# Policies that Work: How vehicle standards and fuel taxes can cut $CO_2$ emissions and boost the economy

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### Who we are – the ClimateWorks Foundation

- The ClimateWorks Foundation supports public policies that prevent dangerous climate change and promote global prosperity
- ClimateWorks' goal is to reduce global greenhouse gas emissions by 6 billion metric tons by the year 2020 (~25 percent below business-as-usual projections) and by 11 billion metric tons by 2030 (~50 percent below projections)
- These ambitious targets require the immediate and widespread adoption of smart energy and land use policies. ClimateWorks partners with an international network of affiliated organizations — the ClimateWorks Network — to promote these policies in the regions and sectors responsible for most greenhouse gas emissions





### ClimateWorks' Best Practice Networks



### **POWER**

The Regulatory Assistance Project





### **BUILDINGS AND APPLIANCES**

The Global Buildings Performance Network The Collaborative Labeling and Appliance Standards Program



### **INDUSTRY**

The Institute for Industrial Productivity





### **TRANSPORT**

The International Council on Clean Transportation The Institute for Transportation and Development Policies



### **FORESTS & LAND USE**

The Climate and Land Use Alliance

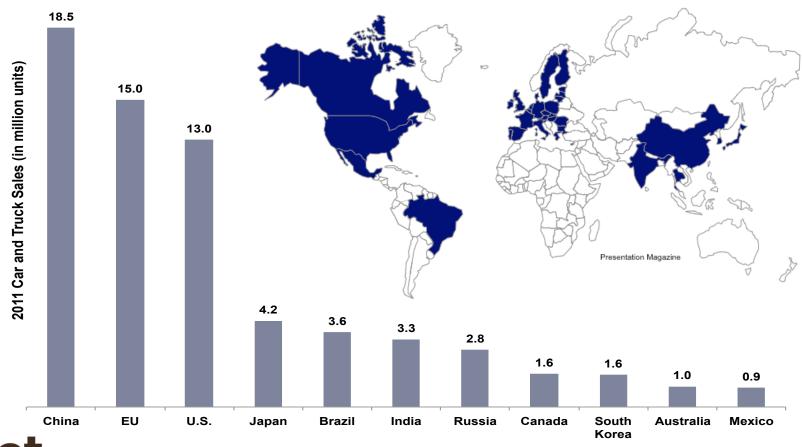




### Who we are - ICCT

The mission of the ICCT is to dramatically improve the environmental performance and efficiency of cars, trucks, buses and transportation systems in order to protect and improve public health, the environment, and quality of life.

### **Top Vehicle Market Sales in 2011**







### **Policies That Work:**

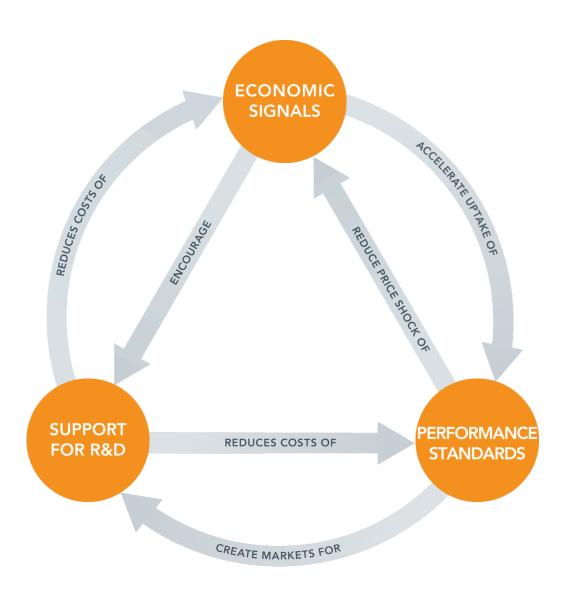
A toolkit to help solve nations' climate and energy challenges







# Three kinds of policy tools







## Ten policies can make the difference

- Vehicle performance standards
- 2. Fuel and vehicle levies
- 3. Energy efficiency standards and labels
- 4. Clean energy supply policies
- 5. Utility-scale energy efficiency programs

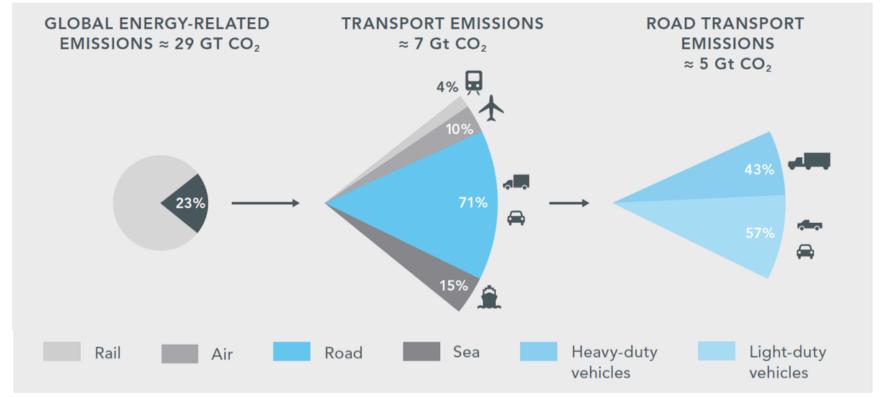
- Industrial energy efficiency programs
- Effectively enforced building energy codes
- Properly aligned economic incentives
- 9. Smart urban design
- 10. Support for R&D and innovation





## Focus on Transportation

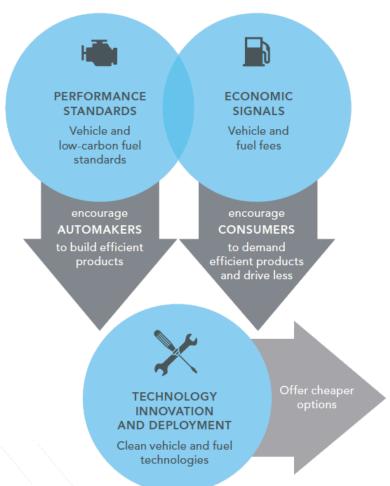
- 65 million new vehicles in 2011 (ICCT countries only)
- Road emissions are projected to grow more than 2% annually, reaching 8.4 Gt CO<sub>2</sub> in 2030
- US, China and EU are the top emitters focus of PTW report







## Most Effective GHG Regulations



Most effective ways to reduce GHG emission from the transport sector are:

- Vehicle performance Standards
- Vehicle and fuel fees/rebates

The report **Policies that Work** presents recommendations for performance standards and fees/rebates that are effective at aligning automakers and consumers with global GHG targets







## Five Steps to Successful Policy Design

Set overarching goal

- Base standards and fees on GHG emissions
- Don't mandate particular technology solutions

Require consistent rate of improvement

- Steady basis over several product development cycles
- 3%-6% per annum to encourage constant innovation

Cover all vehicles and Fuels

• No vehicle or fuel should be exempt – avoid consumers and manufactueres from circunventing the standards

Long term signals

 Manufactueres need stable market signals to invest in new technology

Reward performance

- Combine fees with rebates, "feebates", rewarding low emission models and penalizing high emitters
- Avoid GHG standards based on vehicle weight –this promotes heavier models





## Vehicle Standards - history

1960s

#### **PROGRAM**

First emissions regulations, covering hydrocarbons (HC) and carbon monoxide (CO) from passenger vehicles

California, United States

1970s

#### **PROGRAM**

Clean Air Act amendments: 75% reductions in HC and CO, 70% reduction in NO<sub>\*</sub>

Lead in gasoline phased out, with major health benefits

United States

1980s

#### **PROGRAM**

Clean Air Act: 60% reduction in HC and CO emissions from passenger vehicles, introduced control of nitrogen oxides (NO<sub>x</sub>) emissions

First fuel economy (corporate average fuel economy, or CAFE) standards

United States

1990s

#### PROGRAM

United States Tier 1 levels: 60% reduction in NO, emissions

European Union Euro 1 and 2 standards First voluntary CO<sub>2</sub> emissions standards

Japan

Top Runner program introduced

California Low-emission vehicle (LEV) levels 20008

#### PROGRAM

Tier 2 levels: 65% reduction in NO<sub>x</sub> emissions United States

European Union

Euro 3 levels: 25% reduction in NO<sub>2</sub> emissions

China

Fuel economy standards

First heavy-duty vehicle standards

European Union Euro 4 levels: 50% reductions in NO<sub>x</sub>, HC, and CO 2010

California, European Union

First mandatory greenhouse gas rules

PROGRAM European Union Euro 5 levels: 25% reductions in NO.

PROGRAM United States Higher fuel economy standards for passenger vehicles, greenhouse gas emissions standards, fuel economy standards for heavy-duty vehicles

#### **TECHNOLOGY**

Positive crank-case ventilation, secondary air injection, adjusted spark timing

#### TECHNOLOGY

Three-way catalytic system and exhaust oxygen sensors; electronic systems to precisely control airfuel mix, including engine control unit, electronic air sensing, fuel metering via fuel injection, and electronic spark ignition timing

#### TECHNOLOGY

Catalytic converters (led to phaseout of lead in gasoline), exhaust gas recirculation

#### TECHNOLOGY

Catalyst and fuel injection improvements, including multipoint fuel injection, improved airfuel control with single oxygen (O<sub>2</sub>) sensor self-diagnosis technology

#### TECHNOLOGY

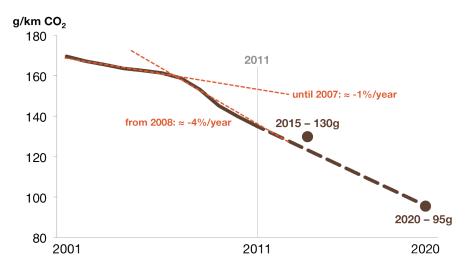
Sequential multipoint fuel injection, variable spark timing, double O<sub>2</sub> sensor, advances in three-way catalytic systems, cold-start emissions

#### **TECHNOLOGY**

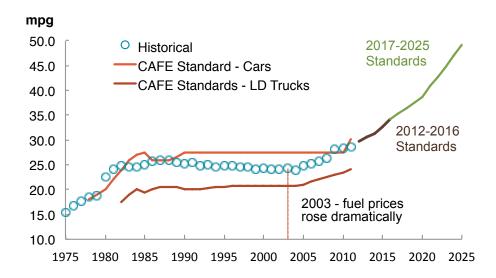
Advanced direct injection, turbochargers, engine downsizing, low-rolling-resistance tires, improved aerodynamics and transmissions, lightweight materials

# Vehicle CO<sub>2</sub>/FE Standards

EU Passenger new vehicle CO<sub>2</sub> Standards



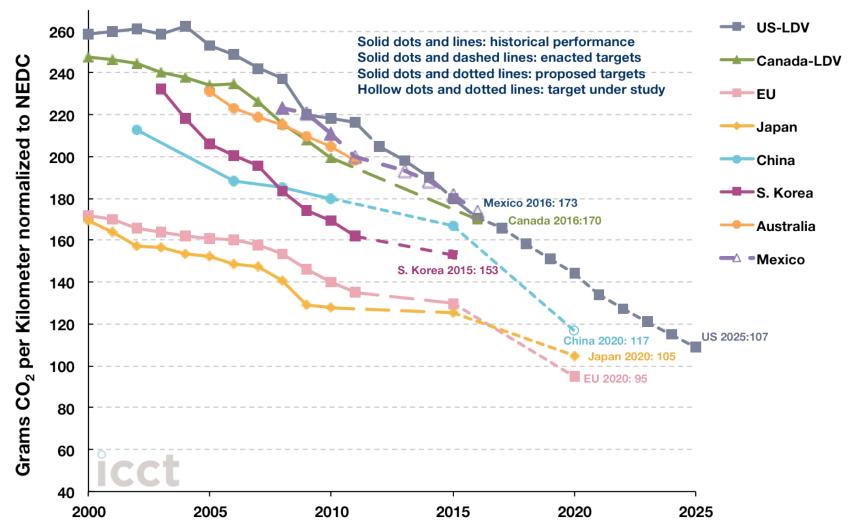
US Passenger new vehicle fleet average fuel economy







### Global Vehicle Performance Standards

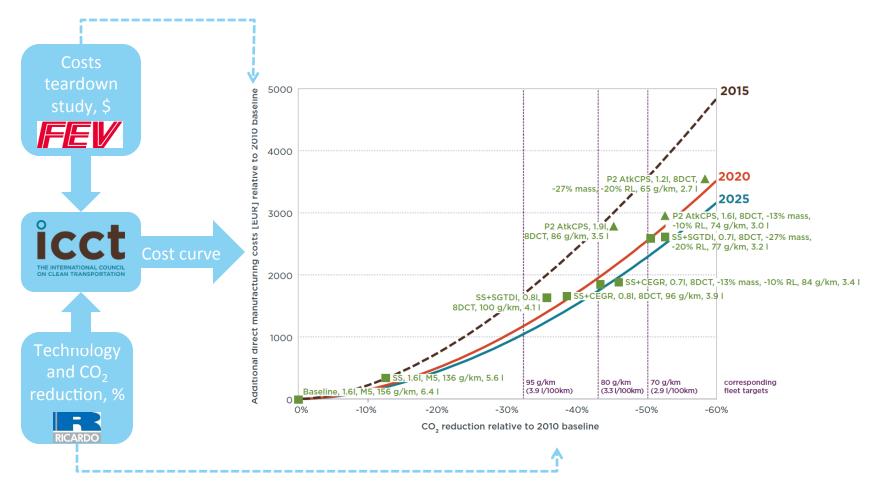


- [1] China's target reflects gasoline vehicles only. The target may be lower after new energy vehicles are considered.
- [2] US, Canada, and Mexico light-duty vehicles include light-commercial vehicles.





# Cost and Benefit of CO<sub>2</sub> reduction technologies

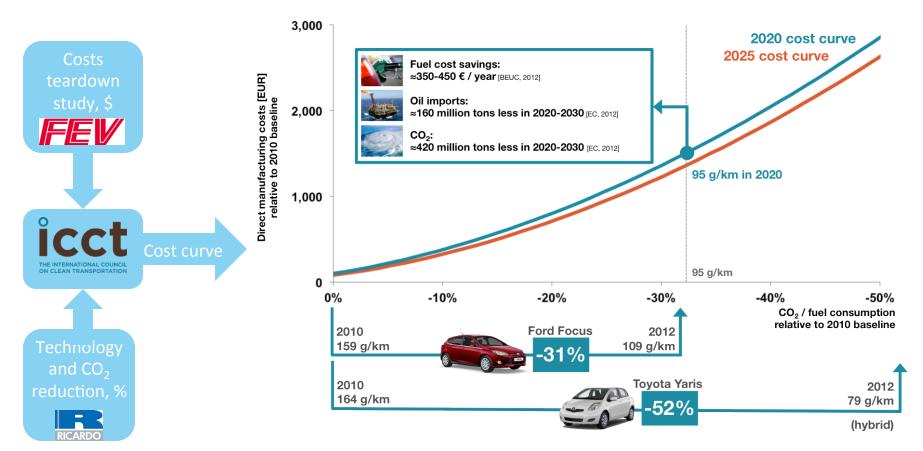


 2020 targets can be attained by improvements to internal combustion engines and moderate lightweighting





# Cost and Benefit of CO<sub>2</sub> reduction technologies



- The estimated additional manufacturing cost for attaining a CO<sub>2</sub> target of 95 g/km for passenger vehicles by 2020 is approximately €1000 per vehicle
- Fuel cost savings for drivers €350-450/year.





### **Effective Vehicle Standards**

Set the goal

• Let the market choose the most cost effective technology

Go upstream

 Targert small number of market players, manufacturers, rather than consumers

Use GHG as the metric

- GHG (gCO2e/km) has advantages over Fuel Economy (mpg or km/L) as the metric is fuel neutral.
- Can accomodate non-CO2 gases

Base the standard on Vehicle footprint over vehicle weight

- Weight based standards are more lenient for heavier vehicles,
- Footprint<sup>1</sup> encourages implementation of lightweighting techniques

Long term standard

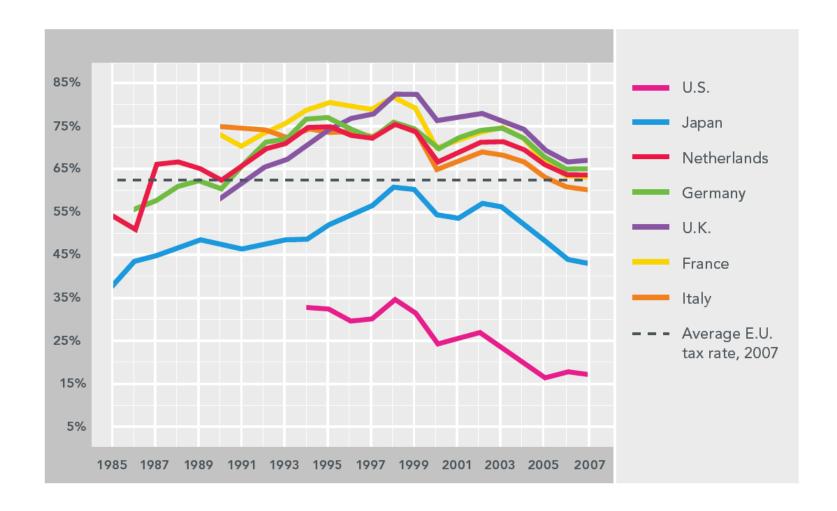
- Rate of improvement at 3%-6% per annum to encourage constant innovation
- Sufficient lead time

Continual rather than stepwise standard

- Stepwise standards lead manufacturers to meet only the minimum requirements for each class
- A continual standard requires improvements across all models



### **Fuel Taxes**

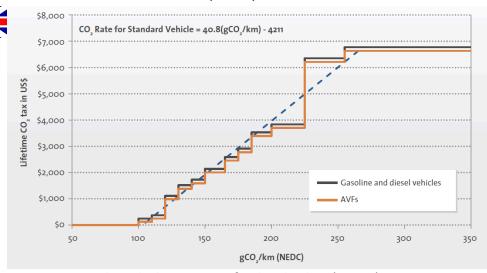




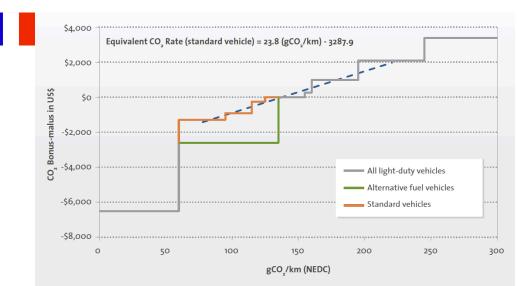


## Vehicle Fees Examples

CO<sub>2</sub> Tax on conventional and alternative fuel vehicles (AFVS)



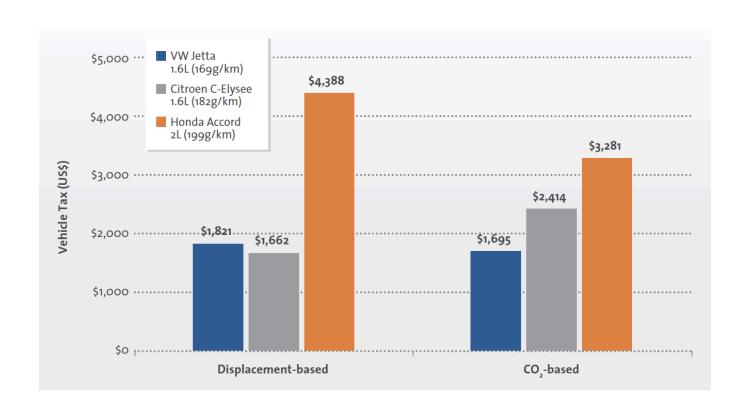
CO<sub>2</sub> Feebate program for conventional and alternative fuel vehicles (AFVS)







# Vehicle fees based on CO<sub>2</sub> vs Attributes







### **Effective Vehicle and Fuel Fees**

Set the goal

• Adjust fees to meet revenue targets

Use GHG as the metric

- GHG (gCO<sub>2</sub>e/km) is fuel and technology neutral.
- Can accomodate non-CO<sub>2</sub> gases

Cover all vehicles and fuels

• Selective taxation can shift consumer demand to untaxed options and circunvent policy goals

**Feebates** 

• For vehicles fees, the pricing strucure charges high emitters, while rewarding low emission models with rebates

Long term signals

- Transparent fees allow sufficient lead time to implement new technologies
- Increase rate annually and predictably

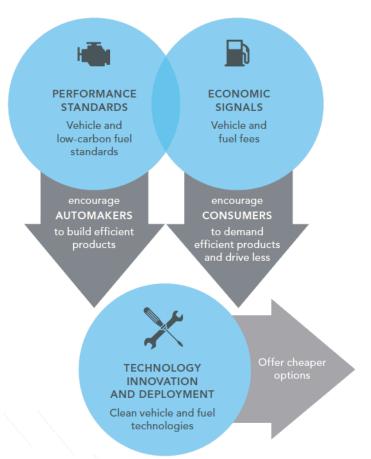
Linear rather than stepwise fees

- Stepwise fees lead consumers to purchase vehicles that only meet the minimum requirements for each class
- A linear standard requires improvements across all models

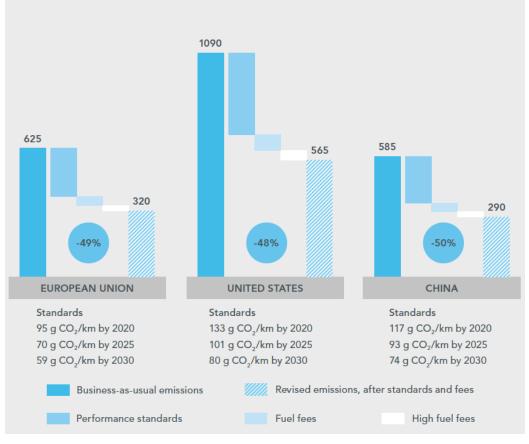




## Combining Standards and Fees



### Potential Reduction in CO<sub>2</sub> Emissions





<sup>&</sup>lt;sup>2</sup> High Fuel fees: 25% of current fuel price



 $<sup>^{1}</sup>$  Fuel fees: 10% of current fuel price

### Conclusions – Vehicle Performance Standards

- Emissions performance standards increase efficiency without dictating a specific technology solution
- Development and adoption of GHG reduction technologies implies a cost, but also promotes investment and labor while providing fuel savings to costumers
- Fuel and vehicle fees complement performance standards and can align market forces with social benefits
- Long-term policies are crucial to provide manufacturers and investors the reliable signals they need to boost R&D, deploy new technologies, and transform the market
- Our conservative analysis show that we could reduce  $CO_2$  emissions from the U.S., China, and the E.U. by more than 1 Gt in 2030
- Fuel cost net savings of roughly \$130 billion in 2030, or a cumulative savings of approximately \$800 billion to \$1.5 trillion by 2030





# **THANK YOU!**

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