Zero Emissions Technology for Airport Snow Removal Equipment

Airport & Municipal Days 2024 | September 4-5, 2024

Dolf Strydom | VP Group Technology Airport | Aebi Schmidt Group

Agenda

1. The Platform for Airport Snow removal
2. What are the alternatives to diesel powered Airport Snow removal?
3. A practical evaluation of the technologies for the Application
4. Potential technology partners
5. Airport Infrastructure requirement for H2
6. Technology roadmap for H2 Airport Snow Removal
7. Battery Electric applications for Airport machines

1. Typical Application

Focus for this Technology Update: Large Airport Snow Removal Equipment.
Alternative Fuels like HVO and Liquid Propane is available in Europe and North America.

European Market:

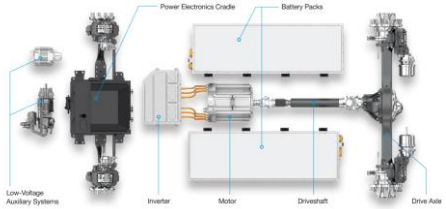
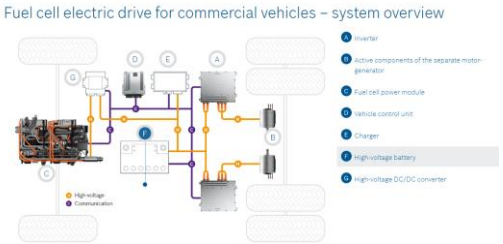
Schmidt Towed Jet Sweeper (TJS)
with airport plow

North American Market:

MB5C Multi Tasking Equipment (MTE)

2. Applicable Zero Emissions Technology

Battery Electric and Hydrogen systems are the options available for low or zero emission technologies.

	Battery Electric systems	Hydrogen systems	
		Hydrogen Fuel Cell Electric (HFCE)	**Hydrogen Internal Combustion Engine (HICE)**
			
Technical comments	▪ Low Energy density ▪ Machine weight high ▪ Low temp. penalty in energy density ▪ Long recharge times	▪ Energy density 3x compared to diesel fuel by weight ▪ Energy Density 1/3 by volume compared to diesel	▪ HICE requires the rework of Industrial diesel engines to function ▪ Several Engine OEM are developing
Infrastructure	▪ 8 Machines require 4MW to charge in 3hrs ▪ Not supported by existing grid capacity	▪ Hydrogen delivery like diesel ▪ Generated on site through Electrolysis ▪ Is a by-product of oil and gas exploration and refinery	

3. Zero Emissions Technology: Practical Evaluation

Hydrogen systems are better than Battery Electric systems, based on sustainability, technical and business assessment.

Zero Emissions Technology Evaluation

	Criteria	Diesel (baseline)	Battery Electric systems	Hydrogen systems
Sustainability assessment	CO_2 emission	1,620 kg	0 kg*	0 kg* (70% less NOx)
Technical assessment	Compactness	600 liter	12,800 liter	2,000 liter
	System Weight	516 kg	23,930 kg	191 kg
	Refueling time	20 min	4 hours	20 min
	R&D Effort	N/A	Long	Medium
	Cold weather	Good	Bad	Medium
	Required Infrastructure	Gas Station	Electric Grid	H_2 Station
Business assessment	Cost	Low	High	Medium
	Customer acceptability	Baseline	Low	Good

Legend: Favorable alternative to diesel | Worse than Diesel but still a viable option | Not viable for a plow application

Recommendation

The **team recommendation is hydrogen systems** as the mid-long-term solution

Commentary

Even if battery weight is cut in half, system weight and infrastructure will still be a challenge.

* Assuming creation from non-fossil fuels.

4. Potential Technology partners

Several OEMs developing Hydrogen ICE technology.

CAT

- Developing - Hydrogen Engines
- Engine size C13D – Good match for SRE
- Time frame: Availability 2026

Volvo Penta

- Developing a Hybrid fuel, Hydrogen Diesel Option
- Target Engine – D8 – Low Power

Deutz

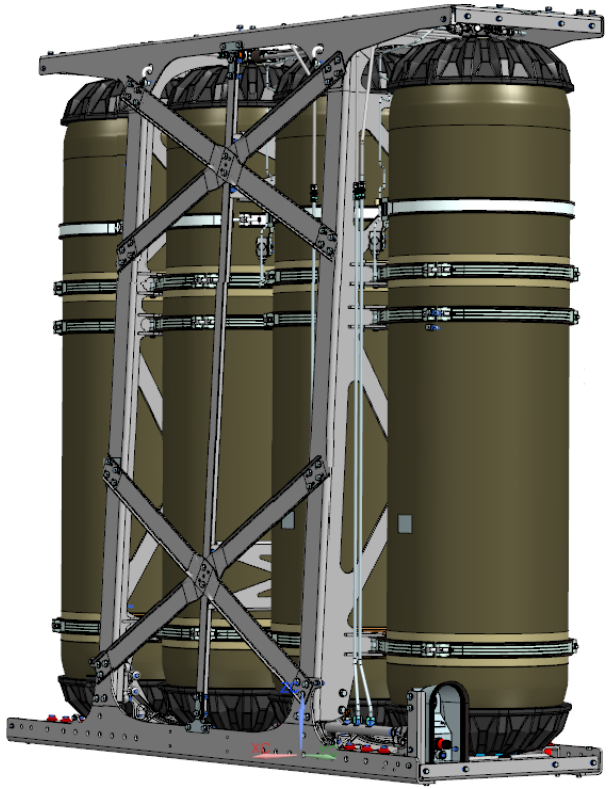
- Deutz TCG 7.8 H_2 available
- Engine generates 220kW/300hp

Cummins

- Developing Clean Hydrogen Engines
- X15 – Feasible for SRE at 395kW / 530hp
- Published X15 engine production start - 2027

4. Technology Partners for the On-Board Fuel system

Several OEMs are offering Hydrogen Fuel system ICE technology for mobile applications .



Safety testing

5. Airport Infrastructure

There are several suppliers for Hydrogen Electrolyzer substations.

- Truck Refueling time 15 – 30min
- Generation throughout the year – Eliminates peak demand
- Relatively small footprint – 12.2m x 2.5m (40ft) container
- Scalable power consumption 50kW – 500kW

On-Site
Hydrogen Refueling

6. Zero-Emissions H_2 Technology Roadmap

Hydrogen Internal Combustion most suitable for airport snow removal. Market introduction dictated by engine availability.

Technology	Timeline and Recommendation					Comments
	2024	2025	2026	2027	2028	
Technology demonstrator Hydrogen ICE (Germany)	Evaluation for TJS 420	Execute R&D project		Larger machines		Hydrogen ICE has the shortest time to market (Deutz). ▪ TJS 420 – Tech demonstrator. ▪ Selected for engine availability
Larger Hydrogen ICE (US)			**Move to larger machines as engines become available** Feasibility	R&D design and Proto build		▪ Technology partner with CAT Hydrogen ICE program. ▪ Cummins X15– Option II ▪ Suitable platform TBD (MB5/MB5C/MB2)

Legend: Technology evaluation phase Implementation phase

7. Battery Electric Applications for Airport

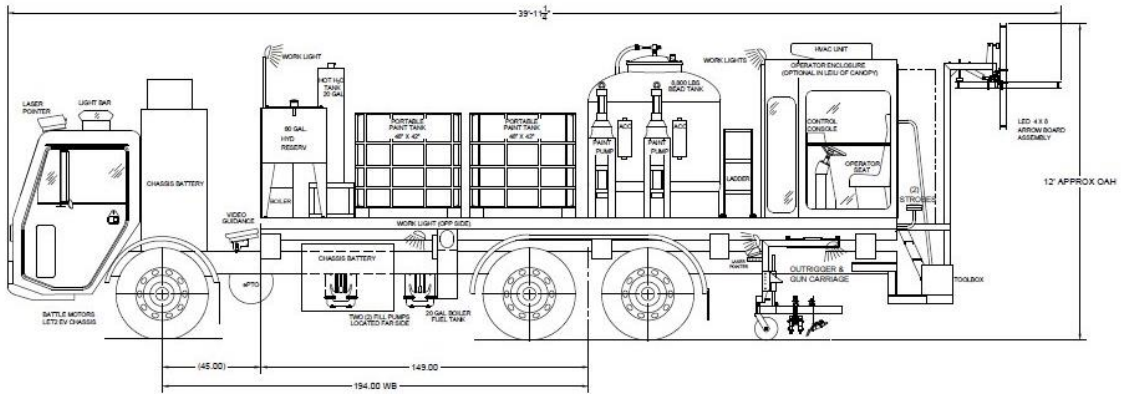
Battery Electric energy systems work well when you do not need to push a snowplow.

Schmidt eAS 990 Airport Sweeper

Basic Description:

- Hopper Volume – 9.5 m^3
- ePTO Sweeping unit
- Battery capacity 500 kWh +
- Sweep speed – 20 km/h

MB Airless MAXI-1,000 A



Basic Description:

- Battery: 400 kWh
- Paint 6.5 hrs @ 8 km/h
- Striping range: ± 48 km
- Paint: 4 totes– 3,800 l
- Glass Beads: 4,000 kg
- Paint width: 1.2m
- Availability – Q3 2025

7. Battery Electric Applications for Airport

Battery Electric energy systems work well when you do not need to push a snowplow.

Schmidt eASP Airport Sprayer

Basic Description:

- Volvo FM 62R Electric truck with ePTO interface
- 11,000 Liter capacity
- Spray speed up to 45 km/h
- Spray width: 24 m (up to 30 m)
- Availability Q4 2024
- Testing 2024/25 season at Avinor in Norway

Questions? Comments? Feedback?

aebi schmidt
group

Thank you for your time and interest!