

瑞士如何在建筑领域 实现其2050+的零碳目标

中瑞零碳建筑系列研讨会
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How Switzerland meets its Zero-Emission targets
for 2050+ in the building sector

瑞士零碳建筑标准发展历史和未来

Swiss ZEB Standards
History & Future

Overview 概览

- Introductory remark
开场白
- Genesis of technical regulation on building performance
建筑性能技术法规的起源
- Where does the Swiss building sector stand today
瑞士建筑业现况
- Plans and strategies for bringing the building sector to net-zero emissions
瑞士使建筑业达到净零排放的计划和战略
- Key learnings that might be fruitful also for China
对中国可能有用的重要瑞士经验



Source: Schweizer Luftwaffe, 1989

当前挑战： TODAY'S CHALLENGE:

Greenhouse gas emissions of buildings originate from all three phases of building life-cycle: Design/Construction, Operation and Decommissioning

建筑温室气体排放源自建筑整个生命周期的三个阶段：
设计/建造，运营和废弃

Reaching net-zero GHG emissions requires progress in all phases

实现温室气体净零排放需要在所有阶段的取得进展

Reducing operation phase emissions is the fastest track

减少运营阶段的排放是最快的路径

快速有效地实施零碳建筑

EFFECTIVELY IMPLEMENTING ZEB ON A FAST TRACK



Source: www.maxpixel.net

50+ YEARS OF EXPERIENCE WITH TER ON THE WAY TO ZEB 瑞士50多年来在零碳建筑路上的法规经验

1960-1972: Ensuring a comfortable indoor climate and preventing structural damage

确保舒适的室内微气候并预防结构受损

1973-1989: Piloting and anchoring technical regulation (TER) on thermal performance of buildings

尝试和制定建筑热性能方面的技术法规

1990-1993: Harmonizing of TER and scaling up market for efficient buildings

统一技术法规并扩大高效建筑市场

瑞士零排放建筑的起步

GENESIS
TOWARDS ZEB



Source: [South-east view of NEST with its new unit UMAR](#) | ©Zooey Brau... | Flickr

50+ YEARS OF EXPERIENCE WITH TER ON
THE WAY TO ZEB

瑞士50多年在零碳建筑路上的法规经验

1994-2014: Tightening TER and shift to
Renewable Energies

加强技术法规并转向可再生能源

2015-today: Net-zero emission readiness
of Regulation and Policies

2015-今天: 净零排放的法规和政策准备就绪

瑞士零排放建筑的起步

GENESIS TOWARDS ZEB

零碳建筑成功实施的三大柱

THREE PILLARS FOR SUCCESSFUL IMPLEMENTATION



标准规范，立法和执法

Norms, legislation and enforcement

教育培训和能力建设

Information, education and capacity building

激励政策，领导力和积极鼓励

Incentives, leadership and motivation

将零碳法规整合在有效的政策环境里

REGULATION
TO BE EMBEDDED
IN A EFFECTIVE
POLICY ENVIRONMENT

National support program and coordination body
国家支持计划和协调机构

Voluntary measures

(lighthouse projects, information, outreach, training, private market frontrunners, ...)

自愿性措施

(示范项目, 资讯, 学习, 培训, 私人市场领跑者)

Legal based instruments

法律工具

Financial measures

(Subsidies, CO₂ tax, ...)

财政措施

(补贴, 碳排放税等)

Technical regulations and norms

技术法规和标准

Innovation and technology development support

对创新和技术发展的支持

建立措施生态体系 – 而不仅仅是法规

ECOSYSTEM OF MEASURES – NOT ONLY REGULATION

法规措施（标准规范，技术规范等等）

Regulative Measures (Norms, TER,...)

财政措施（补贴，税收等等）

Financial Measures (Subsidies, Taxes, ...)

配套措施（资讯，培训，科研等等）

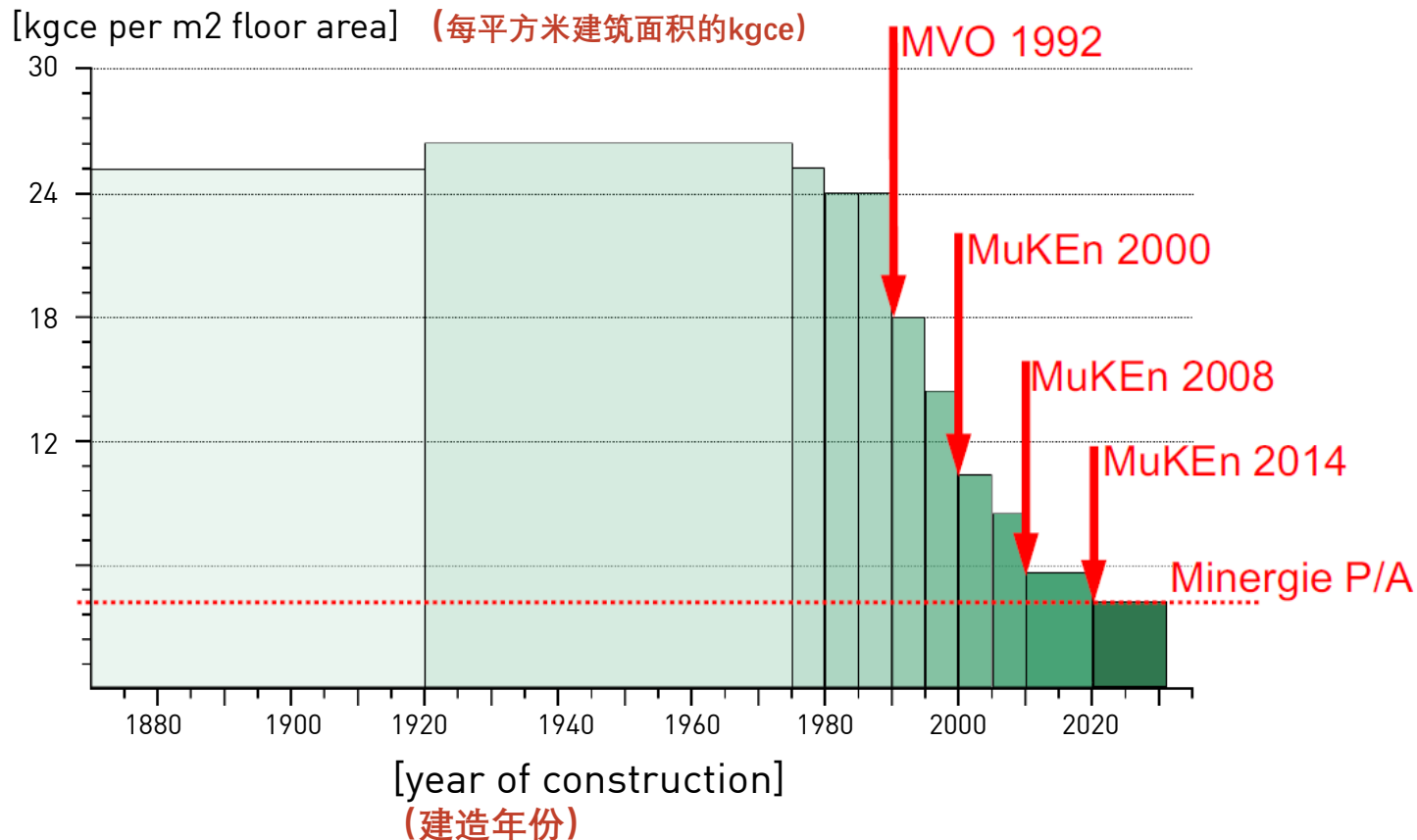
Accompanying Measures (Information, Training, Research...)

法规仅是有效政策方案的一个因素

REGULATION ONLY
ONE ELEMENT OF
EFFECTIVE POLICY DESIGN

Evolution of heating energy demand in new residential buildings (room heating and domestic hot water)

对新建住宅建筑供热需求的评估 (室内供暖和生活热水)



评估新建建筑的技术法规

EVOLUTION OF TECHNICAL
REGULATIONS FOR NEW BUILDINGS

制定各州能耗法规范文 (MuKEN)

Ratcheting up of regulation (MuKEN)

能效持续提高

Efficiency is constantly increasing

今天，瑞士新建筑大部分都是零碳建筑

Today new buildings are mostly ZEB

瑞士新建建筑正在成为NZEB和ZEB

NEW BUILDINGS ARE ON TRACK
FOR NZEB AND ZEB

瑞士新建建筑能源的市场份额

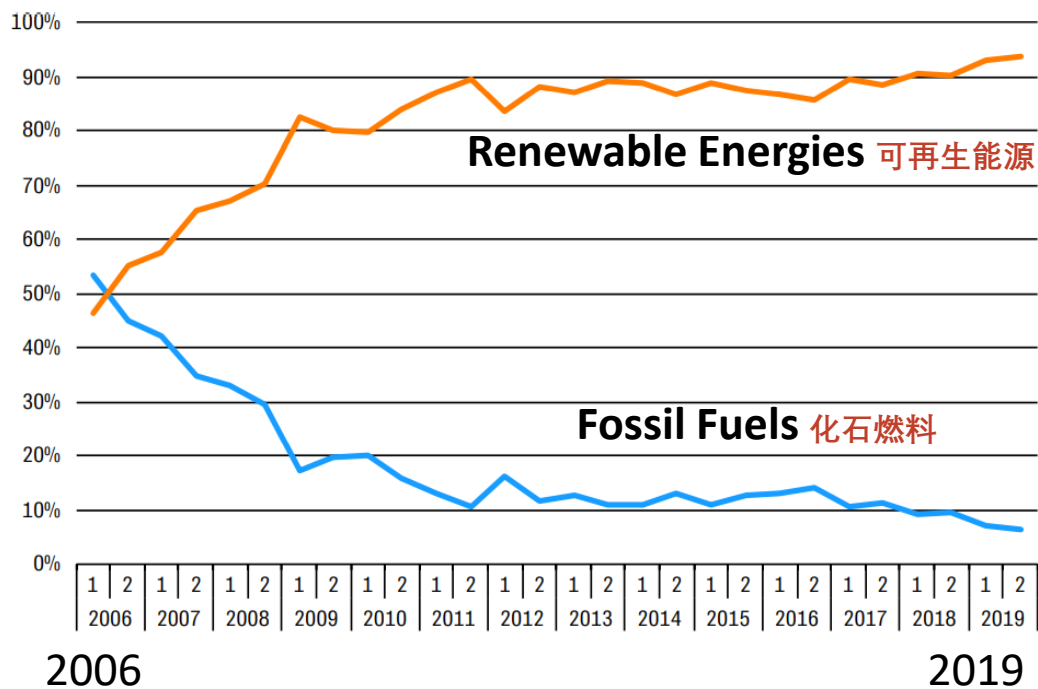
MARKET SHARE OF ENERGY SOURCES IN NEW BUILDINGS

瑞士新建建筑正在成为近零碳和零碳的路上
New buildings are on track for NZEB and ZEB

自2010年以来，
瑞士90%的新建住宅建筑已使用可再生能源
90% of new residential buildings have
renewable energies since~2010

挑战在于改造既有建筑

The challenge lies in transforming existing
building stock



可再生能源系统已主导新建建筑

RENEWABLE SYSTEMS DOMINATE
IN NEW BUILDINGS



2050+ 能源远景展望 - 重要成果汇集

能源展望 2050+

ENERGY PERSPECTIVES 2050+

2050年瑞士的净零目标

Objectives for net-zero in Switzerland by 2050

需要将脱碳和可再生能源联系起来

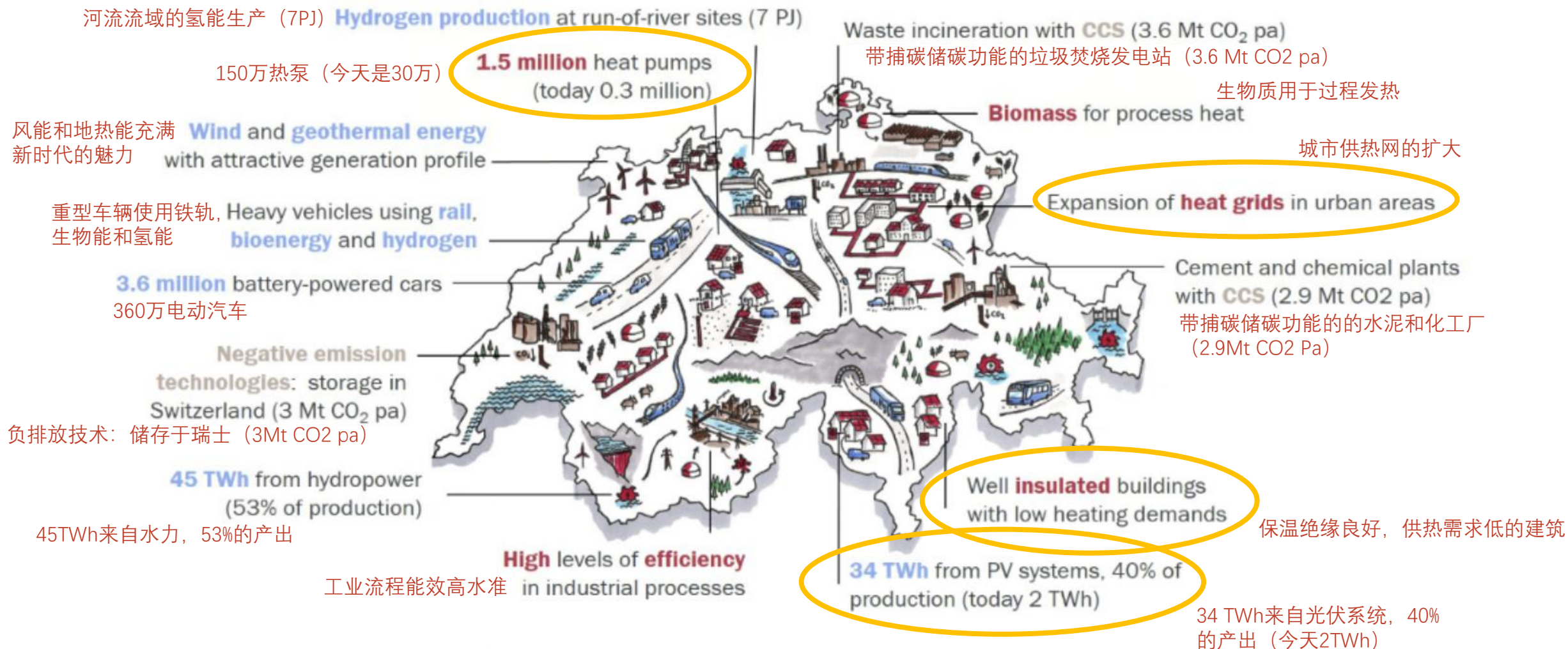
Need for interlinking decarbonization and renewable electricity

在园区层面上实施跨领域耦合和优化措施的发展趋势

Trend towards sector coupling and optimization on a district level

2050年瑞士有可能实现净零排放

Achieving net-zero emissions in
Switzerland by 2050 is possible

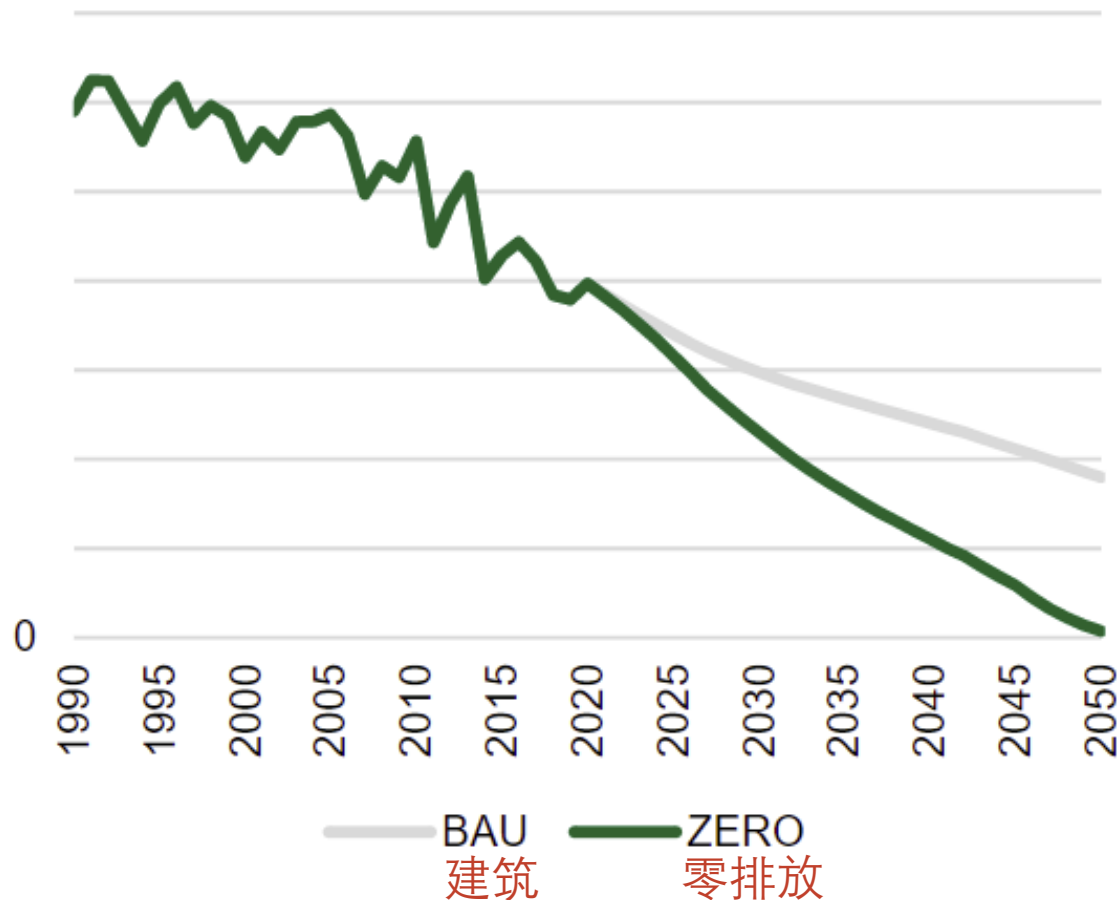


耗电的建筑正在变为产电设施

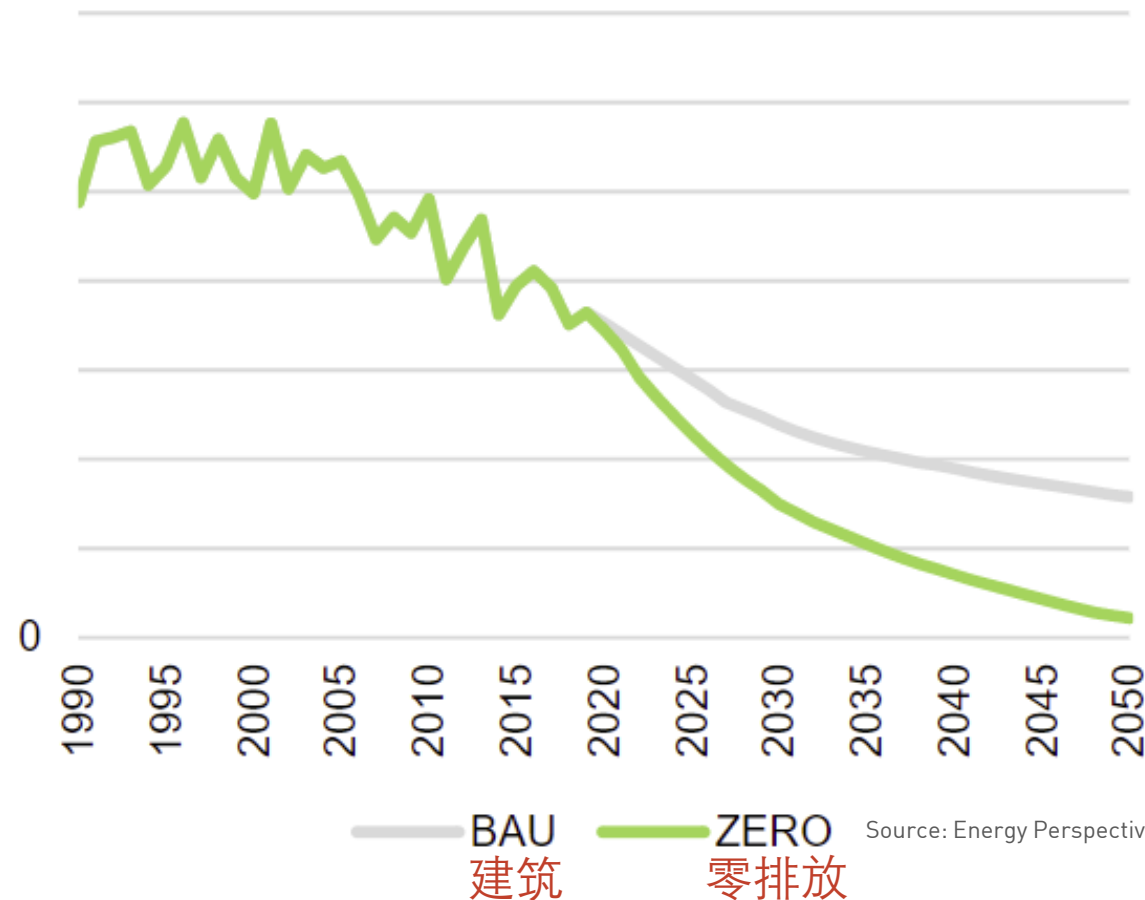
Buildings powered by electricity and becoming electricity producers

RESIDENTIAL BUILDING STOCK: 居住建筑:

Emissions from buildings
建筑的温室气体排放



COMMERCIAL BUILDING STOCK: 商业建筑:

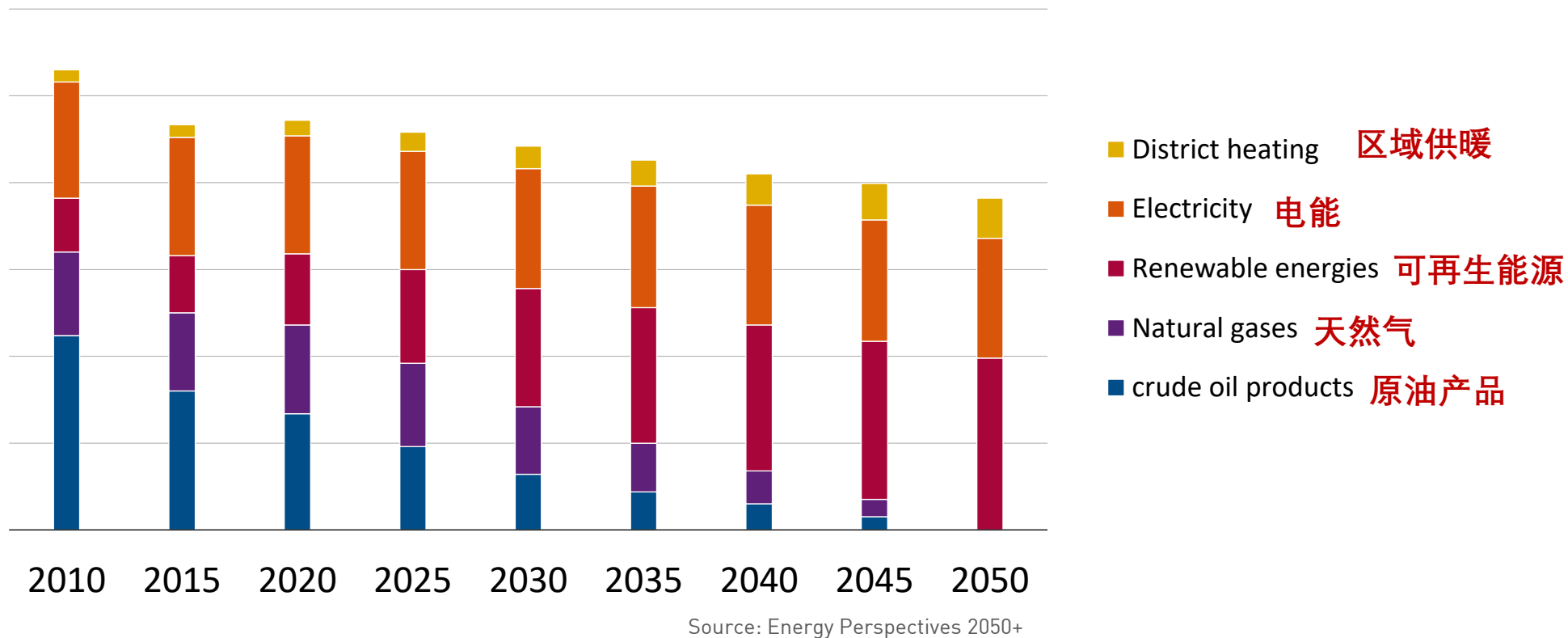


Source: Energy Perspectives 2050+

目标-2050年达到既有建筑零排放

TARGET: ZERO GHG EMISSIONS
FROM BUILDING STOCK BY 2050

DEVELOPMENT OF ENERGY CONSUMPTION FOR RESIDENTIAL BUILDINGS: 居住建筑的能耗发展：



2050年最重要的能源：可再生能源，社区供暖和电能

MOST IMPORTANT SOURCES 2050:
RENEWABLE ENERGIES, DISTRICT
HEATING AND ELECTRICITY



Source: www.video-drohne.ch

瑞士建筑领域未来法规方案

CONCEPTS FOR FUTURE REGULATION IN SWISS BUILDING SECTOR

规划建造阶段： 设定能源系统最大输出热功率的额定值 – 来表示建筑能效 – 而不再直接看建筑能耗

Planning Phase: Set limits for maximum deliverable thermal power output of the energy system - a proxy for the energy efficiency of the building - rather than directly for energy consumption

比以往简单多了 → simpler

运营阶段： 通过设定每单位建筑面积的CO₂额定值来调控能源组合

Operating phase: Regulate energy mix by setting CO₂-limits per floor area

高度灵活 → highly flexible

废弃阶段： 对建材预收基于“隐含能耗”的建材回收再用费

Decommissioning phase: Upfront recycling fee for building materials based on “embodied emissions”

循环经济 → circular economy

简单有效的法规 涵盖全生命周期排放

SIMPLE AND EFFECTIVE REGULATION
COVERING LIFE-CYCLE EMISSIONS

FINDINGS FROM SWISS EXPERIENCE FOR SUCCESSFUL TRANSFORMATION TO ZEB 成功转型为零碳建筑的瑞士经验 - 可成为中国零碳建筑的参考

- Technical regulation is the main driver – but no “success guarantee”
技术法规是主要驱动力 – 但不是“成功的保障”
- Diversity in support measures needed, integrating all stakeholders, push and pull
需要多样化的支持措施，应联合所有利益相关方参与，“推动和拉动”双管齐下
- TER must be simple and easy to apply, supported by guidelines
技术法规必须简单易用，并有指南做支持
- Predictability of policy is key for investors, planners and technology providers
政策的可靠性对投资商，规划师和技术提供者来说是关键
- Net-zero emission targets require shift to life-cycle approach in the building industry
建筑业的净零碳排放目标需要转为全生命周期的计算方法
- Robust technologies for ZEB 零碳建筑强大而坚实的技术
- Optimization at district level needed 需要在社区层面上得到优化
- Successful implementation requires monitoring of real-life performance
成功实施需要监控真实状况的能耗表现
- Use of renewable energy sources is the key for fast track towards climate targets
使用可再生能源是达到保护气候目标捷径中的关键

感谢您的关注

THANK YOU FOR YOUR ATTENTION