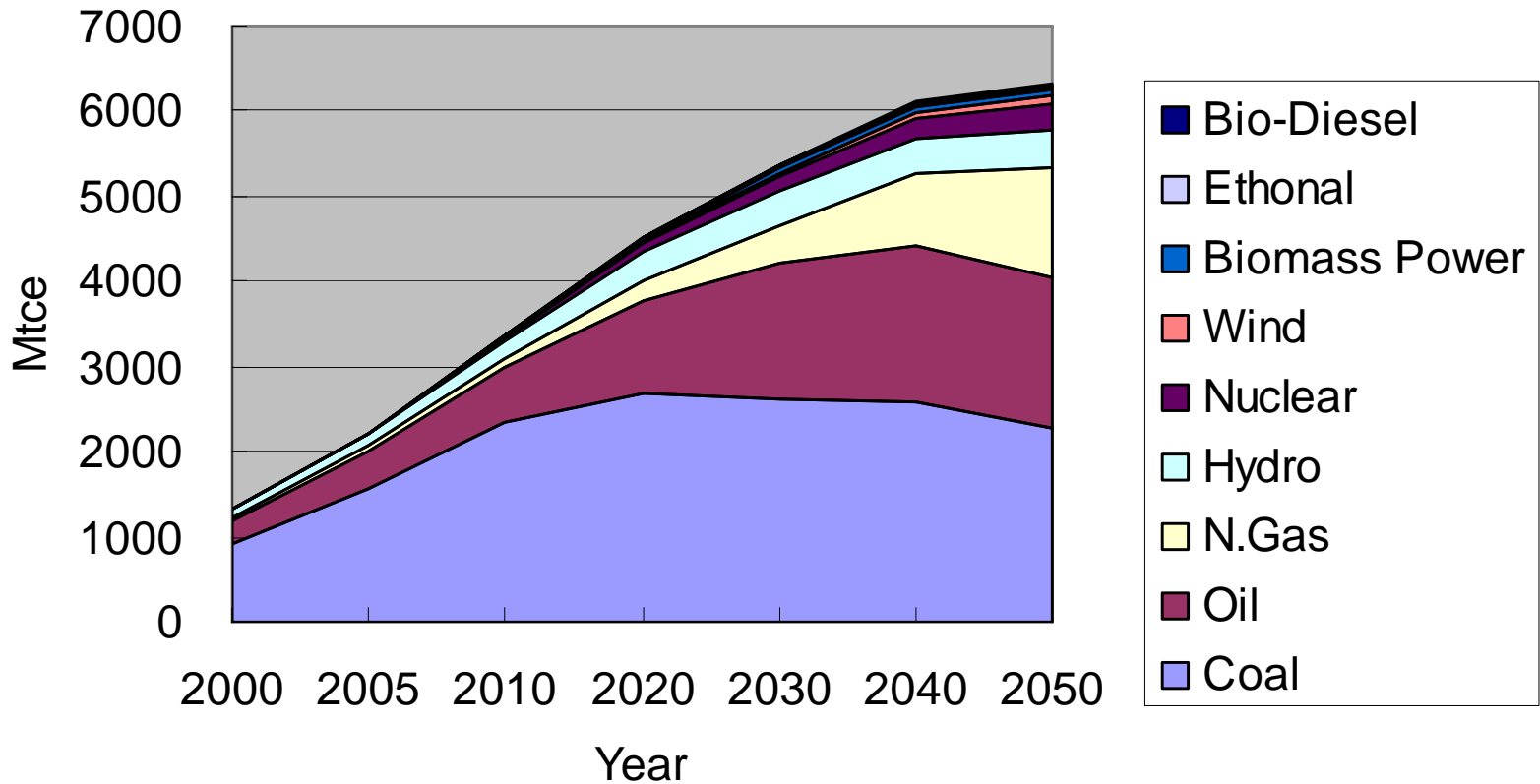


# Low Carbon Societies in China: Scenario and Road Map

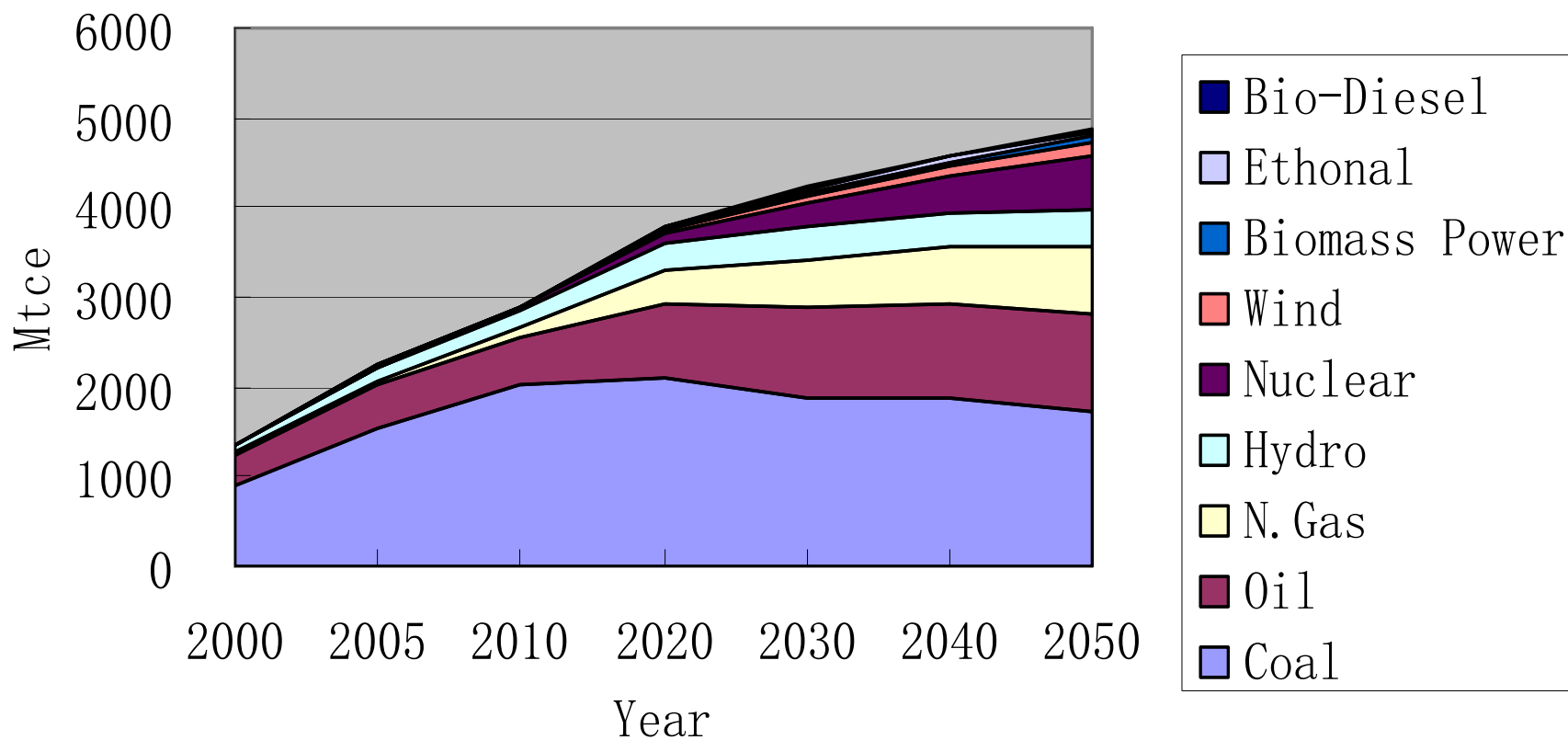
ERI Team

Energy Research Institute, China

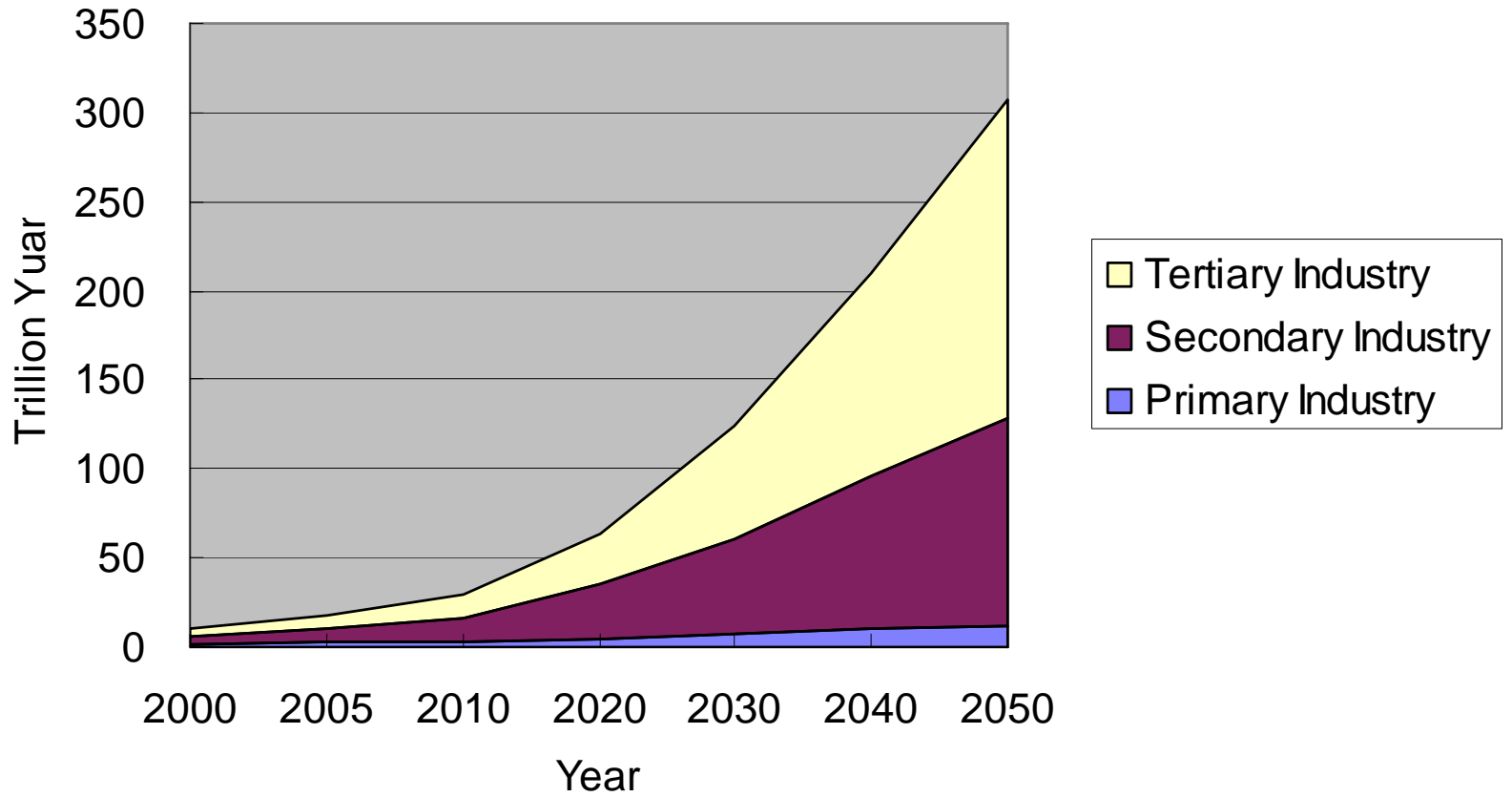
## Primary Energy Demand, Baseline Scenario



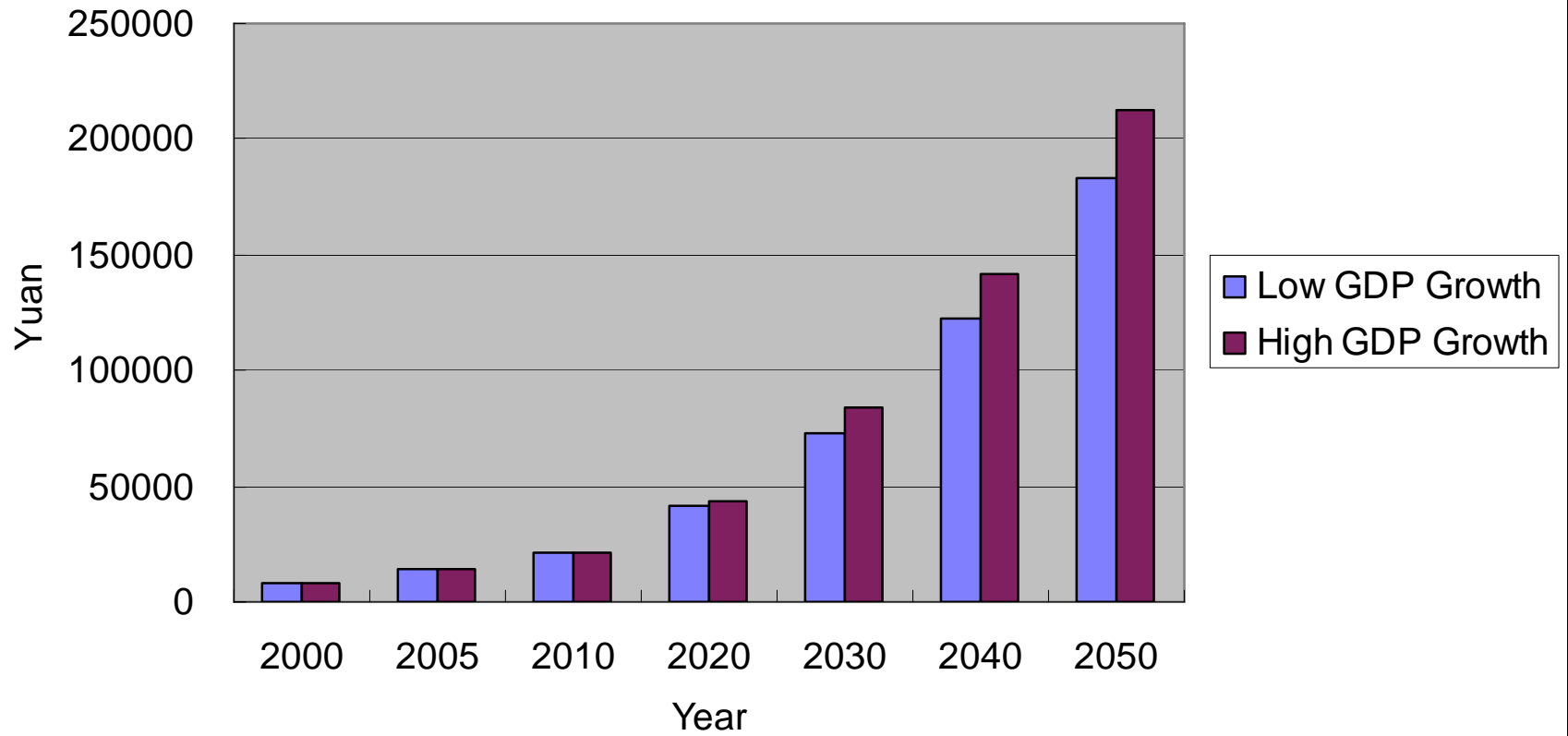
# Primary Energy Demand in China, policy scenario



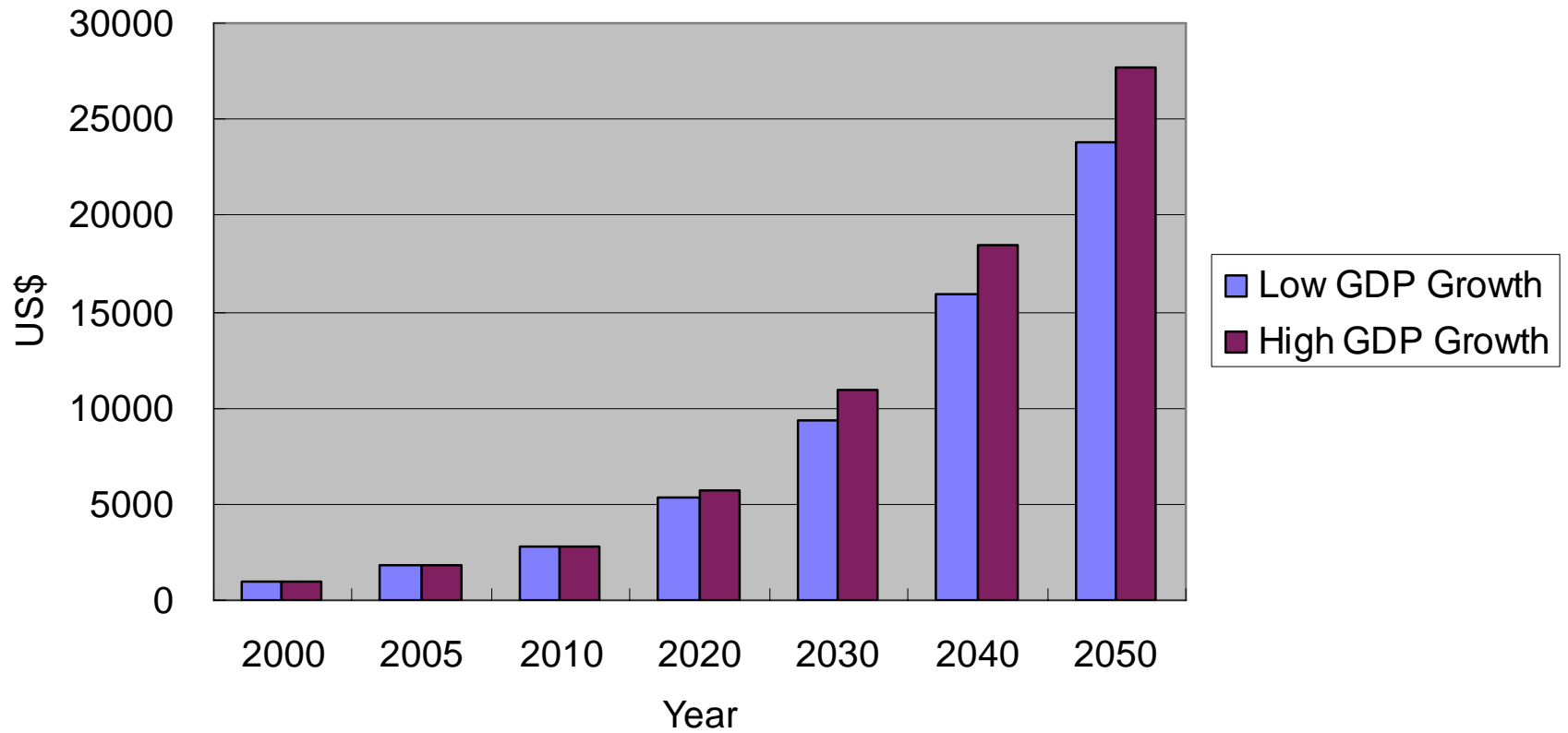
## GDP in China



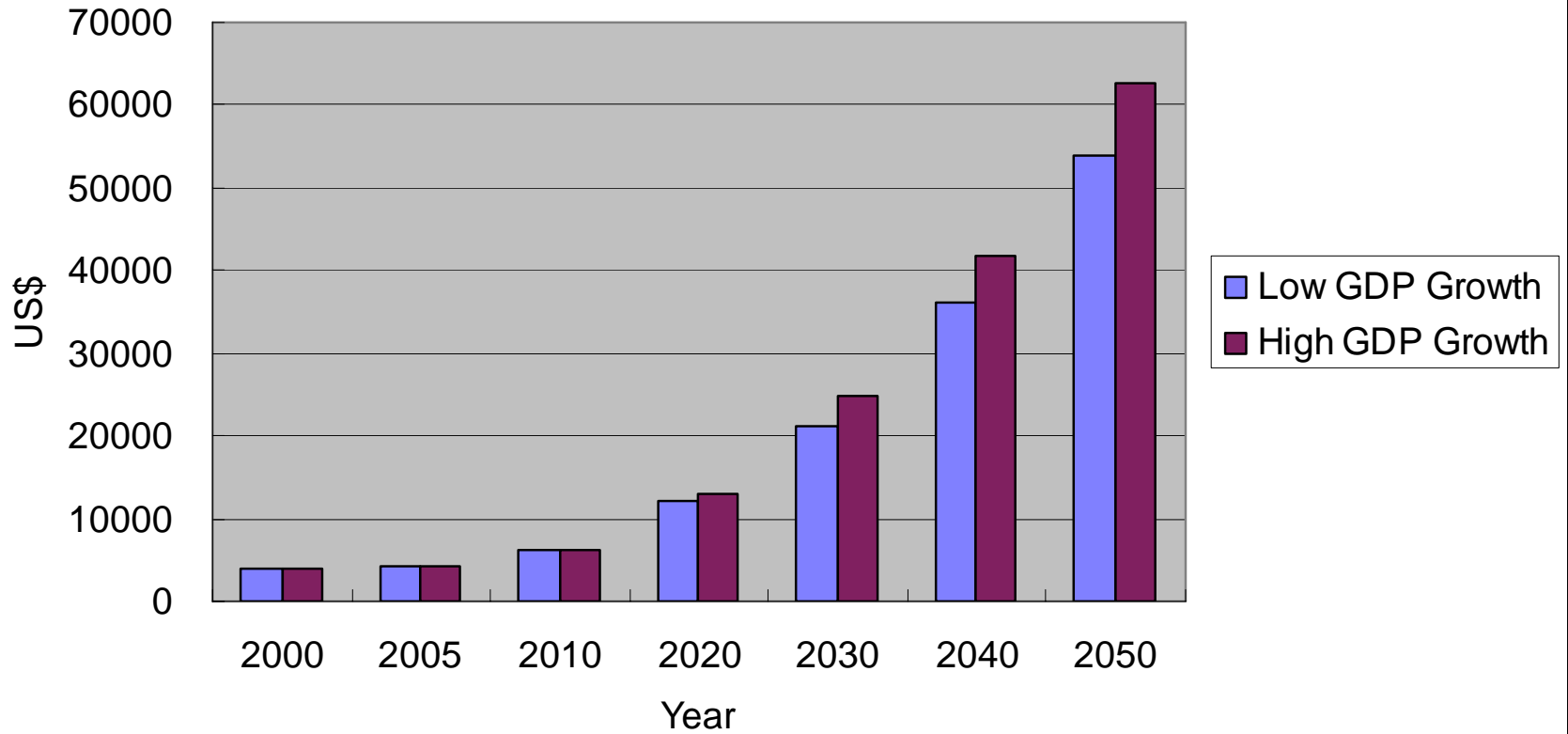
### GDP per Capita, yuan



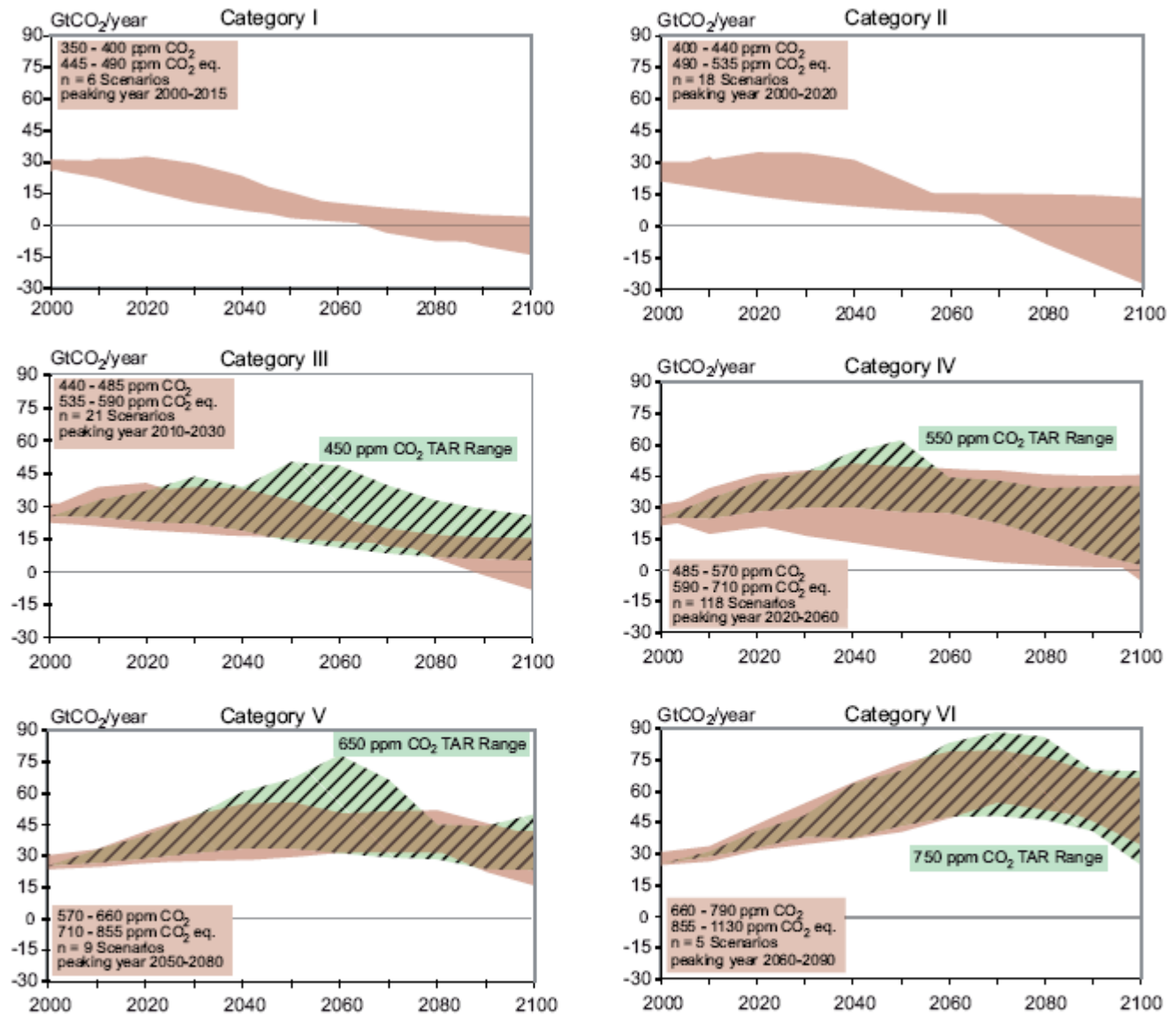
### GDP per Capita, US\$, exchange rate



### GDP per Capita, US\$, PPP



# IPCC Range



**Figure SPM.7: Emissions pathways of mitigation scenarios for alternative categories of stabilization levels (Category I to VI as defined in the box in each panel). The pathways are for CO<sub>2</sub> emissions only. Light brown shaded areas give the CO<sub>2</sub> emissions for the post-TAR emissions scenarios. Green shaded and hatched areas depict the range of more than 80 TAR stabilization scenarios. Base year emissions may differ between models due to differences in sector and industry coverage. To reach the lower stabilization levels some scenarios deploy removal of CO<sub>2</sub> from the atmosphere (negative emissions) using technologies such as biomass energy production utilizing carbon capture and storage. [Figure 3.17]**



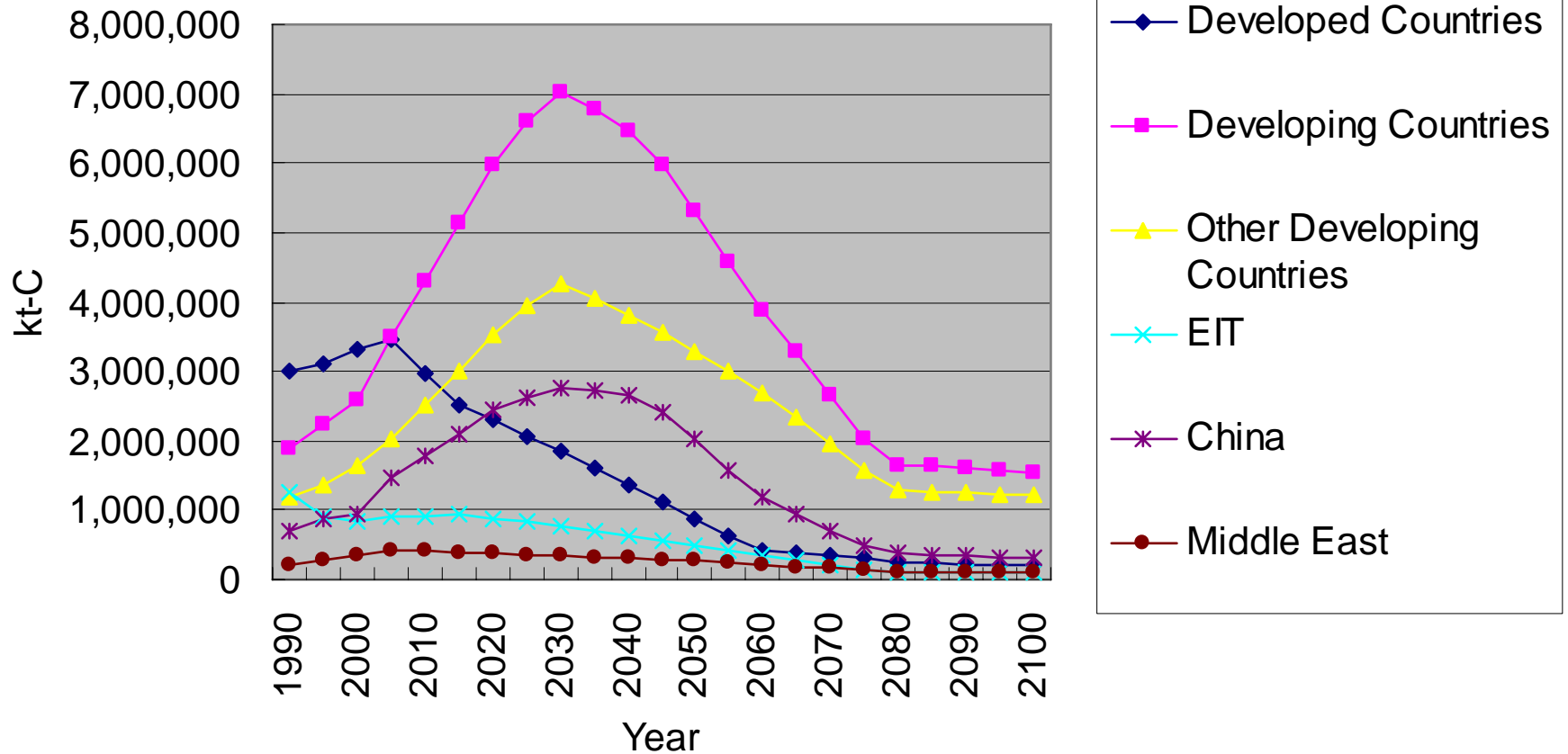
# IPCC Range

**Table SPM.5:** Characteristics of post-TAR stabilization scenarios [Table TS 2, 3.10]<sup>b)</sup>

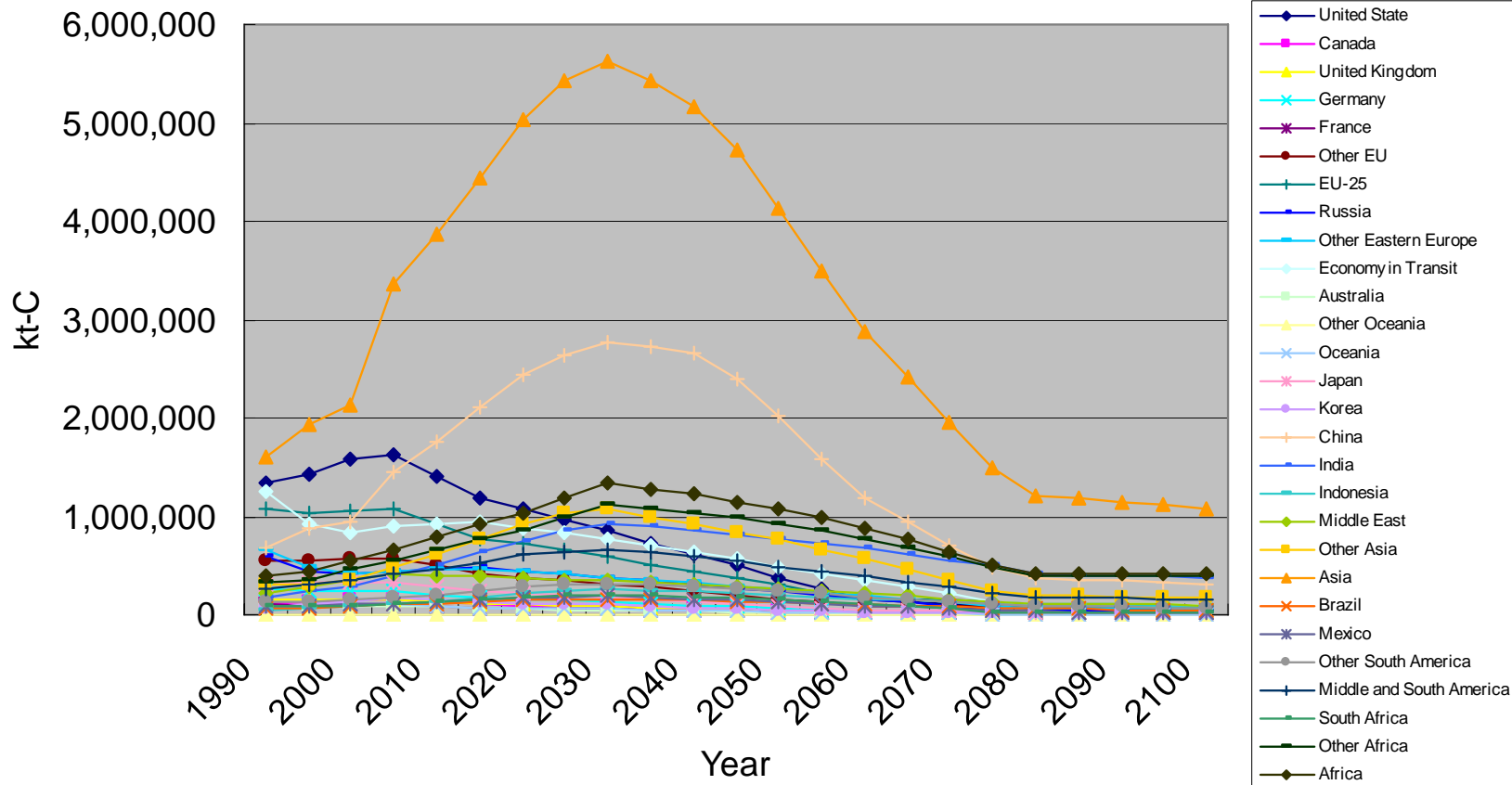
Category	Radiative forcing (W/m <sup>2</sup> )	CO <sub>2</sub> concentration <sup>c)</sup> (ppm)	CO <sub>2</sub> -eq concentration <sup>c)</sup> (ppm)	Global mean temperature increase above pre-industrial at equilibrium, using "best estimate" climate sensitivity <sup>b), c)</sup> (°C)	Peaking year for CO <sub>2</sub> emissions <sup>d)</sup>	Change in global CO <sub>2</sub> emissions in 2050 (% of 2000 emissions) <sup>d)</sup>	No. of assessed scenarios
I	2.5-3.0	350-400	445-490	2.0-2.4	2000-2015	-85 to -50	6
II	3.0-3.5	400-440	490-535	2.4-2.8	2000-2020	-60 to -30	18
III	3.5-4.0	440-485	535-590	2.8-3.2	2010-2030	-30 to +5	21
IV	4.0-5.0	485-570	590-710	3.2-4.0	2020-2060	+10 to +60	118
V	5.0-6.0	570-660	710-855	4.0-4.9	2050-2080	+25 to +85	9
VI	6.0-7.5	660-790	855-1130	4.9-6.1	2060-2090	+90 to +140	5
Total							177

- a) The understanding of the climate system response to radiative forcing as well as feedbacks is assessed in detail in the AR4 WGI Report. Feedbacks between the carbon cycle and climate change affect the required mitigation for a particular stabilization level of atmospheric carbon dioxide concentration. These feedbacks are expected to increase the fraction of anthropogenic emissions that remains in the atmosphere as the climate system warms. Therefore, the emission reductions to meet a particular stabilization level reported in the mitigation studies assessed here might be underestimated.
- b) The best estimate of climate sensitivity is 3°C [WG 1 SPM].
- c) Note that global mean temperature at equilibrium is different from expected global mean temperature at the time of stabilization of GHG concentrations due to the inertia of the climate system. For the majority of scenarios assessed, stabilisation of GHG concentrations occurs between 2100 and 2150.
- d) Ranges correspond to the 15<sup>th</sup> to 85<sup>th</sup> percentile of the post-TAR scenario distribution. CO<sub>2</sub> emissions are shown so multi-gas scenarios can be compared with CO<sub>2</sub>-only scenarios.

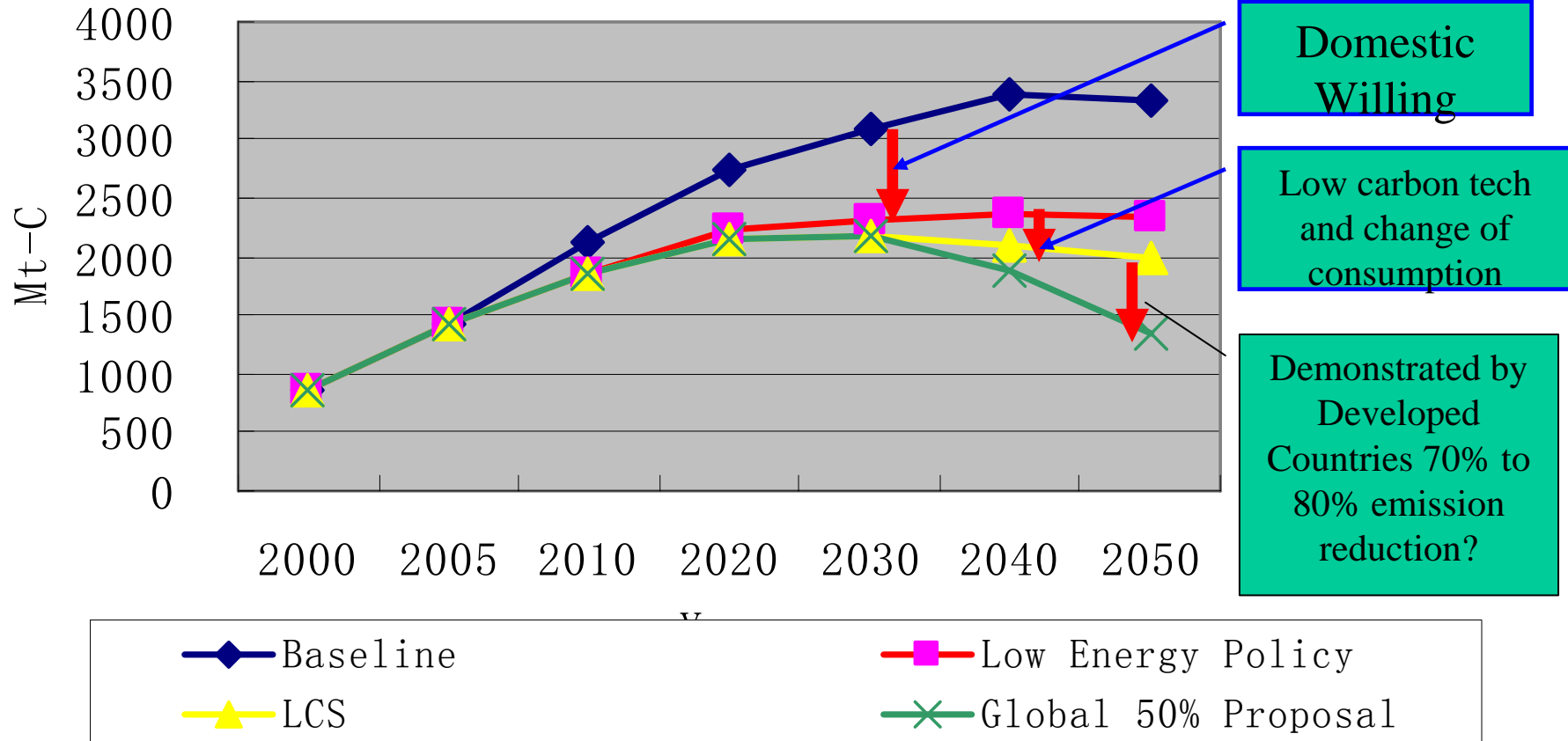
CO2 Emission by Region, IPAC results, 560ppmCO2eq, per capita emission convergency



### CO2 Emission, IPAC

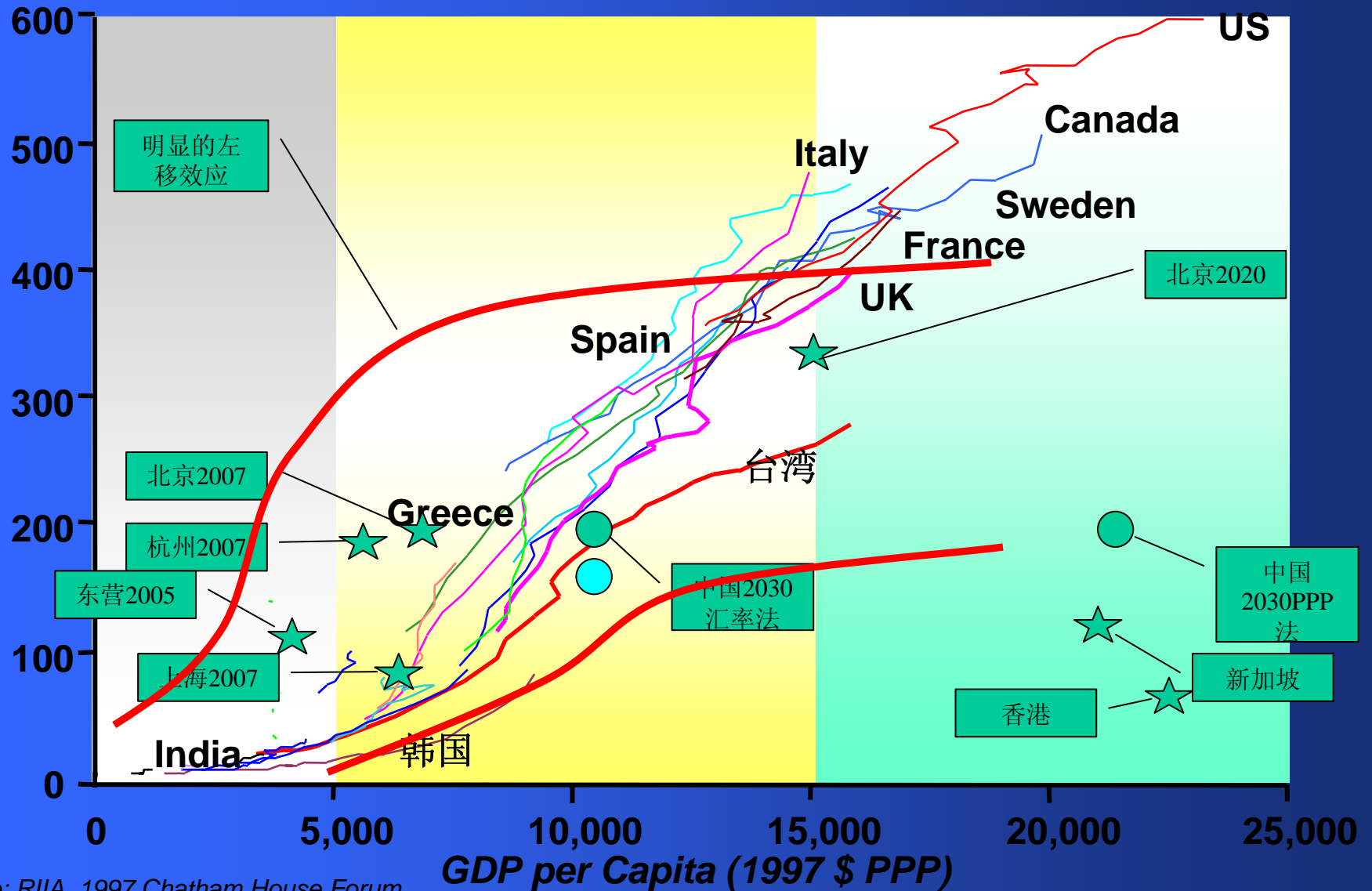


# CO2 Emission from Energy Activities in China, IPAC Results

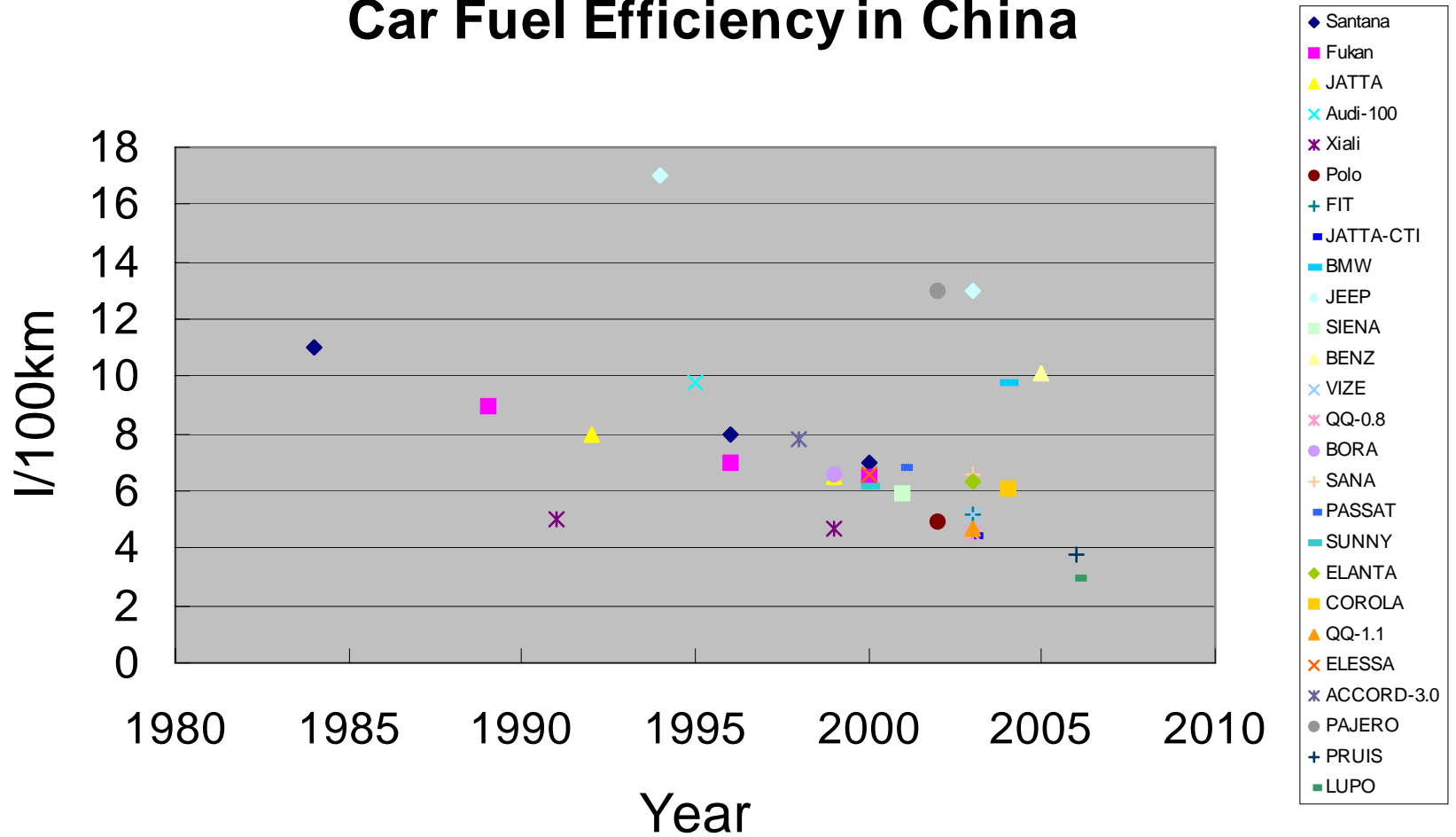


# Ownership of Vehicle

vehicle/1000people



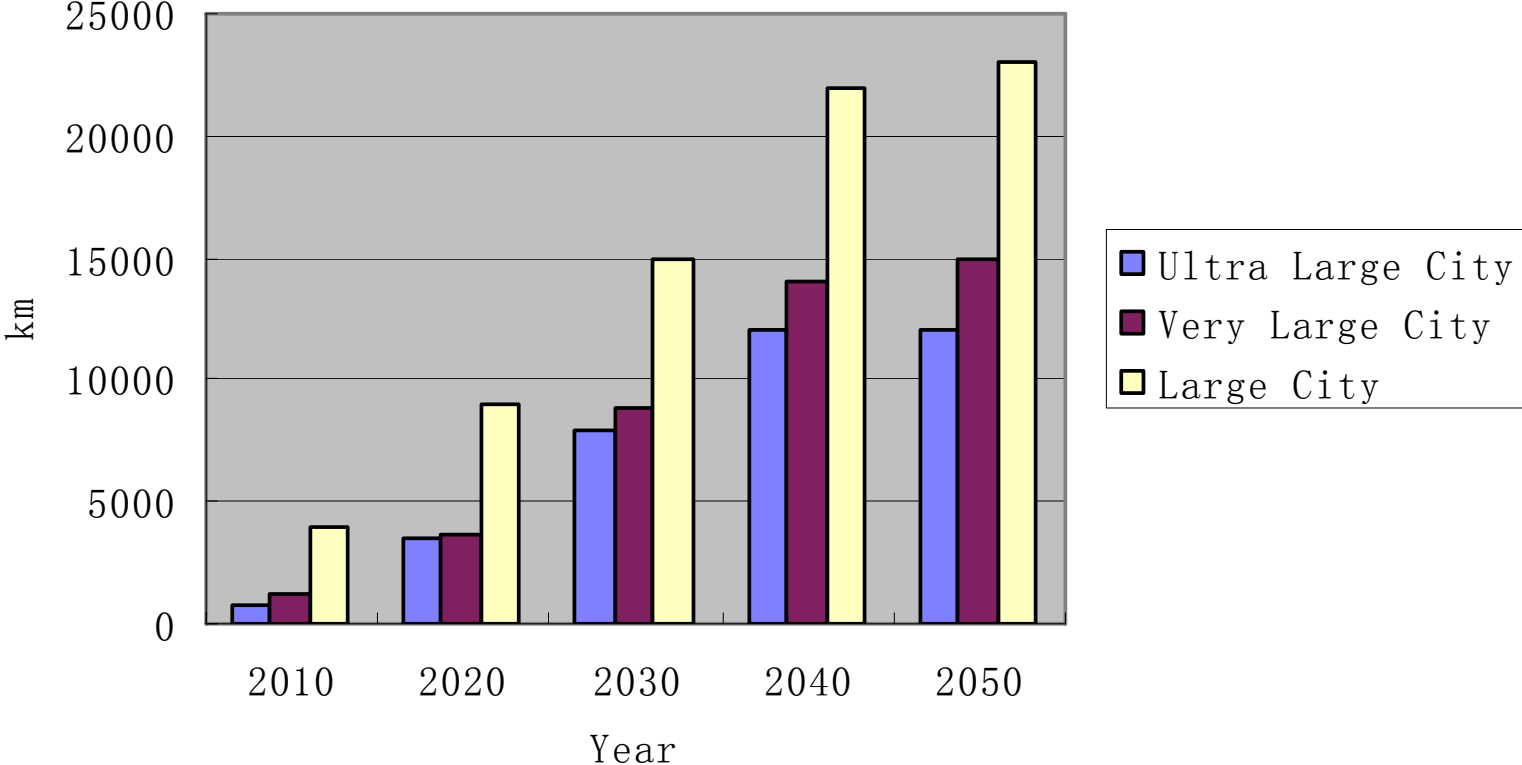
# Car Fuel Efficiency in China



# Planning scheme of Rail-based transit system in Beijing's urban area

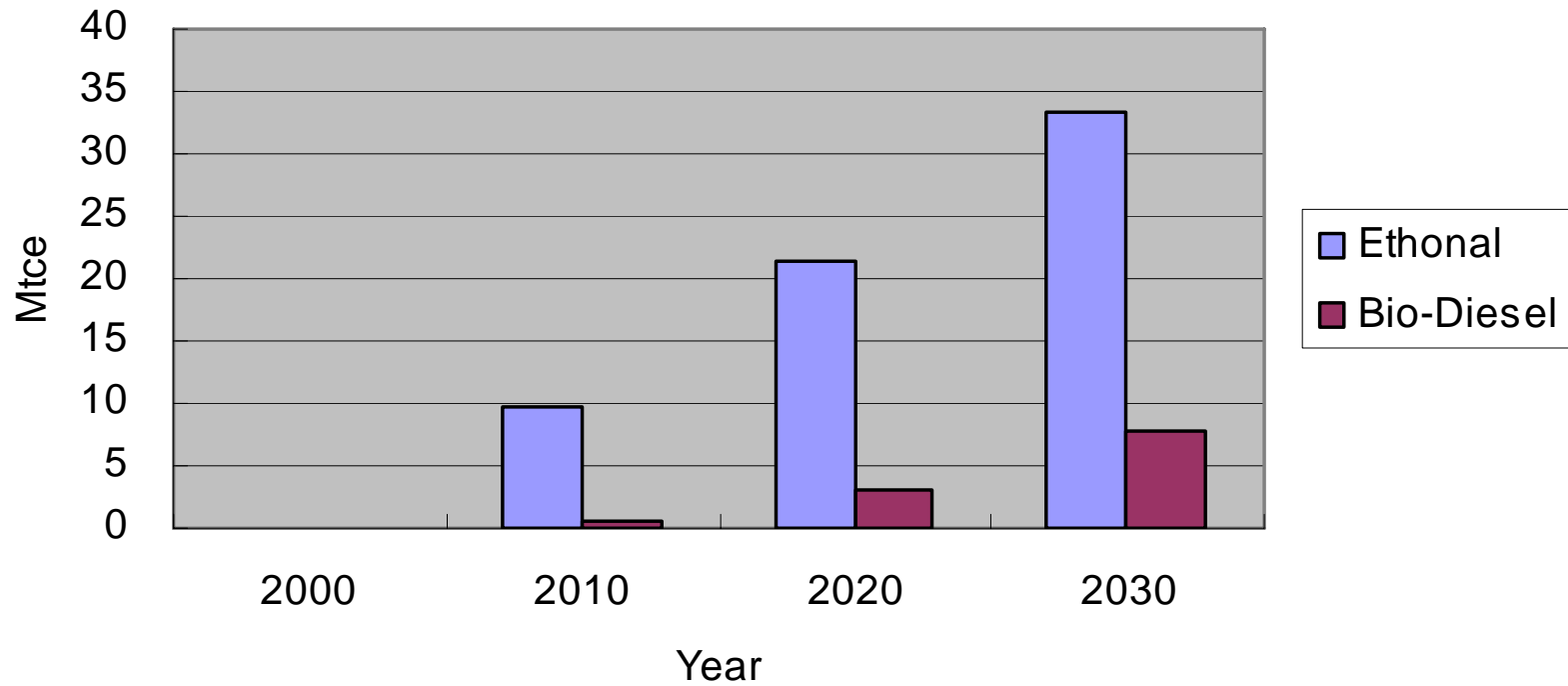


Metro length





## Bio-Fuel in Transport



## *key technologies in long term*

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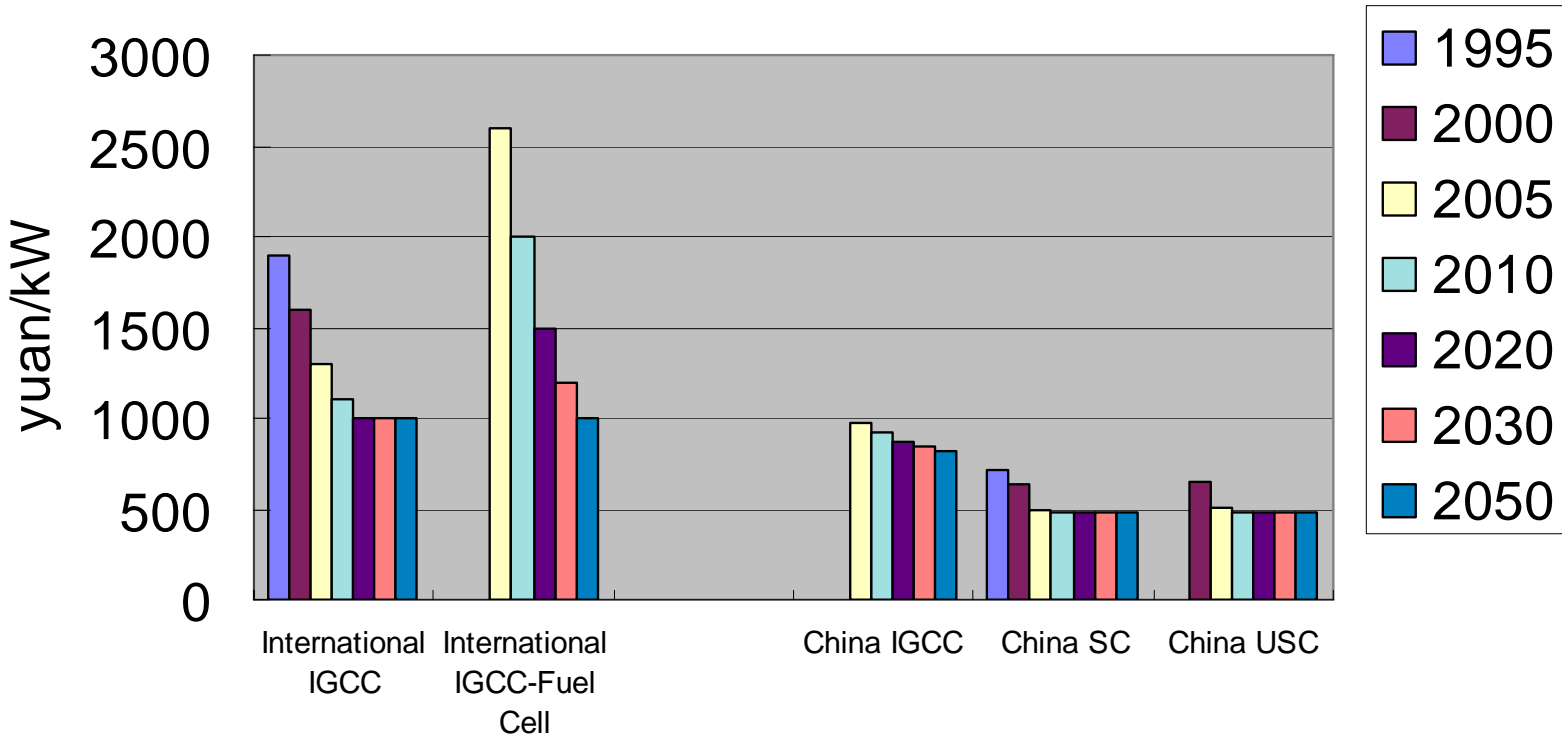
- a. Modern renewable energy production technology (solar power and etc)
- b. Advanced nuclear power generation system
- c. Fuel cell
- d. IGCC/advanced clean coal technology/carbon capture and carbon storage technologies
- e. Advanced gas turbine
- f. Unconventional natural gas and crude oil production technology
- g. Synthetic fuel production technology
- h. Ultra-low-power and zero-emission advanced transport technologies

## *Roadmap of Industry*

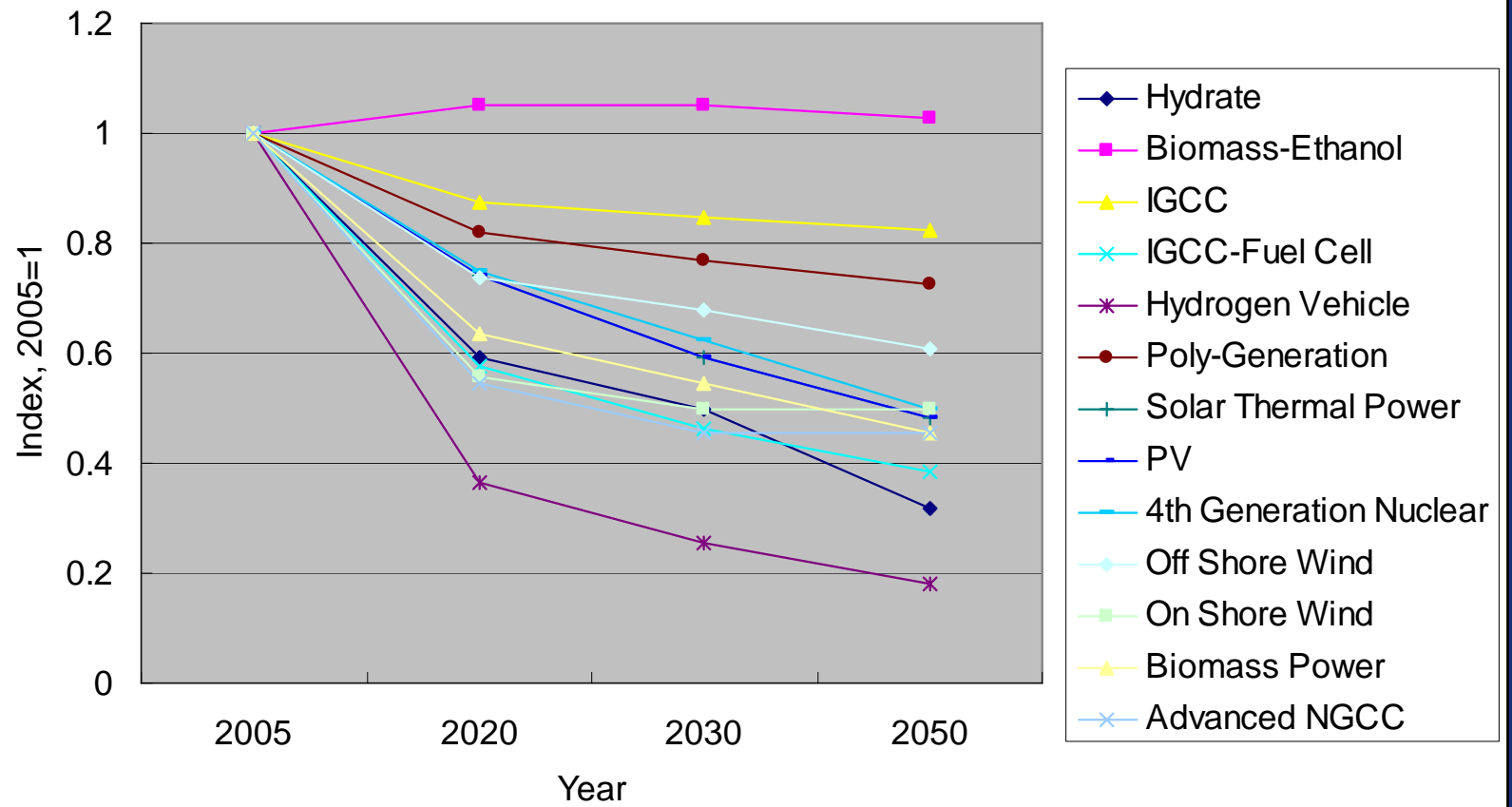
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- By 2030, best efficiency in the world
- From now, newly installed capacity should go to best or second best technology
- After 2030, innovation on new technology and new production process
- Establishing recycling economy

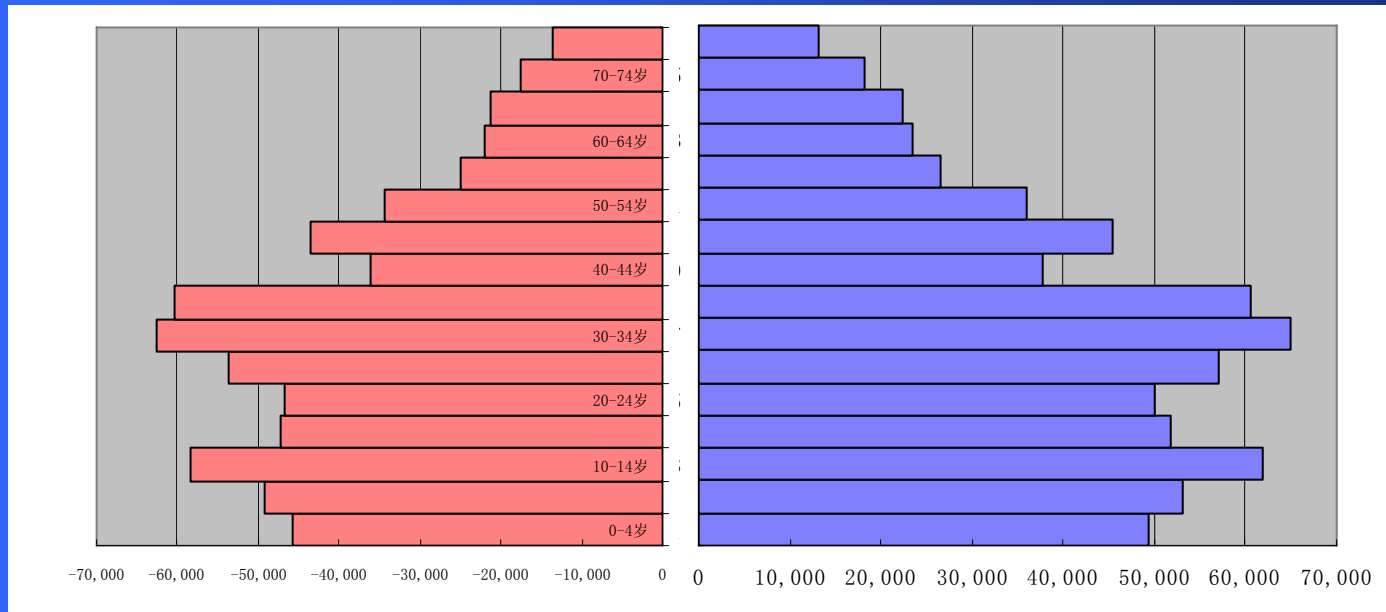
# Fixed Unit Investment



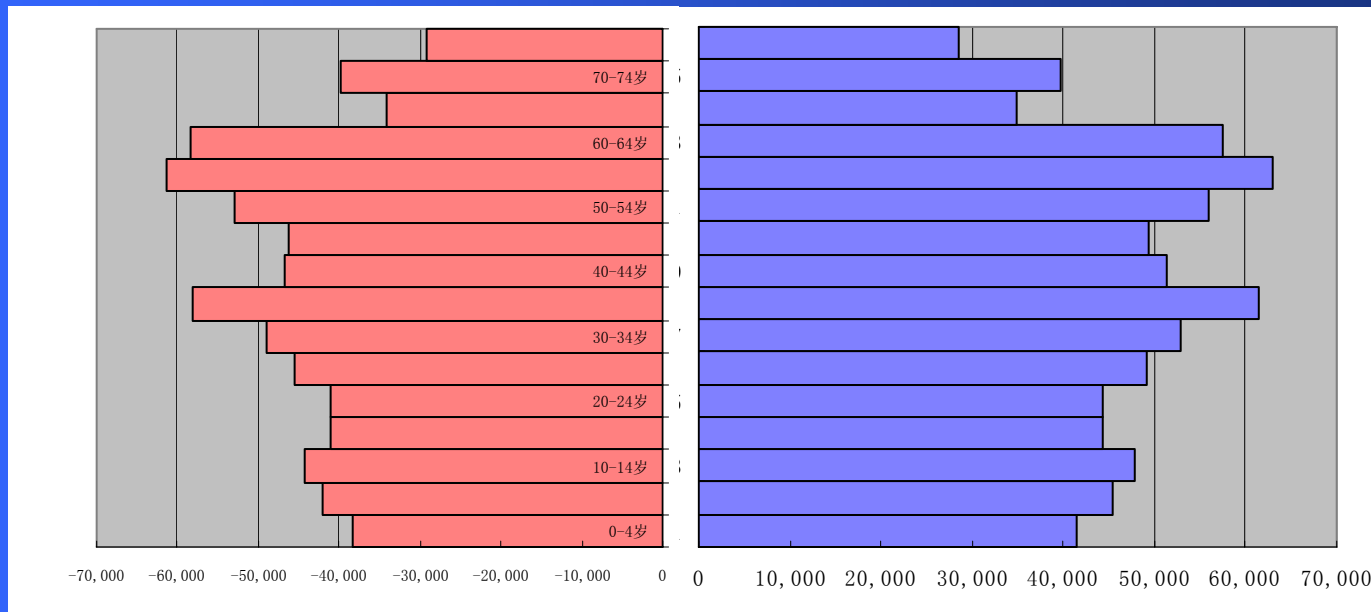
# Technology learning curve



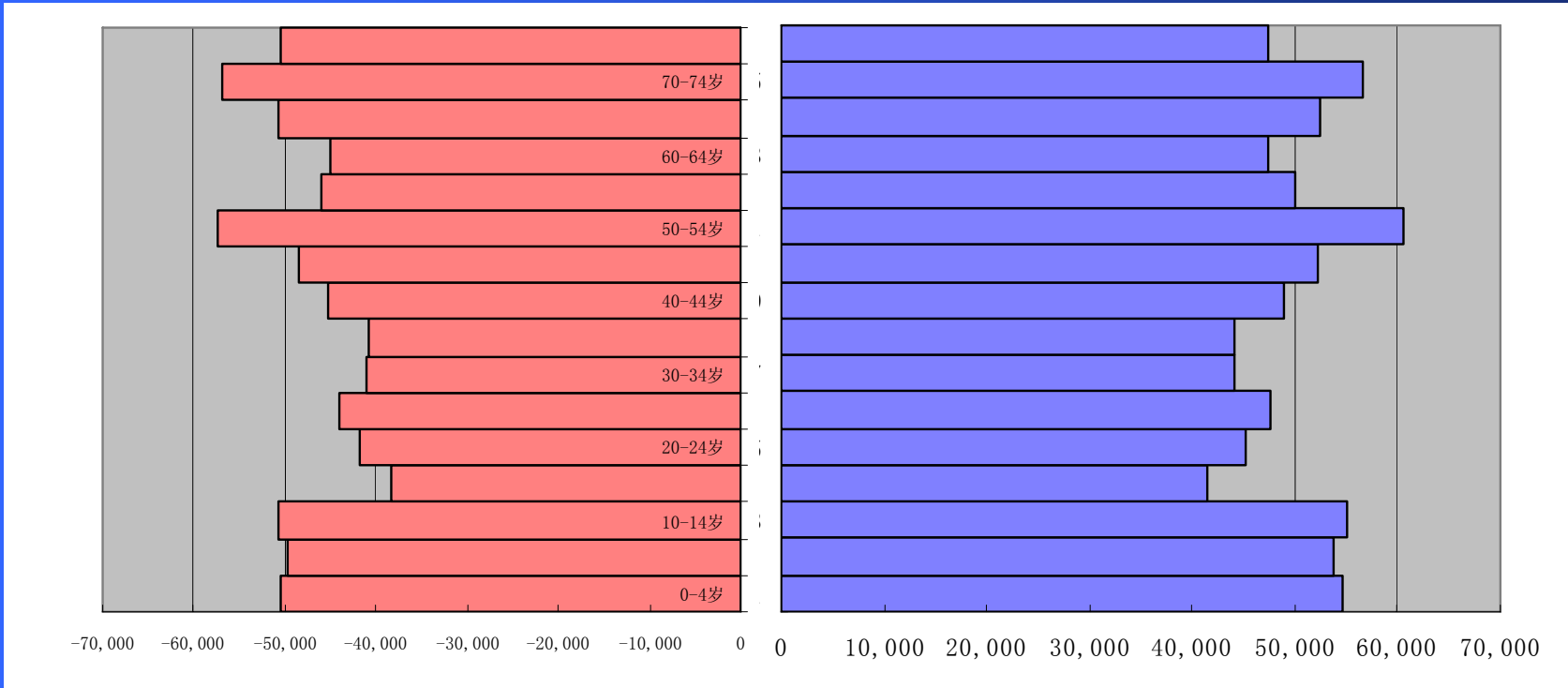
# Population in 2005



# Population in 2030



# Population in 2050



# 2050年的低碳住宅

## 舒适和节能

### 太阳能利用

光伏电池

(25-47% 的家庭拥有屋顶光伏电池, 转换效率接近30%)

生态生活教育

减少10-20% 能源需求

屋顶植被

太阳热利用

普及率: 20-60%  
(目前 6%)

能源检测系统  
(家用电器)

超高效空调

COP =8,  
普及率 100%

待机电源耗电

降低1/3,  
普及率100%

高效照明  
【如 LED照明】

减少50%照明需求,  
普及率 100%

高效绝热

减少 60% 采暖需求,  
普及率70%

燃料电池

普及率 0-20%

热泵采暖

COP=5  
普及率 30-70%

向公众提供经济和环境  
信息促使大家成为  
低碳消费

高效家用电器

减少能源需求, 支持舒适和安全生活方式





We can do more, with new technologies





# Common Policy Settings in Scenario Analysis

Policy measures	Possible policy tools	Applicability	Effects in laboratory experiments
1. Encourage of energy efficiency investment	Tax/Subsidy	++	The distance between end-use energy intensity in west Europe and China will be lessened by 30% in 2050.
	Low/Zero interest loans	++	
	Information	++	
	Appliances brand/criteria	+++	
	Investment in public transportation	++	
2. Energy tax and the effects	Industrial voluntary agreement	++	Implement the energy tax (for all fuels) with the same standards as the petrol and natural gas tax implemented in industry and transport in west Europe
	“Green tax” - petrol/coal oil tax	+++	
3. Impacts to the end-use energy market	Tax/subsidy, such as the emission standards towards natural gas and bio-fuels	+	Decrease of coal consumption in construction sector
		+++	
4. High efficient and gas-based combined cycle (CC) in electricity generation	Technology and emission standards	++	Till 2050, 15-20% of electricity will use the combined cycle gas.
	System reformation R&D projects		
5. Advanced Clean Coal (ACC) Option including IGCC	Investment	++	All coal-fired power plants realize the high efficiency production since 2010.
6. Decrease in transmission loss		++	Losses during electricity distribution and transmission will decrease to the level of OECD countries (8%).
7. Increase in the share of nuclear power	Technology and emission standards	+	The share of nuclear power in electricity production will increase from 7% (B2-C) to 20%.
	Quota system/Renewable energy obligations	++	
8. Increase in the share of renewable energy such as solar power and wind power	System reformation R&D projects		Renewable energy power generation will increase from 7% to 20% by 2020
	Investment		

# A Snapshot of Selected China Energy Options Today: Climate and Energy Security Impacts and Tradeoffs in 2025

This chart compares the energy security and climate characteristics of different energy options. Bubble size corresponds to incremental energy provided or avoided in 2025. The reference point is the "business as usual" mix in 2025. The horizontal axis includes sustainability as well as traditional aspects of sufficiency, reliability, and affordability. The vertical axis illustrates lifecycle greenhouse gas intensity. Bubble placements are based on quantitative analysis and ERI expert judgment.

-  Power Sector (this size corresponds to 40 billion kWh)
-  Transport Sector (this size corresponds to 200 thousand barrels of oil per day)

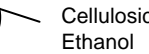
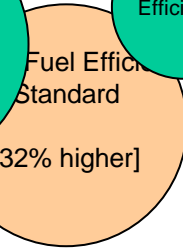
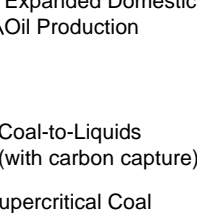
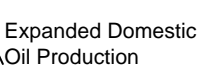
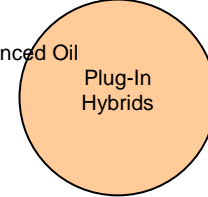
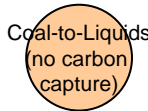
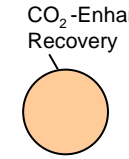
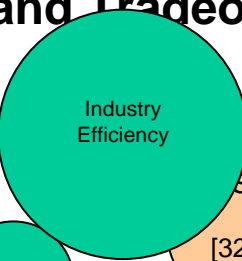
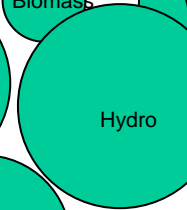
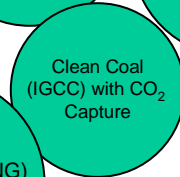
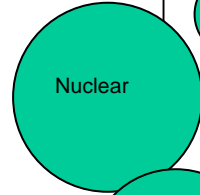
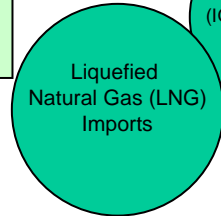
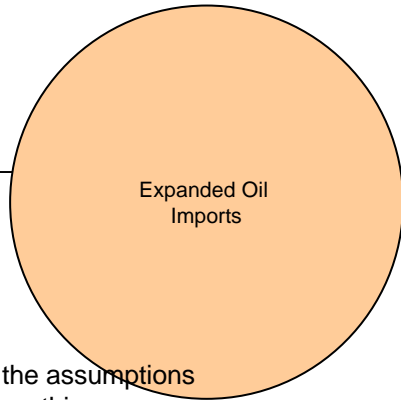
**Reduce Energy Security**

**Increase Energy Security**

**Positive Climate Characteristics**

**Negative Climate Characteristics**

Business As Usual In 2025



Building Efficiency

Frozen MPG for Vehicle Fleet (at 2005)

For specific details on the assumptions underlying the options on this chart, go to [www.wri.org/usenergyoptions](http://www.wri.org/usenergyoptions)

Revised 6/14/2007