

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 CO₂ data

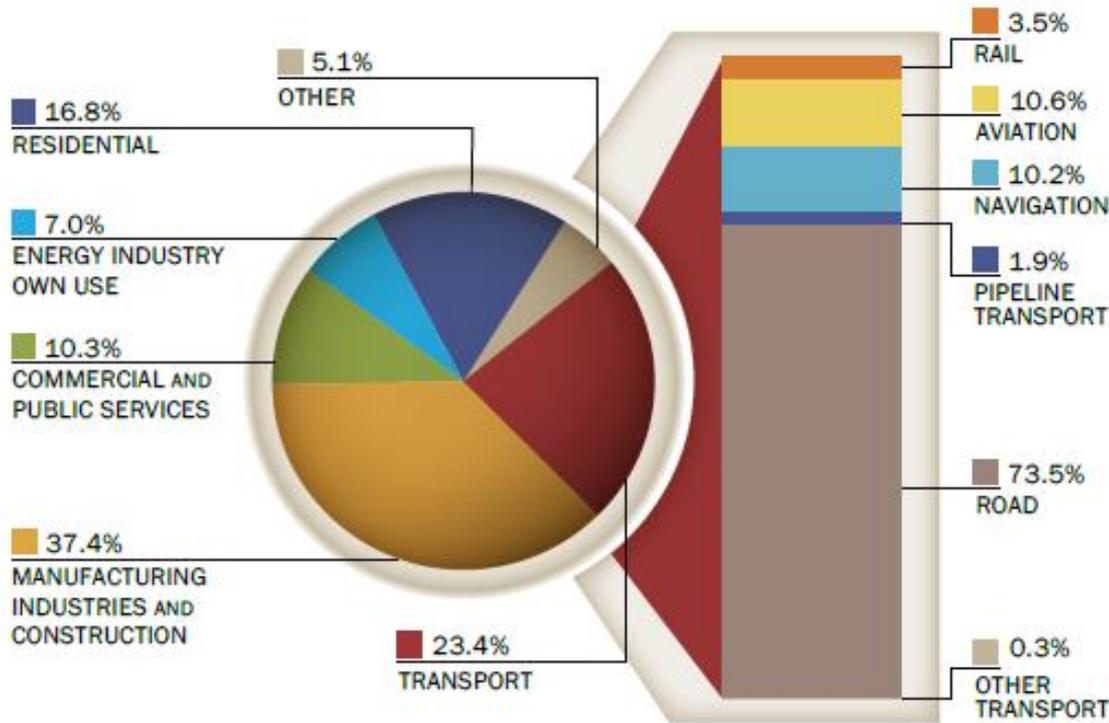
IEA and UIC signed an agreement to publish one Handbook every year





Handbook 2016: World key facts

Rail represents 8% of total transport but only emits 3.5% of CO₂



Share of CO₂ Emissions from fuel combustion by sector, 2013

Source: IEA, UIC and UNCTAD

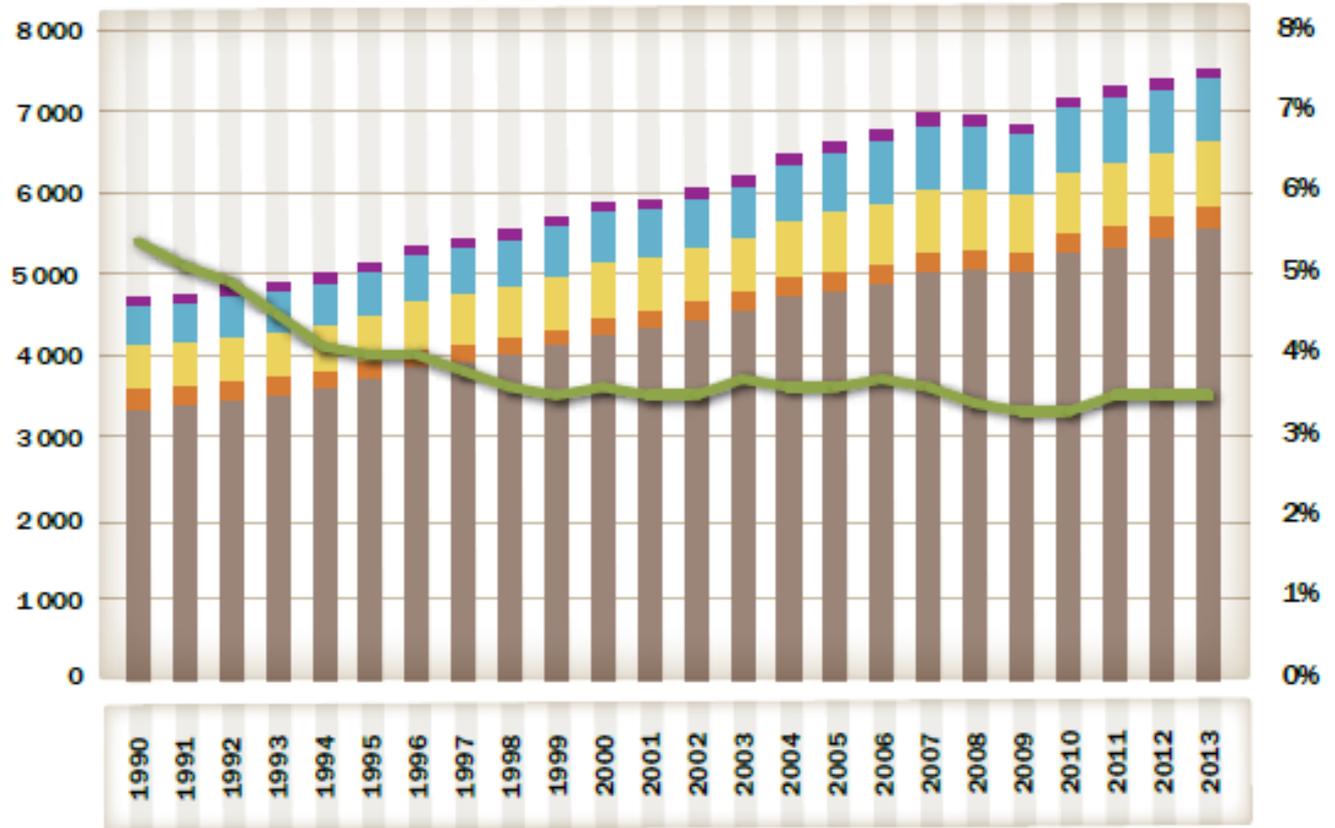
World transport modal share, 2013

	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%

Source: IEA

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

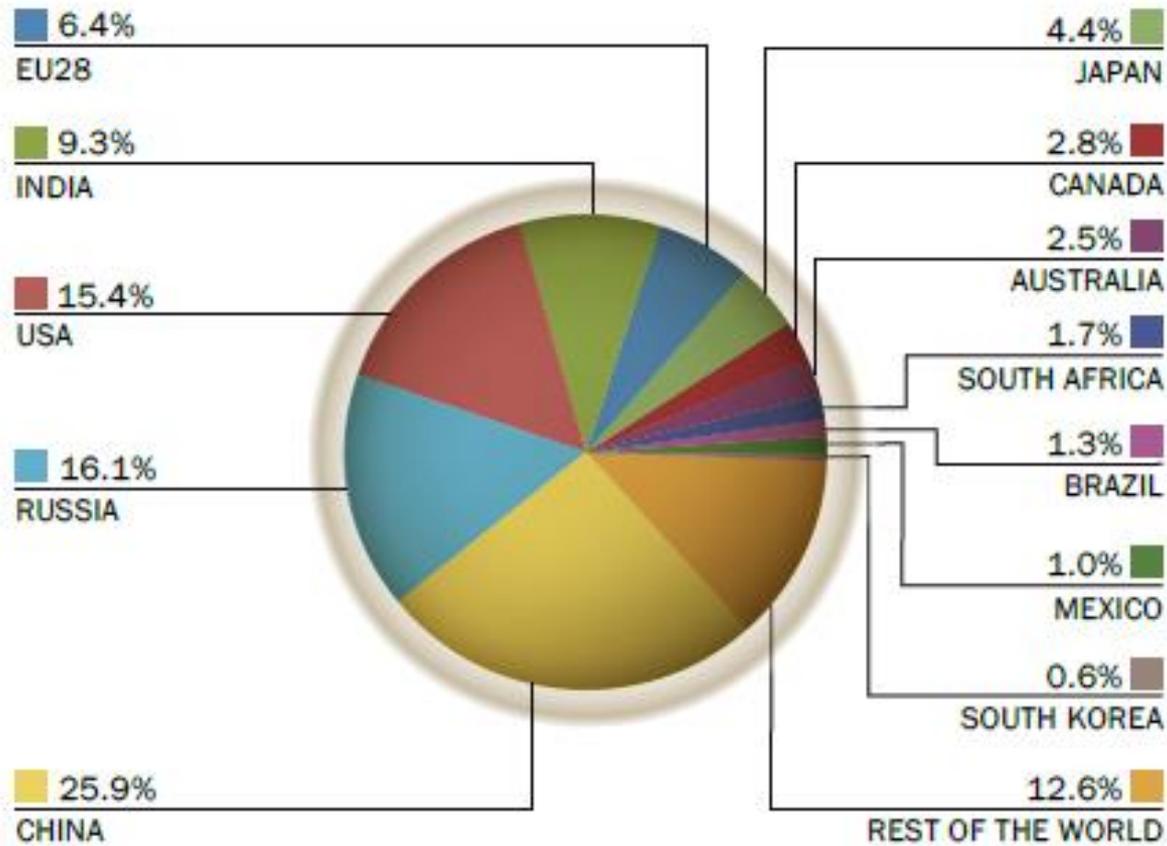
■ % RAIL
 ■ ROAD
 ■ RAIL
 ■ AVIATION
 ■ NAVIGATION
 ■ PIPELINE TRANSPORT



Transport sector CO₂ emissions by mode, 1990-2013 (million tCO₂ - left, share of rail over total - right)

Source: IEA CO₂ Emissions from Fuel Combustion

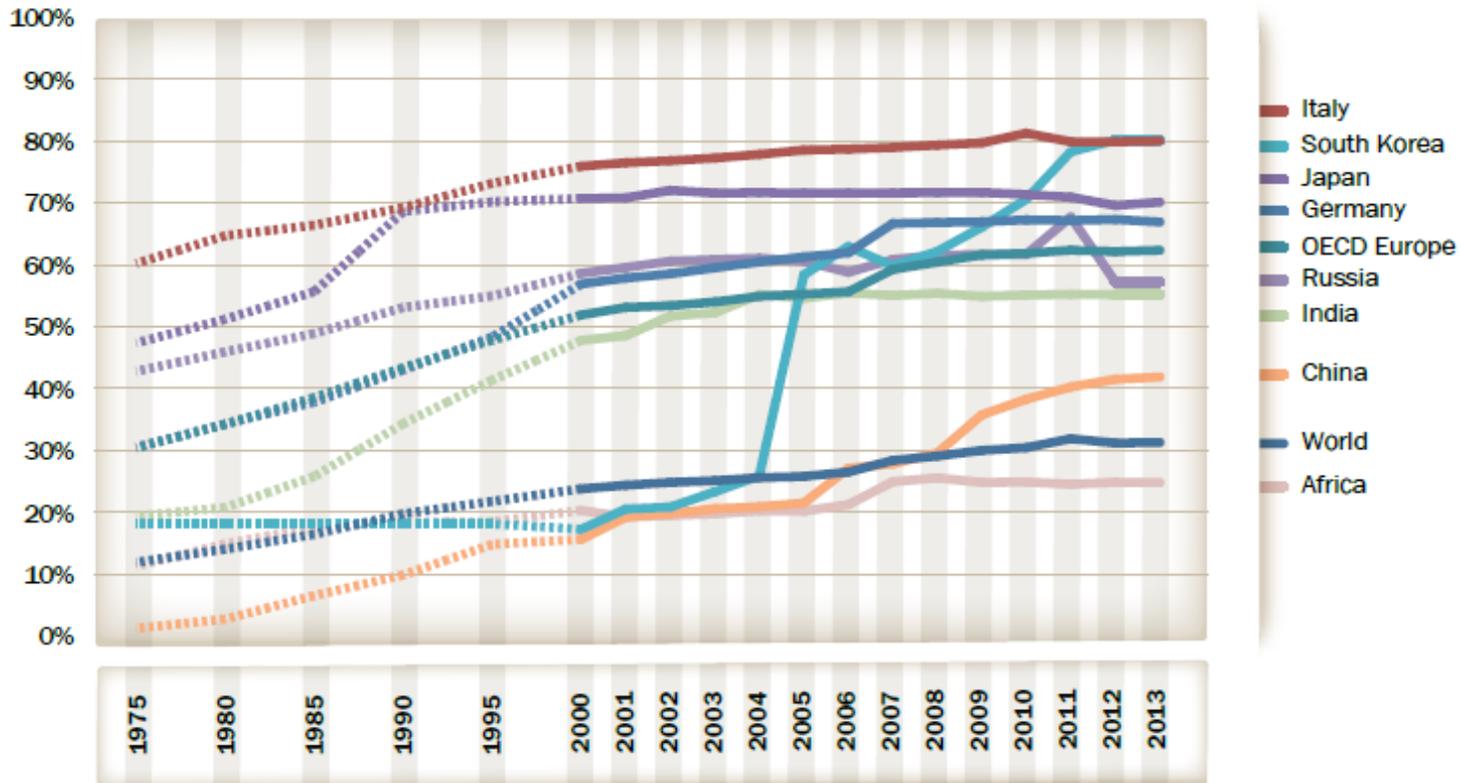
China and USA are responsible for 41.3% of global CO₂ emissions



Share of railway CO₂ emissions by geographic area, 2013

Source: IEA CO₂ Emissions from Fuel Combustion

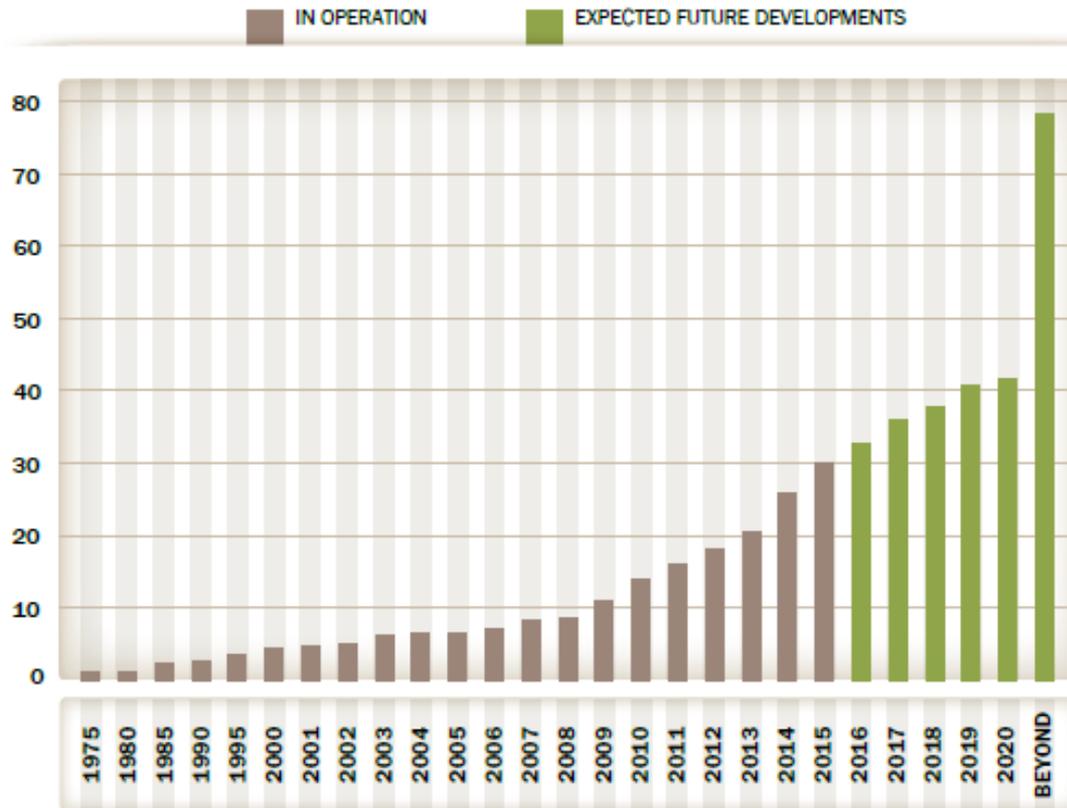
The share of electrified railway tracks has increased by 163% between 1975 and 2013 at world level.



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

Source: UIC

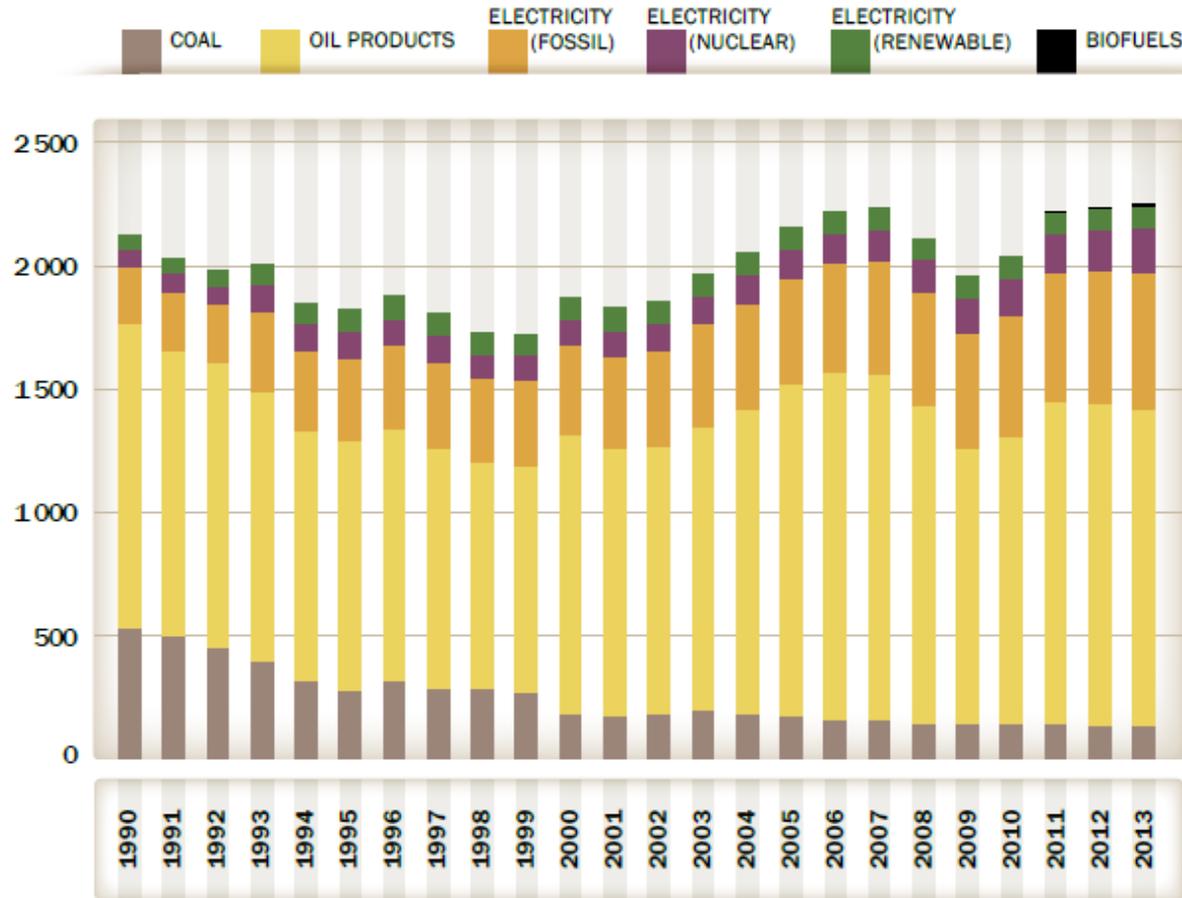
The HS lines in operation increased by 10 times between 1990 and 2015
China HS lines grew by 540% in 5 years (2009-2015)



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

Source: IEA *World Energy Balances*

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*

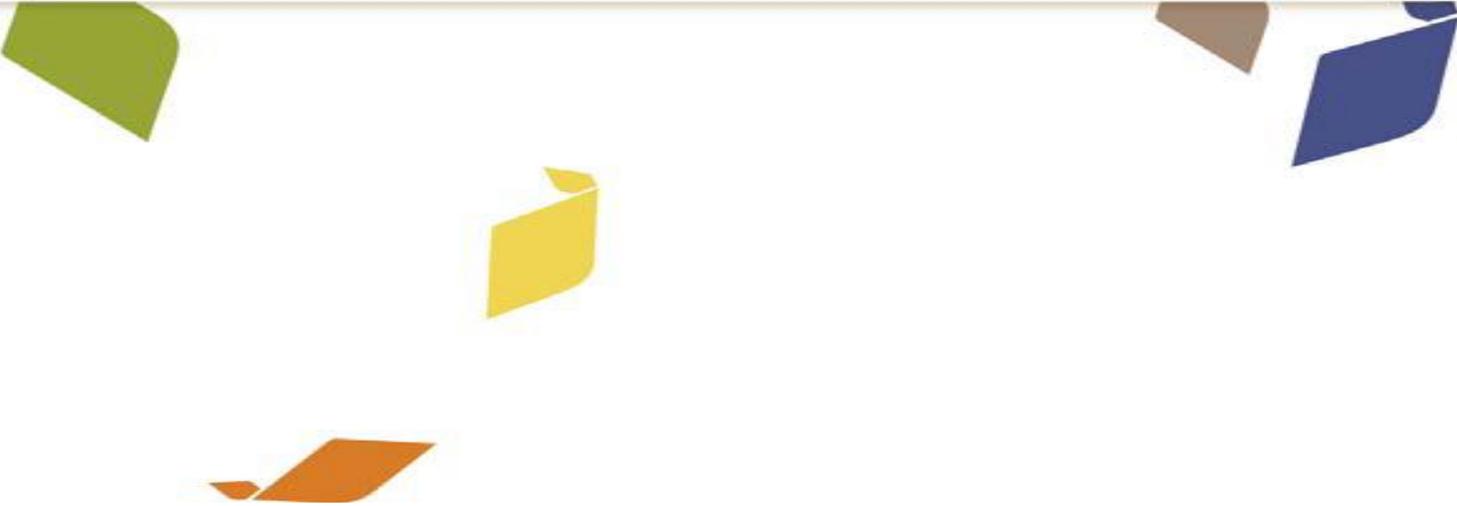
Coal consumption in rail has fallen from 25% to 6% between 1990 and 2013. In the same period, renewable energy sources have risen from 3.4% to 8.7%.

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.

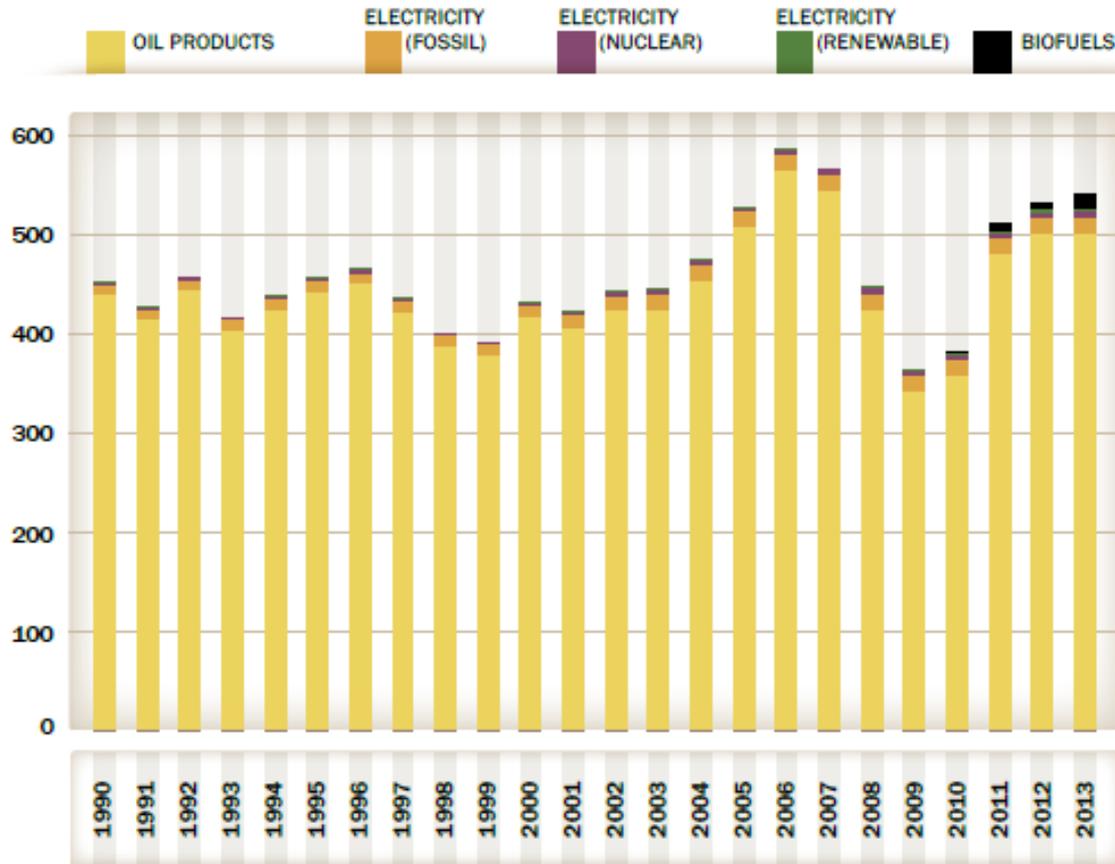
	Passenger PKM	Freight TKM	Total TU
ROAD	87.9%	56.8%	72.5%
AVIATION	12.0%	0.2%	6.2%
NAVIGATION	0.0% *	10.4%	5.1%
RAIL	0.1%	32.6%	16.2%

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 rail sector used about 540 PJ of final energy in 2013, of which 92.8% were provided by oil products, because of the low electrification rate of US railway lines.



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

SOURCE: IEA

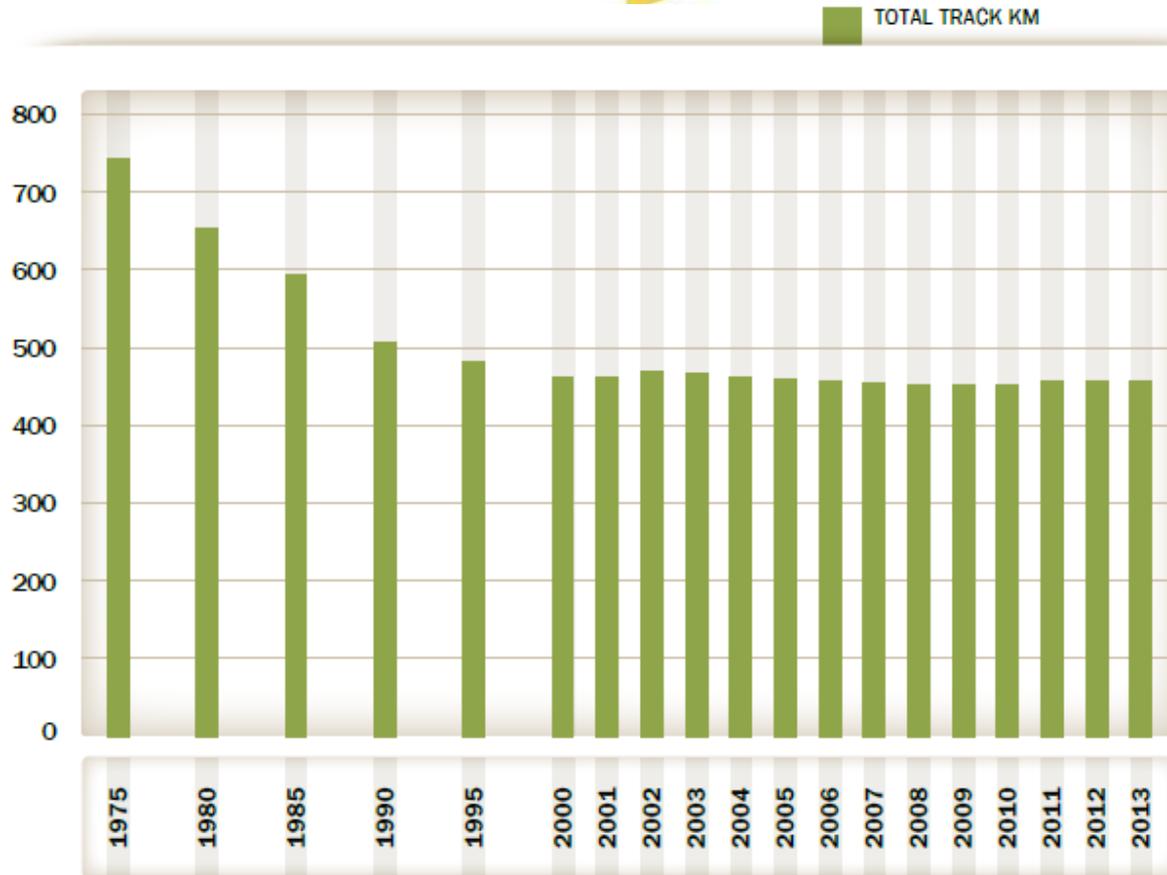
Rail's share of total transport activity reached 28.5% for passenger services and about 87% for freight services in 2013, making it the first transport mode in the country

	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)

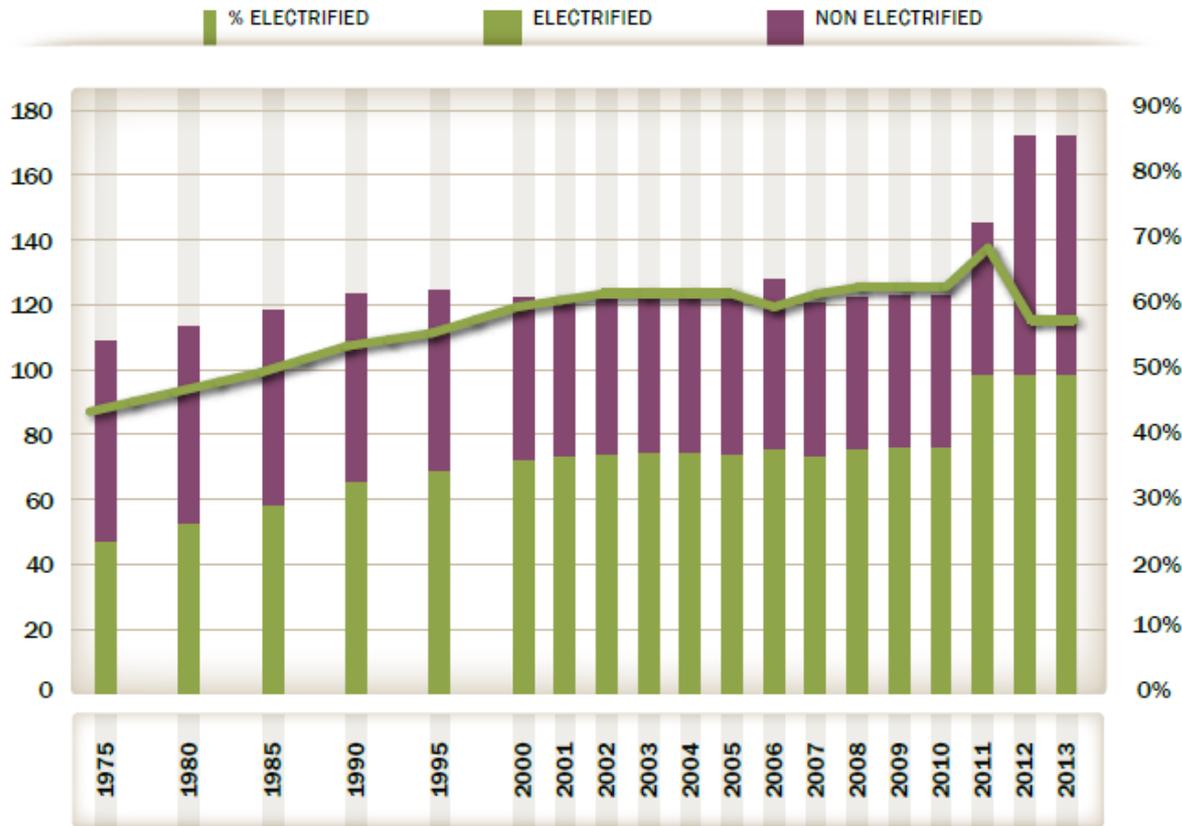
The American railway tracks are mainly not-electrified and they have decreased by 39% between 1975 and 2013.



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

Source: UIC

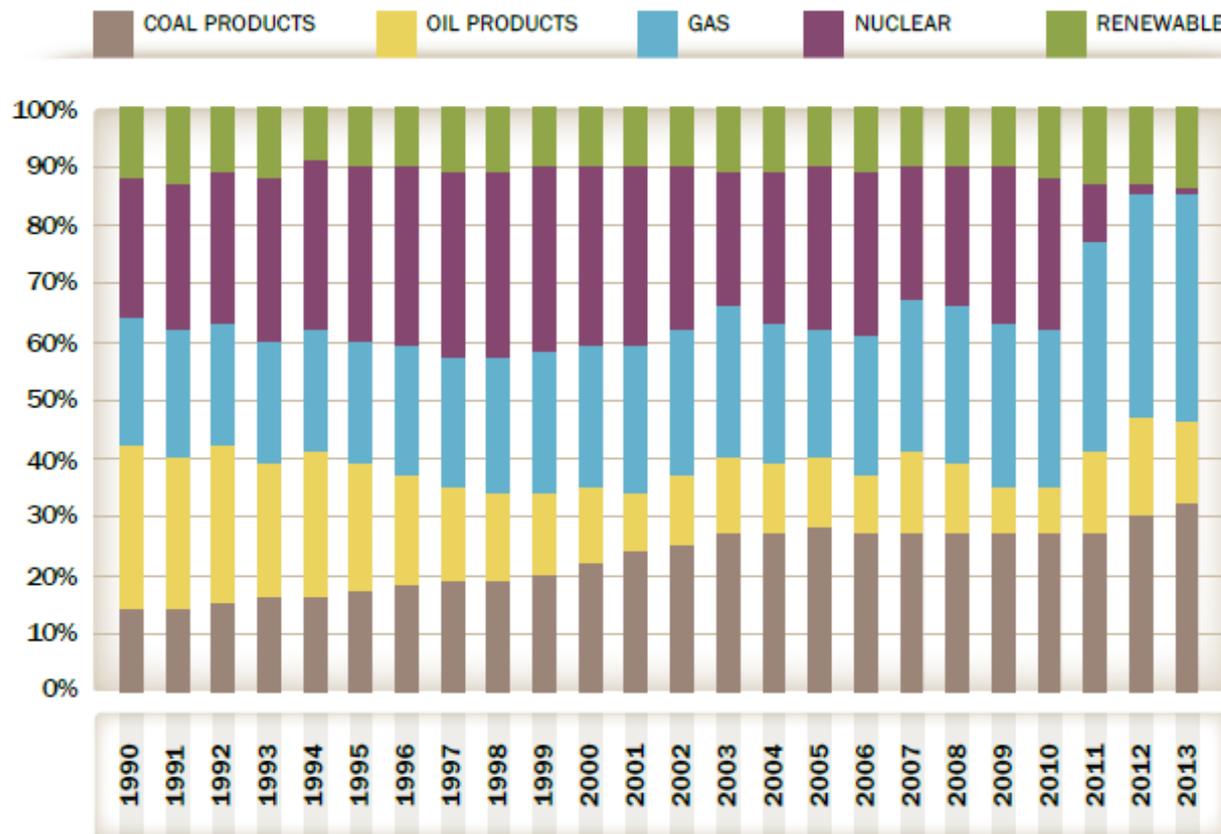
The length of electrified railway tracks has more than doubled between 1975 and 2013 and accounted for 57% of the total network in 2013.



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

Source: UIC

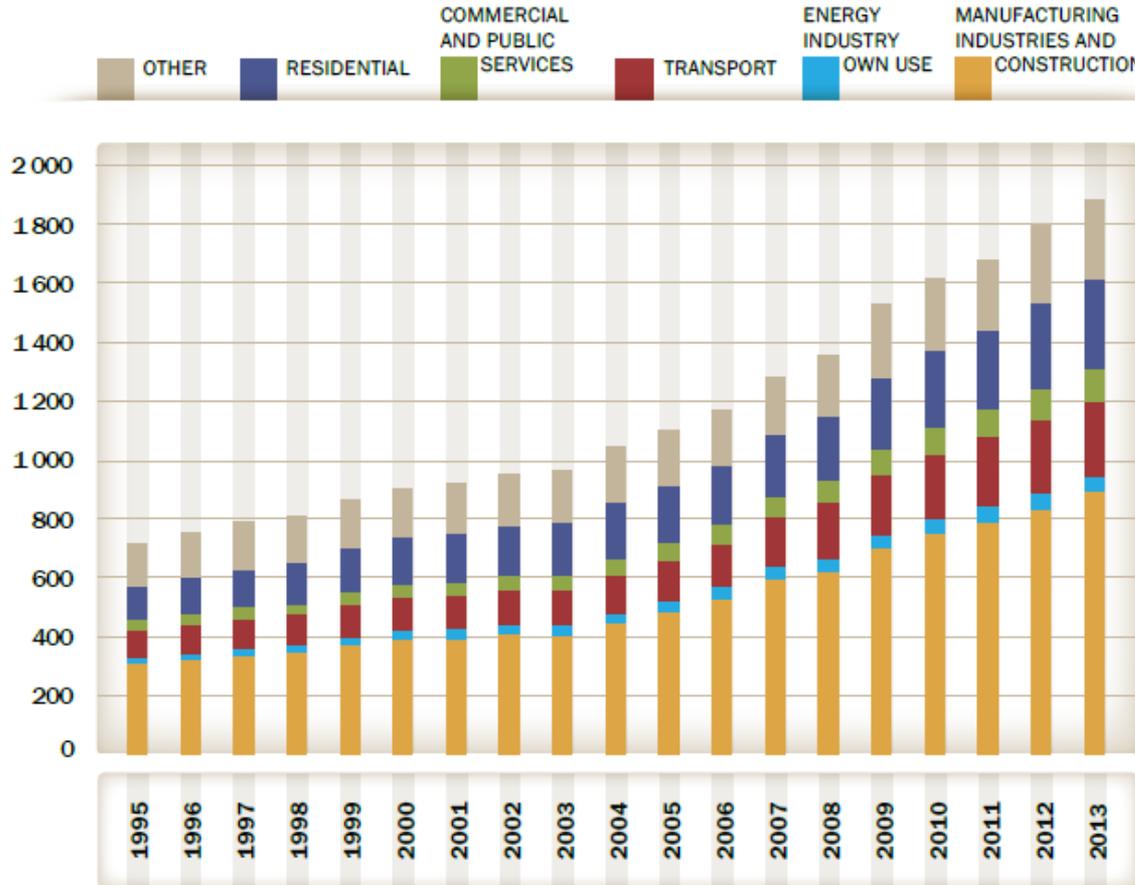
The share of nuclear electricity in the national electricity production mix has decreased from 18% to 1% after the Fukushima accident of 2011. This has mainly been replaced by natural gas.



National electricity production mix evolution, 1990-2013

Source: IEA World Energy Balances

The transport sector was responsible for 13.5% of total CO₂ emissions in 2013 (equal to 250 million tCO₂), increasing its share about 3.5 times from 1990.



Total CO₂ emissions from fuel combustion by sector, 1995-2013 (million tCO₂)

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

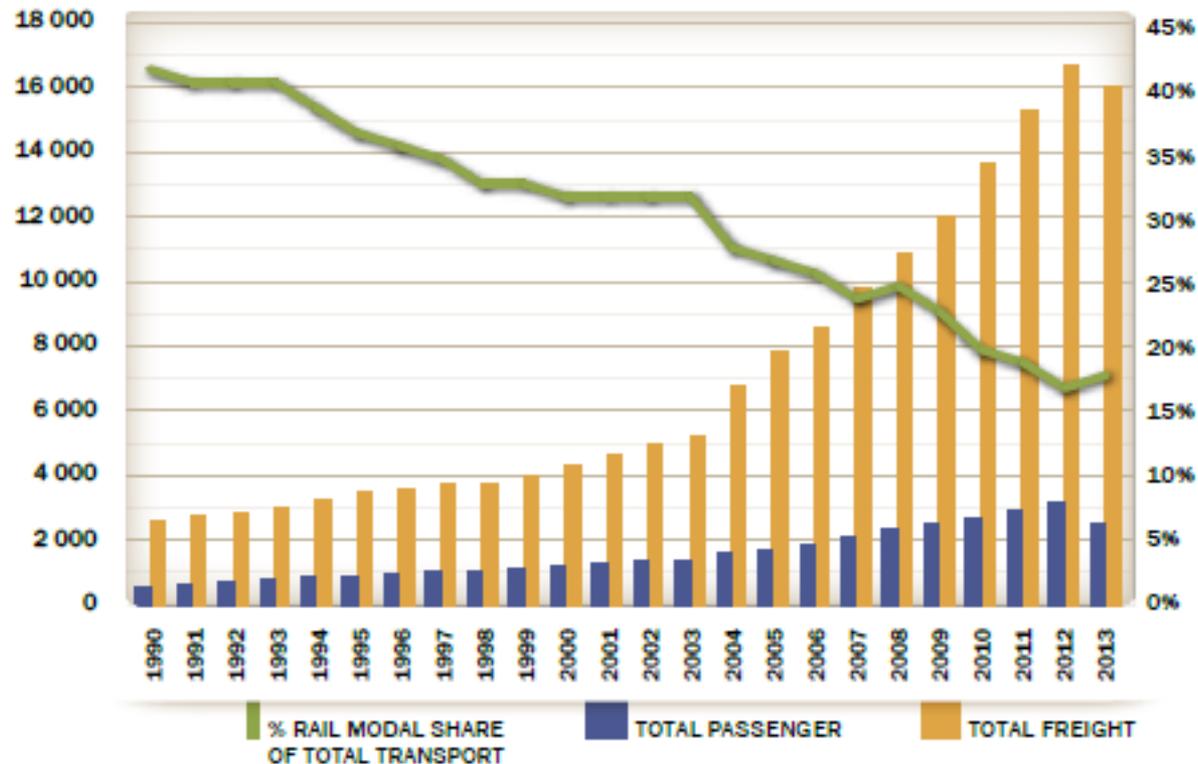
ENERGY MIX BY SOURCE		1990	2013
OIL PRODUCTS		36.6%	67.3%
COAL PRODUCTS		54.9%	0.0%
ELECTRICITY		8.5%	32.7%
of which Fossil		6.2%	26.3%
of which Nuclear		0.2%	0.9%
of which Renewable		2.1%	5.5%

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

India railway
energy fuel
mix, 1990-
2013

SOURCE: IEA *World Energy Balances*

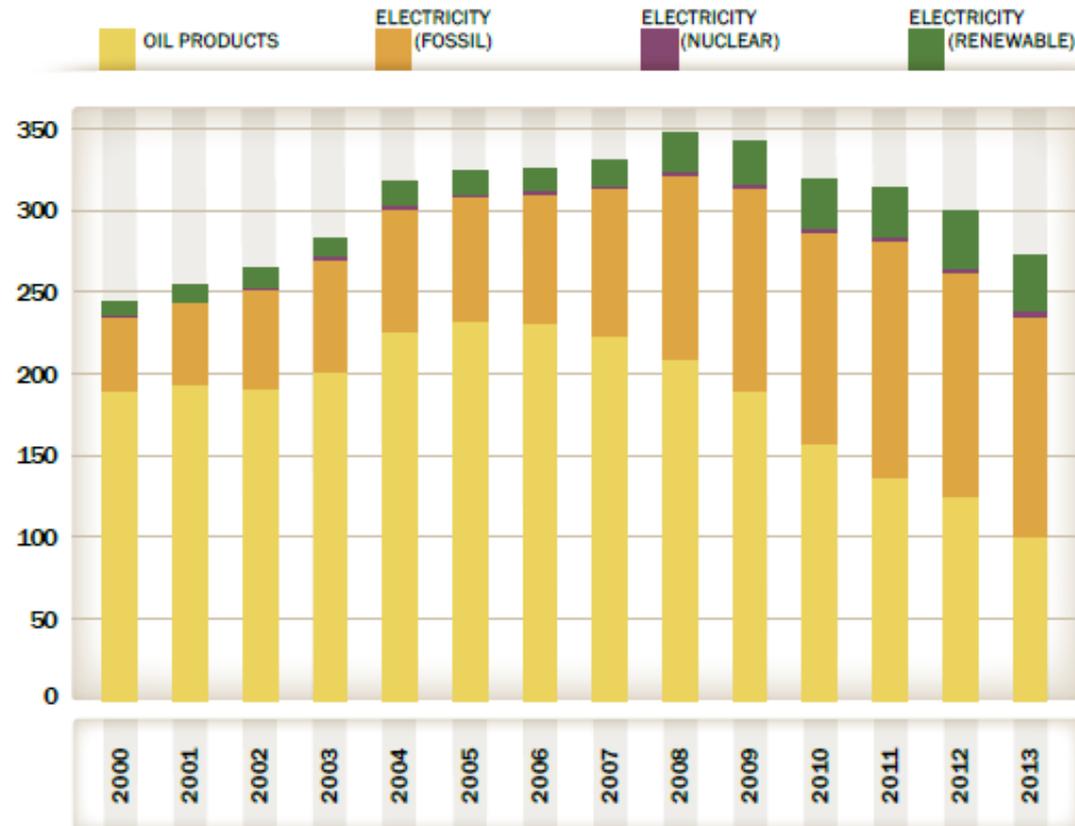
Passenger and freight activity have decreased respectively by 20% and 4% compared to the last year (2012)



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

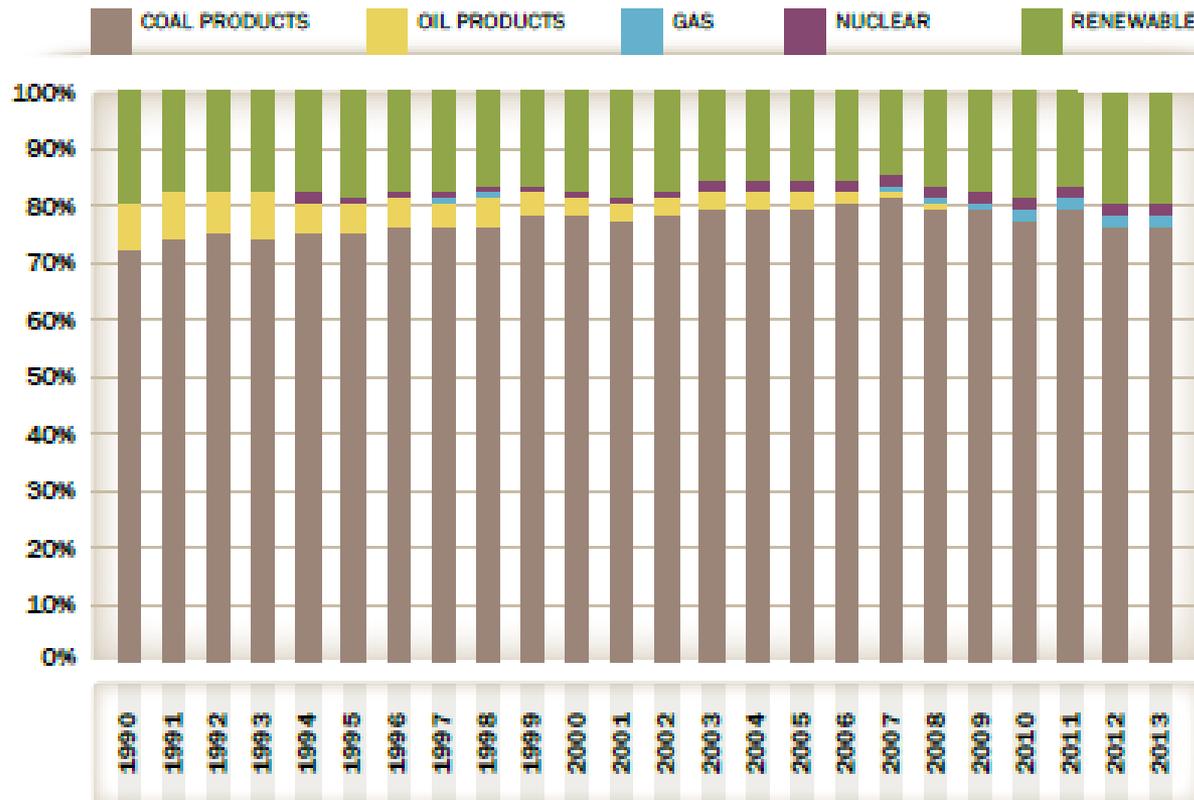
SOURCE: UIC and CNBS

Rail's final energy use was close to 273 PJ in 2013, of which 36% results from oil products and 64% from electricity. The share of renewable electricity sources in the same period (from 3.8% in 2000 to 13.1% in 2013).



Railway final energy consumption by fuel, 2000-2013 (PJ)

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

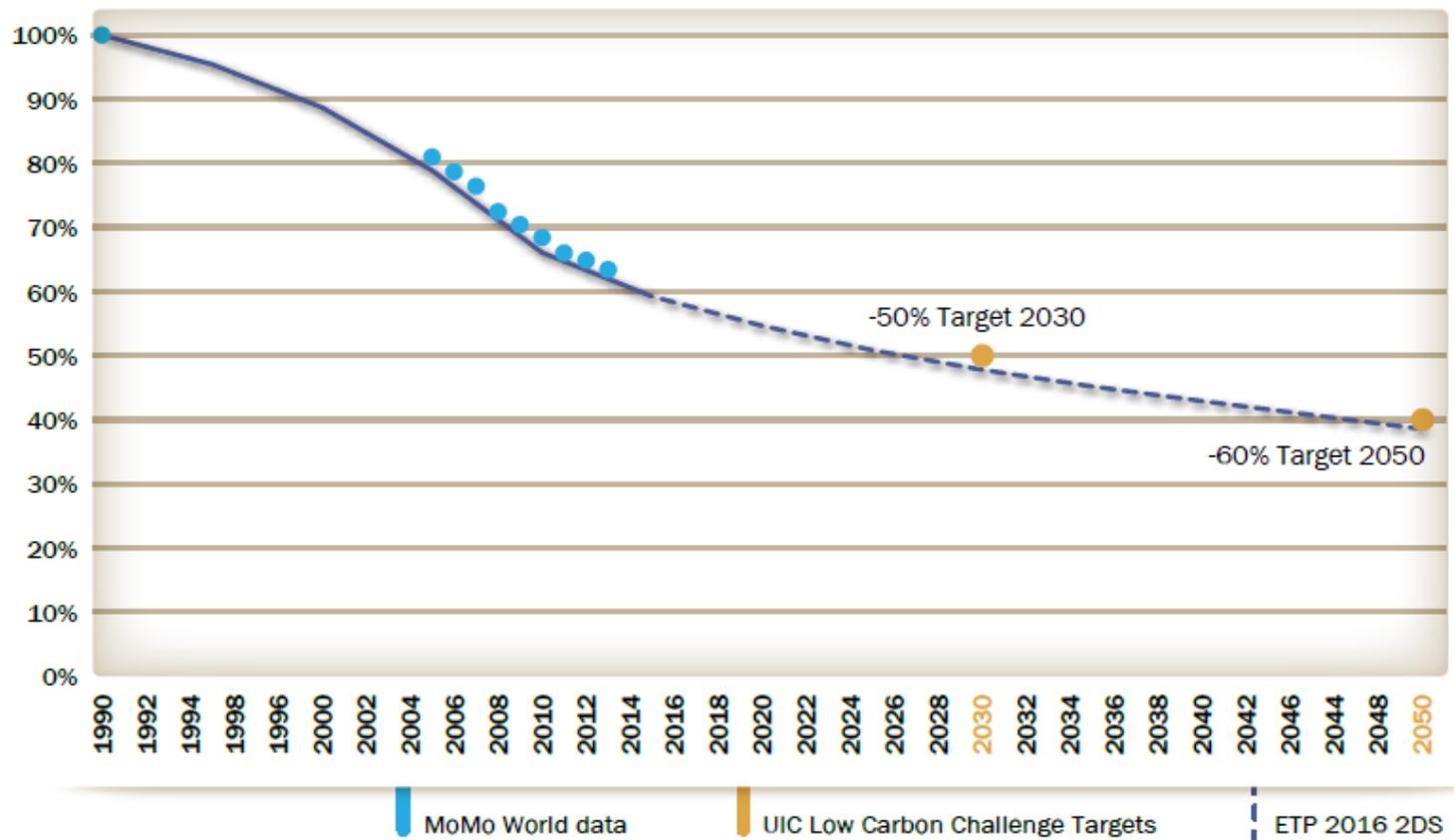
SOURCE: IEA



Handbook 2016: Focus on Sustainability Targets

Focus: Sustainability Targets

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



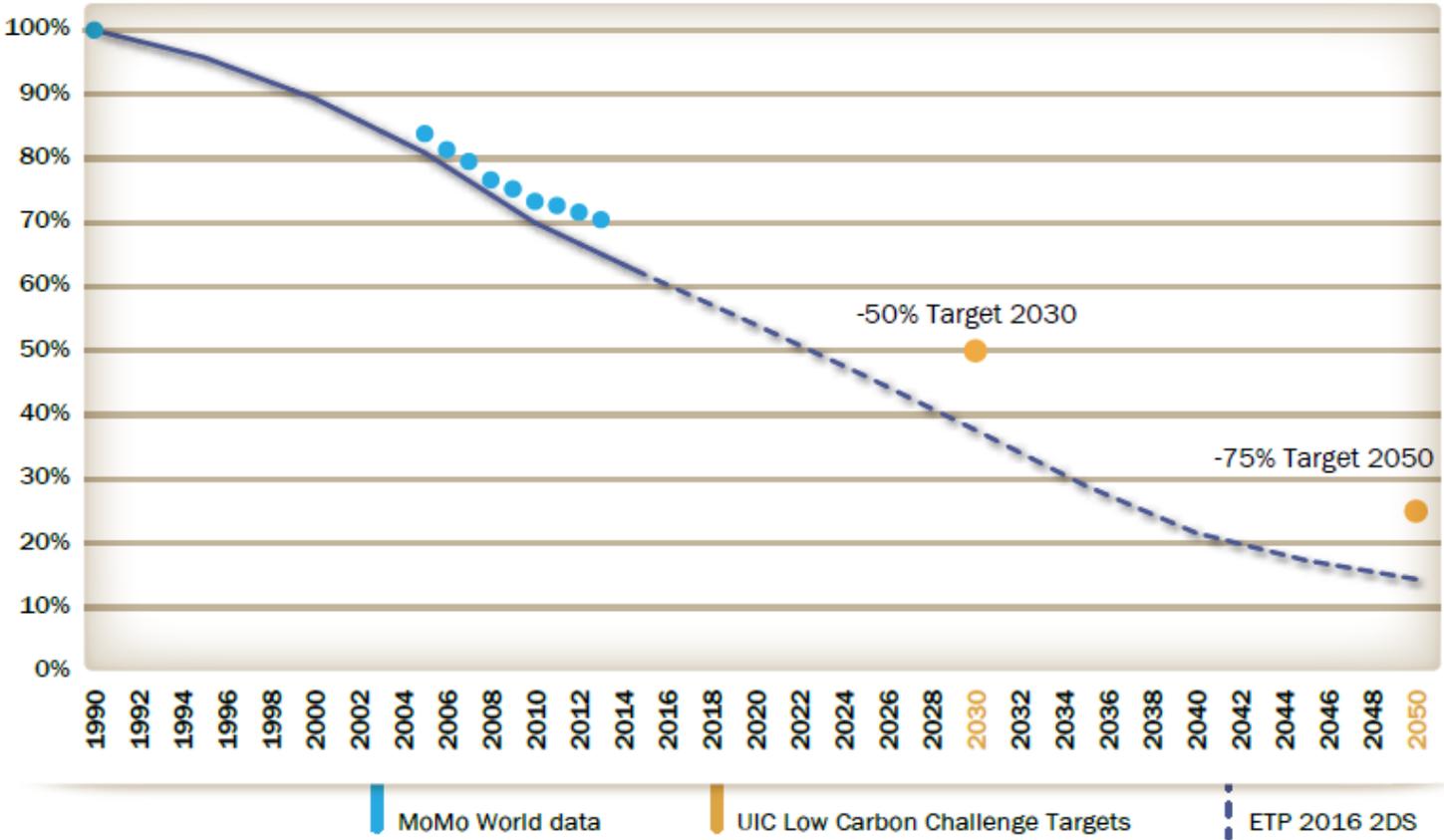
World specific rail energy consumption evolution per traffic unit (TU) between 1990-2013 compared to 2030 and 2050 targets (1990=100)

Elaboration by SUSDEF based on IEA and UIC



Focus: Sustainability Targets

Specific CO₂ emissions have reduced by 30% between 1990 and 2013



World specific rail CO₂ emissions evolution per traffic unit (TU) between 1990 and 2013 compared to 2030 and 2050 targets (1990=100)

Elaboration by SUSDEF based on IEA and UIC



Thank you!

