Proposal for a Quick Pilot on EV Charging Infrastructure

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EXECUTIVE SUMMARY

Proposal for a Quick Pilot on EV Charging Infrastructure

The objective of this proposal is to provide a structure for EV charging infrastructure rollout in the Gurgaon-IGI-South Delhi-Noida corridor. This proposalis expected to make the actual rollout easier and faster and serve as a pilot study for deployment. The proposal (supported by the planning tool) is based on a five-step process; 1) kickoff, 2) formation of "master list" of locations, 3) streamlining and timing, 4) documentation and 5) wrap-up. The planning was done is five separate sub-plans of which four were based on the type of collaborating organizations and one (IGI airport) on a geographical location.

The plan for the corridor includes 55 locations with 135 charging stations of which 46 are DC quick charging stations and 89 are slower AC charging stations. Theactual deployment will rely on co-operation with state governments, selected government authorities, Ministry of Power, gridcompanies as well as some private enterprises (e.g. DIAL at IGI, DLF Mall).

The plan includes a deployment timeline with first installations in November 2017 and completion in June 2018 (tentative timelines). Additional locations have also beenidentified for the next phase of adoption.

The proposal includes a large number of stations especially in the South Delhi area where the likely use is higher and traffic more congested. The scope of planning includes the Gurgaon-IGI-South Delhi-Noida corridor. The scope can however be expanded via a new project. Thefollowing issues need to be address to create charging infrastructure:

1. Standardization for charging stations in India
2. Governmental support for rollout
3. Regulatory issues on safety
4. Availability of electricity at sufficient level in the planned locations

The planning can assist in the deployment of EV charging stations in India. Further expansion toother cities in India could be explored based on the experiences from this "Quick pilot"

1. Introduction

This proposal describes the results of the work done for planning the EV charginginfrastructure rollout in the urban corridor of Gurgaon-IGI airport-South Delhi-Noida.Planning for broader range of users and geographical scope can be undertakenas an extension of this plan at a later date when needed.

1.1. Targets of the Work

The plan described in this document is intended to reflect as practical conditions as possible and provide a realistic plan for rolling out EVcharginginfrastructure in these parts of Delhi. In addition to this it has been done to:

- illustrate the scope and advantages of the planning process and tool for the overall EV charging infrastructure rollout
- create a basis for a discussion on how to continue the work in India to scale up the deployment of EV charging infrastructure and thus EV adoption.

While the rollout of the EV charginginfrastructure for the whole of India is a huge task and it is impossible to predict what that will ultimately entail and how the deployment will happen, this work has been focusing on the amount and type of infrastructure required to get that process started within a very specific geographic area.

1.2. Timeline of the Project

The "Quick Pilot" was started in early September and in the first phase the planning tool was customised, background information collected and most importantly the scope of the trial was agreed.

Based on this information material was prepared for the kickoff meeting and additional information was collected on major roads, intersections, Delhi geography and outline of the IGI airport to prepare for the planning exercise.

The wrap-up meeting to complete the project was held on 25th of September 2017 and the findings were reviewed with the whole team from NITI Aayog and AC2SG Software.

1.3. Tools and Methodology (details about tool)

The work was based on AC2SG Software planning methodology and supported with a planning tool developed by AC2SG Software specifically for this purpose. The methodology aims at identifying good locations for charging stations based on traffic patterns, parking and time-based factors such as commuting and residential parking. All possible locations are documented in the tool and then the most suitable locations are selected based on geographical coverage and estimated capacity.

The planning tool supports the methodology by allowing the work to be broken into smaller parts (so called sub-plans), storing the data in an electronic format and by displaying relevant background information in the tool's map-based user interface. The tool could also be used to display information on traffic density and grid capacity to support the choice of the sites into the plan.

2. The Planning Process

Planning of EV charging infrastructure needs to take into account multiple issues that often appear to be contradictory. Therefore the plan is a compromise that is attempting to find a balance between the various parameters and issues. Examples of such issues are:

- number of charging stations needed and their locations
- availability of sites for the charging stations
- type of charging station needed at each location
- rules and regulations relevant for the deployment
- availability of electrical grid capacity
- timing of the rollout
- dealing with possible changes in the plan

The planning was done for 9-12 months more accurately by identifying potential locations with an approximate timeline. If the EV adoption happens more quickly than anticipated, then the timeline for the construction is adjusted and deployment accelerated.

The overall targets for the planning outlined in the kick-off meetingare as follows:

- create sufficient public EV charging station network to enable EV rollout
- cover a multitude of user needs with the EV charging infrastructure
- support cost-efficient and timely rollout of the EV charging infrastructure that allows complementary private investments
- create sufficient capacity and geographical coverage for the first users in 2018

As the targets indicate, the plan and the process are intended to improve the understanding of the issues and challenges in the implementation process. It should be noted that while the plan is based on user needs and technical solutions to create the necessary services for the users, the plan will also create the basis for the following tasks that are fundamentally important for the charging station deployment:

- budgeting for the deployment of the EV charginginfrastructure and installation
- discussions with stakeholders and partners on rollout
- further location planning for grid capacity, ease of construction and possible impediments to traffic

The proposal was created in a stepwise manner with the support of AC2SG Software's planning tool. The tool is especially helpful in breaking down the full plan into smaller sub-plans that can look at a specific area or use case. The overall planning process has five major steps:

1. Clarification of requirements and guidelines for the infrastructure
2. Creation of a "long list" of likely and potential charging station locations within the geographic area
3. Streamlining this "long list" to a smaller number of sites as a consistent plan and estimating the timing of deployment for each site
4. Documenting the finalized plan and cross-checking it for consistency
5. Wrap-up and feedback collection

The first task was performed with NITI Aayog in the kickoff meeting. The creation of a "masterlist" of charging station locations was performed by AC2SG Software after the kickoff in some cases via site visits and travel, but most importantly using the planning tool complemented by other IT tools such as Google Maps and other search engines. AC2SG Software also performed the import of some Points of Interest (POI) data on Indian Oil LPG station locations and McDonald's restaurants within the Delhi area.

The streamlining was carried out by AC2SG Software after an interim review of results. The timelines for the deployment for each charging unit were reviewed and some new locations were added. In addition to this the geographic scope of the planned first phase rollout was reviewed and stations deemed unnecessary in the short term were moved to year 2019 for implementation.

3. Summary of the Plan

This section of the document describes the first approved version of the plan after streamlining and reviewing. It should be noted that the plan should not be considered to be a static plan, but it should evolve as the discussions with the partners and collaborators proceed and decisions on implementation timelines are confirmed.

3.1. Sub-Plans

In order to manage the full plan it was broken into five separate sub-plans. These sub-plans are mainly based on the ownership of the sites and ease of access to help with the deployment. The sub-plans are:

- government locations
- governmental authorities (e.g. Highway Authority)
- government owned companies
- IGI airport
- private locations

These sub-plans are slightly overlapping e.g. the charging units at the IGI airport have been included in this sub-plan regardless of the ownership of the EV charging station. Each sub-plan has a set of charging stations for the "first wave" (until June 2018) as well as a set of charging stations for the "second wave" starting (January 2019).These are tentative timelines. However, these periods will again depend upon adoption. The gap in the timeline between these two "waves" is intended to be a stabilization period during which the use of the charging stations can be measured and analyzed for deciding on further actions.

3.2. Parameters and Assumptions

The proposalis based on a set of assumptions about the capabilities of the EVs and the behavior of the users. The key ones are listed below:

- Delhi traffic is slow-moving and prone to congestion, therefore the EV charging network needs to be relatively dense. This was dealt with by using a 3 km coverage radius for the quick charging stations and a 1 km radius for the slow charging units.

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- Daily driving distance in the Delhi region is around 100 km. This means that one or two charging sessions are needed for the car per day (to maintain enough range in the car). In case residential charging is available, the charging could fully happen overnight.

These assumptions are the basis for the geographical coverage planning and ensuring that sufficient coverage is available throughout the selected pilot area. These assumptions can be changed later on in case practical user data is available and the data clearly indicates that these assumptions are misleading.

3.3. Numbers and Timelines

In its current format the full plan includes the following number of charging stations in the "first wave" rollout:

- 42 DC quick charging stations
- 93 AC slow charging stations

Altogether there are 135 charging stations and these are in 55 different locations within the "Quick pilot" focus area. Most of the locations are such that security and access to the charging stations can be managed and therefore parking enforcement, availability issues and vandalism are minor issues at this stage. These will become more important as public charging stations are built.
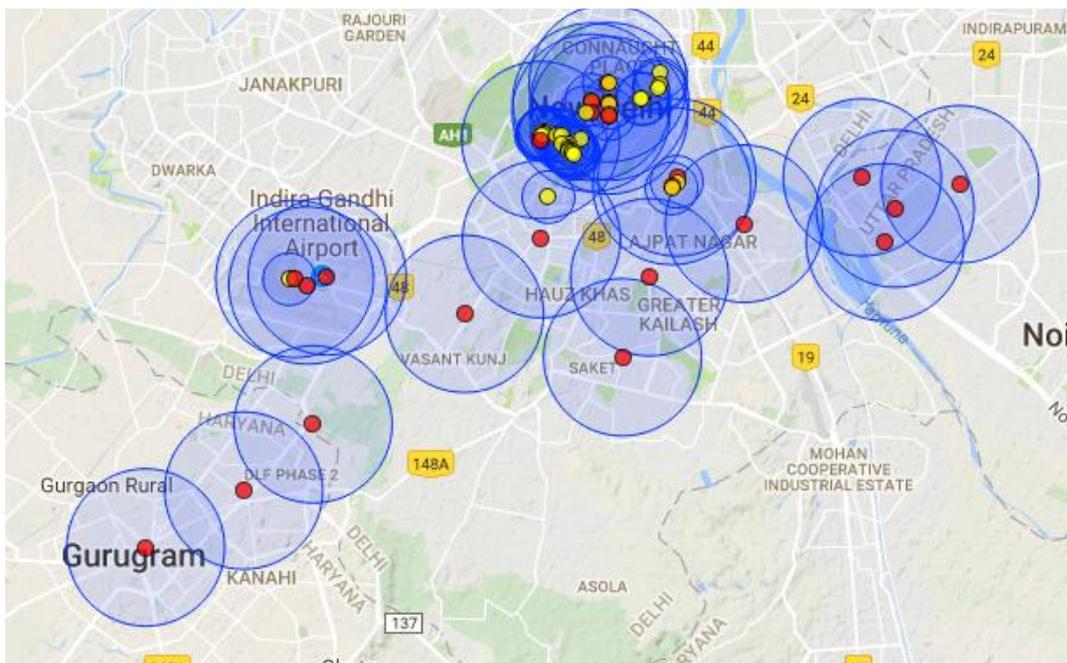

Figure 1: Geographical Representation of the Full Network ("first wave")

The map above depicts the locations of the charging stations, there are 55 locations in the map (notation: yellow = AC 1 phase, orange = AC 3 phase and red = DC). Each location has typically more than one charging station, especially in the case of AC charging stations that charge the EV slower. While the entire geographical area is well covered and the distances between the stations are not very long, there is an evenhigher density of charging stations in south Delhi. This is

necessary for two reasons: 1) there are likely to be more users in the south Delhi area and 2) the traffic is more congested in the central parts of Delhi.
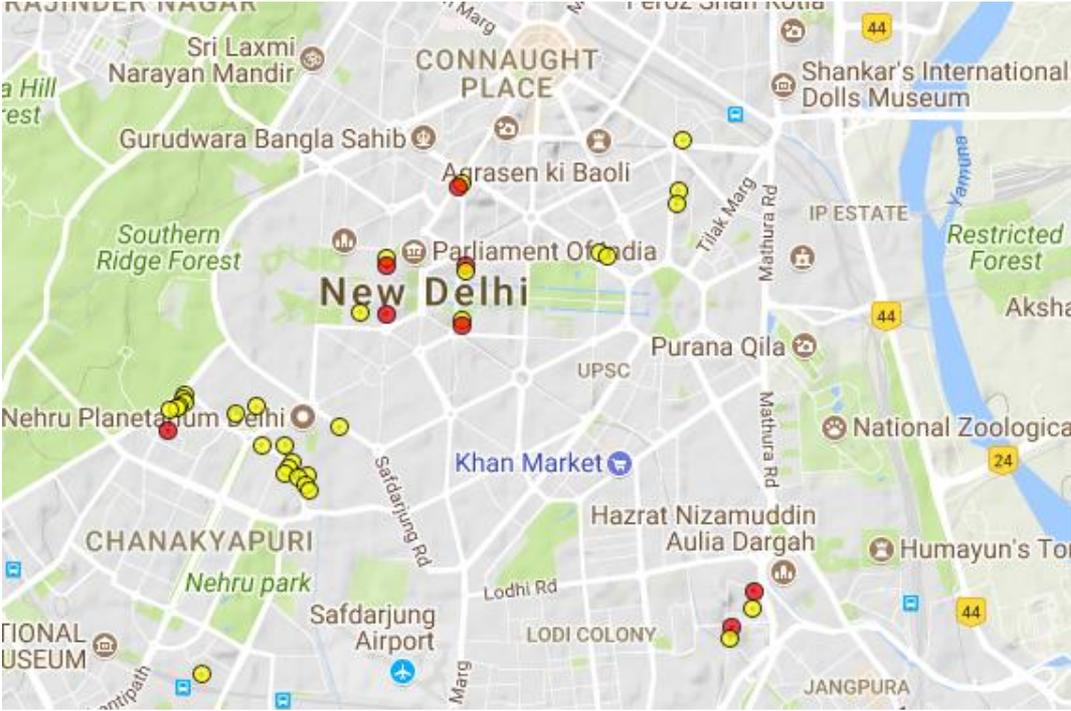

Figure 2: South Delhi Area (no geographical coverage indicated)

The charging station network near the key governmental buildings is very dense and is a mix of slow and quick charging stations. The slow charging stations are meant to gather information on residential charging as well as on the use of slow chargers at places of employment.The deployment timeline starts with the first chargers planned for installation in November 2017 at NITI Aayog.

4. Key Findings

Although the "Quick pilot" was done within a limited geographical scope and time, there are some findings that can be pointed out with regards to the planning process and deployment issues overall. These are briefly summarized below.

4.1. Availability of Sites

There are some locations in the proposal that are accessible to the general public, these are especially the locations in the IGI airport area and the locations in commercial shopping malls.

4.2. Organizations that need to be involved

One of the key issues to assess is the number organizations that need to be involved in the deployment. The more organizations, the slower the overall progress in the typical case. Therefore the planning process was done in such a way that the number of organizations was kept at a reasonable level while at the same time ensuring that the coverage is broad enough.

Additionally the choice of the organizations was done in such a way that they have an interest in using or deploying the EV charging stations, ideally both.

In the first wave of the plan there are 10 organizations that are planned to have charging stations at their premises. These organizations are:

- NITI Aayog
- Indian government (e.g. North and South Block, NirmanBhawan, UdyogBhawan)
- Government companies: GAIL, NTPC, Rural Electrification Corporation, Indian Oil, India Post
- IGI airport (optional, requires a discussion with DIAL)
- DLF Mall (optional, requires discussion with the property owner)
- National Highway Authority of India , Airports Authority of India

An adequate geographical coverage was possible to be planned with this number for the first wave of installations. In addition to these organizations, the power utilities need to be involved in the discussions to ensure that adequate grid capacity exists in the planned locations as the plan is utilized in the implementation phase.

4.3. Choice of Charging Station Type

The current version of the plan uses three basic types of charging stations, two DC variantsand one AC variant. The plan has been designed in such a way that the type is appropriate for the planned location and use. Some further work is needed on this and thus the type may change at the time of implementation.

It should be noted that the plan itself is not dependent on the choice of EV charging station standards in India and the plan is also manufacturer-neutral. However, the deployment timescales are going to be affected by the availability (or rather unavailability) of the right types of charging stations for deployment. This has not been taken into account in the planning.

5. Issues to Be Addressed

While the planning itself has been completed there are a few issues that are relevant to be considered as implementation proceeds in the near future. While AC2SG Software does not have detailed information on the timelines for the implementation the underlying assumption for these comments is that the rollout should start as soon as possible and should expand to other cities and locations as quickly as possible.

5.1. Standardization

Although the plan is neutral in terms of standardization, the standardization decisions will have an impact on the implementation timelines. Although EV charging equipment is available in the market, but investments are difficult when clarity on standards is missing.

Largely the standardization is not a question of technical capabilities or features, but more a question of market policies and openness. In Europe the EV charging equipment is moving towards CCS Combo with multiple automakers supporting this. Increasingly US and Korean automakers are using CCS, while Japan follows CHAdeMOand China follows GB/T standards.

5.2. Discussions with Stakeholders and Partners

While this plan does not cover the full geographical area of Delhi, it is possible to approach the key stakeholders with the plan and ask for feedback. At minimum discussions with the grid companies in this area are relevant to evaluate whether there are major issues with the planned implementation.

Discussions with public stakeholders and companies may be easier to conduct, therefore it might be wise to start with these companies. With regards to the private companies more thought is needed on the proposed model and possible support of private investments with subsidies. The private companies should be approached with a win-win scenario, e.g. increase in customer loyalty, new attraction for EV users or additional sales through investment in EV charging stations.

5.3. Related Regulation

The construction of EV charging stations requires adequate and safe sites as well as an electric feed. In most cases with public charging stations the impact on traffic needs to be considered, but in this "Quick Pilot" this is not an issue since all charging stations are at government properties, parking lots or garages. The one exception of this is the DC charging station at the IGI airport outside the parking structure.

The availability of sites is a challenging issue in typical Indian urban environments. Construction of EV charging station requires space mainly due to the space needed for the cars themselves while they are being charged. Also a typical problem in Western Europe is non-EVs using the parking spaces reserved for EV charging. These issues should be considered beforehand and regulations for this should be developed in order to ensure that officials in the cities and states do not need to develop these from scratch. The more universal the markings, conventions and regulations are, the easier it is for people to adopt the use of an EV.

Safety issues appear especially with electrical feeds into the public charging stations as well as with charging stations that are located near petrol pumps and other flammable materials. The feeders of electricity into especially DC charging stations (3*100A) are very powerful, therefore the construction work should be done thoroughly especially for ground-mounted units. While the risk of a spark is minimal, the regulations for the construction in the vicinity of petrol pumps should be reviewed prior to EV charging station rollout to these locations.

Electricity sales regulation also complicates things further and limits the amount of companies that could potentially offer EV charging services.

6. Conclusions

This proposal presents a plan for building an EV charging station network in the Gurgaon-IGI-South Delhi-Noida corridor.

The deployment timeline for the "first wave" of these charging stations starts in November 2017which is very aggressive but at the same time it reflects the importance of moving forward with the infrastructure deployment in a speedy manner. In order to proceed with the deployment a number of issues needs need to be worked out, most importantly the decisions on standardization of the charging technologies for the Indian market.

In terms of getting access to the sites, the deployment plan relies on co-operation with four key groups of organizations in addition to the central government: 1) State organizations (in Delhi), 2) Government-owned companies 3) Government authorities and 4) Private companies. Discussions with these groups are needed to ensure a smooth rollout. Policy decisions on the (possible) governmental financial support for this rollout need to be made for the dialogue with the stakeholder organizations. Additionally, discussions with the power utilities in the Delhi area are needed to ensure that sufficient electricity capacity is available in these locations.

This plan has been prepared with as much effort and expertise as possible in this short time, it is likely that further optimization and modification could be performed with more time. However, ideally a plan should be constructed for the entirety of Delhi NCR or any other city or region to have a full plan on the rollout.

It should also be noted that the planned rollout may be affected by unforeseen circumstances and therefore the ideal rollout and numbers cannot be achieved within the tight timelines. Issues that may affect the numbers are for example access to sites, building permissions and grid capacity.