

# 13<sup>th</sup> UIC Sustainability Conference



## UIC-IEA Railway Handbook 2016 Focus on sustainability targets

Energy efficiency projects: potential  
improvements for mid and long term

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12, 13, 14 October 2016

# UIC-IEA Railway Handbook 2016

## Focus on sustainability targets



### **Joint initiative UIC-IEA (International Energy Agency)**

- Objectives:
- Promote good performance of railways with sound evidence
- "Certification" of railways official data within international context
- Co-operation for robust Energy and CO<sub>2</sub> data

**IEA and UIC signed an agreement to publish one Handbook every year**



# Focus: Sustainability Targets



COMPANIES	CO <sub>2</sub> TARGETS	ENERGY TARGETS
<b>ATOC</b> <b>NETWORK RAIL</b> Country: United-Kingdom Source: ATOC (2015)	Reduction of carbon emissions by 34% by 2020 and by 80% by 2050, both from 1990 levels (in line with the UK Government targets).	
<b>DEUTSCHE BAHN</b> Country: Germany Source: DB (2016)	By 2020, reduction of specific CO <sub>2</sub> emissions from rail, road, air and ocean transportation by 30% compared to 2006 levels. By 2050, rail transport completely CO <sub>2</sub> -free.	Increase of renewable energy sources (increase to 45% until 2020).
<b>INDIAN RAILWAYS</b> Country: India Source: UNDP (2011)	Saving of 3.33 million tonnes of CO <sub>2</sub> by 2020 (80% over the period 2011/12-2020/21).	Saving of 4.05 billion kWh by 2020.
<b>JR-EAST</b> Country: Japan Source: JR East (2014)	Halving of CO <sub>2</sub> emissions from its railway business by FY 2030 compared to FY 1990. CO <sub>2</sub> emissions: -30% by 2021 relative to 1991.	Energy Consumption: -8% by 2021 relative to 2011.
<b>JR-WEST</b> Country: Japan Source: JR West (2016)		Energy consumption rate (MJ/Rolling-stock km) -3% compared to FY 2011. 83% Energy-saving railcars as a percentage of total railcars in FY 2018.
<b>KORAIL</b> Country: South Korea Source: KORAIL (2015)	GHG mid-term reduction goals: -8% by 2019 from 2015 levels.	
<b>NS Group</b> Country: Netherlands Source: NS (2015)	Full CO <sub>2</sub> neutral railway sector (CO <sub>2</sub> emissions from energy and materials) by 2050.	Improve energy efficiency by 35% by 2030 and 40% by 2050 compared to 2013
<b>NSB</b> Country: Norway Source: NSB (2015)		Reduction of power consumption by 15% from 2013 to 2017.
<b>Renfe</b> Country: Spain Source: Renfe (2015)	Less than 20 g of CO <sub>2</sub> per traffic unit (TU).	

In parallel to the targets set for the rail sector as a whole, a number of railway companies are showing initiative by setting their own energy and sustainability goals.

Table. 19: Examples of targets set by rail companies \_ PART 1



# Focus: Sustainability Targets



COMPANIES	CO <sub>2</sub> TARGETS	ENERGY TARGETS
<b>RZD</b> Country: Russia  Source: RZD (2014)	Reduction of the negative environmental impact (CO <sub>2</sub> emissions) by 7% in 2017 and by 15% in 2030 compared to 2012 (optimistic scenario).	
<b>SNCB</b> Country: Belgium  Source: SNCB (2012)		Use 1% less traction-energy per passenger-km annually between 2010 and 2020.
<b>SNCF</b> Country: France  Source: SNCF (2016)	Cutting GHG emissions by 20% between 2014 and 2025.	Traction: reduce electricity and diesel fuel consumption by 20% between 2012 and 2022. Buildings: reduce electricity, home heating oil and natural gas consumption by 20% between 2012 and 2020.
<b>THALYS</b> Country: International HS Source: THALYS (2015)	Reduction of CO <sub>2</sub> emissions by 40% by 2020 compared to 2008 levels.	
<b>VIA RAIL CANADA</b> Country: Canada Source: VIA RAIL CANADA (2015)	Reduce GHG emissions by 20% by 2020 and 30% by 2030 compared to 2005 levels.	

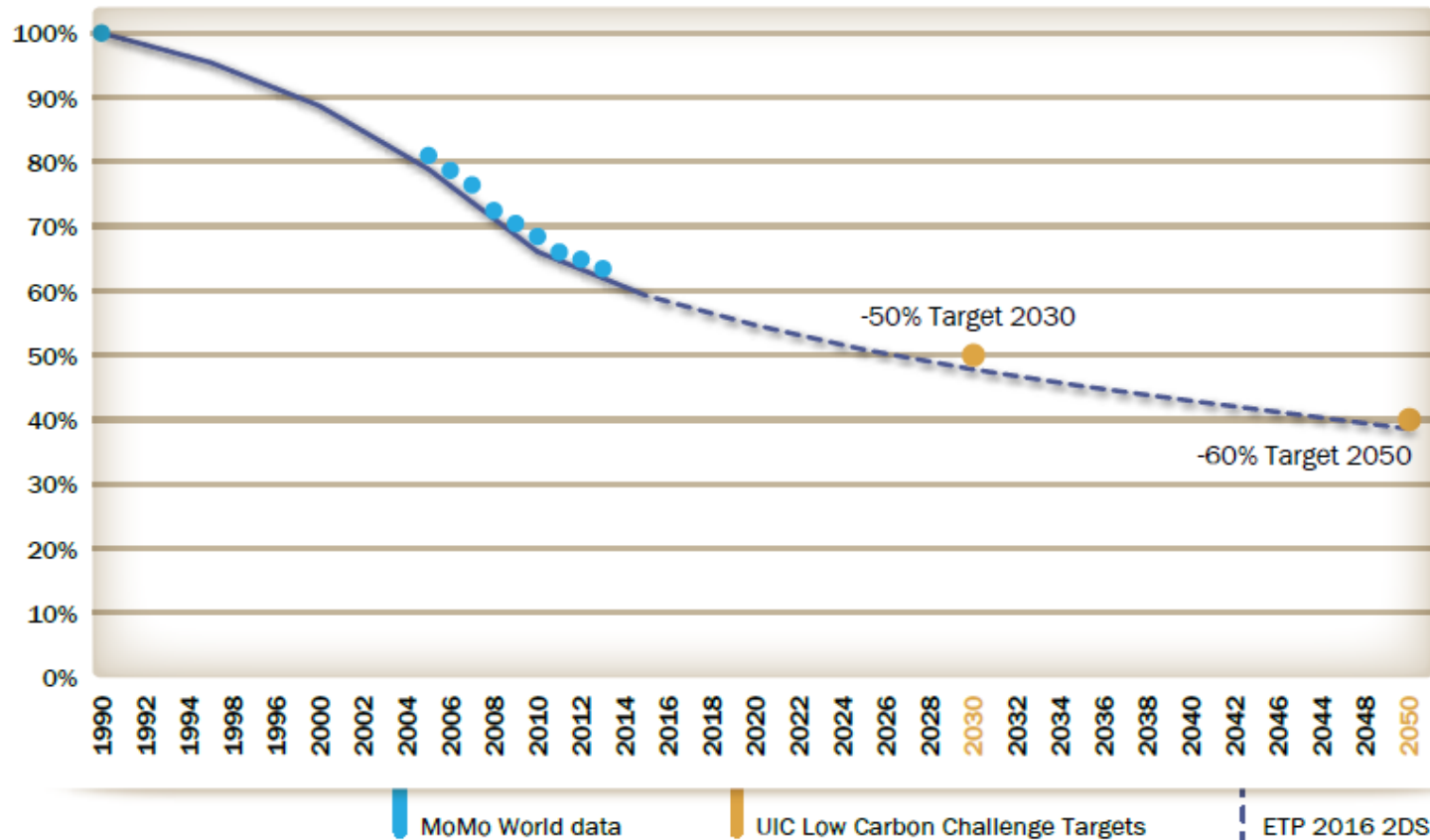
Table. 19: Examples of targets set by rail companies \_ PART 2



# Focus: Sustainability Targets



World specific rail energy consumption evolution per traffic unit (TU) between 1990-2013 compared to 2030 and 2050 targets (1990=100)



**Specific energy consumption has reduced by 37% between 1990 and 2013**

Elaboration by SUSDEF based on IEA and UIC

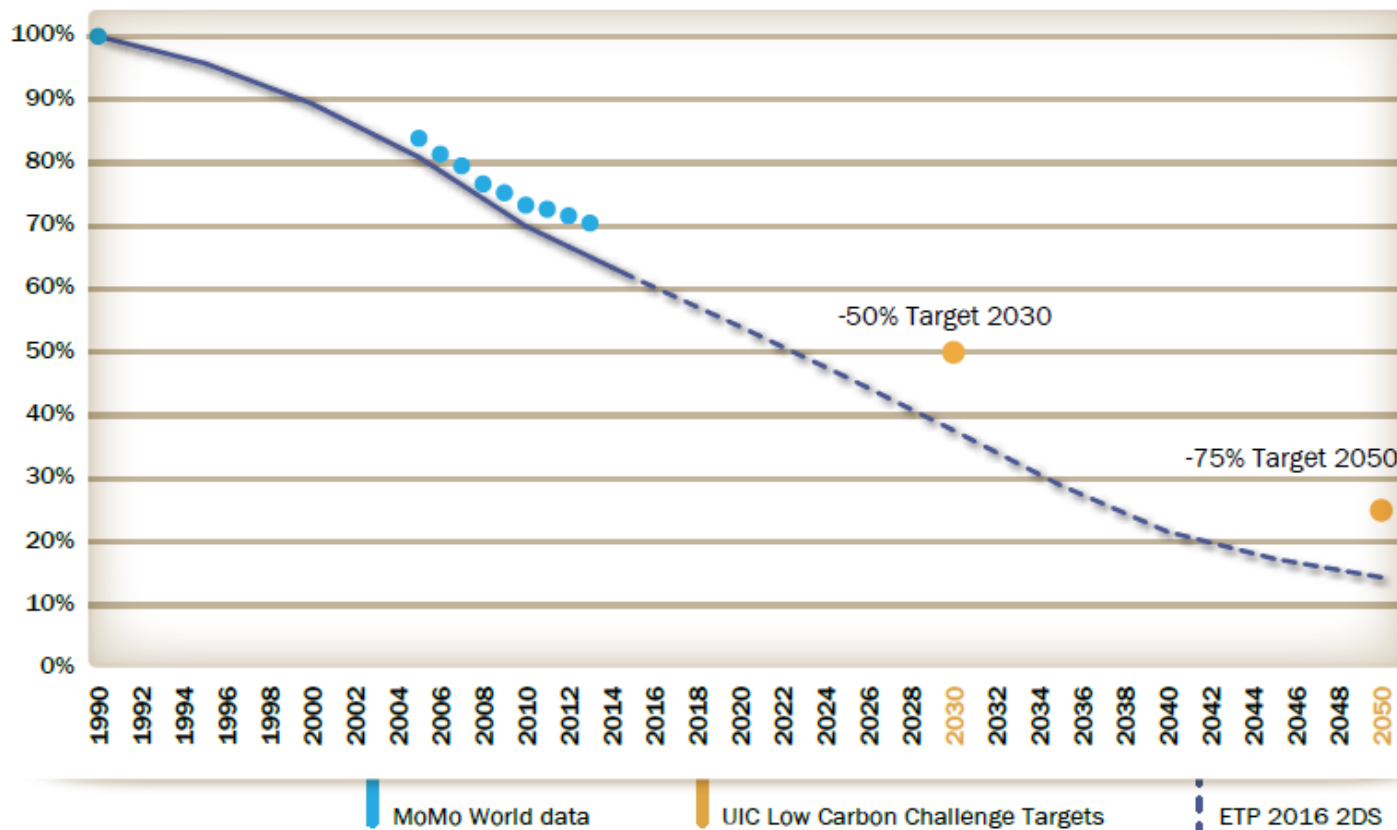




# Focus: Sustainability Targets



World specific CO<sub>2</sub> emissions evolution per traffic unit (TU) between 1990-2013 compared to 2030 and 2050 targets (1990=100)



**Specific CO<sub>2</sub> emissions have reduced by 30% between 1990 and 2013**

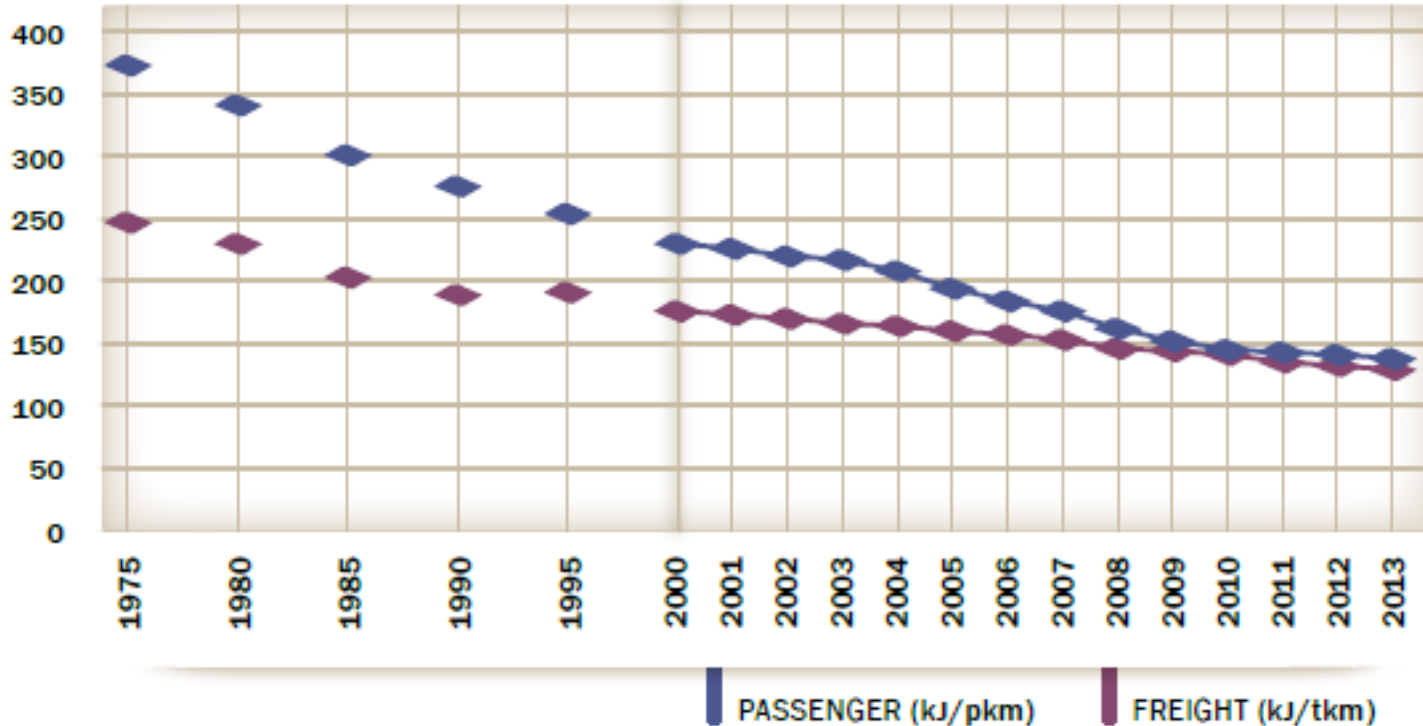
Elaboration by SUSDEF based on IEA and UIC



# Focus: Sustainability Targets



Railway specific energy consumption, 1975-2013



**Specific energy consumption decreased by 63% for passenger service and 48% for freight service from 1975 to 2013.**

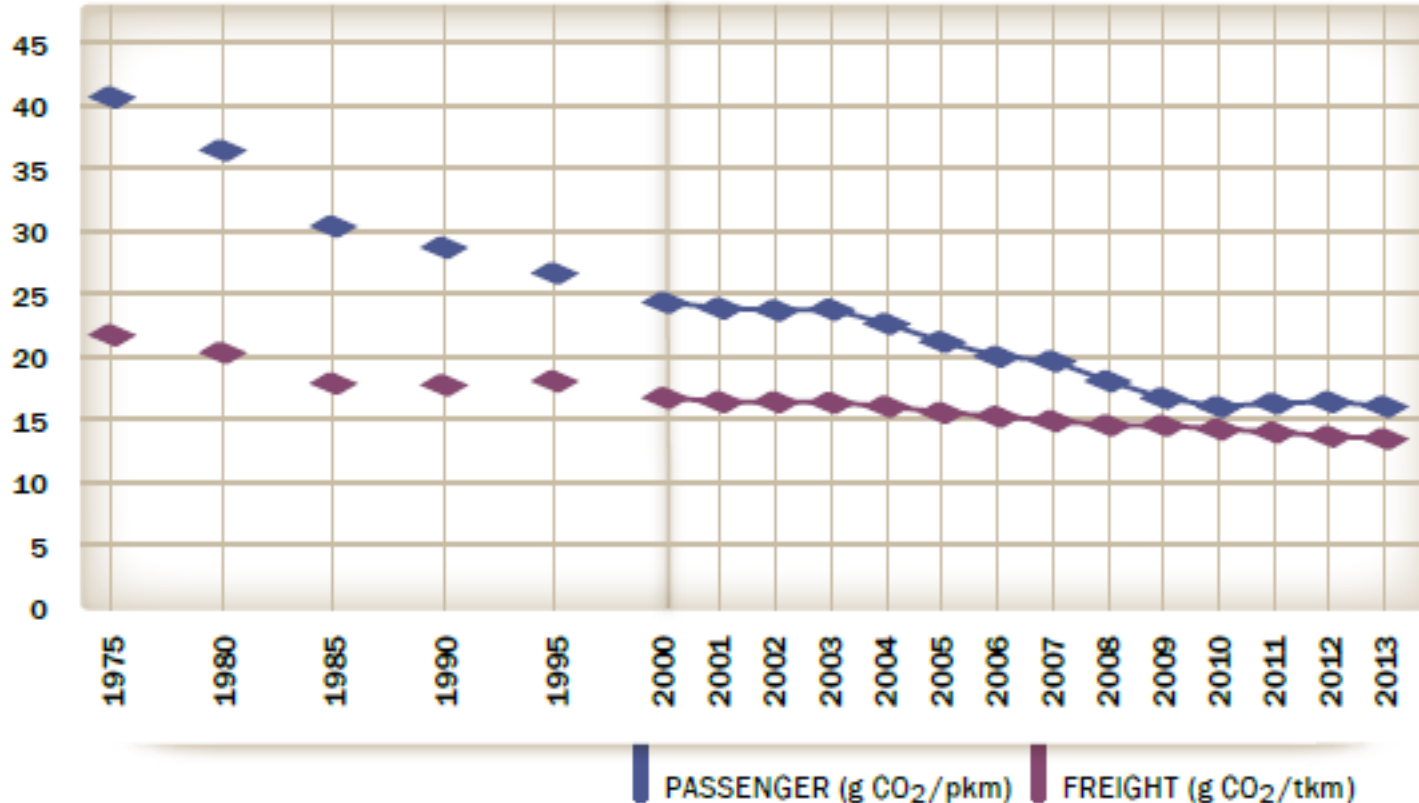
Source: Elaboration based on IEA Mobility Model and UIC Statistics



# Focus: Sustainability Targets



Railway specific CO<sub>2</sub> emissions, 1975-2013



**Specific CO<sub>2</sub> emissions decreased by 60% and 38% in passenger and freight services respectively from 1975 to 2013**

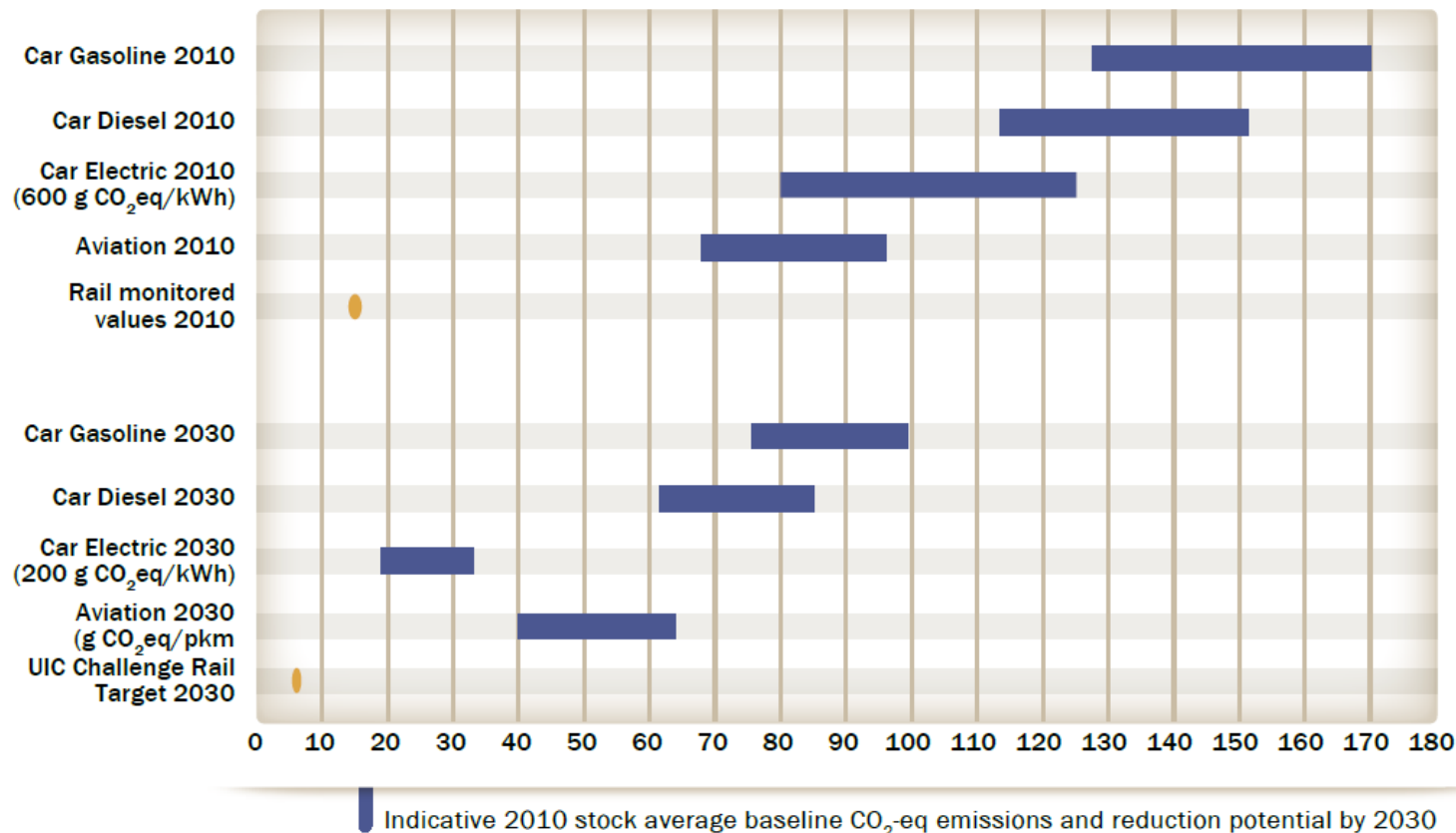
Source: Elaboration based on IEA Mobility Model and UIC Statistics





# Focus: Sustainability Targets

Comparison between UIC Low Carbon Rail Transport Challenge Targets and CO<sub>2</sub>-eq mitigation potential by 2030 – Passenger (gCO<sub>2</sub>-eq/pkm)

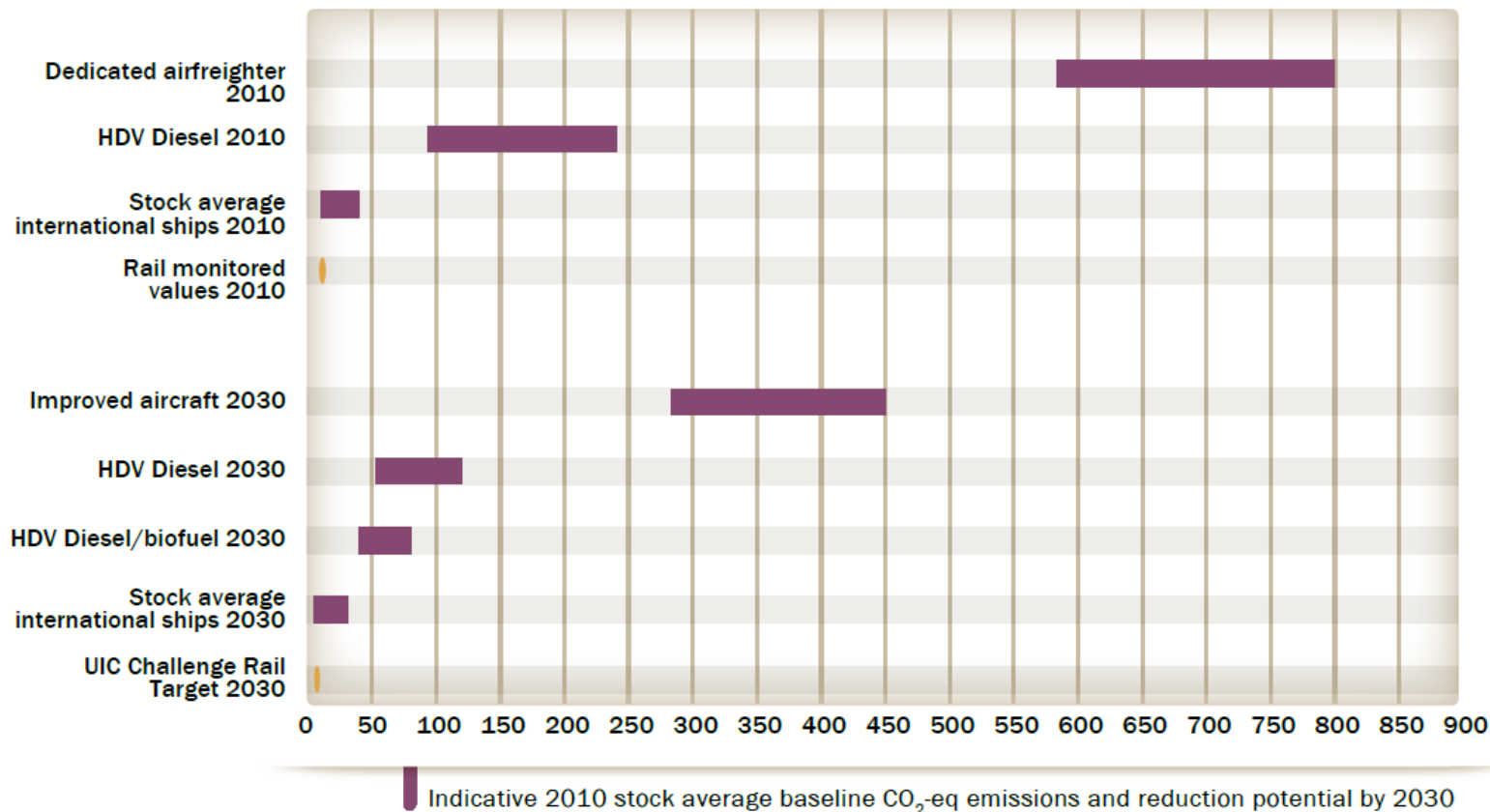


Elaboration by SUSDEF based on IPCC and IEA



# Focus: Sustainability Targets

Comparison between UIC Low Carbon Rail Transport Challenge Targets and CO<sub>2</sub>-eq mitigation potential by 2030 – Freight (gCO<sub>2</sub>-eq/tkm)



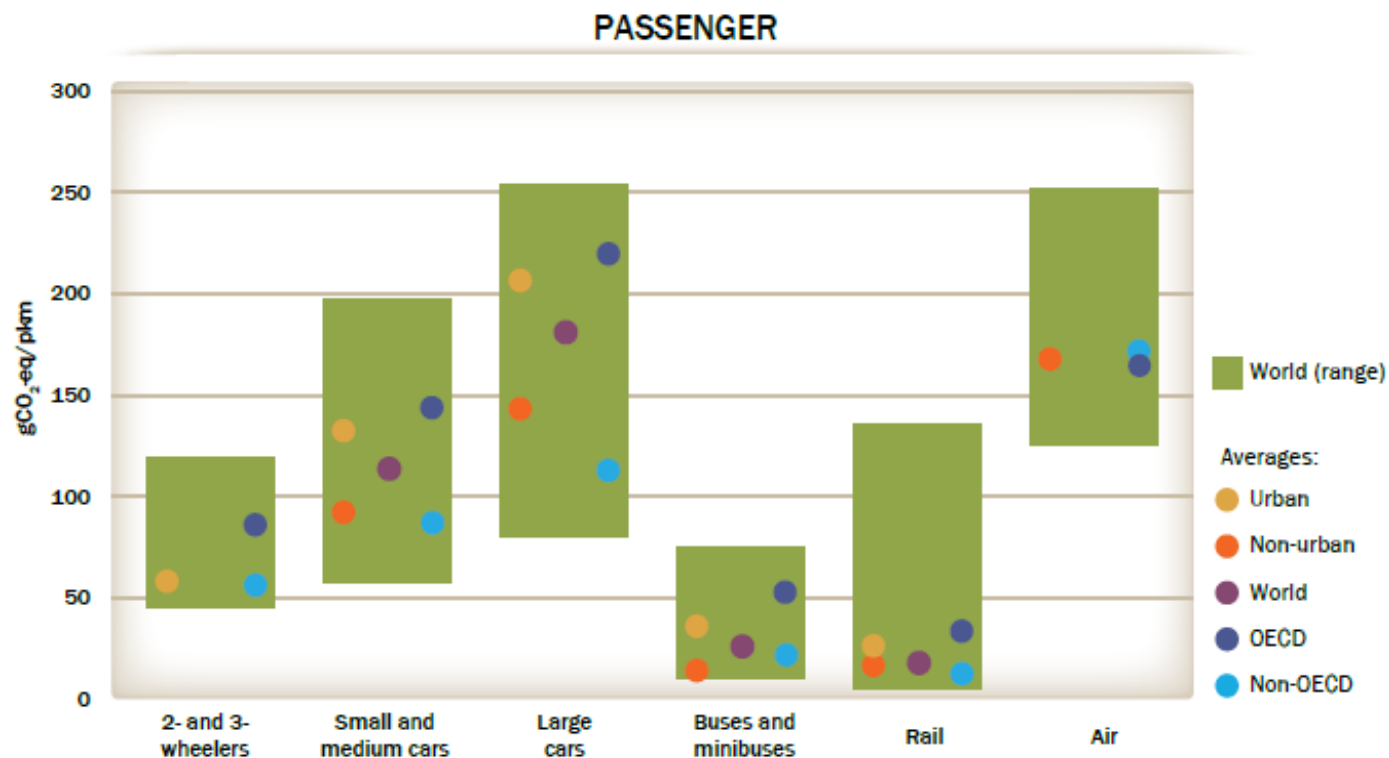
Elaboration by SUSDEF based on IPCC and IEA



# Focus: Sustainability Targets



Current Well-to-Wheel GHG intensities of passenger transport activity, 2015



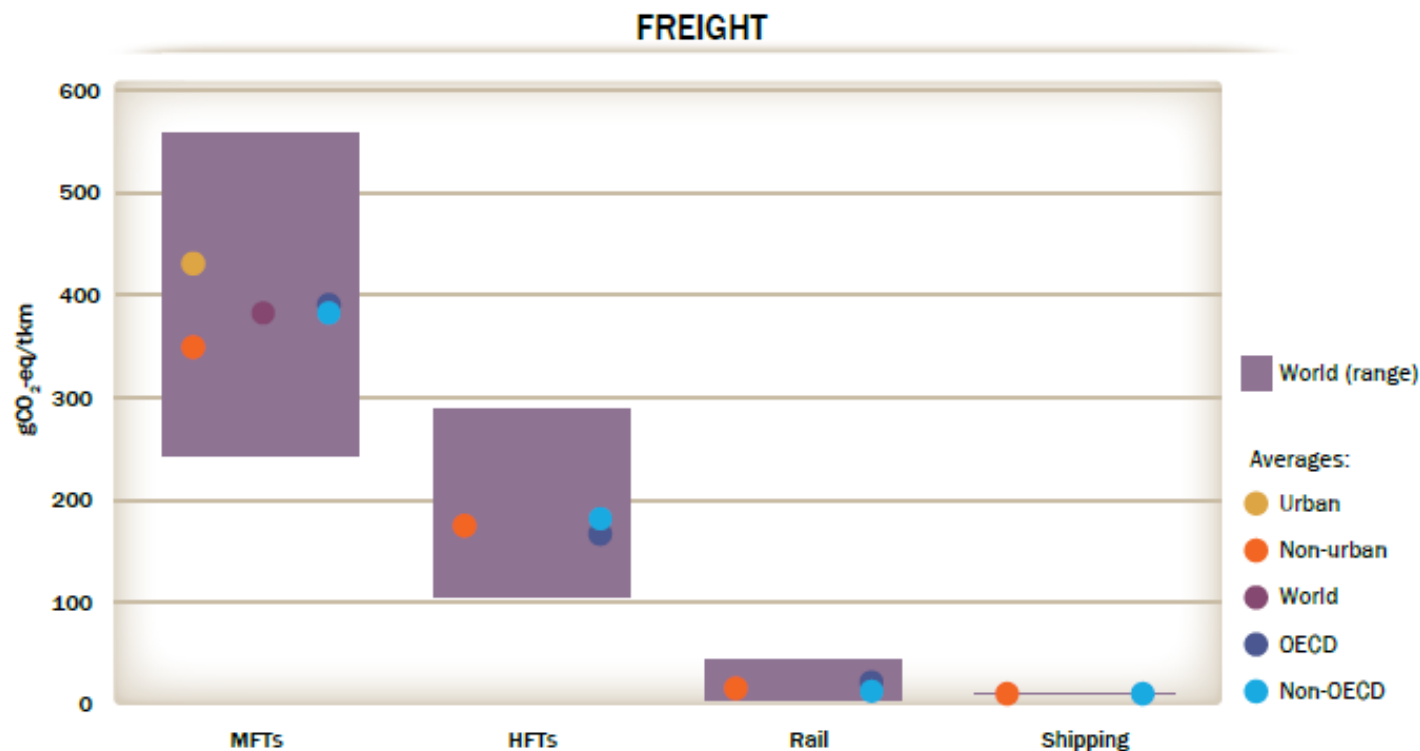
Source IEA ETP  
2016



# Focus: Sustainability Targets



Current Well-to-Wheel GHG intensities of freight transport activity, 2015



Source IEA ETP  
2016





# Handbook 2016: World key facts



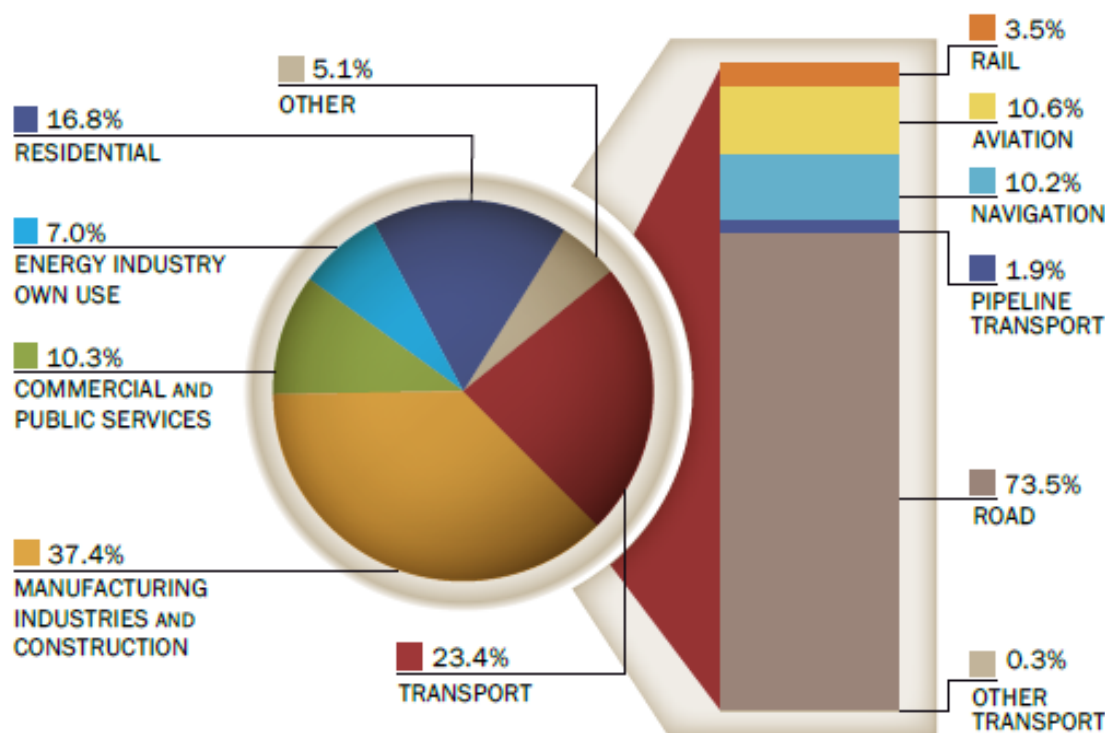


# Handbook 2016: World key facts



VIENNA 2016

**Rail represents 8% of total transport but only emits 3.5% of CO<sub>2</sub>**



Share of CO<sub>2</sub> Emissions from fuel combustion by sector, 2013

Source: IEA, UIC and UNCTAD

Source: IEA

**World transport modal share, 2013**

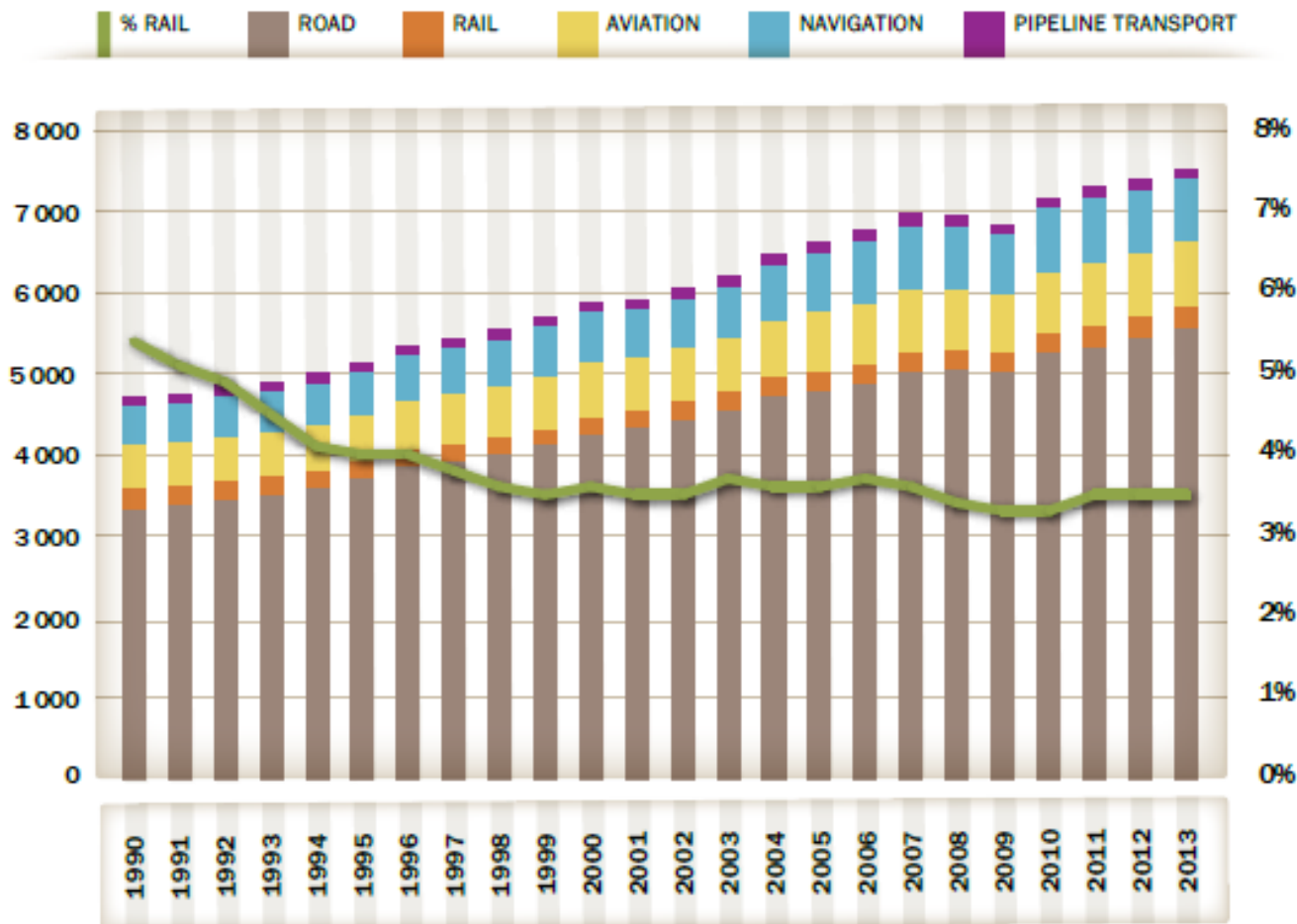
	Passenger PKM	Freight TKM	Total TU
Road	81.9%	8.3%	30.5%
Aviation	11.4%	0.8%	4.0%
Navigation	0.3%	82.2%	57.5%
Rail	6.4%	8.7%	8.0%



# Handbook 2016: World key facts



**Transport sector emissions increased by 60% in 1990-2013, the share of railway emissions decreased from 5.4% to 3.5%**



Transport sector CO<sub>2</sub> emissions by mode, 1990-2013 (million tCO<sub>2</sub> - left, share of rail over total - right)

Source: IEA CO<sub>2</sub> Emissions from Fuel Combustion

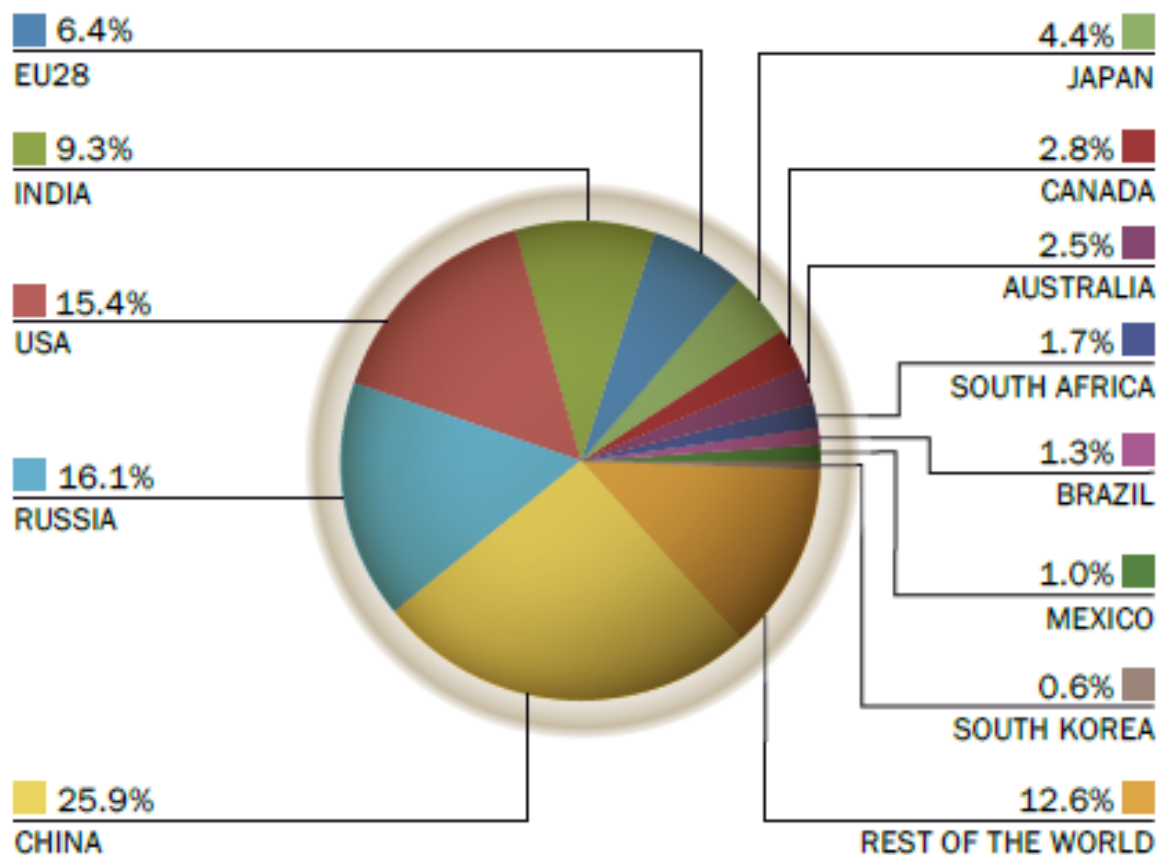


# Handbook 2016: World key facts



VIENNA 2016

**China and USA are responsible for 41.3% of global CO<sub>2</sub> emissions**



Share of railway CO<sub>2</sub> emissions by geographic area, 2013

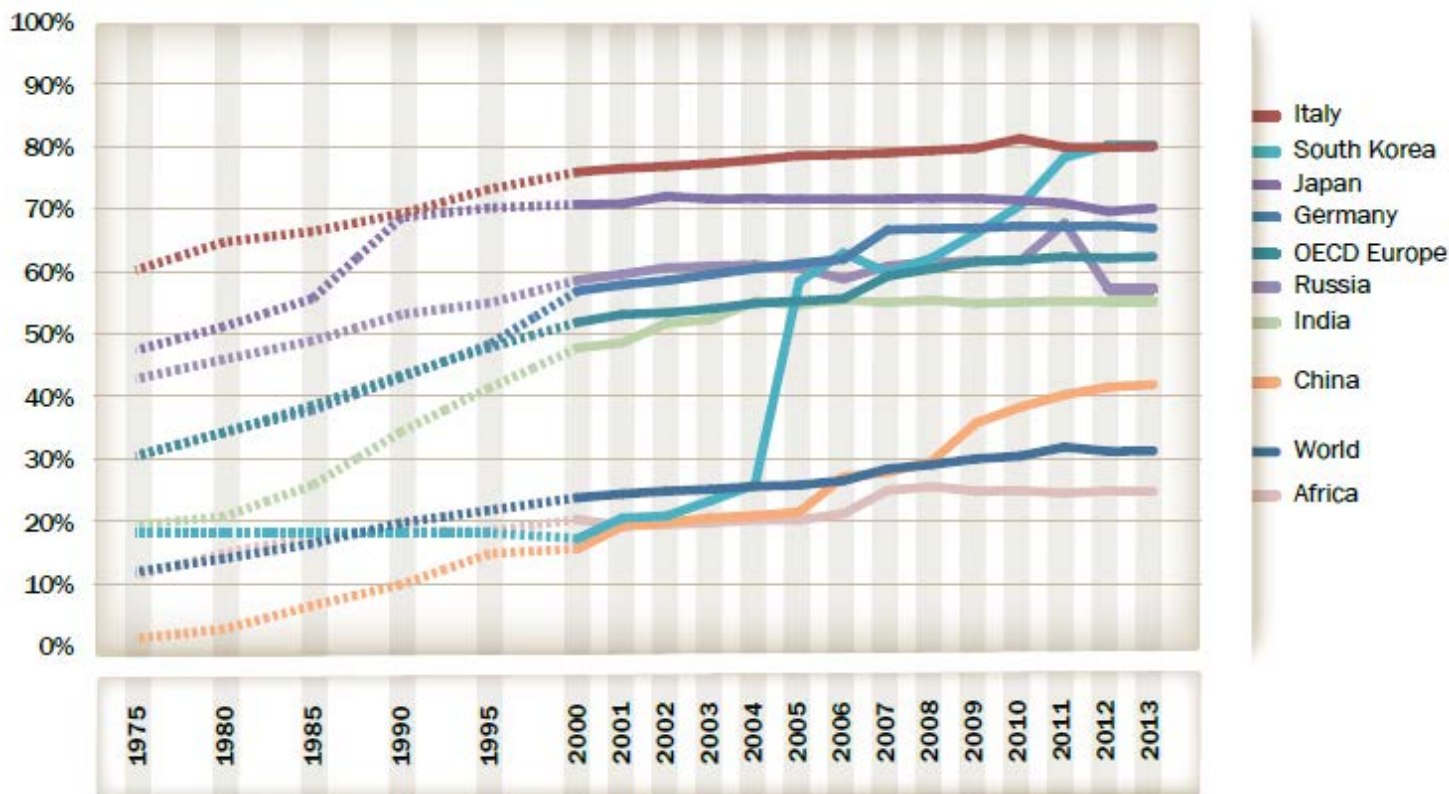
Source: IEA CO<sub>2</sub> Emissions from Fuel Combustion



# Handbook 2016: World key facts



**The share of electrified railway tracks has increased by 163% between 1975 and 2013 at world level.**



Share of electrified railway tracks in selected countries and geographic areas, 1975-2013

Source: UIC

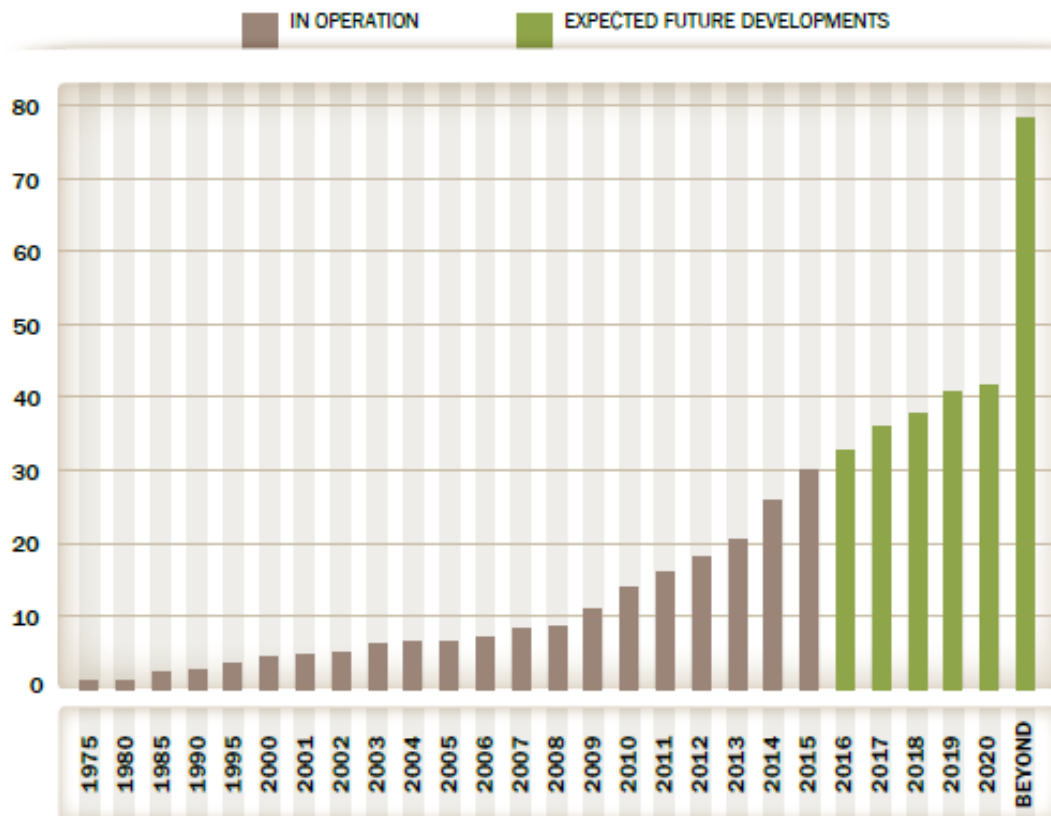




# Handbook 2016: World key facts



The HS lines in operation increased by 10 times between 1990 and 2015. China HS lines grew by 540% in 5 years (2009-2015)



Global high-speed lines (>250 km/h) in operation and expected future developments, 1975-2015 (thousand km)

Source: IEA World Energy Balances

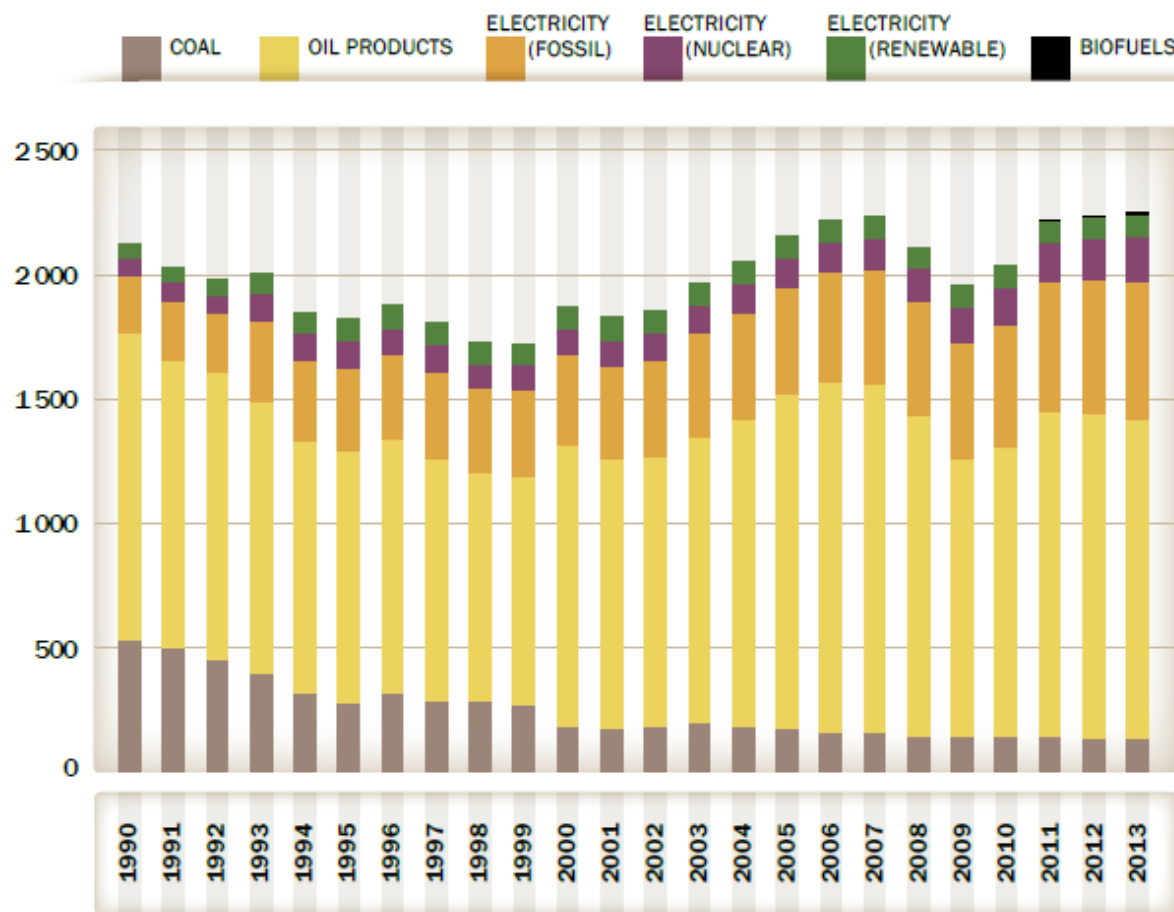




# Handbook 2016: World key facts



**Railway energy that is fuelled for 57% by oil products and for 36.5% electricity.**



Railway final  
energy  
consumption  
by fuel, 1990-  
2013 (PJ)








Source: IEA World Energy Balances






# Handbook 2016: World key facts



**Coal consumption in rail has fallen from 25% to 6% between 1990 and 2013. In the same period, renewable energy sources have risen from 3.4% to 8.7%.**

ENERGY MIX BY SOURCE		1990	2013
OIL PRODUCTS		58.0%	57.3%
COAL PRODUCTS		24.8%	5.6%
BIOFUELS		0.0%	0.7%
ELECTRICITY		17.2%	36.4%
of which Fossil		10.9%	24.5%
of which Nuclear		2.9%	3.9%
of which Renewable		3.4%	8.0%

SUMMARY BY SOURCE TYPE		1990	2013
FOSSIL SOURCE		93.7%	87.4%
NUCLEAR		2.9%	3.9%
RENEWABLE		3.4%	8.7%

World  
railway  
energy fuel  
mix, 1990-  
2013

Source: IEA *World  
Energy Balances*









# Handbook 2016: Glimpses from countries





**0.1% of passenger-km and 32.6% of goods (in tonne-km)  
were transported by rail in 2013.**

		Passenger PKM	Freight TKM	Total TU
ROAD		87.9%	56.8%	72.5%
AVIATION		12.0%	0.2%	6.2%
NAVIGATION		0.0% *	10.4%	5.1%
RAIL		0.1%	32.6%	16.2%

USA transport  
modal share,  
2013

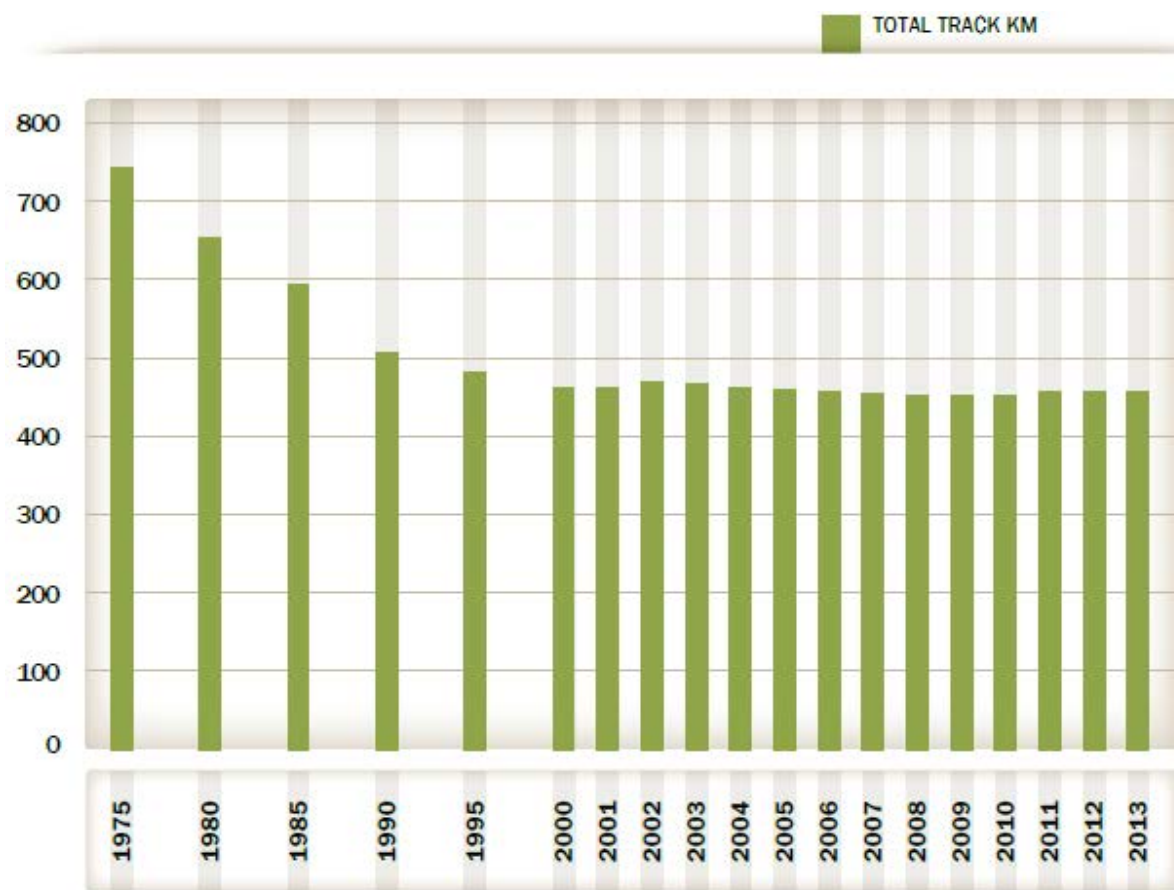
\* Note: Navigation's passenger activity has a value of 0.03%, corresponding to 647 million passenger-km.

Source: UIC and NTS





**The American railway tracks are mainly not-electrified and they have decreased by 39% between 1975 and 2013.**



Length of railway tracks,  
1975-2013 (thousand km)

Source: UIC

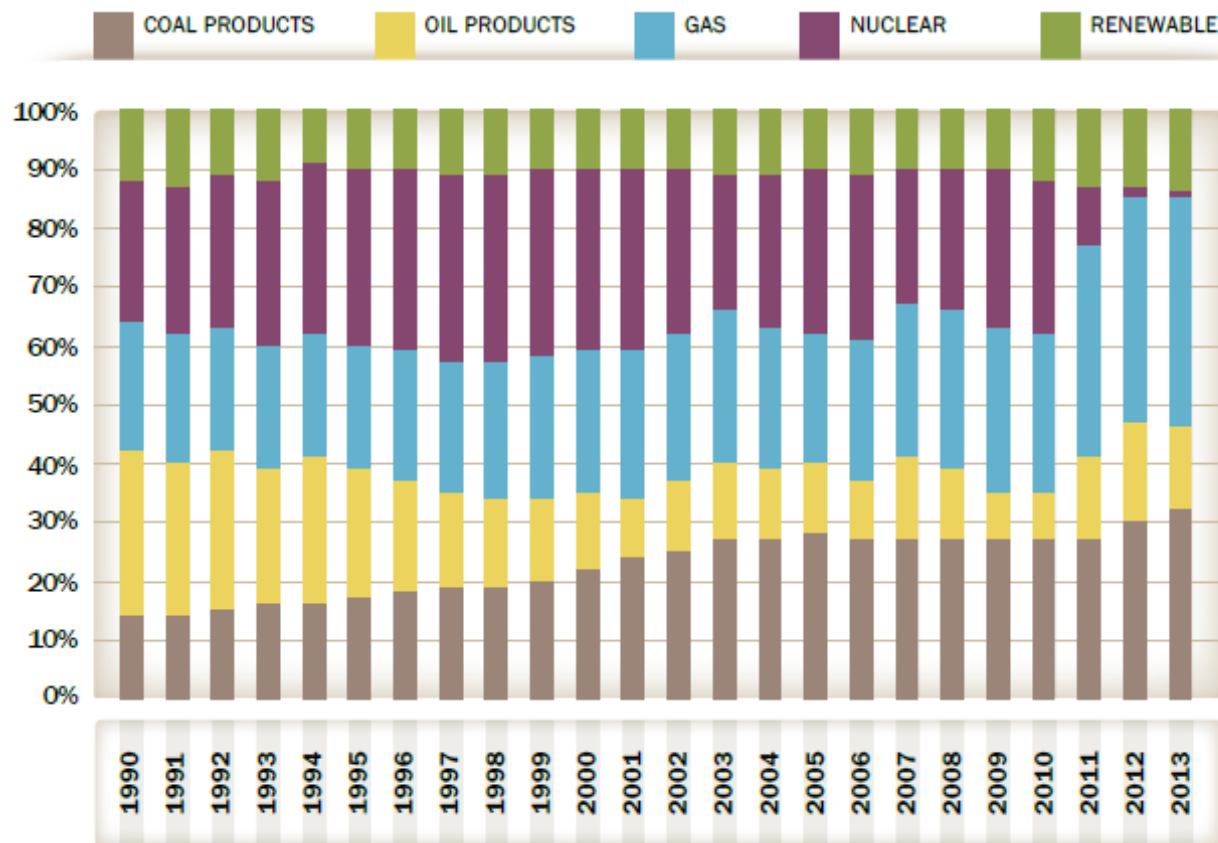




# Handbook 2016: Glimpses from countries

The share of nuclear electricity in the national electricity production mix has decreased from 18% to 1% after the Fukushima accident of 2011. This has mainly been replaced by natural gas.

VIENNA 2016







National electricity production mix evolution, 1990-2013

Source: IEA World Energy Balances





**Rail's share of total transport activity reached 28.5% for passenger services and about 87% for freight services in 2013, making it the first transport mode in the country**

		Passenger PKM	Freight TKM	Total TU
ROAD		25.5%	9.8%	12.3%
AVIATION		45.9%	0.2%	7.6%
NAVIGATION		0.1%	3.1%	2.6%
RAIL		28.5%	86.9%	77.5%

Russia  
transport  
modal share,  
2013

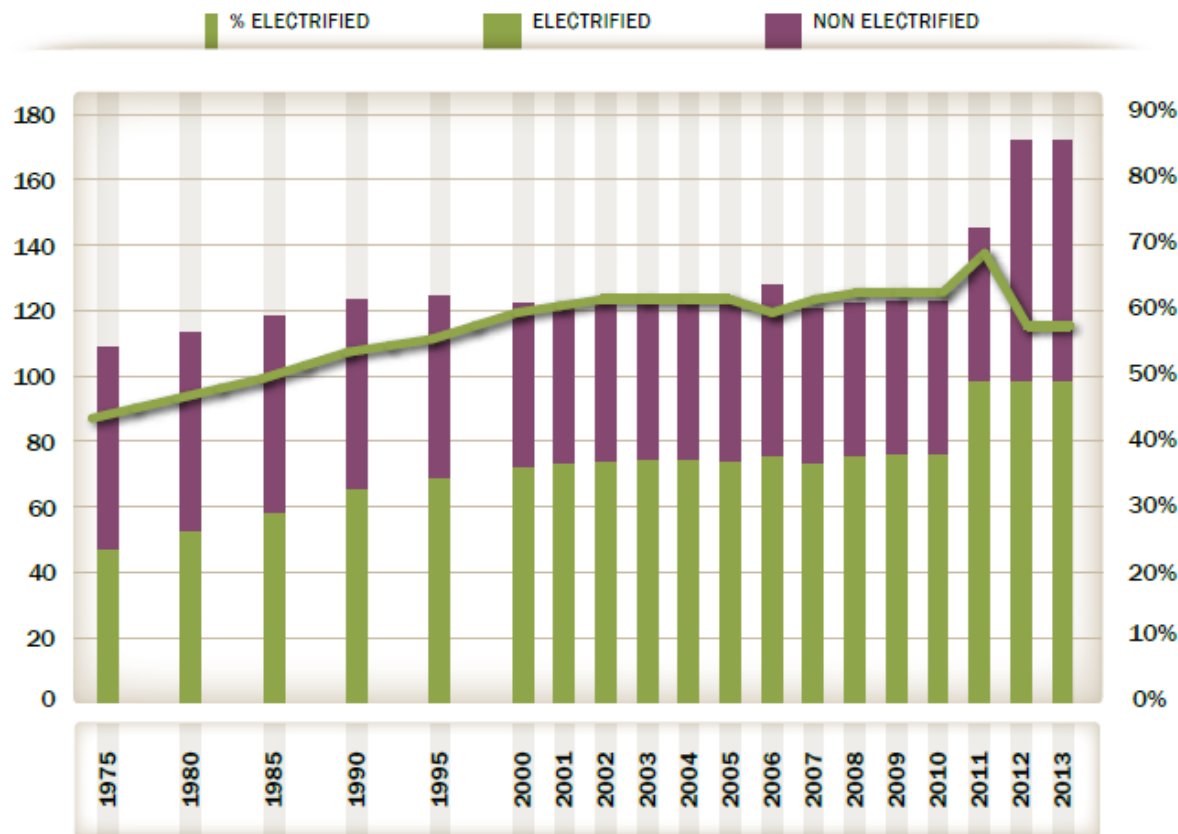
Source: OECD (2016), UIC (2015a) and Rosstat (2015)



# Handbook 2016: Glimpses from countries

Russia

**The length of electrified railway tracks has more than doubled between 1975 and 2013 and accounted for 57% of the total network in 2013.**



Length and share of electrified and non-electrified railway tracks, 1975-2013 (thousand km)

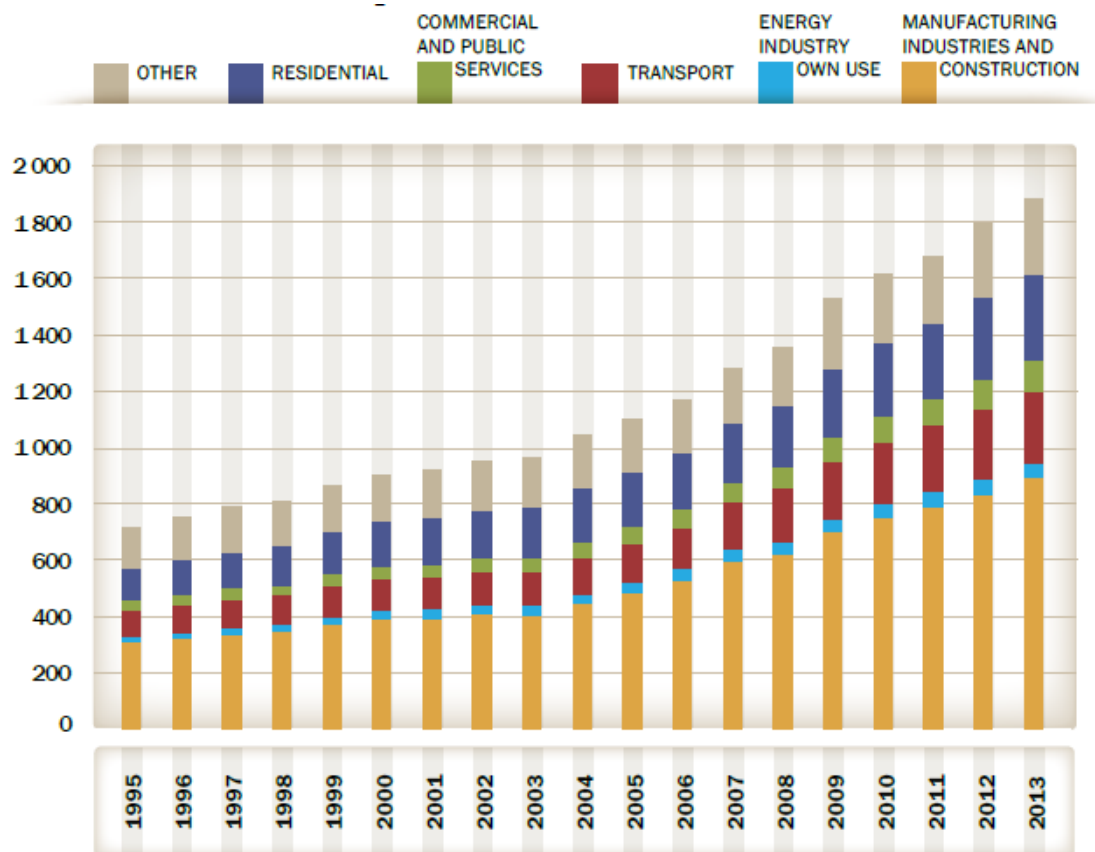
Source: UIC



# Handbook 2016: Glimpses from countries



The transport sector was responsible for 13.5% of total CO<sub>2</sub> emissions in 2013 (equal to 250 million tCO<sub>2</sub>), increasing its share about 3.5 times from 1990.









Total CO<sub>2</sub> emissions from fuel combustion by sector, 1995-2013 (million tCO<sub>2</sub>)

SOURCE: IEA World Energy Balances








**The rail sector used about 170 PJ of energy in 2013, two thirds of which were provided by oil products. The share of coal products was entirely phased out by 1997**

ENERGY MIX BY SOURCE		1990	2013
OIL PRODUCTS		36.6%	67.3%
COAL PRODUCTS		54.9%	0.0%
ELECTRICITY		8.5%	32.7%
of which Fossil		6.2%	26.3%
of which Nuclear		0.2%	0.9%
of which Renewable		2.1%	5.5%

India railway  
energy fuel  
mix, 1990-  
2013

SUMMARY BY SOURCE TYPE		1990	2013
FOSSIL SOURCE		97.7%	93.6%
NUCLEAR		0.2%	0.9%
RENEWABLE		2.1%	5.5%

SOURCE: IEA *World Energy Balances*

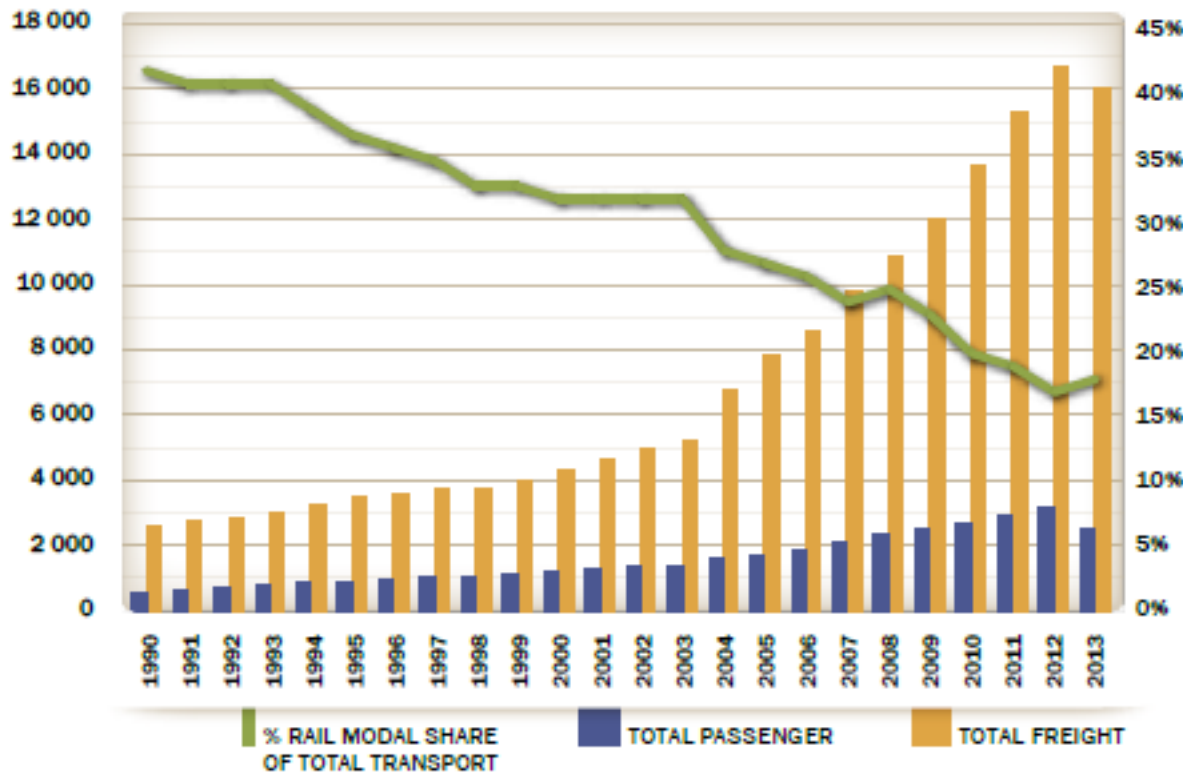




# Handbook 2016: Glimpses from countries

China

**Passenger and freight activity have decreased respectively by 20% and 4% compared to the last year (2012)**



Passenger and freight transport activity - all modes, 1990-2013

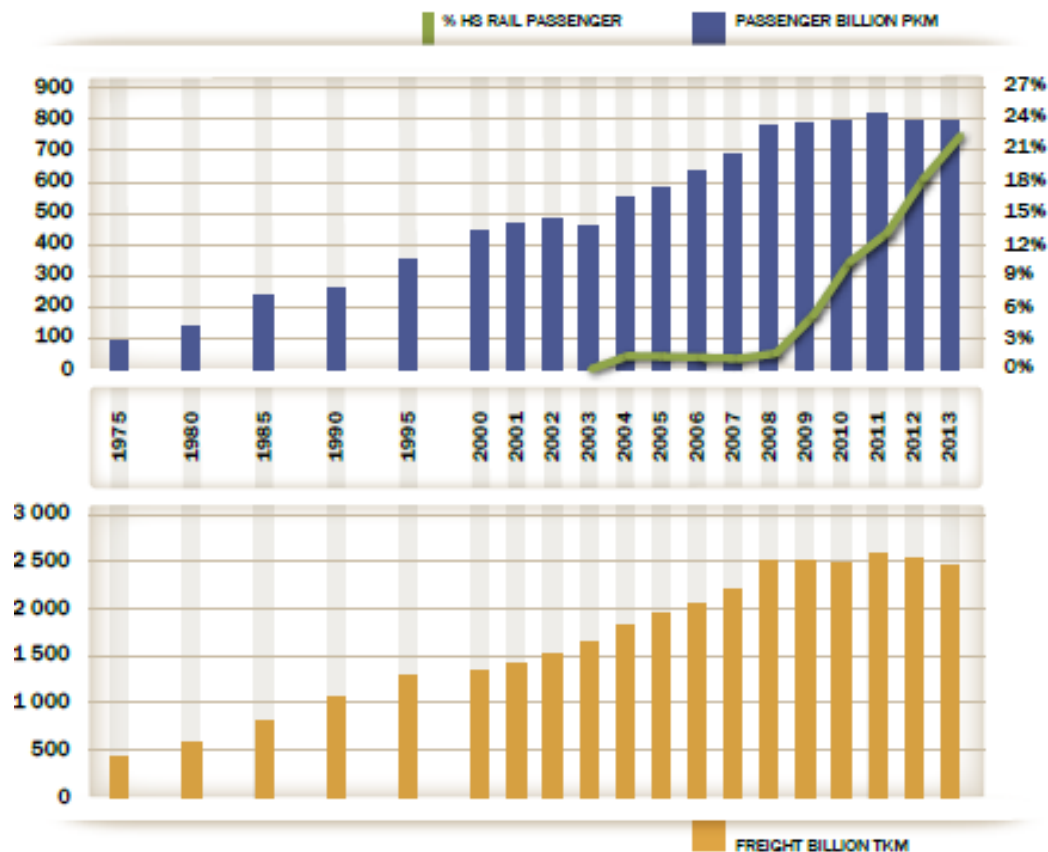
SOURCE: UIC and CNBS



# Handbook 2016: Glimpses from countries



With more than 2.5 trillion tonne-km in 2013, China has the highest freight rail activity globally (6-fold increase between 1975 and 2013). Within the same period, passenger rail activity increased with a factor 8 reaching a total of 794 billion passenger km



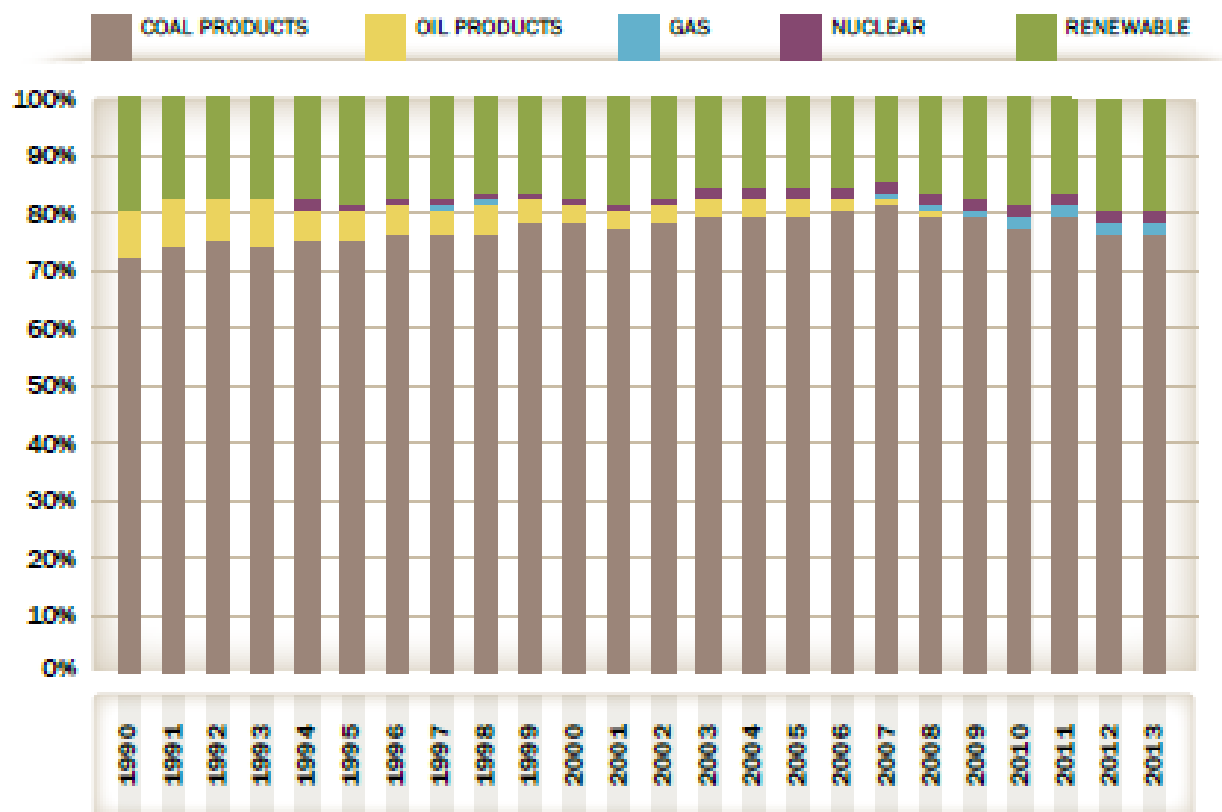
Passenger and freight railway activity and High-Speed activity as a share of total passenger railway activity, 1975-2013

SOURCE: UIC





The share of electricity use in the rail sector grew with a factor 3 between 2000 and 2013, with an increasing contribution of renewable electricity sources in the same period (from 3.8% in 2000 to 13.1% in 2013).



National electricity production mix evolution, 1990-2013

SOURCE: IEA





# Thank you!

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