

# Heavy-Duty Vehicles

Regulatory opportunities, design challenges and policy-relevant research

Fanta Kamakaté

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# Topics

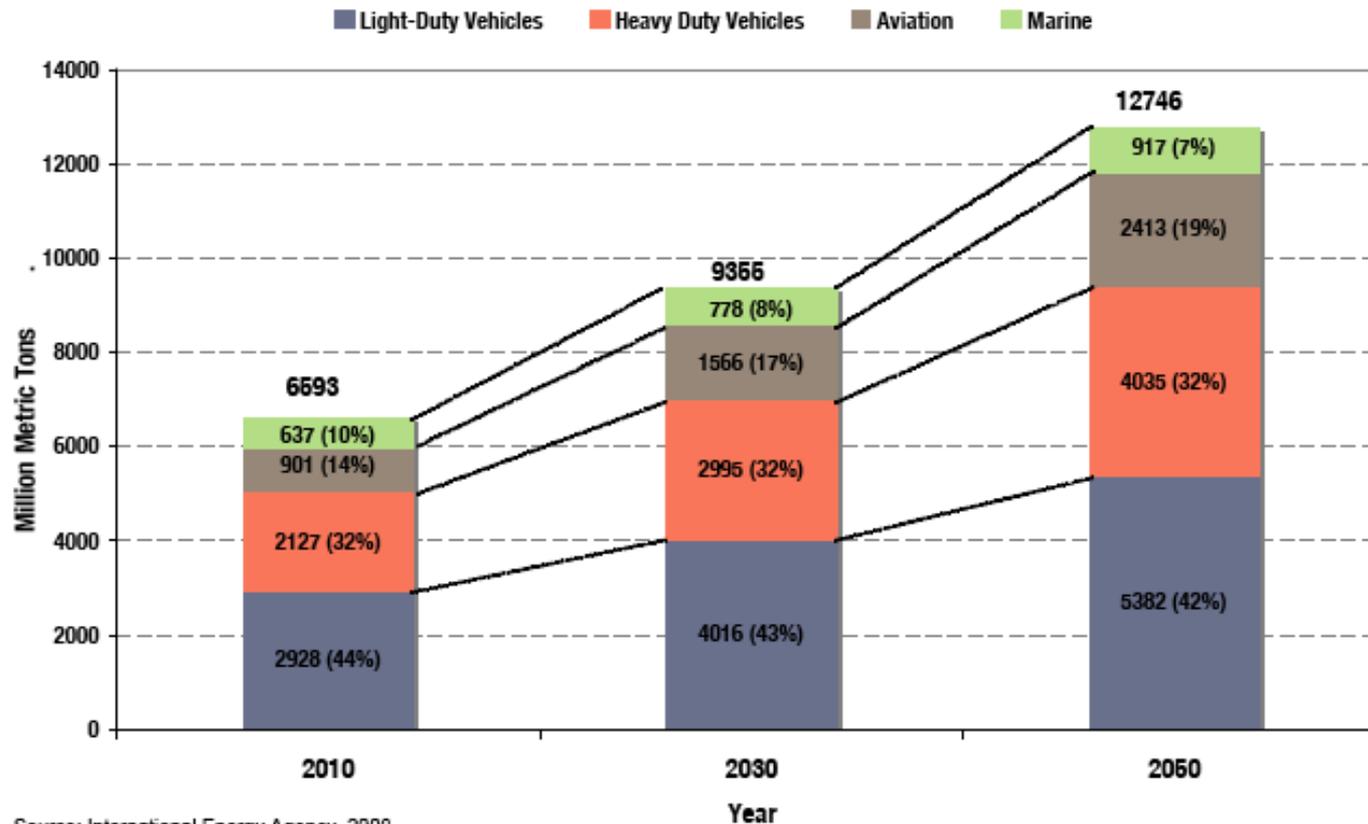
- Background
- Policy landscape
- Policy design considerations
  - Regulated entities
  - Metrics
  - Test Procedures

# International Council on Clean Transportation

The ICCT is made up of regulators and experts from leading vehicle markets around the world. The goal of the ICCT is to dramatically reduce conventional pollutant and greenhouse gas emissions from personal, public and goods transportation in order to improve air quality and human health, and mitigate climate change.

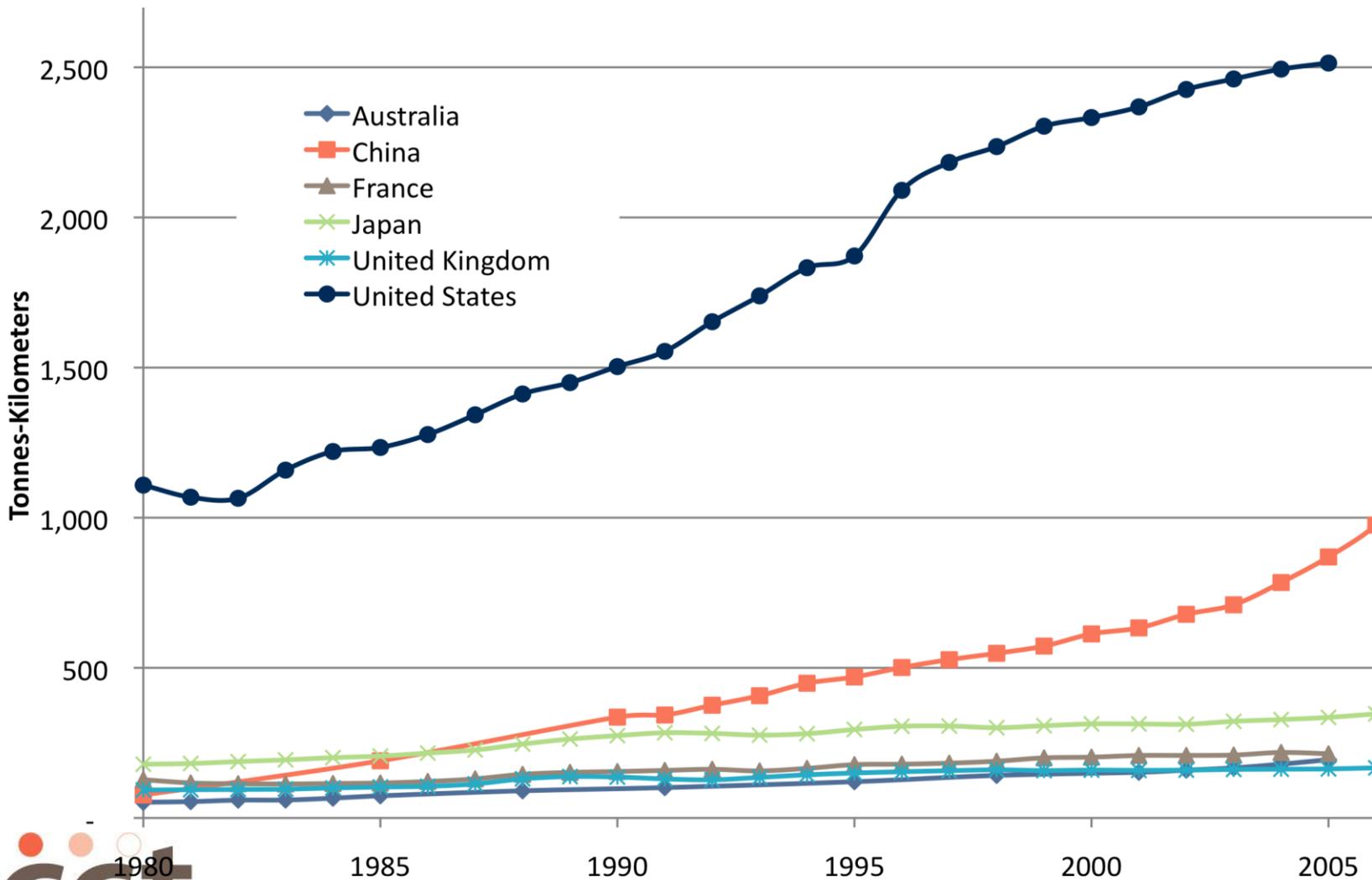


# Trucks & buses account for a third of global transport CO<sub>2</sub>

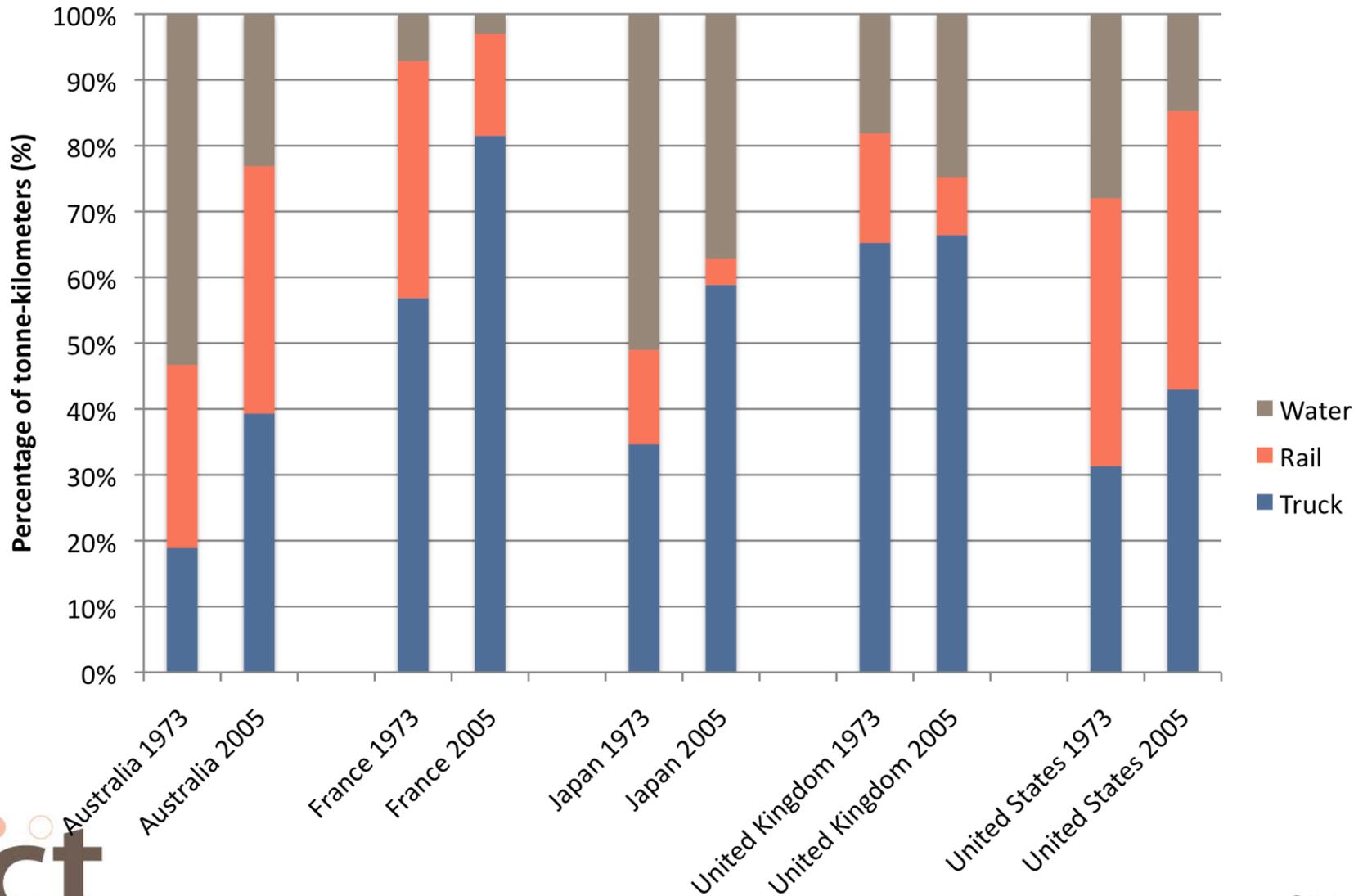


Source: International Energy Agency, 2008

# Growth in truck activity in tonne-kms (1980-2007)



# Increase in truck modal share (1973 vs. 2005)



# Market is not driving efficiency gains

- Conventional wisdom
  - Fuel savings affect fleet bottom line, cost effective technologies will get adopted
- However, many barriers exist
  - US new vehicles <1%/year improvement fleet-wide in last 15 years
  - Low market share for cost-effective retrofits (e.g. aerodynamic and rolling resistance)
  - Lack of standardized and reliable information on efficiency technologies
  - Other priorities (e.g. driver retention, concerns about maintenance and downtime )

# Policy landscape: Regulation in major HDV markets

Country/Region	Regulation	2005	2006	2007	2008	2009	2010	2011	2012
Japan	Fuel economy	Reg. adopted							
China	Fuel consumption						Test procedure proposal & regulatory proposal		Final rule
United States	Fuel economy/GHG			EISA 2007	EPA ANPRM		Regulatory proposal and final rule		
European Union	GHG labels						Test procedure	EC proposal	

Country/Region	Regulation	2013	2014	2015	2016	2017	2018	2019	2020
Japan	Fuel economy			Regulation implemented starting MY 2015					
China	Fuel consumption			Regulation implemented starting MY 2015?					
United States	Fuel economy/GHG				Regulation implemented starting MY 2016?				
European Union	GHG labels								

# Policy landscape: Japan

- Adopted in 2005 for model year 2015
- Top runner approach
  - ~12% average improvement over MY 2002
- Compliance testing combines engine testing and vehicle simulation modeling
  - Standard values used for many parameters (e.g. aerodynamic drag, rolling resistance)
- Delay in post-2009 NOx “challenge goal” adoption

# Policy landscape: United States

- Energy Independence and Security Act 2007
  - US DOT to develop fuel economy standards for trucks 8,500 lbs GVWR and above
  - Effective model year 2016 at the earliest (4 years lead time, 3 years stability)
  - NAS panel to determine technology potential
    - Final report March 2010
- US EPA GHG rulemaking process
  - HDV options in Advance Notice of Proposed Rulemaking in 2008
  - GHG proposal likely in 2010

# Policy landscape: California

- Trucks operating in CA pulling 53+ ft trailers
- Tractors
  - Lower rolling resistance (LRR) tires for all existing tractors (some exceptions) by 2012
  - MY 2011+ sleeper tractors must be SmartWay certified
  - MY 2011+ day cab tractors must have LRR tires
- Box-type 53+ ft trailers
  - MY 2011 must be SmartWay certified or retrofitted with SmartWay verified technologies
  - Existing trailers meet same standards by 2013 with some options
- Expect 750 million gallons diesel saved by 2020

# Regulatory Update: EU

- Euro VI text instructs the commission to:
  - “Study the feasibility and the development of a definition and methodology of energy consumption and CO2 emissions for whole vehicles and not only for engines”
- EC commissioned two studies to be completed 2010/2011
  - Develop test procedures
  - Perform a market analysis
- Expected revision of Directive 96/53 on dimensions and weight of trucks has spark a debate on longer heavier combination vehicles

# Regulatory Update: China

- Central government's goal is to reduce fuel consumption from all modes
- Homegrown industry
  - 400 HDV manufacturers (15,000 vehicle types)
- China Automotive Technology & Research Center (CATARC) lead agency for LDV and HDV fuel consumption standards development:
  - Develop draft test procedures by early 2010 and finalized in 2010
    - Simulation modeling as one of the compliance options
  - Standard limits and program design to be established in 2010/2011 and finalized in 2012

# Key Policy Design Questions

- Who to regulate?
- What is the regulation's form and stringency?
- What is the test procedure?
- How will compliance and enforcement be conducted?

# GHG standard design: Regulated entities & vehicles

- Options for regulated entities:
  - Vehicle manufacturers, engine manufacturers, trailer manufacturers, fleets
- Questions to answer:
  - During vehicle design and manufacture, what party is responsible for the major decisions affecting FE/GHG?
- Vehicle manufacturers (chassis+ cab) control or coordinate most of the truck specification process for certain market segments
- In US, class 8b (long-haul) and class 2b (work trucks) stand out
  - Large fraction of fuel use
  - Most straightforward specification process
- Vocational trucks more complex
  - Cab+ chassis often sold without body
  - However, is aerodynamic performance as important?
- Trailers
  - Different owners, separate requirements?

# GHG/FE standard design: Metric & Stringency

- Options for a vehicle standard:
  - per km, per tonne-km or per m<sup>3</sup>-km
- Questions to answer:
  - Will a per tonne-km or per m<sup>3</sup>-km regulatory metric be more “effective” to reduce HDV GHG/ fuel use than the more familiar /km?
  - Are there further benefits from a volumetric metric?
- Grams or liter/km may be appropriate for HDV not used in goods movement such as work trucks
- Grams or liter/tonne-km can allow setting more aggressive targets for goods transport truck
  - Compliance would include measures to reduce vehicle weight
  - Based available data, in the US approximately 50-60% of trucks cube-out and the remainder weigh-out or are empty

# GHG standard design: Test procedures, compliance and enforcement

- Options
  - In-use, test track, chassis dyno, simulation modeling
- Questions to consider
  - What are the strengths and weaknesses of each method in regulatory context?
  - What are the implications for compliance and enforcement?
- Simulation modeling could be a useful compliance tool
  - Enforcement would need some actual testing during certification process

# Relevant ICCT Research

- HDV Fuel Consumption Improvement Modeling and Cost Assessment
  - Partnership with NESCCAF
- Workshops series: Improving the fuel economy of HDV fleets
  - Jointly sponsored with CalStart and NESCAUM in February 2006 and 2008
- Trends in Truck Freight Energy use and CO<sub>2</sub> in selected OECD countries (1973-2005)
  - Partnership with UC Berkeley Global Metropolitan Studies
  - Published in Energy Policy March 2009
- HDV Fuel Economy Scoping Paper
  - MJ Bradley & Assoc., released February 2009
- Heavy-duty Fleet and Industry Characteristics
  - Polk data analysis by MJ Bradley & Assoc.,
- Modeling Fuel Economy vs. Duty Cycle
  - WVU CAFEE
- Evaluation of Existing Simulation Model
  - Ricardo

Available on our  
website at  
<http://www.theicct.org/>



# Thank you!

## Fanta Kamakaté

One Post Street Suite 2700

San Francisco CA 94104

Tel: 415-202-5750

Fanta@theicct.org

# Japanese test procedure

