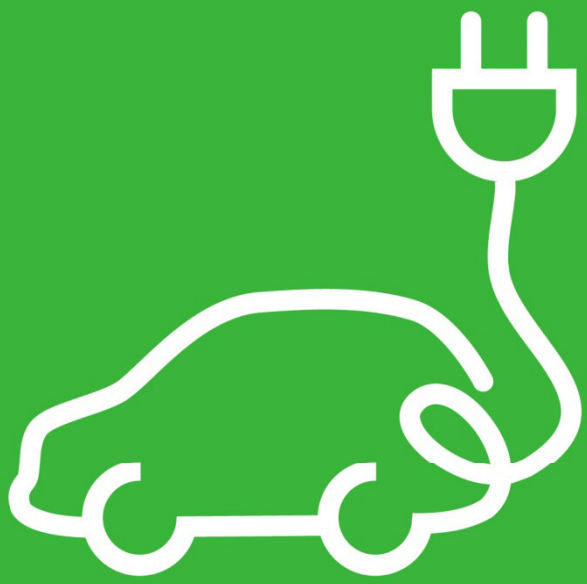
ROLAND BERGER STRATEGY CONSULTANTS

E-mobility in Central and Eastern Europe

OCTOBER 2011

Maturity and potential of electric vehicle markets in CEE



CONTENTS

A. FOREWORD **3**

B. KEY LEARNINGS **4**

C. STUDY OBJECTIVES, SCOPE AND FRAMEWORK **8**

D. STUDY RESULTS **10**

1. E-mobility framework elements 10

2. Definition of e-mobility clusters 16

E. OUTLOOK **17**

F. BACKUP: COUNTRIES SUMMARY **20**

G. AUTHORS **22**

A. FOREWORD

E-mobility is one of tomorrow's major business opportunities. By the year 2025, electric or partially electric vehicles will account for up to 50% of new vehicle registrations in Europe. Although e-mobility is certainly not part of our everyday lives yet, it is definitely picking up speed. The European Union is setting the pace of change: it has decreed that CO_2 emissions must be reduced by 20% between now and 2020.

But who are the major players, and what are the most important drivers? Utility companies, for instance, want to become greener and boost sales in the process. At the same time, they hope that electricity storage and grid balancing become easier. Automakers, on the other hand, must develop new technological know-how to gain the edge over their competitors and fulfill EU emissions targets. Governments hope to use e-mobility to reduce dependence on oil, improve the quality of life and promote their local economies.

E-mobility is here to stay. This is clearly illustrated by the fact that Mr. Obama's stated goal is to have one million electric vehicles on the road in four years' time, while China is running 25 pilot projects and has pledged to invest more than EUR 10 billion in vehicle electrification.

While some Western European economies, especially France and Germany, are known as highly developed e-mobility countries, our study is the first to look into the situation in Central and Eastern Europe – we set out to take a closer look at eight countries in this region. Who is the regional leader? What can the followers learn from the leaders? What are the regional best practices? Why should one get involved already now? What challenges can be expected along the way?

To find out, we scrutinized publicly available information and complemented it with Roland Berger e-mobility know-how and experience. The general structure of our analysis is based on the four key elements of the industry: market supply and demand, the regulatory environment and the general operating environment (such as the number of big cities, per capita GDP, number of cars, etc.). To clearly assess these elements using a comparable methodology we have created an e-mobility maturity index. Our general goal is to show how mature the selected e-mobility markets are and make recommendations for the stakeholders involved.

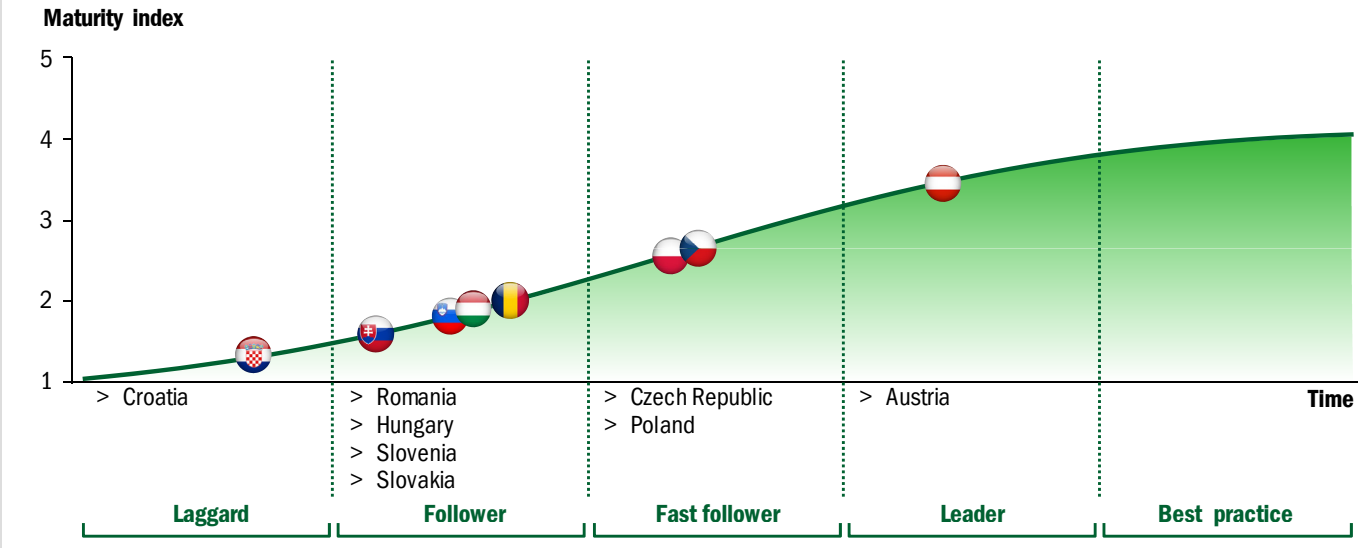
B. KEY LEARNINGS

Although the golden age for e-mobility is still a long way off, the e-mobility concept is making rapid advances, especially thanks to a number of pilot projects. Despite the high uncertainty of the future development of e-mobility, the question is no longer "whether" it will come, but rather "how fast and where first", and "what can we do to accelerate it".

We measured the e-mobility readiness of specific CEE countries by constructing the "maturity index", which combines four key elements: demand, supply, operating environment and regulatory environment.

The results show that CEE countries are relatively strongly differentiated in terms of the maturity of their e-mobility markets. In a nutshell, while there is no best-practice example in the region (from the European perspective), there is a clear regional leader (Austria), followed by two fast followers (Czech Republic and Poland). Other countries achieved a rather low score and were classified as followers (Romania, Hungary, Slovenia and Slovakia) or laggards (Croatia).

FIGURE 1:
COUNTRY POSITIONING: MATURITY CURVE



A number of countries in Europe have paved the way in particular areas and thus serve as best-practice examples. Germany supports eight model regions with well advanced pilot projects and shows high infrastructure readiness. French national automakers number among the most advanced, with seven market-ready electric vehicles (EV) models as of 2012. Denmark is boosting e-mobility through intense government support (purchase subsidy and tax reliefs up to approximately EUR 31,000, or more than 30% of the 2010 EV price), and the City of London has developed a scheme of operational benefits (e.g. free parking and free entrance into the city center) and is building a dense infrastructure network (1,300 public charging points by 2013).

Based on international best practices and the analysis of stakeholders across CEE, we have summarized the regional best practices (figure 2) and have used these characteristics as a benchmark to assess the maturity of the e-mobility elements in all other countries.

Austria's regional e-mobility leadership is fueled by its high public interest and regular EV events, which translate into growing demand. The number of registered EVs reached a total of approximately 600 (mid-2011, out of that 370 in pilot projects), almost double the 2010 figure. Simultaneously, major Austrian utilities are involved in a number of pilot projects in five model regions (which translates into strong supply), and there is clear support from the government and municipalities (key drivers).

Also the fast followers – the Czech Republic and Poland – show relatively high public awareness and regular e-mobility events, although there are smaller pilot projects in place resulting in generally lower supply (1 city in CZ with around 65 EVs, 5 cities in Poland with up to around 50 EVs, compared with about 370 EVs across 5 model regions in Austria). However, the major differentiating factor is the limited government support. This leads to a lack of incentives and no clear nationwide strategy, especially as all three countries have similar e-mobility potential (demonstrated by the operating environment score). Whereas the Austrian government aims to have 250,000 EVs on the streets by 2020, with a committed budget of more than EUR 40 million to date and established subsidies for EV buyers (up to EUR 5,000 per car), there are no initiatives of such scale in either the Czech Republic or Poland.

FIGURE 2:
CHARACTERISTICS OF E-MOBILITY LEADER

DEMAND

> High awareness and activities by a number of consumer groups
> Regular nationwide events, meetings and competitions
> Publication of dedicated magazines

SUPPLY

> Utilities with clear long-term e-mobility strategy
> Numerous regional pilots with a large number of EVs and an extensive charging station network
> Many e-mobility activities by OEMs and specialized EV producers
> Availability of charging station providers

REGULATORY ENVIRONMENT

> Clear long-term e-mobility strategy at government and municipal level
> Favorable legislation
> Subsidies for stakeholders
> Strong incentive programs for consumers

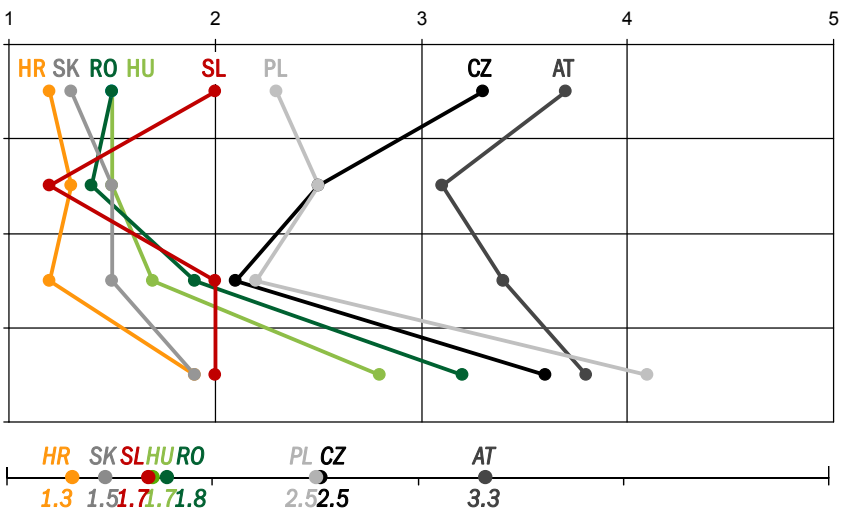
OPERATING ENVIRONMENT

> Very high GDP per capita
> High number of vehicles per capita
> High share of urban population in cities of >100,000 inhabitants
> High R&D spending

FIGURE 3:

COUNTRY POSITIONING: SCORE IN INDIVIDUAL CATEGORIES

Categories		Weight
1	Demand	10%
2	Supply	40%
3	Regulatory environment	40%
4	Operating environment	10%



Overall weighted index

Note: 1: low, 5: high

Behind the Czech Republic and Poland is a relatively homogeneous group (in terms of overall ranking) of followers: Romania, Hungary, Slovenia and Slovakia. These countries are characterized by low customer awareness (demand) and almost non-existent supply. The differentiating factors are the regulatory and operating environment. Government/municipal support is low in Slovakia and medium in Hungary, with Slovenia and Romania reaching the level of Poland and the Czech Republic. Two of the followers (Romania and Hungary) score high in the operating environment category compared with the other followers.

The least-developed CEE country examined is Croatia (laggard), with very low public interest in e-mobility, limited events and low interest on the part of the authorities.

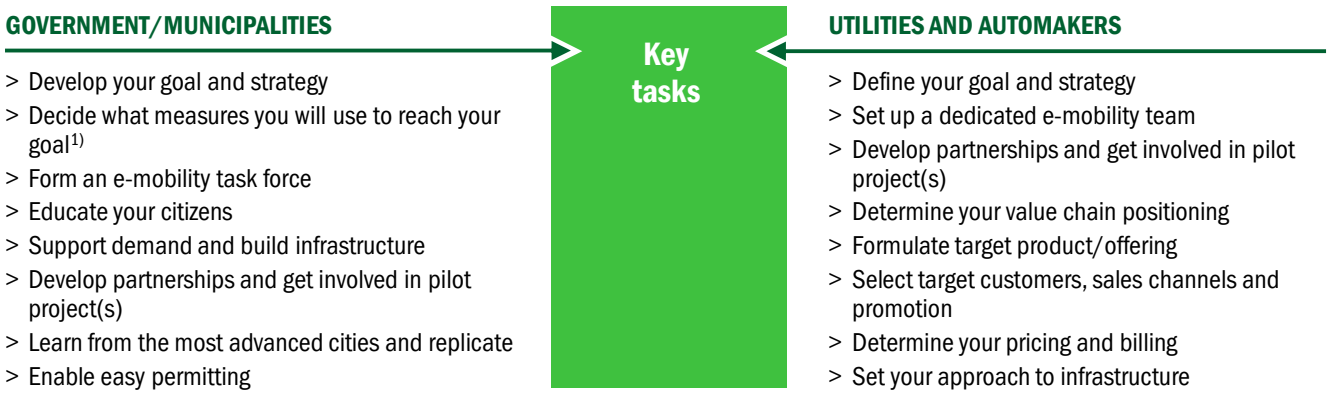
The overall promising assessment of the operating environment – the most highly ranked element for all countries (except Slovenia) – implies a positive outlook for the future. In other words, the CEE countries have not yet tapped their e-mobility potential.

The good news is that it isn't too late to start, and today's laggards can (still) become tomorrow's leaders. In figure 4, we have summarized key learnings for major stakeholders – if they want to become e-mobility champions – based on the best practices we found.

Governments/municipalities need to set up a dedicated e-mobility team (ideally cross-functional), develop a clear, target-based strategy (to clearly signal its goals) and adopt measures in line with the strategy to put it into practice. Authorities should also boost awareness among the public and get involved in pilot projects and infrastructure development to keep close contact with the industry and gain access to state-of-the-art information. Clear government support is especially crucial in the early stages (i.e. now), as it can help significantly increase awareness and "kick off" e-mobility through subsidies and incentives. Limited contribution from authorities doesn't mean that e-mobility "won't fly", just that it won't fly as soon as it could or as high as it does in countries with high government involvement.

Utilities and automakers must follow their e-mobility strategy and get involved in pilot projects. These can also serve as PR, but the primary focus must be on real data and know-how generation through extensive infrastructure and business models/technology testing. This information will be needed in order to readjust the strategy and business models before the large-scale business starts. Making the right decisions on products and value chain coverage, target customers and sales channels, pricing and billing, and the infrastructure approach is key for real future (profitable) business development.

FIGURE 4:
KEY LEARNINGS FOR E-MOBILITY STAKEHOLDERS IN CEE



1) Several types of monetary incentives can be applied: support for manufacturing and research, grants and loans for building charging infrastructure, incentives for buying electric vehicles or disincentives in the form of a carbon tax, which should be balanced with non-monetary incentives such as preferential parking and driving lane access

C. STUDY OBJECTIVES, SCOPE AND FRAMEWORK

FIGURE 5:
STRUCTURE OF THE STUDY

1 MARKET MATURITY ASSESSMENT

> Characterizing the overall e-mobility framework in CEE

> Highlighting the role of individual e-mobility stakeholders

> Assessing each country's maturity and potential based on a comprehensive set of criteria

> Mapping each country's maturity and potential on the e-mobility development curve

2 MARKET COMPARISON AND CLUSTERING

> Building maturity clusters
– On country level: identifying the countries that are the leaders, fast followers, followers and laggards
– On e-mobility element level: assessing supply, demand, regulatory environment and operating environment

> Defining best practices

3 RECOMMENDATIONS FOR NEXT STEPS

> Providing recommendations on next steps for key stakeholders (government/municipalities, utilities, and automakers)

The aim of the study is to evaluate the overall maturity/development of the e-mobility market in Central and Eastern Europe by comparing individual CEE countries and suggesting next steps for key stakeholders.

Eight CEE countries were selected for the purpose of the study: Austria, Czech Republic, Slovakia, Poland, Hungary, Romania, Slovenia and Croatia. These countries are leaders in the region and represent the majority of the population (53%) and GDP (80%) of the region (Russia not considered).

The study was conducted outside-in – that is, it was based on publicly available information regarding the development in specific countries. This information was complemented by Roland Berger e-mobility industry know-how and experience.

The study was structured within the basic e-mobility framework, which consists of four key elements: market demand and supply, regulatory environment and operating environment (see figure 6 for details).

Demand is the main driver of e-mobility success – it is customers and users who will decide where (and when) EVs will become a viable transportation mode. The key long-term demand enablers are the price of EVs, their driving range, market availability of EVs and environmental awareness. However, as the market is not sufficiently developed in any of the analyzed countries, other categories had to be selected to assess the current state of demand. In the early stages of e-mobility markets, it is crucial to build general awareness – so elements such as the current number of EVs in the country and e-mobility events were assessed.

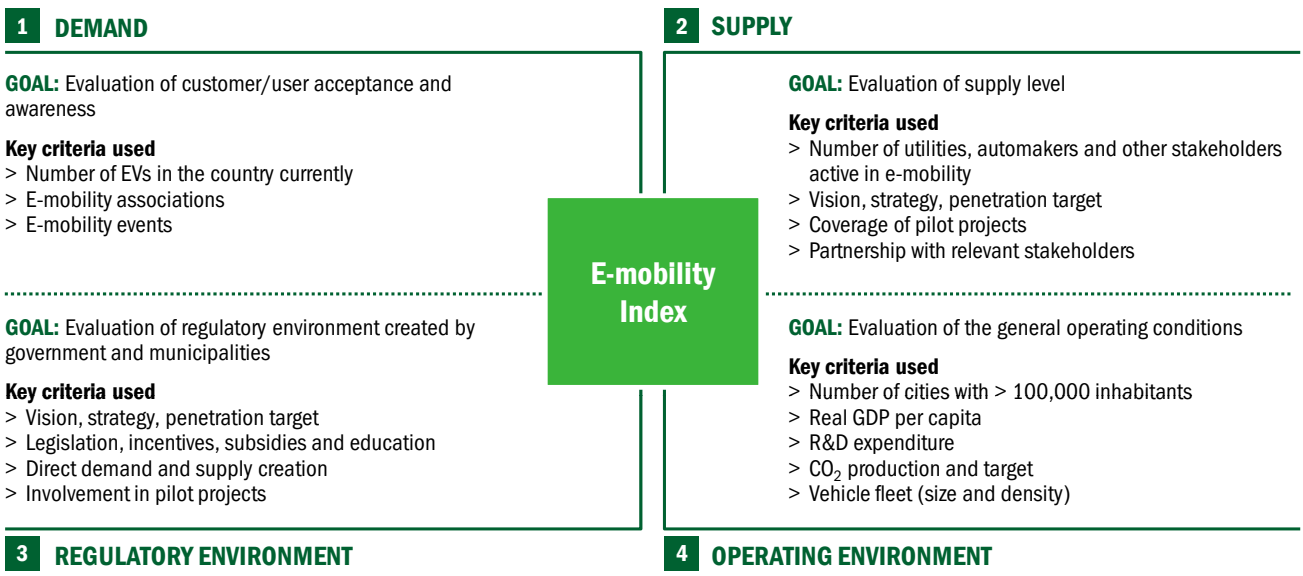
There are three basic groups of stakeholders that must satisfy the demand from customers/users: utilities, automakers and infrastructure providers. To evaluate the level of supply, elements such as the number of players active in e-mobility, their vision, strategy and pilot project coverage were defined.

Governments and municipalities also play a crucial role, as they set the overall scene and define the "rules of play". Vision/strategy and level of legislation/subsidies were thus selected as the most appropriate categories.

The final element, the operating environment, is shaped by the overall economic and technological status of the country. Generally speaking, the operating environment enables practical application of EVs and is thus a key indicator of the future potential for EVs in the country. The operating environment was assessed using a number of macroeconomic/statistical indicators, such as per capita GDP, number of cars in operation, number of cars per capita and number of cities with 100,000 or more inhabitants.

All the categories were ranked and weighted to form the e-mobility index, an aggregated indicator of e-mobility market maturity/development in a given country.

FIGURE 6
METHODOLOGY: E-MOBILITY INDEX OVERVIEW



Based on the e-mobility index score, the specific countries were split into maturity clusters (i.e. leaders, fast followers, followers and laggards). Similarly, the key stakeholders were clustered according to their e-mobility index result.

As the EV markets are very dynamic, and as our analysis was conducted outside-in and based on number of subjective categories, we understand that our findings must be considered to be indicative. Nevertheless, we hope that the study will provide a useful reading on where certain countries stand today and what needs to be done to potentially become an e-mobility champion.

D. STUDY RESULTS

Each stakeholder contributes a certain input to the e-mobility market and pursues its own set of goals that must be understood to comprehensively assess its e-mobility readiness.

FIGURE 7:
STAKEHOLDERS, THEIR PRIMARY GOALS AND THEIR ROLES IN E-MOBILITY

ELEMENT	STAKEHOLDER	GOAL	ROLE/INPUT
Demand	Customers/users	> Meet mobility needs	> Generate demand
Supply	Utilities	> Image improvement (short-term goal) > Sales increase (long-term goal)[1)] > Tighter customer relationship > Grid balancing, energy storage	> Electricity > Grid > Billing know-how > Customer contacts > Possible e-mobility provision[2)]
	Automakers	> EV technology testing (short-term goal) > Higher sales (long-term goal) > Compliance with CO_2 regulations	> Electric vehicles > Maintenance and repair infrastructure > Possible e-mobility provision[2)]
	Other stakeholders (infrastructure providers, car dealers)	> Sales generation	> Provision of charging infrastructure > Sale of EVs > Possible e-mobility provision[2)]
Regulatory environment	Government/ municipality	> Reduction in energy dependency > Reduction in CO_2 emissions > Improvement in quality of life (air quality, noise reduction) > Boost for the economy	> Regulation > Incentives on the supply and demand sides

1) Through e-mobility provision, increased electricity sales, enhanced customer retention or new customer acquisition
2) E-mobility provider supplies electricity, infrastructure access, billing and add-on services

D.1 E-MOBILITY FRAMEWORK ELEMENTS

We assessed the maturity of the key elements (supply, demand, regulatory and operating environment) based on the readiness of individual stakeholders (summary in figure 9).

The assessment of individual stakeholders in the analyzed countries highlights which of them are the e-mobility drivers. Whereas, in the case of Austria, supply is driven mainly by utilities (leader) and other stakeholders (fast follower), the Czech Republic is the only country that also shows a contribution from automakers.

FIGURE 8:
COUNTRY POSITIONING: STAKEHOLDERS' SCORES

	Austria	Czech Republic	Poland	Hungary	Slovakia	Slovenia	Romania	Croatia
DEMAND	◕	◕	◑	◔	○	◔	◔	○
SUPPLY								
> Utilities	◕	◑	◑	◔	○	○	○	◔
> Automakers	◔	◑	○	◔	○	○	◔	○
> Other stakeholders	◑	◔	◑	◔	◔	◔	◔	○
REGULATORY ENVIRONMENT								
> Government	◕	◔	◑	◔	◔	◔	◑	○
> Municipalities	◕	◑	◑	◔	◔	◔	◔	◔
OPERATING ENVIRONMENT	◕	◕	●	◑	◔	◔	◕	◔

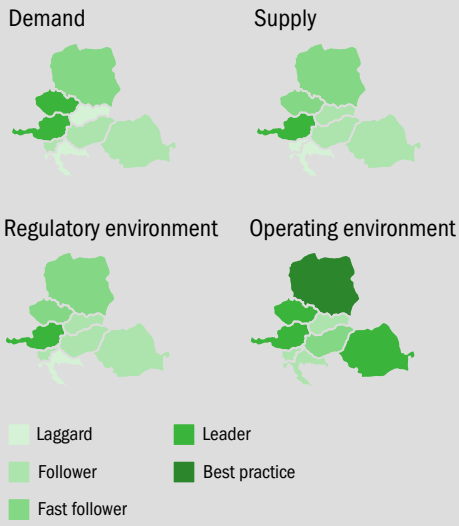
○ Laggard ◔ Follower ◑ Fast follower ◕ Leader ● Best practice

The success or failure of e-mobility depends on the DEMAND generated by consumers/users. Early deployment of e-mobility is typically started by groups of enthusiasts who care about the environment and/or who are fascinated by electric propulsion. These enthusiasts form EV associations (e.g. Electromobiles Civic Society [CZ], Association of Electric Vehicle Users [PL] and Association for the Promotion of Electric Vehicles [RO]), launch web-based magazines (e.g. futureage.eu, elektromobily.sk, hybrid.cz and stromfahren.at) and organize EV events (such as e-mobility days [CZ] and e-mobility power Großglockner [AT]).

As far as the penetration of EVs is concerned, in the first stage, the enthusiast groups convert regular cars into EVs for their own use/testing. Later, the converted EVs are sold to other customers, and in the final stage, customers start buying original EVs.

Mass penetration of EVs (i.e. to B2C customers) is also aided by the initial focus of e-mobility providers on B2B customers. For them, e-mobility is a convenient tool to promote their green image or comply with corporate emissions standards, despite potentially higher costs. Penetration of EVs into the B2B world will pave the way for ramping up production capacities. This, in turn, will reduce EV production costs and also generate first positive experiences that will be decisive for penetration into the B2C segment.

FIGURE 9:
MATURITY OF KEY ELEMENTS

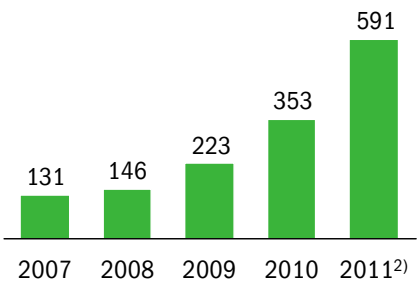


In most of the countries analyzed, there were already early signs of e-mobility acceptance, such as a wide variety of different EV associations and events. However, there are as yet only a few registered EVs and, as expected, a significant number of them were converted from regular cars. Original EVs were only recently launched on the focus markets.

The regional best-in-class example of customer demand is Austria, where the highest number of EVs (almost 600 in mid-2011) in the region can be found (driven mostly by the Vlotte project). Austria also shows high public awareness, boosted by numerous events and a wide range of available EVs (generally all EVs commercially available in Europe).

FIGURE 10:
DEMAND – CEE BEST-IN-CLASS EXAMPLE: AUSTRIA

NUMBER OF EVs[1)]



MAJOR EV BRANDS

THINK, AIXAM, TESLA, FIAT, CITROËN, TAZZARI ZERO, PEUGEOT, smart, TWIKE, MiEV, smiles e-mobility

MAJOR EV EVENTS

- E-Mobility Power Großglockner
- Euro EV Race 2010
- Information events by fleet operators (e.g. Vlotte, Salzburg AG)
- EV infrastructure demonstration at European Forum Alpbach
- E-mobility expo 2011

1) Pure EVs only, additional 4,800 hybrids/PHEVs in 2010
2) By April 2011, driven by the Vlotte project with 250 operational EVs by mid-2011 (300 acquired), at the end of 2010 only 77 EVs operational

On the SUPPLY side, utilities play a crucial role. They can be either the true driving force (e.g. CEZ in the Czech Republic) or merely an active player. In the latter case, the driving force behind e-mobility is then typically the government and/or the municipalities (e.g. Austria).

There are several types of automakers that are active in e-mobility: traditional OEMs, specialized EV producers and retrofit manufacturers that convert traditional cars to EVs. Of these players, traditional OEMs clearly have much greater market power, and their involvement in e-mobility is an important indicator of the country's e-mobility readiness.

FIGURE 11:
SUPPLY – UTILITY AS E-MOBILITY DRIVER EXAMPLE: CZECH REPUBLIC

Utilities/automakers involved in e-mobility

Utilities

- CEZ
- RWE
- E.ON
- PRE

All major utilities in the Czech Republic

Automakers

- SKODA
- AVIA
- SOR

Considerable involvement of local automakers in the region

CEZ e-mobility vision/strategy

Vision

- CEZ is committed to tackling climate change in CEE and is actively looking for opportunities to reduce pollution in any given sector by offering new solutions such as e-mobility

Strategy

- Leverage first mover position
- Test and develop long-term business model
- Gather know-how and develop infrastructure

CEZ e-mobility pilot project

- Location: City of Prague, Vrchlabí region
- Timing: 2010-2013
- No. of EVs: >65
- Number of charging stations: >150
- Locations of charging stations: At home, at work, retail parking lots, public places
- Automaker partners: PSA (Peugeot Citroen)
- Budget: EUR 20 m for FuturEmotion program altogether (e-mobility not specified)

The traditional automotive industry is very strong in some of the CEE countries, such as Slovakia and the Czech Republic. However, OEMs are not yet the driving force behind e-mobility in any of the countries studied. The traditional OEMs in CEE who made the greatest progress are found in the Czech Republic: Skoda released its EV Octavia Green E Line in 2010 (only testing stage), AVIA plans to sell e-trucks in cooperation with Smith Electric Vehicles (AVIA focuses on cabins and chassis sub-deliveries, some units already sold on the US market, launch on Czech market planned by 2012) and SOR produces electric-powered buses (marketed since late 2010).

In several CEE countries, one can find specialized EV producers – new companies or companies that did not previously produce cars. Specialized EV producers can be found even in countries with a rather weak automotive industry, such as Croatia (DOK-ING).

There are also a number of retrofit manufacturers, which convert conventional ICE cars to electric vehicles, such as the EVC Group based in the Czech Republic.

Access to the charging infrastructure is ensured by an infrastructure provider, which may be a specialized company or any other e-mobility stakeholder. In the focus countries, the role of infrastructure provider is frequently played by a utility company, e.g. CEZ in the Czech Republic. It is rare for a non-utility company to announce its intention to build a charging infrastructure (as happened in the case of Telekom Austria and Elektromobil in Slovakia). As far as the infrastructure itself is concerned, there is no nationwide network in any of the focus countries. Infrastructure is just now being built in conjunction with pilot projects.

Governments and municipalities are the key stakeholders that define the REGULATORY ENVIRONMENT. Government involvement in e-mobility in the analyzed countries ranges from being the driving force to practical inactivity.

FIGURE 12:
REGULATORY ENVIRONMENT – CEE BEST-IN-CLASS EXAMPLE: AUSTRIA

OVERALL SETUP

Vision

> EVs should form a significant proportion of new vehicles – Penetration target of 250,000 in 2020 (i.e. 3-5% of the vehicle fleet)

Coverage

> State of Vorarlberg (2008)
> City of Salzburg (2009)
> City of Vienna (2010)
> City of Graz (2010)
> City of Eisenstadt (2010)

LEGISLATION & SUPPORT

Government

> Public knowledge sharing via "e-connected.at"
> PR work through the ministries involved and the Climate and Energy Fund
> Ministries develop specific measures needed to promote e-mobility (ready by end of 2011)
> PPP research program A3PS[1] – Collaboration platform for domestic industry players and universities

Municipalities

> Plans to push building societies and developers into integrating charging points into new apartment complexes, garages, etc.
> Substantial PR work in all of the model regions to promote e-mobility (e.g. Kitzbühel)

SUBSIDIES

Government

> Project financing – Committed budget of EUR >40 m to date
> Ministry of Environmental Affairs co-financed the installation of 1,000 EV charging stations across the country
> Purchase incentives of up to EUR 5,000 per EV (companies only)
> Exemption of EVs from fuel consumption tax (up to EUR 500)[2] and vehicle tax

Municipalities

> Various subsidy programs for e-mobility – Different subsidy amounts for buyers of new EVs (cars, scooters, e-bikes)
> A universal, time-limited subsidy of EUR 300 has led to a small boom in e-bikes in Vienna; the subsidies initiated orders and special offers by retailers that previously did not carry e-bikes

1) Austrian Agency for Alternative Propulsion Systems 2) Until mid-2012

The most advanced status was reached in Austria. Its government published a strategy and goals, including a penetration target of 250,000 EVs in 2020 (which would mean 3-5% of the vehicle fleet). Austria also defined five so-called model regions, one of them being among the three largest pilot projects in Europe (Vlotte, with around 300 EVs acquired by mid-2011).

Moreover, Austria has committed a budget worth more than EUR 40 million to date to support the model regions and various research programs, with EUR 35 million still open (aimed at supporting new energy systems). The government also conducts PR work via a dedicated website (e-connected.at).

The Polish government provided some EUR 5 million to the Mielec Regional Development Agency for the project "Building the electric vehicle market and charging point infrastructure as the basis for energy security". This body coordinates pilot projects in five major cities. Among other things, it aims to build the infrastructure of 330 charging points, deliver 20 test electric vehicles, build a monitoring station and gather information about users' habits.

The Slovenian government targets 23% of EVs in Slovenia by 2030. So far, however, it has introduced only indirect support through a CO_2-based tax system. The Romanian government has introduced direct subsidies to EV buyers within the scrappage scheme (20% subsidy capped at EUR 3,700), and Romanian electric vehicles are also exempt from CO_2 tax. The involvement of the Czech and Hungarian governments is limited to tax advantages. Slovakia does not yet offer any specific subsidies or incentives.

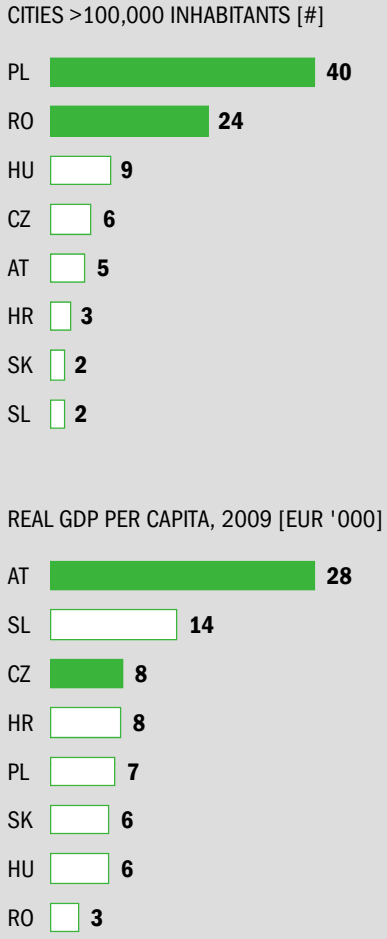
Due to the fact that the OPERATING ENVIRONMENT is tightly linked with a country's socio-economic development, it is difficult to influence it in the short term. However, it has an important impact on e-mobility development.

There are great differences in the countries studied as far as the operating environment is concerned. The number of inhabitants ranges from 2 million in Slovenia to about 38 million in Poland. Real GDP per capita is as high as nearly EUR 30,000 in Austria and as low as about EUR 3,000 in Romania. R&D expenditures vary between 0.5% of GDP in Slovakia and 2.7% of GDP in Austria. The number of vehicles in the country ranges from about 19 million in Poland to slightly over 1 million in Slovenia.

Nevertheless, there are four markets that score high in the operating environment category. Poland and Romania, for their overall market size (demonstrated by number of cities with more than 100,000 inhabitants), and Austria and Czech Republic, as the most developed countries (assessed by per capita GDP) in the region (and still relatively large markets, unlike Slovenia).

Poland's high score in operating environment is also the reason why even non-domestic utilities launched e-mobility projects here (e.g. RWE), to benefit from the first-mover position in this promising market.

FIGURE 13:
OPERATING ENVIRONMENT – SELECTED CRITERIA



D.2 DEFINITION OF E-MOBILITY CLUSTERS

Clear cluster characteristics were identified based on the countries analyzed. These clusters also present the basic "ladder" that the particular stakeholders have to climb to become e-mobility champions.

FIGURE 14:
CHARACTERISTICS OF MATURITY CLUSTERS

Category	Laggard	Follower	Fast follower	Leader
DEMAND	> No consumer groups > Minimal public interest	> Presence of EV hobby groups > Rare events > Occasional press coverage	> Presence of several EV consumer organizations > Occasional local/national events and meetings > Regular online and offline press coverage	> High awareness and activities by number of consumer groups > Regular nationwide events, meetings and competitions > Publication of dedicated magazines
SUPPLY	> Low e-mobility activity by utilities > No pilot programs > No EV manufacturing, only conversions by individual enthusiasts	> Utilities use e-mobility for PR purposes, initial signs of long-term view on e-mobility > Initial discussions among stakeholders about pilot project partnerships > Companies offering custom conversions of ICEs to EVs	> Utilities show serious interest in e-mobility and have long-term view > At least one pilot project is launched with medium test fleet size and medium charging network > Some boutique EV manufacturing	> Utilities with clear long-term e-mobility strategy > Numerous regional pilots with a large number of EVs and an extensive charging station network > Many e-mobility activities by OEMs and specialized EV producers > Availability of charging station providers
REGULATORY ENVIRON-MENT	> Government and municipalities have no interest in e-mobility	> Government and municipalities show interest in e-mobility, but no action taken	> Initial e-mobility initiatives from the government and municipalities > Limited support to stakeholders > Symbolic incentives for consumers (e.g. free parking)	> Clear long-term e-mobility strategy at government and municipal level > Favorable legislation > Subsidies for stakeholders > Strong incentive programs for consumers
OPERATING ENVIRON-MENT	> Below average GDP per capita > Low number of vehicles per capita > Low share of urban population in cities of >100,000 inhabitants > Low R&D spending	> Average GDP per capita > Average number of vehicles per capita > Medium share of urban population in cities of >100,000 inhabitants > Average R&D spending	> Above average GDP per capita > Above average number of vehicles per capita > High share of urban population in cities of >100,000 inhabitants > Above average R&D spending	> Very high GDP per capita > High number of vehicles per capita > High share of urban population in cities of >100,000 inhabitants > High R&D spending

While "laggards" are countries with limited e-mobility development on both the demand and the supply side, and no interest on the part of their governments, e-mobility "leaders", in contrast, must show high public awareness driven by nationwide events and promoted by dedicated consumer groups, and strong supply demonstrated by numerous pilot projects with clear strategies and visions and supported by both utilities and automakers.

Simultaneously, to become a leader, the government must develop a clear nationwide strategy that covers both early-stage development incentives and overall e-mobility legislation.

E. OUTLOOK

E-mobility will play a crucial role in future transportation systems. By 2025, up to 50% of newly registered vehicles in Europe are expected to be fueled by some kind of electric propulsion, and almost every fourth car sold in CEE markets in 2025 is likely to be EV or PHEV[1)].

However, there is not expected to be any genuine rise in e-mobility before 2015. Then, it will initially be driven by B2B customers, and the main boom will come after 2020, when B2C customers join in. The share of B2C customers is estimated to reach 30% in 2015, and increase to 70% in 2020.

Over the next 15 years, we expect e-mobility to develop in three major stages, closely linked to the ramp-up of EVs sold (figure 15). In the initial stage (i.e. now), the number of EVs is driven mostly by pilot projects, and there is virtually no standalone market, neither in the B2B nor in the B2C segment. The primary task of the key stakeholders involved is thus to generate sufficient know-how to fine-tune their strategies and business models before the next phase commences. Mass production of a number of EV models is expected as early as at the end of this phase, in line with increasing overall awareness among the public.

Starting in 2015, the number of EV users is likely to grow, with the B2B segment initially playing a key role. The main demand drivers of this segment are the need for companies to enhance green image, ambitions to meet corporate emissions targets and fleet purchases by state-owned companies. Nevertheless, this will be possible only with simultaneous infrastructure development, which, based on the chicken-and-egg paradox, will be both the main driver and the main inhibitor of development in certain countries. The growing number of players will lead to a rise in competition, thus increasing the need to differentiate and to build a unique selling proposition (USP) in order to attract customers. The growing EV penetration will further push the unification of technological standards and the specification of a legal framework (e.g. safety rules).

1) PHEV – Plug-in-Hybrid electric vehicle

In the third phase, the focus will be on capturing market share, especially in the B2C segment, which will become fully addressable (focus on B2C segment already at the end of phase II). A clear USP (already shaped in the earlier phase) will be the key success factor, as the competition will be intense. Penetration into the B2C segment will be enabled particularly by technological progress and a corresponding drop in production costs. Earlier Roland Berger studies revealed that consumers are ready to pay extra for EVs in order to benefit from cheaper operational costs later, but they are not willing to pay more than EUR 4,500. While the cost difference between EVs and conventional cars will still be around EUR 10,000 -15,000 in 2015, it is expected to fall below the break-even limit of EUR 4,500 by 2020.

Uncertainty regarding the ramp-up of electric-powered vehicles is extremely high, fueled by unpredictable oil price development, the speed of necessary technological improvements and the level of governments' involvement. As we have already noted, the question is no longer "whether" but rather "when" – the above-mentioned factors will speed up (or slow down) EV market growth rather than influence its magnitude as such. Thus, we consider it of crucial importance for all stakeholders to keep pace with e-mobility developments – in other words, to work hard on being ready for the next phase, when "full scale" e-mobility kicks off.

There are number of reasons to start "getting ready" now. The demand ramp-up could turn out to be faster than expected, and only the players with turnkey solutions in place (business model, offering, billing and pricing, profitability and investment expectations, etc.) will be able to benefit from it. This is all the more valid as the e-mobility industry shows rather high entry barriers caused by R&D and infrastructure development costs – it will be costly to win market shares over established players at later stages, once the "die has been cast".

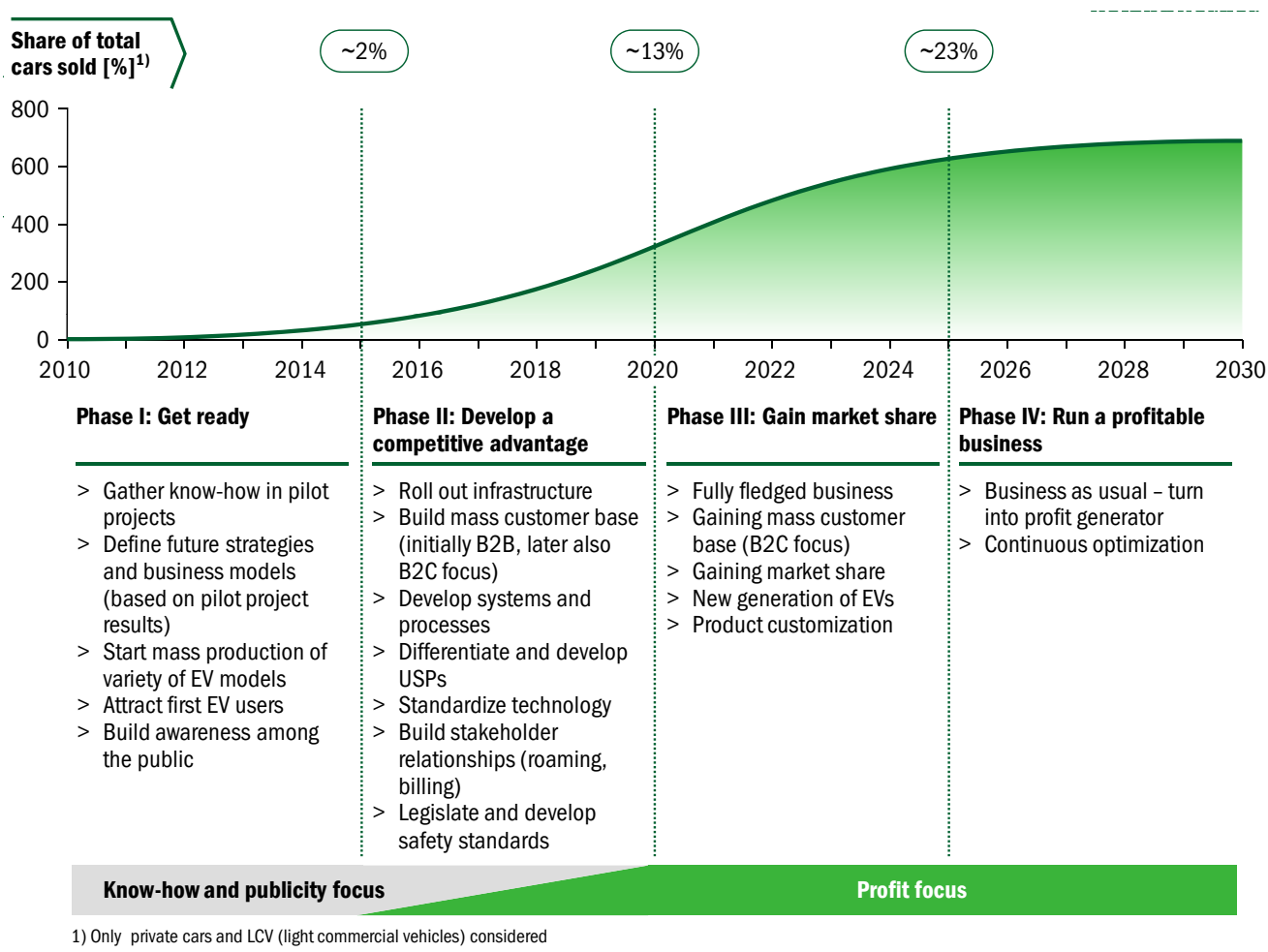
Early involvement will also secure the first-mover advantage, which is significant especially with regard to infrastructure. To cover all critical places and provide peace of mind, the infrastructure must be wise, rather than dense. Studies showed that customers with access to public infrastructure used EVs much more intensively, as their "range anxiety" was eliminated. As infrastructure development costs are high, the player who manages to cover the key spots first will gain an advantage over the followers.

Also the cost burden can be lower at the beginning, as models and technologies can be tested through joint data collection on the cost-sharing principle. Joint development will become less likely as the market matures, since by that time, the early players will have developed significant know-how that they will not be willing to share.

Early players will not only benefit from mutual learning through partner networks, but they will also be able to shape the overall e-mobility framework, i.e. technology standards, legislation framework, compatibility, etc.

And last but not least, it is not easy for any organization to embrace such a change as e-mobility (new business model, new product, new technology, new partners and relationships). Developing the e-mobility concept, generating know-how, educating staff and turning the concept into a practical reality will take several years, and many as yet unforeseen hurdles will emerge on the way. Early involvement will ensure sufficient time to master all these challenges and thus provide a valuable advantage.

FIGURE 15:
EV/PHEV DEVELOPMENT IN CEE ['000 UNITS]



1) Only private cars and LCV (light commercial vehicles) considered

F. BACKUP: COUNTRIES SUMMARY

AUSTRIA


DEMAND


SUPPLY


REGULATORY ENVIRONMENT


OPERATING ENVIRONMENT

> High level of public interest, currently more than 590 EVs
> Regular EV events (e.g E-Mobility Power Großglockner, Euro EV Race), various web platforms
> Five utility providers active in e-mobility with large-scale pilot projects
> Many R&D and production activities by OEMs and specialized manufacturers in the field of electric propulsion
> High number of dealerships selling a wide range of EVs
> Strong support from the Federal Ministry for Transportation, Innovation and Technology

CZECH REPUBLIC


DEMAND


SUPPLY


REGULATORY ENVIRONMENT


OPERATING ENVIRONMENT

> Considerable public interest, currently more than 100 EVs
> Regular EV events (exhibitions, reunions of owners of EVs, competitions, conferences), several EV associations and online platforms
> Main utility provider CEZ developed a long term e-mobility strategy and launched pilot project
> Above-average R&D intensity and EV manufacturing activity (e.g. Skoda, AVIA)
> Limited government support, with few incentives to buy

POLAND


DEMAND


SUPPLY


REGULATORY ENVIRONMENT


OPERATING ENVIRONMENT

> Medium public interest in EVs
> Three major EV associations, some occasional events
> Three utility providers active in e-mobility, several large scale pilot projects in place
> R&D activity is low, OEMs do not participate in development, some smaller specialized manufacturers are involved in e-mobility
> Special governmental workgroup is studying the possibility of supporting e-mobility, but has no strategy so far
  – Some tax based incentives are already in place

HUNGARY


DEMAND


SUPPLY


REGULATORY ENVIRONMENT


OPERATING ENVIRONMENT

> Moderate public interest in EVs
> One formal interest group recently established, some online communities, events are rare
> One utility provider showed signs of e-mobility involvement, however the project has still a PR nature, rather than actual testing
> R&D intensity is average, OEM involvement limited to one bus manufacturer, however activity of specialized manufacturers is very high
> Government has announced interest in e-mobility, however has not taken any steps in actual support, some taxation incentives are in place

 Laggard  Follower  Fast follower  Leader  Best practice

SLOVAKIA

DEMAND
SUPPLY
REGULATORY ENVIRONMENT
OPERATING ENVIRONMENT

> Little public interest in EVs
> No events, no formal associations, only some online platforms
> Limited utility involvement in e-mobility, no full scale pilot projects
> Very low R&D intensity, no OEM or specialized manufacturer involvement, long-term production plans only
> Government is contemplating e-mobility support possibilities but has not taken any specific actions yet
> Bratislava and Vienna work on cross border project

SLOVENIA

DEMAND
SUPPLY
REGULATORY ENVIRONMENT
OPERATING ENVIRONMENT

> Interest in EVs is fairly low
> There is only one major formal association and one online platform
> No e-mobility involvement of Slovenian utility companies has been reported
> No OEM involvement and very low activity of specialized producers
> Government announced a long term penetration target and took initial measures for e-mobility development (CO_2 based taxation)

ROMANIA

DEMAND
SUPPLY
REGULATORY ENVIRONMENT
OPERATING ENVIRONMENT

> Interest in EVs is currently fairly low, with only one association
> Several players are interested in e-mobility involvement (partnership was recently set up between Renault, Electrica, Siemens and Schneider Electric); no projects yet
> Low R&D intensity; Renault involved in promoting e-mobility
> Government set up a special working group for developing the e-mobility strategy in Romania, subsidies for EV purchase recently introduced (up to EUR 3,700)

CROATIA

DEMAND
SUPPLY
REGULATORY ENVIRONMENT
OPERATING ENVIRONMENT

> Very little public interest
> Virtually no regular events, one formal association
> Local utility provider HEP is preparing to roll out a pilot project to test charging infrastructure
> R&D intensity is average, no OEM activity and only one specialized producer
> City of Zagreb is preparing an infrastructure development project, no specific details known
> Government has so far indicated no interest in supporting e-mobility

Laggard Follower Fast follower Leader Best practice

G. AUTHORS

Roland Berger
Strategy Consultants

Roland Berger Strategy Consultants
Na Porici 24
Praha 110 00
Czech Republic

www.rolandberger.cz
www.rolandberger.com

ROLAND ZSILINSZKY

Head of the Automotive Competence Center in CEE

+420 210 219 524
Roland_Zsilinszky@cz.rolandberger.com

ALEXANDER KAINER

Head of the Energy Competence Center in CEE

+43 1 536 02 139
Alexander_Kainer@at.rolandberger.com

JAN SKLENAR

Senior consultant in the Automotive Competence Center in CEE

+420 210 219 531
Jan_Sklenar@cz.rolandberger.com

ALEKSZEJ BORSCS

Senior consultant in the Automotive Competence Center in CEE

+36 1 301 70 70
Alekszej_Borscs@ru.rolandberger.com

Roland Berger
Strategy Consultants