Hyundai
Hydrogen Mobility
Partnership with H2Energy

Sustainable Distribution with Fuel Cell Trucks – A reality in Switzerland

March 24, 2021

Mark Freymüller

FCEV Vision 2030 for Hyundai Motor Group

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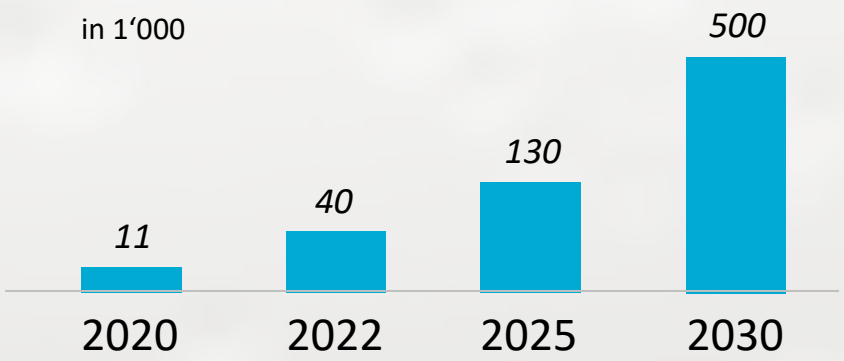

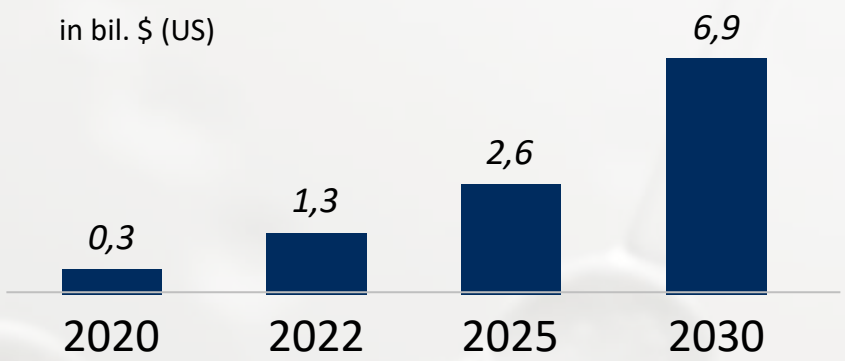

December 2018

„As a first mover in the forthcoming hydrogen economy, we will lead a society that uses hydrogen as ist main source of energy.“

Eui-Sun Chung

Executive Vice Chairman of Hyundai Motor Group

Eco-friendly CV development strategy

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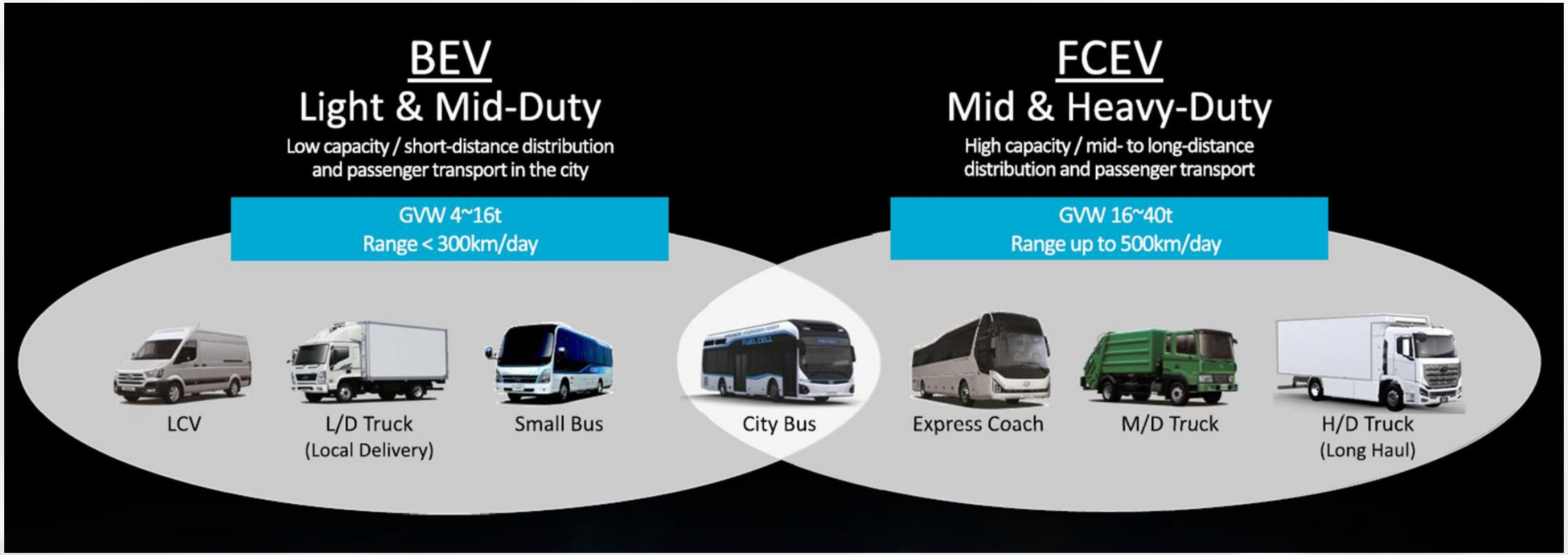

- Standardization and common use of major components across the variant models and even with the passenger cars
- Customer use & business case based vehicle development

Fuel Cells are the perfect fit for heavy duty trucks & long driving distances

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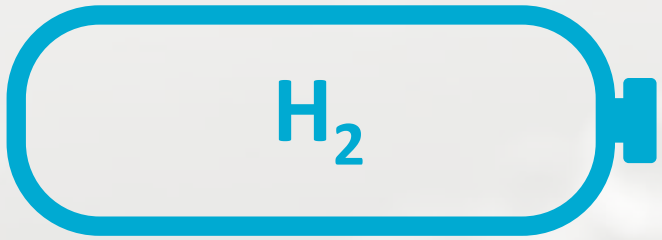
Range / Payload



About 400 km

No big impact in low ambient temperatures

Refueling Time

Just 15 min

Switzerland for „Lead Country“ Strategy

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- Hyundai and H2 Energy established ‘Hyundai Hydrogen Mobility’ to **tap into Europe’s hydrogen mobility ecosystem** with fuel cell trucks
- Hyundai to deliver **1,600 fuel cell heavy-duty trucks** to the JV through 2025 (1’000 by 2023)
- Showing that it works (financially viable)
- JV to expand business to other European countries

Pay per use Model

Takes a lot of hassle away from the client…

Hydrogen production

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The climate-friendly hydrogen value chain:

- Hydropower plants, wind farms and PV systems supply electricity from renewable sources for electrolysis
- In the electrolysis process water is split into oxygen and hydrogen
- The hydrogen produced is stored in containers specially designed for handling gases and delivered to filling stations. There it is offered for sale to the public via a dispenser
- The gas is converted on board the vehicle into electricity for propulsion by means of a fuel cell.
- The vehicle emits only water (steam). The cycle closes.

Link to Video of H_2 supplier

First Trucks leaving Korea / HRS opening in St.Gallen

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Arrival of the trucks in Antwerp
and transport to Rothenburg, CH

Handover of first seven trucks to seven different customers

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„Verkehrshaus der Schweiz“,
Lucern, Oct 7, 2020

Vehicles in regular customer operation now…

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- 25 vehicles on the road right now, 46 by beginning of May
- 380’000 km driven so far – saving over 300 t CO_2 emission

HRS Infrastructure roll-out

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#	Location of HRS	Start of operation	Operated by
1	**Hunzenschwil** Gewerbestrasse 1	Live	CMA
2	**St. Gallen** Oberstrasse 137	Jun 2020	AVIA
3	**Zofingen** Bleicheweg 6	Oct 2020	AGROLA
4	**Rothenburg** Stationsstrasse 82	Jan 2021	Agrola
5	**Crissier (West)** Chemin de Saugy 3	Feb 2021	CMA
6	**Rümlang** Riedgrabenstrasse 26	Feb 2021	AVIA
7	**Bern Bethlehem** Eymattstrasse 15	Apr 2021	CMA
8	**Geuensee** Schäracher 2	Apr 2021	AVIA

Trucks have the better economical lever for HRS operators

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Rough HRS cost p.a., in CHF

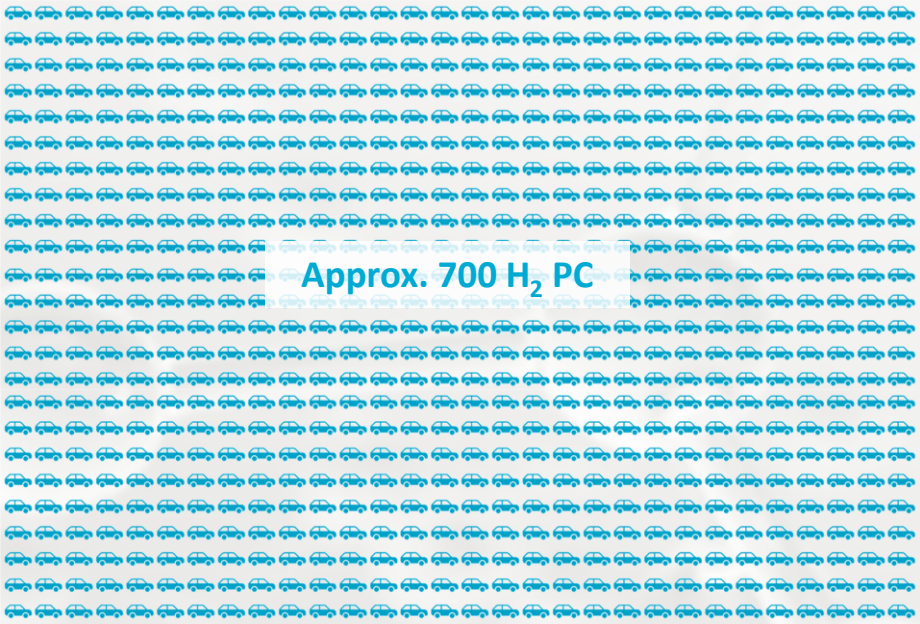
• Depreciation	130’000
• Service	20’000
• Electricity	15’000
• Staff / space	25’000
Total	190’000

CHF 190’000

At 2.0 CHF profit per kg H_2

Sales of 95 ton H_2 per year necessary

Break even bei….



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Fuel cell trucks open up potential for much higher CO_2 reduction

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Introduction of fuel cell trucks will spark investments for national hydrogen infrastructure

H_2 trucks enable economically viable operation of hydrogen refuelling stations

H_2 refuelling infrastructure leads to higher request for H_2 passenger cars

Fuel cell passenger cars will not only save additional CO_2 but also trigger further investments

Higher TCO gap in other European countries

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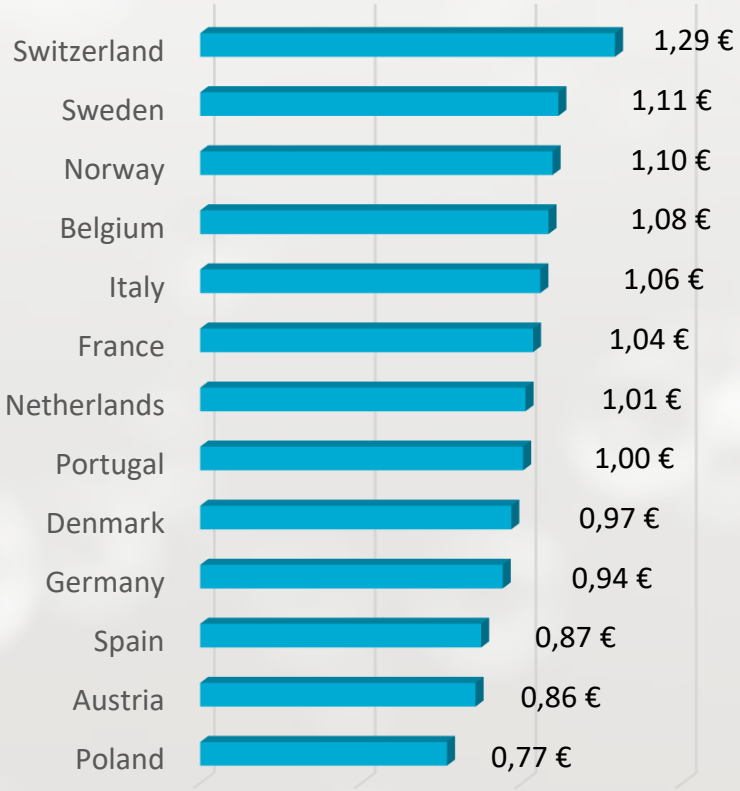
Massive difference in diesel price



CO_2 tax in Switzerland (LSVA)

- Road tax for heavy duty transportation was established already two decades ago
- Depending on km per year and vehicle weight
- Emission free vehicles are exempted from this regulation
- So Switzerland has already a CO_2 tax benefit for ZEV
- Adds up to about 65’000 CHF (about 60’000 EUR)per year

Impact of Diesel cost difference

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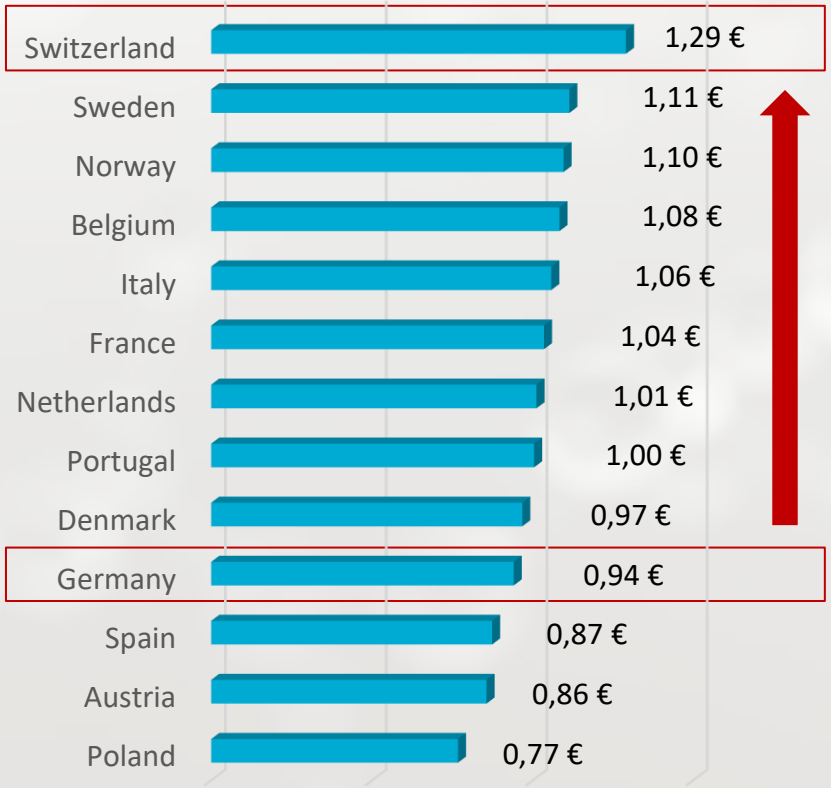
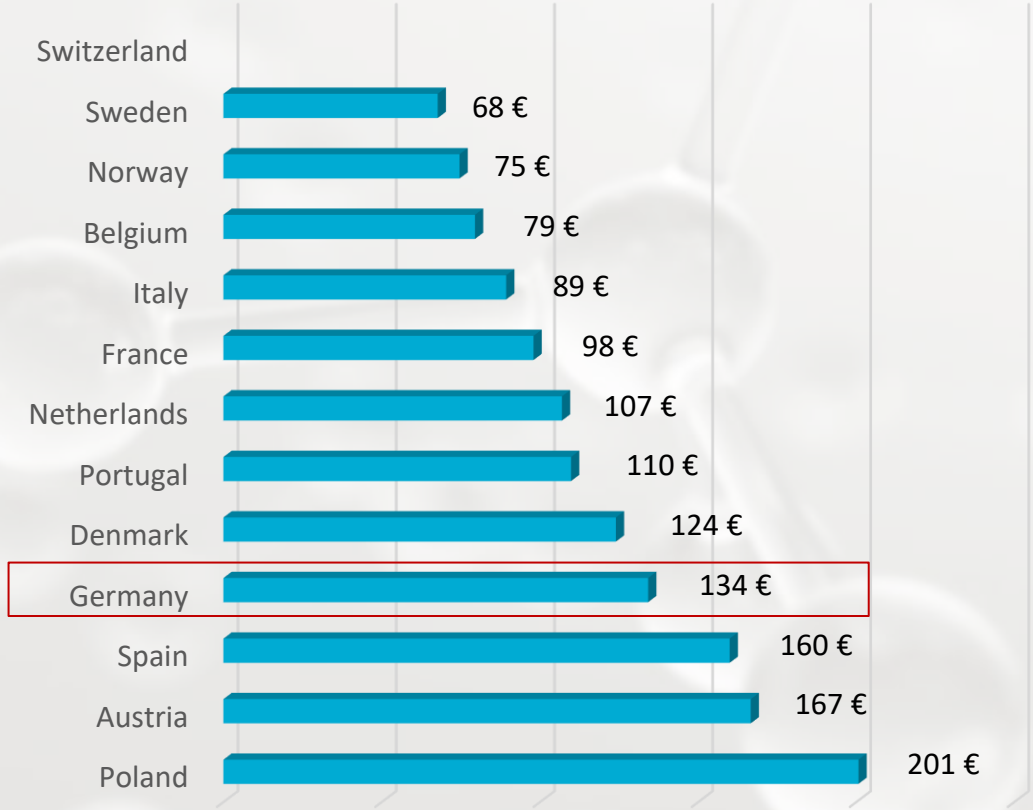
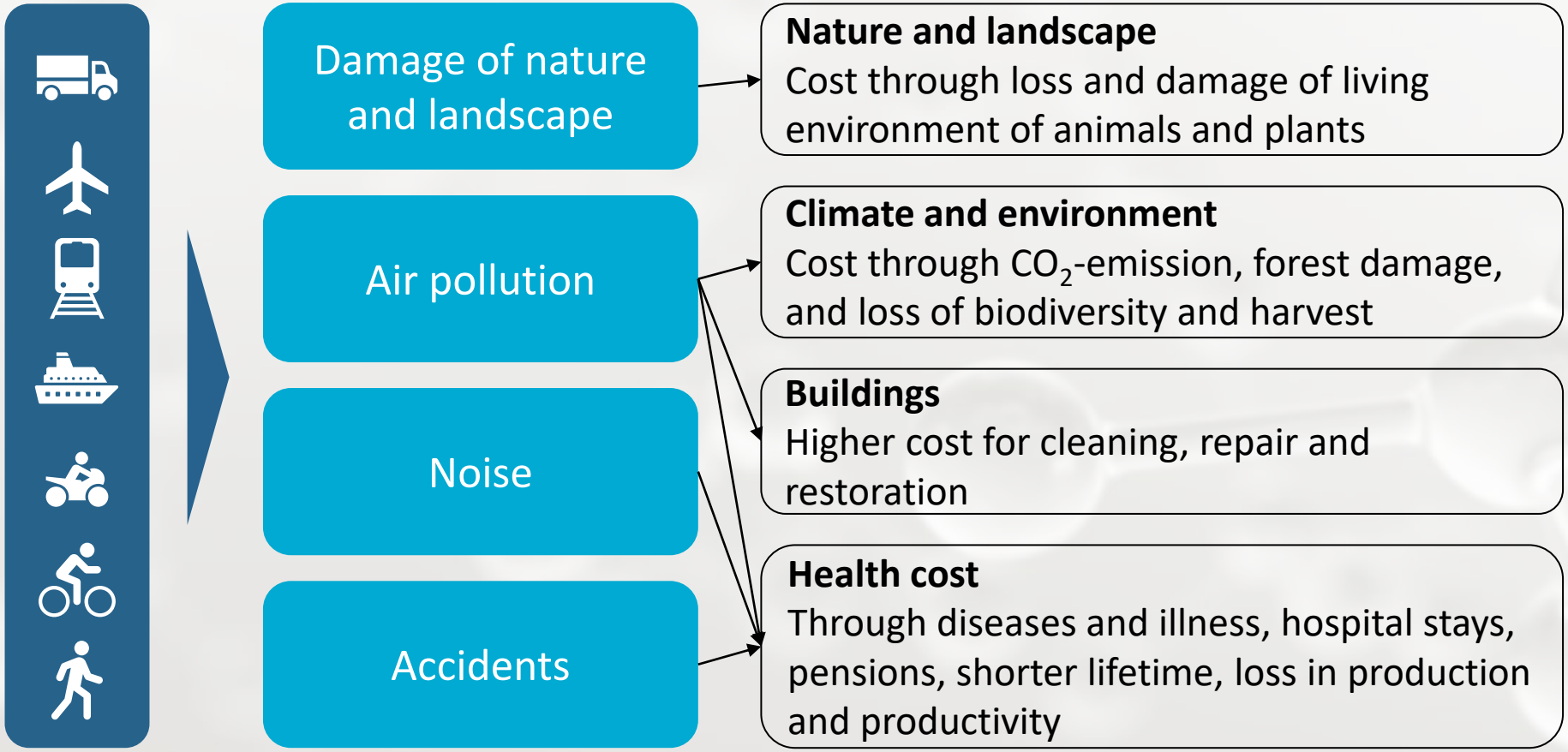
Diesel price per country (in EUR per litre)



Necessary CO2-tax to settle disadvantage compared to Switzerland (in EUR per ton CO2)



External Cost of Traffic



source: Externe Kosten und Nutzen des Verkehrs in der Schweiz, Bundesamt für Raumentwicklung ARE, 2016

Potential for cost reduction through H_2 Trucks

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External cost of heavy duty traffic, Switzerland, 2016

in mil. CHF	**Diesel**	**H_2**
Air pollution	634	5%
Noise	573	50%
Climate	206	5%
Nature and landscape	116	100%
Upstream/downstream processes	142	50%
Accidents	99	100%
Traffic congestion cost	466	100%
Miscellaneous	63	100%
Total	**2'299**	**50%**

- Diesel truck triggers external costs of approx. 270’000 CHF per year (34to truck with 80’000km pa)
- LSVA (Maut)-compensation of just 62’000 CHF p.a.
- H_2 truck with approx. 140’000 CHF less external cost p.a.

source: Externe Kosten und Nutzen des Verkehrs in der Schweiz, Bundesamt für Raumentwicklung ARE, 2016

It must be become more attractive to drive a zero-emission vehicle compared to diesel trucks

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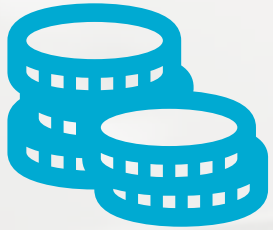
More attractive in usability

- Night driving permit
- Exception from entry restrictions and city bans
- …

Financially more attractive



- Diesel price / CO_2 taxation
- Subsidies that build sustainable stable overall system

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