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Alternative fuels for road transport

IEA EGRD mobility: technology priorities and strategic urban planning workshop
22 -24 May 2013, Finland

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VITO

Outline

- VITO
- European context
- Overview of alternative fuels
- FP7 LNG demonstration project


Environmental Modelling
Energy Technology
Transition Energy & Environment
Seperation & Conversion Technology
Materials Technology
Remote Sensing
Environmental Analysis & Technology
Environmental Risk & Health
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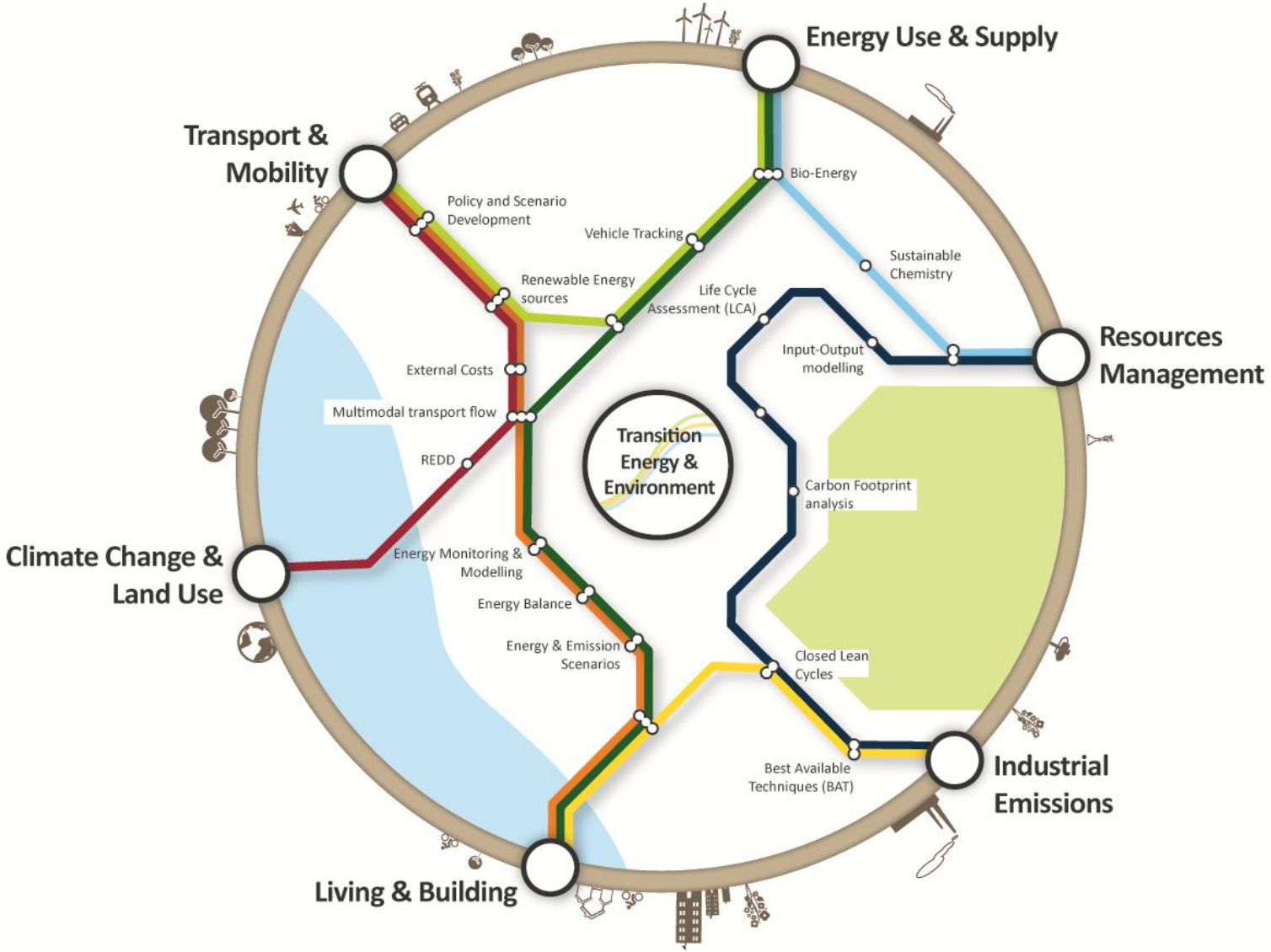
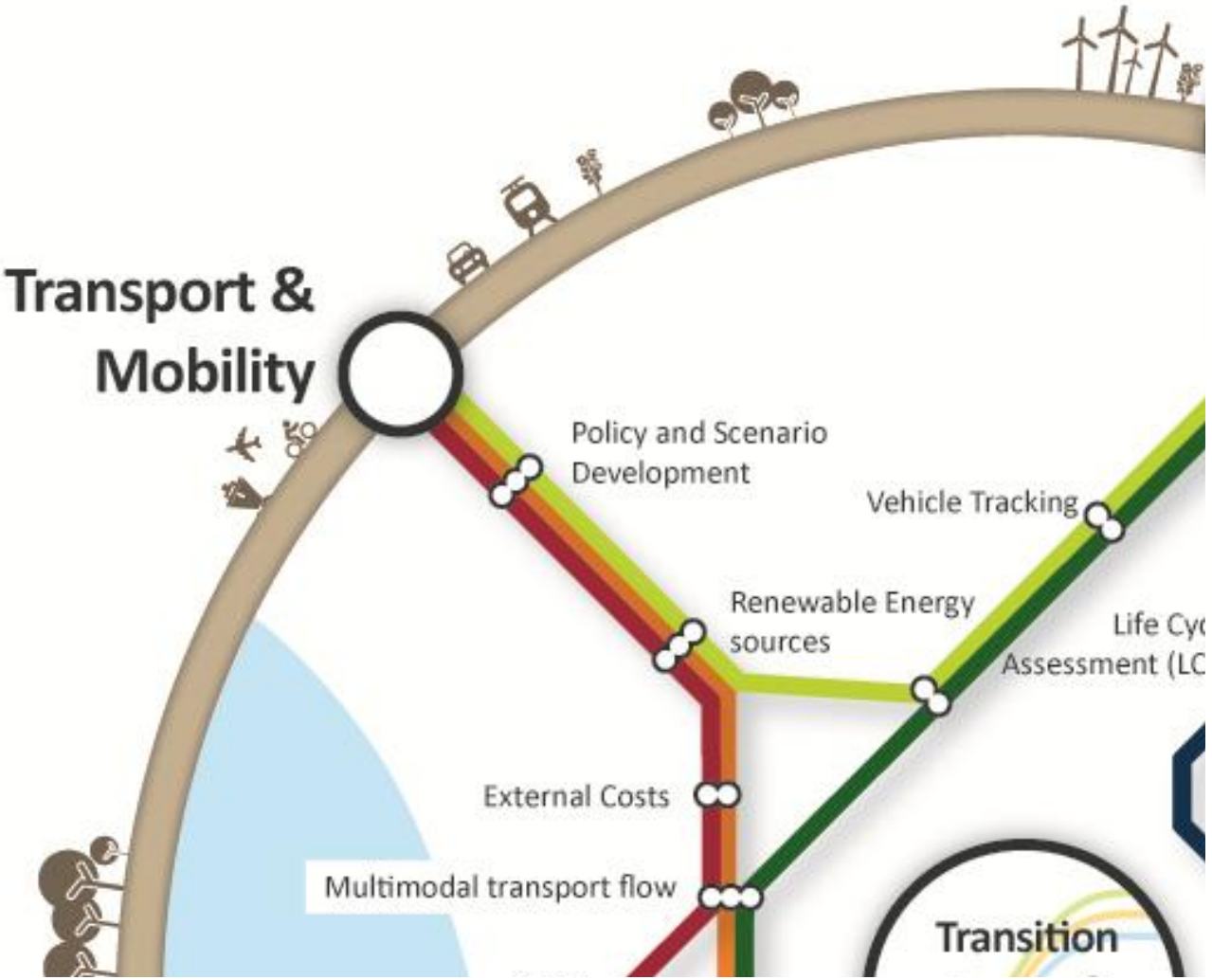

Energy Use & Supply
Transport & Mobility
Resources Management
Climate Change & Land Use
Industrial Emissions
Living & Building
Transition Energy & Environment
Bio-Energy
Policy and Scenario Development
Vehicle Tracking
Sustainable Chemistry
Renewable Energy sources
Life Cycle Assessment (LCA)
Input-Output modelling
External Costs
Multimodal transport flow
REDD
Carbon Footprint analysis
Energy Monitoring & Modelling
Energy Balance
Energy & Emission Scenarios
Closed Lean Cycles
Best Available Techniques (BAT)


Transport &
Mobility
Policy and Scenario
Development
Vehicle Tracking
Renewable Energy
sources
Life Cyc
Assessment (LC
External Costs
Multimodal transport flow
Transition

European context

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European context

Let's start in 2010…

- → EC communication "A European strategy on clean and energy efficient vehicles"
- » Promotion of clean and energy efficient mobility on the EU level
- » > 40 actions in the field of legislation, research, standardization, etc. for:
  - » Conventional ICE (eg. CO_2-legislation, alternative fuels)
  - » Ultra-low carbon EV & H_2 (eg. standardized recharging plug)

European context

- European Expert Group on Future Transport Fuels (EGFTF) Report on Future Transport Fuels (2011)
- Alternative fuel options for substituting oil as energy source for propulsion in transport are:
  - EV/H_2, and liquid biofuels as the main options
  - Synthetic fuels as a technology bridge
  - CH_4 (natural gas and biogas) as complementary fuels
  - LPG as supplementary fuel
- For road transport, this means:
  - EV for short distances
  - H_2 and CH_4 up to medium distance
  - biofuels/synthetic fuels, LNG and LPG up to long distance

European context

- → White Paper on Transport (2011)
- » Presents the Commission's vision for the future of the EU transport system and defines a policy agenda for the next decade
- » By 2050, key goals will include (a.o.):
  - » No more conventionally-fuelled cars in cities
  - » A 60% cut in transport emissions
- » Alternative fuels as defined by EGFTF

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European context

- → European Expert Group on Future Transport Fuels (EGFTF) Report on Infrastructure for Alternative Fuels (2011)
- » Establish EU-wide minimum coverage of refuelling infrastructure for the main alternative fuels
- » Implementation of harmonized standards for the main alternative fuels
- » Align policy and public/private funding and taxation in the field of alternative fuel infrastructure

- » *"Targets for MS with regard to alternative fuel infrastructure is considered a feasible path forward for ensuring the availability of alternative fuels"*

European context

- → EC communication “Clean Power for Transport: a European alternative fuels strategy” (2013)
- » The Communication lays out a comprehensive alternative fuels strategy for the long-term substitution of oil as the primary energy source for transport.
  - » Alternative fuel infrastructure
  - » Common technical specifications → proposal for a Directive
  - » Addressing consumer acceptance → R&D Horizon 2020
  - » Addressing technological development
- » Alternative fuels as defined by EGFTF (– LPG)

European context

Range	Urban	Short	Medium	Long	Short	Medium	Long
Methane							LNG
Electricity							
Biofuels							
Hydrogen							

European context

- → Proposal for a “Directive on the deployment of alternative fuels infrastructure” (2013)
- » Legislative proposal on infrastructure: each MS shall adopt a national policy framework for the market development of alternative fuels and their infrastructure
  - » support the build-up of alternative fuels infrastructure
  - » support research, technological development and demonstration
- » Sets binding targets for the build-up of alternative fuels
- » Ensure clarity on consumer information (labelling, compatibility, …)

European context

- Infrastructure build-up by 2020
  - A minimum number of recharging points for EVs are put in place, with at least 10% publicly accessible
  - A sufficient number of H_2 refuelling stations, with a maximum distances of 300 km
  - A sufficient number of CNG refuelling stations with maximum distances of 150 km
  - LNG refuelling points for road transport vehicles along the TEN-T Core Network, with a maximum distance of 400 km
  - Complying with common technical specifications

TEN-T EU Core Network...

- ... is a multi-modal transport network
- ... will remove bottlenecks, upgrade infrastructure and streamline cross border transport operations
- ... will improve connections between different modes of transport
- ... will contribute to the EU's climate change objectives
- ... is to be completed by 2030

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European context

- Targets for each MS have been defined according to:
  - Current vehicle fleet
  - National targets
  - Share of population in urban areas
- Example: Belgium in 2020
  - Electricity: 210.000 recharging points (10% publicly accessible)
  - Hydrogen: 1 existing station, 3 stations to be built
  - CNG for vehicles: 9 existing stations, 10 stations to be built
  - LNG for trucks: 1 existing station, 2 stations to be built

European context

- → Renewable Energy Directive
  - » 10% renewable energy in transport by 2020
  - » Biofuels and green electricity

- → Fuel Quality Directive
  - » to reduce the greenhouse gas intensity of transport fuels
  - » sustainability criteria for biofuels

- → Proposal for Energy Taxation Directive
  - » CO_2 emissions and energy content taken into account

- → ...

Overview of alternative fuels

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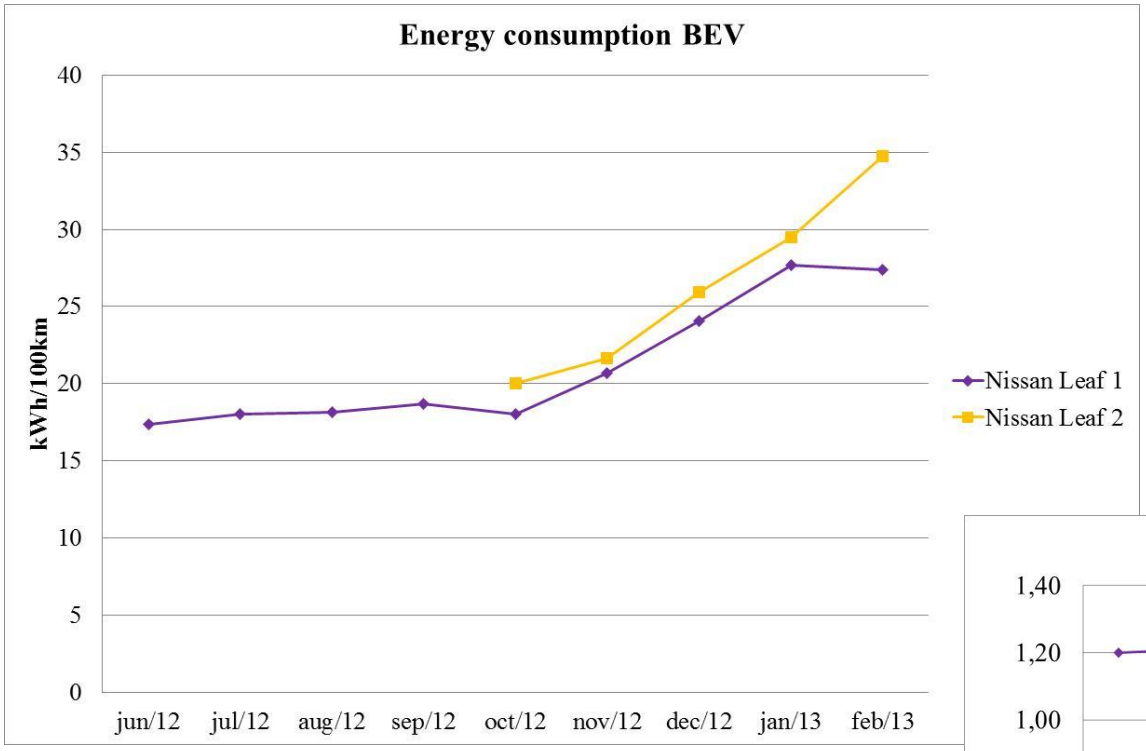
Alternative fuels – LPG

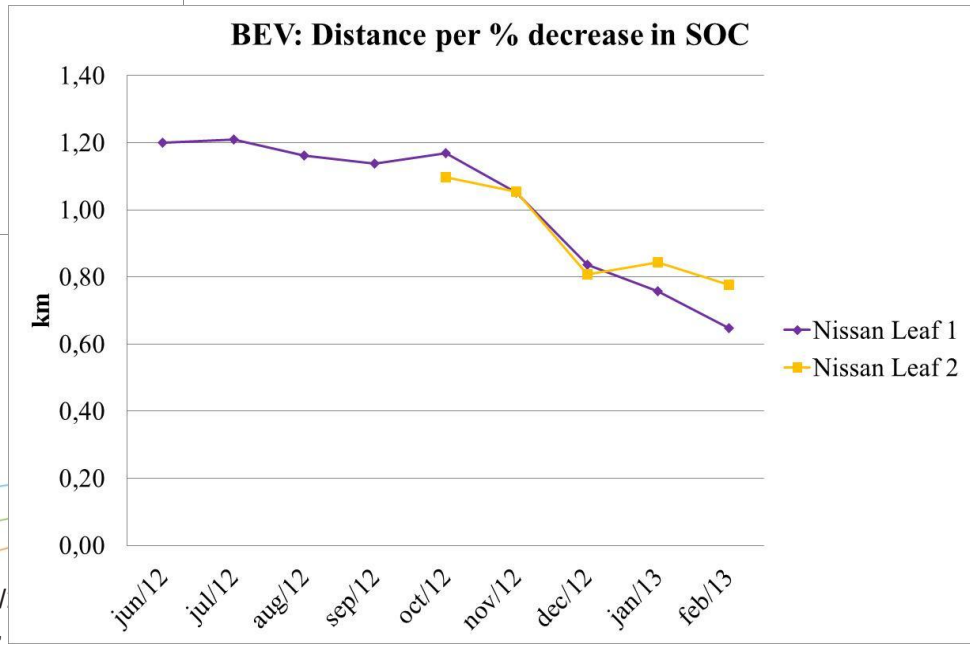
- Proven technology
- By-product of hydrocarbon fuel chain
- Interesting WTW GHG emissions, low air quality impact
- Future: possibly from biomass?
- Currently most widely used alternative fuel in EU
  - 3% of the fuel for cars, 5 million cars
  - > 27.000 filling stations

Alternative fuels – electricity

- Short range road transport – passenger cars & delivery vans & city busses?
- Promising technology
- Can be considered as the cleanest fuel (E-production!!!), no local emissions
- Demonstration projects EU wide
- Large part of infrastructure already exists: electricity grid
- Challenges
  - Battery technology (E-density, temp sensitivity, …)
  - Cost of the vehicles/batteries
  - New business models?
  - Build-up of charging infrastructure (slow charge vs. fast charge)
  - Smart grids to cope with increasing E-demand & renewable (and mostly intermittent) E-production

Alternative fuels – electricity





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Alternative fuels – hydrogen or H_2

- Same propulsion technology as EV
- E-storage in H_2 instead of battery
- Electricity production in fuel cell
- Longer range and faster recharging then EV
- H_2-production determines environmental benefit, no local emissions
- Challenges:
  - New infrastructure needed for H_2 production, distribution and storage
  - Cost-competitive fuel cells
  - On-board H_2 storage
  - Refuelling infrastructure

Alternative fuels – biofuels

- 1st generation: biodiesel & bio-ethanol
  - Controversial: competition with food & sustainability uncertain
  - Mainly blends with fossil fuel, minor engine modification for high blends
  - GHG benefits uncertain
  - Economically viable only within MS incentive schemes
  - Will be limited in the future…
- Future generation: synthetic fuels (eg. FT diesel), ethanol, HVO, …
  - Waste streams (residues, animal fat, …), ligno-cellulosic biomass, non food feedstock (such as algae, jatropha)
  - Evolution slower than expected
  - Economical viability & environmental benefits uncertain
  - Large scale demo needed → financing?

Alternative fuels – methane or CH_4

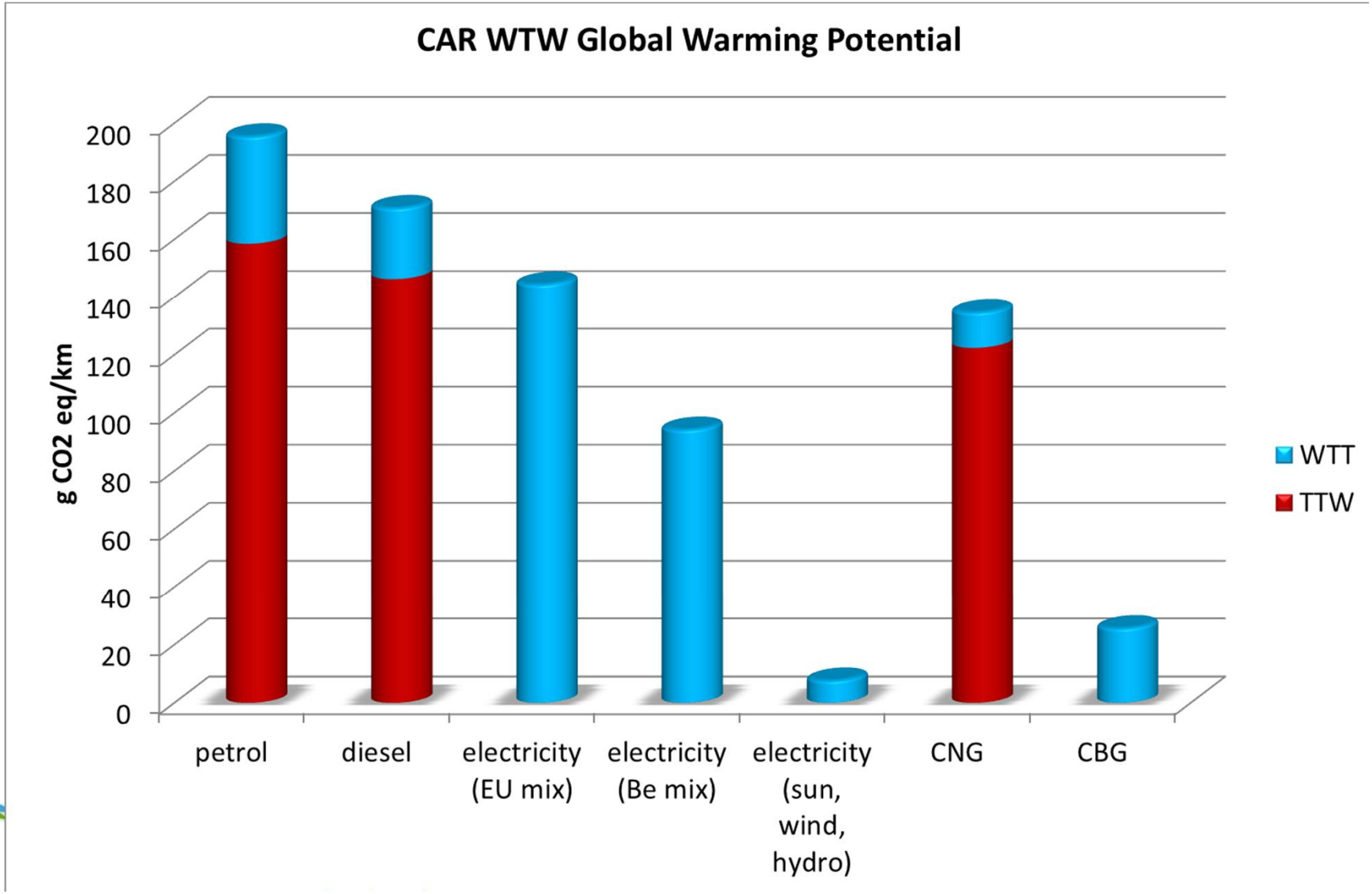
- CNG for short & medium distance
  - Passenger cars, vans, city busses, distribution trucks
  - Proven technology
  - Air quality benefits greater then GHG benefits
  - Biogas/biomethane also great GHG benefits
  - Economically viable (low excise duties…)
- LNG for long distance road transport
  - 3 times energy density CNG → long distance trucks
  - <100 trucks & <40 stations in the EU
  - Refuelling stations independent of gas grid
  - Dual fuel & dedicated engines

Alternative fuels – Well to Wheel

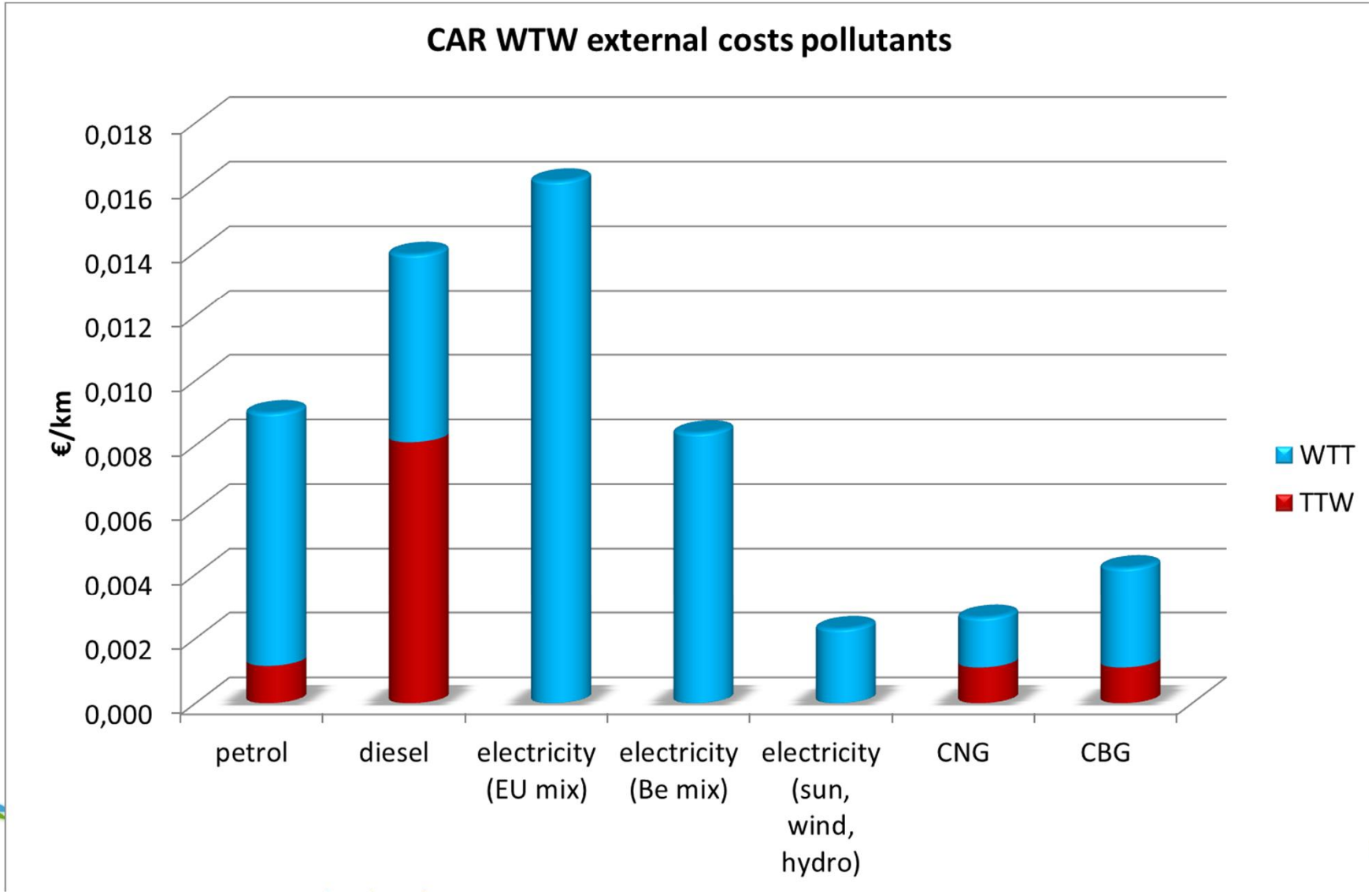
Well to tank

Tank to wheel

Passenger car



Passenger car



FP7 LNG demonstration project

LNG BLUE CORRIDORS

LNG Blue Corridors

- European Expert Group on Future Transport Fuels (2011)
  - *"European Blue Corridors should be investigated for the build-up of Liquefied Natural Gas (LNG) infrastructure to support the use of liquefied methane gas in medium and long distance freight transport."*
- EU FP7 DG MOVE call 2012
  - *"to perform a large-scale demonstration in order to facilitate a broad market development for heavy duty trucks running with liquefied methane"*

EU FP7 call 2012:
"Demonstration of HDV running with liquefied methane"

Project:	8 M€	4 years	05/13 start
EU scope	4 corridors	27 partners	12 countries

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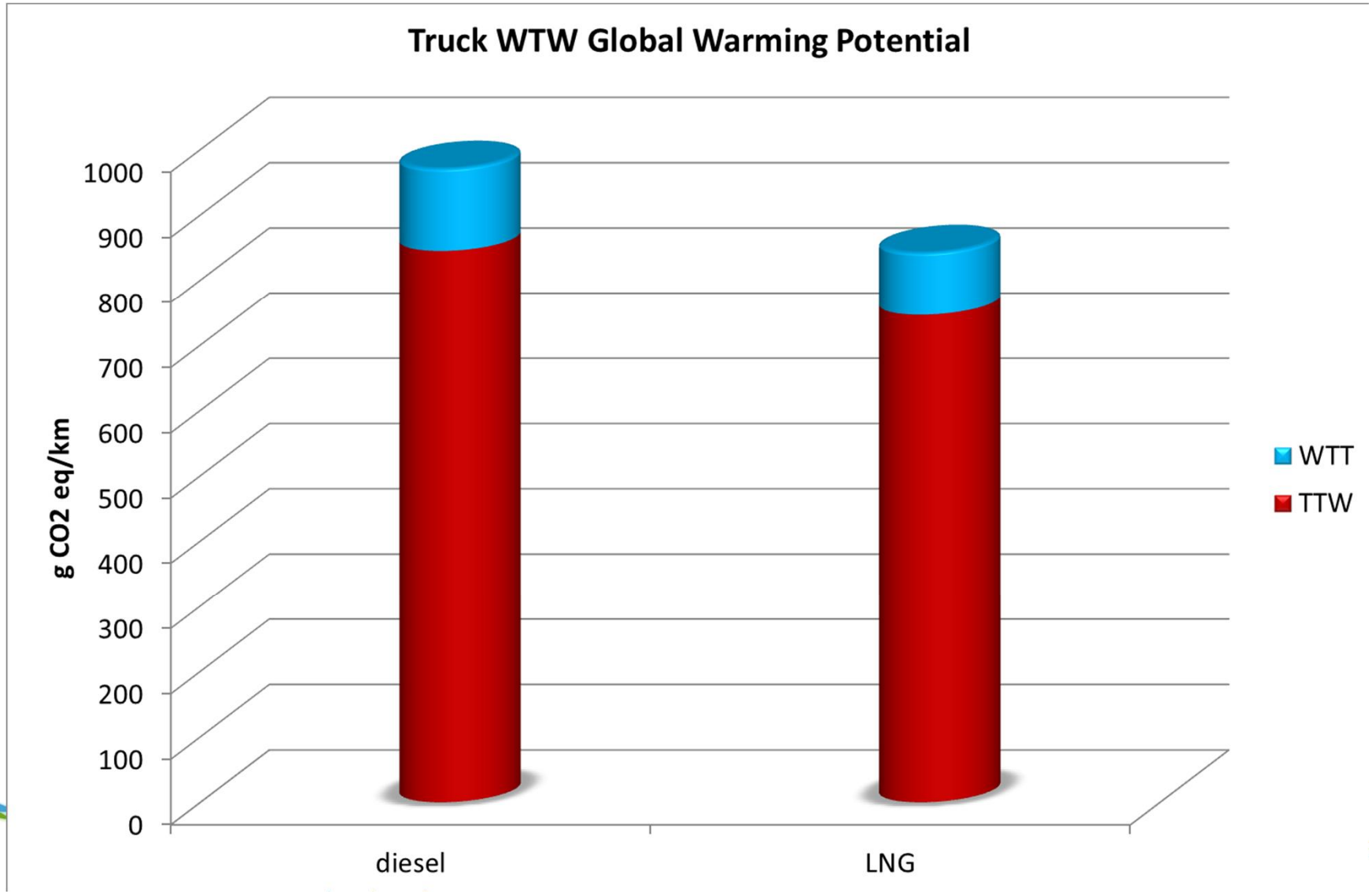
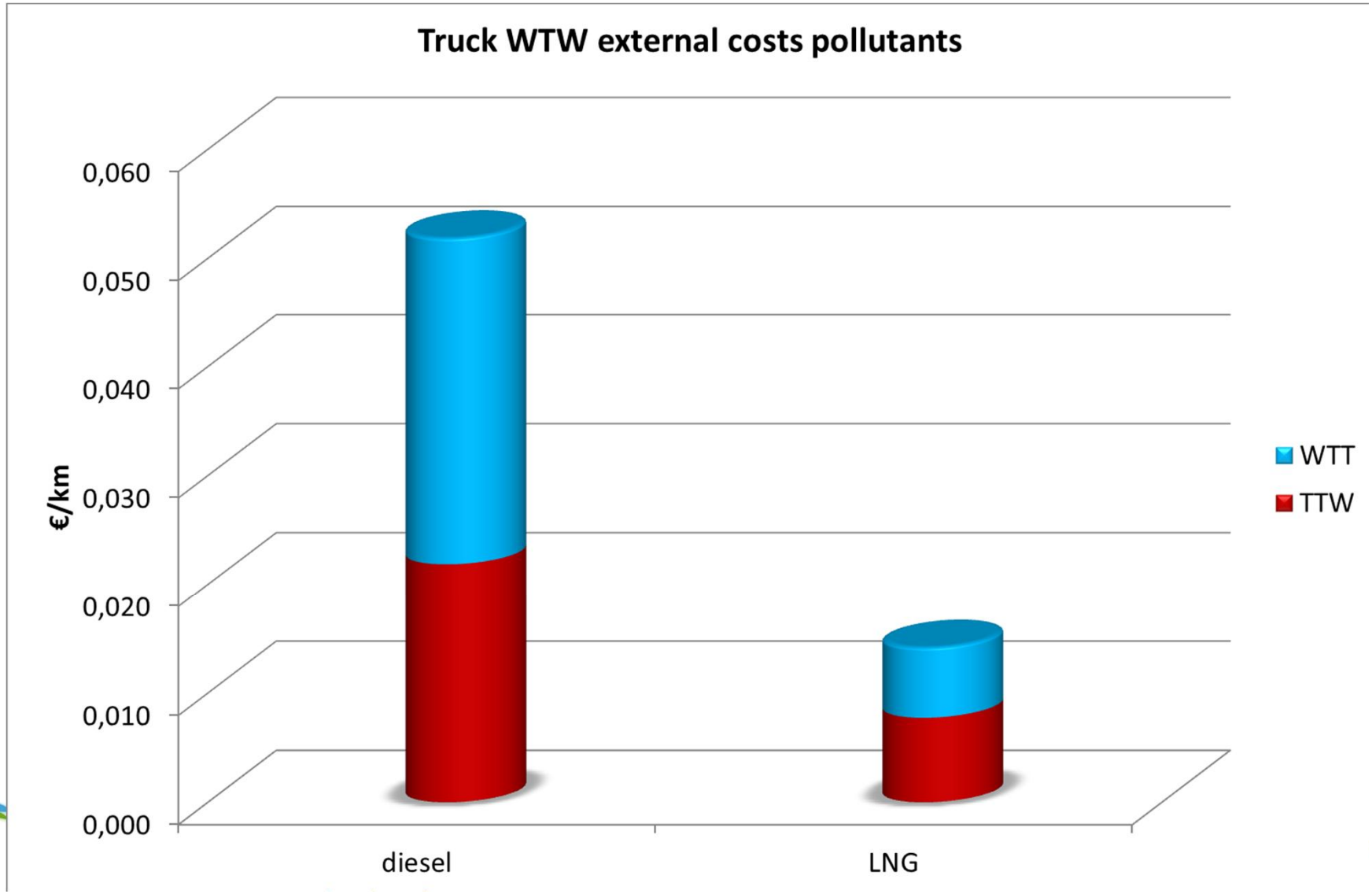
LNG Blue Corridors Goals

- Oil substitution
- Reduction of GHG emissions
- Increase of E efficiency
- Euro VI
- Facilitate market development

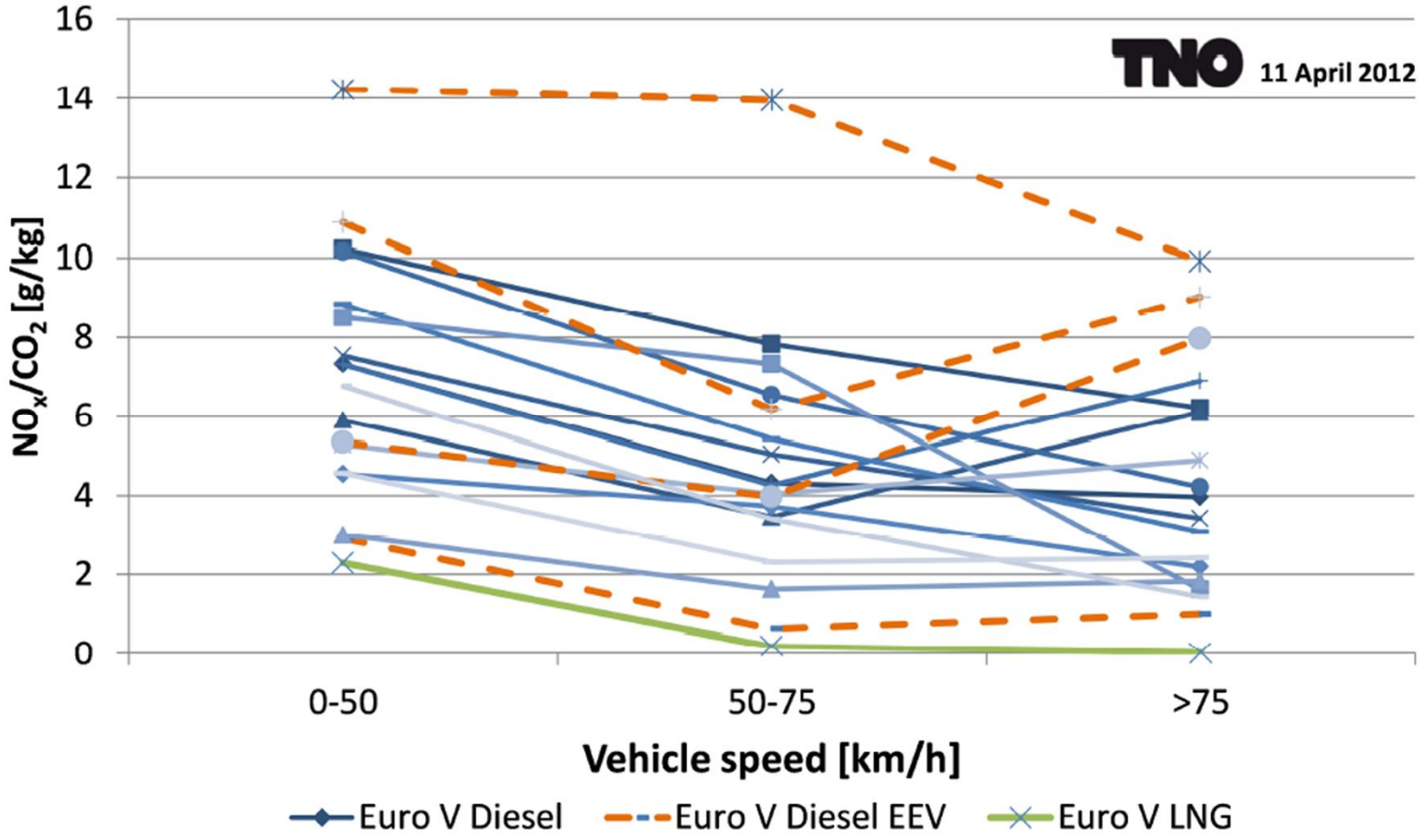
Long distance truck



Long distance truck



Long distance truck



LNG Blue Corridors WP's

- Work Package on LNG Vehicles
  - Euro VI dual fuel & dedicated engines
  - Identification of other LNG vehicle & engine technologies
- Work Package on LNG Fuel Logistics
  - Guideline and Best practices of LNG refuelling stations
  - Identification of EU LNG network and supporting infrastructure
  - Technology and processes to secure full compatibility between fuel, refuelling stations and vehicles
- Work Package on Harmonization and Standarization
  - State of the art & identify limitations and missing aspects
  - Further improvement and development of common EU standards and regulations

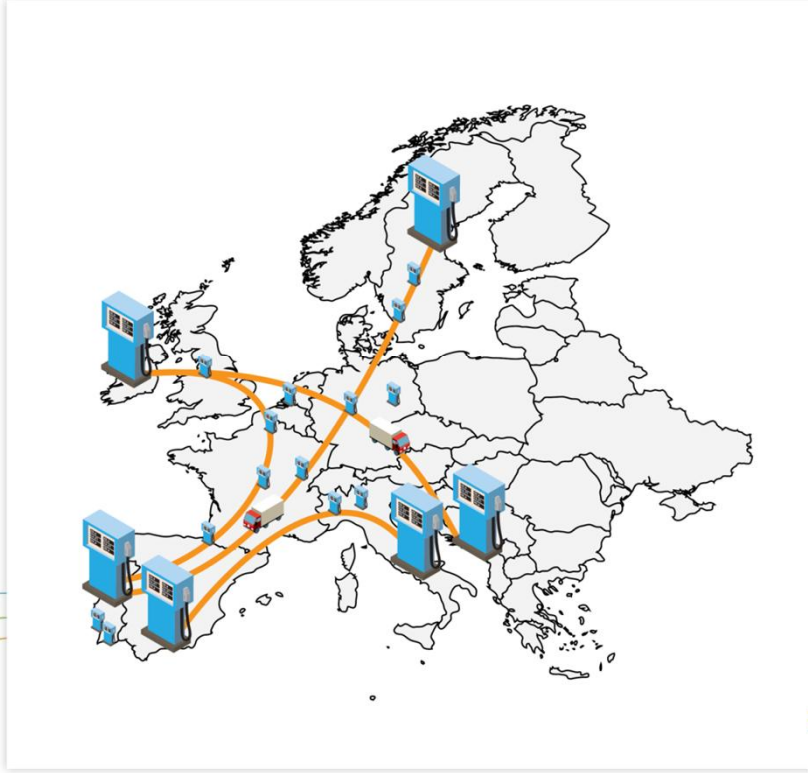
LNG Blue Corridors WP's

- Work Package on analysis & evaluation
  - Quantitative & qualitative evaluation of the demonstration activities
  - Provide recommendations for a broad market development

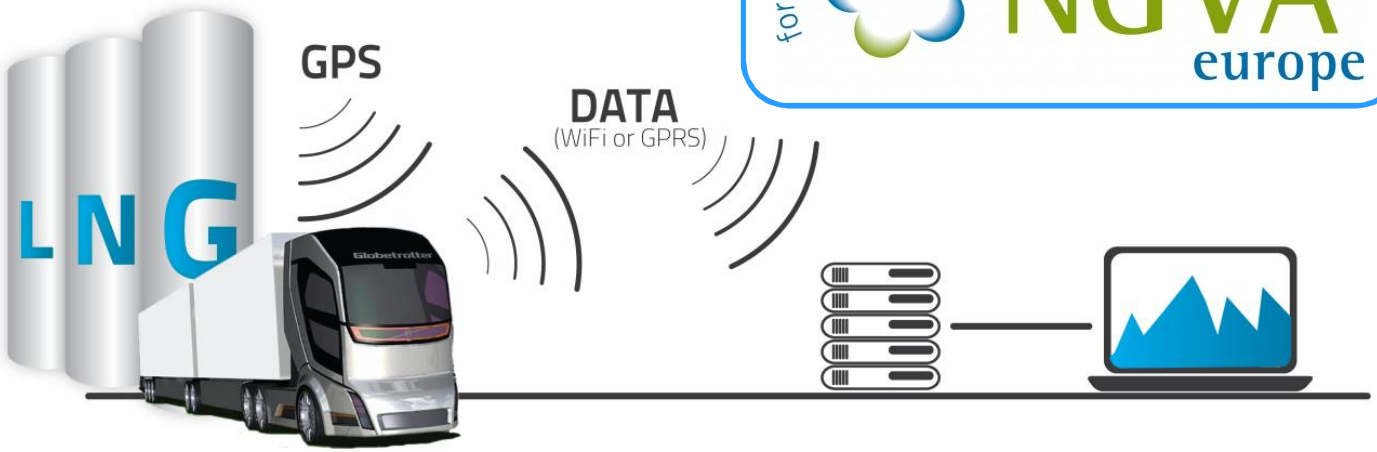
- Work Package on Roadmap to LNG Blue Corridors
  - Define new corridors & optimize existing
  - Further market development

LNG Blue Corridors

- Core of the project: demonstration activities
  - 4,8 M€ (of the 8 M€)
  - Direct subsidy for 100 heavy duty vehicles
  - 14 LNG filling stations (in addition to existing)
- 4 corridors:
  - WEBlue: West-East corridor
  - SONOR: South-North corridor
  - ATBlue: Atlantic corridor
  - MEDBlue: Mediterranean corridor



LNG Blue Corridors



Thank you for your attention!

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LNG BLUE CORRIDORS

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