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Office for Sustainable Built Environment Engineering

EGS-plan international GmbH

Integrated Energy Planning and Green Transformation of Industry Parks: Experiences from Germany
综合能源规划和工业园区绿色转型：德国经验

Dr. Zhou Yanping 周宴平 博士
www.energydesign-asia.com 设能建筑咨询（上海）有限公司
www.egs-int.com 德国EGS-plan International 公司

MITTELSTAND GLOBAL
ENERGY SOLUTIONS MADE IN GERMANY

June 28th, 2019

Who are we 我们的背景

Totally about 180 architects, civil, mechanical , material, and electrical engineers, researchers and scientists

建筑师，土木、机械、材料、结构和电气工程师，研究人员和科学家 180余人

head office Stuttgart, Germany
德国巴登符腾堡州斯图加特总部

Subsidiary Shanghai since 2008上海子公司，2008年进入中国

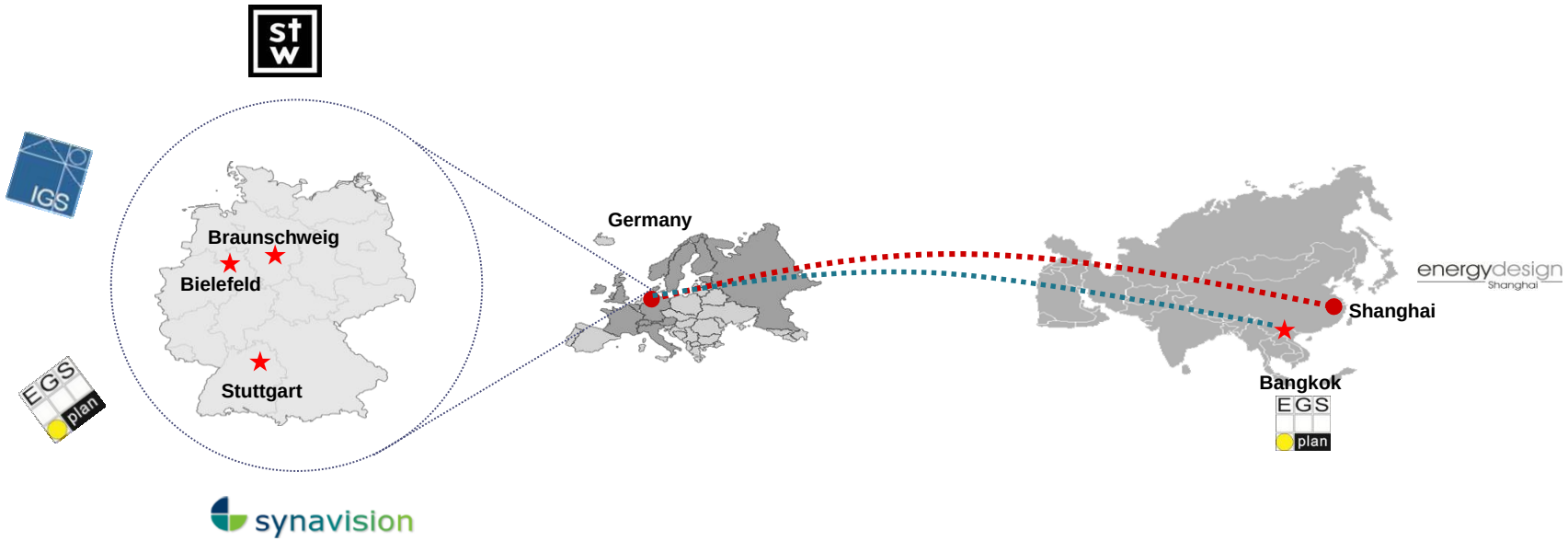
Who are we 我们的背景

Over 100 innovation Projects in China

100多个在中国的创新项目

- ➔ energy concepts and design services 能源方案和设计服务
- ➔ energy audits 能源诊断和审计
- ➔ simulations & studies 模拟研究
- ➔ passive house and low energy building 被动房和低能耗建筑
- ➔ certifications (LEED, DGNB, GBL, HQE) 建筑及区域认证
- ➔ MEP consulting 机电咨询
- ➔ Innovative energy solutions 创新能源解决方案

- ➔ …energyPLUS 产能



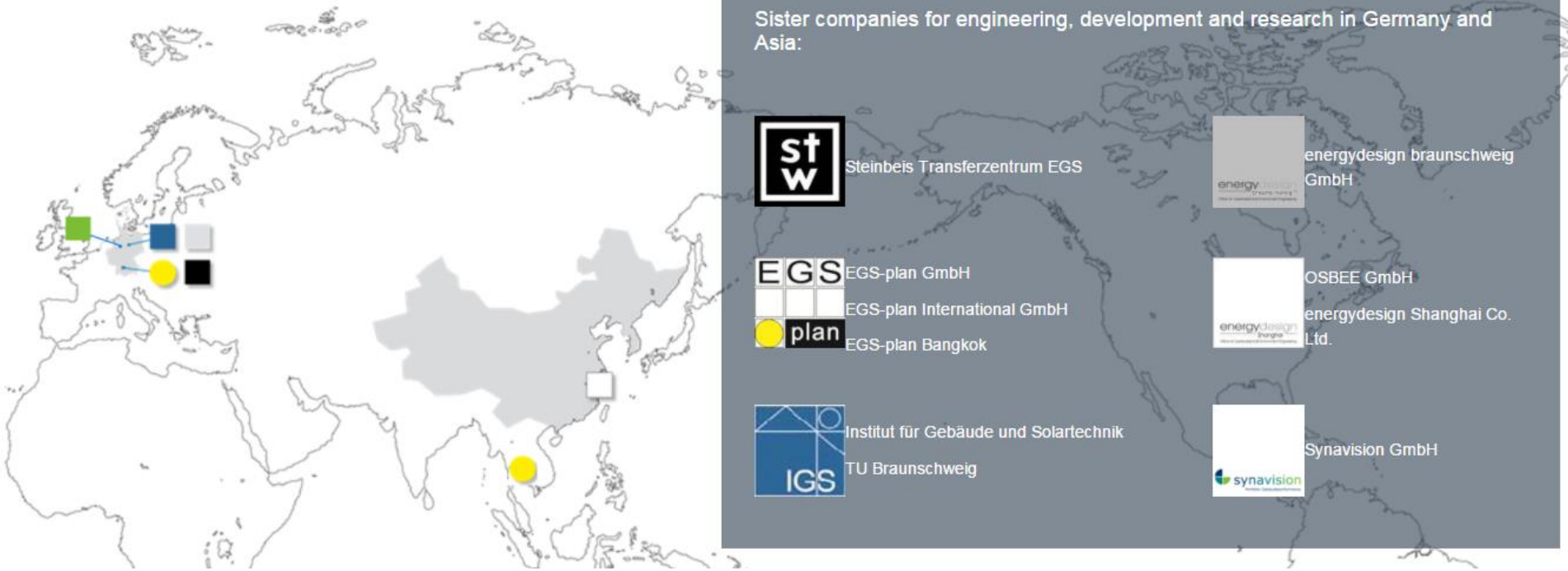
Innovation Network of Prof. Dr. M. Norbert Fisch
我们的机构 – 诺伯特·费什教授创新网络

Prof. Dr. M. Norbert Fisch
Institute for Building Physics & Solar Technology
TU Braunschweig, Germany

Scientific Advisory Board for the German Federal Government
德国联邦政府科学顾问委员会

INNOVATION NETWORK

Braunschweig - Stuttgart - Bielefeld - Shanghai - Bangkok



EGS-plan: Energy, Building and Solar Technology
EGS-plan: 能源， 建筑及太阳能技术

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EGS plan


Solar City, Neckarsulm


Solon, Berlin Adlershof


Plusenergiegebäude, Stuttgart


SMA, Kassel

Konzept	概念设计
Planung	规划
Monitoring	监测
Betriebs-optimierung	运营优化
Zertifizierung	认证

EGS plan

EGS-plan Ingenieurgesellschaft mbH
Gropiusplatz 10
70563 Stuttgart

Platinum certified
GreenWorx, Wien


Aktivstadthaus, Frankfurt


Tor zur Welt, IBA Hamburg

Office Building / Mixed-Use, Qingdao, ca..
80.000m² 办公室酒店多用途建筑，青岛


Qingdao Ecopark District C2 青岛中德生态园C2组团


Research and Development Centre BASF Shanghai, im Bau 巴斯夫研发中心，上海

Office for Sustainable Built Environment Engineering
可持续建成环境工程专家

energydesign Shanghai
Office for Sustainable Built Environment Engineering

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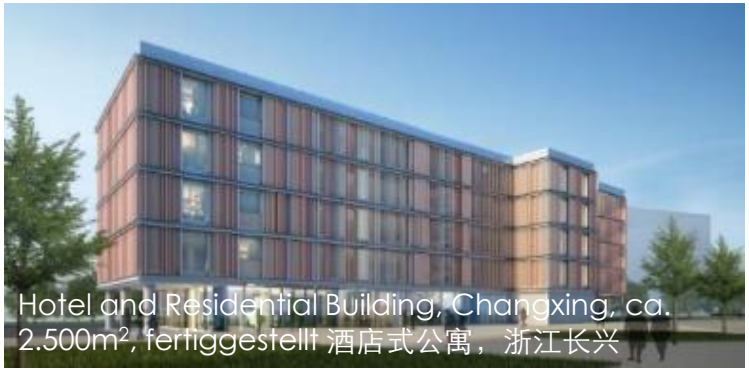
http://www.energydesign – asia.com


Hotel and Residential Building, Changxing, ca.
2.500m², fertiggestellt 酒店式公寓，浙江长兴

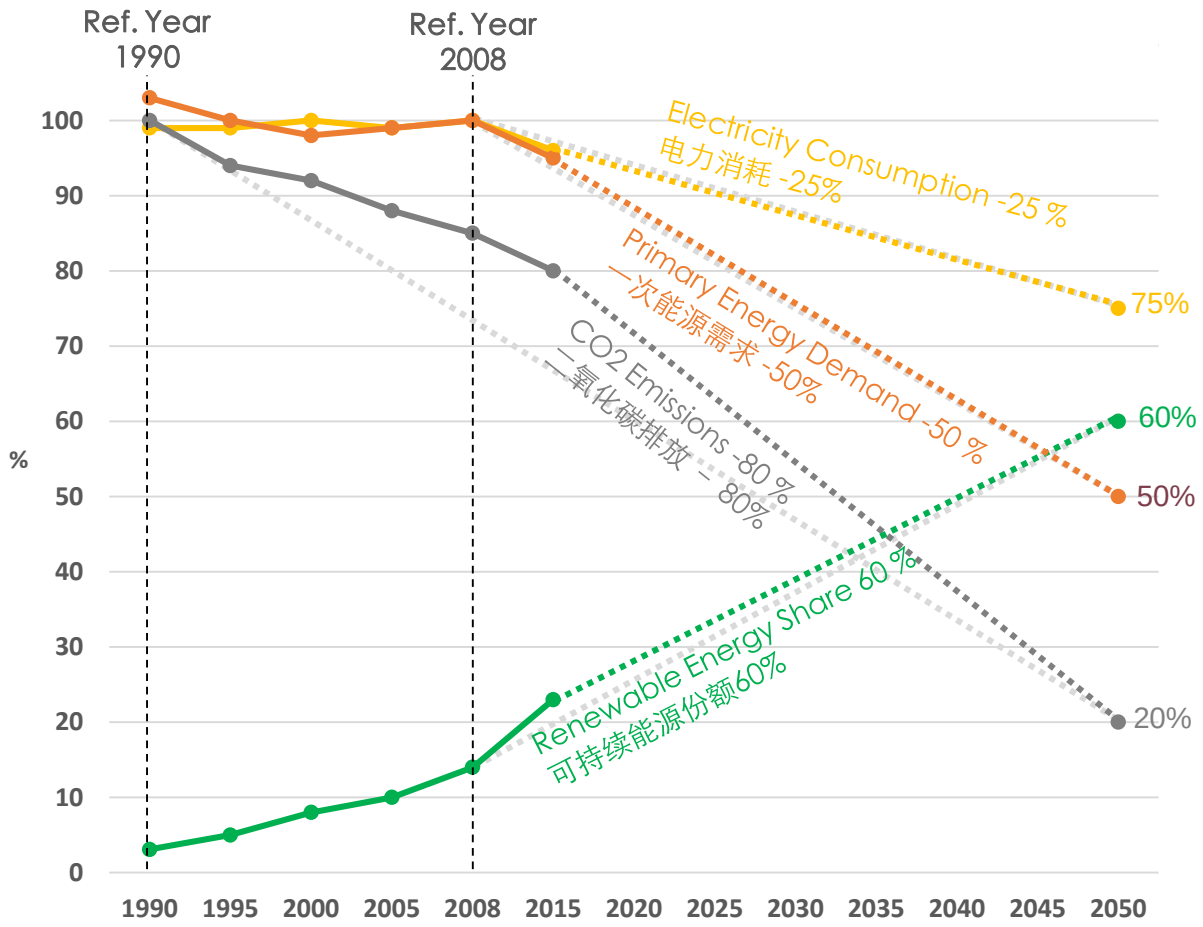

Factory Building
工业厂房

Chinese Passive House, Hebei
中国被动房，河北

Energy Transformation of German City (district, campus)

德国城市（片区/园区）能源转型

Energy goals 能源目标



"National Action Plan for Energy Efficiency"
德国能源效率行动计划

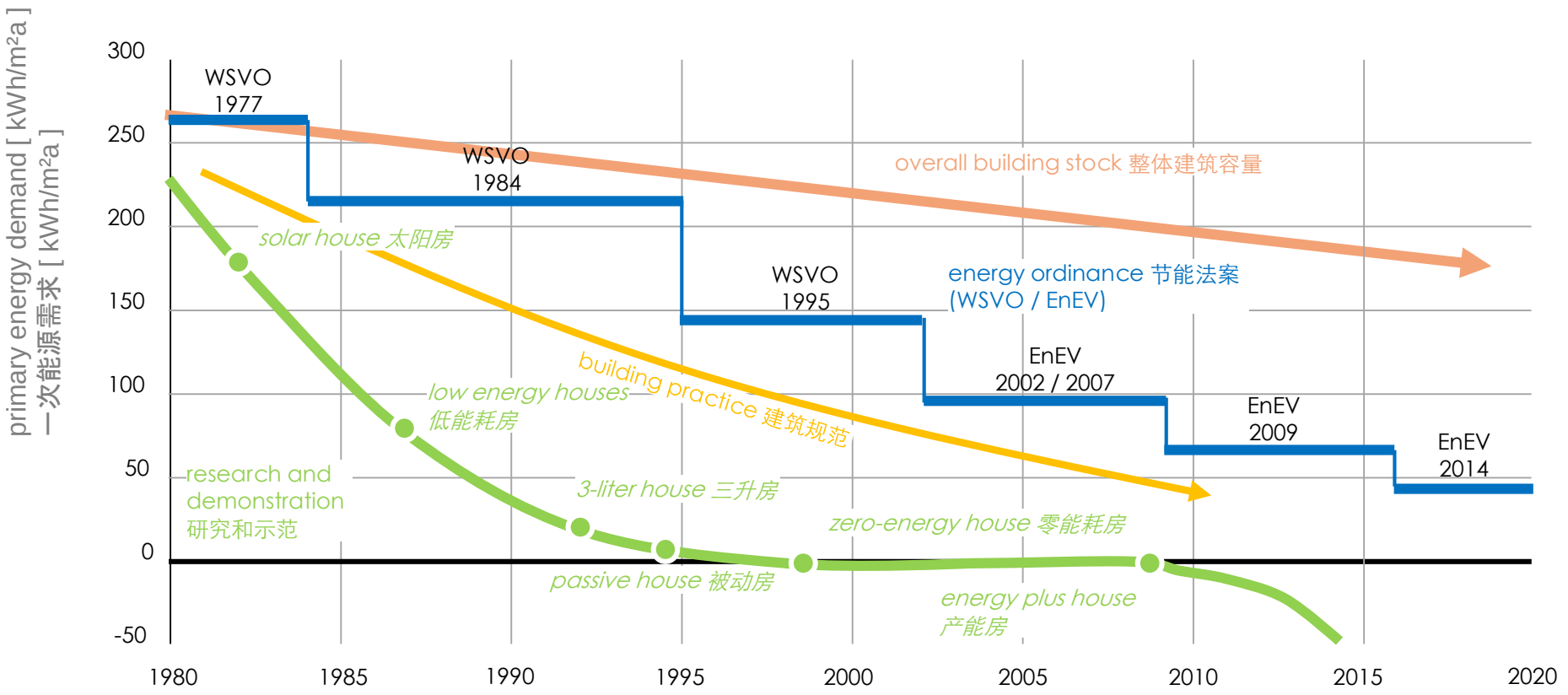
Roadmap Germany
德国路线图

German National Roadmap
„Energy efficient buildings and cities “
德国国家发展路线图
“能效建筑和城市”

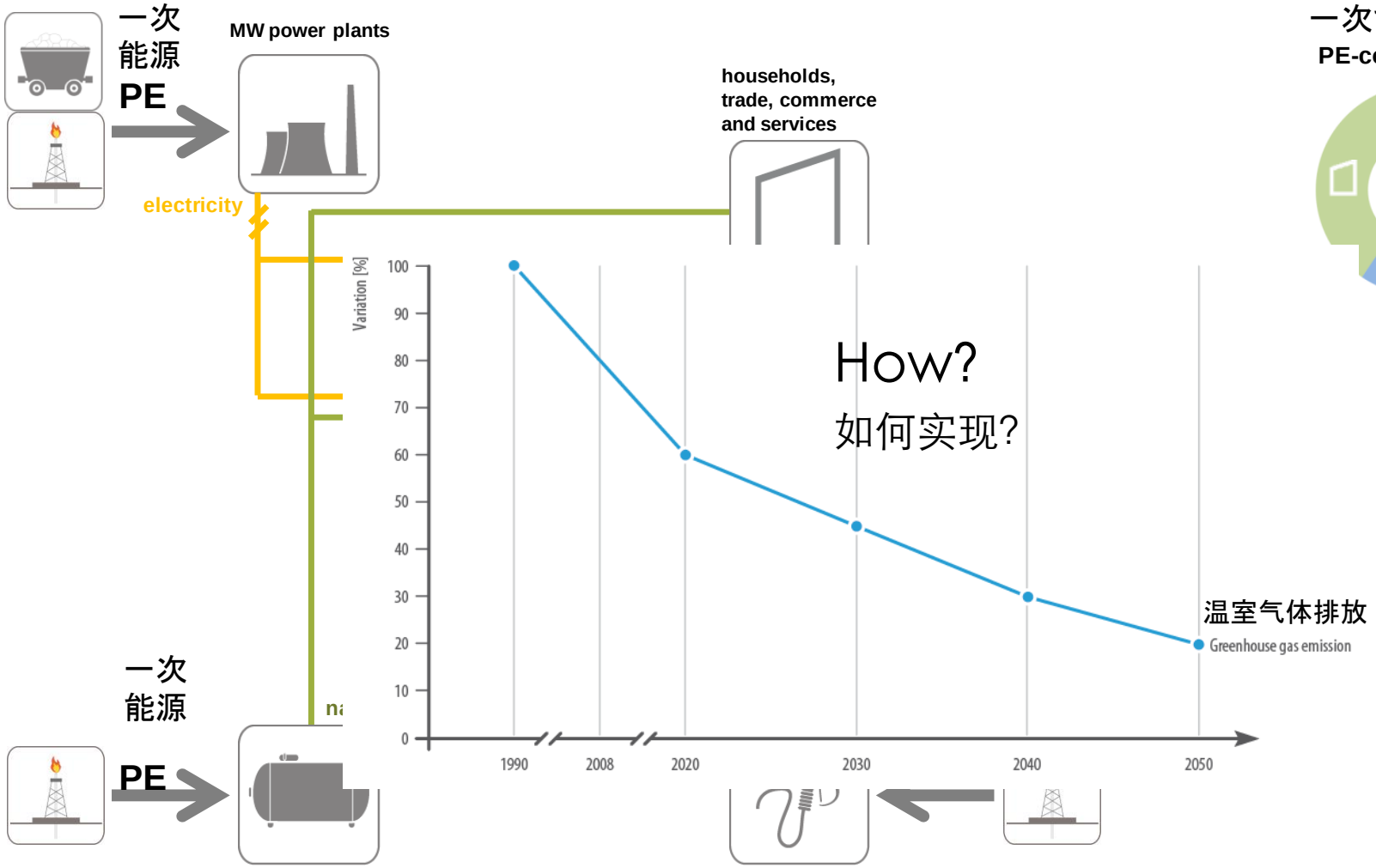
Goal 目标:
By 2020 all new buildings are nearly zero-energy buildings”
到2020年，所有新建建筑都要近零能耗

Target: a “nearly climate-neutral building stock” until 2050!

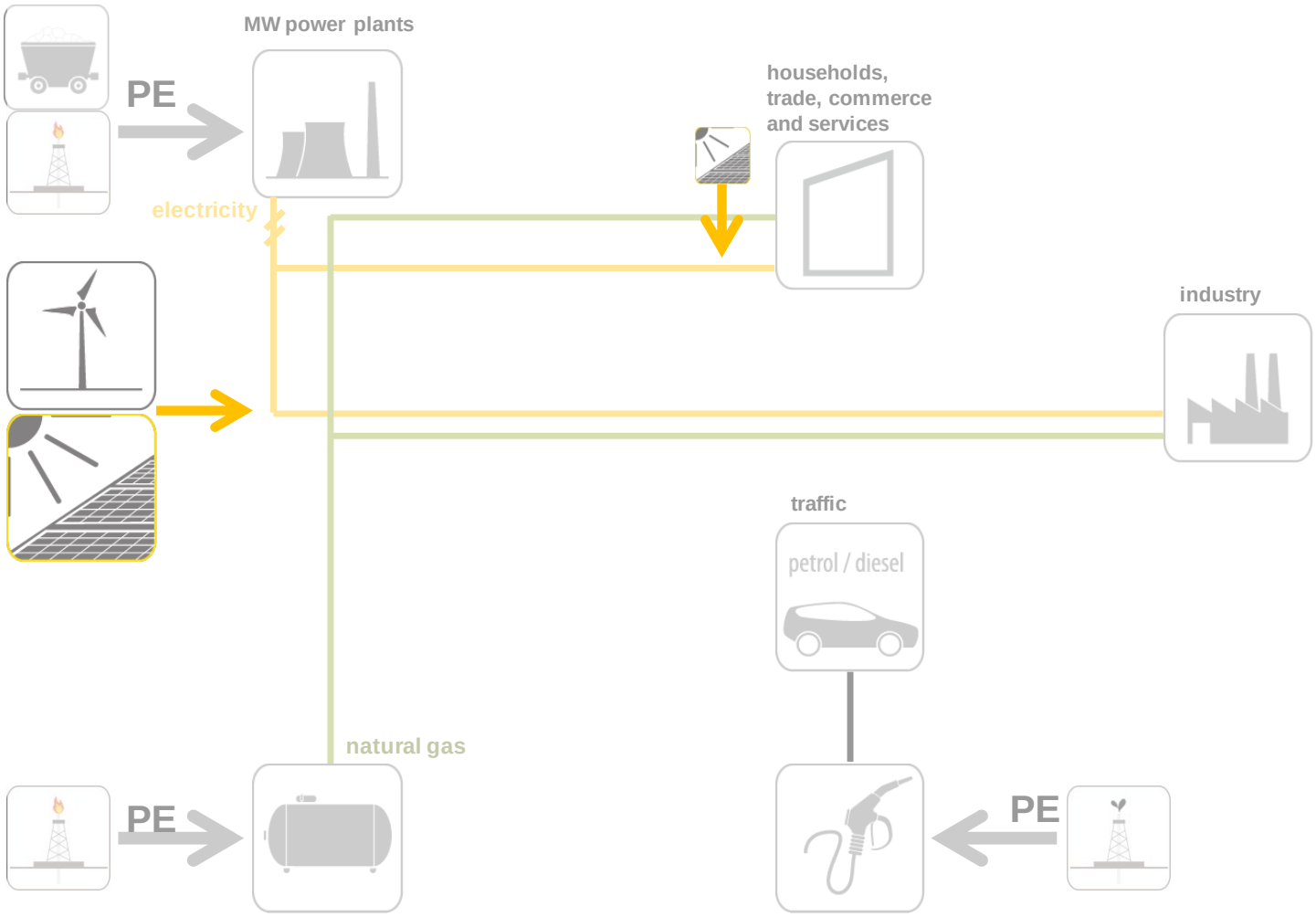
目标：2050年完成“近碳中和建筑”



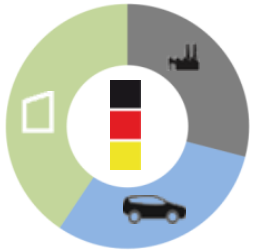
Energy supply today
当今能源供应



future – strategy 1 – RE
未来——战略1——可再生能源



一次能源消耗
PE-consumption



future – strategy 2 – E-Mobility
未来——战略2——电气化出行

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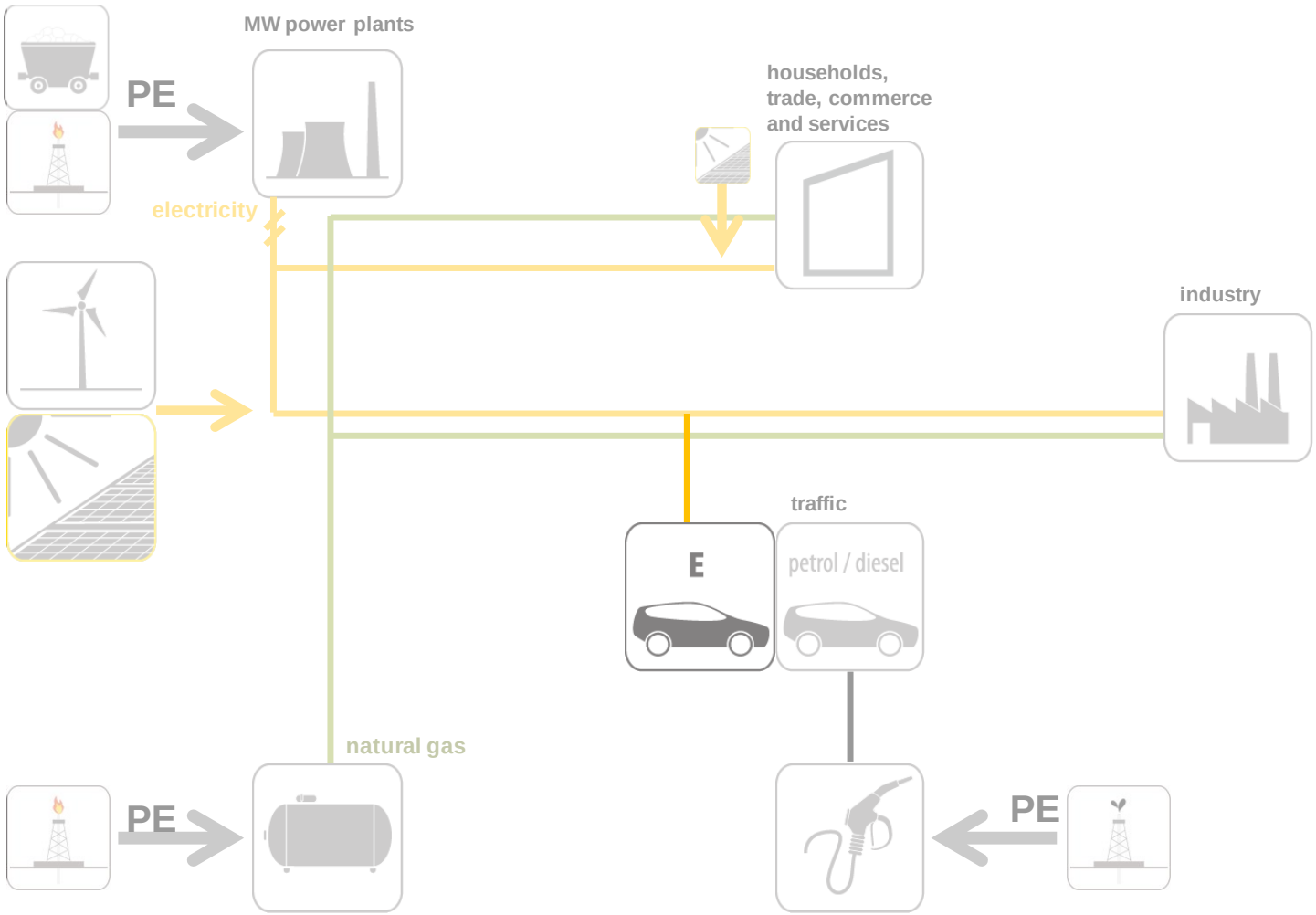
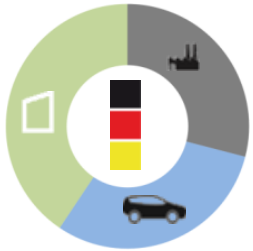


一次能源消耗
PE-consumption



future – strategy 3 – efficiency
未来——战略3——能效

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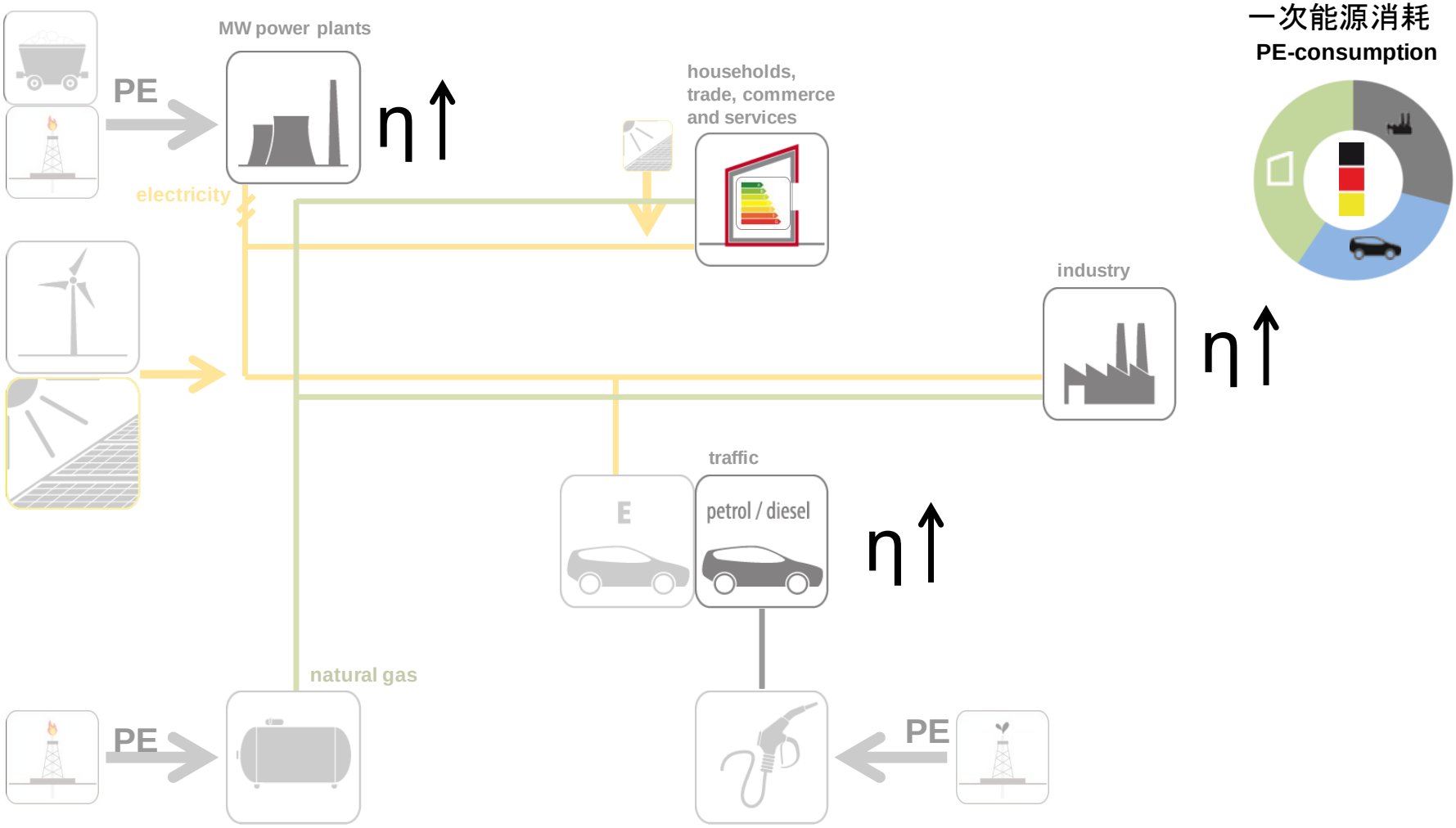
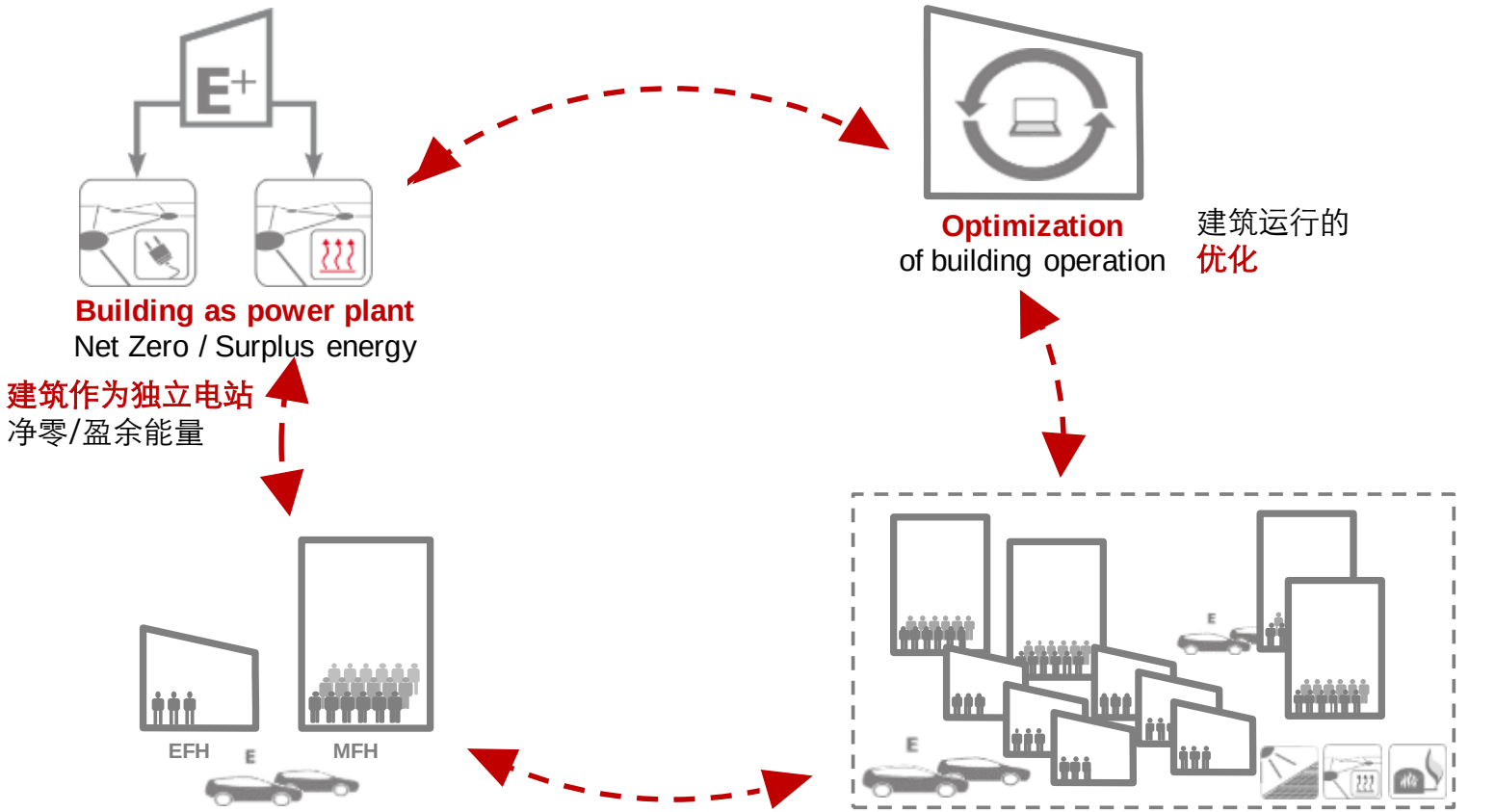


Climate neutral districts
气候中和区

Climate neutral districts – innovation cycle
气候中和区域——创新的循环



Building as power plant
Net Zero / Surplus energy
建筑作为独立电站
净零/盈余能量

Optimization
of building operation
建筑运行的
优化

Integrated approach
buildings and mobility
整合方案
建筑与出行

climate neutral cities and urban districts
holistic sustainable renovation of urban settlements
气候中和城市和城市区域
城市居住区整体可持续改造

The road to climate neutral city districts from buildings to districts
从建筑物到区域的城市区域气候中和之路

The road to climate neutral city districts from buildings to districts
从建筑物到区域的城市区域气候中和之路

Energy Planning for Industrial Parcels
工业园区能源规划

Decentralization of Energy Supply
分布式能源供应

District
街区

Industry
工厂

e-mobility
电动交通工具

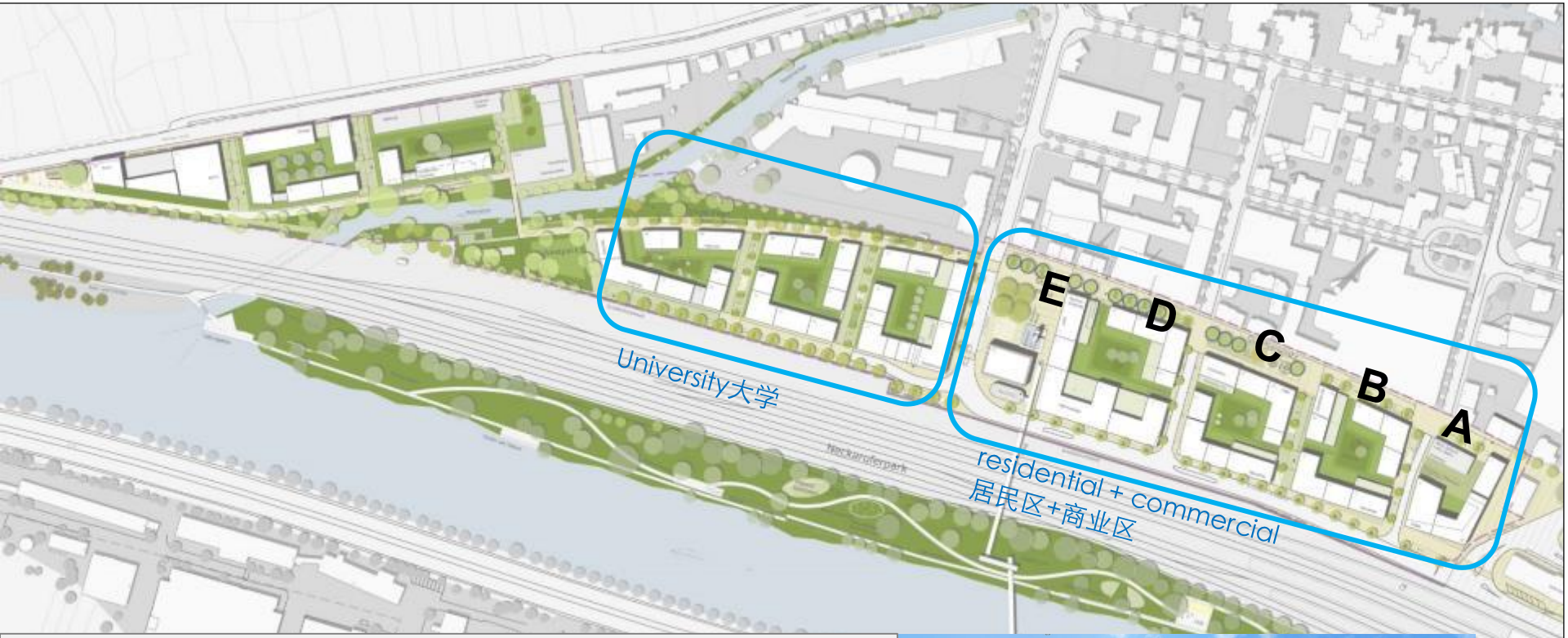
residential buildings
居住建筑

non-
residential buildings
非居住建筑

电动交通工具

PV 光伏
235 kWP
Lade-
Stationen
充电站
BHKW: 75 kWel
140 kWth
小型热电联产
BZ: 20 kWel
14 kWth
燃料电池
GK: 640 kWth
燃气锅炉
Gasnetz 燃气
Stromnetz 供电

Neue Weststadt Esslingen
艾斯灵根新西城项目



Total gross floor area: ~ 105.000 m²

residential ~ 56.000 m² ; commercial ~ 24.000 m² ; university ~ 25.000 m²

总建筑面积：约10.5万平方米

住宅：约5.6万平方米，商业区2.4万平方米，大学2.5万平方米

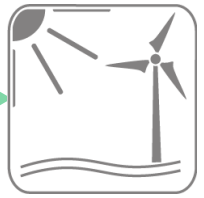
Time schedule: 2016 – 2022

时间规划：2016年—2022年

Climate neutrality for districts – definition
城区气候中和——定义

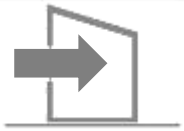
Fuels燃料

Electricity电力

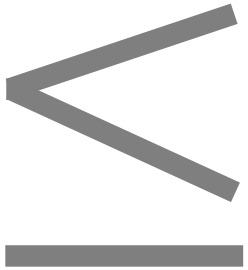


Electricity production Credits
电力生产额度

CO2 – Consumption
CO_2—消费

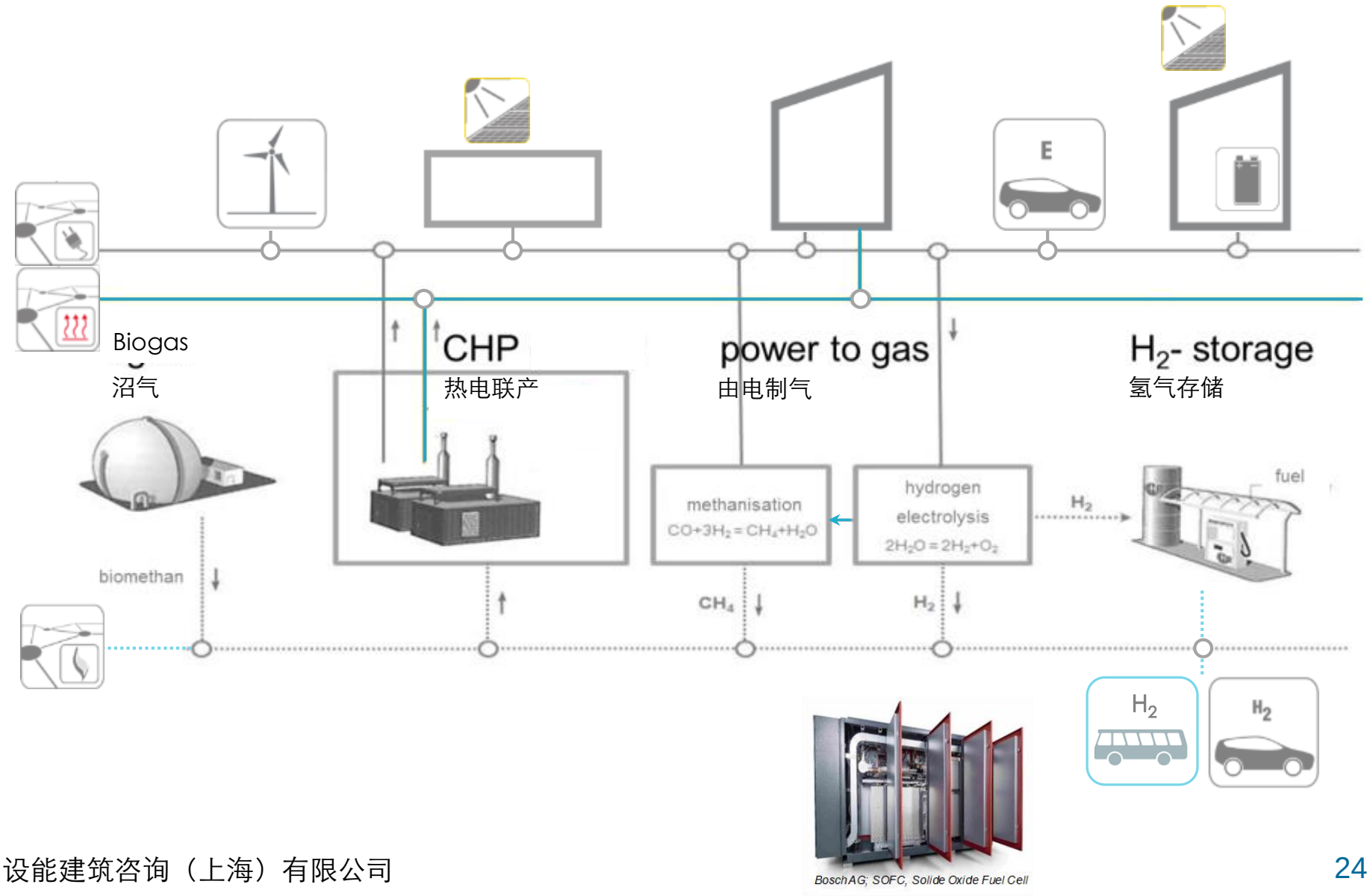


Input 输入

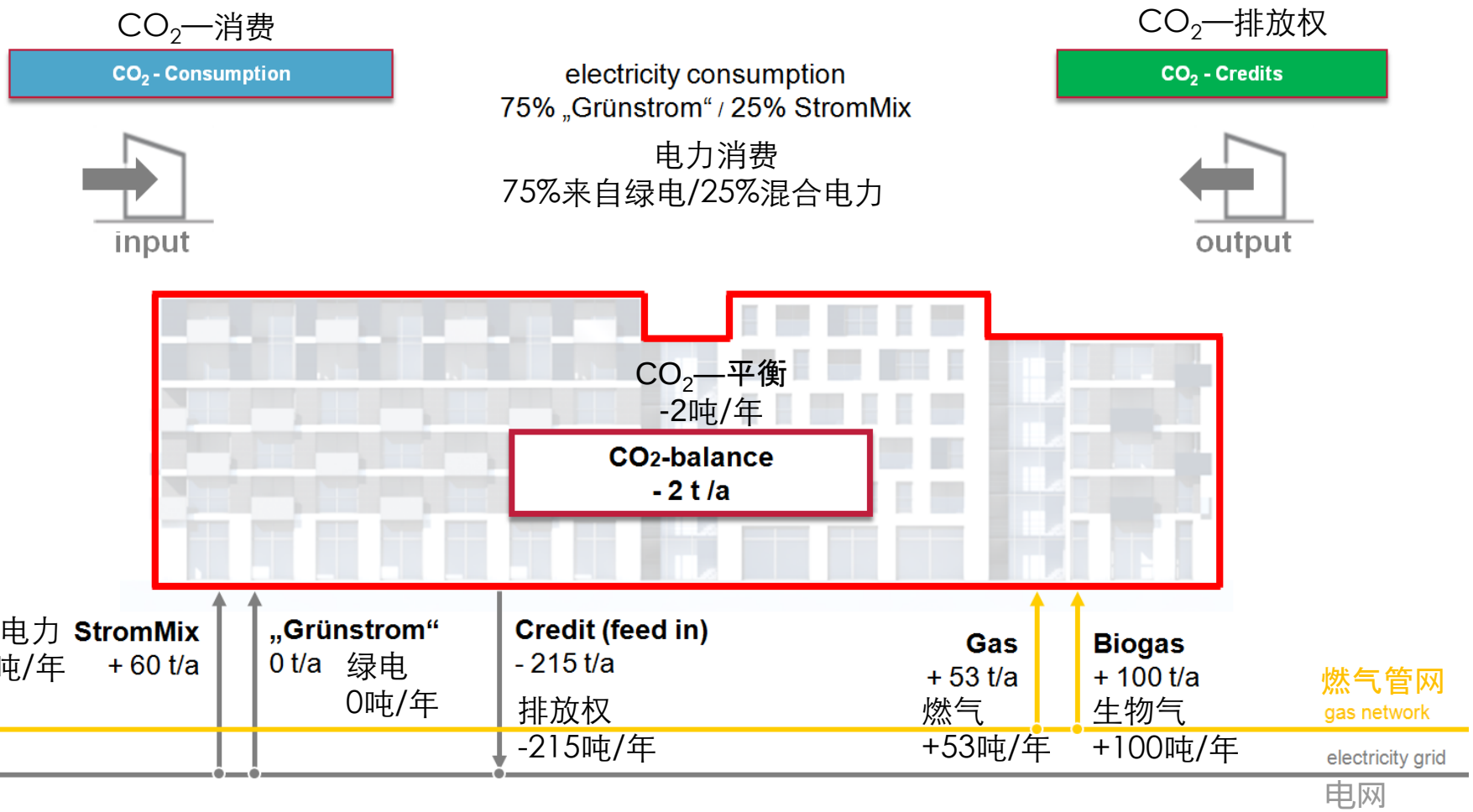


CO2 – Credits
CO_2—排放权

Output 输出


E
Biogas
沼气
CHP
热电联产
power to gas
由电制气
H_2- storage
氢气存储
methanisation
$CO+3H_2=CH_4+H_2O$
hydrogen
electrolysis
$2H_2O=2H_2+O_2$
H_2
fuel
biomethan
CH_4
H_2
H_2
H_2
BoschAG; SOFC, Solide Oxide Fuel Cell

Neue Weststadt Esslingen – energy balance 1st block
艾斯灵根新西城项目——第1区的能源平衡

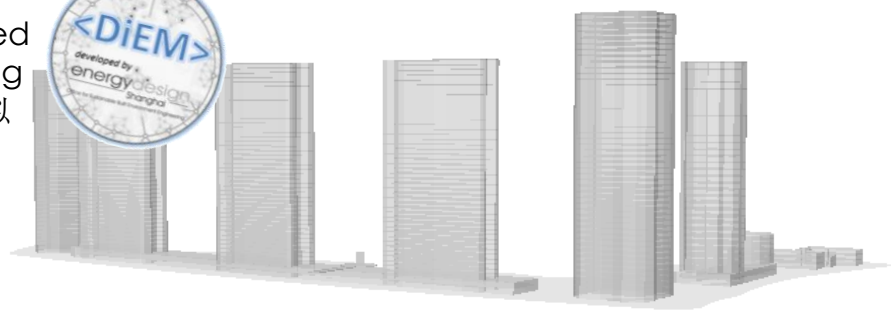


Energy Analysis Tool

能源分析工具

District-integrated energy modelling
区域综合能耗模拟

<DiEM>
District-integrated
Energy Modelling
区域综合能耗模拟



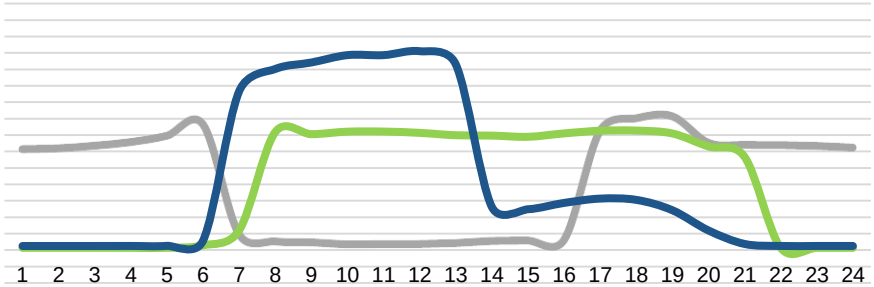
- Building Footprints
  占地面积
- Building Orientation
  建筑朝向
- Number of Floors
  楼层数
- Basic Design Setup
  基础设计布局
- Electricity Demand
  电力需求
- Heating Demand
  供热需求
- Cooling Demand
  制冷需求

Basic Building Design
建筑设计基础

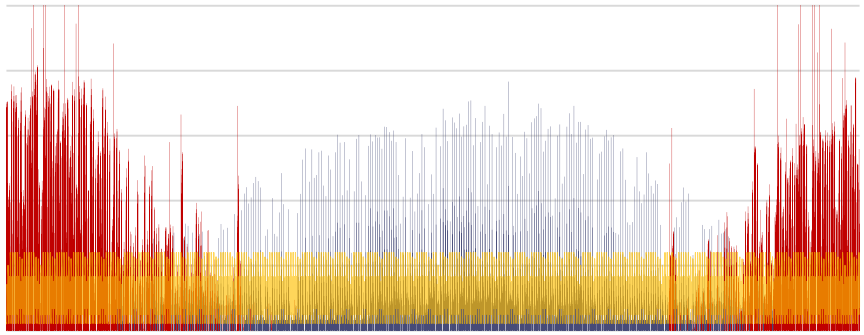
Building Use Profiles
建筑使用情况

Energy Demand Patterns
能耗需求模式

Building Use Profiles (24h)
建筑使用数据图（24小时）



Energy Demand Patterns
能耗需求模式



District-integrated energy modelling
区域综合能耗模拟

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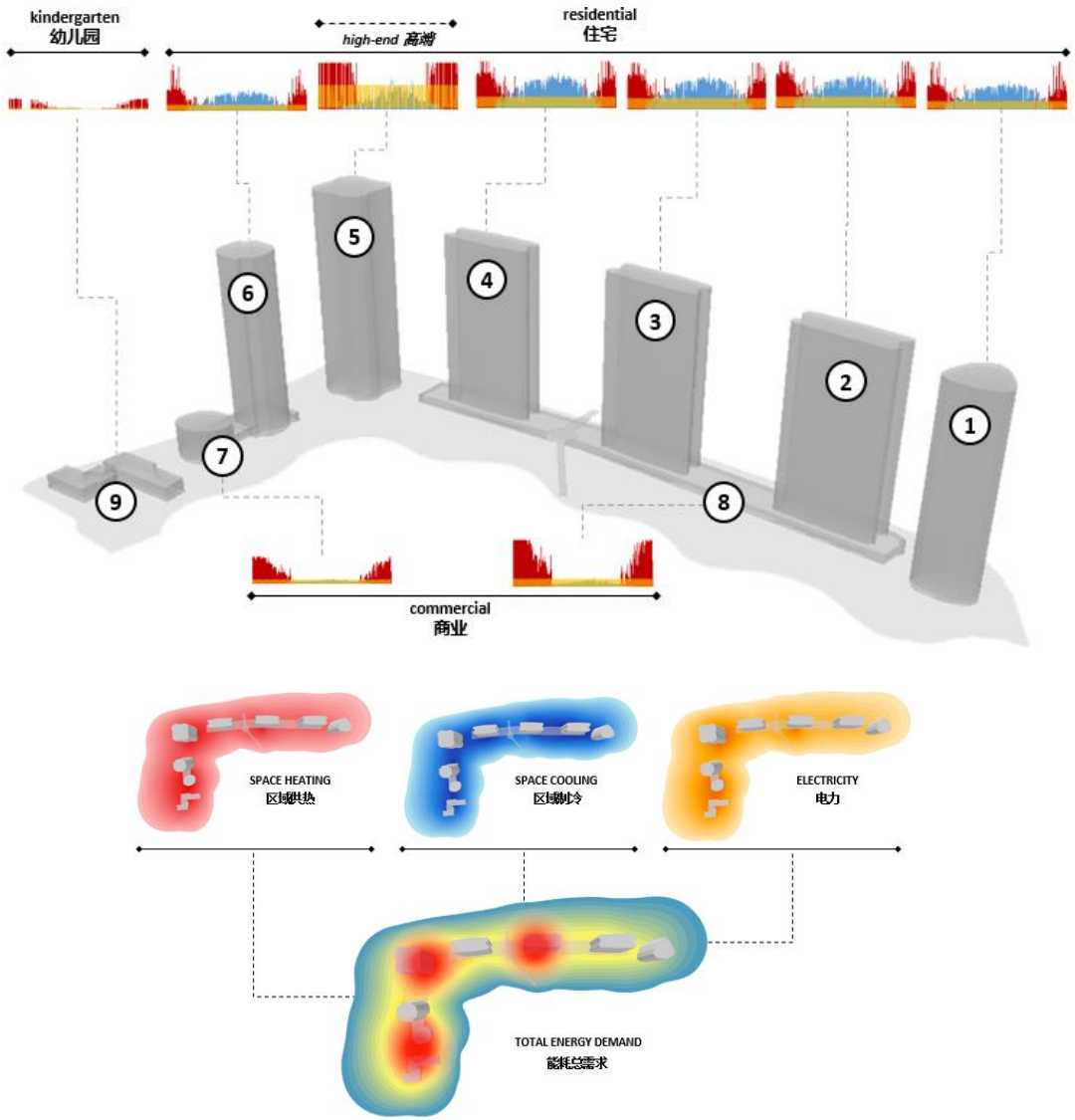
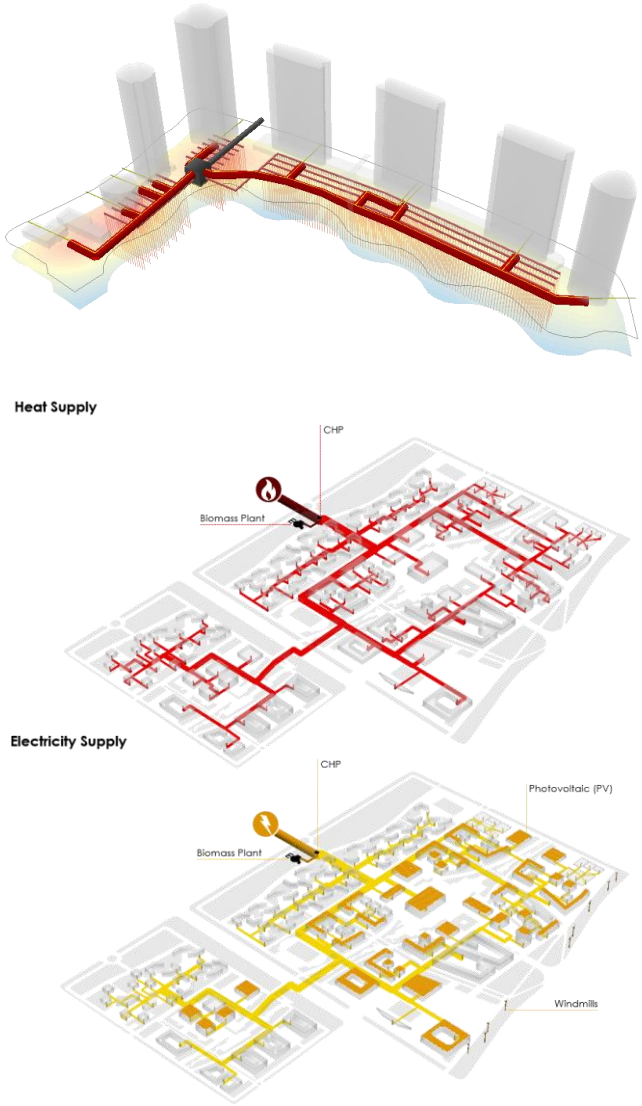
EGS plan

assessing load profiles
负荷评估

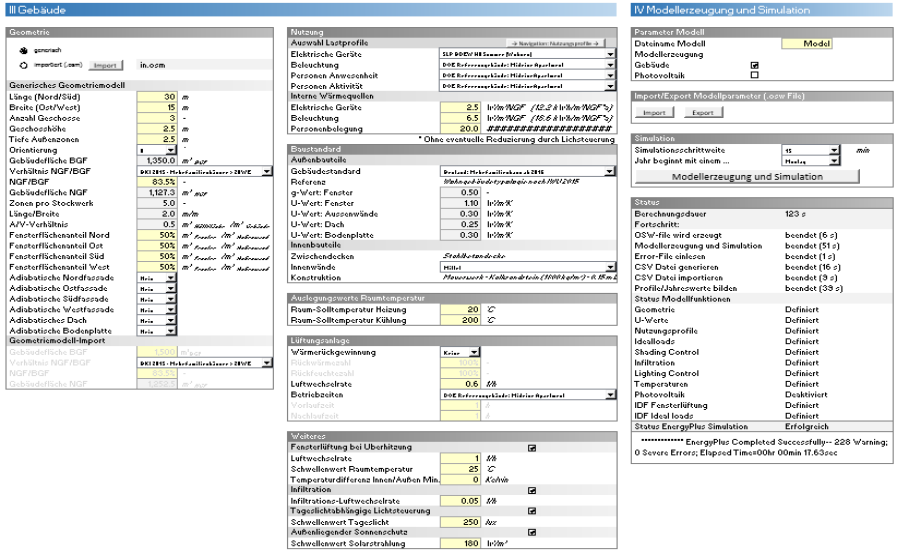


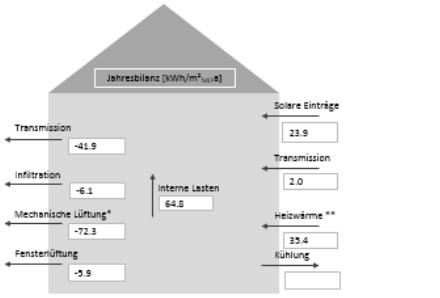
sizing district-wide energy networks
区域能源网络



QUARTO Tool

- Compiling energy demand patterns 整合能源需求模式
- Scenarios for future implementations 未来可实施的方案





	kWh/m²NGF*a	Anteil
Lüftungswärmeverluste	0.0	0%
Transmissionsverluste	35.4	100%
Heizenergiebedarf	**35.4**	100%

Lüftung mit Wärmerückgewinnung - Bilanzielle Ermittlung

Rückwärmeanzahl 100%

Heizwärmebedarf mit WRG 0.0 kWh/m²NGFa

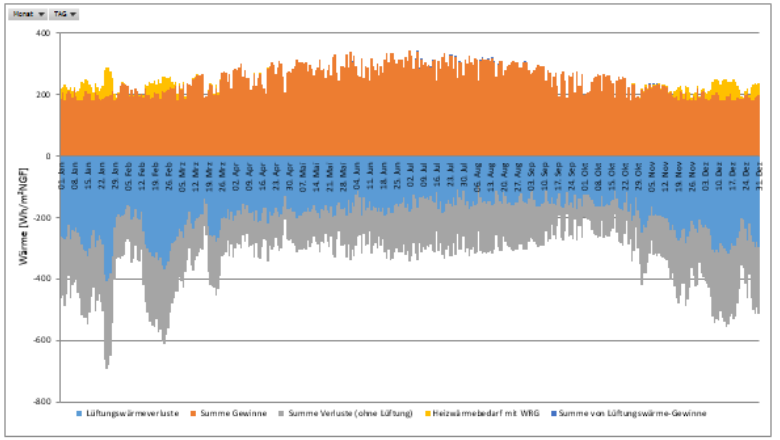
Update

VERLUSTE	[kWh/m²NGF*a]
Wände	-21.1
Fenster	-20.8
Infiltration	-6.1
Fensterlüftung	-5.9
Mechanische Lüftung	-72.3
Gesamt	**-126.1**

GEWINNE	[kWh/m²NGF*a]
Wände	2.0
Fenster	23.9
Infiltration	0.0
Fensterlüftung	0.0
Interne Last: Elektrische Geräte	12.3
Interne Last: Beleuchtung	16.3
Interne Last: Personen	36.2
Gesamt	**90.7**

GESAMTBILANZ	[kWh/m²NGF*a]
Verluste	-126.1
Gewinne	90.7
Heizen	35.4
Kühlen	0.0
Bilanz	**0.0**

GESAMTWERTE	[kWh/m²NGF*a]
Transmissionsverluste Gesamt	-41.9
Infiltration Gesamt	-6.1
Fensterlüftung Gesamt	-5.9

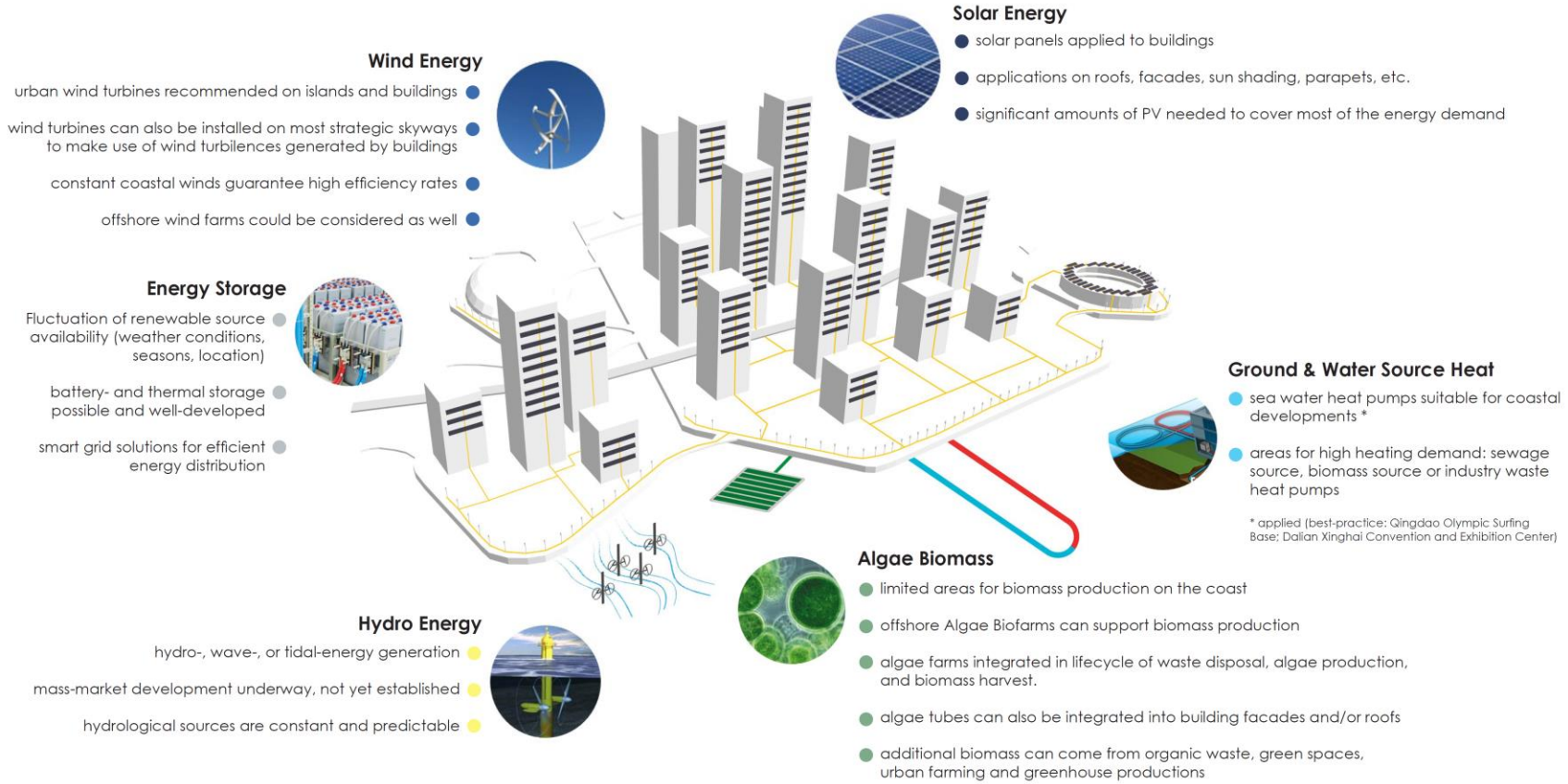


Road to new industrial parcels

通往新型工业园区之路

Renewable energy
可再生能源

- Sustainable industrial parcels need to cover their energy demand at all times from renewable energies
  可持续的工业园区任何时候的能源需求都应可以由可再生能源来满足
- Renewable energy solutions are well developed allowing to be combined to fully integrated supply systems
  可再生能源解决方案得到了很好的发展，可以结合到完全集成的供应系统中
- A large variety of renewable sources can be suggested for coastal developments
  沿海区域发展有各种各样的可再生资源利用建议



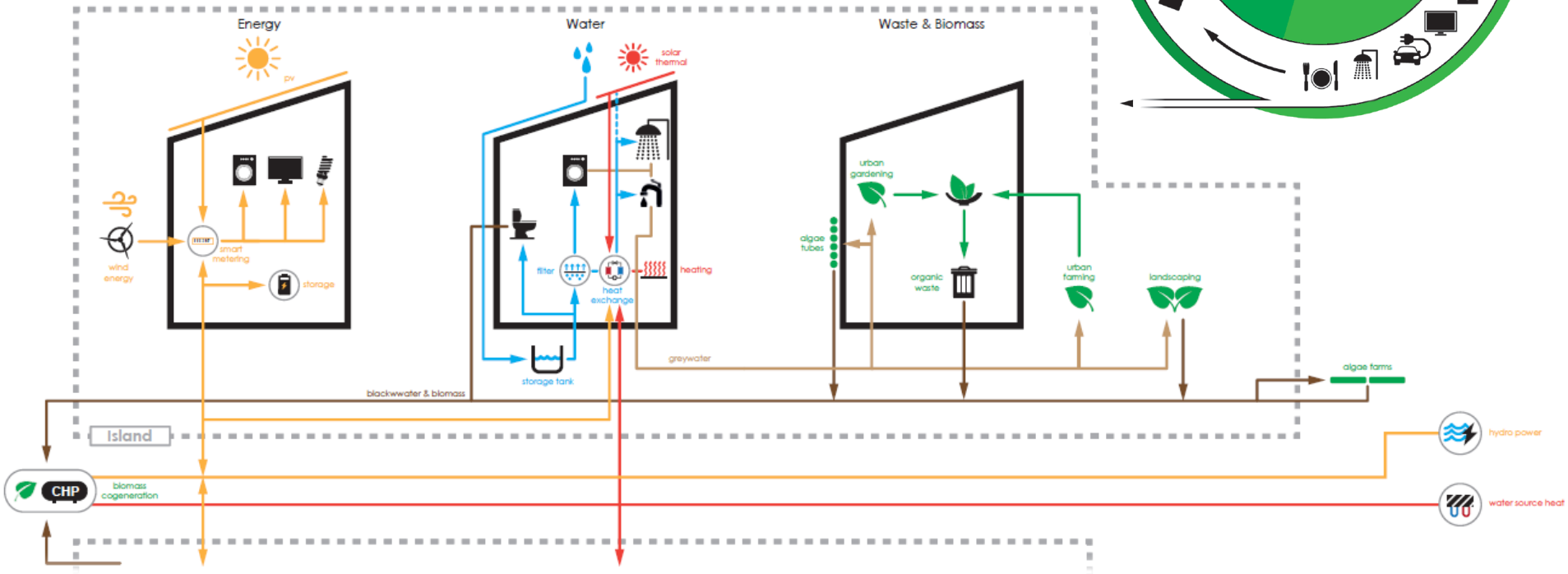
Lifecycle approach
全生命周期管理

➔Full life-cycle approach　　全生命周期管理

➔Reuse of organic waste and greywater:　有机废物和废水的再利用
　　➔Biomass production 生物质生产 ➔ energy generation 产生能量

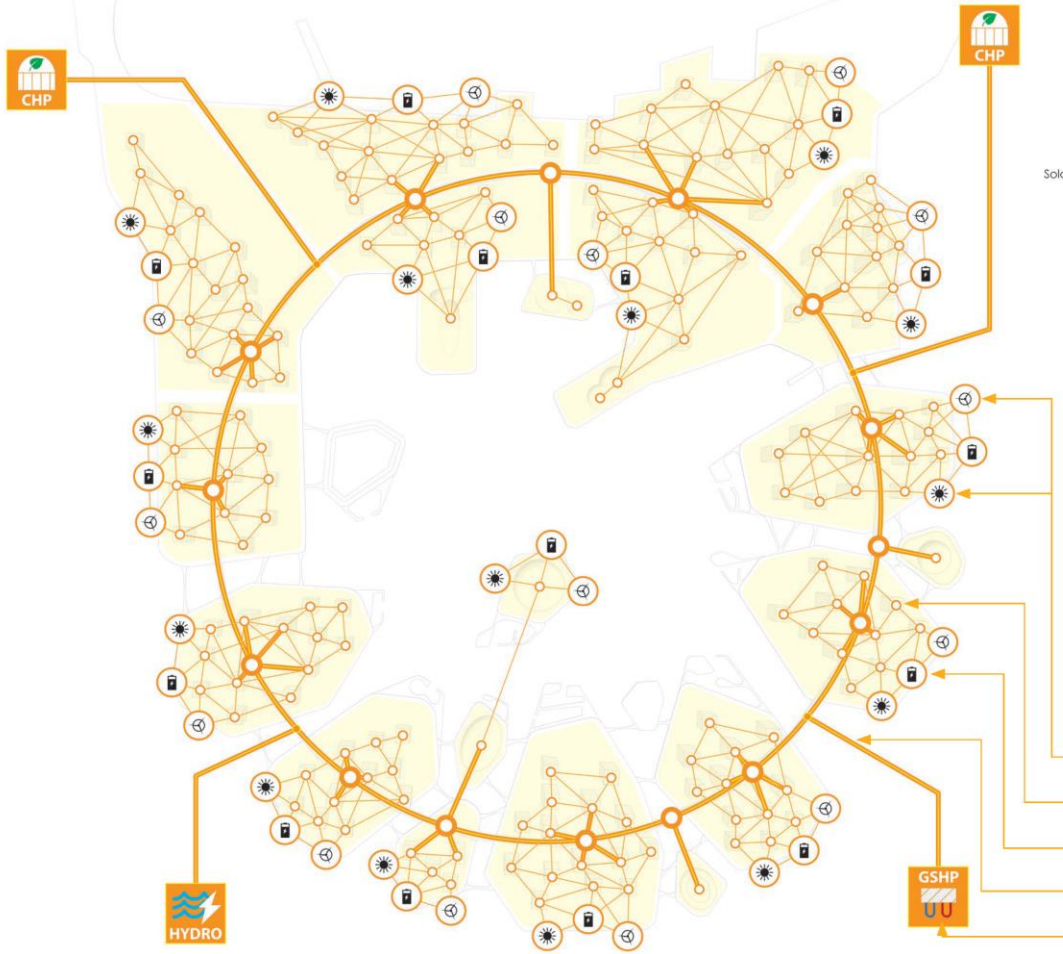
➔Interconnection of buildings and districts 建筑物和城市区域的互联

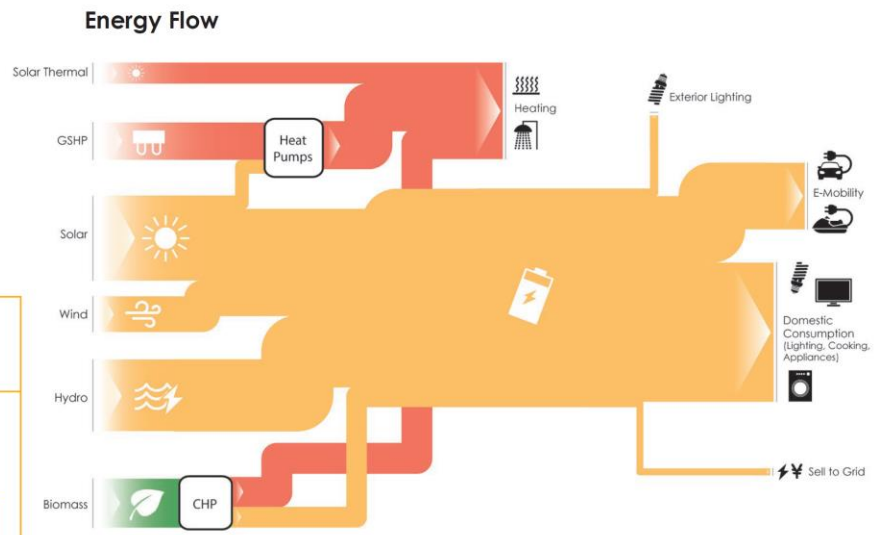
➔District-level energy demand distribution 城市区域层面的能源需求分布



Smart grid & energy demand distribution
智能电网和能源配送

- Peak load energy distribution needs to be well-organized 峰值负荷能量分布需要被很好的规划
- Need efficient management of energy supply and demand 能源的供给和需求需要有效的管理
- Digital interaction of supply and demand to avoid shortages and overproduction
  供给和需求数字化的交互能避免供应短缺和过度生产

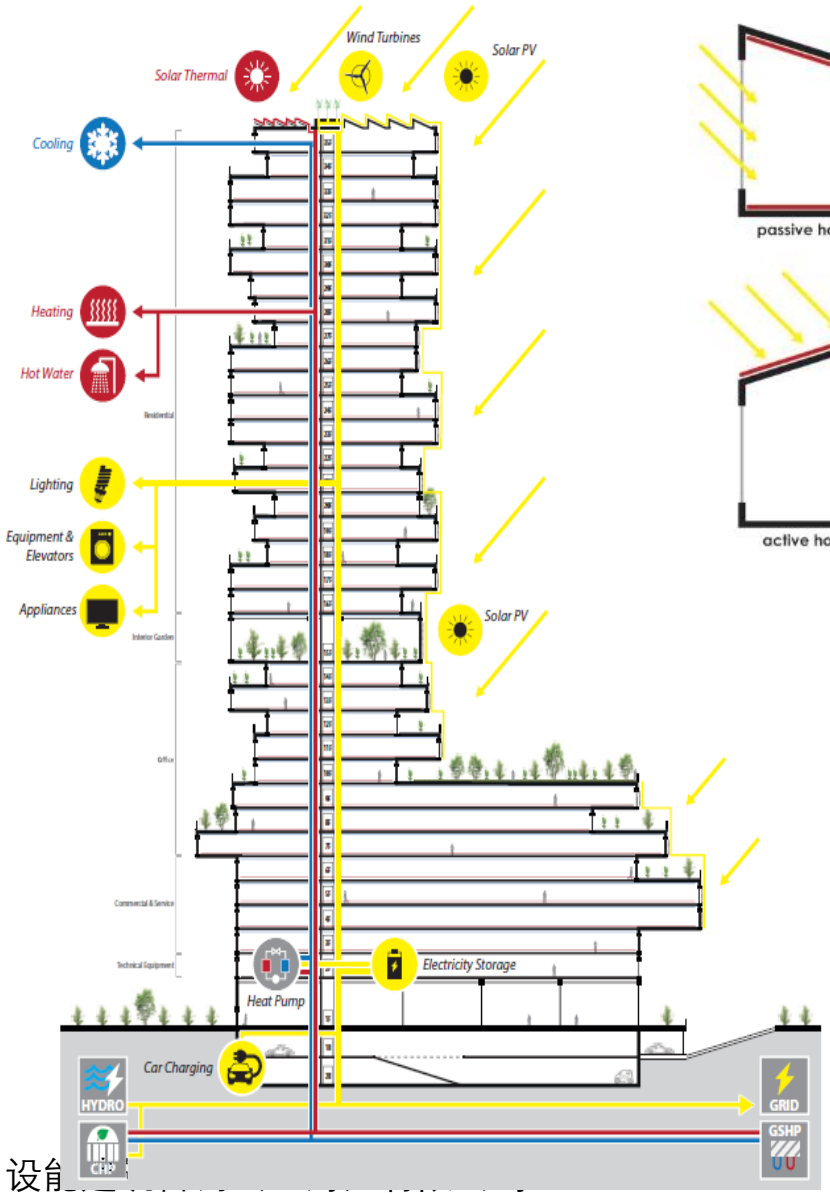




Smart Grid

- net-zero buildings and energyPLUS islands
- island grids to manage energy demand between buildings
- renewable energy storage within each island grid
- inter-grid communication to distribute energy between islands
- baseline supply by district-scale hydro energy and biomass energy generation
- additional surplus can be sold to the state grid

Integrated energy solutions for building
整合式的能源供给



Mix of passive and active building technologies 主动和被动式技术的融合

High quality of building materials 高质量的建筑材料

Recycled and reused material sourcing 可回收和可再利用的材料

Climate-specific facade designs 特定气候条件的外立面设计

- Renewable energy systems applied to buildings 建筑物可再生能源系统的应用
- Energy storage systems 储能系统
- Heat recovery & free cooling systems 热回收和自然冷却系统
- Vertical greening and interior gardens 垂直绿化和室内花园
- Energy efficient lighting 高能效照明
- Advanced metering and BMS control 智能计量和BMS控制

设能

Solon SE Headquarter, Berlin – Climate neutral factory
柏林Solon零碳工厂

primary energy demand< 100 kWh/(m²a)
年均一次能耗<100千瓦时/平方米
CO_2 – neutral energy supply
零碳能源供应

Summary

小结

Good practices for the new industrial parcels
新型工业园区具备的优秀实践措施

- 提升能效（建筑能效、设备能效、系统能效）
- 充分利用当地资源（太阳能、风能、地源能、工业废热等）
- 系统灵活性（电、气、热/冷能的储存和多向互动）
- 智能电网、智能监控和优化，需求侧管理DSM
- 全生命周期管理
- 关键角色：PV+热泵+低温系统+调控

THANK YOU!
谢谢！

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