让我们共同打造气候中和的未来
Building a climate-neutral future together.

中华人民共和国
住房和城乡建设部

Schweizerische Eidgenossenschaft
Confédération suisse
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环能科技
CABR EET

中国建筑节能协会

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skat Swiss Resource Centre and Consultancies for Development

Empa

HSLU Lucerne University of Applied Sciences and Arts

ZEB Talk - PV battery storage
中瑞零碳建筑专题研讨会 - 光伏电池储能

Zurich, Switzerland
7th November 2023
瑞士苏黎世
2023年11月7日


ZEB
让我们共同打造气候中和的未来
Building a climate-neutral future together.
WILLERS

让我们共同打造气候中和的未来
Building a climate-neutral future together.

Engineering for a better world.
工程让世界更美好

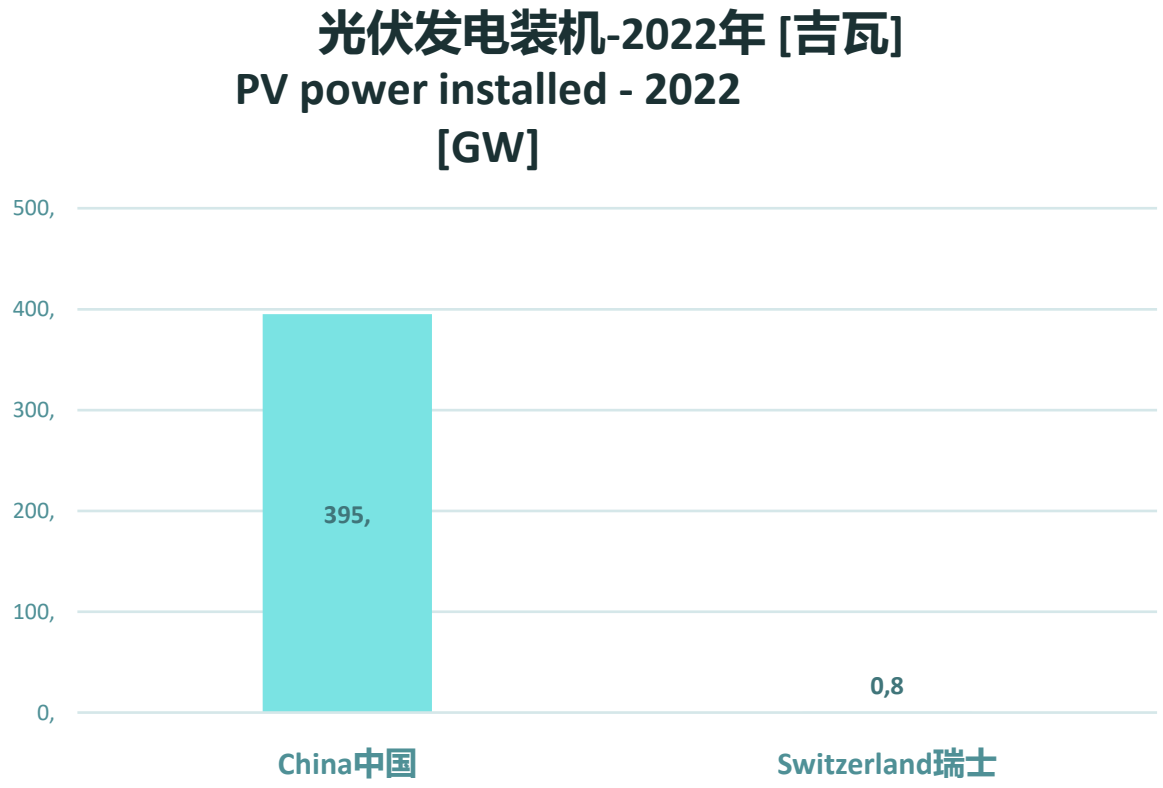
PV battery storage
光伏电池储能

David Stamm

November 7, 2023

WILLERS

China has a lot of experience in the field of PV!
中国在光伏领域拥有丰富经验！



Source: https://www.volker-quaschning.de/datserv/pv-welt/index.php

Agenda议程

1. Willers Who we are **品牌故事**
2. Use of storage **应用储能**
3. AC / DC integration **交流/直流集成**

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1989

foundation of the willers company
公司成立

>90

employees
员工

12

nationalities
国籍

5

locations
地点

WILLERS

Zürich 苏黎世

Bern 伯尔尼

Rheinfelden 莱茵费尔登

Locations in Switzerland

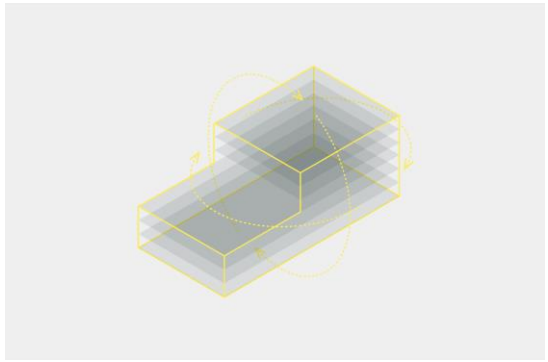
瑞士分公司

Wroclaw, Polen
弗罗茨瓦夫，波兰

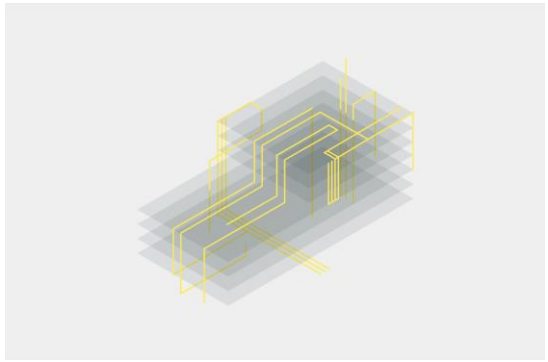
Shanghai, China
上海，中国

International locations

国际地点

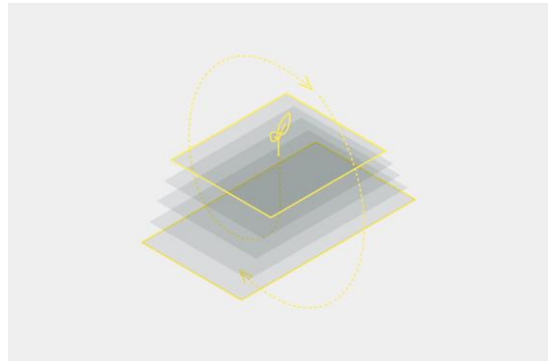


general planning
总体规划

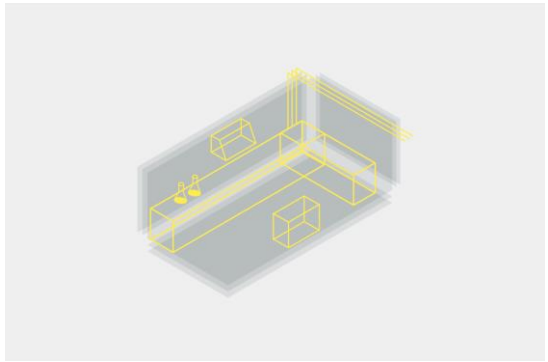


building technology
建造技术

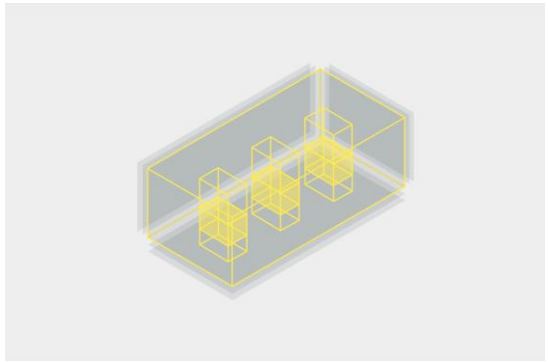
digital building
数字建造



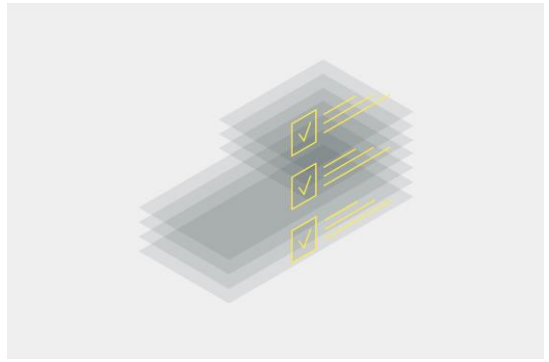
energy efficiency
节能



labs
实验室



clean room
无尘室



GMP
良好生产规范

Our expertise

我们的专长

- Division Manager Electrical Engineering @ Willers
  Willers电气工程部经理
- Bsc. Building Electrical Engineering, University of Lucerne
  卢塞恩大学建筑电气工程学士
- MAS Digital Construction (VDC) University of Applied Sciences Northwestern Switzerland / Stanford University

  瑞士西北应用科学大学/斯坦福大学数字建造硕士

David Stamm

Use Case of storage
储能案例

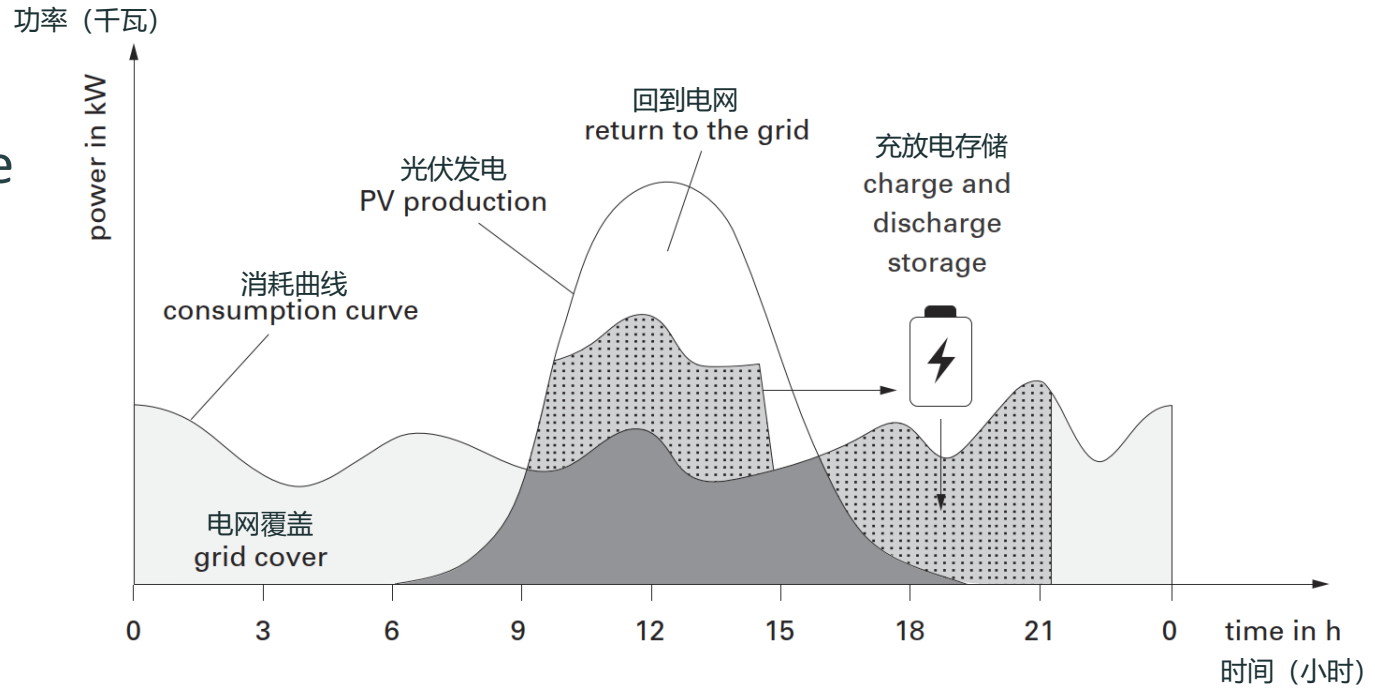
- Self-consumption optimization 自我消耗优化
- Autarky optimization 自主优化
- Peak load reduction 峰值负荷降低
  - **House connection is smaller 房屋连接更小**
  - **Reduce load curve 减小负荷曲线**
- Electricity exchange 电力交换
- Backup 备份

These concepts are described in SIA 2061 Battery storage systems in buildings.
这些概念在SIA 2061 建筑电池存储系统中有所描述。

Goal: to supply as little PV energy as possible to the grid

目标：向电网提供尽可能少的光伏能源

- Cheaper energy, as there is no need to use the grid
  更便宜的能源，因为不需要使用电网
- storage systems are designed for daily cycles
  存储系统是为每日循环设计的



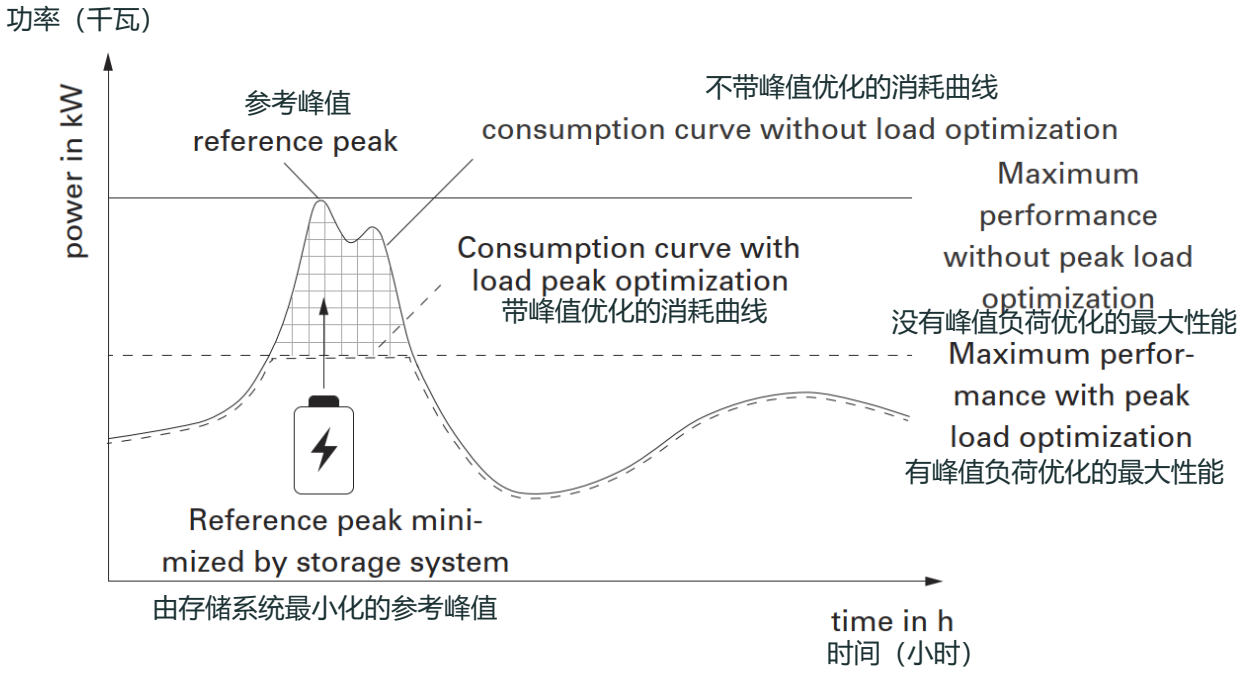
Use Case - Self-consumption optimization

使用案例 - 自我消耗优化

Goal: Mains supply and mains regeneration are balanced out

目标：电力供应与电力生产达到平衡

- Power peaks determine the costs in relation to the grid connection, these are reduced
  电力峰值决定了与电网连接相关的成本，目标是降低该成本
- Grid connection can be limited
  电网连接可能受到限制



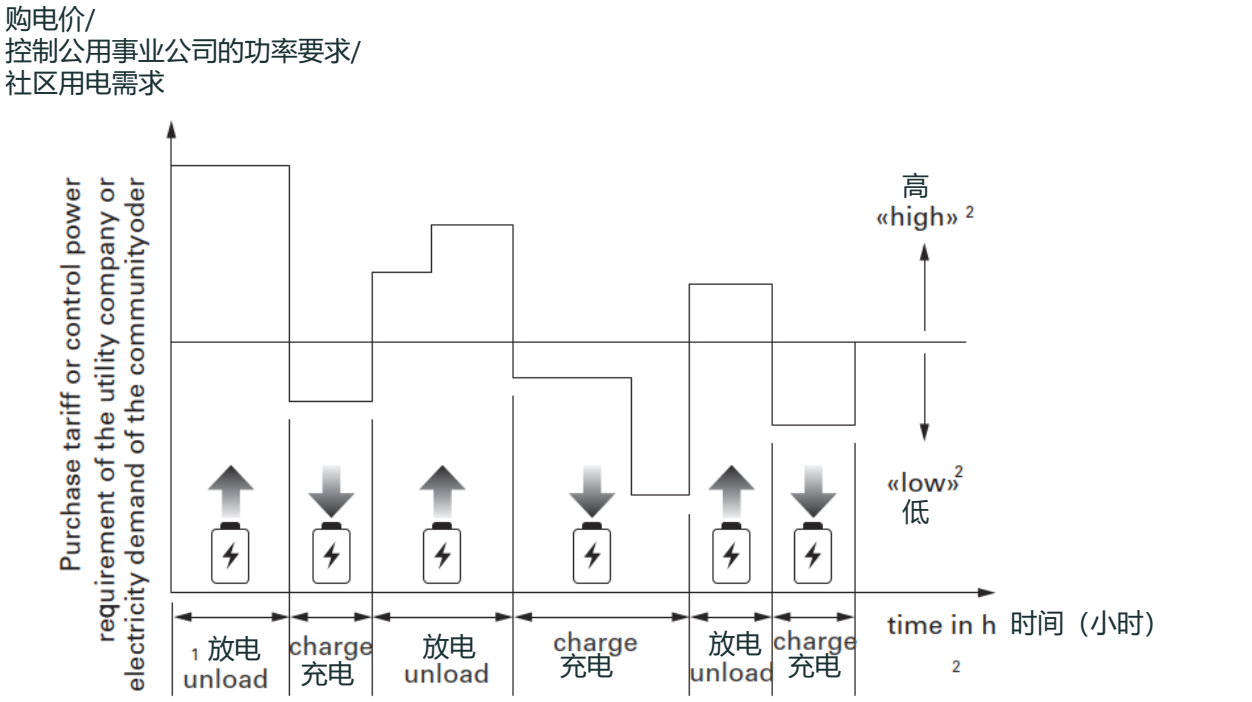
Use Case - Peak load reduction

使用案例 - 峰值负荷降低

Goal: electricity between the grid and the storage system:

目标：调节电网与存储系统之间的电力

- Helps stabilise the grid
  有助于稳定电网
- Draws electricity when tariff is low and supplies when tariffs (demand) is high
  电价低时汲取电力，电价（需求）高时供应电力



1 Storage system feeds electricity consumers or into the grid
2 Different progressions for purchase tariff, control power demand and electricity demand. Temporally fixed (purchase tariff today) or variable.

[1]储能系统向消费者或电网输送电能
[2]阶梯电价，控制功率需求和电力需求。临时固定（今日购电价）或可变的。

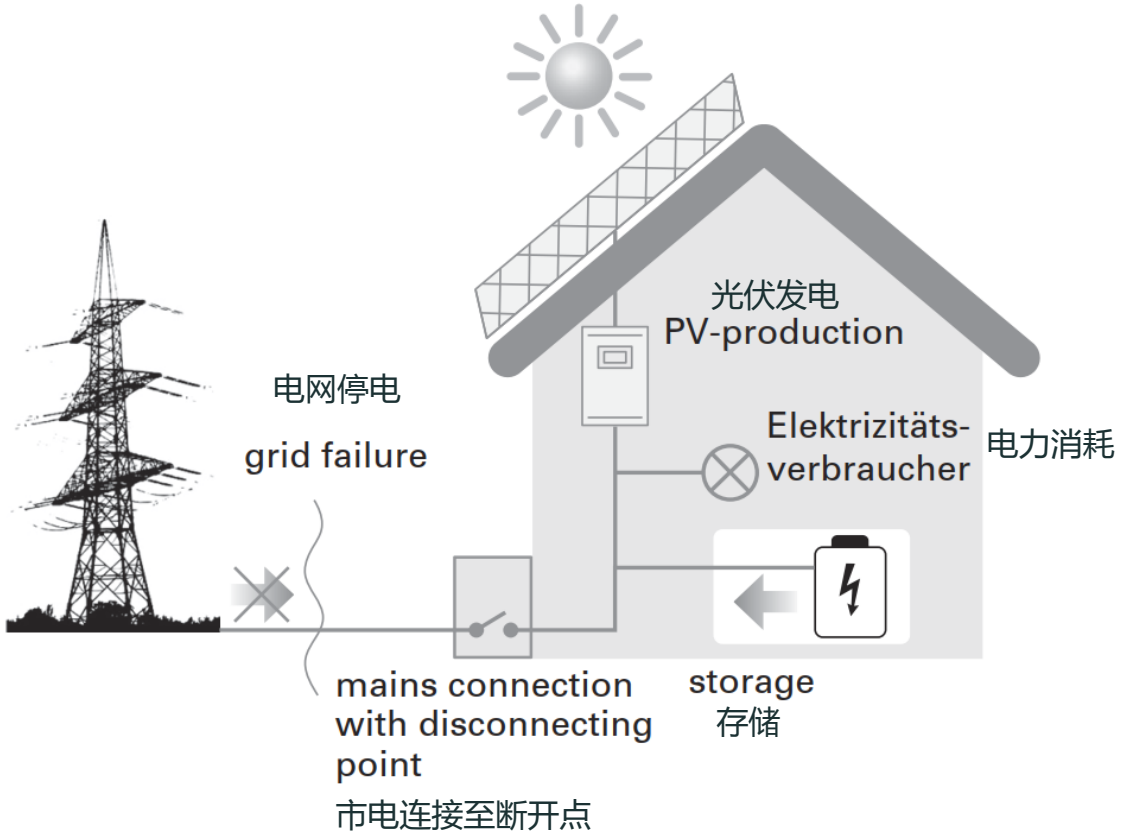
Use Case - electricity exchange

使用案例 - 电力交换

Goal: In case of mains failure, battery supplies the electrical installation, or parts of it

市电停电时，电池为电气设施提供全部或部分电力

- Backup is not an ups because there is an interruption when switching
  备份不是不间断电源，因为切换时有中断
- Storage must be backup capable
  储能必须有备份能力
- Backup consumers should be reduced, operate only necessary consumers
  应减少备用消耗者，只为必要的消耗者供能



Use Case - backup

使用案例 - 备份

Storage use with different targets.

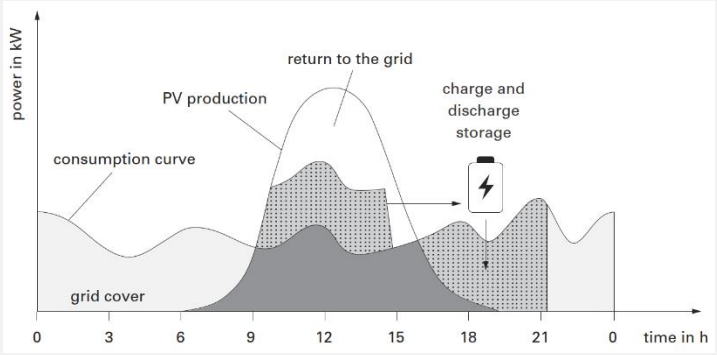
储能可以满足不同目标

As an example, for self-consumption optimization and backup

作为自我消耗优化和备份的案例

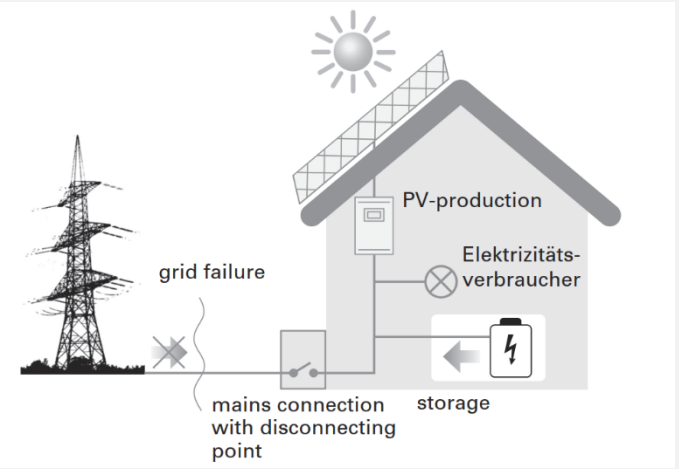
Prio 1.

第一优先级



Prio 2.

第二优先级



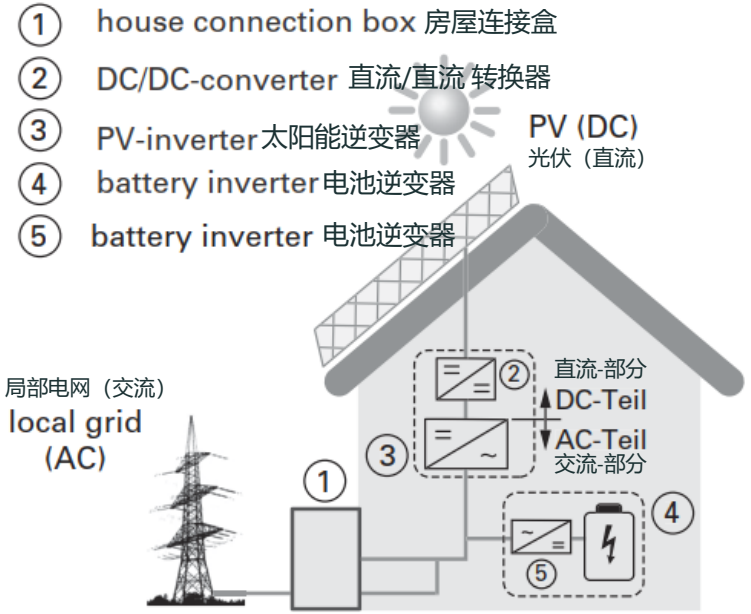
Use Case - several applications

使用案例 - 几个应用

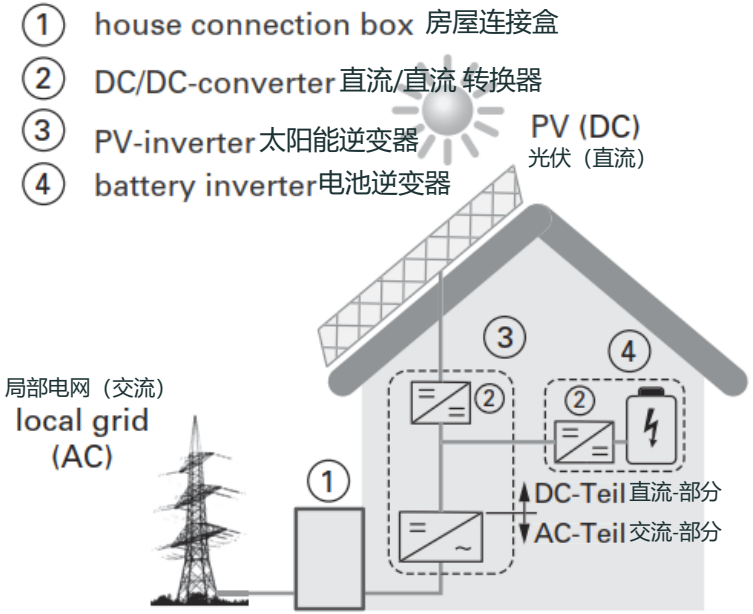
AC / DC Integration
交流/直流整合

- Efficency vs. Flexibility
  效率 vs 灵活性
- AC coupling
  交流耦合
  - more flexiblity 灵活性更高
  - less efficency 效率更低
- DC coupling
  直流耦合
  - less flexiblity 灵活性更低
  - more efficency 效率更高
  - fewer systems 系统更少

交流耦合系统
AC coupled system



直流耦合系统
DC coupled system

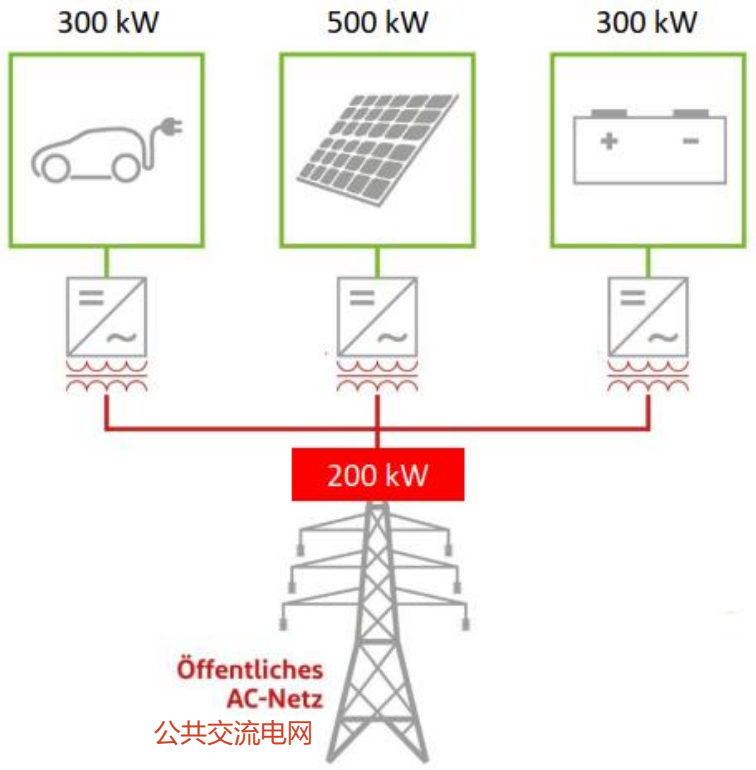


AC/DC integration

交流/直流整合

New technologies have a major impact on the grid.
新技术对电网有重大影响
Electromobility and PV are introduced on a large scale, but the grid is not equipped, especially in rural areas.
电动车和光伏被大规模引进，但没有对应升级电网，尤其在农村
If no grid expansion, then:
如果电网没有扩张，那么：

- Grid installs power reduction
  电网安装节能装置
- EMS internal, for Battery und Charging EV
  内置能量管理系统，为电池和电动车充电
- Customer installs less pv 客户安装更少光伏



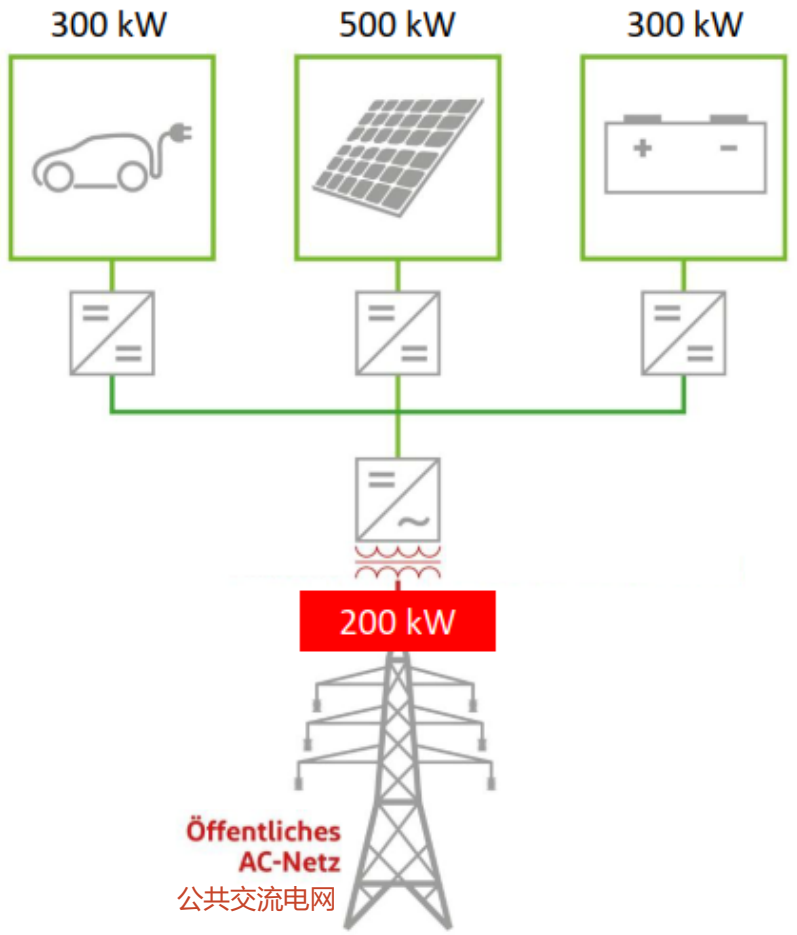
AC/DC integration

交流/直流整合

With a DC grid:

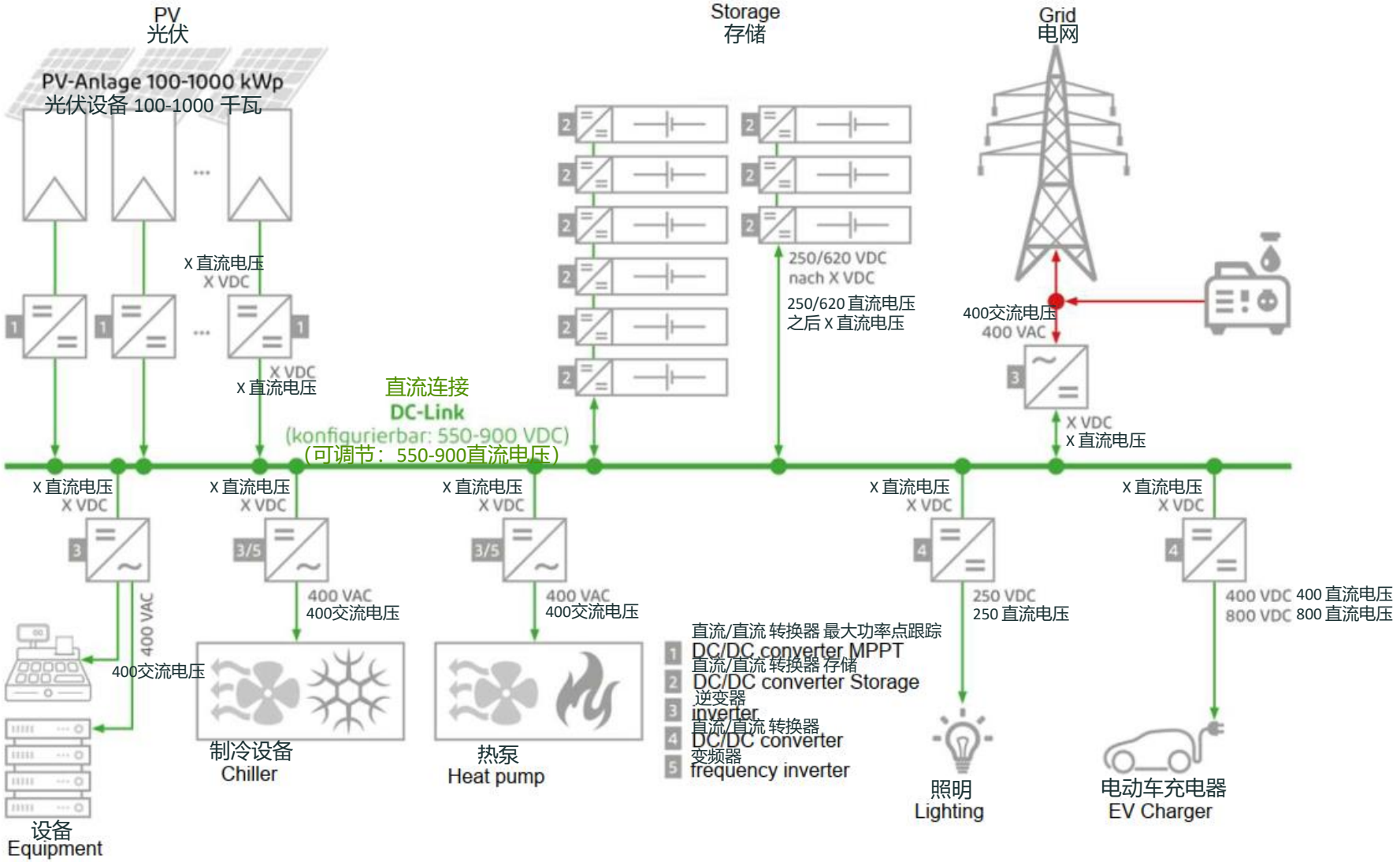
直流电网：

- Installation 200 kVA inverter to the grid
  安装200千伏安逆变器
- Self-regulating system on the DC side
  直流端的自我调节系统
- DC grid easier to regulate
  直流电网更易调节
- When batteries are full and no one charges -> self-acting throttling of PV
  当电池充满且无人充电时 -> 光伏自动节流



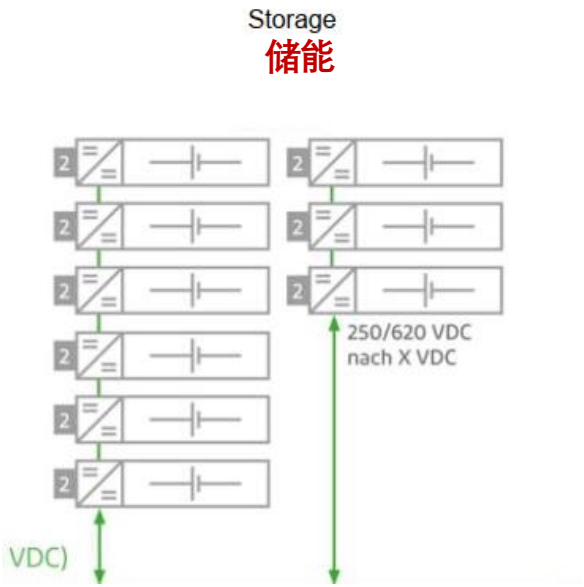
AC/DC integration

交流/直流整合



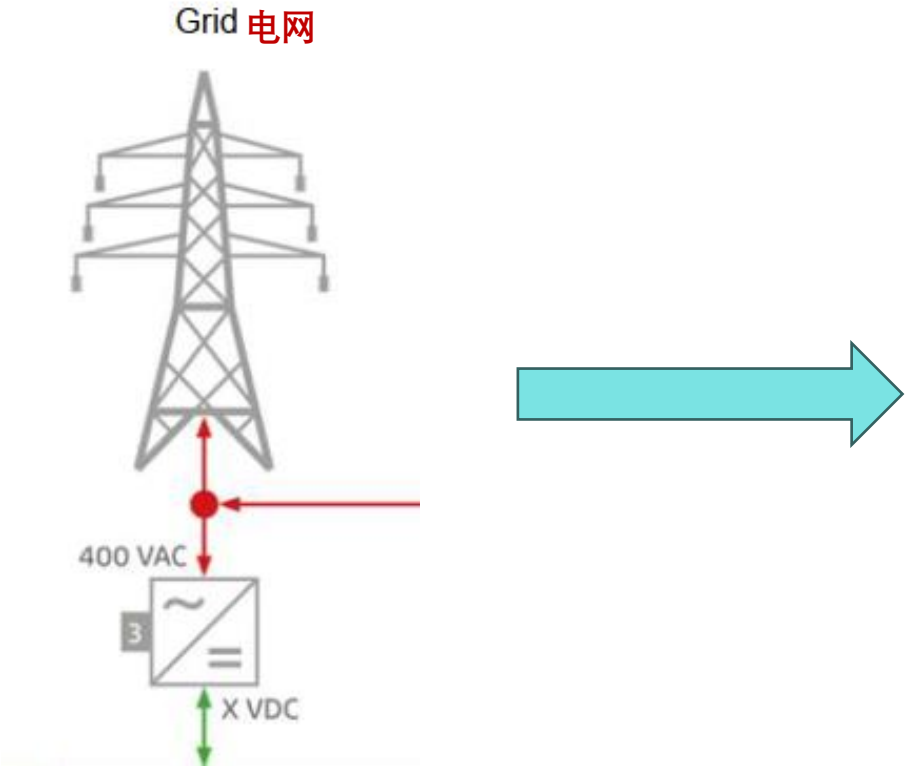
AC/DC integration

交流/直流整合



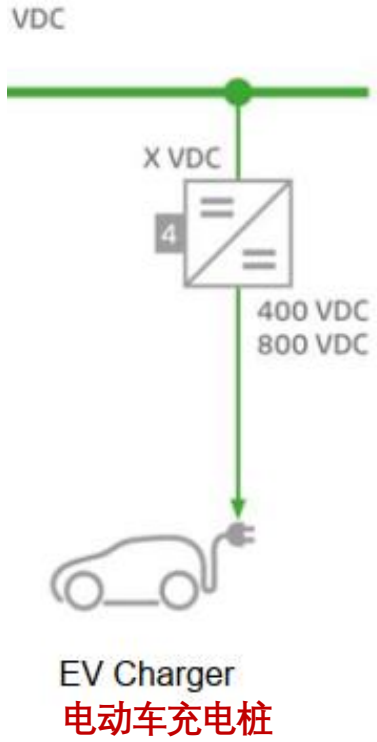
AC/DC integration

交流/直流整合



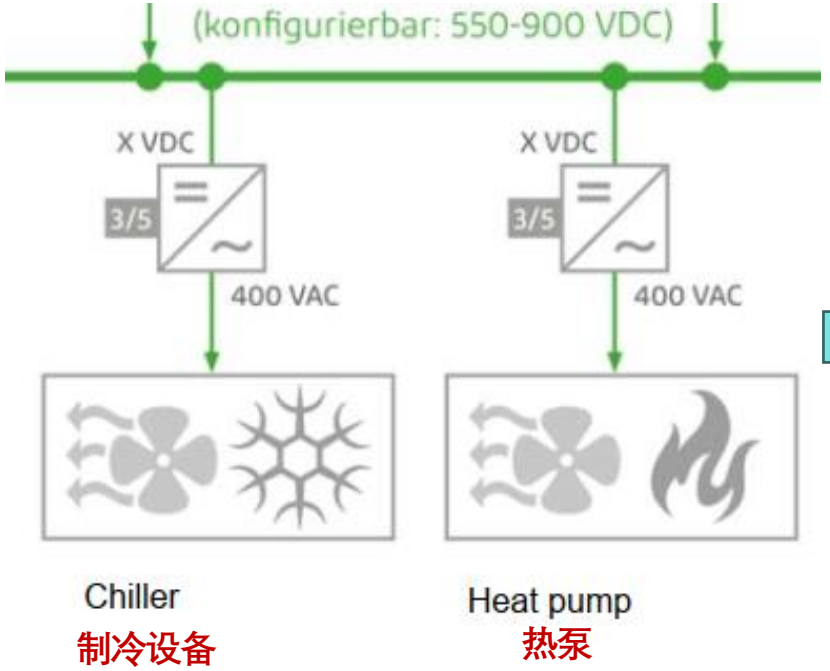
AC/DC integration

交流/直流整合



AC/DC integration

交流/直流整合



AC/DC integration

交流/直流整合

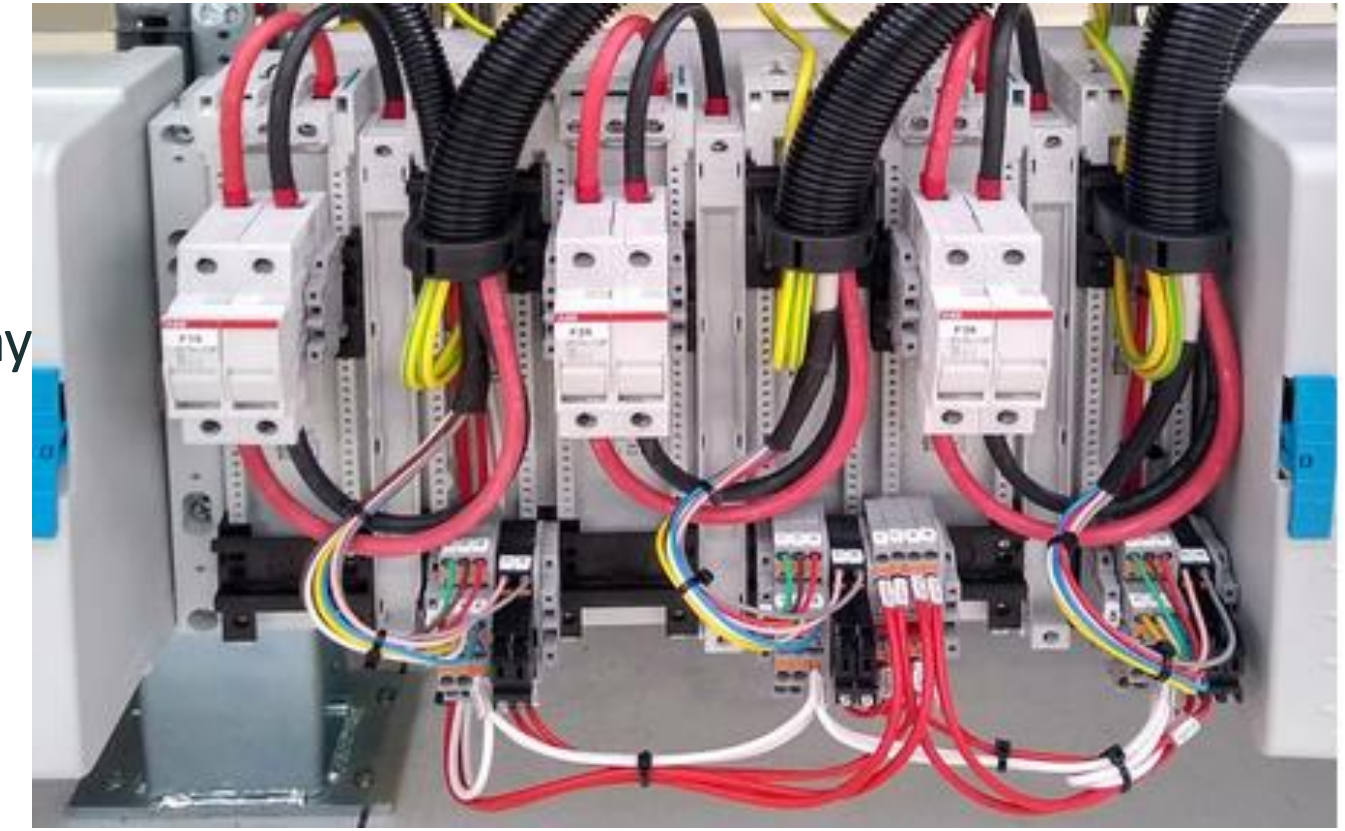
barriers for DC grids:

直流电网面临的障碍

- less experience in buildings
  建筑领域经验不足
- Protection systems are more costly (today
  目前来看，保护系统更昂贵
- less component 更少的组件
- Standardization less 标准化更少

It is unfamiliar but will help us solve the challenges.

很多人对比不熟悉，但将帮助我们解决挑战。



AC/DC integration

交流/直流整合

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Thank you for your attention!
感谢您的关注

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