Electric Vehicle Applications of flow batteries

Rapid recharging of EV’s by electrolyte exchange

Sir John Samuel

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Flow batteries are unique
The most practical route from Renewable Energy to Road Transport

• Rapid and safe recharging by electrolyte exchange
• Well to wheel efficiency four times better than Hydrogen as a fuel
• Flow battery road fuel is untaxed, totally recycled, zero emission at point of use
• Proprietary technology will be applied first to city busses – later to postal and delivery vans, taxis..
• Costs are lowest in advanced battery field and lower than hydrocarbon fuels

• Improved energy and power density electrolyte could open a $25Bn market...

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UK City transport - Energy & Operations

BLUE = DAILY ENERGY USE kWh,
RED = OPERATING (Hours x10)
GREEN = DOWNTIME (Hours x 10)

Commuter car
Postal Vans
Taxis
City Buses

E per day kWh
Operating hours x10
Downtime hours x 10

REDT
UK City transport - Energy & Operations
Recharge or Refuel?

Commuter car
Postal Vans
Taxis
City Buses

- Overnight 3kW
- Boost 50kW
- Flow Battery Refuelling @300kW
- Flow Battery Refuelling @600kW

- E per day kWh
- Operating hours x10
- Downtime hours x10

REDT
Boost charge concept vehicle
Wavedriver® Battery Electric Van – Royal Mail, London

- Lead Acid (VRLA)
- On board 50 kW fast charger
- 250V 3 phase feed
- 80% recovery in 1 hour
- Overnight slow charge
- Developed by EA Technology
Modec electric delivery van

• NaS or Lithium powered – 130km autonomy
• One charge per day in normal operation
• Diesel equivalent road performance
• Battery depreciation is main cost element
Vanadium in vehicles

Here is where it all started. Maria’s flow battery technology at UNSW; her Vanadium powered golf cart was an inspiration to us all....
Refuelling Station Schematic
Vanadium Redox Flow Battery (VRFB) technology

- Digital LCD Display
- Recharge Stack
- Catholyte 300L
- Ground Plane
- Anolyte 300L
- Internal 4 Way Hose Retraction
- Pumps & Valving
- Power & Electronics Controls
- Dry-Break Coupling
- Mains Power Feed

REDT
ECOBUS FEASIBILITY STUDY

120kW electric 20 seat bus operating in Milan, Bologna, Rome with frequent opportunity charging

- Flow battery would replace 50kWh PbA battery
- Hybrid system: VRFB 50kW stack + 70kW PbA buffer
- 40kWh electrolyte – 2 x 625L tanks – 30 km autonomy
- 5/10 minute refuelling, off-peak or renewable power
- 24 hour operations, low cost, zero emissions at point of use
Battery depreciation -
the operating cost driver for electric city vehicles

Lifetime cost per kWh in US Dollars

Ref: Sandia National Labs, Energy Storage Association, EPRI, NGK, Refuel Tech.
Flow batteries into the future

Our vision of the future – the stand alone zero carbon community

A concept extending renewable energy beyond village power into agriculture, marine propulsion, electric railway locomotives......