15:15– 16:45 Session IV (Chairperson: KOSEKI) Advanced Technologies for Land Transportation

15:15-15:40 History and state-of-the-arts of electric traction systems for rail-guided transports (KOSEKI, UOT) 軌道交通の電気駆動の技術史と動向

15:40-16:05 Future EV with Choco-Choco charge (HORI, UOT) ちょこちょこ充電する未来の電気自動車

Panel discussion: 16:10-16:45

(1) Dr. Hayashiya (JR-East): Are railways able to be as useful as automobiles? Are automobiles able to be as ecological as railways?鉄道は自動車ほど魅力的になれるか？自動車は鉄道ほど環境負荷の小さなものになるか？

(2)Mr. Teratani (TOYOTA): Expansion of HV, PHEV and EV for Sustainable Mobility and Society?持続可能な交通・社会のためのハイブリッド車、燃料電池車、電気自動車の展開

International Workshop on Sustainable Transportation and Energy

History and state-of-the-art of electric traction systems for rail-guided public transports

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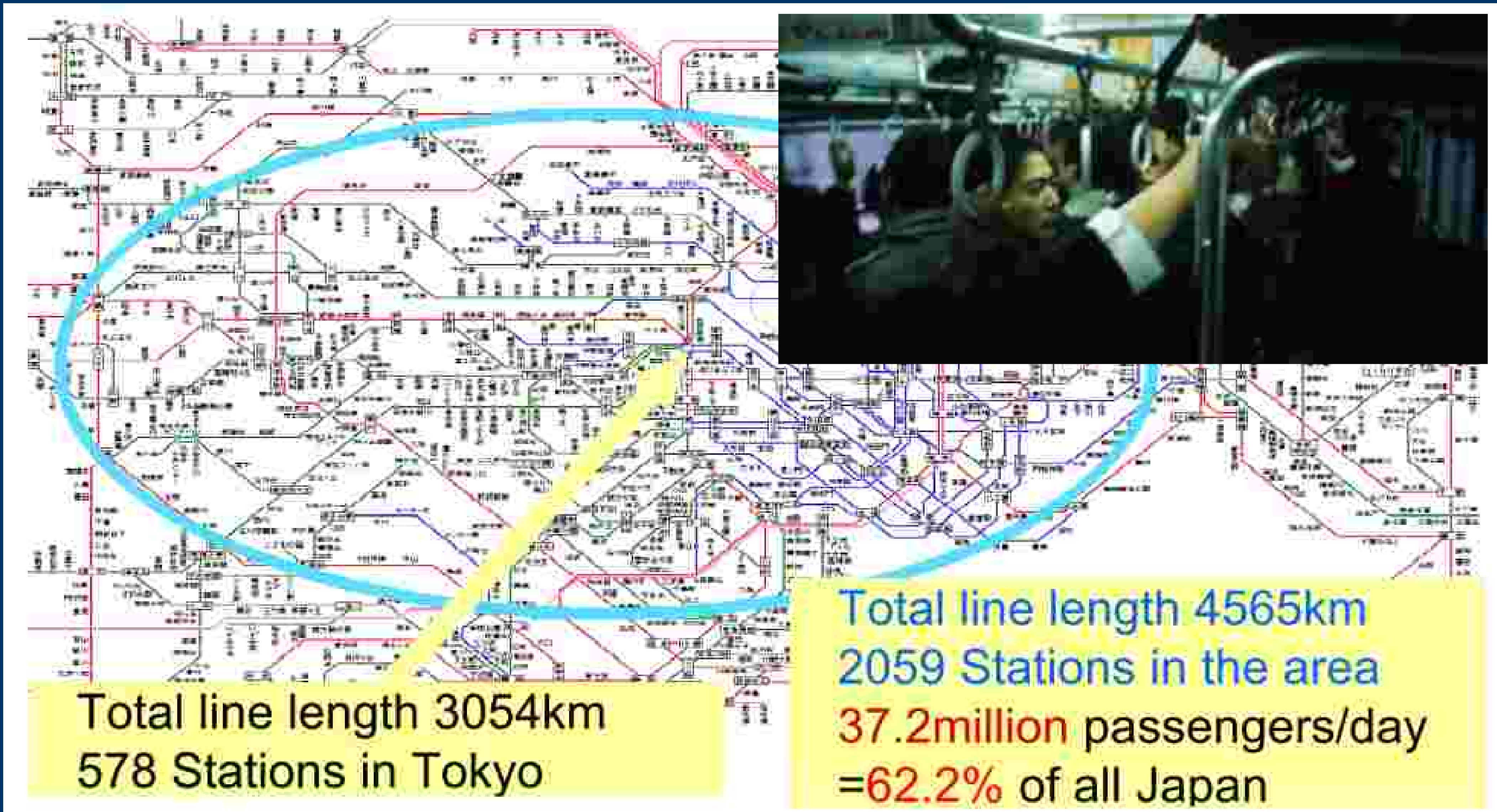
Introduction

1. Electric traction for automobile and railway

2. Regenerative brake and energy management

3. High Speed ground Transportation
   World trend
   R & D in China

Large transportation market in Tokyo area



Total line length 3054km
578 Stations in Tokyo

Total line length 4565km
2059 Stations in the area
37.2million passengers/day
=62.2% of all Japan

Birth of electric traction and its strong points

Click here!

Click here!

Electric vehicle in 19C
（The First Porsche）

The first electric train
demonstrated by W. Siemens
in Berlin in 1879

Power supply to early electric trains II
Realization of 210km/h in 1903

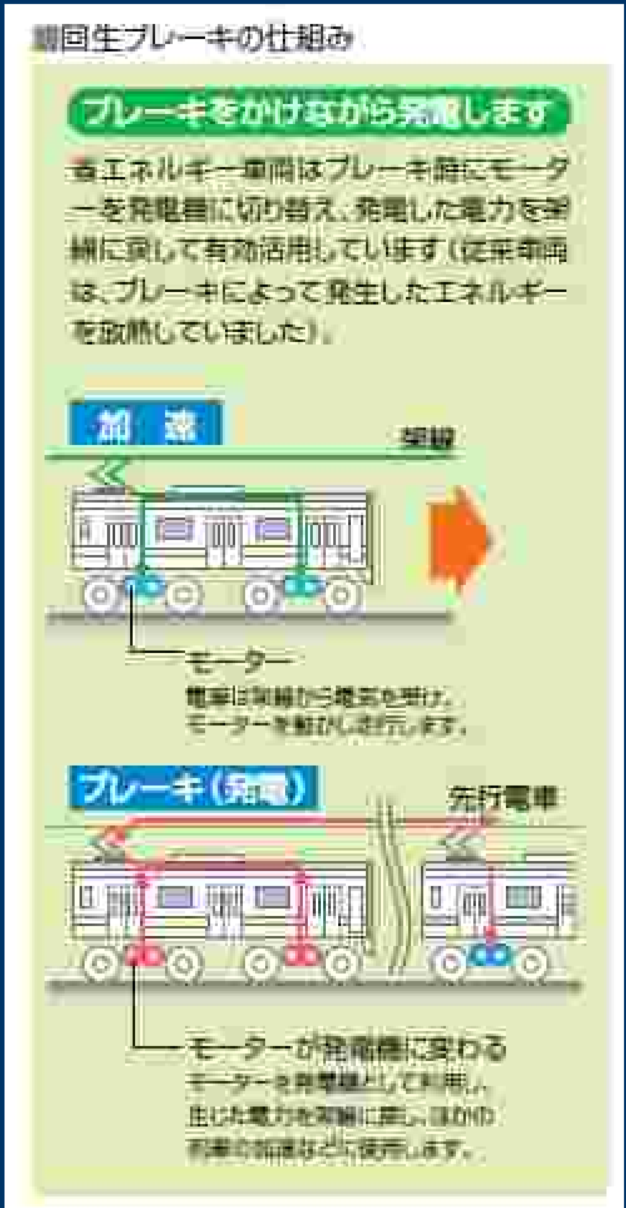
Click here!

The Era of AC-drive: substantial role of power electronics

Commutator motor and ASM (DB 120type in 1987)

Click here!

Regeneration: Pure Electric Brake



Energy storage and regenerative brakes
Zushi fly-wheel post at Keikyu

Click here!

25kWh, 3MW in August 1998
+ 12% more efficient usage of regenerated energy

Trolley less electric transports

Click here!

Bombardier catenary-free tram

Click here!

Shanghai Aowei
Technology Development Ltd.

人と環境にやさしい交通を
めざす協議会HPより転載

R&D for intercity high speed ground transports

Click here!

Source: Wikipedia--Schnellfahrstrecke

Japanese SHINKANSEN

Tokaido	270km/h	515.4km	1964–
Sanyo	300km/h	553.7km	1972–
Tohoku	270km/h	593.1km	1982–
Joetsu	225km/h	269.5km	1982–
Hokuriku			
Kyushu			
……			

Click here!

Click here!

N700 32% reduction of energy compared with series: simultaneous speed-up and energy saving

Source: Wikipedia--Schnellfahrstrecke

EXPORTED by Hitachi： BR Class 395

Click here!

For London Olympic in 2012: Olympic Javelin Shuttle
St. Pancras International Station---Ebbsflat International Sta. Shuttle operation with 6 Min headway

2009年から ロンドン –ケント間を High Spped 1（旧 Channel Tunnel rail Link）経由で運行
AC25kB 高速新線は225km/h走行、 直流750V在来線区間は160km/h走行
日立 笠戸工場で製作

French TGV

Click here!

LGV 1840km

1981 LGV SE   260km/h
1983 270km/h operation

1993 LGV Nord
Paris-Lille 300km/h operation
2007 LGV Est européenne
301km 320km/h operation
World speed record
3rd April 2007 2M3T
LGV-Est 574.8km/h
TGV/ICE

Source: Wikipedia--Schnellfahrstrecke

Automotrice à grande vitesse

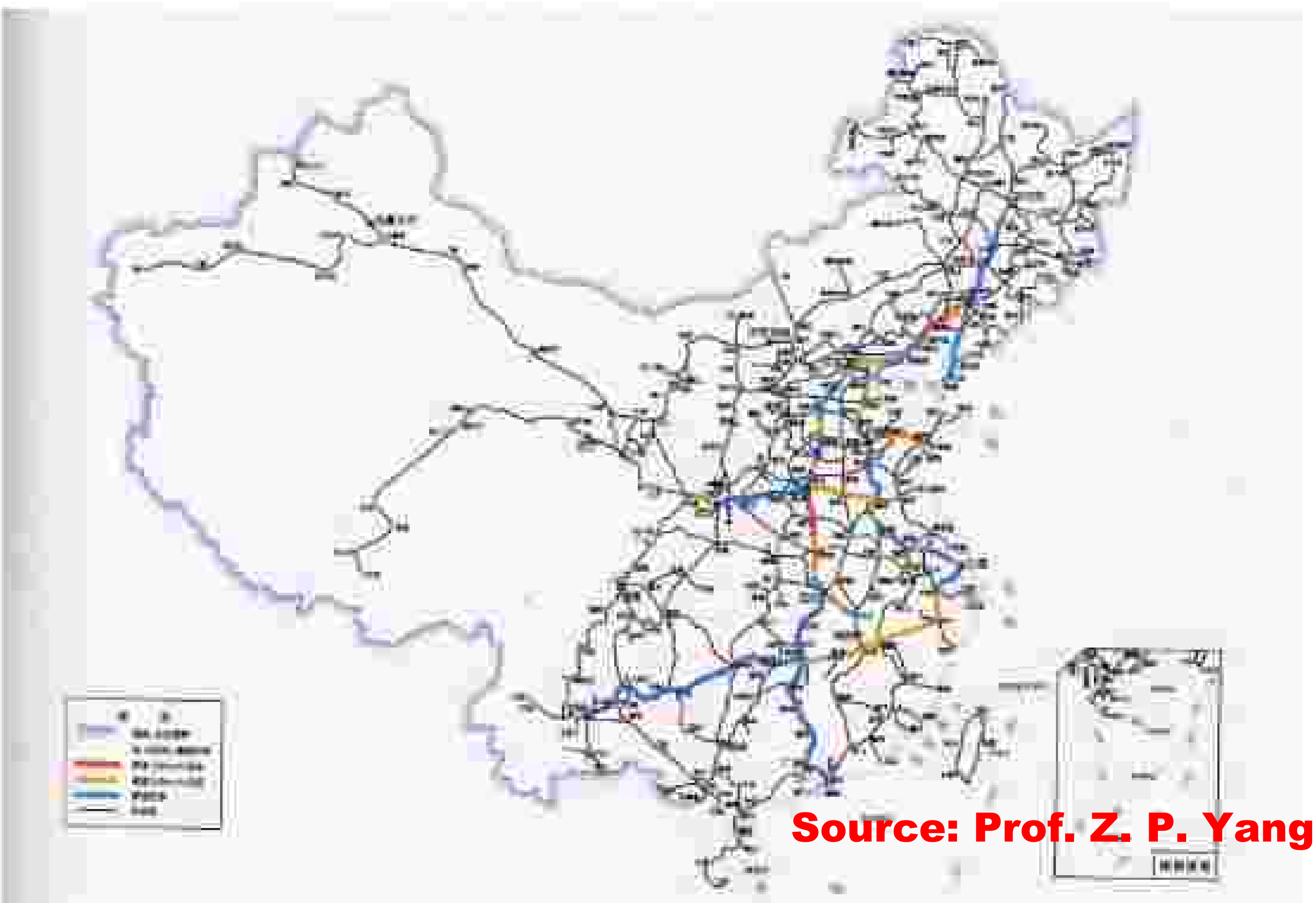
Click here!

R & D for 360km/h operation by Alsthom
IGBT inverter Permanent magnet synchronous motor **distributed drive**
June 2008- Checo Velim tesst line 7car train 210km/h test-operation for 4 months
December 2008- 360km/h trial at LGV Est

Source: Wikipedia--AVG

HGST-market in China

The 6th Speed Up Lines

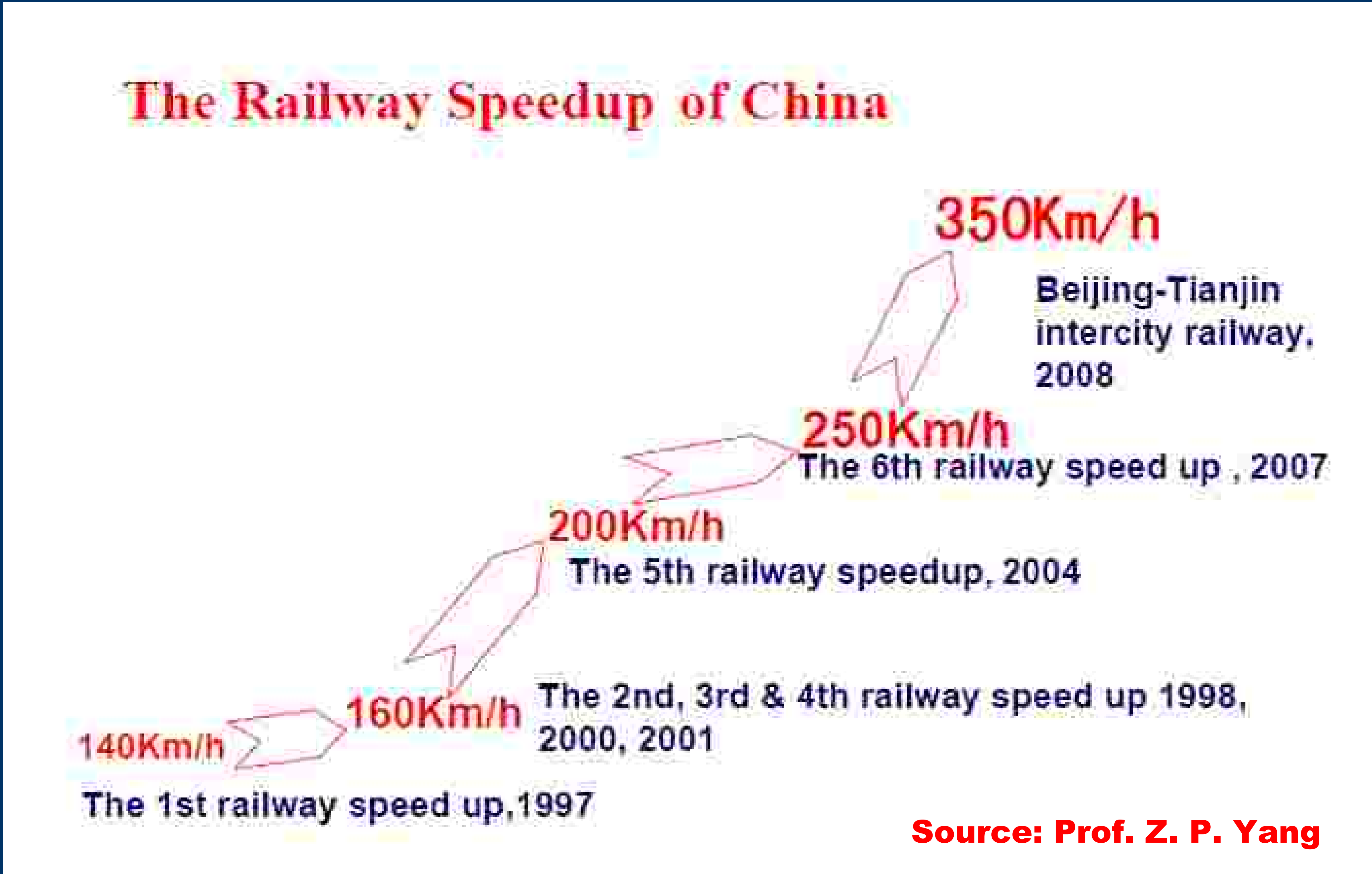


Source: Prof. Z. P. Yang

The main data comparison between China and Japan

Railway Data	China (2008)	Japan (2007)
Route length (km)	79687	27, 625
The ratio of electrified railway(%)	34. 6	63
The ratio of double track railway (%)	36. 2	41
Passenger traffic volume (billion person-km)	1461. 9	384. 4
Freight dispatch volumn(billion t-km)	3290. 4	22. 4
High speed railway data	**China (now)**	**Japan (now)**
Existing line operation speed (km/h)	250	160
Maximum operation speed (km/h)	350	300
Maximum test speed (km/h)	394	443

Source: Prof. Z. P. Yang


The Railway Speedup of China
350Km/h
Beijing-Tianjin intercity railway, 2008
250Km/h
The 6th railway speed up , 2007
200Km/h
The 5th railway speedup, 2004
160Km/h
The 2nd, 3rd & 4th railway speed up 1998, 2000, 2001
140Km/h
The 1st railway speed up,1997
Source: Prof. Z. P. Yang

The 6th Speed Up

- The 6th large scale train speed up was done in China on 18th April 2007.
- Four types Chinese high speed trains (CRH series) were introduced for the existing lines for 200km/h operation.
- The 6th speed up was very successful, it has received considerable attention in the world.

Source: Prof. Z. P. Yang

The prototype high speed trains for CRH Series

Regins → CRH 1 (BSP)

ICE3 → CRH 3 (Tangshan)

E2-1000 → CRH 2 (shifang)

SM3 → CRH 5 (Changchun)

Source: Prof. Z. P. Yang

Shorter traveling time by the 6th speed up

Line	Section	Distance	Before the 6th speed up	Now	Shorter time
Jingha Line	Beijing~ Changchun	1,126 km	8 h 20 min	6 h 7min	2 h13min
	Beijing~ Harbin	1,372 km	10 h30min	7 h 50min	2 h40min
Jinghu Line	Beijing~ Tianjin	137 km	1 h14min	1 h6min	8min
	Beijing~ Shanghai	1,463 km	11h58min	9 h59min	1 h59min
Jingguang Line	Beijingxi~ Wuhan	1,205 km	10h0min	8h22min	1h58min

Source: Prof. Z. P. Yang

The Characteristic of Beijing-Tianjin intercity railway, 2008

- Length of line is 120 km, the ratio of elevated bridge is 87%, the total line adopts ballastless track and jointless track;
- Simple catenary wire-supported overhead conduct system is adopted;
- The CRH2-300 and CRH3 EMU are applied, these amount is approximate 20;
- Maximum operation speed is 350km/h.

Source: Prof. Z. P. Yang

The current CRH EMUs in China

CRH1(Baed on Bonbardier Regina)

CRH2(Based on KHI E2-1000)

CRH3(Based on Simens Velaro-E)

CRH5(Based on Alstom SM3)

Source: Prof. Z. P. Yang

Main technical parameters of CRH EMUs

Item \ Train	CRH1	CRH2	CRH3	CRH5
Train Formation	5M3T	4M+4T 6M+2T 8M8T	4M4T	5M3T
Fixed number of persons (person)	668	610（long formation） 1230（long formation） 630（long formation & sleeper train）	557	622
Operating speed (km/h)	250	250/350	350	250
Test speed (km/h)	275	275/385	394.3	275
Traction power (kW)	5500	4800/8200（short formation） 9600（long formation）	8800	5500
Car body style	Stainless steel	Aluminum alloy		
Axle load (t)	≤16	≤14 ≤17	≤17	
Brake mode	Electro-pneumatic and regenerative brake			

Source: Prof. Z. P. Yang

High speed rail program in China

The China contribution and impaction for global high speed railway

- Because a large scale development in China, more and more counties are planning to build high speed railway, for example USA;
- Though Power-distributed EMU was established by Japan, owing to acceptance and adoption by China high-speed train, so this model maybe will be widely used in the world;
- The operation speed 350km/h is sampled and succeeded for the first time in China. At present, France is doing the same experiments.

Source: Prof. Z. P. Yang

Concluding remarks

1. Continuous power supply played significant roles in early growth of electric railway.
2. New technology for energy storage shall be a key for energy management in electric traction.
3. Environmental friendliness will be a key word for electric drives, especially for rail-guided public transports.
4. Electric High Speed Ground Transport will play significant roles in sustainable further growth all over the world, especially in Eastern Asian market including China.

Thank you for your attention!

Discussion I

Will electric automobiles be ecological transport mode like electric railways in future?

Will a novel way of use of electric cars and their limited performance change the modal split in preferable direction?

Discussion II

How large will be a desirable energy storage for personal cars?

What is the target in a long-term R & D by automobile manufacturers?

Discussion III

What is the substantial advantage of electric automobiles? Is it just more ECOLOGICAL?

Discussion IIIA

Electric installation will make automobiles substantially safer?

To what extent is it possible?

Discussion IV

What efforts are railway operators making to realize "attractive" rail-service competent to automobiles?

Will the efforts contribute to the realization of sustainable mobility ad society?

Discussion V

How do automobile engineers or TOYOTA observe such technical efforts of railway operators for realizing ATTRACTIVE rail transport service?