Transition of the Chinese Economy in the Face of Deep Greenhouse Gas Emissions Cuts in the Future

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Energy Research Institute, China

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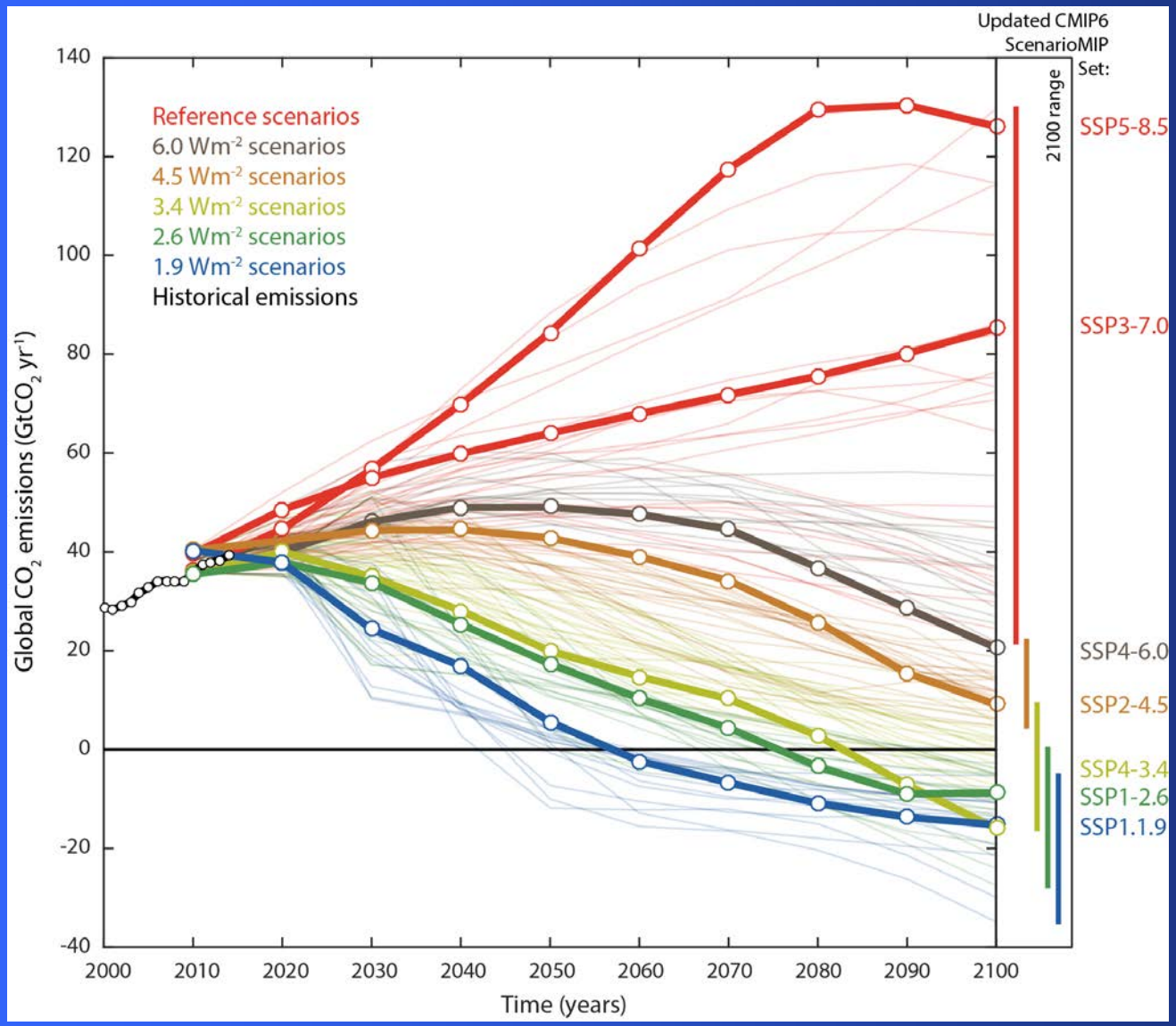
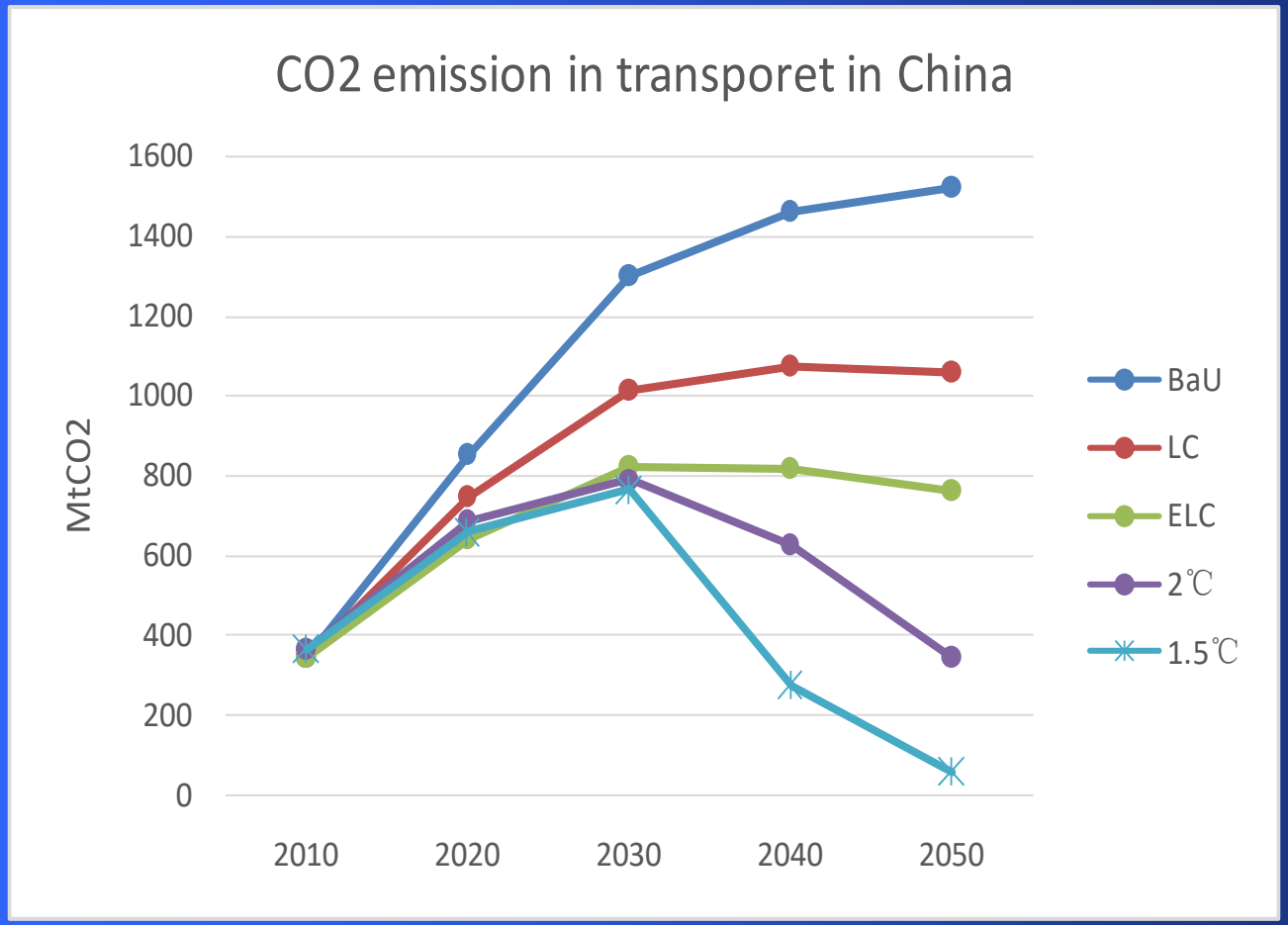
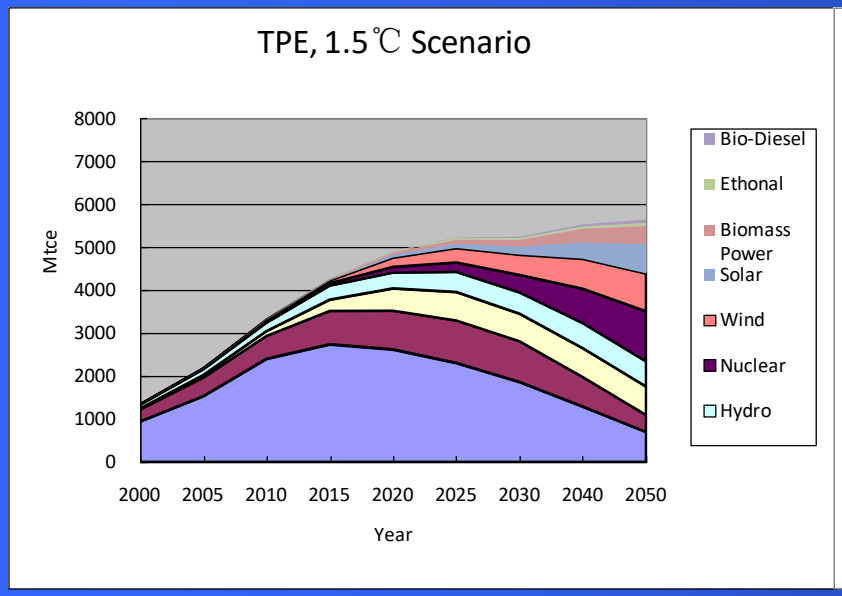
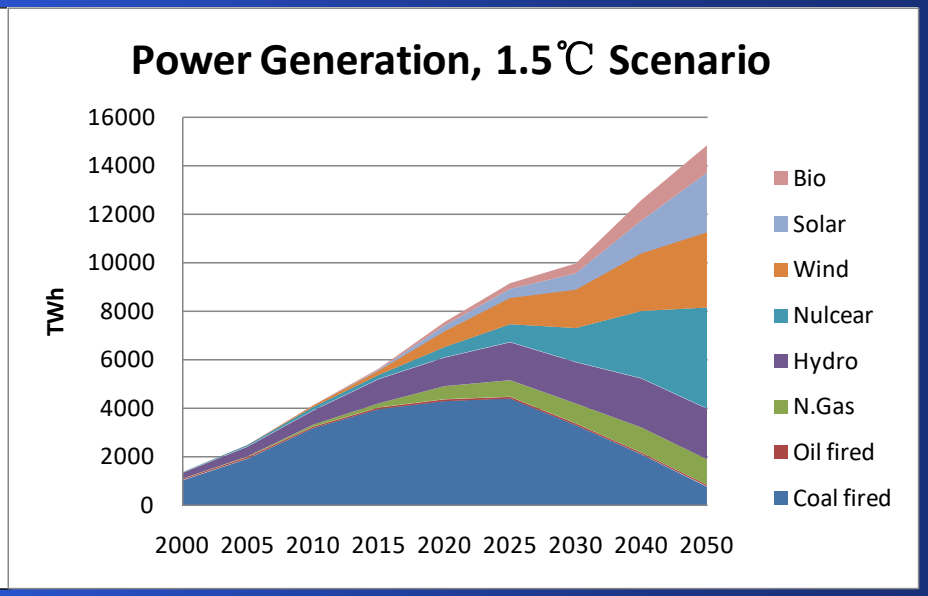
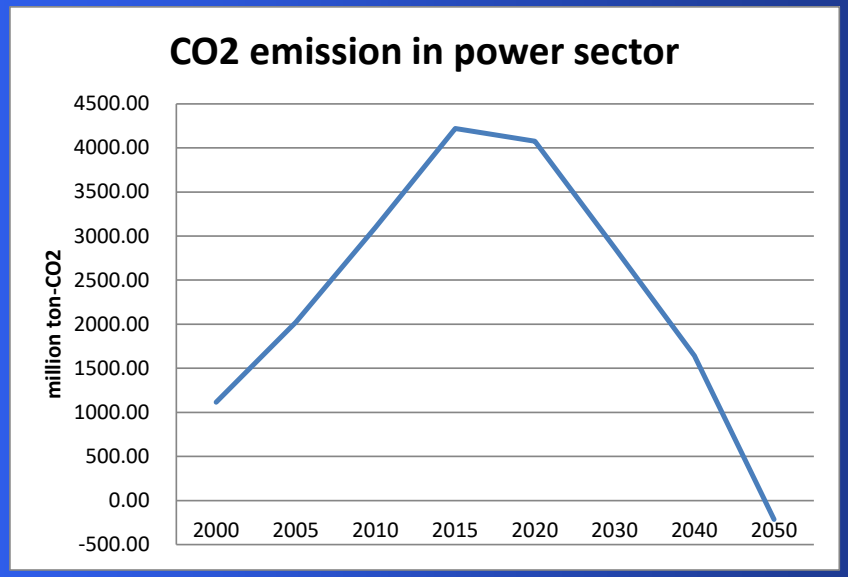
Global CO2 Emissions, IPCC 1.5C Report




CO2 emission in transporet in China
MtCO2
1600
1400
1200
1000
800
600
400
200
0
2010
2020
2030
2040
2050
BaU
LC
ELC
2℃
1.5℃

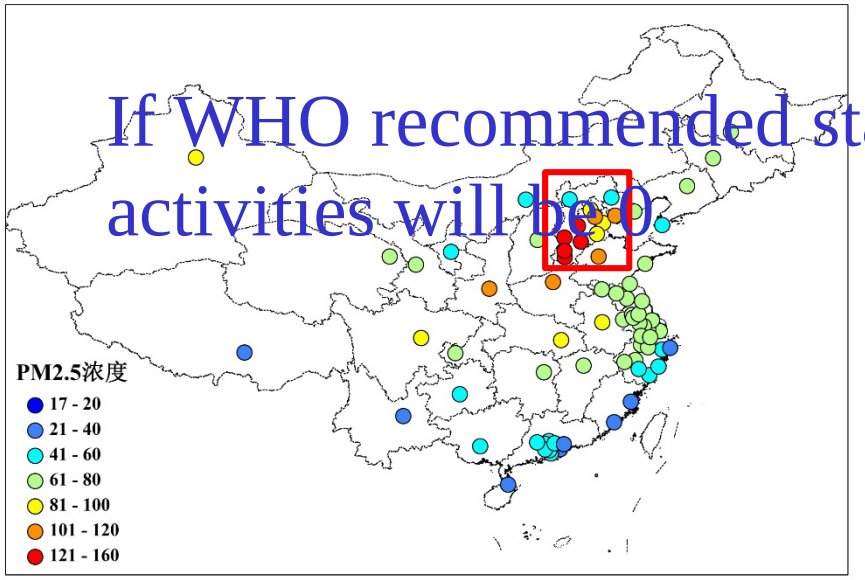

TPE, 1.5℃ Scenario
Mtce
8000
7000
6000
5000
4000
3000
2000
1000
0
2000
2005
2010
2015
2020
2025
2030
2040
2050
Year
Bio-Diesel
Ethonal
Biomass Power
Solar
Wind
Nuclear
Hydro


Power Generation, 1.5℃ Scenario
TWh
16000
14000
12000
10000
8000
6000
4000
2000
0
2000
2005
2010
2015
2020
2025
2030
2040
2050
Bio
Solar
Wind
Nulcear
Hydro
N.Gas
Oil fired
Coal fired

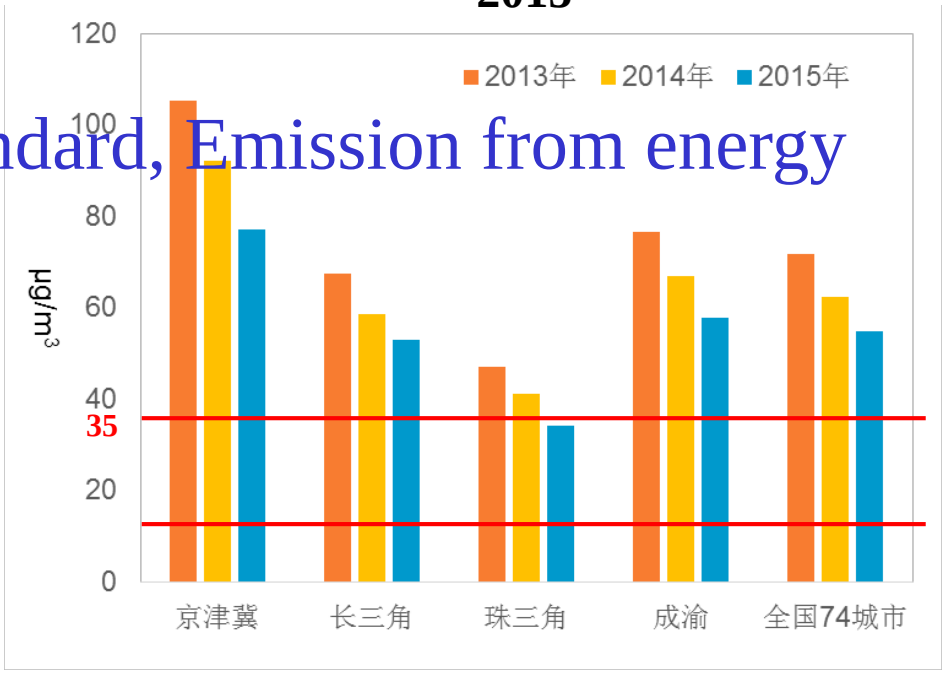

CO2 emission in power sector
million ton-CO2
4500.00
4000.00
3500.00
3000.00
2500.00
2000.00
1500.00
1000.00
500.00
0.00
-500.00
2000
2005
2010
2015
2020
2030
2040
2050

$PM_{2.5}$ Concentration is much higher than standard

PM2.5 concentration of 74 cities in 2013



PM2.5 annual concentration from 2013-2015



If WHO recommended standard, Emission from energy activities will be 0.

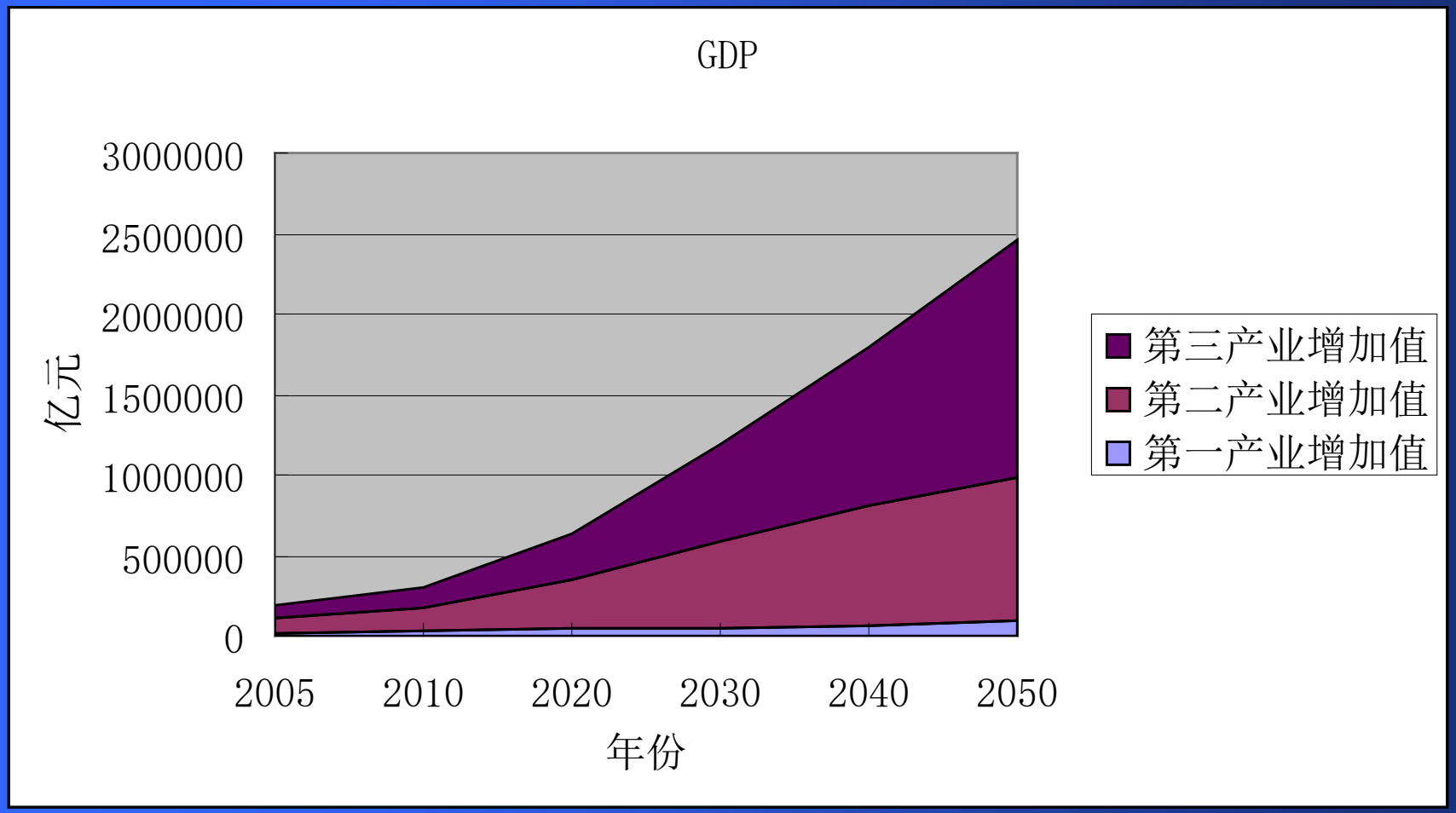
- 2013年京津冀地区所有城市$PM_{2.5}$年均浓度均超标，区域内$PM_{2.5}$年平均浓度达106μg/m³，虽2014、2015年空气质量有所改善，但仍大幅超过国家空气质量二级标准。

SUSTAINABLE DEVELOPMENT GOALS

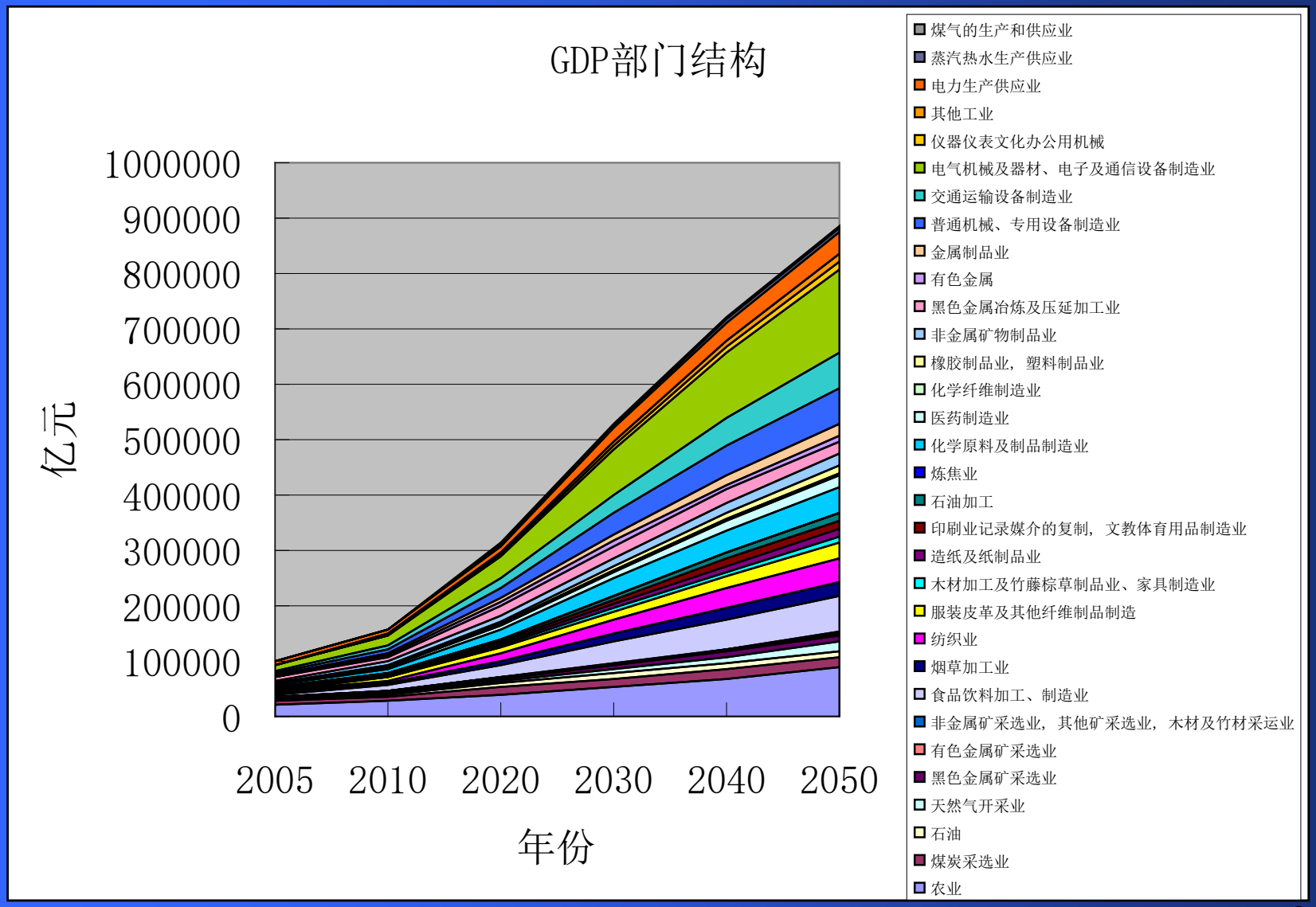
Ways from deep cut of GHGs on impacting economy development

- Overall impact in economic development pattern
- Energy supply industry will have strong transition
- Transition in end use sector
- New manufactures process in some sectors
- Mitigation of GHGs may increase GDP in China
- China’s oversea investment are increasing rapidly

GDP in China, IPAC output



GDP by sectors

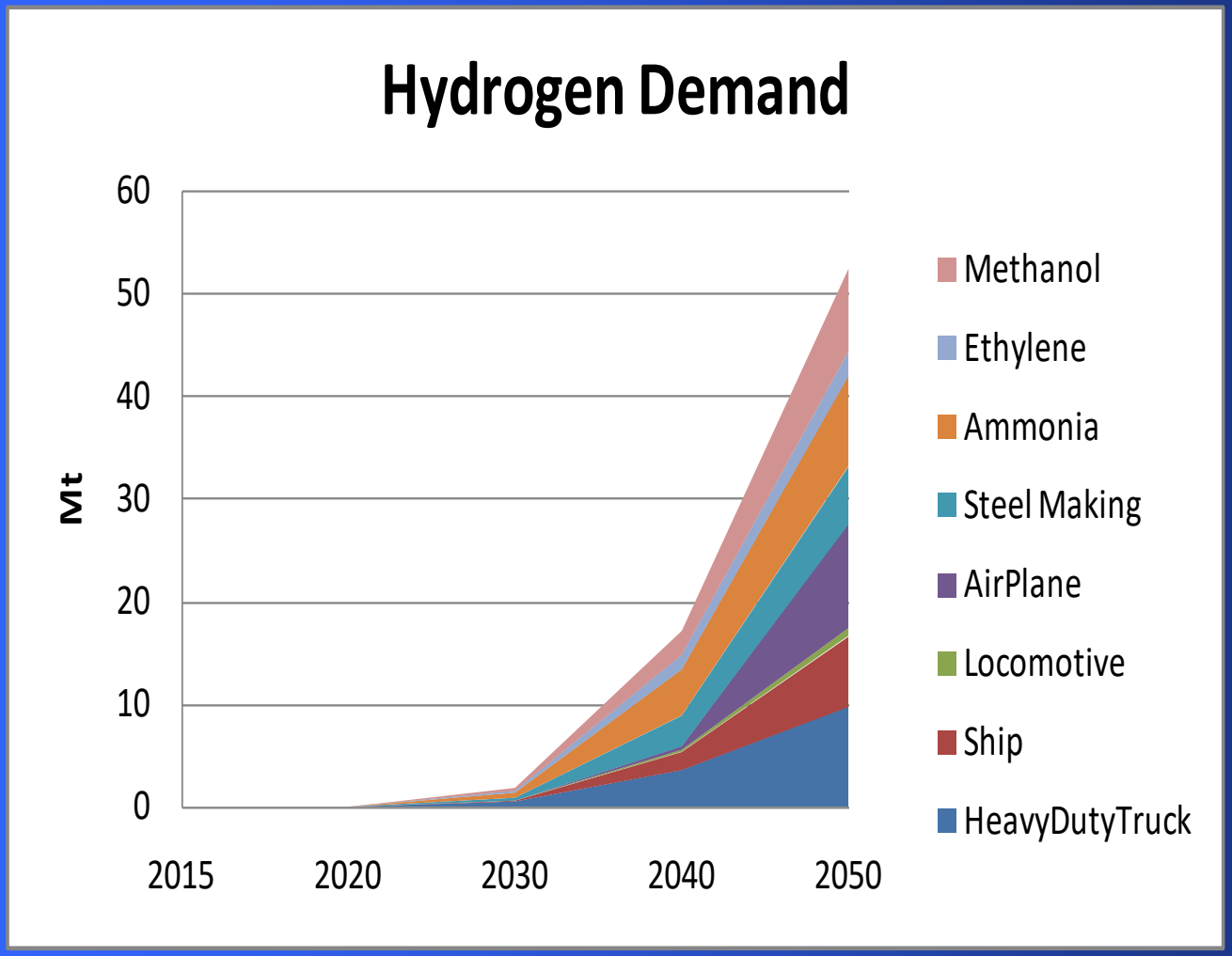


Significant Transition in Industry Sectors and Transport: Hydrogen Based Process

- Steel making
- Ammonia
- Benzene
- Ethylene
- Methanol
- Clinker
- Heavy Duty transport and air plane

Industry: Course changing? Hydrogen!

Sector	Activities
Transport	Heavy-duty truck
	Railway locomotives
	Ship
	Airplane
Industry	Steelmaking
	Ammonia
	Ethylene
	Methanol


Hydrogen Demand
Mt
60
50
40
30
20
10
0
2015
2020
2030
2040
2050
Methanol
Ethylene
Ammonia
Steel Making
AirPlane
Locomotive
Ship
HeavyDutyTruck

The Economy development map will be changed by location of very cheap renewable energy or nuclear?

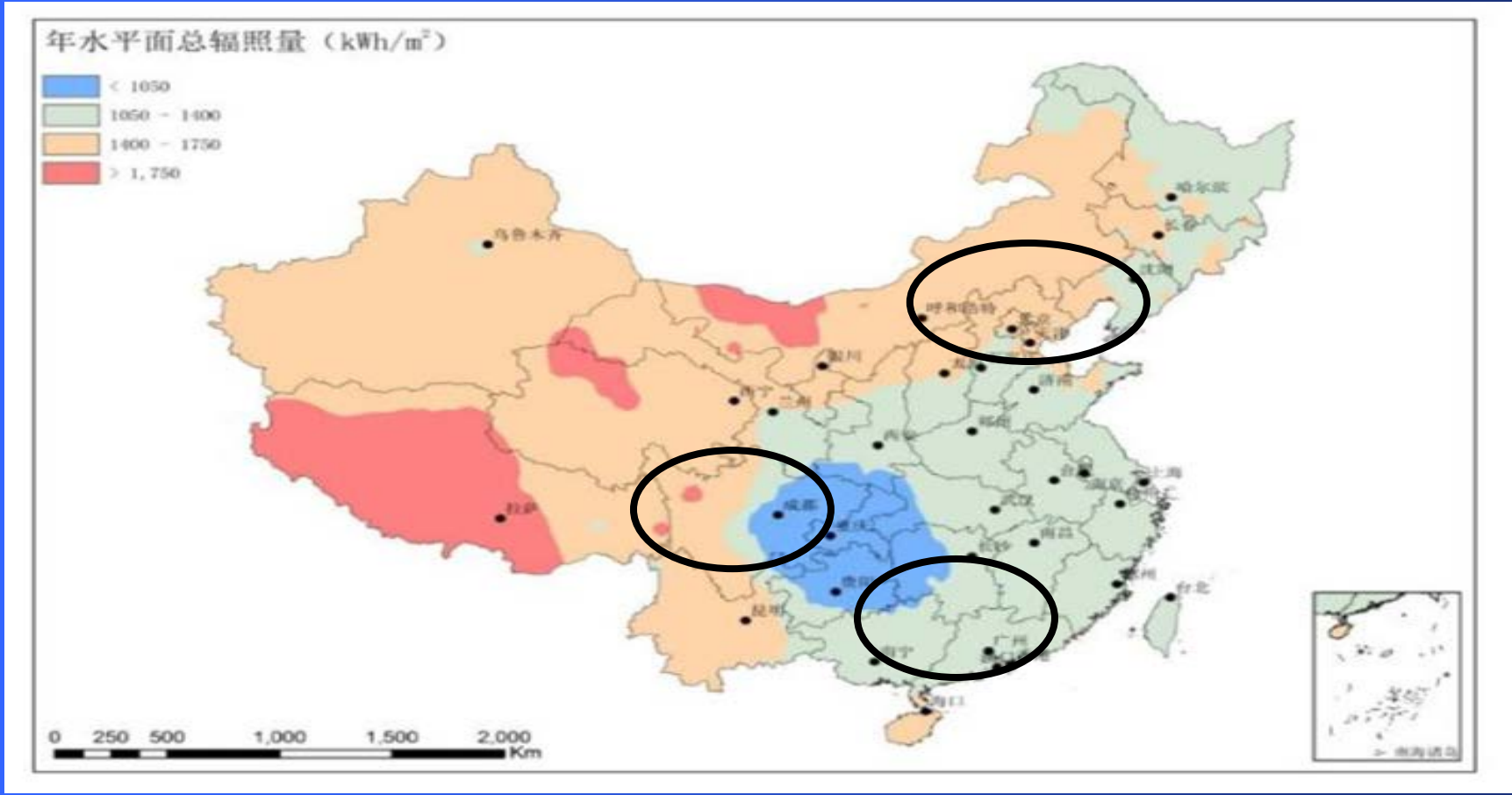


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Figure 13. Solar PV Capacity and Additions, Top 10 Countries, 2013

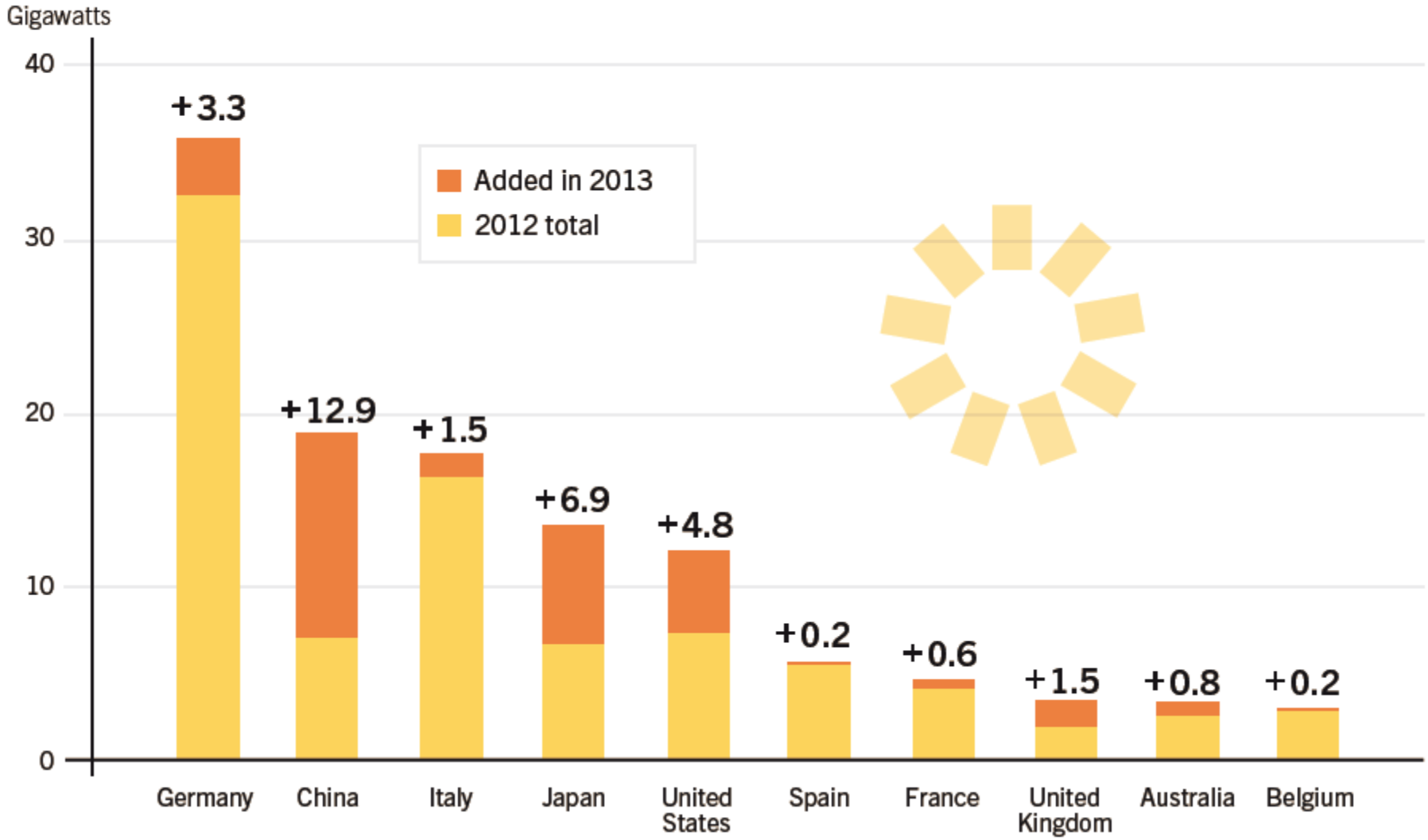

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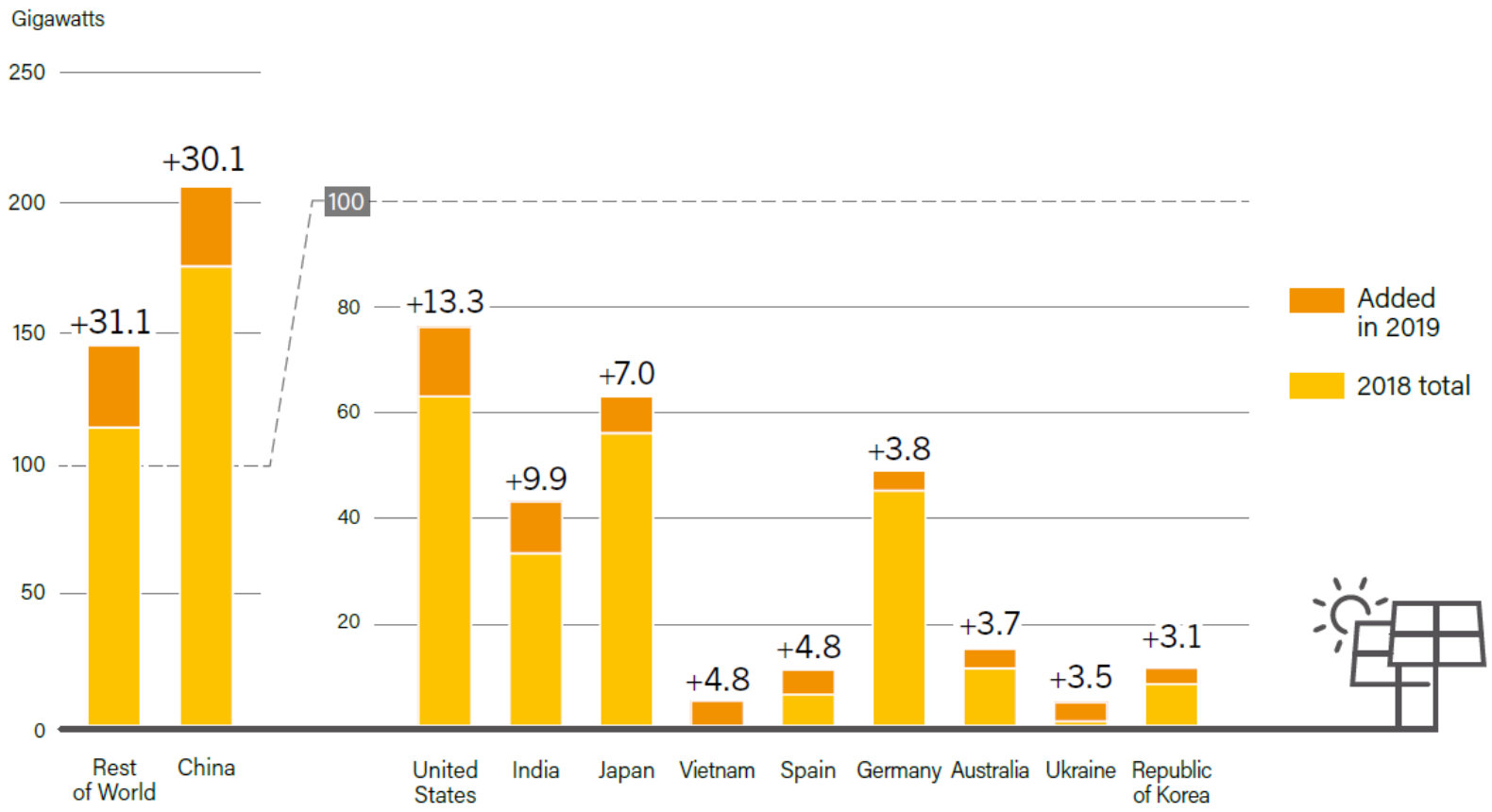
FIGURE 30. Solar PV Capacity and Additions, Top 10 Countries for Capacity Added, 2019



Note: Data are provided in direct current (DC).

Source: See endnote 27 for this section.

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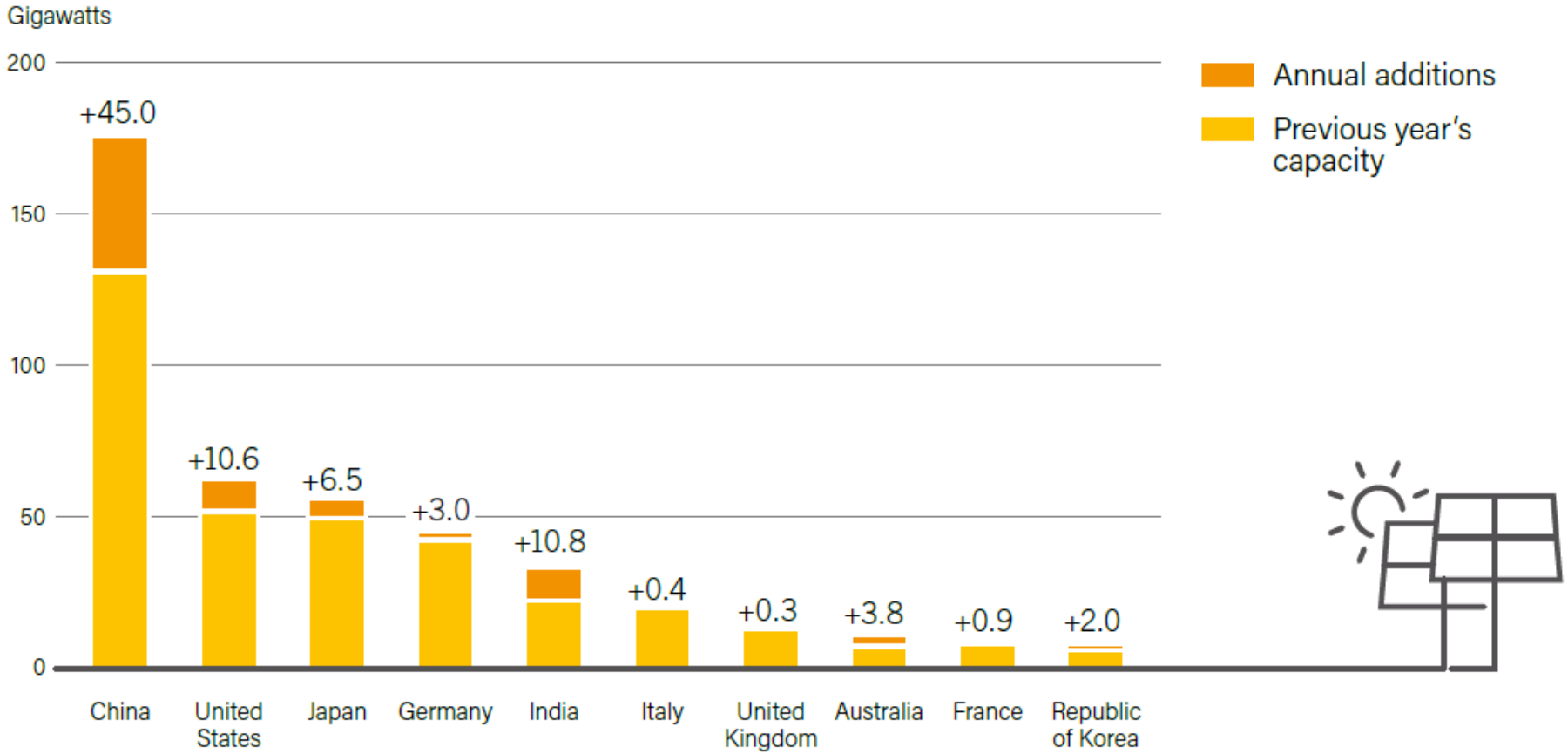
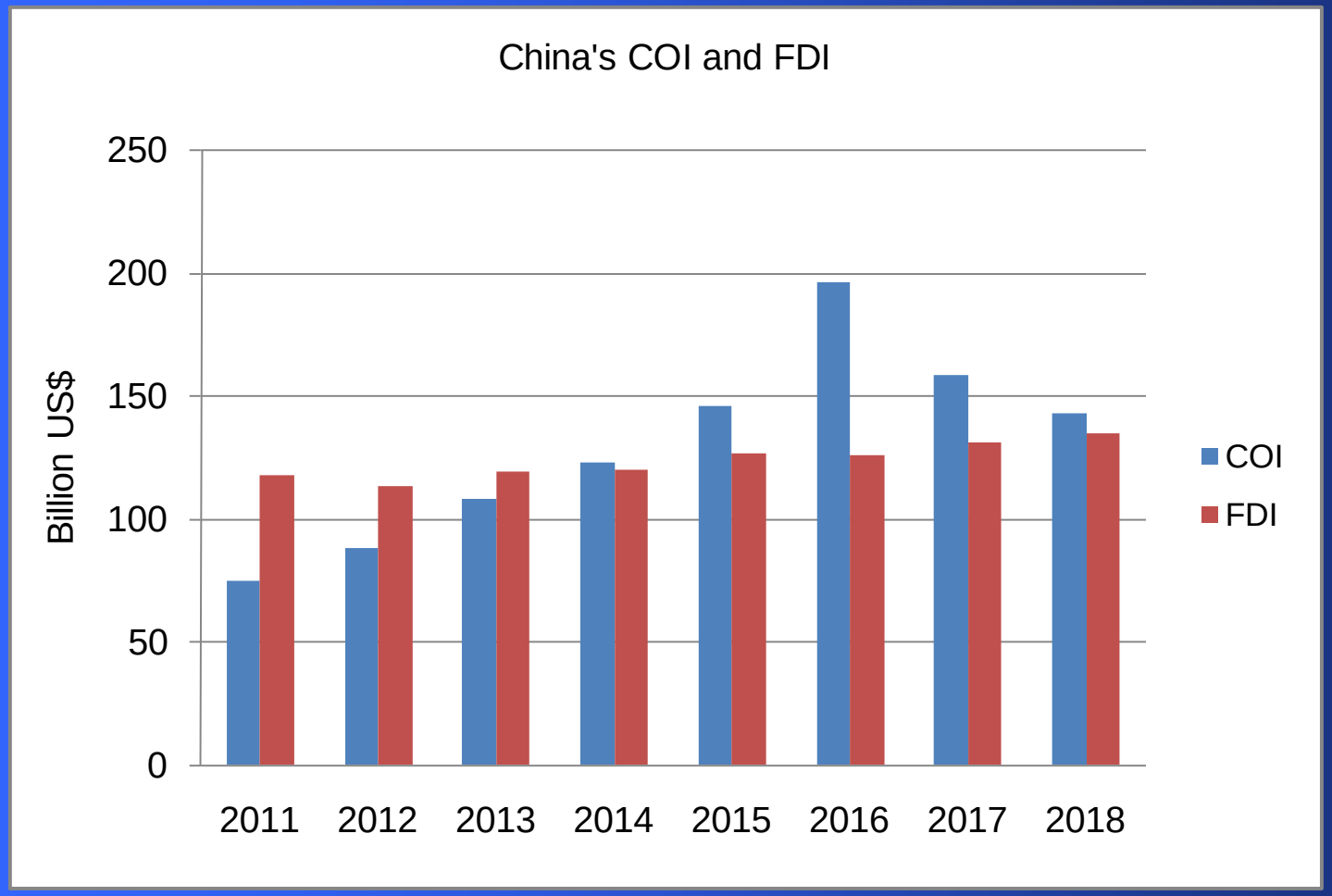
FIGURE 27. Solar PV Capacity and Additions, Top 10 Countries, 2018

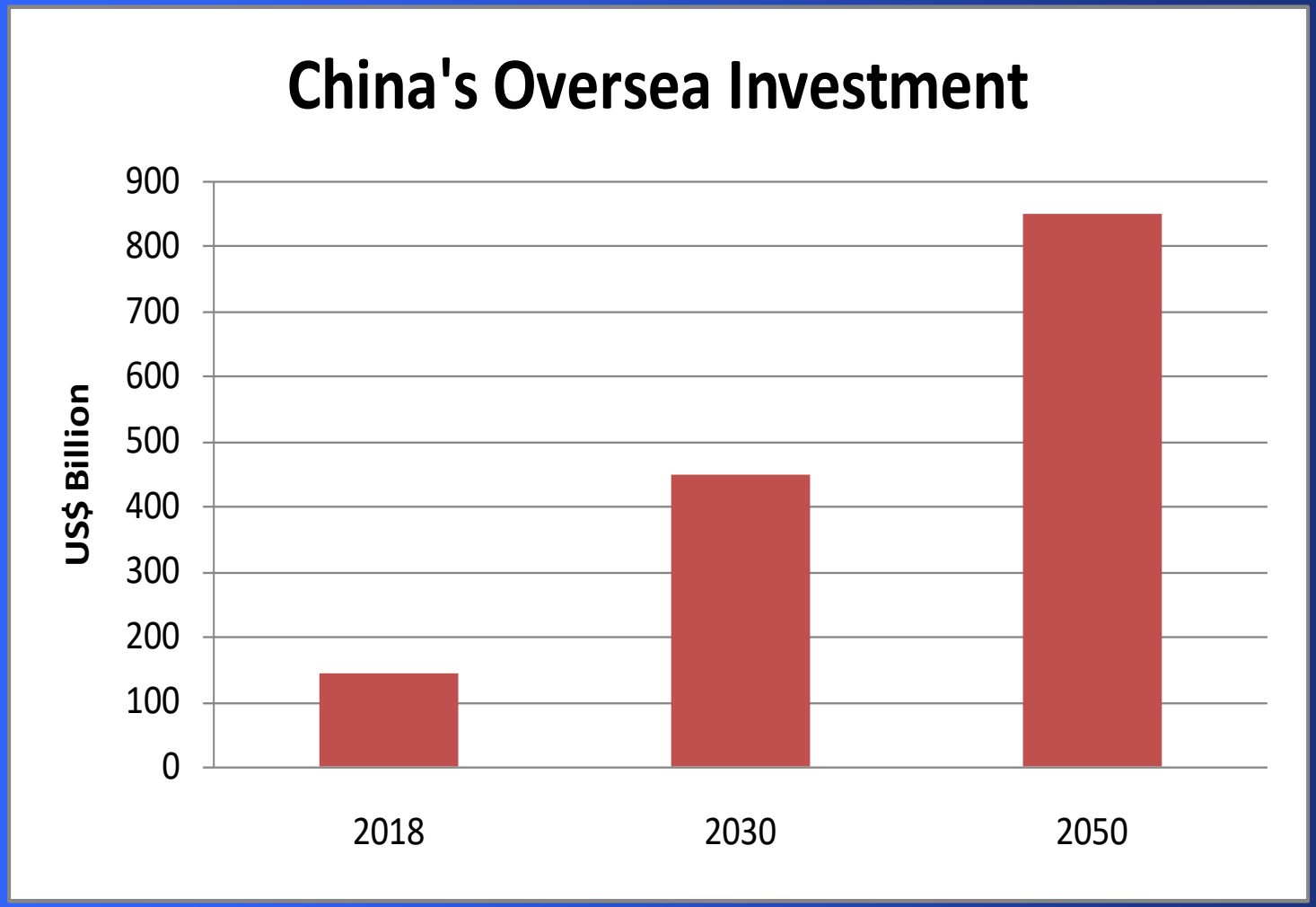


Note: Data are provided in direct current (DC).
Data for India are highly uncertain.

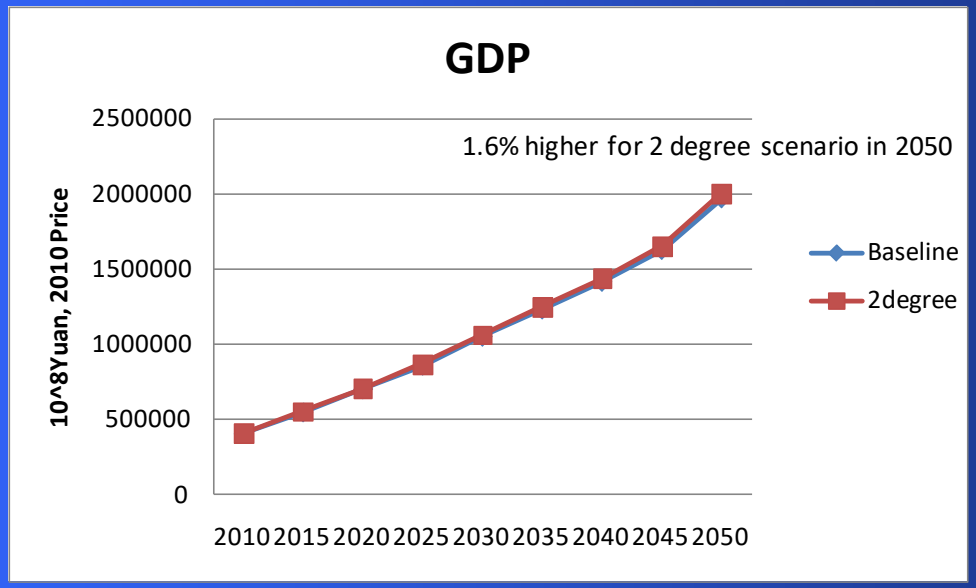
Source: See endnote 23 for this section.

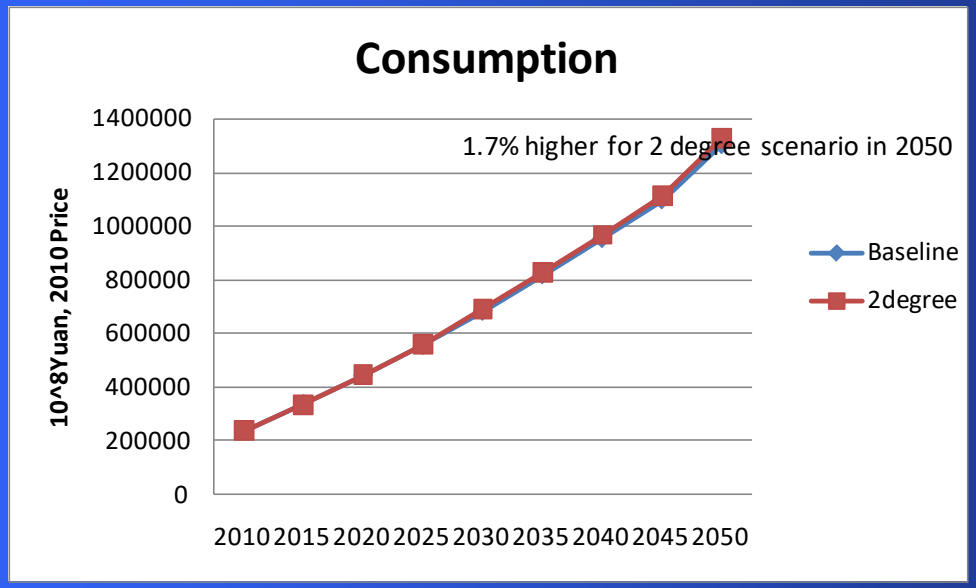
New Battery for vehicles and power storage


China's COI and FDI
Billion US$
250
200
150
100
50
0
2011
2012
2013
2014
2015
2016
2017
2018
COI
FDI


China's Oversea Investment
US$ Billion
900
800
700
600
500
400
300
200
100
0
2018
2030
2050

Mitigation Would Increase GDP!





No carbon pricing needed after 2020

Thanks!

Paper accepted in Asian Economic Policy Review

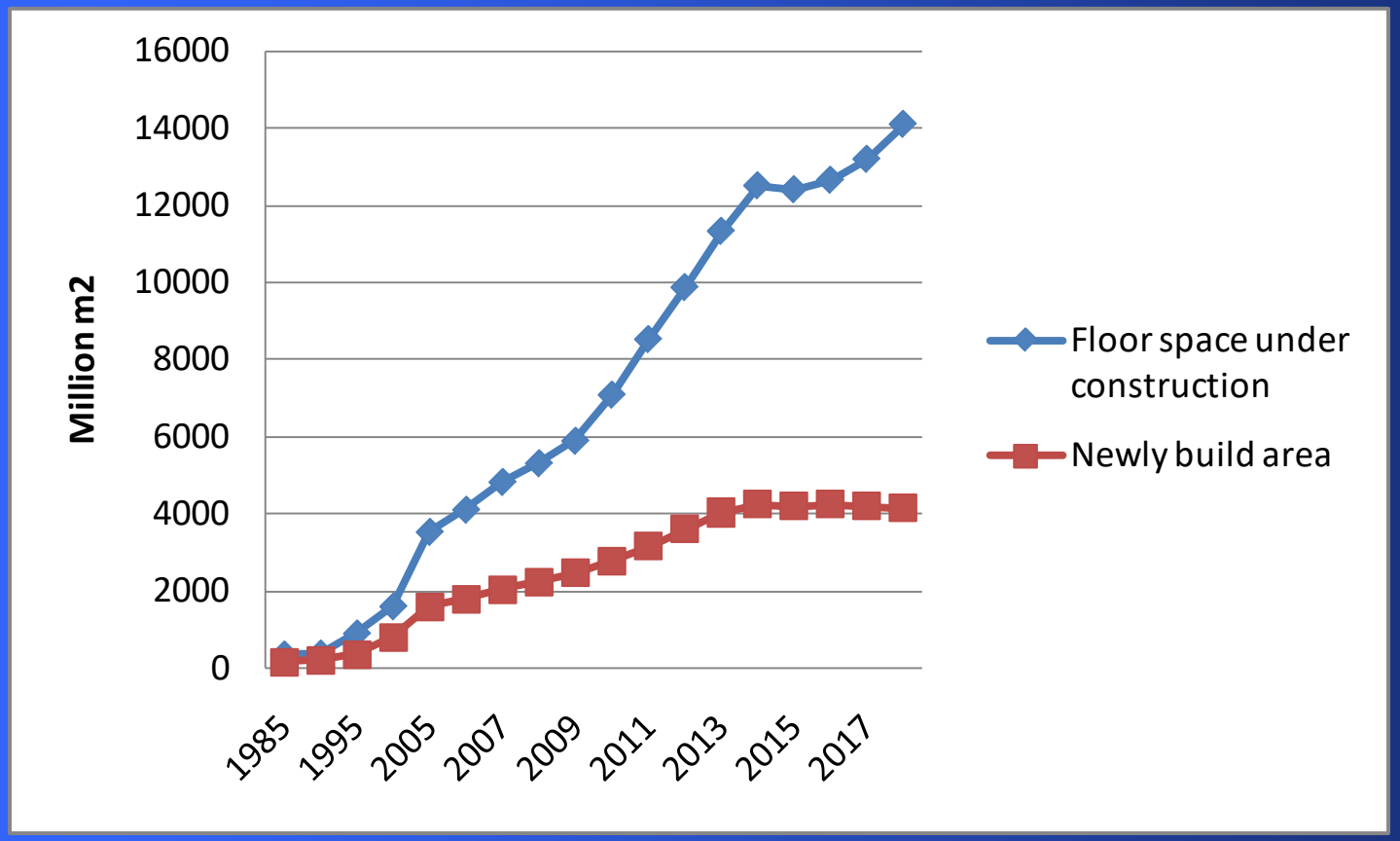
Products output in major sectors

	Unit	2005	2020	2030	2040	2050
Steel	Million ton	355	610	570	440	360
Cement	Million ton	1060	1600	1600	1200	900
Glass	Million cases	399	650	690	670	580
Copper	Million ton	2.6	7	7	6.5	4.6
Ammonia	Million ton	8.51	16	16	15	12
Ethylene	Million ton	5.1	7.2	7	6.5	5.5
Soda Ash	Million ton	14.67	23	24.5	23.5	22
Casutic	Million ton	12.64	24	25	25	24
Paper	Million ton	62.05	110	115	120	120
Fertilize	Million ton	52.2	61	61	61	61
Aluminum	Million ton	7.56	34	36	36	33
Paper	Million ton	46.3	50	50	50	45
Calcium c	Million ton	8.5	10	8	7	4

Products output in major sectors, setup in 2018 in IPAC

Product	Unit	**2005**	**2010**	**2014**	**2018**	**2020**	**2030**	**2040**	**2050**
Steel	Million ton	3.55	6.27	8.13	9.28	7.1	5.7	4.4	3.6
Cement	Million ton	10.6	18.68	24.9	23.6	22	16	12	9
Glass	Million cases	3.99	5.8	8.31	8.68	7.4	6.9	6.7	5.8
Copper	Million ton	260	479	795		760	700	650	460
Ammonia	Million ton	851	1695	2438		2500	1700	1500	1200
Ethylene	Million ton	510		1005		1000	700	650	550
Soda Ash	Million ton	1467		2525	2620	2500	2450	2350	2200
Caustic	Million ton	1264		3063	3420	3000	2500	2500	2400
Paper	Million ton	6205	9270	11785	11600	11000	11000	10500	10000
Fertilizer	Million ton	5220		6876	5418	6400	5900	5600	5300
Aluminum	Million ton	756		1696	1840	2400	2300	2300	2300
Paper	Million ton	4630		5699		5200	5000	5000	4500
Calcium carbide	Million ton	850				2200	1600	1100	700

Newly Build Building Floor Space in China



Products output in China and their share in the world

	2009			2018	
	Output	Unit	Share in the world	Output	Share in the world
Raw steel	568	million ton	46.6%	982.3	51.3%
Cement	1630	million ton	51%	22100	55.95%
Glass	580	million ton	50%	868.63	50%
Chemical fiber	27.3	million ton	57%	50.111	68.27%
Aluminum	12.8	million ton	60%	35.8	55.64%
Copper	4.13	million ton	25%	9.03	35%
Cloth	74000	million ton meter		65726	>50%
Coal	3050	million ton	45%	3680	46%
Fertilizer	66	million ton	35%	54.59	
Plastic	44.8	million ton		60.42	17.8%
Automobile	13.8	Million	25%	1798.4	>90%
Ship	42.43	million carrying ton	34.8%	34.58	36.3%
Computer	182	million	60%	351.92	>90%
Refrigerator	59.3	Million	60%	78.77	>50%
TV	98.99	Million	48%	203.81	>70%
Air Conditioner	80.78	Million	70%	2048	0.75%
Washing Machine	49.45	Million	40%	71.51	>50%
Mobile phone	619	Million	50%	1800	90%
Microwave oven	60.38	Million	70%	62.72	0.75%
Shoes		Million shoes		24200	55.8%