

Electric mobility in Bulgaria



Electric mobility


Introduction

- ⚡ What is an electric car?
- ⚡ First prototypes – late 1820s
- ⚡ Electric mobility – on par with Gas mobility until the 1930s of the 20th century
- ⚡ Revival after the Second World War, the oil crises of the 1970s and 1980s. Today.
- ⚡ Versatility of applicable technologies



Global Trends



- **World economy transition to green technologies, due to the growing public awareness towards:**
 - Pollution, Recycling
 - Fossil fuels scarcity and growing prices, unstable oil supplying regions
 - Advanced technologies 
 - Energy efficiency and Renewable Energy Systems
 - Ecological and environmentally friendly technologies



Global Trends



Legal environment, strategic and priority framework

International level:

- Kyoto Protocol
- United Nations Framework Convention on Climate Change
- EU economy recovery plan, issued by the EU commission, Nov. 2008, which states: “promote, research and development activities in safe and energy efficient mobility, particularly in electric mobility”
- European commission’s “Energy roadmap 2050”

National level:

- National strategies
- National legislative initiatives

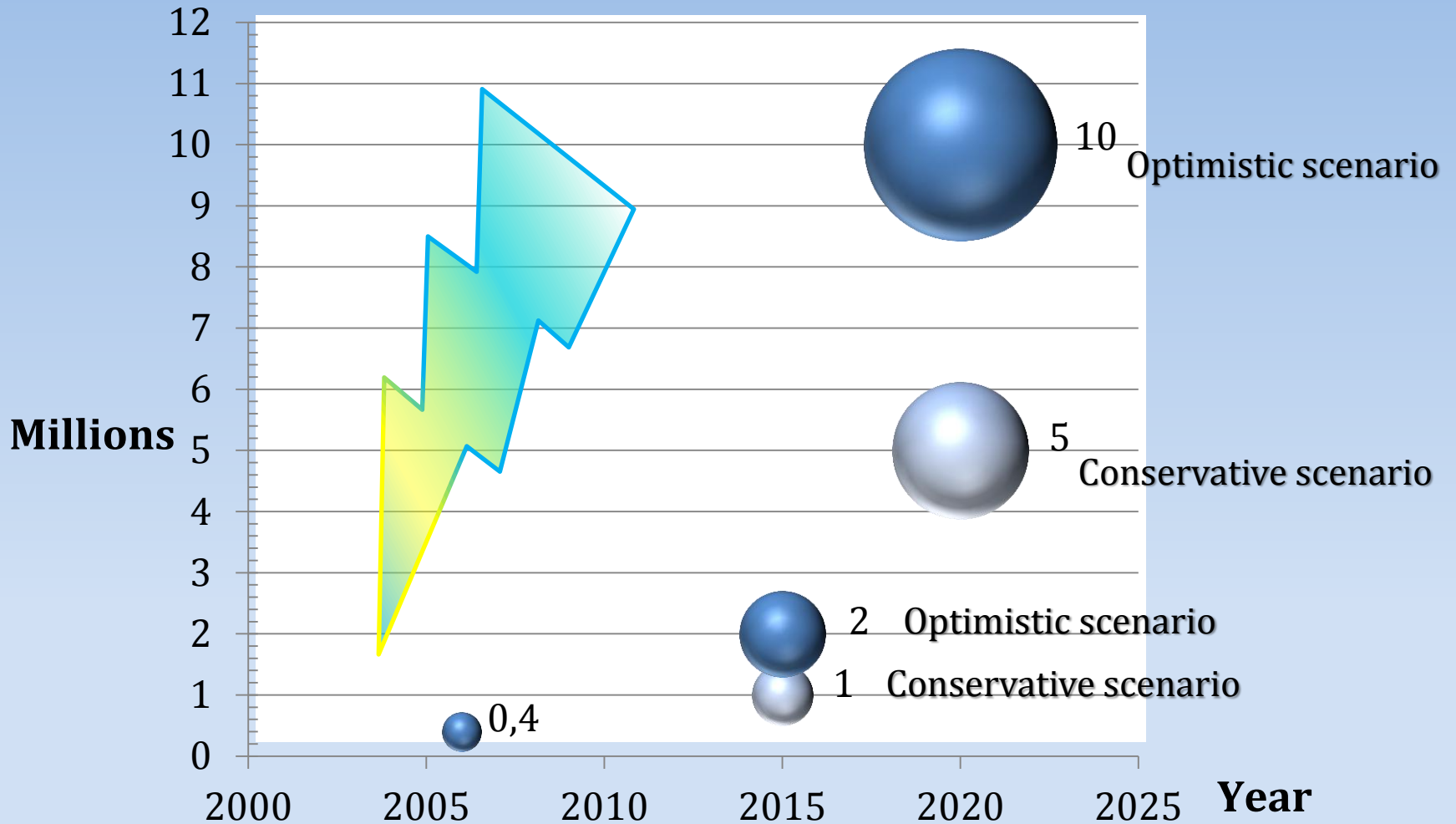
Regional, municipal level:

- Energy efficiency/clean energy municipal incentives
- Tax, tolls, etc. incentives
- Others

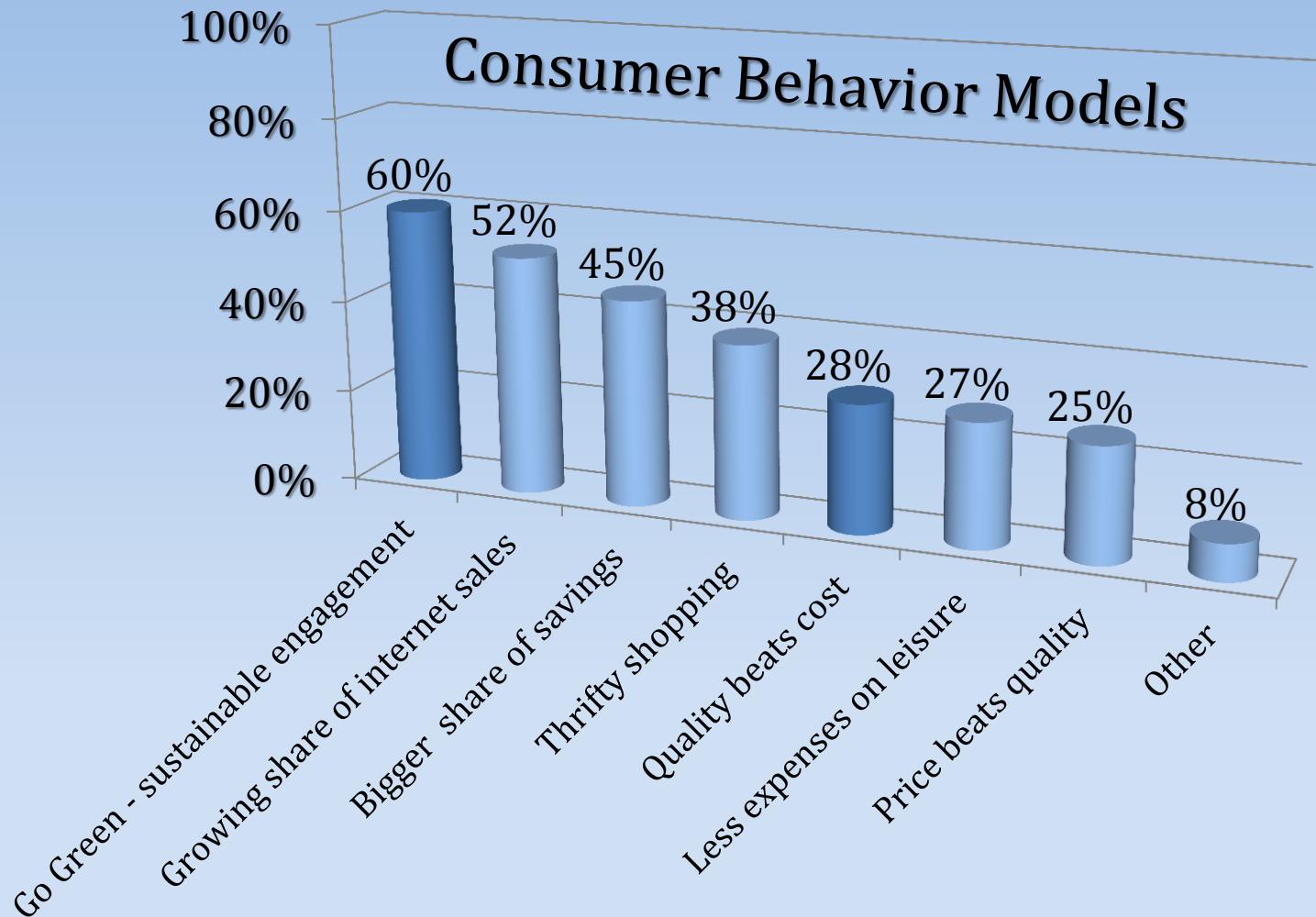


Global Trends

Predicted global sales of ecological vehicles

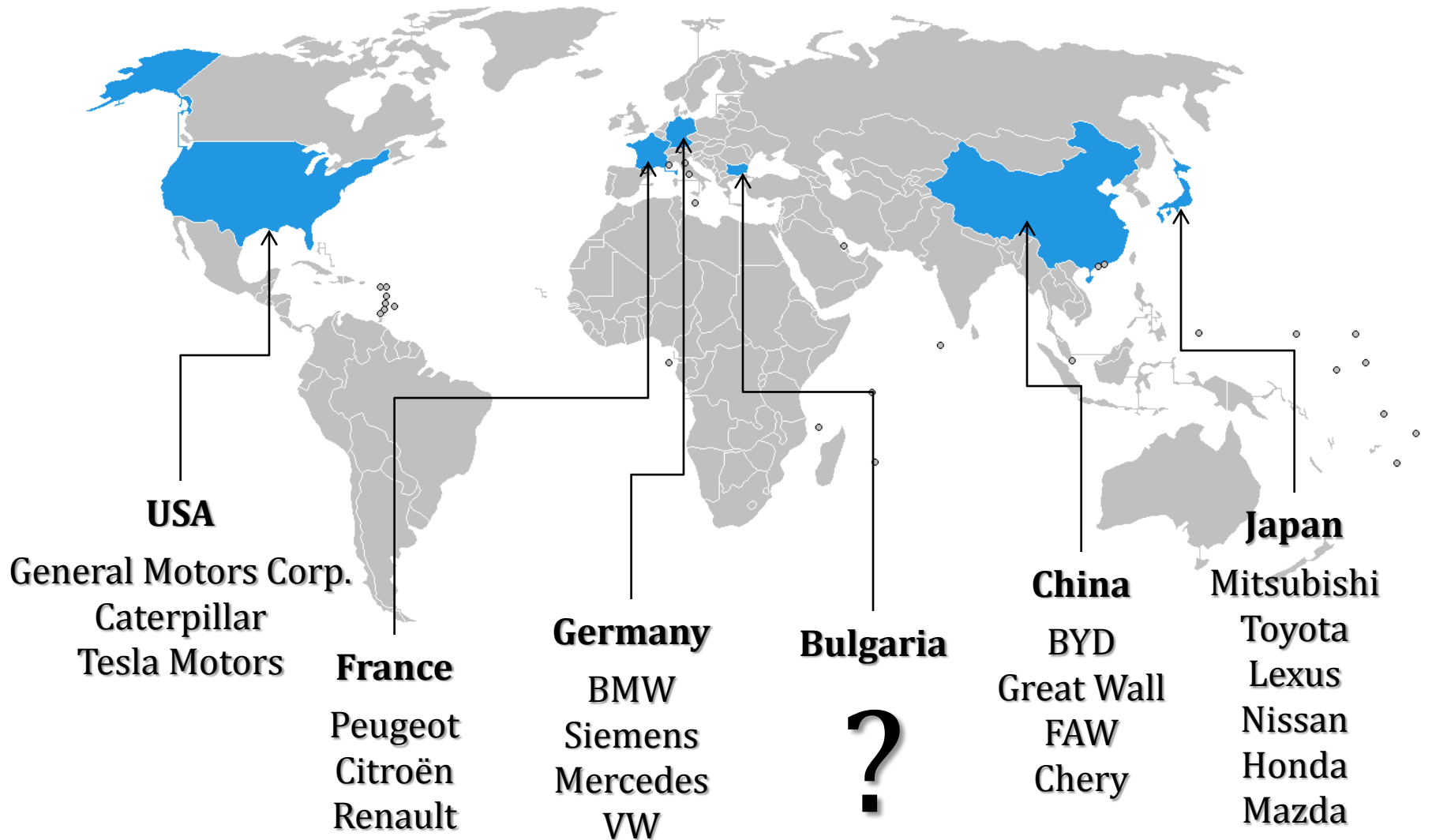


Global Trends



Source: A.T. Confidence Index 2010: 44 countries, 17 industries; Top Level Management Interviews

Global Trends

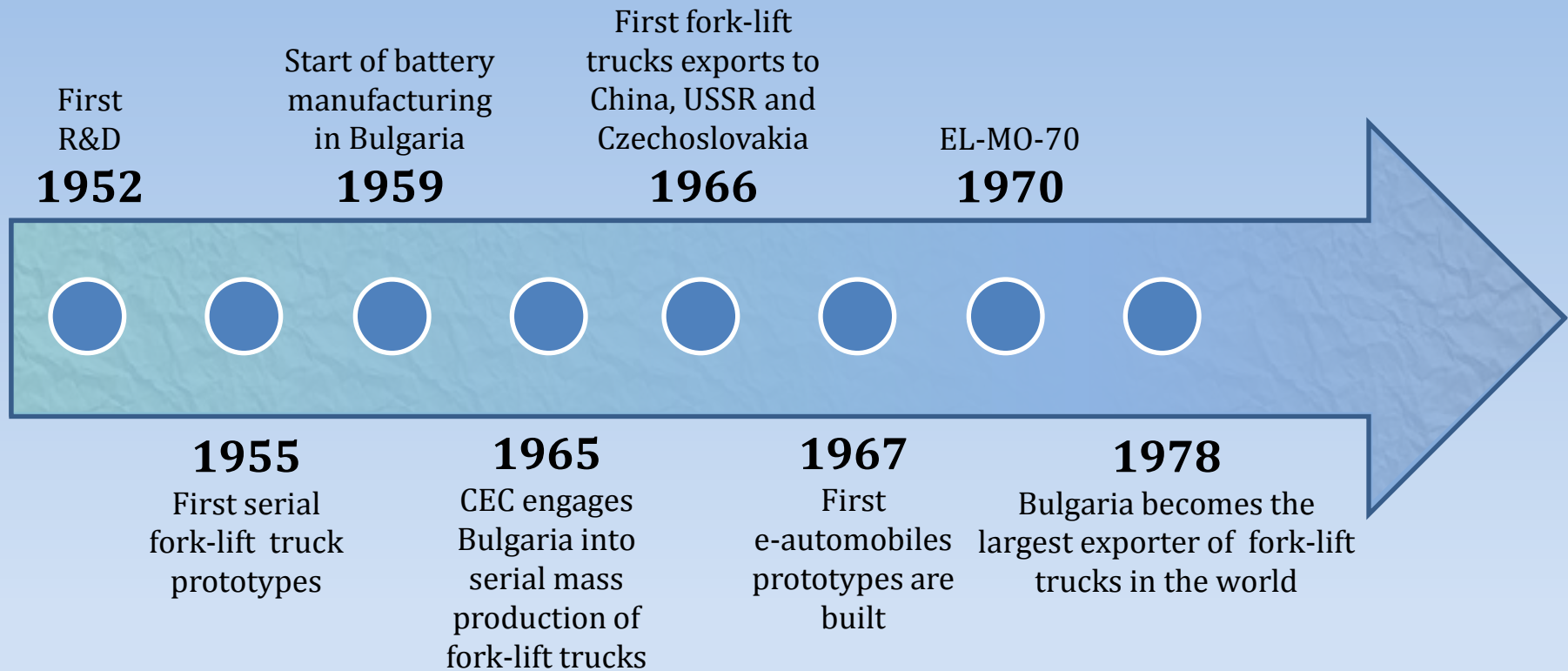


Challenges

- Research & Development
 - Batteries, energy storage
 - Vehicle technology for electric mobility
 - Technology for infrastructure/system and grid integration
- Regulation and Standardization issues
- Impacts on energy efficiency and greenhouse gas emissions

The electric mobility cluster in Bulgaria

1952-1989



The Cluster in 1989: - **39 manufacturing plants**, 8 of which – abroad;
- A sub-cluster of **4 R&D establishments** under Bulgarian Academy of Sciences' umbrella

Cluster Diamond

FIRM RIVALRY

- **2249 companies** in Manufacturing of **electrical equipment**; 44 679 employees; Revenue: 1.5 bn. EURO; Profile: SME & Large;
- 267 companies in Automotive; 5700 employees; Profile: SME;
- 942 companies in ICT, 24 063 employees;
- **MONBAT** – among the 5 biggest battery manufacturers in Europe;
- Existing automotive industries in Romania, Serbia and Turkey;
- **IFC - ICEM**

FACTOR/INPUT CONDITIONS

- **Traditions** in electric mobility;
- **Skilled labor** force;
- Good **technical literacy** of the population;
- **Benign investment environment** – tax, location, free access to EU Single Market

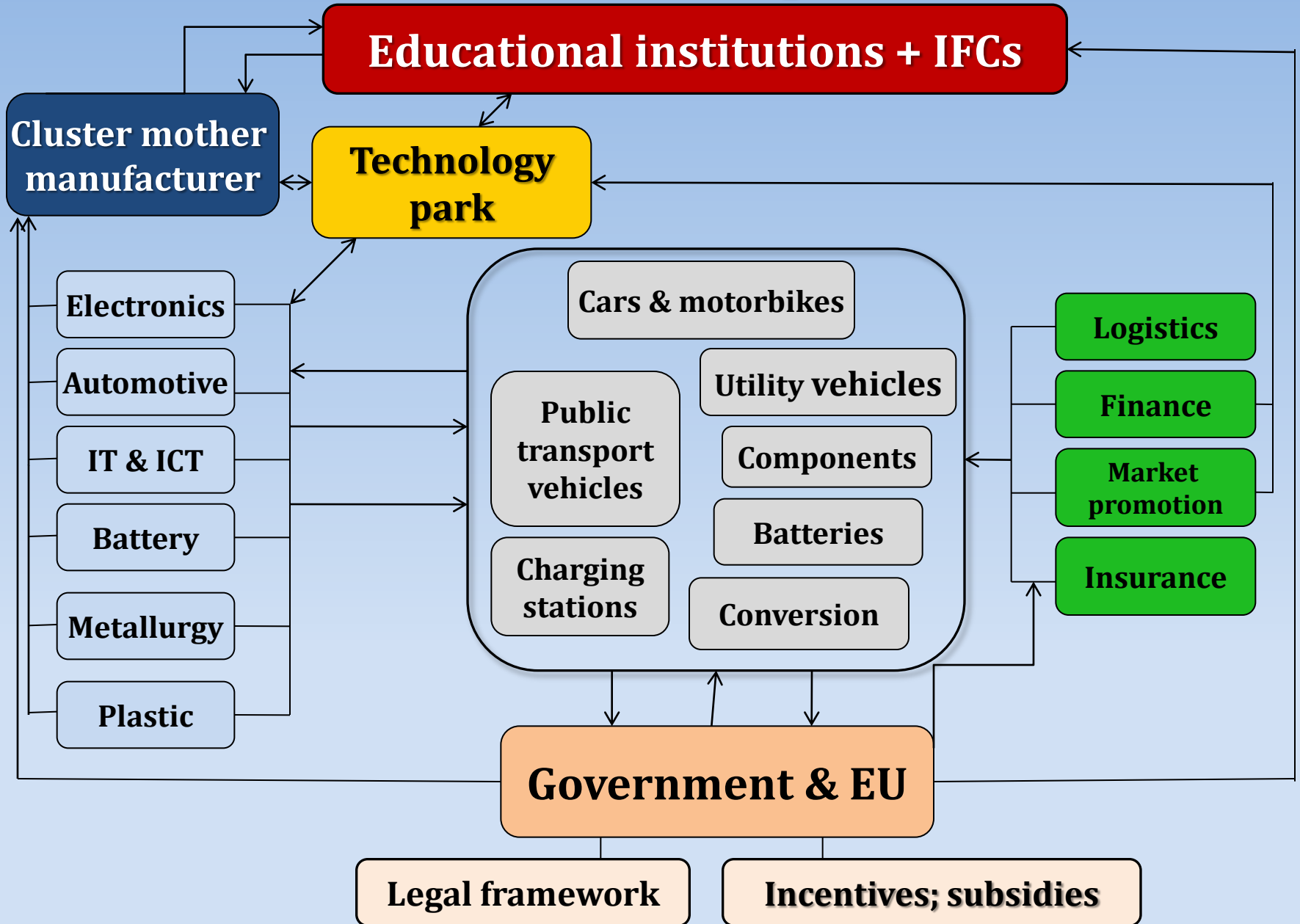
DEMAND CONDITIONS

- Emerging industry worldwide;
- EU Commission back-up;
- High prices;
- Substantial R&D needed in both drive-train and battery technologies;

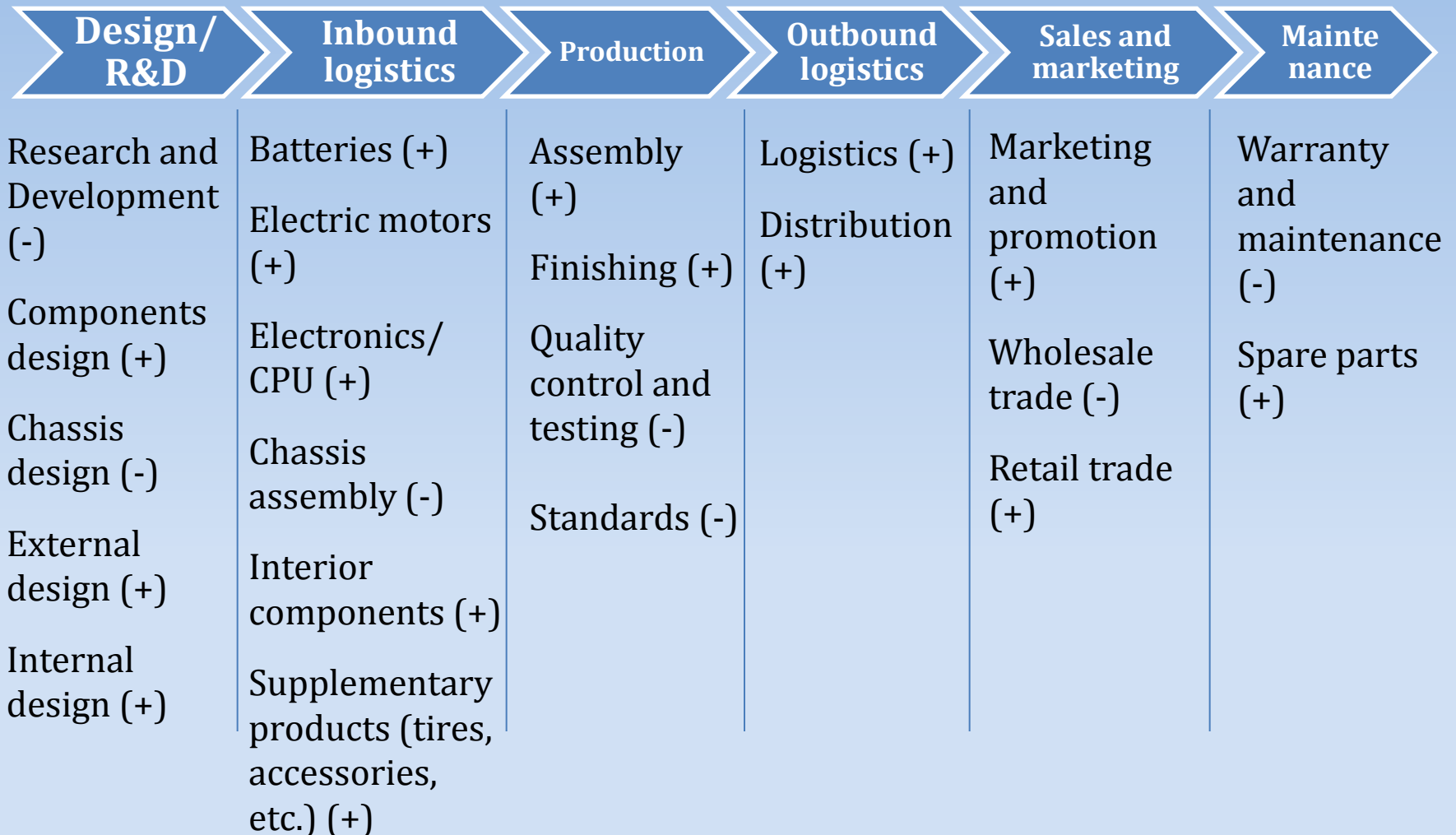
RELATED & SUPPORTING INDUSTRIES

- Financial services & Insurance;;
- Maintenance;
- **Charging infrastructure**;
- **Recycling**;
- Logistics;
- Chemicals;
- Metals and metallurgy;

Cluster Map



Supply chain



Bulgarian Electric mobility cluster today – milestone examples and case studies

Foreign Development Companies:

- Yazaki
- Curtis Balkan
- Melexis
- EPIQ
- MONTURET
- GRAMMER
- PALFINGER
- Se Bordnetze
- Great Wall
- Zero Carbon



Local Development Companies:

- Kostov Motors
- DINAMO
- ELPROM Elhovo
- ELHIM Iskra
- MONBAT
- CAPRONI
- M+S Hydraulic
- HES
- KIRKOVO
- Drouzhba
- Madara
- PRESKOV
- Magnetic Media Automotive



Competences:

Alternators; Starters; Ignition; Electric Motors; Converters; Electronic modules; Int. Circuits (ASICs) for automotive electronics; Cylinder heads; Engine blocks; Brake parts; Armrests & seats; Automotive wiring harnesses; Hydraulic cylinders; Pistons and pistons sets; Rear and front driving truck axles; Trailers and ball races; Brake drums; Ball joints; Link bolts; End pieces; Axial rods, AC&BLDC servo drives, frequency invertors (drives, wind & PV), electronic modules for power electronics etc.



Why Bulgaria?

- Historical endowments in the sector
- Good strategic location + low factor cost within the Single market (0 import-export tariffs)
- Good macroeconomic environment (currency board, low taxes)
- Access to EU funding
- Opportunity to build a regional cluster in Southeast Europe with Bulgaria as a leader



Strategy

- 1. Manufacturing of electric vehicles** (drive-trains and batteries) and components for them;
- 2. Manufacturing of charging stations/battery-swap stations;**
- 3. Conversion services;**
- 4. Development of specialized Educational facilities** in electric mobility engineering.

**Full package of Adding Value - Design & R&D;
Manufacturing, Testing, Marketing**

**Goal: Electric Mobility Industry – Headliner in
Bulgarian economy in 2020. R&D**

Strategy

- ⚡ Conversion
- ⚡ Investments & sector capacity development
- ⚡ Legal initiatives
- ⚡ Technological park
- ⚡ Targets and indicators

Strategy

The 3 Stages Approach

Stage 1 - Sparks

- Raise a cluster awareness – identify relevant companies, list them, make them meet together and discuss cooperation;
- Trigger the conversion process;
- Establish government initiatives and subsidies;
- Channel EU and other financial schemes to the cluster;
- Academic reforms;
- Subsidiary infrastructure

Success Indicators: Grown public and industrial awareness of the sector. Companies and Academic Institutions start diversifying competences towards electric mobility

Stage 2 – Flame

- Draw a large multinational manufacturer and consolidate the industry around it;
- Attempt to establish Bulgarian brands;
- Boost marketing for Bulgaria as a top high-tech destination in electric mobility;
- Induce R&D activities of Bulgarian based companies within the cluster – soft measures and subsidies;
- Boost internal non-conversion demand for EM

Success Indicators: Drawn considerable strategic FDI; Bigger, more consolidated and integrated Bulgarian based companies; Created the brand “Bulgaria”; Growth of Bulgarian filed patents. Spin-off industries thriving around the EM cluster

Stage 3 – Fire

- Establish a national high-tech innovation powerhouse (Lovech could be the Electric Mobility capital of Eastern Europe). The capital will host a technology park and manufacturing plants;
- Further induce the process of technology transfer between business and universities/laboratories;
- Promote internationalization of EM higher education in Bulgaria;

Success Indicators: A Bulgarian city, dubbed “EM Capital”; Created sophisticated, high-end innovation infrastructure. EM employs 150k people.

Strategy

⚡ Investments and sector capacity development

- Cluster development financing and Strategy development (economic aspects, standardization, certification, legal initiatives, education, etc.)
- Company development and capacity building
 - EU financing
 - Venture funds
 - Strategic investors
 - Investment/equity funds
 - Marketing and promotion
- Education
- Infrastructure

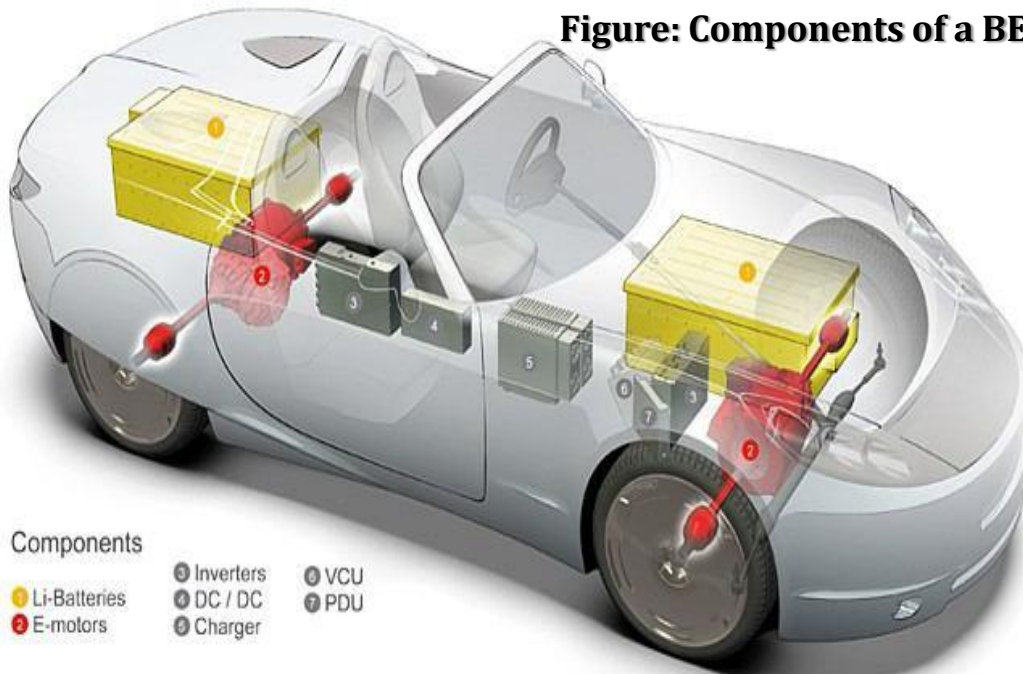
Strategy

- Legal initiatives
 - National strategies
 - FDI sector strategy
 - Act on investment attraction
 - Local investment legislation
 - Municipal initiatives
 - Registration, standardization and safety legislation

Strategy

Electric vehicle conversion – Why?

Figure: Components of a BEV



Components

1 Li-Batteries

2 E-motors

3 Inverters

4 DC / DC

5 Charger

6 VCU

7 PDU

Source: www.brusa.biz

For customers

- EVs are still **expensive**
- Conversion of old vehicle is estimated to be **under EUR 7000**
- **1.46 EUR / 100 km !**
- All **incentives** for EVs are valid here - free parking, tax rebates, etc.









For Industry/Government

- The **essential technologies** for electric drives, energy storage and grid infrastructure have been developed
- **Initial step** to test the capacity of EV market
- Conversion will **further develop production** and assembly of vehicle components supply industry in BG.
- Conversion will promote new technologies to **grow the economy** in the present economic situation
- **Multisectoral cooperation** - energy suppliers, public utilities, ICT service providers and research institutions will also **benefit**
- Creation of **new jobs** for highly skilled personnel
- Producing a lot of converted EVs => development of power grid stations => pushes EV production

Strategy

Conversion - Why?

Table: Specs and expected retail price of some EVs in the market or coming into the market

Powertrain		Model	Type	Battery pack (kWh)	Range (mi)	Acceleration (sec/60mph)	Expected Retail Price
BEV		Tesla Model S	Sports car	42	300	5.6	\$57,400
		Tesla Roadster	Roadster	53	236	3.9	\$109,000
		Nissan Leaf	small	24	100	5.4	\$32,780
		Mitsubishi iMiEV	City car	16	100	13.5	\$32,000
		BYDe6	medium	48	200	8	\$40,000
		Think City	small	28.3	130	20	\$40,000
PHEV		Prius + Hymotion	medium	5	40	9.8	\$35,000
		BYD F3DM	sedan	13.2	62	10.5	\$21,900
ReEV		Chevy Volt	sedan	16	40	6	\$35,000
		Opel Ampera	sedan	16	37.5	9	\$35,000

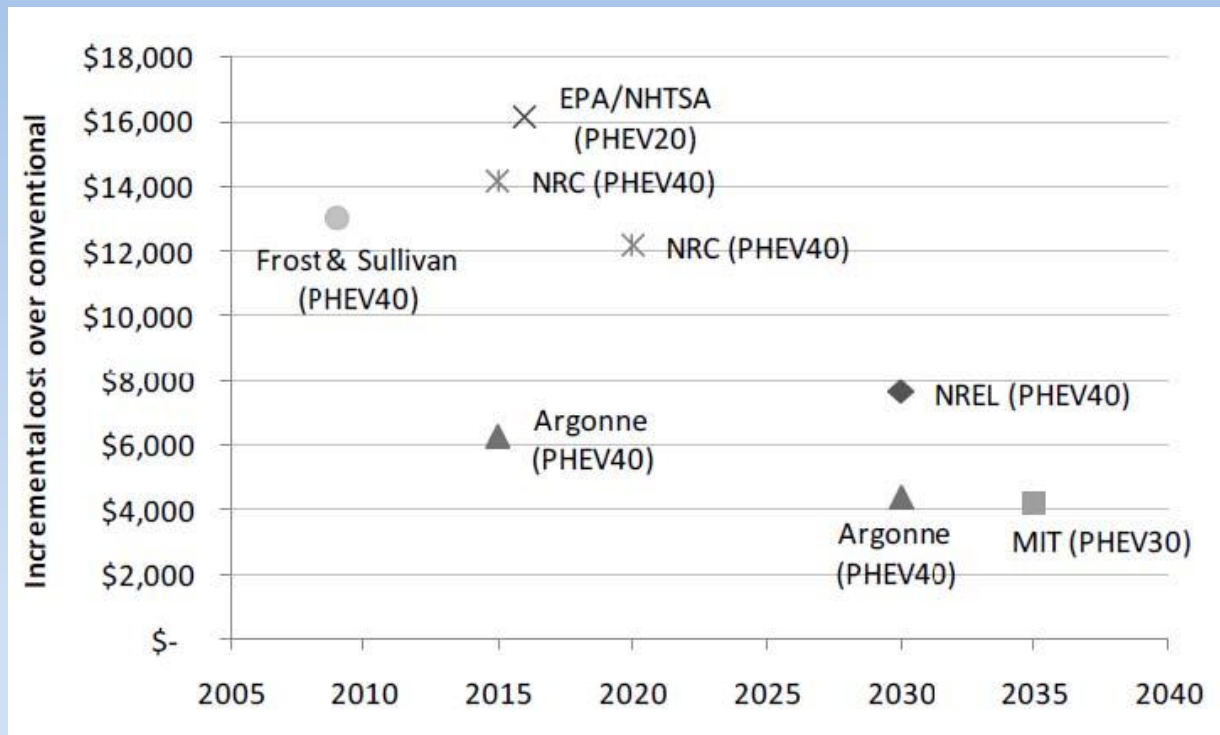
Source: Plug-In Electric Vehicle Introduction in the EU by F. J. de Sisternes. 2010

Present market of EVs and expected price depict that EVs are **still expensive**

Strategy

Conversion – Why?

Figure: Estimates of PHEV' incremental manufacturing cost over conventional vehicles



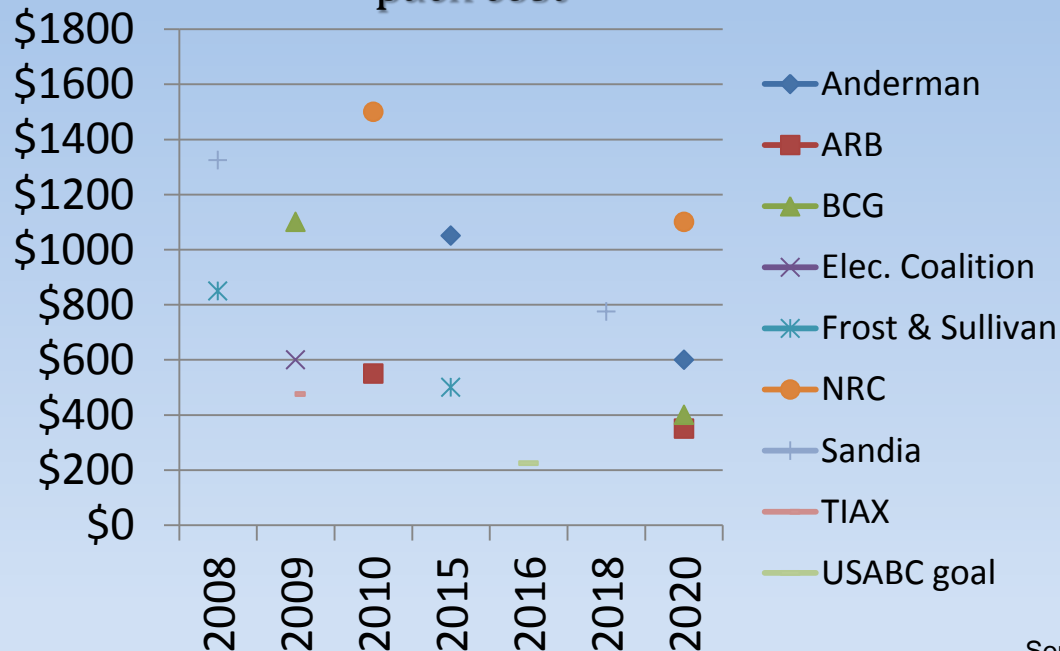
Source: Cheah & Heywood

The **considerable price premium** of electric vehicles – mainly caused by the high cost battery system – remains the major drawback of electric vehicles. Only if considerable cost reductions can be achieved in the future, electric vehicles are likely to penetrate the automotive market at relevant production volumes.

Strategy

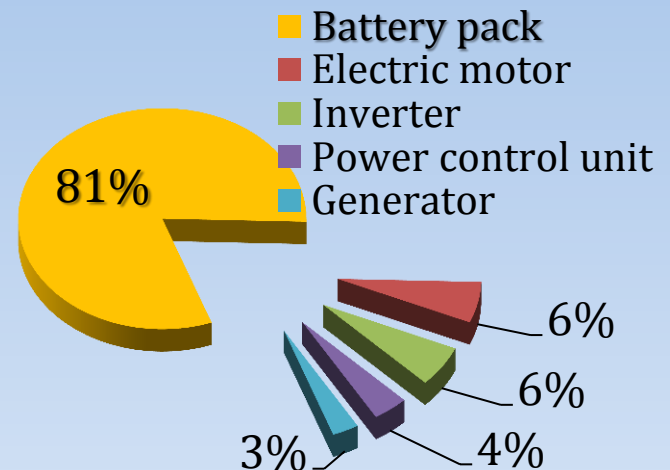
Battery Costs

Figure: Estimates of EV Li-ion battery pack cost



Source: Cheah & Heywood

Figure: Breakdown of EV drive system cost by component



Source: Plug-In Electric Vehicle Introduction in the EU by F. J. de Sistesnes. 2010

- 81% of the total cost of a EV drive system can be attributed to the battery
- High cost of the battery
- Depends on the production volume - battery costs are expected to decrease as battery production volumes raise
- Market for EVs is still highly uncertain, estimates for future battery cost vary widely

Strategy

Users	Fuel /liters/		Price of fuel /EUR/		Electricity (kWh)		Price of electricity /EUR/		Economic effect /EUR/	
	50 000 km	100 000 km	50 000 km	100 000 km	50 000	100 000	50 000	100 000	50 000 km	100 000 km
Automobile/ EV	3 000	6 000	3 651	7 302	7 500	15 000	728	1 455	2 924	5 847
Firm with 5 automobiles	4 000	8 000	4 868	9 736	12 500	25 000	1 213	2 425	3 656	7 311
Minibus	7 000	14 000	8 519	17 038	17 500	35 000	1 698	3 395	6 822	13 643
Truck	7 000	14 000	8 519	17 038	17 500	35 000	1 698	3 395	6 822	13 643
Firm with 5 trucks	35 000	70 000	42 595	85 190	87 500	175 000	8 488	16 975	34 108	68 215

Source (methodology): EVIC – Electric vehicles industrial cluster

Source (prices): www.energy.eu

* The estimates above are made at an average consumption **per 100 km**, as follows:

- **Unleaded fuel (Euro95)** at price (as of June 12, 2011) of **1.217 EUR/liter** (2.38 BGN/l): automobile – 6 liters, minibus – 14 l., truck – 14 l.

- **Electricity** at price (as of January, 2011) of **0.097 EUR/kWh**: automobile – 15 kWh, minibus – 35 kWh, truck – 35 kWh.

Fuel cost savings over the driven lifetime of an EV are **significant**. This depends on fuel and electricity prices. With present fuel and electricity prices, EV adoption can bring significant economic fuel savings for consumers.

Strategy

Programs for EV Conversion – How?

Challenges

- Need to have an **authorization** for conversion from the representatives of all auto importers in Bulgaria
- The traffic control authorities shall prepare **model and standards** for the registration of vehicles with electric drive conversion.
- Develop **advanced conversion technology** of ICVs to electric drive - parameters for conversion shall be determined (maximum speed, mileage per charge, battery size, electric drive).
- **Safety** inspections
- Need to have enough **technicians/firms**, ready to start converting their car-repair business to electric-car-repair through technical courses

Programs

- Converter firms in Bulgaria will purchase **new vehicles** without an engine and related equipment and then perform the conversion.
- Conversion of **used vehicles**, usually with non-functioning engines, as such defective vehicles can be quite inexpensive to purchase. No need of special authorization.
- **Kit models** for conversion for different makes and models of ICEV (internal combustion engine vehicle). These kit models shall have indicative price for conversion, which would depend of tax relieves, financial incentives benefits provided by the respective municipality.
- Fleets are expected to be first customers

Technology Park

What is a Technology park?

Science + R&D meet Business

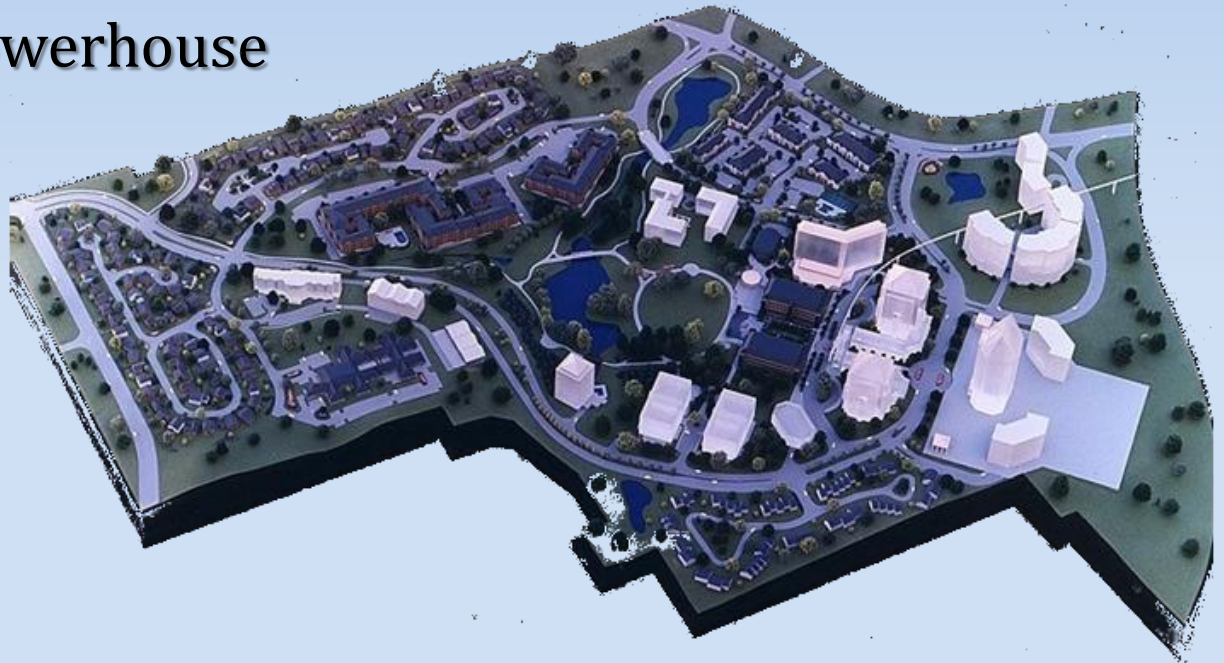
Identity

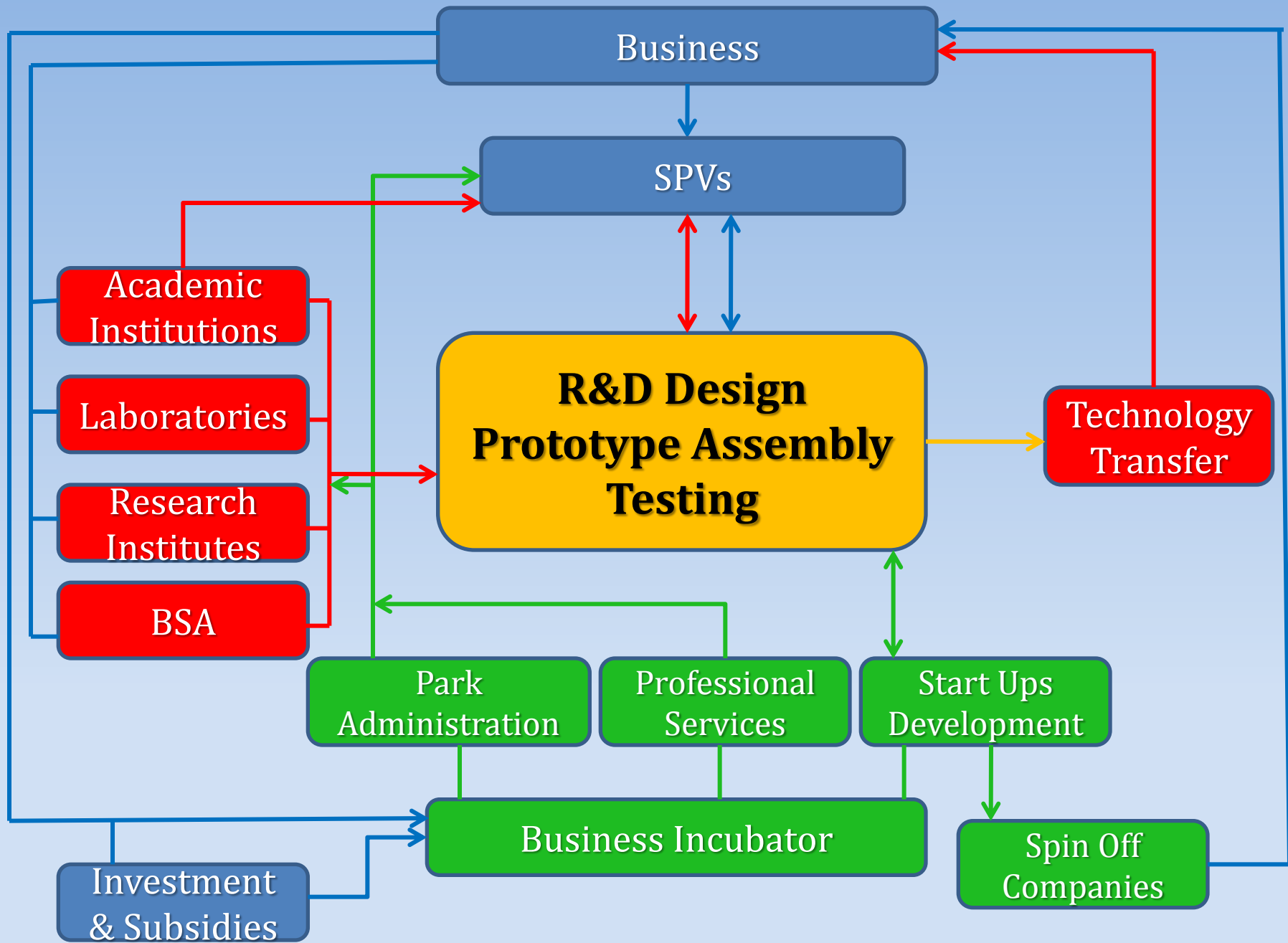
Specific, common shared

Infrastructure

Innovations Powerhouse

Incubator





SWOT Analysis

Strengths

- Good geographic location – proximity to large markets, including the EU Single market
- Benign tax policies;
- Good literacy of the population, including technical literacy;
- Stable currency and macroeconomic environment;
- History/experience in high-value added industries, including electric mobility;
- Existing manufacturing infrastructure in electrical equipment;
- MONBAT;
- Good and recognized IT specialists;
- Outsource establishments of global companies
- Cluster could evolve on a regional level

Weaknesses

- Small market;
- Incompetitive education curriculums
- Very low expenditure on R&D
- Old and worn out infrastructure, including industrial, educational and scientific;
- Negative connotation on the brand “Bulgaria”
- Low and weak level of clustering - existing facilities export 100%;
- Incompetitive rivalry;
- Underperforming legal system;
- Not sufficient protection on Intellectual Property Rights

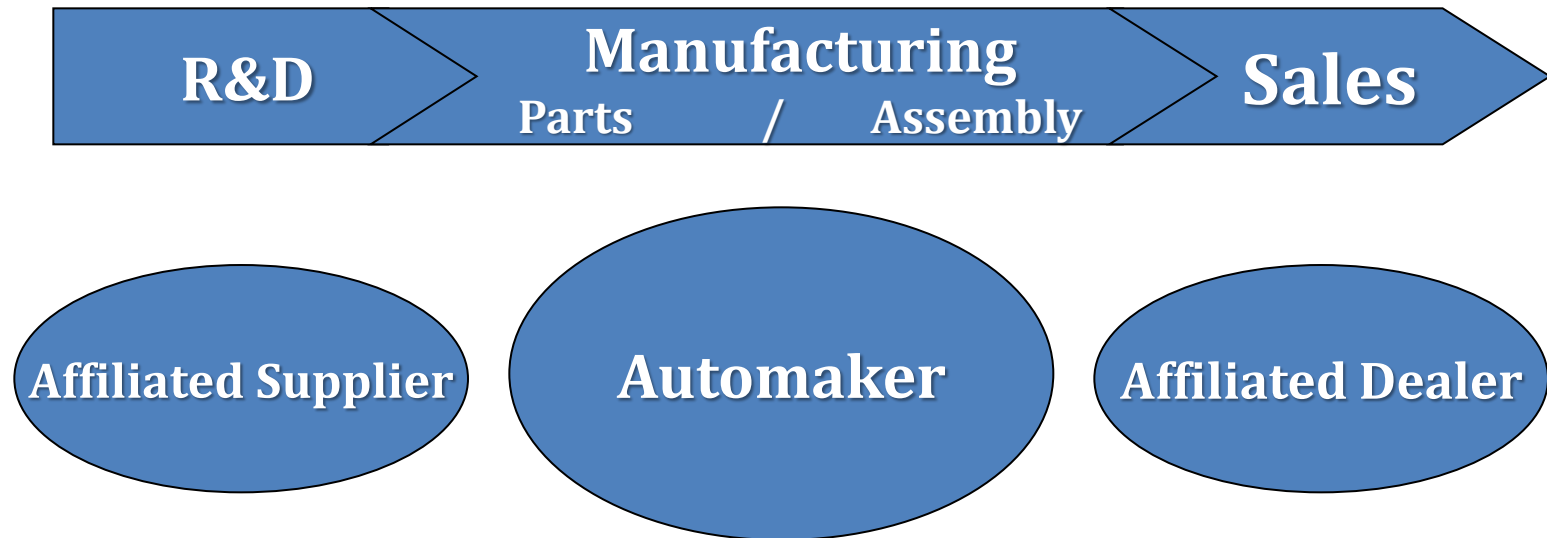
Opportunities

- Create and market Bulgarian high-tech brands;
- Become a manufacturing and logistic hub for Chinese/other investments within the EU Common market
- Create the proper environment for innovative firms to thrive – EU and other funding
- Cooperation with existing facilities in neighbor countries – Serbia, Romania, Greece, Turkey
- Induce R&D in electric mobility and become a global high-tech center
- Fortified flows of FDI on a global scale – in 2014 – expected to reach 2007 levels. BG could draw investments in sustainable, high-tech industries

Threats

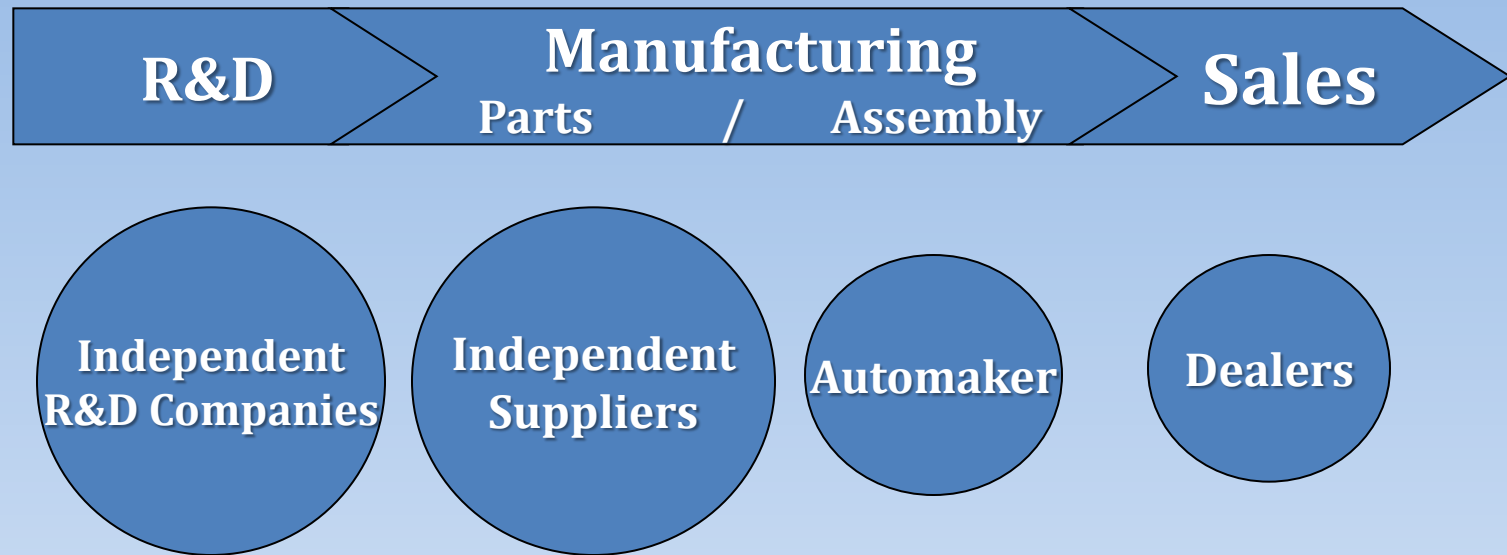
- FDI is not a prerequisite for R&D and innovations driven economy. BG could stay a factor driven economy
- Strengths and Opportunities are not unique for Bulgaria – other countries could go first
- In the case of el. mobility – high prices, unknown product, underdeveloped technology = risks
- The underperformance of Greece could pose treats for the whole region

Simplified Battery Electric Vehicle Value Chain



- Largest share of value is captured in the middle of the value chain
- Need for calibration of components
- Plant and equipment specialization
- Vertically integrated automakers

Simplified Battery Electric Vehicle Value Chain



- Much less collaboration between suppliers and automakers
- Simplification of production line, leading to lower entry barriers
- Industry standardization of components

Summary



Belchev Motors, Stara Zagora, Bulgaria

Q & A