360 Degree Perspective Of The Central And Eastern European Electric Vehicle Industry

On the Way to Smart Mobility

Executive Summary

May 2012

FROST & SULLIVAN

Contents

Research Aim, Objectives and Scope

Aim

The aim of this study is to research, analyse, and forecast electric vehicle and charging infrastructure industries in CEE and their impact on personal mobility in the region.

Objectives

- Provide a strategic overview of the CEE EV and relevant charging infrastructure market. Includes key technology trends, market drivers, and restraints for EVs and relevant charging infrastructure.
- Provide market size and forecasts of the EV and charging infrastructure market by OEM, model, segment, charging station type and location, and breakdown by region, 2007–2017.
- Provide forecasts of the current and future models in the market within the region by type (city electric vehicle, plug-in hybrid electric vehicle), 2007 to 2017.
- Competitor analysis: Analyse competitive factors, competitor market shares, and product portfolio analysis and capabilities.
- Develop an actionable set of recommendations for market participants from both OEM and charging station manufacturer sides to enter and grow in the market.

CEE region is defined as:

- Bulgaria,
- Czech Republic,
- Estonia,
- Hungary,
- Latvia,
- Lithuania,
- Poland,
- Romania,
- Slovakia,
- Slovenia

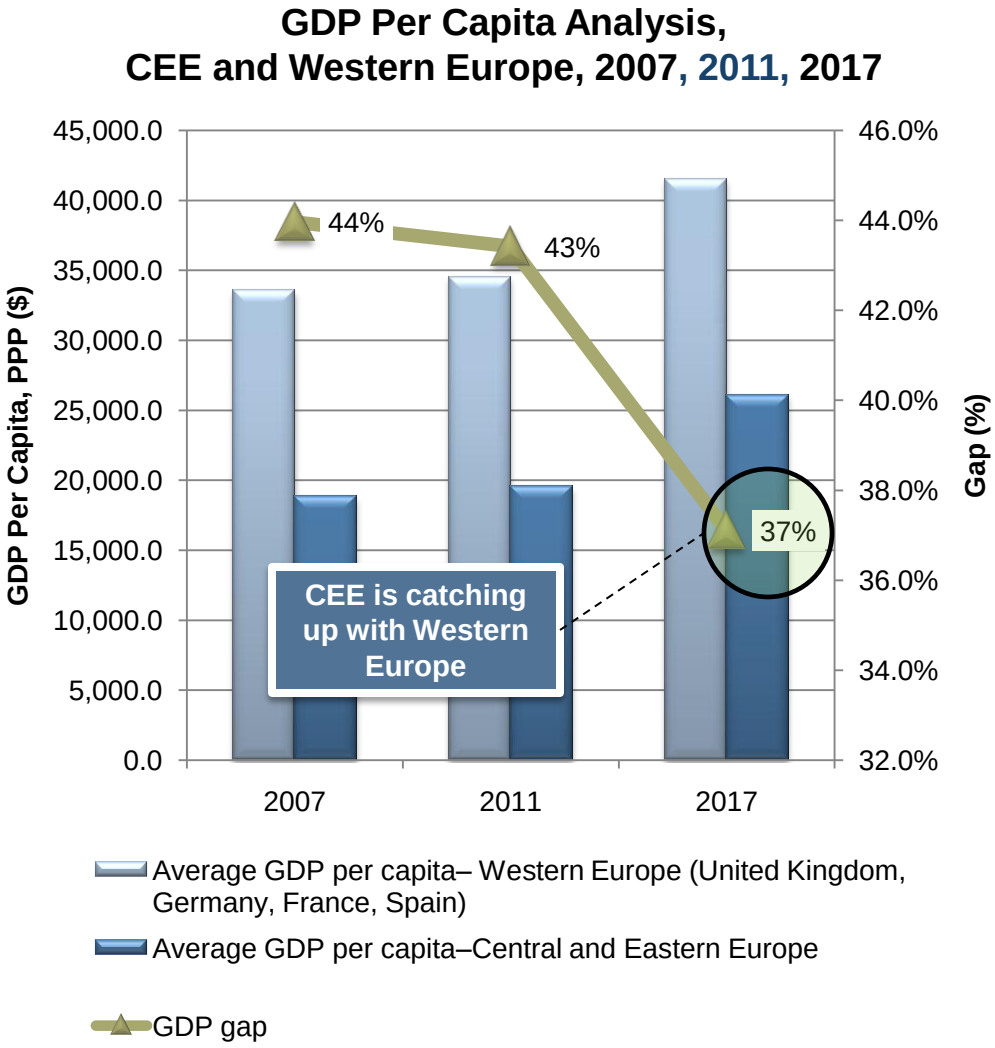
Key Questions This Study Will Answer

EV Industry: Key Questions This Study Will Answer, CEE, 2007–2017

What is the business environment of the EV industry in CEE, the dynamics, and its impact on future growth prospects?
Is demand ready, and do OEMs have required capacities to satisfy the demand?
What are the key limitations in the development of the EV market in CEE?
What are the best practices within the CEE EV industry?

Source: Frost & Sullivan analysis.

CEE Economic Convergence with Western Europe:
GDP Prospects Remain Positive Despite European Debt Crisis



- Central and Eastern Europe as a region is expected to generate roughly 23 percent of GDP* of top four countries investing in the electric vehicle industry (United Kingdom, Germany, France, Spain) by 2016.
- Enriching society is expected to catalyse development of EV industry—CEE region is expected to grow by approximately 5.2 percent annually in terms of GDP per capita during 2011–2017 (3.3 percent CAGR for Western Europe during 2011–2017).
- Electric vehicles not a priority at this time for governments due to budget issues.
- Relatively low purchasing power acting as a key restraint for the EV market.

*Total GDP per country (measured in PPP)

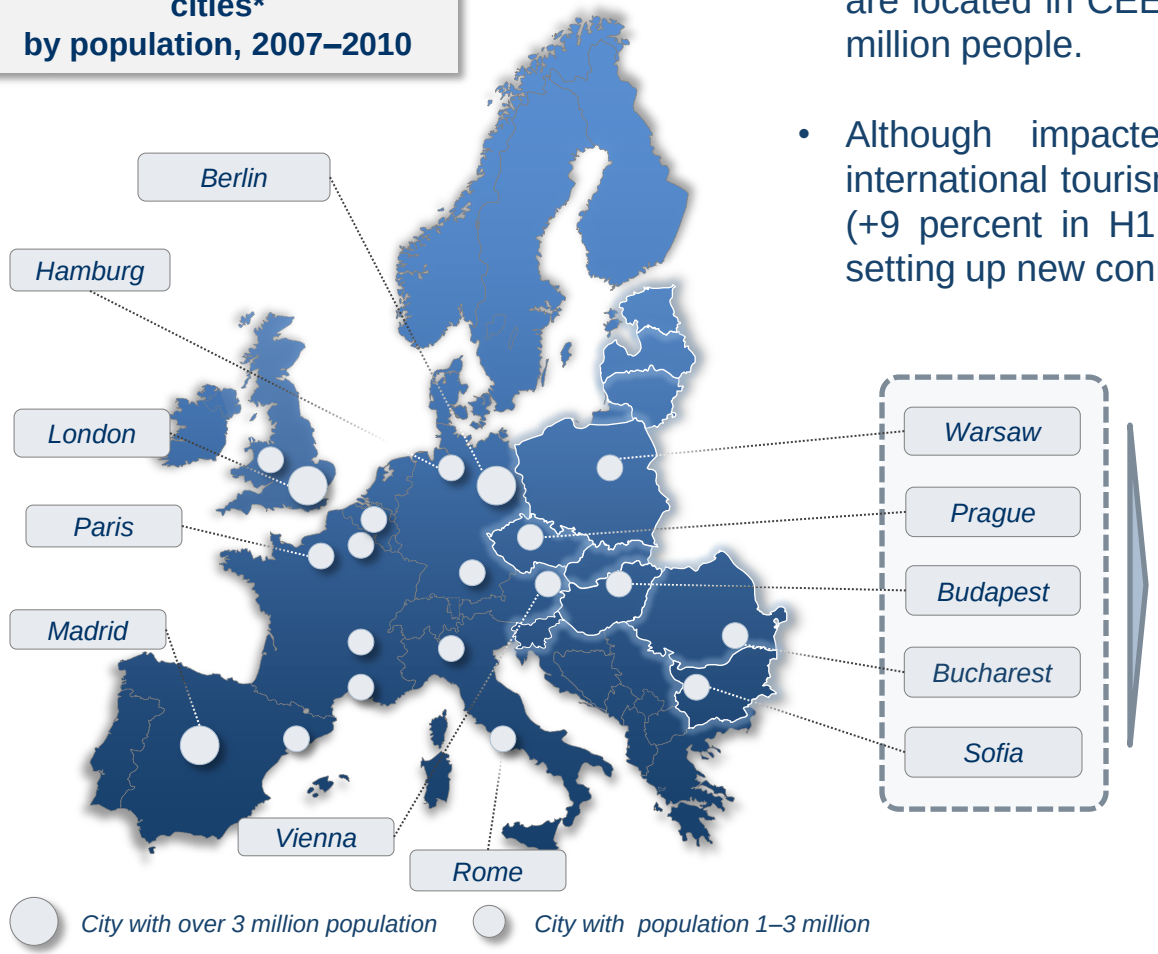
Note: All figures are rounded; the base year is 2011. Source: IMF, Frost & Sullivan analysis.

Urban Sprawl in CEE

Deteriorating Traffic Situation to Push for New Mobility Solutions

EV Industry: Urban Sorawl, CEE, 2011

Top 20 largest European cities* by population, 2007–2010



- Five out of 20 of Europe's largest cities (by population) are located in CEE with populations of approximately 7.7 million people.
- Although impacted by the 2009 economic crisis, international tourism has been growing in 2010 and 2011 (+9 percent in H1 2011) supported by low-cost airlines setting up new connections.

- *Total of 7.8 million people in Top 5 CEE cities*
- *19.3 percent of population of top 20 cities in Europe*
- *Dynamic sub-urbanisation processes in place except for Sofia*

*Population in core cities
Source: Eurostat, Frost & Sullivan analysis.

Executive Summary—Growth Prerequisites and Future Market Snapshot

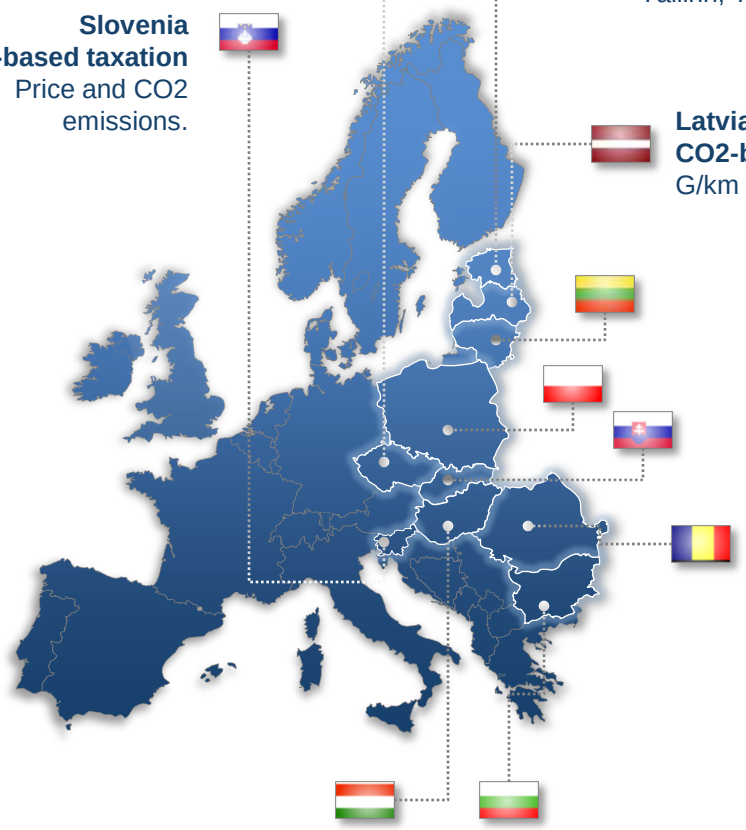
EV Industry: Key Industry Indicators Comparison, CEE, 2011–2017

	Macro Indicator	Value (2011)
1	Region GDP	$1,244 billion
2	Average GDP per capita	$19,423 (PPP)
3	Population	101.7 million
4	Urbanisation rate (2010)	64%
5	Light vehicle market sales	881,827
	EV Market Indicator	**Value (2017)**
1	Number of EVs in operation	104,967
2	EV annual sales	61,538
3	Average sales per original equipment manufacturer (OEM)	3,418
4	Number of total charging points installed	127,565
5	Number of public charging stations installed	41,274
6	Number of charging stations per EV	1.2 (including home, public, and semi-public charging)

Source: Frost & Sullivan analysis.

Overview of Current Government Incentives in CEE

Government Support to Increase Significantly by 2014–2015



Czech Republic
Car ownership/Road tax exemption
Cars used for business purposes only.

Slovenia
CO2-based taxation
Price and CO2 emissions.

Estonia
- **Purchase subsidy**
  Up to €18,000 for max 500 EVs.
- **Parking fee exception**
  Tallinn, Tartu, Parnu.

Latvia
CO2-based taxation
G/km based.

Romania
- **CO2-based taxation**
  CO2 emissions, cylinder capacity, EURO norm based.
- **Purchase subsidy**
  25 percent of EV price, but up to €5,000. Over €5,000 if combined with cash-for-clunkers.
- **Registration tax exception**
  EVs and hybrids . Registration tax to be cancelled for all vehicles from 2013. Green card to be introduced.

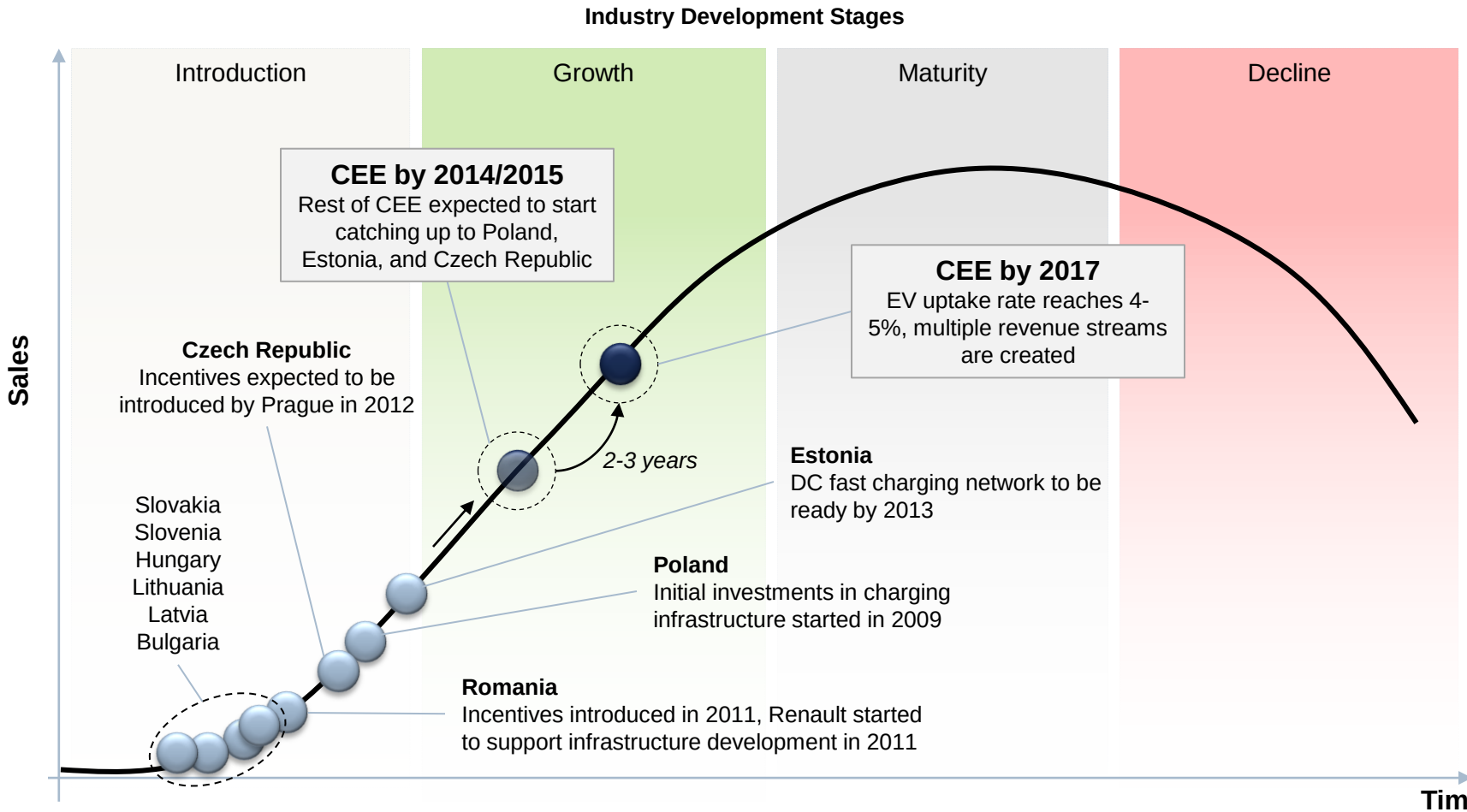
- Low level of government support towards eco-friendly vehicles is expected to hold the EV market back in the short term (only Estonia and Romania offer purchase subsidies in CEE, and only three countries have taxation system based on CO2: Slovenia, Latvia and Romania).
- Full-scale support programs are expected to become available from late 2014/early 2015 in most countries when pilot projects are completed.
- Low level of municipality support (free parking for EVs, bus lane usage) is one of the key negative factors affecting the early adopters such as businesses and techno-savvy consumers.

Base year: 2011. Source: Frost & Sullivan analysis.

Industry Lifecycle Analysis

Early Start for Poland, Czech Republic, Estonia, and Romania

EV Industry: Industry Lifecycle Analysis, CEE, 2011–2017

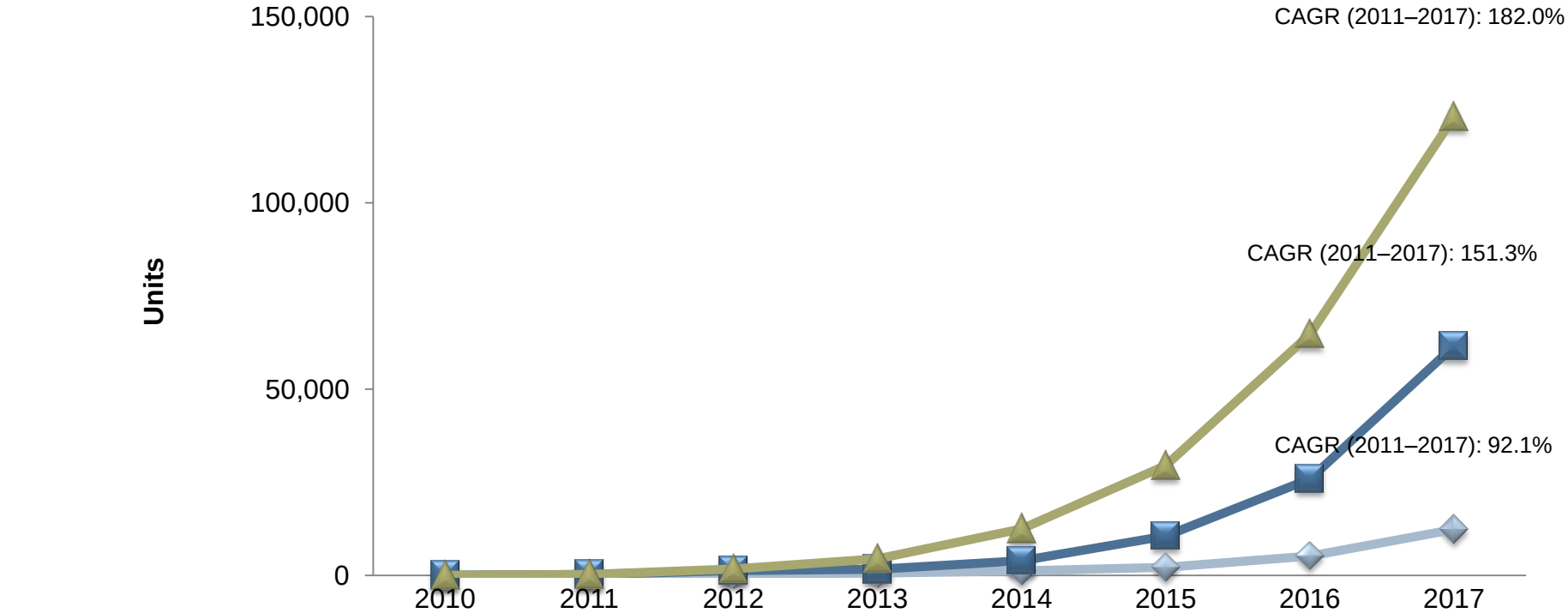


Source: Frost & Sullivan analysis.

EV Unit Shipment Forecast by Scenario

Key Takeaway: Market Expected to Speed Up After 2014/2015.

EV Industry: Unit Shipment Forecast by Scenario, CEE, 2010–2017



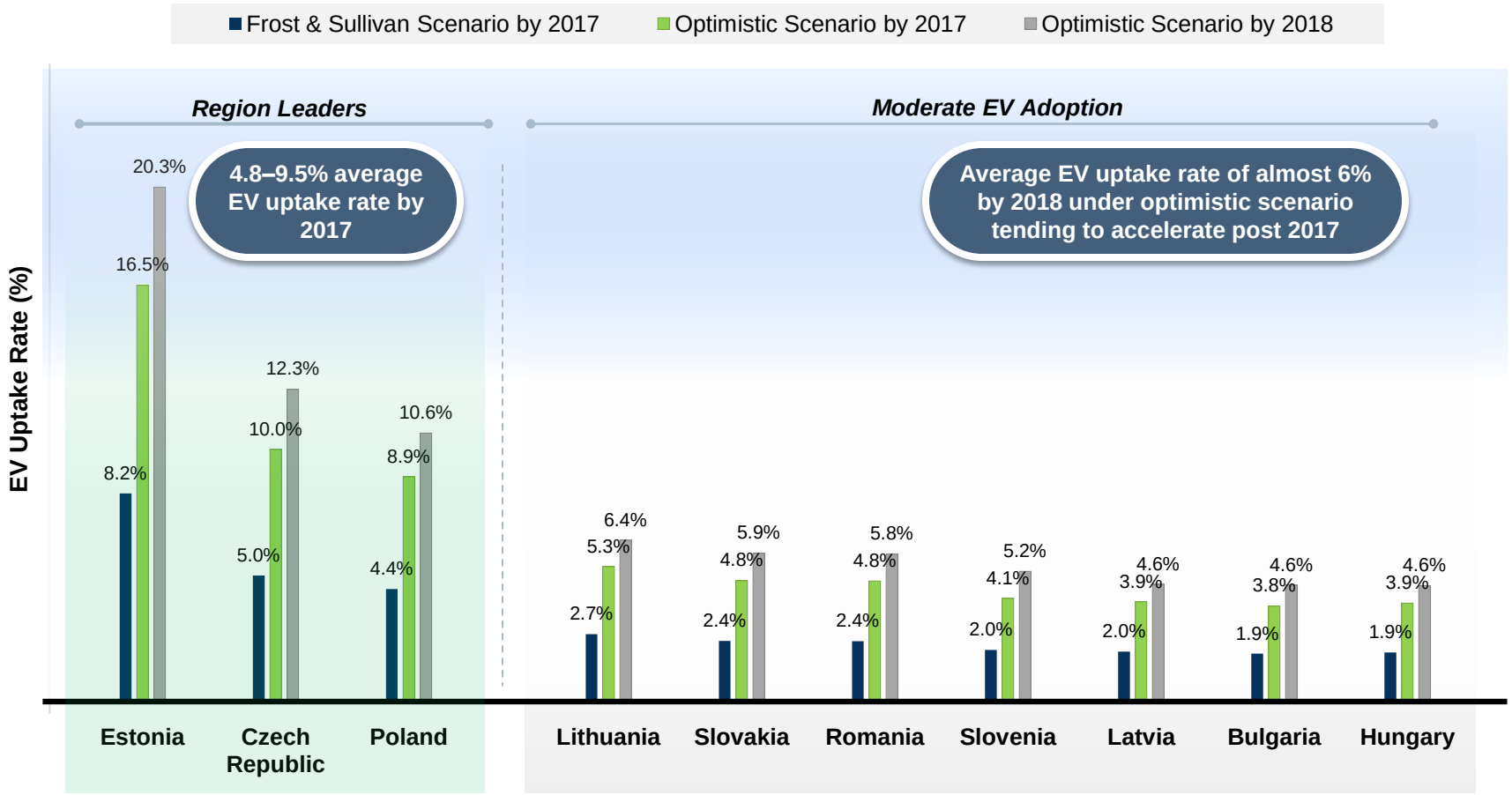
	2010	2011	2012	2013	2014	2015	2016	2017
Conservative Scenario	0	245	341	588	1,167	2,105	5,174	12,308
Frost & Sullivan Scenario	0	245	1,287	1,610	3,891	10,526	25,870	61,538
Optimistic Scenario	0	245	1,704	4,407	12,452	29,473	64,674	123,075

Note: All figures are rounded. The base year is 2011. Source: Frost & Sullivan analysis.

EV Industry Outlook

Up to 17 Percent EV Uptake Rate in Estonia Under Optimistic Scenario by 2017

EV Industry: EV Uptake Rate Scenario Analysis, CEE, 2017



Note: forecast for 2018 is provided specifically to reflect stronger growth prospects post 2017.

Source: Frost & Sullivan analysis.

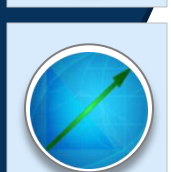
EV Demand Analysis in CEE

Hidden Potential for the Medium to Long Term

Low — High

Status: emerging

Demand for electric vehicles is expected to increase slowly in the short term (1-2 years) and accelerate afterwards.

 **1. Customer Awareness**	Still low yet increasing level of customer knowledge (types of EVs, charging modes, and EV-related advantages) might be one of the largest restraints for the market in the medium term (3–5 years).
 **2. Early Adopters**	Fleets to be among the early adopters in CEE; however, they are keen on being able to use bus lanes and benefit from free parking and tax and future possible congestion charge exceptions. Nevertheless, high total cost of ownership and uncertainty of EV residual value to have a negative impact on the market in the short term (1-2 years).
 **3. Enriching Society**	Increasing personal income, changing approach toward personal mobility in cities, and growing eco-awareness are expected to drive the EV market in the medium to long term (3 years and further).
 **4. Complexity of the Industry**	Lack of a single game changer for the CEE EV industry in the future: market to be shaped by multiple factors (decreasing cost of batteries, economies of scale, availability of charging points).

Source: Frost & Sullivan analysis.

EV Supply Analysis in CEE

2012–2014 Crucial for Industry Readiness

Supply restrictions in CEE are expected to have a negative impact on the industry in the short term (1-2 years), as currently only several global OEMs are present in the CEE market (e.g., Peugeot, Citroën, and Mitsubishi).	**1. Supply Shortage**
While the CEE region has recently become one of the production hubs for the global OEMs with such OEMs like VW, Suzuki, Toyota, PSA, Hyundai, and others (total of 19 factories manufacturing passenger cars), manufacturing capacities can be leveraged for EV production by global OEMs and non-traditional OEMs.	**2. Future Production Plans**
Converted vehicles are expected to gain popularity in CEE (e.g., Poland, Bulgaria) due to lower cost compared with factory-built EVs and are expected to have a positive effect on EV market development in the medium to long term (3 years and further).	**3. ICE Vehicle Conversions**
European-based production of electric vehicles (e.g., production of Nissan Leaf in Sunderland, United Kingdom is expected to start in 2013, reaching a capacity of 50,000 units) is expected to have a strong positive impact on electric vehicle availability in CEE.	**4. Europe-based Production**

Supply of electric vehicles is expected to depend on EV industry development in Western Europe and therefore improve significantly in the medium term (3–5 years).

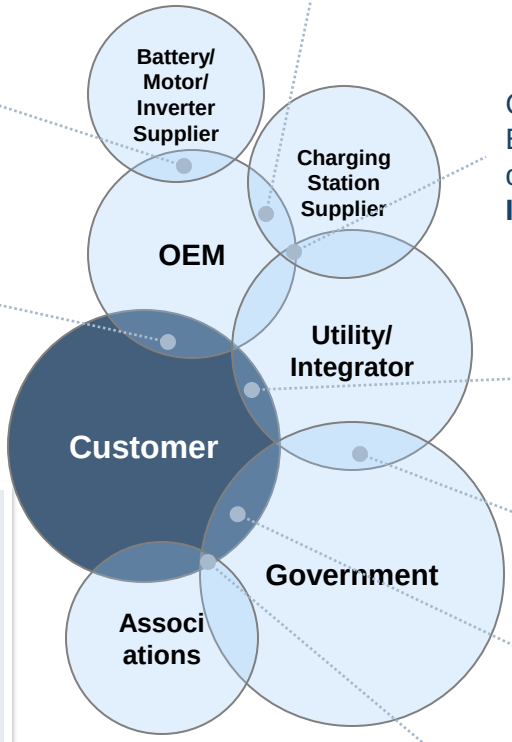
Source: Frost & Sullivan analysis.

Key Stakeholder Analysis

Partner Identification for OEMs Crucial at This Stage

Battery/motor/inverter cost control (e.g., joint development by GM and ABB).
Impact on the industry: high

Charger development (especially DC, e.g., joint development by Nissan, Endesa, Siemens, Efacec, DBT, and Circutor)
Impact on the industry: medium



- Vehicle purchase options
- On-board telematics
- Customer education (Up-front cost vs. TCO concept)

Impact on the industry: medium

Charging infrastructure development (e.g., Renault, Electrica, Schneider Electric, and Siemens partnering on infrastructure development in Romania)
Impact on the industry: medium

- Installation cost payback
- Access/Payment (customer satisfaction crucial)
- Revenue and ROI potential

Impact on the industry: low

Installation process facilitation
Impact on the industry: low

Financial and non-financial support (e.g., subsidies, free parking for EVs)
Impact on the industry: medium

- Customer education
- Strong impact on regulation base

Impact on the industry: low

Conclusions:

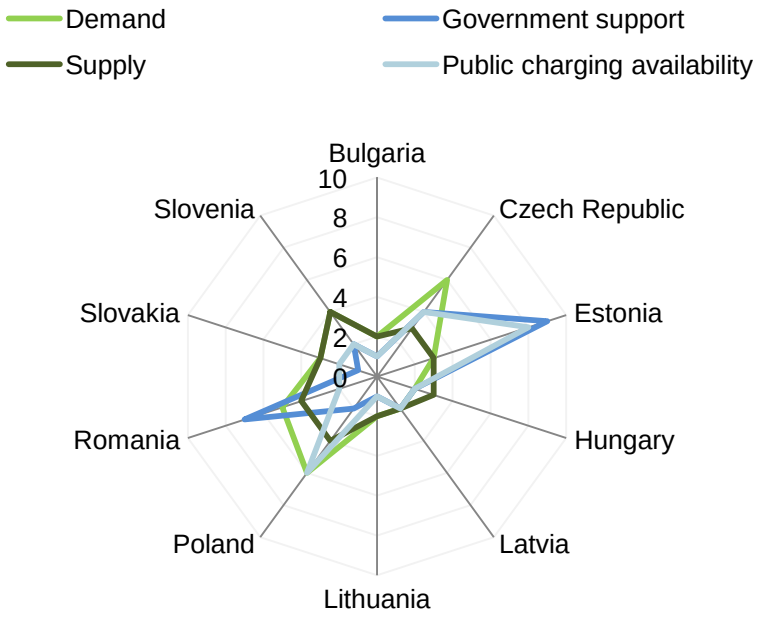
- Price of vehicles (batteries) to remain crucial in CEE
- Customer education is critical for dynamic development of the market
- OEM will have to participate in charging infrastructure (especially DC charging) to facilitate market growth
- Government support is required in the short to medium term to support private investments

Source: Frost & Sullivan analysis.

Four Factors to Monitor

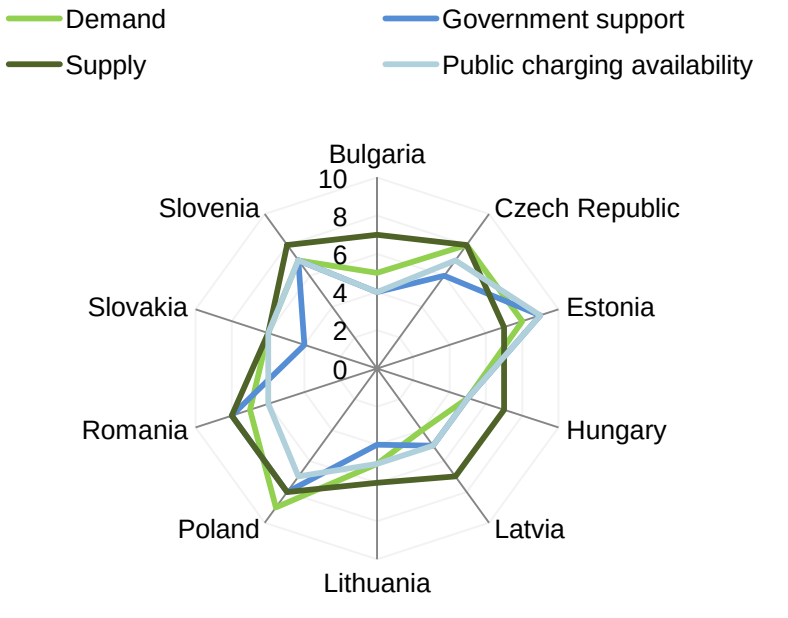
EV Industry Expected to See Full-Scale Government Support by 2014

EV Industry: Developments Outlook, CEE, 2011



Source: Frost & Sullivan analysis.

EV Industry: Developments Outlook, CEE, 2017



Source: Frost & Sullivan analysis.

- Lack of government-level long-term strategies related to electric vehicles is expected to have a strong negative impact on the industry's readiness level until 2014–2015.
- In the medium to long term, the EV industry is expected to engage in dynamic development due to increasing government support, charging infrastructure availability, and diminishing supply restraints.

Note: Scale reflects current and forecasted impact of key factors influencing development of the EV industry (where means low strength and 10 means high strength).

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