INSTITUT FÜR ENERGIE- UND UMWELTFORSCHUNG HEIDELBERG

Sustainable Heating and Waste Heat Utilization – Strategies, Technologies, Policies and Experiences in Germany

可持续供热与废热利用——德国的战略、技术、政策以及经验

Dr. Martin Pehnt, ifeu // 11.12.2018 Maritin Pehnt博士，海德堡能源与环境研究所//2018年12月11日

SINO-GERMAN EXPERTS SALON ON ENERGY EFFICIENCY IN BUILDINGS AND SUSTAINABLE HEATING

海德堡能源环境研究所的主页

Welcome to ifeu

ifeu conducts research and provides a worldwide consultancy service in relation to all major environmental and sustainability issues. With almost 40 years of experience, ifeu is one of the most important ecological research institutes in Germany. Our work is characterised by experience and independence combined with a practical and target-based approach. ifeu currently employs 80 staff with a background in natural sciences, engineering and social sciences at its sites in Heidelberg and Berlin.

This month's number

More than 25.000

Over the past ten years, the National Climate Initiative has supported more than 25.000 projects with around 790 million euros.

You can find more information here.

News

NEWS ARCHIVE

How can the Sharing Economy contribute to more sustainable consumption patterns?

19 November 2018

Answers are provided by the collective volume "Digital Culture of Sharing" (in German), written based on the findings of the research project "PeerSharing" by the involved research institutions IÖW, IZT and ifeu.

Read more

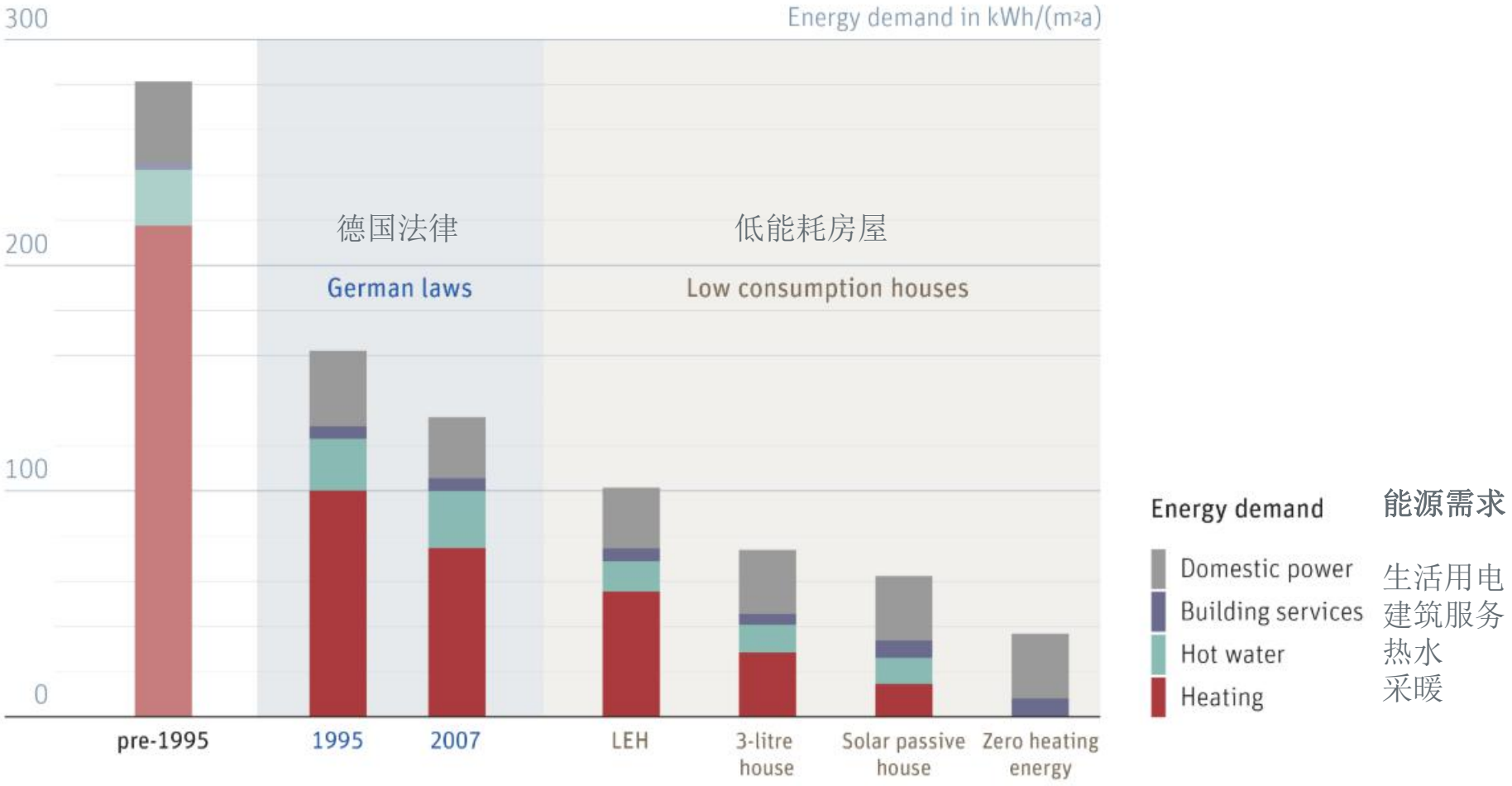
Kigali on the way to a sustainable and affordable infrastructure

7 November 2018

At the 2018 Rapid Planning Stakeholder Conference in Kigali, Rwanda, the results and plans of the BMBF-funded project were presented, among others by the Mayor of Kigali, Marie Chantal Rwakazina, who shared her vision of a science-based infrastructure development of Kigali.

Read more

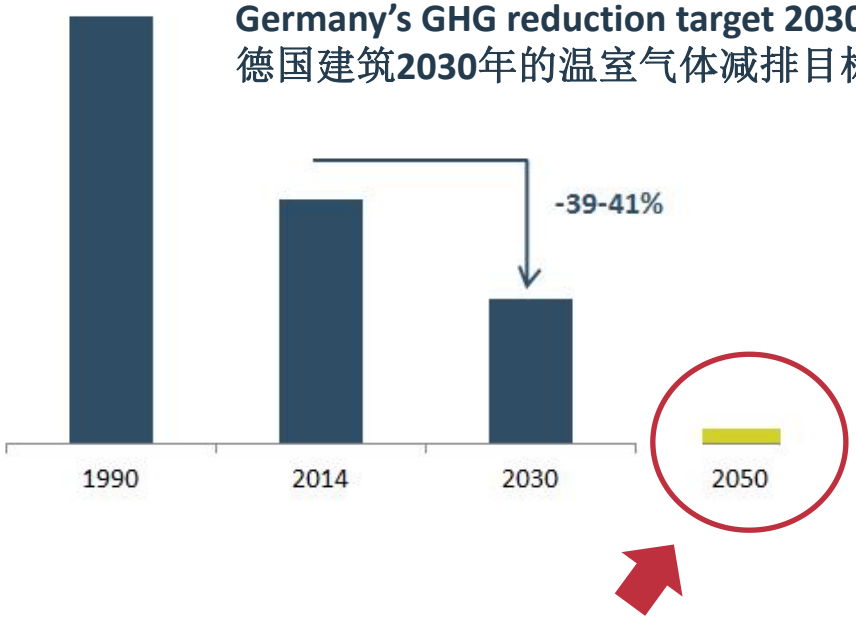
The housing sector offers large potentials for GHG and energy savings.
建筑领域提供了温室气体减排和节能的巨大潜力。



Source: ifeu 2011 on energytransition.org

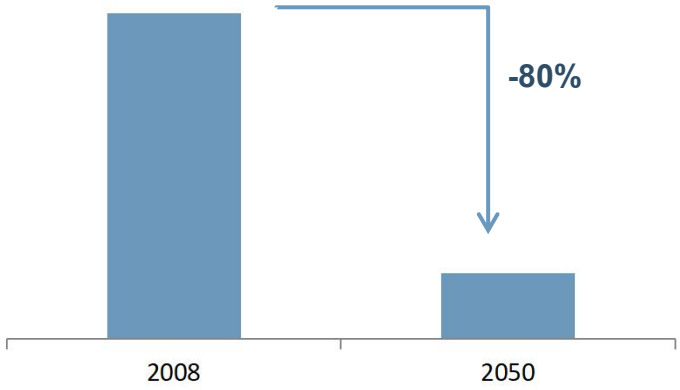
The national targets in the building sector are ambitious…
德国在建筑领域设定了雄伟的目标

Germany's GHG reduction target 2030 for buildings
德国建筑2030年的温室气体减排目标



Necessary GHG reduction 2050 in view of Paris Climate Agreement
根据巴黎气候协定在2050年必须达到的温室气体减排量

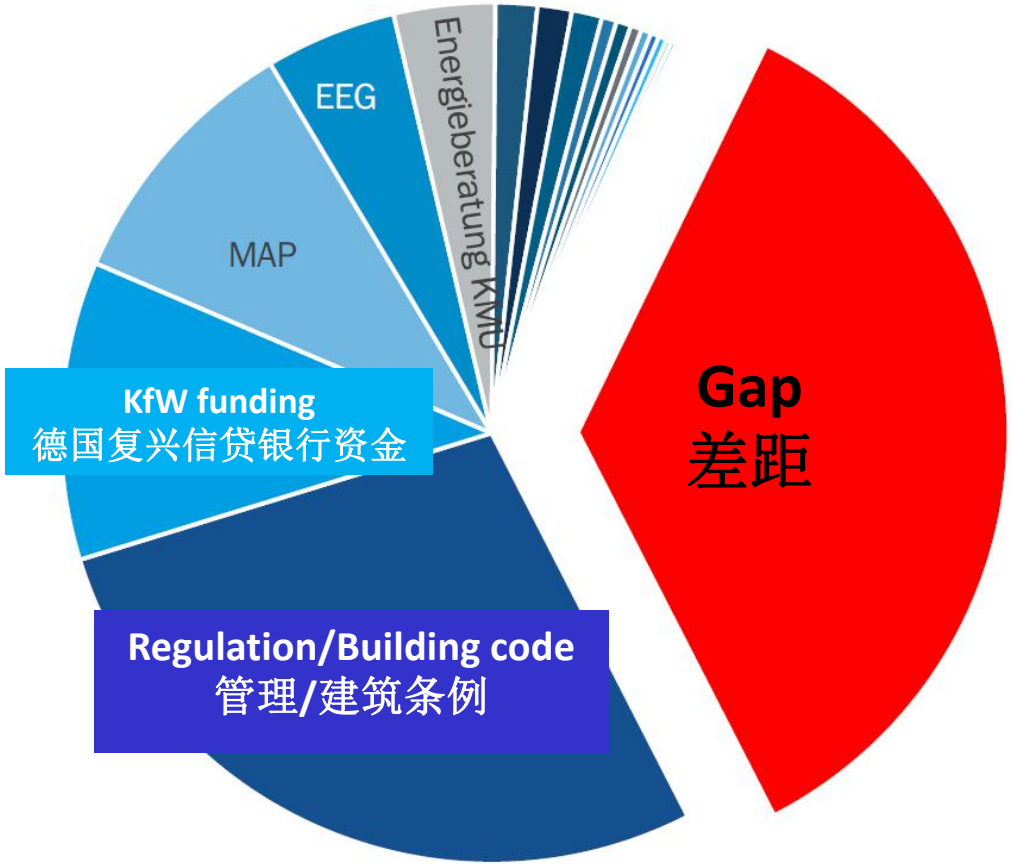
Germany's primary energy reduction target 2050 for buildings
德国建筑一次能源在2050年的削减目标



… but there is a gap between targets and reality.
……但是目标和现实之间存在差距。

Expected contribution of policy measures to 2030 greenhouse gas savings

政策措施对2030年温室气体减排的预期贡献



- From 25 evaluated building measures, 90 % of the expected GHG savings until 2030 stem from five measures.
  从25项已评估的建筑措施中可知，到2030年将会有90%的预期温室气体减排来自于其中5项措施。
- A large gap remains. The annual GHG savings must be increased by 50 %.
  仍旧存在巨大差距，每年的温室气体减排量必须增加50%。

MAP: 使用可再生能源的市场激励项目
EEG: 德国可再生能源法案
Energieberatung KMU: 德国中小企业能源咨询

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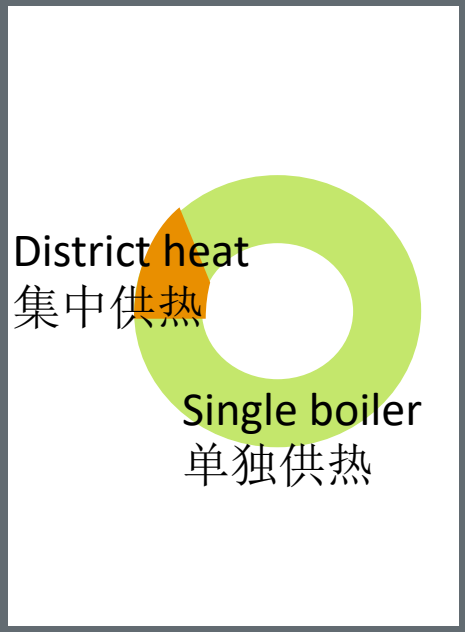
Status quo of heating market and policy instruments

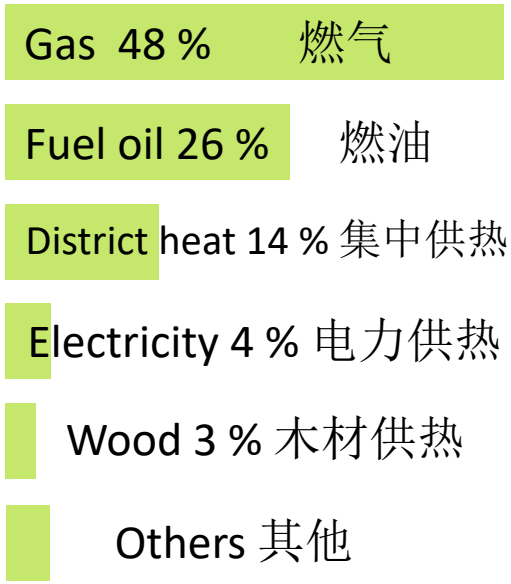
供热市场现状与政策工具

Reality check: How Germans heat their buildings
审视现实：德国如何给建筑供暖

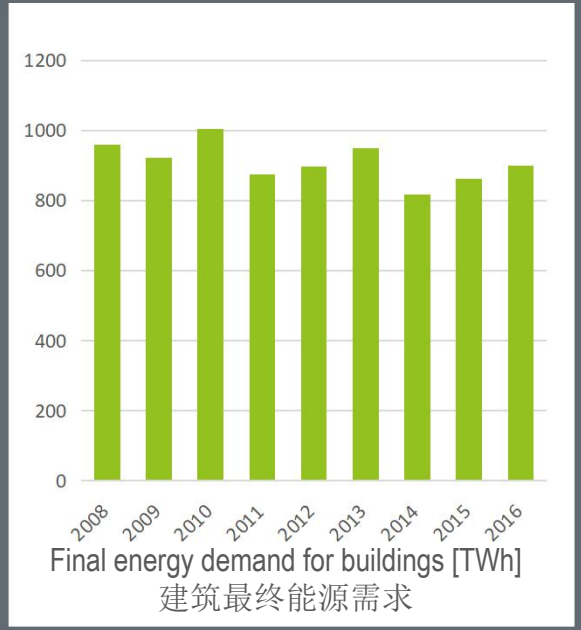
District heat mainly in Eastern Germany and Cities
区域集中供热主要在德国东部和城市



Fossil fuels are still dominating
化石燃料仍处于主导地位



Specific heat demand per m² decreases, absolute fuel consumption stagnates
单位平方米供热需求下降，绝对燃料消费水平停滞



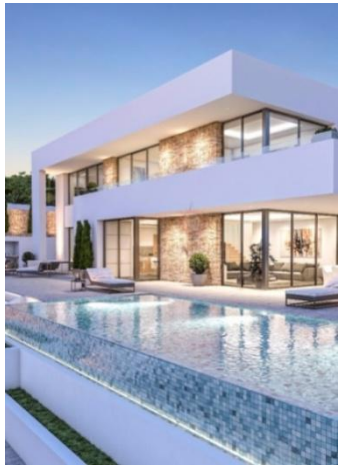
Middle: Destatis 2018 für 2016. Right: BMWi 2018

Reasons for GHG gap
温室气体减排目标与现实存在差距的原因

Insulation Restrictions
隔热层的限制

Effect of the Last Centimeter
最后一厘米的影响

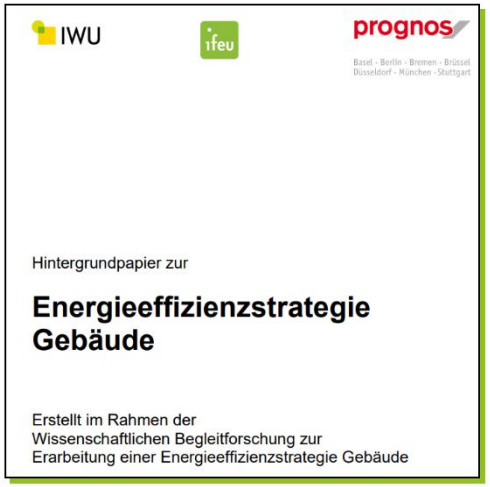
Acceptance and Implementation Rate of Efficiency Measures
能效措施的接受度和施行度
Low energy prices
较低的能源价格



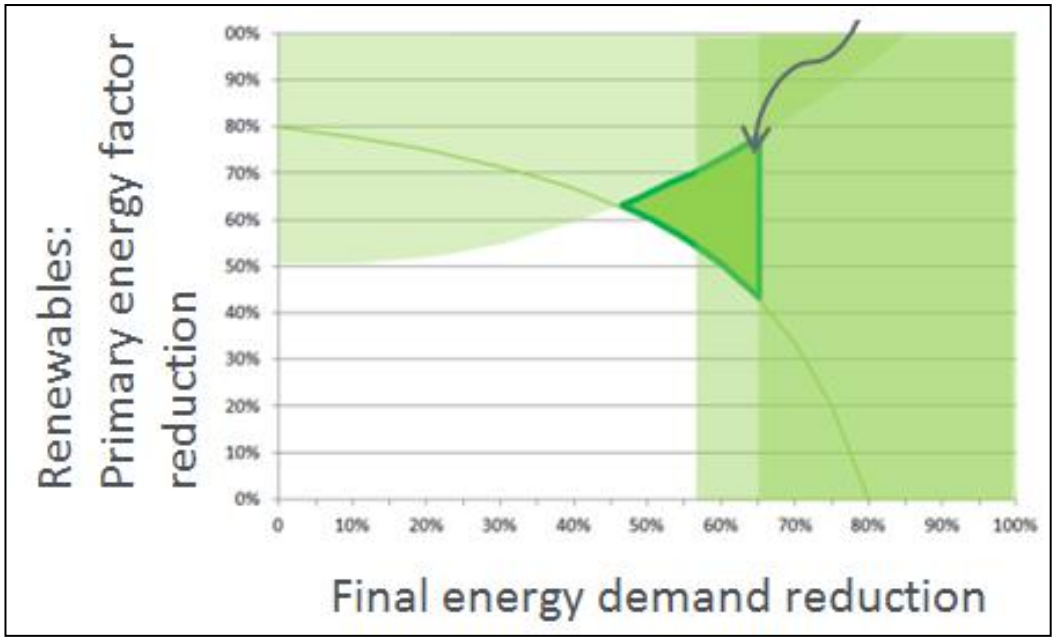
Living Space Growth
居住空间的增长

Rebound through Greater Comfort
追求更高的生活舒适度

The Federal Efficiency strategy of the Federal government calls for…
联邦政府的能效政策要求是：

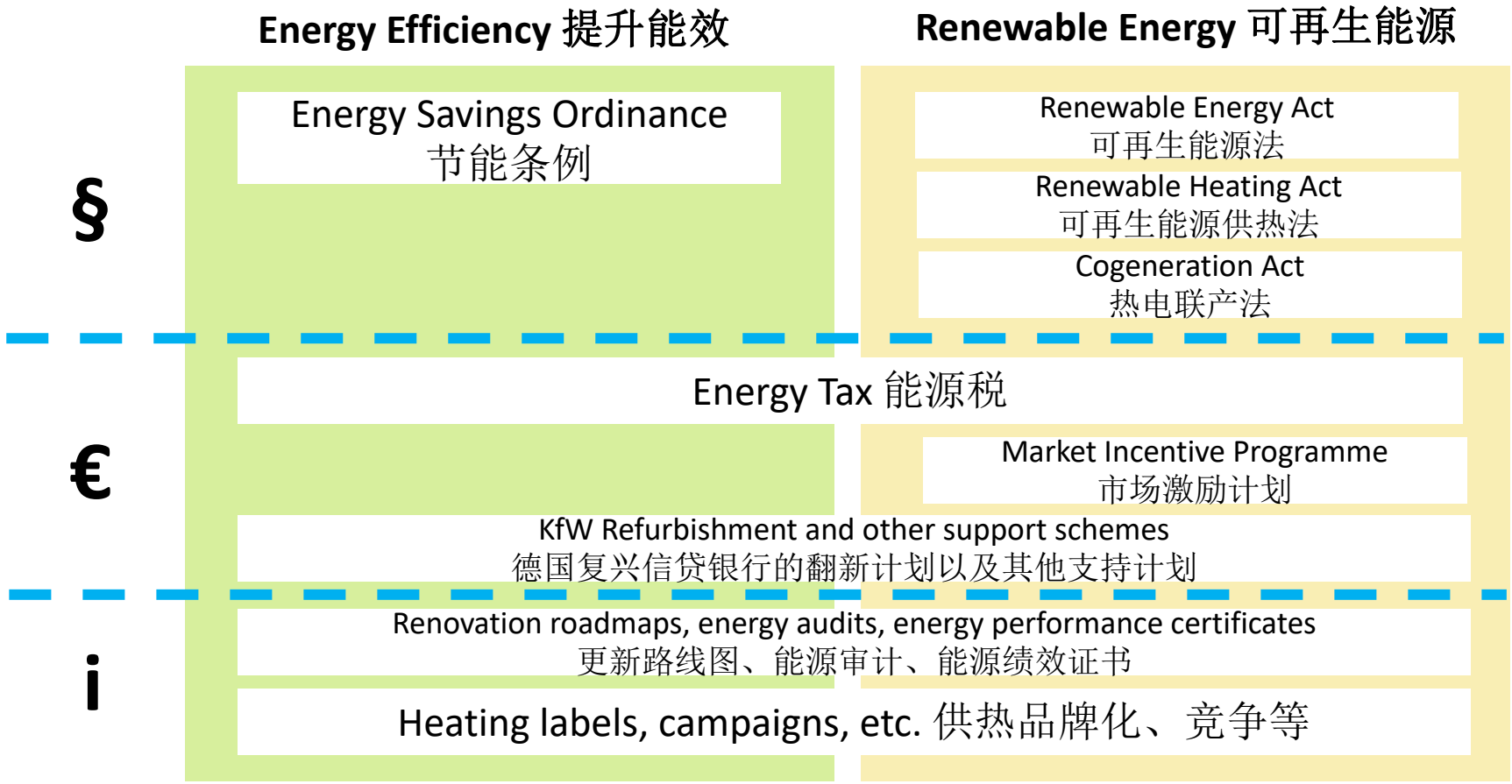


… simultaneous implementation of renewables AND efficiency, because… 同时实现可再生能源的利用**并且**提升能效，因为：



…. energy efficiency is the door opener for many renewable heating systems and increases their yields and performance.
提高能效使得大量可再生能源供热系统成为可能，而且能提升其产量和性能

Main instruments 2018
2018年主要的政策工具



Strategies
政策：

Climate protection plan 2050, Efficiency strategy for buildings, National Energy Efficiency Action Plan, Energiekonzept, Roadmap Heat Transition, Long Term Renovation Strategy
《2050年气候保护计划》、《建筑能效战略》、《国家能效行动计划》、《能源合作计划》、《热转型路线图》、《长期改造战略》

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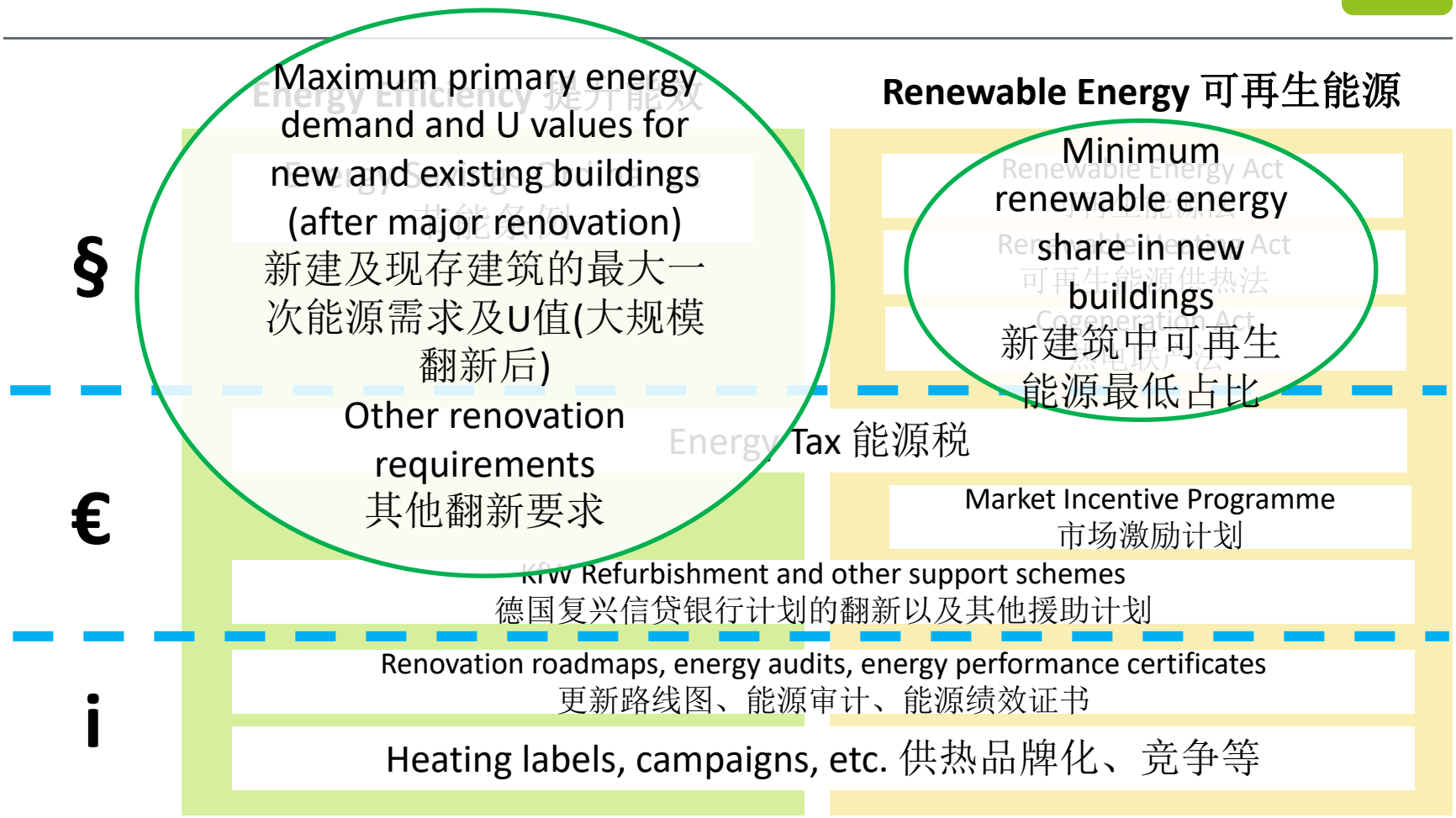

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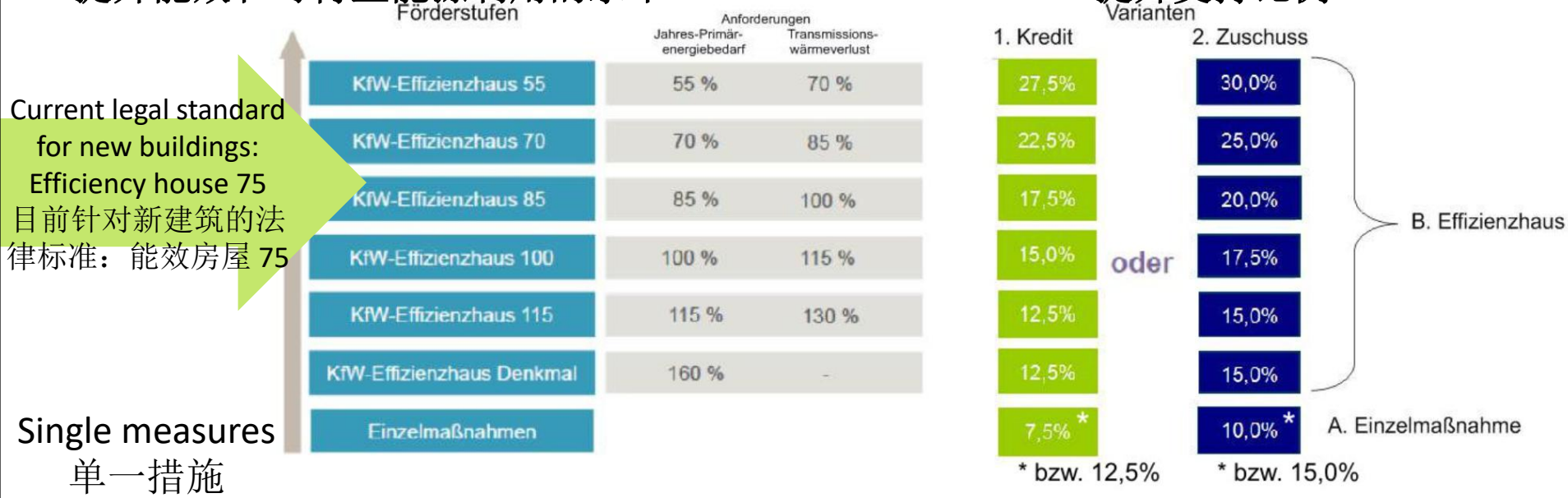
KfW Programme for efficient buildings
德国复兴信贷银行的节能建筑项目

Example: refurbishment

例如：翻新

With increasing level of efficiency and renewables….
提升能效和可再生能源利用的水平

…. increasing support rates.
提升支持比例



Current legal standard for new buildings: Efficiency house 75
目前针对新建筑的法律标准：能效房屋 75

Single measures
单一措施

*Example: The KfW Efficiency house 55 has a primary energy demand which is 20 % points below the requirements for new buildings. Refurbishment to this level yields a support of 30 % of the eligible costs.*例子: KfW能效屋55要求一次能源的需求比新建筑低20%。翻新到这个水平将给予30%（符合条件的）翻新成本的支持。

Market Incentive Programme MAP and KfW Waste heat Programme

使用可再生能源的市场激励项目（MAP）以及德国复兴信贷银行（KfW）的废热项目

National subsidy schemes 国家补贴政策

Renewable heating (MAP) 可再生能源供热

- Investment grants and low interest loans (subsidy rate between 10 and ca. 40 %)
  投资补贴及低息贷款(补贴率介于10-40%)
- 2017: 253 Mio. € budget for renewable heating, e.g.
  2017年2.53亿欧元可再生能源供热预算，例如：
  - 18.000 small solar collectors 小型太阳能集热器
  - 24.000 small biomass boilers 小型生物质锅炉
  - 18.000 heat pumps 热泵
  - 1.200 district heating systems 区域集中供暖系统
  - Etc. 等等
- Large impact on quality and efficiency of sold products due to technical requirements
  技术要求对出售产品的质量和效率影响较大

Waste heat 废热

- Investment grants and low interest loans (subsidy rate 30 - 40 % of additional efficiency related investment costs)
  资助补贴及低息贷款（补贴率是与节能相关的额外投资成本的30-40%）
- Condition: Waste heat concept by energy expert
  条件：能源专家提出的废热方案
- 2017: 20 Mio. € budget
  2017年：2千万欧元的预算

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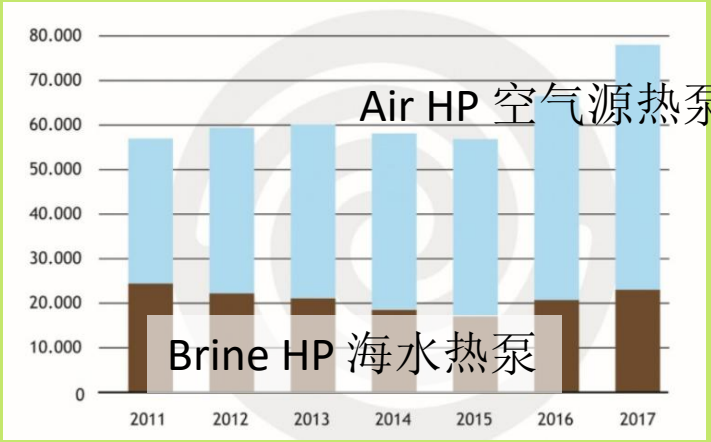
Future trends // Technologies

未来趋势 // 技术

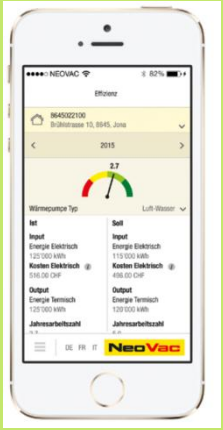
Technology trends I: Heat pumps
技术趋势之一：热泵



Record year for heat pumps
热泵数量创纪录的一年

Trend towards own PV production
自有光伏产能趋势提升

Hybrid systems for lower-efficient buildings and for flexible, grid-oriented operation
混合系统针对低效率建筑和灵活的、以电网为导向的运行



Measuring and smart-grid Readiness of heat pumps.
热泵的测量和电网的准备就绪

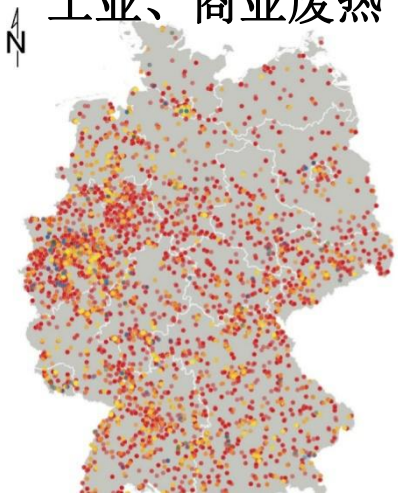
Smart tariffs for electricity??
智能电价？

Sales: BWP 2018.

Technology trends II: Waste heat
技术趋势之二：废热

Industrial/commercial waste heat
工业、商业废热

ifeu waste heat map and heat Atlas
来自ifeu的废热和供热地图



Waste water heat use with heat pumps
用热泵利用废水余热

Example例子:

Karlsruhe 卡尔斯鲁厄 :

- Refinery providing 90 MW heat
  炼油厂提供90兆瓦废热
- More than 50 % of the district heat of city of Karlsruhe 城市集中供热超过50%

Stuttgart 斯图加特 :

- around 9 GWh heat for residential buildings with canal heat exchanger
  约9吉瓦时用于居民楼的管道热交换器
- Using heat pump plus CHP unit 1300 l/s
  热泵及热电联产单元利用达到1300升每秒

Technical potential* 技术潜力:

- Around 20-30 TWh ** 大约为20-30太瓦时
- Around 20 TWh ** 大约为20太瓦时

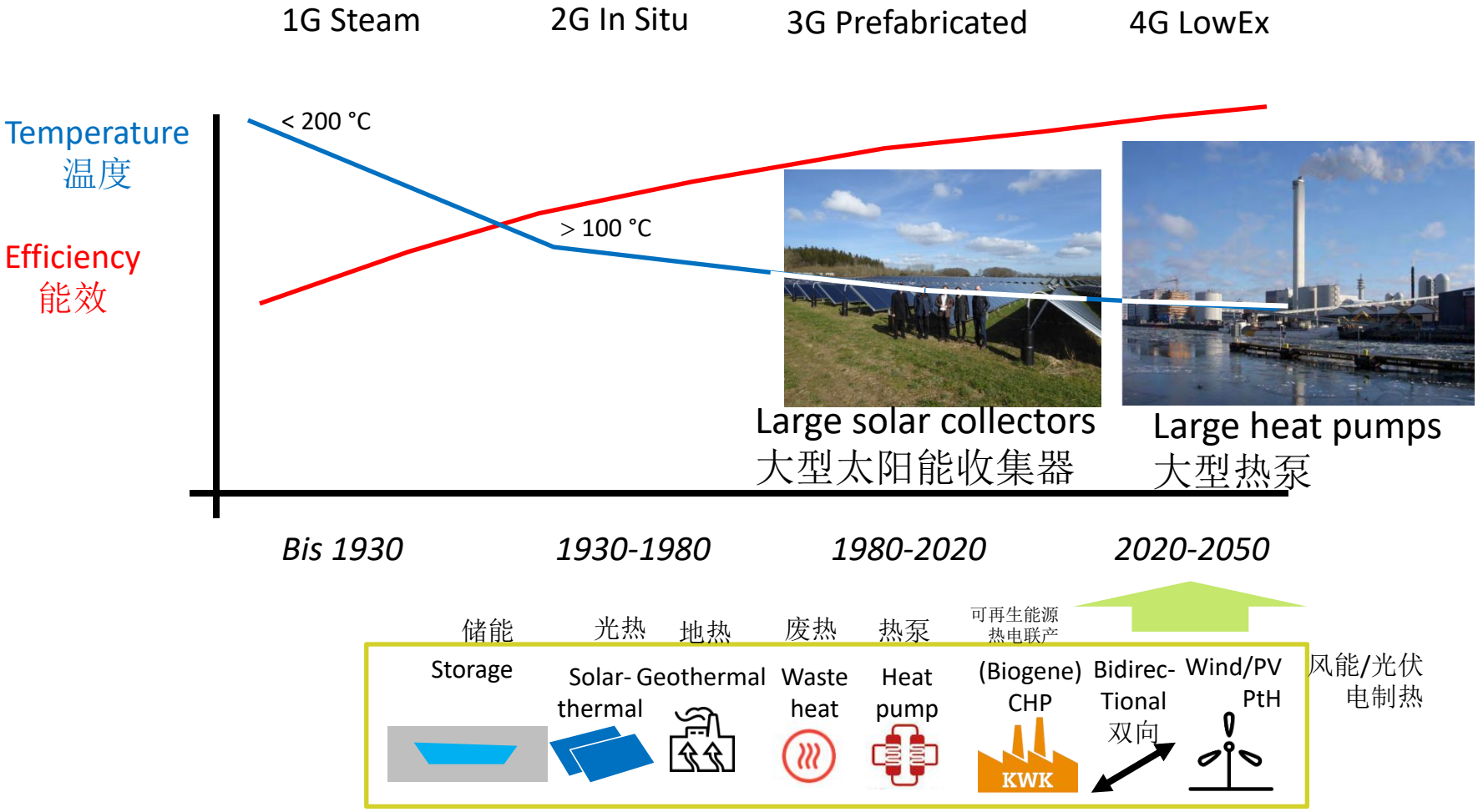
Source信息来源:

https://www.ifeu.de/en/project/nenia/

https://www.ifeu.de/kommunale-abwaesser-als-potenzial-fuer-die-waermewende/

* In Germany. ** 20 TWh/a corresponds to around 3 % of heat demand for buildings.

Technology trends III: District heat 4th Generation
技术趋势之三：第四代区域集中供热



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Future trends // Policy Approaches

未来趋势 // 政策方针

Discussion on new policy instruments
关于新政策工具的讨论

Discussion I: „Support scheme strategy“
讨论一：“支持方案策略”

- Simplification 简化
  - Various support schemes will be amalgamated to void a „support scheme dschungle (e. g. the various industrial energy efficiency schemes; and the KfW/MAP programmes).
    以多种支持方案的合并来避免“支持方案丛林”（例如多种工业提升能效方案以及Kfw/MAP项目）
  - One-stop shop: Easy internet portal for support scheme access (in preparation)
    一站式服务：简易的互联网端口来支持方案的接入（筹备中）
  - Renovation networks and regional energy agencies as support locations
    更新网络和区域能源机构作为支持单位
- Trend towards tendering/auctions 趋向于利用招标/拍卖
  - Electrical efficiency tender STEP up! will be extended to heat market
    开展提高电能效益的招标工作，将会扩展至供暖市场
  - Tendering innovative cogeneration
    为创新型热电联产招标
- Support schemes for innovative transformation approaches, e. g. district heat 4th generation
  对创新转型方法提供支持方案，例如第4代区域集中供暖
  - Programme with up to 50 % support rate for district heat with low temperatures and high shares of RES and waste heat 对低温采暖和高度利用可再生能源及废热的区域给予高达50%支持比例的项目

Discussion II:
New building code und European EPBD
讨论二：新建筑条例与欧洲建筑能效指令

- The European Energy Performance of Buildings Directive demands several things, such as definition of a nearly zero energy standard (NZEB), metering the performance of boilers, including measures for social housing, trigger points, cost-effective deep-renovation, consumption based energy tarriffs
  欧洲建筑能指令有几点要求，例如定义近零能耗建筑（NZEB）、测试锅炉性能，包括社会住房措施、触发点，高性价比的深度改造，基于梯度能源价格的消费。

- The new building code („Gebäudeenergiegesetz“ GEG) falls short of the expectations of many stakeholders 新建筑条例（GEG）并未达到众多利益相关方的期望
  - Definition of a nearly zero energy standard on the level of todays energy performance requirements (even though tightening would be cost optimal)
    近零能耗建筑标准的定义应基于现今能源绩效要求的水平（尽管紧缩政策是成本最优的选择）
  - No further provisions for existing buildings 没有为现有建筑作出进一步的规定
  - No switch from primary energy requirements to greenhouse gas requirements
    并未从一次能源需求向温室气体减排需求转换

Discussion III: Renovation roadmap
讨论三：更新路线图

- Audit tool for **onsite-energy audits** for private residential buildings, with a focus on stepwise renovations
  用于私人住宅的**现场能源审计**工具，聚焦于逐步改造
- Carried out by **certified energy auditors**
  审计由被**认证的能源审计师**执行
- **Funded by BAFA** (60 %, max. 800 Euro for one-family house)
  由德国联邦经济与出口管制局资助（60%，每户最多800欧元）
- **Products**: One roadmap document
  产品：一个路线图文件

Plus one detailed **implementation guide**
以及一个详细的实施方针

Discussion IV: Carbon tax
讨论四：碳排放税

CO_2 tax in 2024: + 86 €/t CO_2
到2024年，每吨二氧化碳增加86欧排放税

Natural gas + 1,7 Ct/kWh
天然气增加1.7欧分每千瓦时

Heating oil + 23 Ct/l
供热用燃油增加23欧分每升

Gasoline + 20 Ct/l
汽油增加20欧分每升

Diesel + 41 Ct/l
柴油增加41欧分每升

30 billion € 300 亿欧元

Return to households and companies
返还家庭用户和公司用户

Reducing electricity tax or EEG fee
减少电力税或可再生能源附加费

or

Bonus to households and companies
或者奖励家庭和公司用户

and

Finance programmes for heat and transport sector, with focus on social
用于供热和运输领域的资助项目，重点在于社会

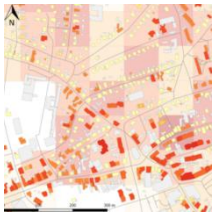
Discussion ongoing
讨论仍在继续

See protest in France

Source: Agora Energiewende 2018

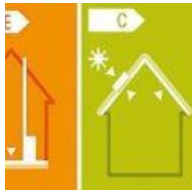
ifeu and the Heat Transition // www.ifeu.de
关于ifeu和供热转型 // 详见官网

Topics and Focii 话题和焦点



Heat Map 供热地图
Building Model 建筑模型
Energy Model 能源模型

Strategies 策略
Political Instruments
政策工具



Energy Consulting
能源咨询
Renovation Plan
更新计划

Heat Network
供热管网
Waste Heat 废热
CHP System
热电联产系统

Renewable Energies
可再生能源

Insulation
隔热层

Pilot Projects
试点项目

Local Climate Protection
当地气候保护

C.HANGE

Craftsmen 专业人员
Building Contractors
建筑承包商

Information 信息
Materials 资料
Media 媒体

Sufficiency
充足性

International
Cooperation
国际合作

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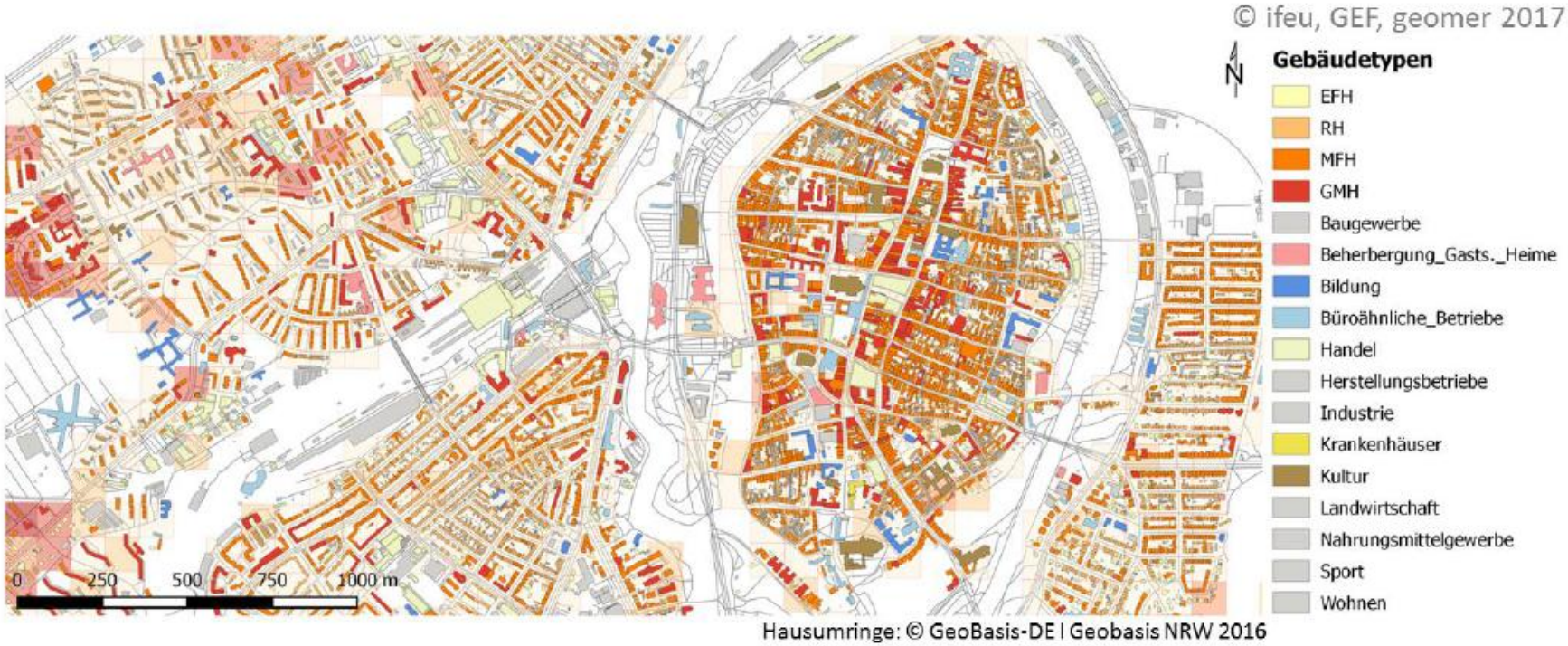
Appendix

附录

Potenziale der Wärmenetze
供热网络的潜力

Analyse mit Wärmeatlas 2.0 (ifeu, GEF, geomer)
根据供热图册2.0分析

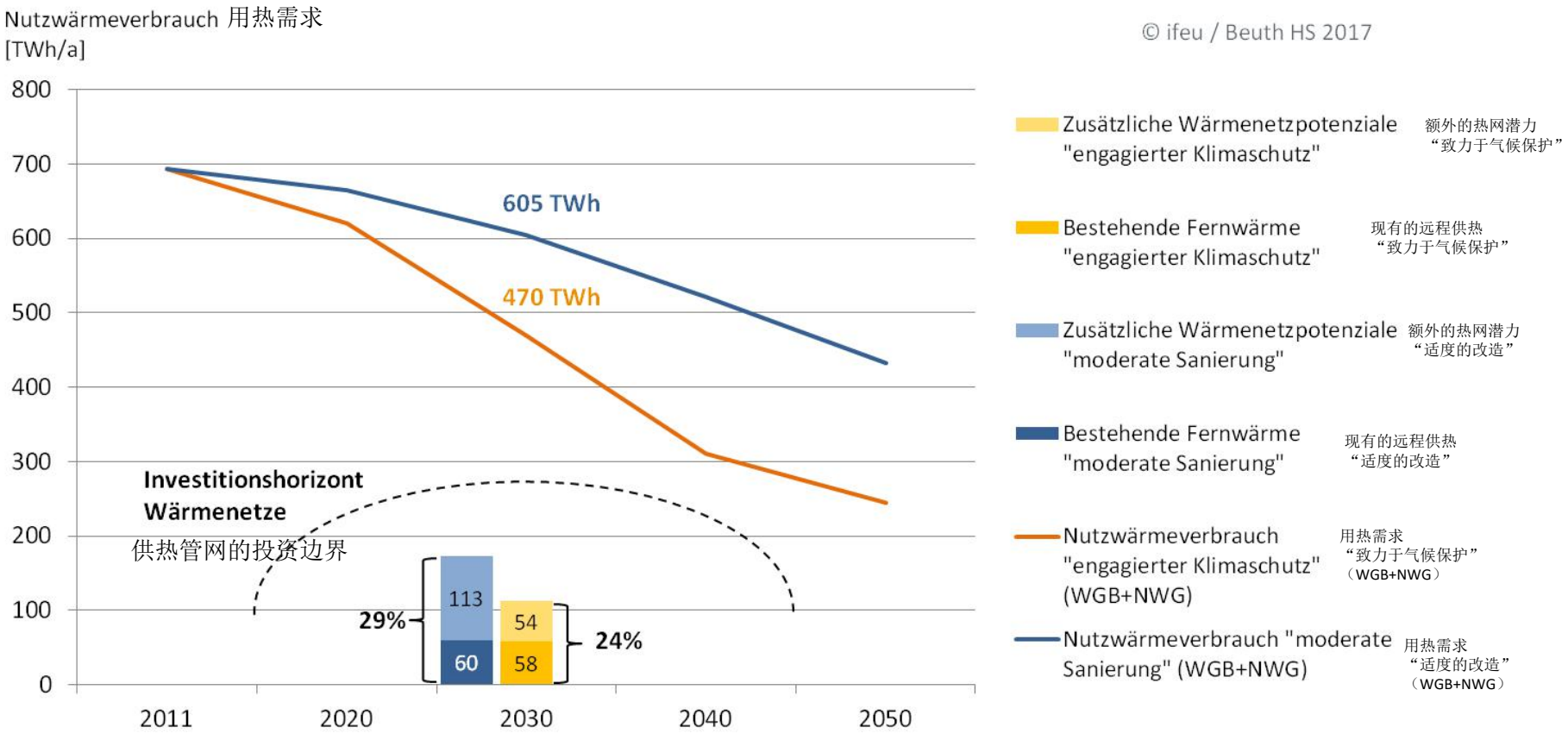


Potenzial von Wärmenetzen
供热网络的潜力

Bis zu 30 % der Nutzwärmebedarfs, wenn wir heute beginnen.

如果我们今天开始，可满足多达30%的热量需求。

GIS-Analyse des Wärmebedarfs und der Wirtschaftlichkeit mit ifeu-Wärmeatlas und GEMOD
热需求的GIS分析和基于ifeu热图谱和GEMOD的经济性



Renewable Heating Market
可再生能源供热市场