clean fleets
purchasing clean public vehicles

BATTERY ELECTRIC VEHICLES – NOW AND IN THE FUTURE

Peter Van den Bossche
Vrije Universiteit Brussel

Co-funded by the Intelligent Energy Europe Programme of the European Union

clean fleets
purchasing clean public vehicles

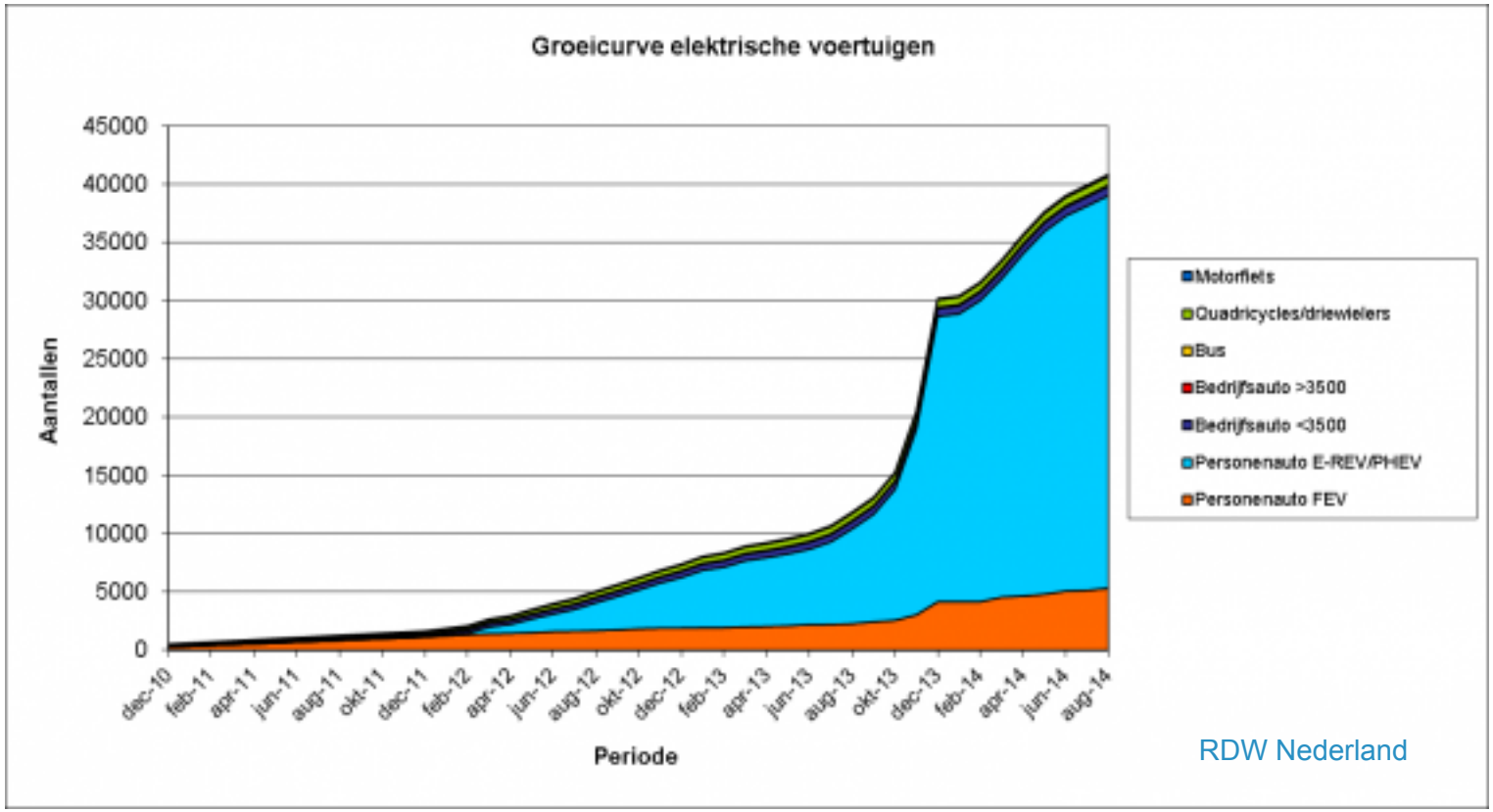
OVERVIEW

- THE BATTERY-ELECTRIC VEHICLE
  - HISTORY
  - CHARACTERISTICS
  - BATTERIES
  - INFRASTRUCTURE
  - STANDARDIZATION

clean fleets
purchasing clean public vehicles

THE NEW EMERGENCE OF THE BATTERY ELECTRIC

- GROWING NUMBER OF VEHICLES ON THE ROAD
- COUNTRY CONTRASTS

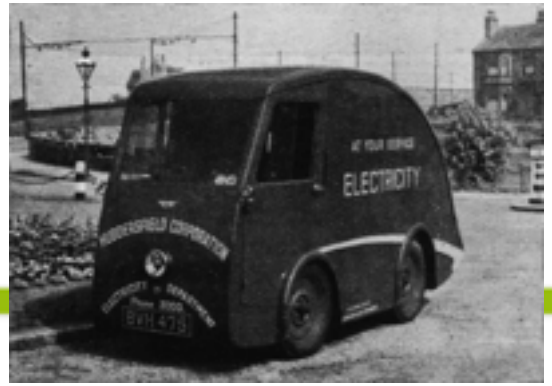


RDW Nederland

clean fleets
purchasing clean public vehicles

“NEW” TECHNOLOGY

- 1900-1920: THE FIRST GOLDEN AGE OF ELECTRIC VEHICLES
- AFTER 1920: RETIREMENT TO THE INDUSTRIAL VEHICLE SPHERE



"NEW" TECHNOLOGY

- GROWING INTEREST IN ENVIRONMENT
- OIL CRISIS
- RENEWED INTEREST
- FIRST GENERATION TAKING THE LEAD WITH LEAD
- SECOND GENERATION (1990S): NICKEL CADMIUM
- 21ST CENTURY: DEVELOPMENT OF LITHIUM BATTERIES

clean fleets
purchasing clean public vehicles

TYPES OF VEHICLES TODAY

SMALL CITY CAR

- TYPICAL VEHICLE FOR URBAN ELECTRIC DEPLOYMENT
- URBAN MOBILITY MODEL
- PROPOSED BY SEVERAL MANUFACTURERS
- ISSUES:
    - COST PREMIUM COMPARED WITH ICEV OF THAT CLASS
    - IMAGE OF THE VEHICLE

clean fleets
purchasing clean public vehicles

TYPES OF VEHICLES TODAY

PERFORMANCE CAR

- NICHE MARKET
- COMPETITIVE IN ITS SEGMENT
- CREATING THE POSITIVE IMAGE OF ELECTRIC VEHICLE

clean fleets
purchasing clean public vehicles

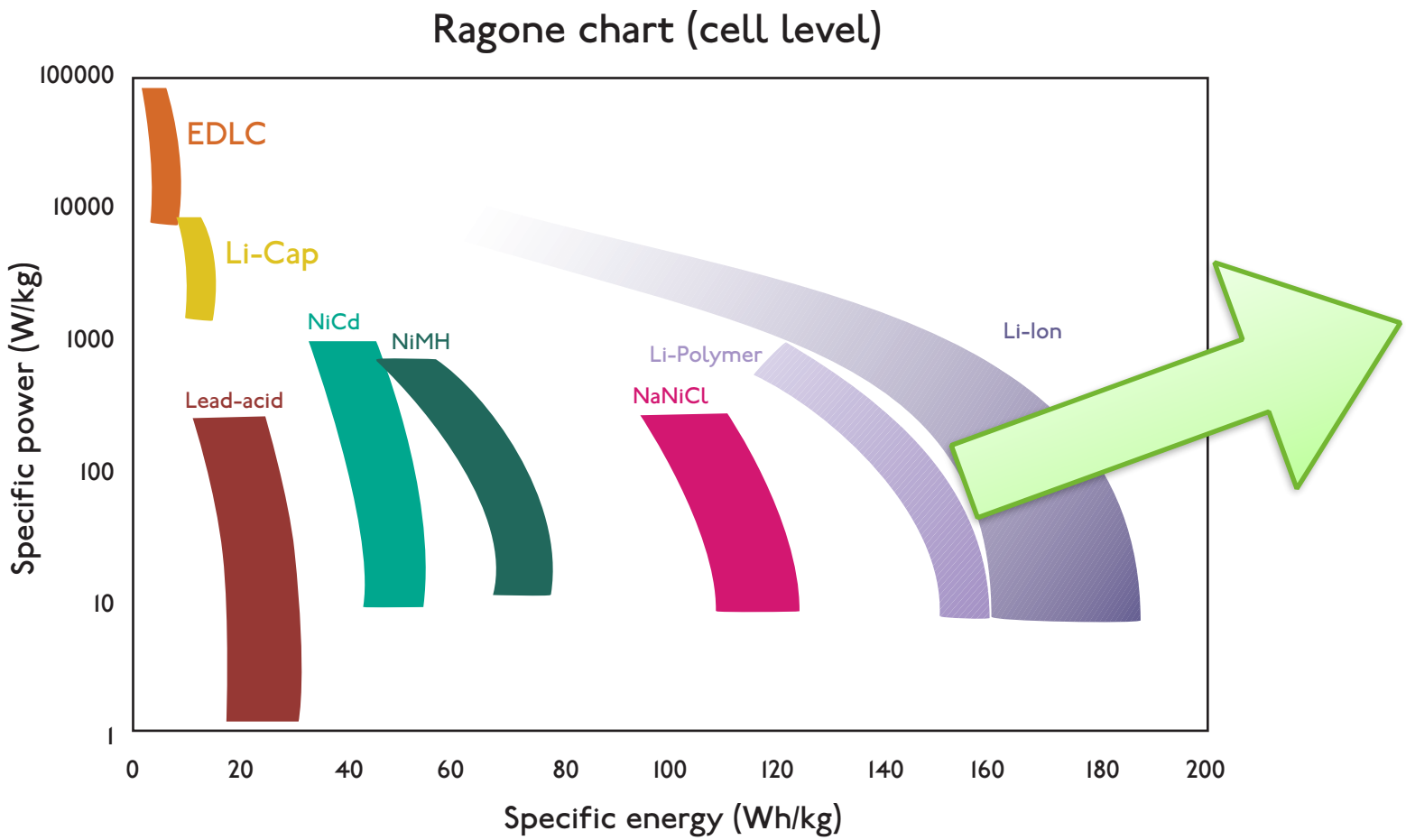
TYPES OF VEHICLES TODAY

UTILITY VAN

- IDEAL EV APPLICATION
- ELCIDIS PROJECT
- ISSUES:
    - LIMITED OFFER

clean fleets
purchasing clean public vehicles

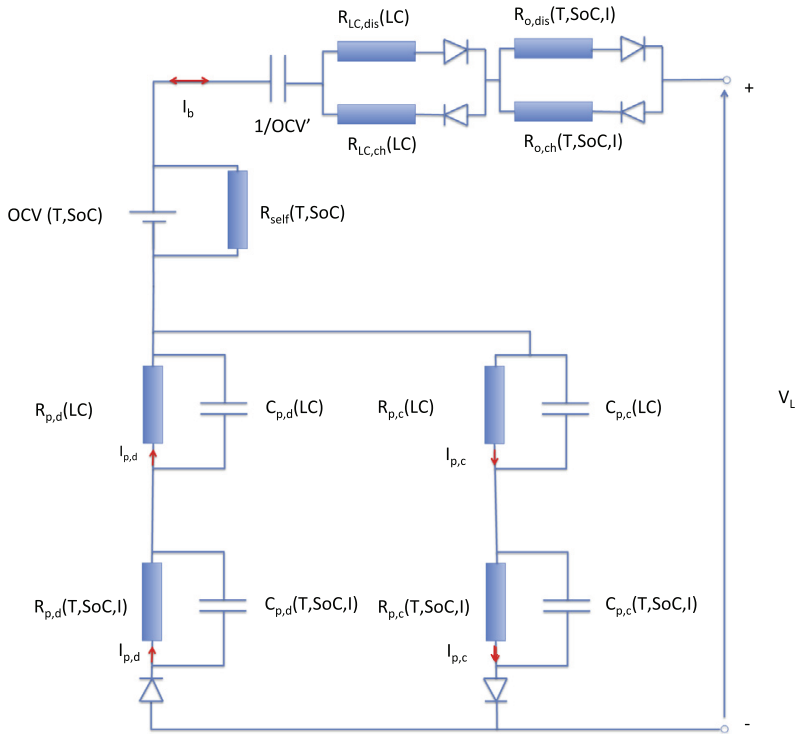
WHAT MADE IT HAPPEN: THE BATTERIES



clean fleets
purchasing clean public vehicles

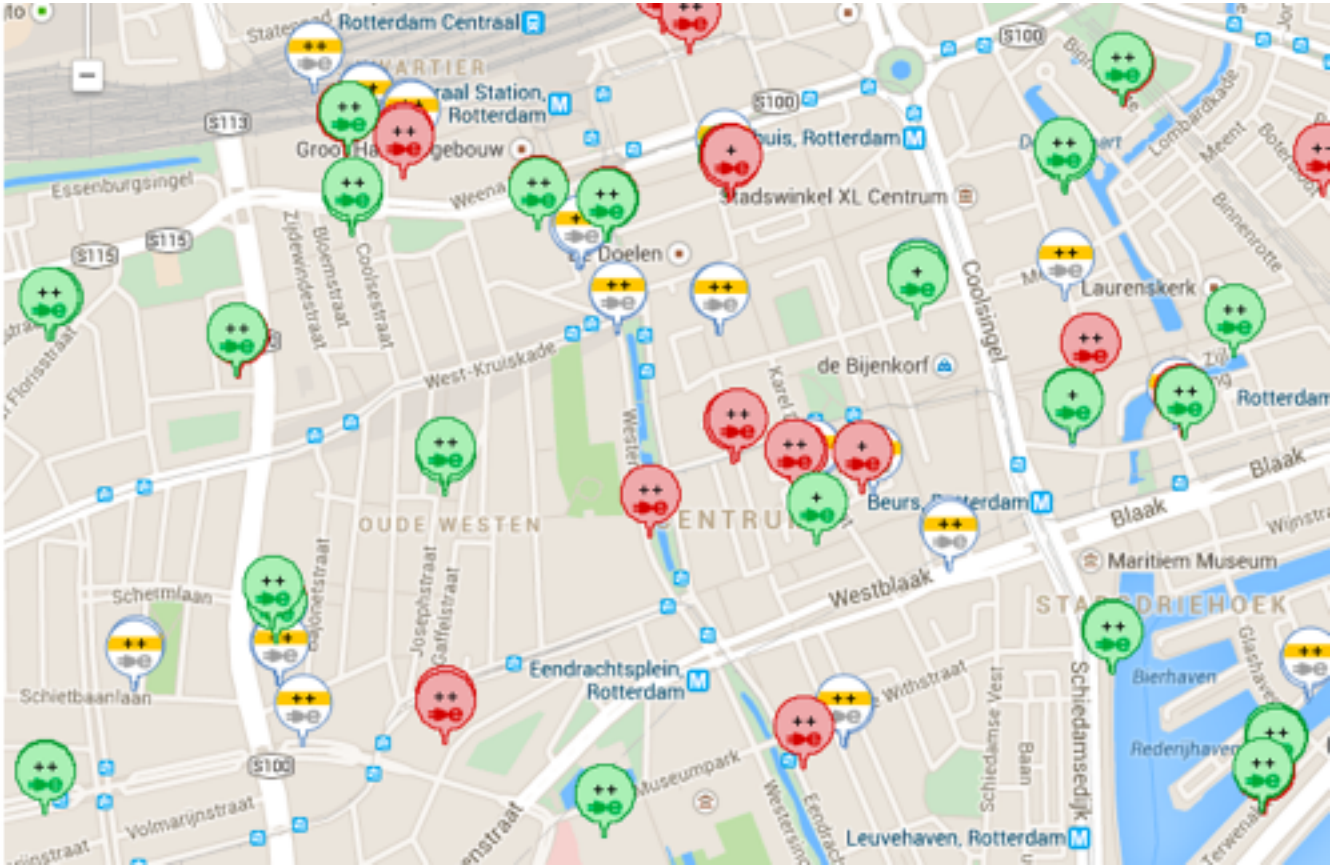
BATTERY EVOLUTION

- LITHIUM ION: VARIOUS TECHNOLOGIES
- ENERGY STORAGE
  - IMPROVING WH/KG
- POWER STORAGE
  - IMPROVING W/KG
  - HYBRID DEVICES: BATTERY/CAPACITOR
- KNOWING AND CHARACTERIZING THE BATTER
  - MODELLING
  - SOC DETERMINATION
  - SOH DETERMINATION
- CYCLE AND CALENDAR AGING
  - SECOND LIFE APPLICATIONS
- CHARGE ACCEPTANCE
- SAFETY



clean fleets
purchasing clean public vehicles

WHAT MADE IT HAPPEN: THE INFRASTRUCTURE



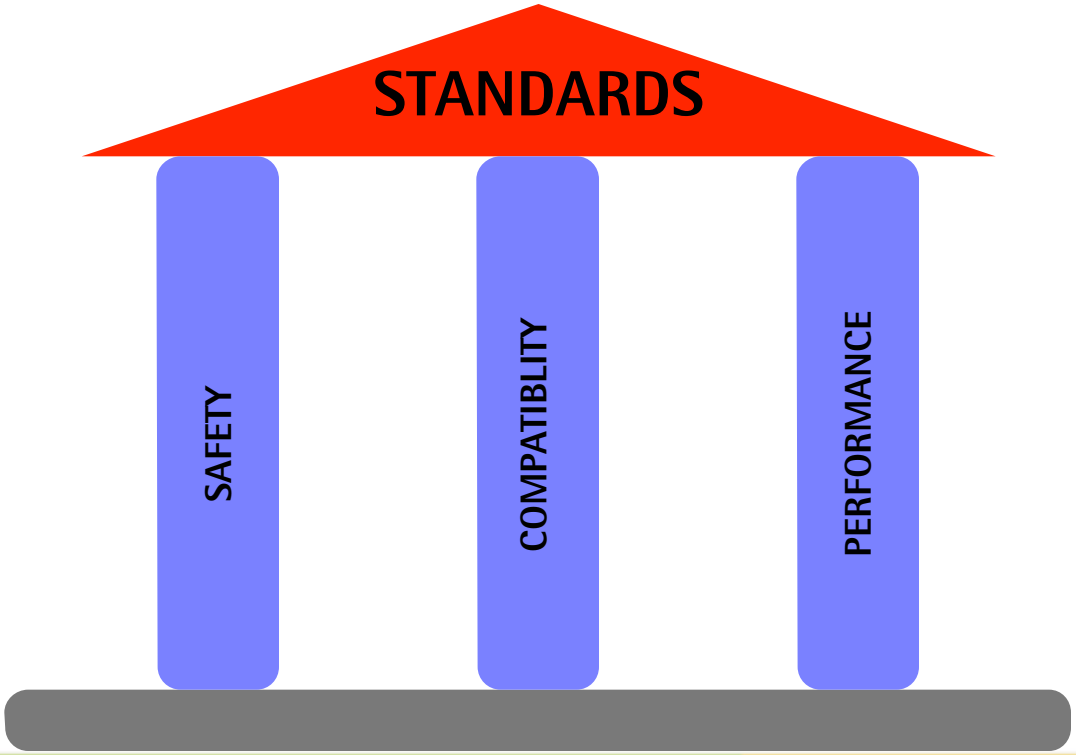
oplaadpalen.nl

clean fleets
purchasing clean public vehicles

INFRASTRUCTURE ISSUES

- SAFETY
- INTEROPERABILITY
- PERFORMANCE

- NEED FOR STANDARDIZATION



STANDARDIZATION

COMPLEX LANDSCAPE

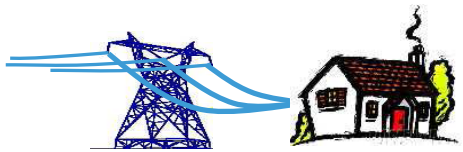
Fixed installations
IEC 60364 (TC64)

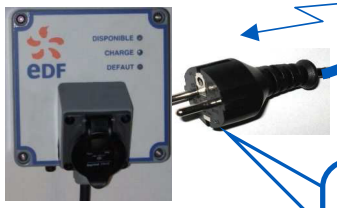
Wireless charging interface
IEC 61980 (TC69)

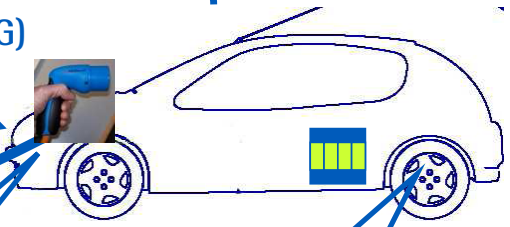
Charging interface
IEC 61851 (TC69)

EV electrical aspects
(if not charging)
ISO 6469 (TC22 SC21)
(when charging)
ISO 17409 (TC22 SC21)

Data transfer
ISO/IEC 15118 (JWG)







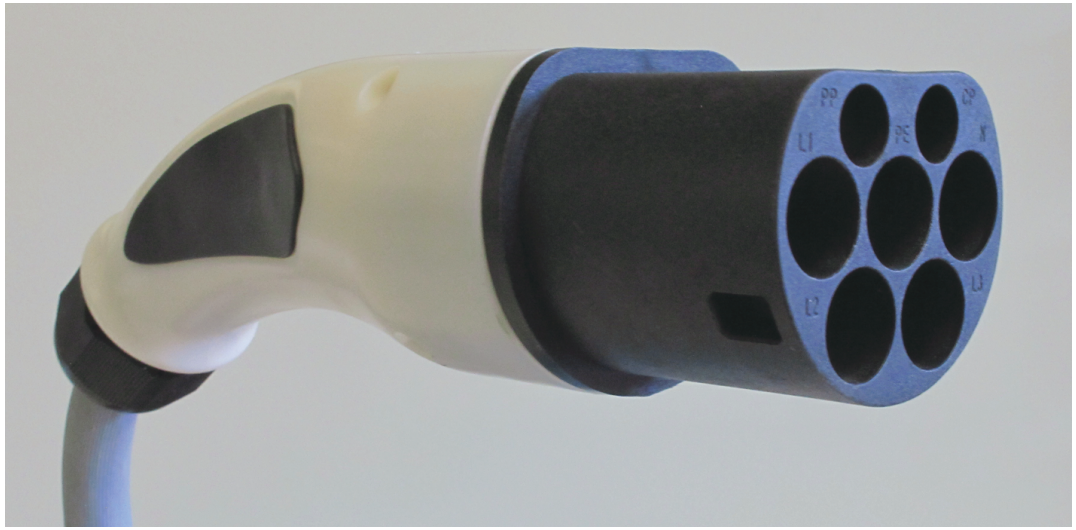
Assemblies
IEC 61439-7
(TC17D)

Connective
Interfaces
IEC 62196
(SC23h)

Battery cells
IEC 62660 (TC21)
Battery assembly
ISO 12405 (TC22SC21)

STANDARDIZATION OUTCOMES

- COMMON CHARGING INFRASTRUCTURE FOR A.C. CHARGING
- STILL COEXISTING STANDARDS FOR D.C.
- VEHICLE/CHARGING POST COMMUNICATION
- NEW TECHNOLOGIES (WIRELESS CHARGING) UNDER DEVELOPMENT
- NEW ENERGY MANAGEMENT (V2G) UNDER DEVELOPMENT
- NETWORK INTEROPERABILITY: WORK TO BE DONE



clean fleets
purchasing clean public vehicles

CONCLUSIONS

- NEW ENERGY STORAGE TECHNOLOGIES
- DEPLOYMENT OF STANDARDIZED ACCESSIBLE INFRASTRUCTURE

HAVE SET THE PATH FOR A MAJOR BREAKTHROUGH OF BATTERY-ELECTRIC VEHICLES

BUT APPROPRIATE POLICIES ARE NEEDED FOR SUCCESS !

THE FUTURE IS ELECTRIC!