Building a U.S. Battery Industry for Electric Drive Vehicles: Progress, Challenges, and Opportunities
July 26, 2010

Defining the Supply Chain: Gaps and Opportunities

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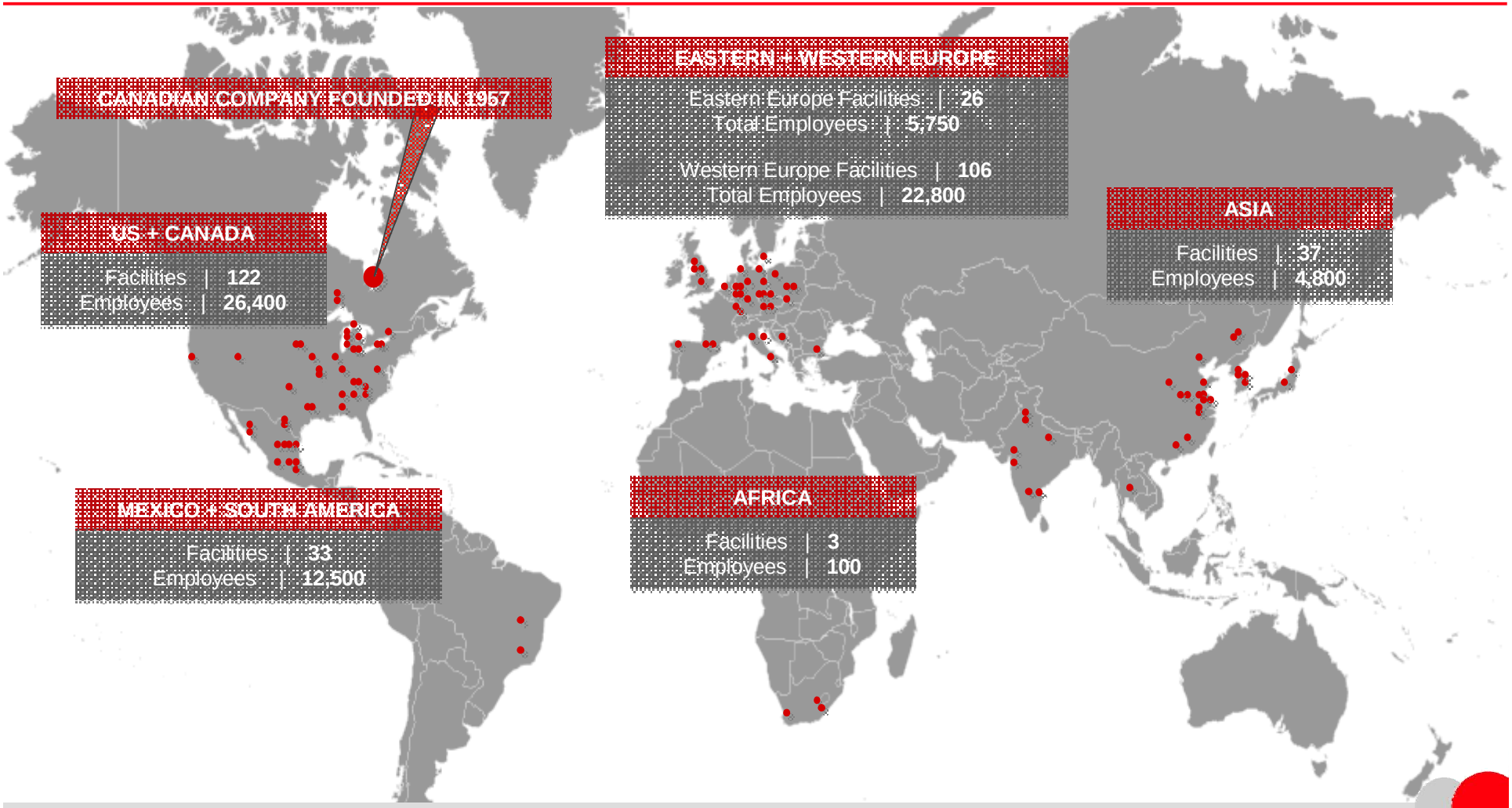
Magna Global Presence



~ 74,000 People | 25 Countries | Global Facilities 316 | $17.4 Billion (2009 Sales)

(As of September 2010)

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Product Portfolio

MAGNA E-CAR SYSTEMS

electric & hybrid systems

MAGNA ELECTRONICS

- ON-BOARD CHARGERS
- GENERATORS
- HUB MOTORS
- MOTOR CONTROL UNIT
- VEHICLE CONTROL UNIT
- CHASSIS TRACTION MOTORS
- DC-DC CONVERTERS
- BRUSHLESS DC COOLING FANS & HVAC MOTORS
- BATTERY MANAGEMENT SYSTEMS

MAGNA STEYR & MAGNA E-CAR SYSTEMS

- LI-ION BATTERY PACK

MAGNA COSMA

- MODULAR POWERTRAIN CRADLE

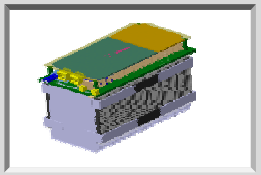
MAGNA POWERTRAIN

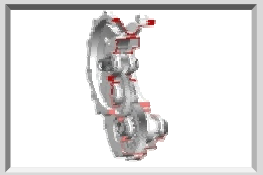
- ELECTRIC TRANSAXLES
- ELECTRIC TRACTION SYSTEMS
- START STOP SYSTEM
- ELECTRIC OIL PUMPS
- ELECTRIC WATER & ENGINE COOLANT PUMPS
- MODULAR ELECTRIC AXLE

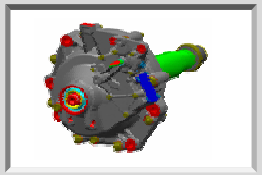

ON BOARD CHARGERS


GENERATORS


HUB MOTORS


LI-ION BATTERY PACK


ELECTRIC TRANSAXLES


ELECTRIC TRACTION SYSTEMS

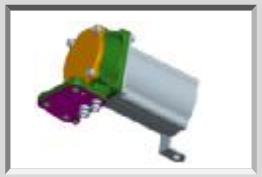

MOTOR CONTROL UNIT


VEHICLE CONTROL UNIT


CHASSIS TRACTION MOTORS


MODULAR POWERTRAIN CRADLE


START STOP SYSTEM


ELECTRIC OIL PUMPS


DC-DC CONVERTERS


BRUSHLESS DC COOLING FANS & HVAC MOTORS


BATTERY MANAGEMENT SYSTEMS


ELECTRIC WATER & ENGINE COOLANT PUMPS


MODULAR ELECTRIC AXLE

Magna E-Car Systems Mission

- **Magna's face to the customer for all hybrid and electric-vehicle programs globally**
- **Founded in 2010 with US Headquarters in Auburn Hills, Michigan**
- **Range of services and products includes:**
  - Integration of components and systems
  - Development and production of innovative, complete vehicle solutions
  - Engineering and turnkey programs
  - Lithium-Ion battery systems
  - Battery and materials testing services

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Lithium Ion Battery Systems

- **Battery Business Unit produces electrical energy storage systems for hybrid- and electric-vehicle applications**
- **We are a buyer of:**
  - Lithium ion cells from various manufacturers
  - Technology and services for cell and pack development
  - Capital equipment for cell and pack manufacturing
  - Material and components for cell and pack manufacturing

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Supply Chain Challenge – Access and Cost

- **Current suppliers are "scattered" all over the globe**
  - Communications are hindered by language and time zones
  - Transportation and customs clearance causes delay and costs
  - Hazardous material and safety regulations vary by country
  - Inventory carrying costs are high
- **Lithium ion cells and materials originate primarily from Asia**
- **Conductive materials, foils, separator and electrolyte are primarily from Asia**
- **Primary soft pouch laminate sources are confined to Japan**
- **Major Asian competitors are vertically integrated or control supply chain providing cost benefits and restricting access**
- **North American investment in cell production has not been matched by necessary investment in supply chain**
- **Uncertainty of vehicle market volume and timing has limited investment in North American supply chain**
- **Development / Validation costs are prohibitive**
  - Lack of industry standards and automotive grade materials and components creates significant non re-occurring engineering costs (NRE)

Opportunities

- **Standardization**
  - Testing –meaningful testing procedures and standards at cell, module, pack, vehicle levels
  - Cell size and fit – unlikely to be determined “by committee” in the short-term; market success will determine long-term
  - Standard, automotive grade hardware and components
- **Investment in Flexible/ Modular designs**
  - Modular systems can be adapted to each application with limited validation, minimizing NRE
- **Continue investment in advanced energy storage and electrified vehicle technologies for near-term applications**
- **Expand government policies, programs and financial incentives to accelerate the market growth for electrified vehicles**

Increase HEV, EV Volumes and Reduce Uncertainty

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