

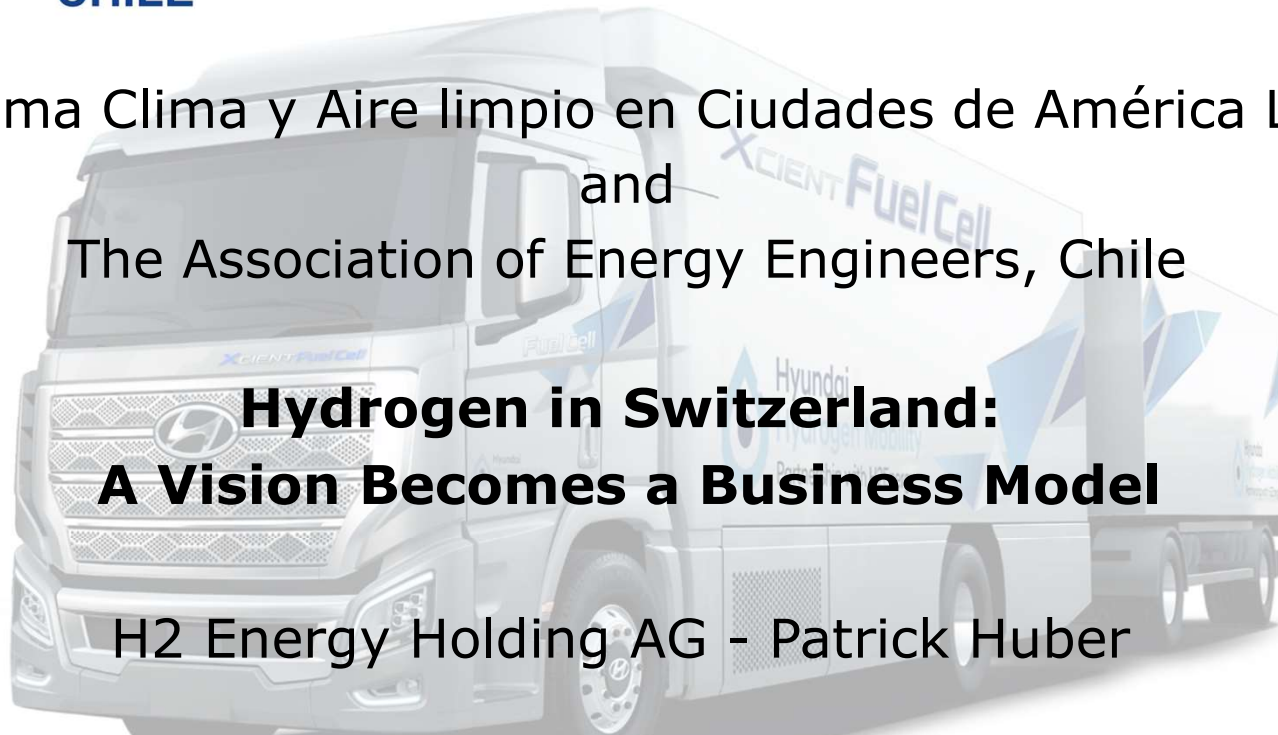


Programa Clima y Aire limpio en Ciudades de América Latina
and
The Association of Energy Engineers, Chile

**Hydrogen in Switzerland:
A Vision Becomes a Business Model**

H2 Energy Holding AG - Patrick Huber

Zurich, March 12, 2021



Agenda

- Introduction
- Coop Hydrogen Cycle
- Pay per Use Model
- Partners and Roles
- External Cost of Heavy-Duty Transportation



Jules Verne's quote on hydrogen

I believe that water will one day be employed as fuel, that hydrogen and oxygen which constitute it, used singly or together, will furnish an inexhaustible source of heat and light, of an intensity of which coal is not capable.

Jules Verne, 1877

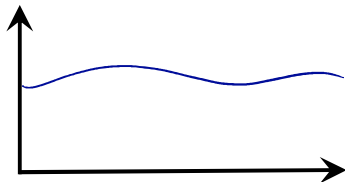


Climate Change - Energy Transition

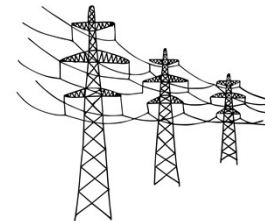
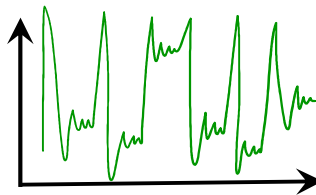


- Emission Reduction/CO₂ (Decarbonisation)
- Energy Transition

Today's system



Renewable Resources



H2 Energy Holding Corporate Profile



Vision

The goal of H2 Energy is nothing less than stopping climate change and to promote hydrogen as supporting pillar of our energy system

Activities

- Fuel Cell Application Engineering
- Power to Gas Engineering
- Hydrogen Refueling Station (HRS) Engineering
- Hydrogen Strategies and Eco-Systems

Entrepreneurs / Partners



Funding

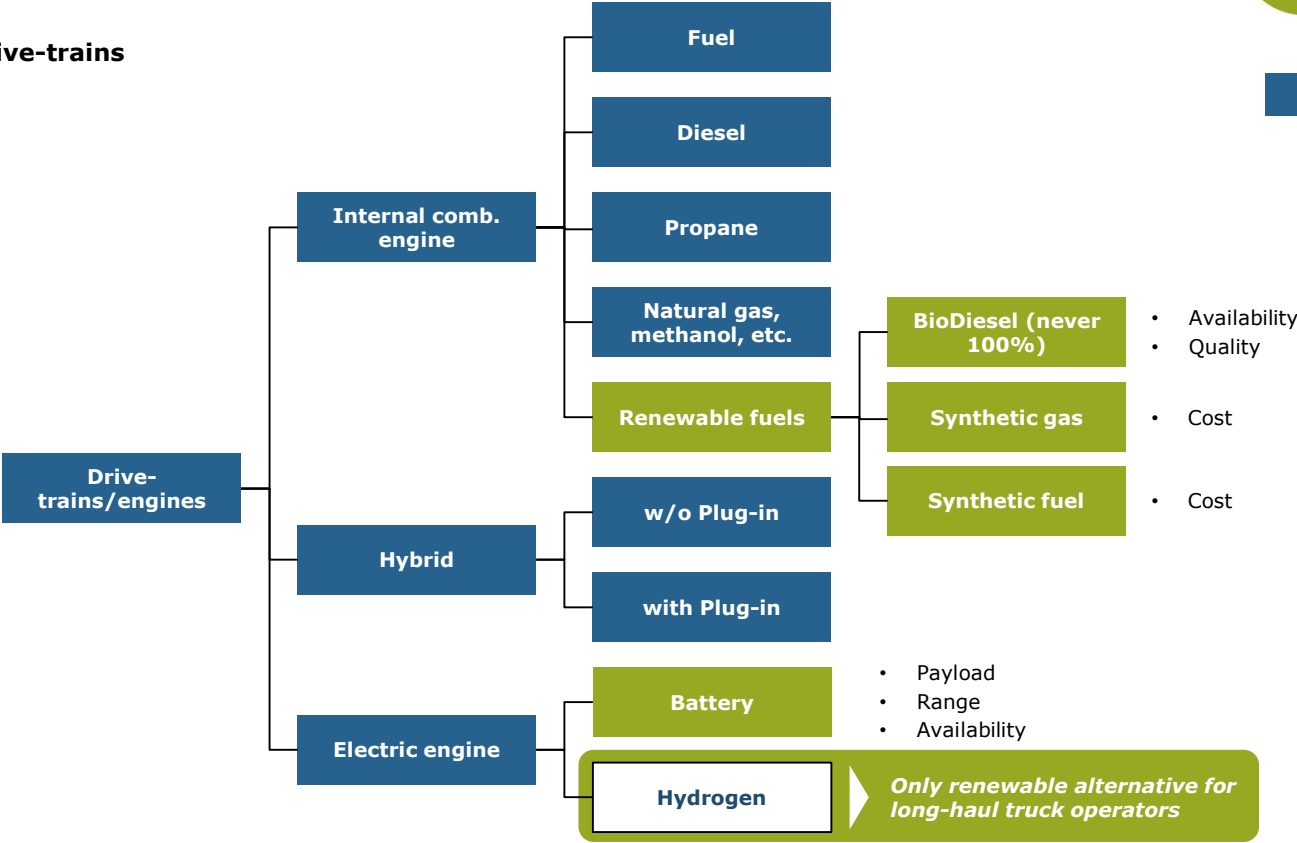
- Self-Funded
- Profitable
- Free of Debt



Hydrogen is only viable non fossil alternative for heavy-duty trucks



Current drive-trains

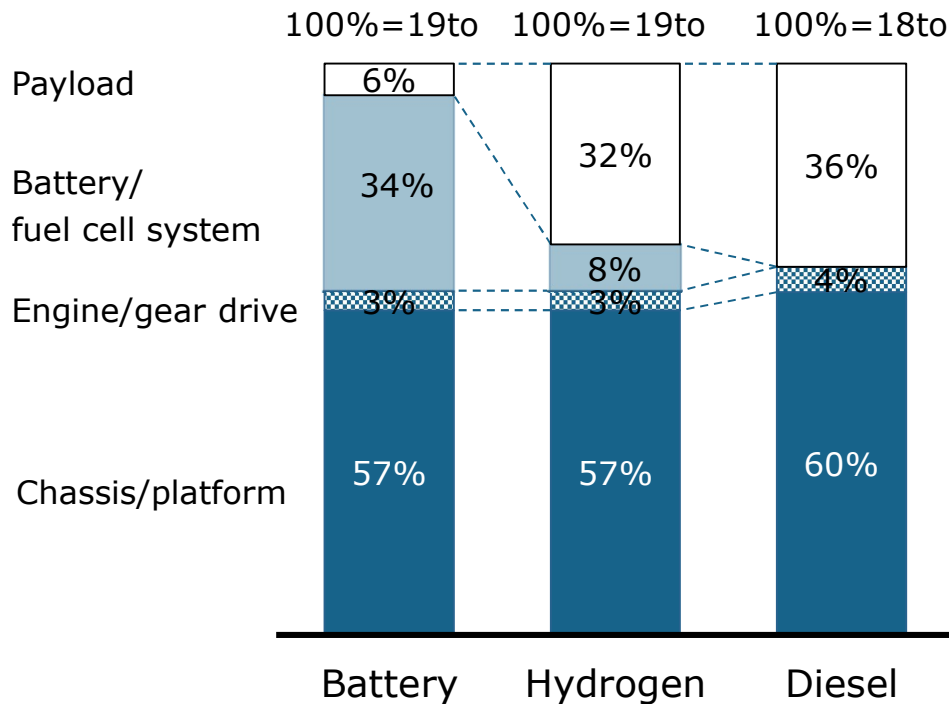


Payload of only one ton for 400km battery electric truck



Weight calculation for 18/19 ton heavy duty rigid vehicle with standard platform and drive train

In Percent



- On May 7, 2017 federal council of Switzerland allows one additional ton of payload for electrified trucks
- Without this decision the battery truck would have zero payload left
- Hydrogen with comparable payload

H2 Energy established Coop hydrogen system – closing the energy cycle



Hydrogen trucks allow fleet operators to decarbonize their logistic and supply chain

Run-of-the-river-plants deliver renewable energy



Delivering to hydrogen refueling stations of Swiss H2 association

PEM electrolyzers transform water and renewable energy into hydrogen

Hydrogen transport

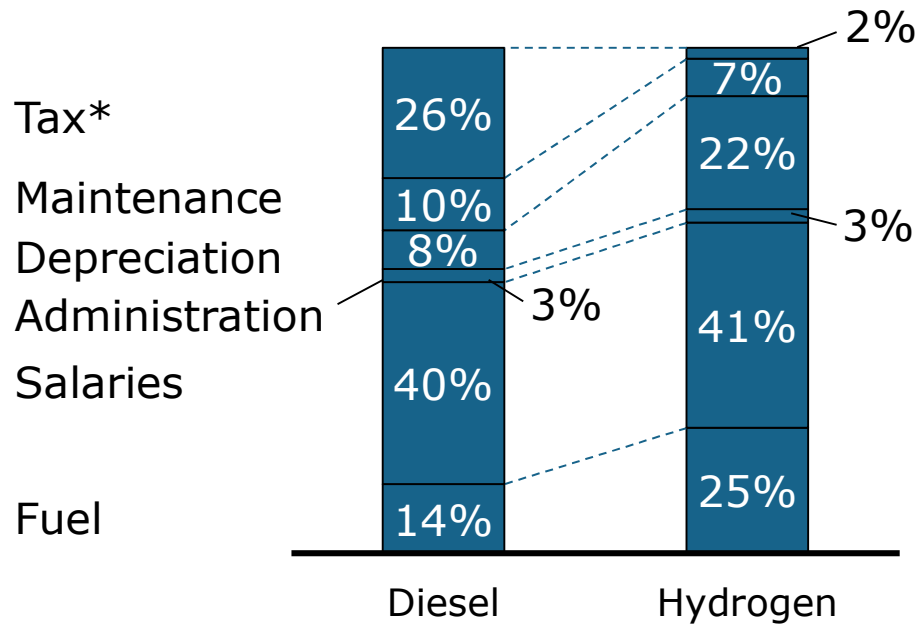
Functioning H₂ Energy hydrogen production plant, Coop HRS and fuel cell truck



LSVA Exemption enables cost party to Diesel



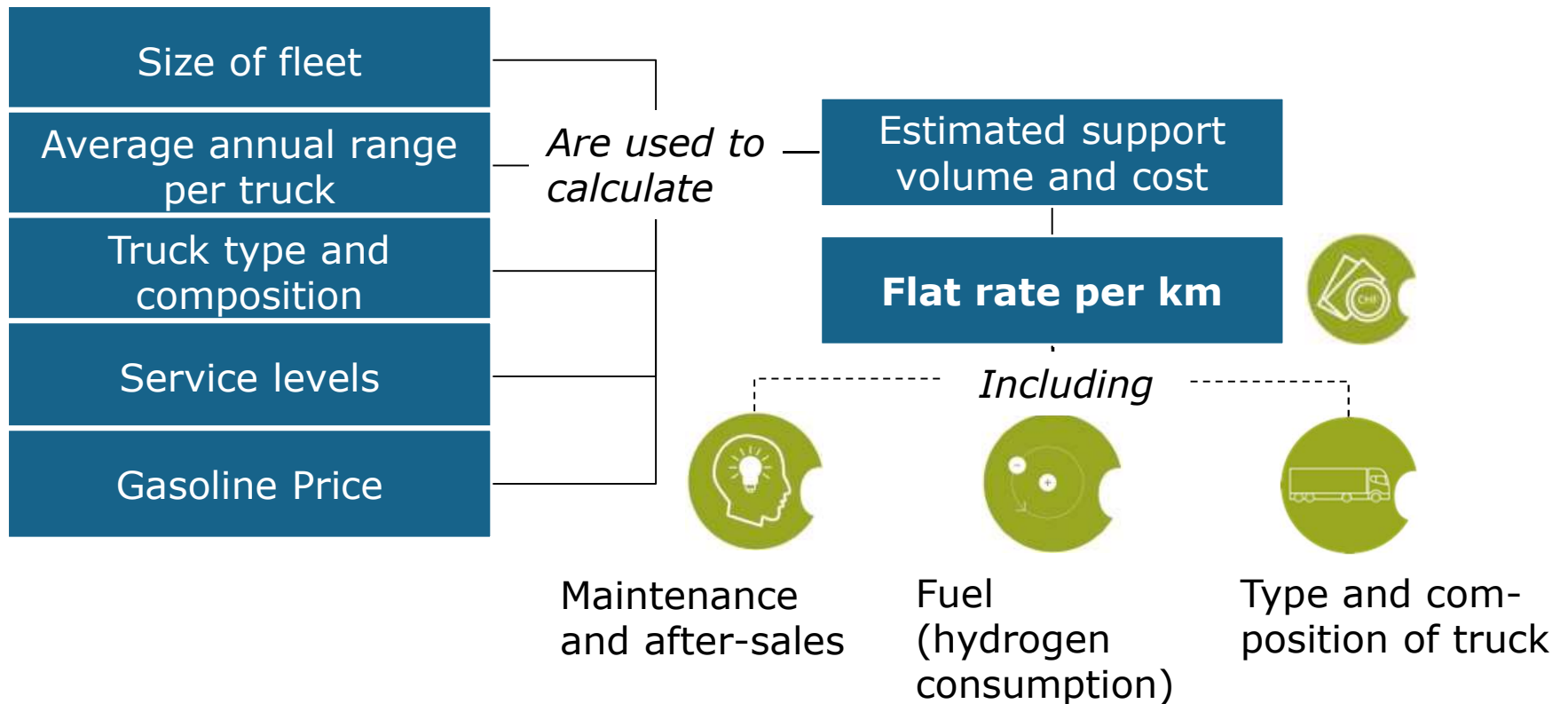
100% approx. 250 kCHF 100% approx. 250 kCHF



- Swiss Heavy-Duty Tax «LSVA» is an «Emission-Tax» going back to the Swiss Alp initiative
- The exemption of «LSVA» offers the opportunity to commercialize emission free heavy-duty trucks in a commercially viable model

* Includes Insurance and Financing costs, Swiss Heavy-Duty Tax «LSVA» for Euro 6 trucks (2.28 Rp./tkm; i.e., 0.91 CHF per km for a 40-ton vehicle)

New pay-per-use business model enables to holistically optimize the "eco-system"



Ecosystem sets the stage for commercial roll-out of heavy-duty trucks



Hyundai | H2 Energy

H2-Truck-Fleet

- Range 400 km
- Total weight 34 t
- 'Pay-per-use' Model

Petrol Station owners – H2 Mobility Association
 Avia, Agrola, Coop/CMA, Migrol, Shell, Socar, Tamoil

H2 Refueling Station
 50 – 100 HRS by 2023



Alpiq | H2 Energy | Linde

Renewable Energy

H2-Production

- 60 MW by 2023
- Decentralised locations

H2-Logistics

Launching plan



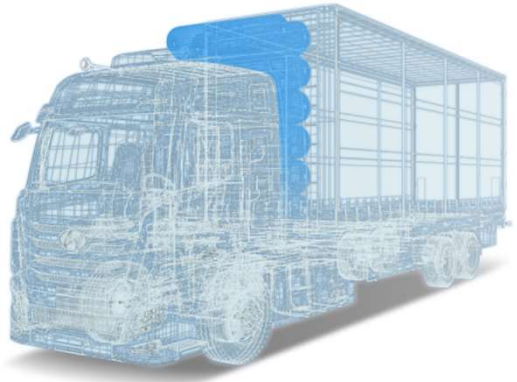
4x2 Fuel Cell
Electric Rigid Truck
Gross Combination
Vehicle Weight : 34 t

6x2 Fuel Cell
Electric Rigid Truck
Gross Combination
Vehicle Weight : 40 t

4x2/6x4 Fuel Cell
Electric Tractor Truck
Gross Combination
Vehicle Weight : 44 t



Roll-out since October
2020 in Switzerland



Starting 2021 in
Switzerland



HDC-6 Neptune US
concept study

Where to launch: "lead-country" strategy



Switzerland

- First H2 trucks end of this year
- 46 trucks currently being rolled out
- Full-roll out starting Q3 2021

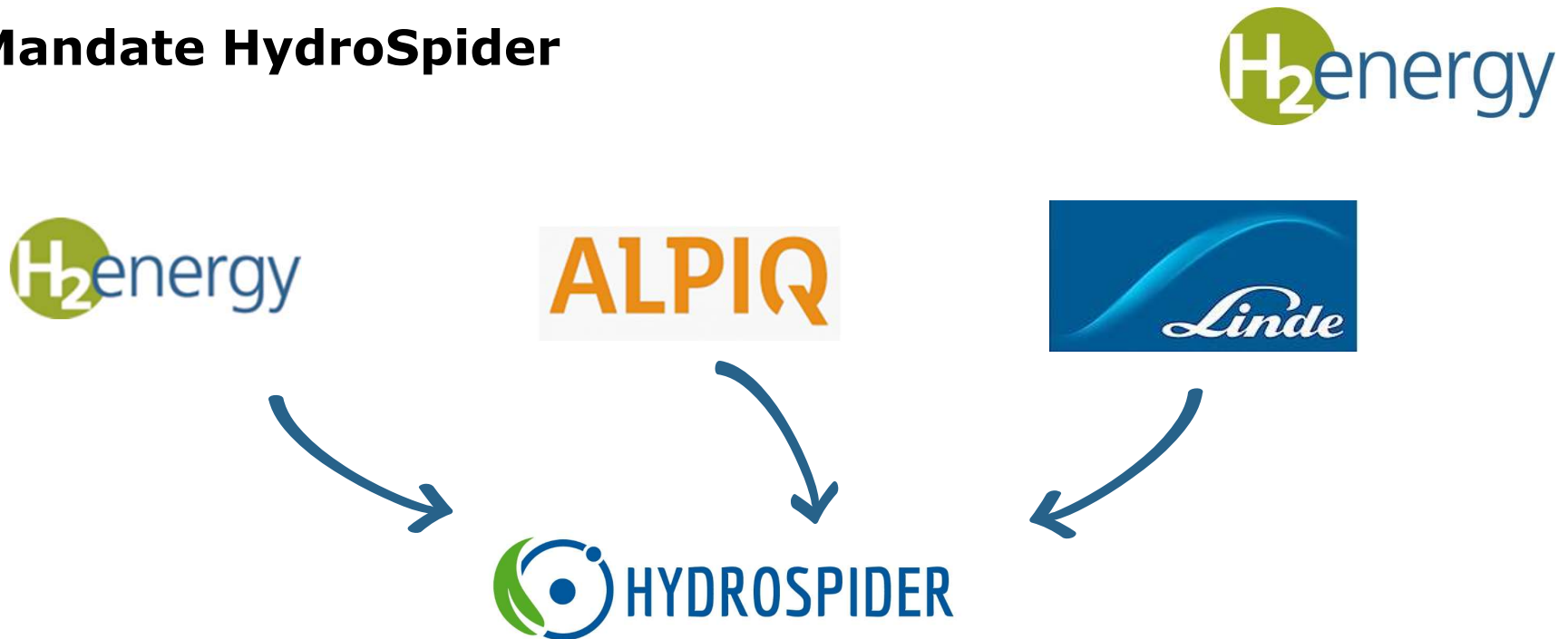
Other European countries

- First H2 trucks in 2021 for two other countries
- Focus areas with min. 250 potential units

First Serial Production Fuel Cell Trucks



Mandate HydroSpider



- Producing and sourcing low cost 'green hydrogen'
- Transparency on origin
- H2 quality – compliant with SAE J 2719

Video on Hydrospider: <https://youtu.be/Je5Ozjfg3g>

**Operational HydrosSpider 2MW Electrolyser
and storage container Switzerland/Gösgen**





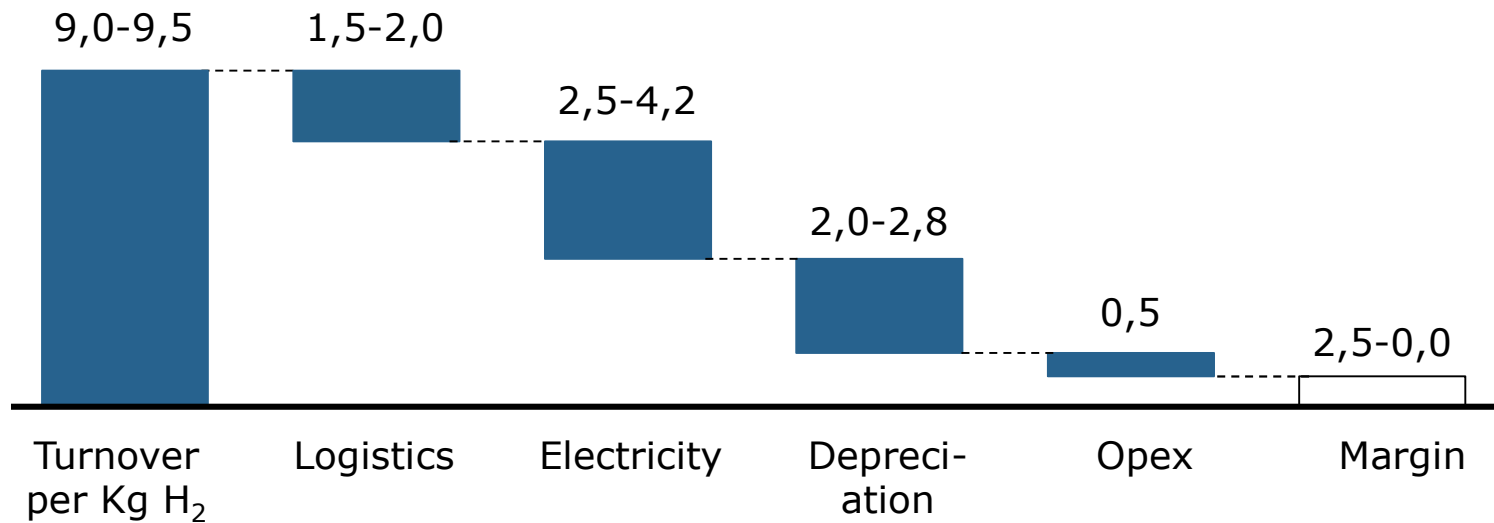
H₂energy

Commercial Incentives for H2 Producers



Financial Planing H2 Provider

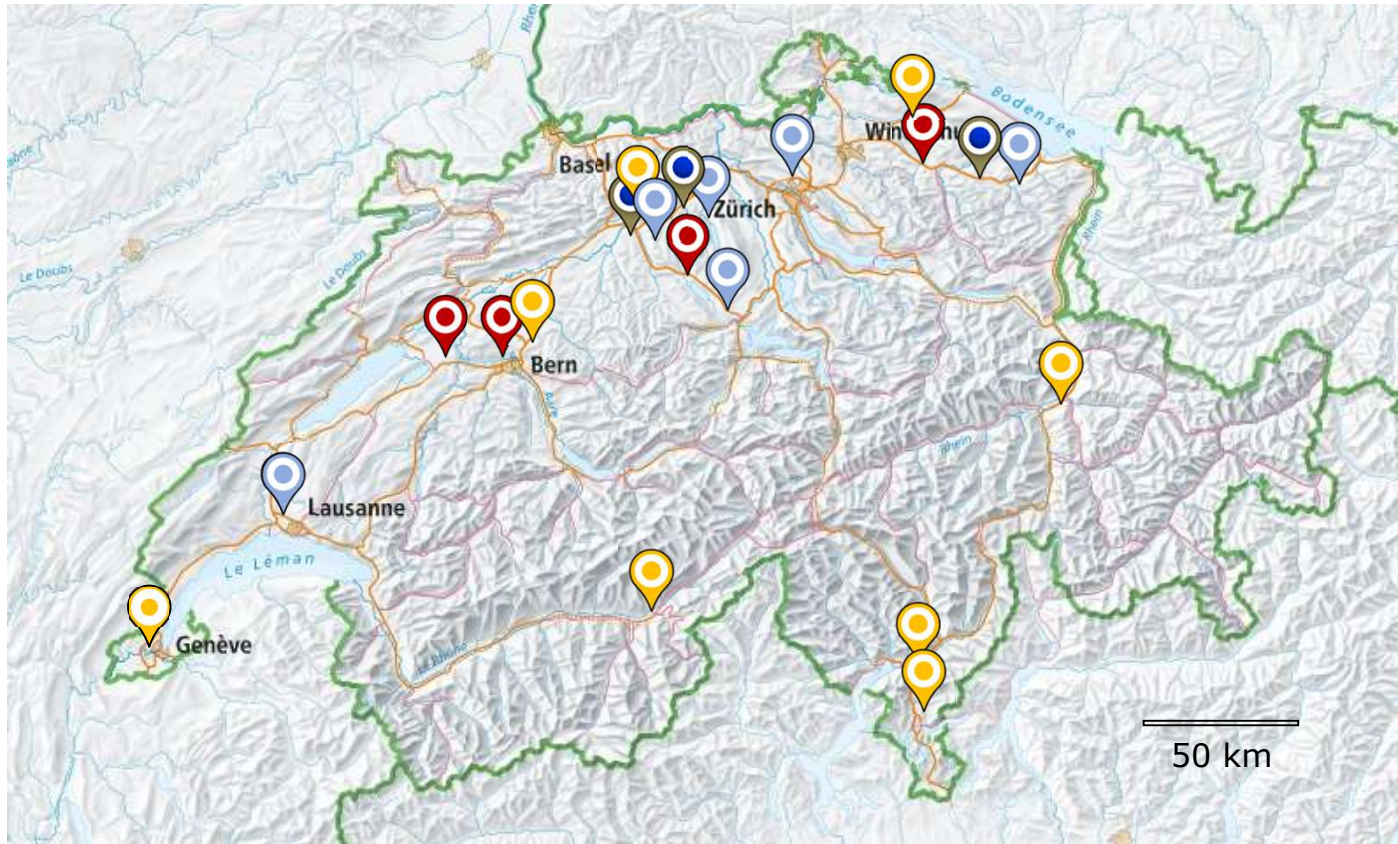
in CHF per Kg Hydrogen (USD/CHF: 0.93)



Association pro H2 mobility Switzerland – not just another hydrogen platform



HRS and PtG Plants Switzerland



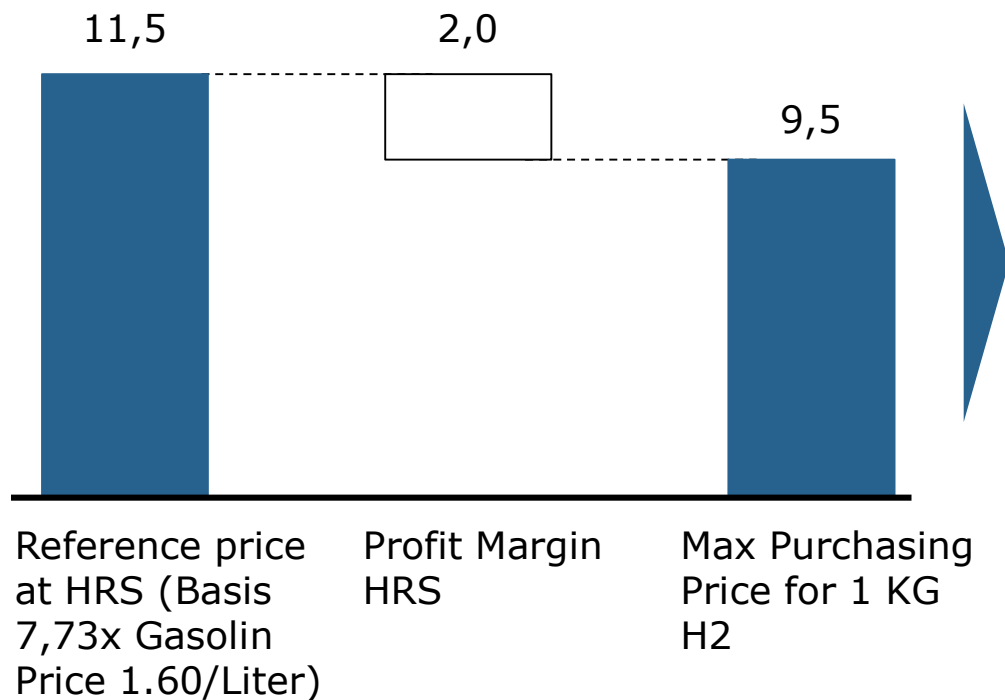
-  Operating HRS
-  HRS to open in 2021
-  HRS to open in 2022
-  Power to Gas plant

Economic incentive for HRS operators



Financial Planing from an HRS view

in CHF per Kg, no VAT



Operating Costs

p.a., in CHF

• Depreciation	130'000
• Service/Admin	20'000
• Electricity	15'000
• Space	25'000
Total	190'000

CHF 190'000 ./ 2,0 = 95 ton

Equates to Break-even @

~ 15 H2 HD Trucks

~ 750 H2 Passenger Cars

Starting with HD H2 trucks makes sense



30-50x more hydrogen p.a. than a car

Optimized utilization of infrastructure

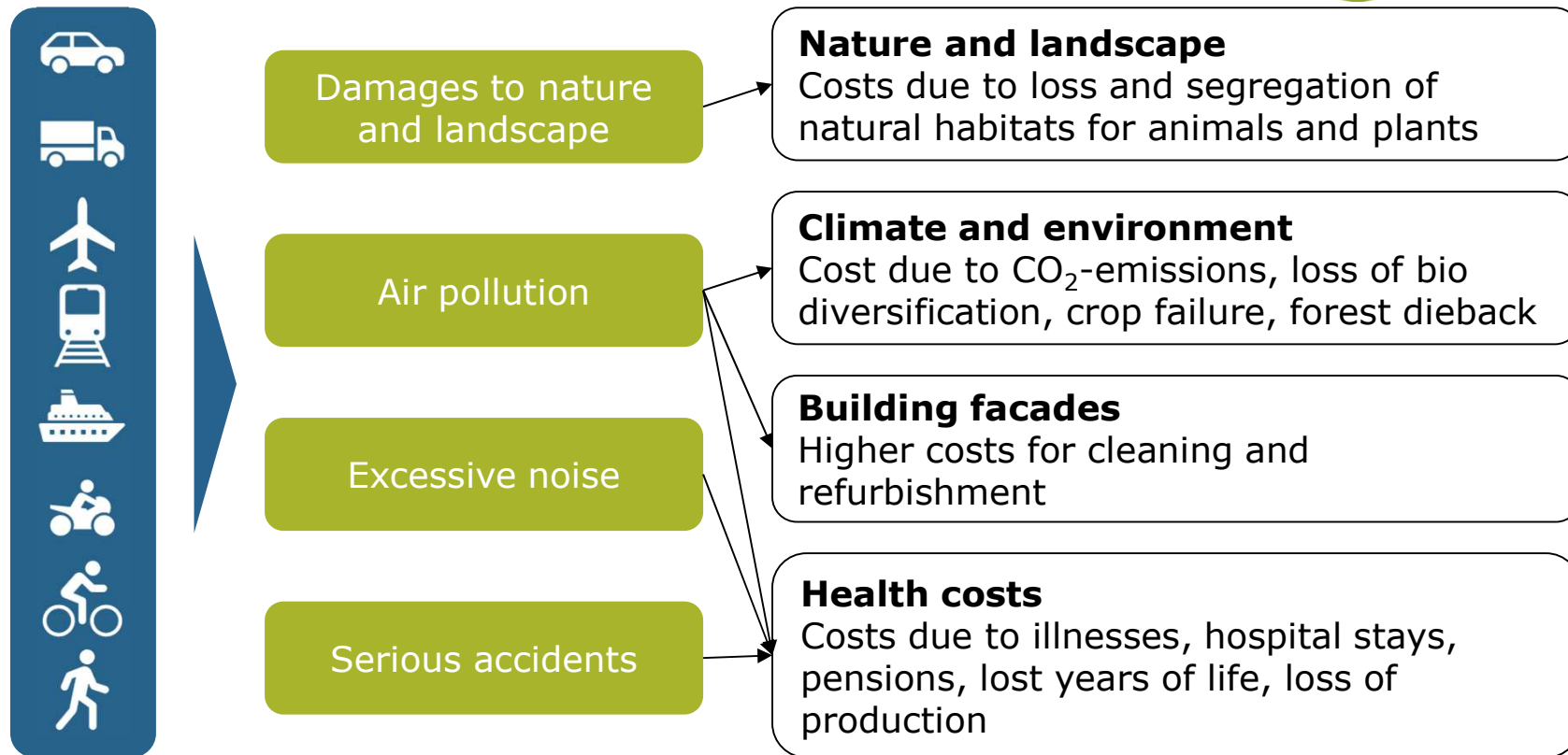
Less expensive technology



Solving chicken-egg dilemma and generating HRS infrastructure

- Pros hydrogen:
- Payload
 - Range
 - Refueling time

External costs of transportation



Source: External costs and benefits of transportation Switzerland, Swiss Department of Spatial Development, ARE, 2016

Cost reduction potential through H2 Trucks

External costs for HD vehicles Switzerland, 2016



In Mio. CHF

	Diesel only	H2 only
Air pollution	634	32
Noise	573	287
Climate	206	10
Nature and landscape	116	116
Up- and downstream proc.	142	71
Casualties	99	99
Congestion costs	466	466
Others	63	63
Total	2'299	1'144

- Diesel truck triggers external costs of around CHF 270,000 per year (34to truck with 80,000km)
- LSVA (toll) cost allocation of CHF 62'000 CHF p.a.
- H2 truck with approx. CHF 140,000 less external costs p.a.

Source: External costs and benefits of transportation Switzerland, Swiss Department of Spatial Development, ARE, 2016

Thank you for your attention!



www.h2energy.ch
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A large, semi-transparent, light blue circular graphic containing the letters 'H2O' in a bold, sans-serif font. The 'H' and '2' are in a darker blue, while the 'O' is in a lighter blue, matching the circle's fill. The background of the slide is a solid dark blue.

H2O