

Consumption-based Heat Metering in Germany

Regulatory framework and implementation

德国基于耗热量的热计量模式

法律框架及具体做法

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内容

Agenda

- i 供热转型目标和现状 Targets and status quo**
- ii 以耗热量为基础的计量模式 Consumption-based heat metering**
- iii 智能热计量 Smart Heat Metering**



The Sino-German Energy Partnership at a glance

中德能源与能效合作伙伴关系概览

Background 背景

„Energy Efficiency First!“

and Renewable Energies...

...are key to the energy transitions in Germany and China.

中德两国能源转型的关键在于“能效优先”和发展可再生能源。



As the German government's central instrument for foreign energy policy...



...the energy partnership serves as a dialogue platform connecting politics and business, and...

...facilitate exchange on both countries' energy transitions.

作为德国政府对外能源政策的核心工具，能源伙伴关系是连接政府和企业界的对话平台，致力于促进两国能源转型方面的交流。



Partners 合作伙伴

Political Partners:

政府合作伙伴:



Implemented by:

实施机构:



in corporation with (excerpt):

合作伙伴 (部分):



Working Groups 工作组

Working Group “Energy” 中德能源工作组

- Electricity and spot market reform
- System integration of renewables
- Sustainable heating and cooling
- Green hydrogen
- Decentralized energy generation
- Biomethane

- 电力和现货市场改革
- 可再生能源系统整合
- 可持续供热和供冷
- 绿氢
- 分布式能源
- 生物天然气

Working Group “Energy Efficiency” 中德能效工作组

- Energy efficiency in industry and buildings
- Energy efficiency in cities
- Energy efficiency networks
- Innovative business and financing models
- 工业和建筑节能和能效提升
- 城镇节能
- 能效网络小组
- 创新商业和融资模式

中德能源合作支持中国可持续供热发展

GIZ and the Energy Partnership support sustainable heating in China

- Policy and regulation, standards

政策建议、标准合作



Group Standard: Heat pump trigeneration heating, electricity, hot water
团体标准：热泵三联供，供热、供电、供热水

- Platform for exchange for policymakers, companies and experts

为政府决策者、企业和专家搭建交流平台



Heating forum, experts workshops and round tables
供热论坛、专家研讨会和企业圆桌讨论

- Publications

研究报告、出版物



Joint analysis on low-carbon (district) heating and policy recommendations by CHIC, GIZ and dena (forthcoming)
GIZ与清洁供热产业委员会、德国能源署联合编写研究报告：集中供热低碳发展及政策建议

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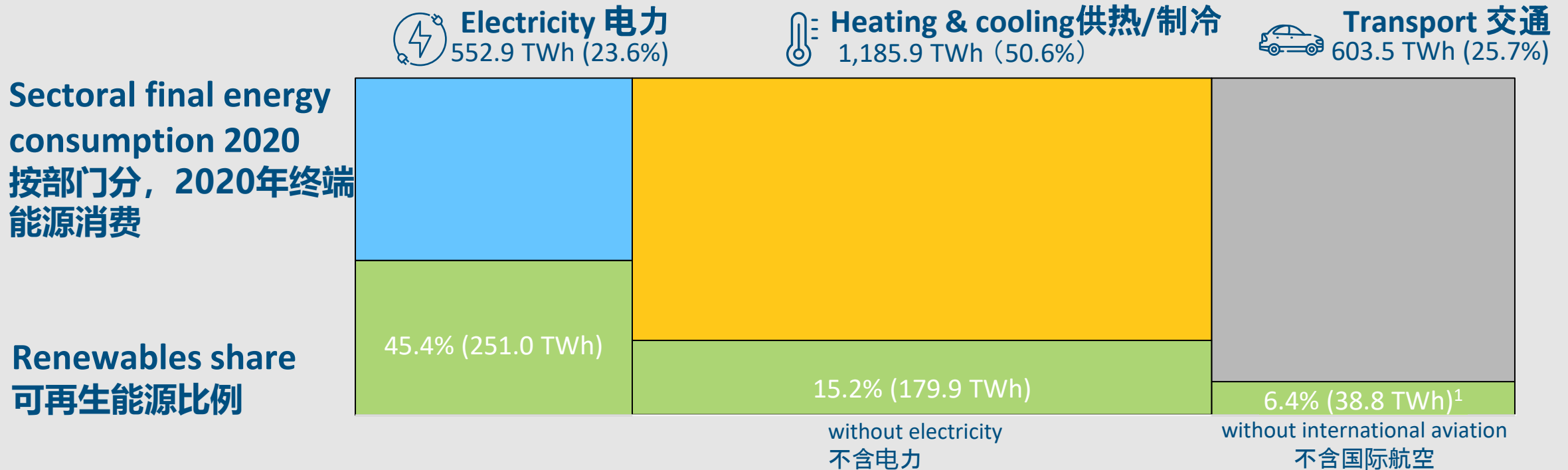
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2020年德国终端能源消费 2342.3 TWh

Final energy consumption in Germany in 2020: 2342.3 TWh

The use of renewable energies in the heating & cooling and transport sectors needs to be increased 供热/制冷和交通部门的可再生能源利用有待提高



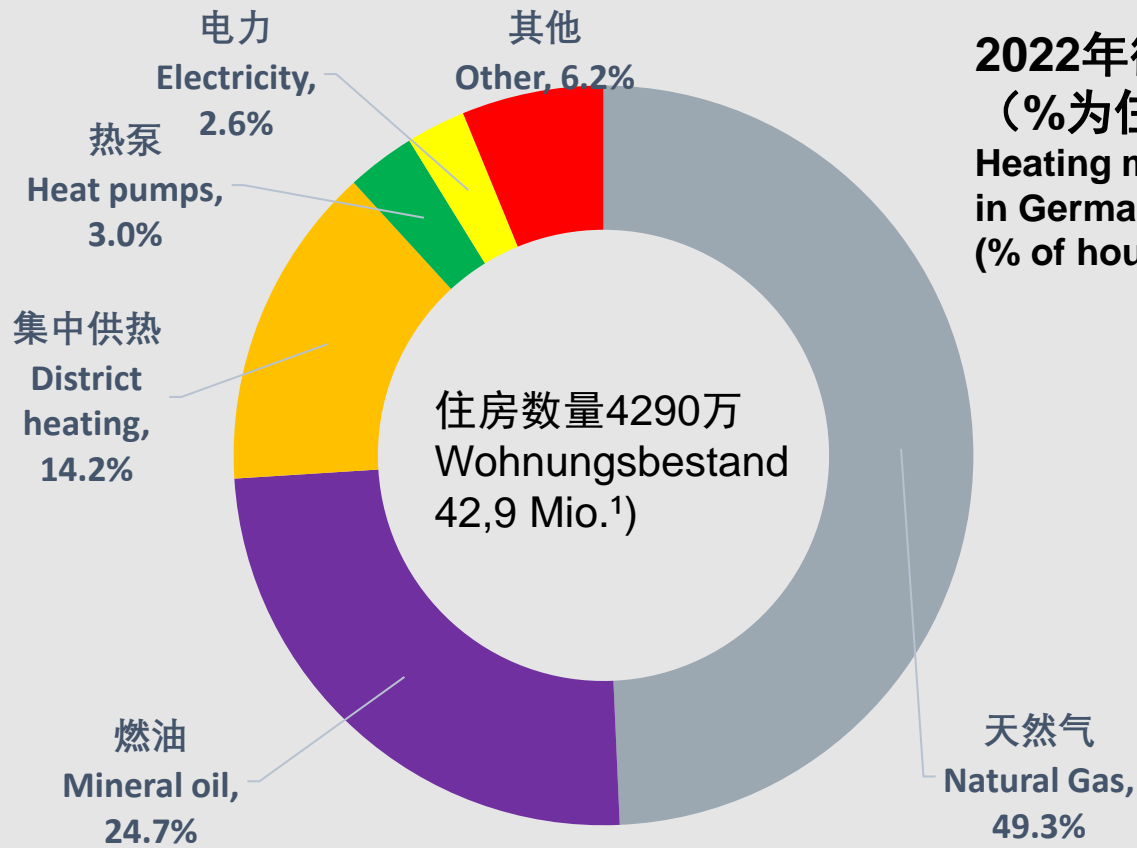
¹ Figure does not include renewable electricity in the transport sector. The 6.4% share is made up of biodiesel (4.9%), bioethanol (1.3%), and biomethane (0.2%). Including renewable electricity would increase the overall share to 7.3%; this value would be in line with international standards and reporting obligations, and is normally published by AGEE-Stat.

¹ 不包括交通部门的可再生电力。6.4%的份额是由生物柴油（4.9%）、生物乙醇（1.3%）和生物甲烷（0.2%）组成的。如包括可再生电力将使总体份额增加到7.3%，该数值符合国际标准和报告义务，通常由德国可再生能源平衡工作组（AGEE-Stat）公布。

居民供暖能源结构

Energy mix of household heat supply

有别于电力系统低碳化发展，供热领域仍是化石能源主导
While decarbonisation of power is advanced, fossil fuels dominate heating in Germany



2022年德国居民供热结构
(%为住户数量占比)
Heating mix of residential units
in Germany 2022
(% of housing units)

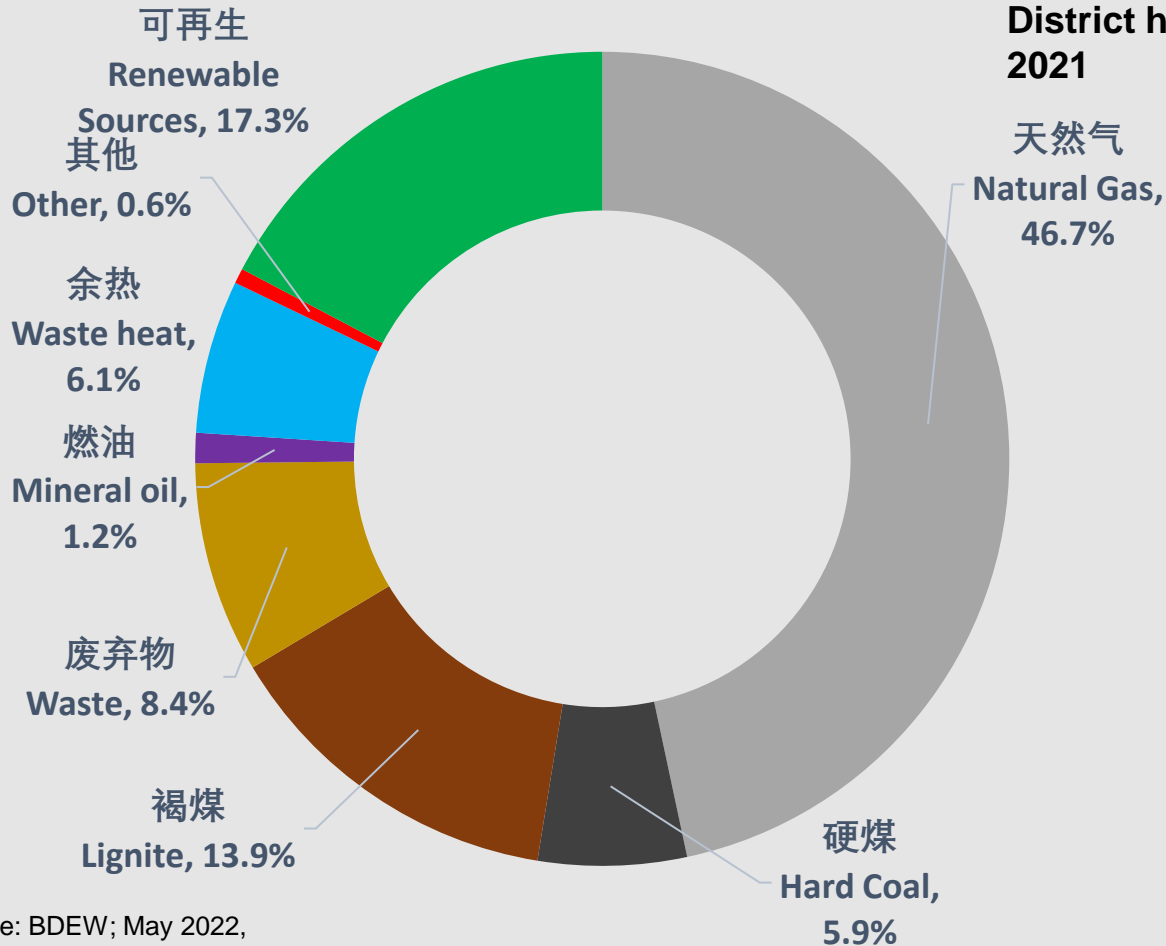
约有75%的住房是靠燃油和天然气供暖
~75% of units heated by gas or oil

2022年：50.2%的新建建筑使用了热泵！

2022: 50.2% of newly built buildings use heat pumps!

德国的集中供热 District heating in Germany

化石能源主导集中供热
Fossil fuels also dominate in district heating



2021年集中供热的能源结构
District heating mix in Germany
2021

约有66%是天然气和煤炭供热

~66% from gas or coal

退煤、摆脱燃气和其他雄心目标会改变现状的结构图

Coal phase-out, move away from gas and ambitious targets will change the picture

供热领域去碳化 – 现状和目标

Decarbonisation of heating – status quo and targets

德国政府制定了极具雄心的气候行动和供热转型目标

The German government has set ambitious targets for climate action and the heating transition

新一届联邦政府的目标和措施：

- **气候目标:** 到2030年温室气体在1990年的基础上减排65%，2045年气候中和；
- **供热目标:** 到2030年，实现50%可再生能源供热
- 2024年1月1日起，新安装的供暖系统必须至少由65%的可再生能源驱动
- 集中供热系统的扩建与低碳发展；扩大热泵使用规模（在2020年约140万台的基础上，2030年扩大到600万台）

Ziele und Maßnahmen der neuen Bundesregierung:

- **Climate targets:** -65% of 1990 emissions by 2030, climate neutrality 2045
- **Heating target:** 50% of heating demand from RE by 2030
- From January 1, 2024, every newly installed heating system must be powered by 65% renewable energy
- Expansion and decarbonization of district heating system, scale up of heat pumps (6 million installed heat pumps intended by 2030 – status 2020: circa 1.4 million)

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以耗热量为基础的计量模式 Consumption-based heat metering

基于热量的收费助推能效和供需互动，通过改变用热行为节能

Billing based on consumption promotes efficiency and provides feedback about behaviour

德国不同供热系统的计量：

Various Heat Metering Methods in GER:

| 热源 Energy supply | 供热系统 Heating System | 计量方式 Metering Method |
|---------------------------------------|---|--|
| 天然气 Gas Heating | 独户建筑或住宅的锅炉 Boiler in a single house or dwelling | 燃气表 Gas meter |
| | 多户住宅的集中锅炉 Central Boiler in multi-family house | 总燃气表 Central gas meter 住宅中每个暖器/回路的热表 Heat meter per radiator/circuit in the dwellings |
| 燃料或生物质颗粒 Fuel or biomass (pellets) | 独户住宅的锅炉 Boiler in a single family house | 个人采购燃料 Individual purchase |
| | 多户住宅的集中锅炉 Central Boiler in multi-family house | 集中采购 Central purchase 住宅中每个暖器/回路的热表 Heat meter per radiator/circuit in the dwellings |
| 集中供热 District heating | 热交换器 Heat Exchanger | 总热表 Central metering 住宅中每个暖器/回路的热表 Heat meter per radiator/ circuit in the dwellings |
| 热泵 Heat Pump | 独户或多户住宅的中央单元 Central unit for single house or multi-family house | 单独电表 Dedicated electricity meter 住宅中每个暖器/回路的热表 Heat meter per radiator/ circuit in the dwellings |

Regulatory framework: The Heating Costs Ordinance (HeizkostenV)

法律框架：《采暖费条例》（HeizkostenV）

德国通过立法及颁布相关规定实现以热耗为基础的计量模式，其中最重要的条例是《采暖费条例》（1981年颁布、2009年修订、2021年2023年调整），它规定了供暖和热水的收费标准。

Germany implements the consumption-based heat metering through legislation and relevant regulations. The most important one is *the Heating Costs Ordinance* (enacted in 1981, revised in 2009, 2021 and 2023) and it regulates the billing of heating and water cost:

适用范围：

- 区域供热的建筑
- 通过集中供热的多住户建筑

Who must comply?

- Buildings supplied by district heating
- Buildings with central heating systems supplying several units

计费方法：

按楼计量、按户分配热量

- 将总供热费用根据每个楼的总热表的读数，分摊到各个楼
- 根据各用户热分配表读数把整楼的供热费用分摊到各户

Billing methods:

Metering by building, heat allocation by household

- Total heating cost apportioned to each building based on the reading of the total heat meter for each building
- Heating cost of the whole building to each household according to the reading of the heat distribution meter of each customer

按户分摊的采暖费由两部分构成：

1. 运行价格：住户实际消耗的热量费，即热分配表的读数，这部分费用是浮动的，取决于住户的消费行为，该部分至少应占到采暖费的50%。如果房东未遵守该要求，租户可以扣除暖费的15%。
2. 基本价格：基于供热公司在供热合同中约定的为用户提供的最大供热容量，取决于住宅面积

The heating charge assessed on a household basis consists of two components:

1. **Consumption-based price:** cost of heat actually consumed by the household, i.e., the reading of the heat distribution meter, which is variable and depends on individual consumer behavior and which should account for min. 50% of the heating bill. If the landlord does not adhere to this requirement, tenants can deduct 15% of the cost.
2. **Basic price:** based on max. heating capacity agreed by the heating company in the heating contract for the customer, depending on square meters or number of occupants

Regulatory framework: The Heating Costs Ordinance (HeizkostenV)

法律框架：《采暖费条例》（HeizkostenV）

热费账单上的信息有什么？

- 2022年1月1日起，用户每月热耗量，以kWh为单位
- 当月与之前的耗热量对比
- 同类型用户平均耗热量的对标信息

What is measured?

- Consumption of user in kWh in certain time interval (monthly since 1.1.2022)
- Comparison with last time interval
- Comparison with benchmarked average for same user type

如何测量？

- 建筑业主方/出租方负责记录并有提供给租户信息的义务，可委托计量服务公司
- 官方许可的**热表**

How is it measured?

- Recorded by building owner
- Officially approved meters

热表在投入使用前会进行标准校准，校准期一般为6年。6年后热表必须更换或重新校准。

Heat meters are calibrated to a standard before they are put into service, and the calibration period is generally 6 years. After 6 years the heat meter must be replaced or recalibrated.



图片来源：代傲表计

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Smart Heat Metering: Definition & goals

智能热计量: 定义和目标

智能热计量是指使用先进技术如远程通信、实时数据传输和智能数据分析来测量和收集耗热数据。

Smart heat metering refers to the measurement and collection of data on heat consumption using advanced technologies such as remote communication, real-time data transfer, and intelligent data analysis.

- 从2027年开始，热计量设施应具备远程读数功能，并符合数据安全法规要求。
From 2027, every heat measuring device will have to be suitable for remote reading in adherence with data security laws.
- 从2032年，已安装的热计量设施也必须兼容智能表计网关。
From 2032, compatibility with smart-meter-gateways will be mandatory for every installed heat meter devices as well.
- 在德国，智能电表设备的强制推广将持续到2032年。它们由现代化的电力计量设备与智能电表网关组成。
In Germany, there is a mandatory rollout of smart metering devices until 2032 for electricity. These consist of a modern electricity measuring device in combination with a smart-meter-gateway.
- 智能电表网关是通信单元，是德国能源转型数字化的关键技术。
Smart-meter-gateways are the communication unit and function as key technology for the digitization of the German energy transition.

Smart Heat Metering: Benefits & relevance for sector coupling

智能热计量: 益处 & 对实现部门耦合的意义

智能热量计的益处:

- 远程监测和管理
- 提高能源计量的准确性
- **通过能源管理的灵活性的提升, 更好地整合可再生能源**
- 提高透明度和对用能的控制, 提高用户体验
- 更好的监测能力以提高能效
- 大数据作为能源管理的基础, 可提高能效, 减少能源浪费, 从而降低碳排放

Benefits of Smart Heat Metering:

- Remote monitoring and management
- Increased accuracy in energy measurement
- **Improved integration of renewable energies due to enhanced flexibility in energy management**
- Improved customer experience due to greater transparency and control over energy usage
- Greater monitoring capacities lead to improved energy efficiency
- Better energy management reduces energy waste and therefore reduces carbon emissions

- 部门耦合是以可再生能源为核心, 整合电力生产和供热、交通和工业等用能部门;
- 供热占德国总能耗的50%以上, 目前热源仍以化石燃料为主, 供热领域电气化是摆脱化石能源的重要路径;
- 为了应对供需两侧特别是可再生能源的波动性, 能源市场需要可调节灵活性容量
→ 智能热计量的大数据处理能力和远程控制功能有助于提高集中和区域供热领域的灵活性, 实现供热和电力领域耦合

- **Sector coupling** aims to integrate electricity, heat, mobility and industrial processes with electricity from renewables as central pillar
- **Heating > 50% of total energy consumption**, still dominated by fossil fuels
- In order to integrate fluctuate renewables, the whole energy system needs more flexible capacity
→ **smart heat metering** helps increasing flexibility of heating sector and enabling interconnection of power and heating sector

谢谢大家!



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