

电动汽车充电站建设与应用

**Construction and Application
of Electric Vehicle Charging Station**

主要内容 Main

1. 充电站建设现状
Situation of Charging Station Construction

2. 充电站建设关键技术
Key technologies of Charging Station Construction

3. 项目启动情况
Initiation of Projects

北京市 Beijing

起步
Start

- 121路公交线—14辆车，
28台充电机
121 bus line,
14 EVs, 28 chargers
- 密云开发区—10余辆车，
10台充电机
Miyun Industrial
Development Zone,
over 10 EVs,
10 chargers

2019

跨越
develop

- 北京市科委示范充电站
- 奥运会充电站
- 多种电能补给模式，国内
• 世界最大55辆纯电动大巴，
• 国内首个光伏、储能、
微网系统
- Charging Station for
Demonstration charging
station of Beijing
Miyun Industrial Development Zone, the largest
scale in the world,
Several innovative
various energy supply
mode,
The First micro-grid
system with
photovoltaic and energy
storage in China .

2019

宏图
future

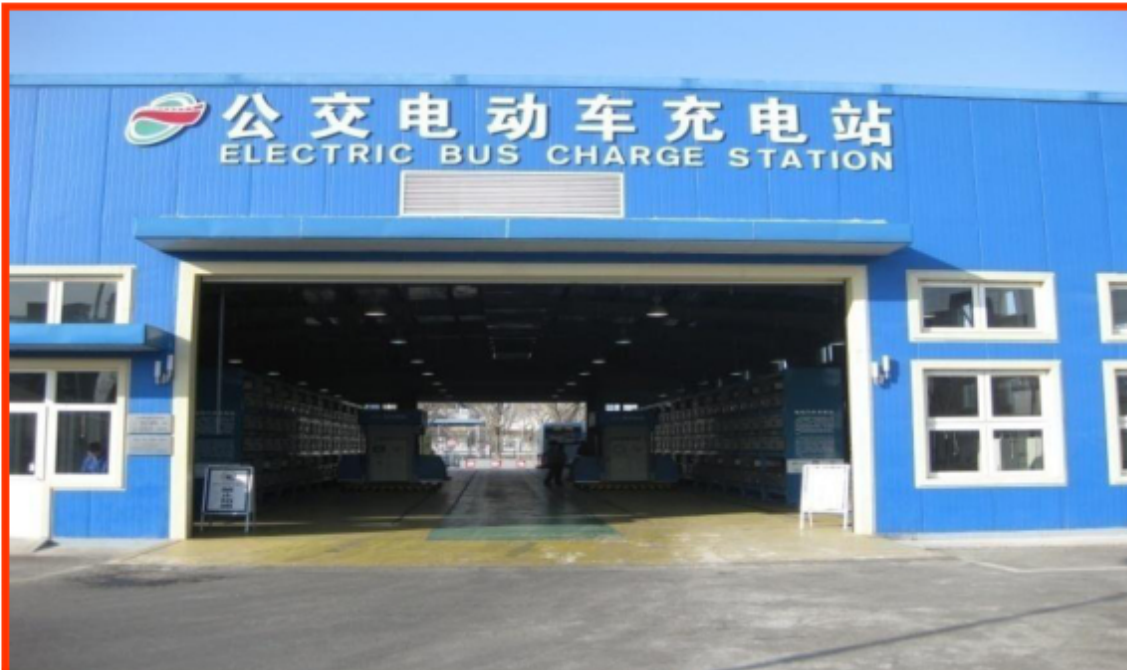
- 四惠大型永久纯电动
公交车充电站
large-scale
permanent EV
charging station in
Sihui
- 航天桥、白云观纯电动
环卫车充电站
EV sanitation
charging station in
Hangtian Qiao、
Baiyun Guan
-

2009、2019...

北京121路电动公交客车充电站 Beijing Bus 121 Charging Station



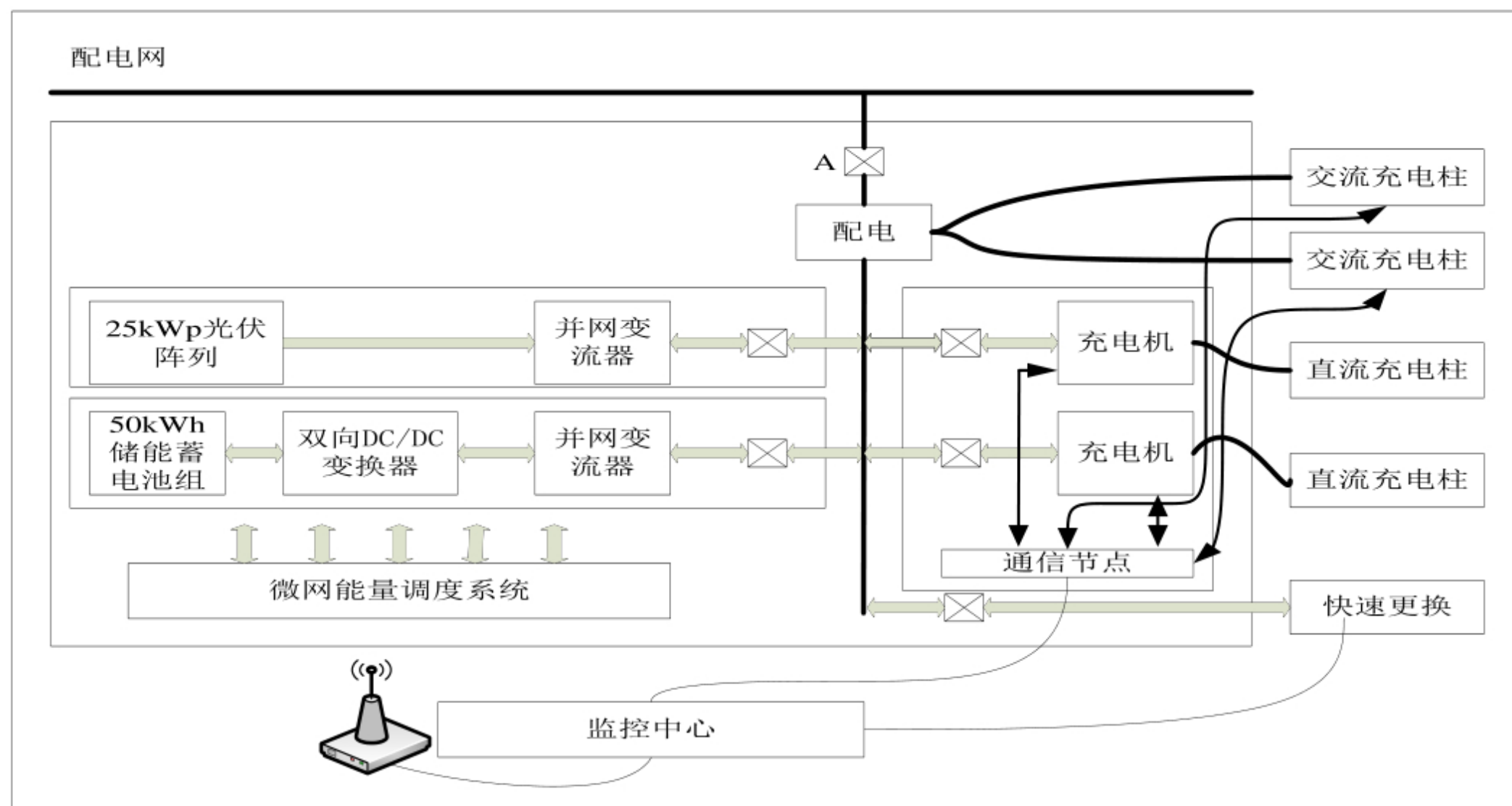
北京奥运大巴充电站 EV Bus Charging Station for Olympic Games



240台 7~9kW



北京纯电动乘用车示范充电站 Beijing Demonstration Charging Station of Pure Electric Passenger Vehicles



上海市 Shanghai

世博会充电站 Charging Station for Expo

- 以奥运会充电站为模板
follow the Olympic Games as a template
- 车辆更多（120辆）
规模更大
**more Vehicles (120)
larger scale**
- 多项关键技术升级
**Many upgraded
key technology**
- 运营管理方式升级
**upgraded Operations
management**

上海市漕溪充电站 Shanghai Caoxi Charging Station

- 电力公司投资建设、面向不同用户需求
**The investment of
the power companies
For different user needs**
- 超前设计理念
Advanced design concepts
- 无人值守全天候运行
**Uninterrupted and
Unattended running**
- 先进计量、计费管理方式
**Advanced metering and
billing management**

上海市V2G示范充电站 Shanghai V2G demonstration charging station

- 国网公司世博会展示内容
**Demonstration in the Expo
of the State Grid
Corporation**
- 智能电网的重要组成部分
**An important component
of smart grid**
- 国内领先的设计思路
**leading design concept
in China**

上海电力公司漕溪充电站 Charging Station of Shanghai Municipal Electric Power Company in Caoxi



上海世博会充电站

Shanghai Charging Station for Expo



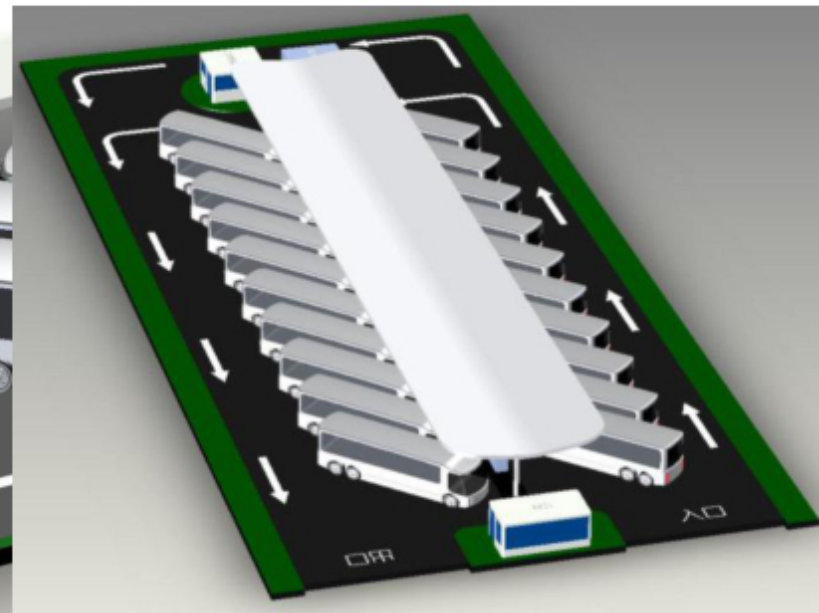
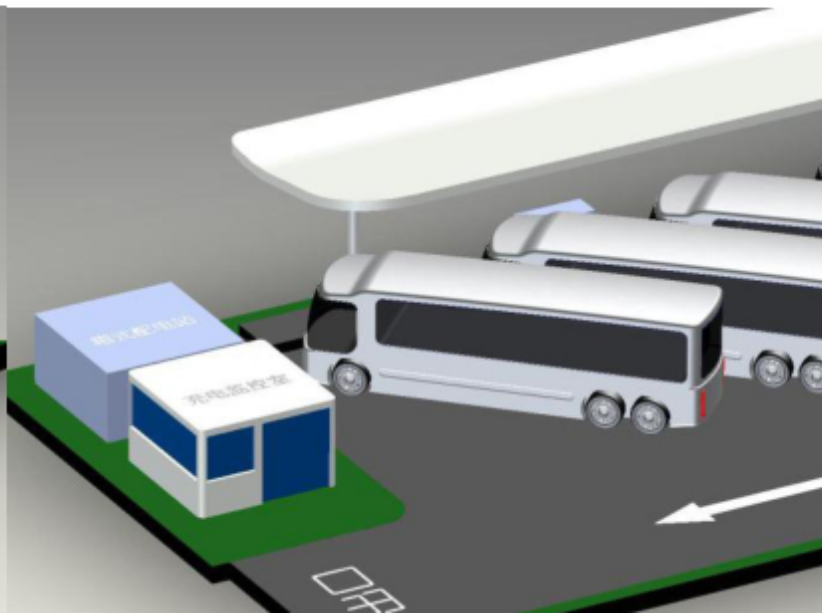
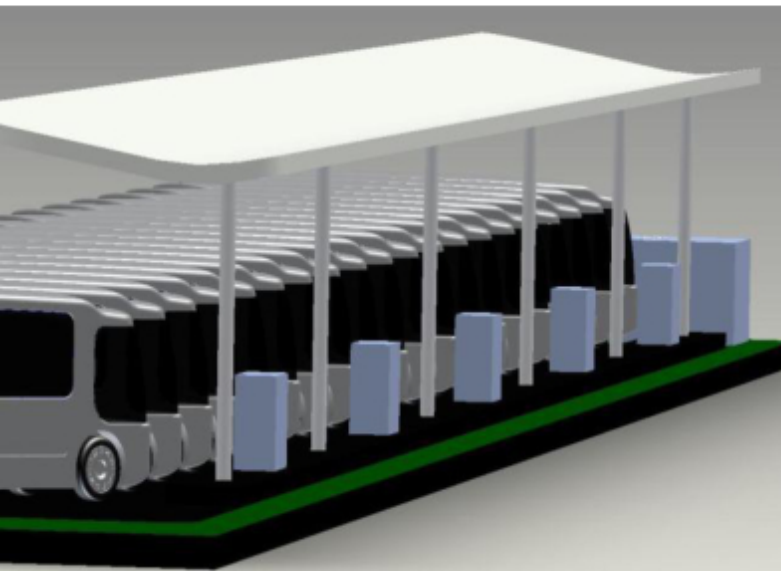
天津充电站 Tianjin Charging Station

泰达公交 Taida Bus

- 纯电动车辆 **PEV**
- 示范运行 **Demonstration**

市区公交 Urban Bus

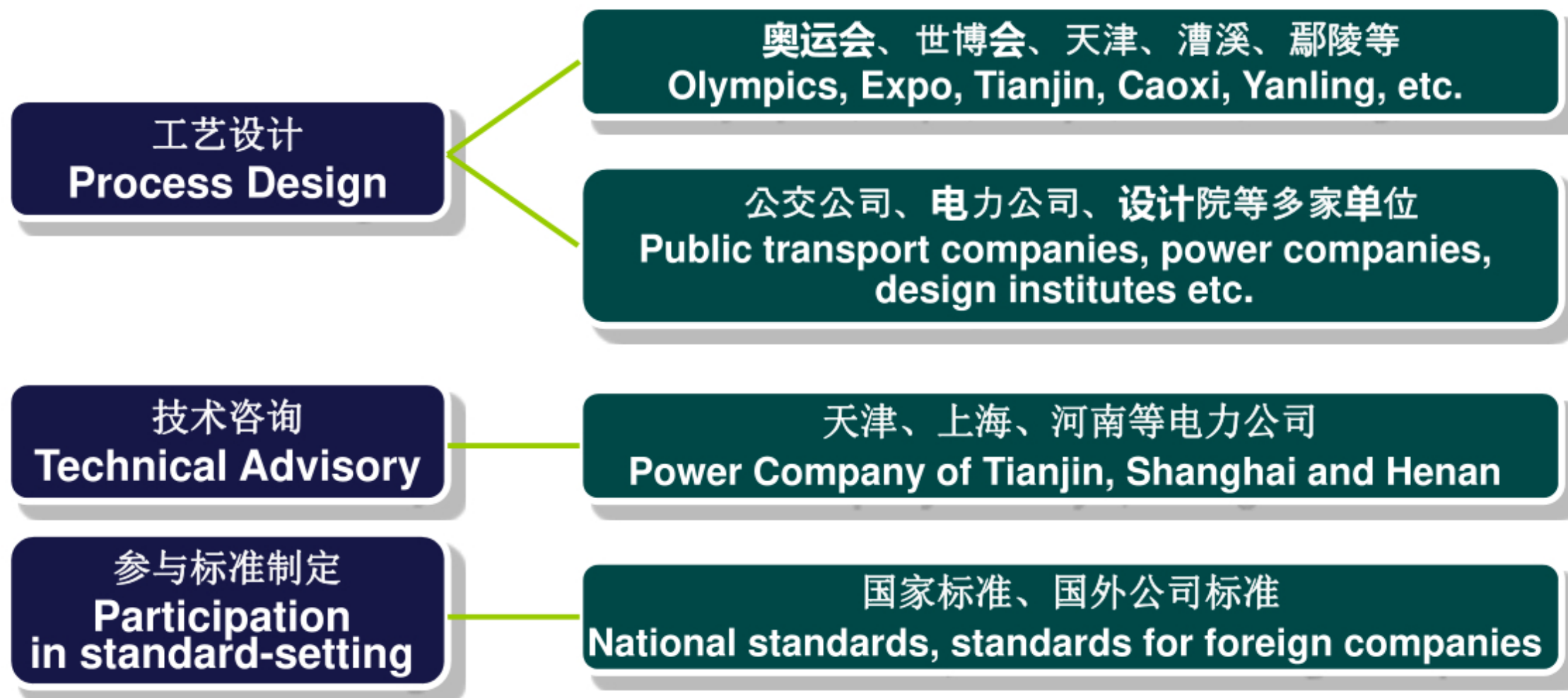
- 纯电动、混合动力 **PEV HEV**
- 电力公司参与 **Power companies**



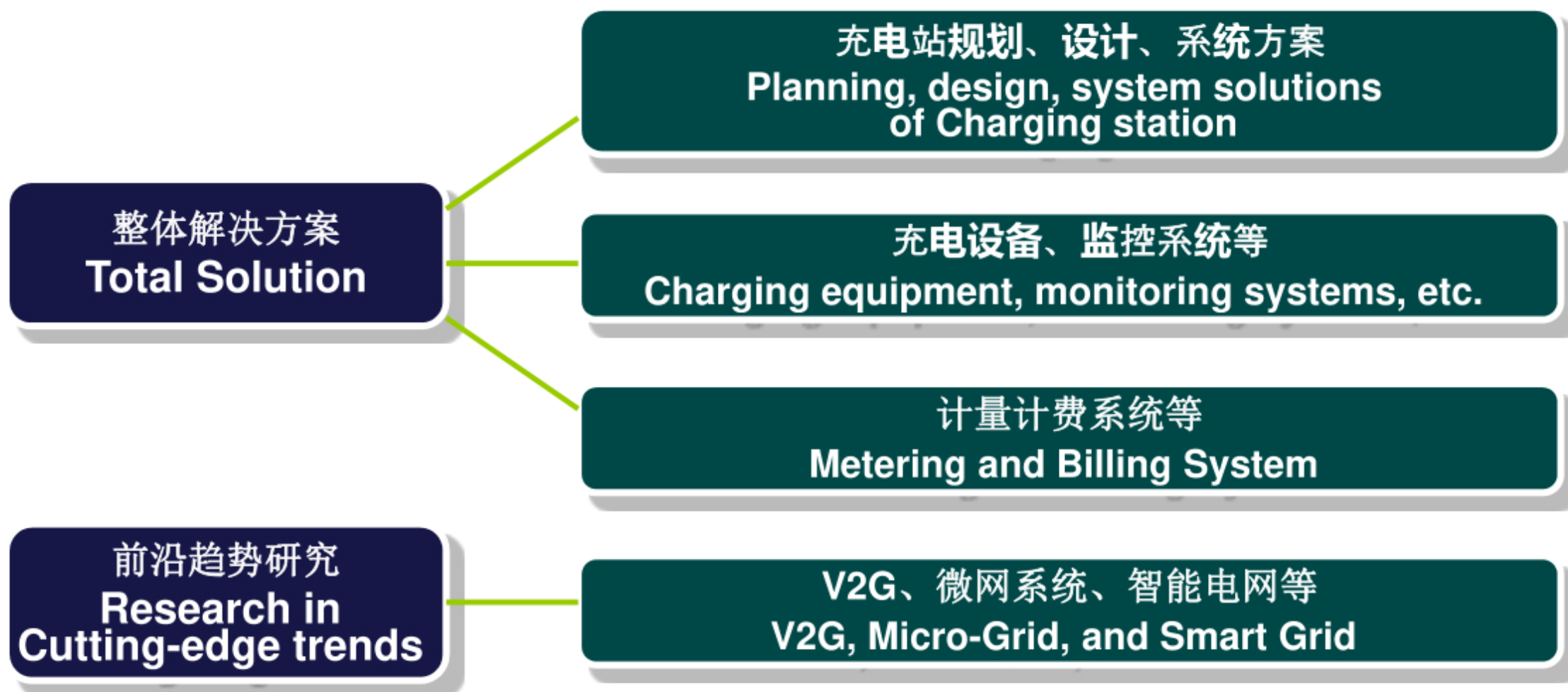
河南鄱陵花木园充电站 Yanling Huamuyuan Charging Stations in Henan



工作成果 Achievements



工作成果 Achievements



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充电站建设关键技术

Key Technologies of Charging Station Construction



动力电池能源补给模式研究

Study of energy supply mode of dynamic battery

- **主要能源补给方式**：电池更换、车载充电、地面常规充电、地面快速充电；

Primary energy supply mode : Battery exchange, on-board charger, ground normal charging, fast charging;

- **纯电动公交大巴和大、中型纯电动环卫车**：由于其特殊的定点定线运行、大密度发车、电池容量大等特点，电池更换是比较适合的能源补给模式。但是这种类型的充电站占地面积大，对电网容量要求高，设备投资大；

EV buses, large and medium-sized electric sanitation vehicles :

Because of its unique characteristics of fixed point and fixed-line operation, big density of starting out, large batteries capacity, etc. the battery exchange is a more appropriate mode of energy supply. But this kind of charging station covers a large area, requires a high grid capacity and a large investment in equipment;

动力电池能源补给模式研究

Study of energy supply mode of dynamic battery

- **纯电动乘用车和小型纯电动环卫车**：充电方法目前还没有形成体系，如果采用分散式的整车充电方式，占地少，对电网增容压力不大；由于节省了更换设备和备用电池，设备投资也能大幅度降低。由于现有的充电技术尚未解决快速充电问题，致使充电时间较长。

Electric passenger vehicles and small electric sanitation vehicles :

As the charging method has not yet been systemized, if decentralized vehicle charging method is adopted, it covers less area and poses less pressure on the grid; due to saved exchange equipment and spare batteries, equipment investment can be significantly reduced. As the existing charging technology issues yet to be resolved of fast charging, charging time.

电池梯级利用与筛选

Cascade utilization and selection of the battery

- **电池的回收和再利用**：锂离子电池容量衰减到80%后，就不能在电动汽车中使用；

Battery recycling and reuse: Lithium-ion battery can not be used in EV when its capacity faded to 80% ;

- **电池再利用价值**：通过电池的梯级利用，将电池应用到其他类领域，至少降低车用动力电池购置成本20%；

Battery reuse value: through cascade use of the battery, battery can be applied to other fields, thus the acquisition cost of battery of EV could be reduced 20% at least;

电池梯级利用与筛选

Cascade utilization and selection of the battery

- **储能应用**：通过电池的大规模储能应用，可以对电网进行削峰填谷，降低充电站负荷的波动，减少对电网的影响；

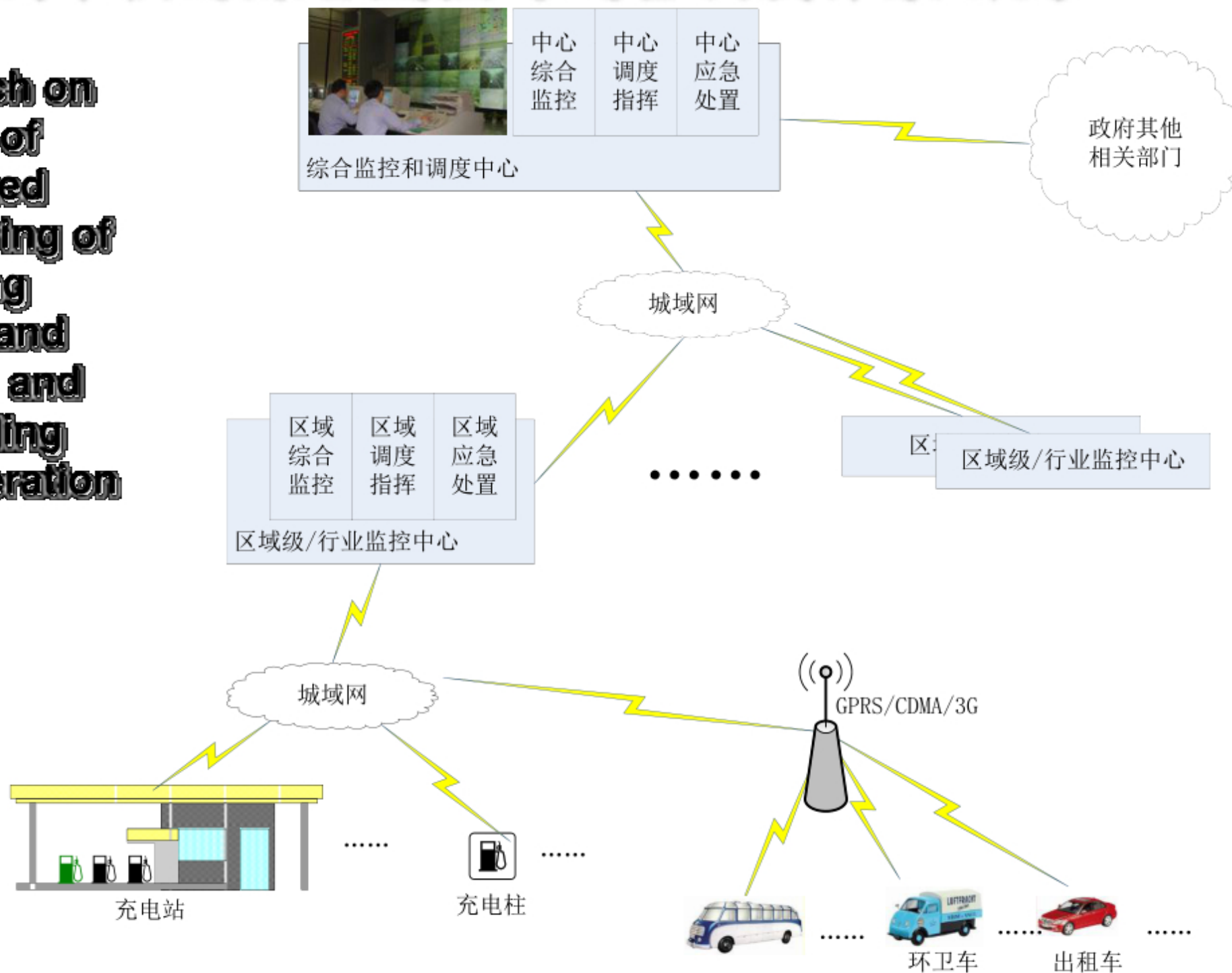
Energy Storage Applications: through large-scale energy storage applications of battery, the peak and valley load of the grid could be shifted; this could reduce the fluctuations of the load and the impact on the power grid;

- **电池筛选**：通过梯级利用电池的容量衰减规律对淘汰电池进行合理筛选，将参数处于同一水平的电池进行合理配组，能够有效的提高车辆淘汰电池容量利用率，延长车辆淘汰电池的继续使用寿命。

Battery selection: using the cascade decay law of the battery capacity to select battery, and grouping battery with parameters of the same level, could effectively improve the capacity utilization of the faded battery, and to extend the life of faded battery .

充电站及车辆的综合监控与运营调度体系研究

Research on
system of
integrated
monitoring of
Charging
station and
vehicle, and
scheduling
and operation



智能电网 Smart Grid

按照国家新能源汽车产业发展规划，预计2020年，仅上海市的电动汽车市场规模就可达到约35万辆，必将成为不可忽视的分布式储能单元。
According to developing plan of the national new energy automotive industry, electric vehicle market of Shanghai is expected to reach about 35 million in 2020, It would become a distributed energy storage units which can not be ignored.

电动汽车作为分布式储能单元接入电网已成为“智能电网”的重要组成部分。
Electric vehicles have become an important component of "smart grid" to access grid as a distributed energy storage unit .

德国、美国等发达国家已开展V2G（Vehicle to Grid）相关技术研究。
Germany, the United States and other developed countries have undertaken studies related to V2G (Vehicle to Grid) technology.

V2G概况 V2G Situation

V2G指电动车辆的能量在受控状态下实现与电网的双向交换

V2G refers to achieve of a two-way exchange between the energy of electric vehicles and the grid in a controlled state.

接入电网的电动汽车数量足够多，可以作为可移动的分布式储能装置，用于：

If the number of EVs access to the grid is large enough, they could be distributed as a removable storage device, for:

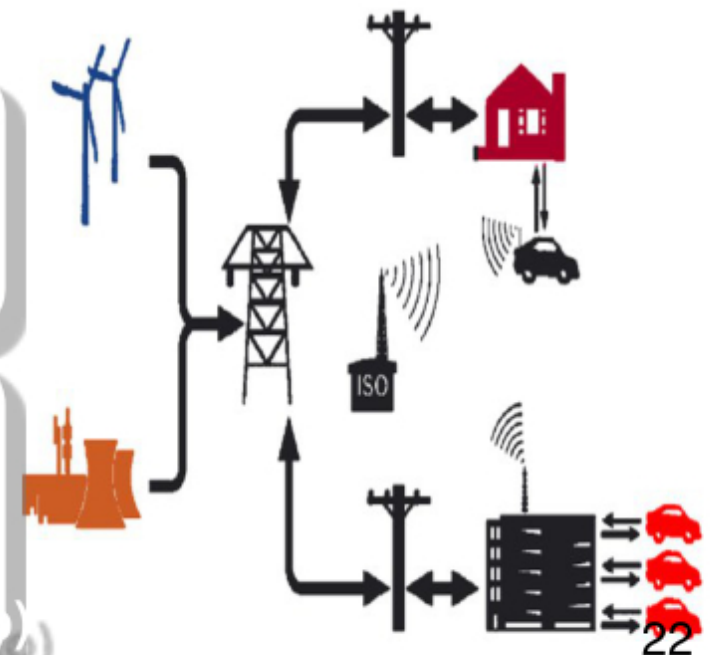
- 调峰 Grid balancing services
- 旋转备用 Spinning reserves
- 新能源接入 new energy access

V2G对未来电动汽车商业模式将产生重大影响

V2G will have a major impact on the future business model of EVs

**V2G要实现商业化应用，最总依赖于电池技术的进步。
(更长的循环寿命，更大的比能量)**

The commercial application of V2G depends on the battery technology. (Longer cycle life, greater energy ratio)



V2G概况 V2G Situation

其他研究V2G的机构有：国家可再生能源实验室，Warwick大学
Other institutions researching V2G are: National Renewable Energy Laboratory, Warwick University

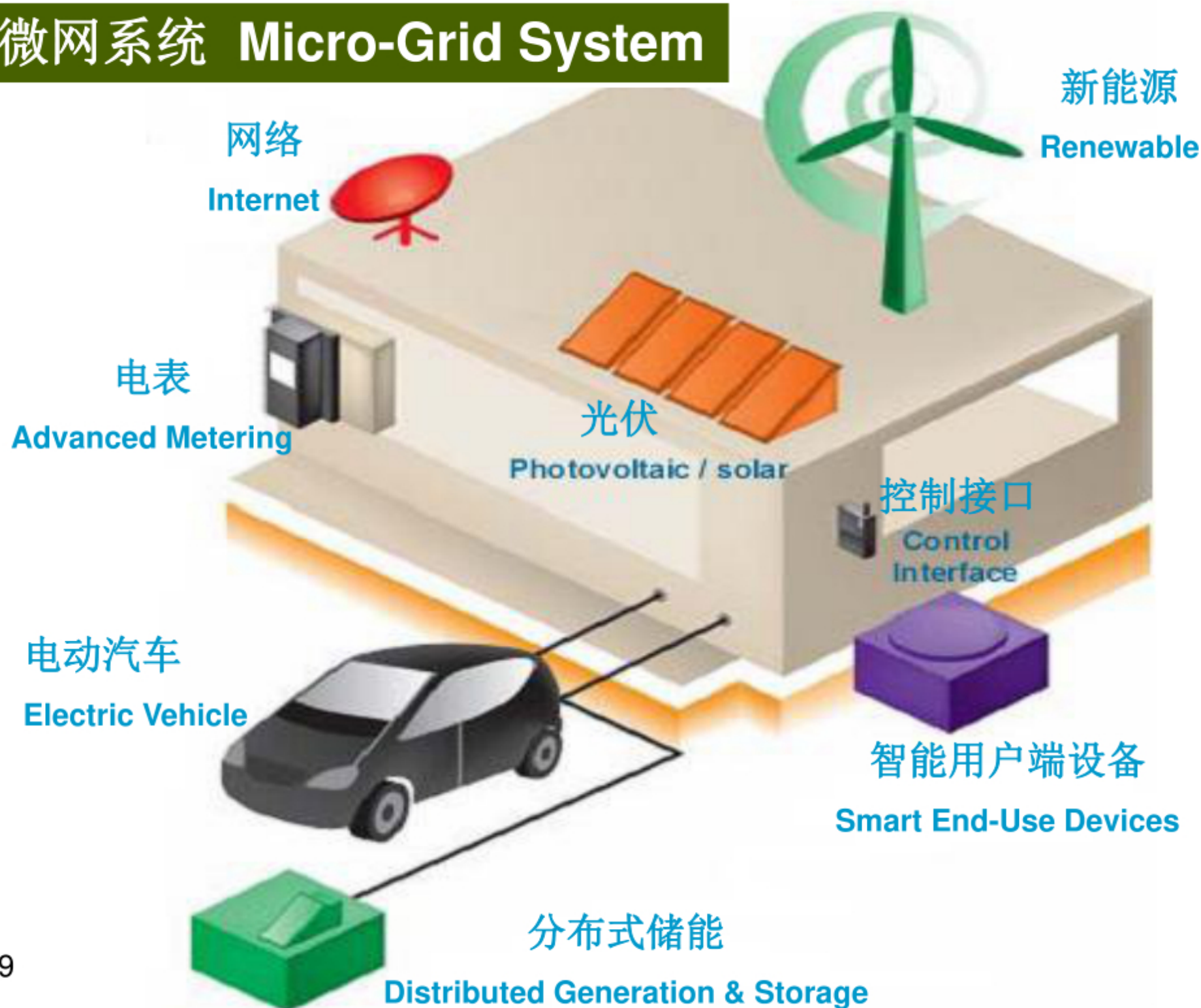
开展V2G示范的电力公司有
The power companies carrying demonstration of V2G are:

- **PG&E**: 一定数量的丰田普锐斯**PHEV**在**GOOGLE**园区示范

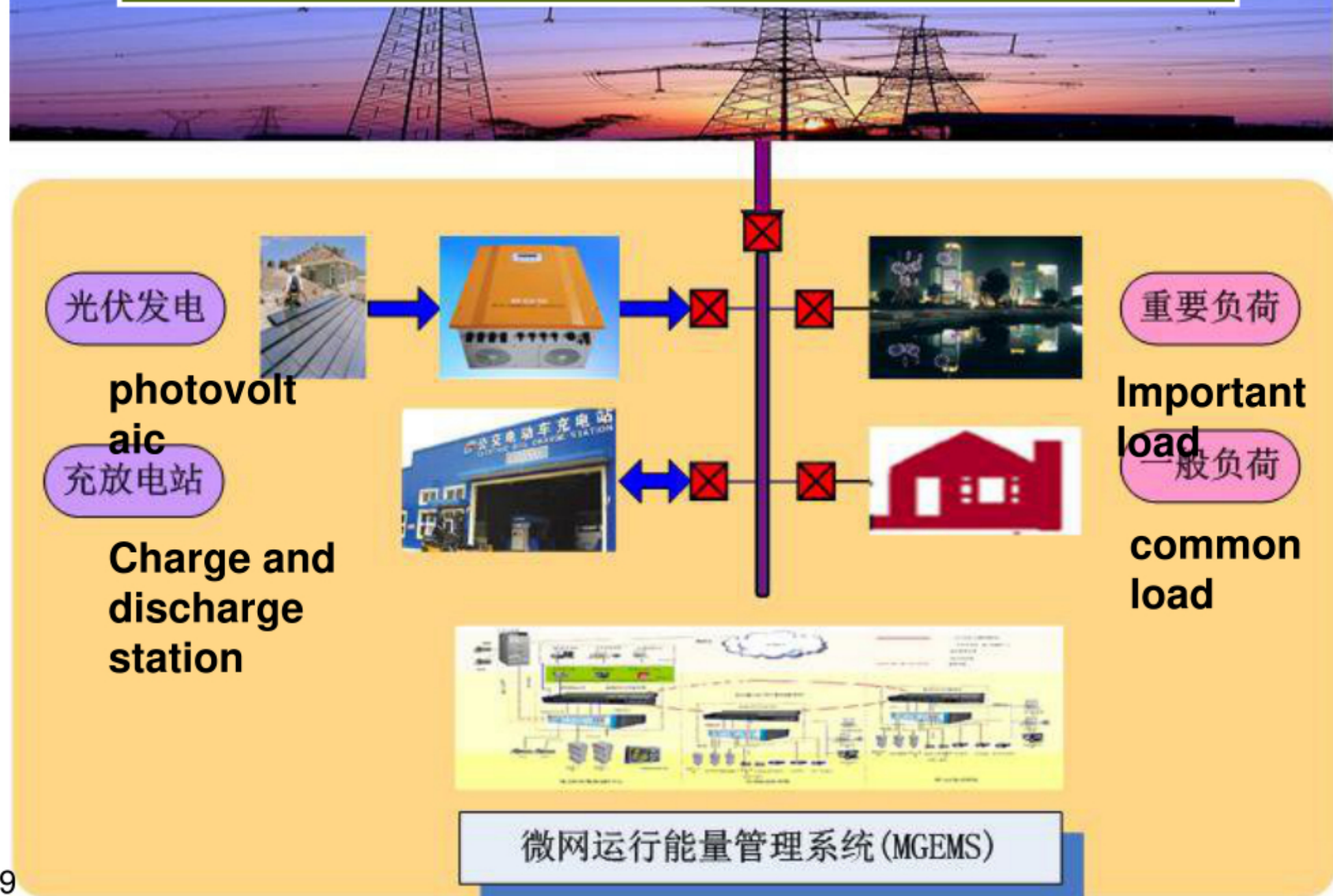
PG & E: a certain number of the Toyota Prius PHEV demonstration in the GOOGLE Park

- **Xcel Energy**: 6辆福特**Escape**
Xcel Energy: 6 Ford Escape

微网系统 Micro-Grid System



充电站微网 Charge and Discharge Station Mico-grid



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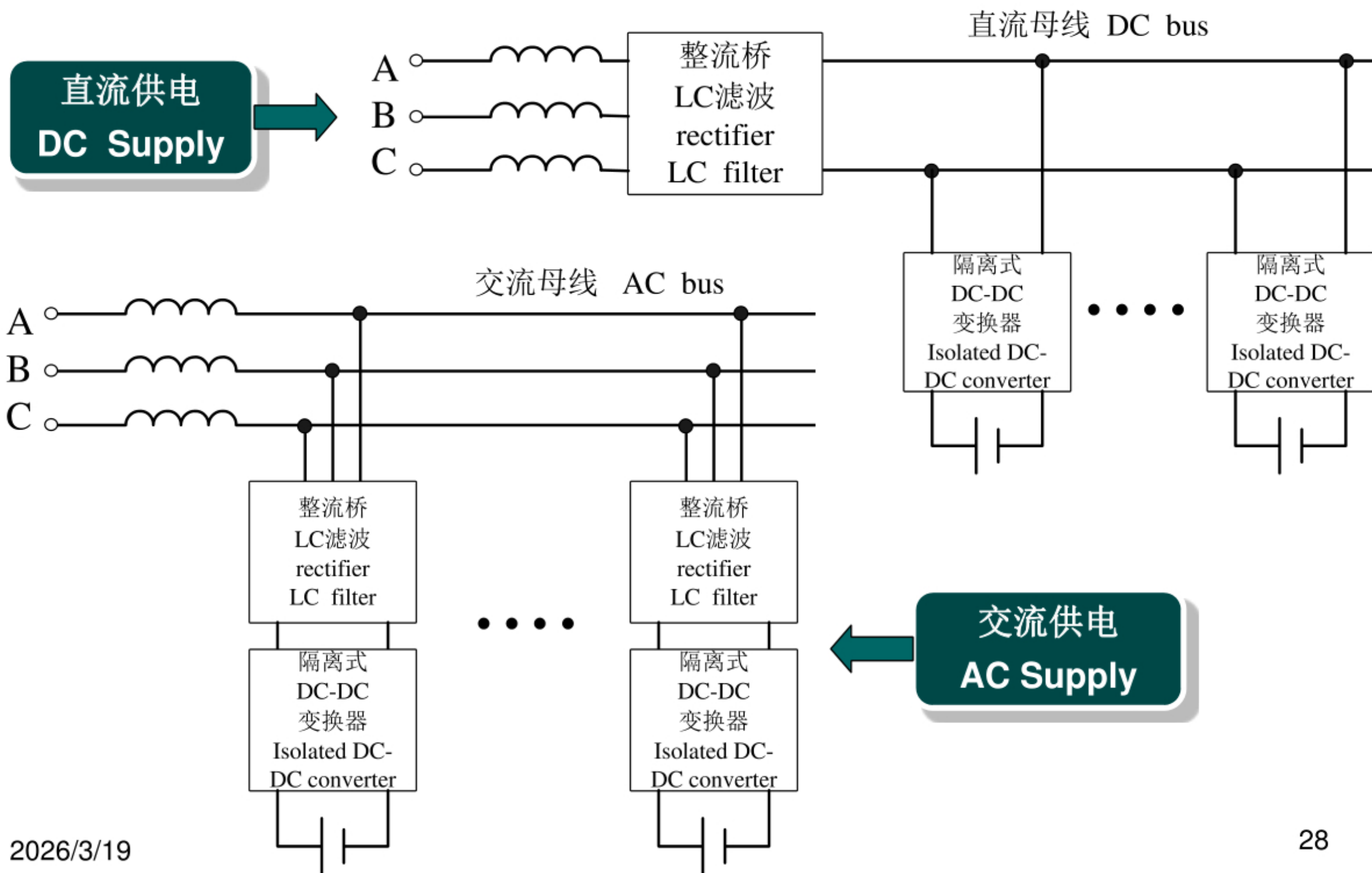
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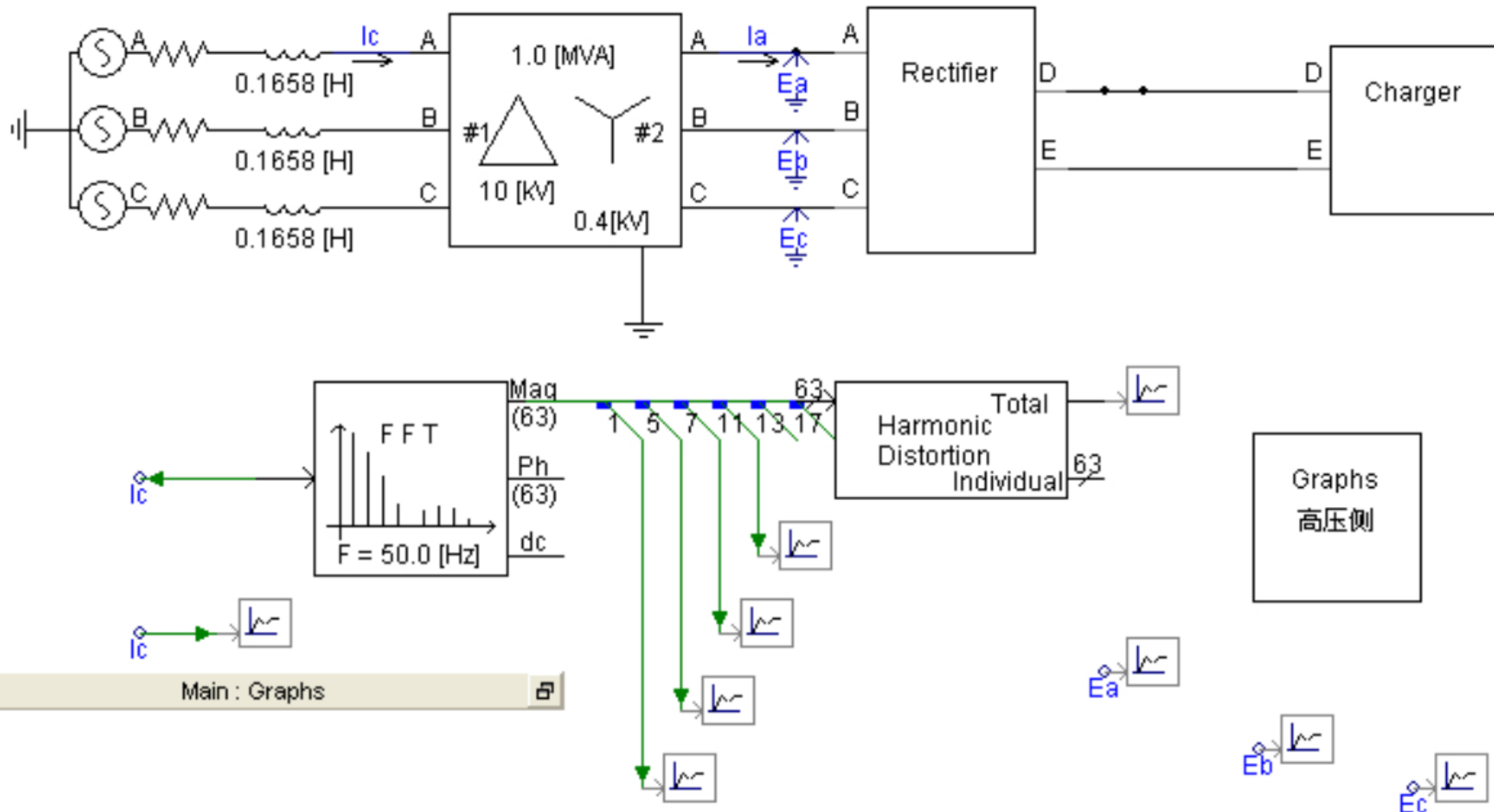
目前进展 Project Situation

- 充电站供电方式和充电机比较
Comparison of Charging Station Power Supply Mode and Charger
- 充电站的优化设计方案
Optimal Design of Charging Station
- 充电站与电网的相互影响
Interaction of Charging station and grid

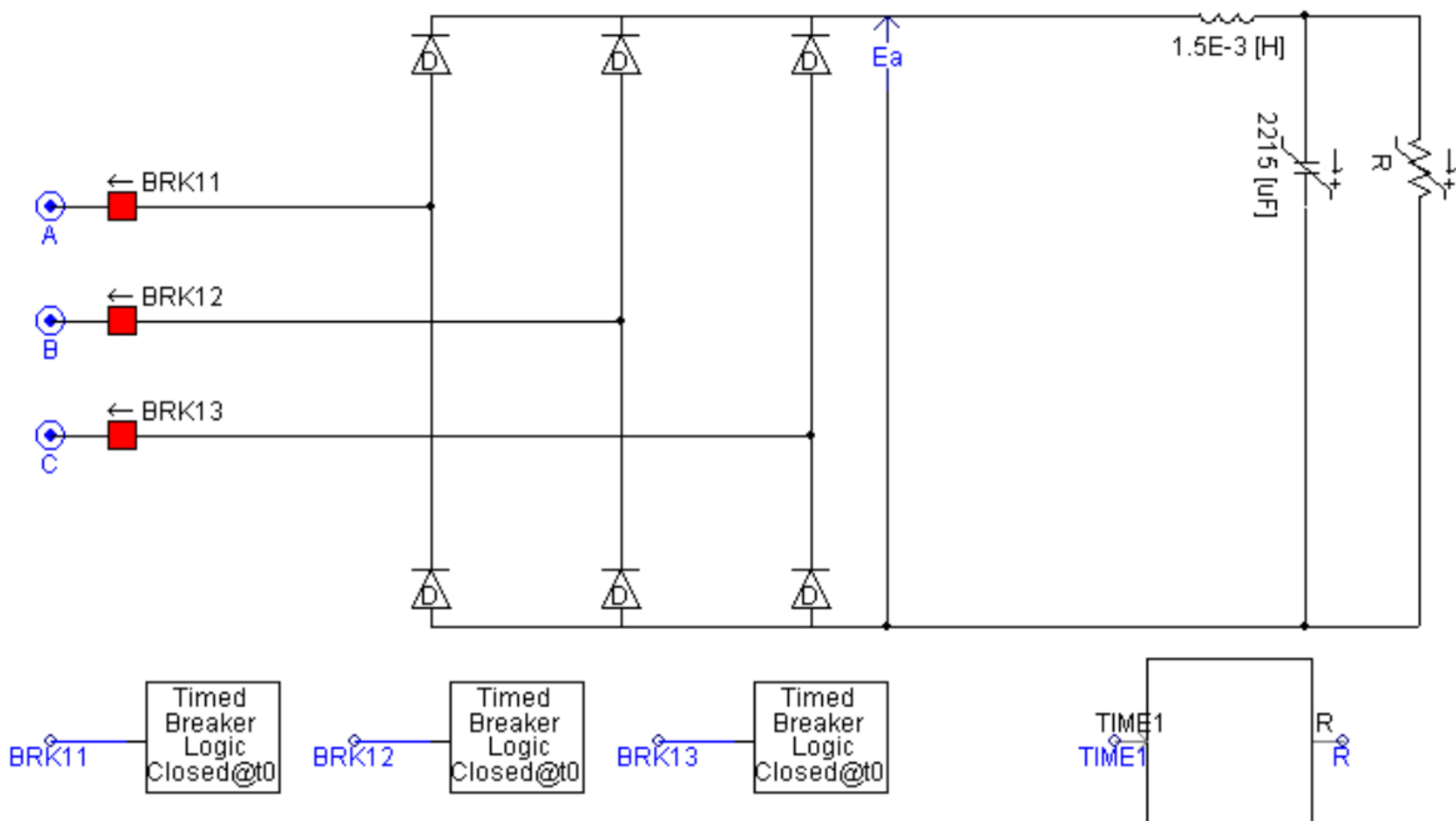
供电方式
Power Supply Mode

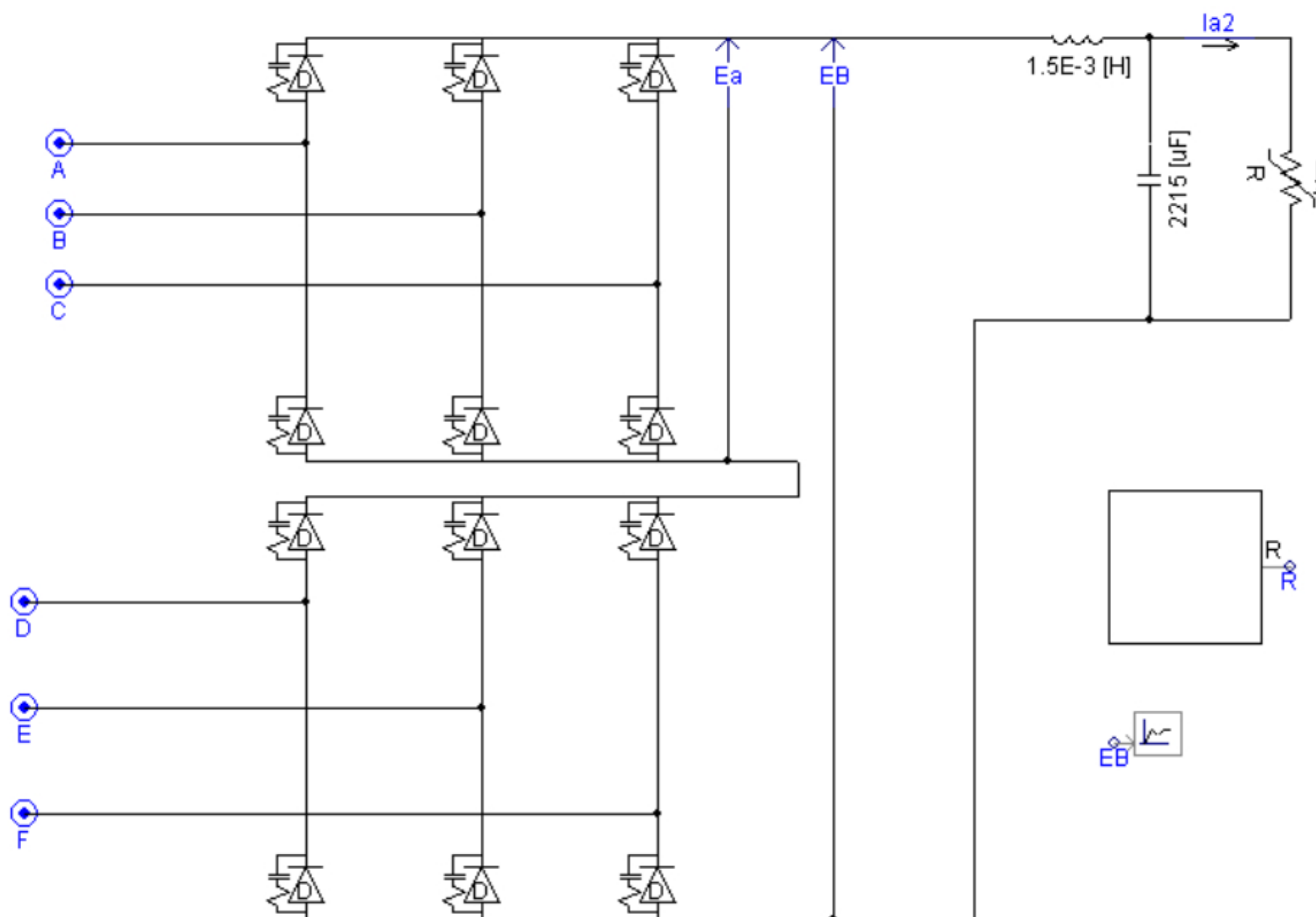


充电机模型 Charger Model



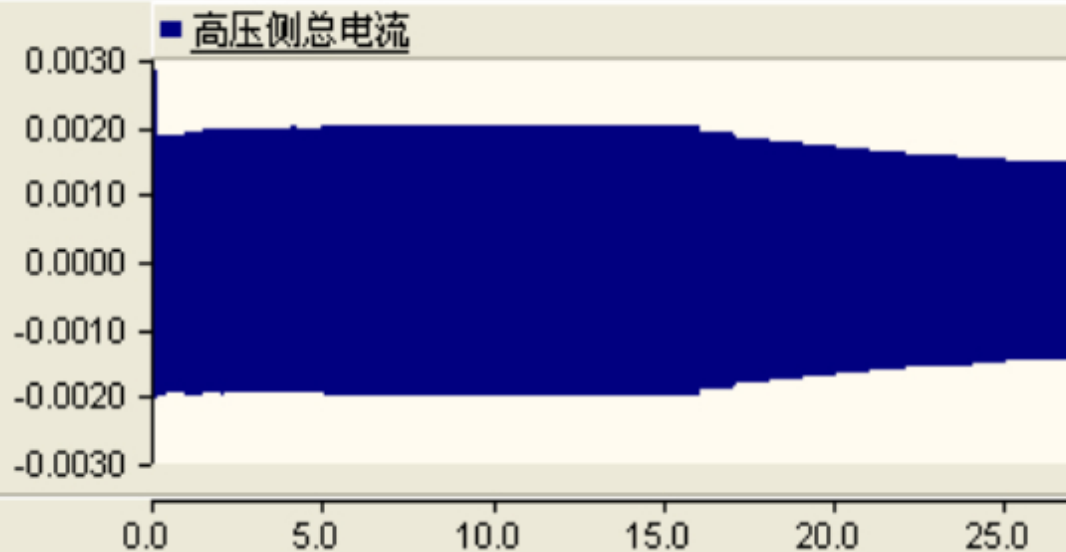
单台充电机接入系统仿真模型
Simulation model of a single charger connected to grid



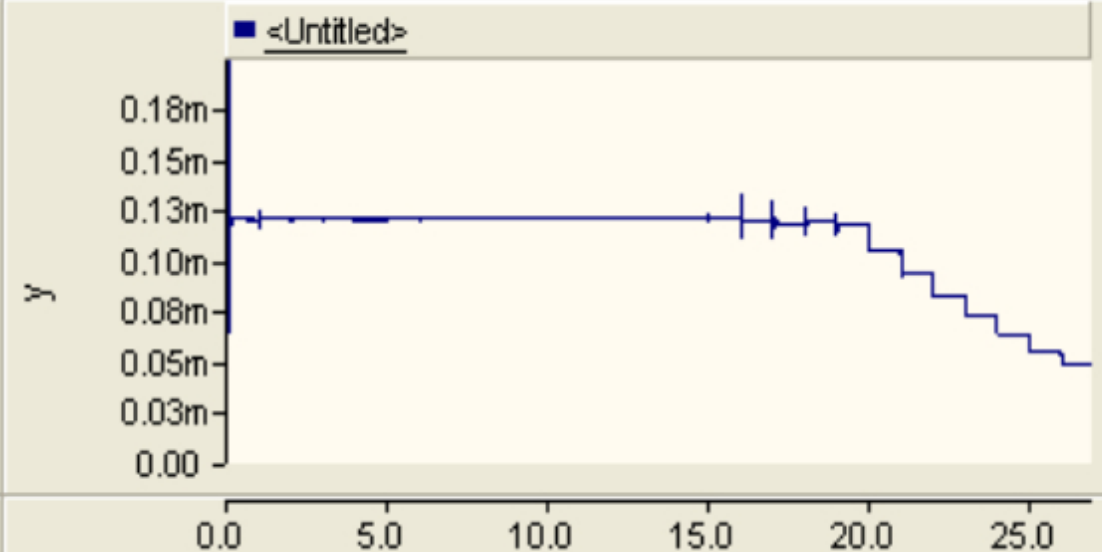


十二脉波整流充电机单台充电机仿真模型
Simulation Model of a single 12-pulse rectifier charger

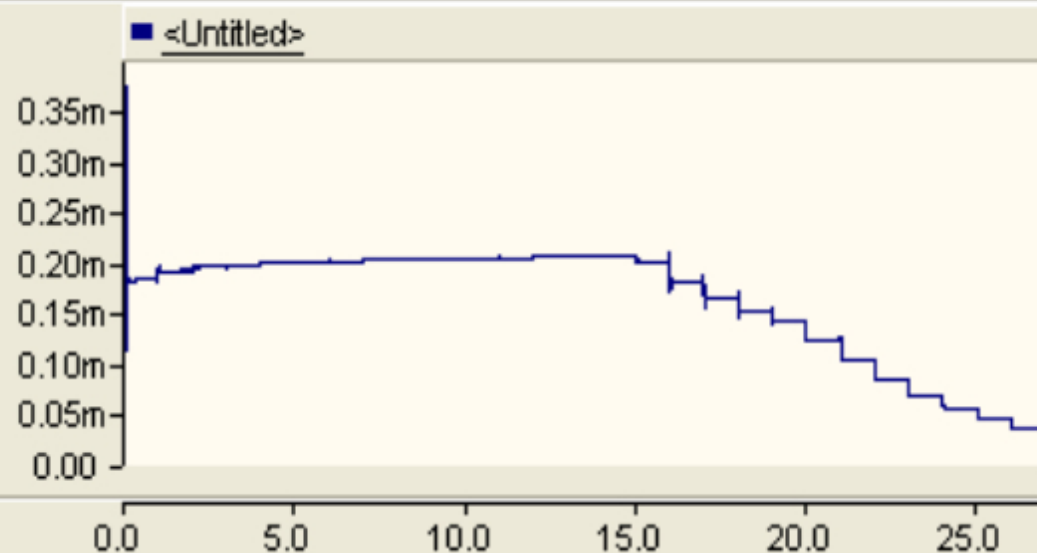
Main: 高压侧总电流



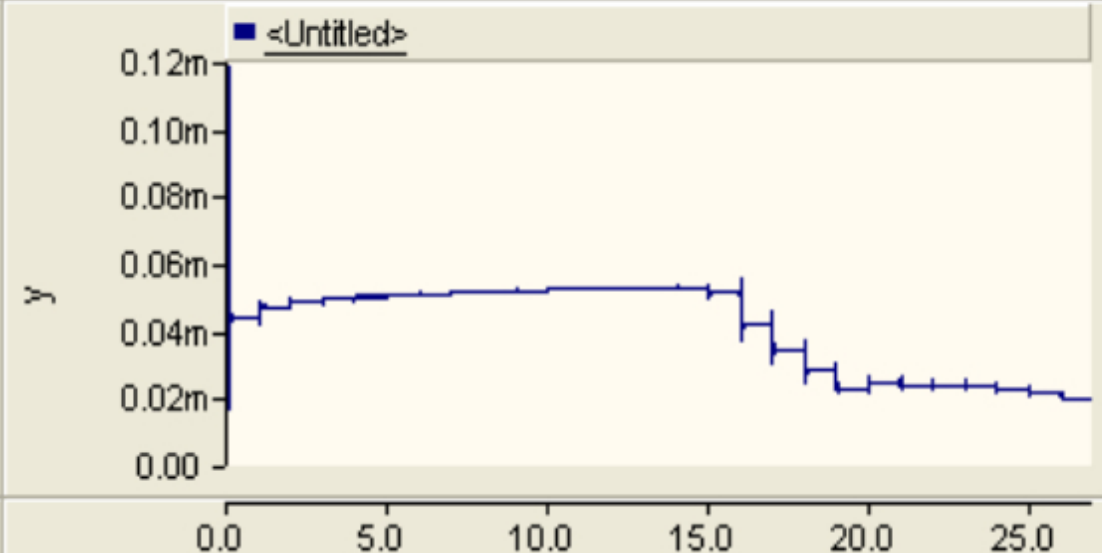
Main: 高压侧7次谐波



Main: 高压侧5次谐波

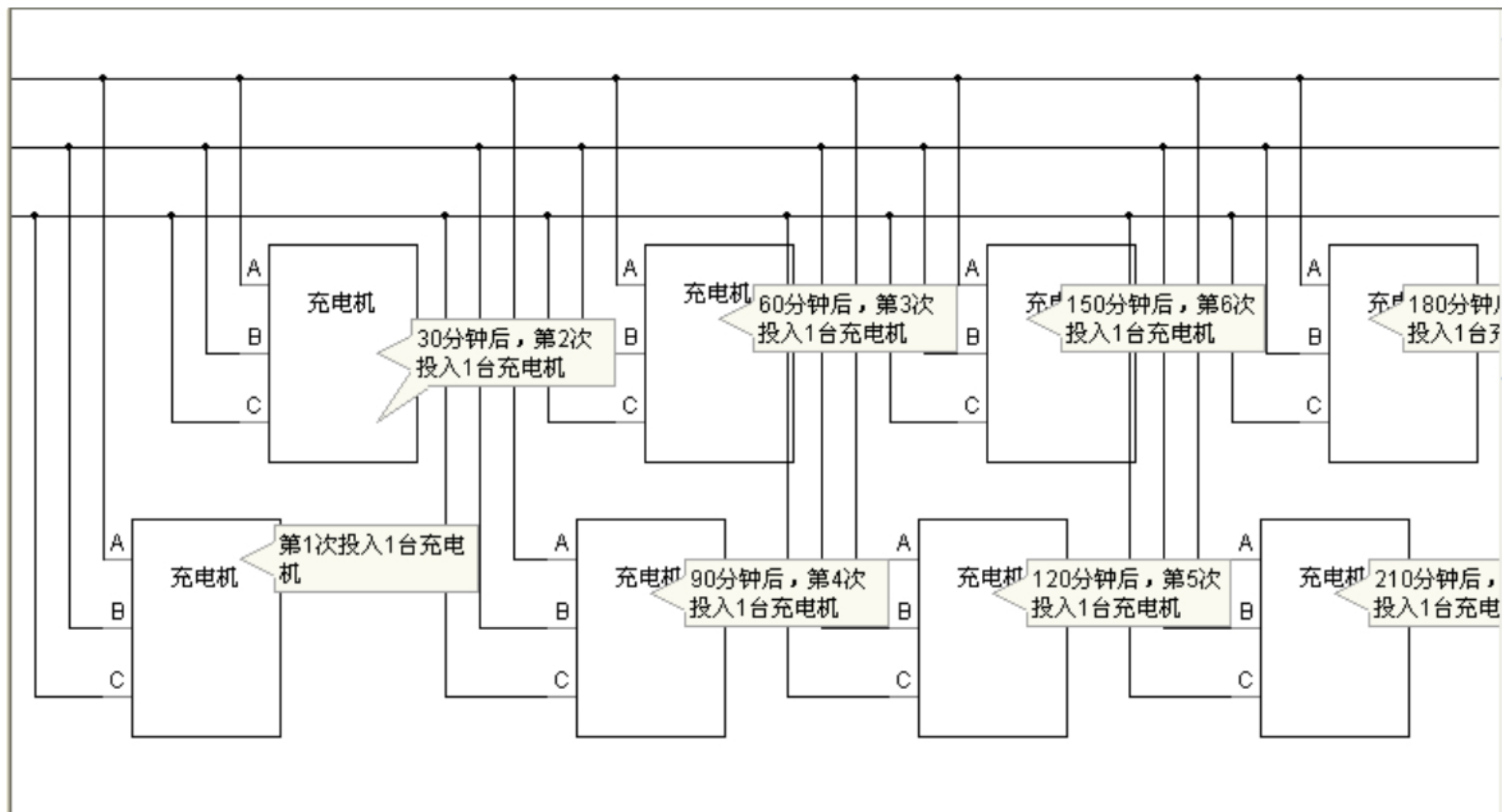


Main: 高压侧11次谐波



单台充电机接入系统谐波曲线

Harmonic Circle of a single charger connected to grid



多台充电机接入系统的仿真模型
Harmonic Circle of multi-chargers connected to grid

Thank You !