PAUL SCHERRER INSTITUT

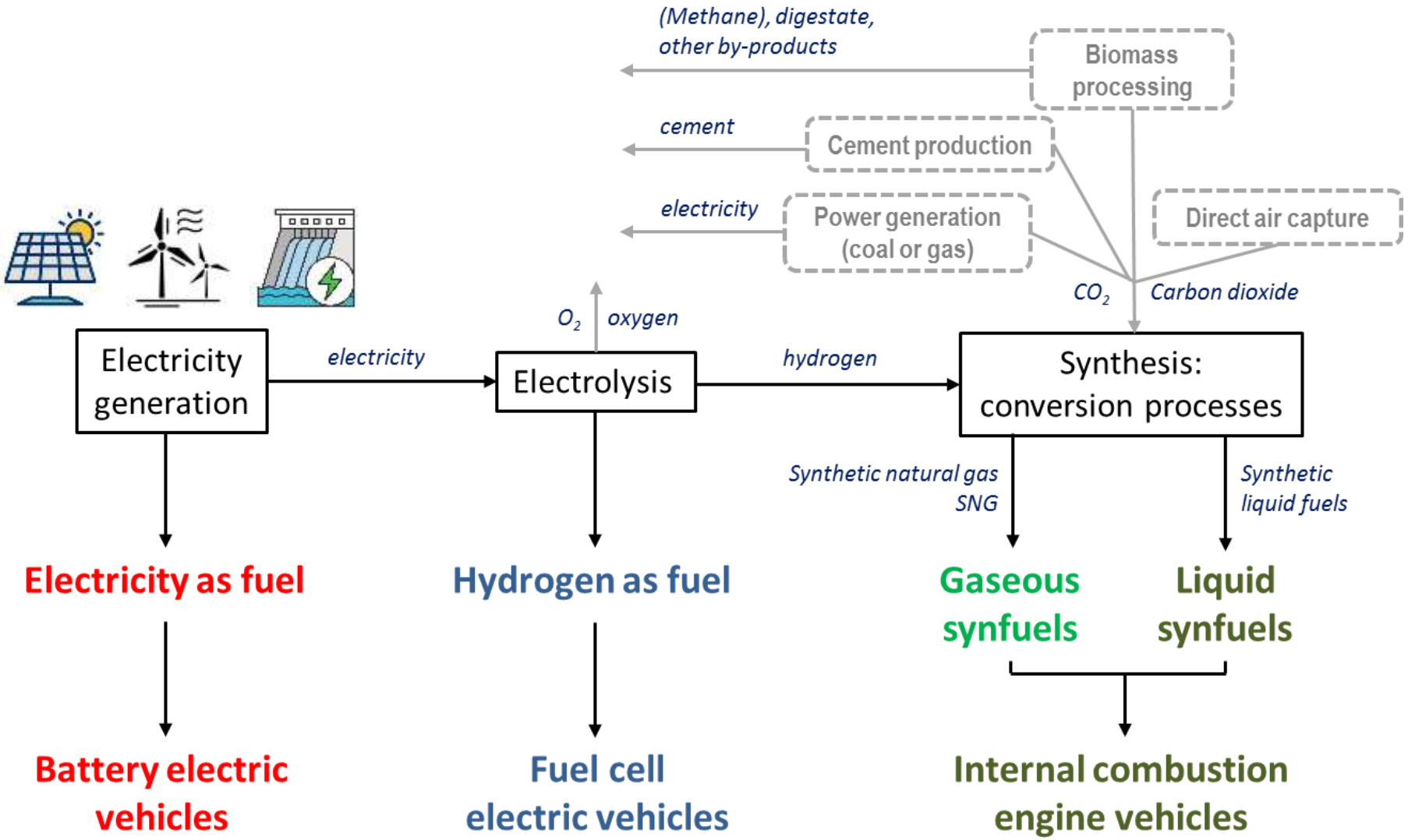
PSI

Christian Bauer :: Labor für Energiesystem-Analysen (LEA), PSI

Ökologische Vor- und Nachteile der Elektrifizierung im Verkehr

TECHNOLOGY BRIEFING - Empa, 11. November 2020

Electrification of mobility – what does it mean?



Direct electrification

Indirect electrification

Why should we electrify mobility?

Two key issues in the context of sustainability:

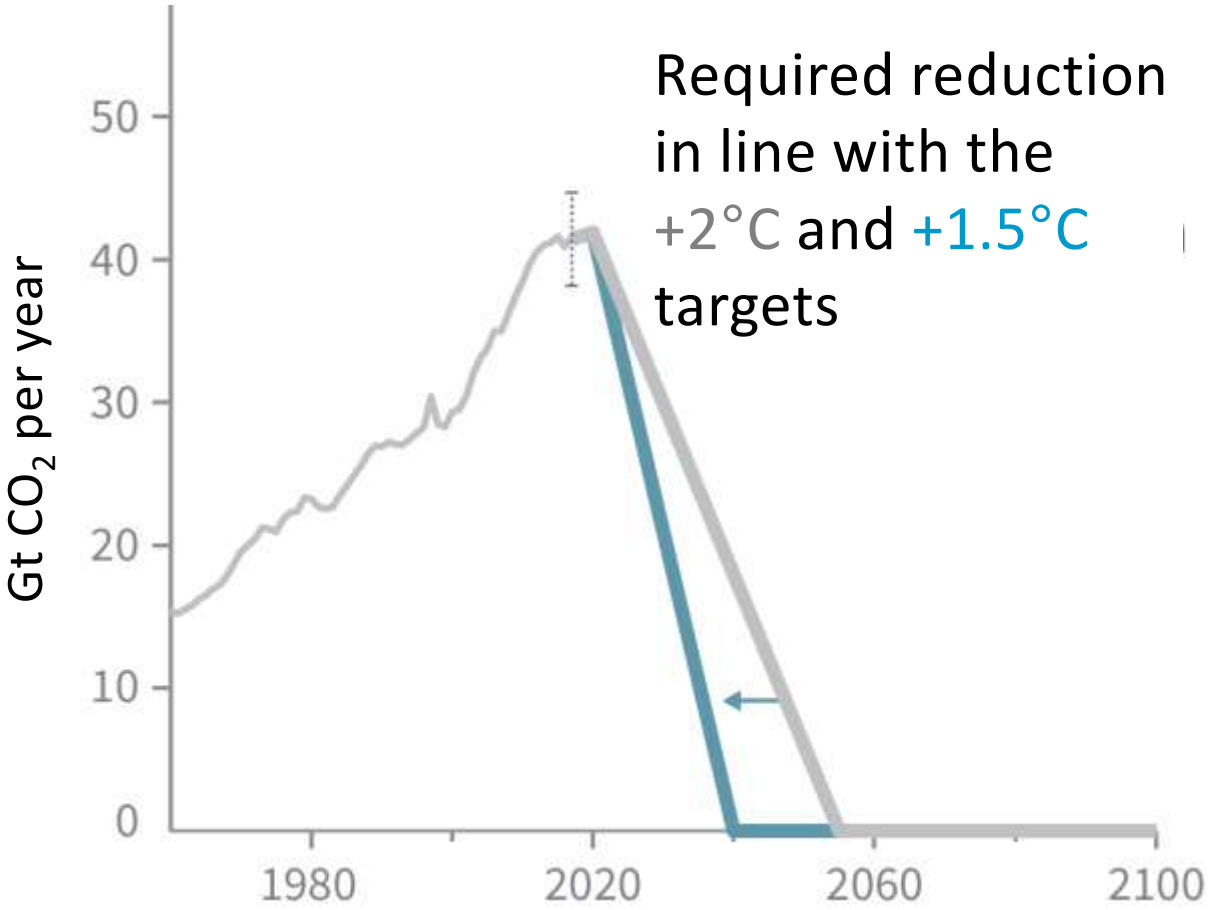
1. Climate change impacts
2. Local/regional impacts on air quality

New Delhi, 2019 – © ABC news

Bejing, 2019 – © Quartz

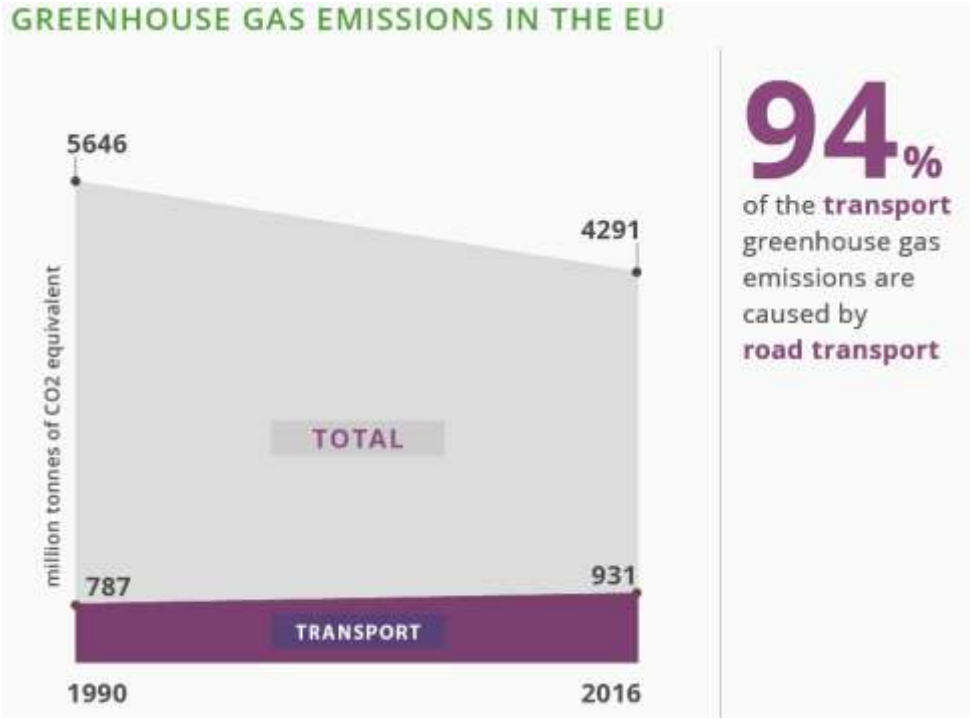
Why should we electrify mobility?

Global net CO_2 emission pathways



Source: IPCC 2018

GHG emissions from road transport in Europe



Source: https://www.consilium.europa.eu/en/infographics/greenhouse-gas-emissions/

Are environmental benefits of electrification real?

GREEN TRANSPORT — Deutsche Welle (DW), 2017

How eco-friendly are electric cars?

Dieselgate has many people turning to electric vehicles as a more environmentally friendly option. But in some respects, e-cars can be just as bad for the environment as traditional cars. So what's the upshot?

Electric cars' green image blackens beneath the bonnet

Research into the lifecycle of electric vehicles is a wake-up call for an industry geared up to promote "zero emission cars"

Financial Times, 2017

ENERGY & ENVIRONMENT — The New York Times, 2017

France Plans to End Sales of Gas and Diesel Cars by 2040

WHEELS — The New York Times, 2017

The Internal Combustion Engine Is Not Dead Yet

Opinion | EDITORIAL — The New York Times, 2017

A Brighter Future for Electric Cars and the Planet

wired.com

LIZZIE WADE SCIENCE 03.31.16 12:45 PM

TESLA'S ELECTRIC CARS AREN'T AS GREEN AS YOU MIGHT THINK

Electric car growth sparks environmental concerns

Mining of raw materials and recycling of lithium-ion batteries in spotlight

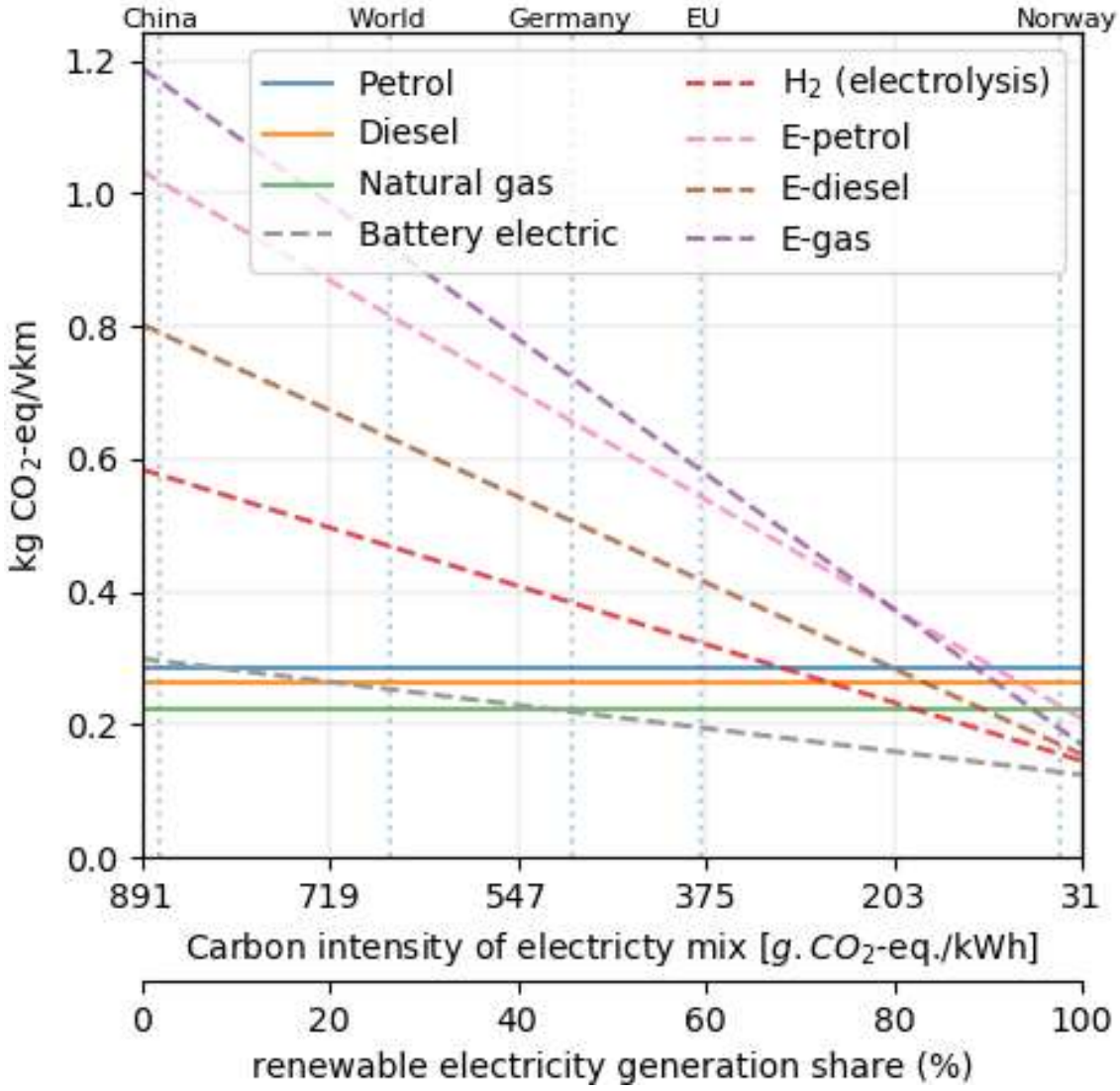
FT, 2017

ELECTRIC CARS ARE A BETTER ENVIRONMENTAL CHOICE – IN SPITE OF ENVIRONMENTAL IMPACT

Vattenfall, 2017

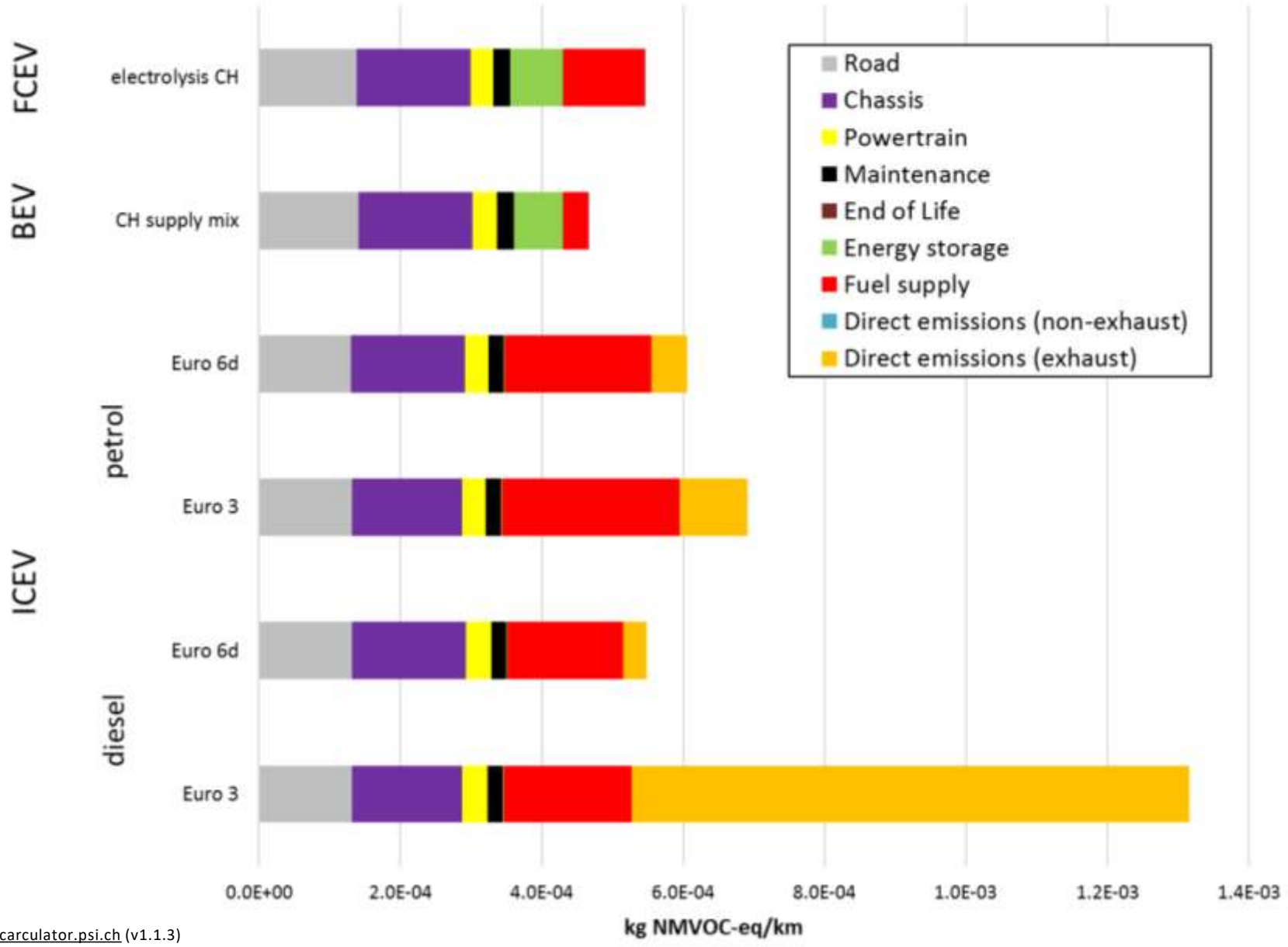
SWEDEN The environmental benefits of electric cars far outweigh the issue of CO_2 emissions from battery production.

Passenger vehicles (2020) – GHG emissions



Source: PIK & PSI, to be published

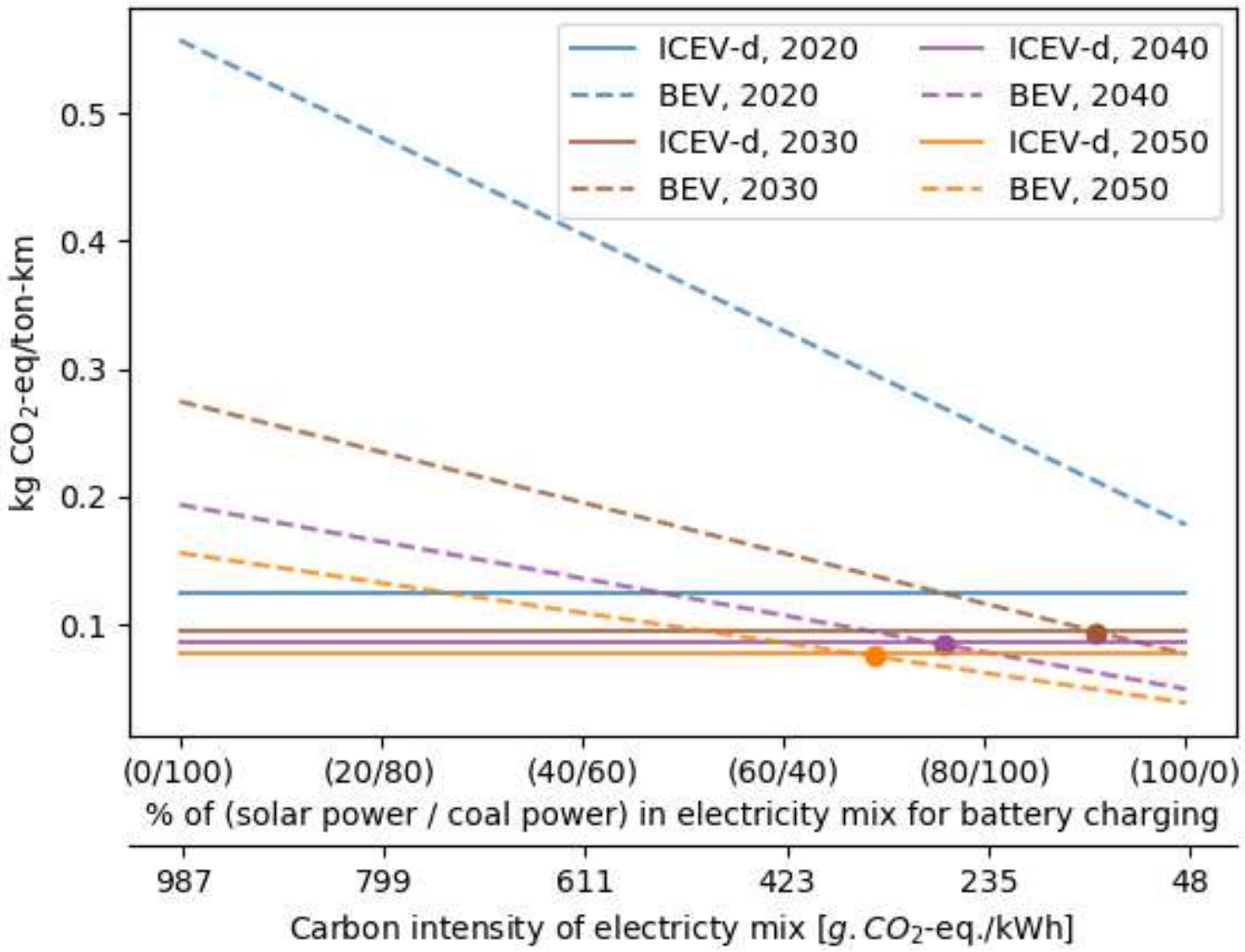
Passenger vehicles – smog formation (air quality)



Source: https://carculator.psi.ch (v1.1.3)

Trucks – GHG emissions BEV vs ICEV-diesel

40t vehicle, 800km range

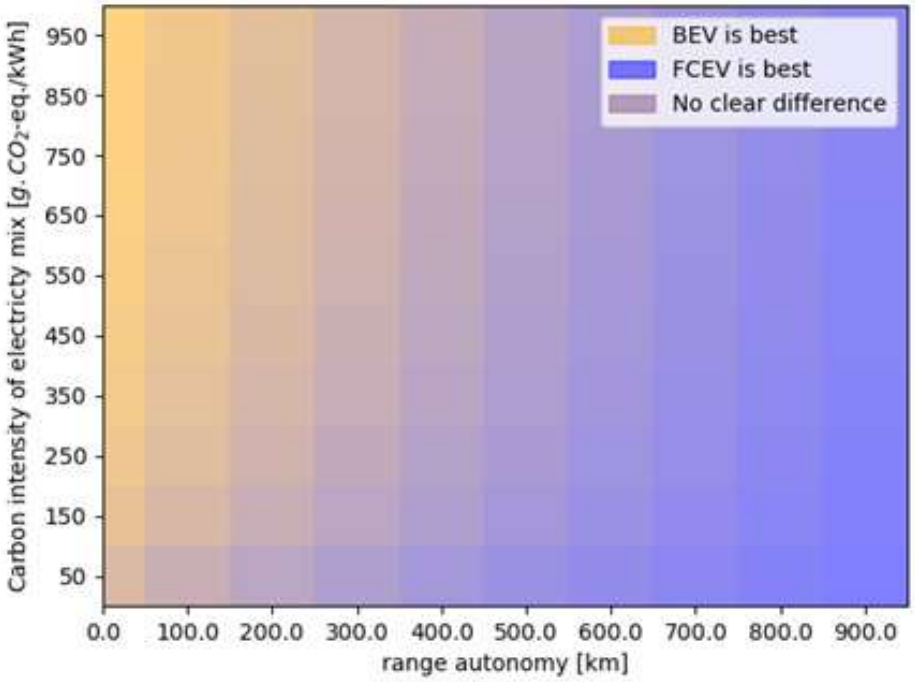


Source: PSI, to be published

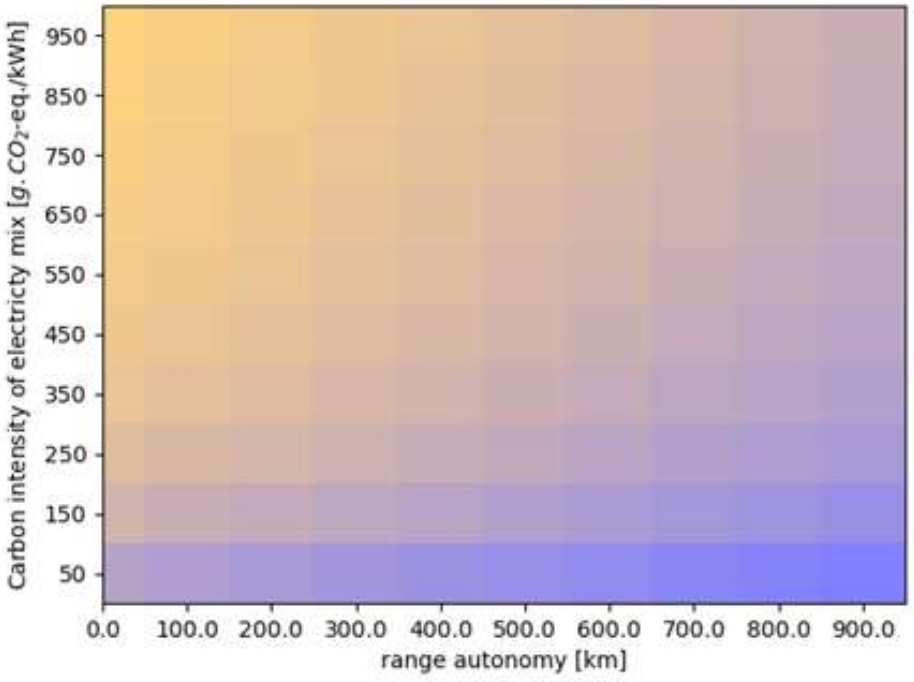
Trucks – GHG emissions BEV vs FCEV

The higher the required range and the lower the GHG-intensity of the electricity, the better FCEV perform

2020



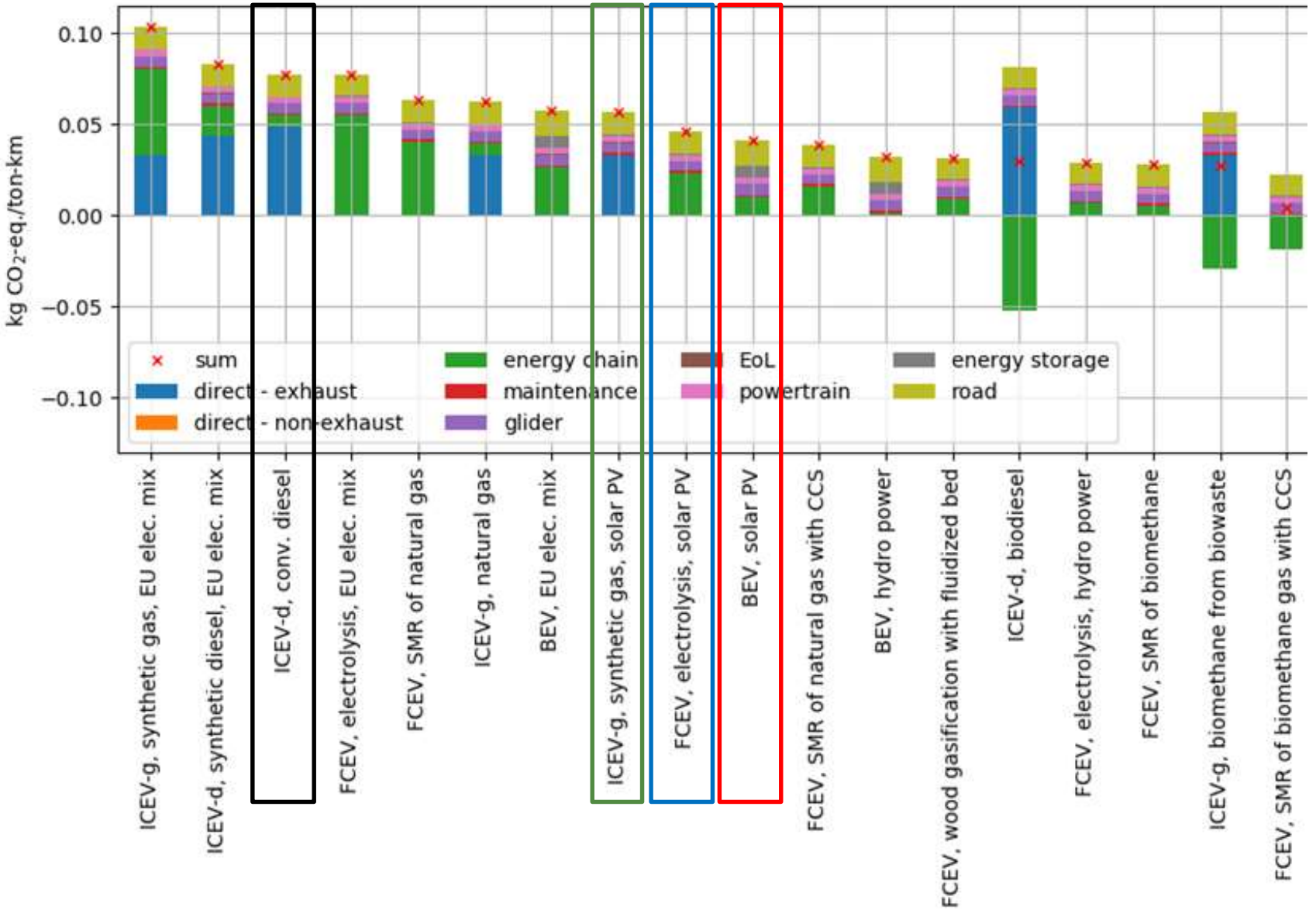
2050



Source: PSI, to be published

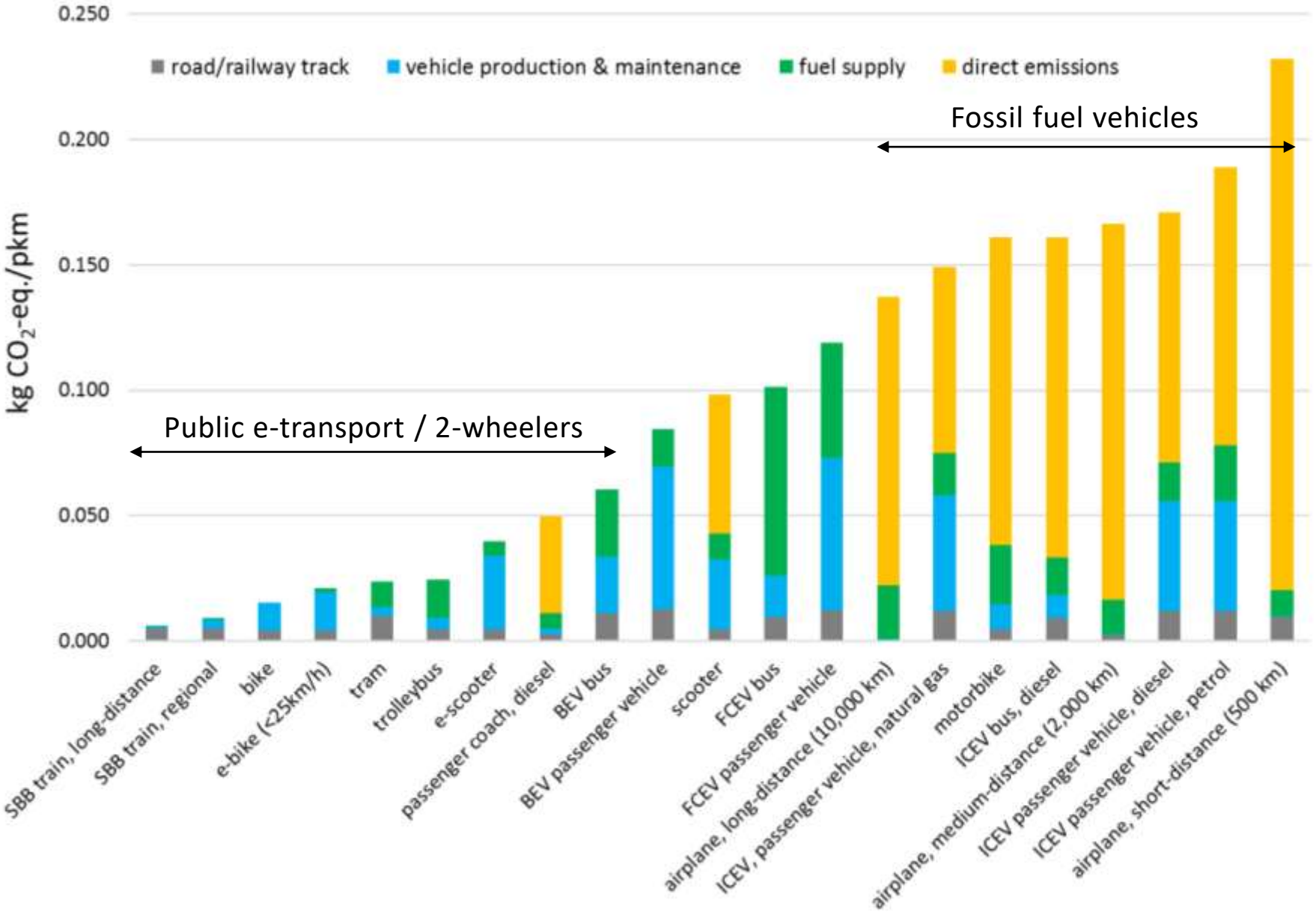
Trucks – GHG emissions

40t vehicle, 2050, 800km range



Source: PSI, to be published

Passenger transport (CH, 2020) – GHG emissions



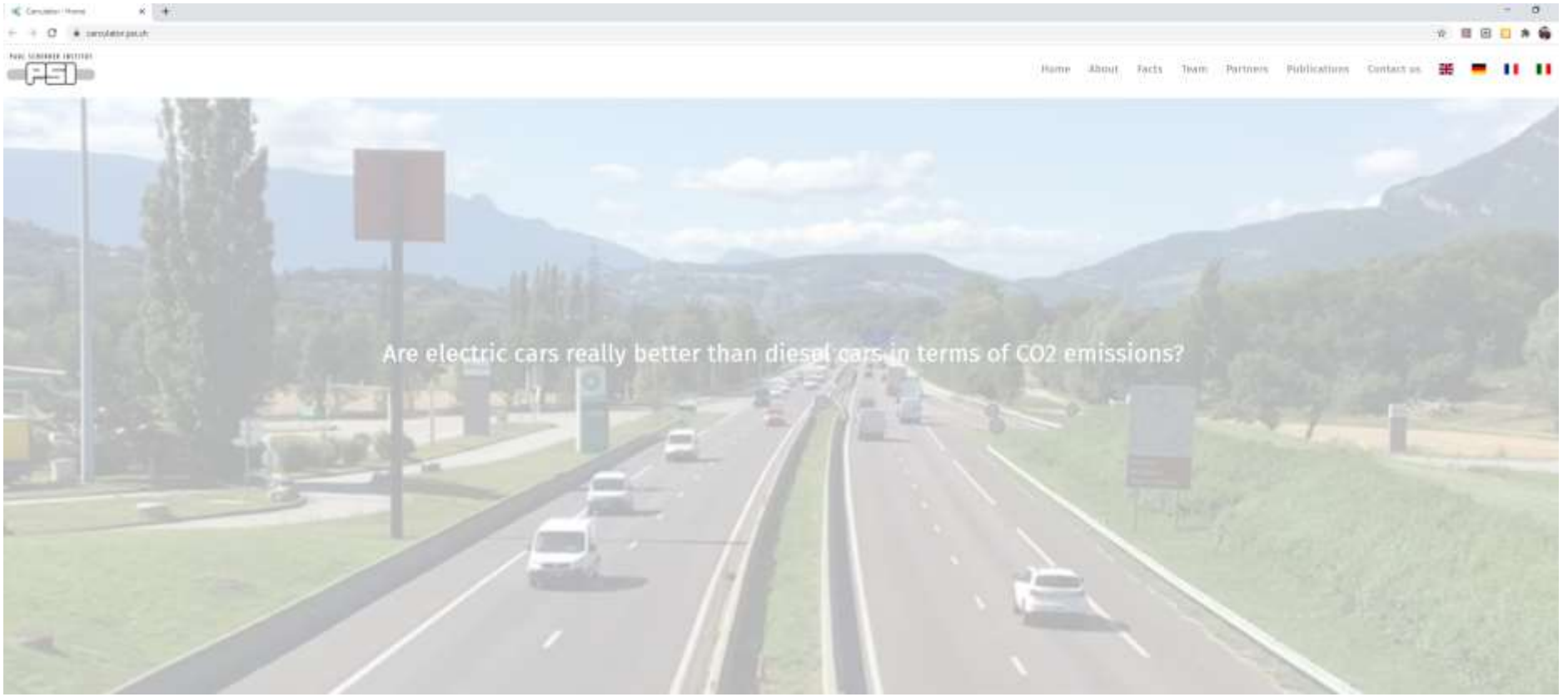
Source: PSI, to be published

Take home messages

- Electrification of transport has the potential for substantial reduction of GHG emissions
  - ✓ If fuel supply is based on low-carbon electricity
- Direct electrification (BEV) should be priority, wherever technically feasible
  - ✓ Most efficient use of renewables
- Indirect electrification seems to be most appropriate for long-haul, heavy-duty vehicles
- Electrification will not reduce non-GHG burdens to the same extent
  - ✓ Shift of burdens from vehicle operation to vehicle & fuel production
- Most environmental friendly overall: electrified public transport

LCA web-tool

https://carculator.psi.ch



Wir schaffen Wissen – heute für morgen

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https://www.psi.ch/ta/