Integration of Electromobility and Renewable Energies – Energy-Economic Impact and Current Developments in Germany

电动汽车与可再生能源的耦合 – 在德国的经济影响和发展现状

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GIZ Key Facts
德国国际合作机构大事记

- German government-owned public-benefit enterprise
  德国国有的公益性企业
- Implementing international cooperation for sustainable development
  执行可持续发展相关的国际合作项目
- Commissioned by well over 300 public and private-sector bodies from Germany and abroad
  受来自德国和国外的超**300**家公共和私营实体的委托
- Operations in Germany and over 130 countries around the world
  在德国和世界上**130**多个国家运营
- Business volume of over EUR 2.03 billion in 2014
  在德国和世界上**130**多个国家运营
- 16,500 employees worldwide
  在全球共有**16500**名员工

GIZ in China
德国国际合作机构（中国）

- More than 30 years experience in Sino-German technical cooperation
  拥有超过**30**年的中德技术合作经验
- Portfolio: Policy advice, technical expertise, knowledge transfer, capacity building etc.
  业务领域：政策建议、专业技术、知识转移、能力建设等
- Approx. 130 employees in China
  在中国约有**130**名员工

Continuous adaption of project portfolio to partner requirements
应合作伙伴的要求，不断调整业务领域

1980
- Rural development
  农村发展
- Forestry
  林业
- Poverty reduction
  减少贫困

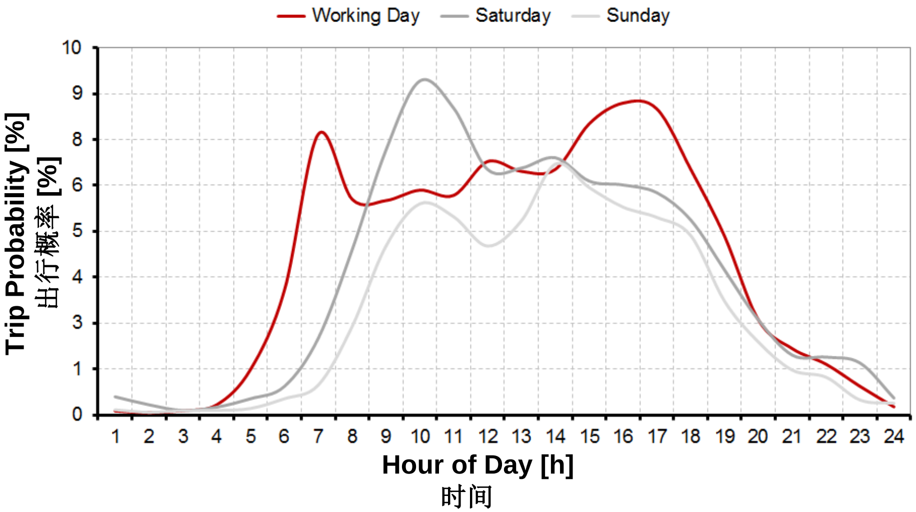
1990
- Sustainable economic development
  可持续性经济发展
- Private sector development
  私营部门发展
- Vocational training
  职业培训

2000
- Environment
- Climate
- Mobility
- Energy
- Urbanization
- Governance

- 环境
- 气候
- 交通
- 能源
- 城市化
- 治理

Trip Probability and Grid Connectivity of Vehicles
汽车的出行概率以及接入电网情况分析

Percentage of Trips in Germany 在德国的出行概率



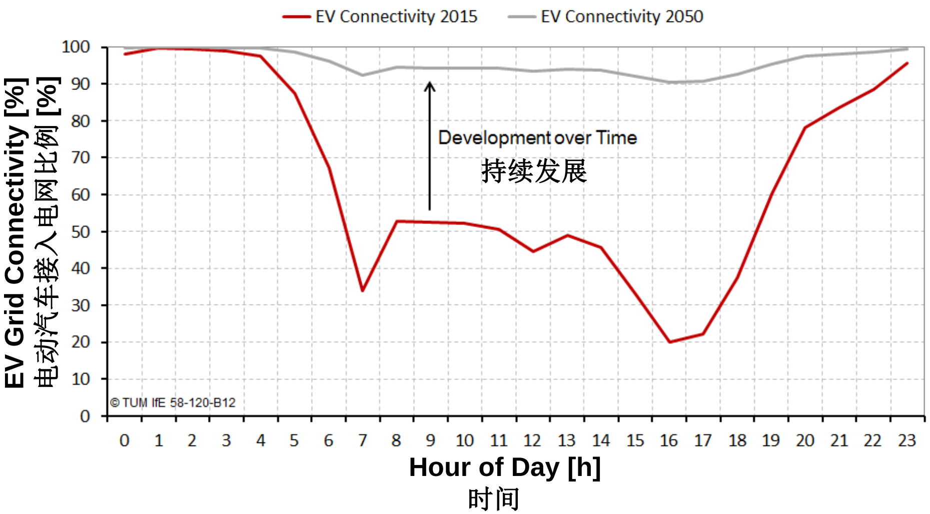
- Similar distribution in most European countries

  在大多数欧洲国家结果分布类似
- Two characteristic traffic density peaks within 24 hours (morning and late afternoon)

  24小时之内的两个交通密度峰值(早上和傍晚)
- Moderate traffic density during the day / nearly no traffic at night

  交通密度在日间缓和/在晚间基本没有汽车

Assumed Percentage of Grid Connectivity 接入电网情况



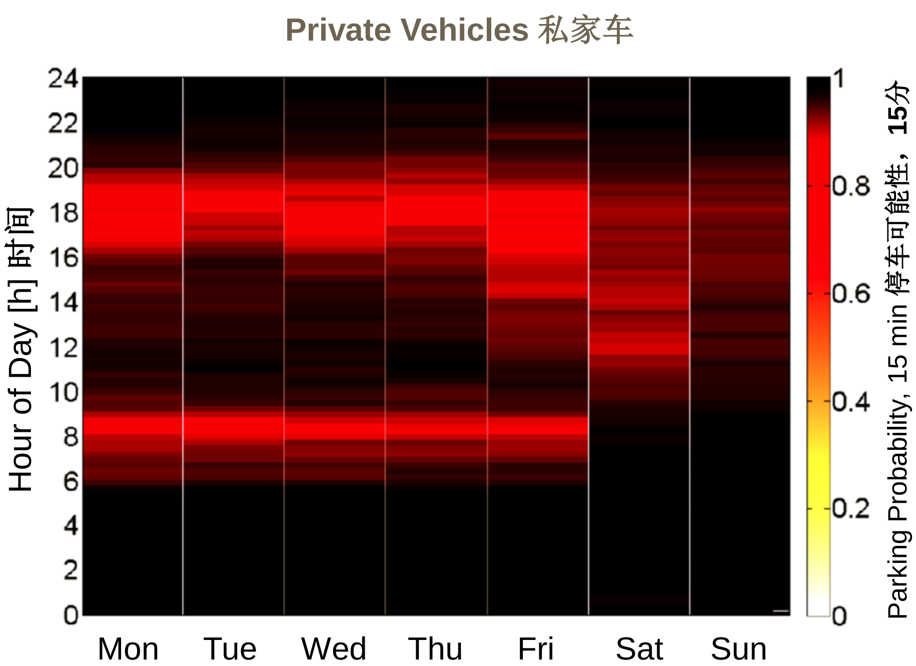
- Most of commuters connect their electric vehicle to the grid at home (2015)

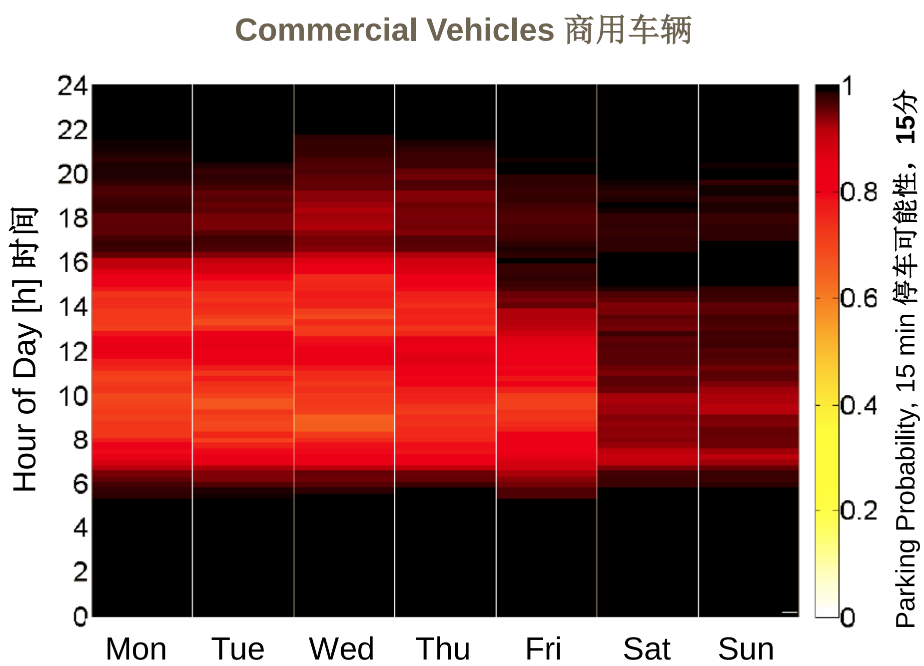
  大多数上班通勤者在家中将电动汽车接入电网进行充电 **(2015)**
- Increasing percentage of grid connectivity through further development of charging infrastructure (2050)

  随着充电基础设施的进一步建设，接入电网的汽车比例会升高 **(2050)**

Source: Federal Ministry of Transport and Digital Infrastructure (BMVI), Mobilität in Deutschland, 2008; Gohla-Neudecker, B., Analysis of Selected Sustainability Criteria of Electric Vehicles from an Energy-Economic Perspective in Europa, Dissertation, 2014

Parking Behavior of Private and Commercial Vehicles
私家车和商用车辆的泊车行为

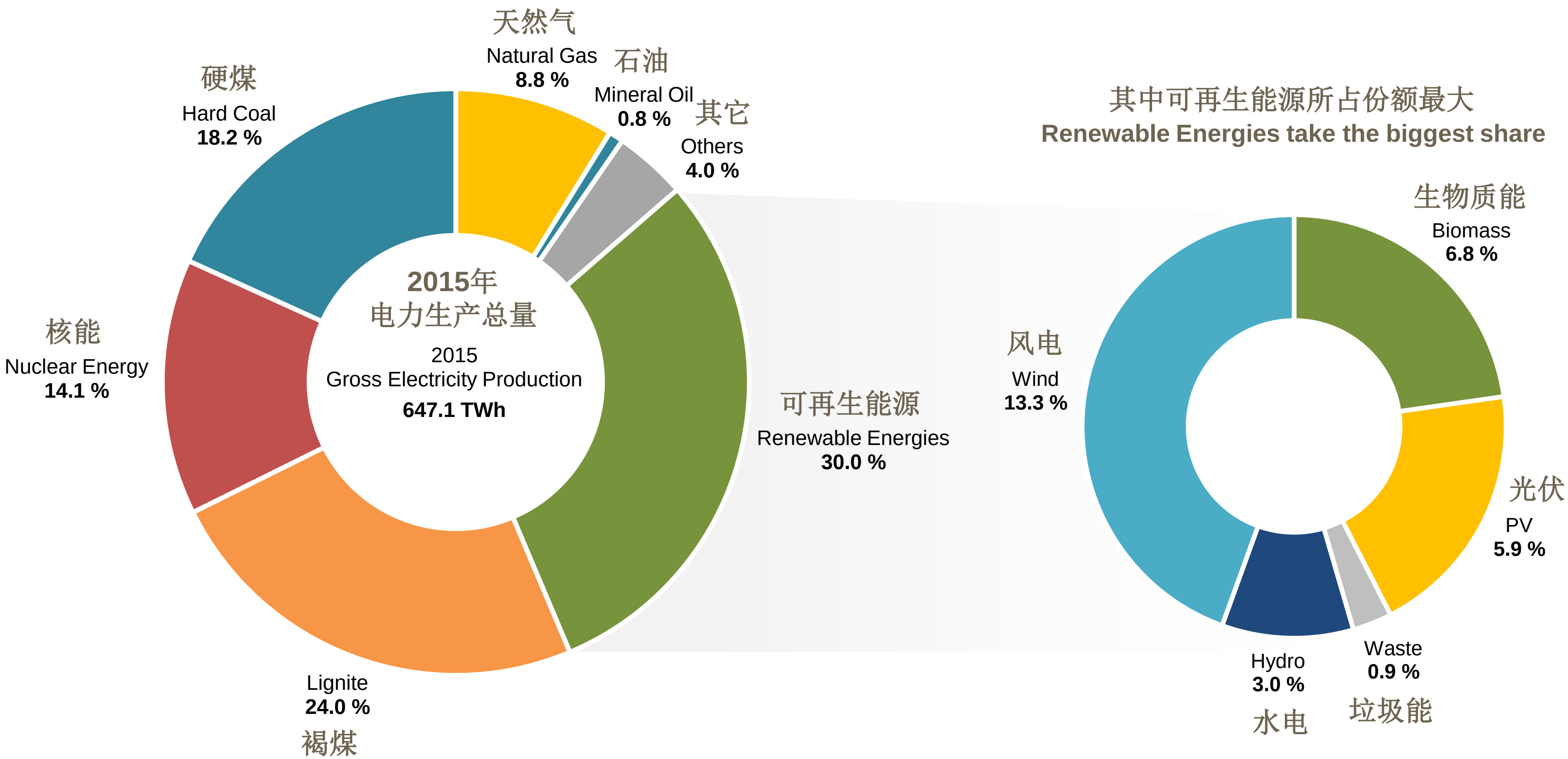




- Limited correlation between parking duration and required energy
  在泊车时长和所需充电能量间仅有有限的关联
- Predictability of parking duration and availability for system services are depending on user group
  泊车时长的可预测性与系统服务的可用性均取决于用户族群

Source: Reseach Center for Energy Economics Munich, eFlott: Wissenschaftliche Analysen zur Elektromobilität, 2011

Energy Sources in German Gross Electricity Production
德国电力生产的能源来源



Source: Arbeitsgemeinschaft Energiebilanzen, 2015; Federal Ministry for Economic Affairs and Energy (BMWi), Zahlen und Fakten Energiedaten, 2016

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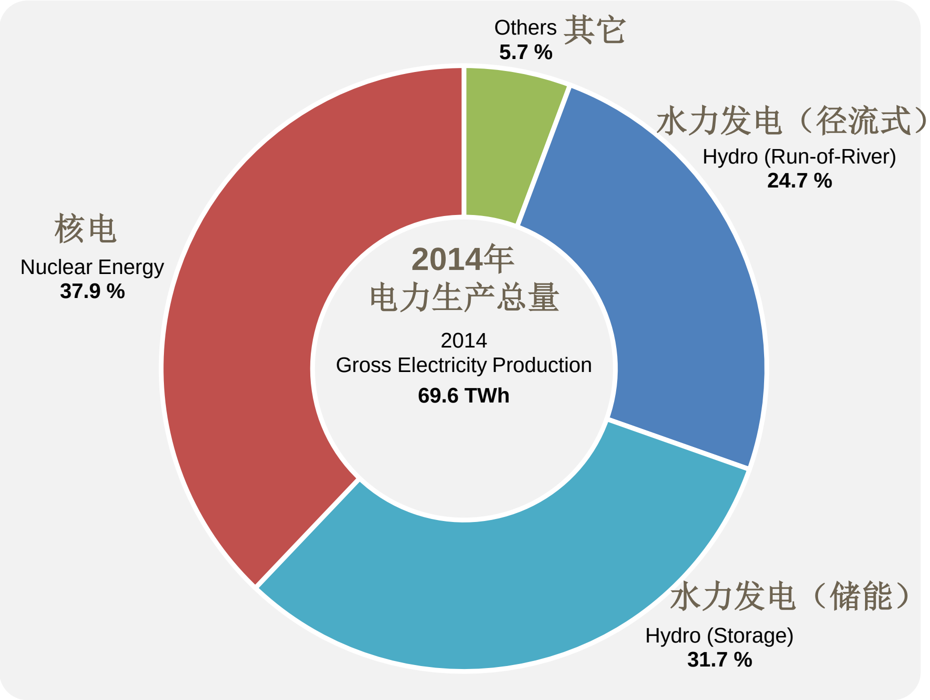
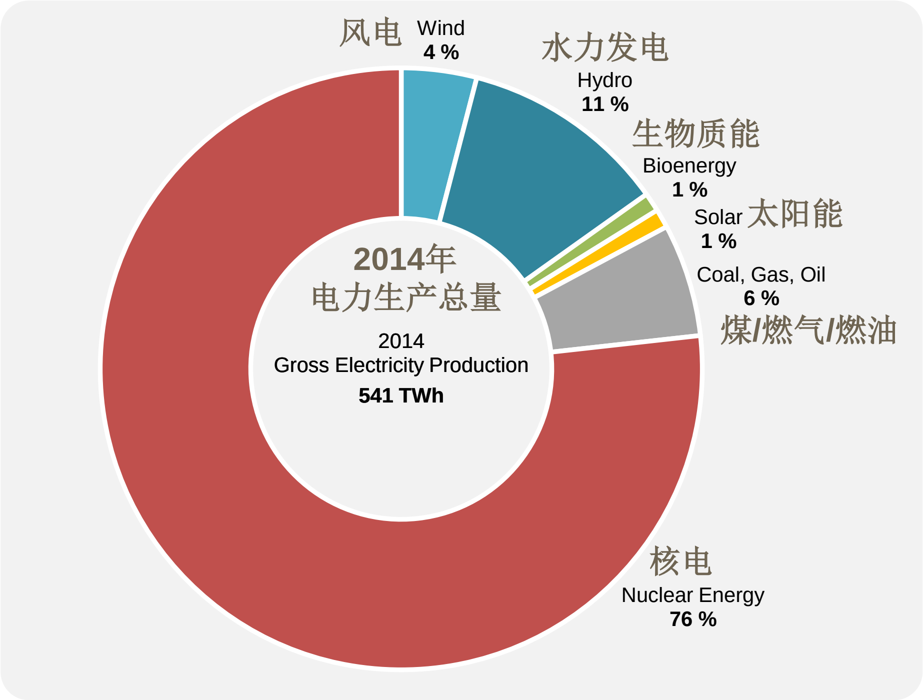
Electricity Production in Europe
欧洲其他国家的发电量情况

Switzerland 瑞士

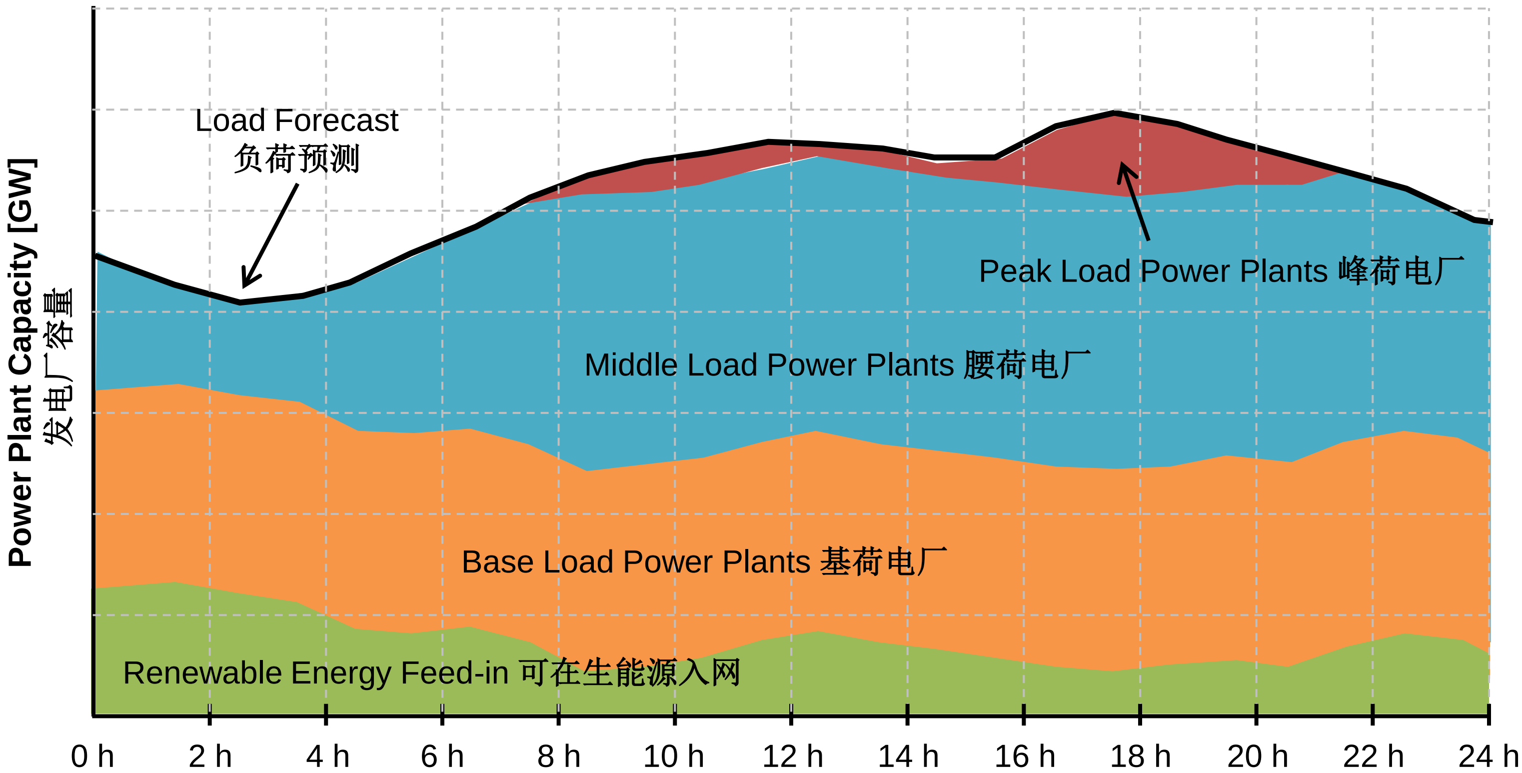


France 法国



Source: Swiss Federal Office of Energy SFOE, 2016; Le réseau de l'intelligence électrique, 2016

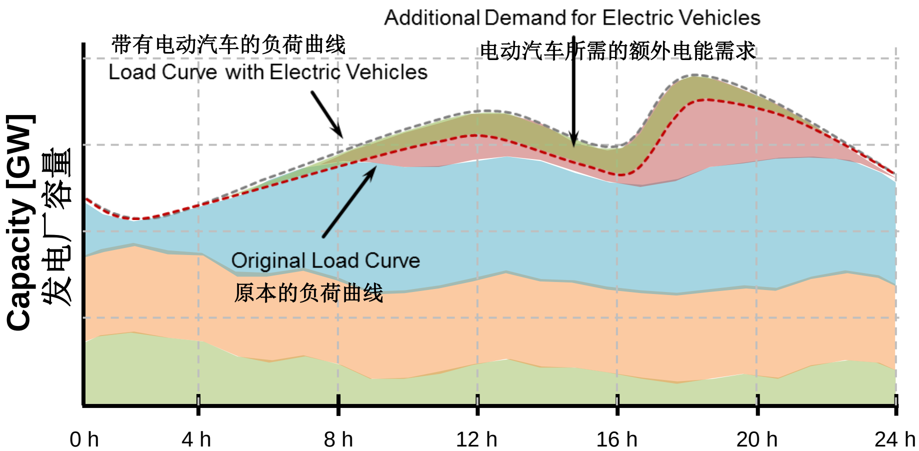
Covering of Load Forecast by Merit Order of Power Plants
通过 Merit Order 来预测负荷覆盖情况



Source: Based on Gohla-Neudecker, B., Analysis of Selected Sustainability Criteria of Electric Vehicles from an Energy-Economic Perspective in Europa, Dissertation, 2014

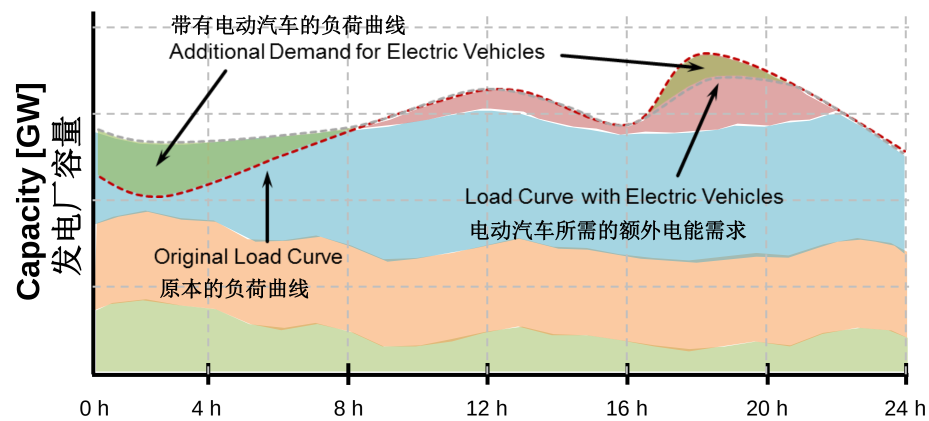
Impacts of Different Charging Strategies on Load Profiles
不同充电策略对负荷分布情况的影响

Uncontrolled Charging 非受控充电



- EVs are connected to the grid after operation on the road
  电动汽车在路上行驶之后直接接入电网充电
- Correlation with daily distribution pattern
  额外需求的功率会叠加在每日的负荷时间分布上
- Impact of uncontrolled charging affects power supply from peak load power plants
  未受控冲点会影响峰荷电厂的电力供给

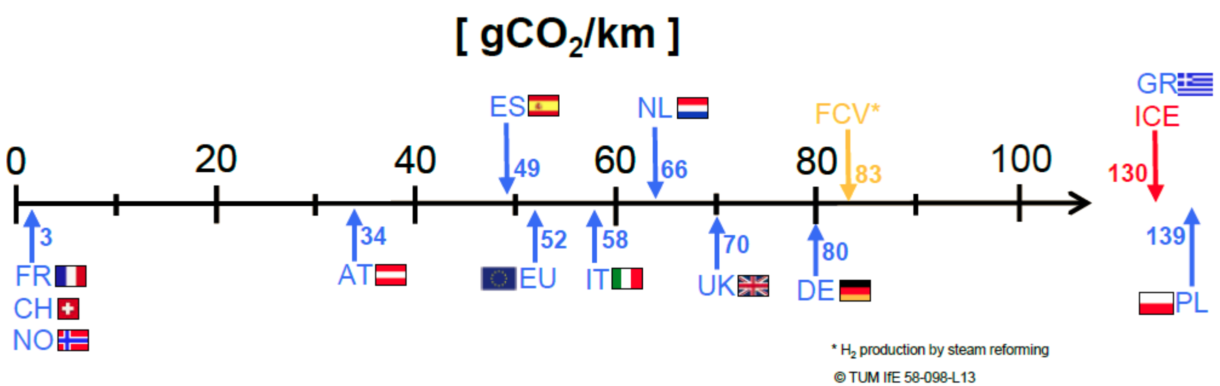
Controlled Charging 受控充电



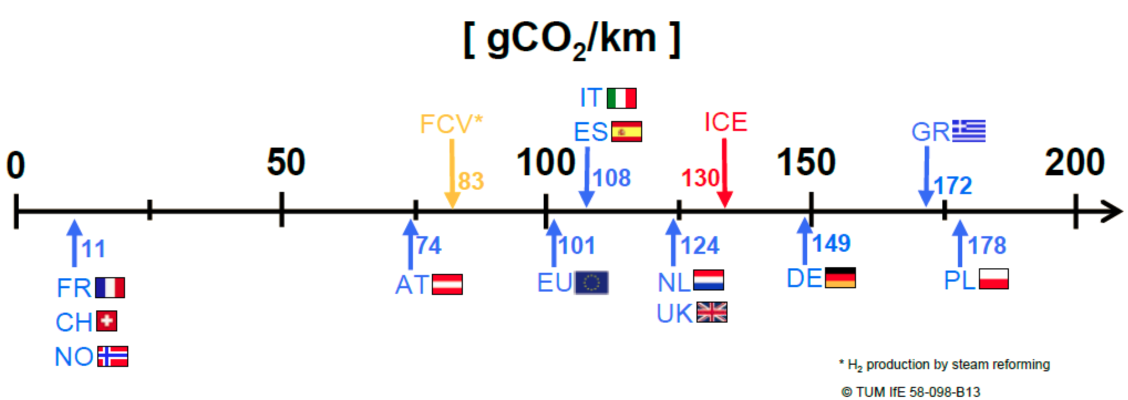
- Cost-optimized controlled charging (e. g. at low consumer demand)
  针对价格优化的受控充电（例如在低负荷时充电）
- Levelling of load profile (valley filling/peak shaving)
  校平目前的负荷曲线（填谷削峰）
- Impacts on middle and peak load power plants
  会影响腰荷及峰荷电厂

Source: Based on Gohla-Neudecker, B., Analysis of Selected Sustainability Criteria of Electric Vehicles from an Energy-Economic Perspective in Europa, Dissertation, 2014

CO_2 Emissions of Electric Vehicles
电动汽车的二氧化碳排放



MIX Method
MIX 方法



DELTA Method
DELTA 方法

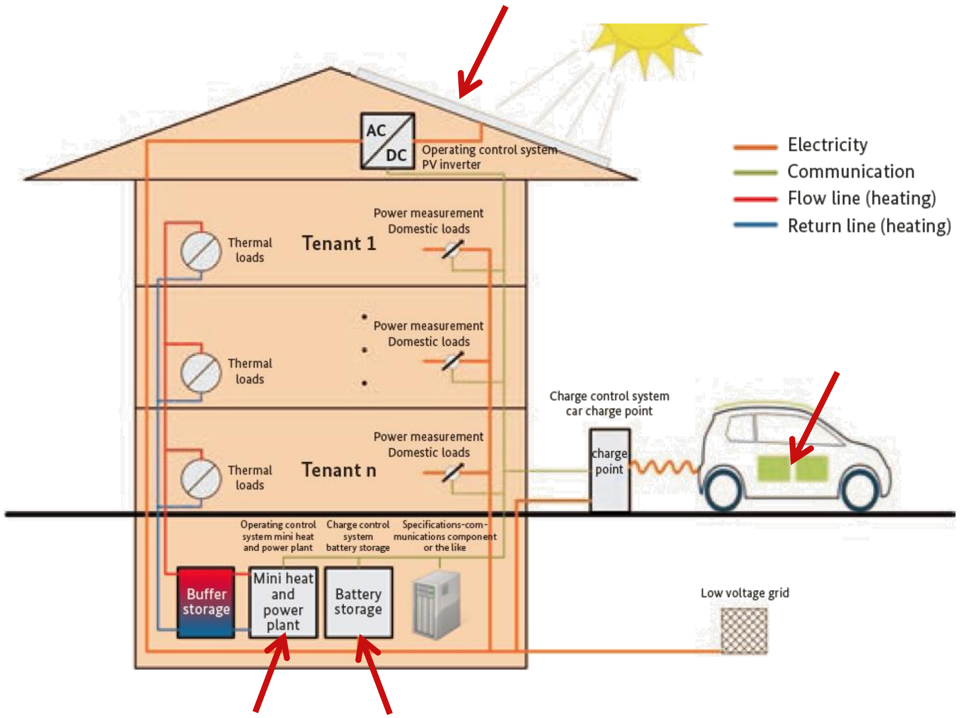
Source: Gohla-Neudecker, B., Analysis of Selected Sustainability Criteria of Electric Vehicles from an Energy-Economic Perspective in Europa, Dissertation, 2014

Funding Priorities and Focus Topics in Germany
德国资助重点和焦点话题

Development 开发	Testing 测试	Analysis/Comparison 对比分析
Methods for Coupling the Use of Electromobility and Renewable Energies 开发与测试电动汽车的应用同可再生能源耦合的方法		Economic and Ecological Comparison of Conductive / Inductive Charging 从经济和生态两方面入手对比接触式充电和感应式充电
Procedures for Controlled Charging and Feedback of Electric Energy into the Powergrid 开发与测试受控充电的流程以及向电网输回电能		
Wireless Charging Methods and Validation Tests of its Positive Impact on Using Renewable Energies 无线充电方法的开发和验证其是否有助于可再生能源的应用		
Development of Business Models under Consideration of Ecological Aspects 基于生态角度开发商业模型		Analysis of Controlled and Wireless Charging Method Grid Impacts and Investigation of Customer Acceptance 分析受控充电和无线充电对电网的影响以及调查用户的接受程度

Source: Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Renewably mobile: Marketable solutions for climate-friendly electric mobility, 2014

Lighthouse Project “3E-multi-familiy-home”
灯塔项目“三级多户住宅”



Objective:
First time testing of decentralized energy system in multi-family home (with larger number of tenants)

目标：
对有很多住客组成的多用户住宅中的分布式能源系统进行第一时间的测试。

Electric Vehicle
电动汽车

Charging Infrastructure
充电基础设施

Power Grid
电网

\+

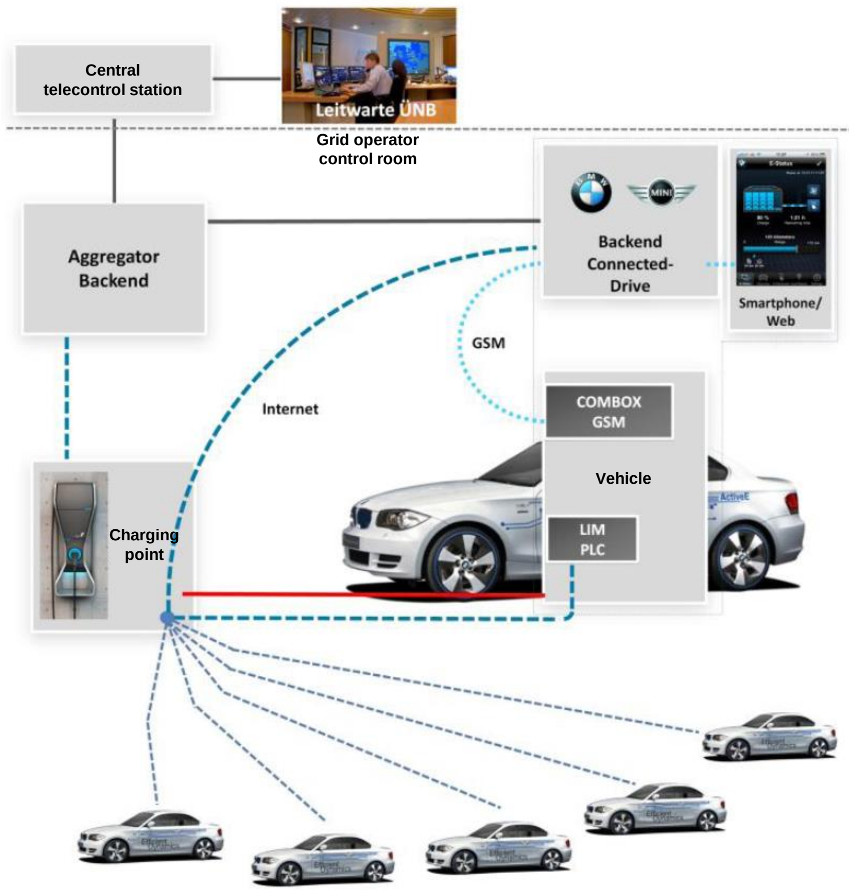
Local Power Plant 当地发电厂

Flexible Local System 灵活的当地能源系统
(Power Plants, Storage) （发电厂，储能设备）

- Optimization of own power generation, own consumption, infeed and mobility requirements
  优化自身发电，自身能耗，向电网输电以及出行需求
- Vehicle battery as an additional, controllable consumer
  汽车电池作为一种额外的可控的能源消耗者
- Integration of system into energy trade markets
  将该系统集成于能源交易市场

Source: Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Renewably mobile: Marketable solutions for climate-friendly electric mobility, 2014

Pilot Project "Controlled Charging V3.0"
试点项目"受控充电V3.0"



Objective:
Identification of technical and economical optimum for charging of electric vehicles through energy management

目标:
通过能量管理，找出技术上和经济上最优的电动汽车充电方式

生成电动汽车电池储电量	充电过程的可控性
Generation of Storage Capacity of EV Batteries	Controllability of Charging Processes

Generation of Balancing Power from Vehicle Fleet
从车队中产生平衡功率

- No restrictions of consumer mobility, avoidance of peak loads and use of existing infrastructure
  用户的出行不受限制，避开峰值负荷，并运用现存充电设备
- Conclusions regarding commercial benefits of controlled charging (grid operation management)
  总结受控充电的商业利益（电网运营管理）
- Examination of existent and necessary market regulations
  检验市场监管的存在性和必要性

Source: Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety, Renewably mobile: Marketable solutions for climate-friendly electric mobility, 2014

Thank you for your attention!
感谢！

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