eTransportation: eBuses and eTrucks

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About

In this book, you will learn about two advancing modes of eTransportation, or electric transportation: eBuses and eTrucks. You will learn about how eBuses are charged and the costs associated with them. You will also learn about eTrucks and how they need to be prepared for, estimations of when they will be widely available, their associated costs compared to diesel trucks, their current status, predicted uses, and ways to bring them onto the road.

eTransportation in the form of eBuses and eTrucks is one step in the right direction to environmental change for the good.

Table of Contents

eBuses 1

- Charging eBuses 3
- Cost of Charging eBuses 7

eTrucks 9

- Preparing for eTrucks 11
- Adopting eTrucks 12
- Total Cost Ownership and eTrucks 13
- Current Status of eTrucks 14
- Using eTrucks 15
- How to Make eTrucks Successful 16

Sources 17

eBuses

About eBuses

eBuses, or electric buses, have made a strong presence in many European countries. Other countries are working to switch their mode of public transportation to eBus through the European Clean Bus Deployment Initiative.

eBuses are more economically and environmentally friendly than diesel forms of transportation.

- eBuses have a lower total cost of ownership (TCO).
- eBuses provide better air quality due to lower exhaust emissions.

Information received from Source 2.

Charging eBuses: Types of eBus Charging

Depot Charging: Charging that occurs overnight
- Depot charging requires depot chargers.

Depot Chargers: Chargers used for overnight charging, and which are typically 30 to 50 kilowatts

Opportunity Charging: Charging that occurs both overnight and during the day
- Opportunity charging requires both depot chargers and opportunity chargers.

Opportunity Chargers: Chargers used for recharging during the day, and which are typically 150 kilowatts or more

Information received from Source 2.

Depot Charging vs. Opportunity Charging

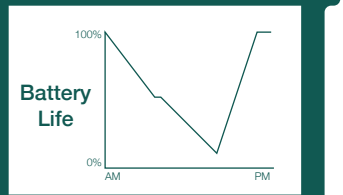
Depot Charging

Typical Range: 100-250 km/day

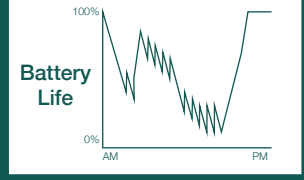
Charger Type: Depot Charger

Charging Technology: Plug-In

Cost Drivers:
- Higher Battery Cost
- Lower Charging Infrastructure Cost



Opportunity Charging



Typical Range: 200-500 km/day

Charger Type: Depot and Opportunity Chargers

Charging Technology: Plug-In, Pantograph, and Induction

Cost Drivers:
- Lower Battery Cost
- Higher Charging Infrastructure Cost
- Higher Maintenance Cost

Information received from Source 2.

Charging eBuses: Ways to Charge eBuses

Plug-In: The eBus is directly plugged into a power source

- Plug-in is commonly used in depot charging.

Pantograph: The eBus is connected by a wire to a power source

- Pantograph is commonly used in opportunity charging.

Induction: The eBus is electromagnetically charged

- Induction is not commonly used because of cost and maintenance.

Information received from Source 2.

Pantograph Charging Options

Pantograph Down
Pole-Mounted (OppCharge)

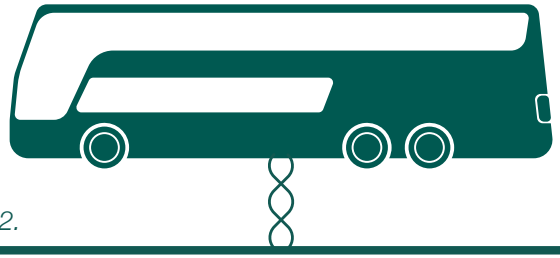
The bus requests connection via WiFi, so that the pantograph can connect to the bus

- Lower cost of installation per bus - Fewer pantographs are required
- Lower weight of system - Especially helpful if the bus is at maximum wieght limit
- Lower height of bus - Enables the bus to pass under low-clearance bridges

Pantograph Up
Roof-Mounted (CCS)

The bus connects to a charger with communication over CCS

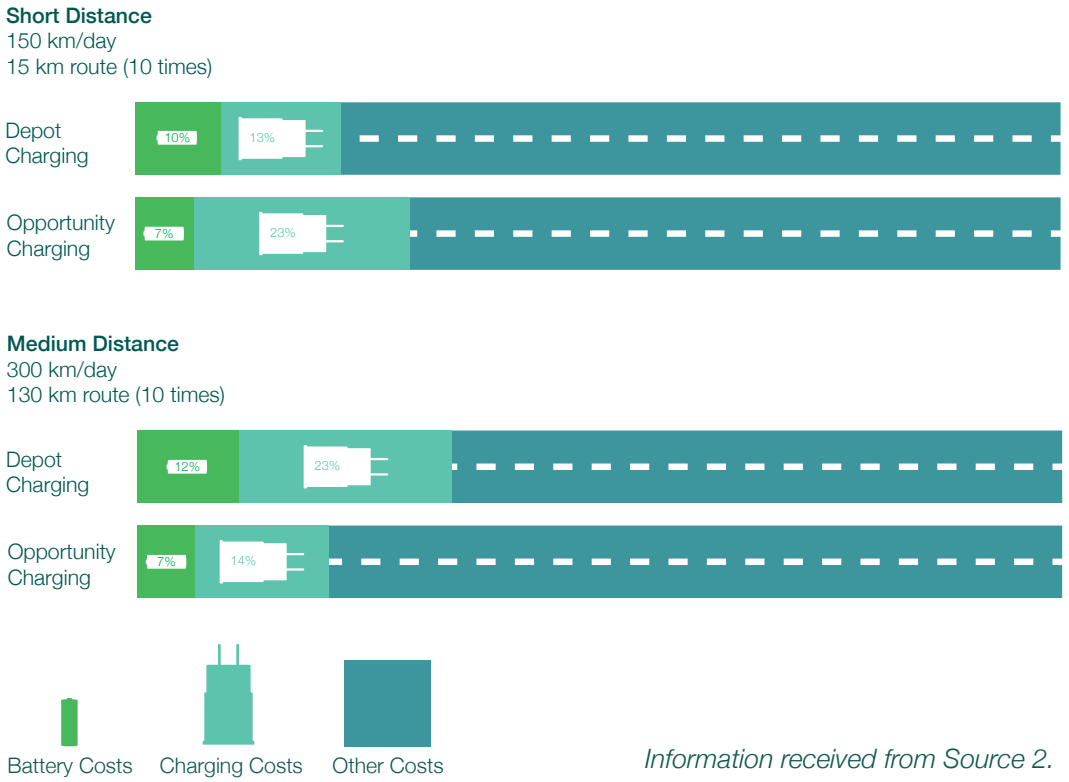
- No WiFi connecion is required becauce the driver initiates charging
- Connections follow exisiting CCS
- Only one bus could be out of order if the pantograph fails
- Maintenance is similar to that of trams and can be completed at the depot - Enables PTO personnel to carry out maintenance procedures



Information received from Source 2.

Total Cost Ownership (TCO) and Depot Charging vs. Opportunity Charging

Infographic A
This infographic compares how the costs of depot charging and opportunity charging compare relative to different travel distances.



Information received from Source 2.

Cost of Charging eBuses

Interpretations of Infographic A

- Depot charging is economically better for short distances.
  - Depot charging is 10-15% less expensive than opportunity charging because of battery size.
- Opportunity charging is economically better for longer distances.
  - Opportunity charging is 10-20% less expensive than opportunity charging because of battery size and lower charging costs.

Other Cost Factors

- Charging Stations
  - Common routes would be consistently made use of and could inform where to place profitable charging stations.
  - Isolated routes would not be consistently made use of and would create unprofitable charging stations.
- Terrain
  - High elevation requires extra power.
- Weather
  - Cold and hot weather require extra power.

Information received from Source 2.

eTrucks

About eTrucks

eTrucks, or electric Trucks, have been around for a long time, but have just recently become a popular form of commercial transportation.

Why are eTrucks becoming popular?

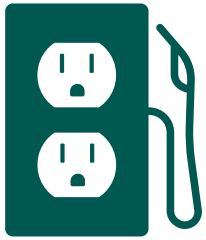
- The technology and infrastructure required for electric transportation are becoming attainable for producers and consumers.
- Environmental concerns are pushing for the adoption of eTrucks.
- eTrucks could become cost equivalent to diesel trucks.

Information received from Source 1.

Preparing for eTrucks

To prepare for eTrucks, investments must be made and charging stations must be created.

eTrucks will require investment by both producer and consumer.



eTrucks will need charging stations at stopping points and on routes.

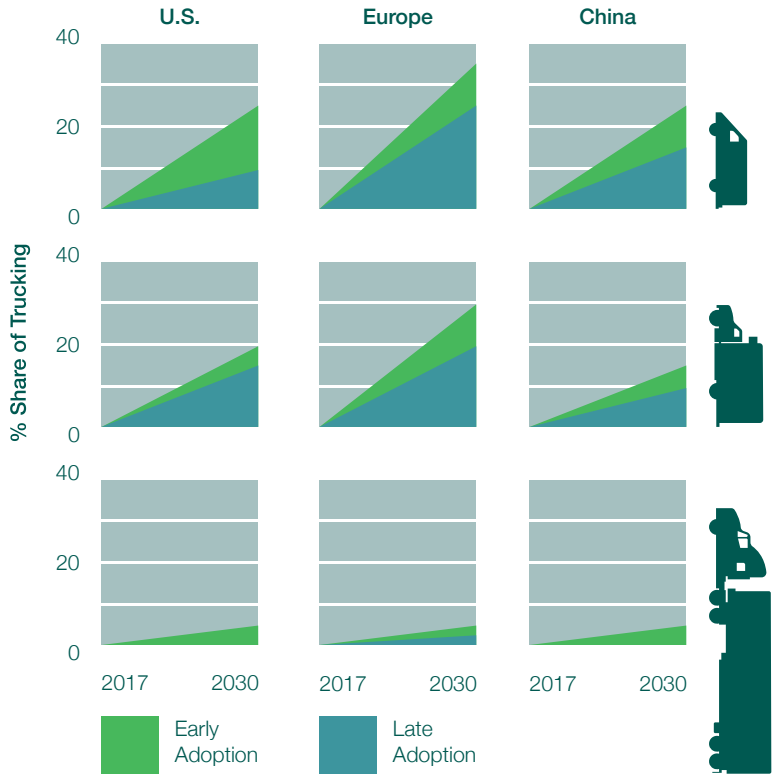
Information received from Source 1.

Adopting eTrucks

Infographic B
This infographic looks at two adoption scenarios, early and late adoption, for different eTrucks. This infographic evaluates adoption scenarios for light-, medium-, and heavy-duty trucks in the U.S., Europe, and China.

Interpretations of Infographic B

- Light- and medium-duty trucks are likely to be adopted.
- Heavy-duty trucks are less likely to be adopted.
- eTruck adoption is expected after 2025.



Information received from Source 1.

TCO and eTrucks

Infographic C

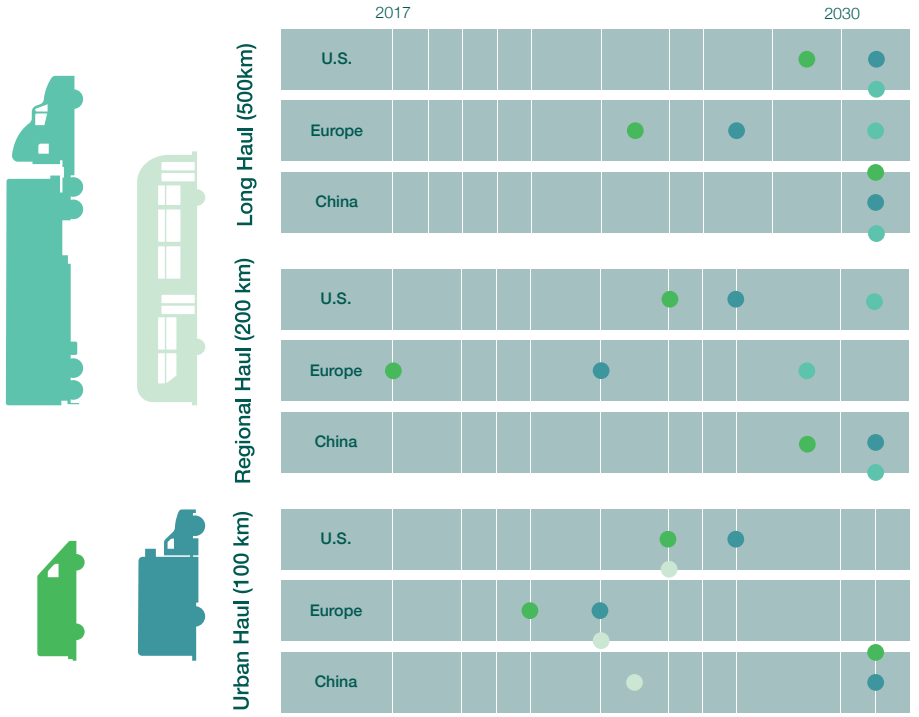
This infographic shows when the TCO of eTrucks will equal the TCO of diesel trucks. This infographic looks at the type of truck, distance travelled, and location.

Interpretations of Infographic C

- The TCO of light- and medium-duty eTrucks will be equal to the TCO of diesel trucks at regional and urban distances first.
- The TCO of heavy-duty eTrucks will be equal to the TCO of diesel trucks last.

Factors That Affect TCO

- The efficiency of fuel and electricity
- The price of fuel and electricity
- The price of batteries



Information received from Source 1.

Current Status of eTrucks

Light-duty eTrucks are on track to launch first.

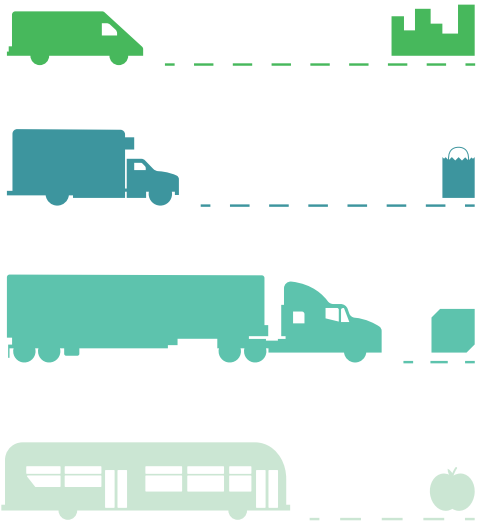
Heavy-duty eTrucks are expected to launch second.

Medium-duty eTrucks are assumed to launch last.

Information received from Source 1.

Using eTrucks

Infographic D
This infographic shows different uses of eTrucks based on the type of truck.



Use:
Urban last-mile distribution with central hub and many stops.

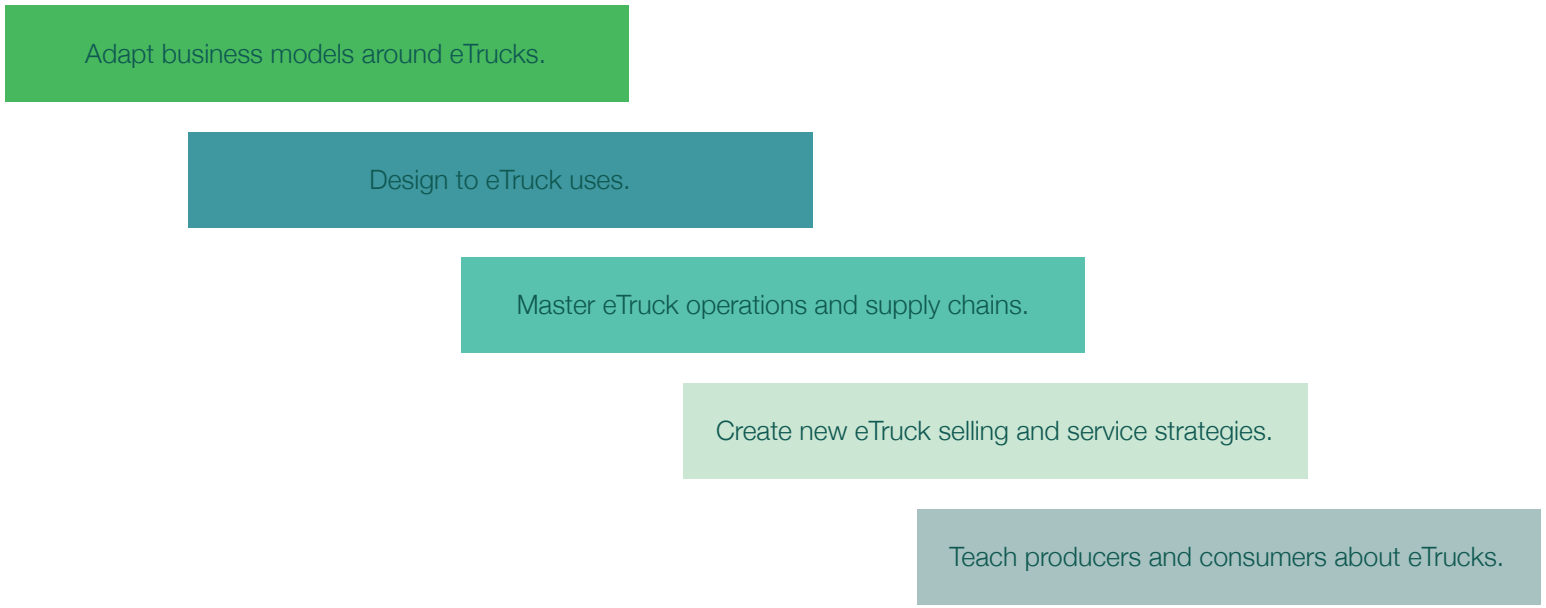
Use:
Grocery store chain with logistics center for several branches.

Use:
International or continental freight logistics.

Use:
Typical city bus or school bus with dozens of stops.

Information received from Source 1.

How to Make eTrucks Successful



Information received from Source 1.

Sources

Source 1:

Heid, Bernd, et al. “What’s Sparking Electric-Vehicle Adoption in the Truck Industry?” *McKinsey & Company*, McKinsey & Company, 8 Jan. 2018, https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/whats-sparking-electric-vehicle-adoption-in-the-truck-industry.

Source 2:

Pee, Arnout de, et al. “The European Electric Bus Market Is Charging Ahead, but How Will It Develop?” *McKinsey & Company*, McKinsey & Company, 27 Mar. 2019, https://www.mckinsey.com/industries/oil-and-gas/our-insights/the-european-electric-bus-market-is-charging-ahead-but-how-will-it-develop.