Energy and Economic Transition with Carbon Neutrality in China

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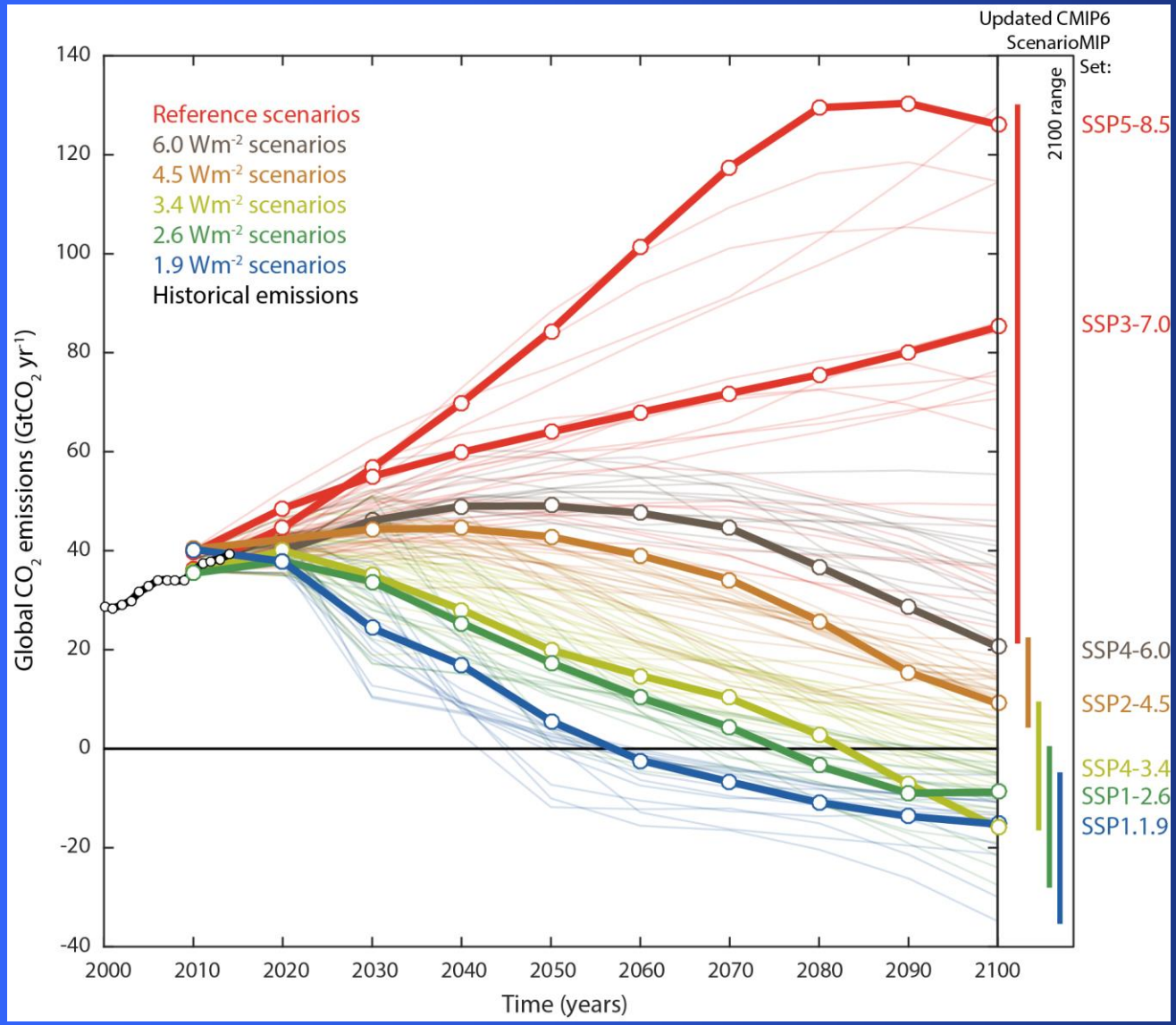
Global CO2 Emissions, IPCC 1.5C Report



China’s Targets

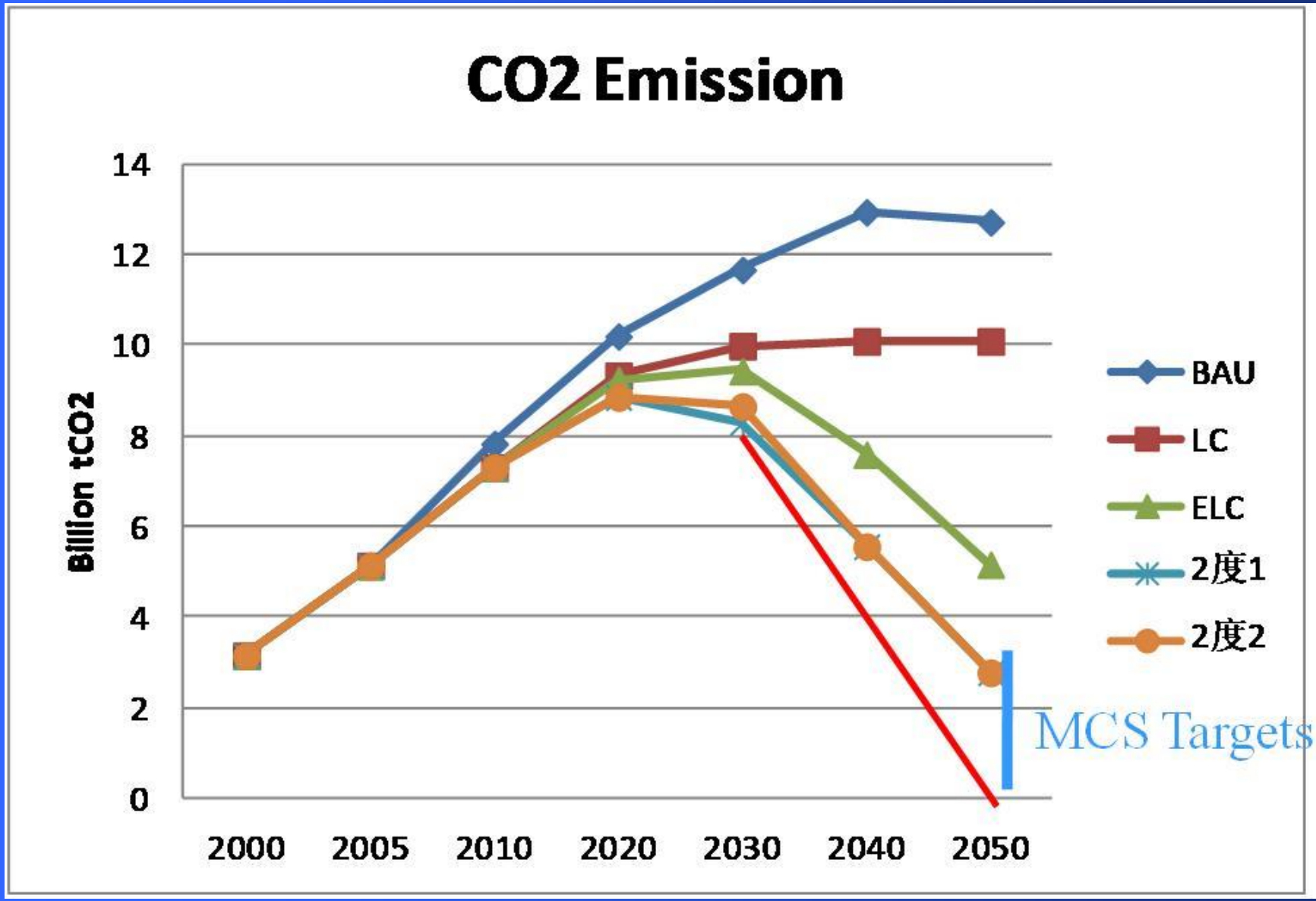
In Sep.22, 2020, President Xi Jinping announced that China’s CO2 emission will peak before 2030, and will make effort to be carbon neutrality before 2060 in China

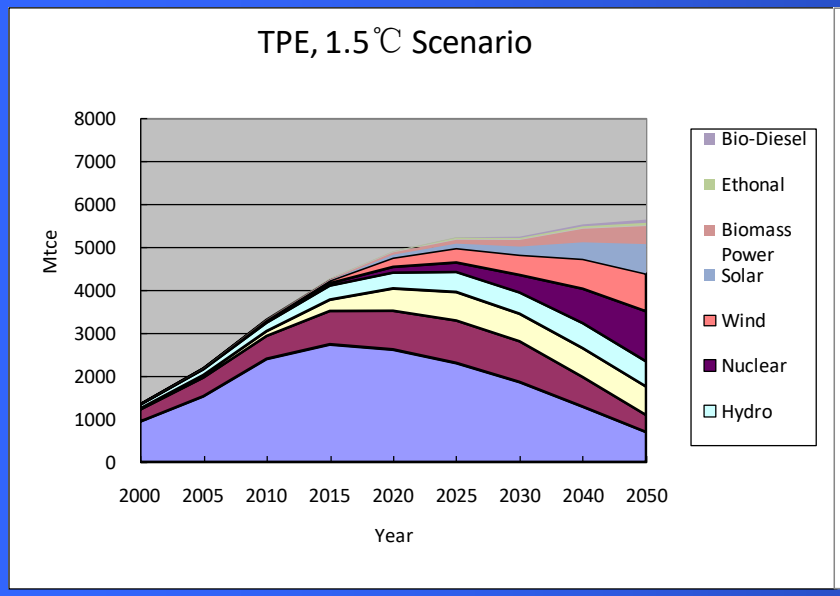
We are here: carbon neutral in line with 1.5℃

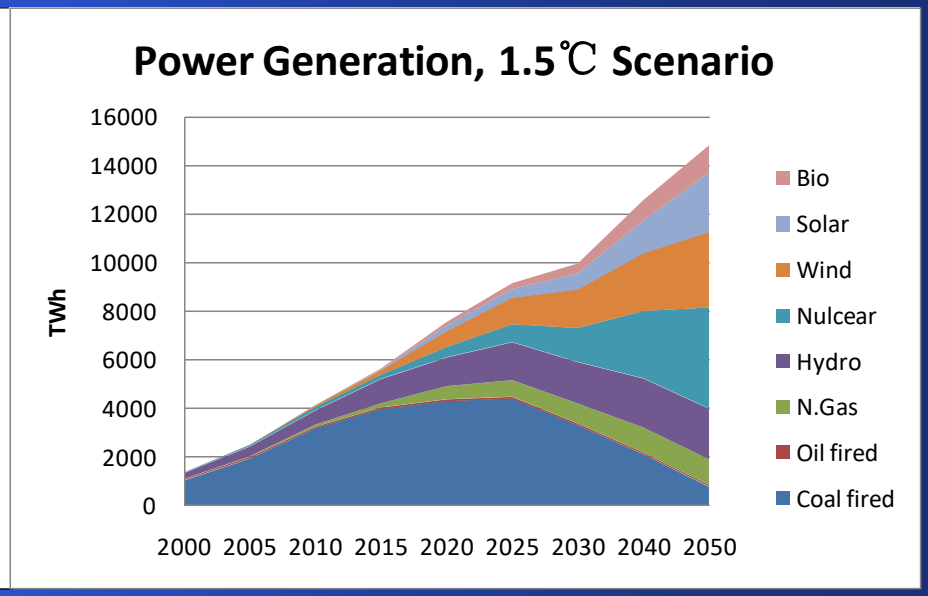
- EU
- Canada
- China
- Japan
- Korea
- South Africa
- US(coming soon)

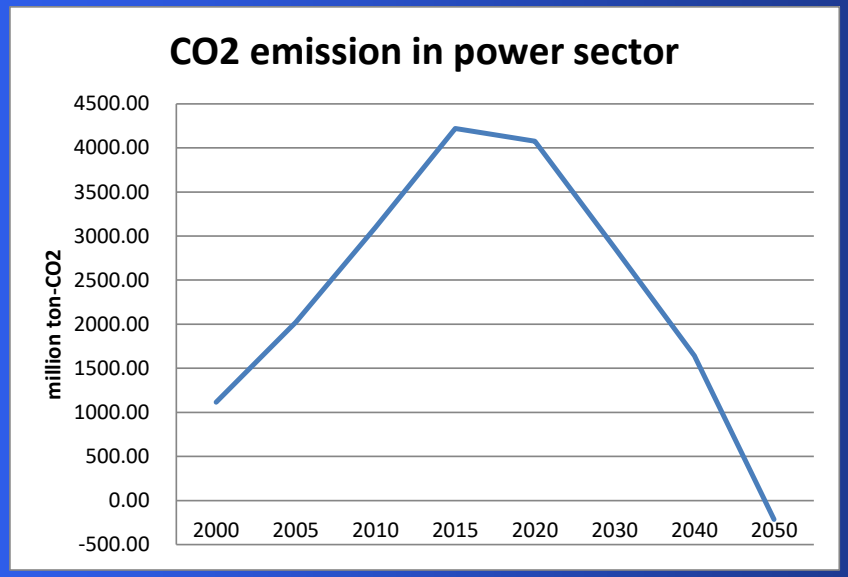
We are here: more than 65% CO2 emission countries

- Technology leading countries are targeting on carbon neutral
- Companies are setting up target for carbon neutral
- Then almost all countries will be carbon neutral


CO2 Emission
Billion tCO2
14
12
10
8
6
4
2
0
2000
2005
2010
2020
2030
2040
2050
BAU
LC
ELC
2度1
2度2
MCS Targets

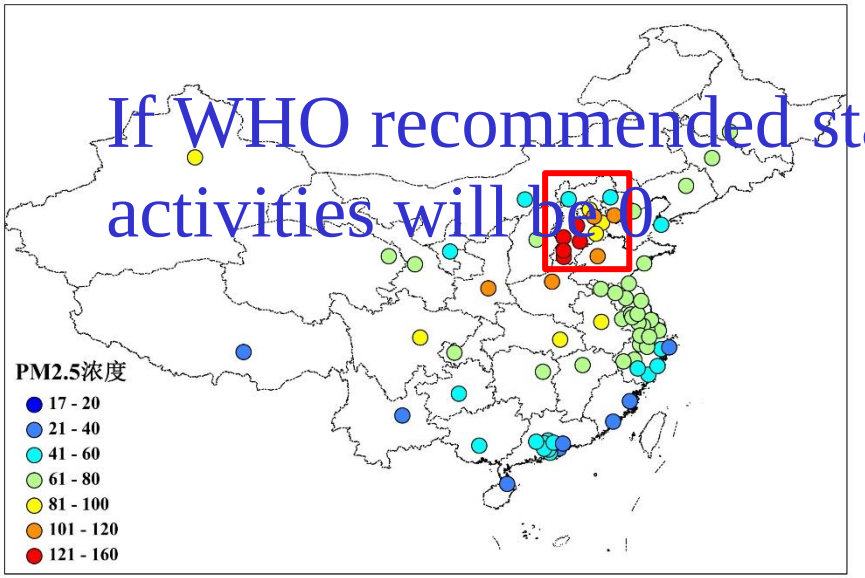

TPE, 1.5℃ Scenario
Mtce
8000
7000
6000
5000
4000
3000
2000
1000
0
2000 2005 2010 2015 2020 2025 2030 2040 2050
Year
Bio-Diesel
Ethonal
Biomass
Power
Solar
Wind
Nuclear
Hydro


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

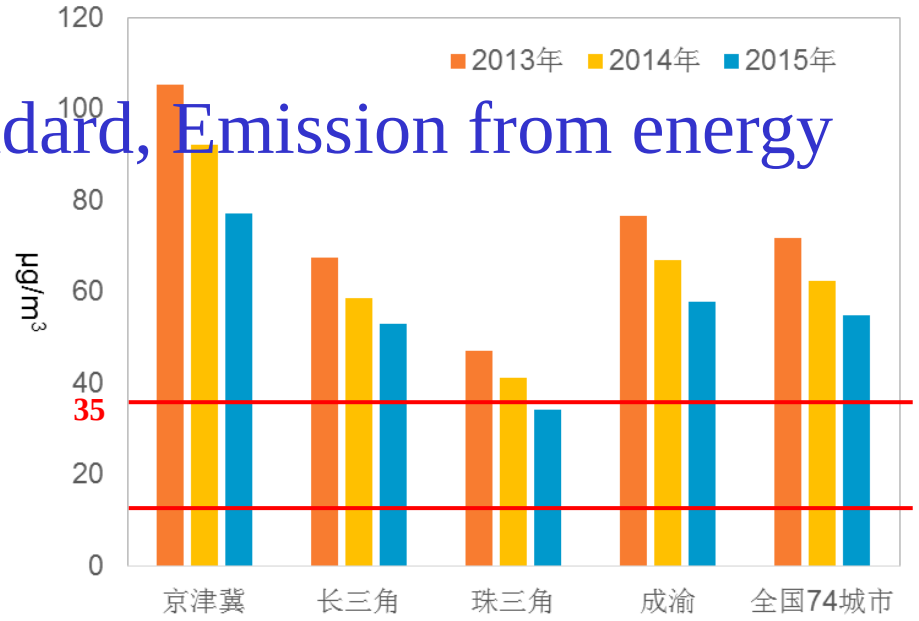

CO2 emission in power sector
million ton-CO2
4500.00
4000.00
3500.00
3000.00
2500.00
2000.00
1500.00
1000.00
500.00
0.00
-500.00
2000 2005 2010 2015 2020 2030 2040 2050

$PM_{2.5}$ 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。

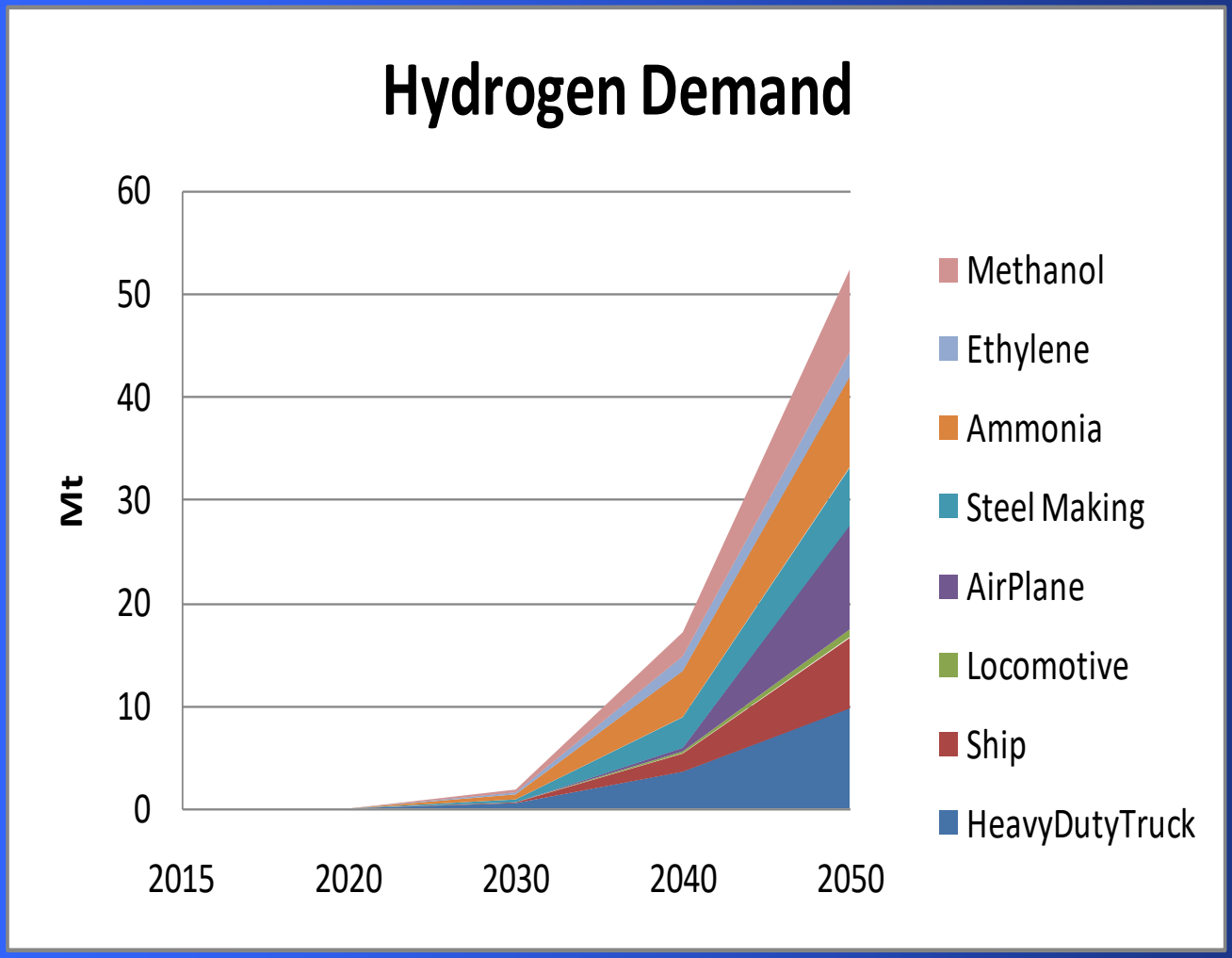

SUSTAINABLE DEVELOPMENT GOALS
1 NO POVERTY
2 ZERO HUNGER
3 GOOD HEALTH AND WELL-BEING
4 QUALITY EDUCATION
5 GENDER EQUALITY
6 CLEAN WATER AND SANITATION
7 AFFORDABLE AND CLEAN ENERGY
8 DECENT WORK AND ECONOMIC GROWTH
9 INDUSTRY, INNOVATION AND INFRASTRUCTURE
10 REDUCED INEQUALITIES
11 SUSTAINABLE CITIES AND COMMUNITIES
12 RESPONSIBLE CONSUMPTION AND PRODUCTION
13 CLIMATE ACTION
14 LIFE BELOW WATER
15 LIFE ON LAND
16 PEACE, JUSTICE AND STRONG INSTITUTIONS
17 PARTNERSHIPS FOR THE GOALS
SUSTAINABLE DEVELOPMENT GOALS

Ways from deep cut of GHGs on impacting economy development

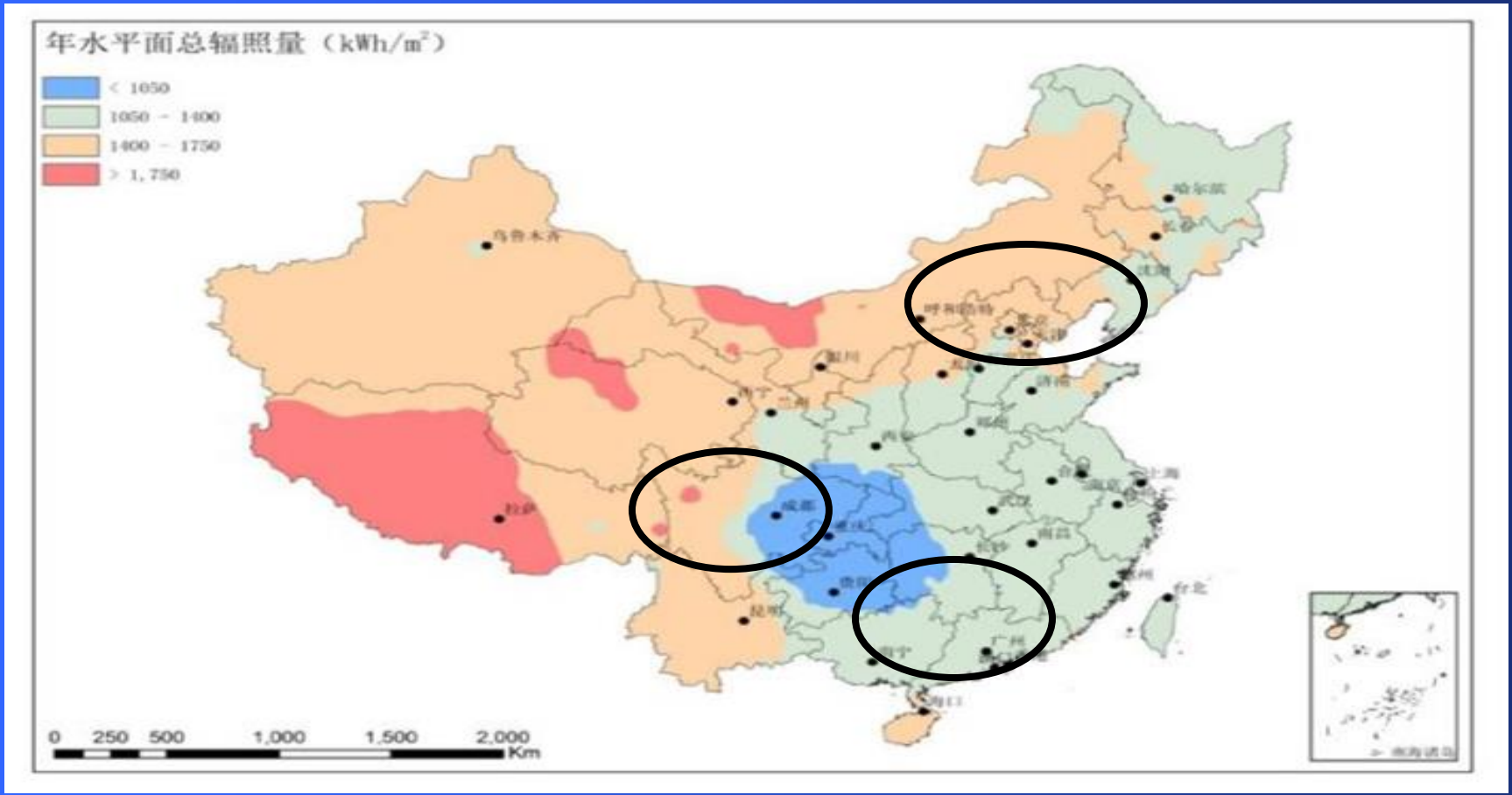
- Overall impact in economic development pattern
- Energy supply industry will have strong transition
- Transition in end use sector
- New manufactures process in some sectors
- Mitigation of GHGs may increase GDP in China
- China’s oversea investment are increasing rapidly

Significant Transition in Industry Sectors and Transport: Hydrogen Based Process

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


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?



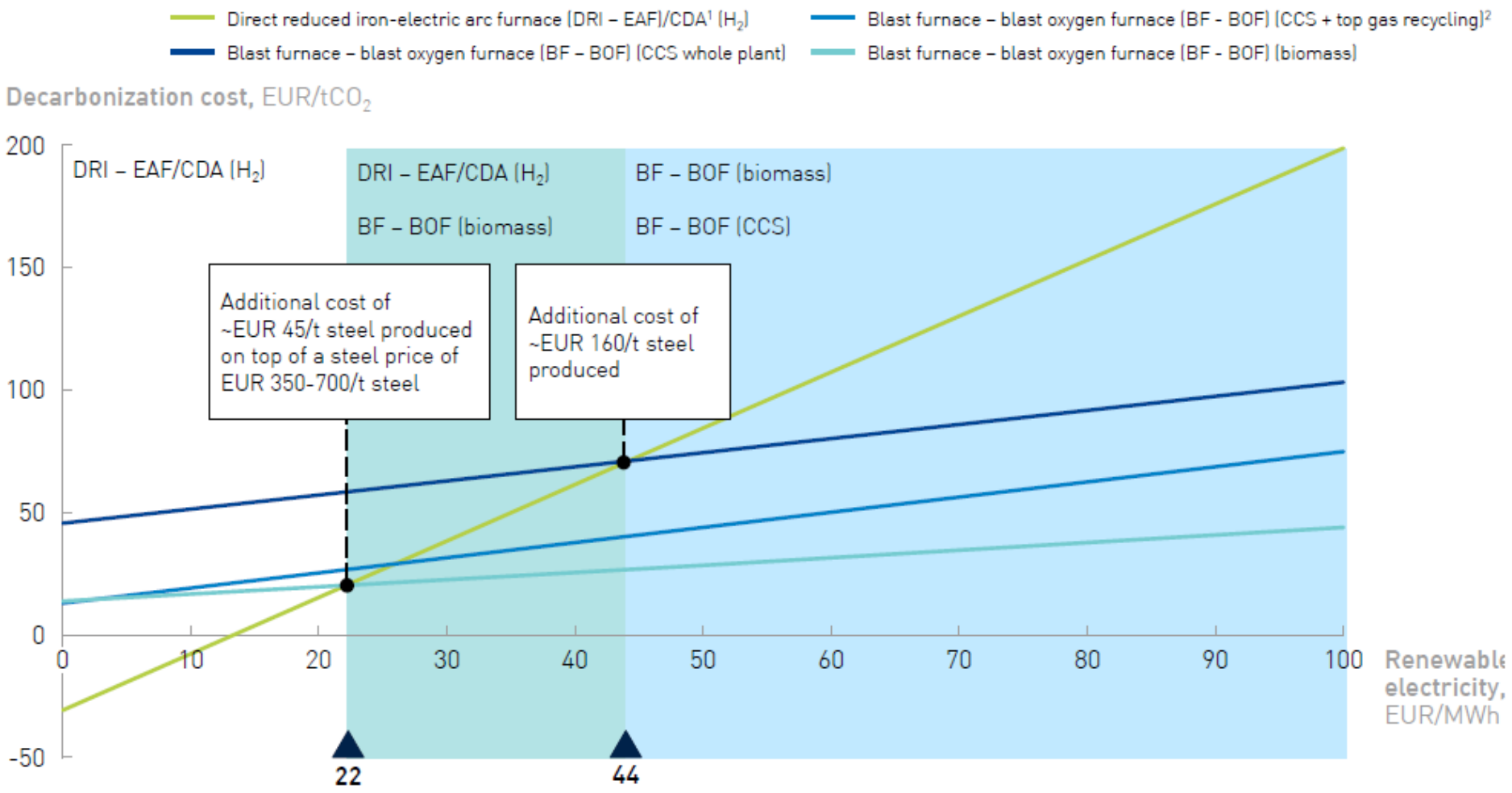
13

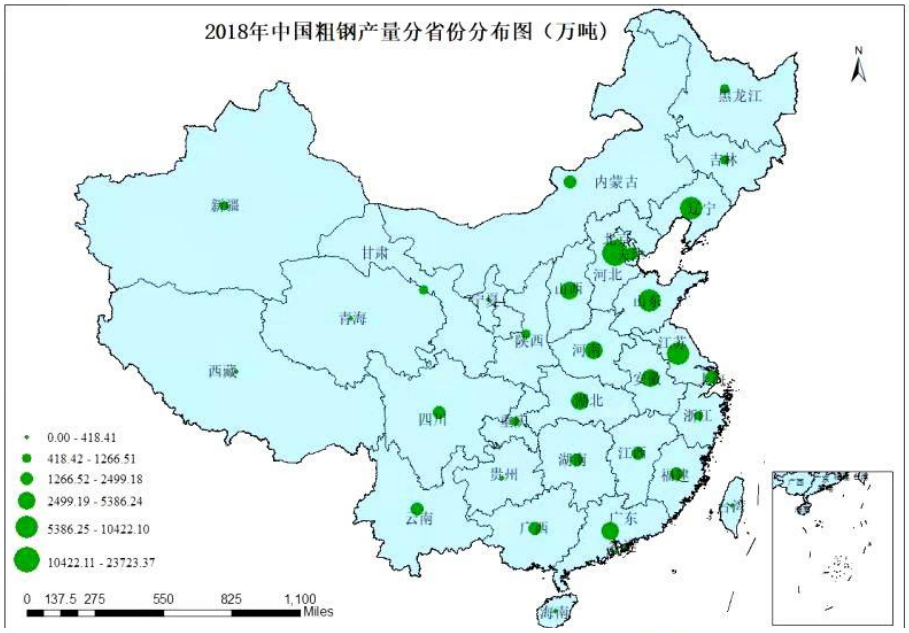
典型地区低成本（低于0.15元/kWh）装机容量、发电量，以及可制氢量

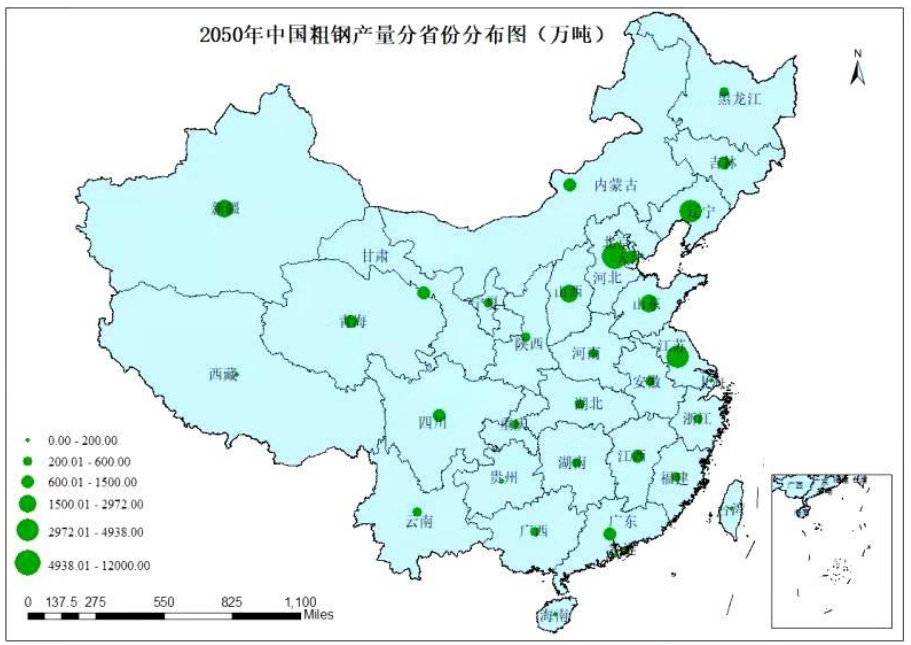
Provinces with solar Power Generation Price Lower Than 0.15yuan/kWh

	装机	发电量	制氢量
	万千瓦	亿kWh	万吨
北京	260	31.2	7.1
天津	300	36	8.2
河北	4500	540	122.7
辽宁	3200	384	87.3
吉林	3500	420	95.5
黑龙江	3000	360	81.8
山东	5000	600	136.4
山西	5000	600	136.4
陕西	4000	480	109.1
海南	800	96	21.8
内蒙古	60000	9000	2045.5
宁夏	60000	9000	2045.5
甘肃	120000	18000	4090.9
青海	150000	22500	5113.6
新疆	200000	30000	6818.2
合计	619560	92047.2	20919.8

EXHIBIT 19: COST COMPARISON OF DECARBONIZATION TECHNIQUES IN THE STEEL INDUSTRY DEPENDING ON ELECTRICITY PRICES




2018年中国粗钢产量分省份分布图（万吨）
N
0.00 - 418.41
418.42 - 1266.51
1266.52 - 2499.18
2499.19 - 5386.24
5386.25 - 10422.10
10422.11 - 23723.37
0 137.5 275 550 825 1,100
Miles


2050年中国粗钢产量分省份分布图（万吨）
N
0.00 - 200.00
200.01 - 600.00
600.01 - 1500.00
1500.01 - 2972.00
2972.01 - 4938.00
4938.01 - 12000.00
0 137.5 275 550 825 1,100
Miles


2018年中国乙烯分省份产量布局图（万吨）
N
0.00 - 5.40
5.41 - 64.39
64.40 - 88.40
88.41 - 132.69
132.70 - 176.18
176.19 - 299.28
0 140 280 560 840 1,120
Miles

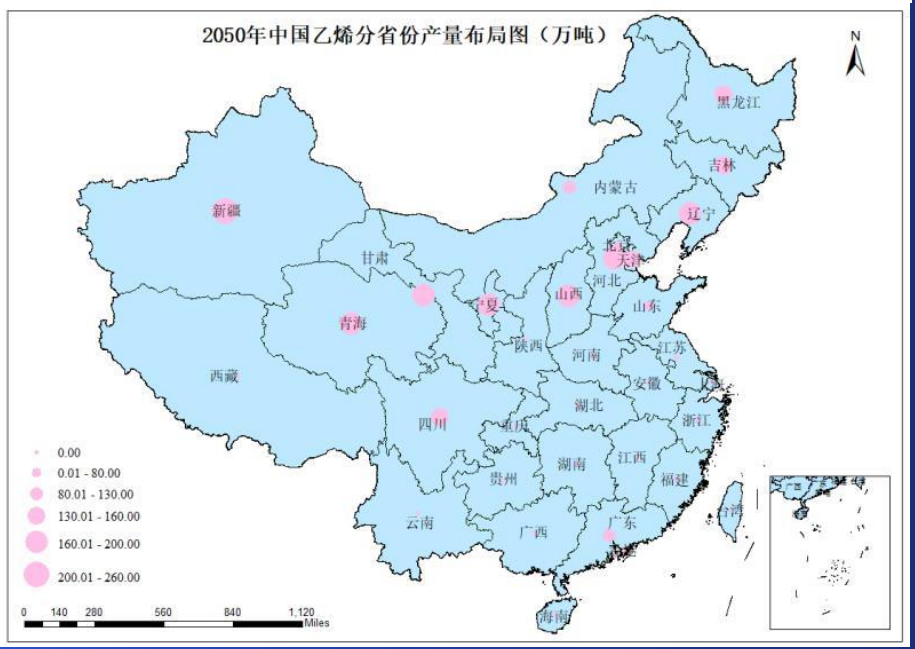

2050年中国乙烯分省份产量布局图（万吨）
N
0.00
0.01 - 80.00
80.01 - 130.00
130.01 - 160.00
160.01 - 200.00
200.01 - 260.00
0 140 280 560 840 1,120
Miles

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

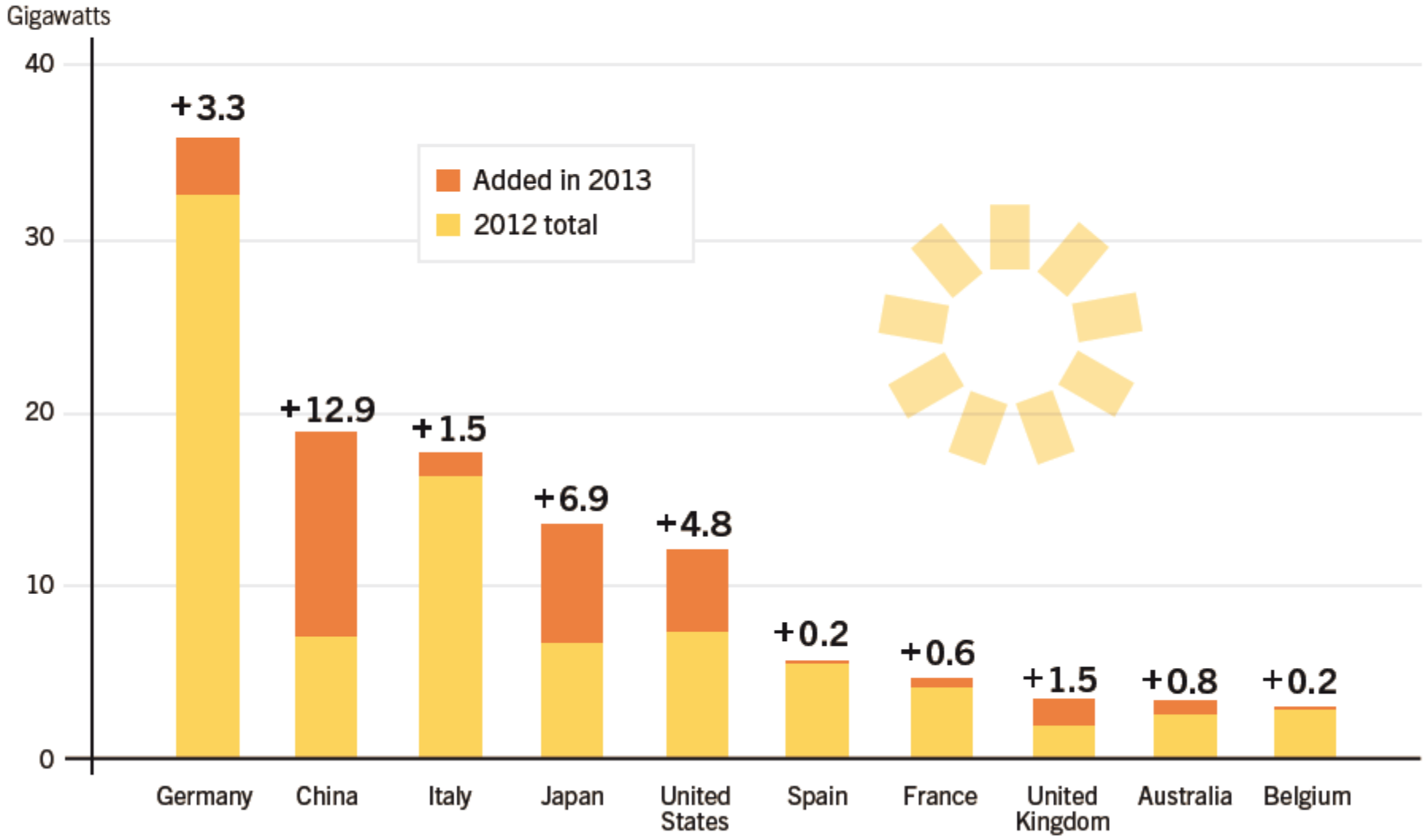
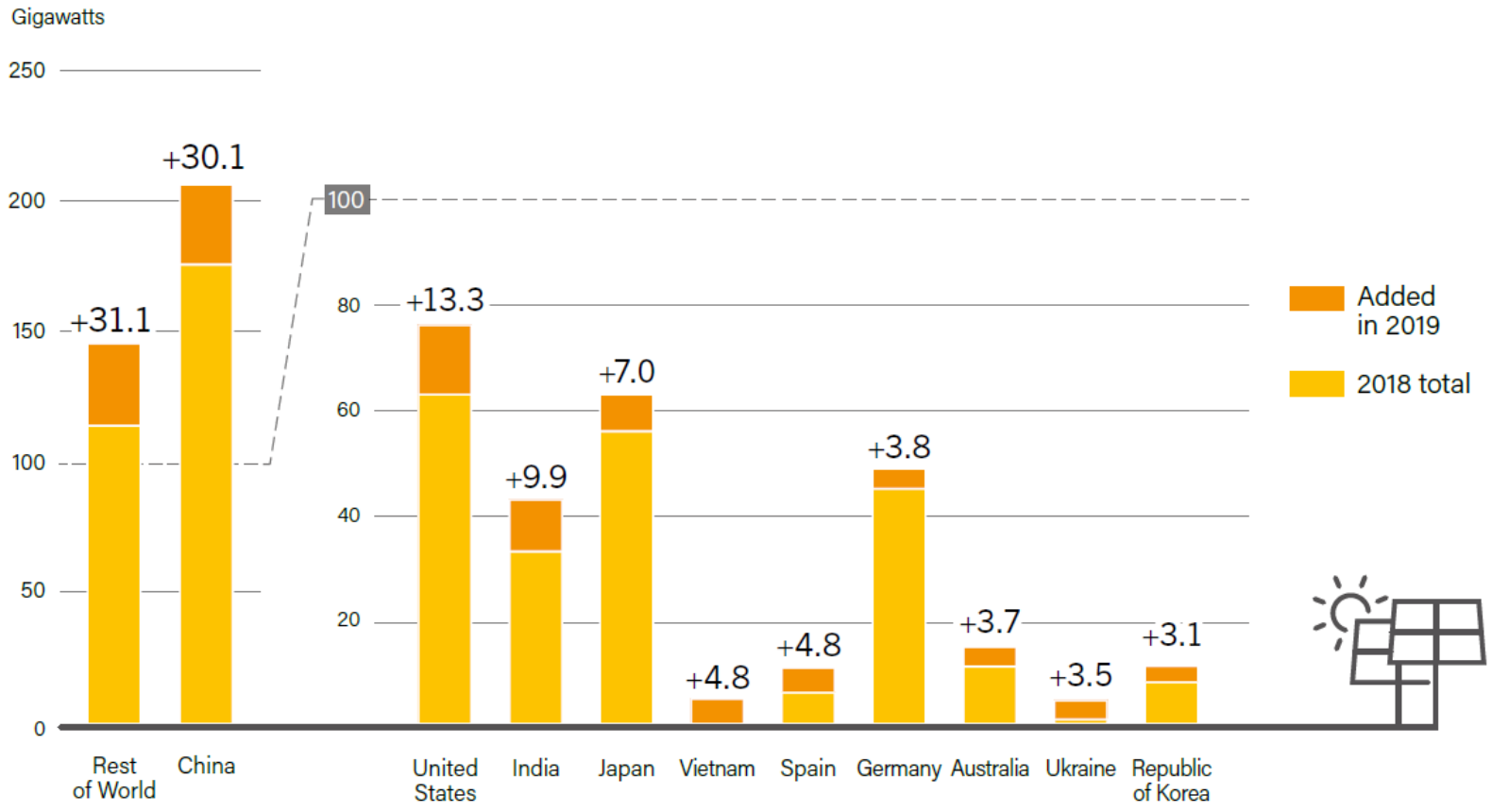


FIGURE 30. Solar PV Capacity and Additions, Top 10 Countries for Capacity Added, 2019



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

Source: See endnote 27 for this section.

- Nuclear power, with cost lower than 0.25yuan/kWh by 2035

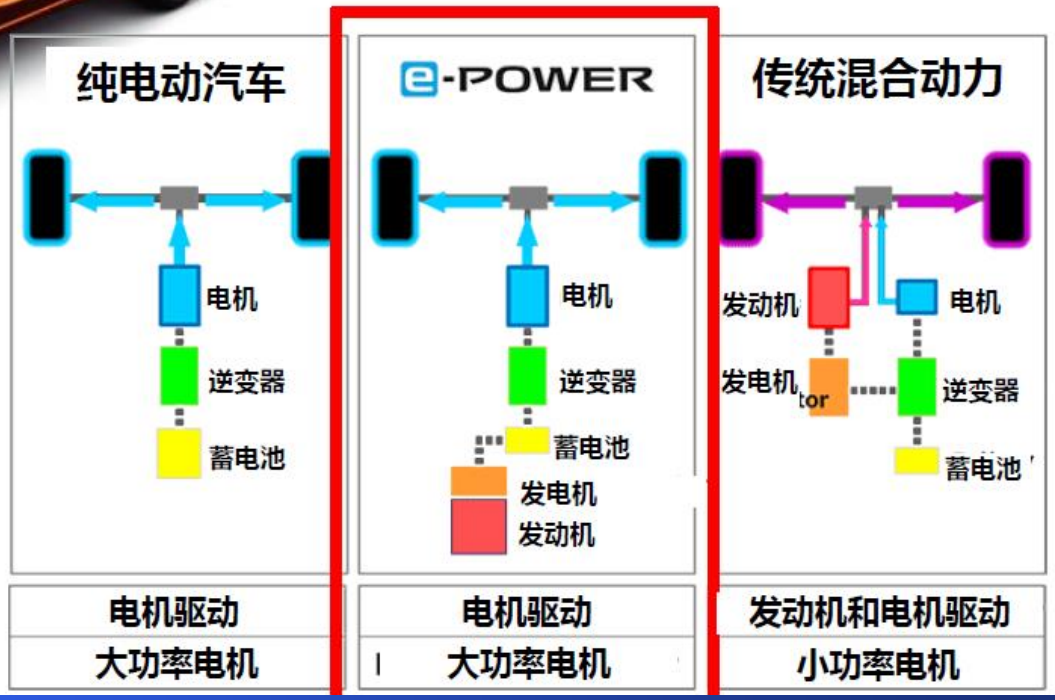
NOTE e-POWER

- 新型e-Power 总成
- 与EV具有较高亲和性

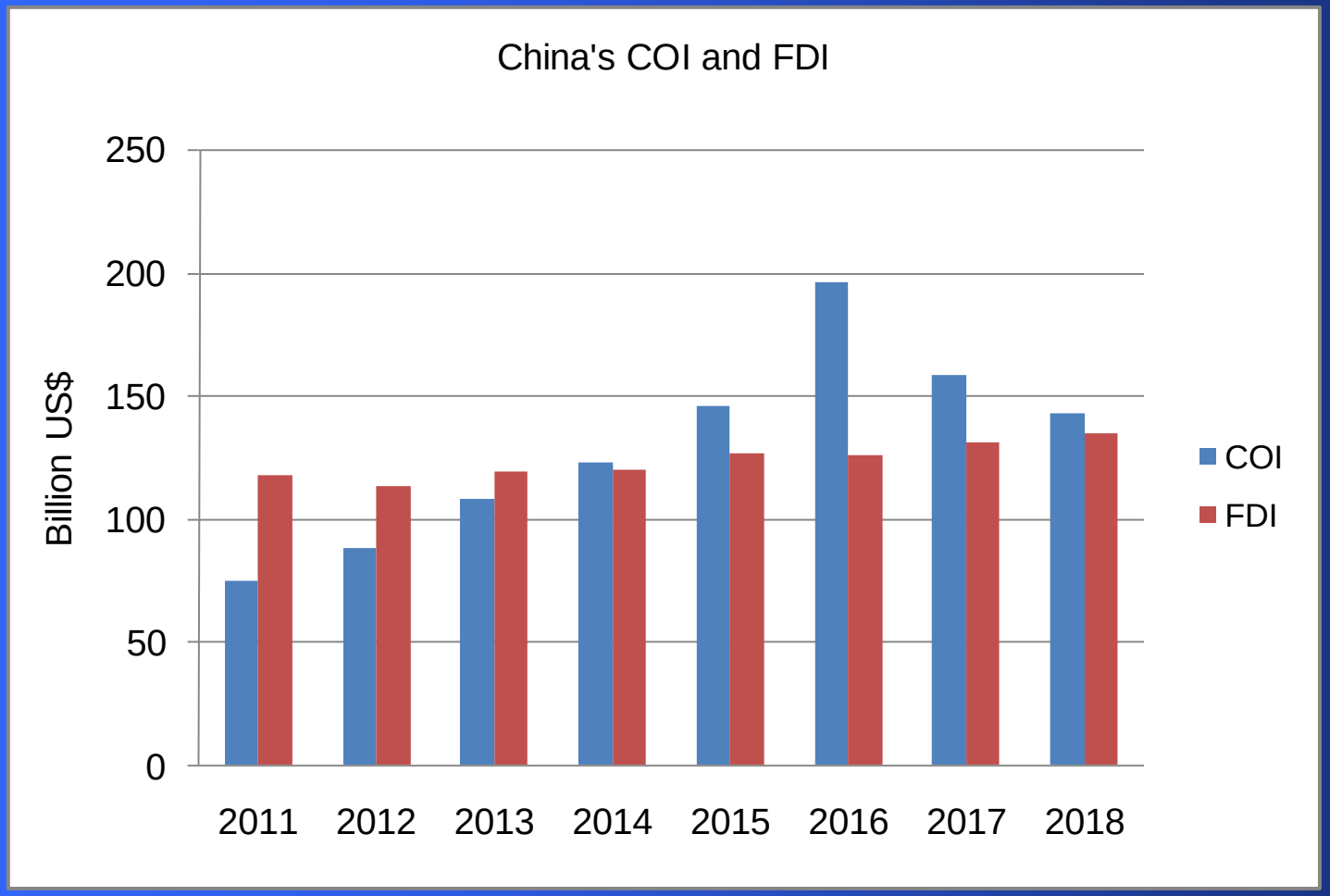
燃料消耗量

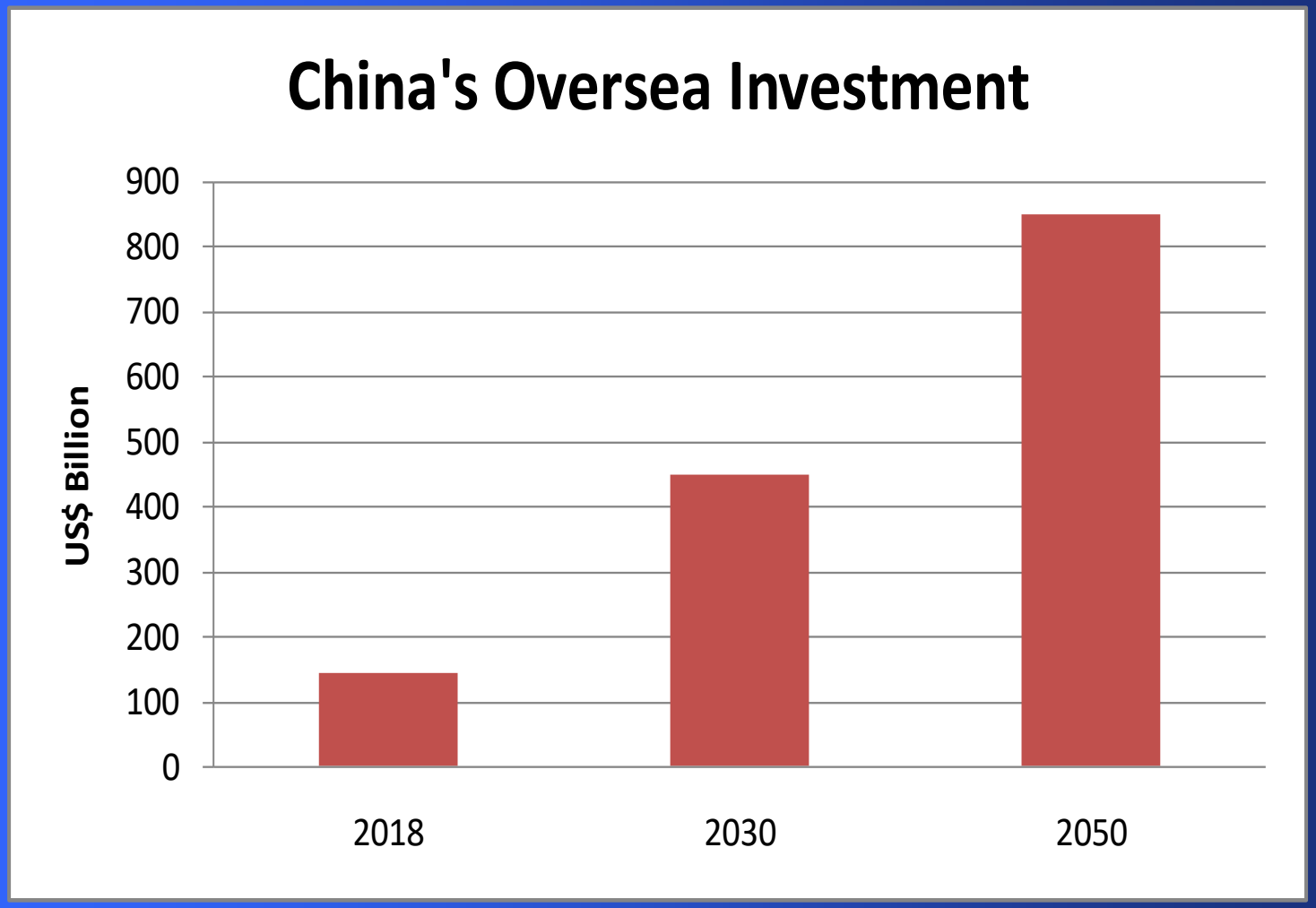
37.2

km/L (JC08)

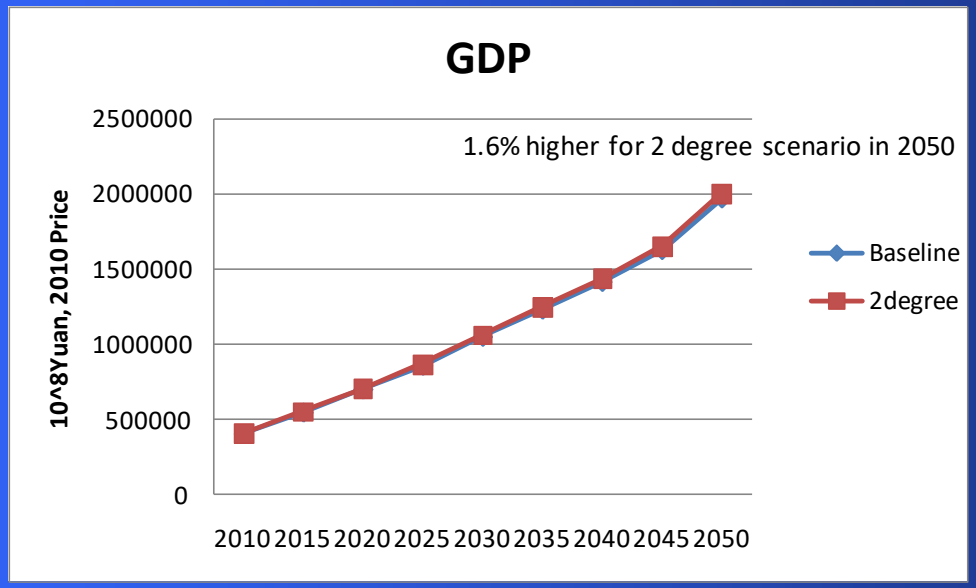


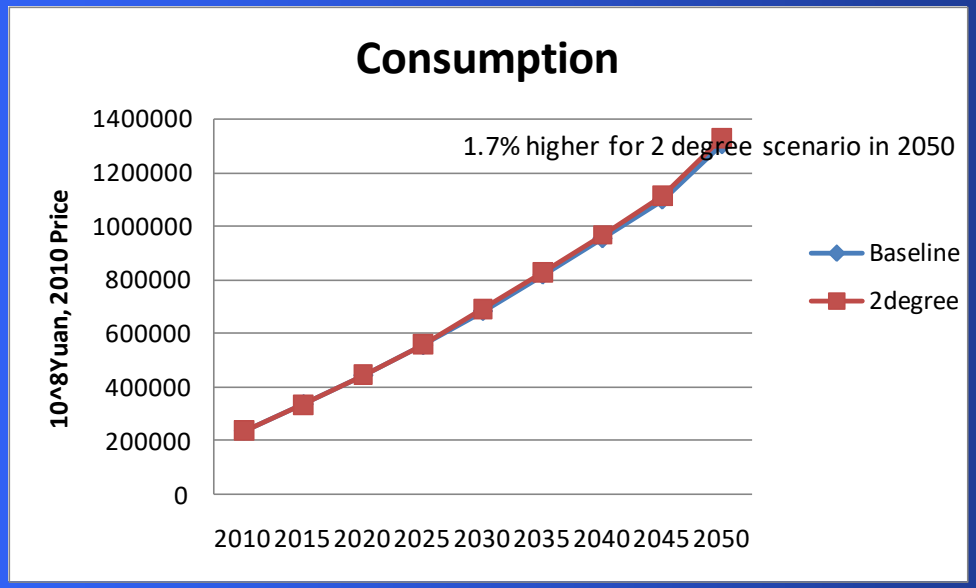
New Battery for vehicles and power storage


China's COI and FDI
250
200
150
100
50
0
Billion US$
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!





Thanks!