

Rotherham – EV's in Yorkshire and Humber

360 Degree Perspective of the Global Electric Vehicle Market

Automotive & Transportation Group



December 2011

F R O S T & S U L L I V A N

Agenda

360 Degree Vision of the Global Electric

Vehicle Industry



Electric Vehicles Market Overview, Technology Roadmap and Forecasts



Business Model Analysis of Key Industry Stakeholders

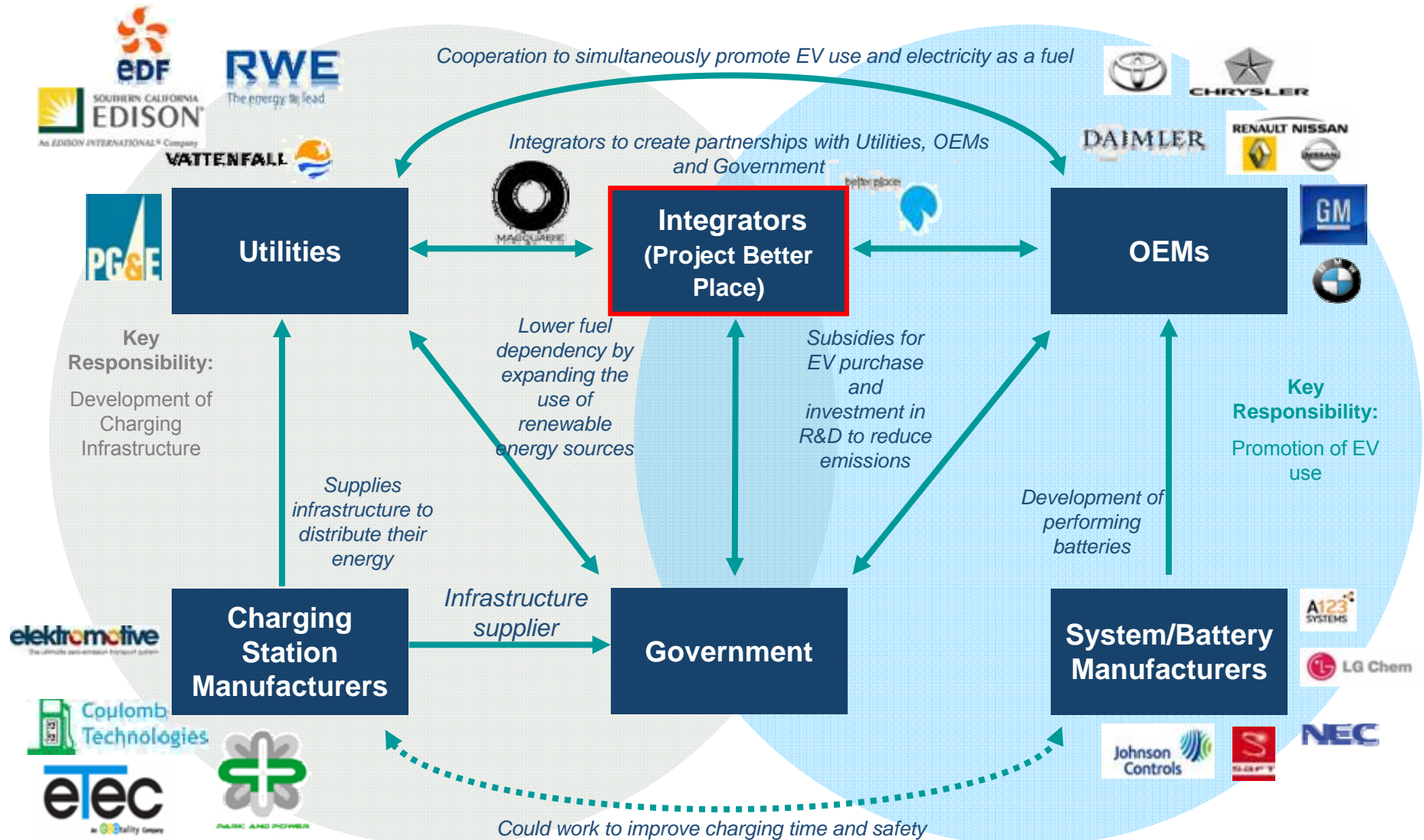


EV Incentive Plans



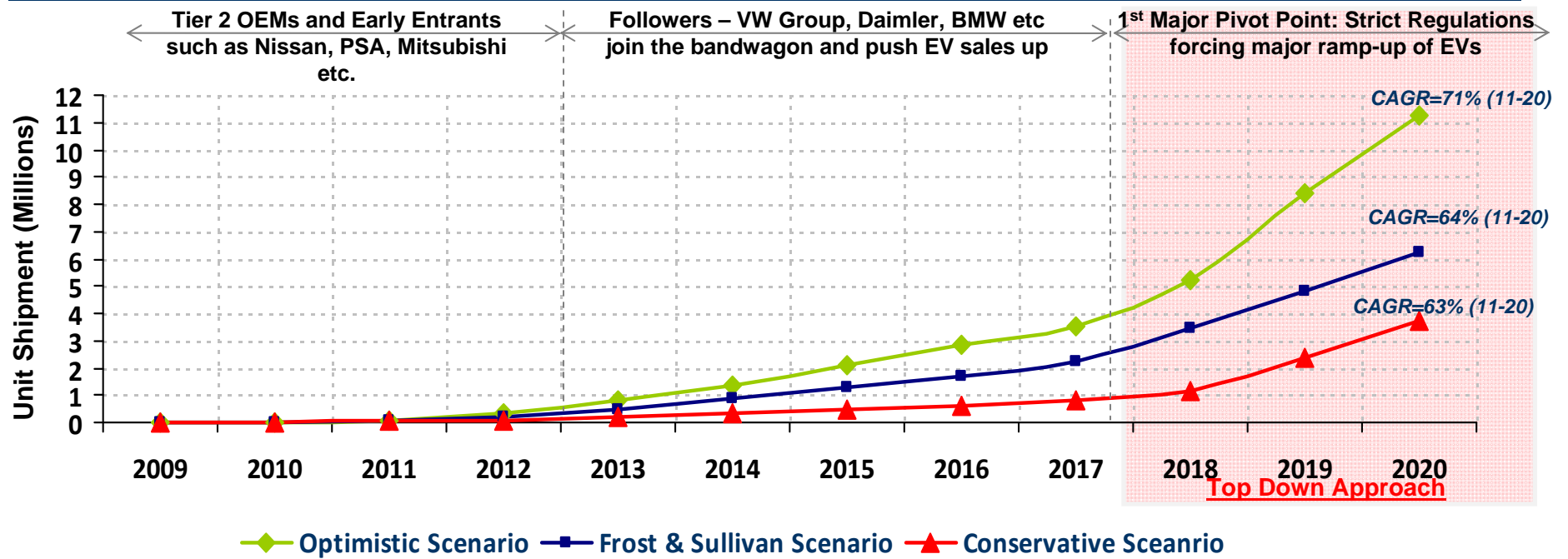
Market Opportunities – Key Conclusion

Electric Vehicle Market Provides Opportunity to Enter New Fields



Frost & Sullivan estimates the Global EV market to reach ~6.2Mn sales/yr by 2020;

Electric Vehicle Market: Scenario Analysis (World), 2010-2020



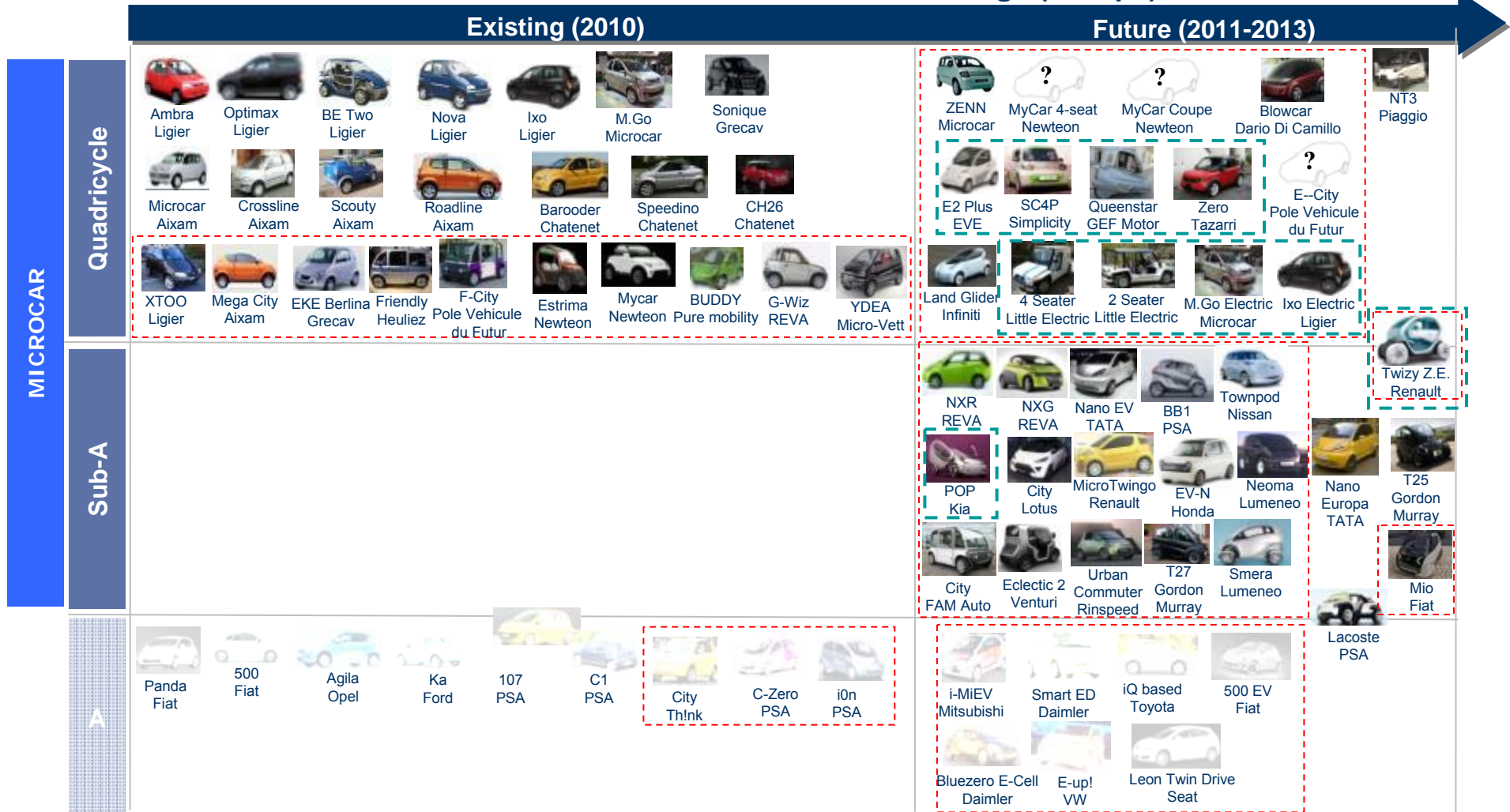
Scenario	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Optimistic	5,900	17,400	91,300	347,200	816,200	1,373,200	2,094,900	2,865,200	3,531,500	5,228,000	8,412,700	11,223,000
Frost & Sullivan	5,900	17,400	76,100	220,800	492,700	852,600	1,292,200	1,724,000	2,214,400	3,485,400	4,807,200	6,235,000
Conservative	5,900	17,400	45,300	94,200	178,700	318,300	451,000	602,300	796,700	1,161,800	2,403,600	3,741,000

Note: All figures are rounded
Refer Appendix for Assumptions

Source: Frost & Sullivan

24 Quadricycles in the Market Today and Expected to be Over 35 Models by 2013; Another 19 Sub-A Vehicles Will Launch in Next Three years

Microcar Market: Planned Microcar Product Offerings (Europe), 2010



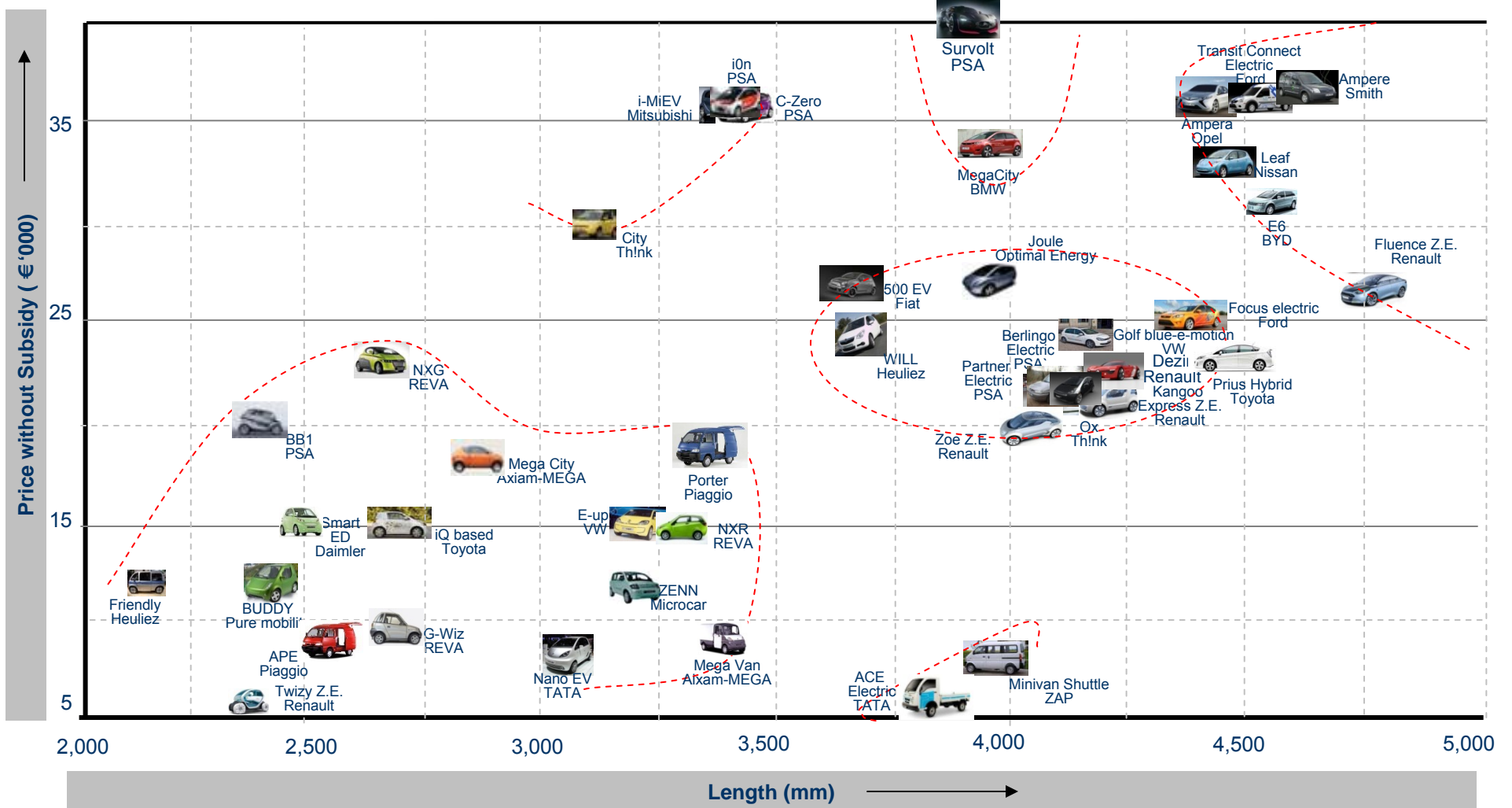
Key models on display at Paris Motor Show 2010

Electric

Source: Frost & Sullivan

16 Base Models will be introduced within the € 25,000 price and 3,500 mm length range in the European Market between 2010 and 2017

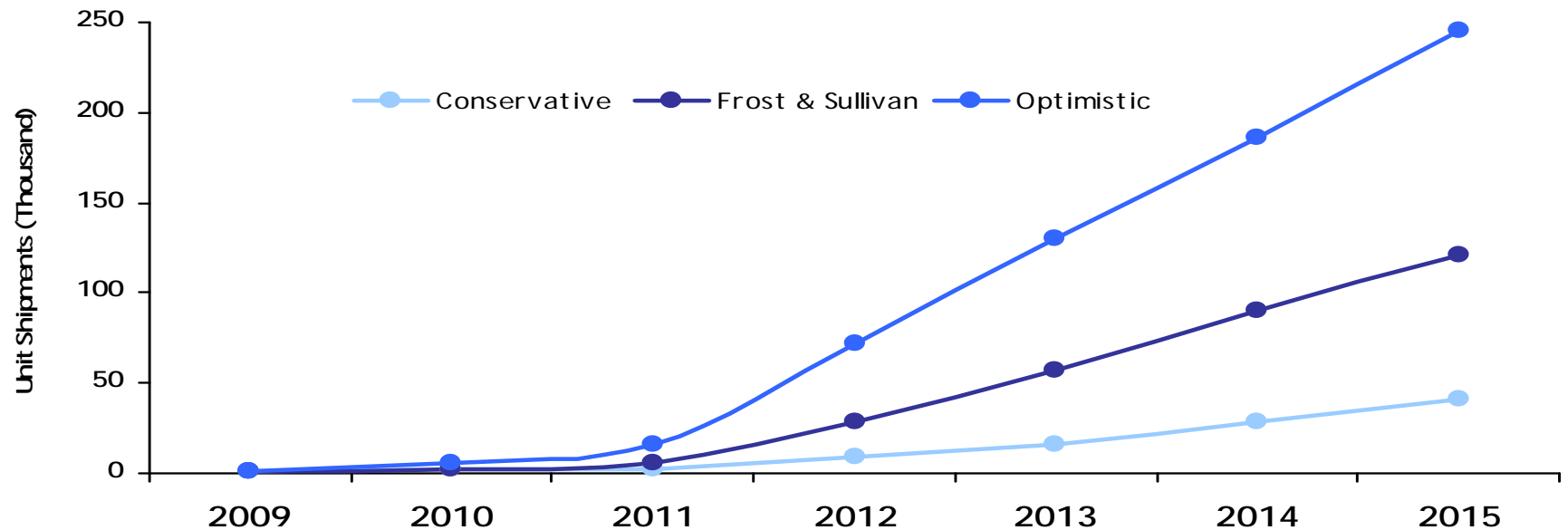
Electric Vehicle Market: Electric Drive Range and Price Segmentation (Europe), 2010-2017



Source: Frost & Sullivan

Total Market for Electric LCV (Europe): 5% of European LCV Sales Could be Electric by 2015 Under F&S Scenerio

Total Electric LCV Market: Production Forecast (Europe), 2009-2015



	2009	2010	2011	2012	2013	2014	2015	CAGR (As %)
Optimistic	904	5,344	15,765	72,484	129,835	186,161	245,034	154%
Frost & Sullivan	904	2,230	6,213	28,606	57,137	90,246	121,370	126%
Conservative	904	1,715	2,455	8,935	16,203	28,466	40,905	88%

Note: This forecast is only for vehicles with a total GVW of 3.5 tonnes. Car derived vans are also included

Source: Frost & Sullivan

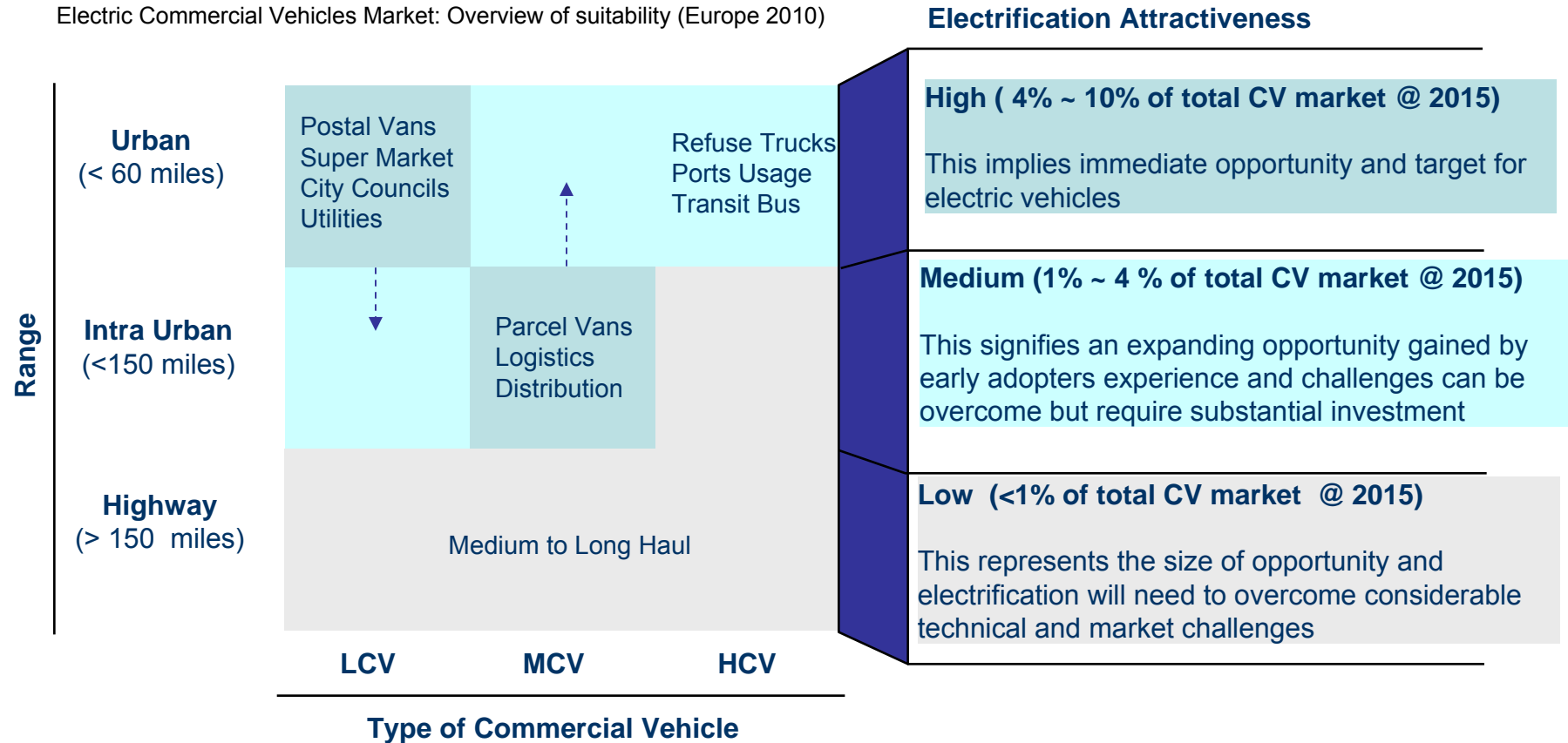
List of Major Electric Light Commercial Vehicles: European electric-LCV Market mostly consists of conversions today. Modec is the only purpose built EV.

Manufacturer	Range Miles	Payload (kg)	Segment			Country	Market Status
			Small (length 3.75m - 4.25m)	Large (> 5m length)	Large – Plus (> 5.5m length)		
Modec	100	2000			●	UK	✓
Smith Electric (Edison model based on Ford Transit)	100	1800		●		UK	✓
Allied ZEV (based on Peugeot Boxer)	120	895		●		UK	✓
PVI – Renault (based on Maxity model)	60	1500*		●		France	2010 expected
Daimler (based on Sprinter Electric)	100*	1500*		●		Germany	2012 expected
Renault (based on Kangoo)	60*	1500*	●			France	2012 expected
Micro – vett (based on Fiat, Ducato)	155*	1670		●		Italy	✓
Venturi Motors (based on Citroen Berlingo)	60	500	●	●		France	✓
Iveco (based on Daily model)	60	2000*			●	Italy	2012 expected
Nissan (based on NV 200)	60*	850*	●			Europe	2012 expected
Volkswagen LCV	60*	1500*		●		Germany	2012 expected
Eco City Vehicles Mercedes Benz Vito taxi	London Taxi			●		UK	✓

Note: Where ever applicable payloads are taken from medium wheelbase panel van / box van body style *Estimated Figures ✓ Available in market currently

Electric Commercial Vehicles will be concentrated more towards depot based delivery vehicles with fixed payload and work schedule cycle.

Electric Commercial Vehicles Market: Overview of suitability (Europe 2010)



Urban
Usage lies in an urban environment with frequent stop and go combined with fixed load

Intra-Urban
Usage lies in an urban and intra-urban distribution. May have stop and go routes

Highway
Usage mostly lies in highway routes long haulage with heavy loads

Source: Frost & Sullivan

Business Model Analysis of Key Industry Stakeholders



Mobility Integrators (MI) to Offer Innovative mobility solutions to complement commuters' inter-modality and multi-modality travel split



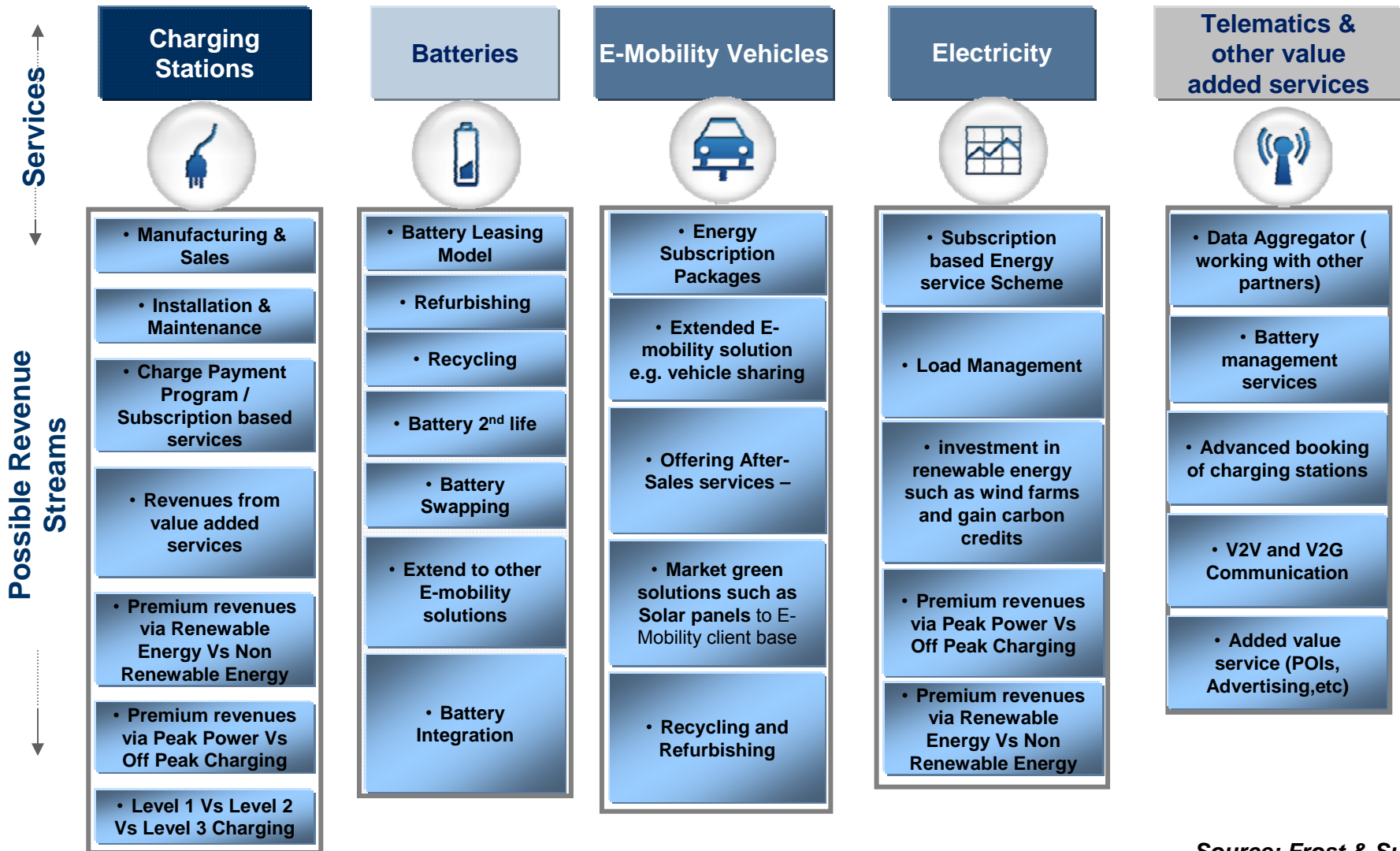
The Concept of a Dynamic Transport Solution Integrating Different Modes Under a Single Entity to make Personal Transportation Easy and Simple

MIs will start exploiting the Web 2.0 and Mobile 2.0 Internet service to offer mobility-based applications (apps) on smart phones.

Source: Frost & Sullivan

*The company logos mentioned are only for descriptive purpose

Example of Products/Services Portfolio That Can be Offered by an Integrator in the E-Mobility Market



Source: Frost & Sullivan

Breakdown of Energy Packages - Innovation Lies in Offsetting High Initial EV Cost by Clubbing Services with Energy into A Subscription Package

	Subs. per month	Rebates	Price of Car	Battery Cost	Public Charging	Battery Swapping	Insurance	Maint.	Battery Recovery	Car Recovery Ass.
ENERGY PACKAGE 1 →~\$225 / month →40% Battery Recovery	\$225	60% of price difference b/w EV and IC engine Vehicle	<input checked="" type="checkbox"/>	40%	<input checked="" type="checkbox"/> (65%)	<input checked="" type="checkbox"/> (60%)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
ENERGY PACKAGE 2 →\$500 / month →40% Battery Recovery	\$500		<input checked="" type="checkbox"/>	40%	<input checked="" type="checkbox"/> (70%)	<input checked="" type="checkbox"/> (75%)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>
ENERGY PACKAGE 3 →~\$1100 / month →60% subsidy →0% Battery Recovery	\$1100		\$4,500 Subject to change – State wise	PART	<input type="checkbox"/>	<input checked="" type="checkbox"/> (80%)	<input checked="" type="checkbox"/> (100%)	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
ENERGY PACKAGE 4 →~\$2,250 / month →100% subsidy →0% Battery Recovery	\$2250		\$4,500 Subject to change – State wise	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/> (100%)	<input checked="" type="checkbox"/> (100%)	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>

Note : Values that have been dealt here are an European perspective converted into US\$ at today's exchange rate.

Utilities Business Model – Revenue Generating Opportunities Are Mainly Outside Selling Energy

Source Of Revenue Generation	CAGR	Calculated over 5 years
1. Revenues from Selling Electricity	CAGR = 242% (Over 5 years) ▲	€390Mn - €400Mn
2. Revenues from selling Charging Stations	CAGR = 153% (Over 5 years) ▲	€650Mn - €700Mn
3. Revenues from Installation & Maintenance of Charging Stations	CAGR = 158% (Over 5 years) ▲	€490Mn - €500Mn
4. Revenues from Diagnostics	CAGR = 153% (Revenue Opportunity to start from 3rd year) ▲	€600K - €625K
5. Revenues from Garage Referrals	CAGR = 242% (Over 5 years) ▲	€25K - €27K
6. Revenues from Music Download	CAGR = 127% (Revenue Opportunity to start from 3rd year) ▲	€150K - €165K
7. Revenues from Others	CAGR = 161% (Over 5 years) ▲	€340Mn - €345Mn

TOTAL: €1.9Bn - €2Bn

Capital Investment
(1st yr)

Includes:
 New Energy Capacity

€48Mn - €50Mn

Fixed & Operating Cost

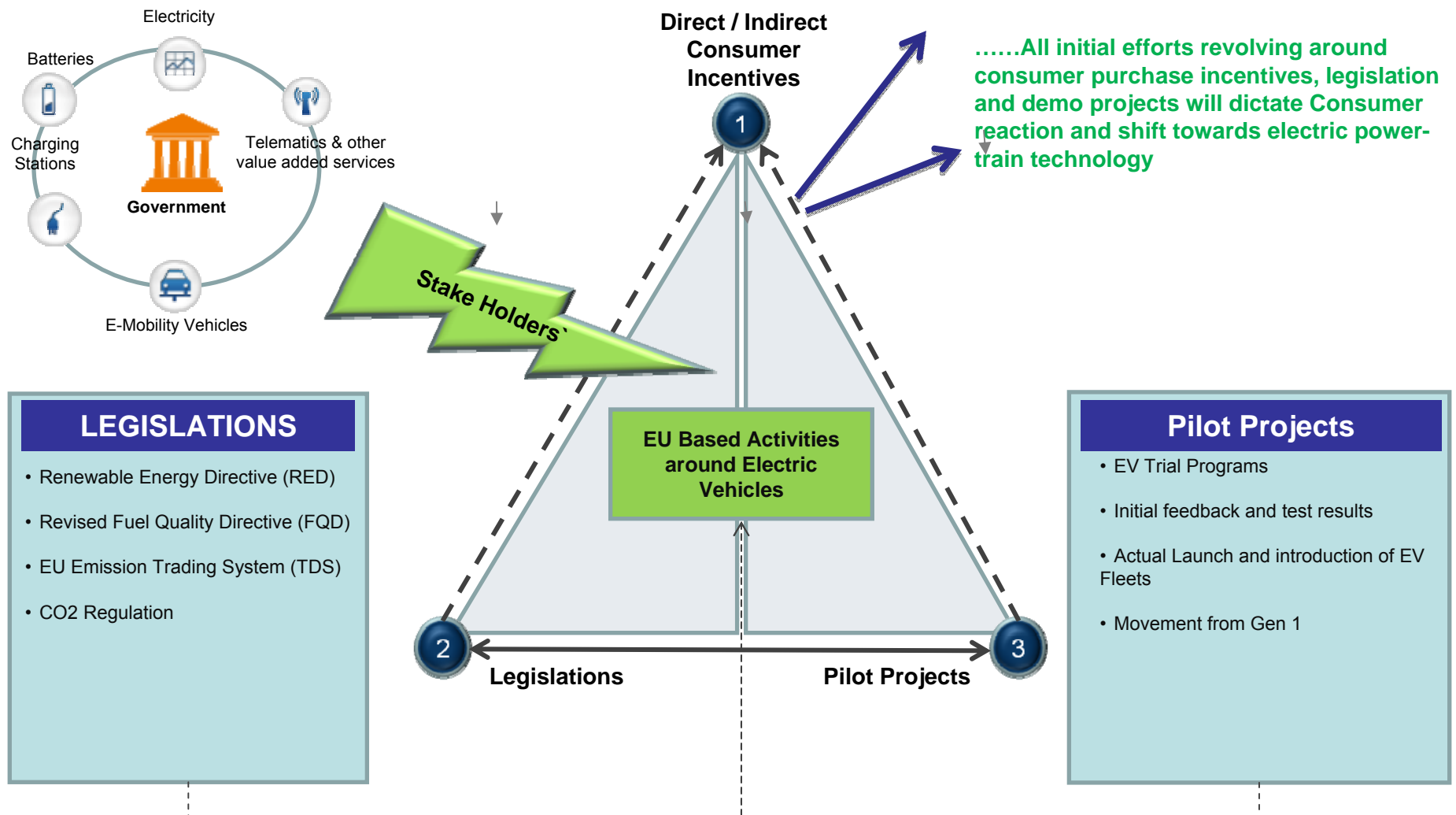
Network Recurring Cost
 Charging Station Purchase Cost
 Installation and Maintenance cost
 Logistics, Admin, Selling, general , rental, Marketing and Labour Cost

€640Mn - €650Mn

EV Incentive Plans



Majority of all EV related activities in EU center around the three pillars of consumer incentives, legislations and pilot projects



EU Electric Vehicle Stimulus: UK, France, Spain and Italy intend to proactively stimulate demand for EVs by offering significant cost discounts to consumers.

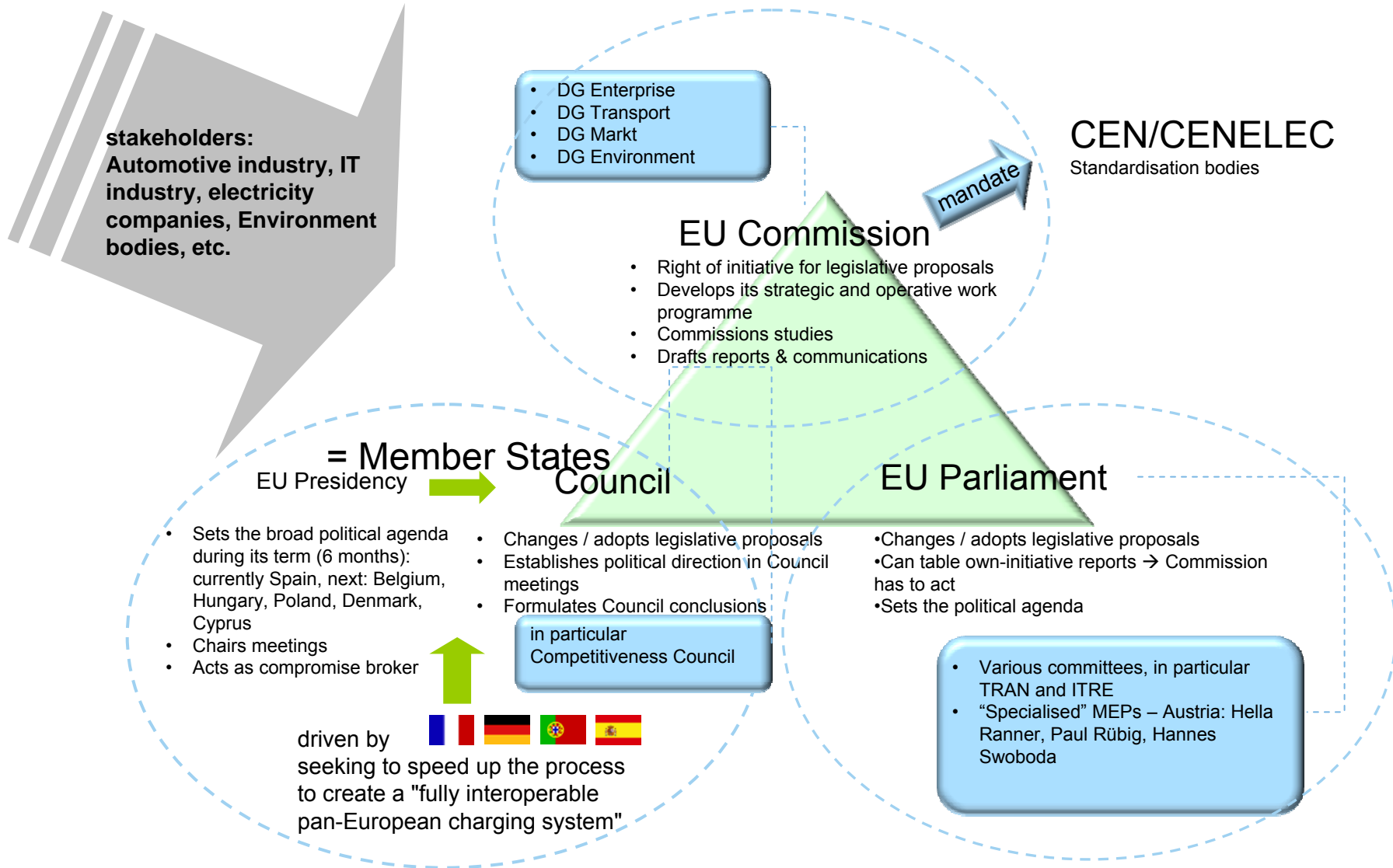
Europe Electric Vehicle Market: Comparative Analysis of Incentives and Legislations Across Countries (Europe), 2008

Country	EV Cash Discount	€/\$ Incentive	Type of Vehicle	Total Budget	Start	Govt. EV Plans	Budget
Austria	✓	€1,000 (Salzburg and Styria)	€500 discount on Alternate Fuel Cars	Salzburg – 100 cars Lower Austria – 1000 cars	Until Dec 09	To subsidize EV fleet (VLOTTE)	€10m
Belgium	✓	€3,280	15%/€3,280 rebate if CO ₂ <105 g/km	< €75 million			
Denmark	✗	-				To subsidize fleet lease of EVs	€35m
Finland	✗						
France	✓	€5,000 (or 20% of retail price)	Cars with CO ₂ emission <60 g/km	€140 million	Jan 2008 - 2012	For EV infrastructure dev. (EDF & Renault)	€400m
Germany	✗						
Greece	✗						
Italy	✓	€3,500	(EV, Hydrogen, CNG)				
Netherlands	✓	€4,000				Supports large scale introduction of EVs	€10m
Portugal	✓	€800 (Income tax benefit)			2010 (continuing for 5 yrs)	Mobi-green Car Project – with Spain	€150m
Spain	✓	€6,000	EVs in Aragon, Asturias, Baleares, Madrid, Navarra, Valencia, Castilla la Mancha, Murcia			1 Mn EVs by 2014	€245m
Sweden	✓	SEK 10,000 / €22	EVs needing less than 37 kwh/100km power		Apr 2007 to Dec 2009	EV discount & development	€24m
UK	✓	£5,000	Full electric / Plug-in Hybrid	£250 million	2011	Allocated for infrastructure	£20m
Norway	✗						

Note: All figures are rounded; the base year is 2008. Source: Frost & Sullivan

Source: Frost & Sullivan

Relevant Actors on the European Level



Potential EU FP7 Funding Opportunity

Call title: FP7-TRANSPORT-2012-MOVE-1

- **Call identifier:** FP7-TRANSPORT-2012-MOVE-1
- **Date of publication:** 20 July 2011
- **Deadline1:** 1 March 2012 at 17.00.00 (Brussels local time)
- **Indicative budget2:** EUR 26.00 million

The final budget awarded to actions implemented through this call for proposals may vary:

- The final budget of the call may vary by up to 10% of the total value of the call; and
- Any repartition of the call budget may also vary by up to 10% of the total value of the indicated budget for the call.

THE 'EUROPEAN GREEN CARS INITIATIVE'	
AREA 7.2.7.1. DEVELOPMENT OF ELECTRIC VEHICLES FOR ROAD TRANSPORT	
GC.SST.2012.1-7. Demonstration of Urban freight Electric Vehicles for clean city logistics. <i>Up to 1 project is expected to be funded.</i>	CP <i>The requested EU contribution shall not exceed EUR 8 000 000</i>

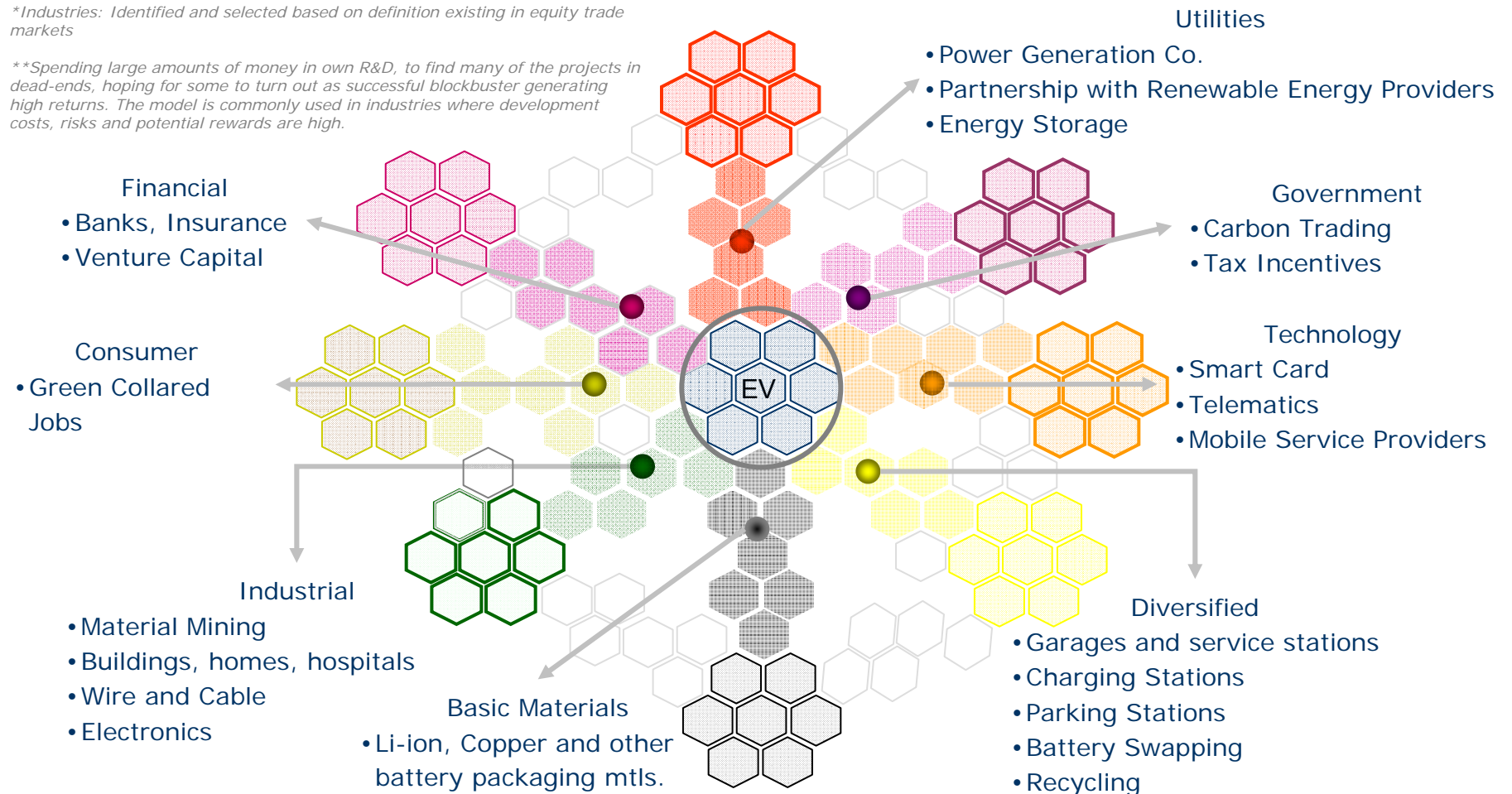
Market Opportunities – Key Conclusion



Innovative business opportunities arise from partnership formed between diverse industries in order to expand infrastructure in time for the EV boom

**Industries: Identified and selected based on definition existing in equity trade markets*

***Spending large amounts of money in own R&D, to find many of the projects in dead-ends, hoping for some to turn out as successful blockbuster generating high returns. The model is commonly used in industries where development costs, risks and potential rewards are high.*



BLOCK BUSTER BUSINESS MODEL**
 New Business Models that will address additional Electric Vehicle (EV) energy requirements will be formed at the intersection of several diverse and cross functional industries

Summary of Frost & Sullivan's Electric Vehicles Research Programme – Providing a 360° overview of the market

Urbanization Trends 	<ul style="list-style-type: none"> Global Urbanization Trends Mega City Trends PESTLE ANALYSIS Effects on personal, Urban & rural mobility EV infrastructure Development of public transport systems 	EV Related Technology 	<ul style="list-style-type: none"> Electronic Corner Module Assessment of Hybrid Market Assessment of Fuel Cell Market Analysis of Green Automotive Technologies Industrial opportunities in EV Segment
Legislations 	<ul style="list-style-type: none"> Country / City specific legislation EV Attractiveness / Ranking for key EU cities Local Incentives for electric vehicle adoption Specifications 	Voice of Consumer 	<ul style="list-style-type: none"> EV Fleets (Drivers / Managers) – EU+NA+APAC EV Consumers – EU+NA Consumer acceptability towards new Business Models Tracking Analysis
Batteries 	<ul style="list-style-type: none"> Market / Technology Trends & Roadmaps Competitive Structure Global Market Forecasts Pricing trends Who supplies whom Database Technical specifications of competitors solutions 	Database 	<ul style="list-style-type: none"> Electric Vehicles Forecasts By OEM – (Global) Hybrid Electric Vehicle – (Global) Battery Technology Technical Specs of EV – (Global) Who Supplies Whom – (Forthcoming)
Infrastructure 	<ul style="list-style-type: none"> Charging Station Roadmap Technical Specs by Type & Mode of charging Evolution of Charging Stations Forecasts for installation by Cities Pricing Analysis Energy Infrastructure and Role of Utilities ROI for charging station and Utility business 	Electric - 2 Wheeler 	<ul style="list-style-type: none"> 360° Market Overview Market Size and Forecast Infrastructure and Legislative Trends Technology Analysis Business Model Assessment Cost of Ownership Consumer Adoption Trends
Business Models 	<ul style="list-style-type: none"> Cash flows and ROI for integrators Business Model assessment for OEMs Cost of Ownership Assessment ROI for Charging Station Manufacturers ROI for Utilities ROI for Battery Swapping Business Analysis of Key Potential Industries 	EV Commercial Vehicle Market 	<ul style="list-style-type: none"> Hybrid & Electric Commercial Vehicle – Global Customer and Market Analysis of Fleets -Global Light CVs Medium and HCVs (Hybrids and Electric)

Upcoming Electric Vehicles Research Plan 2012

Sr. No	Planned Topic	Regional Scope
1	Strategic Analysis of the Market for Electric and Hybrid Vehicles in Brazil	LATAM
2	Analysis Electric Vehicle Platform Strategies of OEMs	Global
3	2011 Global Electric Vehicles 360 Degree Perspective of the Market	EU
4	European Voice of Customer Study on Adoption and Interest in Electric Vehicles	EU
5	Global Electric Vehicle Specification Database- 2012 Edition	Global
6	Strategic Technology and Market Analysis of Electric Vehicle Charging Station Infrastructure in APAC	APAC
7	Technology and Market trends of Lithium-ion Air Batteries for Electric and Hybrid Vehicles	Global
8	Strategic Analysis of Lithium-ion battery Technologies for Hybrid and Electric Vehicles	Global
9	Technology Analysis if BMS and Onboard Chargers	Global
10	Strategic Analysis on Automotive Power Electronics for EV and HEVs	Europe & North America
11	Technology and Market Analysis of Electric Vehicle Transmissions	Europe & North America
12	Strategic Analysis of the Market for Electric and Hybrid Vehicles in Japan	APAC
13	Executive Analysis and Review of Electric Vehicle Manufacturers and Sales in 2011	Global
14	Consumer Study with EV Owners and feedback	EU
15	Global Electric Vehicle Market Forecasts Database – 2012 Update	Global

Upcoming Electric Vehicles Research Plan 2011

Sr. No	Planned Topic	Regional Scope
1	360 Degree Analysis of the Eastern European Passenger Electric Vehicles Market	Russia CEE
3	Strategic Analysis of Electric Motor Technologies for Electric and Hybrid Vehicles in North America	NA
4	Strategic Analysis of Electric Motor Technologies for Electric and Hybrid Vehicles in Europe	EU
5	Strategic Analysis of Electric Motor Technologies for Electric and Hybrid Vehicles in China	China
6	Strategic Technology and Market Analysis of Electric Vehicle Charging Station Infrastructure in North America	NA
7	Executive Report on Global Electric Vehicle Forecasts and Trends	Global
8	Comparative Analysis of North American OEMs Electric Vehicles Launch Strategy and Product and Price Positioning	NA
9	Analysis of Make or Buy OEM Strategies around Electric Vehicle Components	Global
12	Strategic Analysis of Electric Vehicles Market in Turkey	Turkey
13	Strategic Analysis of EV IT Infrastructure and Billing Systems	EU NA
14	Strategic Analysis of Global Market for Range Extenders	Global
16	Strategic Analysis of Fuel Cell Electric Vehicles and applications	Global
17	Strategic Overview of the Global Hybrid and Electric MCV, HCV, and Bus Markets	Global
18	Global MCV, HCV and Bus Markets for Hybrid and Electric Motor/Generators, Inverters and Control Electronics	Global
19	Overview of European Microcars Market	Europe