Plenary session II: Road traffic goes greener

Efficient measures to decrease private vehicle emissions – a local context

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- **Introduction**
  - Current status
  - Methodology
- **Efficient measures to make road transport greener**
  - Changes in travel behavior
  - Implementation of technological solutions
- **Results and conclusions**
  - Cost – Benefit

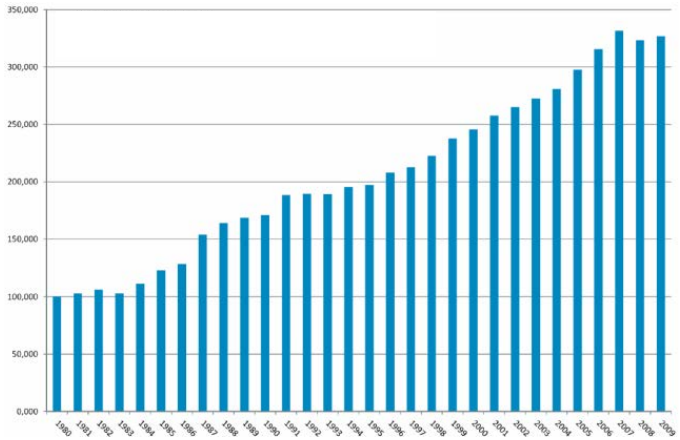
Current status

- Annual primary energy use in 2009-2011 was approx. **235 PJ (65 TWh)**:
  - **85%** from geothermal heat and hydropower
  - **15%** from imported fossil fuel
- Land transport in 2009:
  - **5%** of total primary energy consumption
  - GHG emissions **19%** of the total reported to UNFCCC

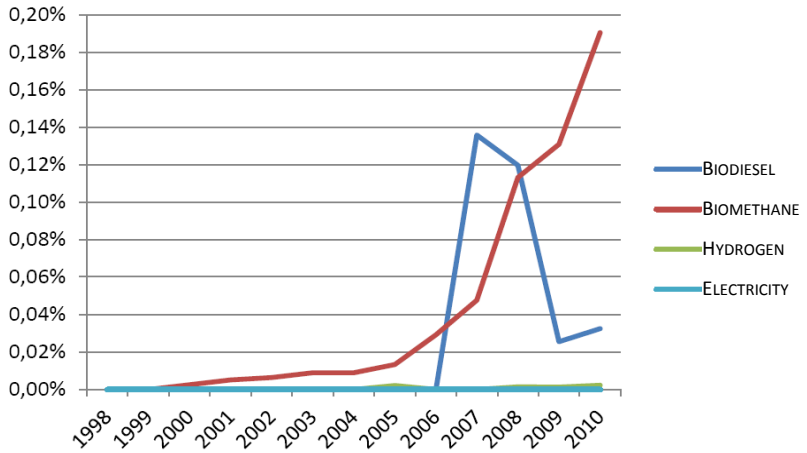
Current status

- Vehicle kilometers travelled (VKT) grew by **226%,** population growth **39%** [1980-2009]
- Fossil fuels account for **99.8%** of energy used in land transport
- Transport GHG emissions grew by **57%** from 1990 to 2008
- **70-80%** of GHG emissions within Reykjavik come from traffic

RELATIVE VEHICLE DISTANCE TRAVELLED ON NATIONAL ROADS
(YEAR 1980 = 100,000)

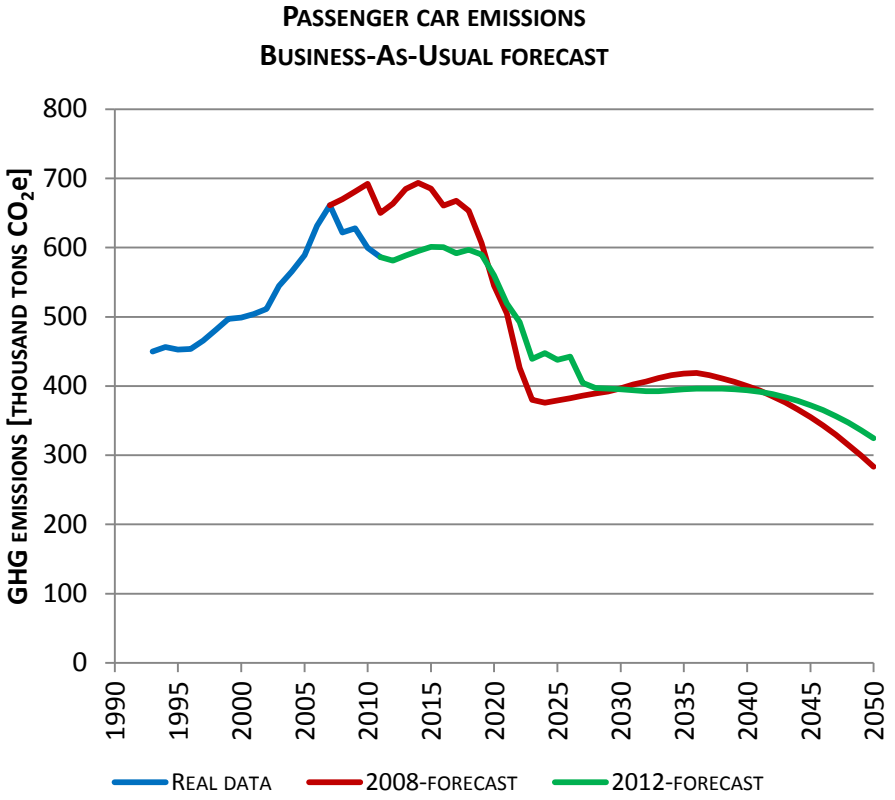


PROPORTIONAL USE OF RENEWABLE FUELS FOR LAND TRANSPORT



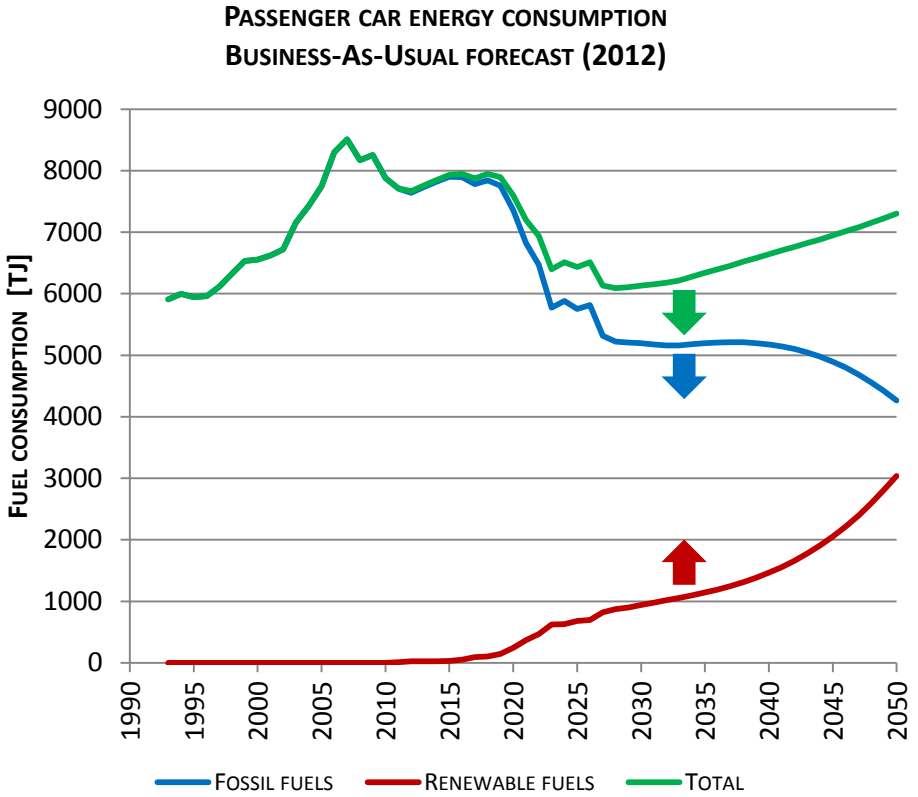
Methodology

- Business-As-Usual (BAU) forecasts used as a baseline in a **mitigation measure exploration**:
  - Energy consumption
  - GHG emissions
- Mitigation measures describe means of reducing GHG emissions **beyond the BAU scenario.**



Methodology

- BAU forecasts **increased use of renewable fuels** and **more energy efficient vehicles**:
  - Cost of measure is the cost of **accelerating the development**
- **Bottom-up calculations** according to IPCC guidelines



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Efficient measures

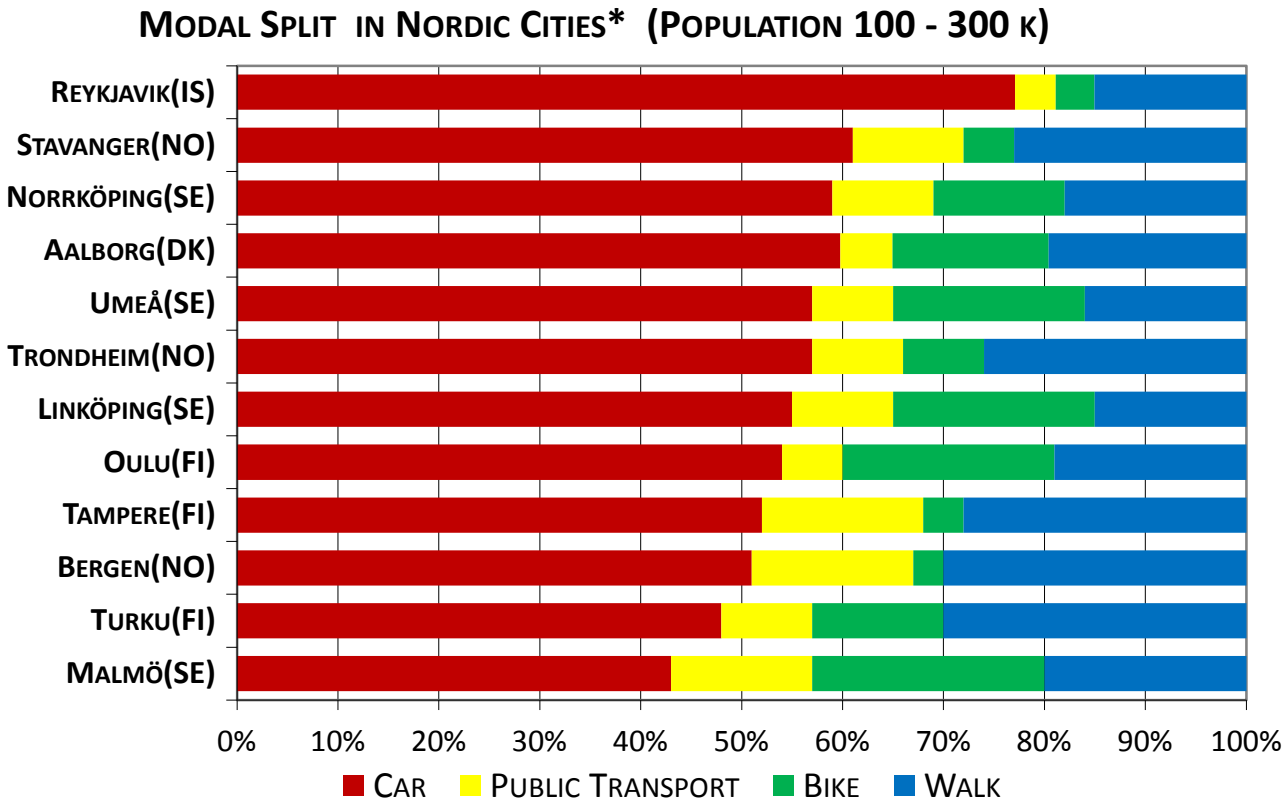
- Four main ways to decrease GHG emissions from land transport:
  - Decrease everyday **transport demand**
  - Change **travel behavior**
  - Improve **energy efficiency**
  - Implement **renewable fuels** and **new vehicle technology**

- *"Technology can deliver some of the greenhouse gas emissions reductions needed — but not all.*
  Behavioral changes are also needed to deliver net reductions" [EEA, 2008]

Efficient measures: Explored scenarios

- Reinforcement of **public transport** in the Reykjavik Area:
  - A Bus Rapid Transit (BRT) system
  - A Light Rail Transit (LRT) system
- Increased **walking and cycling** alternatives in the Reykjavik Area
- Improved **energy efficiency** of the vehicle fleet:
  - Fuel economic passenger cars (gasoline and diesel)
  - Diesel fuelled passenger cars
  - Electric hybrid vehicles (gasoline and diesel)
- Gradual increased **blending of biofuels** in fossil fuels:
  - Bioethanol blending in gasoline
  - Biodiesel blending in diesel
- Gradual increased **blending of renewable methanol (RM)** in gasoline
- Broad introduction of **new vehicle technology**:
  - Biomethane vehicles
  - E85 vehicles
  - Electric vehicles
  - Hydrogen vehicles

Greener travel behavior: Background



Reykjavik Area:
Home to work distance

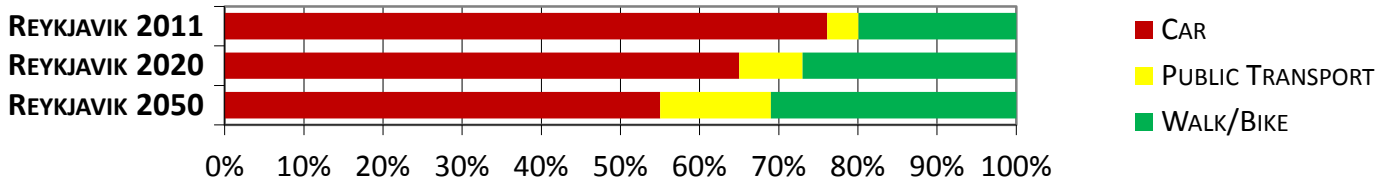
- < 2 km 27%
- < 5 km 60%

* Data from TEMS – The EPOMM Modal Split Tool Database except Data from a Travel Survey in Reykjavik conducted by Capacent in 2011.

Greener travel behavior scenario

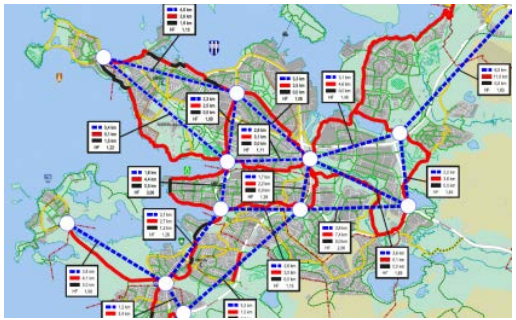
- Reykjavik Area - BAU Scenario:
  - Unchanged modal split and increased trip length
  - VKT to increase by **77%** until 2024 and **119%** until 2050 compared to 2004
- Reykjavik Area – Greener travel behavior Scenario:
  - Modal split evolving towards “a typical small Nordic city modal split”
  - Revision of land use plans, unchanged average trip length

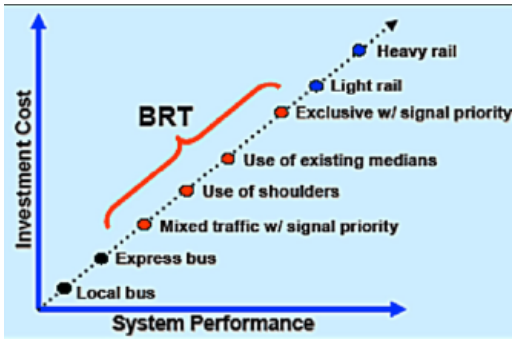
➡ Resulting in slower traffic growth, **on pair** with forecasted population growth



Greener travel behavior scenario: Cost

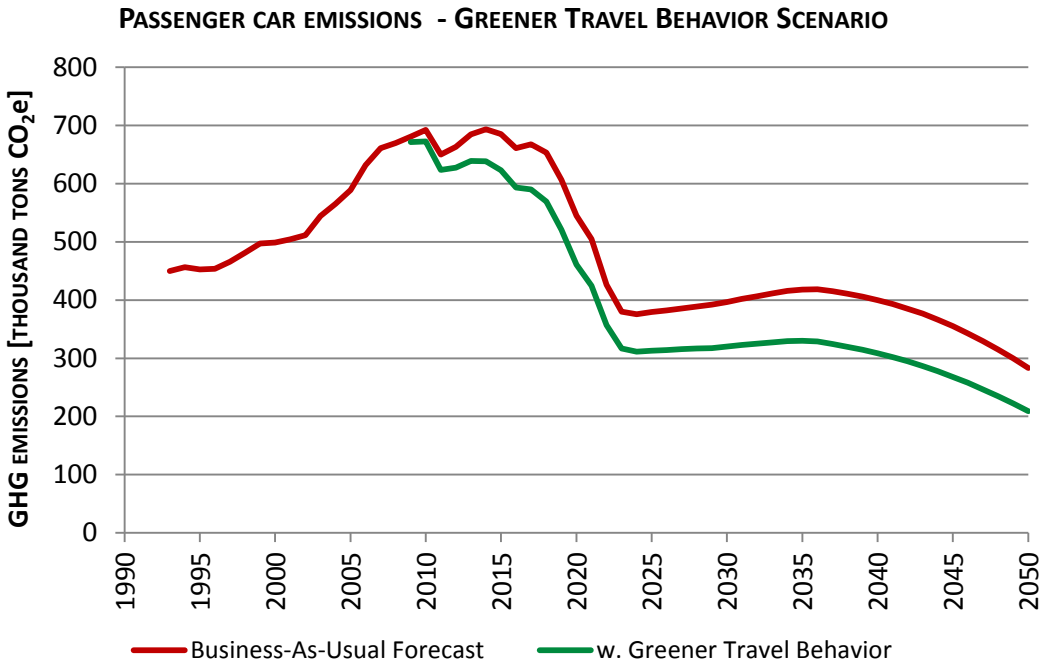
- **Replacing** a part of future car trips with walking/cycling and public transport requires “green” infrastructure, service and mobility management
- Assumed Reykjavik Area infrastructure investment:
  - A comprehensive Bicycle Network for commuters
  - A Bus Rapid Transit (BRT) system replacing seven main routes in the existing bus system till 2020
  - A Light Rail Transit (LRT) system slowly replacing most of the BRT system 2020-2050



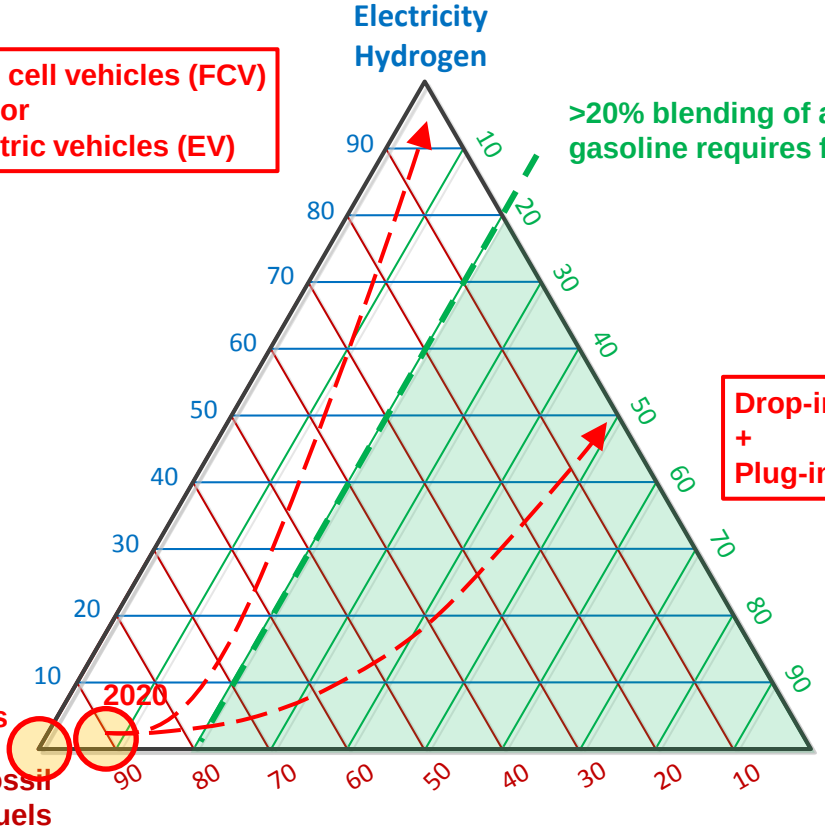


Greener travel behavior scenario: Benefit

- Transport Cost **reduced** with slower traffic growth than forecasted:
  - *Internal cost:* User cost and Road infrastructure cost
  - *External cost:* Traffic accidents, noise & air pollution and health
- GHG emissions savings **beyond** BAU Forecast:
  - **650 000** tons CO_2e 2009-2020
  - **3,1 million** tons CO_2e 2009-2050



Renewable fuels: Technological paths



Fuel cell vehicles (FCV) and/or Electric vehicles (EV)

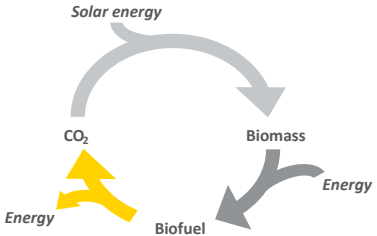
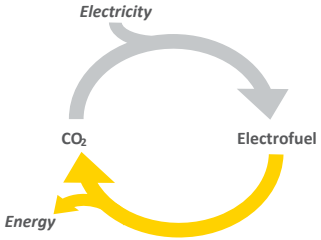
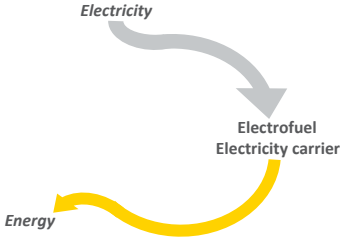
>20% blending of alcohol drop-in fuels in gasoline requires flexi-fuel vehicles (FFV)

Drop-in fuels and/or biomethane and/or DME + Plug-in hybrid electric vehicles (PHEV)

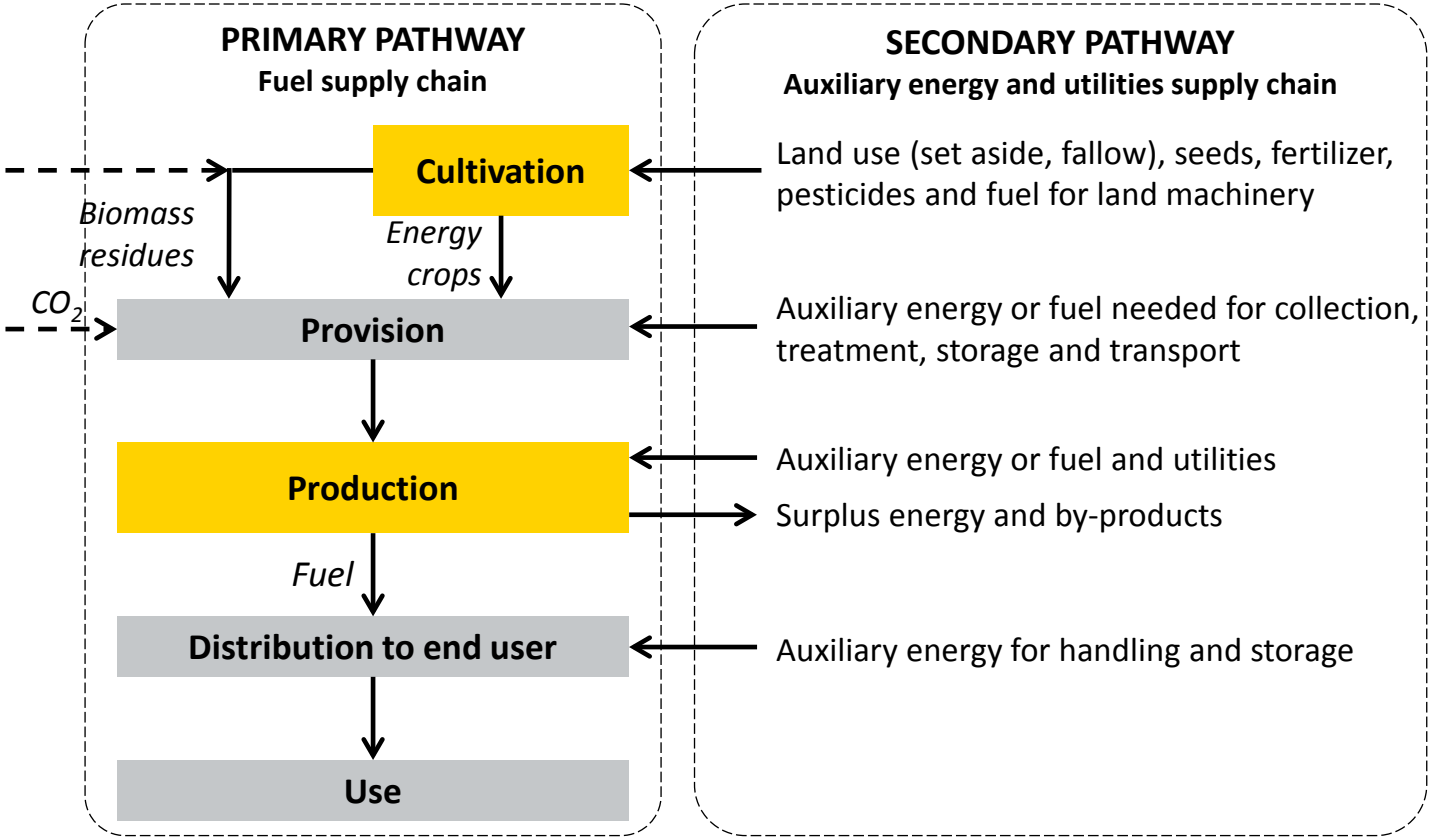
Today: <1% renewable fuels

Drop-in fuels (alcohols, biodiesel, hydrocarbon-based liquid fuels)
Biomethane
DME

Renewable fuels: Current availability and cost

		Fuel / complexity	Cost relative to gasoline and diesel (avg.) without taxes		
			Fuel	Passenger car	Filling equipment
Biofuels		Biodiesel	1,08 - 1,19	1,0	1,0
		Bioethanol	1,01 - 1,13	1,0 E85: 1,0	1,0
		Biomethane	0,76 - 0,85	1,3	2,3
CO_2 electrofuels		Methanol (RM)	1,23 - 1,51	1,0 (M85: 1,0 - 1,1)	1,0
Electrofuels **Electricity carriers**		Hydrogen	1,10 - 1,36 Effective: 0,67 – 1,36	Combustion: 3,6 Fuel cell: 3,7	5,9
		Batteries (electricity)	0,61 - 0,77 Effective: 0,23 – 0,40	2,1	Charging posts: 0,05

Renewable fuels: Life cycle



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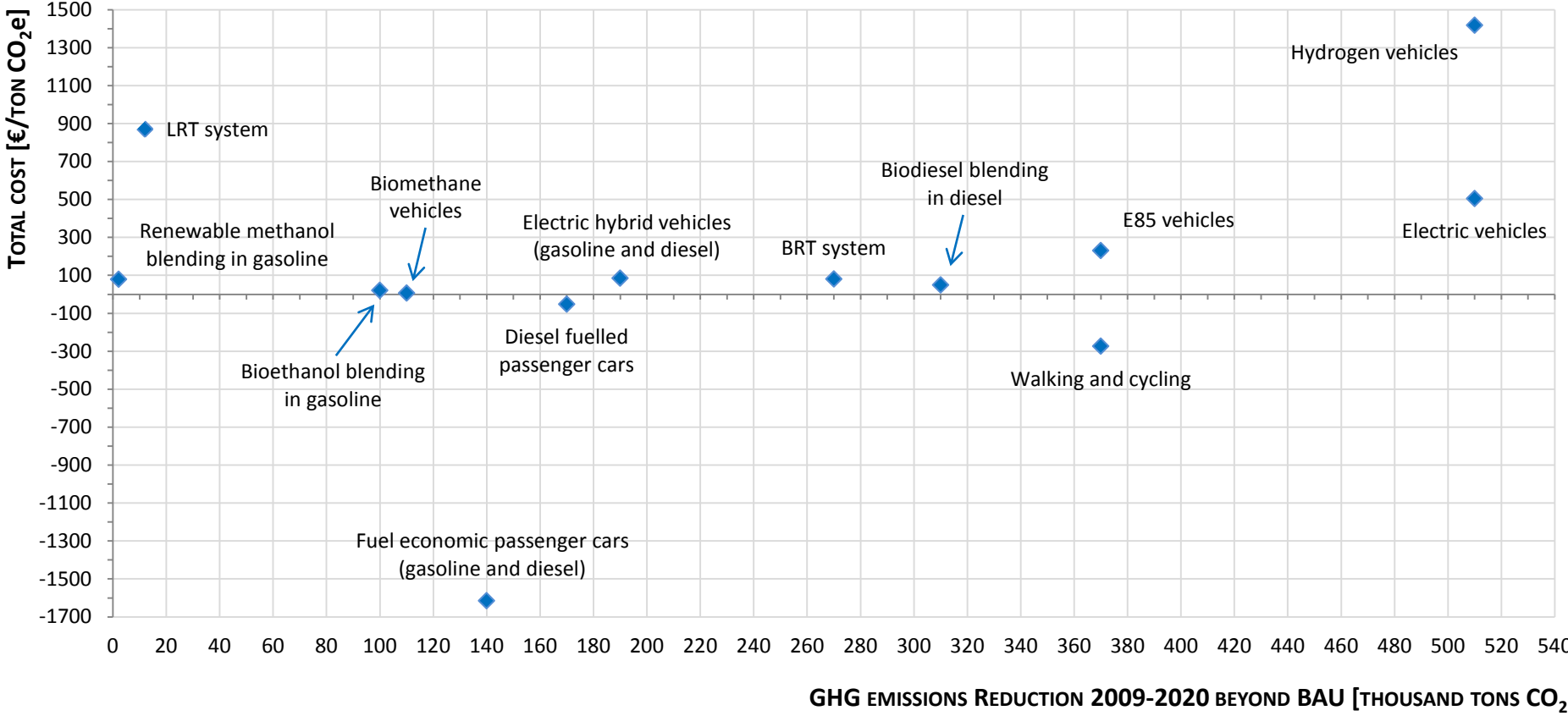
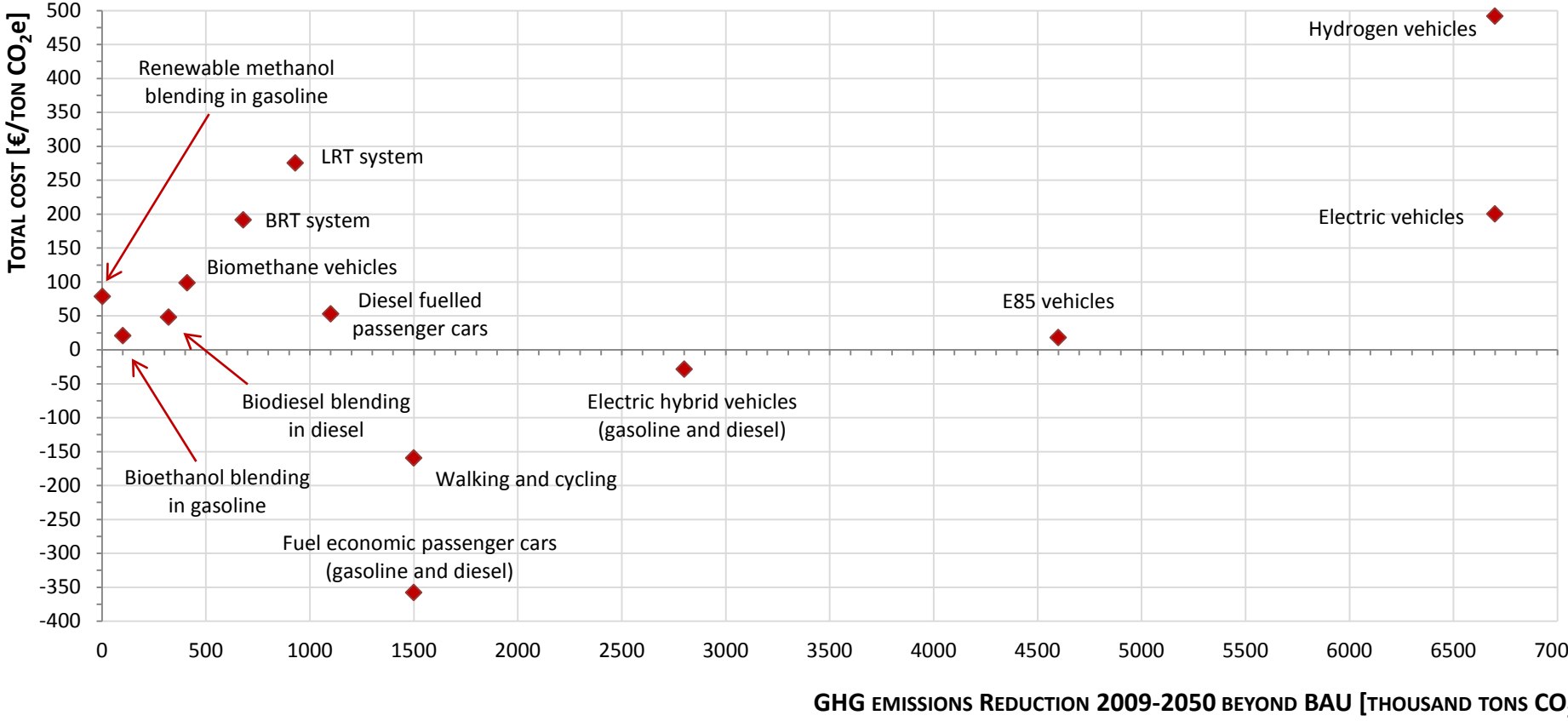
Cost-Benefit: Short term



Cost-Benefit: Long term



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