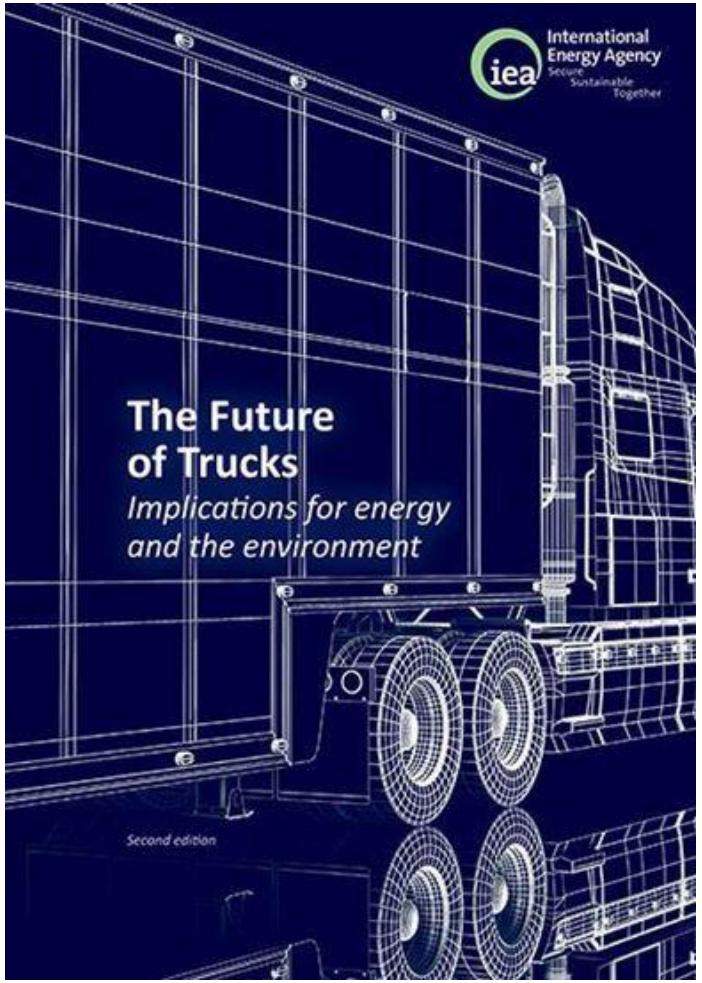
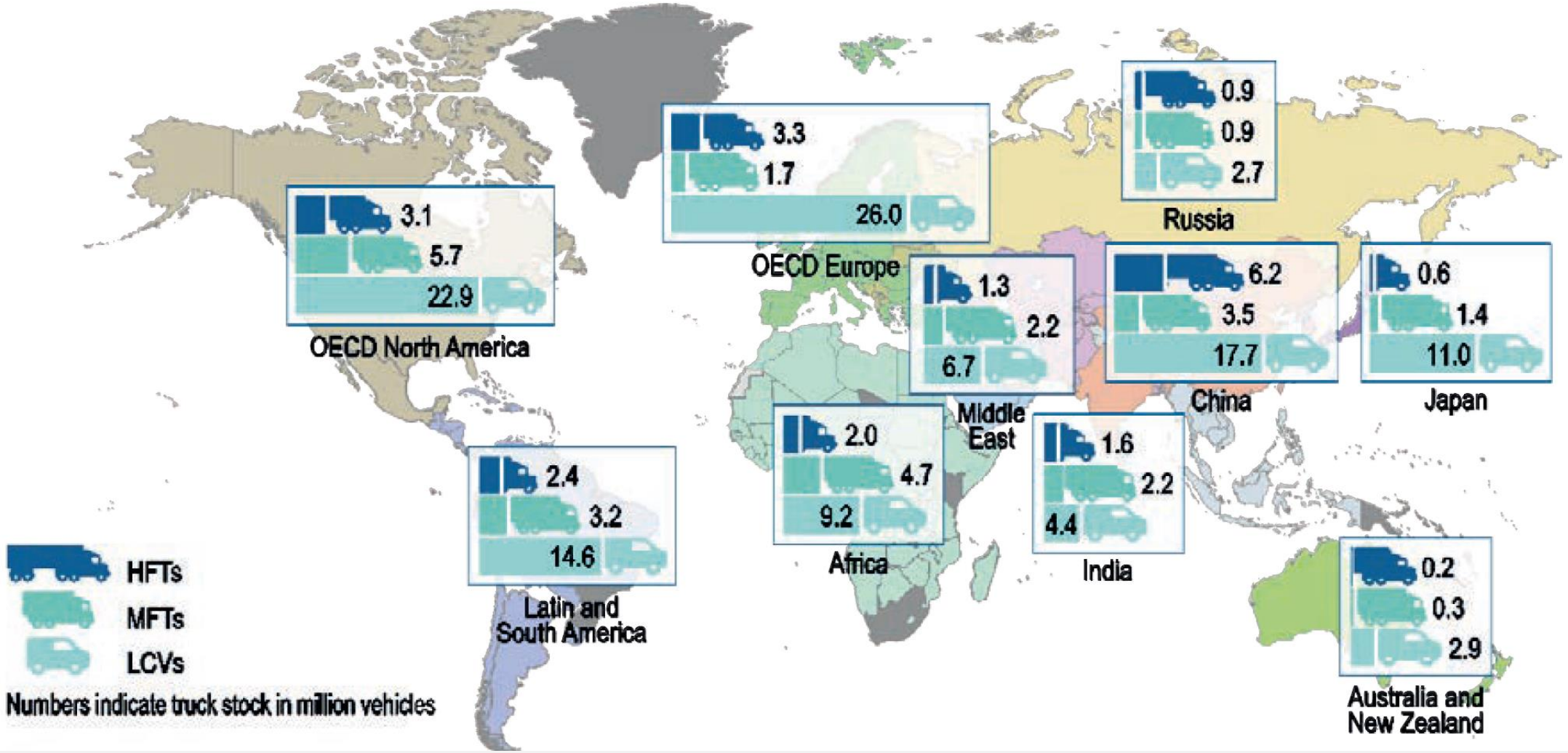
The Future of Trucks



Pierpaolo Cazzola

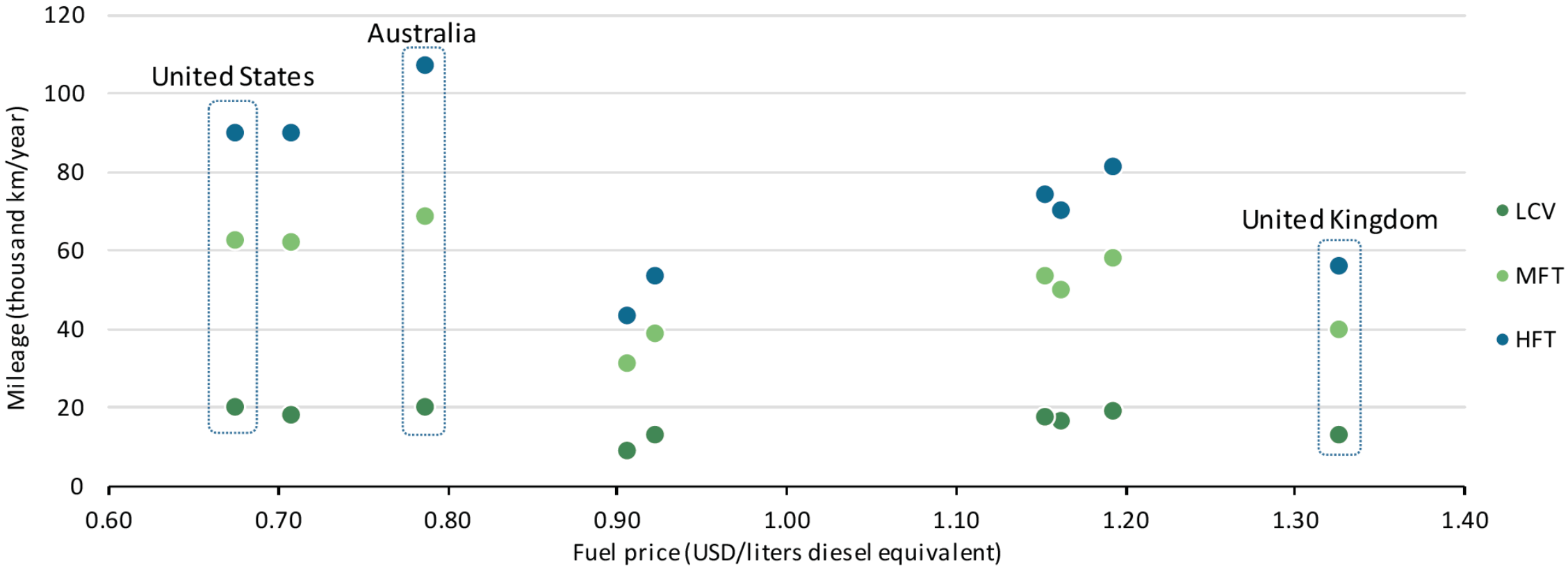
Decarbonising road freight - EXPERT WORKSHOP – OECD – 28-29 June 2018

Vehicle stock



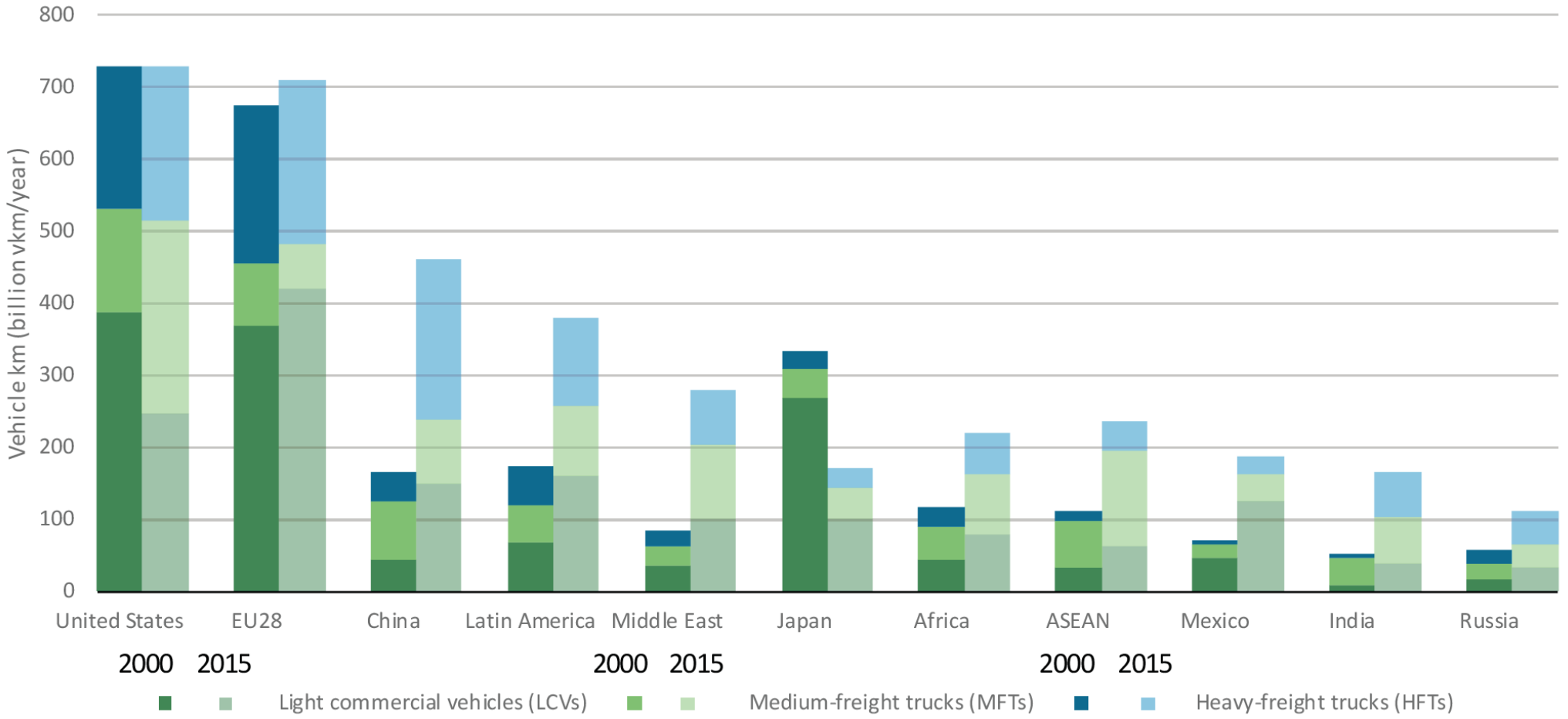
- Vehicle stock is one of the key determinants of road freight activity
- Relevance of different modes not uniform across global regions

Mileage



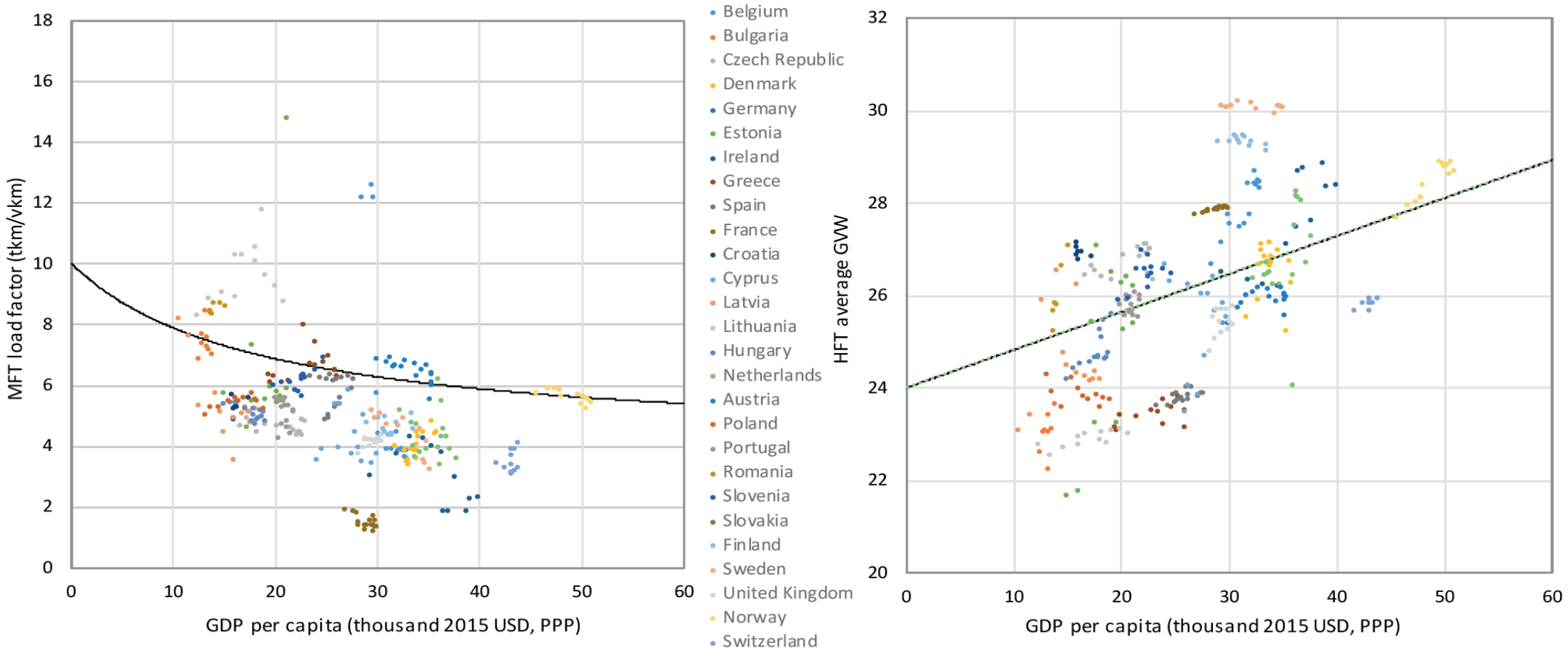
- Mileage tends to be larger in countries with lower fuel prices
- Fuel taxation tends to be lower in low-density countries (longer transport distances)
- Vehicle speed also matters: poorer conditions of the road network in developing regions lead to lower speeds and limit mileage

Vehicle activity



- China catching up fast against Europe and United States, primarily because of HFT and LCV vkm growth
- India still half of China, and with much greater relevance of MFTs

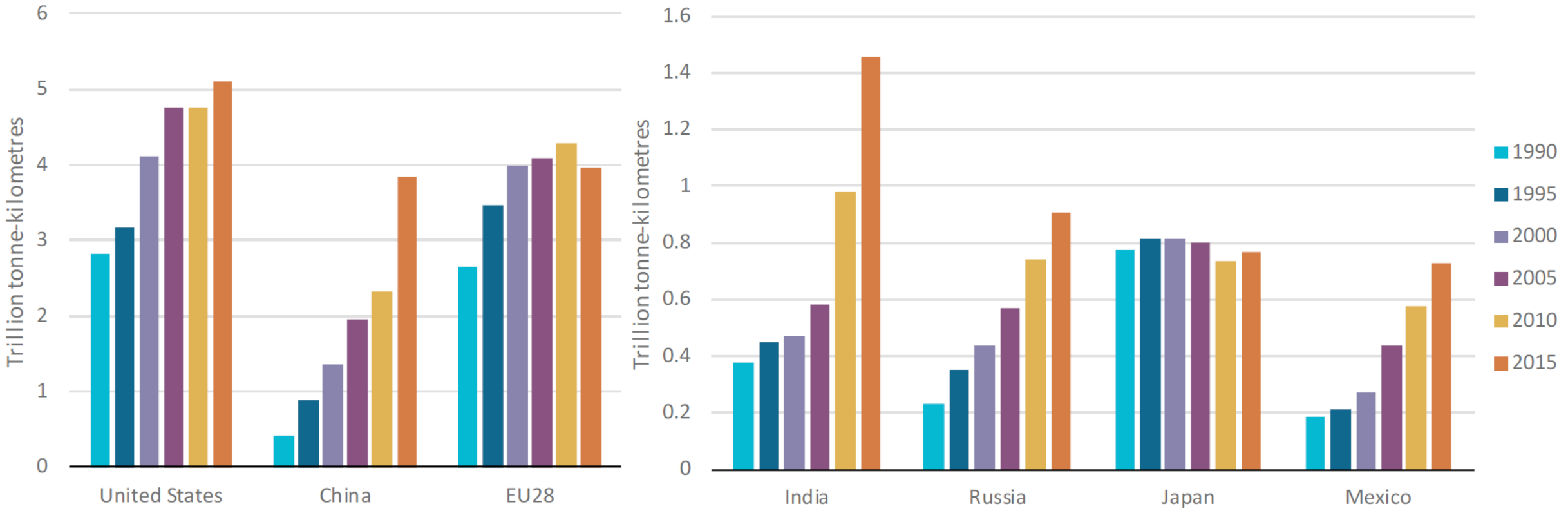
Loads



Sources: Grütter (2016); BTS (2016); Eurostat (2016).

- Loads decline with income growth for medium trucks
- Carrying capacities of heavy trucks increase with income growth
- Data accuracy is a challenge: we used simplifying assumptions to represent this in our models

Road freight activity



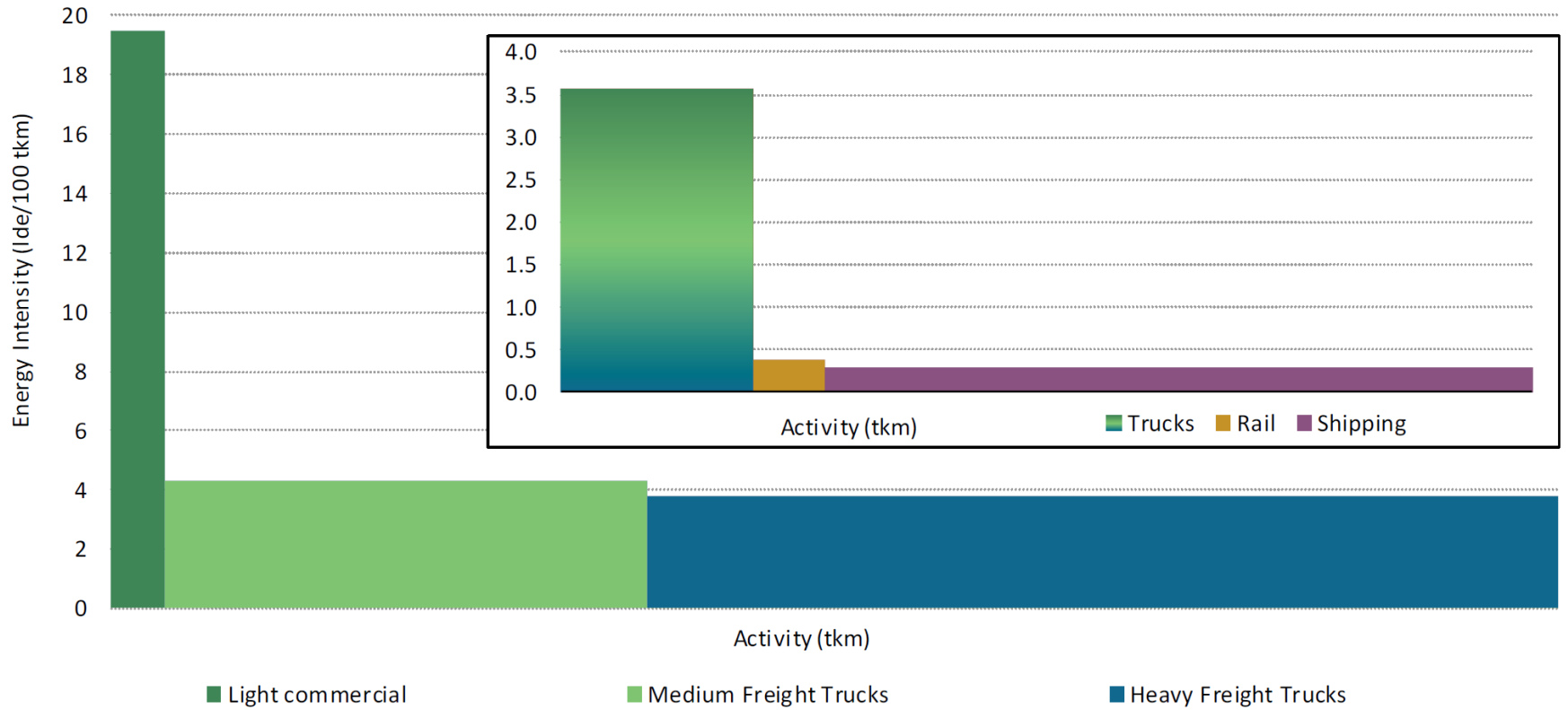
- Combined effect of stock growth (and shifts), mileage and load dynamics
- Road freight activity is stagnating in developed countries, reflecting limited economic growth, while it is subject to significant growth in rapidly developing economies
- In 2015, China accounted for a similar amount of tkm to what can be estimated for the United States and the European Union. Tkm in India were still half of that

Fuel economies

Country	LCVs			MFTs			HFTs		
	lde/ 100 km	payload (tonnes)	lde/ 100 tkm	lde/ 100 km	payload (tonnes)	lde/ 100 tkm	lde/ 100 km	payload (tonnes) tkm	lde/ 100
United States	7.9	0.55	14.4	28.2	6.4	4.4	41.2	15.4	2.7
European Union	6.8	0.62	11.0	23.3	7.0	3.3	34.6	14.5	2.4
China	9.9	0.82	12.1	23.3	8.7	2.7	39.1	13.3	2.9
India	6.4	0.96	6.7	25.0	9.7	2.6	44.9	12.9	3.5

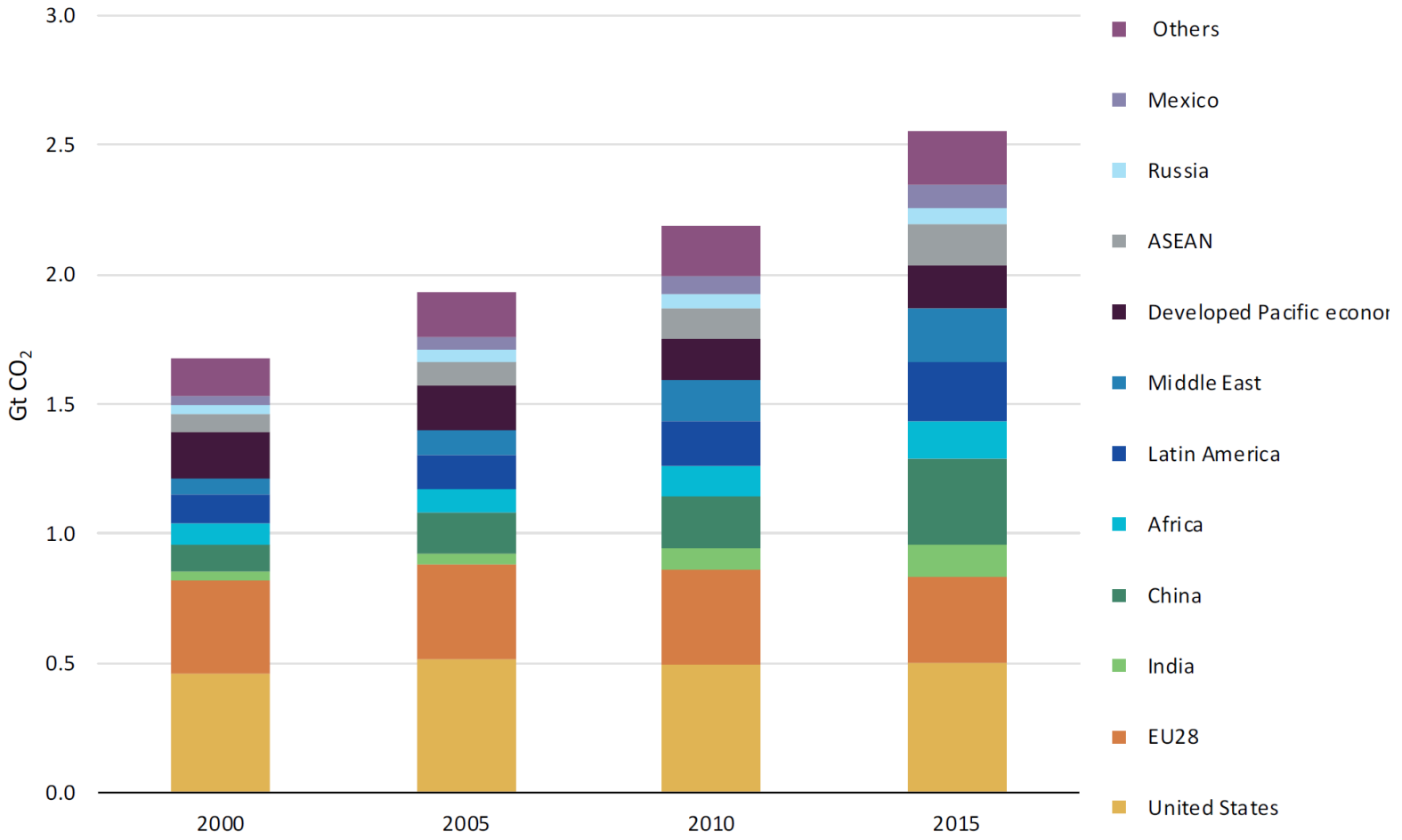
- Differences in vehicle attributes, such as engine size and power, the availability of auxiliaries, and the mission profiles and vehicle size distributions in each category, complicate the comparison of average fuel economy and load across regions
- Trucks are most efficient in Europe
- Higher payloads on LCVs and MFTs lead to lower fuel use per tkm in China and India/

Energy use



- Even if it accounts only for 20% of all tkm globally, road freight consumes more than 70% of the energy needed to move goods
- At around 17 mb/d, road freight transport is the second largest users of oil (after passenger cars) today
- It was also responsible for nearly 40% of the oil demand growth since 2000
- Most of this energy goes to medium and heavy duty trucks
- LCVs are – by far – the least efficiency road freight transport mode

CO_2 emissions



- Energy use and emissions were largely boosted in recent years by growth taking place in China, Latin America, India and other rapidly developing global economies
- By 2015, China's CO_2 emissions in road freight caught up with the EU
- India still accounts for about one third of China

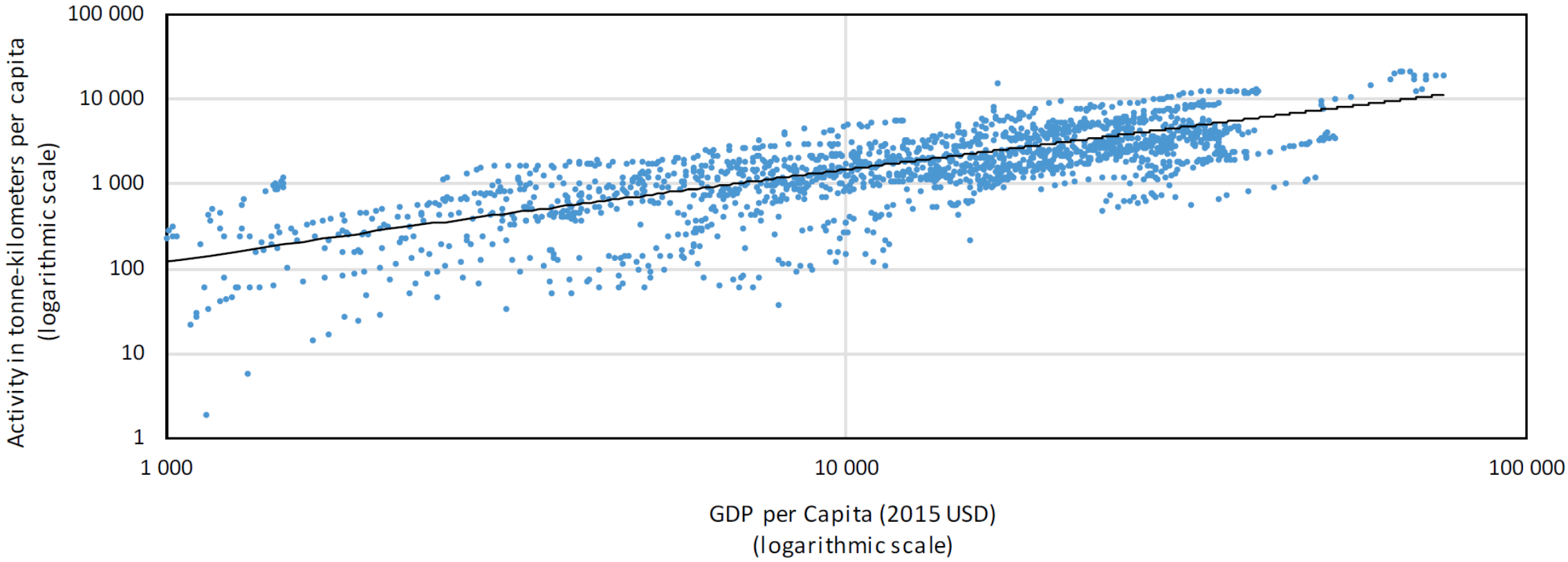
Caveats

- Data availability limitations required the use of estimations
- The main rationale used in our assessment builds on the information flow that links vehicle sales with energy use (through survival rates, stocks, mileages, vkm and fuel economies)

$$A \sum_i S_i I_i = F$$

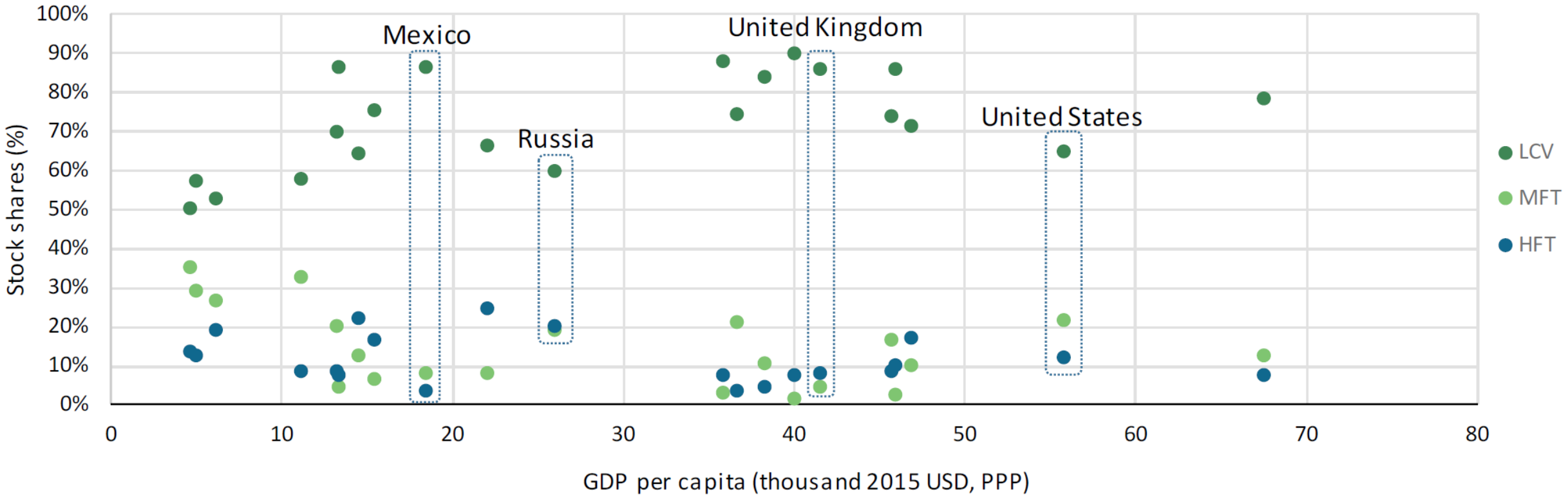
- Bottom up estimations of energy use require data on fuel economies
  - Our work relied primarily on research developed by the ICCT for the GFEI, complemented by information on the fuel consumption of vehicles reported by communities of vehicle users
- Tkm are linked to vkm by the share of empty running and average load on laden trips
  - Surveys focused on developing regions (Grütter, 2016) and available data points from the United States (BTS, 2016) and the European Union (Eurostat, 2016) were the main basis for this assessment
  - This information was then used as the basis for defining the average loads of medium- and heavy-freight trucks as functions of income and used to estimate the loads

Projecting activity



- Freight activity is correlated with income growth

Projecting vehicle stock structure

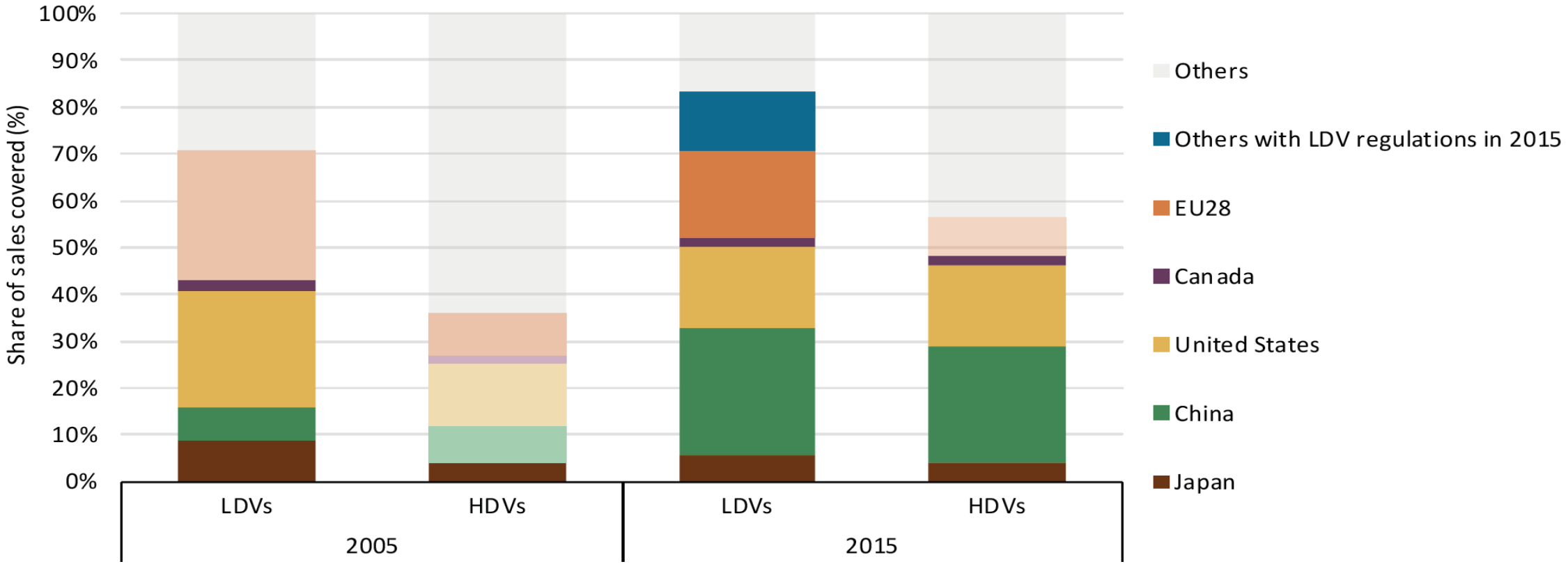


Source: IEA (2017a), Mobility Model, June 2017 version, database and simulation model, www.iea.org/etp/etpmodel/transport.

- Share of LCVs and heavy trucks grows with increasing income levels (better road network, greater use of LCVs for services and urban deliveries, in parallel with growth of car ownership)

Policy efforts for trucks efficiency are not widespread

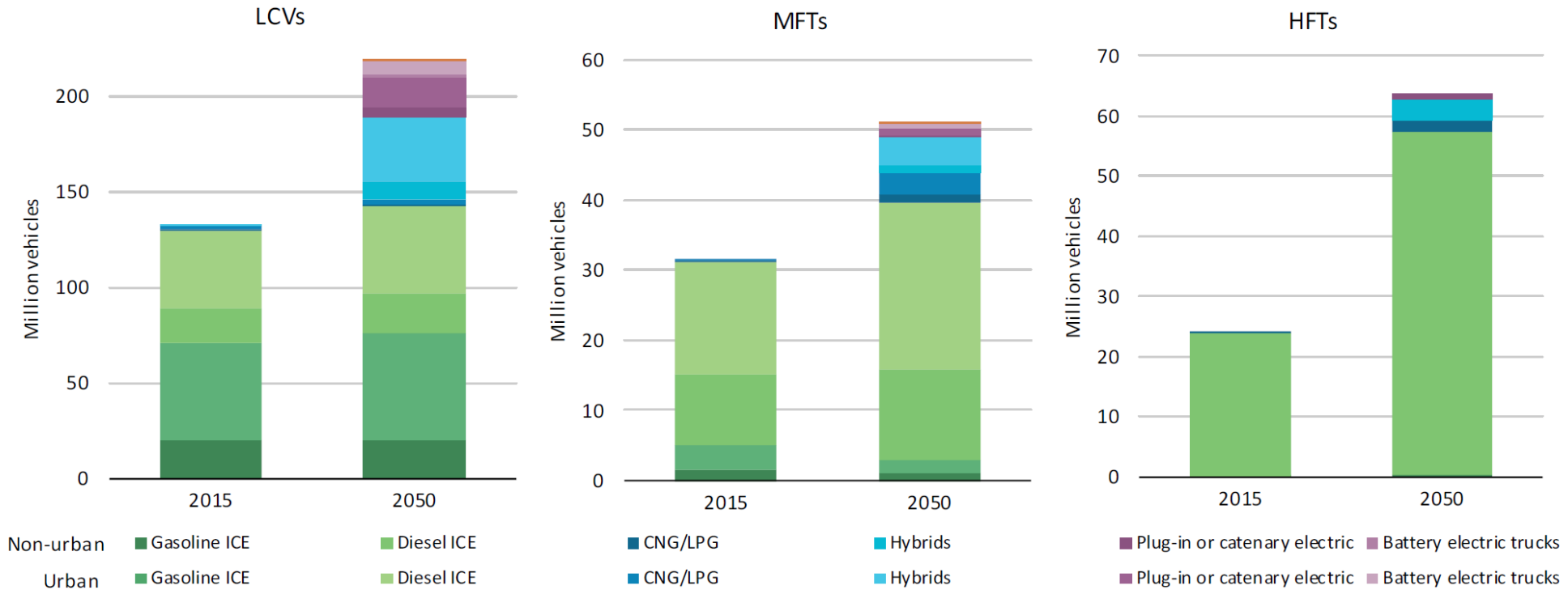
Vehicle efficiency standards for light-duty vehicles (LDVs) and heavy-duty vehicles (HDVs) - 2017



Source: IEA report *The Future of trucks*

While fuel economy standards cover more than 80% of the LDV market,
only 4 countries (Canada, China, Japan and US) have truck fuel economy standards in place

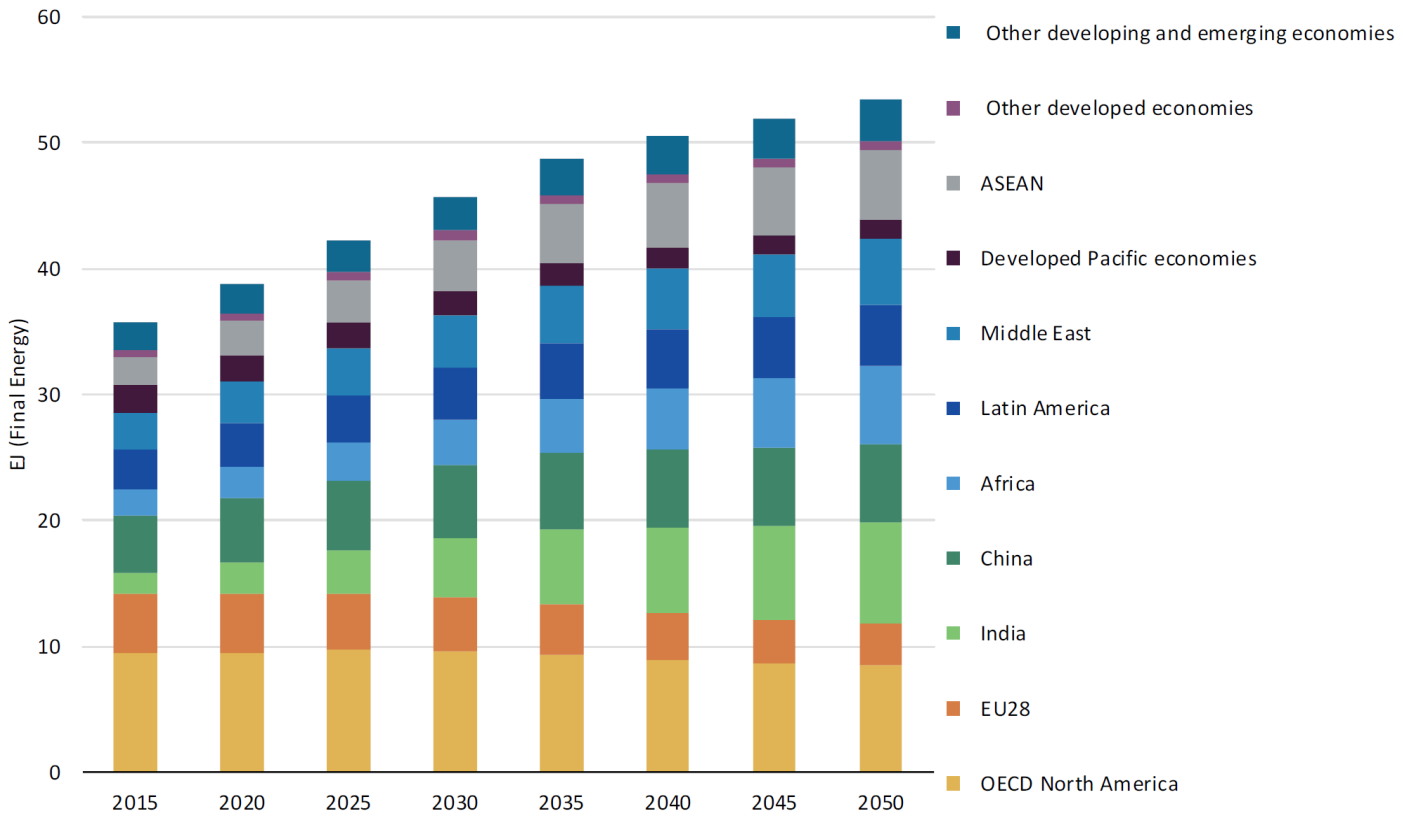
Vehicle technology uptake in the Reference Technology Scenario



Note: CNG = compressed natural gas; ICE = internal combustion engine; LPG = liquefied petroleum gas.

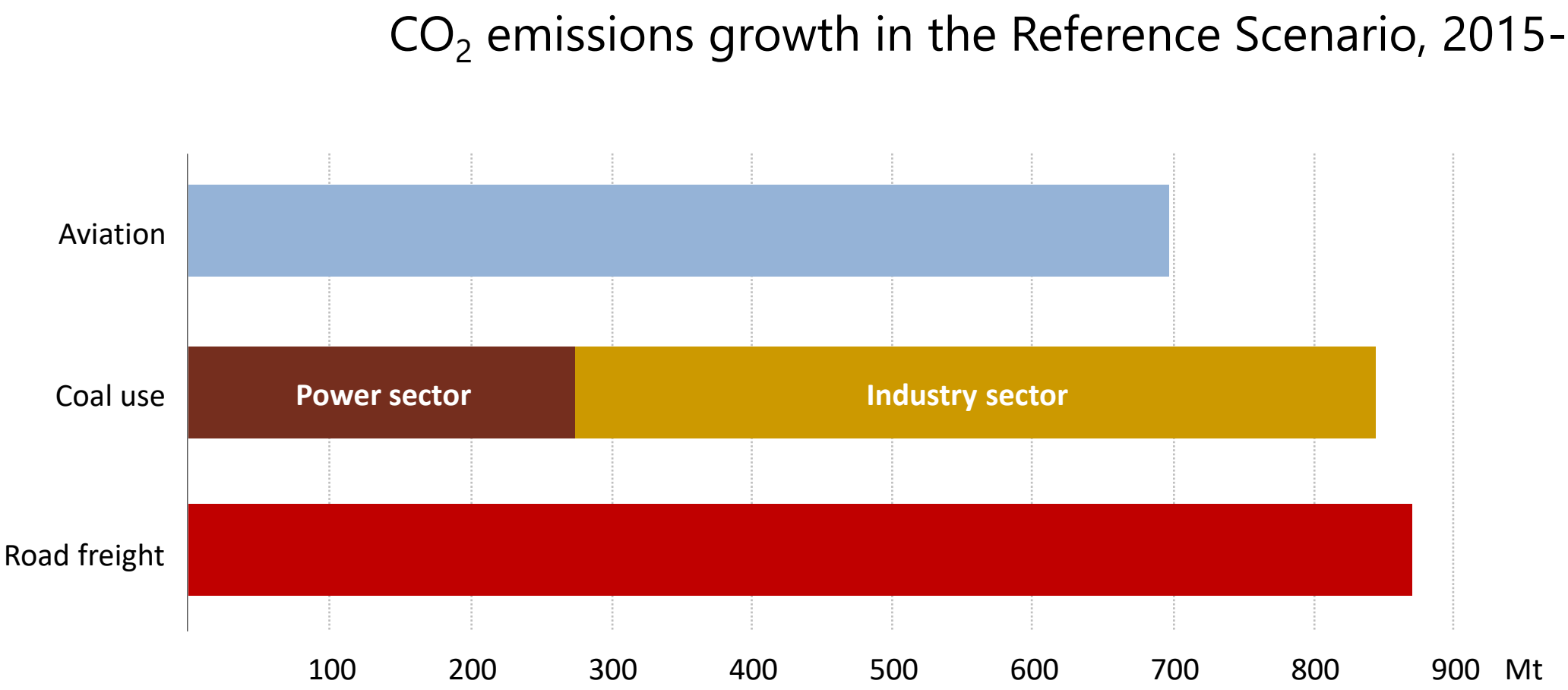
- The existing policy gap leads to limited uptake of fuel saving technologies in the reference scenario
- Despite this, hybrids and EV stock shares grow in light vehicles and vehicles with mission profiles requiring frequent stops

Energy use projections – Reference Technology Scenario



- Combining freight activity growth with mileages and vehicle stock structures that broadly reflect historical development and vehicle technology development that does not factor in major changes leads to nearly 50% growth in energy use from road freight by 2060
- India catches up with China by 2035, and accounts as much as North America by 2060 in this scenario

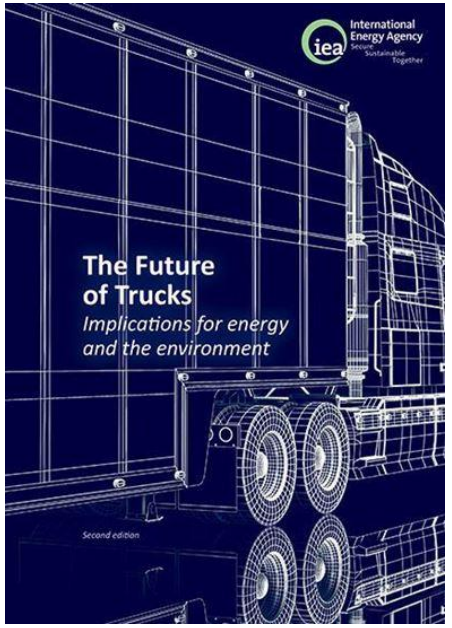
Trucks will surpass passenger cars as the major oil consumer



Trucks are the fastest growing source of global oil demand in RTS, where they account for 40% of the oil demand growth to 2050 and 15% of the increase in global CO_2 emissions

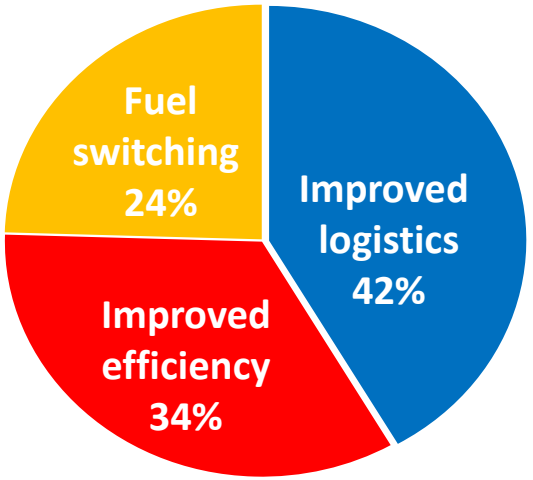
An IEA vision for a modern truck future

- The IEA proposes a vision for modernising truck transport, in light of the increasing relevance of the sector for future oil demand & emissions growth
- The **IEA Modern Truck Scenario** requires near-term efforts across three central areas:
  - *Vehicle efficiency*
  - *Systemic improvements in logistics*
  - *Increased uptake of alternative fuels*



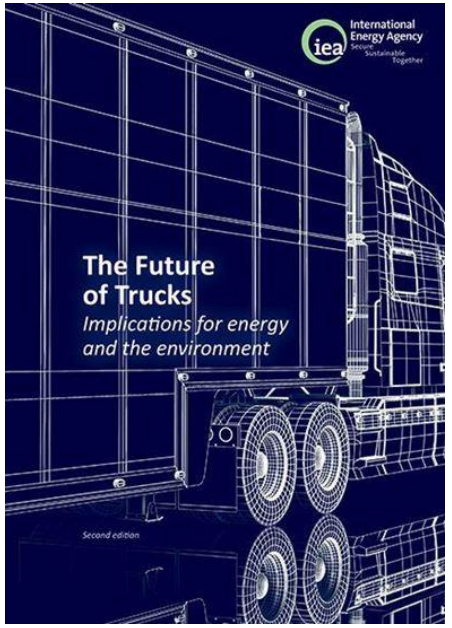
Fuel demand saving in the Modern Truck Scenario relative to the Reference Scenario, 2050

13.5 mb/d



Fuel economy

- There are good opportunities to save fuel and reduce emissions
  - Ranges of potential for technical and operational efficiency investments over the 2015-2030 timeframe fall close to 30% - Many solutions (including retrofits) pay for themselves within less than 3 years
  - Greater potential for savings for HDVs
  - Improvements of 50% proven as technically feasible using best-in-class technologies (SuperTruck challenge)
  - Growing interest for electrification technologies also emerging for trucks (examples include Scania, Tesla, Daimler, Ford-DHL & UPS-UES vans)
- Adopting policies targeting truck efficiency was identified as a key priority in recent IEA report on the future of trucks
- **The IEA report includes a recommendation to progressively reduce the fuel use per km of new vehicles by 35%, relative to a 2015 baseline, by 2035, for MFTs and HFTs taken together**
- **This aligns well with work developed by GFEI partners**



Logistics

Two main groups of solutions

- Measures requiring little or no co-operation across stakeholders

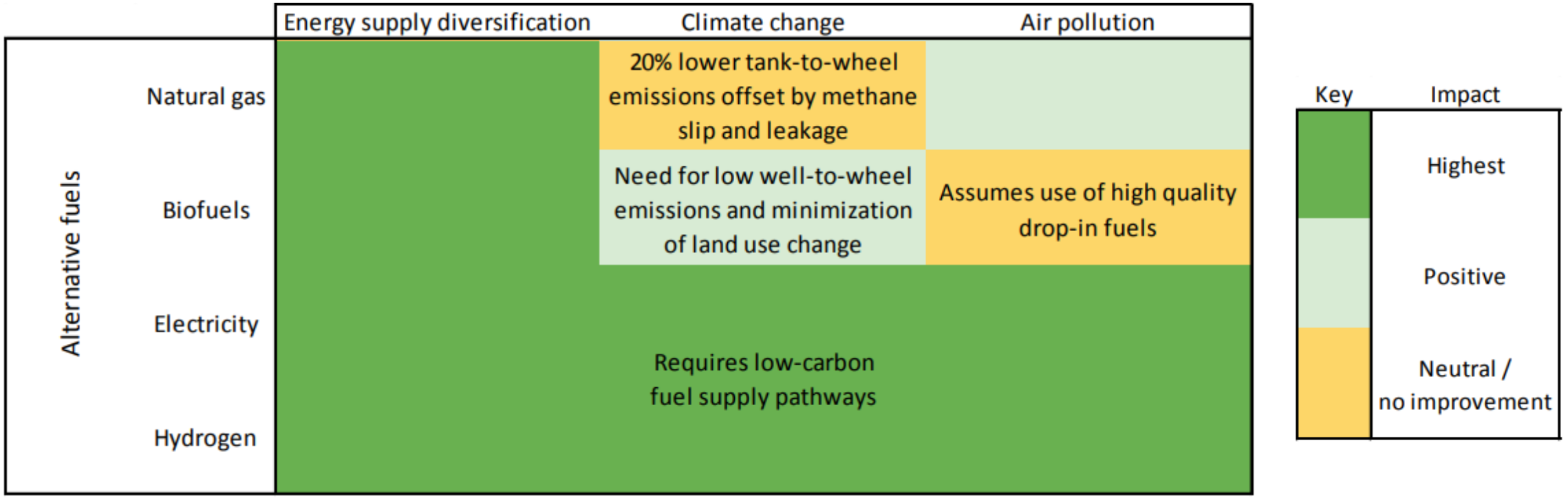
	Range of energy savings
Route optimization	5-10% intra-city, 1% long haul
High Capacity Vehicles (HCVs)	Up to 20%, primarily in long haul, risk of rebound
Driver training and feedback	3 to 10%
Platooning	5 to 15%
Last mile delivery optimization	5 to 10%, depends on degree of implementation

- Measures requiring closer collaboration

  Sharing of assets and services between and among companies and more radical re-envisioning of how logistics systems operate

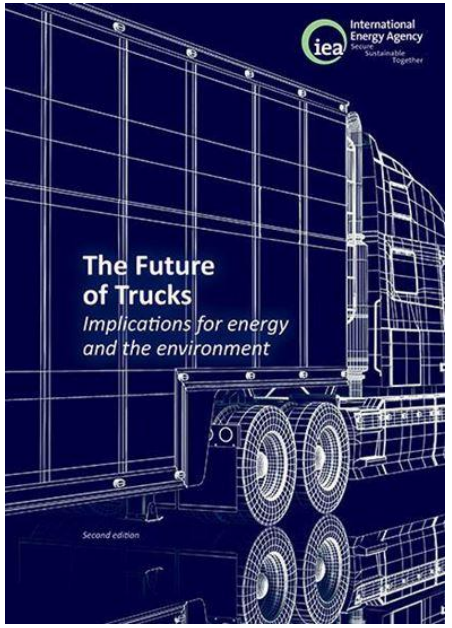
	Range of energy savings
Supply chain collaboration/co-loading	Up to 15%
Matching cargo and vehicles via IT • Freight exchanges, digital freight matching • Links with crowdshipping and co-modality	5 to 10% in urban areas
Urban consolidation centres	20-50% in urban centres (all measures combined, including vehicle techs)
Physical internet	Up to 20%

Alternative fuels and powertrains



- Literature points to high abatement costs of alternative fuels
- Considerable debate on the extent to which they can lead to real-world reductions in greenhouse gas emissions – an issue exemplified by the controversy surrounding indirect land use change for biofuels, but that is also relevant for natural gas and to a lesser extent the cases of electricity and hydrogen
- In all cases, delivering reliable GHG emissions reductions will require that production and supply pathways are themselves decarbonised

Policy priorities



- **Adopting policies targeting vehicle efficiency, including fuel economy standards and differentiated taxes on vehicle purchase**

  Measures complementing each other to promote fuel efficient vehicles

  For MFTs and HFTs taken together, the fuel use per km of new vehicle registrations needs to be progressively reduced by 35%, relative to a 2015 baseline, by 2035.

- **Supporting widespread data collection and information sharing in logistics**

  Data gathering and information sharing are key prerequisites to realising some of the potential that underlies systemic improvements of freight logistics, including the sharing of assets and services.

  Policy makers should take a proactive role in supporting data collection and sharing platforms by promoting closer collaboration among all stakeholders.

- **Promoting the deployment of alternative fuels and the vehicles that use them**

  This typically requires support across four areas: RD&D, market uptake of alternative fuel vehicles, adequate access to charging or refuelling infrastructure and the availability of alternative fuels.

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