Technical Development and Transformation of Building Engineers under New Opportunities and New Situations

Thoughts on Zero-Carbon Goals and Building Industry

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新机遇新形势下建筑工程师技术发展与转型

对碳中和目标与建筑行业发展的思考

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About me

- **Vocational Training at Stadtwerke Bremen (municipal energy supplier)**
- **Studies and Diploma in Electrical Engineering**
- **Long term career in software development**
- **Private investor in renewable energy projects**
- **Hamburg-based, owner of an apartment in a “Jugendstil” house being part of a protected, landmarked heritage ensemble**

关于我

- 在**Bremen Stadtwerke**公司接受培训（市政能源供应商）
- 电气工程专业学习与学位
- 长期从事软件开发
- 可再生能源项目私人投资者
- 汉堡人，在一栋“青年风格”的房子里拥有一套公寓，这栋房子是受保护的历史建筑群的一部分

Energiebunker Wilhelmsburg

Converted from a WWII high-rise bunker into the “Energiebunker” during the International Building Exhibition (IBA) 2010–2013. Connected to Hamburg’s electricity and district heating networks since 2015.

- **Biomass combined heat and power plant (CHP)**
- **Solar thermal system on the roof**
- **Large hot water storage tank (3,3 million liters)**
- **Photovoltaic array on the south façade**
- **Supplies ~3,000 households with heat**
- **Supplies ~1,000 households with electricity**
- **Utilizes waste heat from a nearby industrial facility**

Symbol of reuse + innovation: Transformed from being a relict of World War II into becoming a landmark of energy transition feeding the needs of the local community by supplying heat and electricity.

威廉斯堡能源库

在**2010-2013**年国际建筑展（**IBA**）期间，这座二战时期的高层碉堡被改造成**“**能源碉堡**”**。自**2015**年起，该建筑已接入汉堡的电力系统和区域供热网络。

- 生物质热电联产厂（**CHP**）
- 屋顶太阳能热系统
- 大型热水储罐（**330**万升）
- 南立面光伏阵列
- 为约**3000**户家庭提供供暖
- 为约**1 000**户家庭提供电力
- 利用附近工业设施的余热

重复利用**+**创新的象征：从二战的遗迹转变为能源转型的里程碑，通过供热和供电满足当地社区的需求。

Grüner Bunker (Feldstraße) = Green Bunker

WWII flak tower (38 m, 3.5 m thick walls) → redeveloped 2019–2024

- **Raised by 20 m with green pyramid-style extension**
- **Walk-around stairs to climb up by foot with scenic views**
- **Rooftop garden: ~4,700 trees + 16,000 shrubs/perennials**
- **Environmental impact by improving micro climate:**
  - **reduces heat**
  - **retains rainwater**
  - **boosts biodiversity**
  - **natural insulation**

Transformed from being a relict of World War II into becoming a landmark and a tourist attraction

Actually applying two principles common in German cities like Hamburg:

- Reuse of existing stock instead of building new stock from scratch
- Utilizing limited ground space by incresing height or filling gaps

格林堡（菲尔德大街）=格林堡

二战防空塔（**38**米，**3.5**米厚墙）→**2019-2024**年重新开发

- 高**20m**，顶部为绿色金字塔形结构
- 步行环绕的楼梯，可徒步攀登，沿途风景如画
- 屋顶花园：约**4700**株树木**+16000**株灌木/多年生植物
- 通过改善微气候对环境的影响：
  - 降低热量
  - 蓄雨水
  - 促进生物多样性
  - 天然绝缘

从二战的遗迹变成了一个地标和旅游景点

实际上，应用了在汉堡等德国城市中常见的两个原则：
- 重复使用现有库存，而不是从头开始建立新库存
- 通过增加高度或填补间隙来利用有限的地面空间

HafenCity Sustainable Urban Planning

157 ha total development (Europe’s largest inner-city urban development project)

Iconic Elbphilharmonie concert hall landmark

- **Target: 70% less CO_2 vs. conventional districts**
- **~90% renewable-based district heating/cooling**
- **Zero-emission neighborhoods**
- **Smart grids, green mobility, flood protection**
- **Test area for autonomously driving shuttle bus**
- **Hosting the Greenpeace Headquarters**
  - **Icon for NGOs + architecture + climate advocacy**
  - **Energy-efficient façade shading + natural ventilation**

海港城可持续城市规划

157 ha总开发面积（欧洲最大的市中心开发项目）

标志性易北爱乐音乐厅
地标

- 目标：与传统地区相比，减少**70%**的二氧化碳
- **~90%**可再生的区域供热/制冷
- 零排放社区
- 智能电网、绿色交通、防洪
- **Tes t**区域用于自动驾驶接驳车
- 为绿色和平组织总部提供场地
  - 非政府组织+建筑+气候倡导的图标
  - 节能幕墙遮阳+自然通风

HafenCity New Work (formerly Unilever) Building

Large glass atrium filled with daylight, designed as a public passage (part of HafenCity's open design).

Recognition: Won the DGNB Gold certificate (German Sustainable Building Council) in 2009.

Seen as a pioneer of energy-efficient office architecture in Hamburg.

- **Geothermal heating and cooling via 1,500 m deep wells**
- **Night cooling (building "breathes" through operable façade elements)**
- **Efficient lighting with daylight optimization**
- **Natural ventilation**
- **Protection from wind and sun**

Natural ventilation through an atrium and a glass façade reinforced by a shell made of ETFE foil to protect the office areas from sun and wind exposure

海港城新工作大楼（原联合利华大厦）

充满日光的大型玻璃中庭，设计为公共通道（**HafenCity**开放设计的一部分）。

认证：**2009**年获得**DGNB Gold**证书（德国可持续建筑委员会）。

被视为汉堡节能办公建筑的先驱。

- 通过**1500**米深的井进行地热加热和冷却
- 夜间降温（建筑通过可操作的立面元素“呼吸”）
- 通过日光优化实现高效照明
- 自然通风
- 防风、防晒

通过中庭和玻璃幕墙实现自然通风，并采用**ETFE**箔制成的外壳，以保护办公区域免受阳光和风力的影响

German Energiewende (energy transition)

Origins

- Term coined in the 1980s
- Driven by anti-nuclear and climate movements
- Led to foundation of the new Green Party in 1980
- Moving away from fossil fuels and atomic energy to renewable energies
- Focused on electricity, heat and transportation

Achievements

Renewables often supply 50% or more of electricity on average days —

on some sunny/windy days, even close to 100% for hours.

This created huge technical challenges:

- balancing the grid
- managing frequency
- cross-border trading

Leadership in wind and solar integration

Germany invested early in

- guaranteed feed-in tariffs (Erneuerbare Energien Gesetz)
- grid modernization
- flexible power plants

德国能源转型（**energy transition**）

起源

- 术语，于**20**世纪**80**年代创建
- 受反核运动和气候运动的推动
- 导致了**1980**年新绿党的成立
- 从化石燃料和原子能转向可再生能源
- 聚焦电力、热力和交通

已取得的成就

可再生能源通常在平均日子里提供**50%**或更多的电力，在一些晴天/风天，甚至在数小时内接近**100%**。

这就带来了巨大的技术挑战：

- 电网平衡
- 管理频率
- 跨境贸易

在风能和太阳能集成方面处于领先地位

德国早期投资于

- 保证上网电价（可再生能源法）
- 电网现代化
- 柔性发电厂

Focusing on Building Emissions in Germany

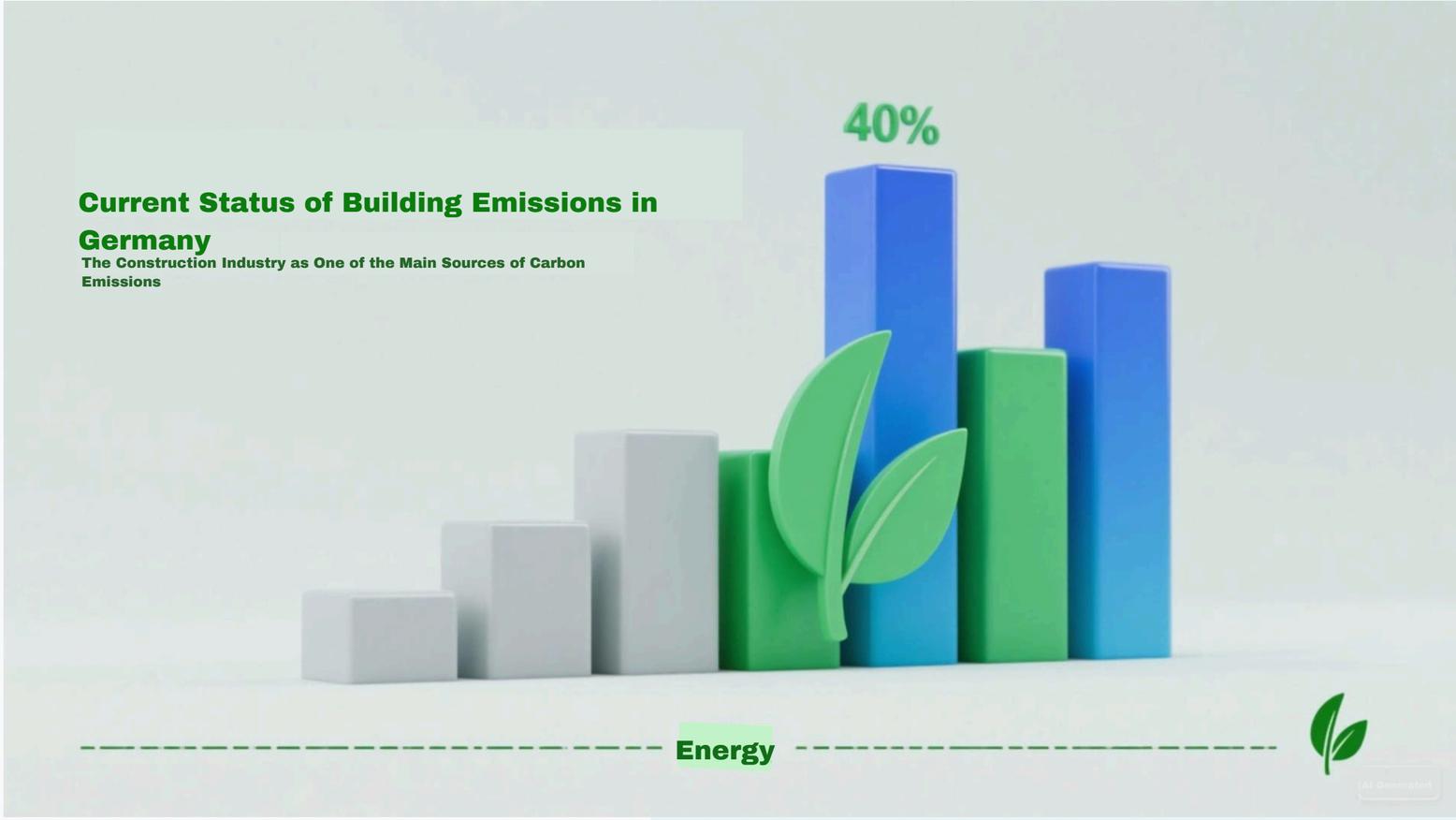
Germany wants to achieve climate neutrality by 2045.

The construction industry is contributing approximately 40% of Germany's carbon dioxide emissions and is the sector with the highest carbon dioxide emissions

The current renovation rate of existing buildings is only about 1%

The 2045 target requires increasing the renovation rate to 2%

Renovation demand creates a trillion-euro market opportunity



To achieve the climate neutrality goal by 2045, renovating buildings must be a priority. The German Energy Agency offers a wide range of solutions:

- energy efficiency and energy-saving renovations
- targeted use of renewable energy and digital technologies
- resource-efficient and sustainable buildings.

聚焦德国建筑排放

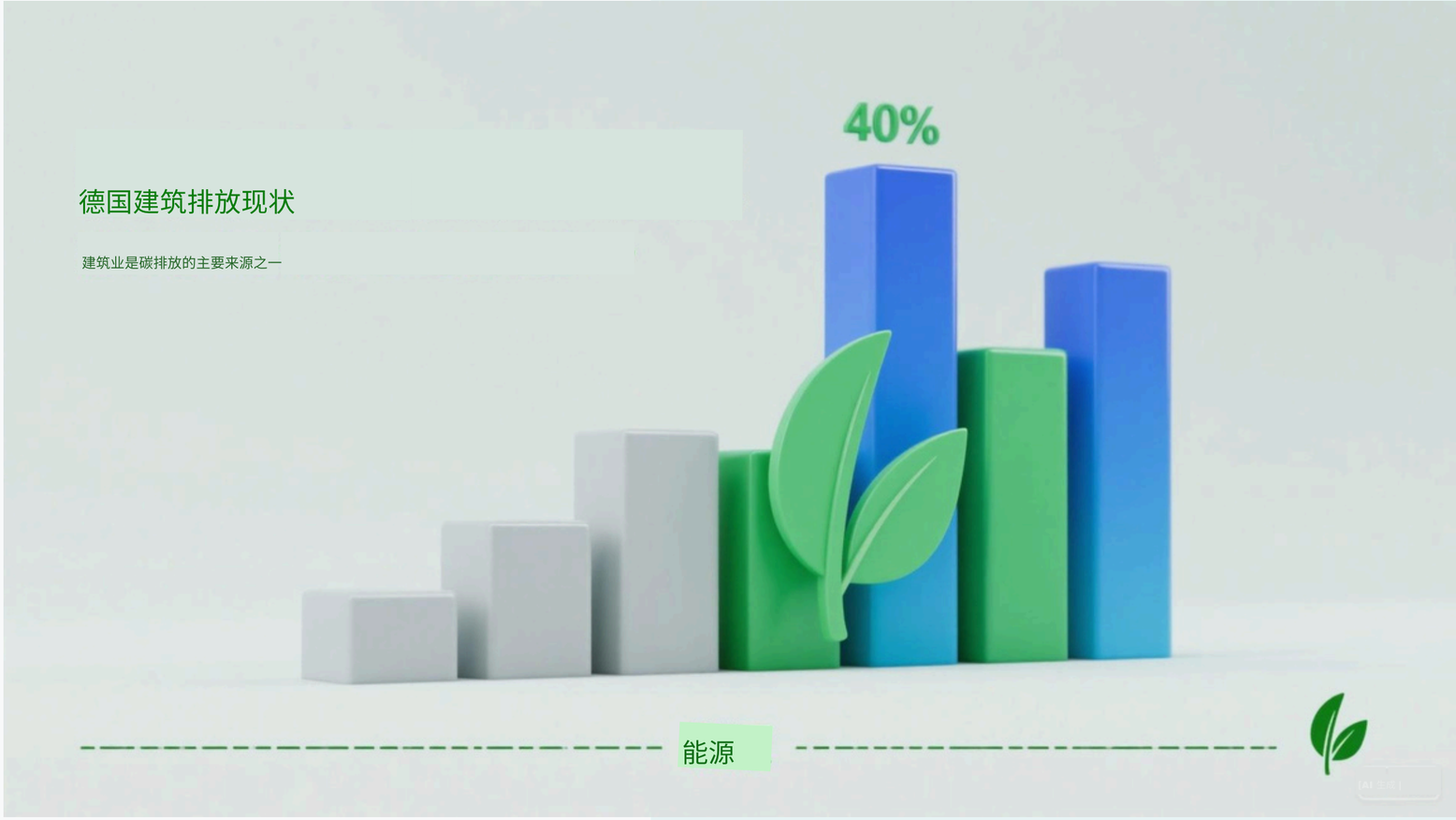
德国希望在**2045**年前实现气候中和。

建筑行业约占德国二氧化碳排放量的**40%**，是二氧化碳排放量最高的行业

现有建筑的改造率目前只有**1%**左右

2045年目标要求将翻新率提高到**2%**

翻新需求创造了一个万亿欧元的市场机会



要实现2045年气候中和目标，建筑改造必须成为优先事项。德国能源署提供了多种解决方案：

- 能源效率和节能改造
- 可再生能源和数字技术的定向使用
- 资源高效和可持续的建筑。

Energiesprong serial renovation

Energiesprong (energy jump) is originally a Dutch initiative focusing on prefab retrofits with ultra-fast modernization (~1 week per building). It was adopted in Germany (via DENA, the German energy agency)

Core principles

Industrialized prefabrication, standardized processes, integrated solutions

Key innovations

Digital construction, prefabricated components, photovoltaic roofs, modular energy

Implementation advantages

Cycle shortened to a few weeks, cost reduced by 30%, immediate compliance upon completion

China's Advantages

Large-scale prefabricated building capacity and cost control capabilities can be deeply integrated

Germany*s capacities regarding workforce in the building sector are too limited to fulfill the ambitious goals, hence there will be opportunities for market entries from outside players

在**Energiesprong**系列翻新中

Energiesprong ia最初是荷兰的一项倡议，专注于预制构件改造，实现超快速现代化（每栋建筑约**1**周）。该倡议随后被德国采纳（通过德国能源署**DENA**实施）。

核心原则

工业化预制、标准化流程、集成化解决方案

关键创新

数字化施工，预制构件，光伏屋顶，模块化能源

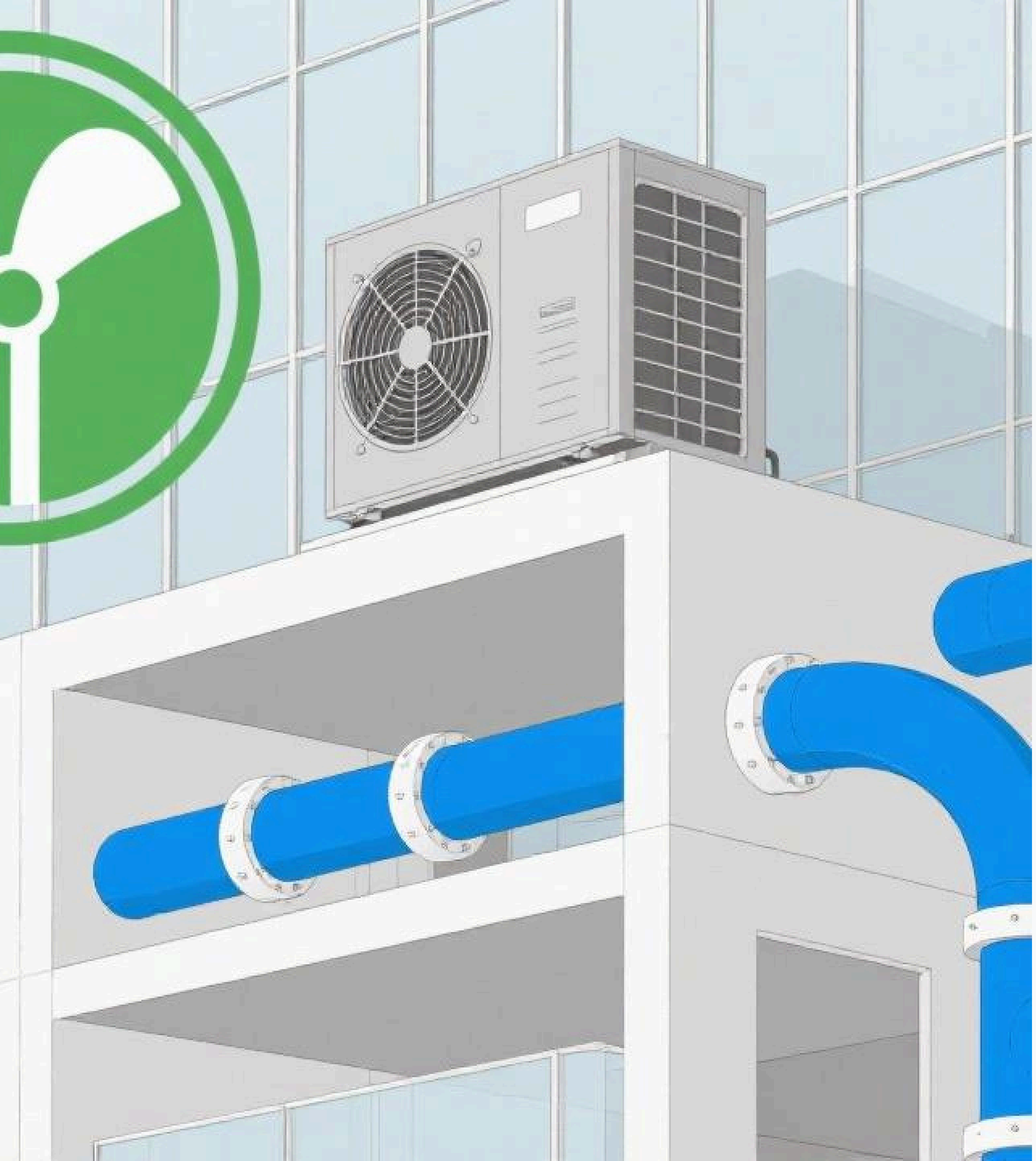
实施优势

周期缩短至几周，成本降低**30%**，完成时立即符合要求

中国的优势

可将大规模预制建筑产能和成本控制能力进行深度整合

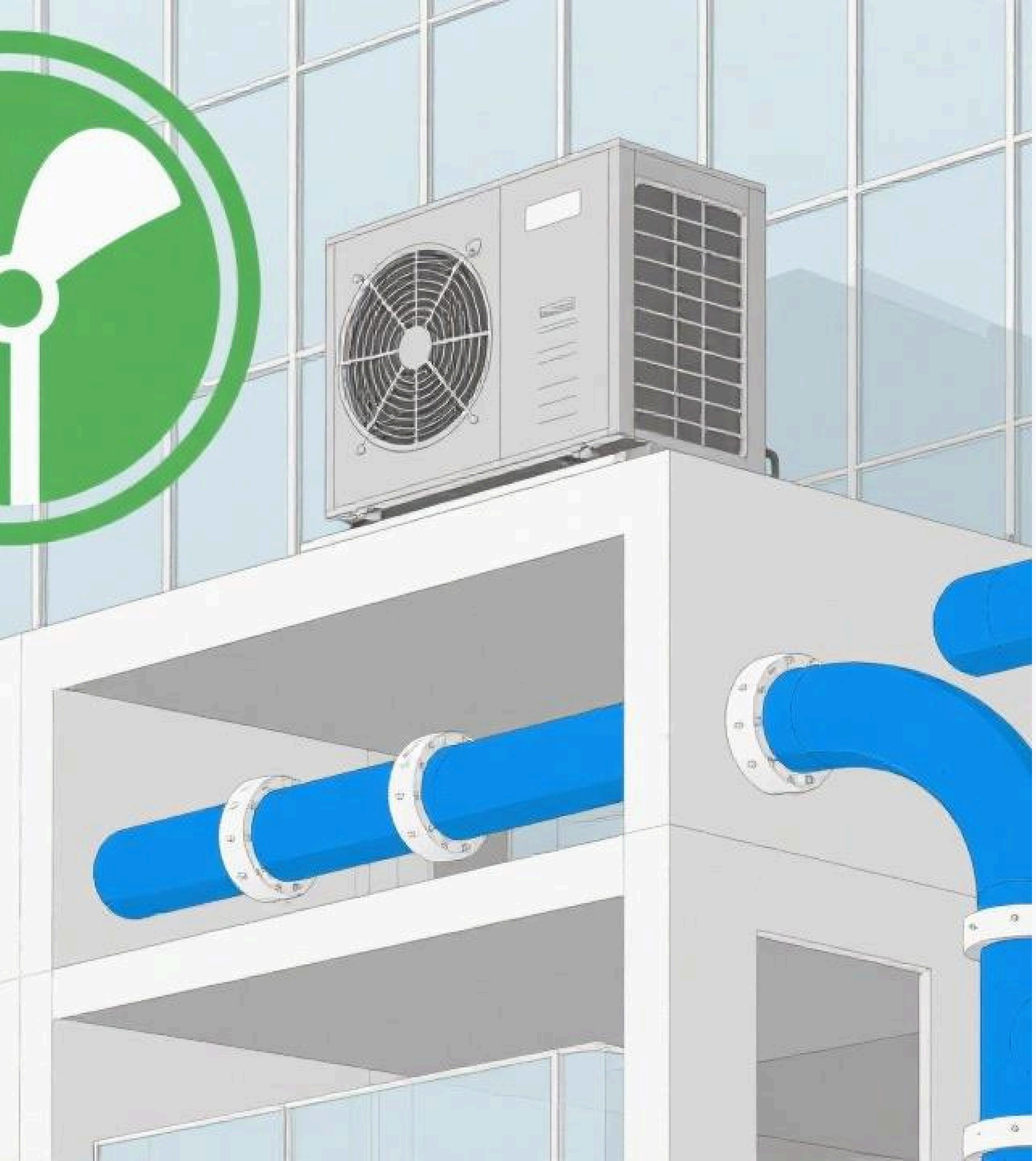
德国在建筑部门劳动力方面的能力过于有限，无法实现雄心勃勃的目标，因此将有外部参与者进入市场的机会



Heat transformation: revolutionizing heating systems

In order to achieve climate neutrality by 2045, heat conversion for individual buildings, regions, and municipalities must be achieved

- **The Building Energy Act (GEG) from January 1, 2024 requires that all new heating systems in newly developed areas use renewable energy by at least 65%**
- **In single-family and two-family houses, heat pumps play a key role in replacing fossil fuel heating systems**
- **Works for new buildings, but low supply temperature causes problems for older buildings with old radiators, lack of insulation and wooden floors preventing underfloor heating.**
- **Opportunities: utilize hybrid systems, high-temp heat pumps or district heating**
- **Chinese engineers can participate in equipment selection, system integration and optimization stages**



热转换：彻底改变供暖系统

为实现**2045**年气候中和目标，必须实现单个建筑、地区和市政的热转换

- 《建筑能源法案》（**GEG**）自**2024**年**1**月**1**日起生效，要求所有新建区域的新供暖系统至少使用**65%**的可再生能源。
- 在单户住宅和双户住宅中，热泵在替代化石燃料供暖系统方面发挥着关键作用
- 新建筑的工作，但供应温度低，对有旧暖气片、缺乏绝缘和木地板的旧建筑造成问题。
- 机遇：利用混合系统、高温热泵或区域供热
- 中国工程师可参与设备选型、系统集成和优化阶段

Resources

The German Energy Agency (https://www.dena.de/en/) offers a wide range of solutions: from energy efficiency and energy-saving renovations to targeted use of renewable energy and digital technologies, to resource-efficient and sustainable buildings.

The KfW (https://www.kfw.de/kfw.de-2.html) can help with research and financial funding: KfW is one of the world's leading promotional banks. KfW has been committed to improving economic, social and environmental living conditions across the globe on behalf of the Federal Republic of Germany and the federal states since 1948. To do this, it provided funds totaling EUR 112.8 billion in 2024 alone.

资源

德国能源署（**https://www.dena.de/en/**）提供了一系列广泛的解决方案：从能源效率和节能改造到有针对性地使用可再生能源和数字技术，再到资源高效和可持续的建筑。

德国复兴信贷银行（**KfW**，官网：**https://www.kfw.de/kfw.de-2.html**）在科研与资金支持方面提供专业服务：作为全球领先的开发性银行，该机构自**1948**年起便代表德意志联邦共和国及其各联邦州，持续致力于改善全球范围内的经济、社会及环境发展水平。仅在**2024**年，该行就累计发放了总额达**1128**亿欧元的专项资金。

German–Chinese Exchange

Germany’s strengths

- Solid foundation of technology (R&D, standards, engineering)
- Long-term persistence (“Energiewende” as project)
- Architectural integration (passive house, retrofitting old buildings)

China’s strengths

- Scale and speed: world’s largest renewable builder
- Innovation in manufacturing, rapid cost reduction
- Urban laboratories: eco-cities, new districts

Joint Opportunities

- Addressing the building sector will be key
- Becoming climate neutral until 2045 was added to the federal constitution
- Strategy: Focus on paint points and their solutions
- Create Zero- and negative-emission buildings at scale (new or retrofitted old stock)
- Apply hybrid heating / cooling solutions for old + new stock
- Introduce digital building technology (AI + IoT for smart energy)

德中交流

德国的优势

- 技术基础扎实（研发、标准、工程）
- 长期持续性（“能源转型”作为项目）
- 建筑一体化（被动式房屋，改造旧建筑）

中国的优势

- 规模和速度：世界上最大的可再生能源建筑商
- 制造创新，快速降低成本
- 城市实验室：生态城市、新区

联合机会

- 解决建筑部门将是关键
- 到**2045**年实现气候中和被加入联邦宪法
- 策略：关注彩点及其解决方案
- 大规模建造零排放和负排放建筑（新建或改造旧建筑）
- 对新旧库存产品采用混合式冷暖方案
- 引入数字化建筑技术（**AI+**物联网实现智能能源）

Pioneer with long-term stability (DE) + Innovator with execution speed (CN)

Germany & China - complementary strengths

An invitation to co-create the future

具有长期稳定性的先驱者（**DE**）+ 执行速度的创新者（**CN**）

德国与中国：互补优势

邀请您共同创造未来