



Electric vehicles and electric utilities

A clear opportunity with many shapes

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Executive summary

While several stakeholders are supportive of the widespread adoption of electric vehicles, we have looked specifically at electric utilities to understand the opportunities that such a change in the transportation landscape can generate, and define the key questions to be addressed in order to embrace them. We have identified four business models – by no means evolutionary – that can be looked at independently, and eventually combined to fit the company’s strategy and the specific market conditions (e.g., regulation, competition, ecosystem, customer readiness). We strongly believe electric utilities are ideally positioned to leverage the opportunities offered by the adoption of electric vehicles on a mass-market scale, but they need to act fast, as many other players are addressing the same opportunity.

1. Demand for electric vehicles grows... and most likely won't stop

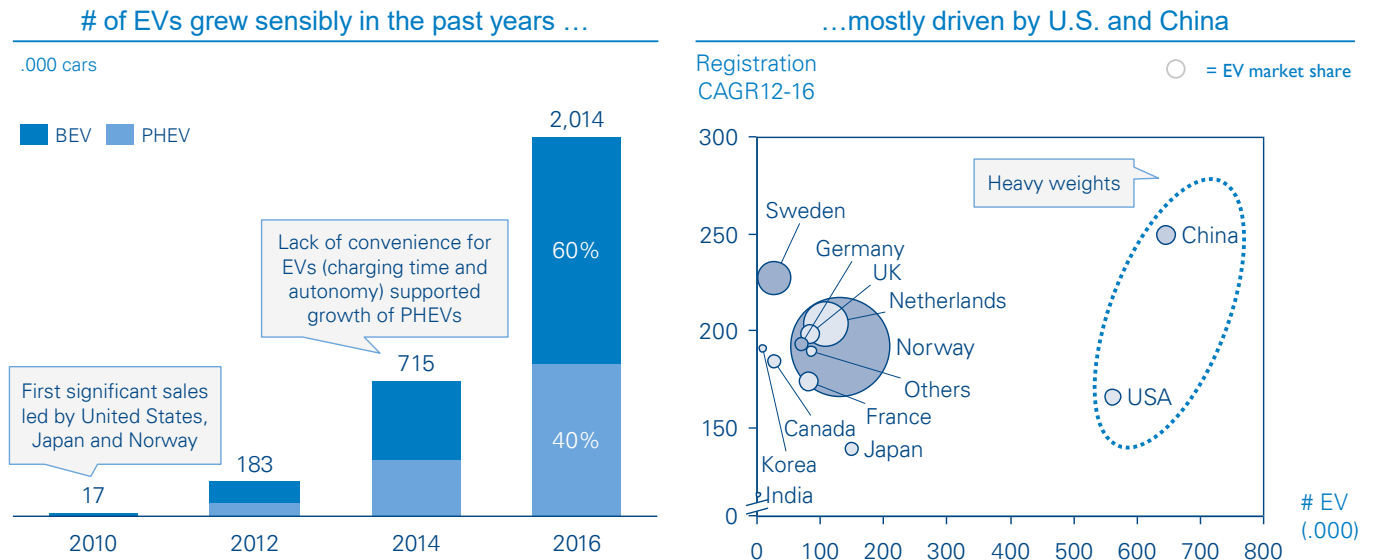
We are in the middle of an EV revolution. Only a decade ago, vehicles with batteries and electric motors felt like a distant sci-fi dream. Today, they are shaping the lives of consumers and the strategies of car producers and governments, showing fast growth.

The global estimated number of EVs in 2016 was 2 million – a number led prominently by the US and China, with approximately half a million EVs each (Figure 1).

Figures for the future vary a lot, as shown in our comparison of several organization and their estimations (Figure 2).

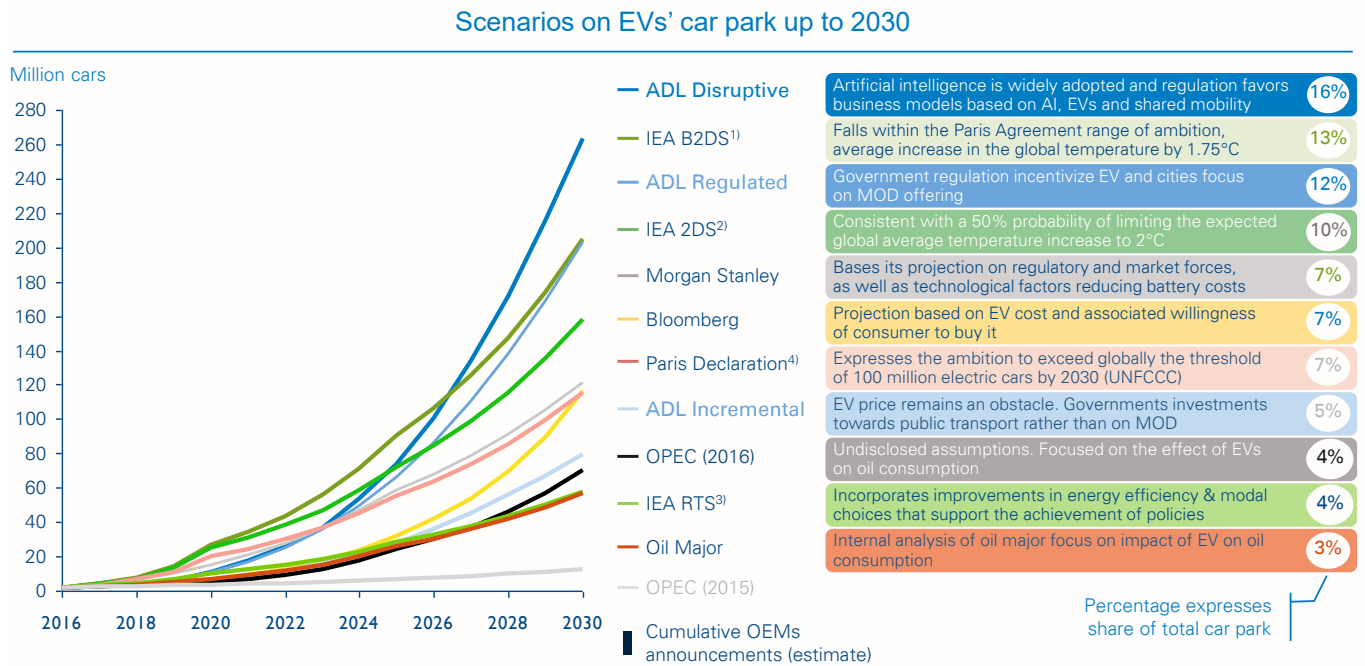
Based on discussions with industry leaders, dedicated surveys, and analyses of market forces, regulations, and industry aspirations, we believe the global light-EV market will represent 5–16 percent of car parks until 2030, translating to 270 mn cars at the high end of the range. The large difference in our estimates comes from the uncertainty around adoption of favorable regulation at the city level, which can favor or curb the growth of EVs.

Figure 1: Growth in EVs led by the US and China



Source: Global EV Outlook 2017 – International Energy Agency (IEA) – 2017
 Countries included in the analysis are: Canada, Chile, France, Germany, India, Japan, Korea, Netherlands, Norway, Sweden, United Kingdom, United States, Austria, Belgium, Bulgaria, Croatia, Cyprus, the Czech Republic, Denmark, Estonia, Finland, Greece, Hungary, Iceland, Italy, Ireland, Latvia, Lichtenstein, Lithuania, Luxemburg, Malta, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Switzerland and Turkey

Figure 2: Scenarios on EV car park up to 2030



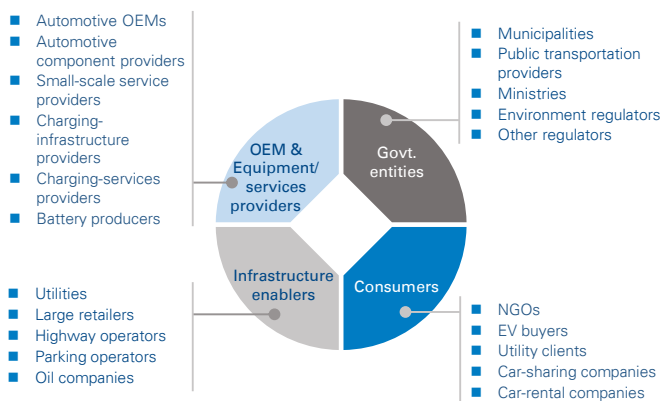
1) B2DS = below 2 degrees; 2) 2DS = 2 degrees; 3) RTS = Reference Technology Scenario; 4) Paris Declaration on Electro-Mobility and Climate Change and Call to Action
 Total car park assumes 0.9bn cars in 2014, 1.6bn in 2030 e.g. to 3% CAGR 2014-40 to reach 2bn cars in 2040.
 Sources: IEA global EV Outlook 2017, Bloomberg, New Energy Finance, OICA, Business Intelligence, BP, OPEC, Arthur D. Little analysis

2. Four main groups of stakeholders play a critical role in the widespread adoption of EVs

The four main stakeholder groups

Four main groups of stakeholders, displayed in Figure 3, play a critical role in the widespread adoption of EVs, involving different interests and motivations.

Figure 3 – Overview of 4 main stakeholder groups



Source: Arthur D. Little analysis

1. Government entities

Public entities have recently embraced environmental causes, recognizing the importance of taking concrete actions to reduce carbon emissions and air pollution.

In the spirit of fighting carbon emissions, eight major nations – Canada, China, France, Japan, Norway, Sweden, the United Kingdom and the United States of America¹ – signed a Government Fleet Declaration in 2016, pledging to increase the share of electric vehicles in their government fleets and calling for other governments to join them to keep global warming on a less-than 2-degrees pathway.

Countries such as Norway, France and the UK have expressed strong commitments to banning all new petrol and diesel cars

and vans latest by 2040 in an attempt to improve poor air quality, which is more and more associated with public health concerns.

We see similar dynamics outside of Europe and North America. India recently set an ambitious target date of 2030 to end sales of new cars with combustion engines. With China’s increased understanding of the effect of pollution on public health (a study done by Nanjing University’s School of the Environment associates toxic smog with one-third of all deaths), the country is considering implementation of a ban on all petrol cars, which could be as early as 2030 or as late as 2040.

In addition to the environmental cause, governments – such as China’s – are expected to push EVs in an attempt to exploit the technology to attain championship and support domestic businesses. (China has already managed to accomplish this with photovoltaic technologies.)

2. OEMs & equipment/service providers

Car manufacturers are in a peculiar situation – they need to balance their strategies between regulatory forces and business-model opportunities.

Increasingly stringent emission regulations posed by governments and regulators or competition are driving manufacturers to develop new solutions to avoid fines or loss of market share. Examples such as the reactions of Porsche (Mission E), Audi (e-tron Quattro) and Daimler (EQ) to Tesla’s moves, slowly eating into their high-margin sales segments, are only the tip of the iceberg. The impact will be clear after volume models become consistently electrified.

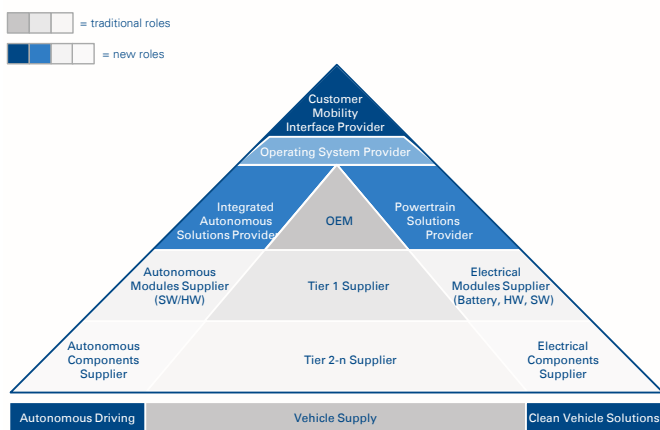
Manufacturers also have a reason to embrace the EV as an opportunity. Companies can use the faster and smoother acceleration of their low-end torque electro-motors to promote a better driving experience, or to make use of federal subsidies or state rebates.

¹ However, the US subsequently withdrew from the Paris Agreements on climate change after the election of President Donald Trump

Battery producers are focusing their R&D to improve both the cost and value of their batteries – as lower price and better performance (higher energy density, better safety and faster recharging cycles) help drive change in the sector. (See the upcoming Arthur D. Little study on battery technologies that will be released in Q1 2018.)

These effects are part of the broader automotive landscape reshaping, in which electric vehicles and autonomous-driving technology will add new ecosystems to the traditional pyramid, offering new mobility players the position at the top of a new pyramid. This will allow them to dictate specifications for the ecosystem, including vehicle-industry incumbents (Figure 4 – for more details please refer to the Arthur D. Little viewpoint, The future of automotive mobility).

Figure 4 – Arthur D. Little Automotive pyramid



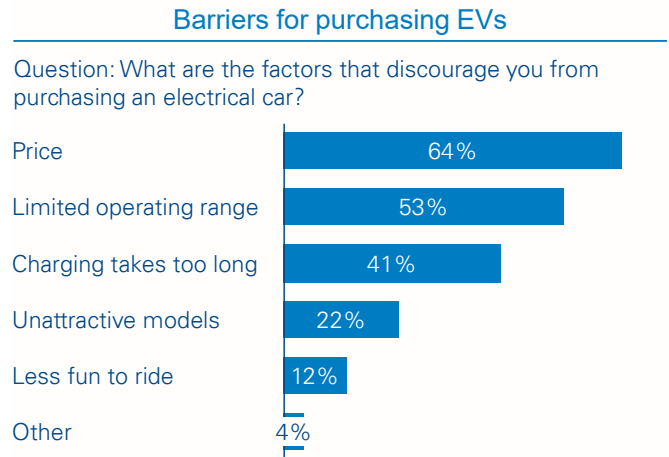
Source: Arthur D. Little analysis

3. Consumers

Still, the number of EVs sold is only a fragment of the total sales volume in most global markets. This has two simple reasons: Perceived price and practicability.

A recent Arthur D. Little study that included thousands of consumers in automotive core markets confirmed the main barriers to purchasing electric vehicles. Those are the higher prices compared to traditional vehicles, the limited operating range, and insufficient charging solutions (Figure 5).

Figure 5 – ADL Global Customer Survey



Source: Arthur D. Little Global Customer Survey

Nevertheless, we expect dramatic improvements on the vehicle side, especially with operating reach, in the next few years. Large initiatives to improve the charging infrastructure are currently being kicked off in leading key markets (e.g., China, the US, Europe), and regulation is further supporting electric vehicles.

EVs are transforming their image – from a choice for prestigious, extremely rich, and extremely green-thinking customers towards the broader mass. With manufacturers such as Volkswagen, GM, Renault Nissan Mitsubishi Alliance and Volvo announcing ambitious plans to develop new EV platforms, we believe mass-marketization is closer than ever.

4. Infrastructure enablers

Among various infrastructure enablers, electric utilities have the potential to increase their presence in the current ecosystem as the main provider of electricity. They can start leveraging the existing infrastructure to find additional sources of revenues or improve the way they manage their energy grids.

In addition to electric utilities, several other players are demonstrating interest in developing the required charging infrastructure – among these are large retailers, which could use it to attract customers; parking operators, which could create extra revenues from their existing businesses; highway operators, which could further leverage their concession

rights; and oil companies, which may be looking to convert or complement their existing fuel-station networks.

In addition, in a world where service boundaries are constantly re-shaping among existing players, OEMs and mobility companies are increasingly interested in the infrastructure

business. For example, Ionity, a consortium consisting of four automotive veterans (Ford, BMW, Daimler, and Volkswagen), recently announced the construction of 400 fast-charging stations across Europe by 2020. Didi, the Chinese ride-hailing giant, has created a JV to roll out charging networks for EVs across China.



“

We will offer 80 new models until 2025 – 50 battery-driven cars and 30 other plug-in hybrids. This is a commitment.

”

Matthias Mueller, CEO of VW, September 2017

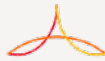


“

GM believes the future is all electric. (...) It all starts with the Chevrolet Bolt EV.

”

Mary Barra, CEO of GM, November 2017



RENAULT NISSAN MITSUBISHI

“

The Renault-Nissan-Mitsubishi Alliance will launch 12 new pure electric vehicles by 2022, utilizing common EV platforms and components.

”

Carlos Ghosn, CEO of the Alliance, September 2017



“

All new Volvos launched from 2019 will be electrified: either fully electric or hybrids. We aim to launch 5 fully electric vehicles between 2019 and 2021.

”

Hakan Samuelson, CEO of Volvo Cars, July 2017

3. Electric utilities can adopt several business models to exploit the opportunity

In this viewpoint we have taken a closer look at the role electric utilities can play in light of the EV trends, and identified four business models that electric utilities can execute – some closer to “business-as-usual” operations, and some more courageous and innovative. These business models are by no means evolutionary. Each utility should evaluate the different options, possibly combine some of them, and strategically decide on the future direction.

1. Energy provider
2. Infrastructure provider
3. Load balancer
4. Mobility provider

1. Energy provider

In this most basic business model, the utility sells more energy for charging EVs. In order to foster EV penetration, attain new customers, or partially manage peak loads, utilities can choose to provide EV-specific bonuses, such as a sign-up rebates, free

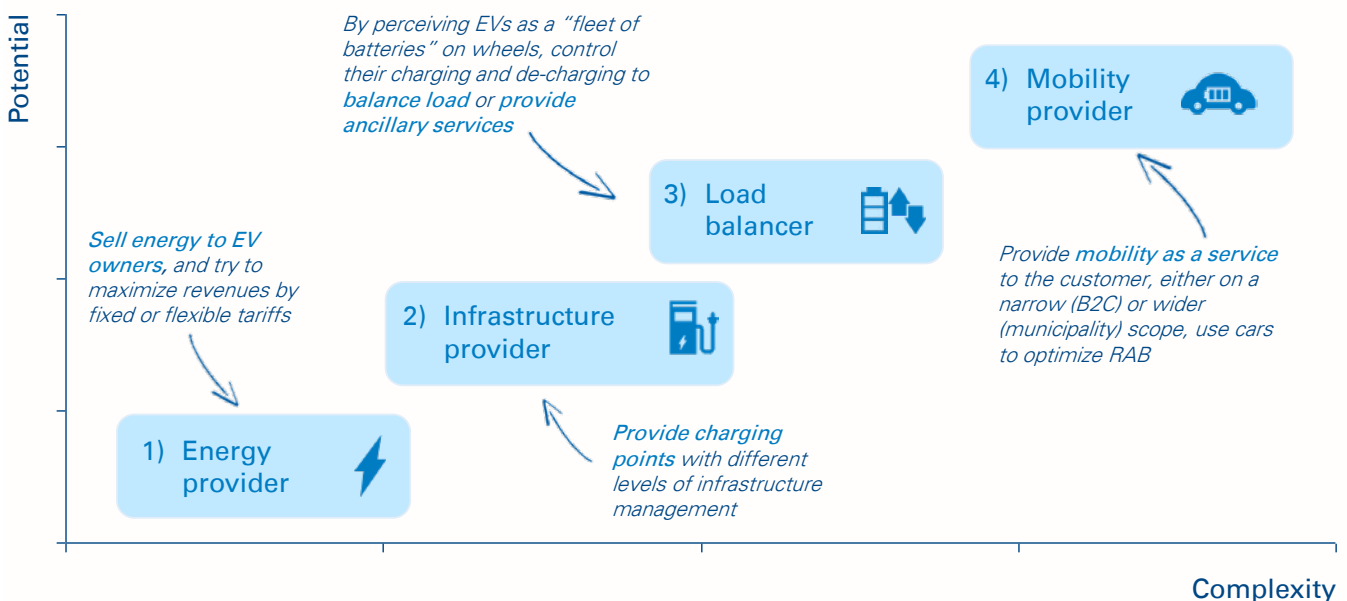
mileage, discounted tariffs for charging at specific times (a basic offer can be introduced to shift some of the demand from daytime to night time, which is cheaper), and guaranteeing that all energy used for EV charging is 100 percent from renewable sources.

Example box

Good Energy, a UK utility, created a tariff for EV users with a GBP60 annual discount. This translates into more than 2,000 free EV miles, calculated on average Nissan Leaf energy consumption. Good Energy also provides a guarantee of 100 percent from renewable sources.

While being closest to “business as usual”, utilities need to understand that EV owners have the potential to become much more profitable customers than the regular ones, as they have higher electricity demand (additional 3,000–4,000 kWh/year for an average EV) and lower churn rates. This business

Figure 6 – Business model overview



Source: Arthur D. Little analysis

model requires the utility to have a profound understanding of EV market development, customer sensitivity, and implications for the organization. Some questions that should be addressed include the following:

- How does EV demand look now, and how will it evolve?
- What are the potential customer segments, and how can we best target, attract and retain relevant ones?
- What will be the impact on the top and bottom lines?
- What are the implications for the business (e.g., sales, trading, network requirements), and how can the utility best adapt to it?
- How can the utility valorize additional customer data?
- What are the additional cross-selling opportunities with the existing product/service portfolio?
- What are the implications for other parts of the business (e.g., sales, trading, network requirements), and how can the utility best adapt?

2. Infrastructure provider

Addressing the often-insufficient public infrastructure, the utility can become both the enabler and the driver of EV penetration by building, operating, and maintaining charging points.

Example box

In March 2017, ENGIE acquired EV-Box, one of the world's leading EV-charging services providers, with over 40,000 charging stations in service. By combining ENGIE's global presence and energy capabilities with EV-Box's leading technology and thought leadership in the EV-charging market, ENGIE will be in a unique position to offer customers in all segments across the globe innovative, attractive and comprehensive EV-charging and related energy services.

Utilities have multiple options on how to leverage charging points. Some of the many possibilities include: strategic coverage of areas with high-potential customers; cooperation with other entities such as malls, restaurants, and hotels to let customers charge their vehicles while shopping, eating or sleeping (to secure additional revenues from managing these charging points); and using the charging points as a part of their

standard service upgrades (i.e., having customers switch and giving them free usage of charging points in their networks).

Even though in many markets it is unclear as of now who will pay for development and construction of a nationwide charging infrastructure, some countries consider charging infrastructure to be a part of the distribution network, and allow it to be included in the regulatory asset base (e.g., Italy, where Enel envisages installation of around 7,000 charging stations by 2020, to reach a total of 14,000 by 2022).

This business model leverages core utility capabilities, but requires the utility to address certain key questions:

- What is possible under the current regulation framework, and what needs to be adjusted?
- Who are the customers, and how to efficiently tap their potential?
- How favorable is the competitive landscape?
- Who is the right partner to team up with, or how to develop new capabilities?
- What is the impact on existing asset infrastructure and operations?
- How to efficiently integrate the new opportunity with the existing product portfolio?
- How to keep operations financially viable, especially in the initial phase, when cars are few and average utilization of charge points is relatively low?
- How to avoid investing in technology today that might be obsolete tomorrow?

3. Load balancer

With the intermittency of wind and solar power, which exacerbates network load balancing, utilities and grid operators are searching for efficient ways to optimize the supply-demand equation and manage the grid load. One possible solution is to take advantage of connected EVs and, based on network requirements, charge and discharge them accordingly.

Provided that the electric utility is granted the right to operate the car battery and the infrastructure is adequate to support a bidirectional flow of energy and communicate with the car system, the utility can save on expensive battery-storage equipment, support development of the EV market, and create

tighter connections with EV owners, leading to customer lock-in. These are only few of opportunities.

Example box

In cooperation with BMW, PG&E, a US utility, tested the feasibility of using EVs as a flexible grid resource over 18 months. The project included 100 BMW i3 vehicles in the San Francisco bay area and a battery system made up of reused EV batteries, ultimately providing 100kWh of resources.

The vehicles contributed an average of 20 percent to the target kW reduction, with only a 6 percent opt-out rate in case of a demand reduction event. Ninety-two percent of participants described their roles as passive – without feeling affected in any significant way.

PG&E is counting on 250,000 enrolled EVs by 2030, which will provide an approximate load-drop potential per event of 77.6 MW.

Example box 2

Enel recently acquired eMotorWerks, an advanced energy and e-mobility solutions company and leading supplier of EV charging stations. The acquisition is expected to enrich Enel’s e-mobility offering and integrate a highly sophisticated smart EV charging solution within a portfolio of grid-flexibility services, which includes a demand-response network, distributed energy management systems, and battery-storage solutions.

Before rushing into hunting for technical solutions (e.g., “smart” chargers that allow bidirectional power flow and enable remote management) and requirements for implementation, utilities should start by understanding the environment and potential of this shift:

- Which customers are currently present, and what market change can we expect in the medium-/long term?
- What is the load curve shift potential?
- What are the financial implications?
- What are the required capabilities?

- Who are the right potential partners?
- How to keep the operations financially viable in the initial phase of the initiative?
- How to avoid investing in technology today that might be obsolete tomorrow?
- How to integrate opportunities coming from EV offerings with smart-home services?

4. Mobility provider

Certain utilities can even consider extending their businesses into mobility services by providing EVs to customers as a service, while leveraging their potential for grid control and further increasing their understanding of customer behavior by collecting (and potentially providing) advanced data.

In the easiest model, the utility combines fees for energy and car rental into one bill. But utilities can also partner with automotive manufacturers and municipalities to go beyond the usual “car-sharing” scheme. This initiative can ultimately lead to development of urban mobility systems that complement existing public transport networks.

Example box

EDF, Toyota, and Citélib are providing 70 EVs and about 30 charging stations in Grenoble, France. Customers use a smartphone app to reserve and pay for the service. EVs are mostly located at tram stops for the first and last kilometers of their transportation.

Besides understanding the technical and financial aspect of this opportunity, utilities should address additional questions such as:

- How to define the whole vision of the project?
- Who are the correct partners?
- How to identify, bring to the table, and align the expectations of all stakeholders?
- What are the largest strategic, technical, and operational challenges that need to be covered?

4. Electric utilities should act fast as many other players are addressing the opportunity

The size of each opportunity is company specific and depends on multiple aspects, such as ecosystem readiness, specific market conditions, stakeholder landscape, and regulatory conditions. Electric utilities should carefully and neutrally evaluate the opportunity in light of the mentioned aspects to identify the best way forward.

While electric utilities remain ideally positioned to leverage the opportunities offered by the adoption of electric vehicles on a mass-market scale, they should act fast, as many other players are addressing the opportunity, including automotive players (e.g., Ionity), mobility players (e.g., Didi) and other infrastructure players (e.g., ChargePoint, Inc.).

Arthur D. Little, facilitating your success

We understand the industry end to end, and are aware of current needs and opportunities across the value chain – we have supported electric utilities, manufacturers, mobility providers, and charging operators/aggregators in identifying and exploiting opportunities arising from the wide growth of EVs. Some examples of our projects include market studies and volume forecasts for charging-infrastructure development; EV technology-roadmap development, charging and mobility business strategies and portfolio development; development of 360-degree e-mobility customer solutions; development and implementation of a commercial plan for the entry of the client into the electric-mobility sector for both B2B and B2C clients; and orchestration of the required activities – from idea detailing to implementation – for the creation of a dense system of charging columns in one of the main metropolitan areas in Europe, in alignment with stakeholders from the OEM and the municipality.

Arthur D. Little is uniquely positioned to support electric utilities in:

- Bringing diversification opportunities to the board
- Identifying business models and developing business plans
- Formulating value propositions towards customers or the ecosystem at large
- Identifying possible partners and negotiating terms and conditions of the agreement between the parties
- Identifying financing strategies in compliance with regulatory constraints
- Identifying governance models between utilities and other parties
- Supporting technology decisions to avoid early obsolescence
- Creating realistic implementation plans with a draft of the PMO structure required to execute the project
- Supporting the implementation with dedicated PMO teams

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Electric vehicles and electric utilities – A clear opportunity with many shapes

Arthur D. Little

Arthur D. Little has been at the forefront of innovation since 1886. We are an acknowledged thought leader in linking strategy, innovation and transformation in technology-intensive and converging industries. We navigate our clients through changing business ecosystems to uncover new growth opportunities. We enable our clients to build innovation capabilities and transform their organizations.

Our consultants have strong practical industry experience combined with excellent knowledge of key trends and dynamics. Arthur D. Little is present in the most important business centers around the world. We are proud to serve most of the Fortune 1000 companies, in addition to other leading firms and public sector organizations.

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