

Table S1 Amount of electricity production in 2015 at province level (TWH)

Region	Province	Thermal power	Nuclear	Wind	Hydropower	Solar PV
North	Beijing	41.1	0.0	0.8	0.7	0.9
	Tianjin	61.4	0.0	0.1	0.0	0.0
	Hebei	227.2	0.0	9.7	1.0	1.7
	Shandong	450.2	0.0	5.2	0.8	0.3
Northeast	Liaoning	135.4	14.5	8.3	3.2	1.0
	Jilin	57.3	0.0	19.7	5.8	0.7
	Heilongjiang	77.1	0.0	8.6	1.7	1.2
Shanxi-InnerM	Shanxi	232.0	0.0	0.9	2.9	0.0
	Inner Mongolia	342.2	0.0	48.2	3.6	1.7
Northwest	Shaanxi	145.2	0.0	3.6	13.4	5.2
	Gansu	71.9	0.0	22.9	33.6	3.5
	Qinghai	12.2	0.0	1.1	36.4	9.4
	Ningxia	101.6	0.0	7.3	1.6	3.5
	Xinjiang	206.0	0.0	13.0	20.9	5.0
Central	Anhui	195.9	0.0	2.7	4.9	0.7
	Jiangxi	78.0	0.0	1.8	17.8	0.7
	Henan	248.1	0.0	3.8	11.0	0.0
	Hubei	96.2	0.0	0.1	132.8	0.0
	Hunan	69.9	0.0	0.1	57.3	0.0
East coastal	Shanghai	78.5	0.0	1.4	0.0	0.5
	Jiangsu	405.3	16.6	9.1	1.2	2.8
	Zhejiang	222.2	49.3	1.7	22.9	1.2
South coastal	Fujian	108.1	27.9	3.9	46.6	0.3
	Guangdong	290.4	47.7	3.7	43.7	0.3
	Guangxi	51.6	12.9	1.4	74.9	0.0
	Hainan	23.4	0.1	0.6	1.1	0.7
Southwest	Chongqing	44.1	0.0	0.4	22.9	0.0
	Sichuan	44.2	0.0	1.4	266.8	1.0
	Guizhou	98.4	0.0	2.7	78.9	0.0
	Yunnan	26.6	0.0	0.9	217.8	1.1
Tibet		0.1	0.0	0.0	3.2	0.6
Total		4241.8	169.0	185.1	1129.4	44.0

Table S2 Amount of electricity production in 2020 and 2030 at province level, reference (TWH)

Region	Province	2020					2030				
		Thermal power	Nuclear	Wind	Hydropower	Solar PV	Thermal power	Nuclear	Wind	Hydropower	Solar PV
North	Beijing	42.8	0.0	2.1	0.9	3.9	45.9	0.0	4.1	1.0	8.2
	Tianjin	64.5	0.0	0.2	0.0	0.0	69.0	0.0	0.4	0.0	0.0
	Hebei	238.1	0.0	24.2	0.5	7.9	255.0	0.0	47.1	0.6	16.4
	Shandong	471.2	42.3	13.1	0.9	1.6	504.7	70.5	25.4	1.0	3.3
Northeast	Liaoning	142.0	51.8	20.6	1.2	4.7	152.1	81.7	40.2	1.3	9.8
	Jilin	58.8	0.0	49.3	7.4	3.1	63.0	41.4	96.1	8.0	6.6
	Heilongjiang	80.8	0.0	21.5	2.0	5.5	86.6	41.4	41.8	2.2	11.5
Shanxi-InnerM	Shanxi	242.8	0.0	2.3	3.7	0.0	260.1	0.0	4.4	4.1	0.0
	Inner Mongolia	343.2	0.0	120.5	3.1	7.9	367.6	0.0	234.8	3.3	16.4
Northwest	Shaanxi	152.2	0.0	9.0	16.1	23.6	163.1	0.0	17.5	17.5	49.2
	Gansu	75.5	0.0	57.3	36.3	15.7	80.9	0.0	111.6	39.4	32.8
	Qinghai	12.8	0.0	2.7	46.0	42.5	13.7	0.0	5.3	50.1	88.5
	Ningxia	102.0	0.0	18.3	2.0	15.7	109.3	0.0	35.7	2.2	32.8
	Xinjiang	212.7	0.0	32.5	23.4	22.5	227.8	0.0	63.3	25.5	46.9
Central	Anhui	205.2	0.0	6.8	4.1	3.1	219.8	0.0	13.2	4.5	6.6
	Jiangxi	81.0	17.6	4.5	8.4	3.1	86.8	66.3	8.8	9.2	6.6
	Henan	260.4	0.0	9.4	13.8	0.0	278.9	0.0	18.3	15.0	0.0
	Hubei	101.0	14.1	0.3	172.6	0.0	108.2	82.9	0.6	187.8	0.0
	Hunan	73.3	35.2	0.2	64.9	0.0	78.5	41.4	0.4	70.6	0.0
East coastal	Shanghai	82.4	0.0	3.5	0.0	2.4	88.3	0.0	6.9	0.0	4.9

	Jiangsu	425.2	29.0	22.7	1.5	12.6	455.4	54.9	44.2	1.6	26.2
	Zhejiang	232.2	60.3	4.2	19.7	5.4	248.7	91.7	8.2	21.4	11.1
South coastal	Fujian	113.5	58.9	9.8	44.3	1.6	121.6	172.9	19.1	48.2	3.3
	Guangdong	304.8	71.3	9.3	40.9	1.6	326.5	146.1	18.0	44.5	3.3
	Guangxi	54.2	29.4	3.4	90.7	0.0	58.0	96.8	6.6	98.7	0.0
	Hainan	23.9	9.2	1.6	0.7	3.1	25.6	31.5	3.0	0.7	6.6
Southwest	Chongqing	46.2	0.0	0.9	26.1	0.0	49.5	0.0	1.8	28.4	0.0
	Sichuan	46.4	0.0	3.4	335.6	4.7	49.7	0.0	6.6	365.1	9.8
	Guizhou	102.9	0.0	6.8	96.9	0.0	110.2	0.0	13.2	105.4	0.0
	Yunnan	27.8	0.0	2.3	264.8	5.0	29.8	0.0	4.5	288.1	10.5
Tibet		0.1	0.0	0.0	4.3	2.5	0.1	0.0	0.0	4.7	5.2
Total		4419.9	419.1	462.7	1332.8	199.7	4734.4	1019.5	901.1	1450.1	416.5

Table S3 Amount of electricity production in 2020 and 2030 at province level, reallocation (TWH)

Region	Province	2020					2030				
		Thermal power	Nuclear	Wind	Hydropower	Solar PV	Thermal power	Nuclear	Wind	Hydropower	Solar PV
North	Beijing	39.0	0.0	2.7	1.0	6.7	39.7	0.0	5.0	1.2	12.4
	Tianjin	58.7	0.0	0.3	0.0	0.0	59.7	0.0	0.5	0.0	0.0
	Hebei	216.7	0.0	31.4	0.6	12.9	220.5	0.0	58.3	0.7	24.8
	Shandong	428.9	42.3	17.0	1.0	2.8	436.4	70.5	31.5	1.2	5.0
Northeast	Liaoning	129.3	51.8	26.8	1.3	8.3	131.5	81.7	49.7	1.5	14.9
	Jilin	53.5	0.0	64.0	8.1	5.5	54.4	41.4	118.8	9.2	9.9
	Heilongjiang	73.6	0.0	27.9	2.2	9.7	74.9	41.4	51.7	2.5	17.4
Shanxi-InnerM	Shanxi	221.0	0.0	2.9	4.1	0.0	224.9	0.0	5.4	4.7	0.0
	Inner Mongolia	312.4	0.0	156.4	3.4	11.2	317.8	0.0	290.5	3.8	24.8
Northwest	Shaanxi	138.6	0.0	11.7	17.7	39.7	141.0	0.0	21.7	20.0	74.4
	Gansu	68.7	0.0	74.4	40.0	18.7	69.9	0.0	138.0	45.3	49.6
	Qinghai	11.7	0.0	3.5	50.8	66.3	11.9	0.0	6.5	57.5	134.0
	Ningxia	92.9	0.0	23.8	2.2	25.4	94.5	0.0	44.2	2.5	49.6
	Xinjiang	193.6	0.0	42.2	25.8	37.2	197.0	0.0	78.4	29.2	71.0
Central	Anhui	186.8	0.0	8.8	4.6	5.5	190.1	0.0	16.3	5.2	9.9
	Jiangxi	73.8	17.6	5.8	9.3	5.5	75.1	66.3	10.9	10.5	9.9
	Henan	237.0	0.0	12.2	15.2	0.0	241.1	0.0	22.7	17.2	0.0
	Hubei	91.9	14.1	0.4	190.5	0.0	93.5	82.9	0.8	215.5	0.0
	Hunan	66.7	35.2	0.3	71.6	0.0	67.9	41.4	0.5	81.0	0.0
East coastal	Shanghai	75.0	0.0	4.6	0.0	4.1	76.3	0.0	8.5	0.0	7.4
	Jiangsu	387.0	29.0	29.4	1.6	22.1	393.8	54.9	54.6	1.8	39.7

	Zhejiang	211.4	60.3	5.5	21.7	9.4	215.1	91.7	10.2	24.6	16.9
South coastal	Fujian	103.3	58.9	12.7	48.9	2.8	105.1	172.9	23.7	55.3	5.0
	Guangdong	277.4	71.3	12.0	45.2	2.8	282.2	146.1	22.3	51.1	5.0
	Guangxi	49.3	29.4	4.4	100.1	0.0	50.2	96.8	8.1	113.2	0.0
	Hainan	21.8	9.2	2.0	0.7	5.5	22.2	31.5	3.7	0.8	9.9
Southwest	Chongqing	42.0	0.0	1.2	28.8	0.0	42.8	0.0	2.2	32.6	0.0
	Sichuan	42.2	0.0	4.4	370.3	8.3	43.0	0.0	8.1	418.9	14.9
	Guizhou	93.6	0.0	8.8	106.9	0.0	95.3	0.0	16.3	120.9	0.0
	Yunnan	25.3	0.0	3.0	292.2	8.8	25.8	0.0	5.5	330.5	15.9
Tibet		0.1	0.0	0.0	4.7	2.5	0.1	0.0	0.0	5.3	7.9
Total		4023.2	419.1	600.5	1470.5	321.7	4093.7	1019.5	1114.6	1663.7	630.2

Table S4 Amount of electricity production in 2020 and 2030 at province level, west-centered (TWH)

Region	Province	2020					2020				
		Thermal power	Nuclear	Wind	Hydropower	Solar PV	Thermal power	Nuclear	Wind	Hydropower	Solar PV
North	Beijing	40.8	0.0	2.1	0.9	3.9	40.8	0.0	4.1	1.0	8.2
	Tianjin	61.4	0.0	0.2	0.0	0.0	61.4	0.0	0.4	0.0	0.0
	Hebei	226.8	0.0	24.2	0.5	7.9	226.8	0.0	47.1	0.6	16.4
	Shandong	471.2	42.3	13.1	0.9	1.6	504.7	70.5	25.4	1.0	3.3
Northeast	Liaoning	142.0	51.8	20.6	1.2	4.7	152.1	81.7	40.2	1.3	9.8
	Jilin	58.8	0.0	49.3	7.4	3.1	63.0	41.4	96.1	8.0	6.6
	Heilongjiang	80.8	0.0	21.5	2.0	5.5	86.6	41.4	41.8	2.2	11.5
Shanxi-InnerM	Shanxi	253.8	0.0	2.3	3.7	0.0	287.6	0.0	4.4	4.1	0.0
	Inner Mongolia	354.2	0.0	120.5	3.1	7.9	395.1	0.0	234.8	3.3	16.4
Northwest	Shaanxi	163.2	0.0	9.0	16.1	23.6	190.5	0.0	17.5	17.5	49.2
	Gansu	86.5	0.0	57.3	36.3	15.7	108.3	0.0	111.6	39.4	32.8
	Qinghai	12.8	0.0	2.7	46.0	42.5	13.7	0.0	5.3	50.1	88.5
	Ningxia	113.0	0.0	18.3	2.0	15.7	136.8	0.0	35.7	2.2	32.8
	Xinjiang	223.7	0.0	32.5	23.4	22.5	255.3	0.0	63.3	25.5	46.9
Central	Anhui	205.2	0.0	6.8	4.1	3.1	219.8	0.0	13.2	4.5	6.6
	Jiangxi	81.0	17.6	4.5	8.4	3.1	86.8	66.3	8.8	9.2	6.6
	Henan	260.4	0.0	9.4	13.8	0.0	278.9	0.0	18.3	15.0	0.0
	Hubei	101.0	14.1	0.3	172.6	0.0	108.2	82.9	0.6	187.8	0.0
	Hunan	73.3	35.2	0.2	64.9	0.0	78.5	41.4	0.4	70.6	0.0
East coastal	Shanghai	78.5	0.0	3.5	0.0	2.4	78.5	0.0	6.9	0.0	4.9
	Jiangsu	405.0	29.0	22.7	1.5	12.6	405.0	54.9	44.2	1.6	26.2

	Zhejiang	221.2	60.3	4.2	19.7	5.4	221.2	91.7	8.2	21.4	11.1
South coastal	Fujian	113.5	58.9	9.8	44.3	1.6	121.6	172.9	19.1	48.2	3.3
	Guangdong	290.3	71.3	9.3	40.9	1.6	290.3	146.1	18.0	44.5	3.3
	Guangxi	54.2	29.4	3.4	90.7	0.0	58.0	96.8	6.6	98.7	0.0
	Hainan	23.9	9.2	1.6	0.7	3.1	25.6	31.5	3.0	0.7	6.6
Southwest	Chongqing	46.2	0.0	0.9	26.1	0.0	49.5	0.0	1.8	28.4	0.0
	Sichuan	46.4	0.0	3.4	335.6	4.7	49.7	0.0	6.6	365.1	9.8
	Guizhou	102.9	0.0	6.8	96.9	0.0	110.2	0.0	13.2	105.4	0.0
	Yunnan	27.8	0.0	2.3	264.8	5.0	29.8	0.0	4.5	288.1	10.5
Total		4419.9	419.0	462.4	1328.5	197.5	4734.4	1019.5	901.0	1445.3	411.3

Table S5 Amount of energy water withdrawal in 2015, 2020, and 2030 under the five scenarios (billion cubic meters)

Region	Province	2015	2020					2030				
			S0	S1	S2	S3	S4	S0	S1	S2	S3	S4
North	Beijing	0.10	0.11	0.10	0.10	0.09	0.10	0.12	0.11	0.10	0.10	0.10
	Tianjin	0.34	0.36	0.16	0.33	0.14	0.15	0.39	0.17	0.33	0.14	0.15
	Hebei	0.51	0.54	0.40	0.49	0.36	0.38	0.58	0.47	0.50	0.41	0.42
	Shandong	1.08	1.14	1.14	1.03	1.03	1.14	1.22	1.22	1.05	1.05	1.22
Northeast	Liaoning	2.03	2.13	1.36	1.94	1.24	1.36	2.28	1.46	1.98	1.26	1.46
	Jilin	0.53	0.56	0.56	0.51	0.51	0.56	0.60	0.60	0.52	0.52	0.60
	Heilongjiang	1.23	1.29	0.77	1.18	0.70	0.77	1.38	0.83	1.20	0.71	0.83
Shanxi-InnerM	Shanxi	0.43	0.45	0.39	0.41	0.36	0.41	0.48	0.46	0.42	0.40	0.51
	Inner Mongolia	0.66	0.70	0.59	0.63	0.53	0.60	0.75	0.69	0.64	0.59	0.74
Northwest	Shaanxi	0.30	0.31	0.21	0.28	0.19	0.23	0.33	0.25	0.29	0.21	0.29
	Gansu	0.26	0.27	0.15	0.25	0.14	0.17	0.29	0.18	0.25	0.16	0.24
	Qinghai	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03	0.03
	Ningxia	0.20	0.21	0.16	0.19	0.15	0.18	0.22	0.19	0.19	0.17	0.24
	Xinjiang	0.64	0.68	0.34	0.61	0.31	0.36	0.72	0.39	0.63	0.31	0.44
Central	Anhui	2.53	2.65	2.65	2.41	2.41	2.65	2.84	2.84	2.46	2.46	2.84
	Jiangxi	2.48	2.66	1.11	2.43	1.02	1.11	3.02	1.36	2.64	1.21	1.36
	Henan	0.59	0.62	0.62	0.56	0.56	0.62	0.66	0.66	0.57	0.57	0.66
	Hubei	2.80	2.99	1.35	2.73	1.24	1.35	3.45	1.69	3.02	1.50	1.69
	Hunan	1.32	1.51	1.07	1.38	0.99	1.07	1.63	1.16	1.43	1.02	1.16
East coastal	Shanghai	3.44	3.61	2.45	3.29	2.23	2.34	3.87	2.63	3.35	2.27	2.34
	Jiangsu	12.07	12.67	12.67	11.53	11.53	12.07	13.57	13.57	11.73	11.73	12.07

	Zhejiang	7.34	7.71	6.92	7.02	6.30	6.59	8.26	7.41	7.14	6.41	6.59
South coastal	Fujian	1.13	1.19	1.19	1.09	1.09	1.19	1.28	1.28	1.11	1.11	1.28
	Guangdong	10.48	11.00	9.08	10.01	8.27	8.65	11.79	9.73	10.19	8.42	8.66
	Guangxi	1.53	1.61	0.32	1.46	0.29	0.32	1.73	0.35	1.49	0.30	0.35
	Hainan	0.05	0.06	0.06	0.05	0.05	0.06	0.06	0.06	0.05	0.05	0.06
Southwest	Chongqing	1.37	1.43	0.27	1.31	0.25	0.27	1.54	0.29	1.33	0.25	0.29
	Sichuan	0.26	0.27	0.27	0.25	0.25	0.27	0.29	0.29	0.25	0.25	0.29
	Guizhou	0.23	0.24	0.60	0.22	0.55	0.60	0.26	0.65	0.23	0.56	0.65
	Yunnan	0.10	0.10	0.16	0.09	0.15	0.16	0.11	0.17	0.09	0.15	0.17
Total		56.06	59.10	47.17	53.82	42.96	45.77	63.75	51.19	55.21	44.33	47.72

Table S6 Amount of energy water consumption in 2015, 2020, and 2030 under the five scenarios (billion cubic meters)

Region	Province	2015	2020					2030				
			S0	S1	S2	S3	S4	S0	S1	S2	S3	S4
North	Beijing	0.08	0.08	0.08	0.07	0.07	0.08	0.09	0.09	0.07	0.07	0.08
	Tianjin	0.11	0.12	0.12	0.11	0.11	0.12	0.13	0.13	0.11	0.11	0.12
	Hebei	0.41	0.43	0.29	0.39	0.26	0.27	0.46	0.35	0.40	0.30	0.31
	Shandong	0.85	0.89	0.89	0.81	0.81	0.89	0.96	0.96	0.83	0.83	0.96
Northeast	Liaoning	0.23	0.24	0.26	0.22	0.23	0.26	0.26	0.28	0.23	0.24	0.28
	Jilin	0.10	0.10	0.10	0.10	0.10	0.10	0.11	0.11	0.10	0.10	0.11
	Heilongjiang	0.13	0.14	0.14	0.12	0.13	0.14	0.15	0.15	0.13	0.13	0.15
Shanxi-InnerM	Shanxi	0.29	0.31	0.25	0.28	0.23	0.26	0.33	0.30	0.28	0.26	0.34
	Inner Mongolia	0.51	0.54	0.38	0.49	0.35	0.40	0.58	0.47	0.50	0.40	0.50
Northwest	Shaanxi	0.21	0.22	0.12	0.20	0.11	0.13	0.23	0.15	0.20	0.13	0.18
	Gansu	0.12	0.13	0.11	0.12	0.10	0.12	0.14	0.13	0.12	0.11	0.17
	Qinghai	0.02	0.02	0.02	0.02	0.02	0.02	0.03	0.03	0.02	0.02	0.03
	Ningxia	0.15	0.16	0.10	0.15	0.09	0.12	0.17	0.13	0.15	0.11	0.16
	Xinjiang	0.38	0.40	0.21	0.36	0.19	0.22	0.43	0.26	0.37	0.22	0.29
Central	Anhui	0.34	0.35	0.35	0.32	0.32	0.35	0.38	0.38	0.33	0.33	0.38
	Jiangxi	0.11	0.17	0.19	0.16	0.18	0.19	0.31	0.34	0.30	0.32	0.34
	Henan	0.47	0.49	0.49	0.45	0.45	0.49	0.53	0.53	0.46	0.46	0.53
	Hubei	0.14	0.19	0.21	0.18	0.20	0.21	0.40	0.42	0.37	0.40	0.42
	Hunan	0.11	0.22	0.23	0.21	0.22	0.23	0.25	0.25	0.23	0.23	0.25
East coastal	Shanghai	0.10	0.10	0.12	0.09	0.11	0.12	0.11	0.13	0.10	0.11	0.12
	Jiangsu	0.60	0.63	0.63	0.57	0.57	0.60	0.67	0.67	0.58	0.58	0.60

	Zhejiang	0.32	0.33	0.34	0.30	0.31	0.33	0.36	0.37	0.31	0.32	0.33
South coastal	Fujian	0.19	0.20	0.20	0.19	0.19	0.20	0.22	0.22	0.19	0.19	0.22
	Guangdong	0.40	0.42	0.45	0.38	0.41	0.43	0.46	0.49	0.39	0.42	0.43
	Guangxi	0.08	0.08	0.10	0.07	0.09	0.10	0.09	0.11	0.08	0.10	0.11
	Hainan	0.04	0.05	0.05	0.04	0.04	0.05	0.05	0.05	0.04	0.04	0.05
Southwest	Chongqing	0.06	0.07	0.08	0.06	0.08	0.08	0.07	0.09	0.06	0.08	0.09
	Sichuan	0.08	0.09	0.09	0.08	0.08	0.09	0.09	0.09	0.08	0.08	0.09
	Guizhou	0.19	0.19	0.19	0.18	0.17	0.19	0.21	0.20	0.18	0.17	0.20
	Yunnan	0.05	0.05	0.05	0.05	0.05	0.05	0.06	0.05	0.05	0.05	0.05
Total		6.87	7.41	6.87	6.77	6.27	6.84	8.30	7.93	7.25	6.93	7.88