



**Asia-Pacific
Economic Cooperation**

Advancing Free Trade
for Asia-Pacific **Prosperity**

Workshop on Electromobility: Infrastructure and Workforce Development

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APEC Energy Working Group

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Table of Contents

I.	Executive Summary	4
	(1) Infrastructure.....	4
	(2) Human Capital	5
II.	Workshop Summary and Conclusions	6
	(1) Introduction and Workshop Objectives	6
	(2) Inaugural Session	6
	(3) Human Capital and Gender Session	8
	(4) Technology and Infrastructure Session	9
	(5) APEC Representatives Round Table	10
III.	Annex	12

Executive Summary

The APEC Workshop on Electromobility: Infrastructure and Workforce Development was proposed in order to support the deployment of Electric Vehicles (EVs) by closing knowledge gaps and promoting dialogue on infrastructure and workforce development. The Workshop was a two-day event focused on sharing information related to EV infrastructure and human capital development, individual economies' best practices and EV development plans and regulations, as well as APEC's work in this area.

Based on the presentations and discussions during the workshop, the organizers would like to highlight the several general conclusions.

The level of knowledge and development with regards to the topics covered in the workshop is very diverse among the different participating economies, therefore, it becomes very important for the APEC economies to generate instances of collaboration. In this manner, those economies that lead the technological advance towards electromobility or have implemented innovative policies could share experiences and good practices around the path traveled and the challenges involved in the large-scale implementation of this technology.

The advance in the technologies presented regarding electric vehicles and infrastructure for battery charging makes it clear that technologies already exist and that they improve day by day. Therefore the future stages for the widespread use of electric vehicles will be strongly related to public policies with regulations or incentives according to the reality of each economy, as well as the impulses given by private and public companies, especially regarding accessible prices in the purchase of vehicles.

The links to speakers' presentations are included in the annex to this document and provide information in greater detail.

1. Infrastructure

Analysis indicates that electric car uptake is strongly linked to policies, as well as to infrastructure development. Critical factors discussed during the workshop include the extension of charging infrastructure, standardization, vehicle range, battery technology and smart charging for grid stability. APEC economies have much to share in this regard, as highlighted in the presentations by speakers from Mexico, Chile, PetroChina Planning and Engineering Institute (China), CHAdeMo (Japan) and MITO (New Zealand). The International Energy Agency also produces materials that address these crucial areas.

2. Human Capital

With regards to the formation of technicians and professionals, the importance of the development of an appropriate and updated curriculum, as well a close link with industry in order to ensure the relevance of training was highlighted. New Zealand's experience in gender and human capital also emphasized the importance of factors that encourage and support the participation of women in these fields, including mentors and cultural recognition.

With regards to gender, the Chilean experience in the capital city of Santiago indicates that there are significant differences between the purposes, schedules and travel experiences of men and women. Furthermore, analysis indicates that passengers in Santiago's public transport system especially valued the qualities of female bus drivers. This information is important to consider in policy development.

Industry participants were impressed by the wide range of participating economies, which were able to present their strategies to promote electric cars. It was considered a good event, covering a range of relevant topics, such as infrastructure, power generation, personnel training, security, financial incentive plans, creation of public fleets and others.

Based on the information collected in the participants' evaluations, potential areas for future APEC initiatives in this area include:

- To continue the networking and cooperation workshops, including a partnership for education and training initiatives across APEC economies.
- To continue sharing policies, regulatory frameworks, strategy and goals to encourage electromobility, with regulatory updates as well.
- Sharing information on technical developments, including automotive manufactures and batteries.
- Organizing a future workshop about smart grids, as well as a workshop on these same topics in two years with updated information.
- Closer links to APEC fora and possible collective actions.

This highlights the importance of collaboration among APEC fora, as well as the efforts of the Automotive Dialogue.

Workshop Summary and Conclusions

1. Introduction and Workshop Objectives

The APEC Workshop on Electromobility: Infrastructure and Workforce Development was proposed in order to support the deployment of Electric Vehicles (EVs) by closing knowledge gaps and promoting dialogue on infrastructure and workforce development.

The Workshop was a two-day event held on February 1st and 2nd, 2018 in Santiago, Chile. The activity included several sessions with different dynamics, including: presentations of experts, expert panels for question and answer sessions and a dynamic round table.

Below is a general summary of the presentations and issues discussed during the workshop. More detailed information can be found in the individual presentations.

2. Inaugural Session¹

The Workshop began with welcome remarks by the Chilean Minister of Energy, Mr. Andres Rebolledo, who discussed global electric vehicle trends and their importance to sustainable energy. The Chilean General Directorate of International Economic Relations (DIRECON) discussed APEC's work to date in sustainable energy as well as Chile's vision as future APEC host economy in 2019, in order to explain the regional and multilateral significance of this workshop. The regional sustainable energy panorama of the Americas was then presented by the Inter-American Development Bank, in order to lay out the context for the insertion of electric vehicles.

Afterwards, Ms. Renske Schuitmaker of the International Energy Agency presented the Global EV Outlook 2017, as well as an overview of the Agency's work in this area. The presentation highlighted the importance of electrification of transport as means to improve public health and energy security, as well as to address climate concerns. It was highlighted that electric car uptake was strongly linked to policies and to the development of infrastructure. In terms of technology, key issues to be addressed include battery and vehicle range, as well as smart charging for grid stability.

¹ The Workshop Agenda is attached as an annex to this document, as well as links to the presentations from the Workshop's technical sessions.

Representatives of Mexico and Chile then presented an overview of electromobility and related policies and initiatives in their economies, given the relevance of these elements to EV uptake.

The following presentation was made by Mr. Vladimir Sosa of Mexico, Coordinator of the Energy Savings Program for the Electricity Sector of the Federal Electricity Commission (Programa de Ahorro de Energía del Sector Eléctrico (PAESE) de la Comisión Federal de Electricidad (CFE)). His presentation delivered data and figures related to the Mexican energy sector, as well as the measures that are being taken with regards to the use of clean energy, appropriate energy use and electromobility.

Mr. Sosa's presentation included the context of the considerable increase in greenhouse gas emissions over the past 60 years. In Mexico, there is great energy demand from the economy's transport sector, linked – among other factors – to higher incomes and access to faster means of transport. Analysis was also presented on the pollution from conventional vs. electric vehicles, including their manufacturing, fuel extraction, etc.

In terms of clean energy and electromobility, the environmental benefits of generating energy with cleaner fuels were presented. With regards to Mexico's experience, Mr. Sosa shared the current status and challenges of the natural gas infrastructure network, as well as new projects related to renewable energy, including wind, geothermal and hydro. With regards to electromobility, data on the prices of electricity vs. gasoline, reduction of the prices of batteries, average vehicle autonomy in Mexico City, reduction of charging times were presented, among other relevant information. Finally, the Program for the promotion of electric mobility through investment in charging infrastructure (PEII) was presented, which will boost electric mobility in México through the installation of universal, public and free electric vehicle supply equipment (EVSE).

The presentation clearly shared the current status and work being done in Mexico, and the economy's initiatives related to electric vehicles.

Mr. Ignacio Santelices, Head of the Chilean Ministry of Energy's Energy Efficiency Division, presented "Chile's Electromobility Strategy". This strategy was recently launched and includes five pillars with key actions to move forward. These pillars are: Regulations and standards; Public transport as a motor for development; Promotion of research and the development of human capital; Initial impetus to the development of electromobility; and Knowledge transfer and delivery of information.

Furthermore, he highlighted the Chilean energy efficiency initiatives linked to transport such as the Vehicle Fuel Economy Labelling, the inclusion of concepts

of efficient driving in the new Driver's Manuel which is used in the exams required for obtaining a driver's license, among other energy efficiency transport programs that have been developed.

Finally, he recognized that the maturity of the energy efficiency market implies dedication to its widespread uptake, which complements Chile's established goals and objectives that 20% of electric energy will come from non-conventional renewable energies by the year 2025 and the energy policy "Energía 2050".

This was then followed by a discussion panel, which answered questions from the audience. The questions included references to the International Energy Agency's projects and analysis of technologies, promoting charging infrastructure, as well as the policies and initiatives carried out in Mexico and Chile.

3. Human Capital and Gender Session

This technical session of the Workshop began with a presentation on "Human Capital and Gender: The New Zealand Experience" by Ms. Janet Lane, Chief Executive of MITO New Zealand. She presented an overview of New Zealand's governmental policies, initiatives and goals with regards to EVs, as well as infrastructure development. The presentation then addressed in-depth MITO's strategy and program to support EV workforce development, including the development of a qualifications framework and next steps in this regard. Special attention was also given to Human Capital Development and Gender, in which insights were shared regarding the factors that attract women to careers related to electric vehicles and how to support their continuity in the field.

The second presentation on "Human Capital Development and Technological Prospects for Electromobility in Chile" was given by Ms. Pilar Henríquez, who was the coordinator of the study carried out by the Universidad Técnico Frederico Santa María (USM) on "Technological Prospects for Electromobility in Chile". The presentation began with a general introduction to the study, focusing on the proposed methodology for the development of the technological prospection study carried out on behalf of the Ministry of Energy. Afterwards the questions that were explored during the study with regards to human capital and the prospection scenarios for Chile were explained, for which information was gathered through surveys, workshops, seminars with questions to the public and expert panels. Finally, the presentation closed with proposals to support and increase human capital in electromobility, based on three main pillars: to boost the knowledge of the existing work force (short term), to increase the formation of new professionals (medium term) and to create a culture of E-mobility incorporating electric mobility in our economy's DNA.

The following presentation by Ms. Francisca Reyes of Chile's Metropolitan Public Transportation Directory focused on gender differences in the mobility pattern, which is a fundamental input for policy, workforce and infrastructure design. The presentation analyzed the gender differences in quantity of trips, reasons for travel, duration of trips, use of modes of transport and schedules, as well as the problems specifically faced by women in public transport in Chile's capital city of Santiago. The positive evaluation of women as drivers of public transport vehicles was also highlighted.

Finally, Mr. Santiago Marín, Director of the Engineering, Construction and Natural Resources Schools of the DUOC-UC Training Institute presented on "The Role of Technical-Professional Education and Its Relevance for the Development of Economies". This presentation was centered on demonstrating the work skills that are demanded by the industry in order to create new professionals and technicians, development of graduate profiles, curriculum design and the design of instruction for process that are required by the industry. The importance of a close connection between educational establishments and the industry was highlighted.

The discussions that followed highlighted the role of technical-professional formation in the development of economies.

4. Technology and Infrastructure Session

Representatives of CHAdeMO (Japan), PetroChina Planning and Engineering Institute (China) and General Motors presented technological and infrastructure developments and trends. In the case of China, the economy's experience in infrastructure development was also shared.

Mr. Makoto Yoshida, Secretary General of CHAdeMO, presented on electric vehicles and infrastructure. The presentation began with a general overview of electric vehicles and their attractive characteristics in terms of sustainability, low operational costs, connectivity, among others. He also shared knowledge regarding the tasks and contribution of electric vehicles, the activities currently being undertaken by automobile manufacturers, as well as the importance of expanding the charging network and standardization. With regards to charging standards, the benefits for consumers, functions and compatibility were addressed. Finally, he presented future directions, including the expansion of a core-protocol guaranteeing security and compatibility, industrial innovation, expansion of categories and technology trends.

He also emphasized that different energy sources will help to combat the dependence on oil, as well as the critical importance of battery technology and charging infrastructure.

Ms. Yue Xiaowen of PetroChina Planning and Engineering Institute presented on EV and Charging Infrastructure Development in China. The presentation began with an overview of how China became the largest electric car market in the world since 2015. Issues regarding the formation of a complete industrial chain and policy support initiatives were addressed, and the case study of Beijing was presented.

The key conclusions of this presentation included:

- Government policy support is indispensable for promoting adoption of EV and charging infrastructure in China, meanwhile, financial incentives will weaken progressively with increasingly cost competitiveness of EV, and support policy adjustments will be required.
- Information technology will help the automobile transforming from transportation to large-scale mobile intelligent terminal, energy storage unit and digital space, and will provide more commercial opportunities.
- In the medium and long term, China is heading for the commercialized promotion mode of deep integration of EV with renewable energy and smart grid, forming experiences and demonstrations that can be replicated and promoted widely.

Mr. Regis Errerias and Demetrio Vettorazzo of the General Motors Product Engineering presented an overview of the development of Green Propulsion Technology, focusing on the current state-of-the-art in hybrid, electric and hydrogen vehicles. Examples of the technology included in different vehicles were explained in-depth. As a conclusion, it was stated that no single technology addresses all portfolio needs meaning that multiple approaches for Hybrid, Electric and Fuel Cell technology play a role within this new exciting portfolio. The future points to a scenario where multiple technologies will coexist and complement themselves, leading us to a world of zero congestion, zero emission and zero crashes.

5. APEC Representatives Round Table

The final session of the workshop was dedicated to a round-table between the participants from APEC economies and experts. The objective was to share information on best practices within APEC economies, as well as to facilitate a direct dialogue in a small and dynamic setting. The representatives of China, Malaysia, Peru and Viet Nam shared their experiences with the group.

Based on the discussions, the policies, initiatives and experience carried out by different APEC economies in the following areas can be highlighted:

- Policies to promote electric vehicle use
- Policies to promote the development of electric vehicles
- Expansion and strategic locations of charging stations, including charging stations powered by solar energy
- Industrial battery standards and recycling
- Promotion of modernization of the automotive industry of economies and insertion in industrial chains
- Studies on the market strengths and weakness, and the opportunities, challenges and next steps related to electric mobility
- Improvement of urban transport and mobility to reduce greenhouse gas emissions
- Development human capital to give support at electric vehicle & infrastructure.

The next steps and future challenges discussed also include:

- Regulations for electric vehicles, as well as vehicle homologation and classification
- Expansion of charging stations and infrastructure, including issues related to standards and power grids, as well as the pricing of electricity for charging
- Need for human capital building in terms of: technical skills and innovation, as well as knowledge sharing for policy development
- Battery technology and recycling
- Promotion of electric vehicles in e-taxis and tourism
- Regulations associated with electric vehicles & infrastructure.

The main comments expressed in the APEC Project Evaluation Survey answered by the participants in the workshop were that the results of the project include its relevance to the improvement of the development of the economies and the opportunities for collaboration. The information shared was considered to be very important for use in regulations, development of new policy initiatives, draft regulations and the opportunity to involve other economies in adapting to the development of electric mobility. It was also suggested that a similar workshop be organized in two more years to learn about new developments on EVs.

Throughout the Workshop, the participants in the different sessions were asked brief questions on the topics discussed and results were compiled through an online platform. These informal surveys were intended to give a general picture of the opinions of the participants, who were both representatives of APEC economies and interested local participants.

Annex:
Links to Technical Presentations

Session	Link	Password
Overview of Electromobility, Public Policy and APEC Initiatives	http://cloud.minenergia.cl/index.php/s/xXlu1JqGkfPgiKz	Elmbt4811M1
Human Capital and Gender	http://cloud.minenergia.cl/index.php/s/6Cn999S4Yhmq8j6	Elmbt6919M2
Technology and Infrastructure	http://cloud.minenergia.cl/index.php/s/2A4ERfFok1o6WWd	Elmbt2622M3