Study of Energy Conservation Policies in Germany

Energy Research Institute of the National Development and Reform Commission

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Foreword

Germany is one of the most energy-efficient countries in the world, with its energy consumption per unit of GDP about only a quarter of that of China. In 2008, Germany became the first country in the world to propose its Energy Transition policy, taking the lead in carrying out substantive work on global energy transition, and playing a leading and exemplary role in terms of energy transition and CO2 emission reduction.

The German government has proposed the “20-20-20” targets, a 20 percent reduction in CO2 emissions by 2020 compared to 2008, a 20 percent reduction in total primary energy consumption compared to 2008, and a 20 percent share of renewable energy in primary energy consumption, the first national goal in human history to reduce total energy consumption, which is ambitious and admirable. Thanks to years of hard work, Germany's total energy consumption has dropped significantly, providing strong support for CO2 emission reduction.

Germany's energy conservation policy has further increased its requirements on top of the European Commission's CO2 emission reduction and energy conservation policy objectives, by further clarifying energy saving obligations for companies and consumers with the help of energy saving laws and regulations on one hand, and incentivizing energy consuming entities to improving energy use efficiency through various energy conservation policies at national, state and municipal levels on the other. Different from China's approach to promoting energy conservation, Germany's energy conservation policy pays more attention to the use of market-oriented means, with special emphasis on the role of publicity, encouragement and guidance.

This report sorts out the energy conservation law and regulation system, the energy conservation obligations and the key energy conservation policies in Germany, evaluates the significance of German energy conservation policies for China’s reference, and on this basis, proposes policy recommendations to further improve China's energy saving systems and policies.

Study of Energy Conservation Policies in Germany

ⅠEnergy conservation policies in Germany

i European Union’s energy saving & carbon reduction requirements and reward/penalty measures for Germany

As a member of the EU, Germany has to ensure its energy conservation policies comply with the EU’s legal system for energy saving and carbon reduction.

The EU has formulated a series of laws to promote energy conservation and low carbon, including the EU Energy Efficiency Directive, the EU Energy Performance of Buildings Directive, the Climate Protection and Energy Directive and Target Package, and the 2030 Climate and Energy Framework. The EU has set a “20-20-20” target to achieve a 20 percent cut in greenhouse gas emissions by 2020 from 1990 levels, a 20 percent increase in the proportion of renewable energy, and a 20 percent improvement in energy efficiency, which plays an important and positive role in pushing Europe’s energy transition and a stronger response to climate change.

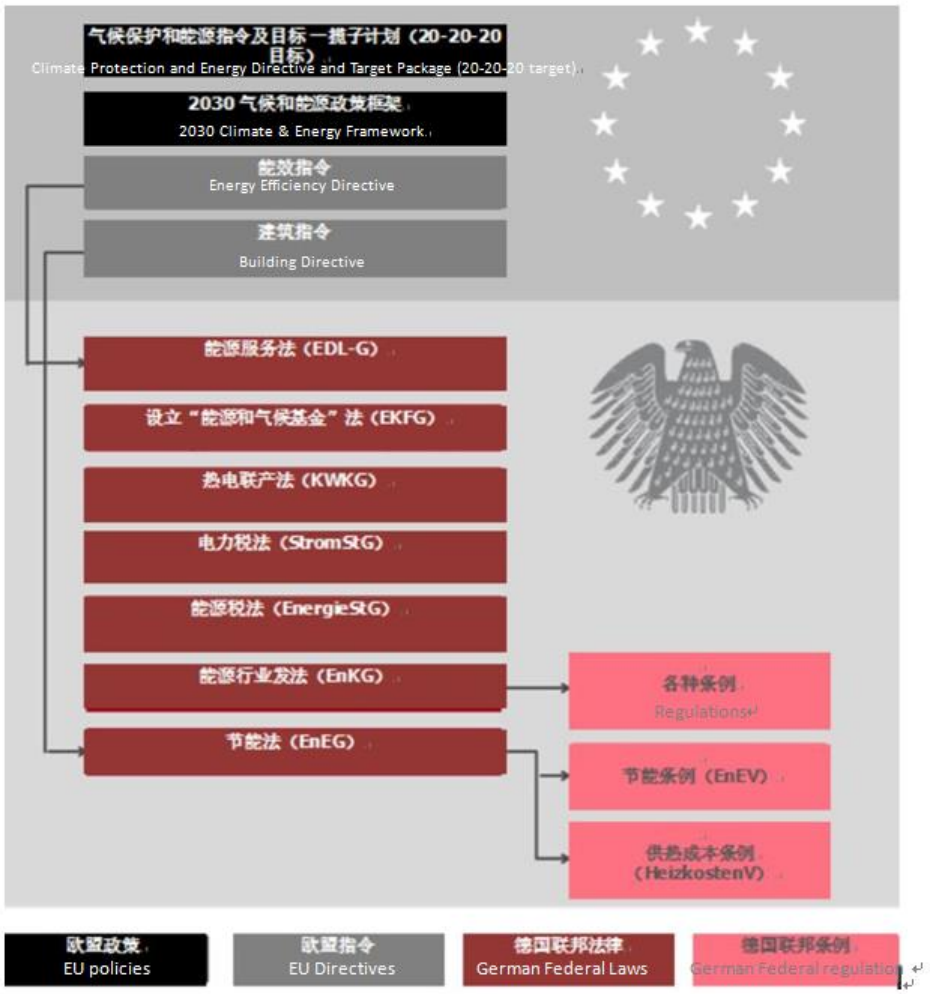


Figure 1 Germany’s legislative framework of energy conservation
Source: Research report titled Providing Economic Incentives and Promoting Energy Efficiency Improvement

In order to fulfill legal requirements e.g. the EU Energy Efficiency Directive, etc., the German government has formulated its Energy Service Act, CHP-Act, Electricity Tax Act, Energy Tax Act, Energy Industry Act, Energy Conservation Law, etc. Germany's energy efficiency laws impose legal requirements for energy saving and energy efficiency improvement on German companies and households (as shown in Figure 1). The German government has also developed Energy Conservation Regulations based on its Energy Conservation Law, to support more detailed implementation of the law.

The EU regularly assesses its members’ energy saving targets. Should a

member fail to achieve its targets defined by EU laws within the set period of time, the European Commission would impose a daily fine on this member until the correction is completed.

ii Energy saving status, objectives and management approach in Germany

Germany puts energy saving at an important position in its development. The German government has pushed for the development of high standards for national energy conservation and formulated a series of policies to promote energy conservation.

1. Energy transition and the status of energy saving in Germany

In June 2011, the German parliament made the decision of Energiewende, pledging to completely shift its reliance on nuclear and coal for electricity to renewable energy in the next 40 years. Figure 2 shows the Energiewende targets proposed by Germany, in which GHG emissions in 2020 will be 40 percent lower than 1990 levels, and the ratio of renewable energy to end energy consumption will increase to 18 percent. In terms of energy conservation and energy efficiency, the goal is to reduce primary energy consumption by 20 percent in 2020 compared to 2008, and by 50 percent in 2050.

Share of renewable energy (%)　　Energy efficiency objective (%)

年份 Year	温室气体减排(%) GHG emission reduction (%)	可再生能源占比(%)		能源效率目标(%)			
		最终能源消费 Final energy consumption	发电量 Power generation	一次能源消费 Primary energy consumption	供热 Heating	交通终端能耗 Final energy consumption by transport	用电量 Power consumption
2020	-40	18	35	-20	-20	-10	-10
2030	-55	30	50				
2040	-70	45	65				
2050	-80~-95	60	80	-50	-80	-40	-25
基准年 Reference year	1990			2008	2008	2005	2008

Figure 2 Germany's Energiewende objectives
Source: Energy Transition Strategy in Germany and its Enlightenments, Zhang Bin, China Power Enterprise Management, August 2014

Germany believes that three aspects should be worked on to achieve

energy transition: Firstly, the demand for energy must be distinctly and sustainably reduced in all sectors (“Efficiency First”). Fossil energy consumption should be significantly reduced through investment in energy conservation, so that the remaining energy demand can be largely covered by renewable sources; secondly, the direct use of renewable energies, including solar, geothermal and biomass energy without converting them to power. Thirdly, renewable power is used efficiently for heat, transport and industry, replacing fossil fuels with power (for example, in heating pumps and electric vehicles), or converting power into other energy sources such as hydrogen.

The initial priority of Germany’s Energiewende strategy was to phase out the use of nuclear energy whilst developing power generating capacities from renewable energies and at the same time meeting the requirement for infrastructure (for example, networks, storage facilities) and giving consideration to the needs of conventional power producers.

Germany believes that improving energy efficiency is the second largest pillar driving its energy transition next to renewable energies. In order to achieve Germany’s energy transition goals, BMWi formulated the Green Paper titled National Action Plan on Energy Efficiency in December 2014, which pays more attention to energy saving against the backdrop of increasingly higher cost for developing renewable energies in the entire society and the fact that energy saving and energy efficiency improvement can effectively lower energy cost for companies and residents. Currently, the fossil energy consumed in Germany is mostly imported. In 2013, Germany's annual energy import expenditure reached 92 billion euros, while the total annual energy consumption in Germany was 356 billion euros. Therefore, improving energy efficiency is also one of Germany's measures to reduce dependence on imported energy.

The German Federal Government has realized that there is still enormous potential for energy saving and efficiency improvement in Germany. Germany has very few large companies. Over 99 percent of the country’s industrial companies are SMEs. Surveys show that German SMEs have huge potential, usually above 25 percent and as high as 70 percent in some sectors (as shown in Figure 3), in terms of retrofitting with general

energy saving technologies. Realizing this potential through energy saving and efficiency improvement will help German companies lower production costs and improve their competitiveness.

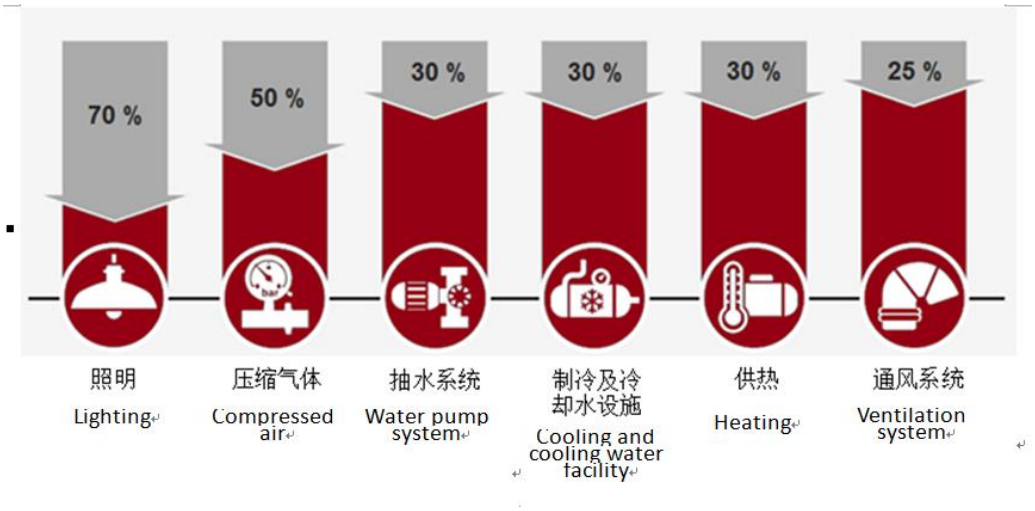


Figure 3 Average energy efficiency potential of industrial companies in Germany in generic technologies

Source: dena, Initiative EnergieEffizienz 2015

Energy saving and improving energy efficiency can bring multiple benefits for Germany:

Firstly, energy saving is an important measure for the German government to implement the national energy conservation obligations stipulated in the EU Energy Efficiency Directive. As a member of the EU, Germany is obliged to push for concrete implementation of energy saving and energy efficiency activities in accordance with EU requirements.

Secondly, from a national perspective, energy saving and energy efficiency are important components of domestic and international development goals. In terms of domestic demand, energy saving and energy efficiency are the key steps that determine the success of Germany's energy transition. In terms of international demand, energy saving and energy efficiency will play a decisive role in Germany's implementation of the climate change targets set in the Paris Agreement.

Thirdly, from the perspective of residents and companies, improving efficiency is the most economical and effective solution, because saving energy can reduce energy losses in the process of energy production, storage

or transmission, and users do not have to pay for any of these saved energies.

Fourthly, Germany views energy efficiency measures as an important business opportunity and a growth point for technological innovation. In Germany, the ROI for SMEs in energy efficiency investment is about 20 percent to 25 percent. Therefore, energy saving and energy efficiency improvement projects have a higher return on investment than other projects in Germany. In the long run, energy saving projects enjoy higher profit margins.

The starting point and focus of Germany's energy conservation policy design is a holistic planning of energy development from the long-term development of the entire energy system. The German government believes that the Efficiency First principle should become a strategic planning tool for the energy system. If the planning for energy system development is oriented towards energy production without ample consideration of impacts from energy conservation, or if the planning and implementation fail to take into account potential reduction in energy demand in the future, it is likely to create the risk of infrastructure overbuilding. Due to the long investment cycle and the large amount of capital involved in investments on energy sector, it is very difficult to change directions once they are determined, bringing critical consequences of wasting a huge amount of social capital. Therefore, energy conservation and energy efficiency must be made an important prerequisite for planning the development of future energy systems. Close attention should be paid to the comprehensive economic cost of the energy system when designing and creating the energy supply system, in particular, capital investment and costs for energy saving should be included when estimating energy investment and costs.

2. Overall and sector-specific objectives of energy saving in Germany

Figure 4 shows the whole process of consumption from primary energy to end energy in Germany, which is the basis for the country to set goals for energy saving and energy efficiency. As can be seen from the figure, in 2014, 13,132 PJ primary energy was converted to 8,648 PJ end energy in Germany, with an energy efficiency of 65.9 percent. Energy conversion losses were 3,482 PJ, accounting for about 1/4 of the primary energy consumption. The

transport sector consumed 2,629 PJ of energy, and the industrial sector 2,508 PJ, ranking second. Energy consumption in households was 2,212 PJ, ranking third, and the energy consumption in trade, commerce and services sector was 1,298 PJ, ranking fourth. It can be seen from the energy consumption mix in Germany that its industrial energy use only accounted for 29.0 percent in the total.

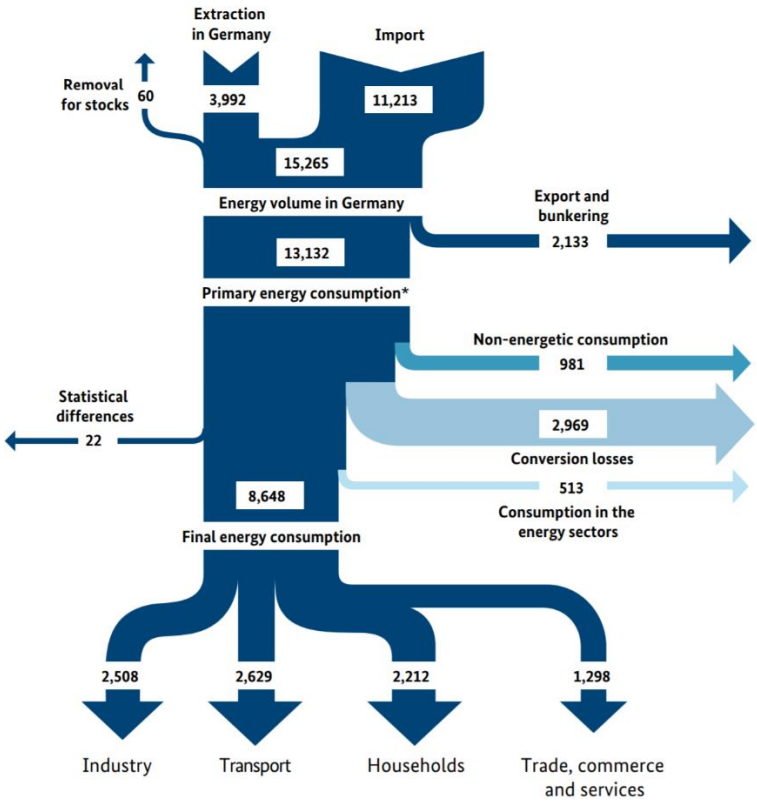


Figure 4 Germany's energy consumption overview in 2014
Source: Federal Ministry for Economic Affairs and Energy (BMWi) Germany, Green Paper on Energy Efficiency

Indicator	Target 2020	Target 2050	Level of implementation 2014
Primary energy consumption (compared with 2008)	-20 %	-50 %	-8.3 %
Gross electricity consumption (compared with 2008)	-10 %	-25 %	-4.2 %
Final energy productivity		2.1 % per annum (2008 – 2050)	1.6 % per annum (Average 2008 – 2014)
Primary energy consumption in buildings (compared with 2008)	–	in the magnitude of -80 %	-14.8 %
Heat consumption in buildings (compared with 2008)	-20 %	–	-12.4 %
Final energy consumption in transport (compared with 2005)	-10 %	-40 %	+1.1 %

Source: The Energy of the Future: Fourth "Energy Transition" Monitoring Report, updated.

Figure 5 Germany's specific targets for energy saving and efficiency improvement
Source: Federal Ministry for Economic Affairs and Energy (BMWi) Germany, Green Paper on Energy Efficiency

The energy saving and energy efficiency improvement objectives for Germany's Energiewende strategy are shown in Figure 5, and specifically as follows:

1. Compared with 2008, primary energy consumption down by 20 percent in 2020, 50 percent in 2050

2. Compared with 2008, gross electricity consumption down by 10 in 2020, 25 percent in 2050

3. Compared with 2008, primary energy demand in buildings down by 80 percent in 2050

4. Compared with 2008, heat energy consumption in buildings down by 20 percent in 2020

5. Compared with 2008, final energy consumption in transport down by 10 percent in 2020, 40 percent in 2050.

The German government has estimated the reduction of primary energy consumption GHG emission that can be achieved after implementing the German National Action Plan on Energy Efficiency (NAPE). According to its analysis, besides measures taken in the transport sector, through energy efficiency measures planned in the NAPE, by 2020, the primary energy consumption in Germany is expected to decrease 390 PJ to 460 PJ, and the CO2 emission reduction is expected to reach 25 million tons to 30 million tons (as shown in Figure 1). Energy conservation measures in the transport sector

are included in the Climate Action Programme 2020, which are expected to reduce primary energy consumption by 110 PJ~160 PJ and GHG emissions by 7 million ton~10 million ton carbon dioxide equivalent.

Measures	**Energy savings estimate by 2020**	
	Primary energy consumption (PJ)	**GHG emission reduction (MtCO2e)**
Energy saving measures included in NAPE		
Quality assurance and optimizing of energy consulting	4.0	0.2
Promoting energy efficiency retrofit through tax breaks	40.0	2.1
Continued development and study on building energy efficiency retrofit programme targeting CO2 emission reduction	12.5	0.7
Introduction of a competitive tendering scheme for energy efficiency	26–51.5	1.5–3.1
Measures to encourage energy performance contracting (including loss guarantee and EPC)	5.5–10	0.3–0.5
Further development of the KfW energy efficiency project	29.5	2.0
Energy Efficiency Networks initiative	74.5	5.0
Top Runner Strategy – at the national and EU level	85.0	5.1
Energy audit obligation for non-SMEs	50.5	3.4
National energy efficiency label for heating equipment	10.0	0.7
Other immediate measures included in the NAPE:	Approx. 10	Approx. 0.5
Energy saving measures total	**350－380**	**21.5－23.3**
Other measures		
Measures implemented from October 2012	43.0	2.5
Provisional estimate of effect from subsequent efforts	Less than or equal to 40	Less than or equal to 4
Total	**390－460**	**Approx. 25－30**
Measures adopted by the transport sector (see Climate Action Programme 2020)	*110－162*	*7－10*

Table 1 Expected effects of the NAPE

Source of information: Fraunhofer ISI/IFAM; Prognos, Ifeu, Ringel, 2014

3. Ideas behind and the general framework of Germany's energy conservation policies

When formulating energy conservation policies, the German government

follows the principles of legal requirements - incentive policies - provision of information. Any energy conservation policies are developed in accordance with these three principles, (as shown in Figure 6), which are also known as “carrots, sticks and tambourines” model (as shown in Figure 7). They are the basic idea behind energy conservation policies development in Germany.

Legal requirements (e.g. regulations, specifications)	Incentive policies (e.g. financial incentives)	Provision of information (e.g. information publicity, awareness improvement, etc.)
▪ No incentives	▪ Main approach for long-term market transformation	▪ Including key message approach

Figure 6 Three pillars of Germany's energy efficiency policies

Source: Research report titled Providing Economic Incentives and Promoting Energy Efficiency Improvement

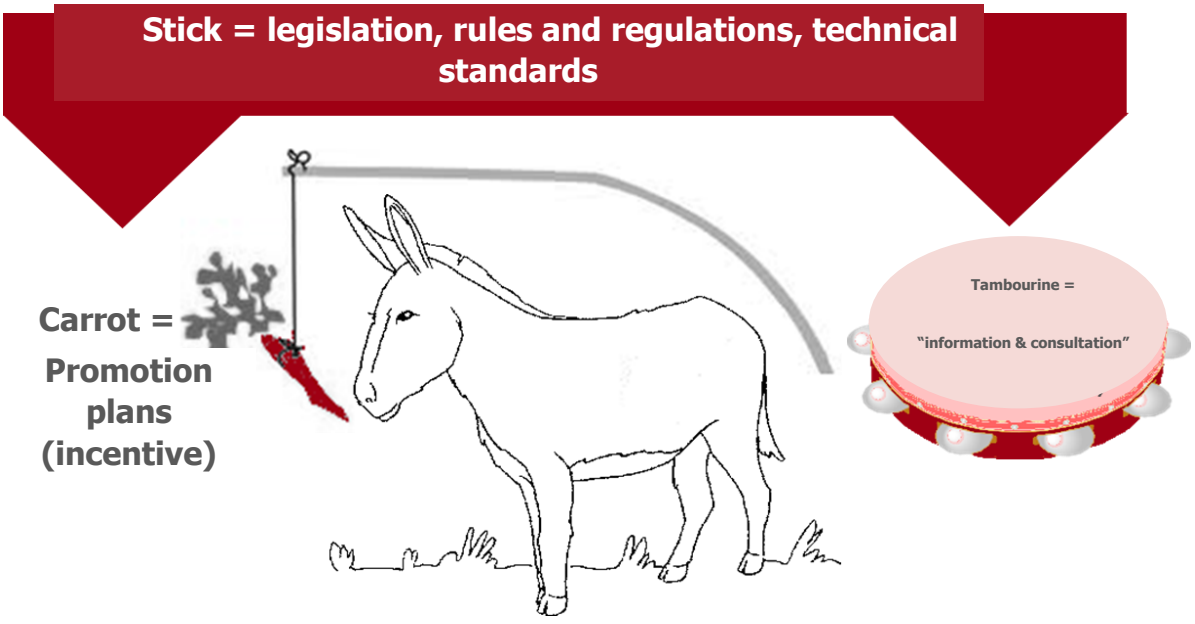


Figure 7 Incentives model of Germany’s energy efficiency policies: Carrots, sticks and tambourines

Source: Research report titled Providing Economic Incentives and Promoting Energy Efficiency Improvement

The German government believes that the foundation of energy policy is always information provision, communication and consultation services.

Information and consultation services enable all energy consumers to recognize the importance of saving energy and improving energy efficiency and the potential for energy savings, to better promote the effectiveness of other policy instruments, maximizing the potential for energy savings. Only individuals and companies provided with sufficient information can make decisions that improve energy efficiency and reduce energy costs in the long run. Proving subsidies and support policies dedicated to energy efficiency investments will encourage individuals and companies to continuously improve energy efficiency levels. The purpose of developing legal provisions is to ensure that individuals and companies meet the minimum energy efficiency levels stipulated by law, e.g. minimum energy efficiency regulations for new buildings, but is unable to arouse the enthusiasm of individuals and companies for energy conservation.

The German government finds it essential to ensure company and household consumers' voluntariness and cost-effectiveness in taking energy conservation measures. Therefore, it is essential to develop incentive systems and information services that meet policy requirements and are acceptable by the society. Such information can allow companies and households to select more targeted energy conservation measures.

Based on the above principles, the German government has developed energy efficiency policy instruments containing six aspects as follows: 1. Financial support, including direct subsidies and preferential loans for investment (mainly for energy-saving and low-carbon retrofit projects in the building sector); 2. Price and tax policies, mainly including energy tax, electricity tax, carbon tax, etc.; 3. Volume control policies, mainly including volume control limits or issuing GHG emissions permits, as well as market trading policies based on them; 4. Support for R&D, including development and demonstration of advanced energy saving and energy efficiency improvement technologies in all sectors. 5. Legal standard support that develops the minimum level to improve energy efficiency of new buildings, and set energy efficiency access criteria for transport vehicles. 6. Information consultation and services providing information on energy saving for companies, individual households and public institutions (federal, state and municipal levels) to help them investment decision-making conducive to

energy saving and energy efficiency improvement.

The NAPE developed by the German government is the energy efficiency strategy in the term of the 18th German Federal Government, with the purpose of providing framework and incentives for energy conservation and energy efficiency to fully tap the potential of energy conservation, minimize the cost of energy conservation, encourage all sectors of society to participate in energy saving actions and guide the whole society to participate in energy-saving and energy-efficient technological innovation and investment. The overall framework of Germany's NAPE is shown in Figure 8.

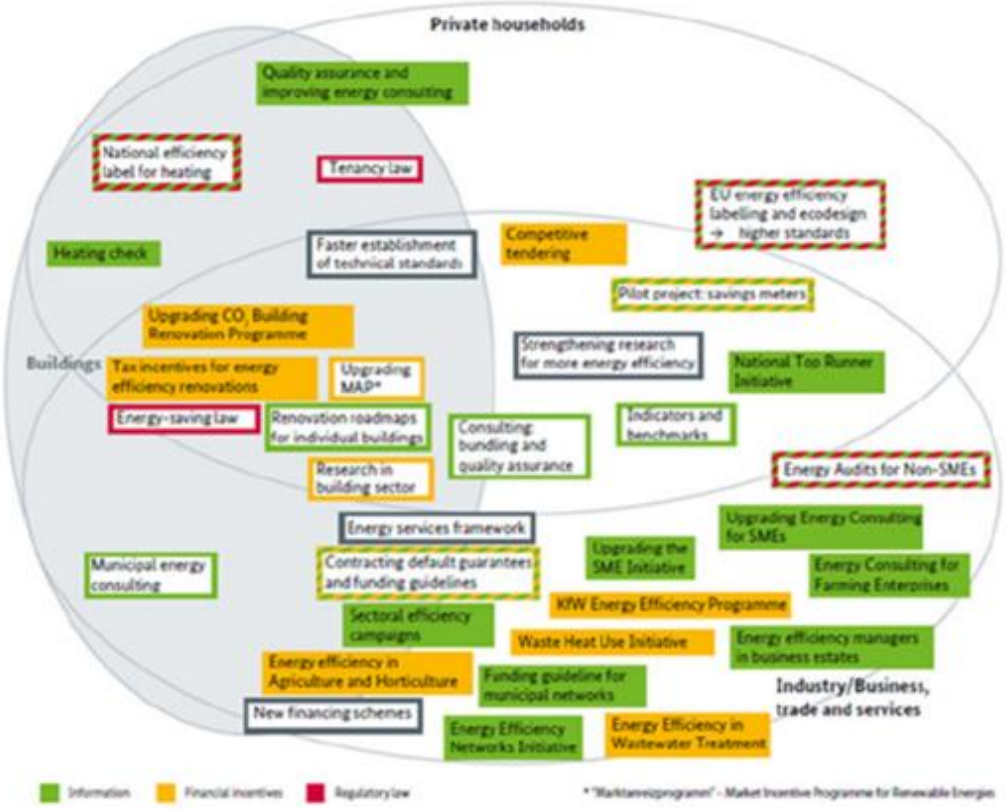


Figure 8 Overall structure of Germany's NAPE
Source: BMWi, NAPE

Germany's NAPE is primarily developed to establish cross-sector energy saving and energy efficiency policies, with three main pillars: firstly, improving energy efficiency in the building sector; secondly, promoting efficiency as a return on investment and business model in the future; and thirdly, enhancing the sense of responsibility for energy efficiency improvements among the

participants.

4. German authorities responsible for energy conservation

Governmental authorities that administer energy conservation in Germany can be divided into two types, namely national level (federal government) and state level authorities, which include governmental departments, affiliated public institutions, development banks and other organizations.

At the federal government level, the most important government agency is the Federal Ministry for Economic Affairs and Energy (BMWi) and the Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB), both of which are responsible mainly for developing energy saving incentives and budgets.

The Federal Office for Economic Affairs and Export Control (BAFA) is affiliated to BMWi and responsible for the implementation of the national plan. KfW Group is a development bank in Germany[1] which also takes part in the implementation of the national plan. Other organizations at the national level also include various non-governmental organizations (NGOs), associations and federations. In 2000, Germany established the German Energy Agency (dena).

The federal government-level energy incentives primarily serve individuals, companies, and municipalities to help them with energy saving (as shown in Table 2).

EU			
	Ministries and associated institutions	**Development banks**	**Other institutions**
National level (Bund)	▪ Federal Ministry for Economic Affairs and Energy (BMWi) ▪ Federal Ministry for the Environment, Nature Conservation, Building and Nuclear	▪ KfW Group	▪ German Energy Agency (dena) ▪ NGOs ▪ Associations and federations

[1] The KfW is owned by the Federal Republic of Germany (80 percent) and the State Governments of Germany (20 percent).

	Safety (BMUB) ▪ Federal Office for Economic Affairs and Export Control (BAFA)		
Federal States (“Länder”)	▪ Departments in Federal States	▪ Federal State banks (Landesbanken)	▪ Federal State energy institutions
Municipalities (Kommunen)			

Table 2 Institutions pushing energy saving in Germany

Source: Research report titled Providing Economic Incentives and Promoting Energy Efficiency Improvement

The 16 states of Germany enjoy a large degree of autonomy and have self-managed budgets. State governments and their institutions are responsible for developing their own energy saving and energy efficiency incentives. Each state also has its own executive department, including state-level banks, etc. Some regions have their own energy agencies that are responsible for implementing the state's energy conservation policies.

5. Implementation progress of energy saving objectives in Germany

In recent years, Germany has made certain progress, with its primary energy consumption has dropped significantly. From 2008 to 2014, Germany's primary energy consumption fell by 8.3 percent. However, there is deviation between the progress in energy saving and energy efficiency improvement in various final energy consumption sectors and the expected objectives. Among them, the energy consumption of the building sector has seen the largest decrease of 14.8 percent compared with 2008, mostly contributed by building heating consumption which is 12.4 percent lower than 2008. Germany’s electricity consumption target for 2020 is 10 percent lower than in 2008. The figure in 2014 was already 4.2 percent lower than 2008 levels. However, energy consumption in the transportation sector has risen by 1.1 percent compared to 2008, running in the opposite direction of the reduction targets in Germany’s Energiewende planning.

The German government estimates that the country’s current progress in energy saving and energy efficiency improvement is still lagging behind the

target of cutting primary energy consumption by half by 2050. Figure 6 is a multi-scenario analysis from different agencies based on Germany's actual progress and the likelihood of achieving its 2020 goals, which provides more detailed calculation of the current development trend and the gap from the 2020 primary energy consumption reduction objectives.

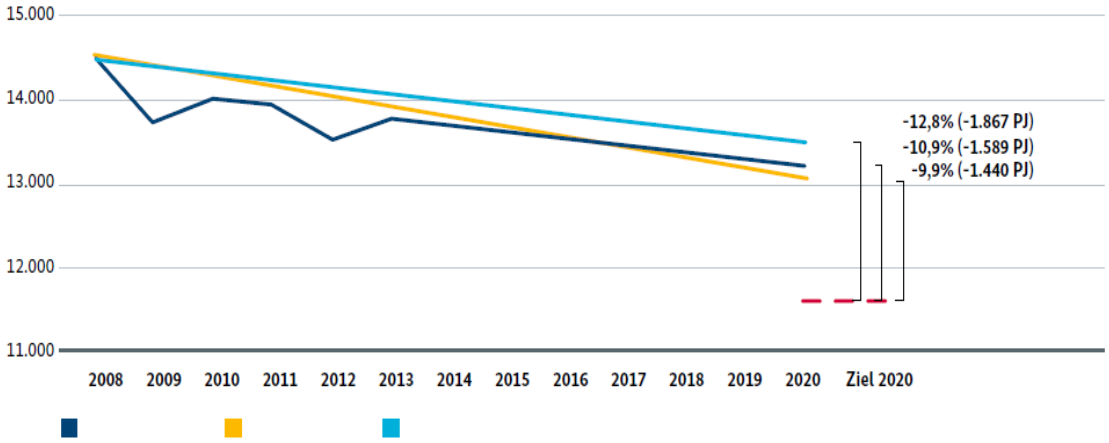


Figure 9 Comparison of multiple 2020 scenario analyses based on the current status-based development trend report, climate scenario analysis and trend forecast report, and the resulting gaps from the 2020 primary energy consumption reduction target

* The value after removing temperature factor (PJ)

* Based on statistics from 2008 to 2013 (2014 edition)

Source of information: Fraunhofer ISI/IFAM; Prognos, Ifeu, Ringel, Ziesing, 2014

Figure 7 shows the energy consumption trend extrapolation in recent years and the gap from 2030 energy transformation goal.

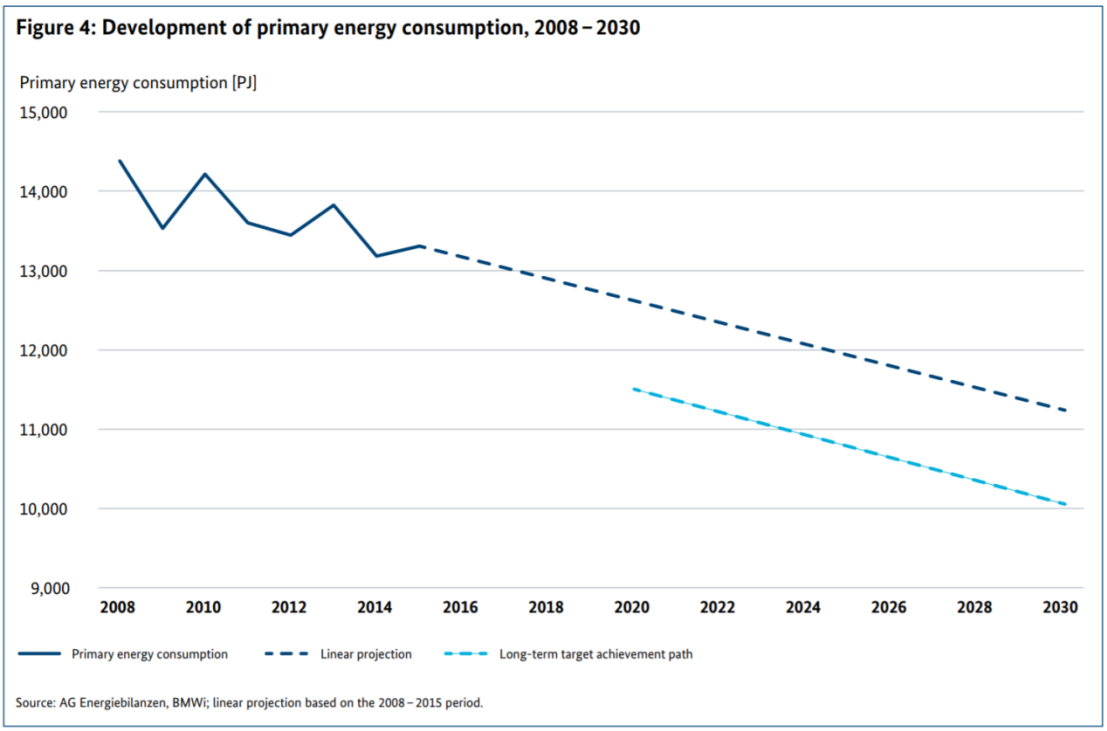


Figure 10 Germany's primary energy consumption trend outlook
Source: Federal Ministry for Economic Affairs and Energy (BMWi) Germany, Green Paper on Energy Efficiency

The German government commissioned a third party to analyze the possibility of achieving its 2020 energy saving and energy efficiency improvement targets. According to the third party, Germany is expected to lower its primary energy demand by 7.2 percent to 10.1 percent by 2020 compared to 2008 levels, as the energy conservation results accomplished over the past few years are not sufficient to support its goal of 20 percent reduction of energy consumption by 2020. This means that Germany still needs to strengthen its efforts in energy conservation and consumption reduction, expand its energy saving results. More arduous challenges must be addressed for Germany to achieve its Energiewende objectives for 2020 and further ahead for 2050. In response to this assessment, as a remedy, the German government will further increase the funding for building energy efficiency renovation (an annual increase of 1.8 billion euros) and strengthen the energy conservation and energy efficiency improvement in the industrial sector.

II. Introduction to Germany's Incentive Policies for Energy Conservation and its Enlightenment

i Overview of Germany's incentive policies for energy conservation

Germany's energy conservation policies are complex. A large number of incentive policies at the central government (federal government) and local governments have been put in place to support energy conservation.

GIZ offered support to German experts in the development of the *Report on Providing Economic Incentives and Promoting Energy Efficiency Improvement*, by collecting and analyzing Germany's 125 energy conservation policies both at the national and state levels, and classifying Germany's energy conservation policies into 22 categories (see Table x).

	Category	No. of Plans
1.	Constructing energy-efficient buildings	13
2.	13	44
3.	Planning/supervision of energy-saving renovation	6
4.	Implementing energy-saving technologies / measures	30
5.	Establishing the monitoring/measurement system	5
6.	Conducting building energy audits	10
7.	Conducting sectoral energy audits	2
8.	(Long-term) energy counseling/consultation	1
9.	Conducting energy efficiency training	4
10.	Establishing the network platform for companies to exchange energy efficiency concepts	4
11.	Implementing the sectoral energy management system	7
12.	Implementing achievement and assessment management system for urban climate and energy targets	1
13.	Developing urban climate/energy concepts	8
14.	Hiring energy managers in public agencies	3
15.	Establishing regional energy agencies	2
16.	Offering energy-saving economic incentives to schools	1
17.	Installing the load management system	1
18.	Encouraging companies to shut down heavy loads during peak hours	1
19.	Installing the energy storage system	6
20.	Installing the combined heat and power (CHP) system	16
21.	Implementing heating/cooling network solutions	7

22.	Providing contract energy management consulting	1

Table 3 Overview of Germany's incentive policies for energy conservation
Source: Research report titled Providing Economic Incentives and Promoting Energy Efficiency Improvement

Based on the above-mentioned 22 categories of Germany's energy conservation policies and combined with the concerns of the Chinese government, experts and companies, this report selects 8 categories of energy conservation policies for further information collection and analysis, and analyzes the reasons for the effectiveness of these key energy conservation policies and its implications for China.

ii Support policy for energy conservation technological transformation

1. Policy and implementation effects

Implementing energy conservation technological transformation in companies through advanced technologies is an important means for companies to achieve energy efficiency improvement. It is also an important policy for the government to promote energy conservation and energy efficiency.

Germany has introduced a variety of policies to support energy conservation technological transformation, most which are basically in a "bottom-up" approach. Germany's research report titled Providing Economic Incentives and Promoting Energy Efficiency Improvement stated that in 2017, there were 33 policies to support energy conservation technological transformation for different sectors and different technologies in Germany. These policies were basically providing economic incentives for energy conservation technological transformation in the form of loans or subsidies. Most of these policies were targeted at SMEs. Some policies were limited to companies in certain regions (such as those in certain states and cities), whereas others were targeted to support general-purpose energy conservation technologies for certain sectors (such as heating), which themselves differ across policies.

SMEs account for 99.6 percent of all industrial companies in Germany. The federal government believes that SMEs need special care to help them

overcome energy conservation barriers. Therefore, the vast majority of energy conservation incentive policies in Germany are aimed at SMEs. Of the 125 energy efficiency incentive policies analyzed in the report titled “Providing Economic Incentives and Promoting Energy Efficiency Improvement”, 95 are used to support energy conservation in SMEs.

The Federal Ministry of Economic Affairs and Energy established the Germany Energy Efficiency Fund (see Insertion 1), which is dedicated to supporting general-purpose energy conservation technologies, energy management system building, energy efficiency improvement in production processes, and energy conservation consulting for general companies and SMEs. In recent years, Germany has witnessed a continuous increase in the amount of the energy efficiency fund, from 11.5 million euros in 2013 to 180 million euros in 2016. This fund has played an important role in promoting energy conservation and energy efficiency improvement in Germany.

Insertion 1: Energy efficiency funds established by the Federal Ministry of Economic Affairs and Energy

Established by the Federal Government of Germany, this fund is part of the Energy and Climate Fund in Germany. The purpose is to support the rational use of energy and improve energy efficiency.

The supportive measures for energy conservation include:

- Upgrading and transformation of general-purpose energy conservation technologies
- Establishing the energy management system
- Improving the energy efficiency of production processes
- Providing energy conservation consultation
- Providing energy conservation consultation for SMEs

The amounts of this fund in different years were:

- 2013: 11.5 million euros
- 2014: 28.6 million euros
- 2015: 140.1 million euros
- 2016: 180.3 million euros

In practice, most of the energy conservation subsidies in Germany are managed by the banking institutions entrusted by the German government (for instance, by the KfW at the national level), whereas some funds (such as general-purpose energy conservation technological promotion projects for SMEs) are managed by the Federal Office for Economic Affairs and Export

Control (BAFA). In case an energy conservation technological transformation project is managed by a banking institution, the bank will be responsible for the entire process of review, evaluation and approval of energy efficiency loans or subsidies. The funds will be provided by the Federal Ministry of Economic Affairs and Energy (BMWi), the Federal Ministry for Environmental, Nature Conservation and Nuclear Safety (BMUB) or government agencies at the state levels.

In Germany, typical energy conservation technology incentives for SMEs include: “General-Purpose Energy Conservation Technology Promotion Project for SMEs”” by the Germany government, “Production Workshop/Process Energy Efficiency Project” by the KfW, and “Energy Conservation Transformation Project for Commercial Refrigeration Systems”.

There are surely also projects in Germany targeting at large and medium-sized companies, such as the “Energy Policy Adjustment Funding Program” that is implemented and funded by the KfW. The project is designed to support energy conservation technological transformation of large and medium-sized companies, provide loans ranging from 25 million euros to 100 million euros for private companies with annual turnover between 500 million euros and 4 billion euros.

The “General-Purpose Energy Conservation Technology Promotion Project for SMEs” by the Germany government is a typical energy conservation technological transformation project in Germany. It mainly targets at SMEs that meet the EU definition on SMEs (see Figure 11), in particular for companies with 250 employees or less. For energy conservation transformation of companies with 500 employees or above and an annual turnover of less than 100 million euros, project support can also be provided though with slightly less support.

EU definition of SMEs:

Company Type	Employees	And	Turnover	Or	Balance Sheet Total
Medium	<250		≤500 million euros		≤43 million euros
Small	<50		≤10 million euros		≤10 million euros
Miniature	<10		≤2 million euros		≤2 million euros

90 percent of companies in the EU are SMEs

Figure 11 EU Definition of SMEs

The “General-Purpose Energy Conservation Technology Promotion Project for SMEs” is funded by the Federal Ministry of Economic Affairs and Energy from the public budget of the Ministry and is implemented by the Federal Office for Economic Affairs and Export Control. The Federal Office for Economic Affairs and Export Control is responsible for all formalities, including verifying to ensure that the application meets the requirements and granting funding to applicants.

The “General-Purpose Energy Conservation Technology Promotion Project for SMEs” can be classified into two types, i.e., developing individual measures for energy conservation technological transformation, and implementing energy conservation technological transformation through system optimization. The government provides financial support for both types. For the first type of projects (implementing individual measures for energy conservation technological transformation), the German government provides financial support of 2,000 euros to 30,000 euros for each energy conservation project. The German government's financial support for small and medium-sized industrial companies to implement individual energy conservation transformation is about 30 percent of the investment for the entire energy conservation transformation project, and 20 percent for non-small and medium-sized industrial companies. For the second type of projects (system-optimized energy conservation technological transformation), at least two individual measures for energy conservation technological transformation are required to be included in the system optimization plan. The energy consumption saved by the project should be not less than 25 percent of that of before transformation. The investment of the project should be not less than 30,000 euros but not be higher than 100,000 euros. After the implementation of conservation technological transformation, it must be used for more than three years.

Germany’s Federal Office for Economic Affairs and Export Control is responsible for accepting applications. Companies can apply online on the website of the Federal Office for Economic Affairs and Export Control for their individual technological transformation projects and system optimization projects. The application procedures include the general information of the

company and the estimated cost of each individual technological transformation measure. In case of applying for a system optimization project, an energy audit of the project should be conducted by an energy auditor prior to financial support application. Germany's energy auditors must have obtained the energy auditing qualifications in Germany and should be listed in a national pool of energy efficiency experts from the Federal Office for Economic Affairs and Export Control (Dena). Regardless of whether an individual technological transformation project or a system optimization project is applied, the applicant company must clearly distinguish the basic cost of the project and the incremental cost required to implement the energy efficiency improvement (such as costs for preparing energy conservation plan, installing energy conservation equipment, etc.). The project cost should not exceed 30 percent of the total funding and must be submitted separately from the labor and material costs. After the Federal Office for Economic Affairs and Export Control issued a funding notice, there is a nine-month payment period. In case any changes have been made to the measures in application, explanation should be submitted within one month of the issuance of such funding notice. All costs for implementing energy conservation technological transformation measures should be advanced by the company, and the Federal Office for Economic Affairs and Export Control will refund up to 30 percent (depending on the size of the company) after the project is completed and verified. All measures must be implemented within 9 months (from the funding application to the final verification). For final verification, the applicant company is required to submit a fact sheet to elaborate the implementation of the company's energy efficiency measures.

After the establishment of the "General-Purpose Energy Conservation Technology Promotion Project for SMEs" in 2012, the number of project applications has been increased, and witnessed an explosive growth in 2014.

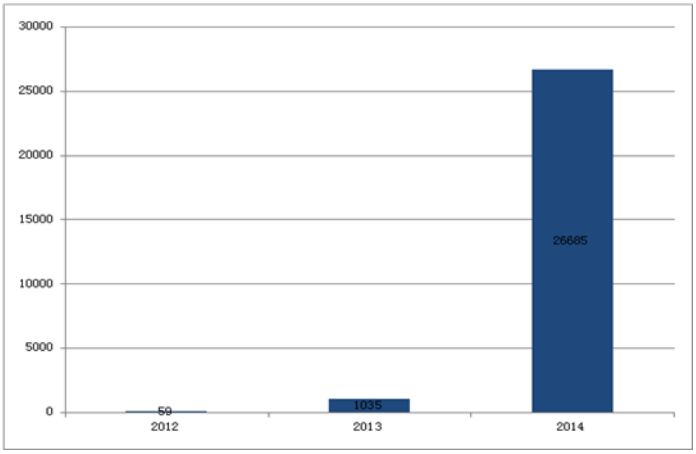


Figure12 Number of project applications for general-purpose energy conservation technological transformation for SMEs 2012-2014

2. Reasons for the effects

(1) In line with Germany’s national conditions (large number of SMEs)

In Germany, most of the companies are SMEs and only a few of them are large companies. Moreover, German SMEs have great potential for energy conservation. However, business owners don’t know the energy conservation potentials. The energy conservation technological transformation policies and supportive policies in Germany are focused on SMEs. This complies with Germany's national conditions and the actual needs of German companies for energy conservation.

(2) Developing diversified technological supportive policies

Given the diversified energy conservation technologies required by different companies, the German government has formulated different technology promotion supportive policies for different types of energy conservation technologies. Governments at different levels have also developed targeted energy conservation policies based on the regional conditions. Most technological policy programs are clearly informed at the beginning of the application process. This can help the companies arrange the start and end time of energy conservation technological transformation projects in a better way, which will be then conducive to the establishment of reasonable market expectations.

(3) Developing different funding solutions for SMEs and large companies

The German government has adopted different financial support programs for energy conservation in SMEs and large companies. For SMEs, the German government's support is mainly in form of financial subsidies with moderate amount yet wide coverage. This reflects the concept of subsidizing vulnerable groups. For large companies, the German government's support is mainly in form of bank loans. This means that large companies are not vulnerable groups, and they should adopt market-based means to support energy conservation measures, especially arousing the enthusiasm of more banking institutions.

(4) Supporting the government based on the network system of commercial organizations

At the executive level, the German government relies on the implementation of the KfW, along with the support from the Federal Office for Economic Affairs and Export Control. The KfW has branches throughout Germany, therefore companies can go to the KfW branches to apply for the government fund and be reviewed by the branches. This approach (i.e., seeking support from the network of commercial institutions to implement energy conservation measures) can save time and cost for the government authorities and can therefore offer better long-term sustainability.

3. Experience China can use for reference

(1) Paying more attention to the energy conservation of SMEs

For a long time, China's energy conservation policies have focused on major energy-consuming companies with energy consumption above 5,000 tons of coal equivalent, and the energy conservation of SMEs is always a "blank" field in China's energy conservation policies. SMEs are weak in the awareness of energy conservation but have great potential in this field. Such potential is the "blue ocean" for China's energy conservation sector, which needs to be further explored. In the context that Chinese government encourages the development of SMEs, energy saving is also an important means for SMEs to reduce costs, increase efficiency and strengthen management. Therefore, supporting the energy conservation measures taken by SMEs is necessary for the Chinese government to "encourage the development of SMEs".

It is recommended that the Chinese government strengthen its support for energy conservation of SMEs, formulate energy conservation policies for SMEs as soon as possible, and support SMEs in terms of energy conservation and energy efficiency.

(2) Taking subsidies as the main means of supporting energy conservation of SMEs

Considering the difficulty for SMEs to get bank loans, it is recommended to take financial subsidies as the main method to support energy conservation projects of SMEs. However, the amount of subsidies for energy efficiency retrofit projects should not be too high, and the subsidy policy should clearly define the “downhill” and termination timing at the beginning. For the issuance of energy saving subsidies, the best way is to “substitute subsidies with rewards”, that is, companies undertake the paying in advance and obtain “rewards” when the project is completed and the expected target is achieved.

(3) Formulating a package of energy saving project service schemes through in-depth cooperation with financial institutions

It is recommended to choose a bank with branches nationwide as the executing agency and make the bank responsible for the energy efficiency technology retrofit projects of companies. This method, on the one hand, can relieve the pressure faced by government authorities or affiliated public institutions, and avoid the risk of bribery to the greatest extent; on the other hand, it can enhance the social responsibility of banks in promoting green development, improve community-level banks’ capacity in promoting energy efficiency retrofit projects, and help the green finance business develop more steadily.

(4) Cultivating more well-qualified energy auditors

According to Germany’s experience, the establishment of a well-qualified professional energy audit group is an important guarantee for the smooth implementation of energy efficiency technology retrofit projects. Especially for the energy conservation of SMEs, it is more important to play the role of energy auditors. Energy auditors must pass rigorous examinations and get necessary certifications.

It is recommended that the Chinese government provide training for professional talents, e.g. energy auditors (mainly serving the third-party verification of energy efficiency retrofit projects), energy managers (mainly helping energy-consuming companies to improve energy management capacity), and compile relevant examination materials. The qualification certificate should be issued by an authoritative organization or industry association. It is recommended that the National Energy Conservation Center establish professional database for energy auditors and energy managers separately, and treat qualified energy auditors or energy managers as important human resources for energy conservation work in the future.

iii Building energy conservation policies

1. Policies and implementation effects

In Germany, the construction sector consumes 40 percent of end energy consumption. Therefore, the country has long regarded the construction sector as the most important energy saving field and has taken strong measures to promote energy conservation.

Heating is the largest individual technical part in Germany's building energy consumption field, which is also an important focus of the country's building energy conservation. In 1977, Germany introduced the Regulations on Building Insulation for the first time, which set clear quantitative indicators for reducing the average heating energy consumption per unit area of buildings by requiring that the heating energy consumption per unit area of buildings set up after 1977 should not exceed 250 kWh/m2•a. In 1984 and 1995, the German government successively reduced the heating energy consumption per unit area of buildings to 150 kWh/m2•a and 100 kWh/m2•a. In 2002, Germany introduced the Regulations on Building Energy Conservation to replace original the Regulations on Building Insulation, and further lowered the requirement for the heating energy consumption per unit area to 75 kWh/m2•a.

The German government began to promote the energy efficiency retrofit of residential buildings since the early 1990s. The supporting policies formulated by the German government include various technical regulations or management regulations for the energy efficiency retrofit of buildings issued by the federal government and the state government, preferential loans provided

by financial or policy banks at all levels (e.g. KfW) to support the energy efficiency retrofit of buildings, providing high feed-in tariff for the electricity from photovoltaic power generation of buildings, encouraging energy efficiency service companies to implement energy efficiency retrofit measures for buildings in accordance with the Energy Performance Contracting mode, etc.

In September 2010 and June 2011, the German federal government successively formulated policies for energy and climate change protection, regarding renewable energy and energy efficiency as the two pillars of energy transition. In December 2014, the German government formulated the Nationaler Aktionsplan Energieeffizienz (NAPE) and the Climate Action Plan 2020, and launched a series of related measures. **According to the energy-saving targets set by the German federal government for the construction sector, near zero emissions will be achieved in all buildings by 2050**, which means that the primary energy demand in the construction sector will be reduced by about 80 percent compared to 2008. Germany's Building Energy Efficiency Strategy is a strategic document aiming to promote energy transition in the German construction sector so as to achieve the above targets.

Overall, Germany's building energy efficiency measures can be divided into four categories: 1) Information and consultation: "on-site consultation", "energy consulting services for SMEs", "energy consulting services for local governments", etc.; 2) financial support: the KfW's funding project and the Marktanreizprogramm (MAP) under the framework of the program of energy conservation and emission reduction in buildings; 3) legal and regulatory requirements: the Energieeinsparverordnung (EnEV), the Renewable Energies Heat Act (EEWaermeG), etc.; 4) strengthening scientific and technological R&D: "EnOB-Energy Optimization Buildings" research project, "Energy Efficiency: Heating – Energy-efficient Heating and Refrigeration Pipe Network" research project, etc.

The measures laid down in the NAPE for the construction sector include the following four aspects:

(1) Providing building energy efficiency consulting services

Helping the building's owner, users, investors and service providers learn

more about the potential for energy conservation through consultation and information, testing whether the building is worthy of medium and long-term energy efficiency investment, learning what energy saving effects will generate from the investment, and demonstrating the potential for return on investment of energy efficiency measures. Eliminating public concerns about the energy efficiency retrofit of existing buildings and the energy-efficient equipment of new buildings with tailor-made consulting services.

Consulting services for building energy efficiency include: 1) first round of consulting services at the consumer center; 2) in-depth on-site consulting services by the Federal Office for Economic Affairs and Export Control; and 3) energy efficiency retrofit measures involved in the KfW's construction supervision projects. All of these consultations have access to the financial support from the German government.

(2) Providing incentives for energy efficiency retrofit and renewable energy heating through different types of projects

Providing financial support and subsidies for building energy efficiency retrofit projects through the "Building Energy Efficiency Retrofit Project for CO2 Emission Reduction" (the KfW's funding project) and the MAP. Providing subsidies for active building demonstration projects through the "Building Energy Efficiency Retrofit Project for CO2 Emission Reduction" (the KfW's funding project).

The German government also supports building energy conservation measures by providing tax subsidies totaling 1 billion euros a year and a 10-year time limit for subsidized projects. In addition to self-occupied property houses, the government subsidizes leased property houses. The statement that the tax deduction and exemption will bring benefits to the lessee should be made when the latter applies for the subsidy. Subsidy projects can adopt either individual energy saving measures or overall energy saving programs. Tax subsidies are provided through direct tax relief and are not cumulative.

(3) Checking heating equipment

In Germany, there is enormous energy saving potential in old and inefficient heating equipment (boilers and peripherals), and the cost of

upgrading these equipment is small. However, owners always understand neither such potential nor the ways and means to explore it.

Conducted by German government, the initiative of checking heating equipment inspection aims at encouraging institutions and individuals to voluntarily carry out on-site inspections on heating equipment with the assistance of professionals (e.g. artisans or chimney cleaners), identify the inadequacies in the energy efficiency of heating equipment through standardized processes, and get recommendations on remedial measures. The national energy efficiency label on old heating equipment can be used as an incentive mechanism to encourage institutions and individuals to participate in the inspection project for heating equipment. Meanwhile, the initiative should also encourage the public to implement optimization measures for heating equipment.

(4) Enhancing building energy efficiency retrofit

The KfW has set up energy efficiency building and energy efficiency retrofit projects within the framework of the building energy efficiency retrofit project for CO2 emission reduction. This project has fundamentally contributed to the achievement of energy-saving targets in the construction sector, and has helped to implement the Energy Performance of Buildings Directive and to prepare for the implementation of minimum standards for energy-consuming buildings in 2019/2021.

With subsidy policies and low-interest loans as well as reimbursement subsidies, the financial support provided by the project for retrofit measures has greatly surpassed statutory energy conservation requirements. In order to extensively improve the implementation of energy efficiency measures, the project deliberately increased the level of reimbursement subsidies.

The project will further improve residential buildings, including: introducing subsidy standards for plus energy houses (including energy consulting services), and further playing the active role of the community of residential property owners; providing 300 million euros as various interest subsidies and subsidies can be combined as a package. The project also complements the financial support for energy efficiency measures for non-residential buildings, including: incorporating these measures into factory buildings (including

productive buildings for processing agricultural products), urban and social security facilities, and introducing funding standards for plus energy houses. In addition, the project supports research projects, demonstration projects and standards preparation projects in the construction sector.

In addition to the above measures, the NAPE also includes the main points of the Building Energy Efficiency Strategy. The Building Energy Efficiency Strategy is a strategic document for energy transition in the construction sector, which integrates various energy saving measures, considers interdisciplinary issues (e.g. social insurance) and financing issues, and will establish a monitoring system for continuous self-improvement. The Building Energy Efficiency Strategy includes the following important measures: 1) the federal government will subsidize professional energy consulting projects for urban buildings and equipment systems to help people better accept building energy efficiency retrofit; 2) revising the Regulations on Energy Conservation in Buildings and carrying out the minimum standards for energy-consuming buildings, of which the standards for civil buildings will start in 2021 and the standards for public buildings will start in 2019, according to the EU's directive for new buildings; coordinating with the EEWaermeG; 3) further studying the issue on whether the house leasees stipulated under the Housing Leasing Act can raise the rent after retrofitting their houses; 4) for residential and non-residential buildings, developing refurbishment and retrofit plans according to the specific conditions of the building; 5) continuing to promote the MAP for using renewable energy in heating; 6) promoting the establishment of new technical standards, including the development of components for buildings and equipment systems; and 7) promoting relevant scientific research and developing a "building and regional energy network platform".

The above measures have brought about significant energy saving effects for Germany buildings: On the one hand, Germany's building energy consumption has been declining since 2008, and on the other hand, the proportion of renewable energy in end-energy consumption has been increasing. Since 2008, the energy consumption in Germany's construction sector has dropped at an average annual rate of more than 2 percent. The end-energy consumption of residential buildings has dropped by about 15

percent, and the energy consumption of buildings for handicraft, commercial and service business has dropped by about 11 percent. Although the energy consumption of industrial buildings has fallen by only about 6 percent in cumulative terms, it has fallen by around 2 percent in 2015 compared with the same period in 2014. In 2012, renewable energy accounted for 14 percent in the total energy consumption of residential buildings and buildings for handicraft, commercial and service business, and this proportion is expected to increase to 19 percent by 2020; the heat supply of biomass energy is expected to increase by around 12TWh in 2012-2020; the installed capacity of heat pumps will increase further based on the average growth rate in previous years. It is expected that by 2020, the heat supply of various types of heat pumps is expected to reach 16TWh; the utilization of light and heat will be further improved.

2. Reasons for the effects

(1) Establishing a comparatively complete legal system

Germany's requirements for building energy efficiency and related incentives are mainly clarified in the form of rules or regulations. E.g. the Regulations on Building Energy Conservation and the Regulations on Building Insulation make the requirements for the energy consumption per unit area of buildings, and the Housing Leasing Act clearly stipulates that the rent of house can be increased after the energy efficiency retrofit. It not only strengthens the legal effectiveness of energy saving requirements for buildings, but also contributes to the promotion of energy saving of buildings in the whole society.

(2) Emphasizing consultation on energy efficiency of buildings

The consultation on energy efficiency of buildings not only enables people to understand the benefits from the energy conservation measures for buildings, but also improves the acceptance of the housing sector towards energy conservation measures; it can also customize the optimal energy saving solutions for different buildings to achieve maximum benefits and energy savings at minimum cost, and thus improve the economy and feasibility of energy conservation measures. In view of the above considerations, the German government's energy conservation policies for buildings in various periods have provided financial support for the consulting services on building

energy efficiency.

(3) Diversified economic incentive policies

The German government has formulated different economic incentive policies for different types of building energy efficiency projects: some of them are subsidized by government's financial contributions, while others are subsidized by policy banks. In general, financing support in Germany mostly focuses on tax break and the proportion of financial subsidies is relatively small.

(4) Paying attention to the economic feasibility of measures

Only economically viable measures can be implemented on a large scale. When the German government formulates energy conservation standards and policies, in addition to technical feasibility, it also attaches great importance to economic feasibility and does not force the promotion of technologies with high cost but low commercialization rate. Therefore, the implementation of the building energy conservation policies is relatively smooth.

3. Experience China can use for reference

(1) Improving legislation related to building energy conservation

It is suggested that the Chinese government should analyze the new requirements for energy conservation and low-carbon development in the construction sector according to the new situation and characteristics of the current economic and social development, and improve the laws and regulations relating to building energy conservation.

(2) Improving consulting services for building energy conservation

It is recommended to incorporate the consultation of building energy conservation into the building energy efficiency planning or strategy as an important supporting measure. Giving relevant incentive policies to the provision of consulting services for building energy-saving technology and, at the same time, strengthening the training of consultants in building energy conservation, expanding the talent team, and improving the capacity building of energy conservation consultation.

(3) Optimizing economic incentive policies

It is recommended that the Chinese government continue to implement the necessary incentive measures for building energy conservation, and support building energy conservation projects by means of tax break, green finance, etc., as far as possible.

(4) Improving the economic evaluation of technologies and measures

It is suggested that the Chinese government, when formulating policies for building energy conservation or conducting technology popularization, should pay more attention to the economy and cost of technology and ensure that feasible and economical technology can be popularized better.

iv Energy management system

1. Policies and implementation effects

The energy management system is an important tool to improve companies' energy efficiency and their energy conservation management.

By applying the energy management system, companies can better understand the energy consumption, determine the potential for energy savings, and identify the biggest potential for energy savings. Experience has shown that after establishing an energy management system, companies can reduce energy consumption by 5-10 percent, that is, reduce energy costs by 5-10 percent.

In Germany, the government has set different requirements for energy management system for companies of different sizes (e.g. SMEs and large companies), as shown in Table 2.

	ISO 50001	**DIN EN 16247-1**	**Alternative system**
Content	• Process-oriented approach, formulating internal policies, setting goals • Continuous system optimization • Top management participation • Requirements for	• Energy use analysis • Identifying and assessing energy saving potential	• Determining management obligations • Appointing the person in charge of the company's energy conservation work • Energy use analysis • Identifying and assessing energy

	documentation • Energy audit		saving potential
Tasks	• Management must actively participate • Work hard to record files • External consultation as an option	• The company not required to actively participate • Annual energy audit by internal or external auditors	• Corporate management actively participates • Energy analysis on the year with the lowest energy consumption
Quality	Formulating guidelines, leaving leeway for interpretation, and achieving continuous system optimization	In the charge of qualified energy auditors, in line with process requirements	Determined based on the ability and motivation of the participants (no legal obligation)
Energy saving	Focusing on energy efficiency and routine monitoring, and continuing to improve	Promoting the optimization of the energy utilization system with external resources	According to the company's internal goals and qualifications
Cost	Certification cost	Audit cost	Proof cost
Target group	SMEs/big companies	SMEs/big companies	SMEs

Table4 Requirements for Germany's ISO 50001, Alternative System and DIN EN 16247-1

Source: Research report titled Providing Economic Incentives and Promoting Energy Efficiency Improvement

Currently, there are 7 policies in Germany to support companies in establishing and improving energy management systems, including 4 financial support policies of different federal states, 2 funding programs of the Federal Ministry for Economic Affairs and Energy, and 1 program supported by KfW.

In Germany's 7 policies supporting energy management systems, Lower Saxony's "Energy Efficiency Production Loan" program is initiated by Lower Saxony and implemented by the Lower Saxony State Bank. The "Sustainable Development" program of Thuringia and the "Environmental Management Audit Plan" of Baden-Württemberg are implemented by their respective state environmental authorities. The two programs focus on not only energy efficiency but also environmental management systems. All these programs have provided financial support for the establishment of energy management systems.

Germany's SMEs, relevant municipal governments, educational

institutions and other public associations can apply for funding. Saxony provides up to 30,000 euros for SMEs and public institutions in the consultation and guidance of energy management systems, in a bid to assist them in obtaining the Energy Management System (ISO 50001 standard) certification, and conduct energy audit according to German law (DIN EN 16247-1).

Environmental Management System Environmental Management System	The environmental management system "manages" the environmental impact of industrial processes. Increasing corporate environmental performance includes energy consumption and energy efficiency. Therefore, the environmental management system can naturally improve energy efficiency.

Figure13 Environmental management systems

Germany's "Energy Management System" incentives are funded by the Federal Ministry for Economic Affairs and Energy and implemented by the Federal Office for Economic Affairs and Export Control. Germany's SMEs which want to obtain the ISO 50001 energy management system certification may apply for government subsidies when they first obtain the certification. The subsidy ratio can be up to 80 percent of the certification fee and the upper limit is 6,000 euros. In addition, SMEs which purchase energy consumption measurement and monitoring equipment and purchase computer software for the energy management system can receive a subsidy of 20 percent of the total cost, with a ceiling of 8,000 euros and 4,000 euros respectively. The installation of measuring and monitoring equipment can be subsidized separately, up to 30 percent of the installation fee.

According to German law, energy-intensive companies that have obtained the energy management system certification can enjoy energy tax credits. Energy-intensive companies can be refunded 90 percent of energy and electricity taxes as long as they meet the requirements of the German government for energy management systems. If energy-intensive companies implement supporting documents for the energy management system, they

must be audited by a qualified individual or institution (the condition for obtaining the qualification is that the individual or institution is accredited by German's National Accreditation Body (DAkkS) or the German Accreditation Council and the EMAS Accreditation Body in Germany (DAU).

Energy-intensive companies must collect energy consumption data of 12 months, which must be no earlier than 12 months before the date when the tax credit is applied.

In 2011, a total of 29,500 energy-intensive companies in Germany obtained the energy management system certification. These companies received a total of 2.108 billion euros in electricity and energy tax credits, equivalent to an average of 71,500 euros per company.

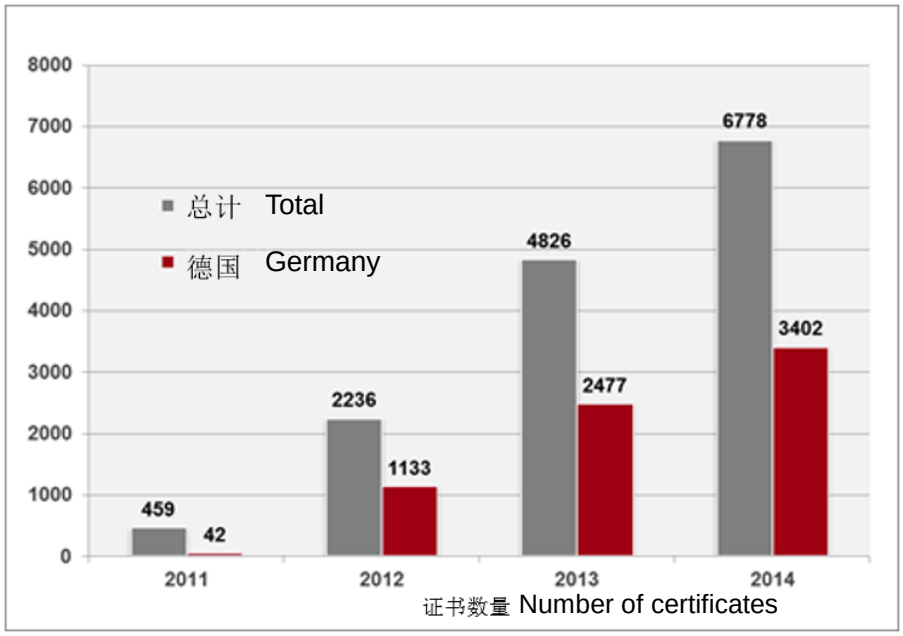


Figure14 Certification of the German Energy Management System (ISO 50001)
Source: Research report titled Providing Economic Incentives and Promoting Energy Efficiency Improvement

Figure 14 shows the effects of Germany's energy management system incentives on companies. From 2011 to 2014, the number of companies obtaining the energy management system certification around the world continued to grow, with Germany's new certified companies accounting for about half of the world's total.

2. Reasons for the effects

(1) Developing different standards of energy management systems for large companies and SMEs.

Germany has developed different requirements for energy management systems for large energy-intensive companies and SMEs. The requirements for energy management of large companies are stricter, while certification costs, management costs, and labor costs are also higher. The requirements for energy management systems for SMEs are relatively low, but the basic requirements for improving energy management can be met, while management costs are relatively low. Such management philosophy which abandons the “one size fits all” approach is worth learning.

(2) Linking the energy management system to tax breaks

Germany’s energy and fossil fuel taxes are higher than other countries. The German government has recognized that this will lead to high costs for domestic companies and is not conducive to international competition. In formulating energy conservation and low-carbon policies, the German government has linked corporate energy-saving efforts to tax breaks. On the one hand, energy-saving companies can improve their management; on the other hand, they can obtain the actual benefits, thus greatly mobilizing their enthusiasm for energy conservation.

(3) Providing financial support to energy management systems

The government provides financial support to companies that have been certified for the first time in the energy management system, which will help them better understand, recognize and accept the new “energy management system”.

3. Experience China can use for reference

(1) Setting different requirements for implementing energy management for companies of different sizes

At present, the energy conservation of SMEs is a points of weakness of China’s energy conservation efforts. In this respect, however, the requirements for energy management systems for large energy-intensive companies cannot be copied. It is recommended that the Chinese government study the energy

management requirements suitable for SMEs in China, appropriately simplify tasks and workflows, and encourage SMEs to improve energy management.

(2) Governments provide incentives for companies to improve energy management

It is recommended that the Chinese government study Germany's experience and set different requirements for implementing energy management systems for SMEs and large companies and give support accordingly. For SMEs planning to improve energy management, it is recommended to use subsidies as the main support means and set a ceiling for subsidies. For large companies planning to improve energy management, the main goal should be obtaining the energy management certification. It is recommended to give certain tax concessions to large companies that have obtained the energy management system certification.

v Energy efficiency network groups

1. Policies and implementation effects

The main purpose of establishing an energy efficiency network in Germany is to increase the awareness of responsibility in energy conservation of the participants of energy efficiency network groups.

The main methods adopted by Germany's energy efficiency network groups are as follows: 1) establishing an energy efficiency network group based on voluntary participation; 2) Inviting energy consultants to participate in and host experience exchange activities on energy conservation and energy efficiency to help companies identify and achieve energy conservation goals.

The initiative to establish an energy efficiency network in Germany began in 2015. The goal is around 500 energy efficiency network groups will be established by 2020, and the participants of all energy efficiency network groups should meet the minimum requirements.

The minimum requirements of Germany's energy efficiency network groups include: 1) all companies participating in energy efficiency network groups conduct energy audits; 2) all energy efficiency network groups must define energy conservation goals based on the company's development goals;

3) all energy efficiency network groups must continuously explore their own energy saving potential; 4) all energy efficiency network groups are required to designate a senior energy consultant to provide technical support; 5) all energy efficiency network groups are required to prepare reports each year to summarize the actions taken.

The specific organization of energy efficiency networks will be further subdivided according to different criteria (e.g. company size, industry or cross-industry network groups, etc.).

2. Reasons for the effects

(1) Meeting companies' needs of capacity building in energy conservation

Different types of companies have objective needs to strengthen capacity building in energy conservation. Energy efficiency network groups can help companies meet actual needs and are one of the important actors to help companies strengthen their capacity building. In addition, they are also an effective way for companies to continuously deepen their understanding of new technologies, new models, new forms of business, and improve energy management and energy efficiency.

(2) Distributed training + personalized service

Energy efficiency network groups abandon the traditional means of disseminating knowledge in the short-term of holding energy conservation knowledge training courses. Instead, they adopt a flat, distributed approach to better meet the needs of modern management and training. Energy efficiency network groups are able to provide more targeted solutions to meet different customers' different needs, and provide customers with personalized and customized energy-saving services, so they are more likely to be favored by customers.

(3) Arousing the enthusiasm of energy professionals

Senior energy consultants are the soul of energy efficiency network groups. Energy consultants can help members of the energy efficiency network group and get paid at weekend to improve their social status. Thus

more engineers and technicians can be encouraged to become professional energy consultants, providing them new opportunities to increase revenue, “climb the career ladder” and “pursue further development”.

3. Experience China can use for reference

(1) Providing new ideas for companies in capacity building in energy conservation

The energy efficiency network groups in Germany abandon the practice of holding traditional skills training courses, providing new ideas for Chinese companies in carrying out capacity building in energy conservation. It is recommended that the Chinese government take the lead in conducting demonstrations and practical activities of energy efficiency network groups in selected sectors and regions on the basis of summing up the German experience, and promote the integration of Germany’s experience in energy efficiency network groups with the practice of China.

(2) Establishing an energy consultant system

As professionals in the field of energy conservation, energy consultants are an indispensable guarantee and prerequisite for the establishment of energy efficiency network groups. It is recommended that the Chinese government establish a professional energy consultant system and create a database of energy consultants as soon as possible to ensure the quality of energy efficiency network groups. By requesting members of energy efficiency network groups to rate energy managers, excellent, popular energy consultants can be selected from the database to play a bigger role in the groups’ future work.

(3) Providing moderate yet necessary financial support

The initial establishment of energy efficiency network groups is inseparable from the support and guidance of the government. It is recommended that the Chinese government provide financial support and institutional guarantee for the establishment and promotion of new energy efficiency network groups, help them to hold regular meetings, organize visits, exchanges and field research to jointly improve energy management.

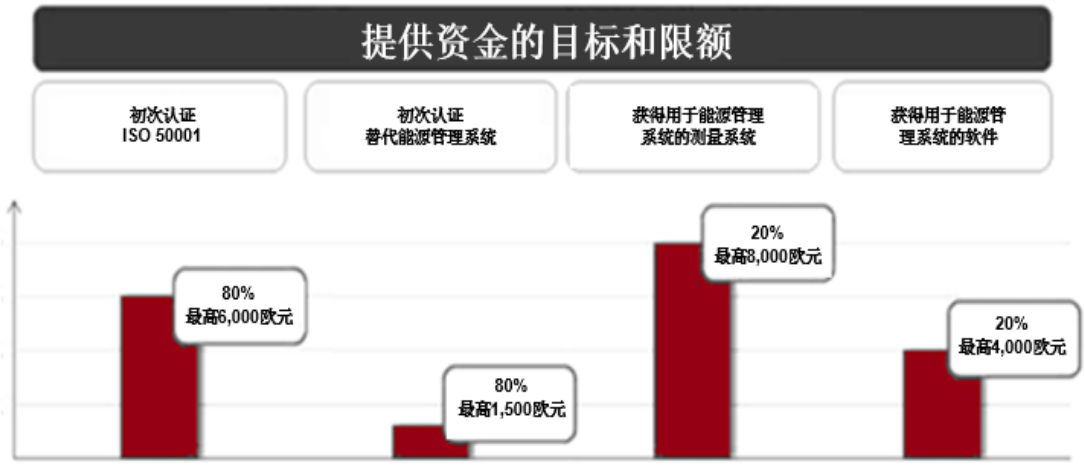
vi Establishing an energy consumption monitoring system

1. Policies and implementation effects

The German government encourages end-energy consumers to use smart meters to monitor energy consumption and establish energy management systems to manage energy consumption. The German government also supports companies to purchase and install energy consumption measurement and monitoring systems and to fund them in this regard. In Germany, there are five incentive policies to support companies to establish energy consumption monitoring systems. However, they are not independent policies, but must be included in comprehensive energy efficiency retrofit projects.

The “Energy Management System Enhancement” policy, funded by the Federal Ministry for Economic Affairs and Energy (BMWi) and implemented by the Federal Office for Economic Affairs and Export Control, is a national policy of energy management system promotion. The policy encourages SMEs to establish energy consumption monitoring systems and manage energy consumption with energy management software. It targets SMEs defined by the European Union, and public institutions are not in scope.

The German government supports companies in the establishment of an energy consumption monitoring system by providing subsidies, the amount of which is 20 percent of the total cost of the energy consumption monitoring system, and the upper limit is 8,000 euros (as shown in Figure 15).



Funding Goals and Limits

Initial certification of ISO 50001	Initial certification of alternative energy management system	Obtaining a measurement system for an energy management system	Obtain a software system for an energy management system
80% Up to 6,000 euros	80% Up to 1,500 euros	80% Up to 8,000 euros	20% Up to 4,000 euros

Figure15 German policies for the promotion of energy monitoring systems

Source: Research report titled Providing Economic Incentives and Promoting Energy Efficiency Improvement

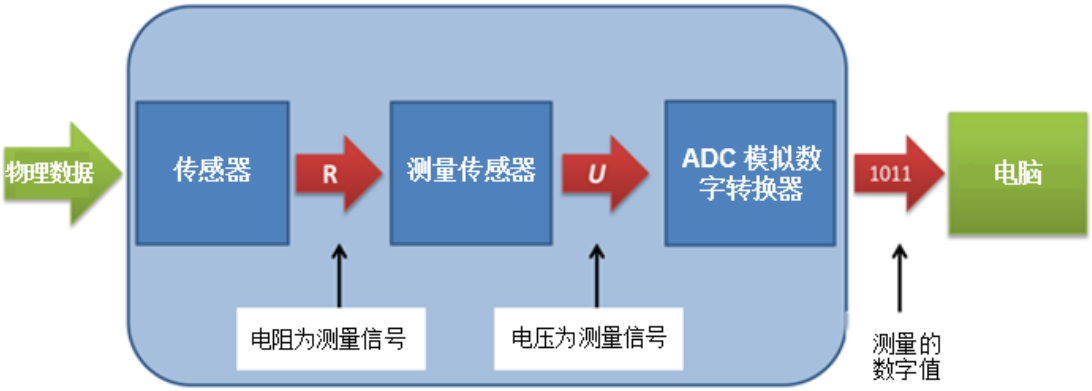
Germany's Federal Office for Economic Affairs and Export Control is responsible for accepting applications and issuing the funding notice to applicants. Applicants may fill in forms and submit applications on the website of the Federal Office for Economic Affairs and Export Control. In the application report, in addition to the general information of the company, the applicant also needs to estimate the cost of establishing an energy consumption monitoring system. Only after receiving the funding notice from the Federal Office for Economic Affairs and Export Control can the applicant start installing a new energy consumption monitoring system and/or energy management system. Within 3 months from the date of approval of the funding application, the applicant must complete all planned measures. After that, the Federal Office for Economic Affairs and Export Control conducts a final verification and then release funding.

It is worth mentioning that only energy measurement and monitoring systems directly related to the energy management system are eligible to apply for funding. The German government has specified the specific requirements for energy measurement and monitoring systems in the standards of the energy management system, i.e. the energy measurement and monitoring system must collect at least one of the following seven data:

1. Current
2. Voltage
3. Electrical energy
4. Temperature
5. Heating or cooling capacity

6. Volume flow (liquefied gas)
7. Illumination intensity and compressed air volume

Figure 16 shows the content and boundaries of an energy monitoring and control system that is eligible for funding. As long as the main function of this part is related to data collection, the system can obtain funding. This provision also applies to the computer software required to run an energy management system. However, other devices and hardware (e.g. computers, servers, and cables) are not in scope.



Physical data	Sensor	Measuring sensor	ADC analog to digital converter	Computer
Resistance is the measurement signal		Voltage is the measurement signal		Measured digital value

Figure16 The content and boundaries of an energy monitoring and control system that is eligible for funding
Source: Research report titled Providing Economic Incentives and Promoting Energy Efficiency Improvement

In addition, there are some local energy conservation policies. E.g. the “Progress • NRW – Reasonable Use of Energy, Renewable Energy and Energy Conservation” project implemented in North Rhine-Westphalia, Germany promotes combined heat and power, indoor ventilation systems with waste heat recovery and energy consumption monitoring systems. The “Energy-Oriented Urban Rehabilitation – Municipal Infrastructure” project implemented by the KfW also includes a variety of energy efficiency retrofit

measures, and the energy consumption measurement and monitoring system is only part of it.

What these energy conservation incentives have in common is to improve energy efficiency by establishing energy consumption monitoring and control systems. The establishment of energy consumption monitoring systems enables consumers to better understand the energy consumption of the company and further adopt multiple energy-saving measures with information provided by the energy consumption monitoring system so as to improve energy efficiency.

2. Reasons for the effects

(1) Directly addressing the extensive management in energy consumption

The energy consumption monitoring system is established to directly address the extensive management in energy consumption. With the establishment of the energy consumption monitoring system, information technology and real-time dynamic data can be utilized to provide more information for companies to improve energy management, thus laying a foundation for delicacy management in the field of energy.

(2) Energy consumption monitoring systems are listed separately and supported, but integrated with energy efficiency retrofit projects.

Germany does not support the energy consumption monitoring system separately. The energy consumption monitoring system must be part of the company’s energy efficiency retrofit and can also be supported by the government. The government has a subsidy cap and a system boundary cap for funding support for the establishment of an energy consumption monitoring system. The government only supports the incremental costs needed for energy conservation, and computers or cables purchased by companies are not covered by the government.

3. Experience China can use for reference

(1) Clearly defining support for the establishment of an energy consumption monitoring system in the energy efficiency retrofit project

It is recommended that the Chinese government does not separately

support the establishment of an energy consumption monitoring system. It is recommended to formulate separate provisions in the energy efficiency retrofit project to support the establishment of an energy consumption monitoring system. In terms of support, only the procurement of data acquisition and data signal conversion equipment is supported, while the procurement of computers and cables is not supported. In terms of subsidies, it is necessary to moderately control the amount of subsidies for individual systems.

(2) Carrying out equipment operation training

It is recommended that the Chinese government train employees on knowledge related to the energy consumption monitoring and control system to ensure long-term and rational use of the newly installed system.

vii Energy conservation consulting services and energy conservation information services

1. Policies and implementation effects

Energy conservation consulting services and energy conservation information services are a core part of Germany’s energy efficiency policies.

Access to independent, credible energy consumption information is a prerequisite for energy conservation decisions and actions by companies, households, and public institutions (federal government, federal states, and municipalities). To obtain independent, credible energy consumption information, quantitative analysis of energy consumption is needed, especially to fully understand and evaluate the impact of energy efficiency retrofit. Only on the basis of quantitative analysis can energy consumers make right decisions, achieve energy savings and improve energy efficiency. Therefore, the German federal government attaches great importance to providing energy conservation information services and energy conservation consulting services to different target groups.

Figure17 A German engineer introduces the performance of energy-saving equipment
Source: Research report titled Providing Economic Incentives and Promoting Energy Efficiency Improvement

Germany's energy conservation consulting services and energy conservation information services include four categories, namely information services, consulting services, energy management services and energy performance contracting services, mainly for homeowners and SMEs.

Homeowners in Germany can consult the **energy consultants** at the **Consumer Center** or ask for advice from the **Strom-spar-Check PLUS**. As a supplement to consulting services, the Strom-spar-Check PLUS project provides and installs simple energy-saving equipment for low-income families free of charge before the end of 2015, and funds the purchase of energy efficient refrigerators for low-income families which meet specific preconditions. Homeowners may participate in the "On-Site Consultation" project of the Federal Office for Economic Affairs and Export Control (BAFA) to obtain tailor-made, individualized energy efficiency retrofit solutions.

For **SMEs**, the German government has set up a dedicated SME energy consulting project. The German Federal Government, in conjunction with the Association of German Chambers of Commerce and Industry and the German Association for Small and Medium-sized Businesses, has organized the "Energy Transition and Climate Protection SME Initiative", which aims to help SMEs. In addition, the German federal government also funds the German Energy Agency (dena) to improve energy efficiency and provide energy conservation information for different target groups (e.g. "Energy Efficiency Initiatives", "Future House", "Building-Transition", etc.).

According to Germany's Green Paper on Energy Efficiency, about 19

percent of homeowners and 23 percent of SMEs commission energy consultants to provide high-quality energy efficiency consulting. In terms of energy management services, in order to enjoy the energy tax or additional tax credit policy, 12 percent of SMEs (50 to 249 employees) have obtained a certified energy management system. In the two areas, energy conservation policies have gradually taken effect.

However, in terms of energy performance contracting, only 1.6 percent of SMEs have adopted energy performance contracting featuring shared energy-saving benefits. The vast majority of SMEs still adopt the energy supply contract model, indicating that the effects of the energy conservation policy are still not satisfactory.

2. Reasons for the effects

(1) Putting energy conservation by vulnerable groups on the top agenda of political and economic work

The German government gives particular attention to helping vulnerable groups, which is also reflected in its energy conservation work. For vulnerable groups, small subsidies or tax breaks can bring significant energy savings and economic benefits, thus helping vulnerable groups to reduce energy costs. By putting energy conservation by vulnerable groups on the top agenda of political and economic work, government leaders can win more votes and win the hearts of the people.

(2) Directly addressing the lack of energy conservation information of Germany’s homeowners and SMEs

Germany’s homeowners and SME owners lack expertise in energy conservation and lack professional energy consumption monitoring equipment. The government provides professional energy conservation information services and consulting services to homeowners and SMEs, and encourages them to implement energy efficiency retrofit.

(3) Technical support from professional energy consultants

Energy conservation work is inseparable from the guidance of professionals, and professional energy consultants can provide professional

energy-saving services. The energy conservation consulting services and energy conservation information service platforms established by the government provide opportunities for energy conservation consultants to develop their professional capabilities.

3. Experience China can use for reference

(1) Meeting the growing needs of the people for a better life by providing energy conservation consulting services

According to the 19th National Congress of the Communist Party of China, “as socialism with Chinese characteristics has entered a new era, the principal contradiction facing Chinese society has evolved. What we now face is the contradiction between unbalanced and inadequate development and the people’s ever-growing needs for a better life.” The needs of the people are shifting from “quantity to “quality”. Energy conservation information services and energy conservation consulting services precisely meet China’s urgent needs for consumption upgrade. It is recommended to explore new methods in this regard and break new ground in energy conservation.

(2) Establishing projects of energy conservation consulting services and energy conservation information services

It is recommended that the Chinese government establish projects of energy conservation consulting services and energy conservation information services. It is recommended that the government fund qualified professionals to provide energy conservation consulting services and energy conservation information services for homeowners and SMEs, and provide technical support for them so that they can understand their own energy consumption and adopt energy efficiency retrofit measures.

(2) Cultivating professional energy consultants

It is recommended that the Chinese government establish a specialized energy consultant training platform and issue certificates to energy consultants who have passed the assessment. It is recommended that certified energy consultants be included in the government’s database management platform to provide energy conservation consulting services to SMEs and homeowners.

viii Energy audit

1. Policy content

Germany has set clear requirements for energy audits of large companies. Article 8 of the EU Energy Efficiency Directive 2012/27/EU stipulates that large companies (non-SMEs) in the EU are obliged to carry out an energy audit in accordance with DIN EN 16247-1 by December 5, 2015, and to conduct at least one energy audit every four years after the completion of the previous one. The German government will waive the obligation of conducting energy audits of companies that have passed the energy management system (DIN EN ISO 50001) certification or those that have passed the EMAS environmental management system certification.

For large companies, the energy audit is mandatory. According to Germany's latest Energy Saving Ordinance, all large companies (non-SMEs) must conduct an energy audit by December 5, 2015. If a company is not covered by the exemption of the Federal Office for Economic Affairs and Export Control and does not conduct an energy audit, it will be penalized for a fine of up to 50,000 euros. The energy audit of large companies is not covered by Germany's energy audit support policy.

The German government provides financial support for energy audits by SMEs defined in the EU Energy Efficiency Directive. SMEs in Germany can apply for funding for energy audits every 24 months. Implementers of energy audits must provide SMEs with detailed, verified analysis of energy savings potential and recommendations for energy conservation measures.

In Germany, the energy audit incentives for SMEs have gone through three phases, namely 2008-2012, 2012-2015 and beyond. Presently, for the SMEs applying for funding, the German government requires that their energy cost must be higher than 10,000 euros, and the funding ceiling is 8,000 euros. In order not to completely exclude smaller companies, the German government has stipulated that SMEs with an energy cost of less than 10,000 euros can also receive funding of no more than 800 euros. Energy auditors can decide which facility to audit. They can also audit multiple sites, but a company can only apply for one funding.

	2008年：特别能效基金（复兴信贷银行）	2012年：中小企业能源审计（复兴信贷银行）	2015年：中小企业能源审计（联邦经济与出口管制局）
能源支出门槛	无门槛	最少5,000欧元	>10,000欧元，最多5,000欧元资助 <10,000欧元，最多800欧元
基本原则	• 对尽可能多的中小企业进行能源审计 • 必须提前进行能源审计	只允许有一处地点或设施申请资金（一处取得的数据和经验应可用于其他地方）	• 根据业务的规模（能源支出）调整资金额度 • 能源审计必须符合欧盟2012年能效指令的方针 • 审计人员可决定审计哪家设施，但是资金只支付一次
问题	• 能耗非常少并且没有必要进行全面审计的公司获得高额资金 • 同一家公司的分支机构/不同地点拷贝审计报告	大量有意义进行能源审计的小公司被排除在外	对大多数能源支出<10,000欧元的公司，800欧元资金不足

	2008: Special Energy Efficiency Fund (KfW)	2012: SME Energy Audit (KfW)	2015: SME Energy Audit (Federal Office for Economic Affairs and Export Control)
Energy expenditure threshold	No threshold	At least 5,000 euros	>10,000 euros: funding of up to 5,000 euros <10,000 euros, up to 800 euros
Basic principles	• Energy audits for as many SMEs as possible • Energy audits must be conducted in advance	Only one site or facility is allowed to apply for funds (data and experience gained at one site can be used elsewhere)	• Adjusting the amount of funds based on the size of the business (energy expenditure) • Energy audits must comply with the EU's Energy Efficiency Directive 2012 • The auditor can decide which facility to audit, but the funds are only paid once
Problems	• Companies with very low energy consumption and no need for a full audit receive high funding • Audit reports are	A large number of small companies interested in conducting energy audits are excluded	For most companies with an energy expenditure of <10,000 euros, the amount of 800 euros is insufficient

	copied by branches/different locations of the same company		

Figure18 Evolution of energy audit funding projects for SMEs in Germany
Source: Research report titled Providing Economic Incentives and Promoting Energy Efficiency Improvement

Currently, the Federal Office for Economic Affairs and Export Control is responsible for implementing Germany's "SME Energy Audit" support policy, while the Federal Ministry for Economic Affairs and Energy provides financial support for the project. The amount of funding for the energy audit project is 80 percent of its funding requirement, and the upper limit is 8,000 euros. The specific application process is as follows: (1) selecting an audited energy efficiency expert from Germany's official database, (2) the energy efficiency expert submits cost estimates in an online agreement provided by the Federal Office for Economic Affairs and Export Control, (3) the Federal Office for Economic Affairs and Export Control issues a funding approval notice and informs SMEs and the energy efficiency expert to conduct energy audits, and (4) in the next 12 months, SMEs and the energy efficiency expert will submit the actual expenditure of the energy audit to the Federal Office for Economic Affairs and Export Control. The implementer can obtain up to 80 percent of the actual expenditure, as shown in Figure 19.

Application process		Selecting an energy auditor	Cost estimate	Online application		
Fund payment	Control	Federal Office for Economic Affairs and Export Control accepts	Expenditure and energy audit report	12 month period begins	Funding notice	Signing an energy audit contract

Figure19 Application process of the “SME Energy Audit” support project

Source: Research report titled Providing Economic Incentives and Promoting Energy Efficiency Improvement

In addition, Article 8(b) of Germany’s Energy Services Act (EDL-G) provides the following qualifications and expertise for energy auditors and energy efficiency experts: (1) education or training received, including: a. university or higher degree; b. obtaining national technical qualifications in relevant fields; (2) at least three years of full-time employment in energy consulting.

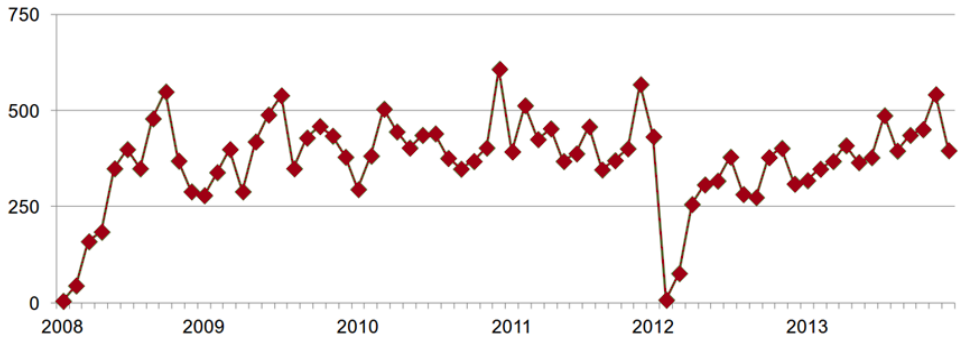


Figure 20 Number of SME energy audit funding projects approved during 2008-2013
Source: Research report titled Providing Economic Incentives and Promoting Energy Efficiency Improvement

In terms of results, the number of SME energy audit funding projects approved by Germany during 2008-2013 is between 250 and 500 per year (as shown in Figure 19). Between 2008 and 2014, the Federal Ministry for Economic Affairs and Energy funded a total of 48.7 million euros to support energy audits of SMEs.

2. Reasons for the effects

(1) Making clear legal requirements for energy audits

Energy audits are the country's requirement for companies. In accordance with the requirements of law-based government administration, energy audits must be supported by national laws. When formulating laws, it is necessary to clearly define the targets of energy audits, the cycle of energy audits, and whether or not to obtain state funding, which are conducive to law-based government administration.

(2) Establishing a dedicated mechanism to urge large companies to conduct energy audits

Large companies consume a large amount of energy. At the same time, they have strong economic strengths, high-caliber personnel, and thus obvious advantages. When encouraging large companies to conduct energy audits, the German government imposes penalties on companies that do not implement energy audits, and implements energy tax credit policies to encourage large companies to conduct energy audits and establish energy management

systems to continuously improve energy efficiency.

(3) Supporting energy audits of SMEs

The energy costs of SMEs account for a low proportion of corporate costs. The energy-saving capacity of SMEs is obviously insufficient. Therefore, the government must encourage them to raise awareness of energy conservation and understand their own energy-saving potential, and help them implement technological transformation for energy conservation.

3. Experience China can use for reference

(1) Including the specific requirements for energy auditing into the Energy Conservation Law

China's current Energy Conservation Law does not require detailed energy audits for companies, does not clearly stipulate the responsibilities and obligations of energy audits for SMEs and large companies, and lacks legal requirements for the energy audit cycle. It is recommended that the Chinese government improve the energy audit provisions in the next revision of the Energy Conservation Law to enhance the operability of the law.

(3) Providing policy support for energy audits of SMEs

It is recommended that the Chinese government increase its attention to SMEs' efforts in energy conservation and energy efficiency improvement, and provide financial support for SMEs to conduct energy audits, ideally with upper limits.

(3) Cultivating professionals to support energy audits of SMEs

It is recommended that the Chinese government strengthen training and qualification certification for energy efficiency experts, establish a credit system for them, and give full play to their role in providing technical support for SMEs which conduct energy audits.

ix Energy efficiency bidding policy

1. Policy content

According to the traditional financial support model, a unified high funding ratio may lead to inefficient input and output. In response, Germany has

introduced a competitive bidding system. The so-called competitive bidding refers to looking for ways to achieve the goal of energy-saving projects at the lowest cost by publicly bidding on such projects.

The German government believes that the new model of competitive bidding can stimulate energy service providers, urban public utilities, energy cooperatives, producers and other participants to save costs in the field of tender funding, to implement energy efficiency retrofits in the most cost-effective way, and to achieve the desired energy savings.

Germany has launched a pilot project for competitive bidding in the improvement of electric energy efficiency, which is called “STEP up!” (fully enhance the energy efficiency potential of power consumption). The project aims to identify measures to save electricity and improve energy efficiency across technologies, across entities and across industries through open tendering, thereby reducing power consumption.

During the pilot phase, the project is mainly targeted at specific areas with great energy-saving potential and major obstacles, e.g. replacement of heating circulating water pumps and hydraulic balancing devices, energy-saving measures for electric-thermal coupling in the industrial field, and “green information technology”. Only schemes that achieve the stated energy-saving goals with the lowest cost-benefit ratio (i.e. the euro saved by saving 1 kWh) can win the bid.

In 2015, Germany launched the pilot phase of the “STEP up!” (Electric Energy Efficiency Improvement) project; the planned financial support is:

2015: 15 million euros
2016: 50 million euros
2017: 100 million euros
2018: 150 million euros

In 2018, the German government will evaluate the effectiveness of the energy efficiency bidding policy and continue to improve the project based on the assessment. In the future, Germany plans to take measures to improve energy efficiency in the thermal field and provide financial support accordingly.

2. Experience China can use for reference

(1) Learning the new idea behind results-oriented bidding

The idea behind the energy efficiency bidding policy is different from that of traditional policies. The idea behind traditional policies is to set the technical direction and requirements for energy-saving funds in advance, so policy designers cannot predict the energy savings that can be realized in the future. The idea behind the energy efficiency bidding policy is to firstly set the goal of energy savings, and encourage companies to find the best solution to achieve the goal at a lower cost, thus giving companies greater freedom in the choice of technology path. For the Chinese government, this new idea is worth learning.

(2) Giving priority to implementing energy efficiency bidding policies in difficult areas

For areas with clear path for the development of energy-saving technology, the German government adopts traditional energy-saving incentive policies. Energy-saving technologies in some areas are difficult and involve much investment, so it is difficult for the government to choose a clear technology path. In view of this, it is appropriate for the government to propose a fixed energy-saving goal, and organize competitive bidding to invite companies with strong scientific and technological strengths to achieve the goal at the lowest cost. For China, the idea of implementing energy efficiency bidding in areas with more technical difficulties and more technical paths is worth learning.

III. Experience China can use for reference from Germany's energy conservation policies

As an old Chinese saying goes: "Stones from other hills are good for processing jade". Whether the idea behind energy conservation policies or specific energy conservation policies, by comparing China's and Germany's energy conservation policies, it can be found that many practices in Germany can bring new enlightenment and inspiration to China.

i Enlightenment from the idea behind Germany's energy conservation policy system

The system of Germany's energy conservation policy has certain commonalities with that of China's energy conservation policy, mainly reflected in the following aspects:

Firstly, both China and Germany attach great importance to energy conservation and energy efficiency improvement at the national strategic level. Germany regards energy conservation and energy efficiency improvement as one of the two pillars of its Energy Transition, while China regards energy conservation and energy efficiency improvement as an important part of its ecological civilization and green development strategy.

Secondly, both China and Germany underline the importance of "law-based governance" and "law-based government administration". Germany has established a series of laws. China has also enacted the Energy Conservation Law and related regulations, norms and national standards to provide legal protection and institutional support for energy conservation through legislation and law enforcement.

Thirdly, both China and Germany adopt the "stick + carrot" policy. In terms of "stick", both countries' energy conservation laws stipulate clear penalties; in terms of "carrot", the two countries have designed various incentives and preferential policies to promote energy conservation, while using incentive policies and restraint policies to promote energy conservation work.

Fourthly, both China and Germany are focusing on the key areas of energy conservation to promote energy conservation. Germany's energy

consumption in buildings accounts for more than 40 percent of the country's total, while China's energy consumption in the industrial sector accounts for more than 60 percent of the country's total.

Fifthly, both China and Germany take various economic measures to promote their work. In terms of fiscal policy, tax break, finance and insurance, and market transactions, both China and Germany have formulated various policies to promote energy conservation and energy efficiency improvement.

Through comparison, it is also found that the ideas behind Germany's energy conservation policy system and those of China's energy conservation policy system are different in some aspects:

Firstly, the German government pays more attention to designing market mechanisms and leveraging market forces to promote energy conservation. The Chinese government places greater emphasis on the government's responsibilities and role. E.g. there has been a lot of successful experience in energy tax credits, cultivating energy consultants and requesting them to provide services, and providing project services through policy banks.

Secondly, the German government places more emphasis on supporting energy conservation work of small and medium-sized energy consumers. The Chinese government places greater emphasis on energy conservation work of large energy consumers. E.g. the German government has adopted strict legal requirements as a primary means for large companies. The German government believes that market competition will force large companies to improve energy efficiency, so it rarely gives financial subsidies to them. On the other hand, it subsidizes the energy conservation work of small and medium-sized energy consumers e.g. SMEs and homeowners. In particular, the German government has implemented a subsidy policy for energy conservation by low-income families, indicating its support for vulnerable groups.

Thirdly, the German government pays more attention to the integration of energy conservation with renewable energy, while China emphasizes the combination of energy conservation and clean energy consumption. In designing policies for improving energy conservation in

buildings, Germany focuses on the integration of energy conservation with renewable energy in areas such as heating and hot water. In order to “fight against environmental pollution”, China emphasizes reducing coal consumption, ensuring the safety of natural gas supply, and implementing the policy of “replacing coal by electricity” and “replacing coal by natural gas”.

Fourthly, the German government places more emphasis on the role of information and consulting services. The system of Germany’s energy conservation policies reflects the idea of “stick + carrot + tambourine”, highlighting the awareness of energy conservation and encouraging energy consumers to save energy. Internationally, the German government’s idea is unique.

ii Suggestions for the Chinese government on improving energy conservation policies

Based on Germany’s experience, in order to improve China’s energy conservation policies, the following policy recommendations are proposed:

1. Increasing support for the energy conservation of SMEs

It is recommended to carry out energy conservation demonstration projects of SMEs during the “14th Five-Year Plan” period. We should help different types of SMEs conduct energy audits, support them in implementing technological transformation for energy conservation, and facilitate them to carry out modern and intelligent energy management so as to improve energy management and energy efficiency.

2. Cultivating energy efficiency management professionals

It is recommended to cultivate energy managers and energy efficiency consultants with Chinese characteristics according to China’s national conditions. Energy managers mainly carry out energy conservation management in entities with big energy consumption. Energy efficiency consultants mainly use energy conservation knowledge and energy management knowledge to provide third-party energy-saving services to the society. We should give full play to the role of third-party organizations in the training of energy managers and energy consultants, foster an energy-saving service market, and provide more space for engineers and technicians in the

energy sector to apply expertise and realize personal value.

3. Conducting energy conservation business with the help of the bank's service network

It is recommended to give full play to the supporting role of policy banks or commercial banks interested in green development in the application, approval, review and loan process of energy conservation projects. It is recommended to implement energy conservation and energy efficiency improvement projects to increase the awareness of banking professionals on such projects and enhance their basic capabilities in green finance.

4. Promoting the integration of energy conservation, renewable energy and smart energy

Saving energy and increasing the proportion of renewable energy are the two pillars of China's efforts to tackle climate change and curb the excessive growth of carbon dioxide emissions. It is necessary to focus on the combination of new technologies of energy consumption and technologies of spot utilization of renewable energy in the process of energy consumption. We should promote the deep integration of energy conservation with renewable energy in terminal electricity, hot water supply, steam supply, etc., and accelerate energy transition. It is recommended to use IT and modern tools, e.g. big data, cloud computing, Internet of Things and artificial intelligence, to improve the traditional energy utilization methods, and further improve energy efficiency with modern and refined energy management.