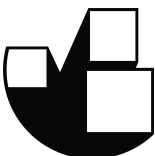


# In Search of Better E-mobility Policies in Indonesia

## Workshop Report

September 2020



## Executive Summary

1. **A three-day stakeholder consultation workshop was conducted as part of the “Support for E-Mobility Transition in Jakarta” project,** a technical assistance program supported by CTCN, with the Ministry of Environment and Forestry acting as the national designated entity (NDE). The workshop, conducted as a webinar series by ITDP under the CTCN program and ADB, aimed to raise the awareness on e-mobility and gain insights from the stakeholders on e-mobility development in Indonesia, especially from the policy sector..
2. **The participants in the workshop were the stakeholders involved in e-mobility development in Indonesia, both from national and local level government agencies, the national power company, local transport operators, and bus manufacturers.** A number of international experts were also present as speakers and resource persons in the discussion sessions. In total, there were 192 high-level participants and 32 key organisations involved in the series of workshops.
3. The main takeaways from the workshop are as follows:
  - a. **Benefits of BEV adoption in Indonesia.** Massive usage of electric vehicles will have a significant impact on the reduction of emission and Greenhouse Gas (GHG), improvement of energy stability, and utilization of electrical energy surplus, especially in Java and Bali.
  - b. **Bus and two-wheelers electrification can be the initial steps for electric mobility development.** Electric motorcycles have a lower price difference with conventional fuel motorcycles compared to electric cars, and buses account for a huge portion of urban GHG emission.
  - c. **Several policy gaps need to be addressed especially to tie in BEV adoption ambition with GHG reduction.** EV has yet to be included in the national GHG reduction plan, and the renewable energy share has not yet included on the EV roadmap and target as the electric grid source in Indonesia is still dominated by fossil fuel.
  - d. **There are a number of supporting policies that have been published by ministries and agencies, and several others are in the pipeline.** The issued policies are the national EV task force establishment, tax incentives for pioneering industries, EV technical testing, free down payment for electric vehicles, charging infrastructure standardization, and a preferential electricity tariff for charging stations. In the future, ministries are preparing to publish other supportive regulations on e-mobility, including battery waste regulation, listing EV in national e-procurement catalogue for state vehicles, battery and

vehicles import incentives, import incentives on charging stations, charging infrastructure and EV roadmaps, and fiscal incentives for the electric bus industry.

- e. **Fiscal incentives are needed to boost charging infrastructure development.** Development of charging infrastructure has high capital expenditure and long payback period, which pose as major barriers for charging infrastructure provision. The financial model and roadmap should also be clarified.
- f. **Compatibility issues should be addressed from the early stage of EV development.** A ministerial decree on charging infrastructure standardization has been introduced. However, battery standardization regulations have yet to be issued.
- g. **The need to reassess the current petrol fuel subsidy scheme.** With the current petrol fuel subsidy scheme, the price difference between electricity and petrol fuel is not attractive enough considering the higher purchasing cost of EV.
- h. **Technological choices should be the key considerations in planning electric bus deployment.** Technological choices affect the operational and financial aspects of electric buses, hence it should be one of the key considerations to make in the initial deployment of electric buses.

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# 1 Background

The transport sector is one of the biggest contributors to air pollution in Indonesia, especially in Jakarta. Based on the report of ICEL in 2018, the transport sector in 2012 accounts for 46% of total emission in Jakarta which is the largest. In the effort to cut the air pollution, there should be integrated actions in the transport sectors from all stakeholders. One of the programs curbing the emissions is the development of electric mobility. The transition to electric mobility will have a significant impact on emission reduction, especially from tailpipe emissions.

Electric mobility or e-mobility in Indonesia is still in the development phase. The national government has put several policies to accelerate the development of e-mobility, such as Presidential Regulation No 55/2019. The policy has set the potential incentives that can be provided by the government, such as fiscal incentives, non-fiscal incentives, etc. Nevertheless, there is still a gap to cover before the initial deployment can finally start both in the national and local context.

The Government of Jakarta has proposed the program titled Supporting Jakarta's Transition to E-mobility in the effort to help the accelerated development of e-mobility in Jakarta. The objective of the program is to give technical assistance to stakeholders in the deployment of e-mobility, such as electric buses. This program led by the Institute for Transportation and Development Policy (ITDP) has started since March 2020. One of the activities in the program is to conduct a consultation workshop with stakeholders.

A consultation workshop was conducted to gain inputs from stakeholders on e-mobility development in Indonesia. Both national and local stakeholders play a huge part in developing the e-mobility ecosystem in Indonesia, thus their insights are essential for developing policy recommendations. The policy recommendation for e-mobility should refer to the insights put forward by the stakeholders.

## 2 Objectives

Based on the terms of references in the program, the workshop is one of the deliverables related to the engagement of stakeholders on e-mobility issues. There are several objectives of the workshop. The objectives are as follows.

1. To increase the basic understanding and the awareness of e-mobility in the world and Indonesia
2. To gain inputs and insights on e-mobility from stakeholders both in national level and in the local level
3. To identify the policy gaps and issues on e-mobility in Indonesia
4. To formulate the policy recommendation for future regulations and actions on e-mobility in Indonesia

### 3 Expected Outcomes

The outcomes from the workshop are as follows.

1. List of insights and inputs from the participants of the workshop on e-mobility
2. Summary of policy gaps and recommendation based on the workshop
3. Workshop report covering the background, the workshop program, and the findings

## 4 Participants

The targeted participants in the workshop were the stakeholders involved in e-mobility development in Indonesia, both from the national and the local level. Participants from national-level stakeholders consisted of the national ministries, agencies and other national institutions such as state-owned enterprises. Participants from local-level stakeholders included local government agencies, local transport operators, and bus manufacturers.

There were 192 high-level participants and 32 key organisations involved in the series of workshops for three days. All participants are based both in Indonesia and abroad consisting of international organizations or non-government organizations. 95 participants were from government organizations, such as national ministries, agencies, local government, and government-owned enterprises. The rest of the participants were from private companies or non-government organizations working on e-mobility.

The first day of workshop discussing on introduction to e-mobility attracted 81 participants in total. Almost 55% of participants in the first day were from government organizations. Most of participants on the first day came from national ministries working on e-mobility issues. The ministries attended on the first day were the Ministry of Environment and Forestry, Ministry of Energy and Natural Resources, Ministry of Finance, and Ministry of Industry.

There were 58 participants taking part in the second day of workshop discussion on charging infrastructures. The participants from government organizations were 27 persons. One of the key participants in the second day was the national grid provider, PT. Perusahaan Listrik Negara (PLN). Essential national ministries were also present, such as the Ministry of Energy and Natural Resources. Agency for the Assessment and Application of Technology also was involved in the discussion sessions.

On the last day, 53 participants attended the workshop discussing electric bus deployment. The last day was dominated by the participants from bus operators and manufacturers as the participants from private companies were 29 persons. Transjakarta was also present on the last day as one of key stakeholders in electric bus deployment.



## 5 Methodology

The series of workshops consisted of three separate days. The dates of workshops were from August 26, 2020, to August 28, 2020. Each workshop day had a main theme to discuss with the stakeholders. The theme of the first day was the introduction to e-mobility and the second day was the charging infrastructure. The last day covered the challenges on electric bus deployment.

The workshop was conducted online using video conferencing tools. Each workshop day took approximately two hours consisting of presentation sessions and discussion sessions. The potential participants registered to the workshop through the registration link for the workshop day they wanted to join. They received the link to join for the workshop after finishing the registration.

The workshop included the presentation sessions from the experts on e-mobility and the discussion sessions. The presentation sessions became the main talking points of the discussion sessions. The expert presented facts, data, and policies related to e-mobility as the supporting elements for the discussion sessions.

The presentation sessions in the workshop are as follows.

- Introduction to E-mobility
  - Background information on why transition to e-mobility is essential
  - Opportunities and the challenges of e-mobility implementation
- E-mobility Policies in Indonesia
  - Existing and actual policies on e-mobility in Indonesia
  - Policy gaps on e-mobility to cover
- Charging Infrastructure Policies and Best Practice
  - Required policies supporting the charging infrastructure
  - Strategies on how to implement charging infrastructure in massive scale
- Challenges on Electric Bus Deployment
  - Technology options for electric bus deployment
  - Investment plan and business scheme for bus operators and manufactures

The discussion sessions allowed the participants to share their experiences and insights on e-mobility. There were a list of questions to address the gaps in the development of e-mobility guiding the discussion session. The identified issues then were discussed to find the right recommendations for the next steps.

## 6 Workshop Findings

The findings of the workshop are as follows.

### 1. Day 1 - Introduction of E-mobility and Policies

- In the long run, electric vehicles will be more economical than conventional vehicles, such as diesel, petrol, and CNG vehicles.
- Massive usage of electric vehicles will have a significant impact on the reduction of emission and Greenhouse Gas (GHG), improvement of energy stability, and utilization of electrical energy surplus.
- Bus and two-wheelers electrification can be the initial steps for electric mobility development. The costs of electric two-wheelers are considerably lower than electric cars, while buses produce considerably higher amounts of greenhouse gases compared to other vehicles.
- There are several supporting policies required to boost adoption of electric mobility in Indonesia, such as national electrification target, institutional setup, coordination between organizations, fiscal and non-fiscal policies.
- There are a number of supporting policies that have been published by ministries and agencies, such as national EV task force establishment, tax incentives for pioneering industries, EV technical testing, free down payment for electric vehicles, charging infrastructure standardization, and a preferential electricity tariff for charging stations.
- In the future, ministries are preparing to publish other supportive regulations on e-mobility, including battery waste regulation, listing EV in national e-procurement catalogue for state vehicles, battery and vehicles import incentives, import incentives on charging stations, charging infrastructure and EV roadmaps, and fiscal incentives for the electric bus industry.
- EV has yet to be included in the national GHG reduction plan even though EV development needs to be initiated on a massive scale. The use of electrical energy sources is still limited compared to fossil fuel, such as petrol, diesel, and CNG.

### 2. Day 2 - Charging Infrastructures

- Development of charging infrastructure has high capital expenditure and long payback period, which pose as major barriers for charging infrastructure provision. A preferential electricity tariff is set by the Ministry of Energy and Mineral as an incentive for companies to develop and operate charging facilities.

- Compatibility issues should be addressed from the early stage of EV development. A ministerial decree on charging infrastructure standardization has been introduced.
- With the current petrol fuel subsidy scheme, the price difference between electricity and petrol fuel is not attractive enough considering the higher purchasing cost of EV.

### **3. Day 3 - Challenges on Electric Bus Deployment**

- Technological choices affect the operational and financial aspects of electric buses, hence it should be one of the key considerations to make in the initial deployment of electric buses.
- The use of electric buses will potentially reduce the GHG emission up to 50% compared to the business as usual scenario using conventional buses (diesel and CNG).
- A proper business scheme should be finalised between the bus operators and the charging providers to get a balanced profit for both companies.
- Incentive from the current preferential electricity tariff set by the Ministry of Energy and Mineral is barely sufficient for electric bus operational feasibility, according to a bus operator (DAMRI).
- The Government of Jakarta has set a task force called Project Implementation Unit (PIU) to monitor and evaluate the progress of electric bus projects.

## 7 Conclusion and Next Steps

Based on the findings, the workshop has met the objectives as follows.

1. The workshop has provided a basic understanding and awareness of e-mobility development both in the world and in Indonesia for stakeholders as participants.
2. The workshop has gathered the inputs and the insights from stakeholders
3. The workshop has validated the identified policy gaps and issues on e-mobility in Indonesia from the desk research, based on inputs from stakeholders
4. The workshop has provided valuable inputs for the policy recommendations for future regulations and action plans on e-mobility

ITDP will start engagement with the key ministries and institutions as a follow-up of this workshop. Separate discussion sessions with the institution will be organized to gather further insight on the action plans by each of the institutions.

## Annexure A. Workshop Agenda

Day 1 - Wednesday, August 26, 2020	
Time	Agenda
08:50 - 09:00	Workshop Preparation and Registration
09:00 - 09:10	Opening Speech
09:10 - 09:20	Welcoming Remarks: ADB's Activities on E-Transport
09:20 - 09:35	Introduction of E-Mobility
09:35 - 09:55	Presentation of Transport Policy Review: Indonesia Context and Gaps
09:55 - 10:55	<p>Discussion on Policy Review and Gaps</p> <p>Breakout Sessions (30 minutes):</p> <ol style="list-style-type: none"> <li>1. Incentives Issues</li> <li>2. Fuel &amp; Environmental Issues</li> </ol> <p>Combined Session (30 minutes)</p>
10:55 - 11:00	Closing Remarks: Conclusions and next workshop agenda

Day 2 - Thursday, August 27, 2020	
Time	Agenda
08:50 - 09:00	Workshop Preparation and Registration
09:00 - 09:10	Opening Speech and Summary from Previous Day Discussion
09:10 - 09:30	Presentation of Charging Infrastructure Policies & Best Practice from Other Countries
09:30 - 10:30	Discussion on E-Mobility infrastructure barrier in Indonesia
10:30 - 10:50	Workshop summary (Consensus / Next Action Plan)
10:50 - 11:00	Closing

<b>Day 3 - Friday, August 28, 2020</b>	
<b>Time</b>	<b>Agenda</b>
13:50 - 14:00	Workshop Preparation and Registration
14:00 - 14:10	Opening Speech and Summary from Previous Day Discussion
14:10 - 14:30	Deep-Dive: Challenges for Opportunities for Public Transport Companies to Deploy E-Buses in Jakarta
14:30 - 15:30	Discussion (QnA) on E-Bus Deployment Challenges
15:30 - 15:50	Workshop Summary (Consensus / Next Action Plan)
15:50 - 16:00	Closing

## Annexure B. Workshop Minutes

Date and time	August 26th 09:00 - 11:30 (GMT+7)	
ITDP Attendee	Faela Sufa, Director of ITDP SEA Insan Ridho Chairuasni, Transport Associate I Made Vikannanda, Transport Associate Etsa Amanda, Transport Policy Associate	
External Attendee	1. ADB: <ul style="list-style-type: none"> <li>• Ki Joon Kim</li> <li>• Faelasufa</li> <li>• Arum Satya Sari</li> <li>• Yustia</li> </ul> 2. CADMUS: <ul style="list-style-type: none"> <li>• Geoff Morrison</li> </ul> 3. IESR: <ul style="list-style-type: none"> <li>• Jannata Giwangkara</li> <li>• Idoan Marciano</li> </ul>	4. Coordinating Ministry for Maritime and Investment Affairs (Kemenkomarves) <ul style="list-style-type: none"> <li>• Yudi Prabangkara</li> </ul> 5. Ministry of Energy and Mineral Resources (ESDM) <ul style="list-style-type: none"> <li>• Inten Sripeni</li> </ul> 6. Agency for the Assessment and Application of Technology (BPPT) <ul style="list-style-type: none"> <li>• Hammam Riza</li> </ul> 7. Agency for Fiscal Regulation (BKF)
Event Summary	The first day of the workshop addressed the current policies, policy gaps, and incentives (both fiscal and non-fiscal) needed to accelerate e-mobility adoption in Indonesia, especially e-bus. Representatives from several ministries, national and city agencies, and transport operators were present and contributed to the discussion.	
Event Details	1. Opening remarks from ITDP and ADB <ol style="list-style-type: none"> <li>ITDP, Faela Sufa:               <ul style="list-style-type: none"> <li>◦ The main objective of this study is to develop a roadmap of e-bus implementation in Jakarta and policy recommendation on EV for Indonesia</li> </ul> </li> <li>ADB, Ki Joon Kim:               <ul style="list-style-type: none"> <li>◦ ADB activities: Studies, loans (for large fleet and leasing fund), pilots (LMD vehicles in Vietnam, Thailand; boats in Thailand)</li> <li>◦ Key remarks:                   <ol style="list-style-type: none"> <li>EV will be cheaper than ICE in the future</li> <li>EV is a direct way of reducing GHG and air pollution</li> <li>Shift to EV reduces oil import</li> </ol> </li> </ul> </li> </ol>	

	<ul style="list-style-type: none"> <li>4. Priority for electrification: Bus and urban trucks</li> <li>5. Financial and non-financial incentives are needed</li> <li>6. Many opportunities of EV-related industry</li> </ul> <p>2. Presentation: Introduction of E-Mobility by Geoff Morrison (CADMUS)</p> <ul style="list-style-type: none"> <li>a. Benefits of EV include energy reserve and security, health, and environment</li> <li>b. EV impacts on electricity distribution system: <ul style="list-style-type: none"> <li>o In the UK, the worst case is an additional 15% of national electricity demand. However, due to a tendency of concentrated distribution of EV in some particular areas, the demand can be much higher in localized grids (up to 30-40%)</li> <li>o Solution: electricity demand management</li> </ul> </li> <li>c. Barriers to adopting EV in SEA (based on a Nissan survey) <ul style="list-style-type: none"> <li>o The concern of running out of power</li> <li>o Safety concern</li> <li>o Limited infrastructure</li> <li>o Reliability concern for new technology</li> <li>o Maintenance and operational costs</li> </ul> </li> <li>d. Key remarks: <ul style="list-style-type: none"> <li>o China is leading EV adoption, SEA can follow</li> <li>o EV will increase electricity demand but with good management, the grid resilience is increased</li> <li>o EV prices will continue to drop as the technology improves</li> </ul> </li> </ul> <p>3. Presentation: Transport Policy Review: Indonesia Context and Gaps by Faela Sufa (ITDP)</p> <ul style="list-style-type: none"> <li>a. Overview of the current e-mobility scene in Indonesia: <ul style="list-style-type: none"> <li>i. Very under-developed e-bus deployment</li> <li>ii. The number of e-motorcycle is only 0.14% of 2025 target</li> </ul> </li> <li>b. Overview of EV policies in Indonesia: <ul style="list-style-type: none"> <li>i. General policies: <ul style="list-style-type: none"> <li>■ RPJMN (National Medium Term Development Plan) 2020-2024: Commitment to reduce GHG and energy consumption from the transportation sector</li> <li>■ Jakarta RPJMD (Regional Long Term Development Plan) 2018-2022: Electric bus deployment</li> <li>■ RITJ (Greater Jakarta Transport Masterplan): EV zones establishment</li> </ul> </li> <li>ii. Fiscal and non-fiscal incentives</li> <li>iii. Fuel and environment-related policies</li> </ul> </li> </ul>
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	<ul style="list-style-type: none"> <li>c. There are still policy gaps, especially on incentives, fuel subsidy, and others, including domestic product content regulations which potentially can hinder early EV development</li> <li>d. E-mobility can start from e-buses, as buses are the main contributor to CO2 in the transport sector</li> <li>e. Next steps: <ul style="list-style-type: none"> <li>i. Pilot e-bus deployment and evaluation</li> <li>ii. Roadmap and business model for large-scale e-bus deployment by Transjakarta</li> <li>iii. Develop charging infrastructure as an inseparable aspect of the e-bus expansion</li> <li>iv. Fill in policy gaps and provide more incentives</li> </ul> </li> </ul> <p>4. First discussion session, led by Jannata Giwangkara (IESR)</p> <ul style="list-style-type: none"> <li>a. Kemenkomarves, Yudi Prabangkara: Does this study include research on EV-related industry opportunities, e.g. battery, e-bus, or charging station manufacture? <ul style="list-style-type: none"> <li>o ITDP, Faela Sufa: Due to project time constraint, the study is scoped on Jakarta e-bus roadmap development and supporting policy recommendation</li> </ul> </li> <li>b. BPPT, Hammam Riza: BPPT has initiated researches on charging station technology and operations</li> <li>c. ESDM, Inten Sripeni: <ul style="list-style-type: none"> <li>o There is already a regulation on public charging station (ESDM Ministerial Decree No. 13/2020 on Public Charging Station)</li> <li>o For the next steps, the government will push the development of EV, battery, and infrastructure manufacturing industries to utilize domestic lithium supplies</li> </ul> </li> <li>d. BKF, Miftahudin: BKF is developing a policy to support EV manufacture industry, especially e-bus</li> <li>e. ADB, Ki Joon: <ul style="list-style-type: none"> <li>o Countries cannot directly replicate China's industrial policy approach on EV development</li> <li>o Private cars should be a marketplace. Governments should prioritize e-bus development and incentives, since buses are public goods</li> <li>o Many countries failed to utilise the infrastructure fund. Charging infrastructure investments need to be coupled with EV fleet development</li> <li>o Need to conduct a survey to determine number of stations needed, disaggregated by types (home-charging, public, private)</li> <li>o Government needs to set leading directions</li> </ul> </li> <li>f. ITDP, Faela Sufa: Non-fiscal incentives are also important to provide</li> </ul> <p>5. Breakout discussion session</p>
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	<p>The attendees were divided into two breakout rooms, each focusing on a predetermined topic:</p> <ol style="list-style-type: none"> <li>1. Breakout room 1: Incentives</li> <li>2. Breakout room 2: Fuel and environment</li> </ol> <p>6. Combined session</p> <p>A representative from each breakout session presented a summary of their discussion in the breakout room. The summary are as follows:</p> <p>Breakout room 1: Incentives, presented by Faelasufa (ADB)</p> <ol style="list-style-type: none"> <li>a. Kemenperin <ul style="list-style-type: none"> <li>o Kemenperin's four tasks in Presidential Regulation No. 55/2019: <ol style="list-style-type: none"> <li>1. Battery Electric Vehicle (BEV) categorization</li> <li>2. Domestic content (TKDN) regulation</li> <li>3. BEV roadmap</li> <li>4. BEV industry development</li> </ol> </li> <li>o Legal outputs of the tasks: <ol style="list-style-type: none"> <li>1. Task 1-3 will be regulated under a Ministerial Decree on BEV industry</li> <li>2. Task 4 will be regulated under a Ministerial Decree on CKD (Completely Knock Down) and IKD (Incompletely Knock Down) BEV industry development. This decree regulates the import taxes for CKD and IKD BEVs. IKD will receive a lower import tax rate. The import tax relaxation will only apply to investors who invest in Indonesia.</li> <li>3. Both of the decrees is under approval process by The Ministry of Law and Human Rights (Kemenkumham) and are targeted to be legalized at the end of this month</li> </ol> </li> <li>o Import tax incentives for charging stations will be regulated by ESDM</li> <li>o Other incentives: <ol style="list-style-type: none"> <li>1. Tax holiday for a limited period for EV-related manufacture industry investments and R&amp;D incentives based on Government Regulation 45/2019</li> <li>2. 0% down payment for EV policy by Bank Indonesia</li> <li>3. Electricity tariff and power increase discount by the National Power Company (PLN)</li> </ol> </li> </ul> </li> <li>b. Kemenkomarves: <ul style="list-style-type: none"> <li>o Ministerial Decree No. 72/2020 requires state vehicles to be BEV</li> <li>o E-motorcycle will be included in National Product Procurement Agency (LKPP) e-catalog</li> <li>o There is already a roadmap on charging infrastructure development by ESDM and PLN</li> </ul> </li> </ol>
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	<p>Breakout room 2: Fuel and environment, presented by Idoan Marciano (IESR)</p> <p>a. ESDM:</p> <ul style="list-style-type: none"> <li>○ The Ministry supports EV development, especially to:             <ol style="list-style-type: none"> <li>1. Utilise power surplus, especially in Java where the grid is already stable</li> <li>2. Achieve renewable energy targets in RPJMN</li> </ol> </li> <li>○ Motorcycles contribute largely to air pollution and GHG. Therefore the Ministry will focus on battery swap technology for e-motorcycles, which will be targeted for ride hailing motorcycles</li> <li>○ Issues on EV development:             <ol style="list-style-type: none"> <li>1. High CAPEX to procure privately-owned EVs. Need procurement incentives such as leasing or vehicle exchange programs</li> <li>2. Long payback period for charging infrastructure investments. The investment for charging infrastructure therefore may need to be bundled with fleet investments. The multiplier factor (ranging from 0.8-2) to determine electricity tariff for charging infrastructure operators in ESDM Ministerial Decree No. 13/2020 can be negotiated to increase the feasibility of charging infrastructure projects.</li> </ol> </li> </ul> <p>b. BPPT:</p> <ul style="list-style-type: none"> <li>○ E-bus can be a big player in EV industry</li> <li>○ We need to push industrial policies from the beginning to prevent many imported products in the future</li> <li>○ BPPT has built 3 charging stations, one of them equipped with 100KwH PV power source. However, additional mechanisms are needed to provide 100% clean grid source for charging stations due to space constraints for the PV cells</li> </ul> <p>c. KLKH:</p> <ul style="list-style-type: none"> <li>○ The directive from NDC mandates the use of biofuels. Although KLKH supports the initiatives, e-mobility is not stated in the NDC and related Presidential or Ministerial Decrees</li> </ul> <p>7. Wrap up, by Jannata Giwangkara (IESR)</p> <ul style="list-style-type: none"> <li>● There will be a rapid development of e-mobility and we need to prepare our country to the trend</li> <li>● Transition to e-mobility is urgently needed</li> </ul>
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Date and time	August 27th 09:00 - 11:30 (GMT+7)	
ITDP Attendee	Faella Sufa, Director of ITDP SEA Li Shanshan, ITDP China Insan Ridho Chairuasni, Transport Associate I Made Vikannanda, Transport Associate Etsa Amanda, Transport Policy Associate	
External Attendee	1. ADB: <ul style="list-style-type: none"> <li>● Faelasufa</li> <li>● Arum Satya Sari</li> <li>● Yustia</li> <li>● Tali</li> </ul> 2. IESR: <ul style="list-style-type: none"> <li>● Jannata Giwangkara</li> <li>● Idoan Marciano</li> </ul>	Other attendees please refer to Attendance List
Event Summary	The second day of the workshop addressed the current policies, policy gaps, and incentives (both fiscal and non-fiscal) needed to accelerate charging infrastructure development. Without any subsidy, the cost of charging infrastructure setup and operation is still high, especially DC fast charging.	
Event Details	1. Charging Infrastructure for E-mobility by Li Shanshan (ITDP China) <ol style="list-style-type: none"> <li>Comparison between charging infrastructure technology:               <ol style="list-style-type: none"> <li>Plug-in (AC 20-50kW):                   <ul style="list-style-type: none"> <li>■ Pro: Lower initial cost, lower grid pressure, grid management by charging at night, cheaper operational costs</li> </ul> </li> <li>Plug-in (DC 50-150kW):                   <ul style="list-style-type: none"> <li>■ Pro: Faster, the price is decreasing over the years</li> <li>■ Cons: Higher pressure on grid, more space requirement than pantograph</li> </ul> </li> <li>Pantograph (&gt;360kW):                   <ul style="list-style-type: none"> <li>■ Pro: Fast charging, flexible location, less space requirement</li> <li>■ Cons: High initial investment, high pressure on grid, harmful to battery life</li> <li>■ However, not popular in China since the technology is not yet mature</li> </ul> </li> </ol> </li> <li>Operational model for public charging:               <ol style="list-style-type: none"> <li>Operators install, operate, maintain</li> <li>Manufacturers install, operate, maintain</li> <li>Operators work together with EV manufacturers</li> </ol> </li> <li>Policy support timeline:               <ol style="list-style-type: none"> <li>July 2014: Reduced electricity tariff for centralized charging and battery replacing facilities</li> </ol> </li> </ol>	

	<ul style="list-style-type: none"> <li>b. October 2015: Accelerating construction of charging infrastructure</li> <li>c. January 2016: <ul style="list-style-type: none"> <li>■ 5 year plan on NEV development</li> <li>■ 2016: Shift of national subsidy from bus procurement to infrastructure support (2016-2020). There are prerequisites for cities to be eligible for the subsidy (more EV, more subsidy)</li> </ul> </li> <li>d. November 2018: Action plan for improving charging support capability by subsidizing local purchase</li> </ul> <p>4. Operation subsidy mechanism in Beijing:</p> <ul style="list-style-type: none"> <li>a. Classify charging stations based on charging fee standard, usage rate, maintenance, management, charging compatibility</li> </ul> <p>5. Operational model for ebus charging infrastructure:</p> <ul style="list-style-type: none"> <li>a. Operated by bus company <ul style="list-style-type: none"> <li>■ Cons: many operators do not have the maintenance capacity</li> </ul> </li> <li>b. BOT+commissioned operation <ul style="list-style-type: none"> <li>■ Used in many Chinese cities</li> </ul> </li> </ul> <p>6. Key lesson learned from China:</p> <ul style="list-style-type: none"> <li>a. Deployment of charging infrastructure has to match the charging needs</li> <li>b. Fast charging is better than slow charging infrastructure</li> <li>c. Need to improve usage rate of charging infrastructure</li> <li>d. Issues: <ul style="list-style-type: none"> <li>■ Many charging space is occupied by parked ICE vehicles</li> <li>■ Need government involvement for land acquisition for charging infrastructure and help with electricity access</li> <li>■ Need to have good maintenance</li> <li>■ Compatibility issues without proper standardization</li> </ul> </li> </ul> <p>2. Question and Answer Session, led by Jannata Giwangkara (IESR), answered by Li Shanshan (ITDP China)</p> <ul style="list-style-type: none"> <li>a. PLN (Zainal Arifin): <ul style="list-style-type: none"> <li>○ How could the DC charger cost in China decrease significantly? <ul style="list-style-type: none"> <li>■ Government provides subsidies for manufacturers for R&amp;D and production.</li> <li>■ The technology has also been developed more.</li> </ul> </li> </ul> </li> </ul>
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	<ul style="list-style-type: none"> <li>○ What is the subsidy model for EV charging infrastructure in China? <ul style="list-style-type: none"> <li>■ National government provides 20 million RMB per city, in addition to the city subsidy itself</li> </ul> </li> <li>○ How to deal with compatibility issues? <ul style="list-style-type: none"> <li>■ In 3 years, all the old charging infrastructure has to comply with universal charging protocols. Operators are responsible for the costs associated</li> </ul> </li> </ul> <p><b>b. TGUPP (Dimas Nu'man): How about the non-fiscal incentives?</b></p> <ul style="list-style-type: none"> <li>○ The government helps the operators to acquire the lands. Mayors get involved directly in supervising the development of EV in their cities</li> <li>○ Cities set targets for number of charging infrastructure in 2025</li> <li>○ Regular leadership meeting on charging infrastructure construction</li> </ul> <p><b>c. BPPT (MM Sarionto):</b></p> <ul style="list-style-type: none"> <li>○ In our prediction, the needs for public charging stations are mainly dominated by public transportation (buses or motorbike). How can we set the target of passenger cars charging infrastructure in China's experience? <ul style="list-style-type: none"> <li>■ Cities have their own plans/regulations for public charging infrastructure, e.g. minimum number of parking spaces for charging infrastructure (10% from the total parking space) for a new development complex.</li> </ul> </li> <li>○ For the initial market, do you have any recommendation for the proportion of Vehicles : Charging Station? <ul style="list-style-type: none"> <li>■ 1:4 charging dock per bus, 1:4-5 charging dock per private vehicle. But it is not enough, private charging infrastructure at houses (slow charging for overnight charging) is still encouraged. The owners bear the cost because it is not much.</li> </ul> </li> </ul> <p><b>d. DAMRI (Ikhsan Mohammad):</b></p> <ul style="list-style-type: none"> <li>○ How long does a charging facility usually last? Is there any specific lifetime for the facility? (ex. for buses or cars) <ul style="list-style-type: none"> <li>■ 20 years for charging infrastructure, for buses it is 8 years.</li> </ul> </li> <li>○ What kind of maintenance does a charging facility require?</li> </ul>
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	<ul style="list-style-type: none"> <li>■ Government will check from time to time the condition of the charging infrastructure, while the public can check it from an app.</li> </ul> <p>e. ITDP (Made Vikannanda): What was the impact that changed greatly when the Chinese government decided to shift the subsidy from bus procurement to charging infrastructure?</p> <ul style="list-style-type: none"> <li>○ In 2016, many cities have a large number of EV already. Therefore the government shifted the procurement subsidy to infrastructure installation, construction, and operation</li> </ul> <p>3. Open discussion session, led by Jannata Giwangkara (IESR):</p> <p>Discussion topic #1: What are the main challenges faced by the government and electricity utility companies in deploying significant charging infrastructure in Indonesia?</p> <p>a. PLN (Zainal Arifin):</p> <ul style="list-style-type: none"> <li>○ What is the best practice for charging infrastructure plugin standardization? Minister Regulation No. 13/2020 still allows a number of interfaces <ul style="list-style-type: none"> <li>■ ADB (Tali): There is still no single standard in Europe, since the focus is on electric rails.</li> </ul> </li> <li>○ Dilemma on the type of charging infrastructure. There are three levels of charging infrastructure in Indonesia. Level 2 charging is still feasible economically for investments, however fast charging costs 2-3 times higher. It will be difficult to find investors without any subsidy. <ul style="list-style-type: none"> <li>■ ADB (Tali): <ul style="list-style-type: none"> <li>● Depo charging costs can be owned by the operators because the overnight charging cost is not too high, meanwhile en-route charging should be incentivized by the government</li> <li>● The utilization factor of the charging infrastructure is one of the key points of cost reduction. A modelling in Stockholm showed that by locating public charging infrastructure in certain corridors the buses can use them as well and increase the chargers' utilization rate</li> <li>● Locate the infrastructure near rail stations. <ul style="list-style-type: none"> <li>i. Promote multimodality</li> <li>ii. The land probably is already owned by the rail</li> </ul> </li> </ul> </li> </ul> </li> </ul>
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	<p>operators/government hence reduce the land acquisition costs</p> <ul style="list-style-type: none"> <li>○ Progress from PLN: <ul style="list-style-type: none"> <li>■ Compatibility will not be a problem. PLN and BPPT have regulated the interface between vehicle-chargers and between chargers.</li> <li>■ Payment methods have been developed.</li> <li>■ A simulation has been done to model the effect of 1 million EV on grid stability, and there should not be any problem.</li> </ul> </li> <li>○ Electrical installation for charging infrastructure for electric buses in bus pools will be easier to build.</li> </ul> <p>b. ESDM (Inten Sripeni):</p> <ul style="list-style-type: none"> <li>○ Subsidies on EV, charging infrastructure, and electricity tariff for EV are highly needed. Kemenkomarves and Kemenperin need to formulate the subsidy soon.</li> <li>○ There should not be any problem on space allocation for private EV charging infrastructure, since most of the residential buildings in Indonesia are landed houses. The next step to be done is power upgrades by PLN</li> </ul> <p>c. ADB (Faelasufa):</p> <ul style="list-style-type: none"> <li>○ ADB is assisting DAMRI for electric bus feasibility analysis. The most feasible routes are the three airport routes.</li> <li>○ Electricity tariff is crucial for e-bus feasibility, especially when there is still diesel fuel subsidy. The multiplier factor of 0.8 is still barely enough for the project to be feasible.</li> <li>○ Recommendations: <ul style="list-style-type: none"> <li>■ Provide a more aggressive electricity tariff subsidy</li> <li>■ Develop a 10-year plan on charging infrastructure to ensure grid stability, taking into account EV projections</li> </ul> </li> </ul> <p>d. DAMRI (Dipowirawan Kurnaen):</p> <ul style="list-style-type: none"> <li>○ Issue: Electric buses are still more costly than conventional diesel buses in the first 8 years, while operators cannot charge passengers more. DAMRI and ADB are working to reduce the cost of capital.</li> <li>○ There is a trade-off between the number of chargers and battery capacity. Higher battery capacity leads to</li> </ul>
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	<p>heavier buses; adjustment on maximum bus weight regulation might need to be done.</p> <ul style="list-style-type: none"> <li>○ There is an opportunity to include Pertamina in developing charging infrastructure. The chargers can be incorporated in Pertamina's fuel stations. DAMRI has done initial engagement with Pertamina.</li> </ul> <p>e. Kemenkeu (Tony Priawan):</p> <ul style="list-style-type: none"> <li>○ Support from Kemenkeu: Presidential Regulation No. 82/2015: <ul style="list-style-type: none"> <li>■ Government may provide loan guarantees for SOEs (credit enhancement), to reduce costs for DAMRI when taking a loan from multilateral parties.</li> <li>■ However, local governments and ROEs are not eligible yet for the scheme. An amendment is currently in development.</li> </ul> </li> <li>○ Incentives for charging infrastructure is within the scope of ESDM</li> </ul> <p>Discussion topic #2: What factors encourage the development of electric vehicle charging?</p> <p>ITDP (Made Vikannanda):</p> <ul style="list-style-type: none"> <li>● The most feasible routes for Transjakarta electrification are corridor 1, 6, and 9. Transjakarta contracts third parties to operate its routes, and pays them on the basis of kilometers serviced (Rp/km).</li> <li>● How can Transjakarta and other operators with a similar business model can adopt electric buses, taking into account the non-ROE operators whom they collaborate with? <ul style="list-style-type: none"> <li>○ IESR (Idoan Marciano): <ul style="list-style-type: none"> <li>■ In Chile, a financial department procures charging infrastructure and EVs, to be leased to bus operators. Battery procurement is done separately from the bus. Bus operators need to lease them separately.</li> <li>■ Objective of the leasing scheme: Lower risks and costs associated with bus operators. Electric bus TCO will still be higher than ICE buses if the cost of charging infrastructure is included in the calculation.</li> </ul> </li> </ul> </li> </ul>
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Date and time	August 27th 14:00 - 16:00 (GMT+7)	
ITDP Attendee	Faella Sufa, Director of ITDP SEA Insan Ridho Chairuasni, Transport Associate I Made Vikannanda, Transport Associate Etsa Amanda, Transport Policy Associate	
External Attendee	1. ADB: <ul style="list-style-type: none"> <li>• Faellasufa</li> <li>• Arum Satya Sari</li> <li>• Yustia</li> <li>• Jurg Grutter (Grutter Consulting)</li> </ul> 2. IESR: <ul style="list-style-type: none"> <li>• Jannata Giwangkara</li> <li>• Idoan Marciano</li> </ul>	For complete list of attendees please refer to Attendance List
Event Summary	The third day of the workshop addressed the challenges met by bus operators.	
Event Details	1. Presentation: Overview of Electric Bus Technology, by Jurg Grutter <ul style="list-style-type: none"> <li>• Battery Electric Bus is the new standard in China (430,000 buses), Moscow, Paris (100 buses, only ZE buses in 2025), India (6,000 buses)</li> <li>• Manufacturers:               <ol style="list-style-type: none"> <li>a. China: Yutong, BYD, Zhongtong, Jinlong, etc (each produces 10x more than the rest of the world together)</li> <li>b. Europe: Irizar, VDL (18 m buses), Solaris, Volvo, etc</li> <li>c. Russia: Kamaz, GAZ</li> <li>d. India: TATA, Ashok Leland</li> <li>e. NA: New Flyer, Proterra</li> </ol> </li> <li>• E-bus technology:               <ol style="list-style-type: none"> <li>a. Hybrid trolleybus (East EU, Switzerland): No onboard battery</li> <li>b. Opportunity charging/pantograph: For end-of-route charging, not for short headway routes (~5 mins)</li> <li>c. Ultra-fast opportunity charging (Geneva, Chinese cities, Australia, France, Austria): 10-20s charging at every station/every 2-3, very small battery, suitable for short headway. This may be the most suitable option for Transjakarta BRT</li> <li>d. Slow-charged BEB: 2-8 hours during the night, bigger battery. Different battery for slow charging (will overheat when using fast charging)</li> <li>e. Fast-charged BEB: 10-20 mins for 100-200 km trip</li> <li>f. Battery swap: Chinese cities 5-10 years ago (has been abandoned), used when there is no fast charging yet</li> </ol> </li> <li>• Energy usage for e-bus:               <ol style="list-style-type: none"> <li>a. 5-30% charger (lost because charger efficiency)</li> <li>b. 40-60% bus traction</li> </ol> </li> </ul>	

	<ul style="list-style-type: none"> <li>c. 30-50% HVAC (heating, aircon): need to install an efficient cooling system. Energy consumption for HVAC is often underestimated, especially in cities with traffic congestion.</li> <li>• E-bus system design considerations: <ul style="list-style-type: none"> <li>a. Bus and charger compatibility</li> <li>b. Daily range and reserves</li> <li>c. Type of charging: Overnight charging / intermediate charging</li> <li>d. Parameters: Routes, distances, operating times, AC usage, congestion risk, bus size, speed, time available for charging, CAPEX, electricity price, risk</li> <li>e. Battery capacity: <ul style="list-style-type: none"> <li>■ Do not underestimate HVAC energy consumption</li> <li>■ Take into account battery capacity loss over time</li> </ul> </li> </ul> </li> <li>• Environmental impact: <ul style="list-style-type: none"> <li>a. There is still PM2.5 from non-combustion particles</li> <li>b. GHG: Need to look into well-to-wheel emission</li> <li>c. Indonesian electric grid still runs on high emission power <ul style="list-style-type: none"> <li>■ However, still 50% reduction of GHG</li> </ul> </li> </ul> </li> <li>• Case studies: <ul style="list-style-type: none"> <li>a. TCO calculation (Yerevan example) for BEB fast-charged: <ul style="list-style-type: none"> <li>■ 2-3x more CAPEX, need more access to capital</li> <li>■ Energy and maintenance cost is very much lower</li> <li>■ More flexibility</li> <li>■ Charging stations could be also used by urban trucks and taxis</li> <li>■ Problem: High subsidy of diesel <ul style="list-style-type: none"> <li>• With subsidized diesel, e-bus cannot recover the incremental costs</li> </ul> </li> </ul> </li> <li>b. Type of charging for Jakarta electric bus: <ul style="list-style-type: none"> <li>1. BRT corridors: flash charging <ul style="list-style-type: none"> <li>○ Charge at end of route 1 and 6: 1-2 mins with 1,600 kW charger</li> <li>○ Charging with 600kW at stations</li> <li>○ Low risk because the buses use different charging stations</li> </ul> </li> <li>2. Airport lines: fast charging at end of routes <ul style="list-style-type: none"> <li>○ Fast charging at end of routes</li> <li>○ 5-15 charging time</li> <li>○ 10.5-12m bus, 200kWh battery set</li> <li>○ 400kW chargers and the end of the routes and 200kW at depot</li> </ul> </li> </ul> </li> </ul> </li> <li>• Key remarks: <ul style="list-style-type: none"> <li>a. Compared to subsidized diesel, e-buses are not financially viable</li> <li>b. Compared to 500ppm non-subsidized diesel: comparable, but long payback period</li> </ul> </li> </ul>
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	<p>c. Need different e-bus technologies for different route types:</p> <ul style="list-style-type: none"> <li>■ Trunk routes (large buses, short headway, long operation hours): ultra-fast charging</li> <li>■ Feeder and normal routes: Overnight charging or fast-charged</li> </ul> <p>2. Question and Answer session, led by Faela Sufa (ITDP), answered by Jurg Grutter (ADB/Grutter Consulting)</p> <p>a. ITDP (Faela Sufa): Is pantograph technology mature enough for Asian market? How about the compatibility with buses in Asia?</p> <ul style="list-style-type: none"> <li>○ There is no added benefit of pantograph compared to plugin chargers, except for space-saving. Buses also need to be parked very nicely for pantograph charging, which could be a challenge.</li> <li>○ China uses ultra-fast charging, which is different from pantograph. Ultra-fast charging system is compatible with any e-bus, as long as the system is designed to be compatible</li> </ul> <p>b. BPPT (Barman Tambunan):</p> <ul style="list-style-type: none"> <li>○ Is the trolleybus system better than battery in the future, considering the limited number of charging stations? <ul style="list-style-type: none"> <li>■ We advise against trolleybuses: <ul style="list-style-type: none"> <li>a. High infrastructure installment cost and maintenance</li> <li>b. Needs more space</li> <li>c. Uses 24 hours of electricity</li> </ul> </li> <li>■ No new trolleybus system is built anymore, cities are scrapping trolleybus and replaced with BEB.</li> <li>■ Cost of plugin chargers is much less than trolleybus system infrastructure.</li> </ul> </li> <li>○ Traffic in Indonesia is very busy. Do you think Indonesia will be able to adopt e-bus? <ul style="list-style-type: none"> <li>■ Yes, but need to consider the energy consumption of HVAC</li> </ul> </li> </ul> <p>c. Transjakarta (Yoga Adiwinarto): What is the second-best technology for BRT after flash charging?</p> <ul style="list-style-type: none"> <li>○ Opportunity charging at the end of the routes, however will increase the CAPEX. Need to reorganize the end of route space and layout. Need more space, and require 10% more buses.</li> <li>○ Especially in the future, when you have more buses the number of the needed bus becomes even larger and hence the costs (drivers, mechanics, space, etc).</li> </ul> <p>d. ITDP (Faela Sufa): How long is the lifetime of flash charging infrastructure?</p> <ul style="list-style-type: none"> <li>○ In Switzerland it is 18 years for the battery, 20 years for the system. The infrastructure lifetime is 30 years in general.</li> </ul> <p>e. Mobil Anak Bangsa (Prabowo Kartoleksono): Why are you not referring to LFP?</p>
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	<ul style="list-style-type: none"> <li>○ LFP is not compatible with fast-charging, only for slow-charged buses. NMC is used for fast-charging and LTO. It is not a one system fits all, need to consider the city context</li> </ul> <p>3. Open discussion session, led by Faela Sufa (ITDP)</p> <p>Discussion topic #1: Transjakarta has BRT and Non-BRT in operation. The Transjakarta BRT system uses a high floor bus, while the high floor e-bus market is still limited. Is it mature enough to introduce the high floor buses in Jakarta? What is the implementation phase of the e-bus system for Transjakarta? Whether it first starts electrifying the non-BRT or we can start both non-BRT and BRT together?</p> <ul style="list-style-type: none"> <li>a. Jurg Grutter: <ul style="list-style-type: none"> <li>○ No problem to have high floor buses for electric buses. The system in Santiago and other BRT have used electric high floor buses.</li> <li>○ Need to electrify various routes at the same time, as well as the number of buses to have the economic scale. However, it is easier to start with feeder routes. The number of fleets should not go below 50 buses, 100 units upwards is better.</li> </ul> </li> <li>b. MAB (Prabowo Kartoleksono): MAB has low entry and high entry buses with the same price, with 314kWh capacity</li> <li>c. BPPT (MM Sarionto): What is the concept from the bus manufacturer? Will the bus charge at the end of routes or can charge along the routes? <ul style="list-style-type: none"> <li>○ ITDP (Faela Sufa): It depends on the route characteristics</li> </ul> </li> <li>d. Transjakarta (Yoga Adiwinarto): <ul style="list-style-type: none"> <li>○ Transjakarta's plan: <ol style="list-style-type: none"> <li>1. Transjakarta has been conducting pilot implementation for three months since July to test vehicle range and consumption rate, assisted by CFF-C40.</li> <li>2. Plan to start from 3-5 non-BRT routes, while planning BRT routes in parallel</li> </ol> </li> <li>○ Implementation timeline: <ol style="list-style-type: none"> <li>1. Transjakarta still commits to deploy 100 e-buses this year, partnering with operators.</li> <li>2. Next year: additional 300 units of e-bus. However Transjakarta is still developing the operational details, including for the charging strategy which affects the investments and grid capability.</li> <li>3. 2030: Full electric buses</li> </ol> </li> </ul> </li> </ul> <p>Discussion topic #2: What are the main obstacles for public transportation companies in implementing electric buses in Jakarta, both in terms of economics, infrastructure, technological, and operations?</p> <ul style="list-style-type: none"> <li>a. DAMRI (Dipowirawan Kurnaen): <ul style="list-style-type: none"> <li>○ Business scheme for pantograph charging will be more complicated. There should be further discussion with PLN on charging infrastructure business model</li> </ul> </li> </ul>
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	<ul style="list-style-type: none"> <li>○ Need for incentives, all cities which deploy electric buses provide fiscal subsidies. <ul style="list-style-type: none"> <li>■ There need to be more detail on the fiscal incentives mentioned in Presidential Regulation 55/2019</li> </ul> </li> <li>b. Mayasari Bakti (Kristofanus): Operators are willing to support Transjakarta's electrification plans, but need clear regulations and guidelines. For example, whether the charging stations will be provided by Transjakarta or by each operator need to be clarified.</li> <li>c. Transjakarta (Yoga Adiwinarto): <ul style="list-style-type: none"> <li>○ ESDM Minister Regulation 13/2020 allows the private sector to install charging infrastructure for public transport. We can explore the opportunity for Transjakarta to install charging stations and lease them to operators to reduce operators' CAPEX.</li> </ul> </li> </ul> <p>Discussion topic #3: Are there any plans to arrange institutional setup (task force) for helping the acceleration of e-mobility in Jakarta?</p> <p>Dinas Perhubungan DKI Jakarta (Hendra): There is already a small team consisting of Dinas Perhubungan, Dinas Perekonomian, TGUPP, Transjakarta, ITDP, and C-40-CFF which has regular monthly meeting.</p> <ul style="list-style-type: none"> <li>● ITDP (Faella Sufa): There is still a need for a permanent task force</li> </ul>
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## Annexure C. Attendance List

Participant Name	Participant Email	Day Attended
ITDP_Faela Sufa (Faela Sufa)	faela.sufa@itdp.org	26/08/2020
IESR_Jannata Giwangkara (Jannata Giwangkara)	egi@iesr.or.id	26/08/2020
ICCT_Mega Kusumaningkatma (Mega Kusumaningkatma)	megakatma@yahoo.com	26/08/2020
UNEP_B Nico (Barlev Hutagalung)	barlevhutagalung@yahoo.com	26/08/2020
BPPT_MM Sarinanto (MM Sarinanto)	mm.sarinanto@bppt.go.id	26/08/2020
Kementerian ESDM_Inten Sripeni 2 (Inten Sripeni 2)	faelasufa1091@gmail.com	26/08/2020
BPPT_Riza Riza (Riza Riza)	riza@bppt.go.id	26/08/2020
Dishub Dki Jakarta_Fani Nursyamsi (Fani Nursyamsi)	bidangkutan@gmail.com	26/08/2020
Dishub Dki Jakarta_Fani Nursyamsi	bidangkutan@gmail.com	26/08/2020
BPPT_MM Sarinanto	mm.sarinanto@bppt.go.id	26/08/2020
UNEP_B Nico	barlevhutagalung@yahoo.com	26/08/2020
IESR_Daniel Kurniawan (Daniel Kurniawan)	daniel@iesr.or.id	26/08/2020
ITDP_Made Vikannanda (Made Vikannanda)	made.vikannanda@itdp.org	26/08/2020
Fitriya Bahasa Global	fitriia24@gmail.com	26/08/2020
Kemenko MarvesD3_Arianto (MarvesD3_Arianto)	w.arianto@gmail.com	26/08/2020
Ministry of Environment and Forestry_Ardina Purbo (Ardina Purbo)	ardinapurbo@gmail.com	26/08/2020
ITDP_Stanford Turner (Stanford Turner)	stanford.turner@itdp.org	26/08/2020

JBB_beny pardede (beny pardede)	benyseptianp@gmail.com	26/08/2020
Dishub DKI Jakarta_Hendra Wijayanto (Hendra Wijayanto)	hendrawj.dki@gmail.com	26/08/2020
BKF_Agung Romy Hasiholan (Agung Romy Hasiholan)	agung.hasiholan@kemenkeu.go.id	26/08/2020
Nugroho Triyono	nugroho.at@gmail.com	26/08/2020
Ministry of Environment and Forestry_Ardina Purbo	ardinapurbo@gmail.com	26/08/2020
Dishub DKI Jakarta_Hendra Wijayanto	hendrawj.dki@gmail.com	26/08/2020
Asih Kurniasari	asih.kurniasari@bppt.go.id	26/08/2020
ADB Ki Joon Kim (Ki Joon Kim)	kjkim@adb.org	26/08/2020
BKF_Miftahudin Miftahudin (Miftahudin Miftahudin)	miftahudin.mof@gmail.com	26/08/2020
ADB_Faela (Faela Sufa ADB)	ffaelasufa.consultant@adb.org	26/08/2020
GIZ_Alin Pratidina (Alin Pratidina)	alin.pratidina@giz.de	26/08/2020
Kemen ESDM_Sripeni Inten Cahyani (Sripeni inten Cahyani)	inten@esdm.go.id	26/08/2020
Pusat Kebijakan APBN-BKF_Ginjar Wibowo (Ginjar Wibowo)	ginjarwibowo@gmail.com	26/08/2020
PT. PLN Indonesia_Benny Reinmart (Benny Reinmart)	benny.reinmart@gmail.com	26/08/2020
Kementrian ESDM_Sripeni inten Cahyani	inten@esdm.go.id	26/08/2020
Ganesha Chandrasa	ganesha.tri@bppt.go.id	26/08/2020
ITDP_SHANSHAN LI (SHANSHAN LI)	li.shanshan@itdp.org	26/08/2020
hosting bahasa global	hosting.bahasaglobal@gmail.com	26/08/2020
Bluebirdgroup_Rizki Bayu Alkautsar (Rizki Bayu Alkautsar)	rizki.bayu@bluebirdgroup.com	26/08/2020
International Council on Clean Transportation_Aditya Mahalana (Aditya Mahalana)	aditya.mahalana@theicct.org	26/08/2020



ITDP_Dewi Novirianti (Dewi Novirianti)	dewi.novirianti1@gmail.com	26/08/2020
Kemenperin_Putu Ardika (Putu Ardika)	dpardika@gmail.com	26/08/2020
Kementrian ESDM_Arjuna Jonathan Paranoan (Arjuna Jonathan Paranoan)	ajparanoan@esdm.go.id	26/08/2020
bappenas_Jadhie Ardajat (Jadhie Ardajat)	jadhie@bappenas.go.id	26/08/2020
NIRAS ADB_Yustiani Anjar Sari (NIRAS ADB_Yustiani Anjar Sari)	yasa@niras.com	26/08/2020
bappenas_Jadhie Ardajat	jadhie@bappenas.go.id	26/08/2020
Kamilia Bahasa Global (Kamilia Bahasa Global)	project@bahasaglobal.com	26/08/2020
International Council on Clean Transporatation_Aditya Mahalana	aditya.mahalana@theicct.org	26/08/2020
ITDP_Insan Ridho Chairuasni (Insan Ridho Chairuasni)	insan.chairuasni@itdp.org	26/08/2020
IEA_Peggy Hariwan (Peggy Hariwan)	peggyhariwan@gmail.com	26/08/2020
Interpreter Ravi Bimo (Ravi Bimo)	ravibimo2@gmail.com	26/08/2020
IESR_Idoan Marciano (Idoan Marciano)	idoan@iesr.or.id	26/08/2020
C40-CFF_Gitafajar Sptyani (Gitafajar Sptyani)	gitafajar.sptyani@giz.de	26/08/2020
NIRAS-ADB_Arum Sari (Arum Sari)	arum.sari@niras.com	26/08/2020
Kemenko Marves_M Aulia (M Aulia Ramadhani)	aulia16@gmail.com	26/08/2020
TGUPP_Mirza Aldi Pamungkas (Mirza Aldi Pamungkas)	mirzaldi@gmail.com	26/08/2020
TGUPP_Dimas Nu'man Fadhil (Dimas Nu'man Fadhil)	dn.fadhil@gmail.com	26/08/2020
dishub dki jakarta_Ferdinand Ginting (Ferdinand Ginting)	ferdinandginting@yahoo.com	26/08/2020
TGUPP_Dimas Nu'man Fadhil	dn.fadhil@gmail.com	26/08/2020
C40-CFF_Gitafajar Sptyani	gitafajar.sptyani@giz.de	26/08/2020

ITDP_Etsa Amanda (Etsa Amanda)	etsa.amanda@itdp.org	26/08/2020
CMMAI Yudi Prabangkara (Yudi Prabangkara)	yudiprabangkara@yahoo.com	26/08/2020
PKAPBN_Indria Syafelifitria (Indria Syafelifitria)	qqindria@gmail.com	26/08/2020
Coordinating Ministry of marine and investment_Yudi Saptono (yudi saptono)	idoey_0910@yahoo.com	26/08/2020
ITDP_Etsa Amanda	etsa.amanda@itdp.org	26/08/2020
(UNDP) Verania Andria (Verania Andria)	verania.andria@undp.org	26/08/2020
CADMUS_Geoff Morrison (Geoff Morrison)	geoffrey.morrison@cadmusgroup.com	26/08/2020
DAMRI_ikhsan mohammad (ikhsan mohammad)	mohammad.ikhsan@damri.co.id	26/08/2020
Bappenas_muh Asrofi (muh Asrofi)	m.asrofi@bappenas.go.id	26/08/2020
UNEP_Bert Fabian (Bert Fabian)	bert.fabian@un.org	26/08/2020
Blue Bird Group_Bambang Wijoyo (Raden Bambang Wijoyo)	bambang.kw@bluebirdgroup.com	26/08/2020
DAMRI_ikhsan mohammad	mohammad.ikhsan@damri.co.id	26/08/2020
UNEP_Bert Fabian	bert.fabian@un.org	26/08/2020
Bappenas_muh Asrofi	m.asrofi@bappenas.go.id	26/08/2020
Parnon_Eugenia Katsigris (Eugenia Katsigris)	eugenia.katsigris@gmail.com	26/08/2020
Interpreter_reza purba (reza purba)	reza.purba@bahasaglobal.com	26/08/2020
Krista Bahasa global	info@bahasaglobal.com	26/08/2020
D3Marves_Naufal Faiz (Naufal Faiz)	naufal.faiz86@gmail.com	26/08/2020
Ministry of Industry_Andi Komara (Andi Komara)	andiko1911@gmail.com	26/08/2020
NIRAS UKCCU_Ayu Ramanadia (Ayu Ramanadia)	ayra@niras.com	26/08/2020

Dishub BAJ - Ariansyah (Ariansyah Np)	nparians16@gmail.com	26/08/2020
Dishub BAJ - Ariansyah	nparians16@gmail.com	26/08/2020
MoF BKF_Fino Waristi (Fino Waristi)	finovalico@gmail.com	26/08/2020
febria laras sari	febrialaras59@gmail.com	26/08/2020
IESR_Daniel Kurniawan (Idoan Marciano)	idoan@iesr.or.id	27/08/2020
KESDM-Sripeni Inten Cahyani (Sripeni Inten Cahyani)	inten@esdm.go.id	27/08/2020
NIRAS ADB_ Arum Sari (Arum Sari)	arum.sari@niras.com	27/08/2020
IESR_Idoan Marciano (Idoan Marciano)	idoan@iesr.or.id	27/08/2020
ITDP_Stanford Turner (Stanford Turner)	stanford.turner@itdp.org	27/08/2020
Kemenkeu_Tony Prianto (Tony Prianto)	tony.prianto@gmail.com	27/08/2020
BAPPENAS_Muh. Asrofi (muh Asrofi)	m.asrofi@bappenas.go.id	27/08/2020
KESDM_Arjuna Jonathan Paranoan (Arjuna Jonathan Paranoan)	ajparanoan@esdm.go.id	27/08/2020
ICCT_Aditya Mahalana (Aditya Mahalana)	aditya.mahalana@theicct.org	27/08/2020
NIRAS ADB_Tali Trigg (Tali Trigg)	tali.trigg@gmail.com	27/08/2020
surya anto	ysfsrynt@gmail.com	27/08/2020
Faela Sufa	faela.sufa@itdp.org	27/08/2020
ADB_Muh Achsani Takwim (Achsan Takwim)	mmahendro.consultant@adb.org	27/08/2020
UNDP_Verania Andria (Verania Andria)	verania.andria@undp.org	27/08/2020
UNEP_Bert Fabian (Bert Fabian)	bert.fabian@un.org	27/08/2020
ITDP_Made Vikannanda (Made Vikannanda)	made.vikannanda@itdp.org	27/08/2020
Blue Bird Group_Bambang Kusumo Wijoyo (Raden Bambang Wijoyo)	bambang.kw@bluebird.com	27/08/2020
ITDP_Dewi Novirianti (Dewi Novirianti)	dewi.novirianti1@gmail.com	27/08/2020

Kemenkeu_May Putri Mirahadi (May Putri Mirahadi)	meykedua@gmail.com	27/08/2020
PLN_Zainal Arifin (Zainal Arifin)	zainal.arifin22@pln.co.id	27/08/2020
Dishub BAJ_Ariansyah (Ariansyah Np)	nparians16@gmail.com	27/08/2020
ITDP_SHANSHAN LI (SHANSHAN LI)	li.shanshan@itdp.org	27/08/2020
Parnon_Eugenia Katsigris (Eugenia Katsigris)	eugenia.katsigris@gmail.com	27/08/2020
hosting bahasa global	hosting.bahasaglobal@gmail.com	27/08/2020
UNEP_B Nico (Barlev Hutagalung)	barlevhutagalung@yahoo.com	27/08/2020
IEA_Peggy hariwan (Peggy Hariwan)	peggyhariwan@gmail.com	27/08/2020
C40-CFF_Gitafajar Sptyani (Gitafajar Sptyani)	gitafajar.sptyani@giz.de	27/08/2020
TGUPP_Farrel Wijaya (Farrel Wijaya)	farrelisworowijaya@gmail.com	27/08/2020
M. Rifqy Nurfausan Abdillah	rifqyabdillah6@gmail.com	27/08/2020
dishub dki_Ferdinand Ginting (dishub dki_Ferdinand Ginting)	ferdinandginting@yahoo.com	27/08/2020
khotimatul fauziah	khotimatul.fauziah@bppt.go.id	27/08/2020
Damri_ikhsan mohammad (mohammad ikhsan)	mohammad.ikhsan@damri.co.id	27/08/2020
KESDM_Wildan (Wildan Fujiansah)	wildanfujiansah@gmail.com	27/08/2020
KESDM DJK_Andi Hanif (Andi Hanif)	andi.hanif87@gmail.com	27/08/2020
KESDM_Eri N (Eri Nurcahyanto)	eri.nurcahyanto@esdm.go.id	27/08/2020
PLN_Benny Reinmart (Benny Reinmart)	benny.reinmart@gmail.com	27/08/2020
DAMRI_Dipowirawan Kurnaen (Dipowirawan Kurnaen)	dipowirawan@damri.co.id	27/08/2020
C40 Cities_Lyan Villacorta (Lyan Villacorta)	lvillacorta@c40.org	27/08/2020
reza purba	reza.purba@bahasaglobal.com	27/08/2020

ADB_Fela (Faella Sufa ADB)	ffaelasufa.consultant@adb.org	27/08/2020
IESR_Agus Tampubolon (Agus Tampubolon)	agus@iesr.or.id	27/08/2020
Kemenkeu_Elfin Luthfiah (Elfin Luthfiah)	elfinluthfiah306@gmail.com	27/08/2020
ITDP_Etsa Amanda (Etsa Amanda)	etsa.amanda@itdp.org	27/08/2020
IESR_Jannata Giwangkara (Egi) (Jannata Giwangkara)	egi@iesr.or.id	27/08/2020
TGUPP_Dimas Nu'man Fadhil (Dimas Nu'man Fadhil)	dn.fadhil@gmail.com	27/08/2020
BPPT_MM Sarinanto (MM Sarinanto)	mm.sarinanto@bppt.go.id	27/08/2020
Kemenperin_Muhammad Ihsan (Muhammad Ihsan)	alexs_san2000@yahoo.com	27/08/2020
PLN_Nugroho Triyono (Nugroho Triyono)	nugroho.at@gmail.com	27/08/2020
GIZ_Alin Pratidina (Alin Pratidina)	alin.pratidina@giz.de	27/08/2020
KESDM_Andrie Syatriawan (Andrie Syatriawan)	andrie.syatriawan@esdm.go.id	27/08/2020
Bahasa Global (Kamilia Bahasa Global)	project@bahasaglobal.com	27/08/2020
Ravi Bimo	ravibimo2@gmail.com	27/08/2020
FPA_Miftahudin Miftahudin (Miftahudin Miftahudin)	miftahudin.mof@gmail.com	27/08/2020
NIRAS ADB_Yustiani (Yustiani Anjar Sari)	yasa@niras.com	27/08/2020
ITDP_Insan Ridho Chairuasni (Insan Ridho Chairuasni)	insan.chairuasni@itdp.org	27/08/2020
KESDM_Inten Sripeni (Inten Sripeni)	faelasufa1091@gmail.com	27/08/2020
Blue Bird Group_Rizki Bayu Alkautsar (Rizki Bayu Alkautsar)	rizki.bayu@bluebirdgroup.com	27/08/2020
Ministry_Olga Arfiandani (Olga Arfiandani)	olgaarfiandani@gmail.com	27/08/2020
ITDP_Faella Sufa (Faella Sufa)	faella.sufa@itdp.org	28/08/2020
Zhong Tong_John Salim (John Salim)	jsalim@dieselindo.co.id	28/08/2020

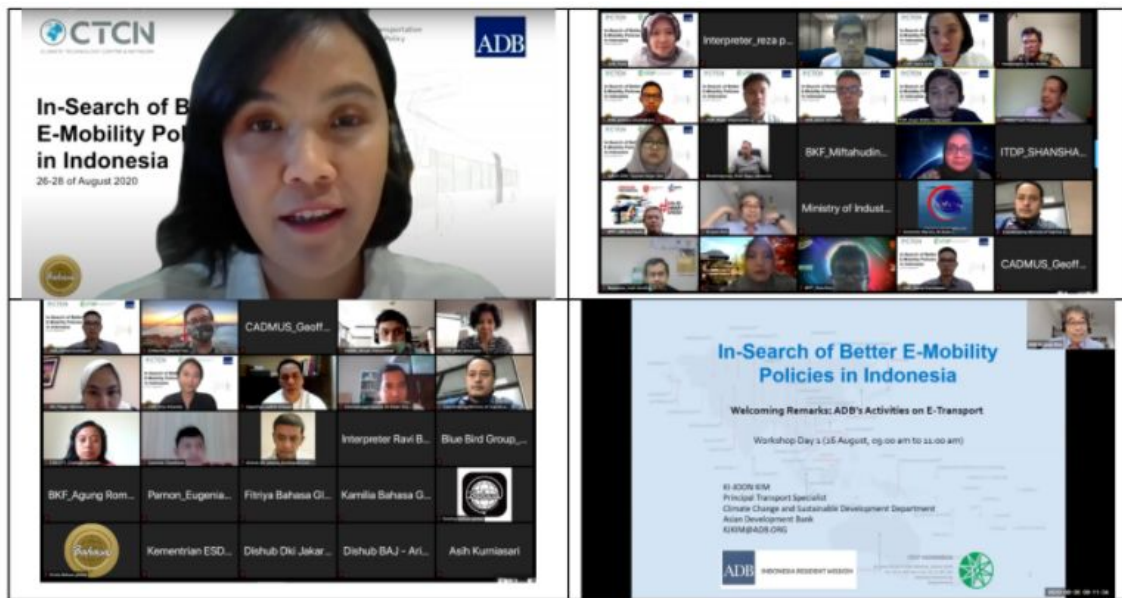
ITDP_Dewi Novirianti (Dewi Novirianti)	dewi.novirianti1@gmail.com	28/08/2020
BPPT_Mahfudz Al Huda (Mahfudz Al Huda)	mahfudz.al@bppt.go.id	28/08/2020
BPPT_Ferdi Armansyah (Ferdi Armansyah)	ferdi.armansyah@bppt.go.id	28/08/2020
Ravi Bimo	ravibimo29@live.com	28/08/2020
Fitriya Bahasa Global	fitriia24@gmail.com	28/08/2020
PPD_Bambang Suryo Susakti (Bambang Suryo Susakti)	bsusakti@yahoo.co.id	28/08/2020
BYD-Bakrie_Kuntoaji (Kuntoadjie BYD-Bakrie)	adjie@bakrie-autoparts.com	28/08/2020
PT Bakrie Autoparts_Harry Iskandar (Harry Iskandar)	harry@bakrie-autoparts.com	28/08/2020
IESR_Jannata Giwangkara (Jannata Giwangkara)	egi@iesr.or.id	28/08/2020
DKI Jakarta_Enggar Ferry (Enggar Ferry Wibowo Sugiharto)	enggarferry@jakarta.go.id	28/08/2020
DAMRI_ikhsan mohammad (mohammad ikhsan)	mohammad.ikhsan@damri.co.id	28/08/2020
ITDP_Shanshan Li (SHANSHAN LI)	li.shanshan@itdp.org	28/08/2020
MAB: B. Prabowo Kartoleksono (Prabowo Karto Leksono)	bpkartoleksono@mabindonesia.com	28/08/2020
Mayasari_Daryono Daryono (Daryono Daryono)	daryonomayasari@gmail.com	28/08/2020
IEA_Peggy Hariwan (Peggy Hariwan)	peggyhariwan@gmail.com	28/08/2020
Dishub DKI Jakarta_Hendra Wijayanto (Hendra Wijayanto)	hendrawj.dki@gmail.com	28/08/2020
Transjakarta_Mugi (Ery Priwan)	erypriwan@transjakarta.co.id	28/08/2020
DAMRI_Dipowirawan Kurnaen (Dipowirawan Kurnaen)	dipowirawan@damri.co.id	28/08/2020
B Nico (Barlev Hutagalung)	barlevhutagalung@yahoo.com	28/08/2020
C40 Cities Finance Facility_Gitafajar Sptyani (Gitafajar Sptyani)	gitafajar.sptyani@giz.de	28/08/2020

hosting bahasa global	hosting.bahasaglobal@gmail.com	28/08/2020
Interpreter-reza purba (reza purba)	reza.purba@bahasaglobal.com	28/08/2020
B2TKE - BPPT_Danang Yogisworo (Danang Yogisworo)	danang.yogisworo@bppt.go.id	28/08/2020
Bluebirdgroup_Rizki Bayu Alkautsar (Rizki Bayu Alkautsar)	rizki.bayu@bluebirdgroup.com	28/08/2020
BPPT_MM Sarinanto (MM Sarinanto)	mm.sarinanto@bppt.go.id	28/08/2020
Biro KSD DKI Jakarta_Ratih (Biro KSD Ratih)	internationalcooperation@jakarta.go.id	28/08/2020
UNDP_Marina Adel (Marina Adel)	marina.adel@undp.org	28/08/2020
Transjakarta_Candra (Transjakarta_Candra)	candra.rakhmat@transjakarta.co.id	28/08/2020
Dishub BAJ_Ariansyah (Ariansyah Np)	nparians16@gmail.com	28/08/2020
MEMR_Sripeni Inten Cahyani (Sripeni Inten Cahyani)	intencahyani68@gmail.com	28/08/2020
Perum PPD_Niken Distian (Niken Distian)	distianniken@gmail.com	28/08/2020
Kem. ESDM_Eri (Eri Nurcahyanto)	eri.nurcahyanto@esdm.go.id	28/08/2020
BPPT_Hafsah Halidah (BPPT_Hafsah Halidah)	hafsah.halidah@bppt.go.id	28/08/2020
PT INKA_Erwin (Apoleus Karo Karo)	apo.karokaro@gmail.com	28/08/2020
NIRAS-ADB_Arum Sari (Arum Sari)	arum.sari@niras.com	28/08/2020
Transjakarta_Yoga Adiwinarto (yoga adiwinarto)	yoga.adiwinarto@transjakarta.co.id	28/08/2020
Grutter Consulting_juerg gruetter (juerg gruetter)	jgruetter@gmail.com	28/08/2020
ITDP_Stanford Turner (Stanford Turner)	stanford.turner@itdp.org	28/08/2020
Hosting Bahasa Global 2 (Kamilia Bahasa Global)	project@bahasaglobal.com	28/08/2020
NIRAS-ADB_Yustiani Anjar Sari (Yustiani Anjar Sari)	yasa@niras.com	28/08/2020

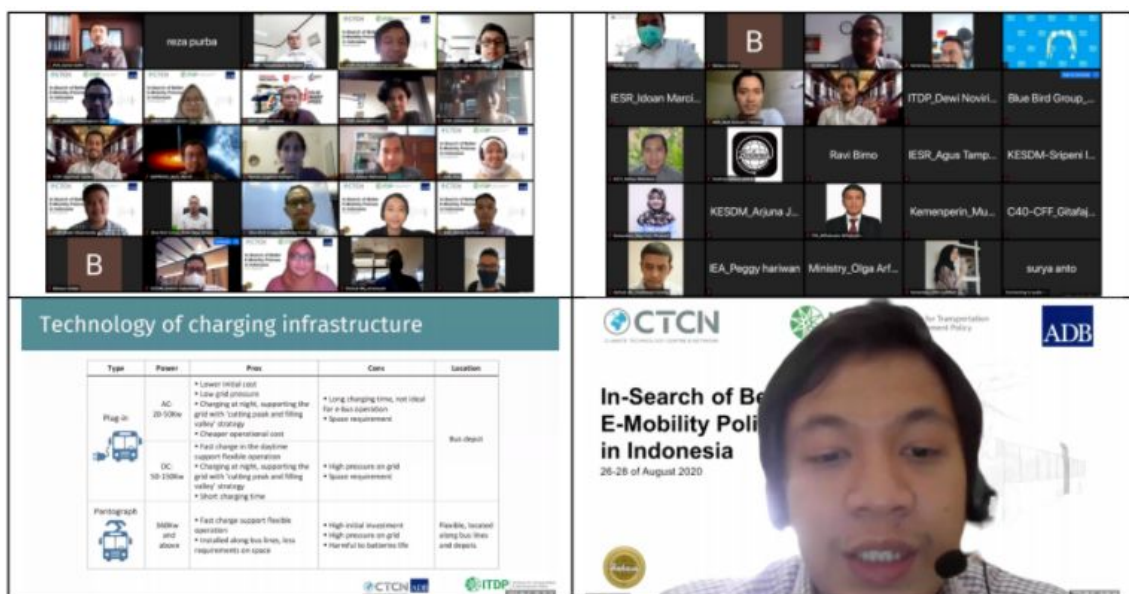
PT Mayasari Bakti_Kristofanus (Kristofanus - PT Mayasari Bakti)	future.pinem@gmail.com	28/08/2020
ADB_Achsani Takwim (Achsani Takwim)	mmahendro.consultant@adb.org	28/08/2020
BPPT_eniya Listiani (eniya Listiani)	eniyalistianidewi@gmail.com	28/08/2020
TGUPP_Farrel Wijaya (Farrel Wijaya)	farrelisworowijaya@gmail.com	28/08/2020
ITDP_Insan Ridho Chairuasni (Insan Ridho Chairuasni)	insan.chairuasni@itdp.org	28/08/2020
ICCT_Aditya Mahalana (Aditya Mahalana)	aditya.mahalana@theicct.org	28/08/2020
BPPT_Barman Tambunan (Barman Tambunan)	barman.tambunan@bppt.go.id	28/08/2020
ITDP_Made Vikannanda (Made Vikannanda)	made.vikannanda@itdp.org	28/08/2020
ADB_Faela (Faela Sufa ADB)	ffaelasufa.consultant@adb.org	28/08/2020
ITDP_Etsa Amanda (Etsa Amanda)	etsa.amanda@itdp.org	28/08/2020
BPPT_Sudarmin Sudarmin (Sudarmin Sudarmin)	sudarmin@bppt.go.id	28/08/2020



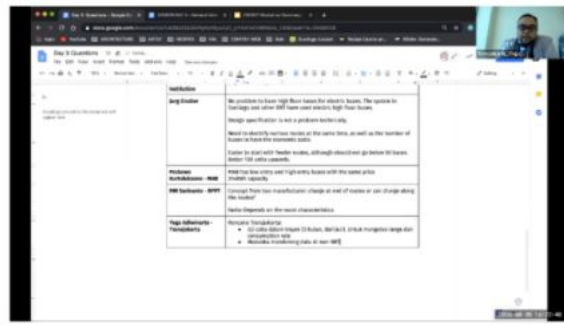
## Annexure D. Workshop Gallery



Workshop Day 1



Workshop Day 2



## Workshop Day 3