Energy efficiency and the heat transition - examples from Germany and Europe
能源效率和供热转型——德国与欧洲案例

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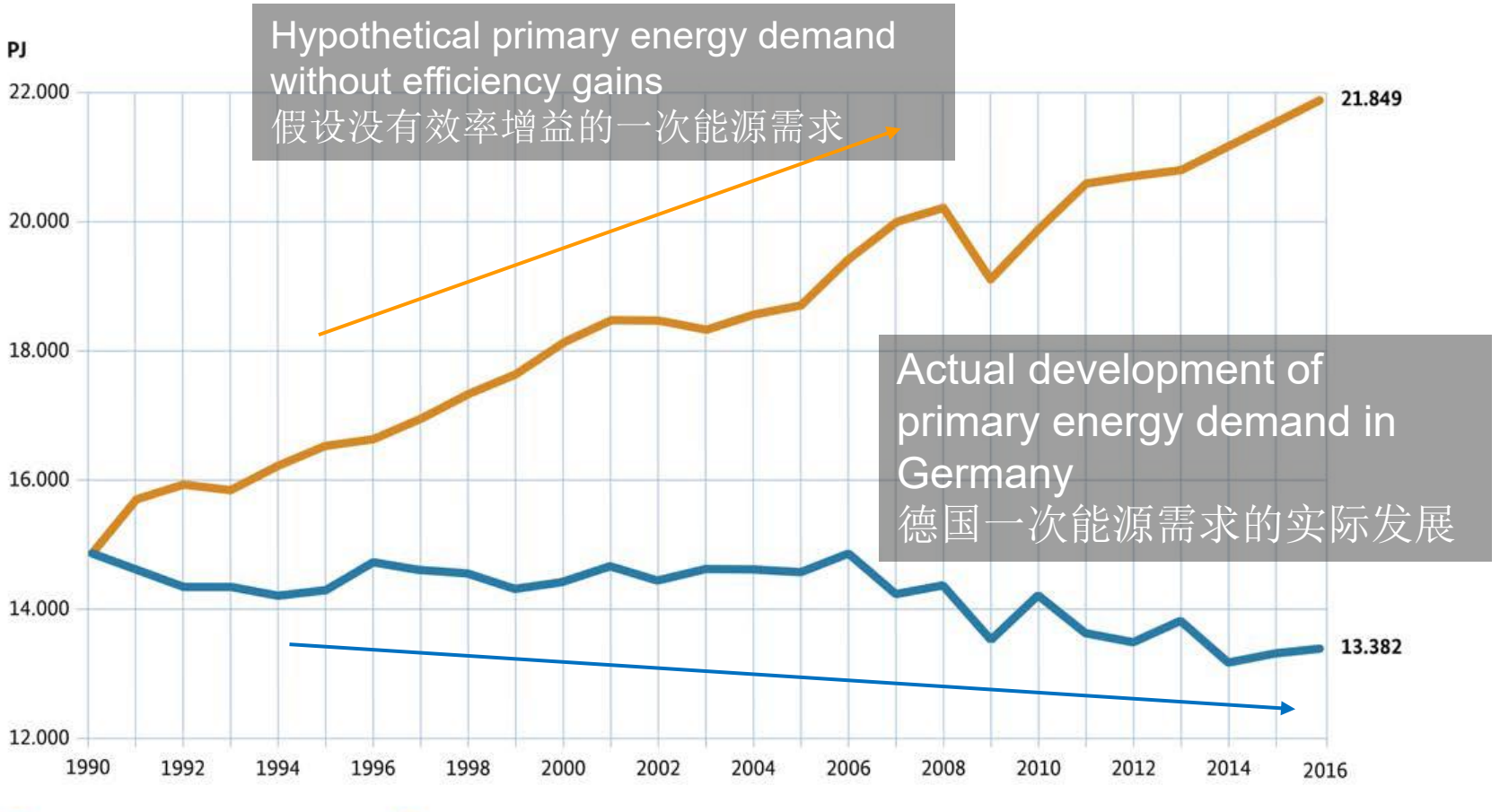
Content 内容

Challenge
挑战

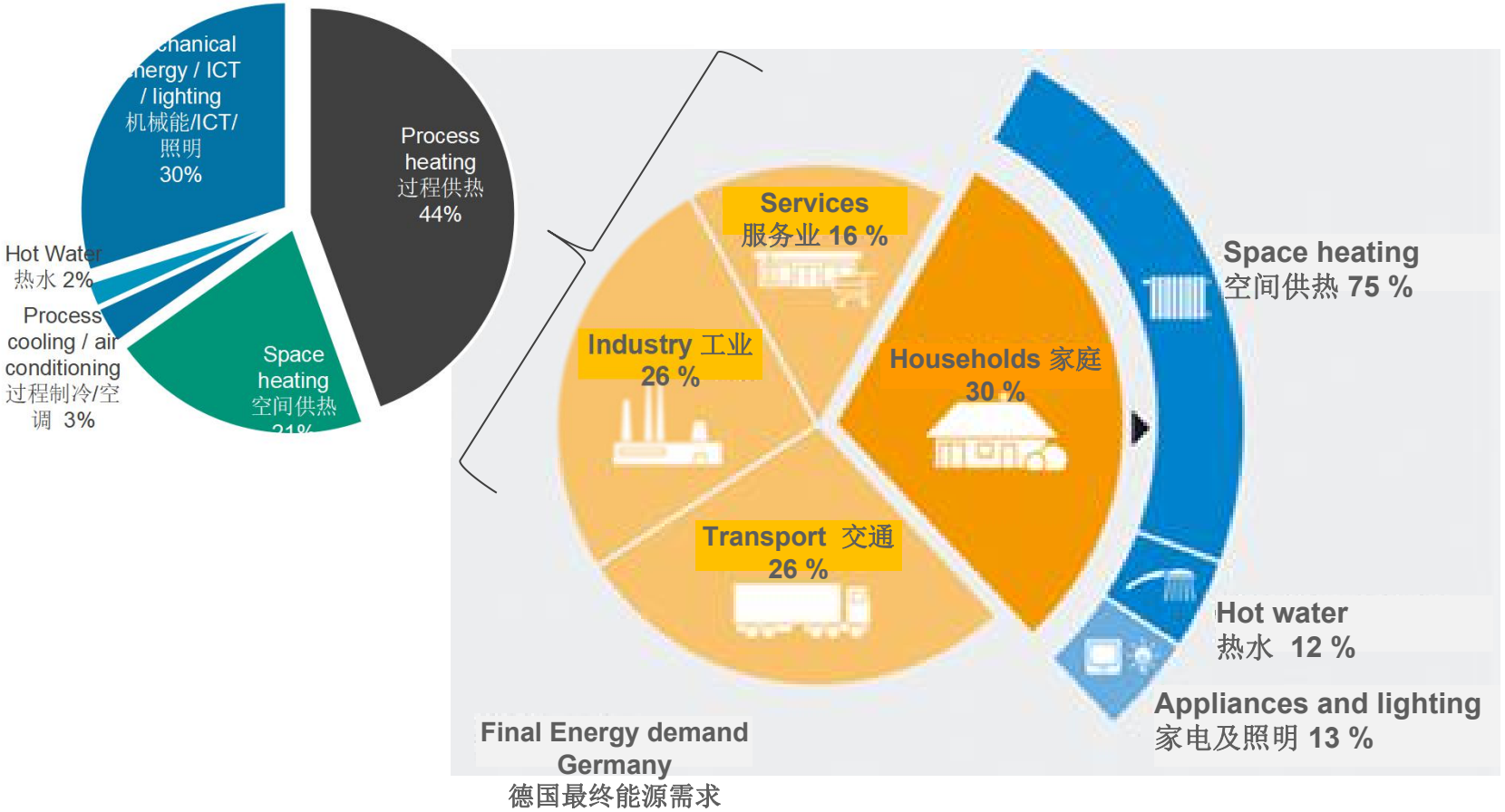
Energy efficiency in buildings and industry
建筑和工业能效

Sustainable heating solutions
可持续供热解决方案

Energy efficiency is the key for the energy transition
能效是能源转型的核心



Final energy demand by end-uses and sector
终端用户及各行业的最终能源需求



Transition of the heating and cooling sector
供热制冷领域的转型

Heating and cooling transition
供热制冷转型

Almost complete decarbonisation of H/C supply
80-95 % reduction of CO2 emissions by 2050 compared to 1990
供热制冷供给基本完全脱碳
到2050年二氧化碳排放相较1990的水平将减少80-95%的排放

Deploy RES supply technologies
可再生能源供给技术的应用

Direct use of renewable energies
直接利用可再生能源

Energy efficiency
能源效率

„Energy Efficiency First“
“能效优先”

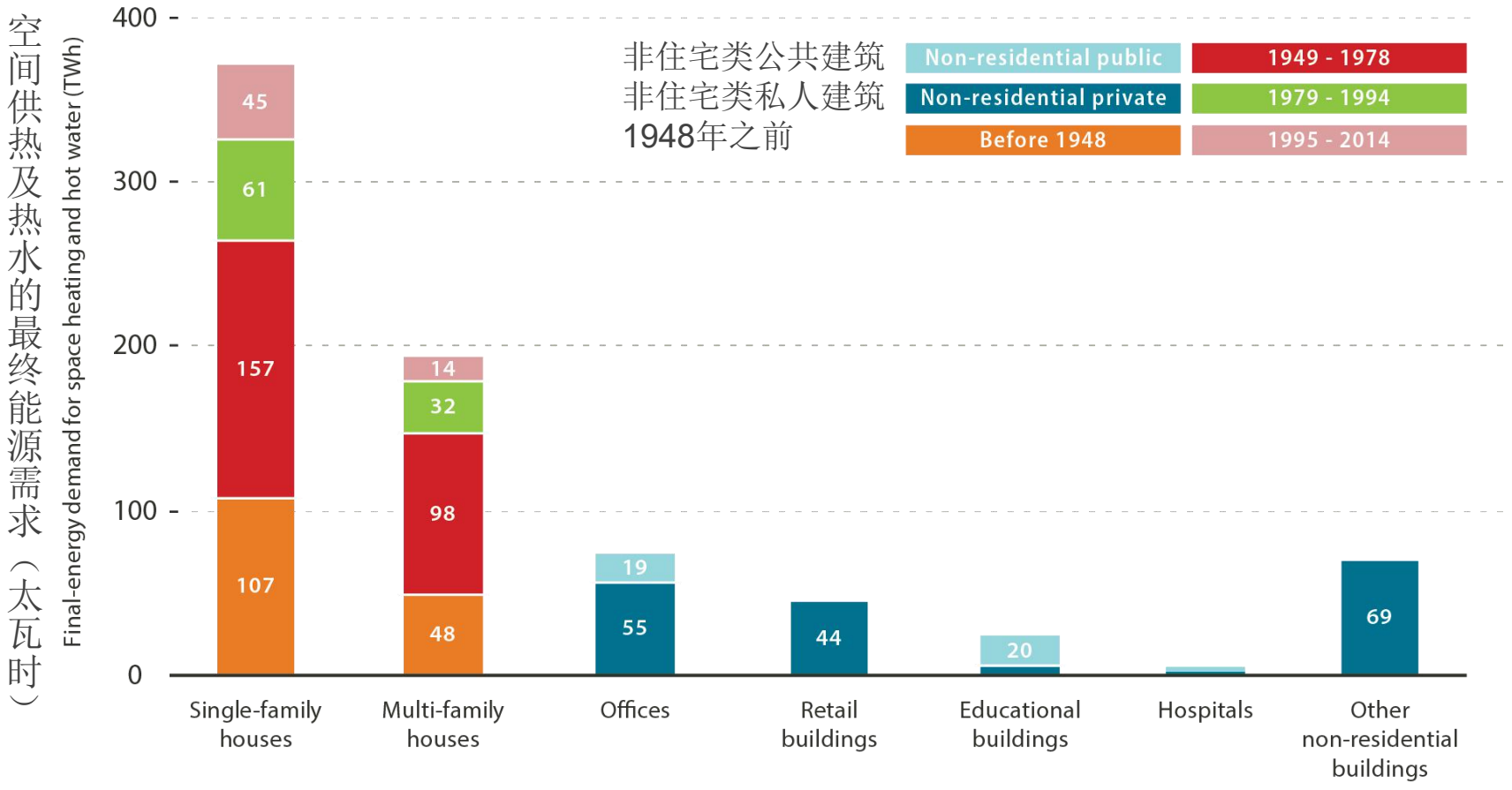
Sector coupling
方式的耦合

Use of power-to-heat and district heat
发展电制热和区域供热

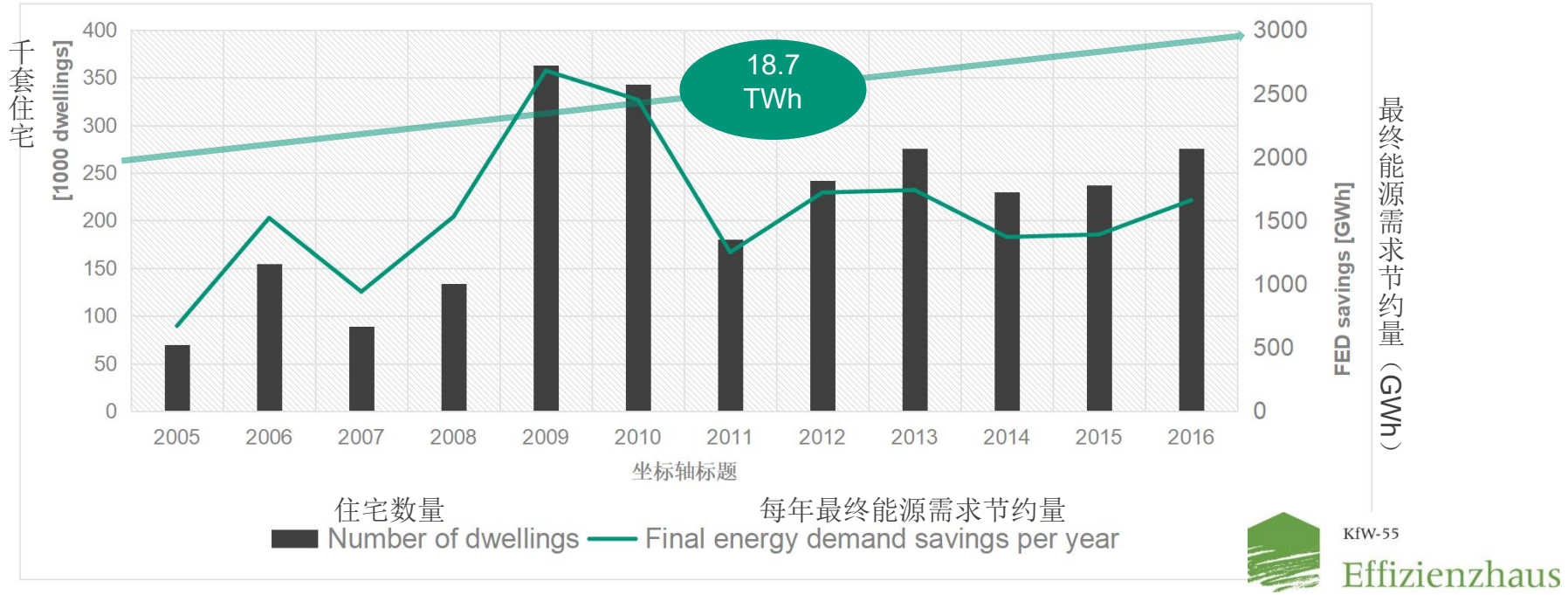
Energy efficiency policy: What delivers?
能效政策：传递了什么？

Energy efficiency in buildings
建筑能效

Two third of building stock has been built before first building code regulation / 三分之二的存量建筑建于第一部建筑规范出台前



KfW Energy Efficient Refurbishment programme
德国复兴信贷银行（KfW）节能改造项目



- Budget: 1.2 to 2 billion €/year
- Measures in 2.6 million dwellings since 2005 → ~ 6 % of residential building stock
- Final energy demand savings of 18.7 TWh → ~ 3.5 % of residential heating demand
- Establish a brand / building standard
- 预算：12-20亿欧元/年
- 自2005年至今共有260万套住宅实施了节能改造： ~ 6%存量住宅
- 节约最终能源需求18.7TWh： ~ 3.5%住宅供热需求
- 建立品牌/建筑标准

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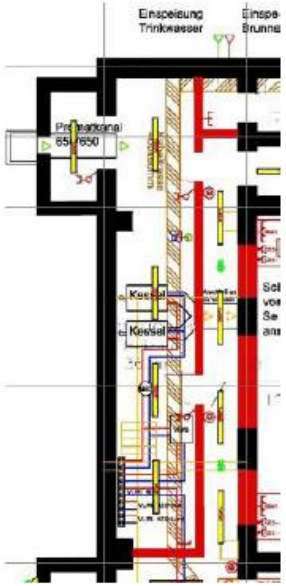
IREES Project: Energy efficient refurbishment of residential buildings block Taking into account technical innovations, economic and social aspects
IREES项目：住宅建筑节能改造（综合考虑技术创新、经济性和社会效应）



Interviews of relevant stakeholders
采访相关利益方

Written surveys
书面调查

Objective measurements in the apartments
对公寓的客观测量

Testing of modular methods
模块化方法测试

- e.g. exterior walls as a thermally activated facade and as an energy store
  例如把外墙用作热激活立面和能源存储室

Socioscientific accompaniment
辅以社会科学

- participative approach　参与式方法
- mixed-method: subjective + objective data混合式方法：主观+客观数据

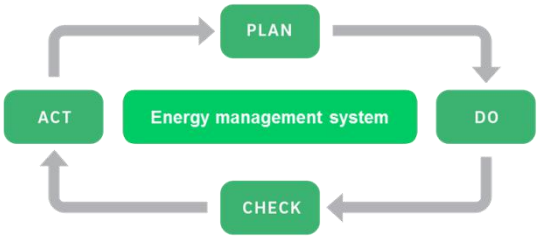
Energy efficiency policy: What delivers?
能效政策：传递了什么？

Energy efficiency in industry
工业能效

Main energy efficiency policy industrial sector in the National Energy Efficiency Action Plan /《国家能效行动计划》中工业领域的主要节能政策

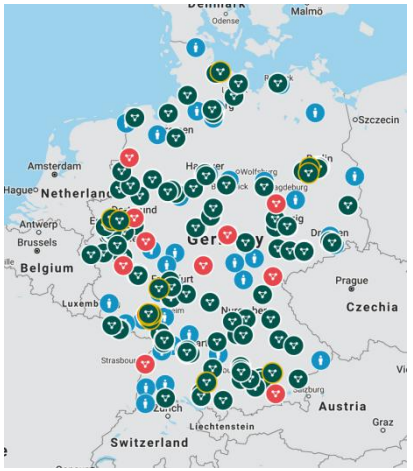
Energy Management / Energy audits
能源管理 / 能源审计

- obligatory energy audit or introduction of a management system
- 50 000 companies
- 强制性能源审计或引入能源管理系统
- 50 000家企业



500 Energy Efficiency Company Networks
500个企业能效网络

- Funding schemes for energy efficiency measures
- Support of excess heat utilization
- Funding schemes for energy audits (SME)
  - 30 000 energy audits since 2008
- 节能措施资助计划
- 支持余热利用
- 能源审计资助计划（中小企业）
  - 自2008年至今共资助3万次能源审计



Evaluation and implementation of Energy Efficiency Company networks by IREES / IREES实施评估企业能效网络

- **Total: 3600 energy efficiency measures in 共实施3600项节能措施**
- **Average measures per production site 每个生产现场平均的措施：**
  - 19 Measures, of which 10 profitable (internal rate of return ≥ 12%)
  - 19项措施，其中10项措施实现盈利（内部回报率≥ 12%）

  - ∅ 2.700 MWh/a Energy savings / 节能：2700 兆瓦时每年
  - ∅ 940 t/a CO_2 reduction / 二氧化碳减排： 940 吨每年
  - ∅ 580.000 € Investment / 投资： 58万欧元
  - ∅ 180.000 € yearly energy cost savings / 能源成本年均节省：18万欧元
  - ∅ rate of internal return of all profitable measures 31% / 所有实现盈利的措施内部回报率：31%

CO_2reduction with substantial profits not with losses
二氧化碳减排并不意味着增加成本，反而可以带来可观的利润

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Implementation examples / 实施案例

Measures identified and implemented within energy efficiency company networks
企业能效网络内部确定并实施的措施

Plastic processing - Energy consumption ca. 2.120 MWh/a
塑料加工——能耗约为2120 兆瓦时每年

Efficiency Measures:	**Heat recovery of compressed air generation**
节能措施：	**空压机热回收**
Investment / 投资：	20.000 € （2万欧元）
Energy savings:	63 MWh/a → 30 % of fossil fuels for heating
节能效果：	63 MWh/a →节约 30 %用于供热的化石燃料

Profitability:
Internal rate of return: 21 %
Payback time ~ 4 years

效益：
内部收益率：21 %
投资回收期：~ 4年

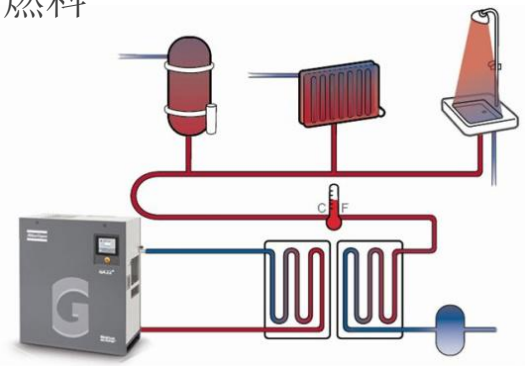


Foto : nold.de

Implementation examples / 实施案例

Measures identified and implemented within energy efficiency company networks
企业能效网络小组内部确定并实施的措施

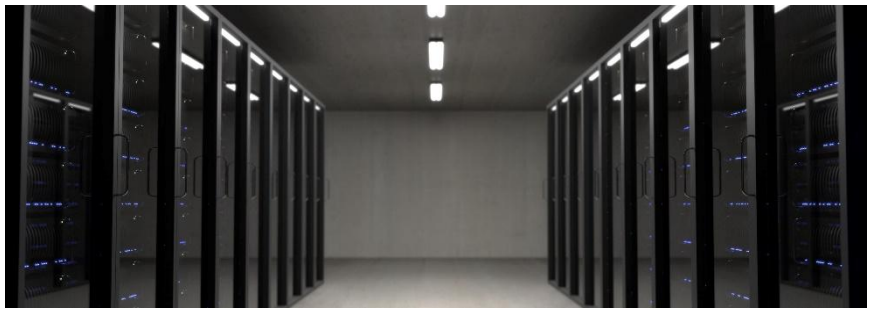
Data Center 数据中心

Efficiency measure:
节能措施：
Investment / 投资：
Energy savings / 节能效果：

Modernisation of cooling systems
配备现代化制冷系统
157,000 €（15.7万欧元）
Energy / 节能： 820 MWh
CO_2 Emissions / 二氧化碳减排： 379 t
Energy costs / 节省能源成本：98 400 €（9.84万欧元）

Profitability:
IRR: 63 %
Payback time: 1.6 years

效益：
内部收益率：63%
投资回收期：1.6年



Ongoing project Interflex4Climate
正在实施的项目：Interflex4Climate

Hochschule Karlsruhe Technik und Wirtschaft
UNIVERSITY OF APPLIED SCIENCES

INTERFLEX 4CLIMATE.de

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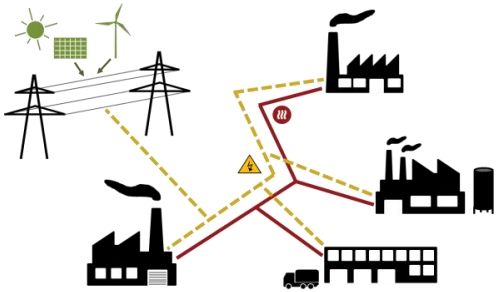
Institut für Ressourceneffizienz und Energiestrategien

Energy efficiency and demand side management of industrial parks / 工业园能效与需求侧管理

Energy efficiency
能效



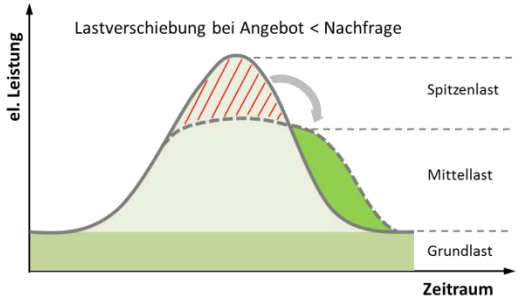
Increase energy efficiency

- Optimization of efficiency measures, heating grids within industrial zones
- Utilisation of excess heat

提高能效

- 优化节能措施，工业园内供热管网
- 余热利用

Demand Side Management
需求侧管理



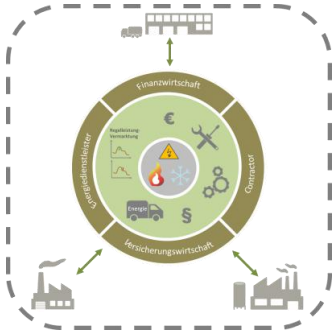
Business areas for DSM

- Balancing energy market
- Management of network congestion
- Load shifting considering volatile RES generation

需求侧管理业务领域

- 平衡能源市场
- 管理网络阻塞
- 由于可再生能源发电的不稳定实行移峰填谷

Business models
商业模式



New business models

- Ensuring security of supply
- Minimize administrative efforts for companies
- Establish new business models

新型商业模式

- 保证供给安全
- 尽量减少企业行政工作
- 建立新型商业模式

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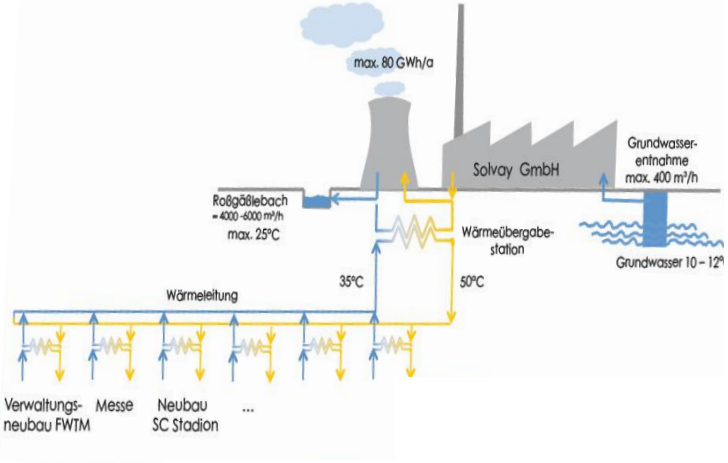
Green Industrial park and climate-neutral soccer stadium in the city of Freiburg 【本页原版】

- **Industrial park**
  - 300 ha area , 500 companies
  - 20 % of electricity consumption of the city
  - 10 % of Greenhouse gas emissions of the city
- **Pilot projects and research activities**
  - **Innovation and efficiency cluster**: cooperation of companies investing in digitalisation, e-mobility and innovative energy efficiency solutions
  - **Joint infrastructure company** for investing in heating networks and cross company smart communication elements
- **Excess heat supply** for city quarter and new stadium of Bundesliga club SC Freiburg
  - 80 GWh excess heat supply at 48° C



- Networking of committed companies as well as individual company solutions
- Establishing **Green Industry Park** as brand with high degree of identification

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Green Industrial park and climate-neutral soccer stadium in the city of Freiburg / 弗莱堡绿色工业园和气候零负荷足球场

- **Industrial park**
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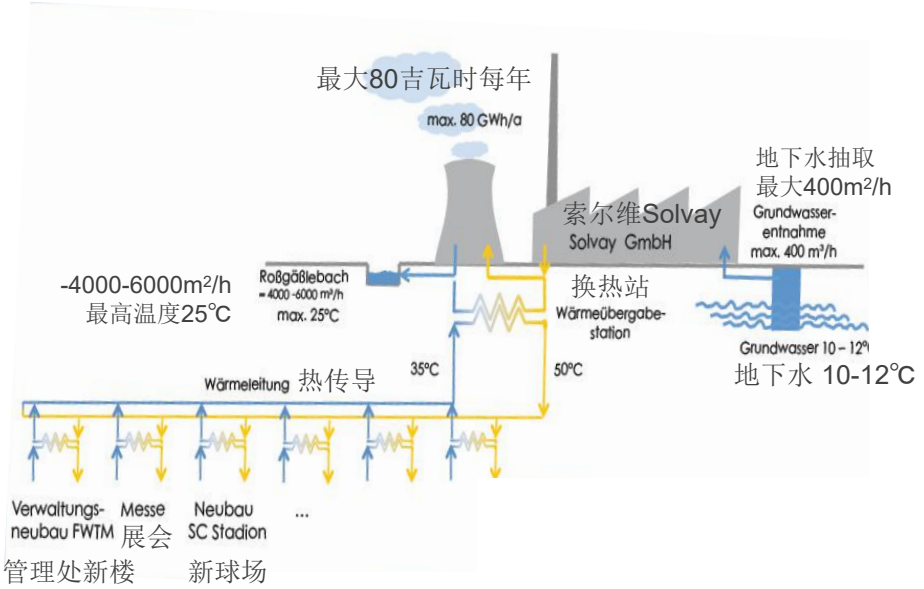
- 工业园
  - 300公顷， 500家企业
  - 电力消费占全市20%
  - 温室气体排放占全市10%
- **试点项目及研究活动**
  - **创新和能效集群：**企业合作，对数字化、电动汽车和创新性能效解决方案进行投资
  - **联合基础设施公司**对供热管网和跨企业智能通信进行投资

Green Industrial park and climate-neutral soccer stadium in the city of Freiburg / 弗莱堡绿色工业园和气候零负荷足球场

- **Excess heat supply** for city quarter and new stadium of Bundesliga club SC Freiburg
  - 80 GWh excess heat supply at 48° C
- 城区和德甲弗莱堡足球俱乐部新建球场**废热利用**
  - 废热热量80吉瓦时，温度为48℃



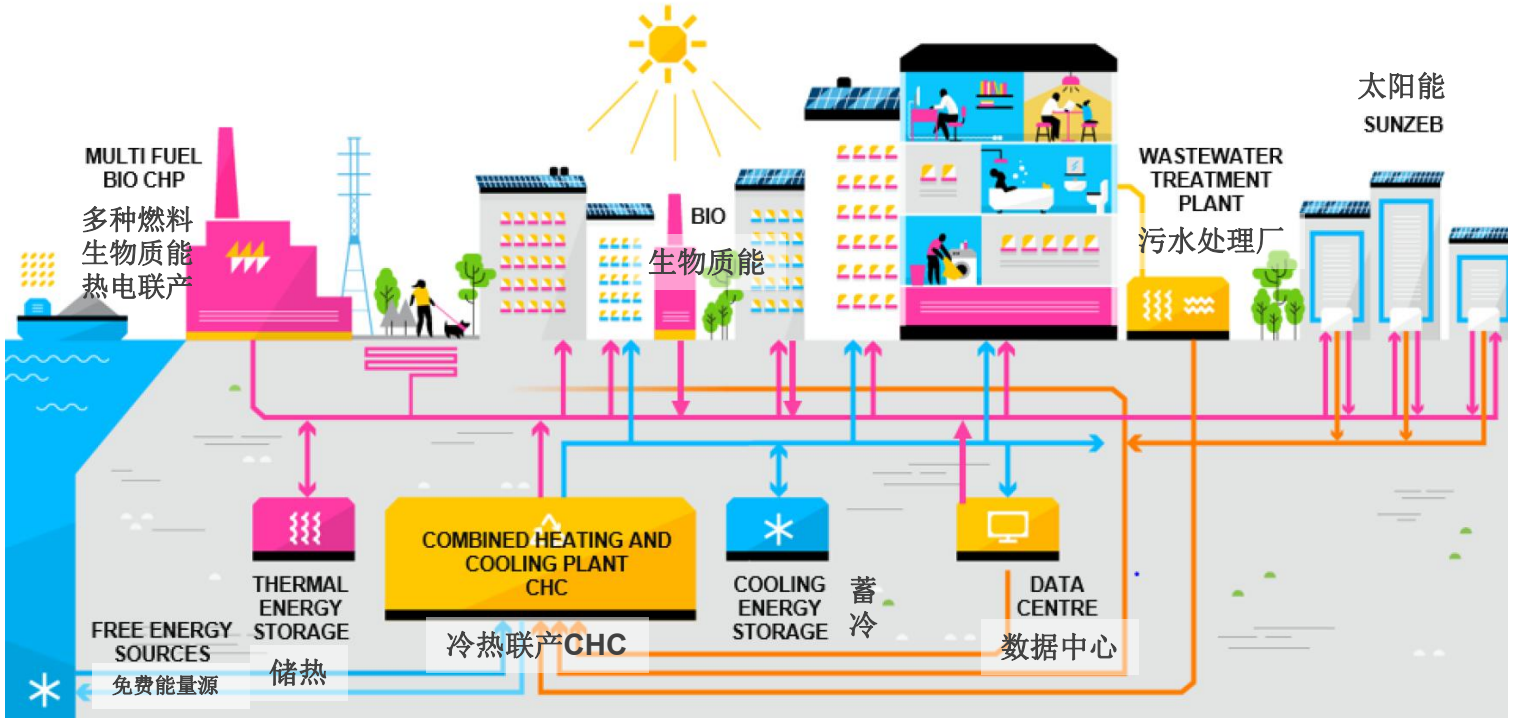
- Networking of committed companies as well as individual company solutions
- Establishing **Green Industry Park** as brand with high degree of identification
- 企业网络及个性化企业解决方案
- 建立**绿色工业园**，打造高认同度品牌

Sustainable heating
可持续供热

Helsinki, Finland: Combined heating and cooling plant
芬兰赫尔辛基：冷热联产设备

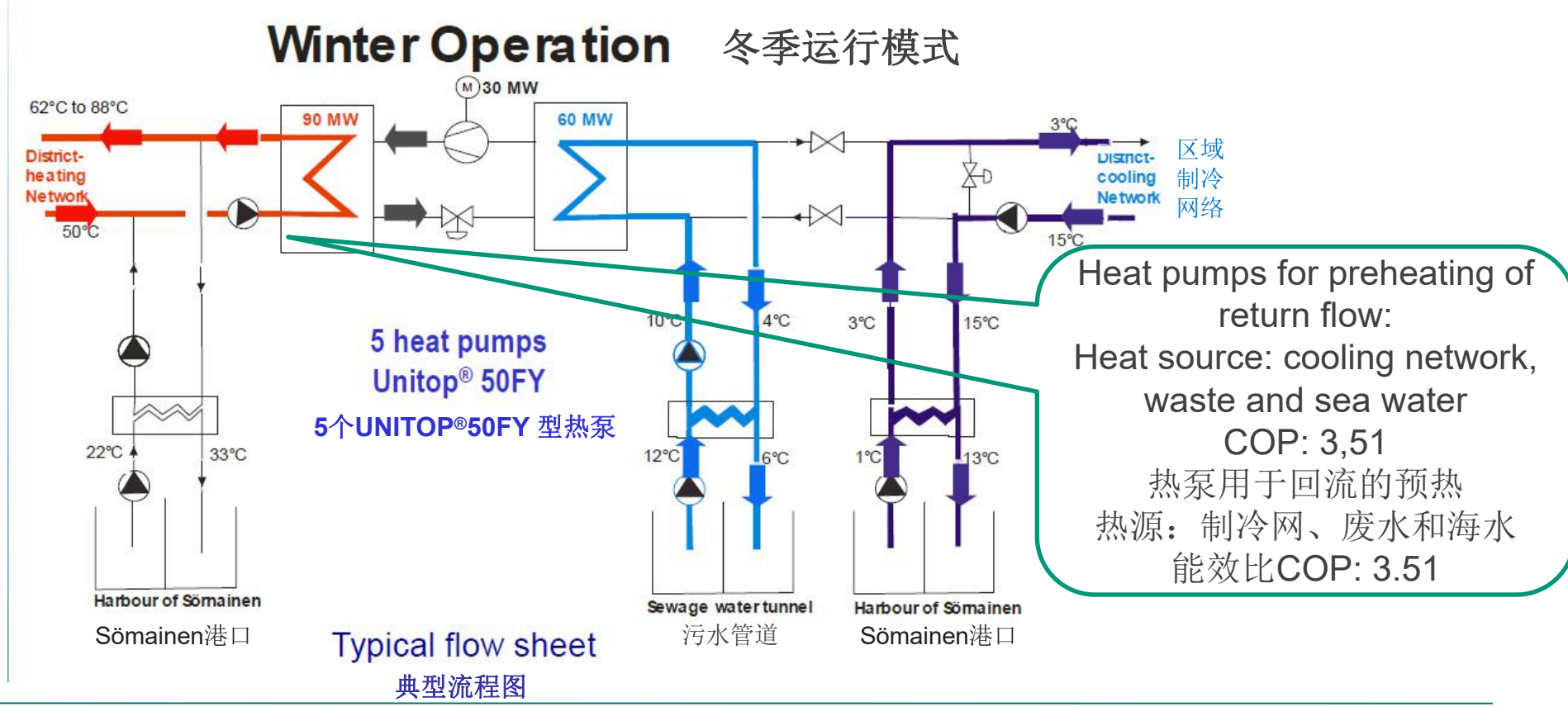
- Largest combined heating and cooling plant
- 90 % connection rate
- Integration of large heat pumps

- 最大的冷热联产设备
- 连接率90 %
- 接入大型热泵



Helsinki, Finnland: Combined heating and cooling plant
芬兰赫尔辛基：冷热联产

- Integration of 5 x 16,8 MW heat pumps in existing heating and cooling network
- 在现有冷热联产网中集成5个功率为16.8兆瓦的热泵



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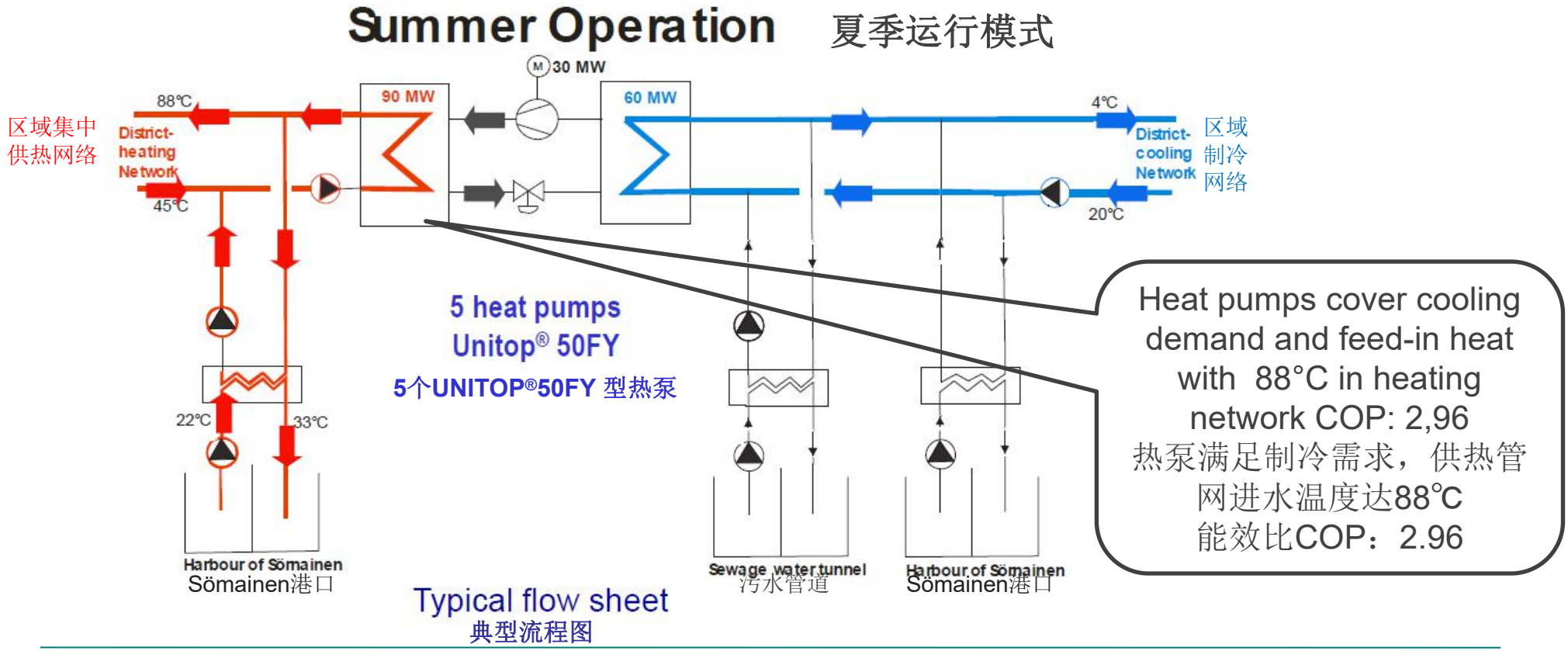
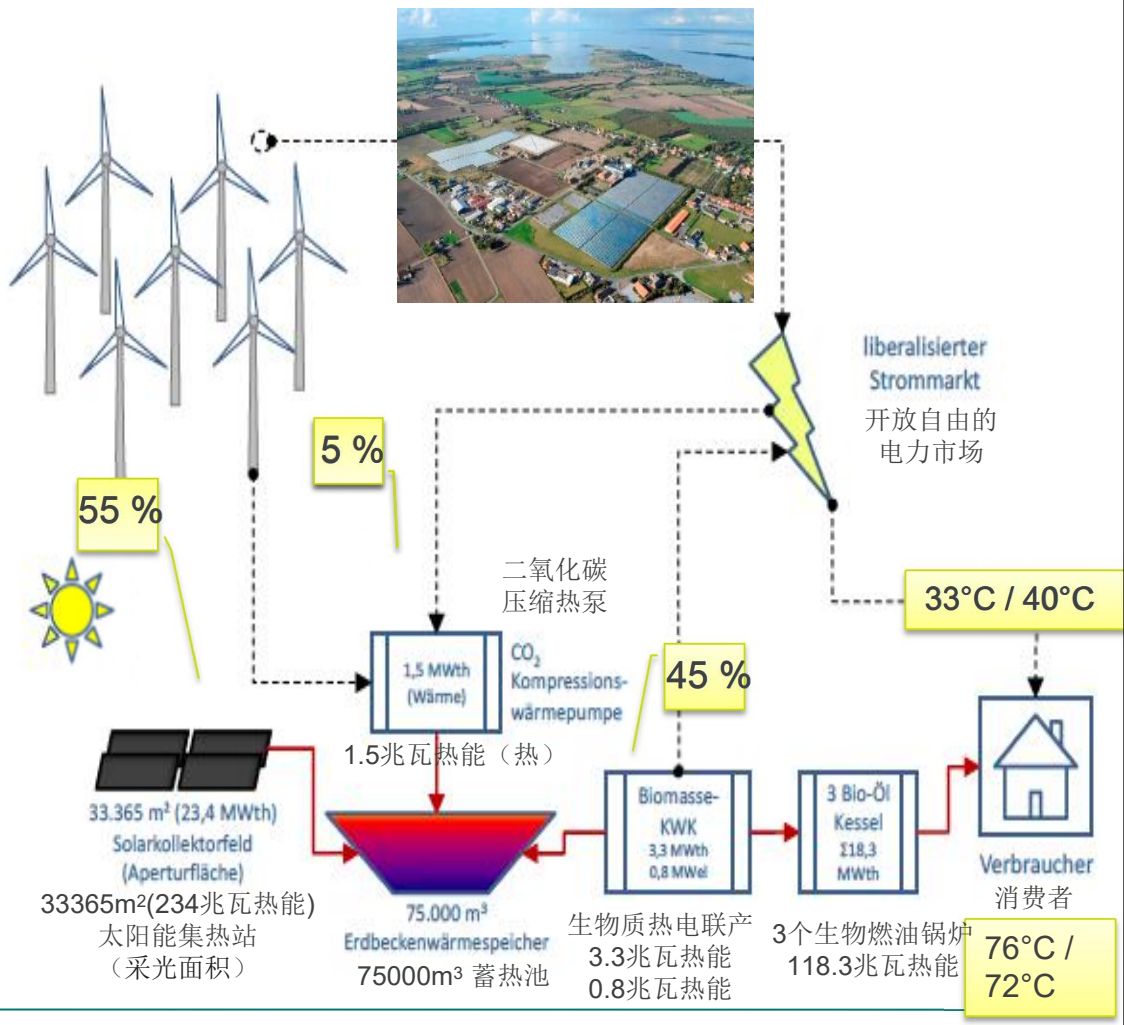


„Smart district heating“ Denmark
丹麦“智能区域供热”

- Optimal integration of different renewable options with district heating and local electricity generation
- Components
  - Solar collector field
  - Biomass ORC plant
  - Bio-oil Heating plant
  - Large heat pump
- Economic feasible 100 % heating supply
  - Heat generation costs 50–60 €/MWh

- 选择不同的可再生能源与区域供热、地方发电的最优组合
- 包括太阳能集热板、生物质有机朗肯循环（ORC）电站、生物燃油热力站、大型热泵
- 经济可行性：100%满足供热需求
  - 供热成本： 50 – 60欧元/兆瓦时



IREES as enabler of energy efficiency and sustainable energy supply
IREES助力节能与可持续能源供给

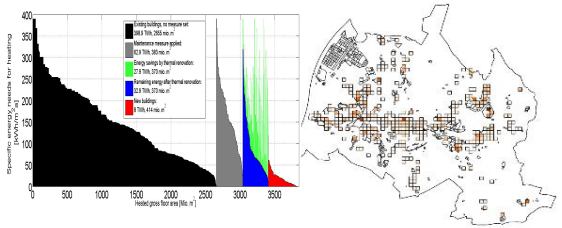
Make it happen / 创造可能

Development of sound policy strategies and framework conditions / 制定健全政策和框架条件

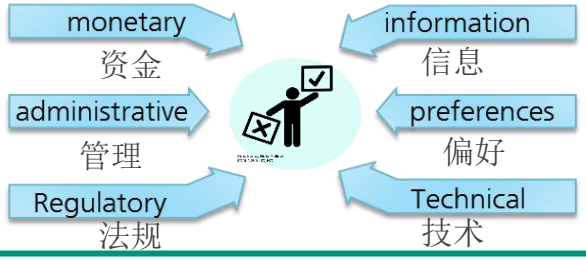
IREES clients: European Commission, Federal Ministries Germany, Europe and South America

IREES客户：欧盟委员会，德国联邦各部委，欧洲和南美

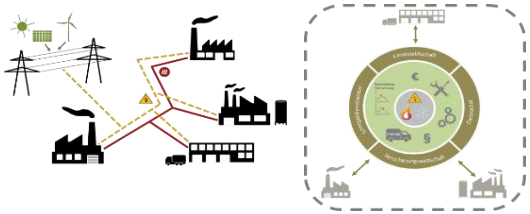
Energy scenarios and smart energy models
能源情景和智慧能源模型



Human-technology interaction
人类技术的交互



Energy management and strategies
能源管理及战略



Make it work / 保证效果

Implementation and accompanying pilot projects – Technology and social acceptance

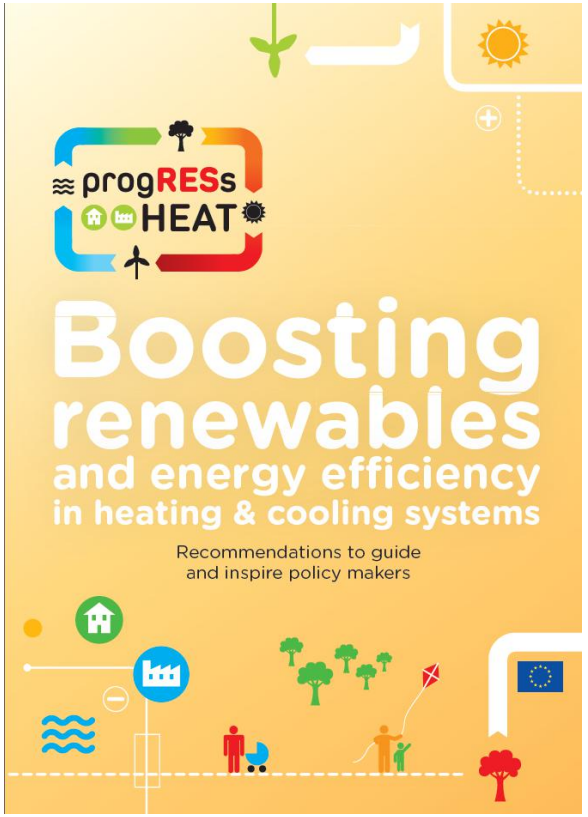
试点项目实施与跟踪：技术和社会接受度

IREES clients / partners: industrial companies, housing companies, municipalities, associations

IREES客户/合作伙伴：工业企业，建筑企业，市镇政府及协会

Recent international publications
近期国际刊物

http://www.irees.de/irees-en/inhalte/projekte/abgeschlossen/GF-uebergreifend/Review-SDG7.php



http://www.progressheat.eu

Thank you for your attention
感谢您的聆听

Beijing, 11 December 2018,
北京，2018年12月11日

Dr. Jan Steinbach
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IREES GmbH - Institute for Resource Efficiency and Energy Strategies

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