

# EMVICTORY



## Proudly Introduces *EMVictory* Bus



## The Triumph of Grid-Less Electric Mobility



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Emp. alt. 6855.5

# EMVictory Bus

An Epic > 10,000 Mile Journey  
Demonstrating The Viability Of  
Novel Renewable Non-Flammable Metal Fuel



Achieving Technology and Energy Sovereignty  
Leadership In Energy & Transportation Industries

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# The Metal Harvesting Paradigm

HARVESTING  
**Food** CYCLE

HARVESTING  
**Fuel** CYCLE



# Historical Milestones of Human Mobility

Music Power



Watt's Steam Engine

18<sup>th</sup> Century

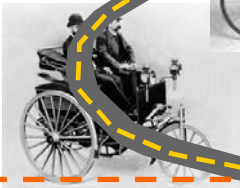
Steam Automobile



1885 Bicycle



Drake's first Oil Well

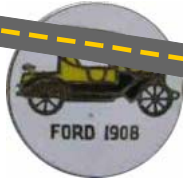


1896 Gasoline Automobile

19<sup>th</sup> Century

1903 Ford Company

1908 First Model T



1907 Peking to Paris Race

Launch of Gasoline Mobility  
Electric Mobility Postponed



*eVionyx Contributions*

1960 OPEC Formation

1973 Arab Oil Embargo

1980-2006 Wars In Oil Regions

20<sup>th</sup> Century

2000 Metal Fuel eVictory

2003 Metal Fuel MeVictory

The Road Ahead



August 10, 2007 EMVictory 10,000 mile Journey

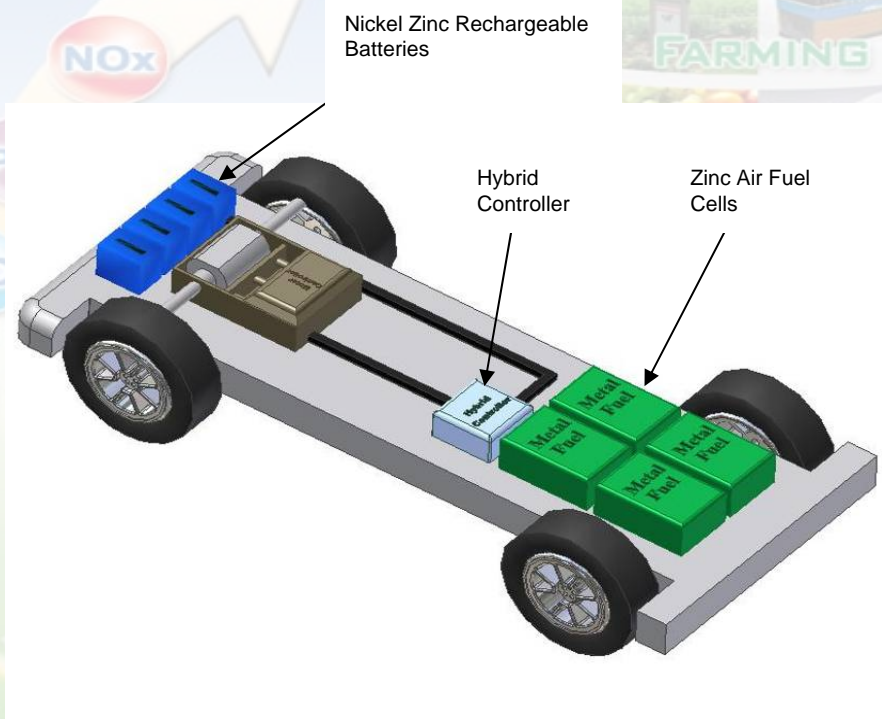
The Dawn Of New Era For Human Mobility

Non-Flammable Metal Fuel For Electric Mobility

21<sup>st</sup> Century

# The Metal Harvesting Paradigm

## eVionyx Has Already Demonstrated Zinc Air Fuel Cell Stacks: 10 kW/300 Ah



**eVionyx**

OXIDES

NO<sub>x</sub>

reducer

FARMING

H<sub>2</sub>C

CO<sub>2</sub>

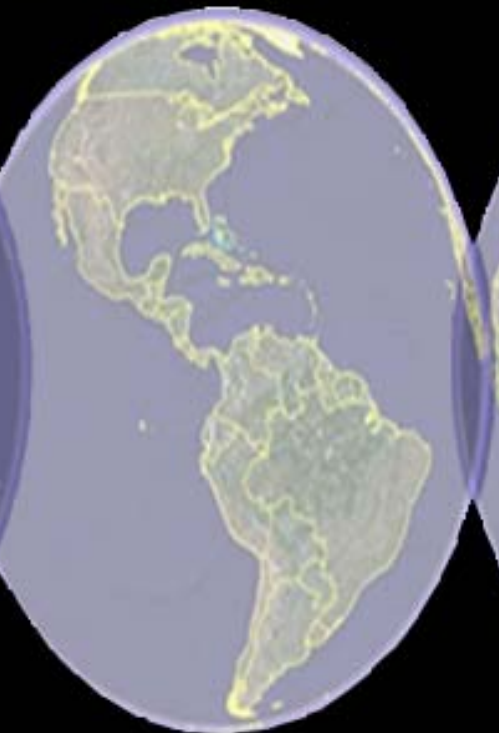
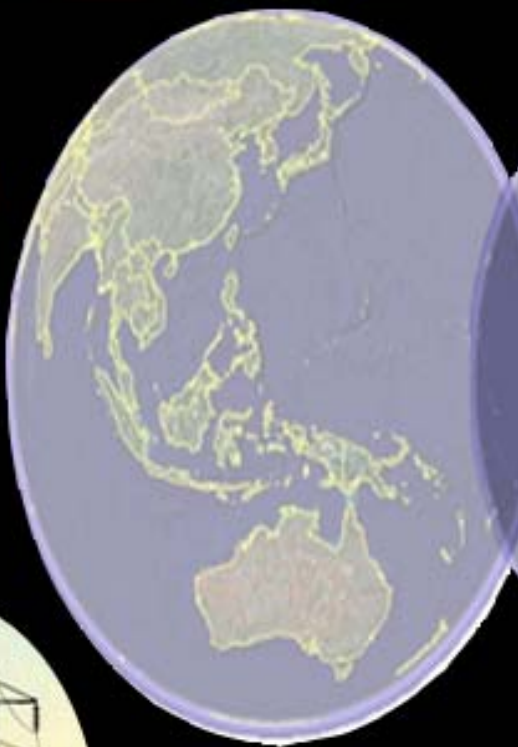
Al<sub>2</sub>O<sub>3</sub>

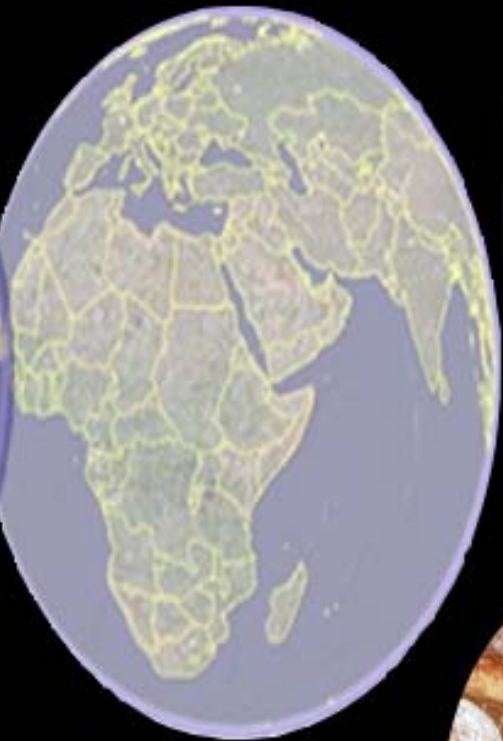
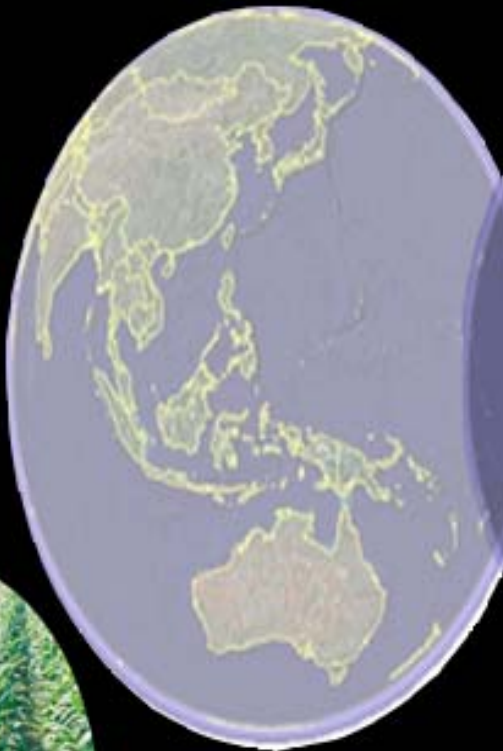
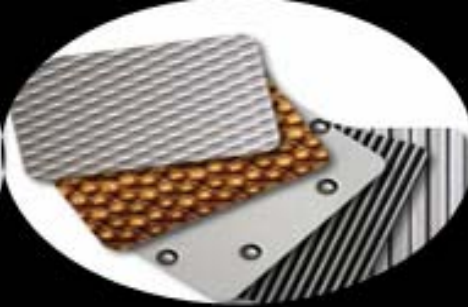
CO<sub>2</sub>

H<sub>2</sub>O

oxidizer

CONSUMPTION





# The Metal Harvesting Paradigm

## Summary

HARVESTING  
Food CYCLE

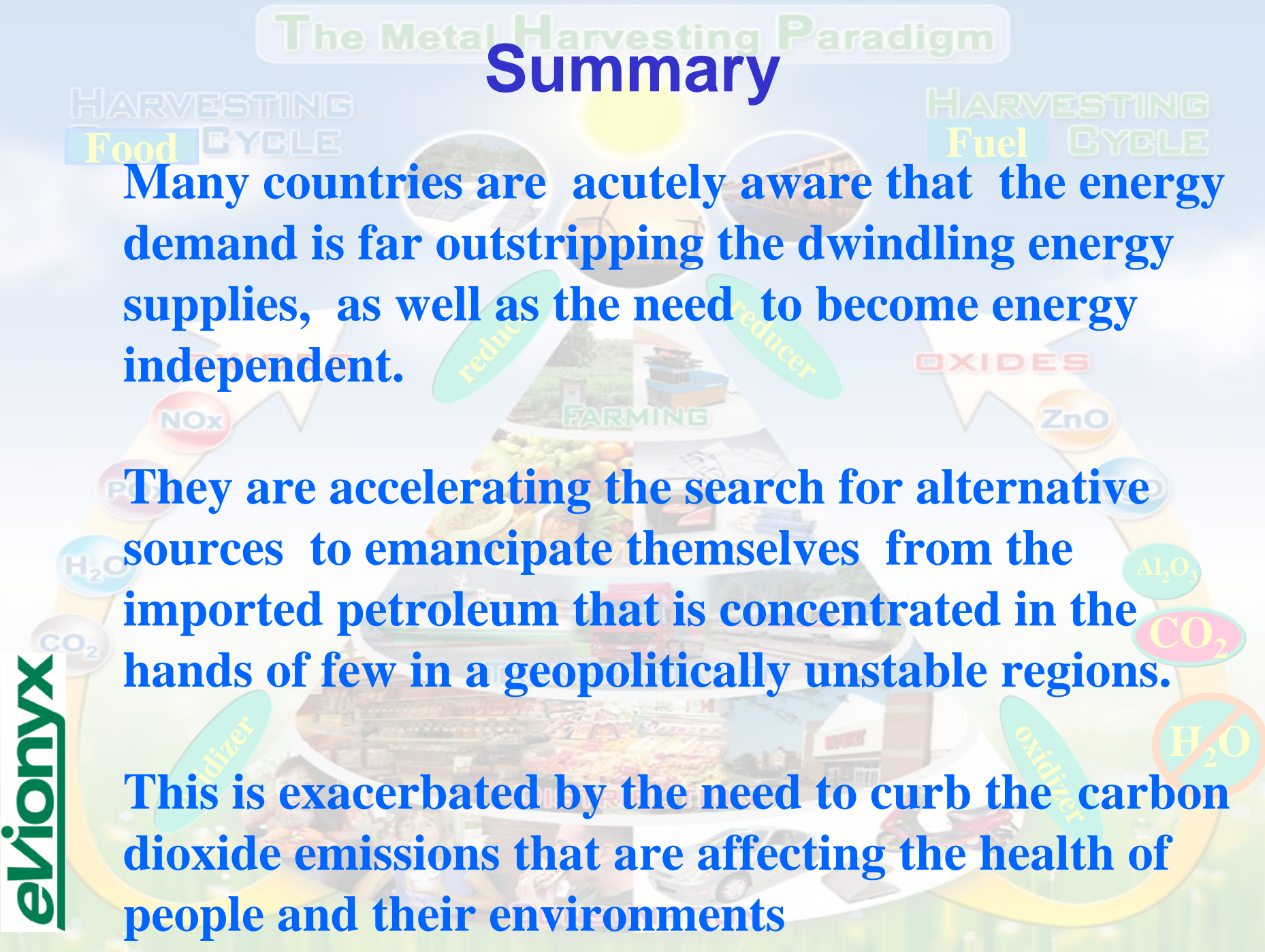
HARVESTING  
Fuel CYCLE

Many countries are acutely aware that the energy demand is far outstripping the dwindling energy supplies, as well as the need to become energy independent.

They are accelerating the search for alternative sources to emancipate themselves from the imported petroleum that is concentrated in the hands of few in a geopolitically unstable regions.

This is exacerbated by the need to curb the carbon dioxide emissions that are affecting the health of people and their environments

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# The Metal Harvesting Paradigm Summary

Alternatives energy sources :

HARVESTING  
Fuel CYCLE

- Nuclear
- Coal liquefaction
- Bio-mass, Bio-Diesel, Ethanol
- Solar
- Geothermal
- Wind
- Hydropower
- Hydrogen Fuel Cells

And Now We Add to the Mix

**eVionyx Non-Flammable Metal Fuels & Metal Fuel Cells For Electric Mobility**

**eVionyx**

OXIDES

NO<sub>x</sub>

PO<sub>x</sub>

H<sub>2</sub>O

CO<sub>2</sub>

oxidizer

OXIDES

ZnO

MgO

Al<sub>2</sub>O<sub>3</sub>

CO<sub>2</sub>

H<sub>2</sub>O

oxidizer

# The Metal Harvesting Paradigm

## Summary

eVionyx Alternative Energy Invention :

*The Metal Energy Cycle To Harvest Metal Fuels*

- 10 years in development
- >\$80 million investment
- Natural like Hydro-Carbon Cycle that produces food for life
- Like Photosynthetic Plants, it derives its energy from the sun, hence it is renewable.
- Like wheat, rice, Metal fuels are non flammable and safe.
- Metal fuels can be transported, stored, and distributed like the treatment of harvested food
- Metal fuel technology has been demonstrated
- More than 200 patents issued and pending

# The Metal Harvesting Paradigm

## Summary

Using eVionyx Alternative Energy Invention We Propose:

- New Option to Achieve Energy Independence From Foreign Petroleum.
- Offer An Economical Alternative non-flammable metal fuel for Electric Mobility
- Transport Metal Fuels (Zinc and Aluminum) Harvested from Regions with Low Cost Surplus Energy to where the demand is
- Prove That Metal Fuels Can Be Used Wide Spectrum of Applications in a Renewable Fashion .
- Prove The Economics Viability and CO<sub>2</sub> Neutrality.



# The Metal Energy Cycle Description

First follow left half of picture  
**Hydro-Carbon Cycle**

First follow right half of picture  
**Metal Fuel Cycle**

Our foods are generated by plants which reduce (convert) oxides to hydro-carbons (foods) with the renewable energy of the sun.

Non-flammable foods are harvested, transported, stored, distributed and consumed.

The chemical energy stored in the food is converted (oxidized) to mechanical, thermal and electro-chemical energy in our power plants. Oxides are produced and recycled



This cycle is analogous. It also uses oxides (metal oxides) which are reduced (converted) to metal fuels with the sun.

renewable energy  
Non-flammable metal fuels are harvested, transported, stored, distributed and consumed.

The chemical energy stored in the metals is converted (oxidized) directly to electricity using novel metal fuel cells. Oxides are produced and recycled

# The Metal Energy Cycle Description

The Hydro-Carbon Cycle evolved over billions of years enabling animals (oxidizers) to live symbiotically with food plants (reducers)

The Metal Fuel Cycle has been discovered by eVionyx when it invented the metal fuel cells (oxidizers) and the ambient temperature reducers

Food Fuel Cycle For Life



Metal Fuel Cycle For Sovereignty AnD Electric Mobility

# Experimental Demonstration of Metal Fuel Harvesting Cycle

HARVESTING  
Food CYCLE

HARVESTING  
Fuel CYCLE

Recharged Fuel Zinc

Harvesting

Zinc fuel

reducer

Power out  
For consumption

Farming

Energy  
In from  
Sun

oxidizer

Metal Fuel Cell

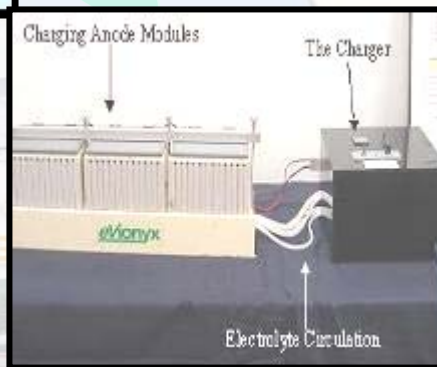
Charging Station

Zinc oxide

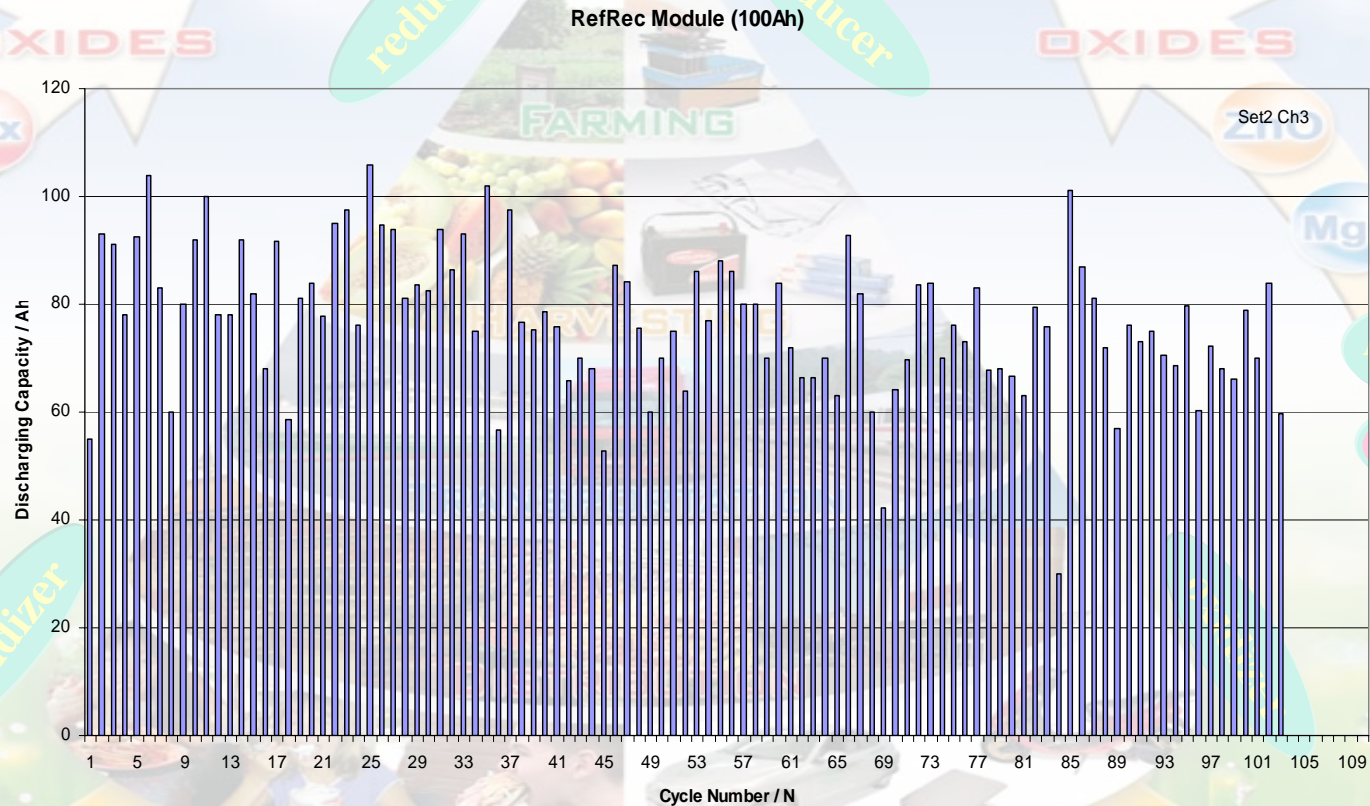
Recycling

Consumed Fuel Zinc Hydroxide and ZnO

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# Metal Fuel Technology Demonstration Exceeded 100 Oxidation-Reduction Cycle In A 12 V Module



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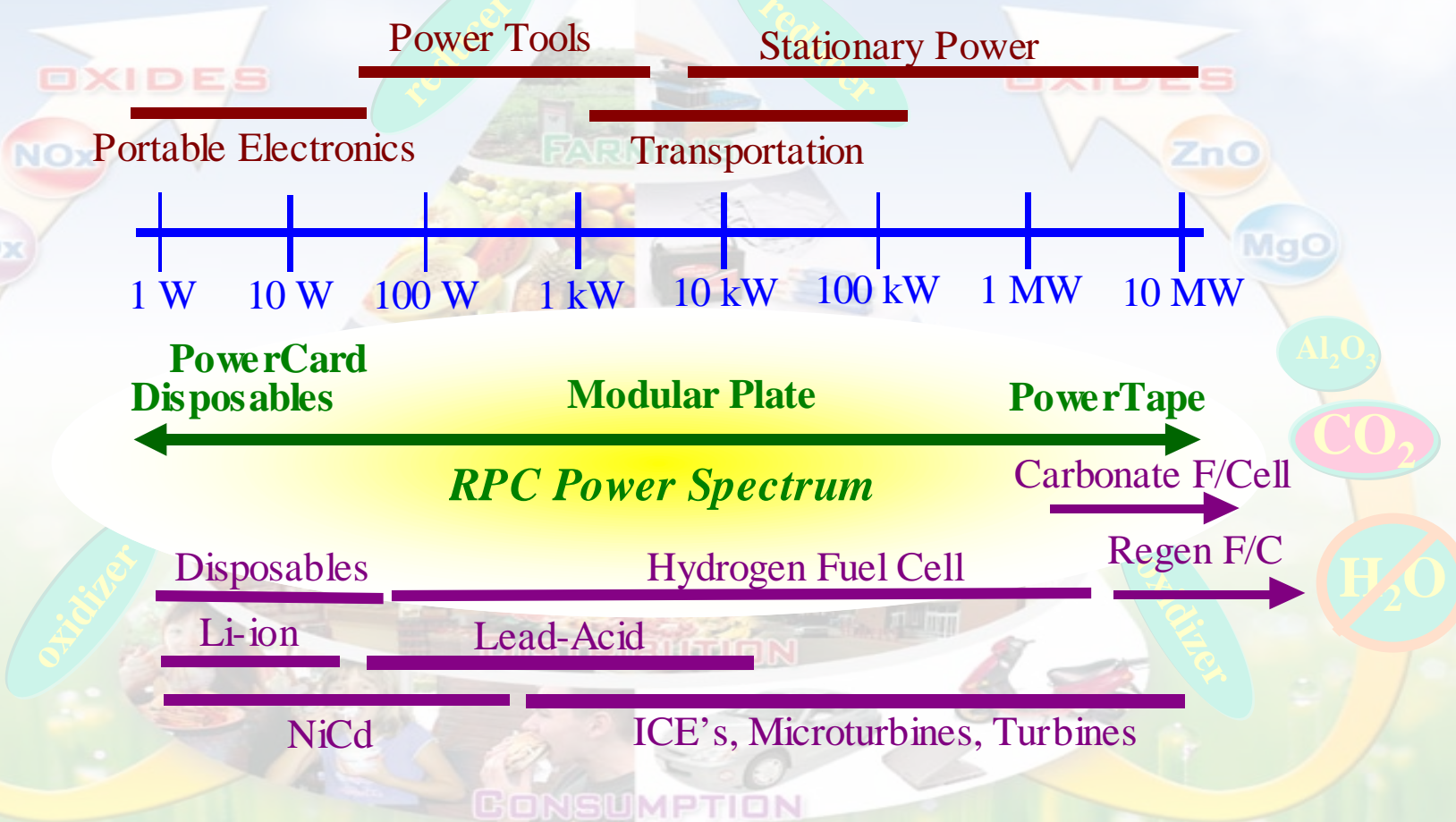
# Wide Power Range Applications

HARVESTING  
**Food** CYCLE

HARVESTING  
**Fuel** CYCLE

## Universal Power: Milliwatts to Megawatts

**evionyx**



# eVictory Car

Food CYCLE

Successfully Demonstrated Metal Fuel Cells for Electric Mobility

OXIDES

NOx

POx

H<sub>2</sub>O

CO<sub>2</sub>

reducer

oxidizer

Time: Oct. 2, 2000 / Location: USA

Distance Record: 334 KM

System: Zn-Air (refuelable)

Vehicle: Modified Honda Insight

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# GUINNESS WORLD RECORDS

## CERTIFICATE

Two modified production cars, powered by metal/air fuel-cells fitted by Evonyx of Elmsford, New York, USA drove a world distance of 344.67 km on public roads without refuelling or recharging on 2 October 2000

Keeper of the Records  
GUINNESS WORLD RECORDS LTD

THIS CERTIFICATE DOES NOT NECESSARILY DENOTE AN ENTRY INTO ANY PRODUCTS DISTRIBUTED OR OWNED BY GUINNESS WORLD RECORDS LTD

# MeVictory Car

Successfully Extended the range  
To another Guinness Record

Time: Oct. 11, 2003 / Location: Malaysia

Distance Record: 524 KM

System: Zn-Air (refuelable) / NiZn hybrid

Vehicle: Modified Honda Insight

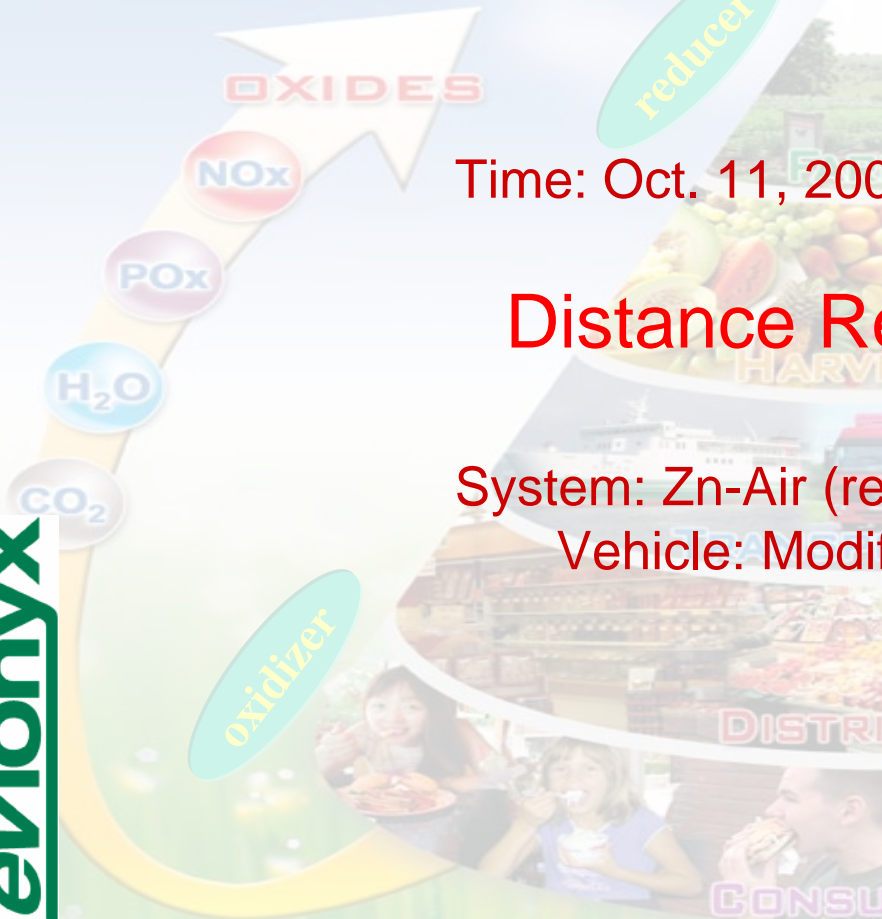


CERTIFICATE

A Modified Honda Insight car called MeVictory and powered by metal fuel cells drove a distance of 524 km (325.5 miles) in and around Kuala Lumpur, Malaysia, on 11 October 2003 without refuelling or recharging. The car was produced by InventoJaya

Keeper of the Records  
GUINNESS WORLD RECORDS LTD

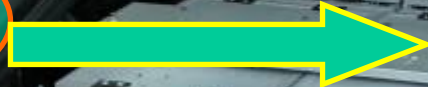
elionyx



# The Metal Harvesting Paradigm

HAF  
Foo

Zinc Fuel Cell  
In The Back



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PO

H<sub>2</sub>O

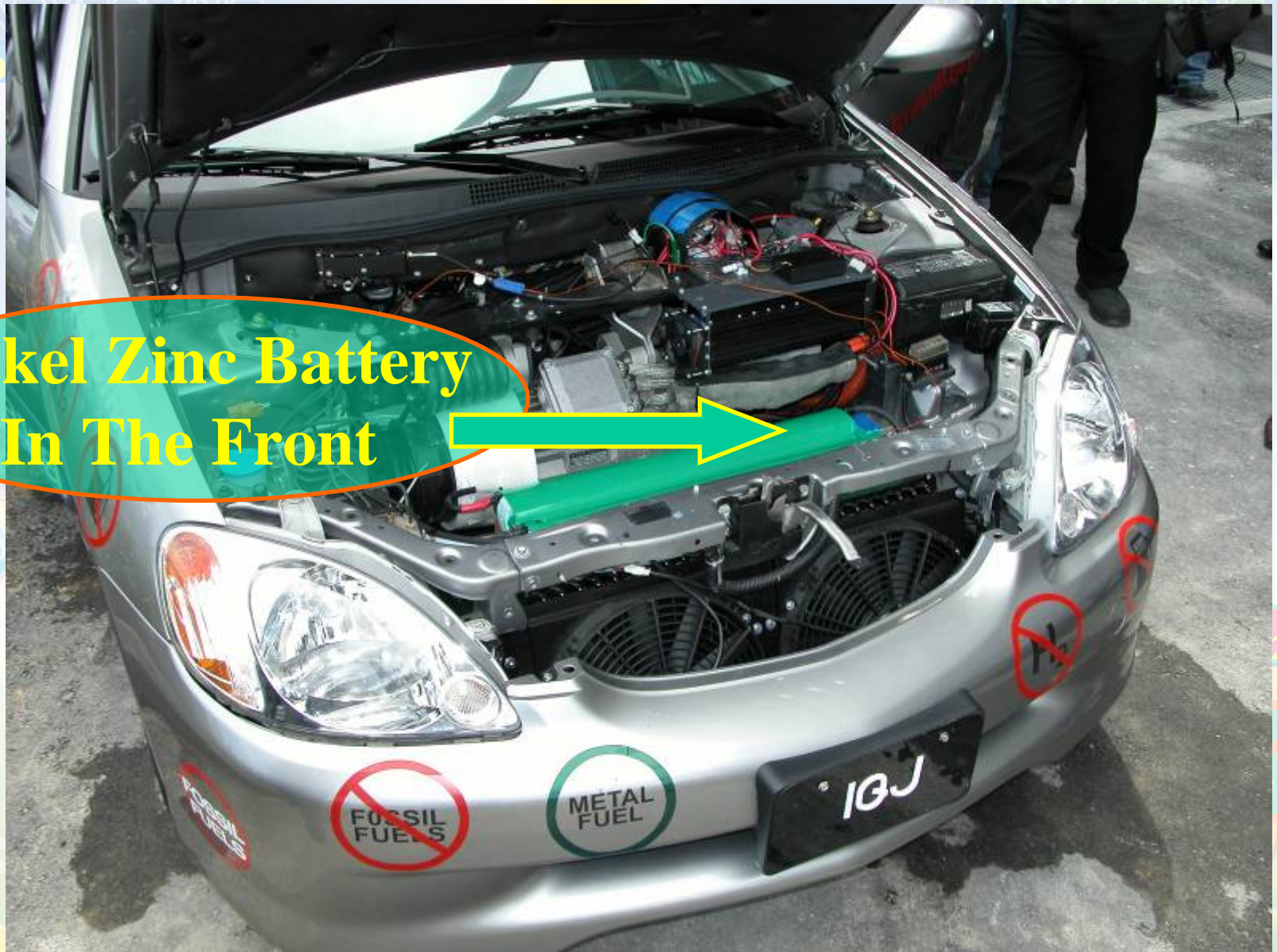
CO<sub>2</sub>

CONSUMPTION

# The Metal Harvesting Paradigm

HA  
Fo

Nickel Zinc Battery  
In The Front



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H<sub>2</sub>O

CO<sub>2</sub>

CONSUMPTION

# The Metal Harvesting Paradigm

HARVESTING  
Fuel

HARVESTING  
Fuel CYCLE



**elionyx**

oxidizer

CONSUMPTION

PC  
H<sub>2</sub>O  
CO<sub>2</sub>

2  
10



# Electric Mobility Victory (EMVictory) Bus Proposal



The success of eVictory and MeVictory Cars in demonstrating >375 mile range is the driving force to Plan the next milestone for Electric Mobility

Triumph of Grid-less Mobility on the 100 year Anniversary of the Peking to Paris Race

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# The Metal Harvesting Paradigm

## Project Summary

HARVESTING

HARVESTING  
CYCLE

Food

eVionyx proposes to use its all-electric hybrid system (Zn-Air fuel cell and NiZn battery) to apply electric bus to demonstrate a driving distance of more than 600 km between refueling.

The energy source is eVionyx's Zn-Air refuelable Metal-Air Fuel Cell

The power booster is Xellerion's NiZn high performance battery.

eVionyx



# The Metal Harvesting Paradigm

## Technical Specifications of EMVictory

HARVESTING  
Food CYCLE

HARVESTING  
Fuel CYCLE

- Estimated Electric Bus Parameters
  - Voltage: 312V
  - Peak Power: 100 kW
  - Constant Power: 45 kW @60 km/hr

- To Achieve 375 Miles Range ,
- Running time: 10 hours
  - Energy required: 450 kWh

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oxidizer

reducer

oxidizer

OXIDES

OXIDES

TRANSPORTATION

DISTRIBUTION

CONSUMPTION

NOx

POx

H<sub>2</sub>O

CO<sub>2</sub>

ZnO

MgO

Al<sub>2</sub>O<sub>3</sub>

CO<sub>2</sub>

~~H<sub>2</sub>O~~

# Preliminary Project Timeline

HARVESTING  
Food CYCLE

HARVESTING  
Fuel CYCLE

- First *EMVictory* Bus Project Organizational Meeting { October x}.
- *EMVictory* Plan & Budget Ready
- *EMVictory* Plan & Budget Approved
- EVionyx Canada (EVC) Incorporated and launched
- EVC Energy Lab Established
- *EMVictory* Project Execution Begins
- *EMVictory* Design Ready
- Demonstrate Metal Fuel Cell Module Design
- *EMVictory* Bus Trail Run Winnipeg to Toronto June 15
- Begin *EMVictory* Bus Epic Journey July XX from Winnipeg
- Return Triumphantly to Winnipeg after >10,000 Mile

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# The Metal Harvesting Paradigm

HARVESTING  
**Food** CYCLE

HARVESTING  
**Fuel** CYCLE

## eVionyx's Unique All Electric Hybrid Approach

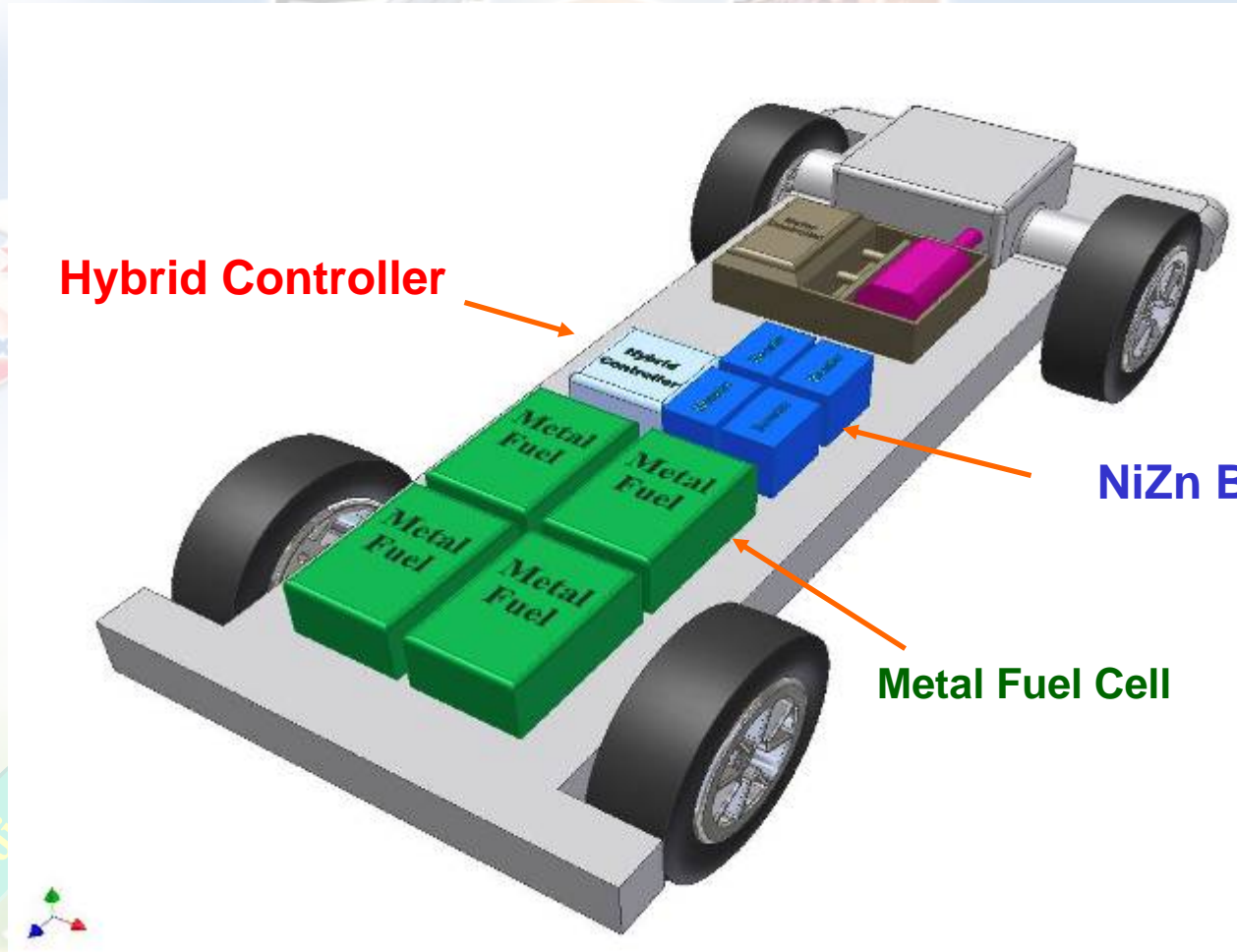
**eVionyx**



# All Electric Hybrid Vehicle

HARVESTING  
Food CYCLE

HARVESTING  
Fuel CYCLE



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Oxidation

CONSUMPTION

$\text{Al}_2\text{O}_3$

$\text{CO}_2$

$\text{H}_2\text{O}$

$\text{H}_2\text{O}$

$\text{PO}_x$

$\text{NO}_x$

# Zinc Air Fuel Cell Stacks: 10 kW/300AH

HARVESTING  
Food CYCLE

HARVESTING  
Fuel CYCLE

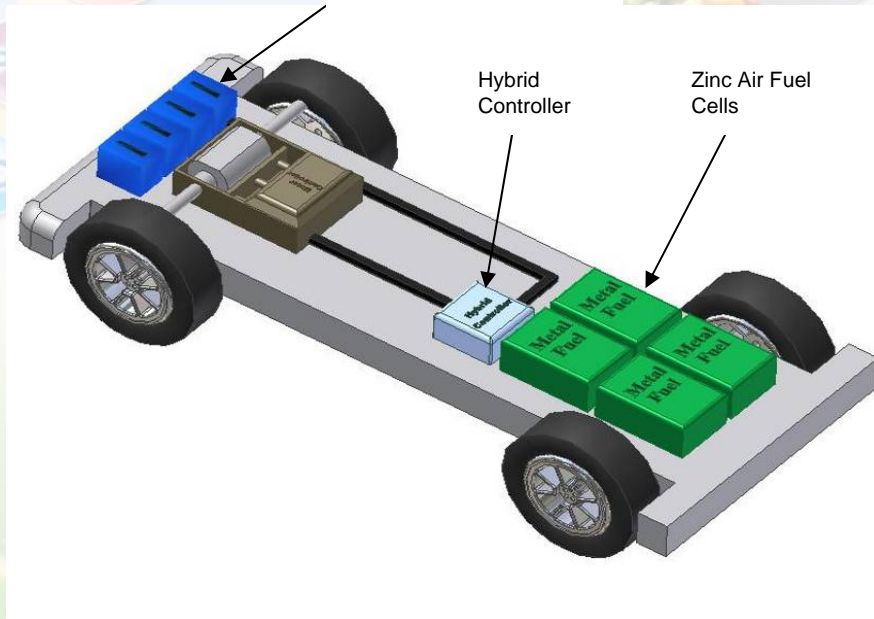
OXIDES

NO<sub>x</sub>

Nickel Zinc Rechargeable Batteries

reducer

FARMING



Al<sub>2</sub>O<sub>3</sub>

CO<sub>2</sub>

H<sub>2</sub>O

oxidizer

evionyx

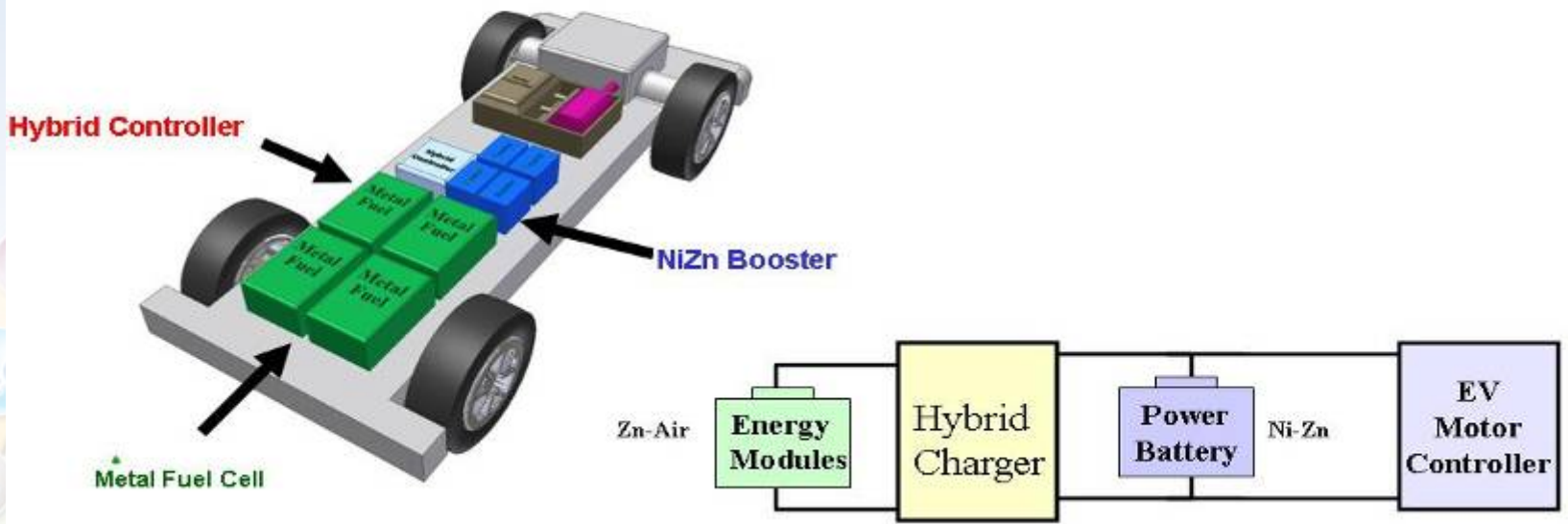
CONSUMPTION

# The Metal Harvesting Paradigm

HARVESTING  
Food CYCLE

## All-Electric Hybrid

HARVESTING  
Fuel CYCLE



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oxidizer

DISTRIBUTION

oxidizer

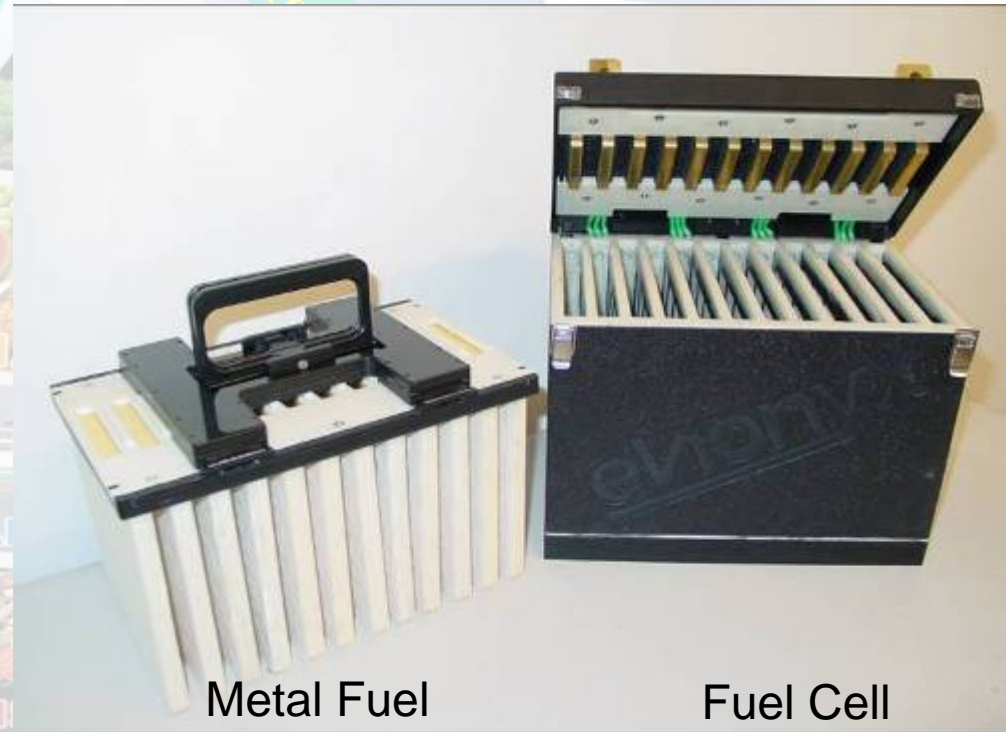
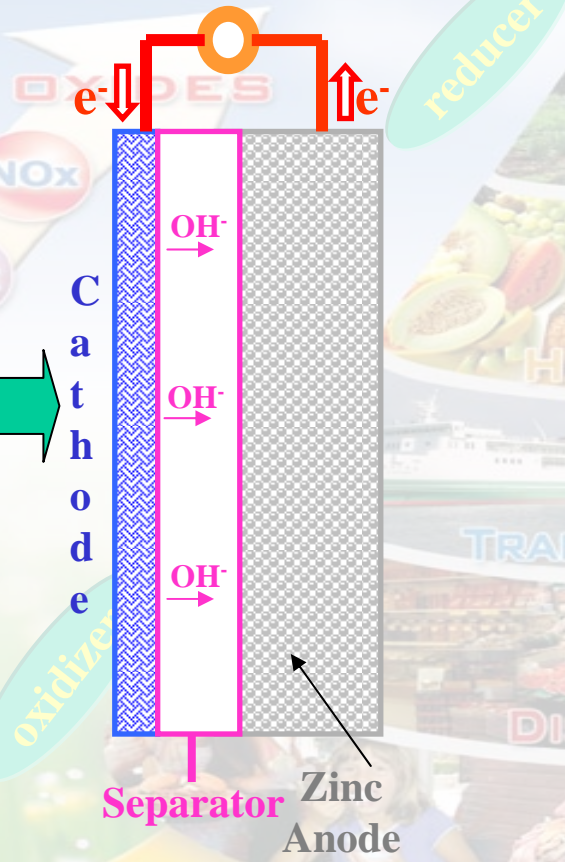
~~H<sub>2</sub>O~~

CONSUMPTION

# Refuelable Metal-Air Fuel Cell

HARVESTING  
Food CYCLE

HARVESTING  
Fuel CYCLE



Metal Fuel

Fuel Cell

evionyx



CONSUMPTION

# NiZn Battery Pack

The Metal Harvesting Paradigm

HARVESTING CYCLE

HARVESTING CYCLE  
Fuel

## Food ■ Xellerion NiZn Battery Pack

- ↪ High power capacity
- ↪ Safe
- ↪ Environmentally friendly
- ↪ Low cost

OXIDES

reducer

reducer

NOx  
POx  
H<sub>2</sub>O  
CO<sub>2</sub>  
oxidizer

O<sub>3</sub>  
O<sub>2</sub>  
H<sub>2</sub>O



12V/50AH NiZn Pack

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# The Metal Harvesting Paradigm

HARVESTING  
**Food** CYCLE

HARVESTING  
**Fuel** CYCLE

## 375 Mile Range Electric Bus Design Parameters

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OXIDES

NO<sub>x</sub>

PO<sub>x</sub>

H<sub>2</sub>O

CO<sub>2</sub>

oxidizer

FARMING

HARVESTING

TRANSPORTATION

DISTRIBUTION

CONSUMPTION

reducer

ZnO

MgO

Al<sub>2</sub>O<sub>3</sub>

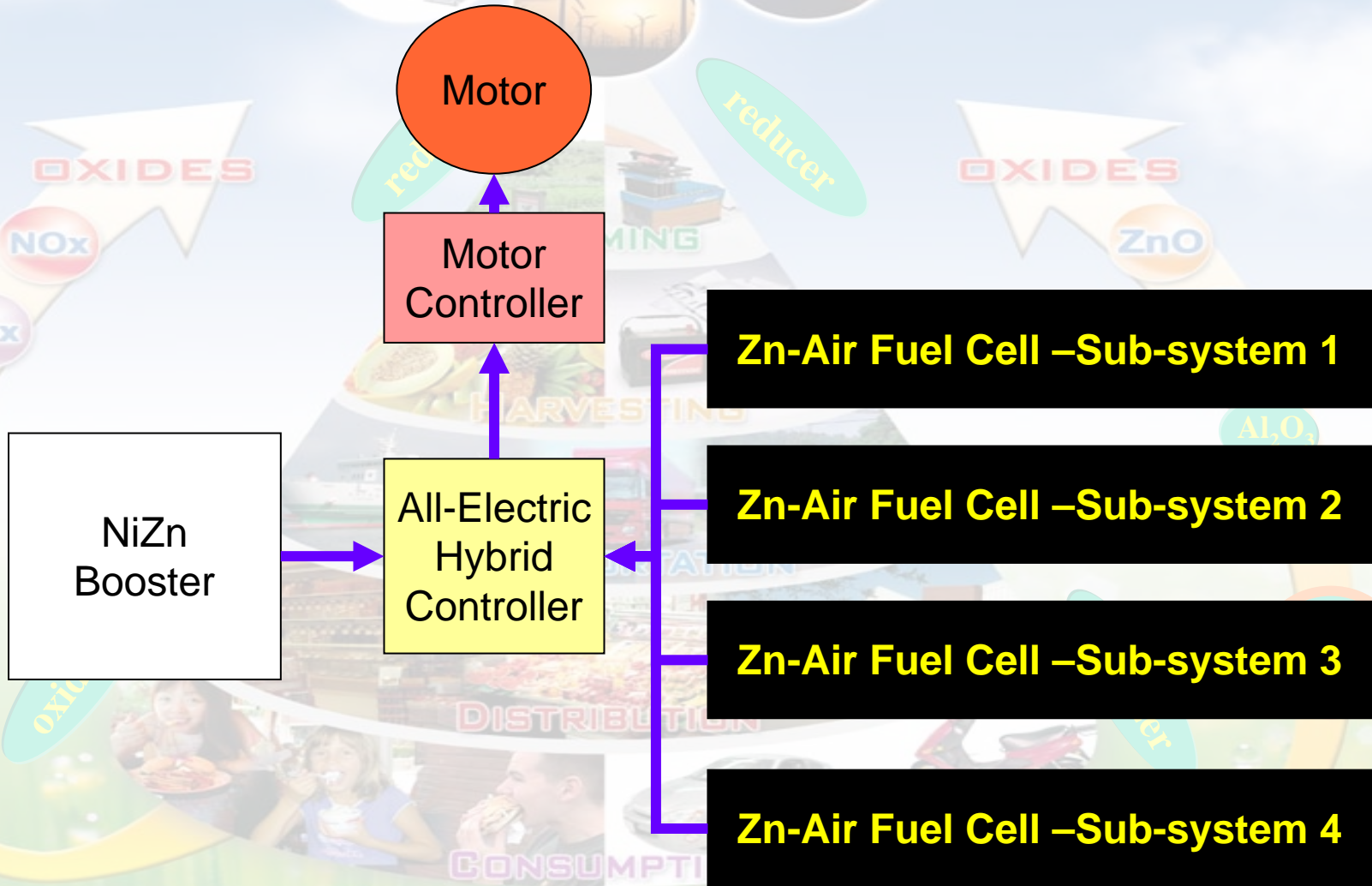
CO<sub>2</sub>

~~H<sub>2</sub>O~~

oxidizer



# All Electric Hybrid System Diagram





# Zn-Air Fuel Cell Sub-System

## Sub-system:

- ↪ Energy: **112 kWh**
- ↪ Nominal Voltage: **312 V**
- ↪ Capacity: **360 AH**
- ↪ Power: **25 kW**

## Weight Estimate:

- ↪ Fuel Cell System Weight ~ 200 kg
- ↪ Zn Fuel Weight ~ 250 kg
- ↪ Total 450 kg

Zn-Air Fuel Cell –Sub-system 1

# NiZn

# Booster

## The Metal Harvesting Paradigm

HARVESTING  
Fuel

HARVESTING  
Fuel CYCLE

### NiZn Booster

- ↪ Nominal Voltage: 312 V
- ↪ Capacity: 120 AH
- ↪ Energy: **36 kWh**
- ↪ Peak Power: **>100 kW**
- ↪ Peak Current: **> 300A**
- ↪ Weight Estimate: ~ 600 kg

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OXIDES

OXIDES

NO<sub>x</sub>

PO<sub>x</sub>

H<sub>2</sub>O

CO<sub>2</sub>

oxidizer

reducer

NiZn  
Booster

Al<sub>2</sub>O<sub>3</sub>

CO<sub>2</sub>

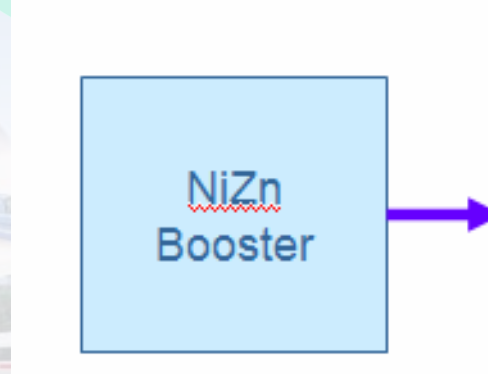
H<sub>2</sub>O

oxidizer

TRANSPORTATION

DISTRIBUTION

CONSUMPTION



# All Electric Hybrid System Summary

## Total Power: 180 kW

Zn-Air Fuel Cell	80 kW
NiZn booster	100 kW
Total:	180 kW

## Total Energy: 486 kWh

Zn-Air Fuel Cell	450 kWh
NiZn Booster	36 kWh
Total:	486 kWh

## Total Weight: 2400 kg

Zn-Air Fuel Cell	800 kg
600km Zn Fuel	1000 kg
NiZn booster	600 kg
Total:	2400 kg

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Image © 2006 NASA

VESTING  
CYCLE

ES

ZnO

MgO

Al<sub>2</sub>O<sub>3</sub>

CO<sub>2</sub>

~~H<sub>2</sub>O~~

idizer

# EMVictory Bus

An Epic > 10,000 Mile Journey  
Demonstrating The Viability Of  
Novel Renewable Non-Flammable Metal Fuel



Achieving Technology and Energy Sovereignty  
Leadership In Energy & Transportation Industries

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# The Metal Harvesting Paradigm

HARVESTING  
**Food** CYCLE

HARVESTING  
**Fuel** CYCLE



reducer

reducer

OXIDES

OXIDES

NO<sub>x</sub>

ZnO

PO<sub>x</sub>

MgO

H<sub>2</sub>O

Al<sub>2</sub>O<sub>3</sub>

CO<sub>2</sub>

CO<sub>2</sub>

**evionyx**

## Thank You



oxidizer

oxidizer

~~H<sub>2</sub>O~~

CONSUMPTION