The future of trucks;
Implications for energy and the environment

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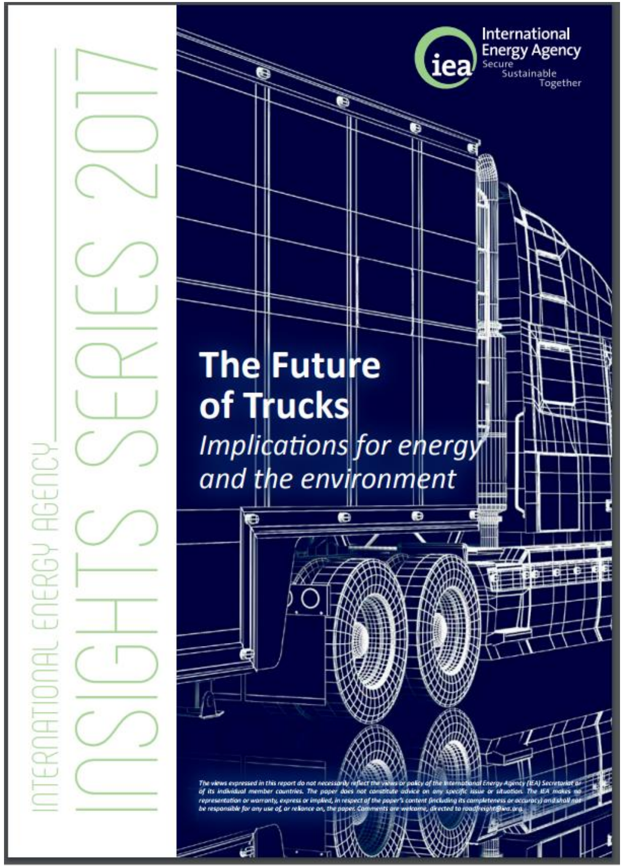
The future of freight energy demand

Insights derived from recent IEA report

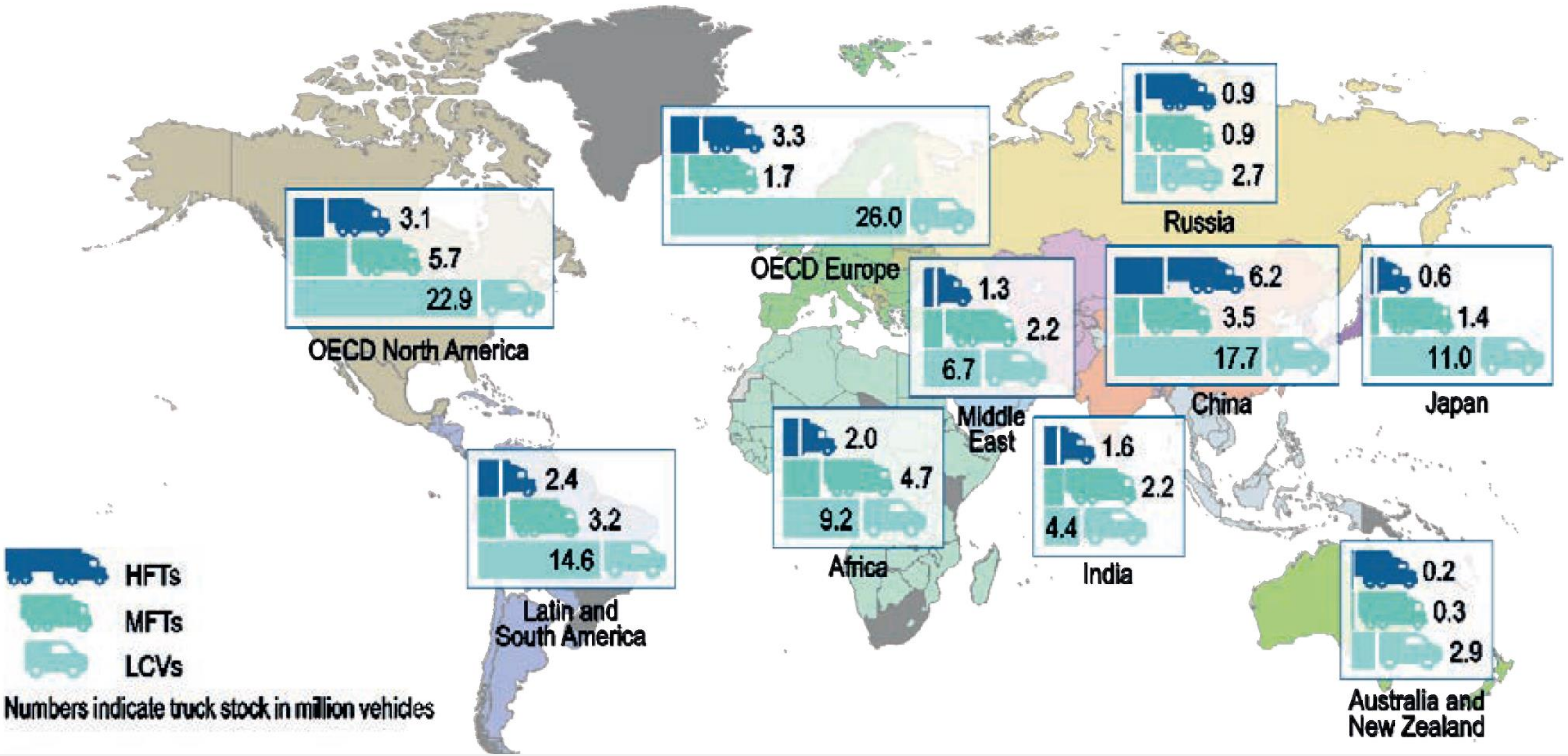
Focus on data & methods

Content

- Status of road freight transport
  - Activity, energy use, emissions
  - Rationale for assessment used in IEA report
  - Challenges on data collection
- Projections
  - Reference scenario results
  - IEA vision for a modern truck future
- Policy recommendations

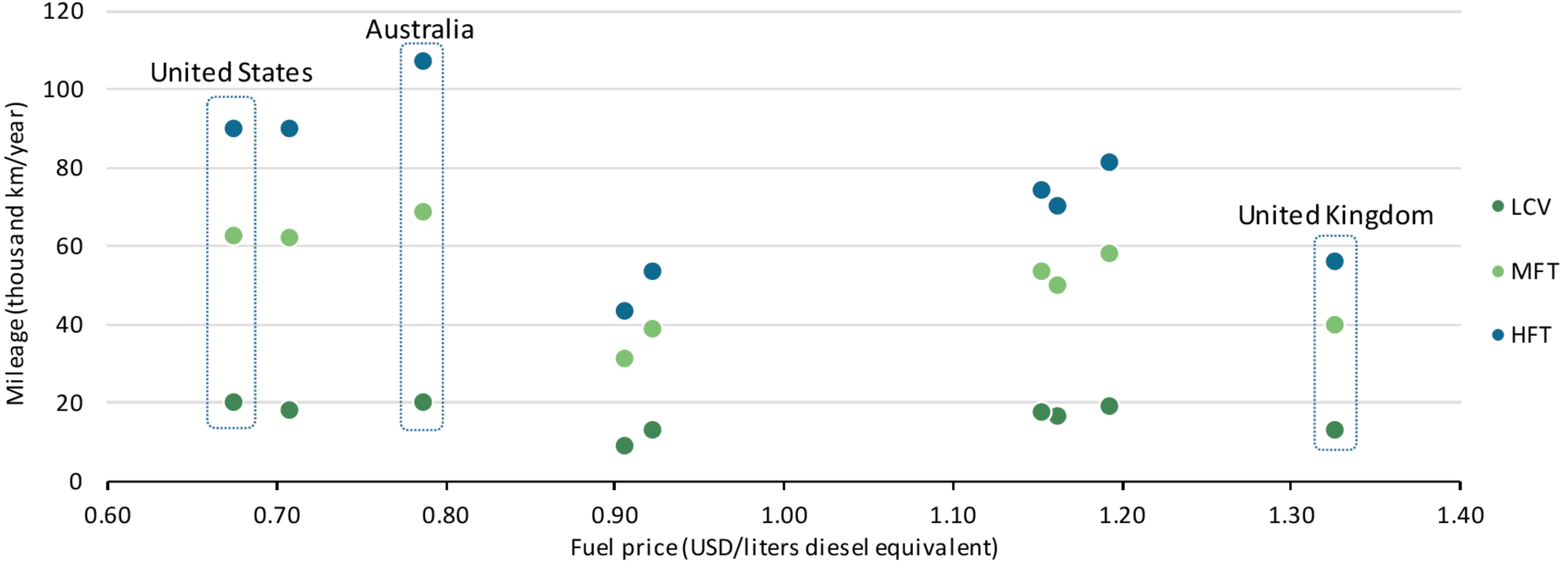


Vehicle stock



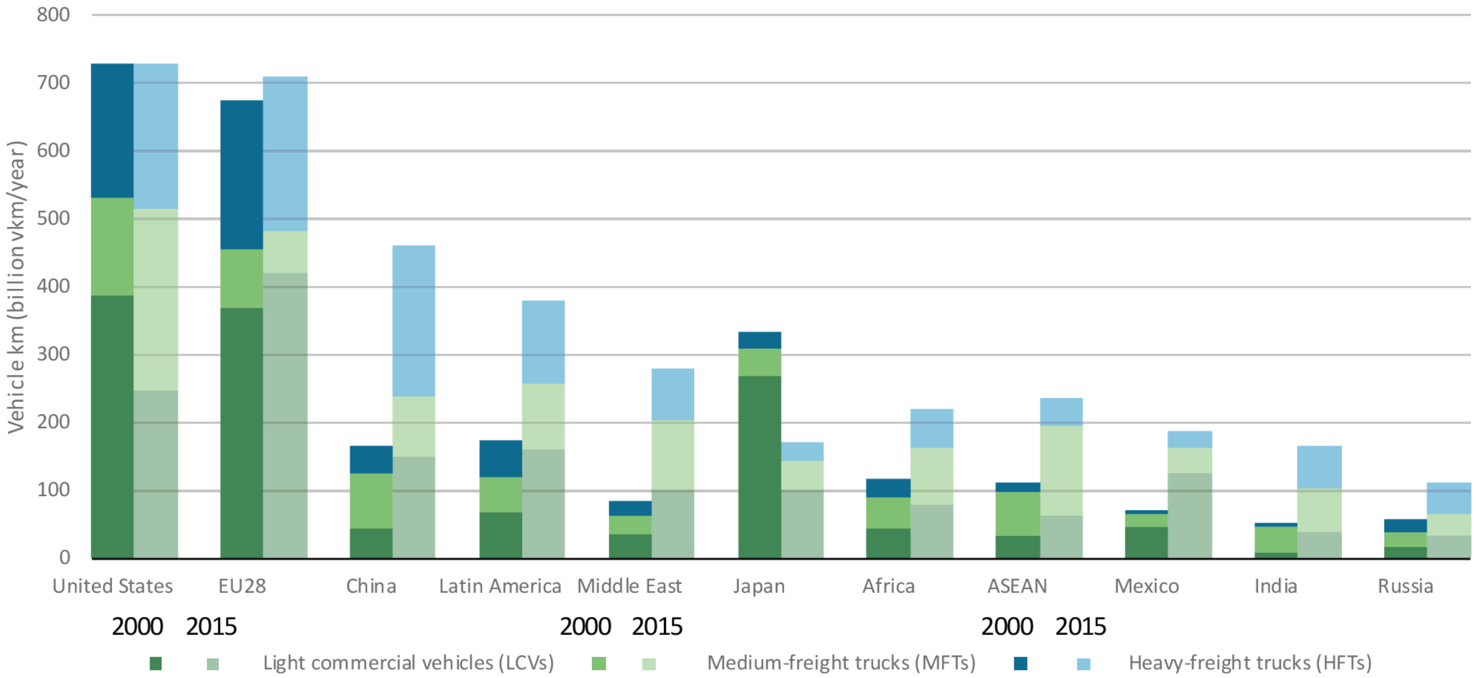
- Vehicle stock is one of the key determinants of road freight activity
- Relevance of different modes not uniform across global regions

Mileage



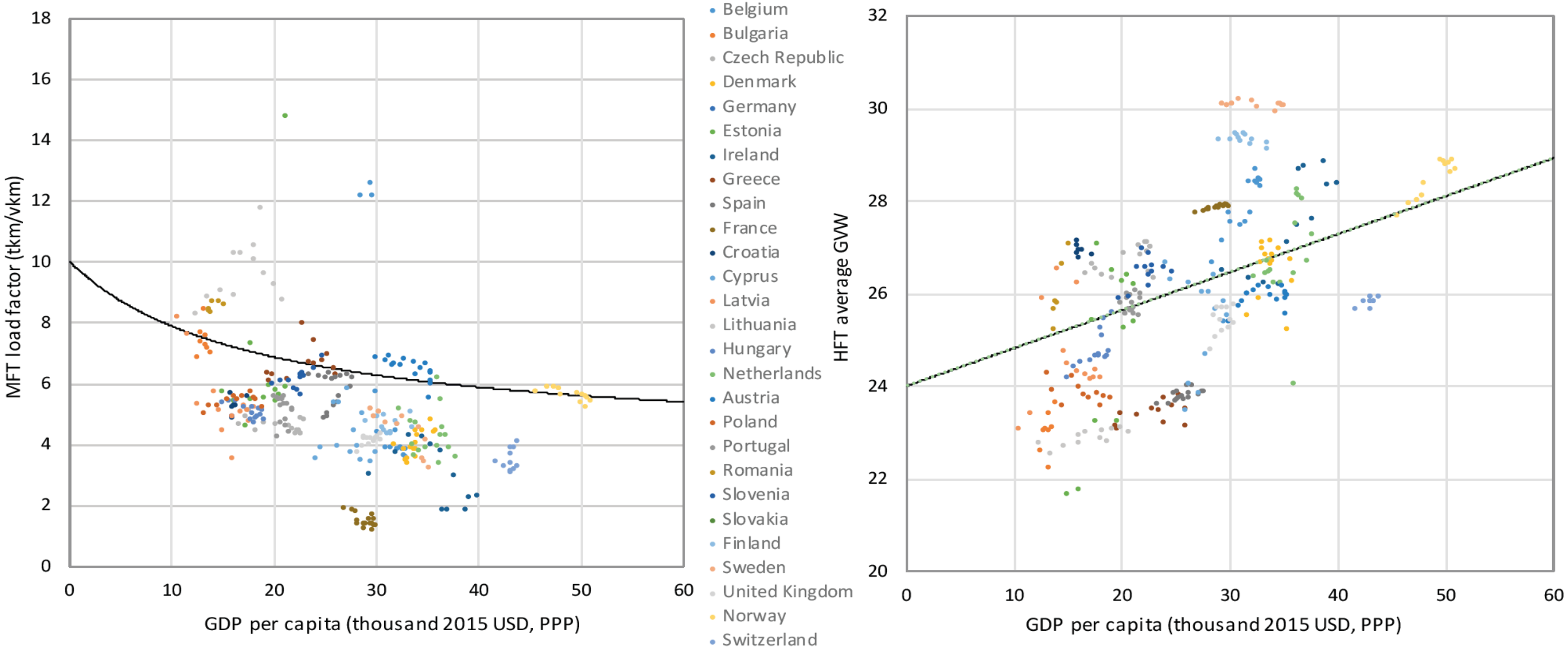
- Mileage tends to be larger in countries with lower fuel prices
- Fuel taxation tends to be lower in low-density countries (longer transport distances)
- Vehicle speed also matters: poorer conditions of the road network in developing regions lead to lower speeds and limit mileage

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**

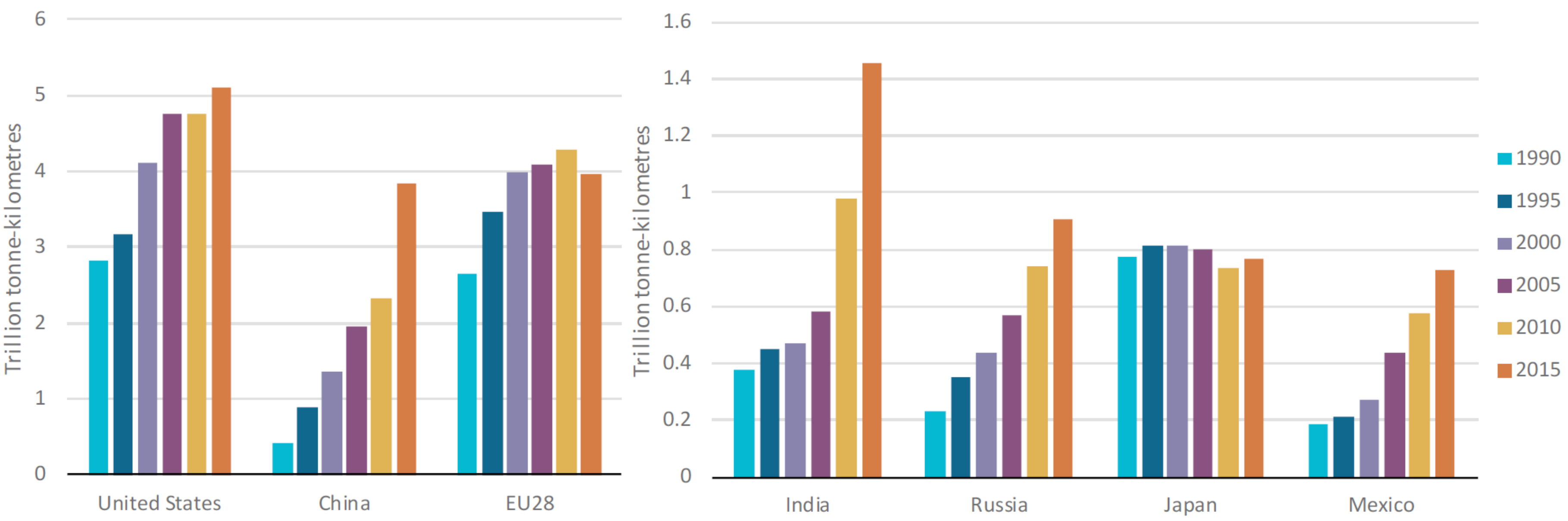
Loads



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

- **Loads decline with income growth for medium trucks**
- **Carrying capacities of heavy trucks increase with income growth**

Road freight activity



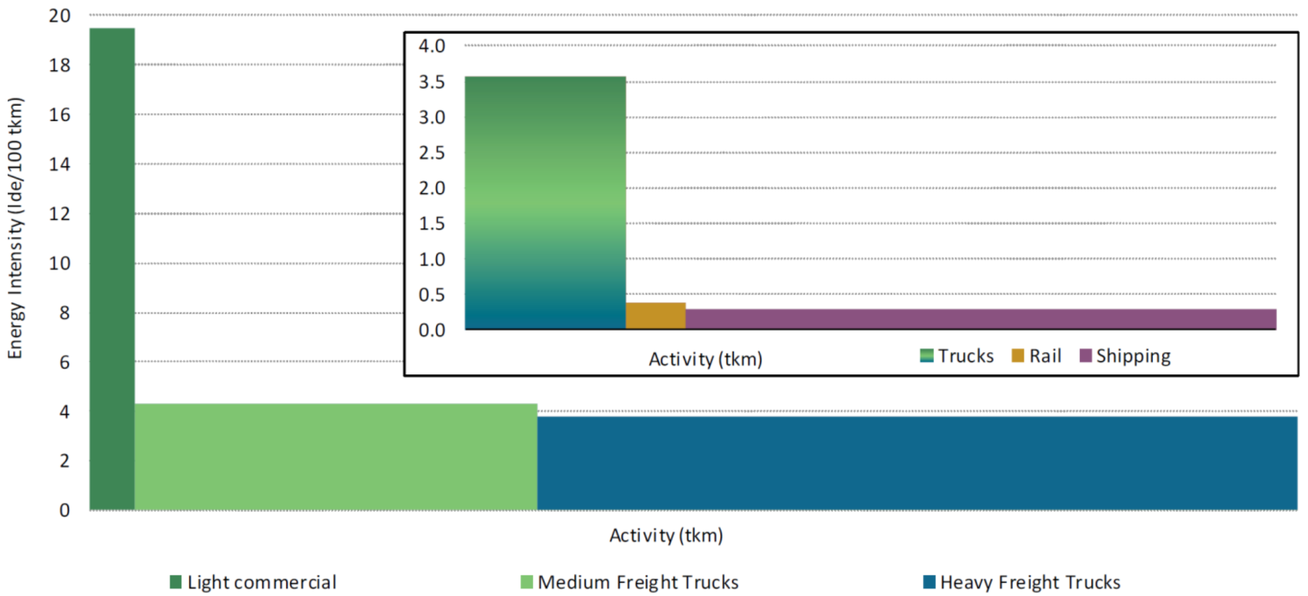
- **Combined effect of stock growth (and shifts), mileage and load dynamics**
- **Road freight activity is stagnating in developed countries, reflecting limited economic growth, while it is subject to significant growth in rapidly developing economies**
- **In 2015, China accounted for a similar amount 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

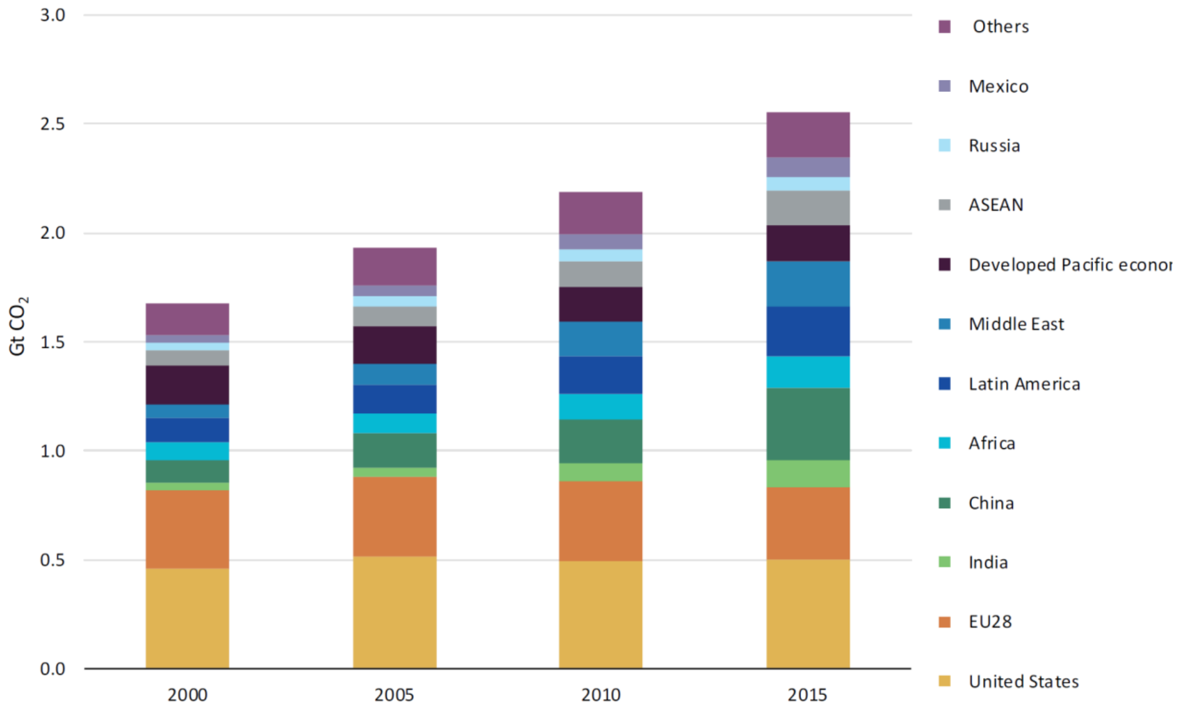
- **Differences in vehicle attributes, such as engine size and power, the availability of auxiliaries, and the mission profiles and vehicle size distributions in each category, complicate the comparison of average fuel economy and load across regions**
- **Trucks are most efficient in Europe**
- **Higher 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 tan 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**

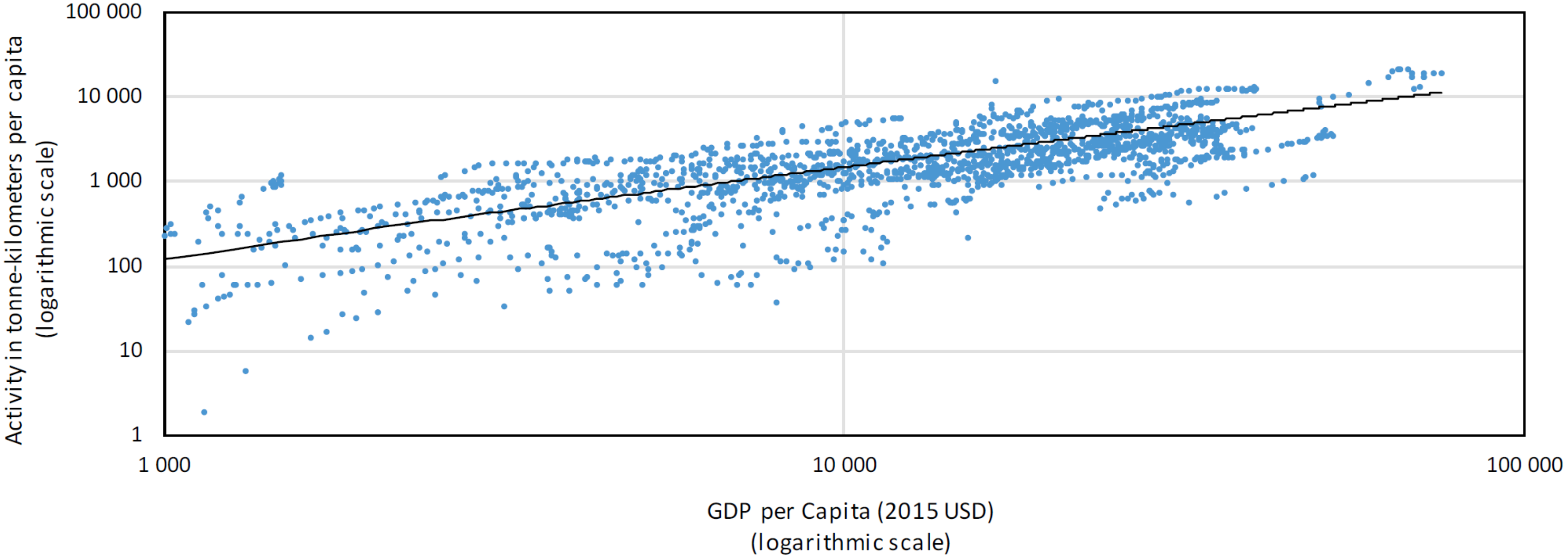
Caveats

- 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)

$$A \sum_{i} S_i I_i = F$$

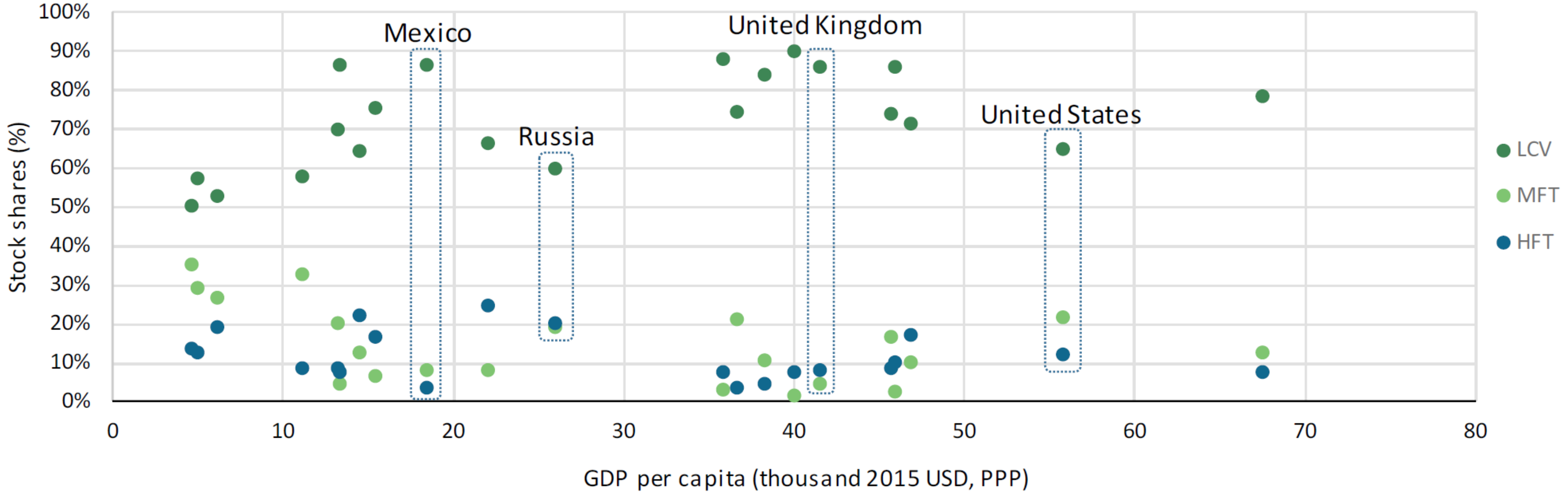
- Bottom up estimations of energy use require data on fuel economies
  - Our work relied primarily on research developed by the ICCT for the GFEI, complemented by information on the fuel consumption of vehicles reported by communities of vehicle users
- Tkm are linked to vkm by the share of empty running 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

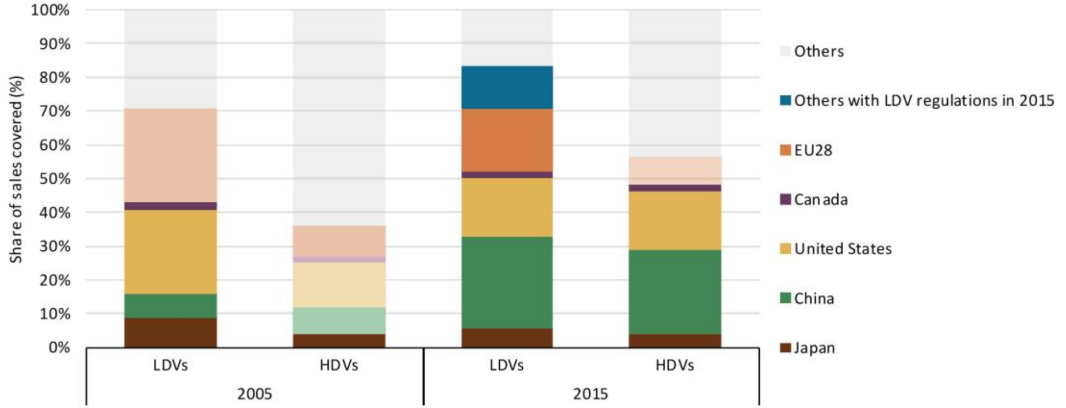


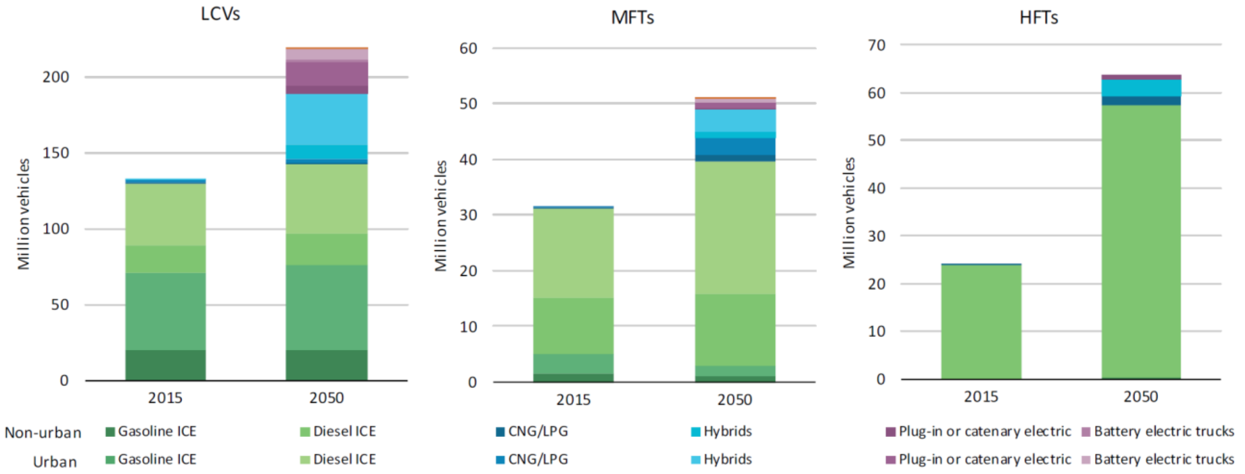
Source: IEA (2017a), Mobility Model, June 2017 version, database and simulation model, www.iea.org/etp/etpmodel/transport.

- **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)**

Projecting vehicle technology uptake (RTS)

- **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**





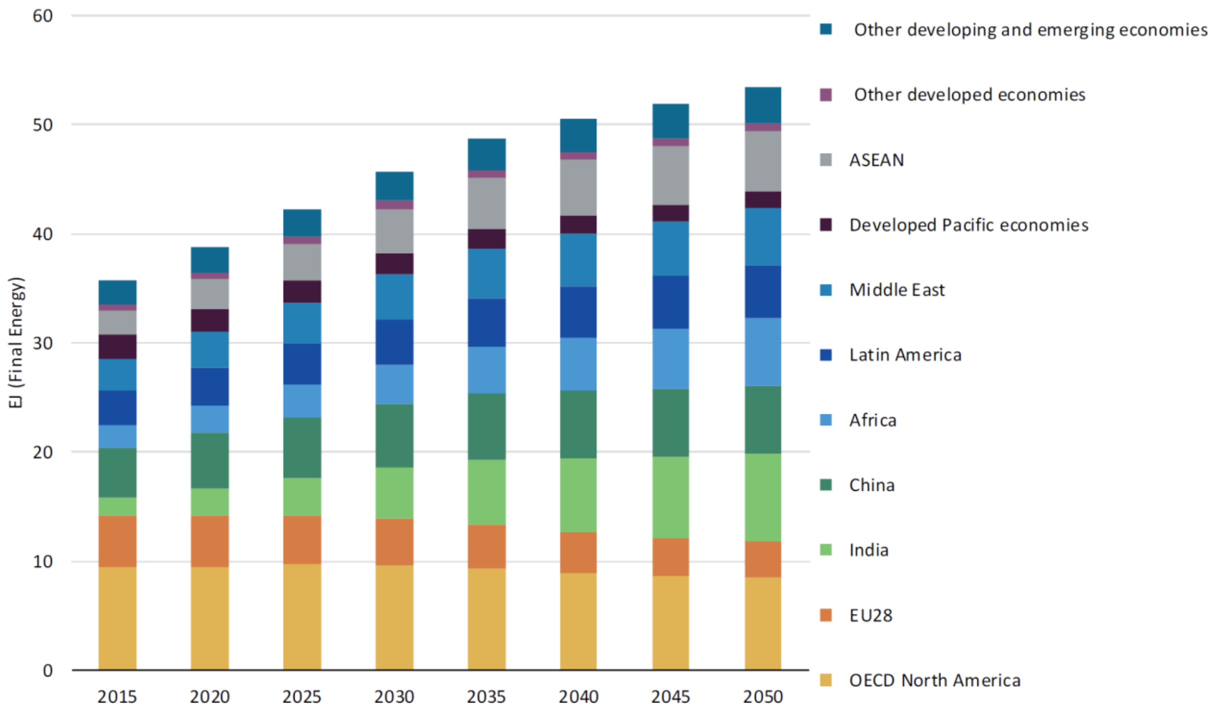
Note: CNG = compressed natural gas; ICE = internal combustion engine; LPG = liquefied petroleum gas.

Supplemental slides – pending time and interest

Otherwise the report is available for free online here:
www.iea.org/publications/freepublications/publication/TheFutureofTrucksImplicationsforEnergyandtheEnvironment.pdf

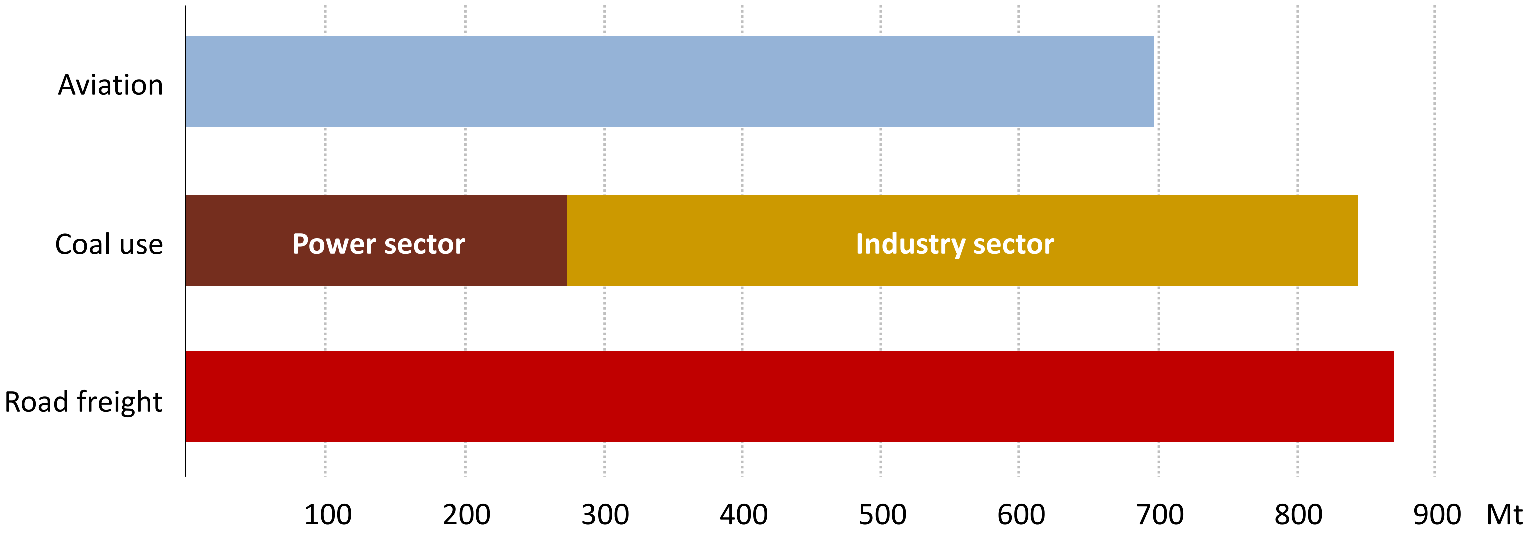
Energy use projections (RTS)

- **Combining freight activity growth with mileages and vehicle stock structures that broadly reflect historical development and vehicle technology development that does not actor 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

CO_2 emissions growth in the Reference Scenario, 2015-2050

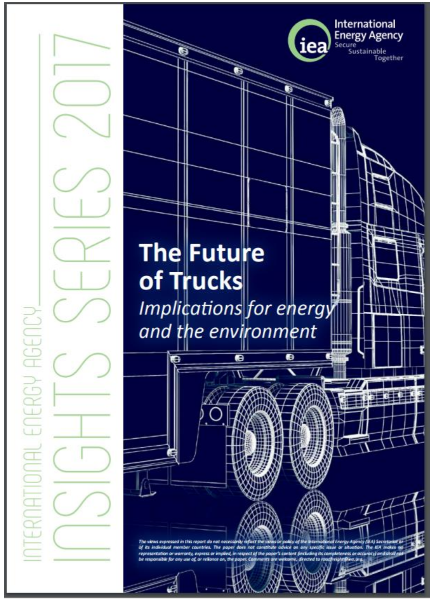


Trucks are the fastest growing source of global oil demand in RTS, where they account for 40% of the oil demand growth to 2050 and 15% of the increase in global CO_2 emissions

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*



Vehicle efficiency

Vehicle and powertrain technologies allowing to reduce consumption

	Range of energy savings
Improved aerodynamics	Up to 3-5% of energy use*, retrofit possible
Lower rolling resistance tyres	10% to 30% reduction of rolling resistance and about 3-5% of total energy use*, retrofit possible
Light weighting/material substitution	1-3% in near term, up to 7% in the long term
Transmission and drivetrain improvements	1 to 5% from automatic transmission (mission profile matters)
Engine efficiency	4 to 18% (long haul)
Reducing idling	Up to 2.5%
Hybridization	6% to 35%, range depends on mission profile

* excluding engine power adjustments

Systemic measures in logistics (1/2)

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

Examples
- Delivery booking and re-timing to optimize use of available facilities
- Changing delivery frequency
- Consolidating orders and suppliers
- Manage waste, reduce volumes and collection frequencies
- Promote the use of efficient and zero emission vehicles

Systemic measures in logistics (2/2)

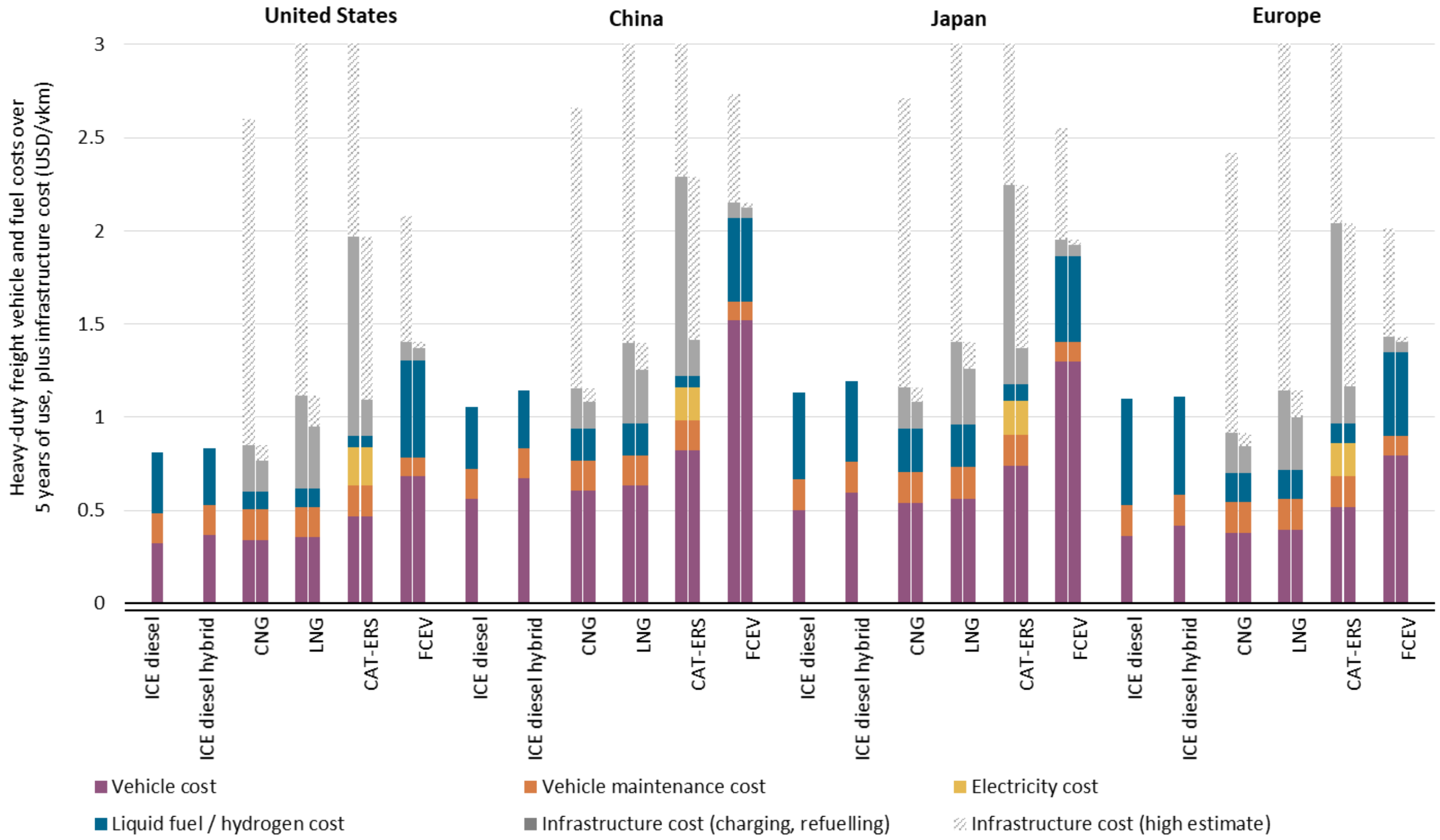
Measures requiring closer collaboration, including sharing of assets and services between and among companies and more radical re-envisioning of how logistics systems operate

	Range of energy savings
Supply chain collaboration/co-loading	Up to 15%
Matching cargo and vehicles via IT • Includes 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%

Efficiency and collaboration can drive major changes leading to reduced GHG emissions – this conflicts with "just-in-time" and same- or next-day deliveries

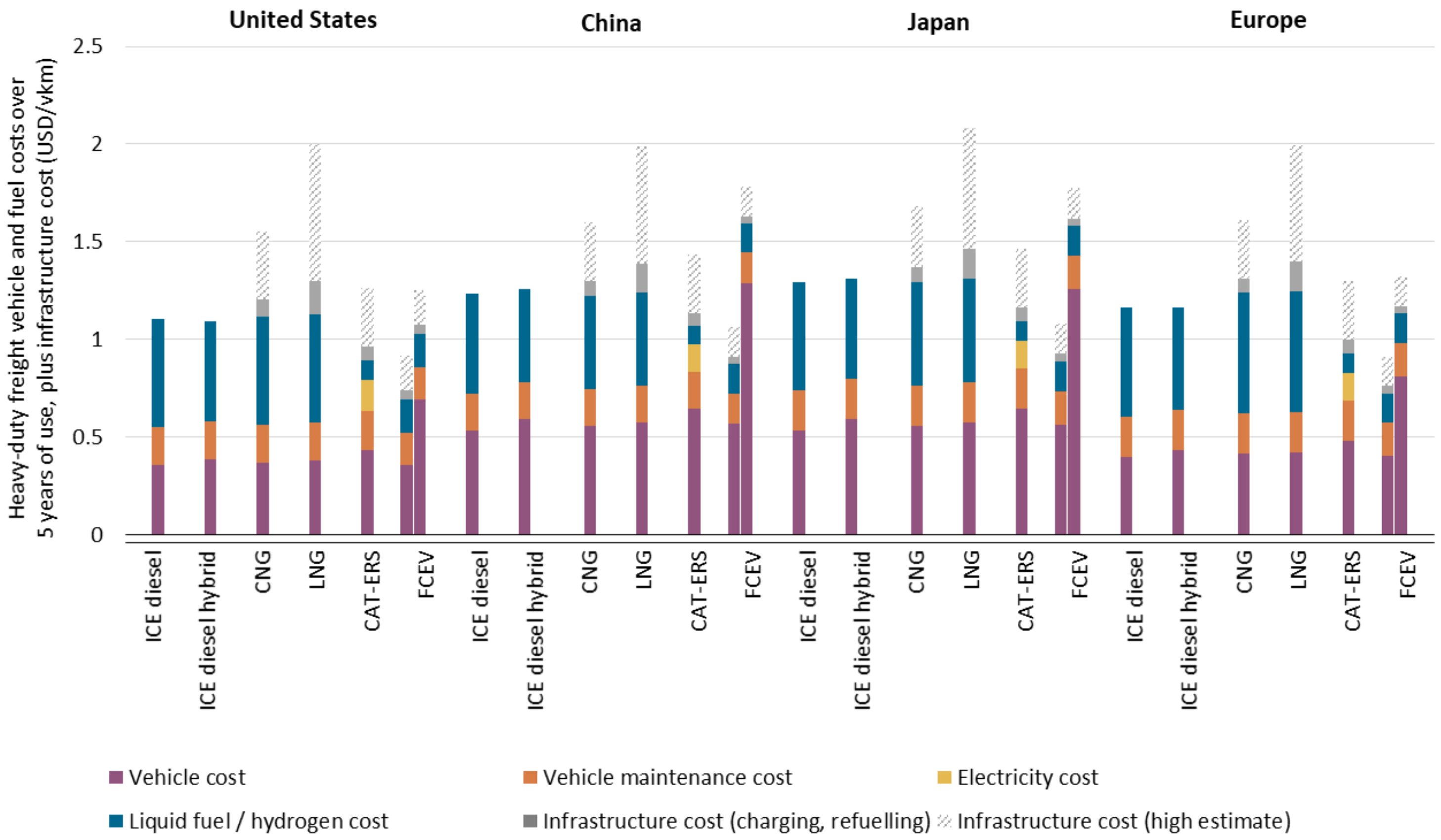
Alternative fuel truck technologies come at higher cost today

Heavy-duty freight vehicle & fuel costs over five years of use, including infrastructure cost, 2015

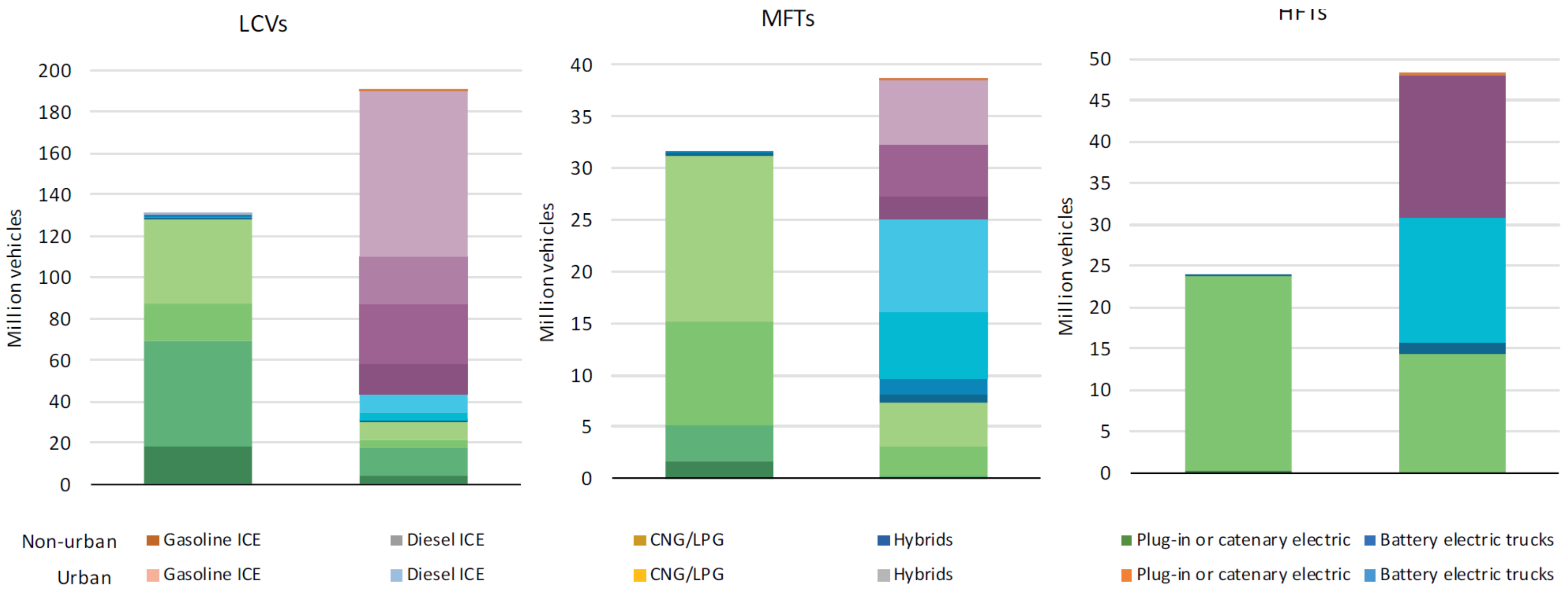


Sustained policy commitment can change the current context…

Heavy-duty freight vehicle & fuel costs over five years of use, including infrastructure cost, 2060

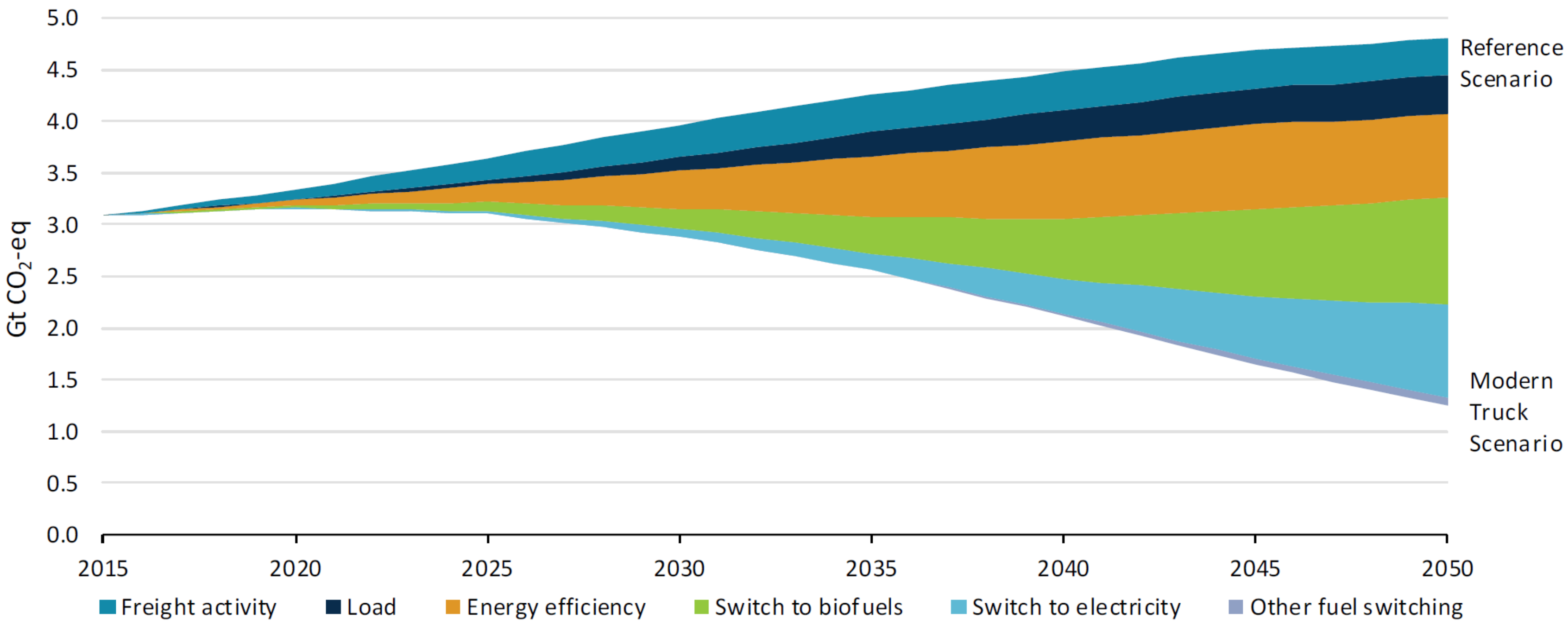


Projecting vehicle technology uptake (MTS)



- **MTS embeds major changes in the vehicle technology mix**

Emission savings in MTS vs. RTS



- **Modernising trucks and systems operations could reduce fuel demand from trucks by 50% in 2050 and emissions by up to 75%, with benefits for energy security and environmental goals**
- **Policy action is key to enable the transition between MTS and RTS**

Policy priorities

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

  The two policies complement each other: the former regulatory policy ensures that all new truck sales achieve minimum efficiency performance, and the latter fiscal measure favours the best performing models, pushing further improvements.

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

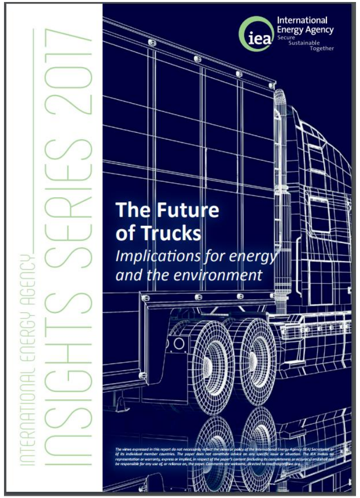
- **Supporting widespread data collection and information sharing in logistics**

  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.



Thank you for your attention

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