Energy Efficiency

The example of the German Power Sector

能效

德国电力行业案例

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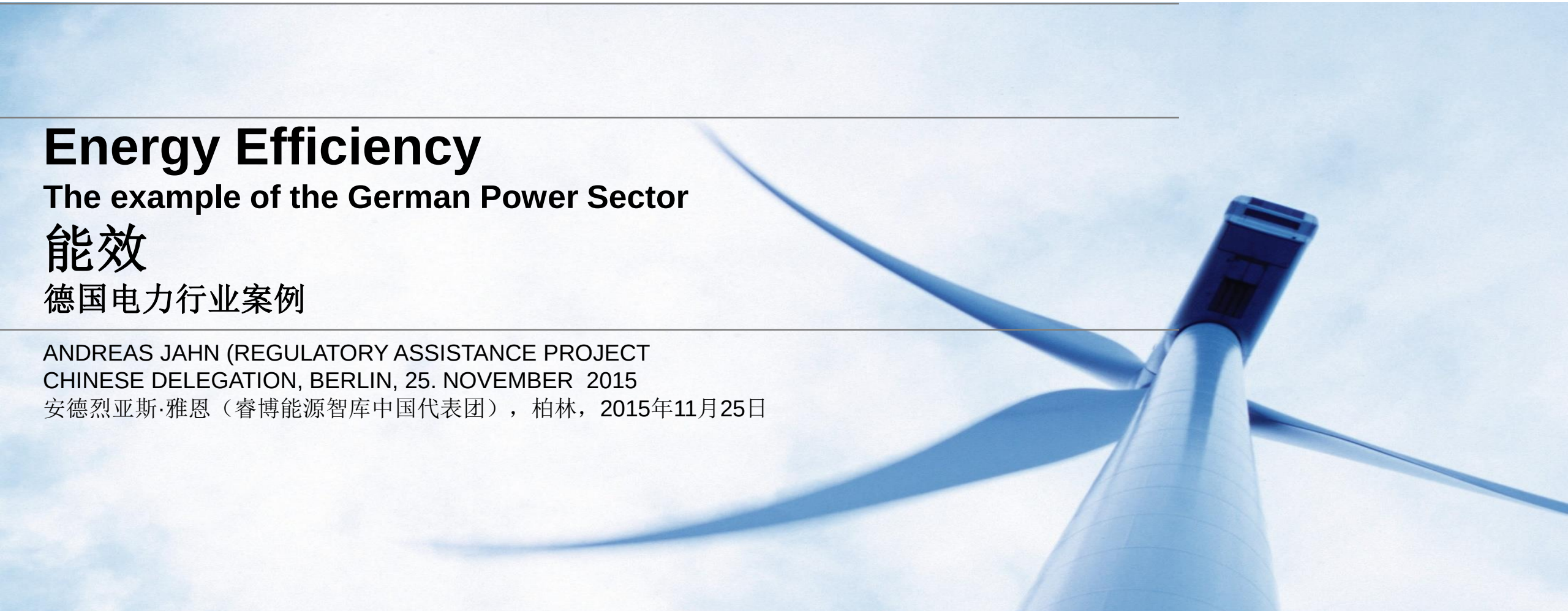
安德烈亚斯·雅恩（睿博能源智库中国代表团），柏林，2015年11月25日



Outline of this Presentation
演讲大纲

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2	**Potential and value of energy efficiency in Germany (power sector)** **德国（电力行业）能效提升潜力与价值**
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A word on Agora Energiewende and RAP

Agora 能源转型研究机构与睿博能源智库简介

Who we are

- Independent and non-partisan Think Tank, currently 19 experts
- Financed by the Mercator Foundation and the European Climate Foundation
- Mission: How to make the Energy Transition a success story?
- Approach: Combining research and dialogue in order to provide sound basis for decision makers

Agora Energiewende简介

- 由19名专家组成的独立无党派智囊团
- 由墨卡托基金会和欧洲气候基金会资助
- 任务：如何引领能源转型计划走向成功？
- 方法：研究与对话相结合，旨在为决策者提供坚实平台

RAP Energy solutions for a changing world

Agora Energiewende

About RAP

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power and natural gas sectors. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

Learn more about RAP at www.raponline.org

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RAP™ 睿博能源智库

Agora Energiewende

关于睿博能源智库

睿博能源智库（RAP）是一个全球性专家咨询机构，主要关注全球能源政策下经济和环境的可持续发展。RAP 在能源政策方面有资深的经验，致力于促进经济效率、保护环境，确保电力系统的可靠性和扩大社会效益。

RAP帮助中国政策制定者制定和实施相关政策，来促进可持续经济发展、增加能源系统可靠性、改善空气质量和公众健康，从而为中国显著和长期地减少温室气体排放作出贡献。

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RAP - The Regulatory Assistance Project

RAP RAP's European headquarter is located in Brussels. Beside EU level RAP's European work is focused to UK, Poland and Germany. In Germany RAP is working closely together with it's core partner **Agora-Energiewende**.

Andreas Jahn joined RAP 2012 as a Senior Associate in Berlin. Mr. Jahn has extensive experience with power markets and regulation, as well as knowledge of the German national political arena. His work focuses on issues relating to the German energy transition, helping develop and advance regulatory options for a carbon neutral energy system in the power sector, including demand-side resources. He also supports RAP's work throughout Europe.

Previously, Mr. Jahn was responsible for energy policy and regulatory matters as the Director of Regulatory Affairs at a German electricity and gas provider. Ahead of this engagement he worked as a senior expert for the Association of New Energy Suppliers, and he was also a member of the Federal Ministry of Economics' task force on legislation to implement grid regulation in Germany.

RAP - 睿博能源智库

***RAP**睿博能源智库欧洲总部位于布鲁塞尔。除欧盟层面外，睿博能源智库在欧洲的工作重心还包括英国、波兰和德国。在德国，睿博能源智库与核心合作伙伴Agora-Energiewende密切合作。*

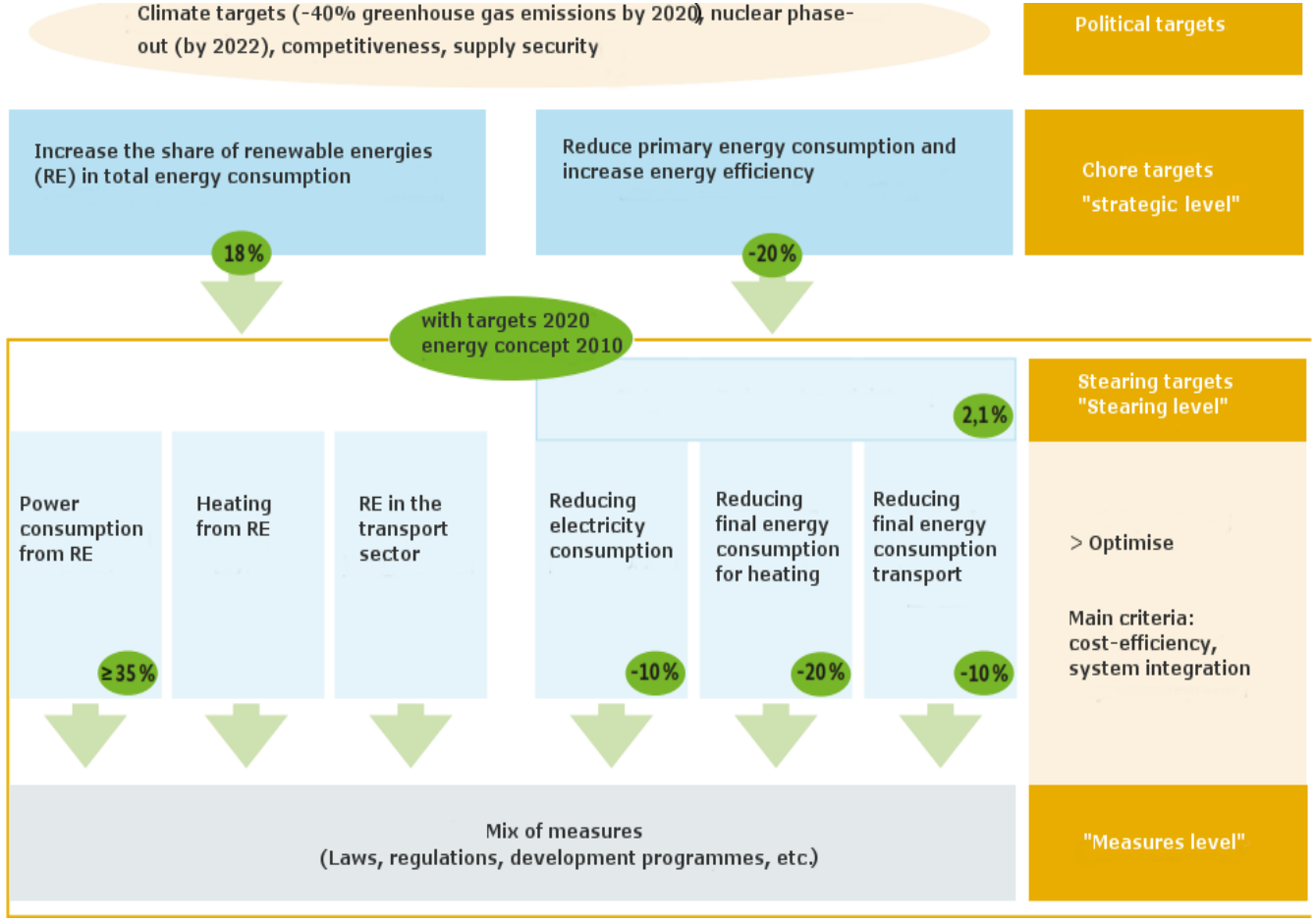
Andreas Jahn *于2012年加入睿博能源智库，担任柏林高级顾问。Jahn先生拥有电力市场及监管领域的丰富经验，并了解德国政坛。他专注于德国能源转型工作，协助建立健全电力行业碳中和能源系统监管方案，包括需求侧资源。他还为睿博能源智库在全欧洲的工作提供支持。*

担任现职前，Jahn先生曾供职于德国某电力及天然气公司，担任法规事务总监一职，负责能源政策及监管事务。在此之前，曾担任新能源供应商协会高级专家，是德国联邦经济部电网监管立法专责小组成员。

Potential and value of energy efficiency in Germany (power sector)

德国（电力行业）能效提升潜力与价值

Energy Transition means: Reducing nuclear and CO_2, and increasing efficiency and renewables



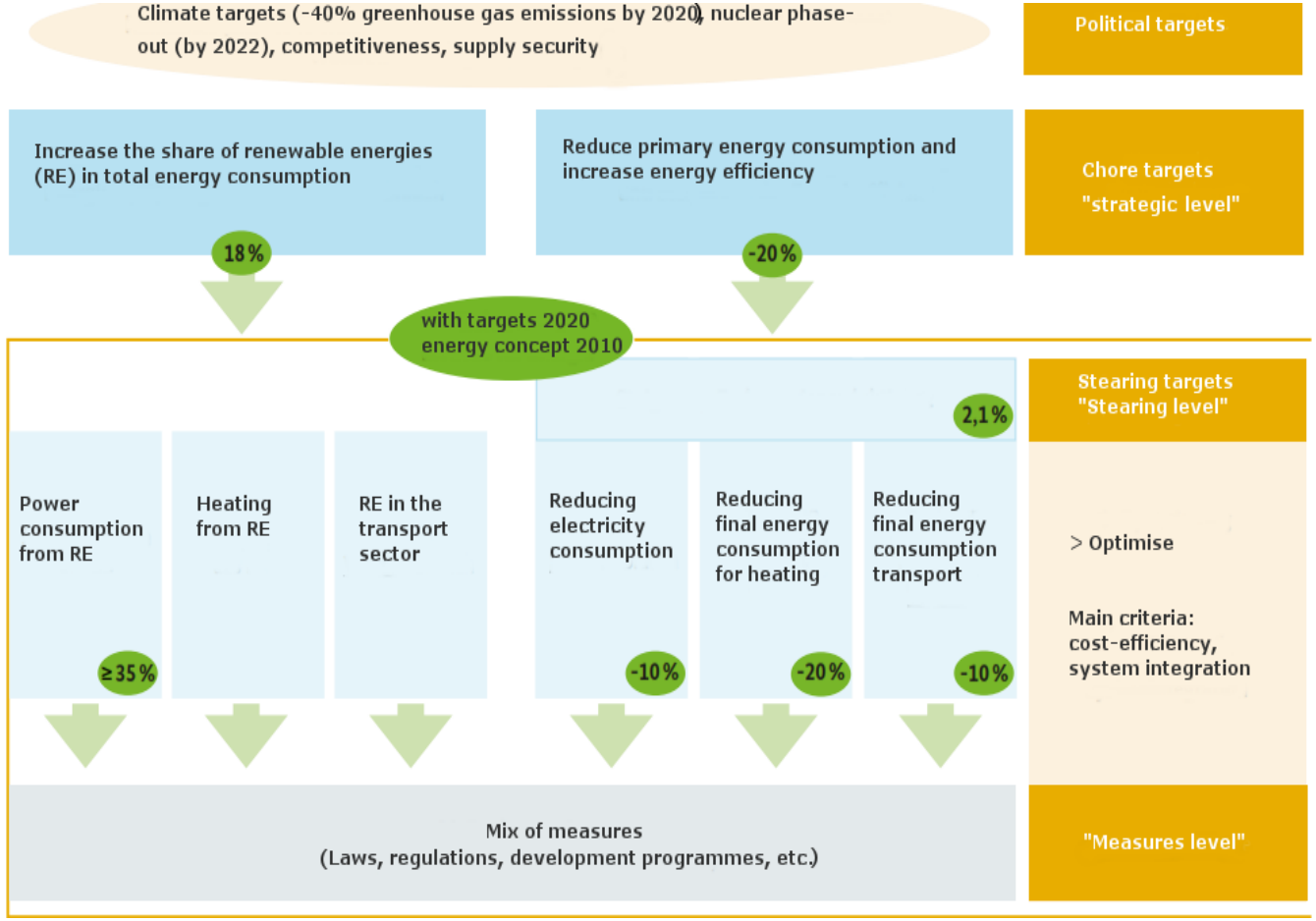
Realising the German Energy Transition requires not only meeting targets for renewables, but also for improved energy efficiency

In 2010, previous German government set ambitious targets for efficiency; confirmed in coalition agreement of 2013 and monitoring report

Improved electricity efficiency will play a critical role in meeting Germany's emission reduction goals

Without greater efficiency, a significantly greater expansion of renewables will be needed to achieve an equivalent reduction of greenhouse gases

能源转型手段：减少核能利用和二氧化碳排放量，提高效率，扩大使用可再生能源



为实现德国能源转型，
不仅要求达到可再生能源使用目标，
还需达到能效提升目标

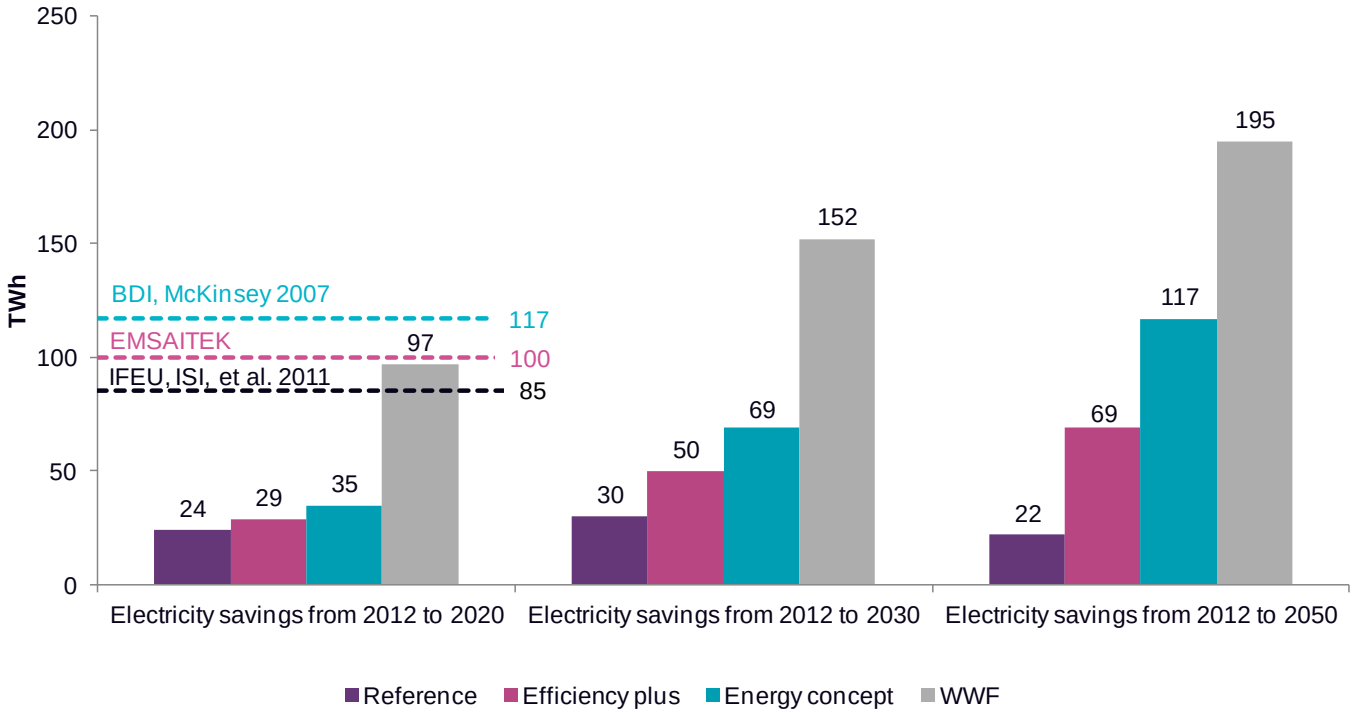
2010年，上届德国政府在能效方面设立宏远目标；在2013年联合协议与监管报告中亦再次确立了该目标

为实现德国减排目标，提高电力效率至关重要

若效率问题得不到解决，
则需要显著扩大可再生能源使用规模，
以此弥补温室气体减排目标

Potential of cost-effective energy savings in Germany is significant

Cost-effective electricity saving potentials from different studies and electricity savings assumed in scenarios compared to BAU in TWh



Agora Energiewende, European Climate Foundation, Regulatory Assistance Project (2014)

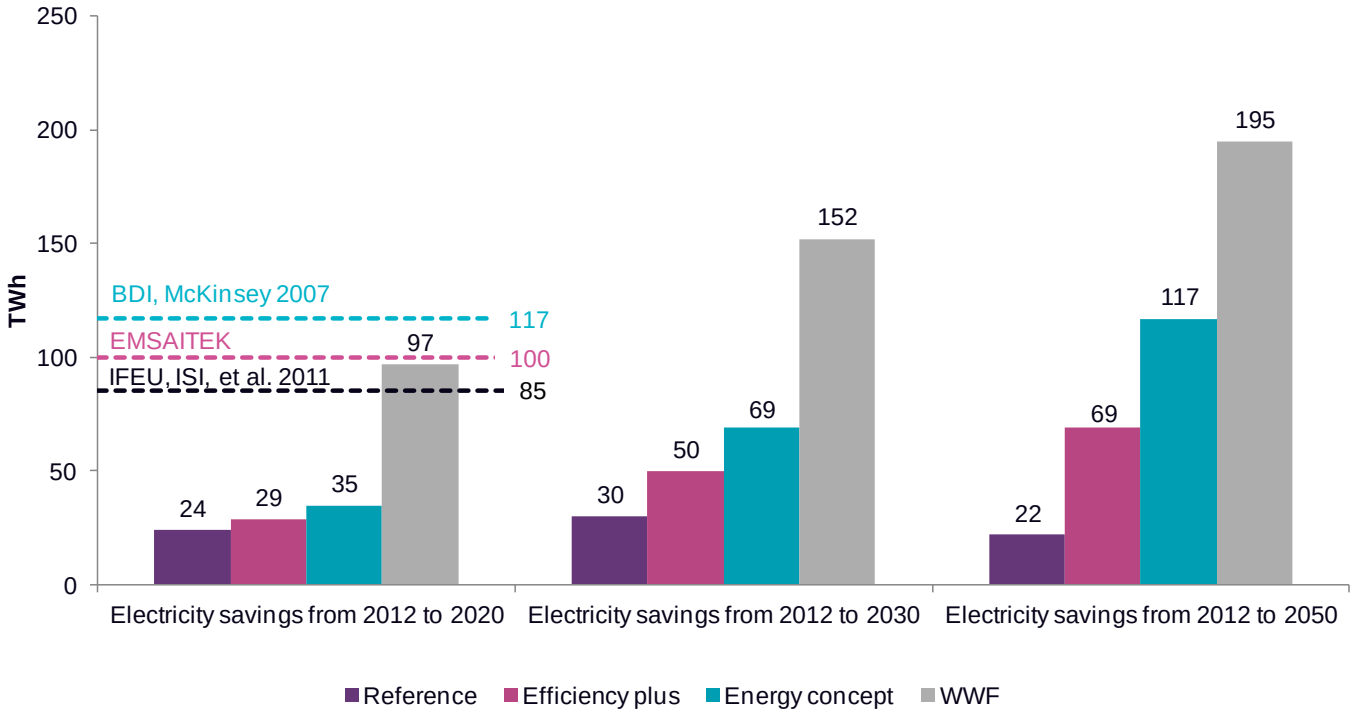
The cost-effective potential for savings in the electricity sector in Germany lies between 85 to 117 TWh in 2020. Total consumption: 600 TWh.

Based on this potential, the Agora-study „Benefits of energy efficiency on the German power sector“ analyses the cost-benefits of energy efficiency in three scenarios compared to BAU for the German electricity system. Even the most ambitious scenario (WWF) can be cost-effectively achieved.

The costs of efficiency investments will run in the range of one-third to one-half of the benefits of efficiency - > net economic benefits are likely to be huge for Germany!

德国高成本效益节能领域潜力无限

不同研究报告的高成本效益节电潜力和
相比常规情形的不同情景假设的节电量（单位：**TWh**）



Agora Energiewende，欧洲气候基金会，Regulatory Assistance Project (2014)

预计到2020年，德国电力行业高成本效益节约潜力为85至117TWh。总耗电量：600 TWh。

基于该潜力，Agora研究报告《提高能效之于德国电力行业的效益》分析了德国电力系统中，相比常规情形的三种情景下能效方面的成本效益。即使最宏远的情景 (WWF)，也可用过高成本效益的方式实现。

能效投资成本是其收益的1/3至1/2 - > 整个德国获奖实现巨大净经济收益！

Efficiency: A saved kilowatt hour is the most cost-effective kilowatt hour

The goals of the German Energy Transition cannot be met without aggressive investment in end-use energy efficiency, particularly in electric end-uses in all sectors of the economy.

- Every kilowatt saved means
  → fewer investments in new power plants, fossil and renewable, and grids
  → less burning of coal and natural gas
  → less CO2 and import dependency.

Until now, **no comprehensive study to determine the value of such efficiency savings**, and thereby the effects on the power sector of such investments, had been performed.

- Agora Energiewende, the European Climate Foundation, and the Regulatory Assistance Project commissioned a study to examine the question.
- The study reveals the value, in terms of reductions in total power sector costs, from investment in end-use energy efficiency in Germany's homes and businesses.
- Three scenarios analyzed. All yielded significant reductions in total power costs, relative to business-as-usual (BAU), in the 2014-2050 timeframe.

能效：节省的电力是成本效益最高的电力

只有通过强势的终端能效投资，尤其投资各经济领域的电力终端使用方面，才能够实现德国能源转型目标。

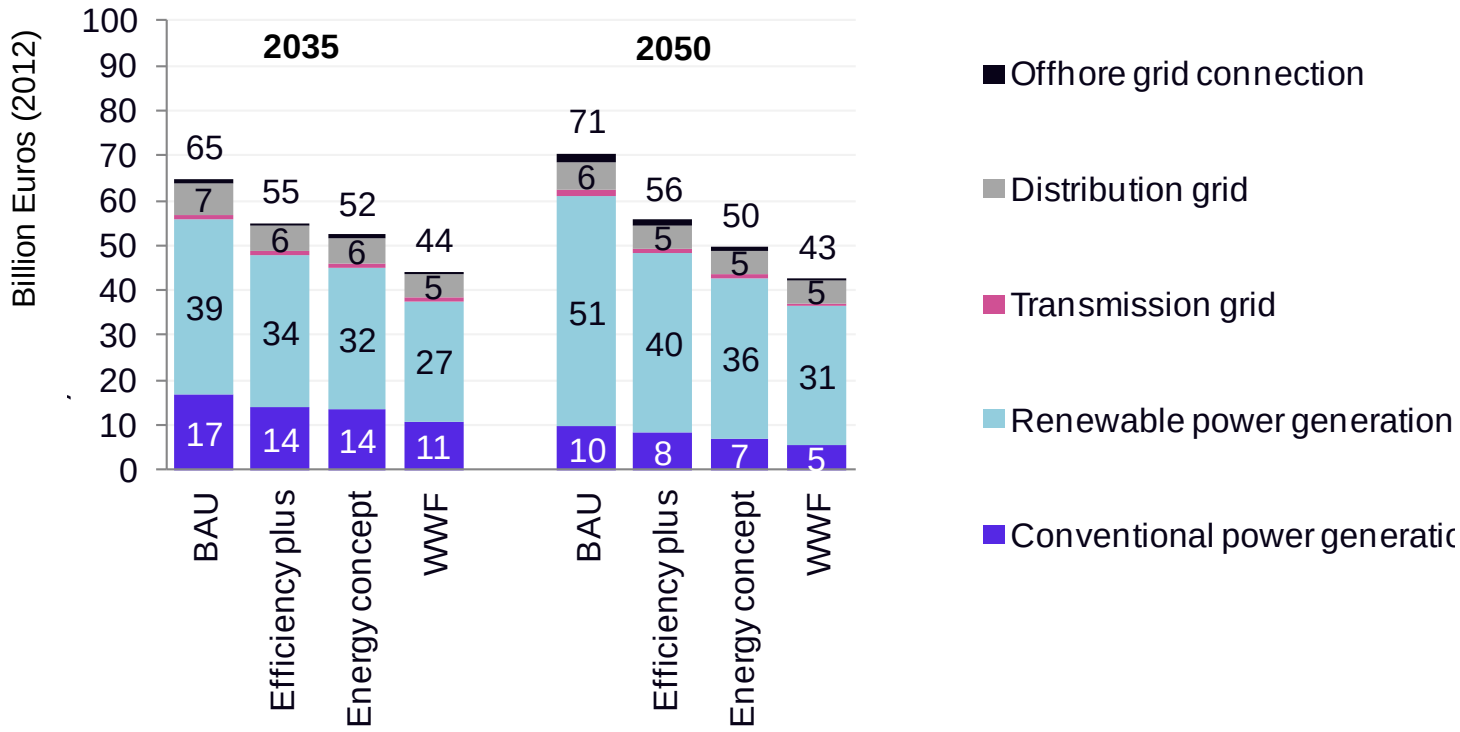
- 节省的电力意味着
  → 用于新建电厂、化石能源、可持续能源以及电网的投资金额下降
  → 煤炭与天然气燃烧量减少
  → 二氧化碳排放量和能源进口依存度降低

迄今为止，**关于确定由效率提高创造的价值**和此类投资对电力部门的影响，**尚未开展综合研究工作**。

- Agora Energiewende、欧洲气候基金会和Regulatory Assistance Project受委托开展相关研究工作。
- 研究得出提高德国家庭与企业终端使用领域的能效投资所创造的价值（即电力行业总成本下降水平）。
- 共分析了3种情景。在2014-2050年时间框架内，相比常规情形 (BAU)，3种情景均显著减少电力行业总成本。

Cost savings by energy efficiency
within fixed RES target (81%)

Total costs of the power system: electricity generation and network



BNetzA (2012), BMU (2013), Calculations by Prognos and IAEW (2014)

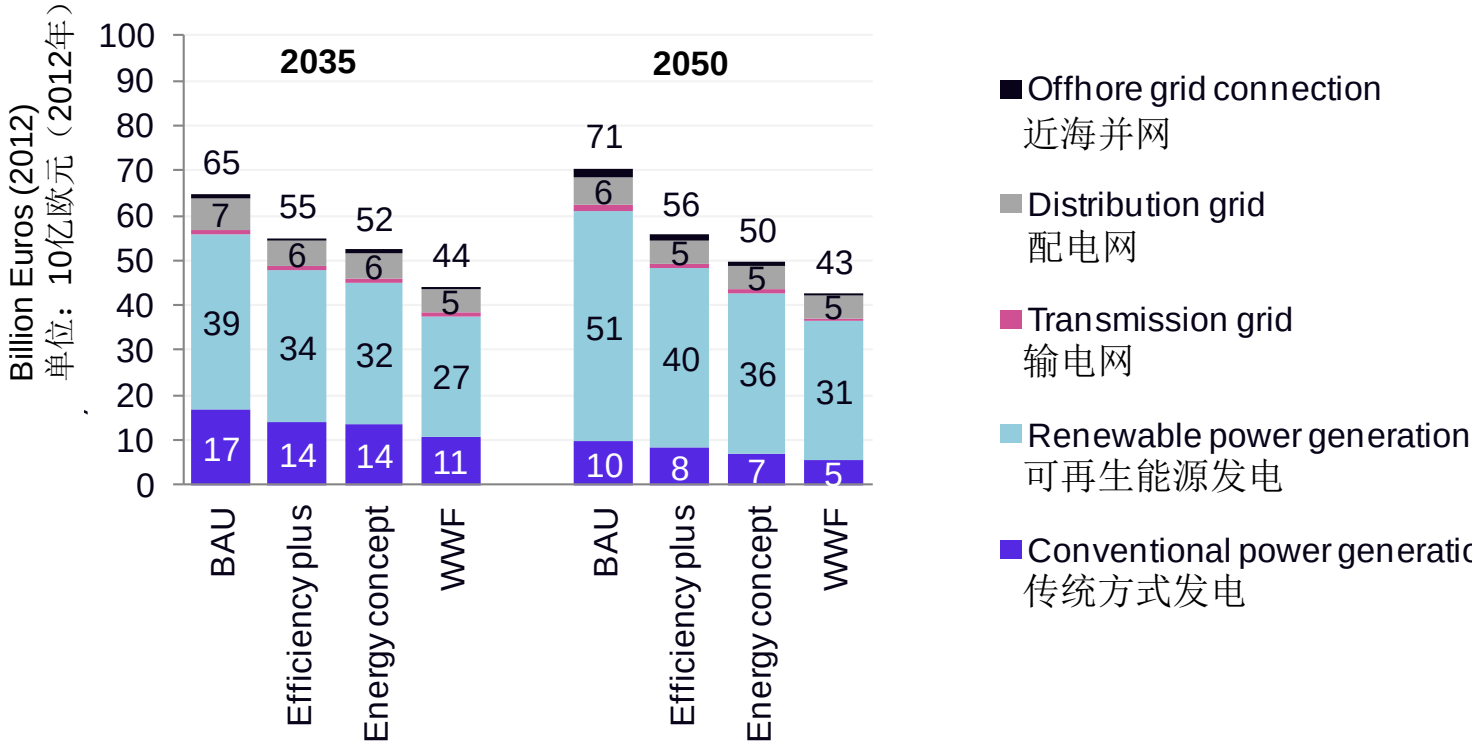
Saving electricity induces cost reductions in the fields of generation, transmission and distribution of electricity

Study shows: Reducing electricity demand by 10-35% in 2035 can save 10-20 bn EUR/year in 2035. Every kWh not used saves 0.11-0.15 Euros.

In addition, up to 6,750 km of new transmission lines would not have to be build.

提高能效所节约的成本
在可再生能源固定目标（81%） 内

电力系统总成本：发电及电力网络基础设施



BNetzA (2012), 德国联邦环境部 (2013), Prognos和IAEW提供计算结果 (2014)

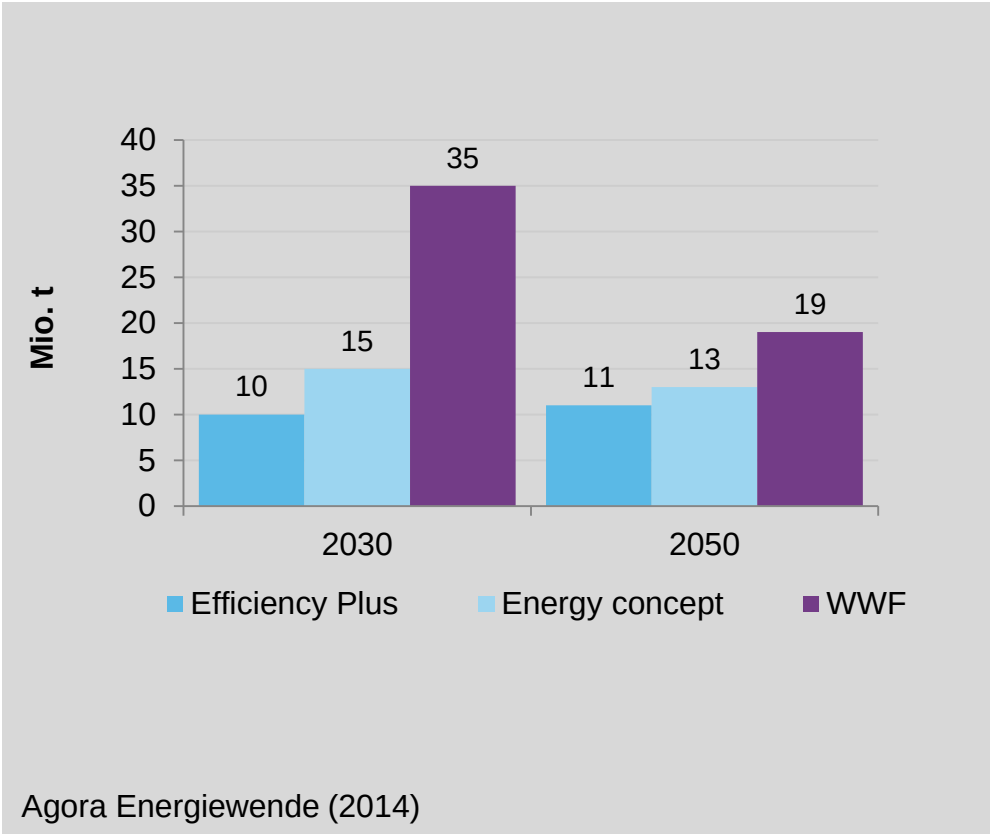
节电可带来发电、输电以及配电成本下降。

研究显示：2035年减少10%-35%
电力需求能够节约100-200亿欧元/年。
每节约1度电相当于节约0.11-0.15欧元。

此外，还可节约6,750千米输电线路。

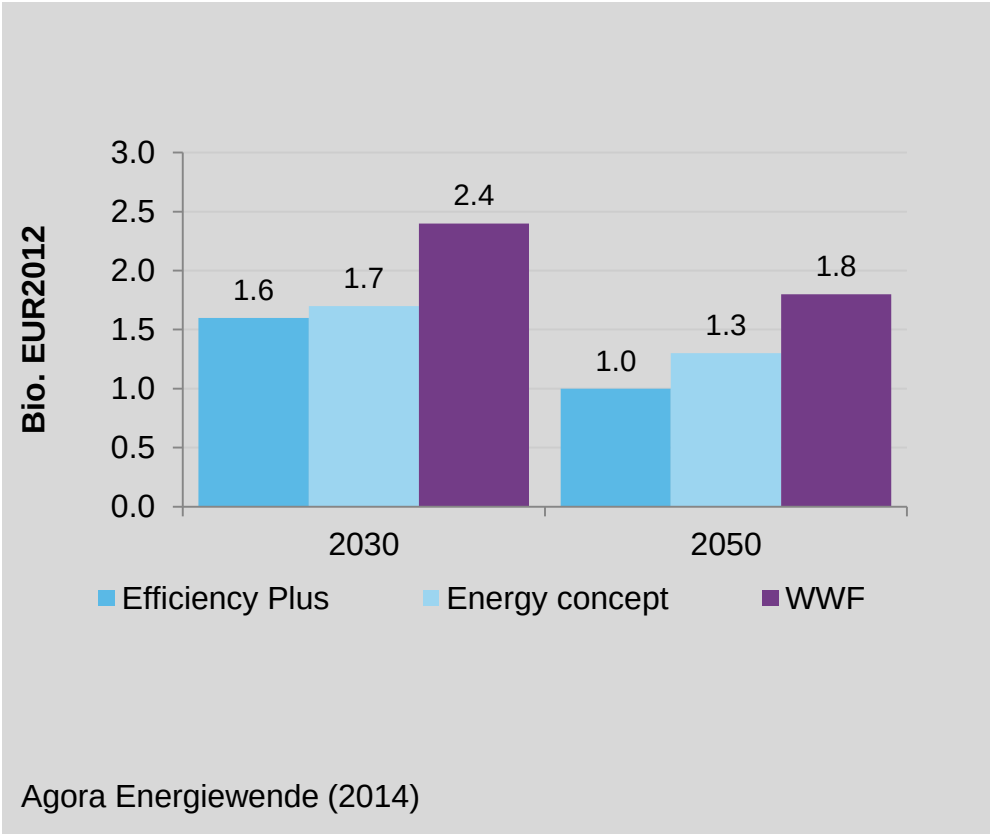
In 2030, CO_2 emissions would be reduced by 10 to 35 Mio. t, fuel imports by +/- 2 bn EUR p.a.

Avoided CO_2-emissions



Agora Energiewende (2014)

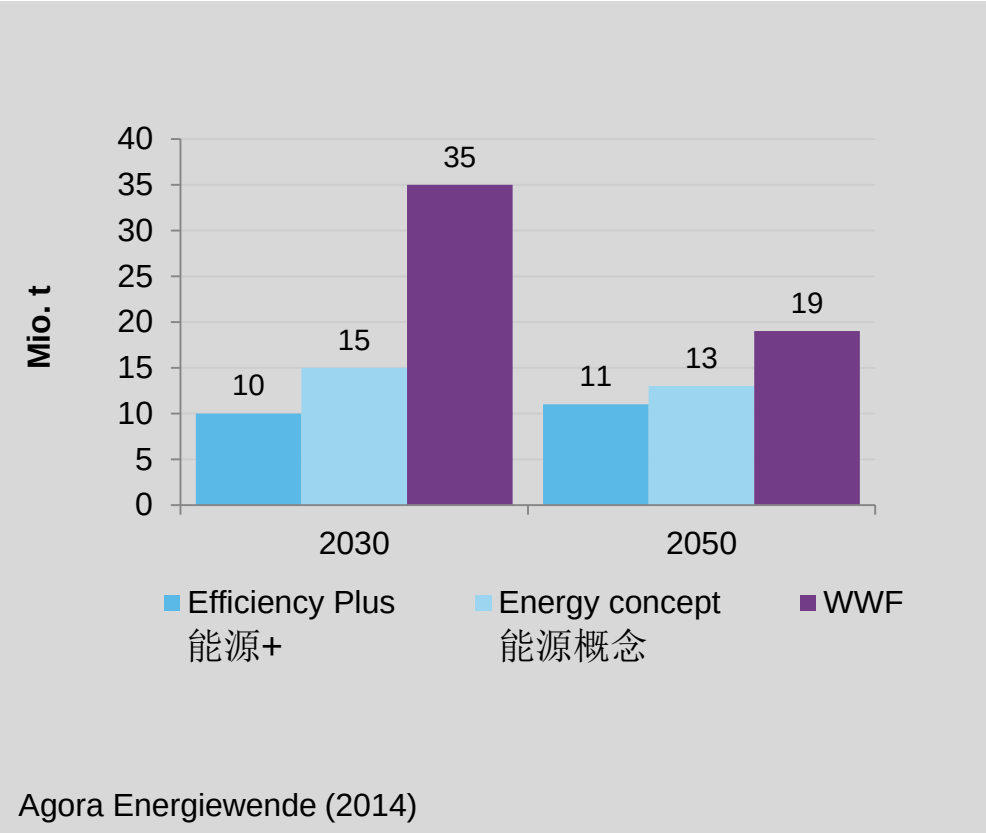
Avoided import costs for fossil fuels



Agora Energiewende (2014)

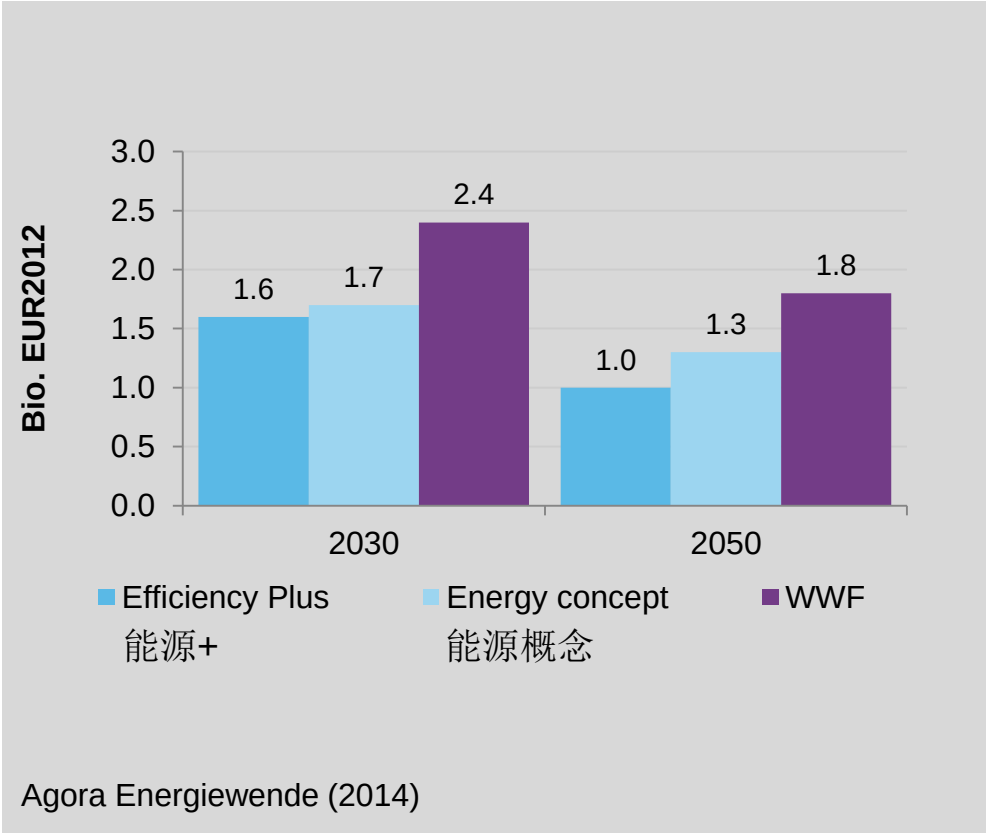
到2030年，二氧化碳排放量减少1000至3500万吨，燃料进口额每年减少 +/- 20亿欧元

二氧化碳减排量



Agora Energiewende (2014)

化石燃料进口成本减少水平



Agora Energiewende (2014)

Energy efficiency in Germany – State of play and targets

德国能效——进展与目标

Existing efficiency measures in Germany

Since the 1970s, Germany has implemented a number of different instruments in the field of energy efficiency (many of them required by EU law). Most important are:

- Various **targeted financial incentives through funding programmes**, e.g. CO2- Building Renovation Programme as the largest of KfW, and others specifically addressed at businesses
- **Regulatory instruments for setting high energy efficiency standards** for new products, buildings and renovations, e.g. Energy Savings Ordinance (from 2020 onwards almost all new buildings have to apply passive standard), energy labelling of products according to efficiency standards, EU Eco-Design Directive – efficiency standards for electric appliances
- **Price signals and incentive mechanisms**, e.g. through energy tax
- **Energy managment systems** (ISO 50001) as prerequisite for industry to receive exemptions from energy taxes and renewables surcharge
- **Multiple information and advice programmes** for households and businesses (e.g. energy certificates for buildings)

德国现有能效措施

自上世纪70年代起，德国为提升能效实施了一系列措施（其中多项为欧盟法律要求）。最重要的几项为：

- **各类以资助计划为形式的特定财政激励措施**，例如德国复兴信贷银行规模最大的“二氧化碳建筑改造计划”，以及其他商业计划
- 针对新产品、建筑以及建筑改造**设立严格能效标准的监管工具**。例如《节能条例》（2020年之后，几乎所有新建建筑均须达到被动房标准），根据效率标准为产品加贴能效标识，《欧盟生态设计指令 – 电器能效标准》
- **价格信号与激励机制**，例如征收能源税
- **能源管理体系** (ISO 50001) 是企业免于交纳能源税和可再生能源附加费的先决条件
- 面向家庭和企业实施**多种信息与咨询项目**（例如建筑能效证书）

Germany is one of the most energy efficient industrialised countries
德国是工业化国家中能效最高的国家之一

Average household electricity bills in EUR/yea 家庭平均电费（欧元/年）

	Consumption (kWh)	Price (Ct/kWh)	Bill (EUR)
Denmark	4,000	30	1,200
US	11,800	9	1,060
Germany	3,500	30	1,050
Japan	5,600	18	1,010
Spain	4,400	23	1,010
Canada	10,800	8	850
UK	4,200	19	800
France	5,000	16	800
Italy	2,700	25	680

世界能源理事会，美国能源信息署，欧洲统计局，Energy Intelligence, New Energy，自行计算

German households consume approx. 3,500 kWh of electricity per year. This is among the lowest amongst OECD countries.

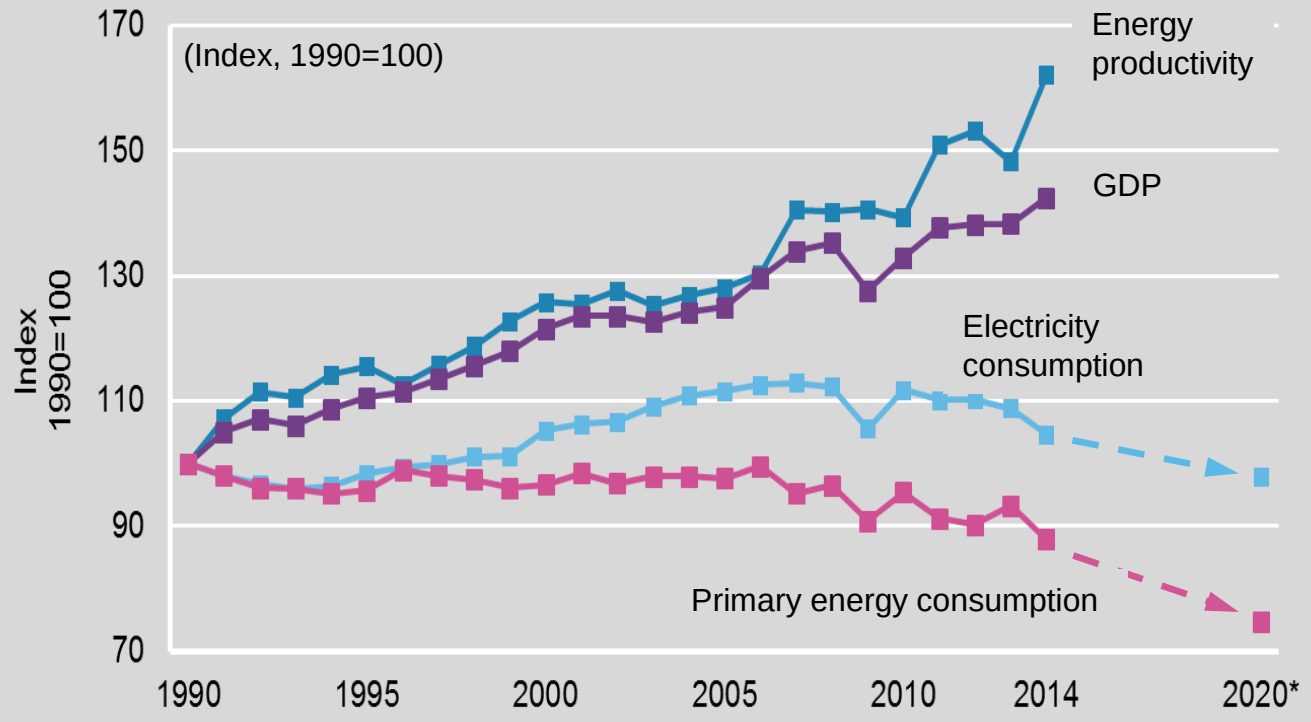
德国家庭年耗电量约3,500kWh。
是经合组织成员国中耗电量最少国家之一。

Consumers in most other countries use significantly more electricity. However, due to lower prices, the average bill is usually similar or lower than in Germany.

大部分其他国家消费者耗电量显著高于德国水平。然而，由于这些国家电价更低，其平均电费通常与德国持平甚至更低。

Germany decoupled economic growth from energy consumption – but there is still work to do to reach the 2020 efficiency targets

Energy productivity and consumption and economic growth 1990 – 2014



AG Energiebilanzen (2014), BMWi (2014)

Targets (against 2008):

⇒ reduction of electricity demand by 10% in 2020, and 25% by 2050

⇒ reduction of primary energy consumption by 20% in 2020, and 50% by 2050

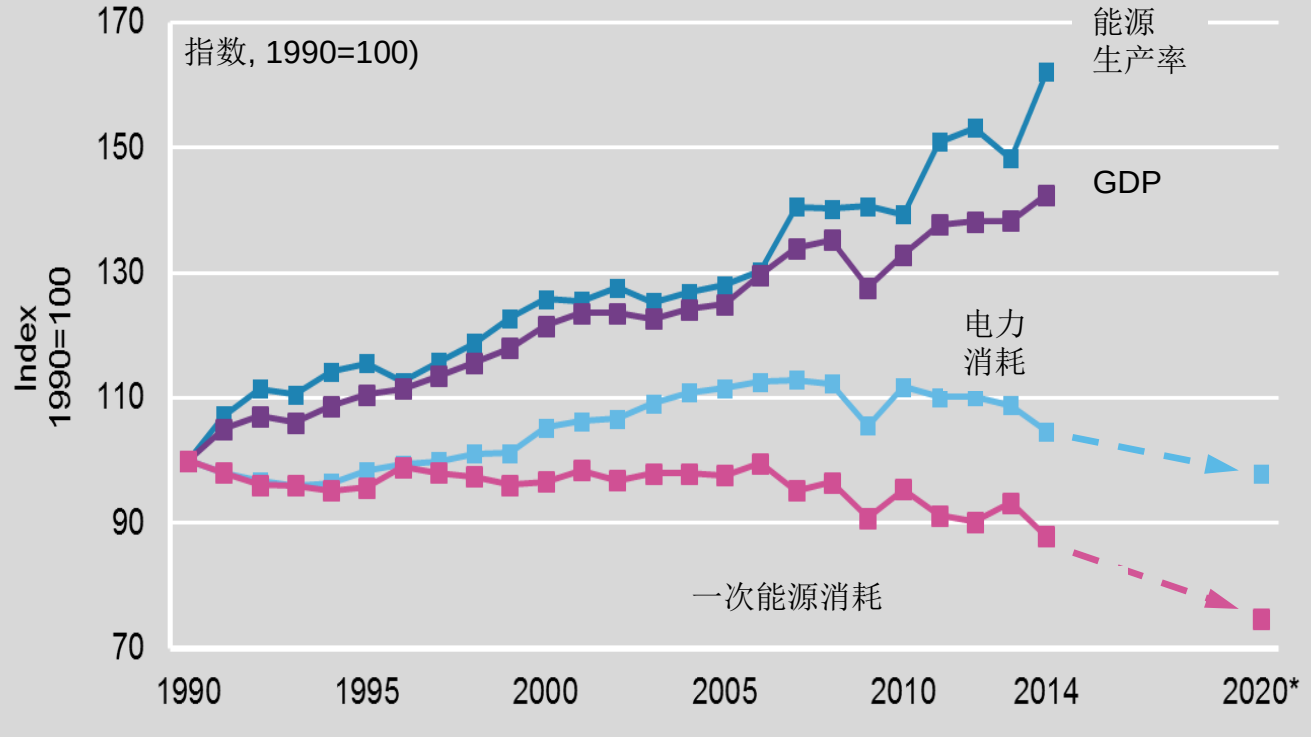
⇒ Heat in buildings: -20% until 2020

Projections: in 2020, primary energy consumption will be reduced by 10.1%. Hence, a gap of at least 9.9% remains (1.400 PetaJoule)

Therefore, additional measures are needed to meet the 2020 targets.

德国经济发展已与能源消耗脱钩 –
但为实现2020年效率目标仍需开展大量工作

1990-2014年能源生产率、消费量及经济增长



AG Energiebilanzen (2014),德国联邦经济事务和能源部 (2014)

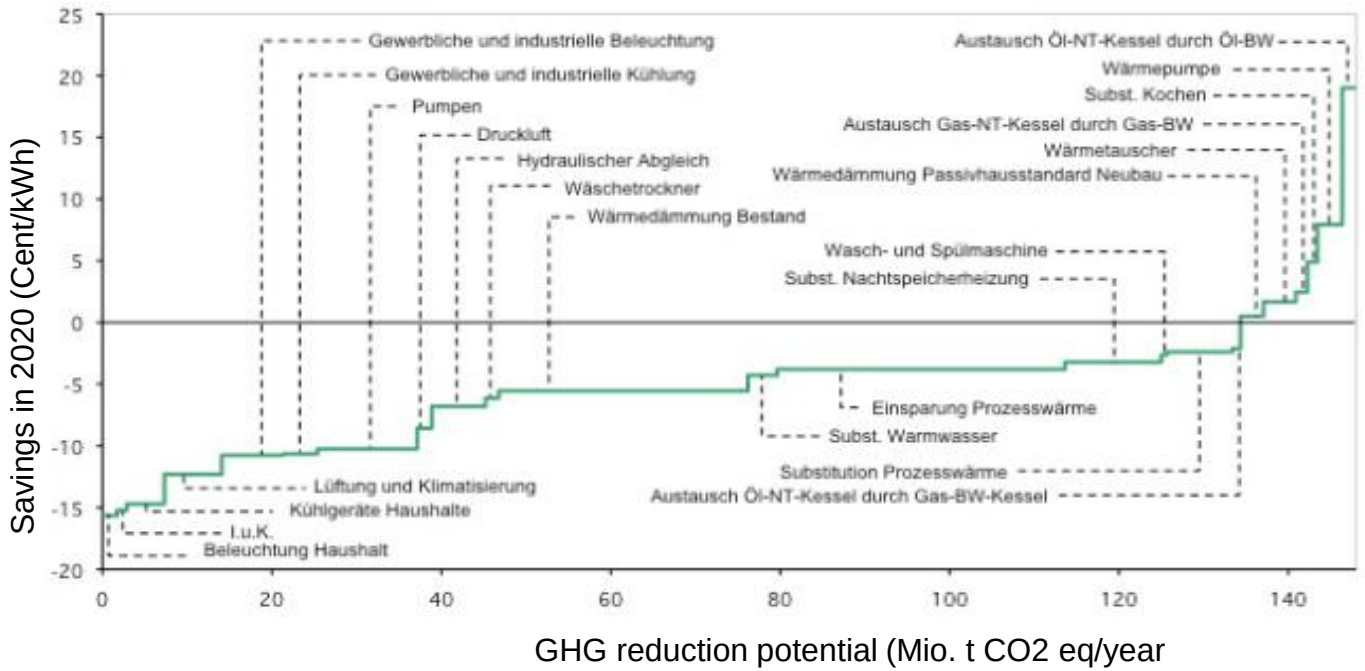
目标 (相较2008年)：
⇒ 到2020年减少10%电力需求，2050年减少25%
⇒ 到2020年减少20%一次能源消耗，2050年减少50%
⇒ 到2020年减少20%建筑供暖

预测：到2020年，一次能源消耗将减少10.1%。 距目标仍有9.9%差距 (1,400拍焦耳)

因此，为实现2020年目标，仍需采取额外措施。

The efficiency dilemma

Efficiency Cost Curve – Illustrative



Wuppertal Institute (2011)

The Efficiency Cost Curve shows that most efficiency measures are cost-effective. 80% of all measures would amortise within 3 years.

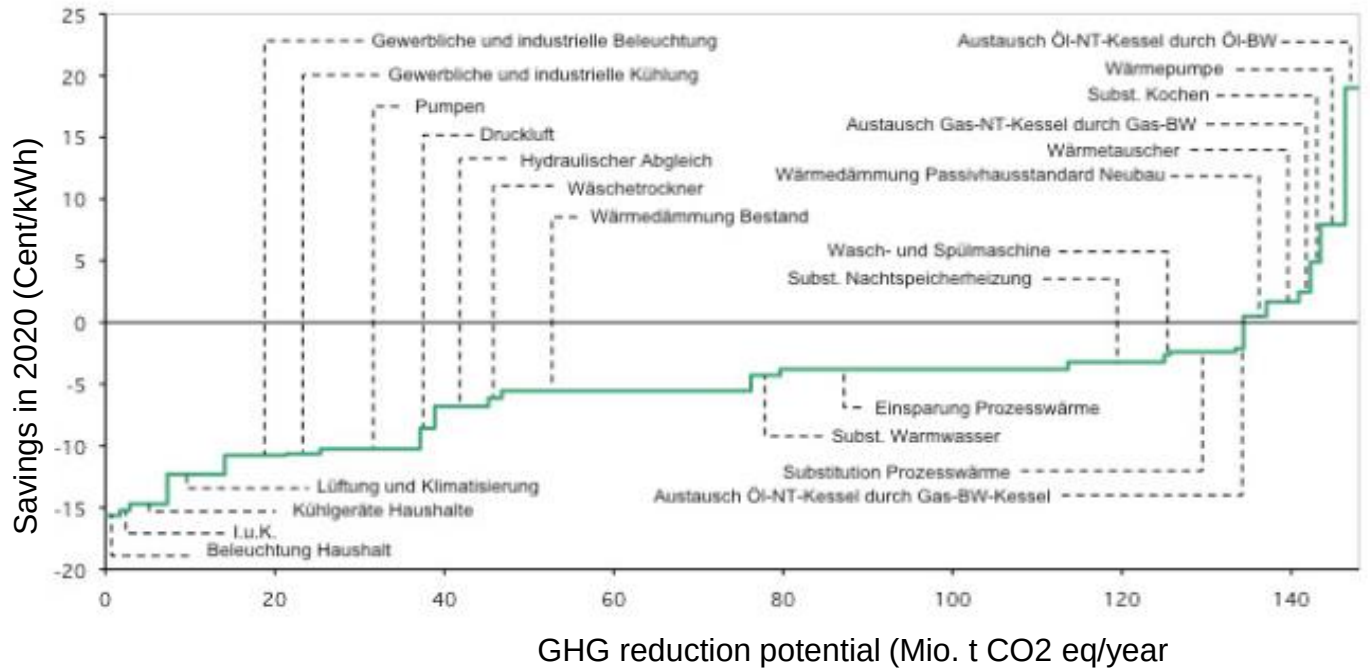
However, many of the cost-effective measures are not implemented.

Most important reasons:

- Liquidity preferences
- Distorted economic rationality
- Risk aversion (amortisation durations)
- Lack of capital (high up-front investments)
- Investor-consumer dilemma
- Lack of information and motivation

效率困境

效率成本曲线 - 示意图



伍珀塔尔研究所 (2011)

效率成本曲线显示，大部分效率措施均具有高成本效益。其中80%的措施成本可在3年之内摊还。

然而，许多高成本效益措施并未执行。

主要原因：

- 流动性偏好
- 经济投资不理性
- 风险规避 (摊还时间太长)
- 缺少资金 (前期投资金额过高)
- 投资者-消费者困境
- 缺乏信息和动力

The Challenge: Energy efficiency as a business model

挑战：能效的商业模式

Realising the potential

Some key considerations:

1. Recap: A high potential for efficiency exists. Saving electricity brings significant cost-benefits. Most efficiency measures are cost-effective in themselves and amortise quickly. Still, measures are not implemented – for various reasons.

2. In order to overcome the hindrances and bottlenecks, the government needs to step in with clear regulation, financial incentives/ solutions and soft instruments like information.

3. The implementation of efficiency measures should be realised by market participants – as it is widely assumed that competition would reduce cost.

4. There is not one single instrument for all efficiency measures, instead one needs to carefully chose the right instrument for the right measure.

实现潜能

关键考量：

1. 概述：能效提升潜力很大。节约用电可带来显著的成本效益。大多数提升能效措施均具有高成本效益，其成本可快速摊还。然而，由于多种原因，此类措施并未执行。

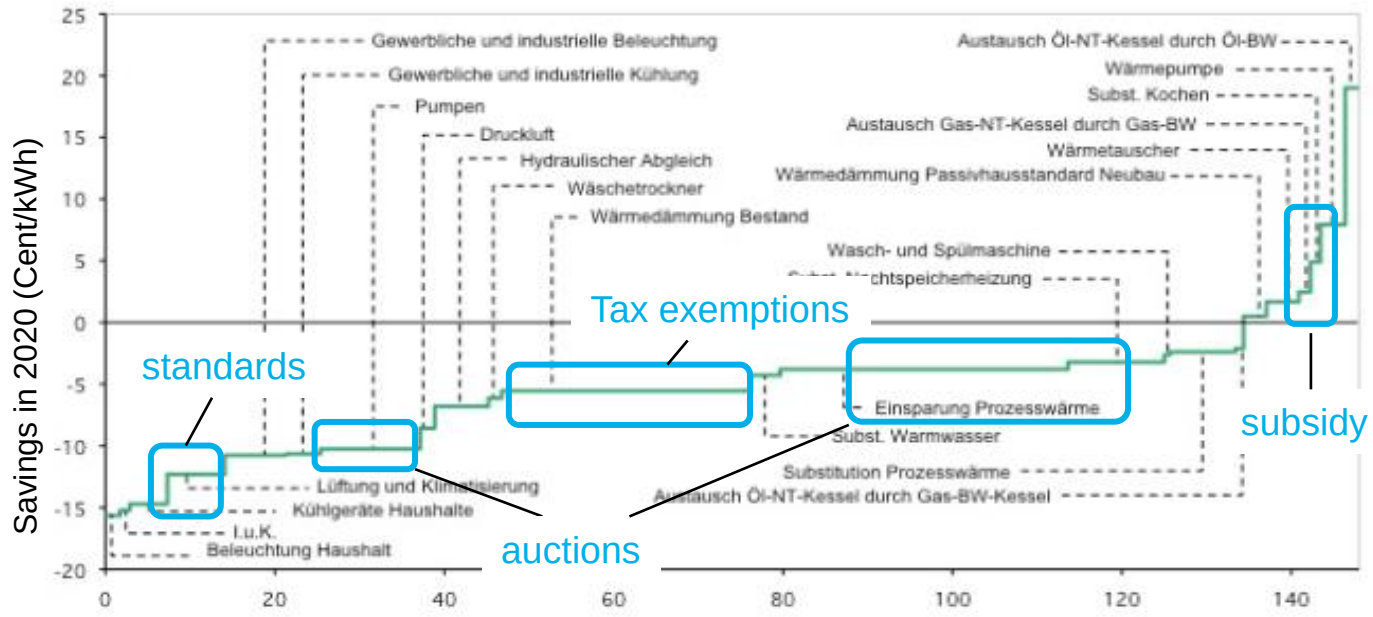
2. 为攻克难关突破瓶颈，政府需参与其中，明确监管措施，提供财政激励/解决方案并给予软工具，例如提供信息。

3. 能效措施应由市场主体执行——竞争降低成本是共识。

4. 没有万能的工具，针对不同措施应审慎使用合适的工具。

Different instruments for different measures

Efficiency Cost Curve – Illustrative



Wuppertal Institute (2011), Pehnt (2014)

As efficiency measures phase numerous different challenges, careful considerations of *what* instrument for which measure is needed.

Tax exemptions might be the right instrument for building retrofits,

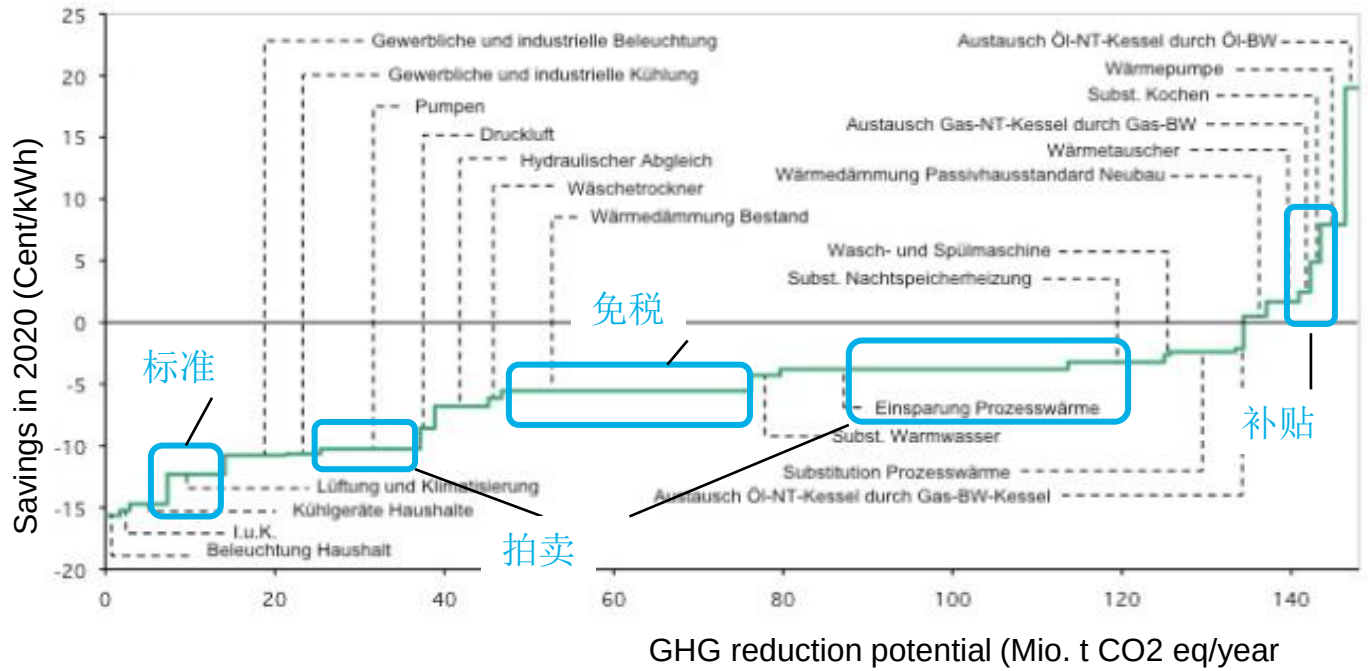
auctions (open or specific) could adress a wide range of measures,

effciency standards have profen effective for e.g. appliances (e.g. refrigerators), and

sometimes financial support might be needed (for higher cost measures).

针对不同措施的对应工具

效率成本曲线 – 示意图



伍珀塔尔研究所 (2011), Pehnt (2014)

提升能效措施需要克服众多挑战，因此需审慎考量针对不同措施应使用何种工具。

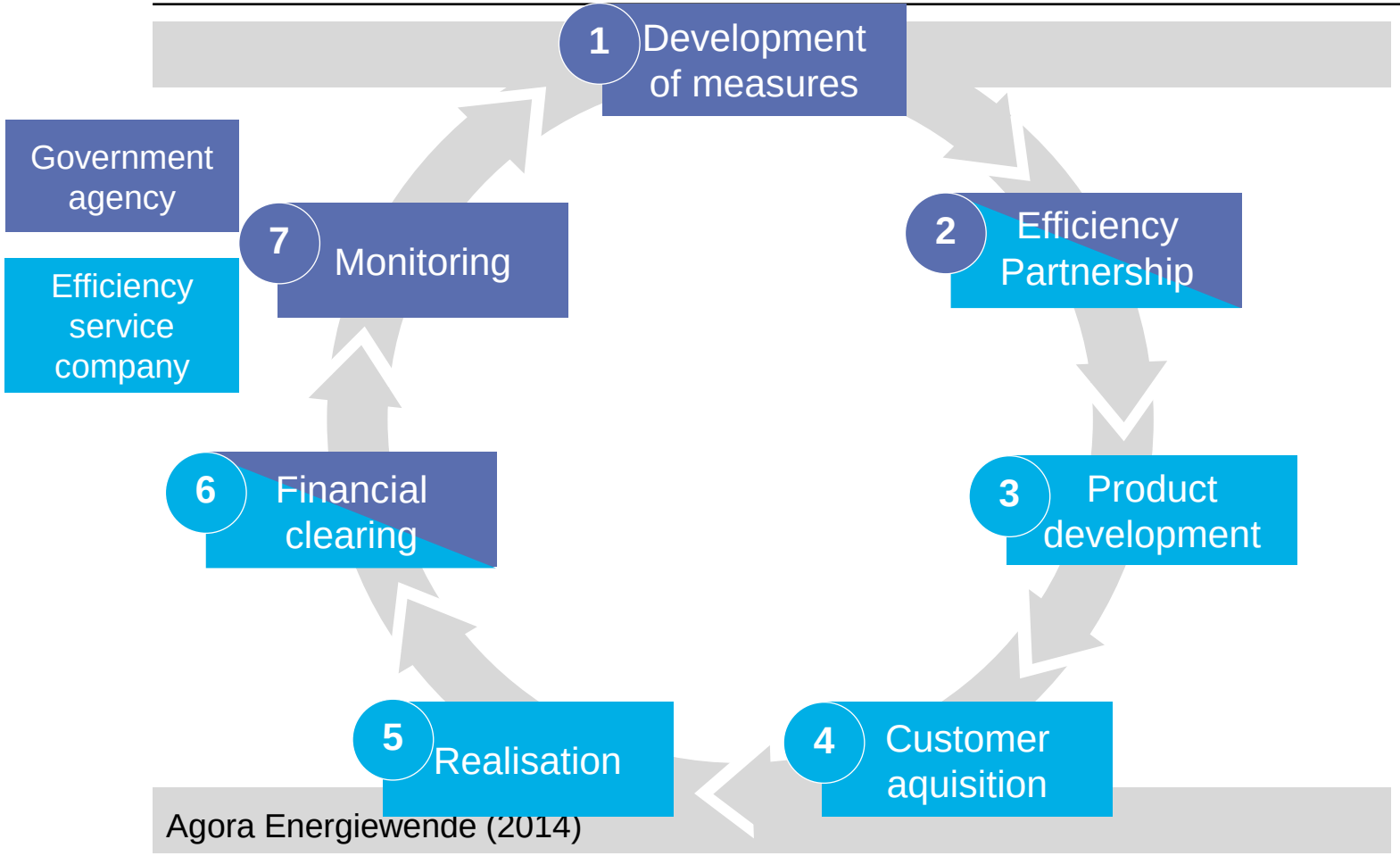
建筑改造适用免税手段，

拍卖（公开或特定）适用于多项措施，

事实证明，效率标准对电器（例如冰箱）行之有效，

有些情况下，可能需要财政支持（针对高成本措施）。

An example for a business model for energy efficiency: Efficiency auctions and partnerships



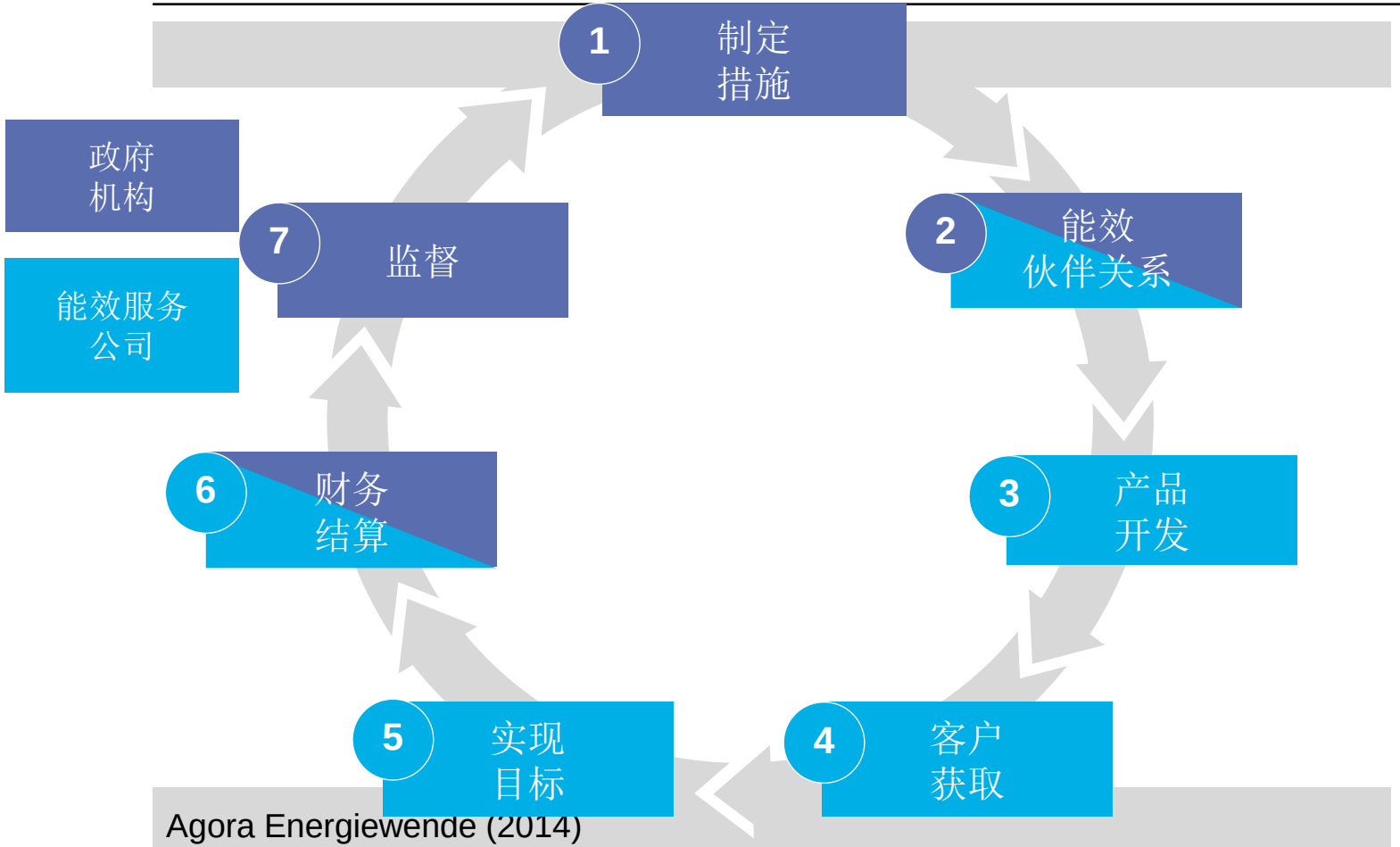
Efficiency auctions have been tested successfully (e.g. Vermont/USA).

Government agency developes and auctions the measure (e.g. exchange of X heating systems in private homes in 2015/2016). Efficiency service companies apply (proposing price and product).

Those companies awarded the contract, realise the product in cooperation with partners. They usually receive two streams of revenues – from the customer and from the gov‘t agency.

Other potential models include fonds to finance efficiency measures or obligations for e.g. utilities to save efficiency.

能效商业模式案例：
效率拍卖与合作伙伴



实践证明能效拍卖成功可行
例如美国佛蒙特州。

政府负责制定和拍卖能效措施（例如2015/2016年家庭X供暖系统交换）。能效服务公司提出申请（价格和产品价格提议）。

中标公司与合作伙伴共同生产。收入通常来自客户和政府。

其他潜在模式包括融资效率措施
和义务，例如效率节约公共事业机构

Options of financing

The question of financing is obviously important. How does the government raise the funds needed to overcome the hindrances of efficiency measures? In Germany, the following options are discussed:

- ⇒ state budget (without reciprocal financing), e.g. KfW funds
- ⇒ state budget (including reciprocal financing via energy taxes)
- ⇒ tax exemptions, e.g. for retrofitting buildings
- ⇒ revenues from emissions trading
- ⇒ levies/ surcharges, e.g. efficiency fee, increasing grid tariffs or CHP surcharge
- ⇒ private capital.

A mix of different financing options will best be applied. In Germany, a mixture of state budget, emissions trading revenues and private capital exist. Tax exemptions and surcharges are under consideration.

融资方式

融资问题显然至关重要。政府该如何筹集足够资金以克服效率措施中的难关？德国讨论过以下几种方式：

⇒ 国家预算（不包括互惠融资），例如由复兴信贷银行提供资金

⇒ 国家预算（包括能源税形式的互惠融资）

⇒ 免税，例如建筑改造

⇒ 来自排放权交易的收入

⇒ 税收/附加费，例如效率费，提高电价或热电联产附加费

⇒ 私人资本。

建议运用混合融资方式。在德国，国家预算、排放权交易收入以及私人资本共存。免税和附加费方式则正在考虑中。

National Action Plan on Energy Efficiency (NAPE)

- **Government committed in its coalition agreement** to adopt an efficiency strategy (NAPE) during current legislative period
- **Adopted December 2014** together with **Climate Action Programme 2020**
- To set out an **Energy Efficiency Strategy of German Government** for the 18th legislative term
- To be **implemented until end of 2016**
- To meet **national and European energy efficiency targets**
- To implement the **EU Energy Efficiency Directive** (EED) and to meet **climate protection targets**
- **Energy efficiency platform:** relevant actors from business and industry, civil society and scientific community to develop joint strategies to raise energy efficiency in Germany

国家能效行动计划 (NAPE)

- **政府在联合协议中承诺，**在本届立法期限内通过一项能效战略法案 (NAPE)
- **2014年12月通过，同时通过2020气候行动计划**
- 着手制定18届立法期限的**德国政府能效战略**
- **2016年年底前执行**
- 实现**国家能效目标以及欧洲能效目标**
- 执行**欧盟能效指令**（EED），实现**气候保护目标**
- **能效平台：**为提高德国能效，来自商业、工业、民间团体以及科学界的相关参与者将共同制定联合战略。

Short-term measures planned by current government under NAPE

Planned short-term efficiency measures in Germany

Measure	Expected savings until 2020	
	Primary Energy Use (PJ)	Greenhouse gas emissions in t/CO2
Quality assurance and optimizing existing energy advice	4.0	0.2
Granting tax incentives for energy efficiency renovations	40.0	2.1
Upgrading the CO2 building renovation programme	12.5	0.7
Introduction of a competitive tendering scheme	26-51.5	1.5-3.1
Funding for energy performance contracting	5.5-10	0.3-0.5
Upgrading KfW energy efficiency programmes	29.5	2.0
Energy efficiency networks initiative	74.5	5.0
Top runner strategy – at national and EU level	85.0	5.1
Energy audit obligation for non-SMEs	50.5	3.4
National energy efficiency label for old heating installations	10.0	0.7
Additional short-term measures	About 10	About 0.5
Total	350-380	21.5-23.3

Government proposal (NAPE), December 2014

In order to meet the 2020 climate target of -40% GHG against 1990, German government in Dec. 2014 adopted a list of additional efficiency measures

The 11 most relevant measures save between 350 and 380 PJ and 21.5 to 23.3 Mio t/CO2 until 2020.

No single measure can deliver large quantities of savings – it is rather the sum of lots of small efforts that sum up to the numbers.

本届政府在NAPE框架下规划的短期措施

德国规划的短期效率措施

措施	预期至2020年总节约量	
	一次能源消耗量 (千万焦)	温室气体排放量 t/CO2
保证质量并优化现有能源战略	4.0	0.2
对能效改造项目提供税收优惠	40.0	2.1
升级二氧化碳建筑改造项目	12.5	0.7
引入竞争性招标方案	26-51.5	1.5-3.1
向高效能承包项目提供资金	5.5-10	0.3-0.5
升级德国复兴信贷银行能效项目	29.5	2.0
能效网络计划	74.5	5.0
国家及欧盟层面的领跑者战略	85.0	5.1
非中小型企业的能源审计责任	50.5	3.4
为老旧供暖设备加贴国家能效标识	10.0	0.7
额外短期措施	约10	约0.5
总计	350-380	21.5-23.3

Government proposal (NAPE), December 2014

德国的气候目标是2020年温室气体排放量较1990年减少40%。为实现此目标，政府于2014年12月采纳了一系列额外效率措施。

11项相关措施，预计到2020年节约350-380拍焦耳，2105-2330万吨二氧化碳。

单项措施并不能节约大量能源——能源节约依托的是众多小项目总和。

New tendering system for energy efficiency

- Pilot project for a **competitive tendering scheme in electrical efficiency** (STEP up!)
- **To let market search** for most cost-efficient, feasable savings potenial
- Tendering procedure to motivate energy service providers, municipal utilities, energy cooperatives, manufacturers and others **to offer cost-effective measures to save energy**
- **Open tender:** to promote electricity-related measures across technologies, actors and sectors
- **Closed tenders:** to address specific sectors with known large potentials and constraints, e.g. replacement of heating pumps, incl. hydraulic balancing, power-heat measures in industry, green IT
- Contract to be awarded to bids with measures with most economic cost-benefit ratio (euro per saved kWh)
- **Implemention:**
  - As of 2015, pilot phase for competitive tendering scheme in electrical efficiency, planned funding in 2015: EUR 15 million, 2016: EUR 50 million, 2017: EUR 100 million, 2018: EUR 150 million
  - As of 2018, continuation and upgrading based on evaluation, possible extension to measures in heating sector, an earlier promotion of heat measures will be considered

新能效招标系统

- **电力效率竞争性投标方案**的试点项目（大步向前！）
- **由市场选择**最经济高效可行的节约方案
- 招标程序激励能源服务供应商、市政公共事业机构、能源企业、制造商和其他机构**提供高成本效益措施，达到节能目的**
- **公开招标：**在不同技术、主体以及行业领域推广电力相关措施
- **非公开招标：**面对拥有巨大潜力但饱受限制的特定领域，例如供热泵更换，包括液压平衡、工业电热措施以及绿色信息技术
- 中标者需提供具有最经济成本收益率的措施（节约每度电的欧元金额）
- **执行：**
  - 电力效率竞争性招标方案于2015年进入试点阶段，预计资金：1500万欧元，
    2016年：5000万欧元，2017年：1亿欧元，2018年：1.5亿欧元
  - 至2018年，维持并根据评估相应升级，极有可能扩展至供热部门措施，同时亦会考虑是否提早推广供热措施

Some conclusions

1. The potential for energy efficiency is enormous – even in a country like Germany that is among the most efficient in the world. Realising the potential would bring about significant system benefits and save money.
2. Although most efficiency measures would be cost-effective in the long run, a variety of reasons prevents them from being realised.
3. Therefore, the state has to play a central role to provide information, finance and a long-term perspective. The realisation of efficiency measures should be left to market participants (e.g. efficiency service companies), however.
4. The challenge is to develop a business model that allows a clever interaction of state and companies. Efficiency partnerships are one solution.

结论

1. 德国以高能效而著称，其能效提升潜力巨大。挖掘潜能将带来显著的系统效益，并节省巨额资金。
2. 尽管大部分能效措施长远来看具有高成本效益，但是出于种种原因，这些措施并未执行。
3. 因此，国家在提供信息、资金和长期视角方面须扮演重要角色。效率措施则应由市场主体执行（例如能效服务公司）。
4. 然而，现在面临的挑战是该如何建立商业模式，实现国家与企业间的良性互动。效率伙伴关系是解决方案之一。

Global Experiences for Efficiency First

1. Express Efficiency First objective(s) to recognize system value of end-use efficiency
2. Engage key government institutions/agencies in an ongoing “living” EF roadmap to reach the objectives
3. Ensure that sustainable and sufficient sources of EF public funding will be available
4. Identify and remove disincentives to energy efficiency still reflected in current regulations
5. Monitor effectively and transparently progress
    - Including best practices for measurement and verification
6. Help further (and not hinder) achieving EF objectives via binding energy law/regulations

节能创优全球经验

1. 制定能效目标，认识终端能效的系统价值
2. 主要政府机构/组织纷纷实施"生活"能效路线图以达成目标
3. 确保提供持续充足的能效公共资金支持
4. 识别并消除现行法规中尚存的阻碍能效提升的不利因素
5. 有效、透明地监测进展
   - 包括测量和核查方面的最佳实践
6. 通过有约束力的能源法律/法规，助力（而非阻碍）实现能效目标

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RAP - Suggestions for China

- Treat demand-side and supply-side resources on an equal basis;
- Recognize the benefits of demand side resources, which are usually much cleaner and less expensive than traditional supply-side resources
- Recognize importance of some basic elements:
  - mechanisms to value and compensate energy efficiency/demand side resources
  - rationalized process to adjust retail prices (reflecting system costs)

睿博能源智库-对中国的建议

- 平等对待需求侧和供应侧资源；
- 认识需求侧资源的益处，需求侧资源通常比传统的供应侧资源更清洁、更具成本效益
- 认识一些基本要素的重要性：
  - 评价和补偿能源效率/需求侧资源的机制
  - 调整零售价格的合理化流程（反映系统成本）

RAP Publication on Energy Efficiency

Germany: Wege zu einem effizienten Energiesystem in Deutschland
http://www.raponline.org/document/download/id/7796

Europe:
Efficiency First: Key Points for the Energy Union Communication
http://www.raponline.org/document/download/id/7507

Unlocking the Promise of the Energy Union: "Efficiency First" is Key
http://www.raponline.org/document/download/id/7401

Global:
Low-Carbon Power Sector Regulation: International Experience from Brazil, Europe, and the United States
http://www.raponline.org/document/download/id/7432

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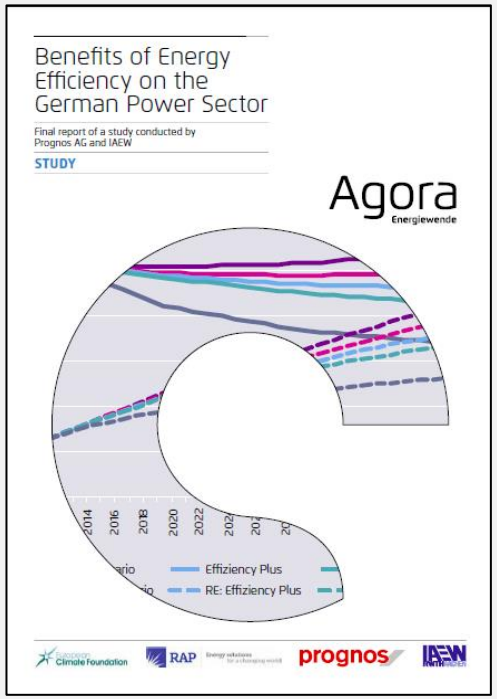

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Thank you for your attention!

谢谢关注！

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Agora Energiewende is a joint initiative
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Back up

参考数据

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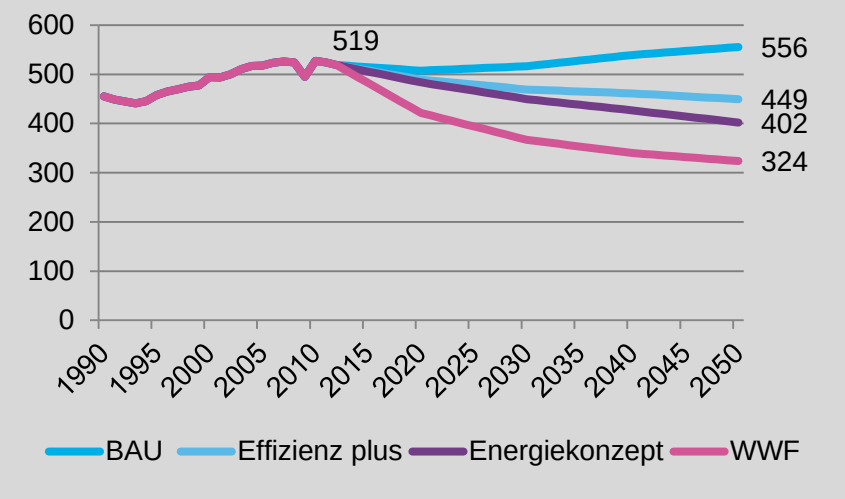
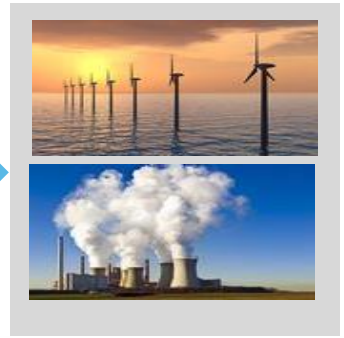
Scope and approach of work



4 development paths for German electricity system with different levels of electricity consumption:

> Time horizon up to 2050
> Comparison of BAU scenario with three efficiency scenarios



Calculating the costs of electricity production:

> Conventional power plants
> Renewable Energies

Calculating the costs of electricity distribution:

> Transmission networks
> Distribution networks

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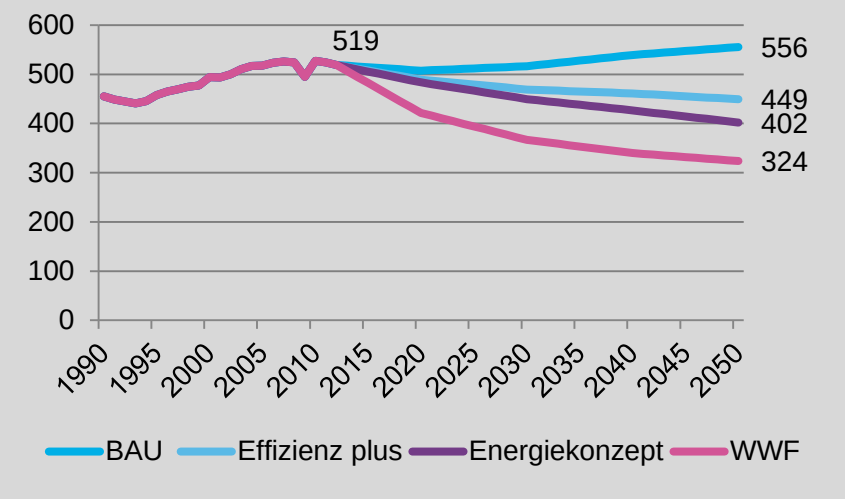
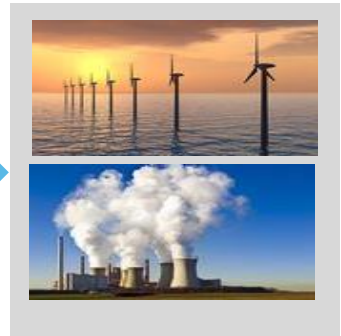
工作方法与范围



德国电力系统4种发展路径（不同水平耗电量）：

> 时间跨度至2050年

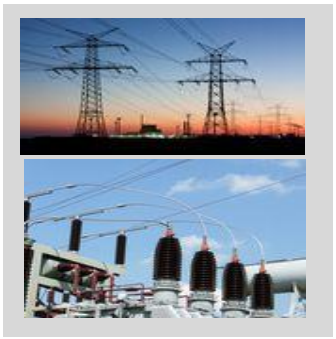
> 三种能效情景分别与常规情形作比较



计算发电成本：

> 传统电厂

> 可再生能源



计算配电成本：

> 输电网络

> 配电网络

Key data of the scenarios

	BAU	Referenz	Effizienz plus	Energie-konzept	WWF
Efficiency development					
Energy productivity growth (GDP/Primary energy consumption)	1,2 - 1,3 %/a	1,7 - 1,9 %/a	2,0 - 2,2 %/a	2,3 - 2,5 %/a	2,6 %/a
Annual change in electricity consumption	+0,3 %/a	-0,1 %/a	-0,3 bis -0,4 %/a	-0,6 %/a	-0,9 %/a
Total change in electricity consumption by 2050 (relative to 2011)	+7 %	-5 %	-10 bis -15 %	-20 bis - 25 %	-40 %
Total change in electricity consumption by 2050 (relative to 2011)	+37 TWh	-22 TWh	-69 TWh	-117 TWh	-195 TWh
E-Mobility (values 2050)					
Share of e-vehicles (passenger cars)		36 %		55 %	46 %
Number of e-vehicles		17 Mio.		25 Mio.	21 Mio.
Electricity consumption of e-vehicles (TWh)		34 TWh		53 TWh	28 TWh

RAP Regulatory Assistance Project

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不同情景的关键数据

	常规情形	参考数据	效率+	能源概念	WWF
效率发展					
能源生产率增幅 (国内生产总值/一次能源消耗量)	1,2 - 1,3 %/a	1,7 - 1,9 %/a	2,0 - 2,2 %/a	2,3 - 2,5 %/a	2,6 %/a
耗电量年变化	+0,3 %/a	-0,1 %/a	-0,3 bis -0,4 %/a	-0,6 %/a	-0,9 %/a
到2050年耗电量总变化 (相对于2011年)	+7 %	-5 %	-10 bis -15 %	-20 bis - 25 %	-40 %
到2050年耗电量总变化 (相对于2011年)	+37 TWh	-22 TWh	-69 TWh	-117 TWh	-195 TWh
电动交通 (2050年数值)					
电动汽车份额 (乘用车)		36 %		55 %	46 %
电动汽车数量		17 Mio.		25 Mio.	21 Mio.
电动汽车耗电量(TWh)		34 TWh		53 TWh	28 TWh

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