

Emerging Battery Technologies

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Electric
Mobility
Canada

Mobilité
électrique
Canada

The Renaissance of Nickel Zinc Batteries

- Recent Developments
- Emphasize Lowering Cost per KWh + Safety
- Make 150 mile range pure EV affordable
- NiZn price performance advantage makes it a contender

Why NiZn Now?

- 1899 NiCd Jungner
- 1900 NiFe Edison
- 1901 NiZn Michaelowski
- 1901 to 2000 Many attempts failed to manufacture dendrite free NiZn Battery
- 2000 eVionyx unreduced its proprietary Membrane to suppress dendrite in NiZn batteries and Zinc Air fuel cells.
- 2005 NiZn manufacturing pilot line established.
- 2005 Xellerion, a new company was established to focus on NiZn commercialization

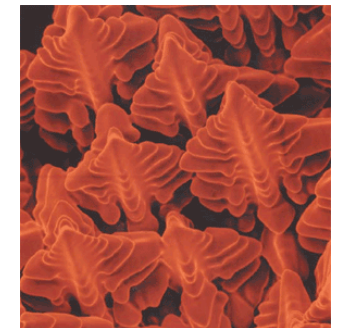
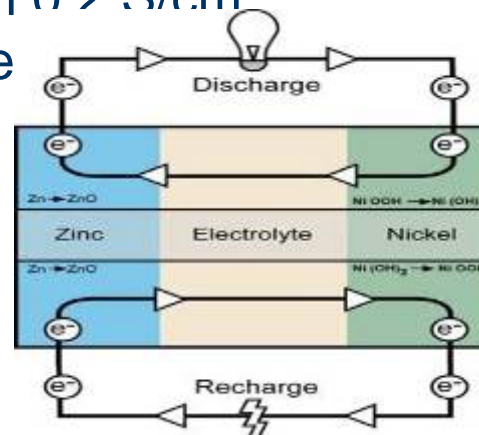
Why NiZn Now?

eVionyx/Xellerion Overcome the Hurdles

- Developments in stabilizing the zinc electrode in alkaline electrolyte has reduced its solubility
- Membrion™, patented solid state membrane, is proven to inhibit dendrite growth during the recharge process

Membrion Features:

- Conductivity is higher than 0.2 S/cm
 - Effective in blocking Zn de
- achieve high cycle life.



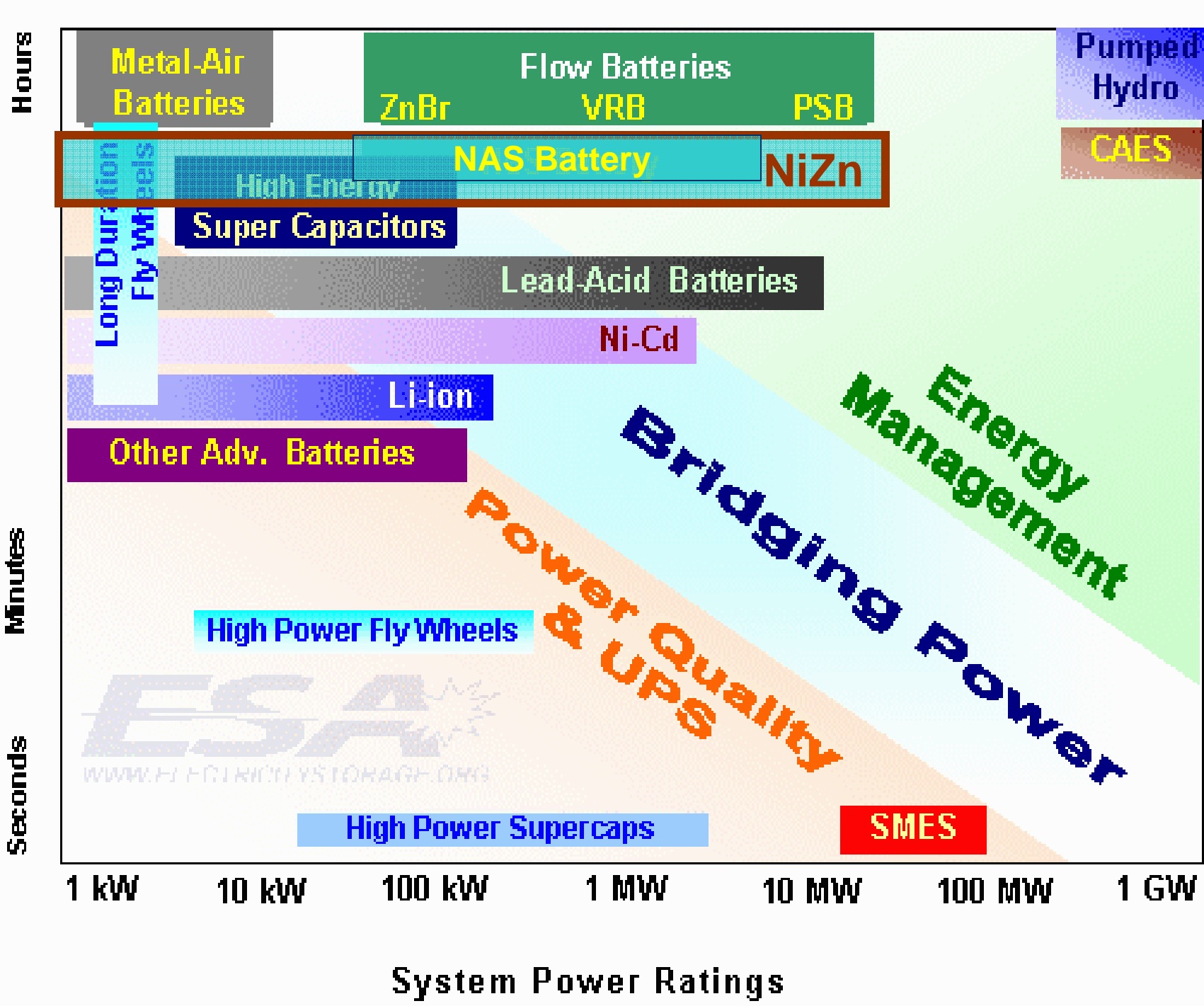
Picture of Zn Dendrite which causes short circuiting

Why NiZn Now?

Great Characteristics

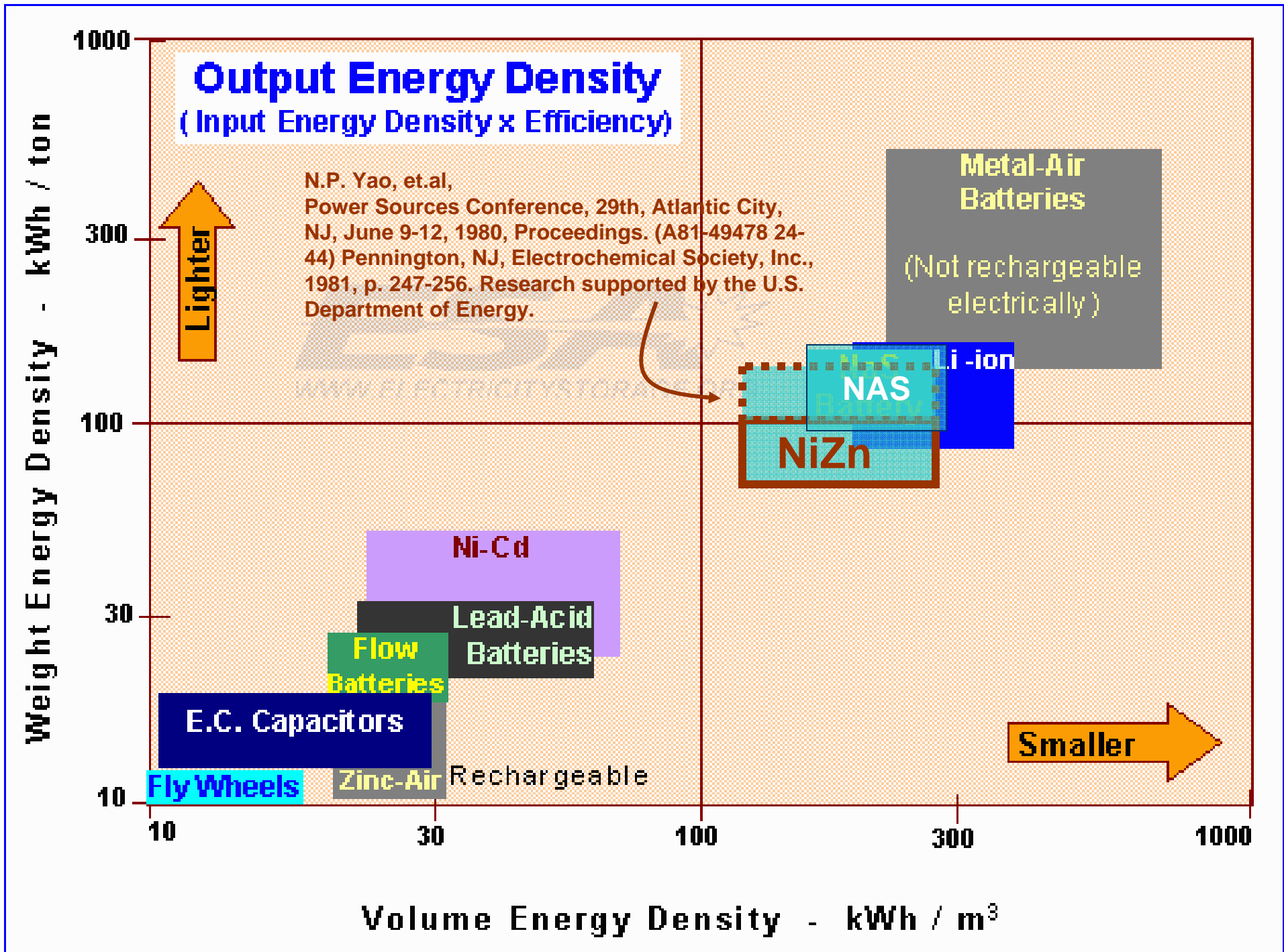
- 60-130 Wh/Kg
- 150-250 Wh/L
- >1000 W/Kg (>10,000 W/Kg possible with Ultra Thin Electrodes)
- Long Charge Retention
- Low Cost per KWh < \$ 250 with novel recycling method.
- Much safer even without liquid or air cooling
- Zn reserve in the billions of tons (Li reserve is a serious limitation)

Discharge Time at Rated Power



es

é ue



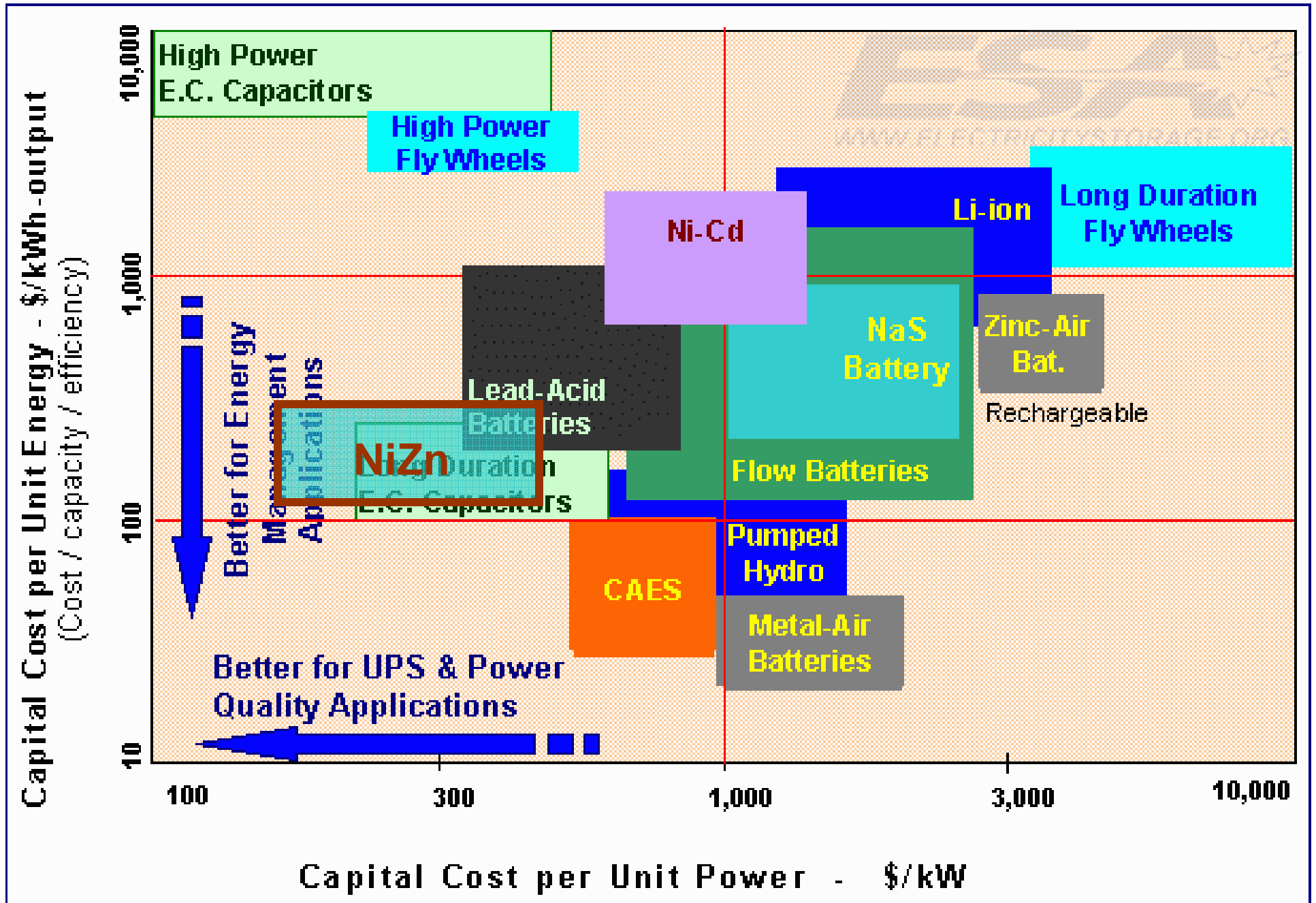
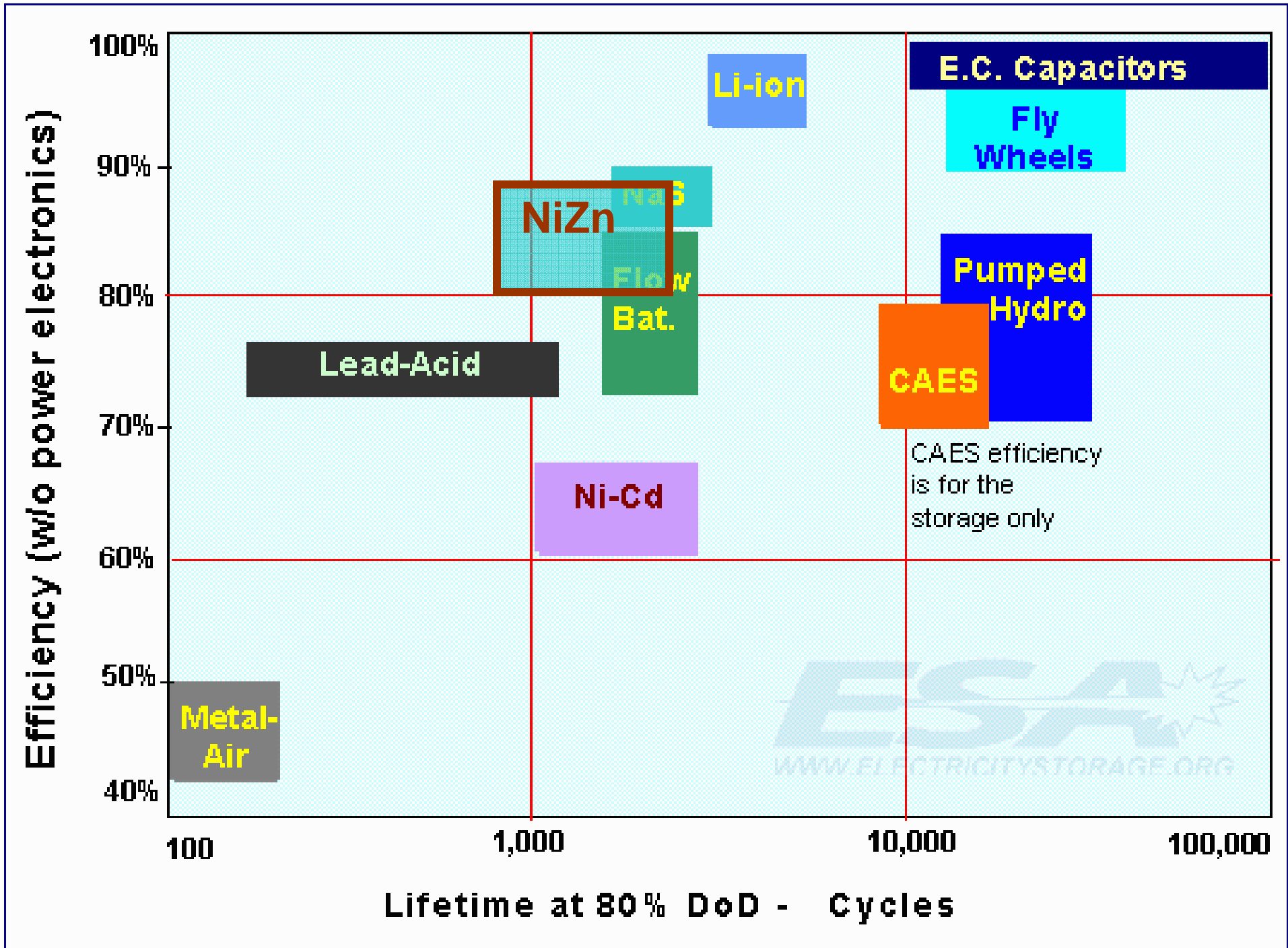
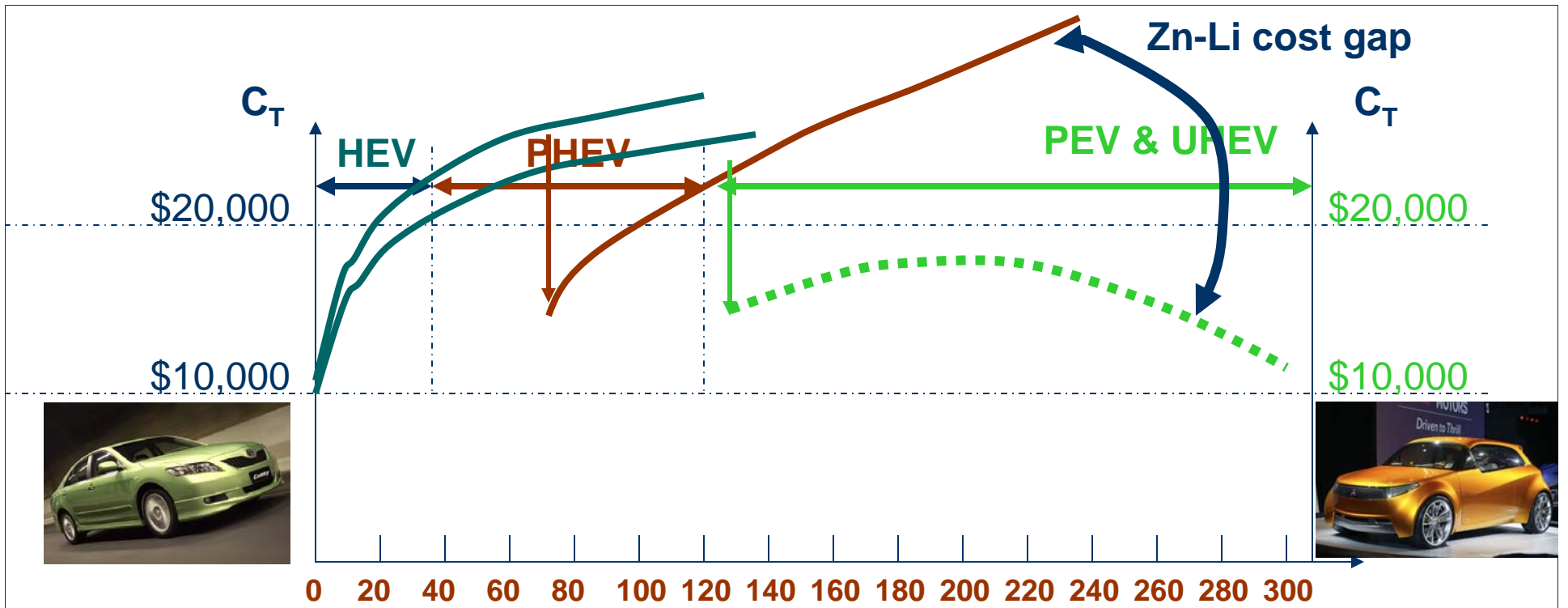


Figure 3





PURE ICE

Range M miles

PURE EV (PEV)



Where We Are



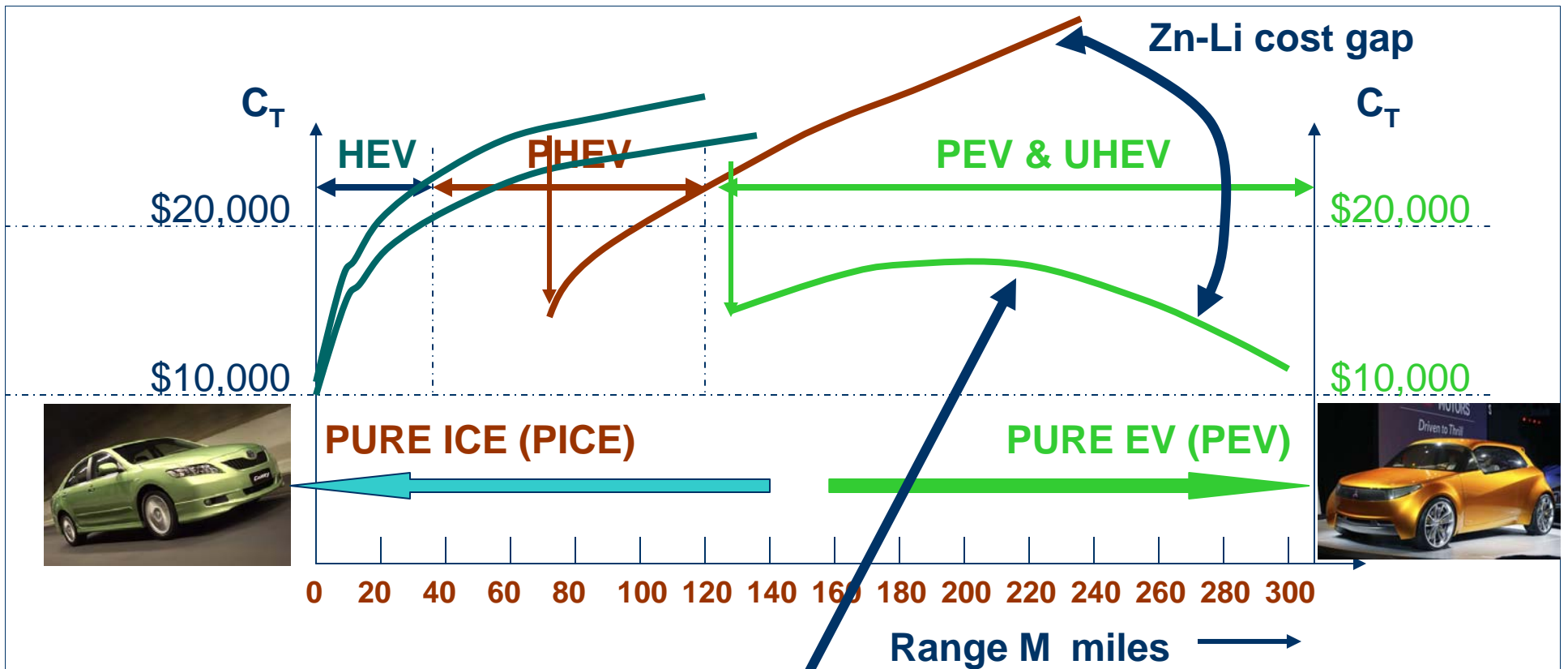
Where We Want to Be

$$C_T = \alpha C_{ice} + \beta C_b(M) + \gamma C_{oc}$$

Cost of ICE

Cost of battery
depends on range

Cost of all other
components, motors etc.



Reasons for This Peak

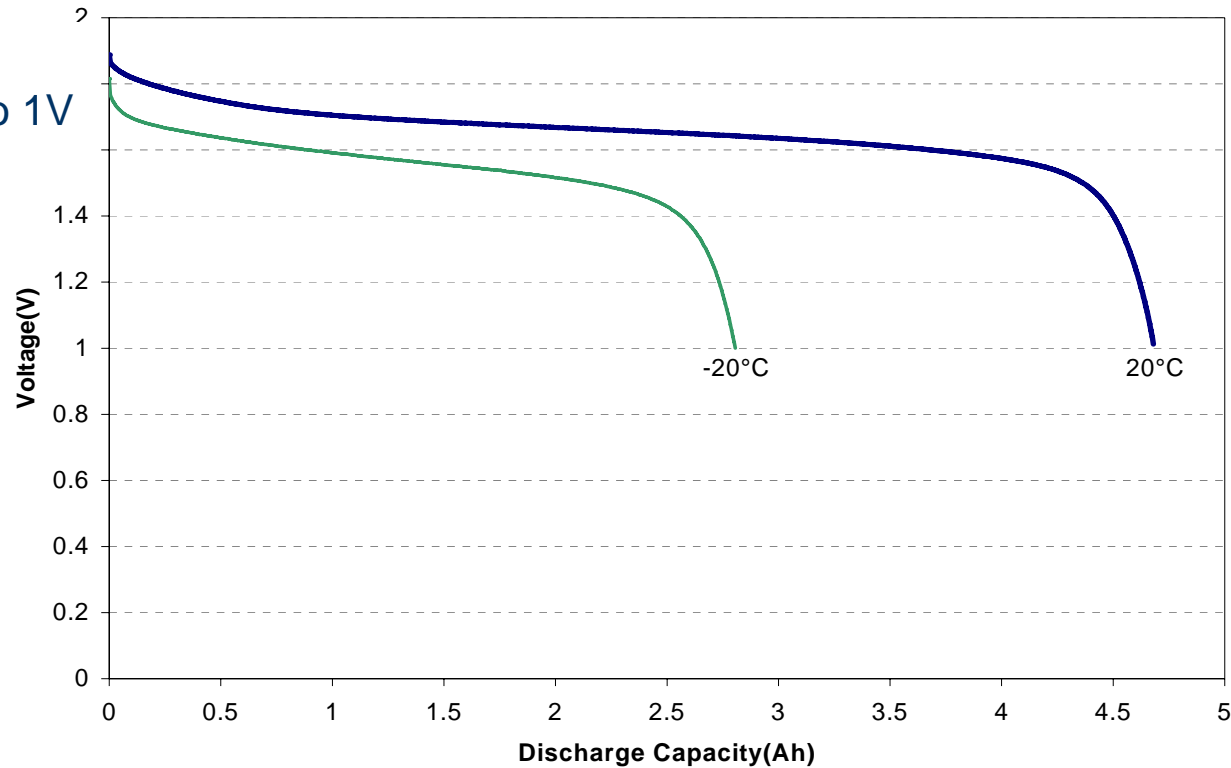
1. Reduced number or cycles reduces cost
2. Reduced cost per mile reflects lower cost renewables
3. Zinc fuel with UHEV dominated by the low electricity cost
4. Less battery more fuel cell

Low Temperature Discharge

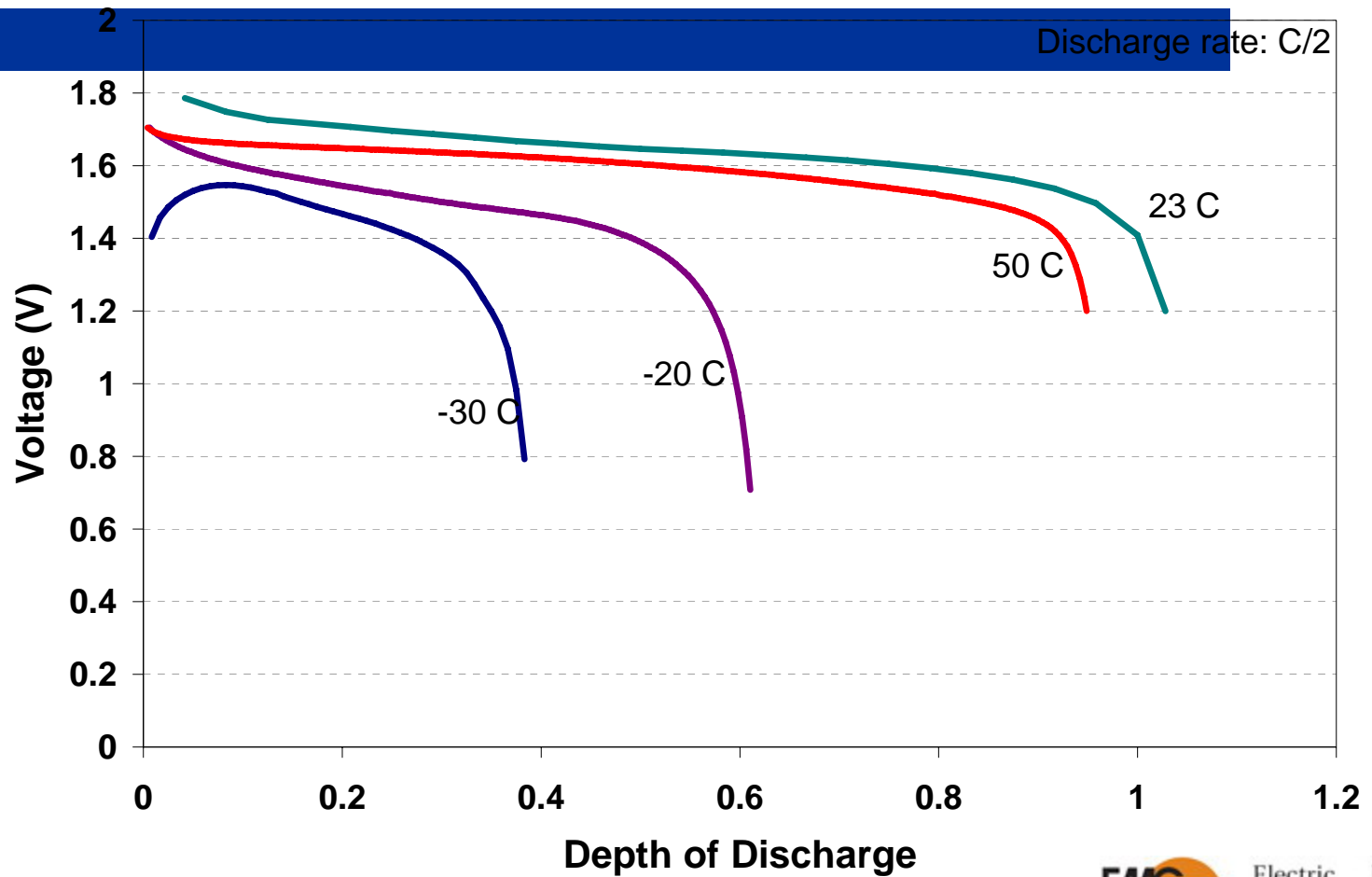
1st Generation Cell

Discharge rate: C/2 to 1V

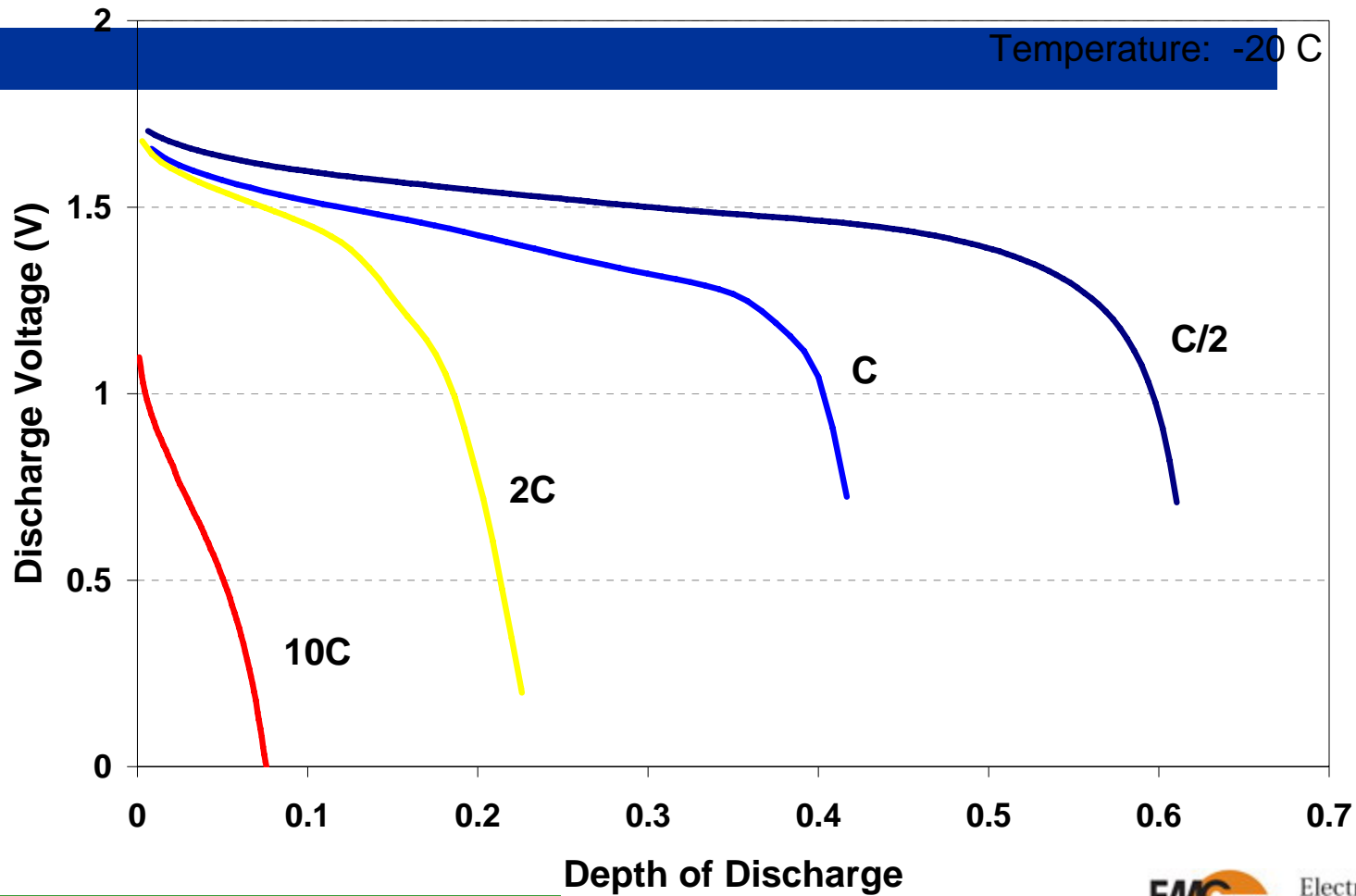
Charge rate: C/4



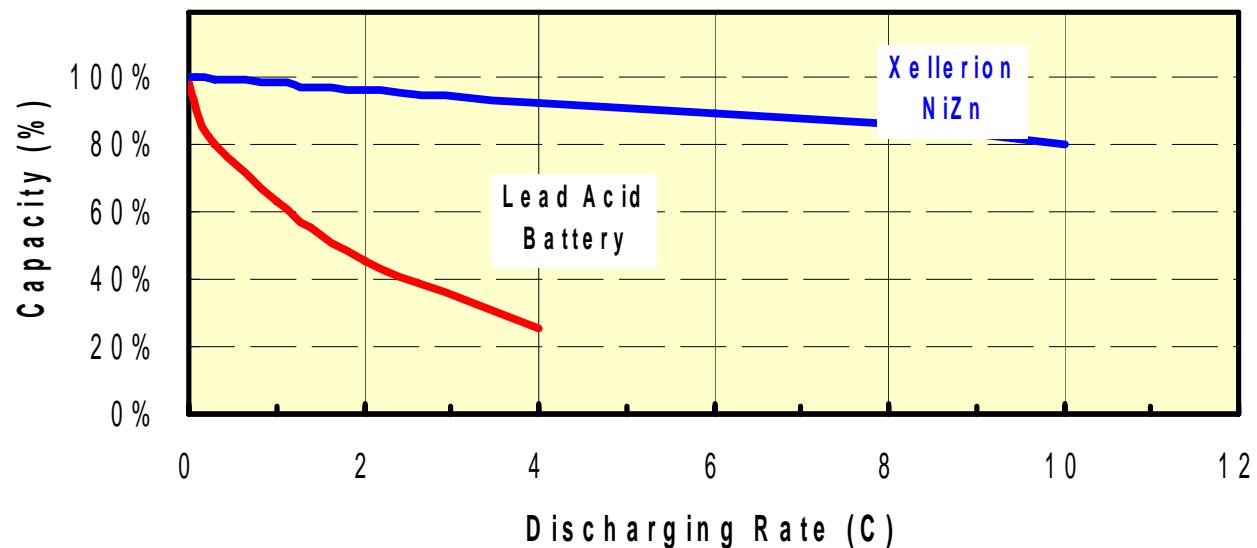
Performance of eVionyx Ni-Zn at Different Temperature



Power Performance at -20°C

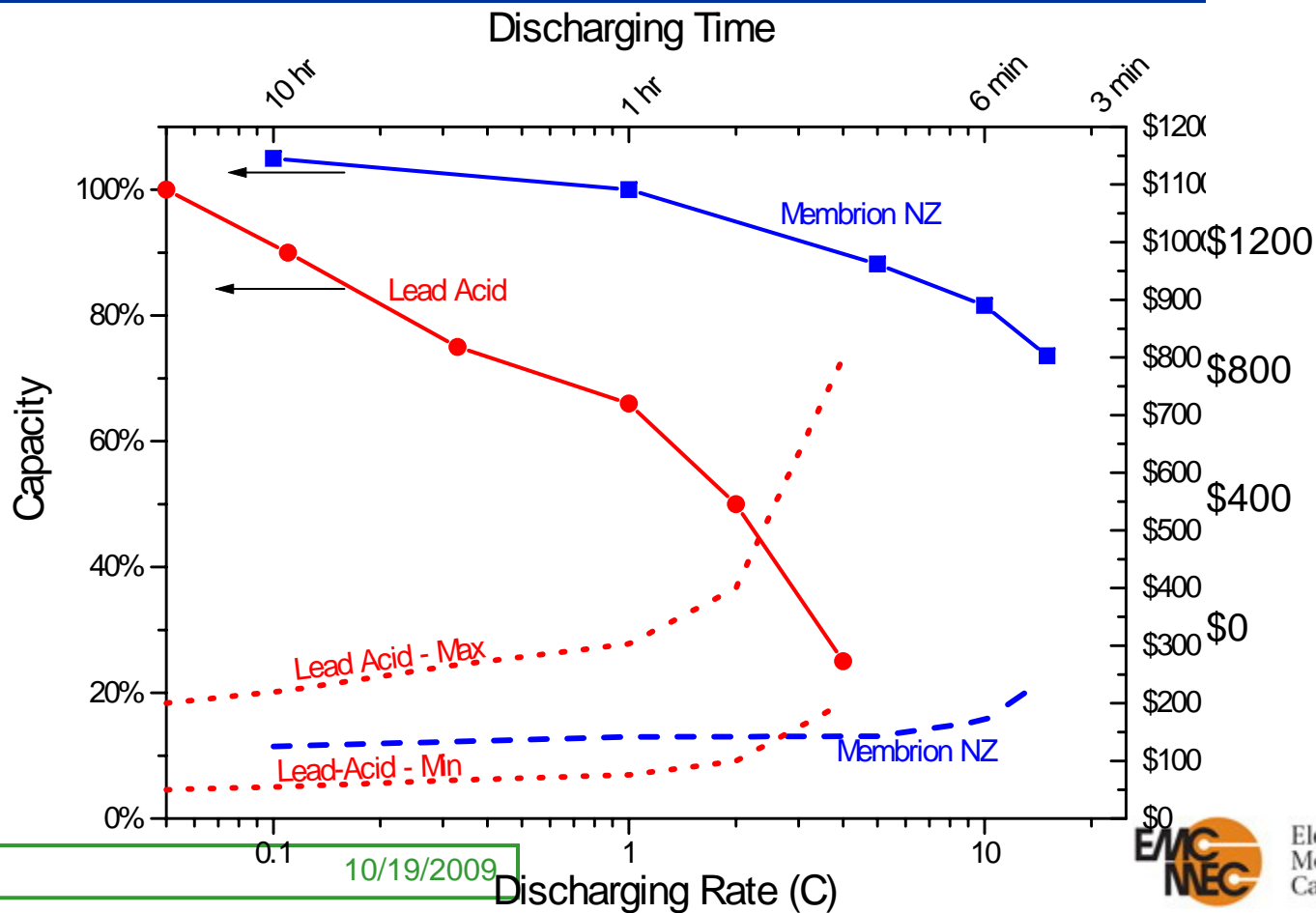


High Rate Deep Discharging Capability

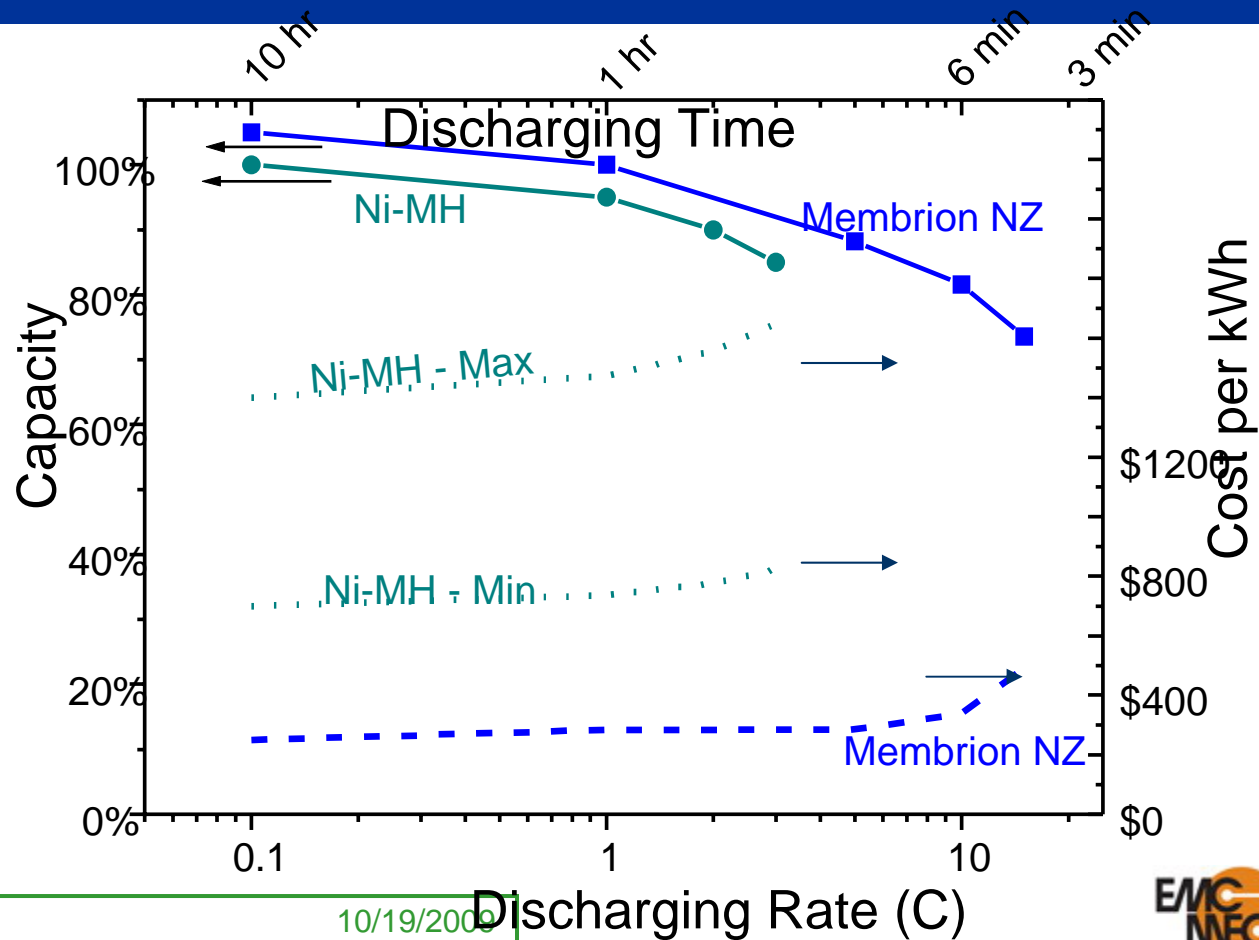


- NiZn is capable of high rate discharging (high C-rate)
 - up to 25C.
- Lead Acid battery has difficulty to perform deep discharging at high C-rate. Significant capacity decrease can be seen,

Comparison (Lead-Acid vs. Ni-Zn)



Comparison (Ni-MH vs. Ni-Zn)



NiZn Performance

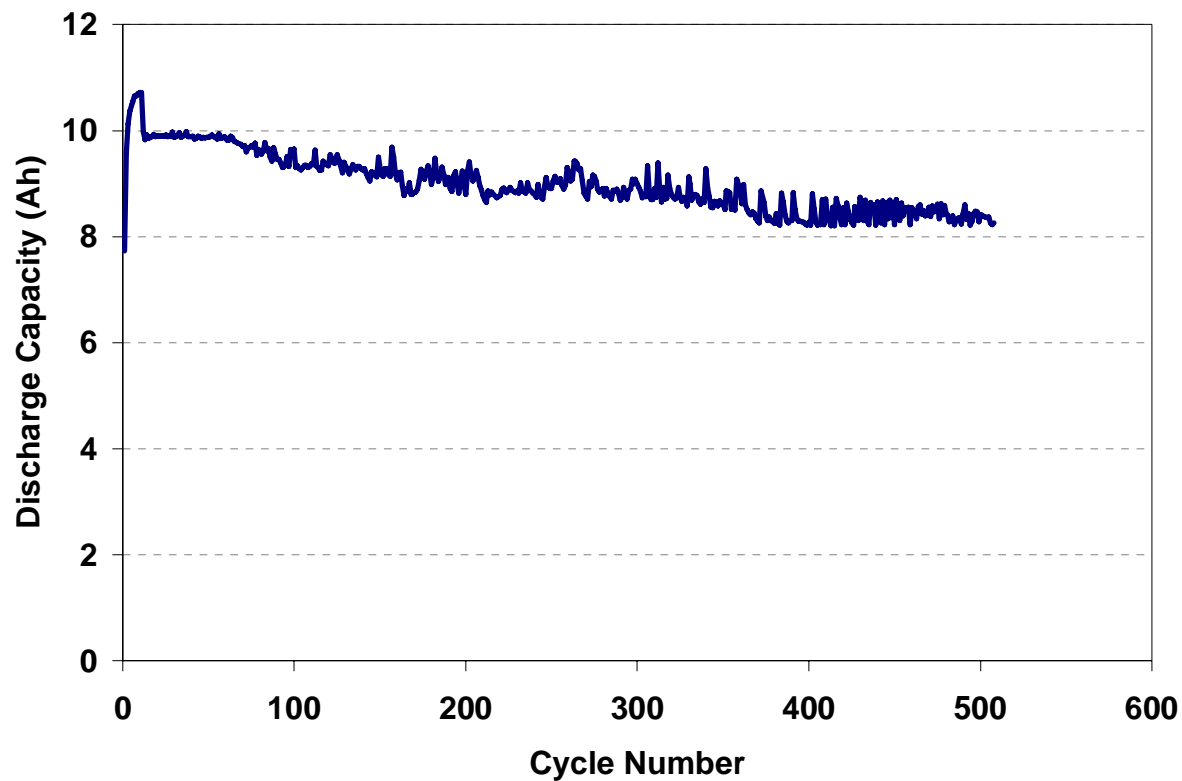


Fig 4. Cycling Performance.
Charge rate: C/4; Discharge rate: C/2

How Many Cycles Are Enough?

- Assume:

150 Wh/mile

150 mile range

50,000 mile life

\$250/KWh

Cycles required = $50,000/150 = 333$

Capacity = 22.5KWh

Initial Cost \$5,626

Cost per mile \$0.11

Weight 320-375 Kg (<30% EV weight)

How Many Cycles Are Enough?

- Assume:

1000 CYCLES

150 Wh/mile

150 mile range

\$250/KWh

Life = $1000 \times 150 = 150,000$ miles!

Capacity = 22.5KWh

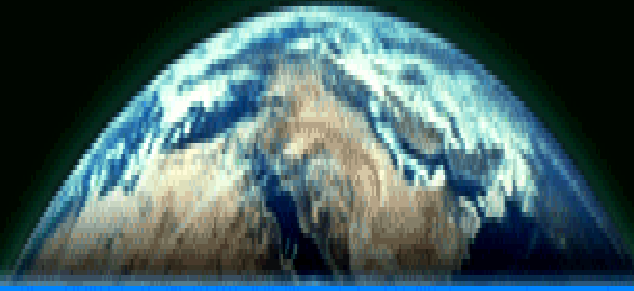
Initial Cost \$5,626

Cost per mile \$0.0375!

Weight 320-375 Kg (<30% EV weight)

About Xellerion

Xellerion



The Right Store For Energy

hybrides
Montréal

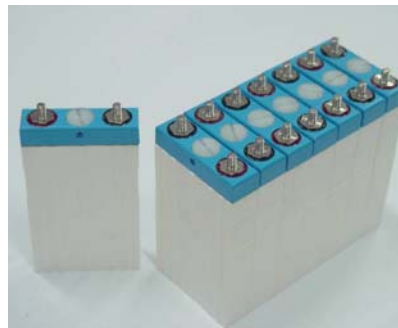
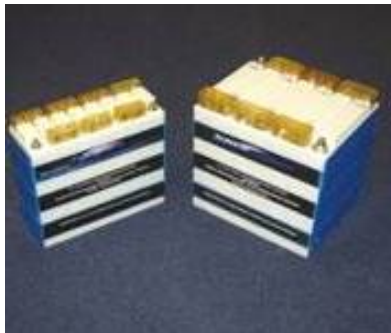
**Wholly Owned Subsidiary
Of**

eVionyx

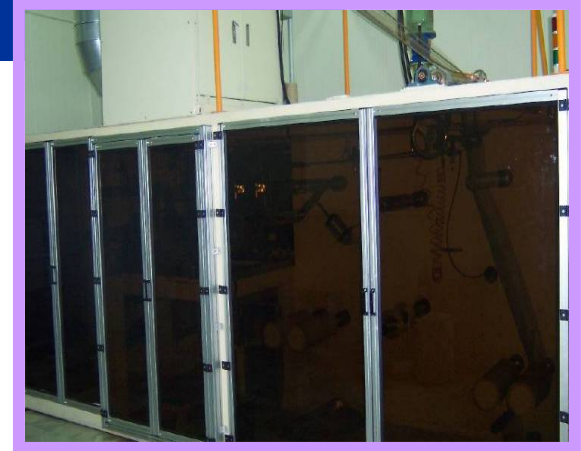
**Leading The World In High-Performance
Battery Technology Ready to Serve
Growing Markets**

At Xellerion We Proudly Introduce

The NiZn Battery Renaissance



The NiZn Renaissance Ready To Ship



What Choices Do We Have?

Lead Acid?

NiCd?

NiMH?

Old Li-Batteries?

New Li-Based Systems?

or

New Zn-Based Systems ?

Is the right choice!

1995

2000 PHEV'09

Plug-In Hybrid

2005

Véhicules électriques et hybrides rechargeables

2010

and Electric Vehicles

September 28 to 30, 2009 - Montréal

rechargeables

28 au 30 septembre, 2009 - Montréal

H2 Economy

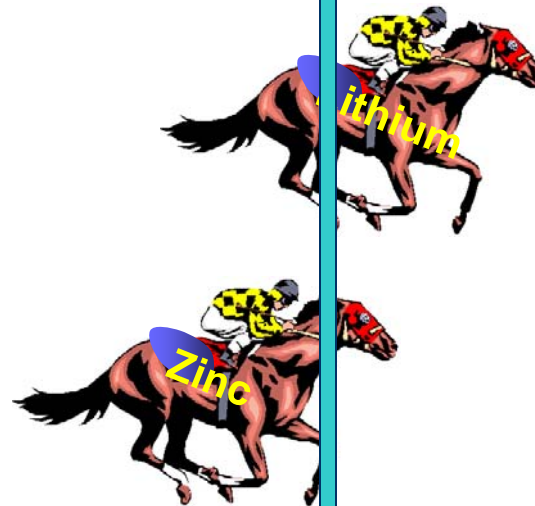
Biomass Economy

Lithium Economy

Zinc Economy

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10/19/2009



Electric Mobility Canada

Mobilité électrique Canada

It is not easy to be green, unless

