Fleet decarbonisation: lessons from a Swiss local authority

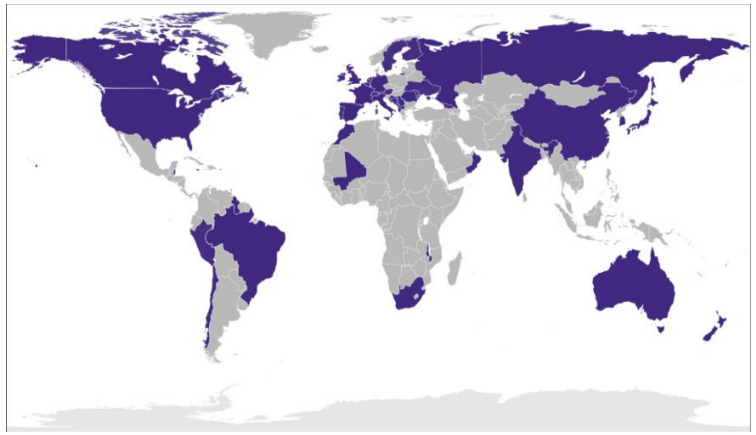
Future Powertrain Conference 2022

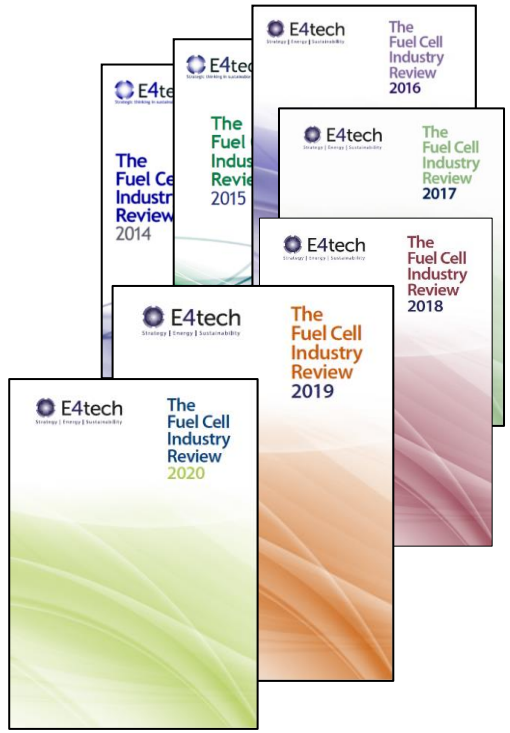
2nd March 2022

E4tech an ERM Group company Strategy | Energy | Sustainability

E4tech perspective: Strategy | Energy | Sustainability

- International consulting firm, UK and Swiss offices
- Focus on sustainable energy, transport and systems
- 24 years old this year
- Deep expertise in technology, business and strategy, market assessment, modelling, policy support…

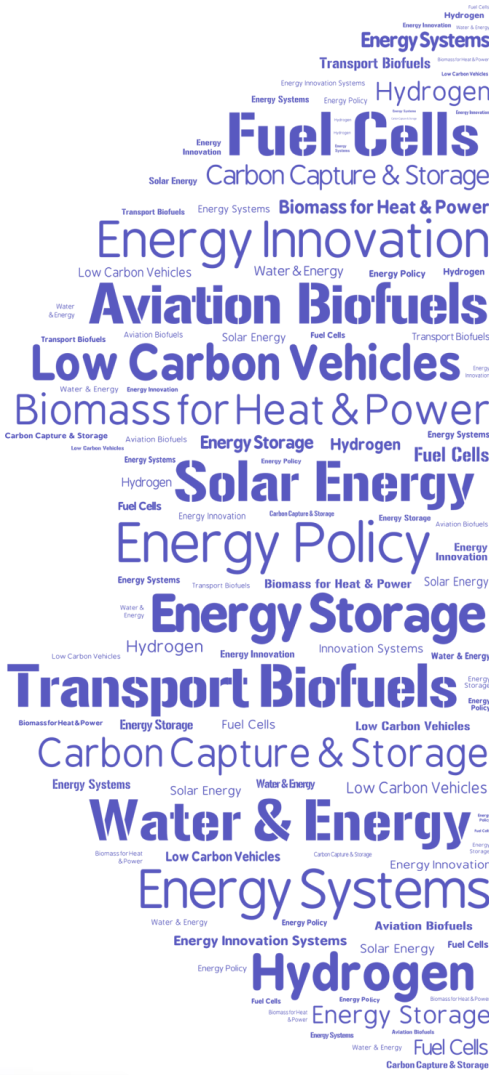




www.FuelCellIndustryReview.com

FUEL CELLS AND HYDROGEN OBSERVATORY

https://www.fchobservatory.eu/



E4tech and Element Energy bring their deep understanding of technology solutions to the increasing number of corporates with decarbonisation plans

Our clients	Solution developers	⇔	Problem owners
What they do	Technology innovators and pioneering adopters		Corporates, national & local governments
Motivation	Growth, revenue, innovation		Compliance, stakeholders, long term shareholder value

ERM Group offer

elementenergy an ERM Group company

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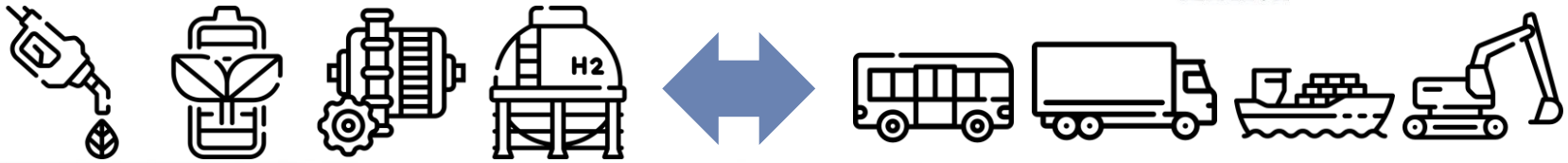
Transport decarbonisation



Local authorities have been the driving force behind decarbonisation and air quality improvement

- Local authorities have been a primary driving force behind low carbon transitions
  - Responsibility to its inhabitants
  - Accountability
  - Access to funding
- Eager to decarbonise and generally understand the low tailpipe emissions solutions
- Uncertainty around solution performance, effectiveness of emissions reduction and cost

The complexity of the problem is evident with regions making significant changes to strategic plans for solutions as technology matures

- BEV or FCEV? Montpellier makes a tough choice to change its plans

- In 2019 FC buses and hydrogen intended to serve 4 lines with a high level of service
  - Part of a regional drive towards a hydrogen sector

- High operating costs caused the u-turn to BEVs in 2022

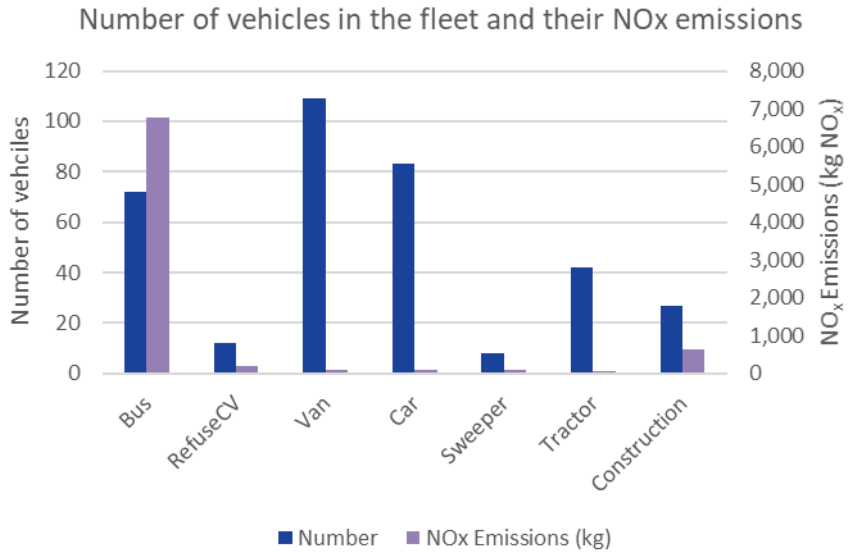
- Subtleties of the operation are the important factor
  - Ensure free public transport for residents
  - Unsupported operating costs and funded capital costs

A Swiss local authority wanted us to plan a hydrogen fleet roll out; instead we took a broader approach

- A fleet of over 350 vehicles, 7 major types with various operating profiles

- Options available to reduce its emissions:
  - Biofuel blends
  - Hybrid electric
  - Battery electric
  - Hydrogen fuel cell electric

- Evaluated against criteria important to the LA:
  - Cost (CapEx and OpEx)
  - Emissions, (TTW only)



Existing fleet characteristics	
Diesel (L/year)	1,800,000
Petrol (L/year)	90,000
CO2 (tCO2e/year)	5,050
NOx (kg)	7,750*
PM(kg)	160*

*__8%__ of NOx and __37%__ PM from 27 construction vehicles alone

Biofuels reduce CO2 emissions by 5% with the existing fleet. Whilst ZEVs are costly, lower OpEx for BEVs makes for a shorter payback than FCEVs

- 5% and 25% reduction in TtW emissions for biofuel and hybrid

- 5 and 8 mGBP premium for BEV and FCEV*
- ~1.25 mGBP for H2 refuelling infrastructure
- ~2 mGBP for charging infrastructure
  - Not including additional cost of grid infrastructure

- 100% increase in OpEx for hydrogen
- 50% decrease in OpEx for electric
  - Could quickly pay for the cost of infrastructure

	Direct emissions			Costs		
	t CO2 e/a	kg NOx /a	kg PM/a	Vehicle (mGBP)	Energy (kGBP/a)	Infrastructure (mGBP)
Existing ICE fleet	5,050	7,750	160	41	2,025	0
ICE and biofuels	4,800	7,900	150	41	2,025	0
Hybrid vehciles	3,800	5,900	120	41	1,550	0
Battery electric	0	0	0	46	950	2 to 6
Hydrogen fuel cell	0	0	0	49	3,000	1.25 to 4.5

* based on existing product examples where available (but not commercially prices)

The results over simplify the system, two major operators with different objectives and a variety of use cases need managing to optimise the system

- The solution is sensitive to factors surrounding the Swiss region

1) Ability to manage the fleet

System structure

- Two fleet operators
- 7 different vehicle types
- Many more operating profiles
- Variability of demand

Poor management

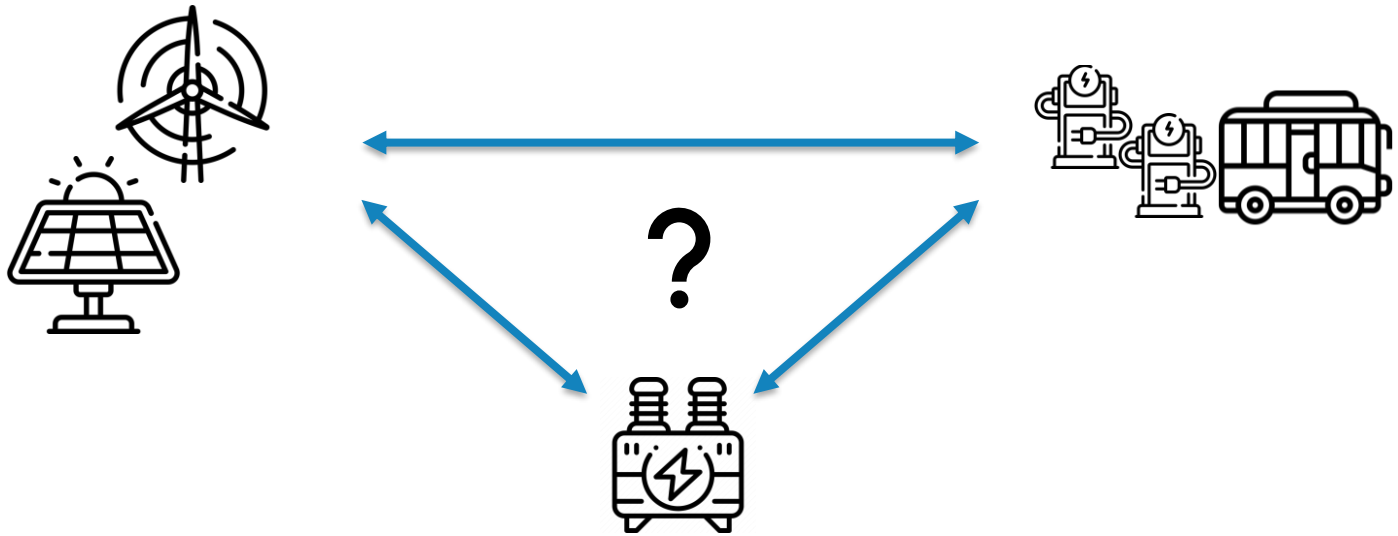
The potential result

- 3 x power requirements and CapEx for infrastructure
- Lower vehicle utilisation
- Additional vehicles in fleet

The subtleties of the Swiss region must be taken into account to appropriately evaluate the true costs and sustainability of solutions

2) Local configuration of existing infrastructure

- Proximity to and capacity of substations at depots
- Space to park vehicles for longer periods
- Access to low cost, low carbon energy



Higher energy consumption in one route may tip the balance to FCEVs being more suited, redefining the input conditions for the optimal system design

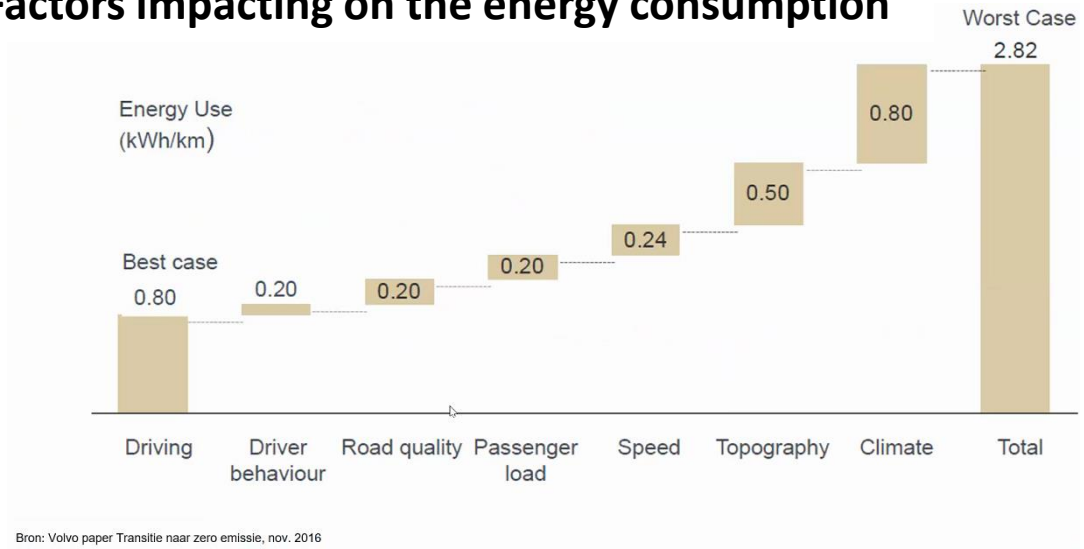
3) Environmental impacts and constraints

- Hilly routes and cold climates can more than double energy consumption

- A single route may no longer be possible to simply replace with BEV and regular charging
  - Multiple vehicles or more frequent pack cycling
  - Shift high utility bus routes to a hydrogen FCEV solution to achieve autonomy

- Specific decisions impact on the system design needing iterations that may favour a mixed fleet

Factors impacting on the energy consumption



Bron: Volvo paper Transitie naar zero emissie, nov. 2016

Net-zero ambitions are not without their risks. We need to assess each fleet on a case-by-case basis, its requirements and its regional influences

- Significant shift to a net-zero mindset, the next steps are how to achieve it
- Understanding the ambitions of all stakeholders and the needs of each operator is a key early step
- For most road transportation, batteries appear to be the lowest cost zero-tailpipe emissions solution
- But hydrogen can play a role, especially if on-board energy demands are high
- Biofuels and hybrids will still have a near-term role to play
- Local authorities are leading the way and those watching are learning from their trials
- Optimisation needs to be based on real world telematics data and the impacts of local conditions
- Specific requirements can drive more significant system level decisions

Thank you

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