Clean**
- **Pivot**
- **Output**



Country	Electricity Genera...	Energy Source (bil...	Years
Austria	15.80	fossil fuels	1,990
Bahrain	3.28	fossil fuels	1,990
Bangladesh	6.74	fossil fuels	1,990
Barbados	0.44	fossil fuels	1,990
Belgium	24.98	fossil fuels	1,990
Belize	0.10	fossil fuels	1,990
Benin	0.02	fossil fuels	1,990
Bermuda	0.46	fossil fuels	1,990
Bhutan	0.01	fossil fuels	1,990
Bolivia	0.85	fossil fuels	1,990
Botswana	0.85	fossil fuels	1,990
Brazil	9.52	fossil fuels	1,990
British Virgin Islands	0.04	fossil fuels	1,990
Brunei	1.16	fossil fuels	1,990
Bulgaria	24.06	fossil fuels	1,990
Burkina Faso	0.17	fossil fuels	1,990
Burma	1.21	fossil fuels	1,990
Burundi	0.00	fossil fuels	1,990
Cabo Verde	0.04	fossil fuels	1,990
Cambodia	0.09	fossil fuels	1,990
Cameroon	0.07	fossil fuels	1,990
Canada	101.88	fossil fuels	1,990

Electricity Generation Sources

Country	GHG Emissions (M...	Years
World	8,604.10	1,990
China	725.40	1,990
United States	2,159.80	1,990
European Union (27)	1,468.10	1,990
India	232.00	1,990
Russia	1,231.40	1,990
Japan	438.30	1,990
South Korea	64.80	1,990
Germany	411.70	1,990
South Africa	145.80	1,990
Saudi Arabia	71.10	1,990
Australia	142.80	1,990
Canada	138.00	1,990
Indonesia	47.80	1,990
Mexico	94.30	1,990
Iran	41.80	1,990
Poland	228.90	1,990
Turkey	39.40	1,990
Kazakhstan	115.20	1,990
United Kingdom	247.90	1,990
Malaysia	19.00	1,990
Italy	143.50	1,990

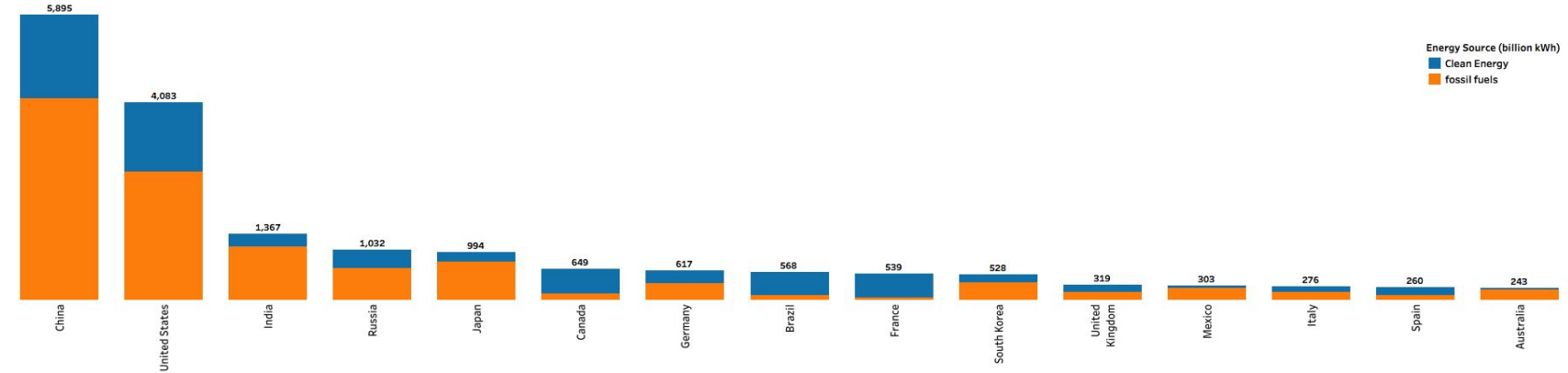
GHG Emissions

Top 15 Countries that are Emitting Greenhouse gases from Electricity Production

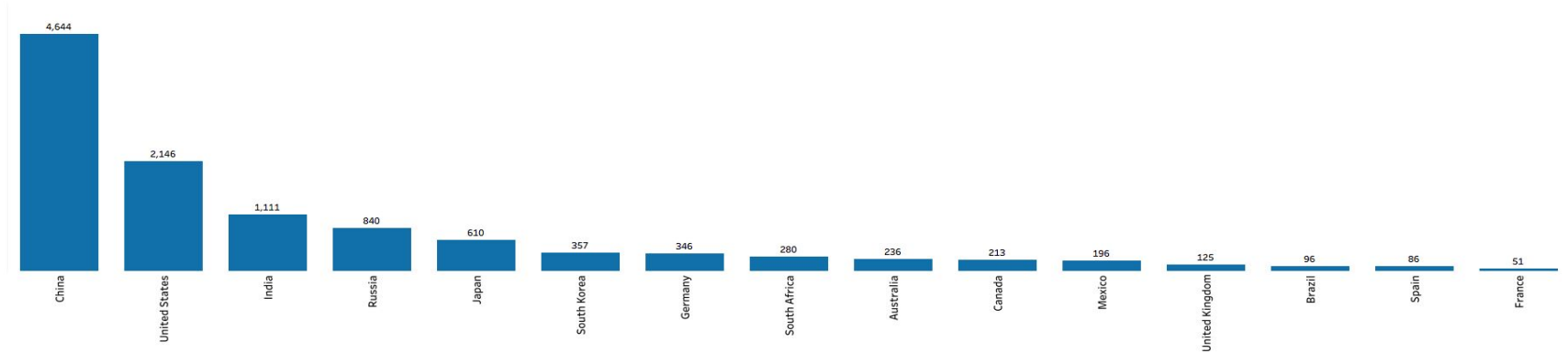
Years: 2016

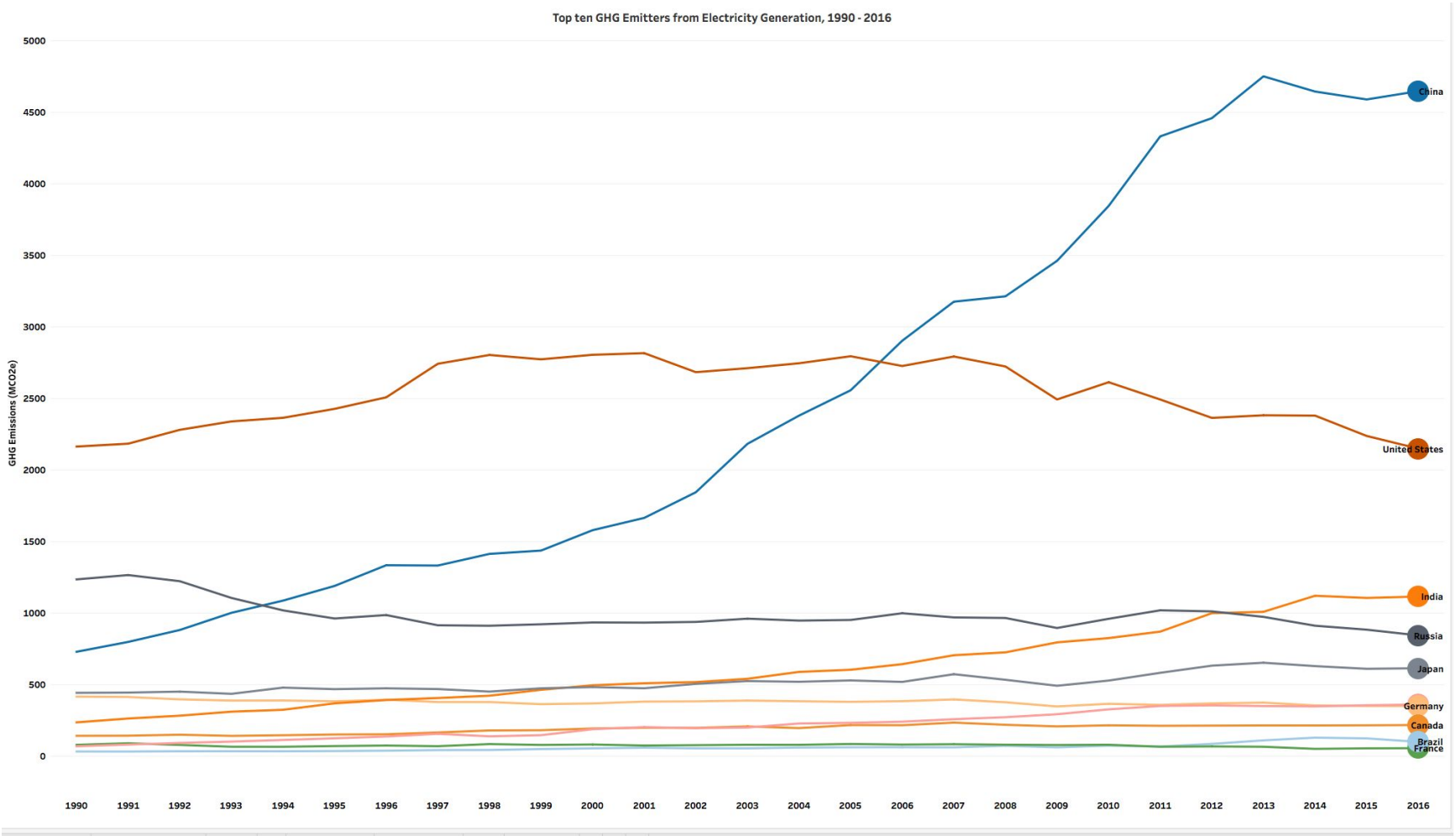
Show history

Electricity Production Sources (billion kWh) by Country- 1990 to 2016

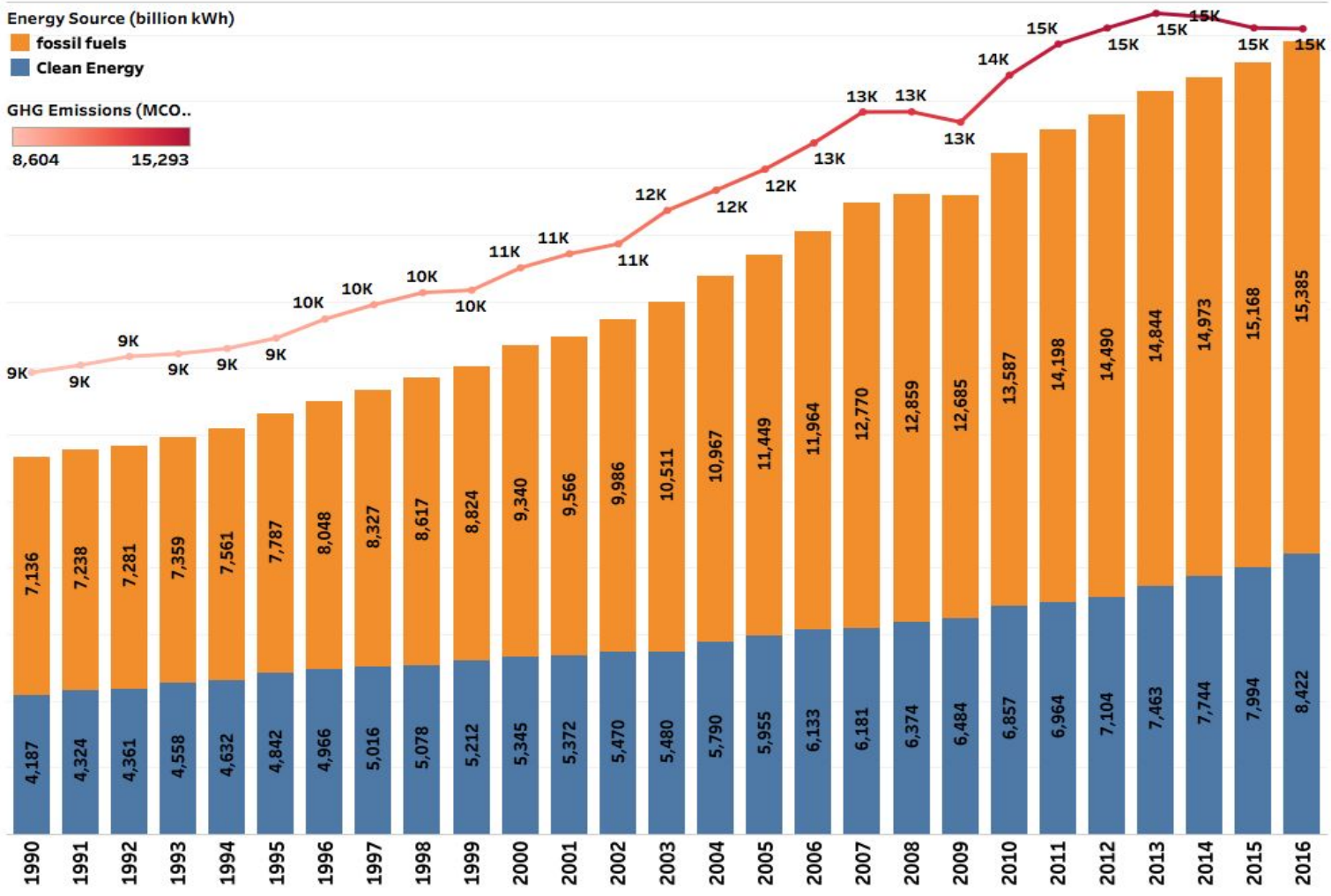


Contribution of GHG (MCO2e) by Country- 1990 to 2016




Top ten GHG Emitters from Electricity Generation, 1990 - 2016
GHG Emissions (MCO2e)
5000
4500
4000
3500
3000
2500
2000
1500
1000
500
0
1990
1991
1992
1993
1994
1995
1996
1997
1998
1999
2000
2001
2002
2003
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013
2014
2015
2016
China
United States
India
Russia
Japan
Germany
Canada
Brazil
France

Global GHG Emissions (MCO2e) from Electricity Generation (billion kWh), 1990-2016



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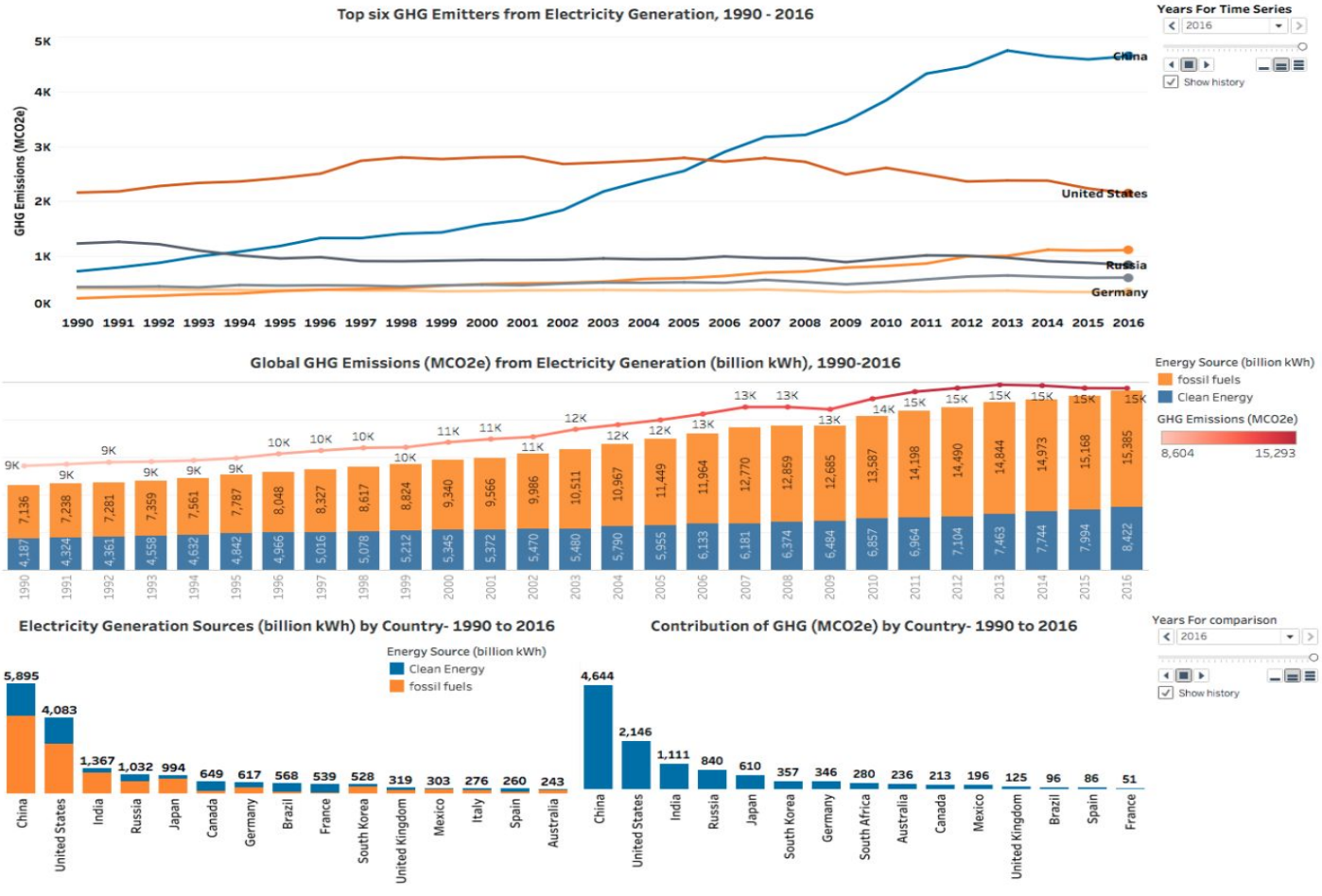

Conclusion and Future Work

1. Developed Countries
2. Developing Countries
3. Future work
    a. in particular fuel sources
    b. Top 10 countries

What did we learn

Thank You!