Chinese EV Development Scenario and Reduction of Energy & Emission

中国电动汽车发展的节能减排情景分析

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Contents 内容

- Vehicle Population Forecast汽车保有量预测
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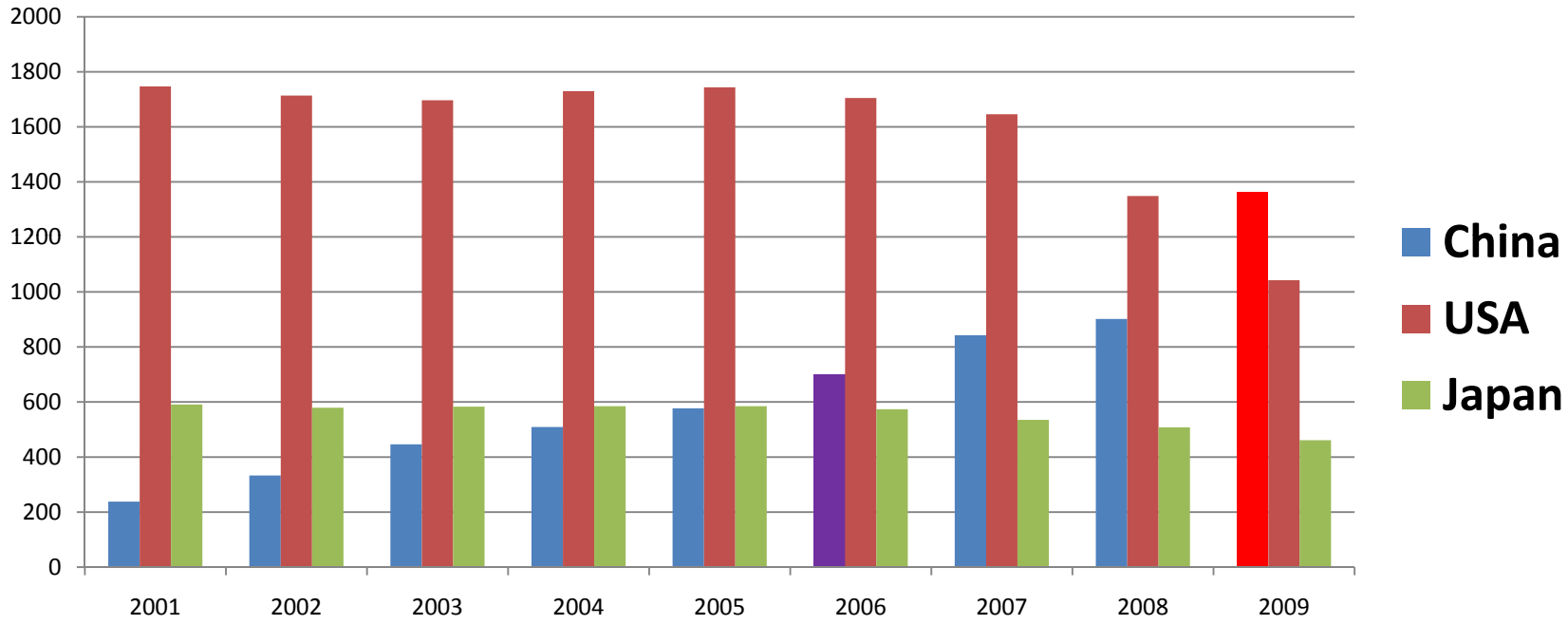
- CO2 Reduction by WTW CO2排放的WTW分析

Rapid growth of vehicle market

Top 3 Vehicle Outputs areas and Rank variation(10 thousand)



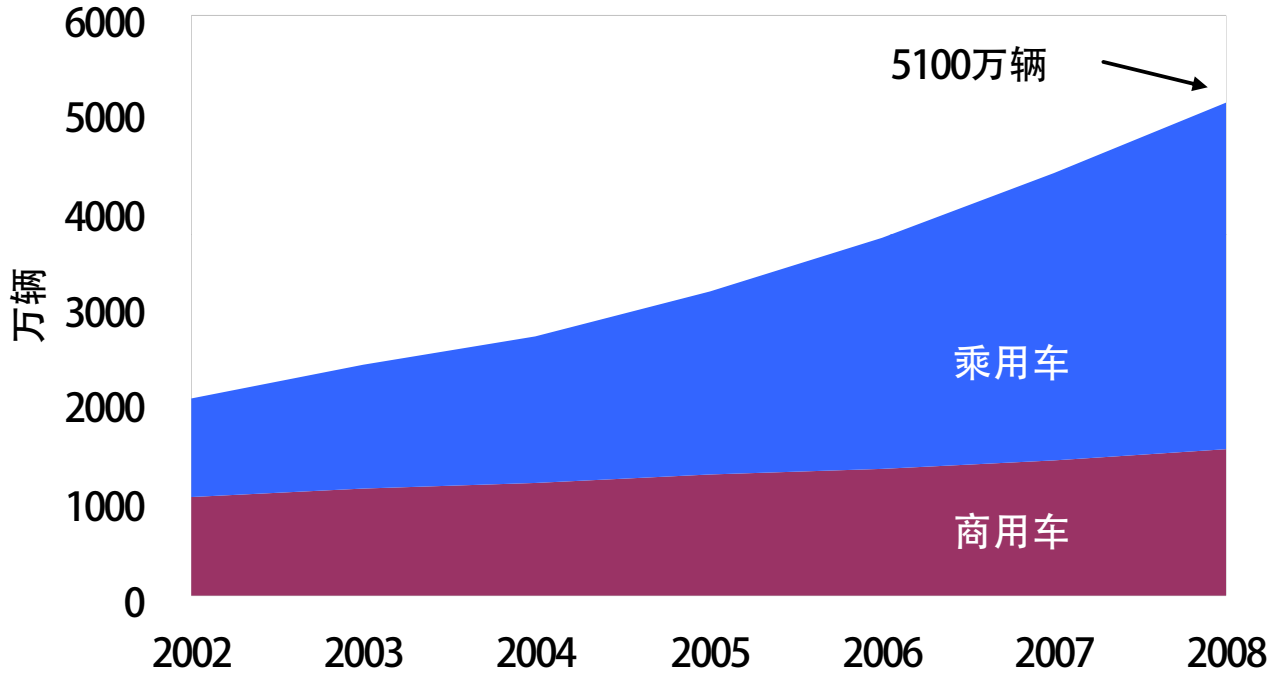
China :

2006:Rank 2nd with 7milliom outputs larger than Japan (5.7million)

2009:Rank 1st with 13.6 million outputs larger than USA (10.4million)

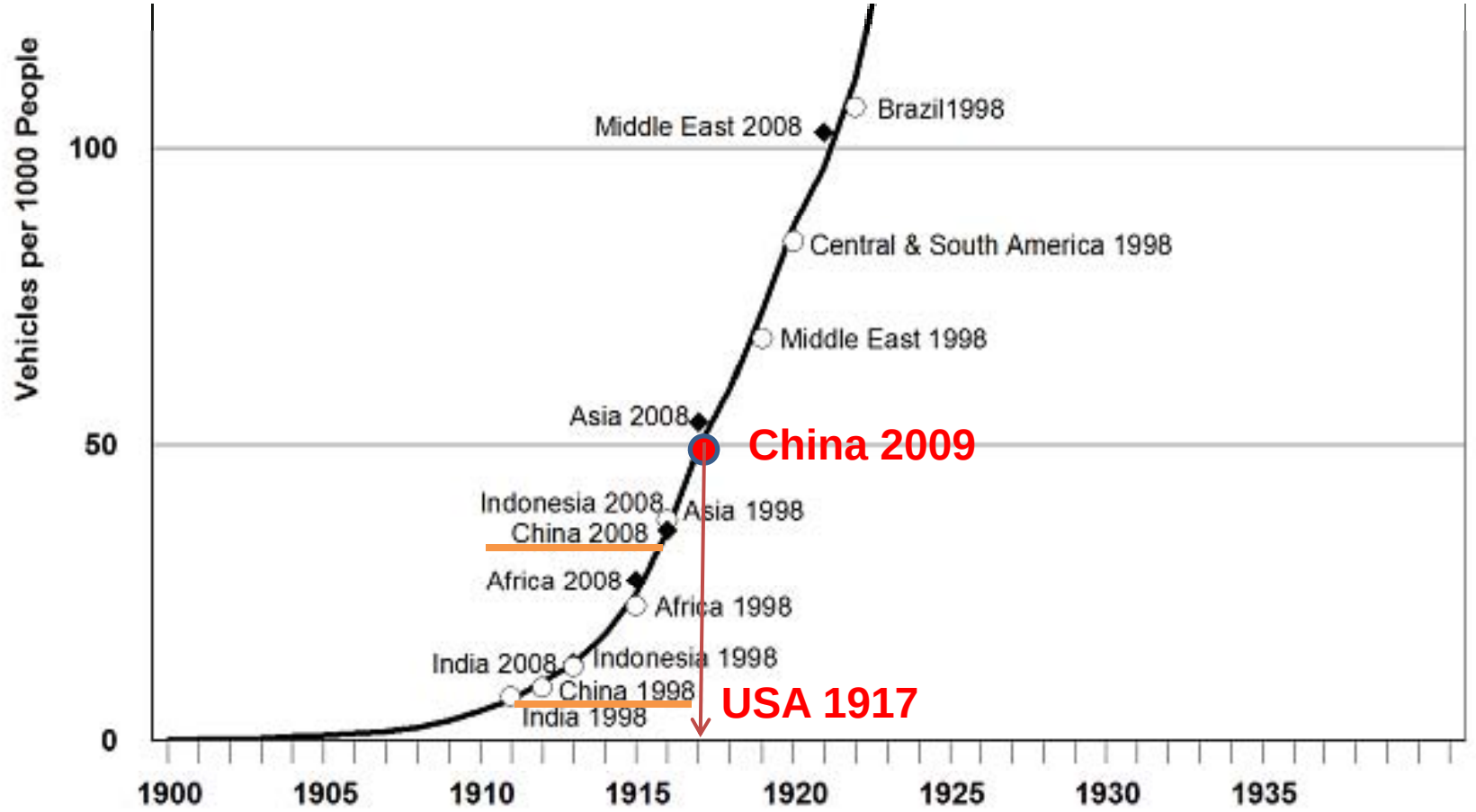
Rapid growth of vehicle population

Top 3 Vehicle Outputs areas and Rank variation(10 thousand)



At the end of 2009
Vehicle population is 76.19million，increased by 17.81%。
Vehicle ownership is 50 vehicles per 1000 persons.

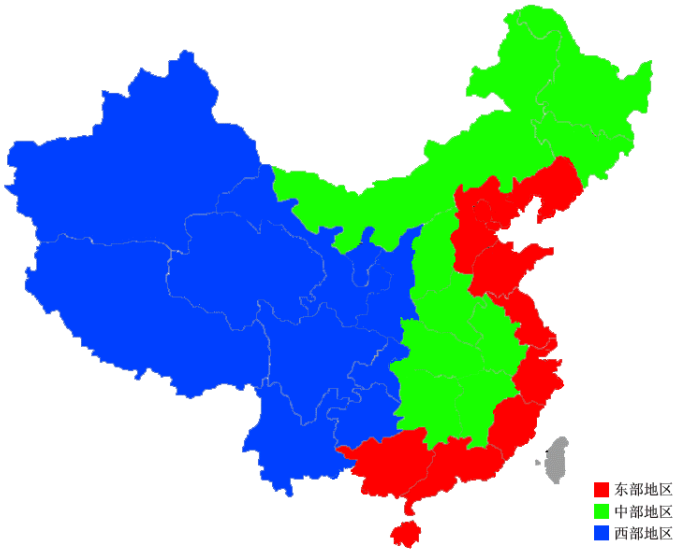
Chinese Vehicle population Vs US History



- China enters the rapid increasing period (USA after 1912)
- China took 10 yrs(1998~2009) vs USA 15 yrs (1912-1917) for same VO increased
- China is about 90 years late

Personal vehicle (car) ownership (PVO) forecast

Consideration of differences among west, central and east regions



$$PVO_i = S \cdot a^{b^{g_i}}$$

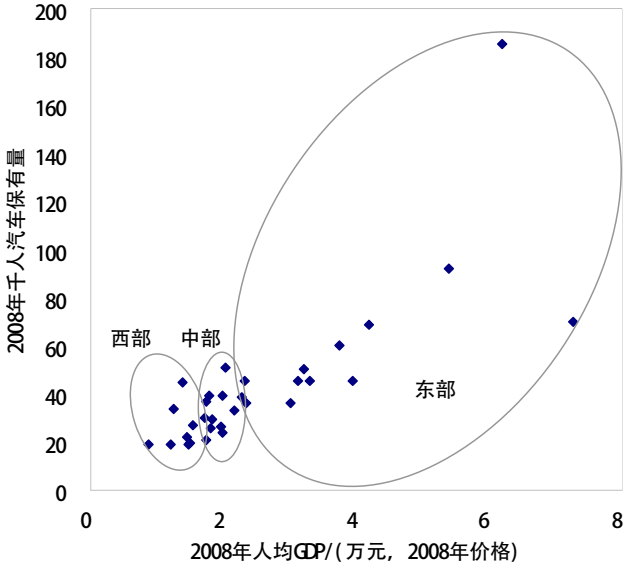
Where：

PVO_i-PV ownership in year i；

S-Saturation level of vehicle ownership；

g_i-per capita GDP in year i；

a，b-Model parameter。



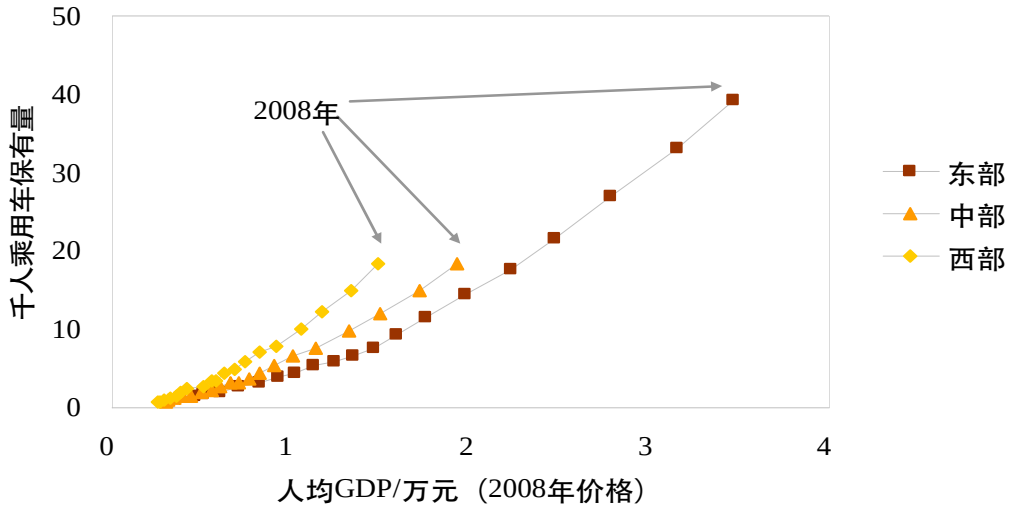
Assumption of the two scenarios

Saturation level assumption

Assumption of saturation level			
		Base	Regulation
CHINA	East	314	236
	Central	236	176
	West	157	118

Economy and social assumption

	2010	2020	2030	2040	2050
Citizen（Million）	1360	1440	1470	1470	1460
GDP(RMB per person)	21206	39403	62871	97639	14001



Commercial Vehicle ownership(CV) growth

$$CVO_i = p \cdot g_i + q$$

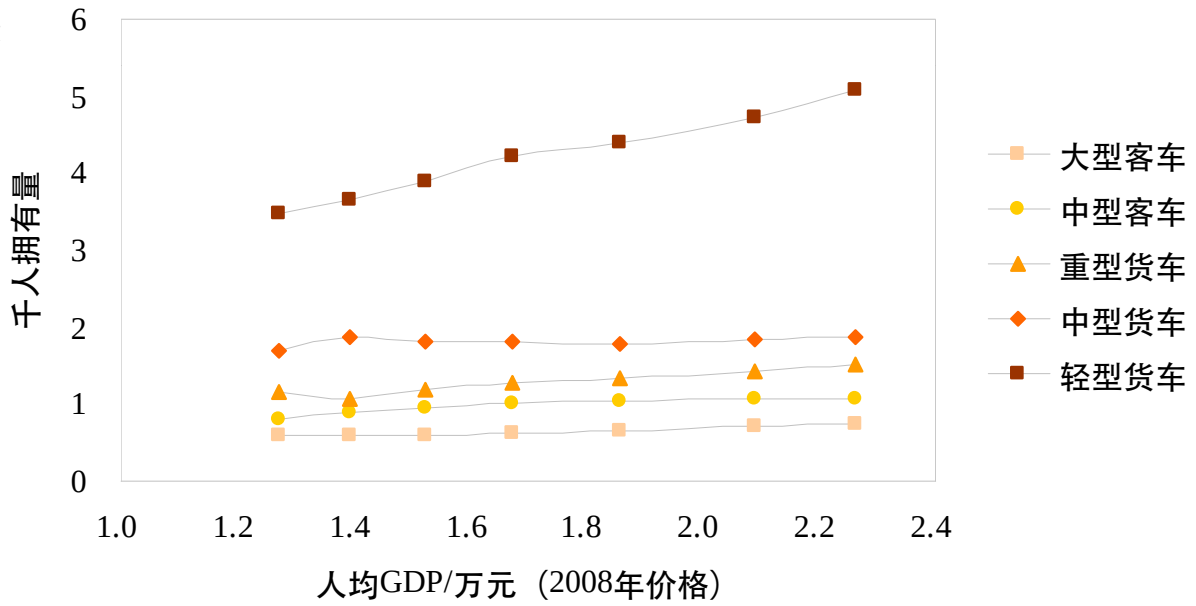
Where,

CVO_i-CV ownership in year i;

g_i-per capita GDP in year i;

p, q-model parameter。

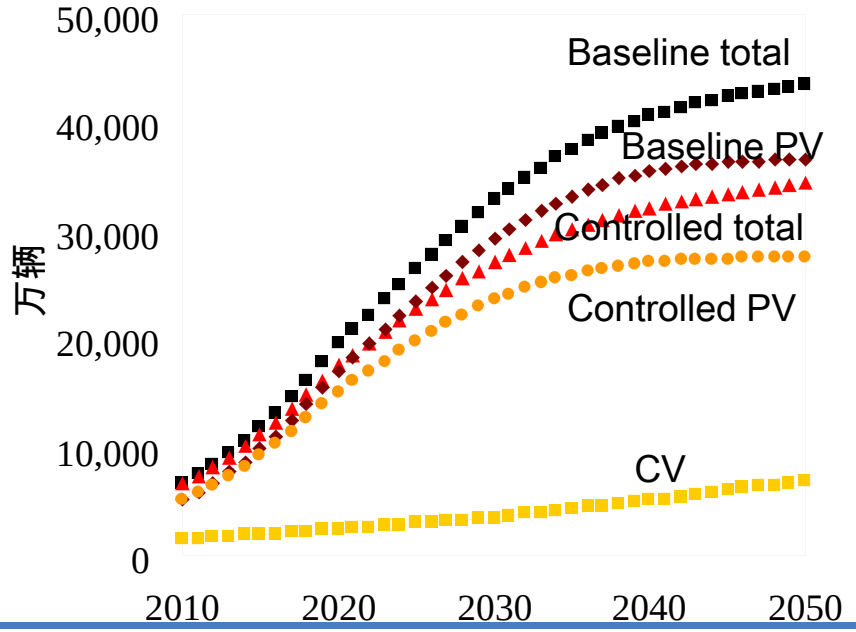
History data presents an approximately linear function of CVO with GDP

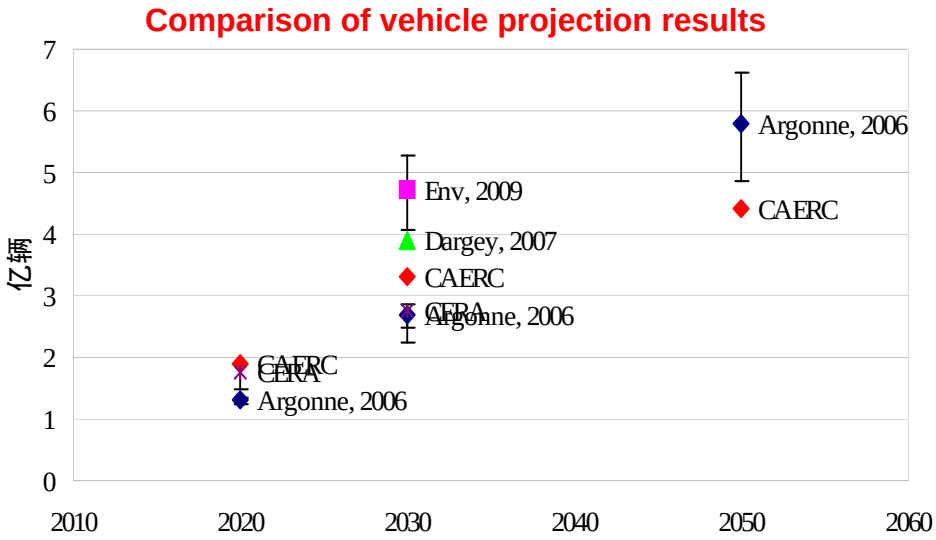


Vehicle population forecast results

Total vehicle population(10 thousand)

	Scenarios	2020	2030	2050
Total	Baseline	19527	32874	43581
	Controlled	17580	27181	34489
PV	Baseline	17125	29365	36643
	Controlled	15178	23672	27551
CV		2402	3509	6938





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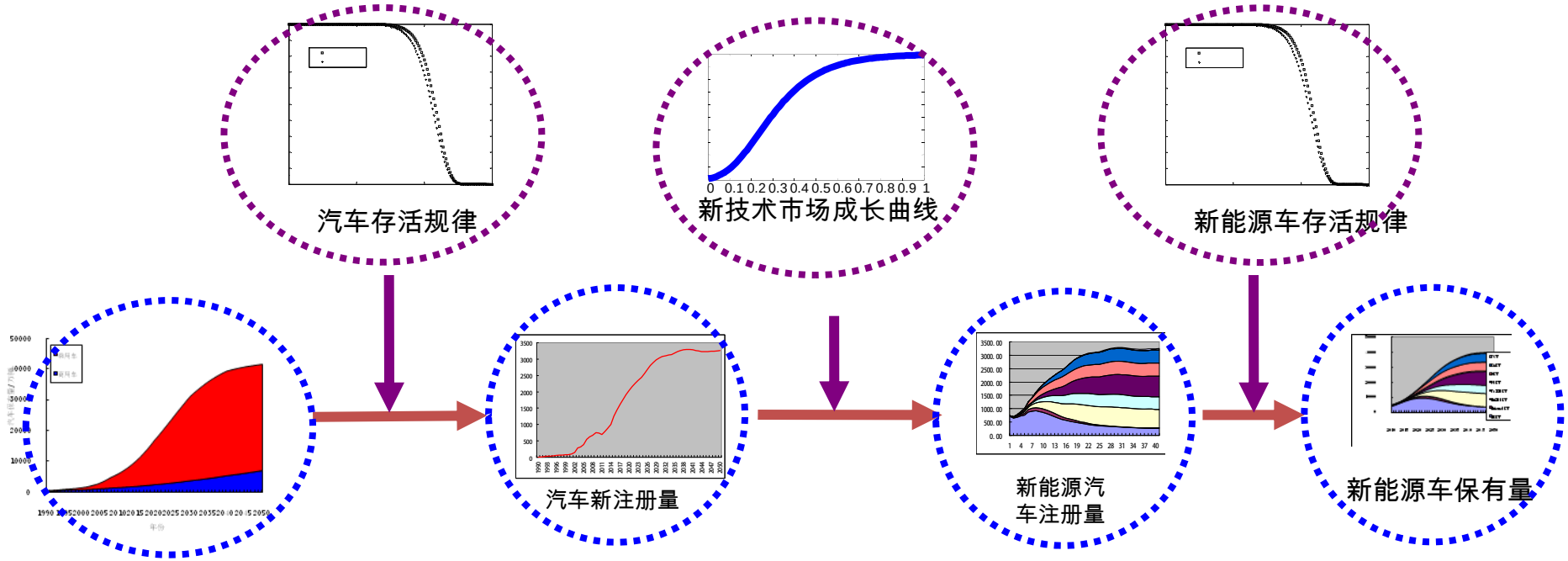
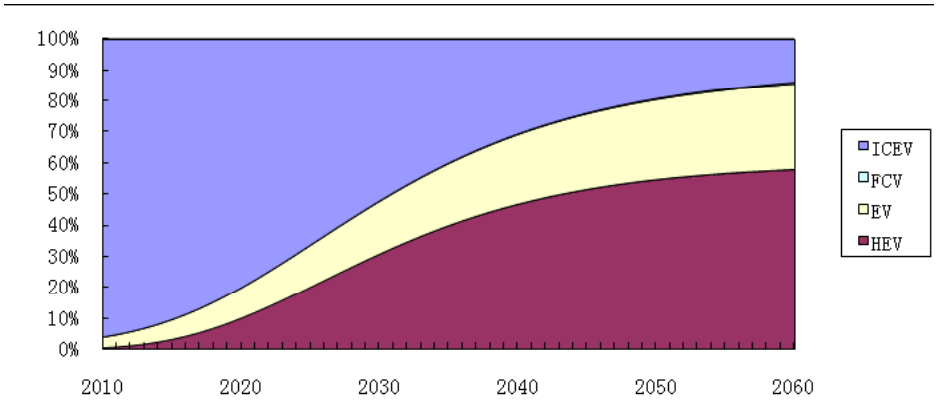
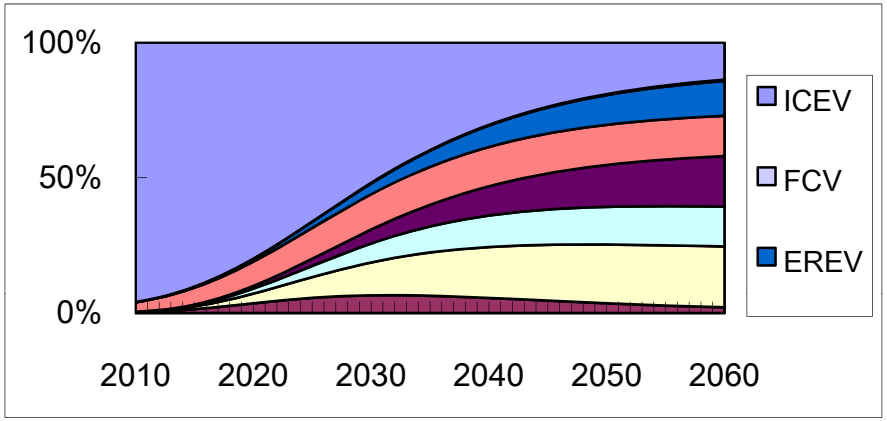
EV population forecast method



Electric vehicle market shares

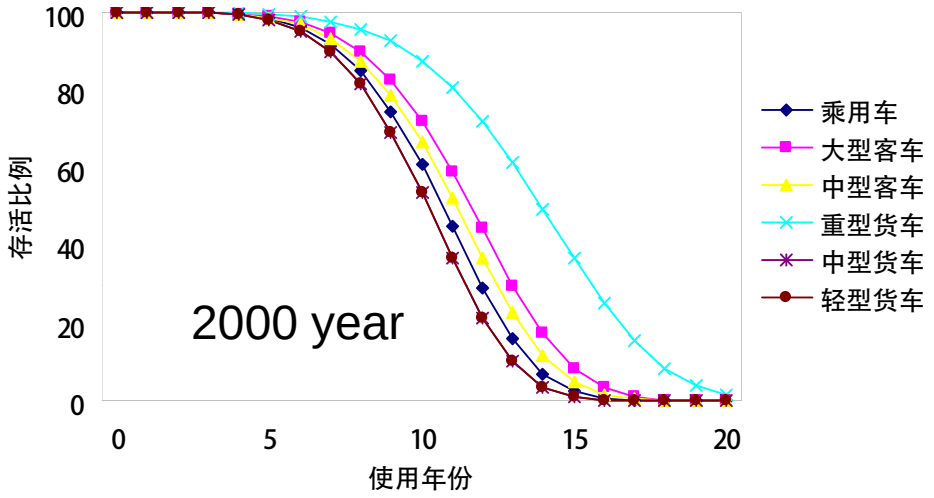


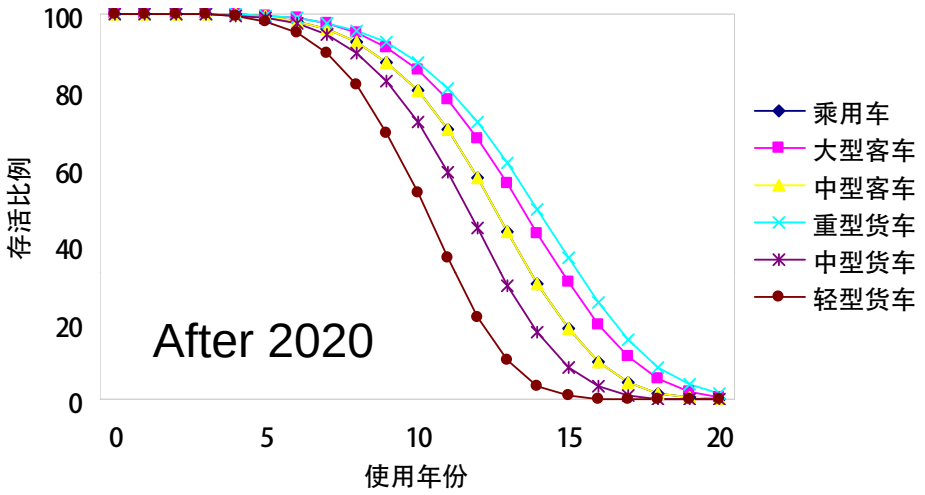


	ICEV	HEV						EV			FCV
			Non-PHEV				PHEV		BEV	EREV	
				Micro	Mild	Full					
2020	79.9%	10%	90%	40%	40%	20%	10%	10%	90%	10%	0.1%
2035	39.8%	40%	80%	20%	50%	30%	20%	20%	70%	30%	0.2%
2050	5%	60%	60%	0	60%	40%	40%	30%	50%	50%	5%

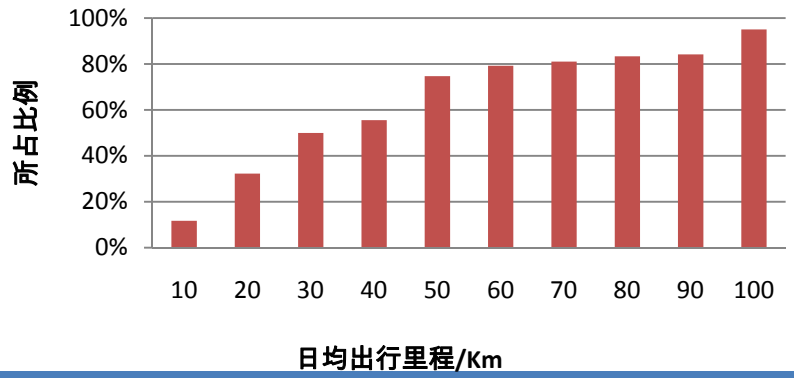
Main parameters

Average survival time increase over time

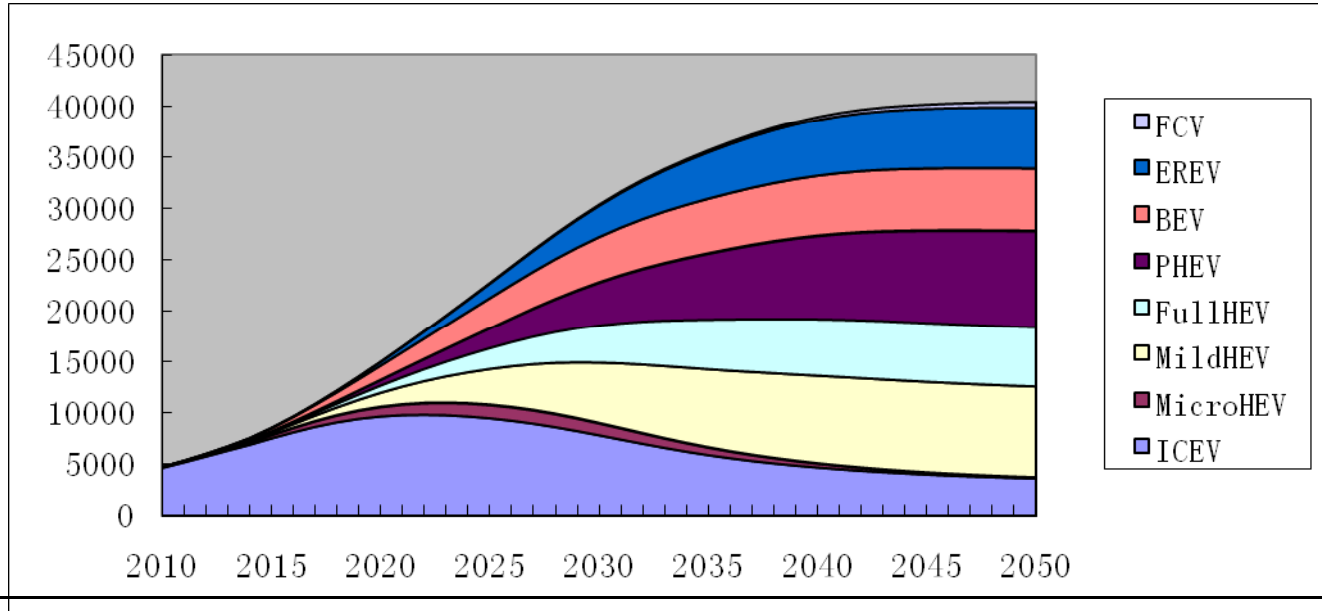




Travel distance per day(Beijing)



Population of EV in the scenario(baseline)



	ICEV	Micro HEV	Mild HEV	Full HEV	PHEV	BEV	EREV	FCV
2015	7537.48	289.58	214.97	98.40	49.80	305.75	20.63	3.94
2020	9672.17	894.24	1345.97	749.56	537.26	1398.13	365.39	15.64
2030	7847.78	1148.13	5863.39	3733.14	4175.86	4393.87	3066.40	98.81
2040	4713.38	374.30	8497.99	5624.60	8102.07	5811.12	5488.36	289.98
2050	3640.25	76.03	8810.50	5870.07	9375.59	6052.47	6013.63	545.98

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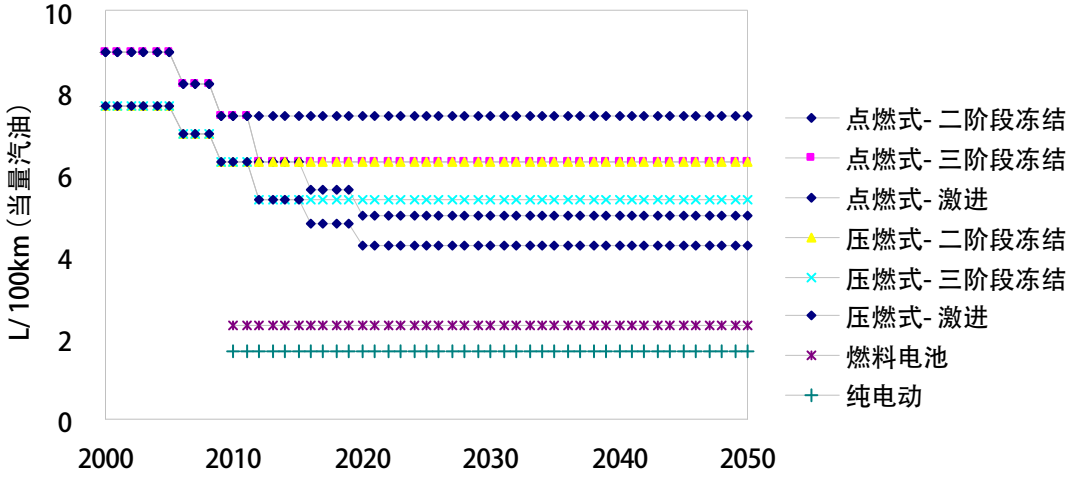
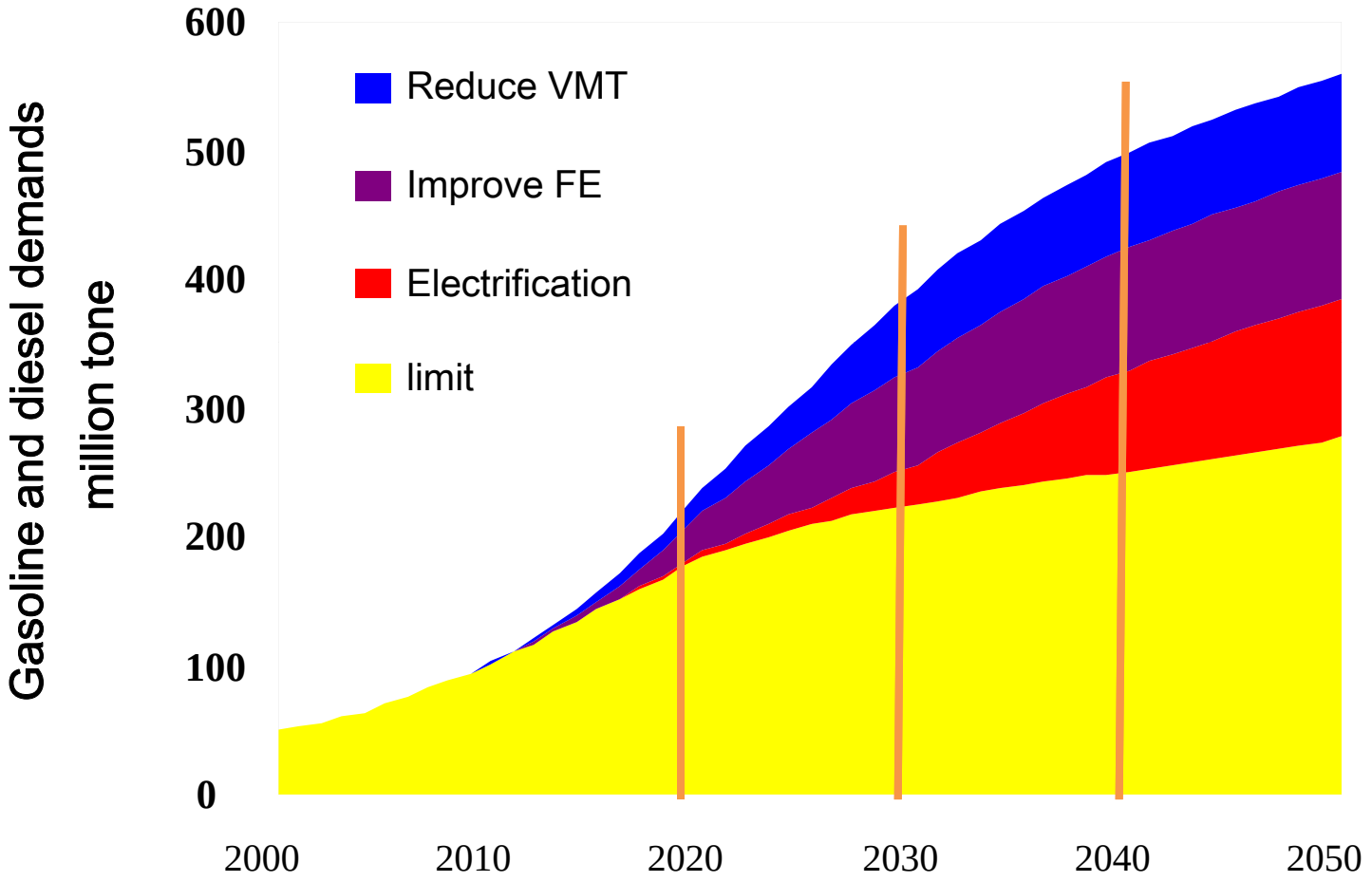
Energy reduction through electrification and comparison with other measurements

- Control vehicle usage: reducing VMT by 20%
- More restrict FE: 3rd car FE limit to 5L/100km

		2010	2030	2050
乘用车	基准情景	2.4	1.3	1.2
	政府积极限行	2.1	1.1	1.0
客车	大型客车	4	3.5	3.5
	中型客车	3.5	2	2
货车	重型货车	4	5	5.5
	中型货车	2.5	2.4	2.4
	轻型货车	2.1	2	2

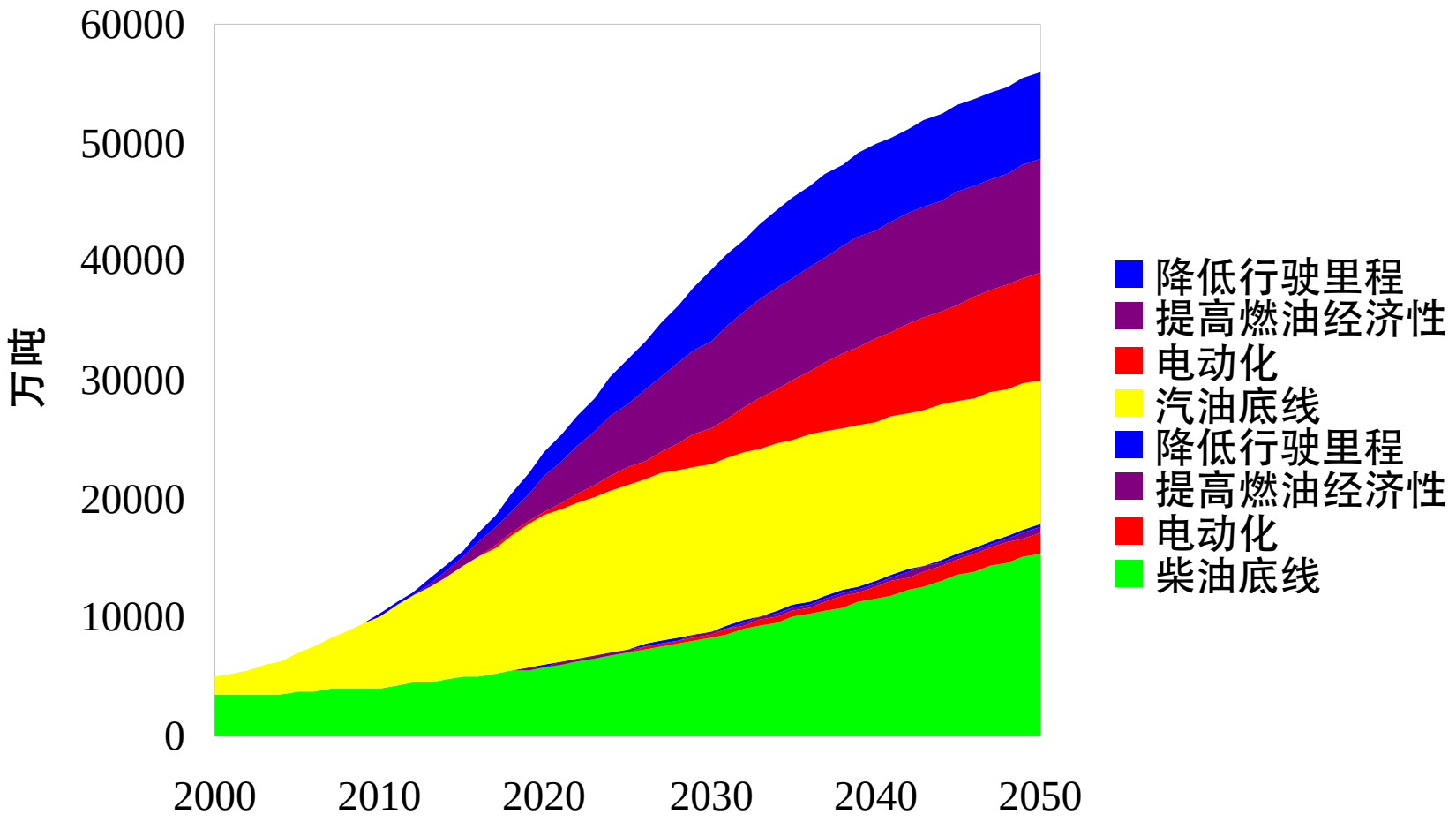


Gasoline and diesel demand



The electrification would be increasingly reducing the petroleum consumption after 2020, and be the leading measurement (more 30% after 2040)

Gasoline and diesel reduction



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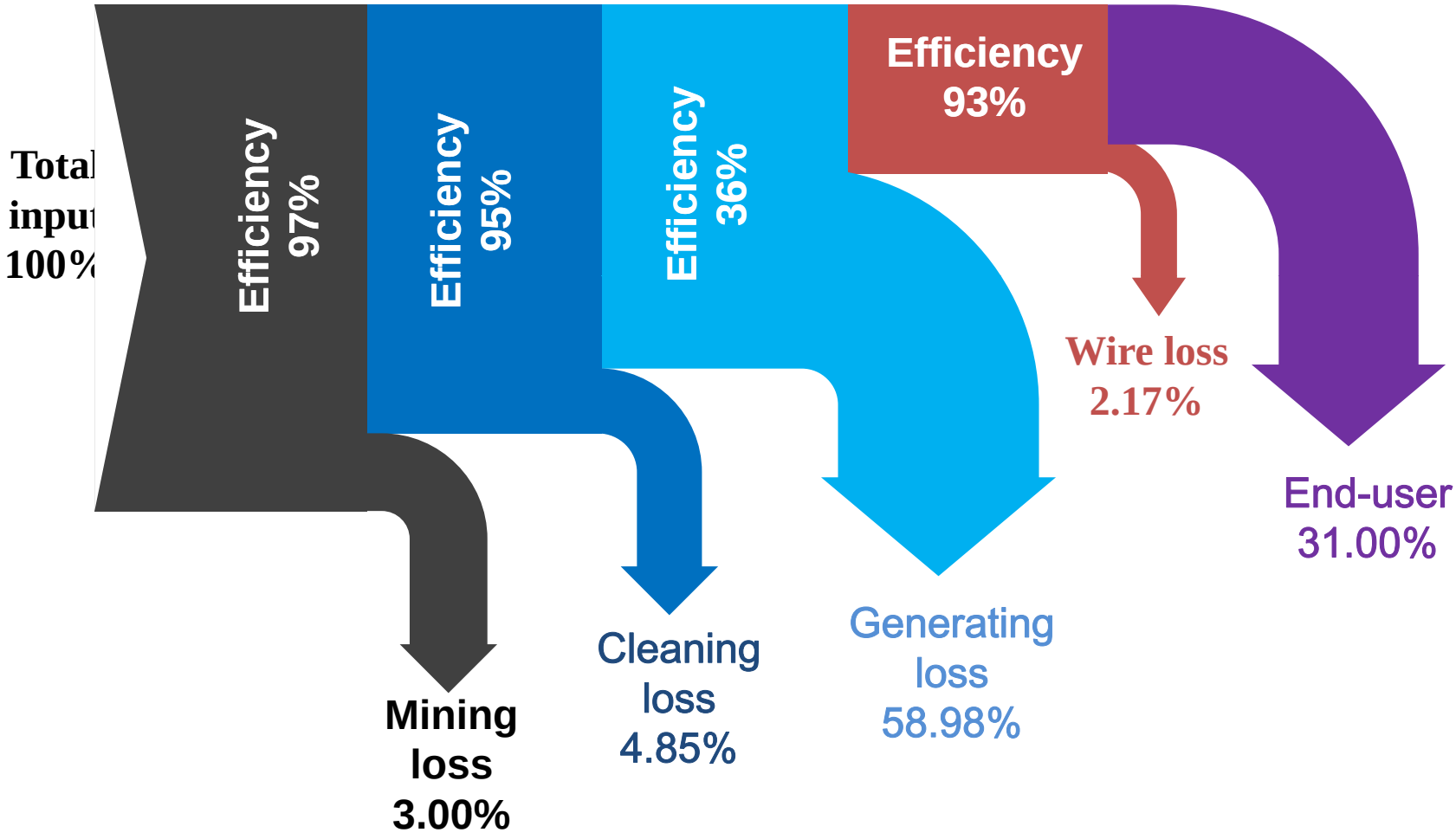
Energy loss during electric power generation (WTW)



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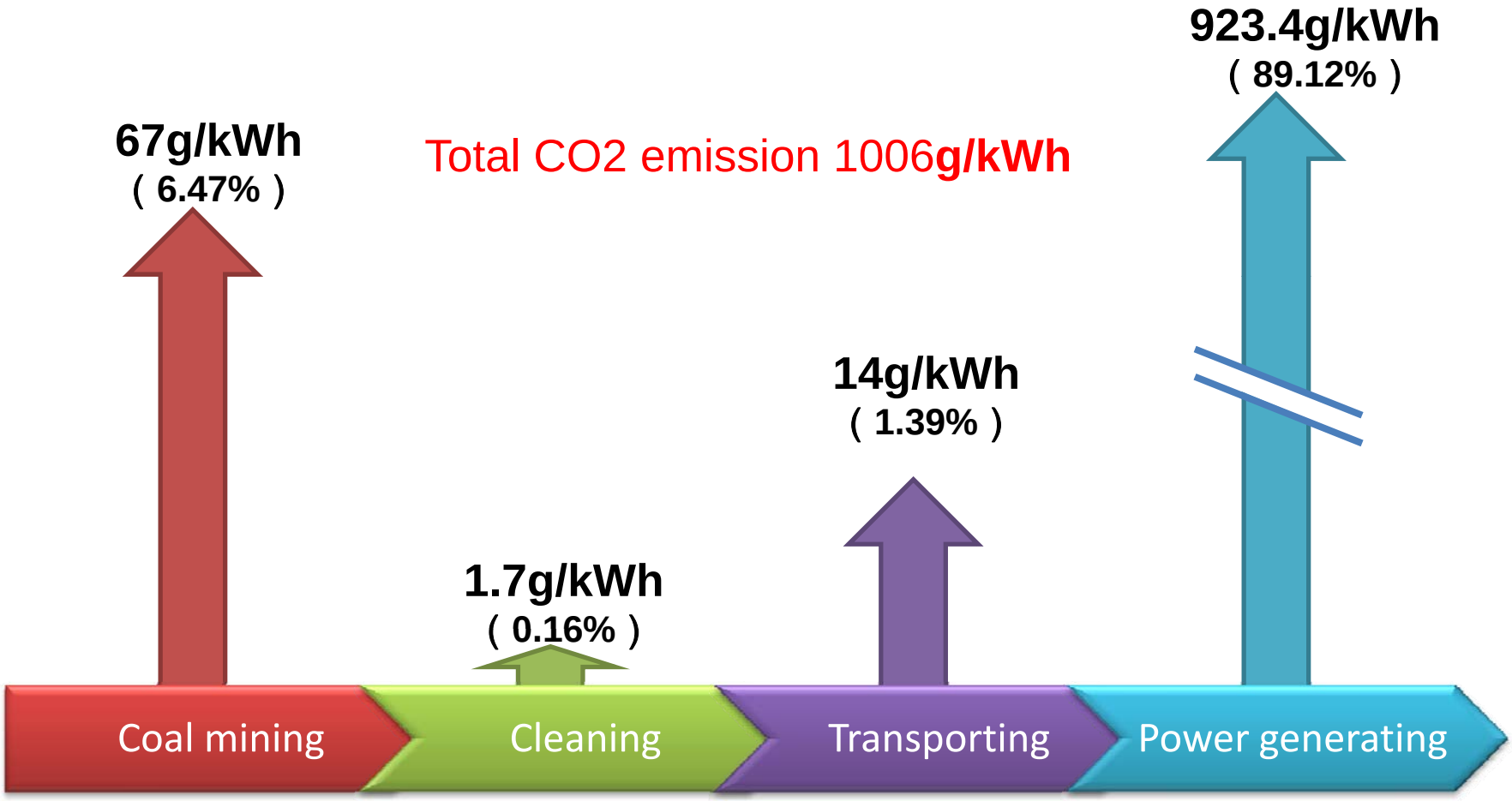
Tsinghua University

中美电动汽车合作研究中心（中国）
US-Sino EV cooperation Center (China)

CO_2 flow during the power generation
煤炭火力发电过程二氧化碳排放（CO_2）分布



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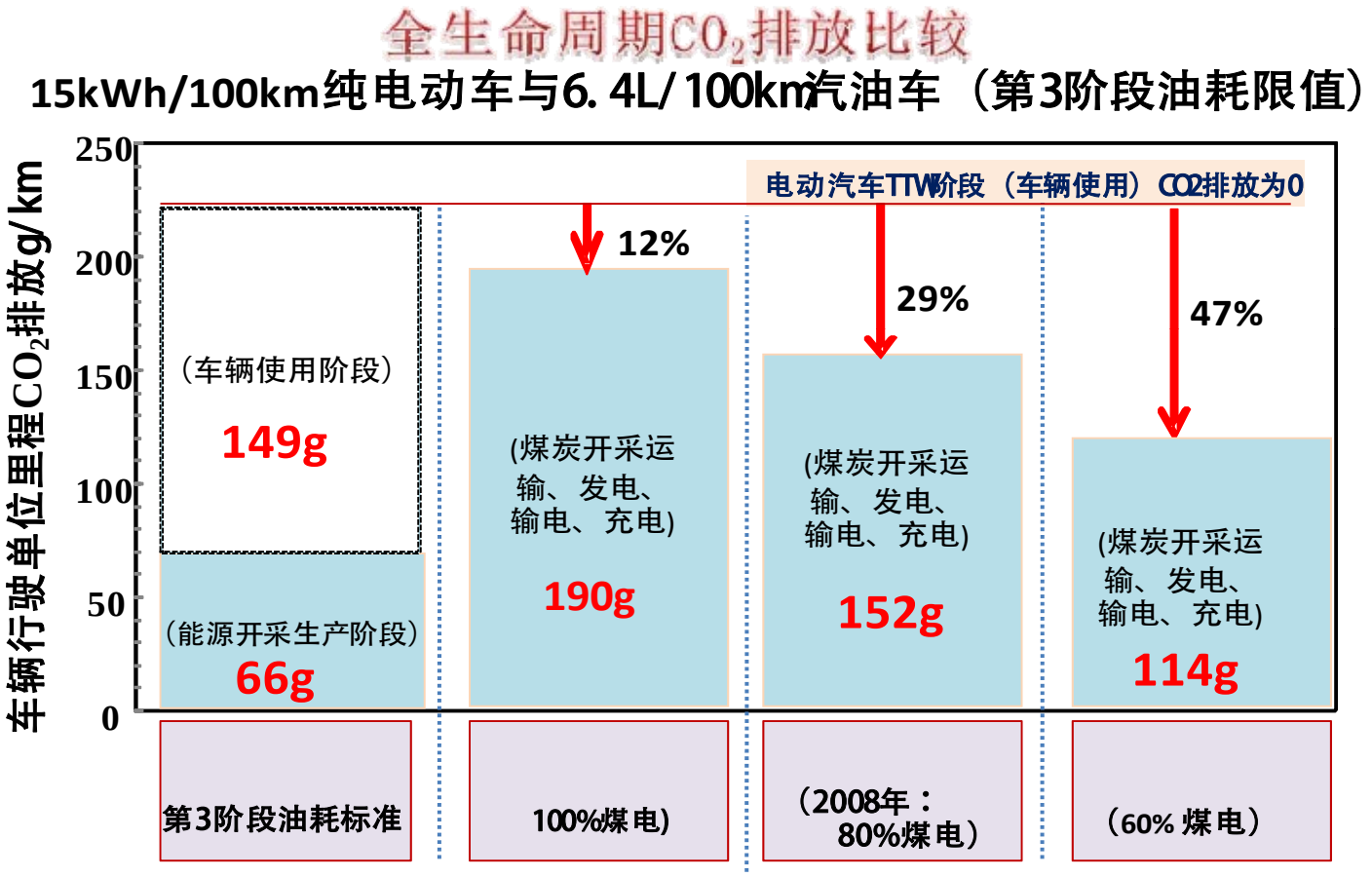
CO2 Reduction potential of EV in China electricity Mix



Conclusion

1. The Chinese vehicle will increase to 200, 300, and 400 millions in 2020, 2030, and 2050 respectively.
2. With 20%, 60% and 95% market share of EV in 2020, 2035 and 2050, the gasoline consumption is reduced by 20%
3. The electrification has the similar energy reduction with VMT and FE measurements
4. EV has 12%, 29% and 47% CO2 reduction potential under 100%, 80% and 60% coal fired generation mix in China

Thank you for your attention!

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