

Checklist for Engaging on Fleet Electrification

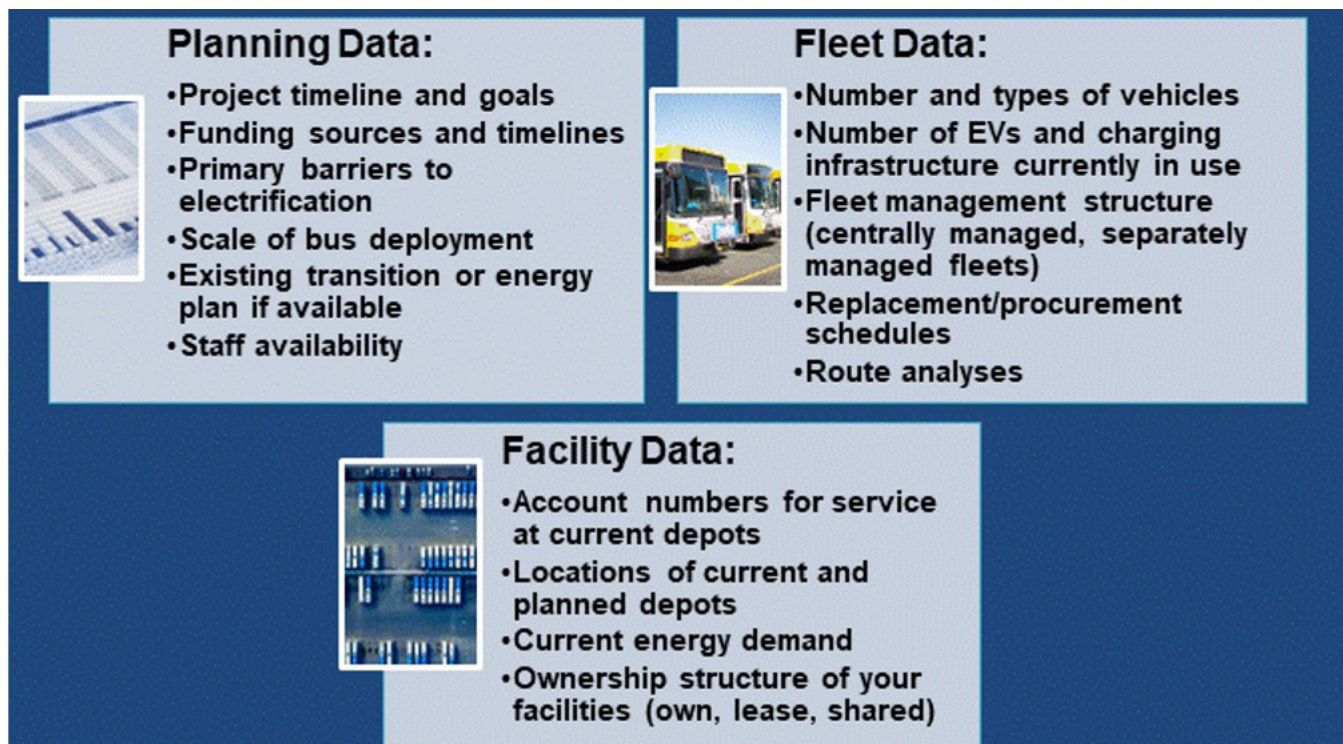
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As any transit agency that has been through the process of battery-electric bus deployment will tell you, the first, middle, and last step is to engage with your electric company. Before you order buses or charging infrastructure, write the fleet transition or sustainability plans, or explore which routes to electrify, you should first reach out to your electric company. But what specifically do you need to talk to the electric company about? This guide is intended to provide transit agencies with a clear idea of what they need to know to begin to form a partnership with their electric company, whether that be for a pilot project for a few buses or embarking on full electrification.

Electric companies are going to be one of your closest partners when it comes to bus fleet electrification and they can be a source of support during planning and implementation of your electrification strategy. Indeed, if you apply for funding from the federal Low and No-Emission Bus program, you will be required to submit a fleet transition plan that includes a description of your “partnership with the utility or alternative fuel provider.” Your electric company can also help you develop, or can sign off on, the transition plan. To help you establish a successful collaboration with your electric company, this guide provides a simple **checklist of the information you should gather to help them understand your plans and operations, and a set of questions that you should ask.**

The **checklist** covers three major areas where your electric company will need information in order to support your efforts: project planning, fleet information, and facility information (see Figure 1).

Figure 1. Information to Have When Engaging with Your Electric Company



The checklist and set of questions can be used as a starting point for agencies just beginning their electrification process or as a way for agencies who have already begun to electrify to double-check that they have covered their bases.

If you do not have all of the information identified in the checklist, **estimates are fine**. If you are using this as a starting point to electrification, it is understood that you may not have detailed information on hand. It is still a valuable exercise to consider all the items needed and come up with even broad estimates, as all these items will help your electric company work with you to optimize infrastructure plans.

Keep in mind that this is just the beginning of the process and, while this exercise will help answer many questions, we expect that it will generate many more. By establishing a close relationship with your electric company, you can address those additional questions together using the information you have gathered by following this document.

Our goal for this guide is to provide a clear starting point for what is involved in electrifying your fleet and break down the complex process of fleet electrification into discrete, manageable steps. We have included a primer on electric company terminology that you will come across during the electrification process. Following the checklist, you will find a more detailed explanation of why the information identified is important to creating a solid foundation for your relationship with your electric company and for your electrification process overall. There are also many good resources available that can help you understand in greater detail the options available to transit agencies for different electrification technologies and strategies such as the TCRP's [Guidebook for Deploying Zero-Emission Transit Buses from the Transportation Cooperative Research Program](#).

CHECKLIST FOR BEGINNING FLEET ELECTRIFICATION DISCUSSIONS WITH YOUR ELECTRIC COMPANY

REMINDER: ESTIMATES ARE FINE SINCE YOU MAY NOT HAVE ALL THIS INFORMATION YET

PLANNING DATA

- Agency fleet electrification, zero emission transition, or sustainability plans
- Short and long-term goals for your bus fleet electrification i.e., number of buses or percentage of the fleet you plan to electrify and expected timeline
- Funding sources for your project, when funding will be received, and any conditions on that funding
- Primary barriers and concerns for electrification of your fleet
- Internal staffing plan for fleet electrification project along with primary points of contact and descriptions of their roles in your organization. This list will vary by agency, but will likely include representatives from: IT, facilities, finance, operations, planning, maintenance, purchasing/procurement, legal, and union representatives
- A contact list for relevant individuals outside of your organization including any grant writers you may have used, representatives from your bus OEMs, representatives from your charging equipment OEMs, your leasing agent if you lease your land or facilities, and any third-party consultants or engineers you have hired for this process

FLEET DATA

- The number of buses in your fleet by size
- The number of auxiliary vehicles owned by your agency such as work trucks or sedans
- How those fleets are managed and points of contact for each fleet if there are multiple
- Replacement schedules for current buses
- Any route analyses you have completed; if you are working with a consultant or other third party on the planning, please have them forward their analyses
- A schedule of when buses are parked/serviced
- Any information on battery buses currently in your fleet including size, manufacturer, battery size (in kWh), and how they are charged
- If you have any battery buses on order: the number of buses, the manufacturer, the size of the buses, the battery size (in kWh), what types of charging they are equipped for (e.g., plug in, overhead, etc.), the expected delivery date, and the planned service date

- Any other procurement plans for battery buses over the next 36 months or the details of any battery bus RFPs you are developing

FACILITY DATA

- Location of all fleet depots along with facility diagrams if available
- Account numbers for existing electrical service
- Current electrical load at those facilities
- Ownership structure of your facilities – do you own or lease?
- If vehicles are parked inside or outside
- Plans to update or expand your facilities and in what timeframe
- Current charging infrastructure installed and total kW rating
- Types of charging planned for future electric bus deployments: number of chargers by type (AC, DC, overhead, or on-route), total kW for all chargers at the facility, and kW rating for each charger
- Charging strategy for your buses (overnight, staggered, on-route, etc.)

QUESTIONS FOR YOUR ELECTRIC COMPANY

- Do they have any available programs or EV specific rate offerings?
- Can they provide estimated timelines for major site or grid upgrades including lead times for equipment like transformers and switchgear?
- What is the availability of the correct phase/voltage of electric service needed for DC fast charging at your facilities?
- Can they provide existing power capacity estimates at facility sites?
- What are the space requirements for electric company equipment?
- Can they provide approximate cost estimates for equipment and construction?
- Can they provide a breakdown of who is responsible for what equipment and potential ownership and maintenance models for that equipment?
- Can they provide reliability reports for your facilities?
- Do they have eligible equipment lists or equipment recommendations?
- What are typical response and repair times for maintenance of grid infrastructure?
- Is redundant service available for resiliency planning?

- Where are our transformers located and where would additional ones need to be placed?
- Do they have an outline of steps that are needed before an electric company can start construction and timelines for each?

ELECTRIC COMPANY TERMINOLOGY 101

- **Transformer** – a piece of electrical equipment that can increase or decrease the voltage of electricity. Electricity traveling through overhead lines is generally high voltage and requires a transformer to convert the electricity to a lower voltage for residential or commercial use.
- **Switchgear** – equipment composed of a series of disconnect switches, fuses, or circuit breakers used to control, protect, and isolate electrical equipment.
- **Single Phase Power** – carried by one line at low power levels. Single phase power is insufficient for large sources of electric demand and would not support the needs of a fleet electrification project.
- **Three Phase Power** – carried by three lines at high power levels. Three phase power is necessary for the level of power required for bus charging.
- **Alternating Current (AC)** – The type of power used in homes and businesses. AC can be converted into DC via a converter.
- **Direct Current (DC)** – The type of power used in batteries and electric motors. To charge the large batteries used in buses, the AC power from the electric company must be converted into DC. For DC fast chargers, this conversion happens inside the charging station, while buses that utilize high-powered AC chargers convert AC into DC via a large onboard converter.
- **Kilowatt (kW)** – the amount of electrical power being delivered. Watts are determined by multiplying voltage and amperage together. Charging infrastructure power is measured by the maximum kW it can deliver into a battery.
- **Kilowatt-hour (kWh)** – the amount of electrical energy delivered by applying one kilowatt for one hour. Kilowatt-hour is the unit of measure for battery size and determines how much energy can be stored in a bus's battery.
- **Voltage** – voltage determines the strength of electrical current. The higher the voltage, the more load in terms of kW can be supported. Typical residential and commercial buildings use 110 –220 volt (V) circuits. DC fast chargers require at least a 400V circuit while Level 2 chargers can use a 220V circuit.
- **Amps** – Amps measure the current in an electric wire, or the “flow rate” of electricity. Amperage determines the amount of electricity a wire can deliver. Higher currents require thicker, more expensive cables. DC fast chargers require a circuit of at least 100 amps. Level 2 chargers can use circuits of between 20 and 80 amps.
- **Demand Charge** – a portion of the electric bill that reflects the cost of the electric infrastructure necessary to serve a customer's peak demand or the maximum amount of kW a customer is using at a given time. Demand charges are usually determined by multiplying a set dollar per kilowatt figure by the maximum amount of kilowatts being used ($\$/kw \times \text{peak kW demand}$).
- **DC Fast Charger** – a DC Fast charger is currently capable of delivering up to 450 kW of power to vehicles and potentially more than one megawatt of power. These chargers typically require significant electrical infrastructure installation including transformers and switchgear. DC Fast Chargers for buses can either be a ground mounted plug-in charger or can utilize overhead conductive catenary systems. Level 2 chargers are another type of charger, but these deliver only up to 19.2 kW of power and are insufficient for charging a bus.

DISCUSSION OF KEY INFORMATION-SHARING ITEMS BETWEEN TRANSIT AGENCIES AND ELECTRIC COMPANIES

In the pages below, we discuss in more detail the elements laid out in the checklist and set of questions.

Project Planning Information

The most important information you can gather when first reaching out to your electric company is information on the scale, timeline, and ultimate goals of your fleet electrification process. This information will help your electric company partners understand the amount of resources they will need to dedicate to the process and where they can help fill in gaps. There is a significant difference in time and effort between electrifying a few buses and embarking on a process to fully electrify your fleet. Note, though, that your electric company partners are able to help you navigate projects of all sizes, small, medium or large.

Telling your electric company what your ultimate goal is and how long you intend the project to take (e.g., fully electric by 2040) will immediately begin a productive conversation about what resources will be required and when. Your electric company partners can also help you fill in any gaps you may have in planning. You are likely not the only fleet in their service territory who is going through this process, and there is ample opportunity to learn from others. Speaking about your goals and expected timeline will allow for level setting around what is possible within your specified timeframe and how your electric company partners can help achieve those goals. Once a baseline is established, planning around the details can begin.

The next step is to identify your funding sources and timelines for the project. Are you relying on federal funding like a Low-No grant? What about other sources of funding for the project? Resources like [EEI's EV Program Database](#) or [U.S. Department of Energy Alternative Fuel Data Center's Laws and Incentives database](#) can point you to other potential funding or other program support from your state or electric company. The amount of public and private funding for fleet electrification has never been higher and reviewing all potential sources could provide millions in additional support. Be aware of how the timelines for your funding sources align with your project plan and if there will be any potential interruption. For example, are you relying on separate sources of funding for the buses and infrastructure and, if so, what are the risks involved in that approach in terms of timing of delivery?

This is also an opportunity to share any agency Sustainability Plan or Fleet Transition Plan that you may have with your electric company and review the details of those plans and how they align with this project. If this project is part of a broader plan to transition your fleet not only to electric buses but also renewable energy, then there is an opportunity to accomplish several initiatives at once. If you plan to utilize onsite generation or battery storage, that should be shared with your electric company so that they can dedicate the proper resources to your fleet transition. There may be additional funding sources for onsite generation or battery storage that are separate from bus or charging infrastructure funding. There can be different planning groups within your electric company and sharing this information will help your electric company build the proper internal team to support you.

Finally, you should have a clear idea of your internal staffing for battery bus planning and rollout – do you have an overall transition manager, what is the size of your transition team, and how much staff time will you allocate to this project? A fleet electrification project will likely involve nearly every department within your agency, and you should make sure you have identified points of contact for each. While smaller agencies may not have a separate staff person for each of these roles, it is important to be prepared to have these different areas of your agency be engaged with the electrification process. For example, since this is a large capital project which may require additional budget work or fund allocations, your finance staff should be involved in the planning process. Procurement staff will need to understand the requirements for a battery electric bus RFP. Installation of charging infrastructure

will require your facilities team's careful input both during the planning and construction process. Your IT staff will need to understand how to interface with your charging equipment and how to manage any additional software you plan to use to help manage bus charging. Your maintenance team will need to prepare for servicing battery electric buses. Union representatives will need to be consulted to review roles and responsibilities as well as training needs. Your legal department will be able to advise on any issues that may arise from employment contracts or leasing agreements. Your electric company partners can help manage the expectations about the level of work involved in fleet electrification projects of various sizes. And, if you are working with a consultant or other third party in planning, then they should be involved in every step of this process as well.

Fleet Data

Detailed fleet data will be a key piece of information to gather when working with your electric company but most, if not all, will likely be close at hand. Information on your fleet will help your electric company partners understand the scale of your electrification goals in both the near term and future which will help begin the planning process for large scale electrification. The specifics of the bus type you are planning to order or already have deployed will also help identify how your electric company can best support your plans for charging infrastructure. In particular, data on the schedules for when buses are parked or on route can help to optimize your charging strategy, minimizing the amount of equipment and grid upgrades you need while still ensuring your buses are always adequately charged. Having this data on hand and ready to share with your electric company can significantly ease the planning process for electrifying your bus fleet.

As already noted, you should also be sharing any zero-emission bus transition plan that you have developed. This includes plans for fuel cell buses, as that infrastructure will also require electric company support and could impact planning for charging infrastructure. If you are working with a consultant or other third party in planning, then they should be involved in every step of this process as well. Additionally, make sure to include the bus manufacturer as a stakeholder in these discussions as they should be well-equipped to answer any questions about the capabilities or requirements for the buses you plan to order.

Facility Data

The last category of data you will want to have on hand when working with your electric company is for your facilities. Outside of your goals and timelines, this will likely be the most relevant piece of information for your electric company to know. Information on your facilities will help determine the extent of service upgrades needed at each location, timelines for those upgrades, potential limitations or opportunities for different types of charging infrastructure, options for resiliency, and more. Information on where your facilities are located, including where and when you plan to build new facilities can have a significant impact on both the cost and timeline of your fleet electrification project. It's possible that some of your depots are located in areas with more grid capacity and that prioritizing them for electrification can mean fewer grid upgrades, saving you time and money. Similarly, incorporating on-route charging in an area with sufficient capacity can mean you need fewer or less costly grid upgrades overall. If you are planning to electrify your fleet in phases, your electric company can help identify which of your facilities are most well-suited for rapid electrification and which may take additional time to retrofit or upgrade.


Grid upgrades for facilities occur in a step function, meaning that going above a certain total power demand will require significant upgrades with no new upgrades required until the next threshold is reached. This means that providing your facility data along with planned bus deployments to your electric company can inform how to most efficiently and expediently electrify your buses. It is possible that spreading out your bus deployments across multiple locations will negate the need for expensive grid upgrades at any one location. Engaging your electric company early and often with the information listed above can quickly illuminate the best path forward for your fleet.

Questions For Your Electric Company

The previous sections focused on what you can bring to your electric company when first engaging them for a fleet electrification project, but fleet electrification is a collaborative process in which your electric company should be providing you with just as much vital information. Your electric company should have a wealth of information they can share that will help shape your plans for fleet electrification, both specific to your project as well as general knowledge about the electrification process. As mentioned previously, it is unlikely that your fleet will be the first organization in your electric company’s service territory to embark on the process of electrification and much can be learned from similar projects. This includes things like recommendations for equipment, different ownership and maintenance models for charging infrastructure, and rate options. Your electric company may also have specific resources you can take advantage of, like EV-specific rates or knowledge of federal or state programs that would provide additional support.

Your electric company will be your closest partner for fleet electrification. By establishing them as your partner, they can provide guidance and support throughout the process. This can be specific information related to your project or it can just be general guidance about the process of fleet electrification. Many electric companies have simple tools that can significantly simplify the process of fleet electrification and will help you to better understand the steps, time, and costs involved. You can always search for these on your own, but engaging your electric company early and requesting these resources will help avoid common pitfalls. An example of a simple document from Entergy which clearly explains the steps for installing infrastructure and tasks involved in each step is below.

Figure 2: Example Outline of Steps for Installing Charging Infrastructure



Step 1: Request new service
First, contact us to initiate a new service request via 1-800-ENERGY or through your key account manager. After we review and approve your request, we will open a work order and assign our designer to your project. Our designer will provide you with a load data sheet to complete. You will also need to provide a site layout diagram.

<p>Your tasks:</p> <ul style="list-style-type: none"> Initiate new service request Fill out load data sheet Develop site layout diagram 	<p>Our tasks:</p> <ul style="list-style-type: none"> Review request Assign project designer Schedule site visit
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Step 2: Site design
We will work with you to conduct a site visit. During that visit, our designer will need the completed load data sheet and site layout diagram. Following the site visit, we will perform right-of-way checks and an engineering review. Then we will provide you with a preliminary design plan including a cost estimate and timeline for your approval. If required, we will send you a Contribution in Aid of Construction (CIAC) invoice.

<p>Your tasks:</p> <ul style="list-style-type: none"> Host a site visit Provide completed load data sheet and site layout diagram 	<p>Our tasks:</p> <ul style="list-style-type: none"> Perform site visit Complete right-of-way and engineering review Provide preliminary design plan and cost estimate Review easements Send CIAC invoice (if required)
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Step 3: Finalize agreement
In order to finalize the agreement, you will need to approve the site design, pay the CIAC (if required), sign the Electric Service Agreement (ESA), and file the permit and easements if needed.

<p>Your tasks:</p> <ul style="list-style-type: none"> Pay CIAC (if required) Sign ESA File permit and easements 	<p>Our tasks:</p> <ul style="list-style-type: none"> Review easements Prepare ESA
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Step 4: Pre-construction planning
Once we receive the finalized permit, we will begin pre-construction planning. We will order materials, schedule construction crews and switching/outages, and provide you with the construction timeline.

<p>Your tasks:</p> <ul style="list-style-type: none"> Provide finalized permit 	<p>Our tasks:</p> <ul style="list-style-type: none"> Design infrastructure upgrades for service Receive finalized permit Order materials Schedule crews Schedule switching/outages (if necessary) Provide construction timeline
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Step 5: Construction
We will have a kickoff meeting when construction begins and will review project milestones with you and maintain a safe work environment as construction proceeds. When construction has wrapped up and interconnection to the distribution system is complete, we will energize the project, clean up the site and finalize billing.

<p>Your tasks:</p> <ul style="list-style-type: none"> Provide information needed for construction as requested 	<p>Our tasks:</p> <ul style="list-style-type: none"> Set milestones and provide updates Maintain safe worksite Provide interconnection to the distribution system Energize site by installing the utility meter Clean up site Finalize billing
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Step 6: Wrapping up
We will verify that your technical requirements are met as stated in the load data sheet and in keeping with our customer installation standards. We will also perform a construction audit to make sure that everything meets design specifications. You will then be able to connect your charging station to the grid.

<p>Your tasks:</p> <ul style="list-style-type: none"> Ask any remaining questions Begin safely using charging station. 	<p>Our tasks:</p> <ul style="list-style-type: none"> Make sure technical requirements are met Perform construction audits as needed
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entergy If you're ready to start charging, call 1-800-368-3749 (1-800-ENERGY) or contact your key account manager today.

(Source: Entergy “EV Charging Service Guide”)

Electric Company Intake Forms

When first reaching out to your electric company to explore fleet electrification, they may have an intake form that lays out the information they will need before they can assign a dedicated representative to support your fleet electrification plans. These forms are often the first step to enrolling in an electric company's fleet advisory program. Fleet advisory programs are becoming increasingly common offerings from electric companies and are designed specifically to help fleets like transit agencies with the process of electrification. Intake forms will vary from company to company, but you should be prepared to fill out any of the data they request if you follow the checklist provided in this document.

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