

Development of Public Electric Vehicle Charging Stations (SPKLU) in Makassar as an Electric Car Supporting Means

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ABSTRACT

Electric vehicles are a potential solution for reducing greenhouse gas emissions and dependence on fossil fuels. However, a successful transition to electric vehicles depends on the availability of adequate charging infrastructure. Therefore, this journal aims to describe the development of Public Electric Vehicle Charging Stations (SPKLU) in the city of Makassar, including an analysis of the obstacles, benefits, and steps taken in the development process. This thesis discusses the latest condition of the electric vehicle battery charging infrastructure, especially the electric car General Electric Vehicle Charging Station (SPKLU) located in Makassar. This thesis also discusses the development of electric car sales in Indonesia, especially in the city of Makassar and other cities around it. How to charge electric vehicle batteries either through portable charging, wall charging or charging at SPKLU as one of the supporting infrastructure for electric vehicles. Programs carried out by both the Government and PLN in an effort to encourage people to switch to electric vehicles to reduce air pollution in big cities and also reduce the use of fossil fuels.

Keywords: infrastructure; electric car; battery charging; SPKLU.

INTRODUCTION

Makassar city has great potential for electric vehicle adoption due to its significant population growth and mobility. However, the limited availability of electric vehicle charging infrastructure is one of the main obstacles in promoting electric vehicles in this city. Therefore, the development of a Public Electric Vehicle Charging Station (SPKLU) is an urgent need to encourage environmentally friendly mobility in the city of Makassar.

Like oil-fueled (BBM) cars, electric cars also require supporting facilities for their mobility. The charging station is the main thing that must be prepared in advance. The government continues to encourage the acceleration of infrastructure development for Public Electric Vehicle Charging Stations (SPKLU) for the sustainability of the electric vehicle ecosystem in the country, especially in the city of Makassar.

PLN as the agency in charge of this matter has declared its ability to build infrastructure and provide electricity supply for electric cars. As PLN has experience in providing electricity facilities for the mass transportation of electric trains. In this case the main problem is that there are two standardization of chargers, namely Japan and Europe. This standard will be used to determine electric cars in Indonesia.

Construction of SPKLU (Public Electric Vehicle Charging Stations) is very cheap when compared to building gas stations. SPKLU only needs 1 percent of the funds to build SPKLU of IDR 3 billion. And also the time it takes, not as long as building gas stations which take up to 2 years, SPKLU only takes a week.

The use of electrical energy for motorized vehicles is increasingly important along with increasing awareness of the environmental impacts of the use of fossil fuels. Several reasons why oil-fueled motor vehicles will be abandoned and replaced by electric vehicles. Electricity can be generated from renewable energy sources such as wind, solar and hydroelectric. This allows reducing dependence on limited fossil fuels (Pratama SD, 2024); (Darmadi D et.al, 2024); (Chakam MF,

Rakhmatulloh A, 2024). Developing a widespread and fast charging infrastructure is a major challenge that needs to be overcome. Overall, the switch from oil-fueled motor vehicles to electric vehicles is an important step towards a cleaner, more efficient and more sustainable future. Electric motors are more efficient than internal combustion engines (ICE). Most of the electrical energy is converted into motion, while in petrol or diesel engine vehicles, most of the energy is wasted as heat (Syaiful S et.al, 2023); (Prayudyanto MN et.al, 2023); (Putri EM, Herwangi Y, 2023).

RESEARCH METHODS

This research will combine Qualitative and Quantitative methods, to analyze the current situation and prospects for the development of Public Electric Vehicle Charging Stations (SPKLU) in the city of Makassar. Primary data was collected through interviews with stakeholders, including energy companies, electric vehicle manufacturers and electric vehicle owners. Researchers used qualitative data collection techniques as a basic guideline. Primary data uses interview and observation techniques, while secondary data uses descriptive analysis of various journal references, articles, reports and others.

Primary data through interviews were conducted with related parties to seek information and at the same time observe the existing SPKLU, and also electric car manufacturers. The data that has been obtained is then examined in depth and then presented and then conclusions are drawn. The conclusions drawn are then used as an analysis for future SPKLU development in the city of Makassar.

Secondary data was collected through information search and data from related articles and journals were also used as material for consideration in conducting the analysis. The information and data that has been obtained is very necessary in understanding the description of the current conditions related to the development of Public Electric Vehicle Charging Stations (SPKLU) in the city of Makassar. Where in this case in the city of Makassar, electric vehicles and SPKLU as supporting facilities are still something new for the community. So this research can also be used as an education and information campaign for the community to build acceptance of electric vehicles.

Related research on the development of electric vehicles and also Public Electric Vehicle Charging Stations (SPKLU) will indeed be more effective with interactive interviews with parties involved in managing facilities and infrastructure in that field.

Research sites

Researchers decided to research at the Public Electric Vehicle Charging Station (SPKLU) UP3 Makassar Selatan which is located at Jl. Lt. Gen. Hertasning No. 99, Bonto Makkio Village, Rappocini Makassar District.

The SPKLU which is in the yard of the South Makassar PLN UP3 Office is the second SPKLU that has been built in the city of Makassar out of the three existing and operating SPKLUs.

This SPKLU is a 50 Kwh Fast Charging type SPKLU that has been connected to the Charge.IN application from PLN. This SPKLU has been able to serve two cars at the same time in recharging with a time of 1.5 hours to 2 hours from 0-100%.

Data collection technique

Looking for articles and journals that review Public Electric Vehicle Charging Stations (SPKLU) and also data on the number of electric vehicles in the city of Makassar. Then carry out a location survey at the SPKLU point that has been built. Then conduct interviews with those who manage the SPKLU, in this case the PLN agency. And also conducted interviews with electric car manufacturers. Then analyze and process the data that has been obtained.

Data analysis

The data that has been obtained is then processed and analyzed to find out the latest specifications and location distribution of the SPKLU that already exist in Makassar City. And also to find out the distribution of data on the number of electric vehicles, especially electric cars that have been registered with Samsat Makassar.

RESULTS AND DISCUSSION

This research concerns the development of Public Electric Vehicle Charging Stations (SPKLU) in the city of Makassar, and to find out the availability of SPKLUs and how they are served.

Based on the results of research conducted by the author for ± one month at 3 SPKLU locations in the city of Makassar, the authors can present the results of observations from in-depth interviews with a number of key informants. The Key Informant in this study was Andi Nurul Fadhilah Ayu with the position of TL SARPP (Marketing and Customer Service Team Leader at the PLN UP3 Makassar South office and an electric car vehicle owner and two sales consultants from two dealers who produce and market electric cars. Informants 4 people used in this study were used as research samples. The questions asked were questions related to SPKLU and electric cars.

The following is data on electric vehicles in the city of Makassar, source: (Makassar Samsat):

Table 1. Number of Electric Vehicles in the city of Makassar

Zona	Two wheels			Four wheels		
	2021	2022	2023	2021	2022	2023
Makassar 1	16	37	42	15	34	43
Makassar 2	11	35	41	8	17	22
Total	27	72	83	23	51	65

Source: Makassar Samsat

Diagram of Electric Vehicles in Makassar City

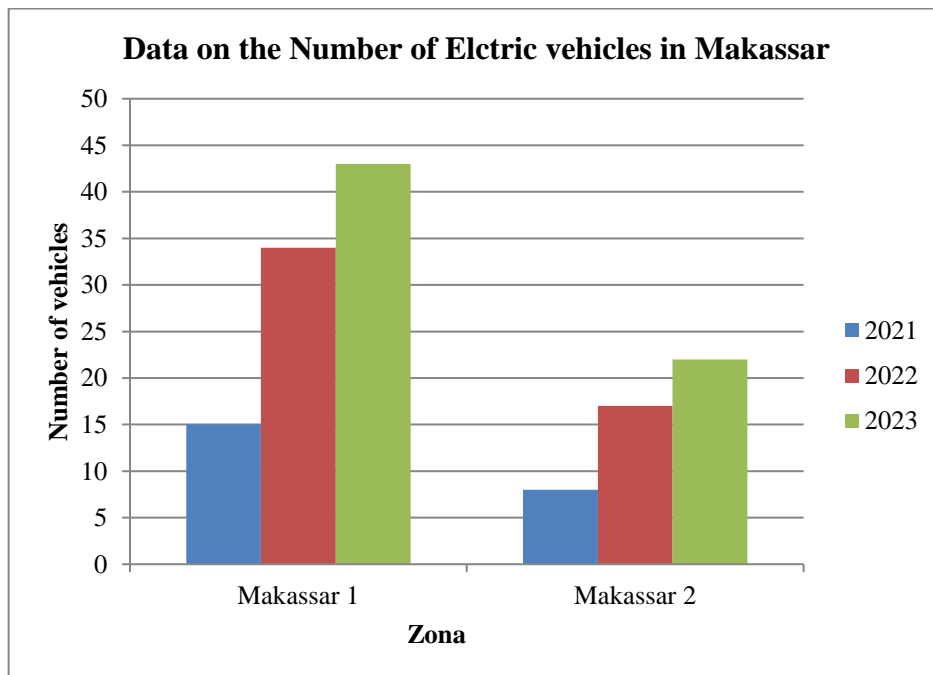


Figure 1. Diagram of Electric Vehicles in Makassar (Samsat Makassar)

From this diagram we can see that electric vehicle users in the city of Makassar, especially electric cars, continue to increase from year to year. This can be seen from the data in 2021 the number of electric cars in the Makassar 1 area is 15 vehicles, then in 2022 there will be 34 vehicles and in 2023 until the end of May there will be 43 vehicles. Whereas in the Makassar 2 area in 2021 the number of electric cars will be 8 vehicles, then in 2022 there will be 17 vehicles and in 2023 until the end of May there will be 22 vehicles.

This shows that sales of electric vehicles are increasing every year. This can happen because people are increasingly aware that electric vehicles are more efficient and environmentally friendly. The government also continues to support in increasing sales of electric vehicles, in this case the subsidy policy, namely providing incentives for every purchase of an electric vehicle. Even this year, in March the government issued a policy in the form of providing incentives for every purchase of an electric vehicle, for electric motorbikes of IDR 7 million and electric cars between IDR 25 and IDR 80 million. However, this only applies to electric vehicles that have a Domestic Local Content Level (TKDN) of 40%, for now electric cars that meet these requirements are the Hyundai Ionic 5 and Wuling Air Ev. According to the results of the interviews, both of these vehicles have experienced a significant increase in sales due to this government policy. For the Hyundai Ionic 5, 10 units have been sold in the last 1 month and the demand continues to grow, as is the case with the Wuling Air Ev car, sales have continued to increase in recent months, with incentives from the government for every purchase of an electric vehicle unit.

SPKLU PLN UP3 South Makassar

Table 2. Data on the Number of Vehicles and Kwh Usage

Month	Number of vehicles		Using Kwh	
	2022	2023	2022	2023
January	5	22	95	228
February	9	19	122	197
March	12	24	134	232
April	11	23	127	246
May	15	25	145	239
June	14		151	
July	16		135	
August	18		142	
September	17		167	
October	19		158	
November	15		145	
December	21		172	
Total	172	113	1693	1142

Source: PLN UP3 South Makassar.

Diagram of Vehicle Users at Spklu Up3 South Makassar

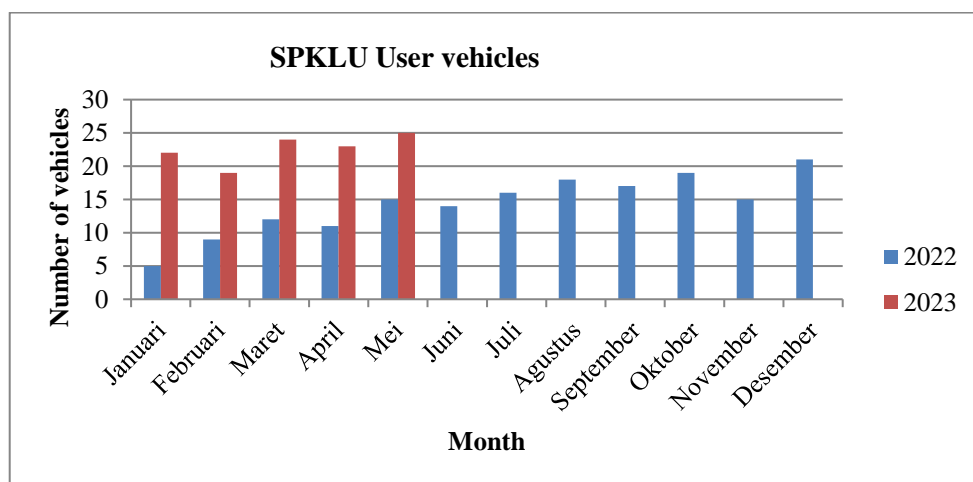


Figure 2. Diagram of vehicle users in the South Makassar PLN UP3 SPKLU (PLN UP3 Makassar Selatan).

From the diagram above, it can be seen that the graph of electric car users at SPKLU UP3 Makassar Selatan, since January 2022 has fluctuated up and down, although it fluctuated but remained stable, moving up until May 2023. Electric car users at SPKLU don't look much different when compared to electric car users at SPKLU ULP Mattoanging, which operates 7 months earlier than SPKLU UP3 Makassar Selatan. This SPKLU is of the Fast Charging type and has a power of 50 Kwh which is higher than the ULP Mattoanging SPKLU which is of the Medium Charging type with a power of 25 Kwh. With the Fast Charging type, it will save more time in recharging the electric car battery than the Medium Charging type.

Diagram of Kwh Usage at Pln Up3 Spklu, South Makassar

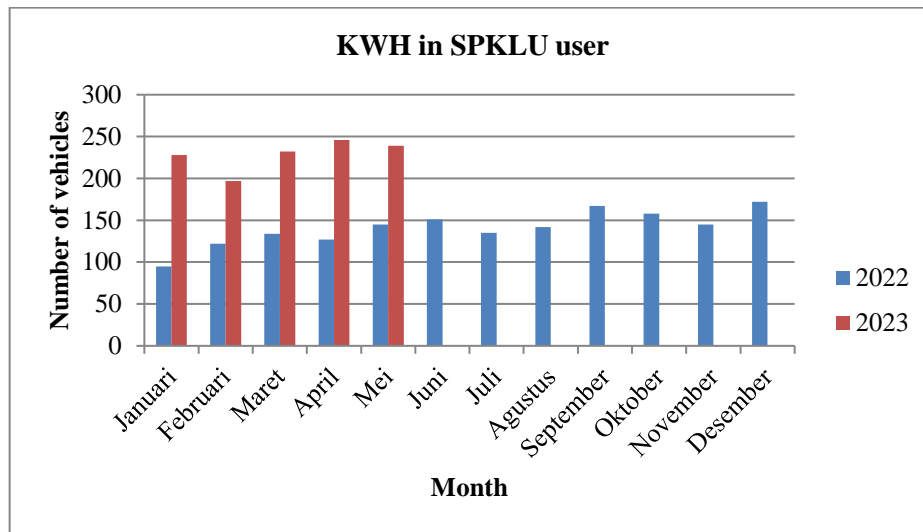


Figure 3. Diagram of Kwh Usage in SPKLU PLN UP3 South Makassar (PLN UP3 Makassar Selatan)

From the diagram above, you can see the graph of the kwh usage of electric car users in the SPKLU has fluctuated up and down since January 2022 but has remained stable going up until May 2023. The average Kwh usage of electric cars in this SPKLU is lower than in SPKLU ULP Mattoanging.

From the two diagrams above, it can be seen that the use of SPKLU in the last three years in recharging electric vehicle batteries has increased from year to year. This increase in the last few months has continued, along with the increasing number of electric vehicle users in the city of Makassar. People are increasingly interested in or switching to using electric vehicles since the government has given incentives for every purchase of an electric vehicle.

The SPKLU is expected to make it easier for electric vehicle users to recharge their electric vehicle batteries. Where in recharging the vehicle battery the charging time is much faster than charging at home.

As seen in Mattoanging's PLN ULP SPKLU there has been an increase in the use of SPKLU from year to year since it was established in June 2021. The medium charging type SPKLU has a power of 25 kwh, which means that in one hour it can charge 25 kilowatts. Likewise with the SPKLU PLN UP3 South Makassar there is also an increase every year, even in the last 5 months the increase has been 2 times the previous months. This SPKLU is of the fast charging type which has a power of 50 kwh, which means that in 1 hour it can charge 50 kilowatts.

From the data, it can be seen that the average electric car vehicle user recharges their vehicle's battery on average in January 2023 at the SPKLU UP3 Makassar Selatan by 10 kilowatts, which means the charging time is between 15 minutes and 30 minutes.

Here's an example of the calculation:

Number of kWh usage in SPKLU UP3 South Makassar:

Number of vehicles in January 2023 = 22 vehicles

Total kwh usage in January 2023 = 228 kwh

Then the number of average kwh usage of the vehicle = $\frac{\text{number of kWh usage}}{\text{number of vehicles}}$

The average number of kwh usage in January 2023 from vehicles = $\frac{228}{22}$
= 10,36 kilowatts

SPKLU power 25 kwh (kilowatt/hour) = 25 kilowatts/hour (60 minutes)

SPKLU power 50 kwh (kilowatt/hour) = 50 kilowatts/hour (60 minutes)

SPKLU charging time of 25 kwh = $\frac{\text{number of kWh usage}}{\text{SPKLU power}} \times 60 \text{ minutes}$
= $\frac{10}{25} \times 60 \text{ minutes} = 24 \text{ minutes}$

SPKLU charging time of 50 kwh = $\frac{10}{50} \times 60 \text{ minutes} = 12 \text{ minutes}$

The greater the power of an SPKLU, the less time it takes to recharge the electric vehicle battery. Apart from being environmentally friendly, this electric vehicle is also very economical in use. By filling 10 kwh at SPKLU, it will only cost Rp. 24,475 at a price of Rp. 2,475 for 1 kwh. This does not include tax and administrative costs. By filling in 10 kwh it can cover a distance of approximately 9.7 km. Meanwhile, if we recharge it at home, it is even cheaper at a cost of Rp. 1,699 per kwh, but it will take longer, because it uses much lower power than at SPKLU.

Based on data, SPKLU in Makassar is only in 3 sub-districts, namely:

1. SPKLU PLN ULP (25 Kw) Mattoanging which is located at Jl. Monginsidi No.2, Maricayya Baru Village, Makassar District.
2. SPKLU PLN UP3 (50 Kw) South Makassar which is located at Jl. Letjen Hertasning No.99, Bonto Makkio Village, Rappocini District.
3. SPKLU OFFICE OF THE GOVERNOR OF SUL-SEL (50 Kw) which is located at. Jl. Urip Sumharjo, Panaikang Village, Panakukang District.

Makassar Region 1 which includes the Districts: Makassar, Mamajang, Mariso, Rappocini, Tallo, Tamalate, Ujung Pandang, Ujung Tanah, Wajo, and Sangkarrang where based on data there have been 95 units of 2-wheeled electric vehicles and 92 units of 4-wheeled electric vehicles. Makassar 2 which includes the Districts of: Biringkanayya, Bontoala, Manggala, Panakukang, and Tamalanrea where based on data there have been 87 units of 2-wheeled electric vehicles and 47 units of 4-wheeled electric vehicles.

The following are several large and strategic Mall locations that can become locations for the development of SPKLU placement in the city of Makassar, namely:

1. Mall Nipah, this mall is located on Jl. Urip Sumoharjo No. 23 C Panakukang District is the largest mall in Makassar, which is a center for shops and offices.
2. Panakukang Mall, this mall is located on Jl. Bolevard No.3 Panakukang District is a strategic area that is densely populated and has offices. This mall is connected to Myko Hotel, Swiss Bellinn and Panakukang Square.
3. Ratuh Indah Mall, this mall is located on Jl. Dr. Sam Ratulangi No.35 Mamajang District is the center of Makassar city which is strategically connected to Hotel Sahid Makassar
4. Trans Studio Mall, this mall is located on Jl. Metro Tanjung Bunga, Tamalate District, is a mall as well as an indoor amusement park.

5. Mtos Mall, this mall is located on Jl. Perintis Kemerdekaan No.26 Kecamatan Tamalarea is a strategically located mall that is passed by various public transportation routes and is close to various campuses.

Location map of some of the biggest malls in the city of Makassar

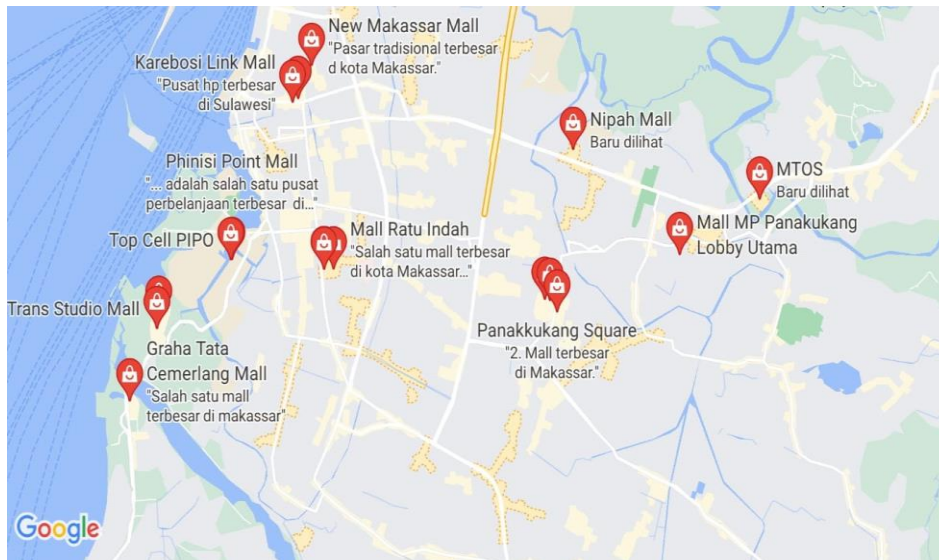


Figure 4. Map of Mall Locations in Makassar Source: Google map

CONCLUSION

Based on the results of research on the development of SPKLU in Makassar city based on the results of interviews and observations and analysis of various related journal and article references, it can be concluded as follows: 1) SPKLU in Makassar city is still sufficient in meeting the needs of electric vehicle users in recharging the vehicle battery, 2) With the CHARGE.IN application that has been made by PLN it is very helpful and simplifies the process of charging batteries both at home and through SPKLU, including making it easier to find the nearest SPKLU location, determining the amount of power and the payment process, 3) SPKLU in Makassar now, among others, has a power of 25 Kw to 50 Kw, which means the charging process takes from 0-100% between 1.5 hours - 4 hours, 4) The existing SPKLU is temporarily still at the PLN office and the government office, namely the South Sulawesi Governor's office . But in the future it will also be built in malls and rest areas.

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