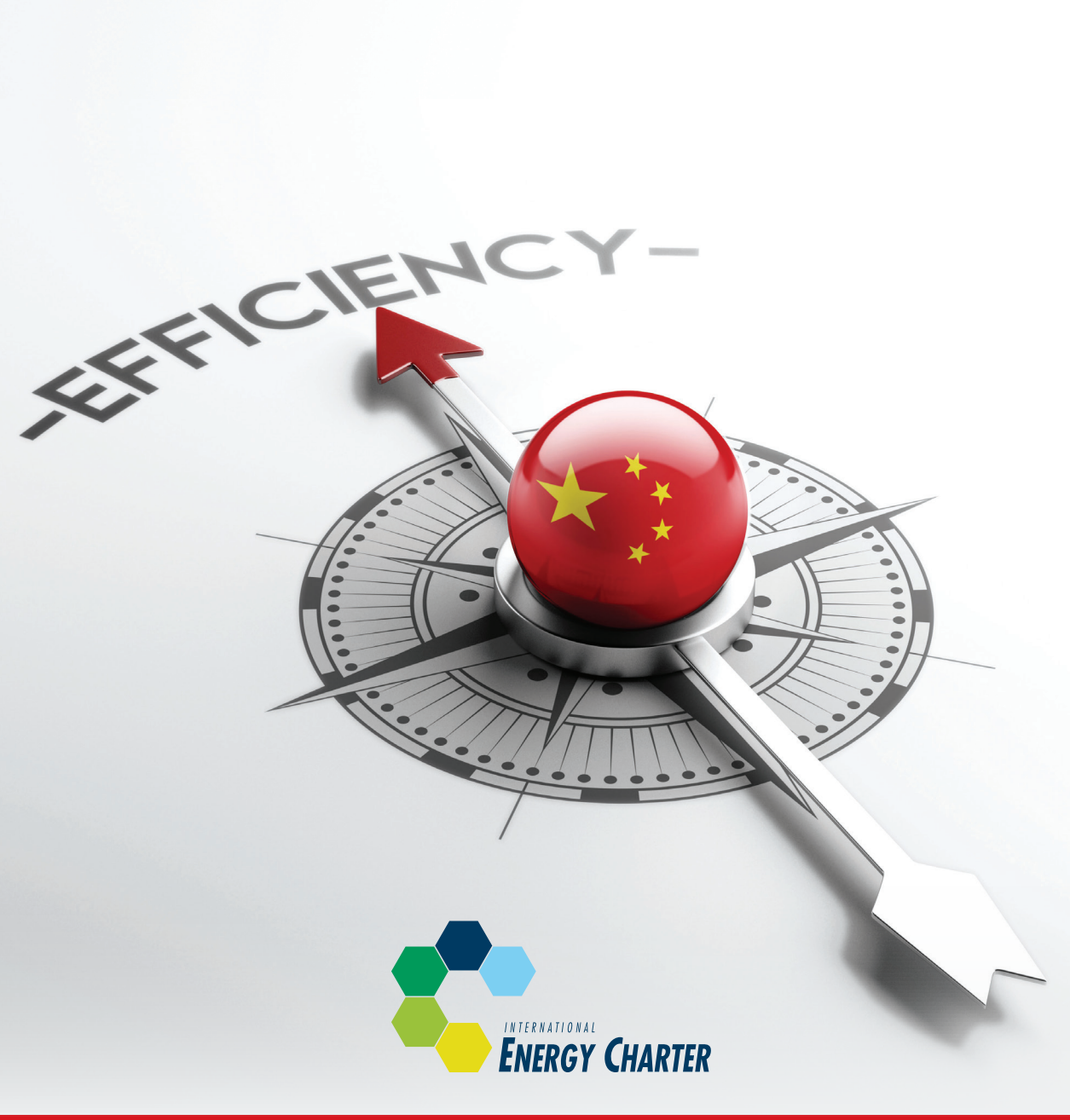

INTERNATIONAL ENERGY CHARTER

CHINA ENERGY EFFICIENCY REPORT

Protocol on Energy Efficiency and Environmental Aspects

COMMON RULES FOR ***GLOBAL ENERGY SECURITY***

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Protocol on Energy Efficiency and Environmental Aspects

COMMON RULES FOR **GLOBAL ENERGY SECURITY**

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FOREWORD

The International Energy Charter has a long-standing history of cooperation with China, which has recently intensified, reflecting China's global energy investment interests. China gained Observer status to the Energy Charter Conference in 2015 when it signed the International Energy Charter political declaration in The Hague. In 2017, the International Energy Charter-China Electricity Council Joint Research Centre was established in Beijing.

China is a pivotal country in the energy sector as both a major energy producer and as the world's largest energy consumer. The country is a global leader in producing renewable energy and taking action to improve energy efficiency.

Successful implementation of energy efficiency policies have helped to dramatically curb growth in China's energy demand alongside structural shifts in the economy and demographic changes. According to IEA figures, China's energy intensity improved by 30% between 2000 and 2015 with much of this driven by energy efficiency policy focused on the energy-intensive industry sector. The scale of energy efficiency improvement during this period was such that the annual energy savings were equal to the country's renewable energy supply.

With increasing wealth and improved access to modern energy services, however, per-capita energy consumption continues to grow. Effectively managing energy demand is central to China's economic development agenda and its efforts to achieve the Paris Agreement goals and control dependency on imports. Energy efficiency policies and measures will make an important contribution to achievement of the country's targeted 15% energy intensity improvement and total energy consumption cap of less than 5 Gtce, to be delivered between 2016 and 2020 by the 13th FYP, alongside economic restructuring and productivity improvements.

China's Energy Efficiency Report details the extent of China's alignment with the Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA). Effective alignment will facilitate the country's smooth accession to the PEEREA and the Energy Charter Treaty (ECT). PEEREA is a political agreement and its focus is on practical implementation of political commitment to improve energy efficiency though market-based approaches and effective policies and measures.

I would like to take this opportunity to thank Ms Lina Yan, seconded official from the Jiangsu Energy Regulatory Office of the National Energy Administration of China, for her dedication to developing this Report and for being instrumental in strengthening relations with China during this critical time as the Energy Charter Process continues to modernise. With the close cooperation of China, the Energy Charter Conference can aspire to achieve a future of strengthened global energy governance for the benefit of all members. Assisting China with its accession to the ECT is therefore a priority for the Energy Charter Secretariat.

Urban RUSNÁK

Secretary General of the Energy Charter Secretariat

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Acronyms, abbreviations and units of measure

Acronyms and abbreviations

ADB	Asian Development Bank
AIIB	Asian Infrastructure Investment Bank
APEC	Asia-Pacific Economic Cooperation
AQSIQ	General Administration of Quality Supervision, Inspection and Quarantine of China
ASEAN	Association of Southeast Asian Nations
ASIFMA	Asia Securities Industry & Financial Markets Association
BP	British Petroleum
BRI	Belt and Road Initiative
CAECER	China Association for Energy Conservation and Emission Reduction
CCDMF	China Clean Development Mechanism Fund
CCER	Chinese Certified Emission Reduction
CCUS	Carbon Capture, Use and Storage
CDB	China Development Bank
CDM	Clean Development Mechanism
CEC	China Electricity Council
CECA	China Energy Conservation Association
CECEP	China Energy Conservation and Environmental Protection Group
CEEIA	China Economize Environmentalist Industry Association
CEIB	China Export-Import Bank
CERC	Clean Energy Research Centre
CFER	China Foreign Exchange Reserve
CIC	China Investment Corporation
CIECCPA	China Industrial Energy Conservation and Clean Production Association
CIF	Climate Investment Fund
CNPC	China National Petroleum Corporation
CNOOC	China National Offshore Oil Cooperation
CNG	Compressed Natural Gas
CNY	Chinese Yuan (Renminbi)
CO_2	Carbon Dioxide
COD	Chemical Oxygen Demand
CPC	Communist Party of China
CPPCC	Chinese People's Political Consultative Conference
CSTC	Construction Science and Technology Industrialization Development Centre

CSUS	China Society for Urban Studies
DES	District Energy System
DSM	Demand-Side Management
EAS	East Asia Summit
EC	European Commission
ECT	Energy Charter Treaty
EEAP	Energy Efficiency Action Plan
EELP	Energy Efficiency Leading Programme
EEO	Energy Efficiency Obligation
EGA	Environmental Goods Agreement
EGEE&C	Expert Group on Energy Efficiency & Conservation (APEC)
EMCA	ESCO Committee of China Energy Conservation Association
EMCO	Energy Management Company
EPC	Energy Performance Contracting
EPPEI	Electric Power Planning & Engineering Institute
EPPI	Efficiency Policy Progress Index
ESCO	Energy Service Company
ESMAP	Energy Sector Management Assistance Programme
EU	European Union
EUR	Euro – the currency of the European Union (1 EUR=7.8 CNY)
EV	Electric Vehicle
EWG	Energy Working Group
FDI	Foreign Direct Investment
FIE	Foreign-Invested Enterprise
FTZ	Free Trade Zone
FYP	Five-Year Plan
GDP	Gross Domestic Product
GEF	Global Environment Facility
GHG	Greenhouse Gas
GOC	Government of China
GSP	Generalised System of Preference
GTF	Global Tracking Framework
HDV	Heavy-Duty Vehicle
IEA	International Energy Agency
IECh	International Energy Charter
IEEFA	Institute for Energy Economics and Financial Analysis

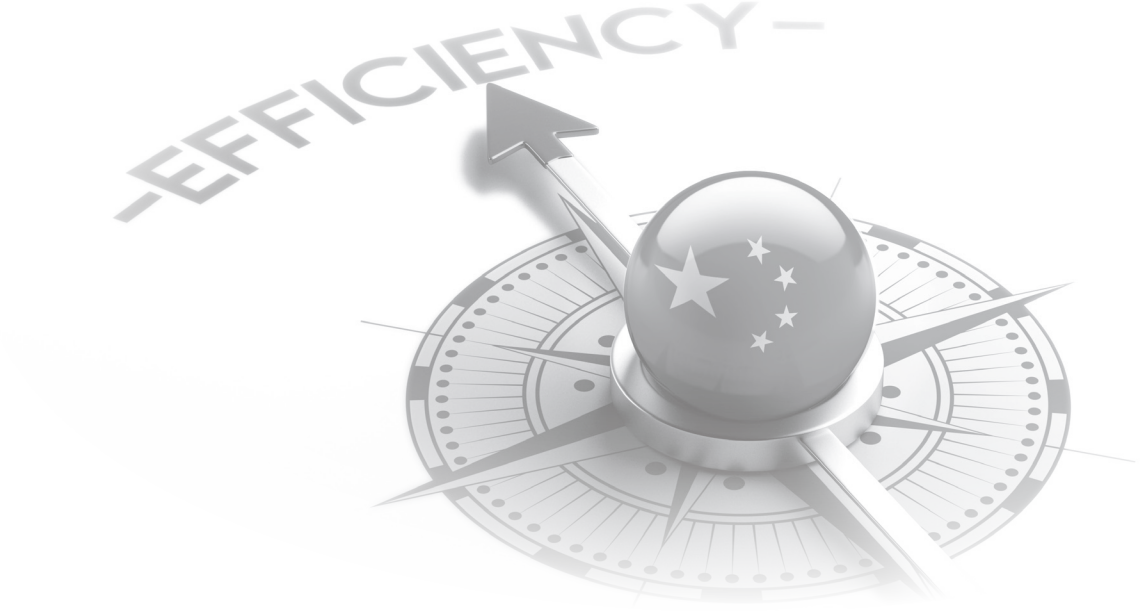
IFC	International Finance Corporation
IFI	International Financial Institution
IIP	Institute for Industrial Productivity
INDCs	Intended Nationally Determined Contributions
IPR	Intellectual Property Right
LAS	League of Arab States
LDV	Light-Duty Vehicle
LEED	Leadership for Energy and Environmental Design
LNG	Liquefied Natural Gas
MEE	Ministry of Ecology and Environment
MEP	Ministry of Environmental Protection
MEPR	Minimum Energy Performance Requirements
MEPS	Minimum Energy Performance Standards
MIIT	Ministry of Industry and Information Technology
MOF	Ministry of Finance
MOHURD	Ministry of Housing and Urban-Rural Development
MOST	Ministry of Science and Technology
MOT	Ministry of Transport
NBS	National Bureau of Statistics
NDRC	National Development and Reform Commission
NEA	National Energy Administration
NEDC	New European Driving Cycle
NEV	New Energy Vehicle
NGO	Non-Government Organisation
NO_X	Nitrogen Oxide
NPC	National People's Congress
NZEB	Nearly Zero-Energy Building
OFDI	Outward Foreign Direct Investment
PEEREA	Protocol on Energy Efficiency and Related Environmental Affects
PENT	Pre-Establishment National Treatment
PM	Particulate Matter
PPP	Purchasing Power Parity
R&D	Research & Development
RISE	Regulatory Indicators for Sustainable Energy
SAC	Standardization Administration of China
SAT	State Administration of Taxation

SDGs	Sustainable Development Goals
SE4ALL	Sustainable Energy for All
SEAD	Super-efficient Equipment and Appliance Deployment
SERC	State Electricity Regulatory Commission
SHPGX	Shanghai Petroleum and Natural Gas Exchange
SO_2	Sulphur Dioxide
SO_X	Sulphur Oxide
SRF	Silk Road Fund
TFC	Total Final Consumption
TOU	Time-of-Use
TPC	Total Primary Consumption
TPES	Total Primary Energy Supply
ULEB	Ultra-Low Energy Building
UNFCCC	United Nations Framework Convention on Climate Change
US	United States
USD	United States Dollars (1 USD=6.8 CNY)
VOC	Volatile Organic Compound
WB	World Bank
WEO	World Energy Outlook
WTO	World Trade Organisation

Units of measurement

Gtce	gigatonnes of coal equivalent
$GtCO_2$	gigatonnes of carbon dioxide
GW	gigawatt
GWh	gigawatt-hour
gce	gram of coal equivalent
kg	kilogram
kgce	kilogram of coal equivalent
kVA	kilovolt-ampere
kW	kilowatt
kWh	kilowatt-hour
km	kilometre
km^2	square kilometre
koe	kilogram of oil equivalent
l	litre

m^2	square metre
m^3	cubic metre
MJ	megajoule
Mt	million tonnes
Mtce	million tonnes of coal equivalent
Mtoe	million tonnes of oil equivalent
MW	megawatt
MWh	megawatt-hour
PWh	petawatt-hour
pp	percentage point
t	tonne
tce	tonnes of coal equivalent
toe	tonnes of oil equivalent
TW	terawatt
TWh	terawatt-hour



EXECUTIVE SUMMARY

Executive Summary

Introduction

China became an Observer to the Energy Charter Conference when it signed the International Energy Charter political declaration in The Hague, Netherlands, in May 2015. Observer countries progress towards accession to the ECT by aligning their legal and regulatory frameworks with the provisions of the Energy Charter Treaty (ECT) and the Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA). When Observer countries accede to the ECT they typically ratify the PEEREA at the same time.

The PEEREA is a political agreement and its focus is on practical implementation of political commitment to improve energy efficiency consistent with sustainable development through efficient energy markets and market-orientated price formation, effective policies and measures as well as through cooperation with other Contracting Parties to the Protocol. PEEREA provides guidance on the development of energy efficiency programmes, indicates areas of cooperation and provides a framework for the development of cooperative and coordinated action.

China's Energy Efficiency Report details the extent of alignment of China's energy efficiency policy with the PEEREA. Effective alignment will facilitate the country's smooth accession to the PEEREA and the ECT.

Ambitious and holistic vision for the energy sector and energy efficiency

PEEREA sets down principles that should underpin a country's energy policy and strategic direction for development of the energy sector and improvement of energy efficiency. Energy efficiency is to be *promoted 'as a considerable source of energy'* and as a means to reduce adverse environmental impacts of energy systems. Contracting Parties are also encouraged to *'adopt a holistic approach that encompasses the whole energy cycle'* when developing energy efficiency policy and programmes. The framework conditions, to be created for enabling energy efficiency improvements, are also to be based on efficient energy markets, market-orientated price formation and fuller reflection of environmental costs and benefits.

China's vision for the development of its energy system clearly takes a holistic approach, aiming to achieve a smart, optimised, clean and low carbon energy system with transformations on the both the demand-side and supply-side aided through 'revolutions' in technology and innovation as well as market design. China's vision for the development of its energy sector is encapsulated in its visionary concepts of 'Ecological Civilisation', 'Four Revolutions and One Cooperation' and the 'Belt and Road Initiative'.

The Strategic Action Plan for Energy Development (2014-2020) and the 13th Five-Year Plan for Energy Development (2016-2020) are important documents providing the overall blueprint and programme of action for implementing the above-mentioned vision for energy development; energy efficiency is a key feature in both.

Institutions: allocation of responsibilities and coordination

There are many government agencies supporting energy efficiency in China that play different roles in supporting energy efficiency efforts and are independent of one another. Clear allocation of responsibilities and effective coordination of these many bodies is prerequisite for the development and implementation of effective energy efficiency policy. Article 4 of the PEEREA on Division of Responsibility and Coordination states, *'Each Contracting Party shall strive to ensure that energy efficiency polices are coordinated among all of its responsible authorities.'*

The National Development Reform Commission (NDRC), an agency of the State Council and a macro-control department, coordinates ministries and departments with allocated powers, responsibilities, functions and duties in accordance with the laws and regulations that have relevance to energy efficiency. The National Energy Administration (NEA) is a subordinate agency directly under the NDRC, responsible for the management of energy conservation and comprehensive use of resources in China's energy industry. Much of this is managed by the NEA's Energy Conservation and Technology and Equipment Department. The NEA also regulates the energy utilities, since the merging of the State Electricity Regulatory Commission (SERC) into the NEA in 2013. Other ministries are responsible for the implementation of energy conservation and energy efficiency policy measures in the industrial, transport and building sectors, guidance of energy efficiency technology research, development of energy efficiency standards and providing financial support for the implementation of energy efficiency policy respectively.

The overarching Five-Year Plans (FYPs) and targets play an important role in driving the cooperation and need for coordination of various responsible Ministries, departments, local government and other actors. For example, the leading department and participating departments responsible for implementing tasks set out in 13th Five-Year Plan (FYP) for Energy Conservation and Emission Reduction are specified. The review and planning process of policies and programmes is aided by the well established and coordinated FYP cycle and the existence of clearly defined and well communicated targets and indicators that enable monitoring of progress. This practice is also well aligned with Article 5 of the PEEREA, which states that Contracting Parties are to formulate energy efficiency strategies and policy aims that are transparent to all interested parties.

Another important coordinating mechanism is the National Climate Change and Energy Conversation and Emission Reduction Leading Group, set up by the State Council in June 2007.[1] which acts as the national coordinating body for policy development and implementation relating to climate change, energy conservation and greenhouse gas emissions reduction. The NDRC is responsible for the specific work of the Leading Group.

Principle of fuller reflection of environmental costs and benefits

While market-orientated price formation is one of fundamental principles of the Energy Charter Treaty, it is well recognised that policy interventions are sometimes necessary to address market failures or barriers. This is particularly the case for environmental protection and for improving energy efficiency, which is why PEEREA was established to guide countries in developing policies on these aspects. A guiding principle for the development of such policies, however, is that interventions should be market-based and designed to minimise market distortions. For example, carbon trading, carbon taxation and Energy Efficiency Obligations (EEO) are measures that align well with this principle. Most of China's energy savings achieved to date have been delivered through the EEO placed on industry.

China is about to introduce a carbon trading scheme, which will enable, to some extent, implementation of the principle set out in Article 19 of the ECT that the polluter should bear the cost of pollution. It has taken a long time to establish the carbon trading scheme with the concept being introduced in 2011 and pilot regions operating since 2013. When established, expected from 2020, China's carbon market will be largest in the world, would provide an efficient price signal to polluters and energy consumers and could provide revenues for the

1 See GOC website: http://www.moh.gov.cn/bgt/gwywj2/201808/0f34b4c58a2e46ca9a3f7061e6556c6c.shtml

Government of China that can be used to support the transition of its energy sector, including energy efficiency programmes.

The co-benefits of energy efficiency are recognised in the PEEREA in relation to achieving sustainable development, particularly the reduction of greenhouse gases to mitigate climate change and other air pollutants that cause acidification of landscapes and ecosystems. Indeed, the improvement of energy efficiency can give rise to many benefits and it is possible to capture the value of these benefits.[2] There exists evidence that the co-benefits of energy efficiency are being increasingly recognised and some strategies and policies attempt to capture these benefits and exploit synergies. For example, the intention to integrate environment, energy and regional development issues within the climate change mitigation context is well documented in China's Intended Nationally Determined Contribution (INDCs). Energy sector reforms, including improved energy efficiency, were integral to China's Action Plan on Air Pollution Prevention and Control for 2013-2017.[3]

Sustainable development and principle of respecting international environmental agreements

A stated objective of the PEEREA is *'promotion of energy efficiency policies consistent with sustainable development.'* Since adoption of the UN's 2030 Agenda for Sustainable Development and the associated 17 Sustainable Development Goals (SDGs) in 2015, studies have been published that illustrate the interaction between the SDG goal No. 7 on energy and the other SDGs, with energy efficiency potentially playing a particularly important role due to its many co-benefits.[4] China's vigorous pursuit of improved energy efficiency is contributing to the achievement of other SDGs. The central role of the energy sector reform, including energy efficiency improvements, in China's actions to achieve the SDGs is well illustrated in China's SDG progress report.[5]

A basic principle of the PEEREA as outlined in Article 3 is that *'cooperative and coordinated action shall take into account relevant principles adopted in international agreements, aimed at protection and improvement of the environment, to which Contracting Parties are party.'* China demonstrated strong global leadership in addressing the challenge of mitigating climate change by being an early Party to ratify the Paris Agreement.[6] It is a given that most countries must continue to assess and develop their commitments to reduce greenhouse gas emissions in order that the global collective effort, currently falling well short, will meet the Paris Agreement goals. China has recently taken some ambitious steps demonstrating its climate action leadership in the energy field through improving energy efficiency. For example, China was the third country in the world, following Japan and the United States, to adopt fuel consumption standards for heavy-duty vehicles. Another example, is China's New Energy Vehicle (NEV) credits mandate,[7] to apply from April 2019.

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2 See IEA website: http://www.iea.org/publications/freepublications/publication/Multiple_Benefits_of_Energy_Efficiency.pdf

3 Available at:
http://www.sustainabletransport.org/wp-content/uploads/2017/08/National-Action-Plan-of-Air-Pollution-Control.pdf

4 See: Connecting the Sustainable Development Goals by their energy inter-linkages, McCollum et al, IIASA, WP-17-006. Available at: http://pure.iiasa.ac.at/id/eprint/14567/1/WP-17-006.pdf; Global exposure and vulnerability to multi-sector development and climate change hotspots, Edward Byers et al, 2018, Environmental Research Letters 13 055012.

5 See GOC website: http://www.fmprc.gov.cn/web/ziliao_674904/zt_674979/dnzt_674981/qtzt/2030kcxfzyc_686343/P020170824650025885740.pdf

6 China was the 23rd country to ratify the Paris Agreement. Available at: http://www.sohu.com/a/113515731_220090

7 See: https://www.theicct.org/publications/china-nev-mandate-final-policy-update-20180111

Market-based approaches, financing and engaging the private sector

A key objective of the PEEREA is that Contracting Parties will establish the framework conditions for promoting energy efficiency by pursing an approach based on efficient energy markets, market-orientated price formation and a fuller reflection of environmental costs and benefits throughout the energy cycle.[8] The PEEREA recognises this to be vital to progressing energy efficiency and associated environmental protection and emphasises that the private sector must play a key role in delivering energy savings.

On energy market design, China has had a longstanding intention to move towards open and competitive markets where the prices of energy resources would be based on supply and demand.[9] Progress, however, has been slow and varied with coal prices liberalising more quickly compared to oil, gas and electricity. Reform efforts, however, continue under the 13th FYP for Energy Development,[10] which aims to achieve market-oriented reforms, rationalise the price system, eliminate institutional barriers and build fair competition in the energy market system. China has had some success in using prices and fiscal incentives to influence energy consumers' behaviour, including time-of-use (TOU) electricity prices to manage peak electricity demand and a consumption tax to promote vehicles of smaller engine size.

China's efforts to develop its ESCO industry provide an excellent example of implementing PEEREA's principles relating to economic efficiency and use of market-based mechanisms (Article 3(2)(a) and Article 3(3)), encouragement of private sector engagement (Article 3(6) and Article 8(2)(d)) and enabling the financing of energy efficiency (Article 3(2)(c), Article 6, Article 8(2)(f)). For some time China has applied energy intensity reduction targets to its energy-intensive industries – essentially through an Energy Efficiency Obligation – and by doing so, created demand for energy efficiency services. China's success in developing its ESCO industry is evidenced by the fact that the global energy services market expanded by 12% to USD 26.8 billion in 2016 with China accounting for over 60% of global revenues.[11]

The effort to improve energy efficiency markets continues to deepen as set out in the 13th FYP for Energy Development (2016-2020). Over time, China has been successful in growing the share of private finance relative to public finance in energy efficiency investments. The share of private finance grew from 76% in 2011 to near 90% in 2014. The 13th FYP states China's intention to continue encouraging this shift by strengthening market-based approaches including ESCOs, risk guarantees for ESCO financing, and mainstreaming energy efficiency lending through dedicated credit lines.

China's public finance to support energy efficiency programmes and initiatives tends to come directly from the central government's budget. The upcoming carbon trading scheme might provide auction revenues that could be used for energy efficiency. China has been successful in obtaining financial and technical support from international financial institutions such as the World Bank, the Global Environment Facility and the Asian Development Bank.

While most investment is currently from domestic sources, China is opening up to foreign investors. Investment conditions in China for foreign investors have improved considerably in recent years due to significant regulatory and legislative efforts.[12] In time, China's ESCOs may

8 See Energy Charter Treaty (Article 19) and the PEEREA (Article 1(2)(b) and Article 3(2)(a)).

9 See NDRC website: http://www.ndrc.gov.cn/fzgggz/tzgg/ggkx/201504/t20150409_676931.html

See GOC website: http://www.gov.cn/zhengce/2017-05/21/content_5195683.htm

10 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbtz/201701/t20170117_835278.html

11 See IEA website: http://www.iea.org/publications/freepublications/publication/Energy_Efficiency_2017.pdf

12 China Investment Report, Energy Charter Secretariat, 2017.

well seek opportunities outside China when other countries develop their energy efficiency markets.

China's energy efficiency policy, strategies and plans

China has a relatively sophisticated energy efficiency policy framework in place, well aligned with PEEREA Article 5 given the clear aims and objectives, targets and indicators, with clear efforts to implement and evolve the framework to deliver targeted energy savings. China has positioned itself to be a world leader in improving energy efficiency and looks set to continue on this path in the future. According to the IEA's efficiency policy progress index,[13] China accounted for more than half of the world's total policy progress 2000-2016 and the country's rate of improvement in policy progress was extremely high between 2011-2015 relative to other countries.

The Energy Conservation Law, updated most recently in 2016, provides the broad legal framework for energy conservation and energy efficiency. It stipulates the responsibilities and obligations of governmental bodies and relevant departments as well as the rights and obligations of energy-consuming entities and energy-using equipment manufacturers. The law also details specific mechanisms to promote energy efficiency and energy conservation such as prohibition of the production, import and sale of products that do not meet the Mandatory Energy Efficiency Standard; the phase-out system for outdated and inefficient products and equipment; energy-efficiency labelling management; and the energy conservation assessment and review system for fixed asset investment projects.[14]

Current policy reforms to drive energy efficiency improvements stem from the above-mentioned Strategic Action Plan for Energy Development (2014-2020) and the 13th FYP for Energy Development (2016-2020). The 13th FYP for Energy Development (2016-2020), continues the approach introduced by the 12th FYP, of applying 'Dual Control' to both total energy consumption and energy intensity, driven by targets to be achieved by 2020 relative to 2015:

- total energy consumption less than 5 Gtce;
- energy consumption per unit of GDP (tce/CNY 10,000) to be reduced by 15%.

Building on the FYP, the Energy Supply and Consumption Revolution Strategy (2016-2030) was introduced to provide a longer term outlook, to 2030, which is very important for investors needing to gauge the likely pace of policy change. This strategy sets a clear target with total energy consumption to be capped at 6 Gtce. By 2030, China also expects its energy consumption per unit of GDP to reach the current global average while the energy efficiency performance levels of China's main industrial products are expected to be among the most advanced in the world.

The above-mentioned strategic plans are the basis for a series of energy efficiency action plans specific to different sectors: coal-fired power units upgrading and renovation; green development of industry; green buildings; and green transport. In addition, to be implemented over the same timeframe (to 2020), there exists the Special Plan for Medium and Long-Term Energy Conservation and the 13th FYP for National Energy Conservation Action. The Special Plan–focussed on industry, buildings and transport – proposes a series of macro energy-saving targets

13 The IEA Efficiency Policy Progress Index (EPPI) combines coverage and strength of codes and standards into single index for measuring overall policy progress. The EPPI covers seven energy end-uses: space cooling, space heating, appliances, water heating, industrial motors, lighting, LDVs and HDVs. For detail on methodology, see IEA website: http://www.iea.org/publications/freepublications/publication/Energy_Efficiency_2017.pdf

14 See NEA website: http://www.nea.gov.cn/2017-11/03/c_136725225.htm

while the 13th FYP emphasises public participation, raising awareness and capacity-building in order to promote the improvement of energy efficiency levels in the industry, building and transport sectors, public institutions and other key energy-consuming sectors.

Energy Efficiency Obligations on Industry

The majority of energy savings achieved to date in China have come from industry. These energy savings have largely been driven by a mandatory target-based programme – TOP 10,000 – which was introduced in 2006 and expanded in 2011 to cover more than 16,000 of the largest energy-intensive companies.[15] An energy-saving target is shared across provinces and cities with local governments being responsible for meeting their quota of energy savings and having the powers to set targets for firms, conduct mandatory audits, monitor progress and apply penalties. An energy efficiency fund supports the enterprises involved in this programme and the Government assists by supporting the ESCO industry, providing fiscal and financial incentives and providing training. China's Top Runner programme complements the TOP 10,000 programme by identifying high energy-efficiency product models and benchmarks for some energy-intensive industrial sectors. For example, 19 Top Runners were in place for industrial production of steel, ethylene, synthesis ammonia, cement, plate glass and electrolytic aluminium in 2017.[16]

In recent years, the industrial sectors have been able to improve industrial energy efficiency through a series of actions such as phasing out excess production capacity, inspection and reduction in energy consumption and decommissioning small coal-fired power units and outdated production capacity. From 2012 to 2016, the energy consumption associated with the added value (i.e. productivity) of the designated industrial enterprises reduced by 29.5% and in 2017 decreased by 4.6% relative to the previous year.[17] Avoided costs in large industry sectors and manufacturing industries in 2014 due to energy efficiency investments were USD 18 billion and USD 10.9 billion respectively.[18]

Looking to the future, the goals set out in the 13th FYP for Green Development of Industry[19] and the 13th FYP for Energy Conservation and Emission Reduction target an 18% energy productivity improvement in unit value-added energy consumption of industrial enterprises above the designated level by 2020 relative to 2015.[20] While energy efficiency will make an important contribution to achieving the 2020 target, economic restructuring is expected to account for a large share of the planned energy savings.

MEPS and trade

Since the 12th FYP, China has released and amended Minimum Energy Performance Standards (MEPS) for 54 end-use energy-consuming products including industrial equipment, household appliances, lighting equipment and office equipment. MEPS have also been issued for a further 73 products on a per unit of product basis that includes the main energy-intensive industries, such as steel, non-ferrous metals, building materials, petrochemicals and electric power.[21]

MEPS are a powerful instrument to improve energy efficiency across regions and internationally by removing the most inefficient energy-using equipment, products and processes from the

15 See IEA website: https://www.iea.org/newsroom/news/2016/october/energy-efficiency-market-report-2016.html

16 See MIIT website: http://www.miit.gov.cn/n1146295/n1652858/n1652930/n4509607/c6226963/content.html

17 Available at: https://baijiahao.baidu.com/s?id=1603708256898198852&wfr=spider&for=pc

18 See IEA website: https://www.iea.org/newsroom/news/2016/october/energy-efficiency-market-report-2016.html

19 See MIIT website:http://www.miit.gov.cn/n1146295/n1652858/n1652930/n3757016/c5143553/content.html

20 See GOC website:http://www.gov.cn/zhengce/content/2017-01/05/content_5156789.htm

21 See MIIT website: http://www.miit.gov.cn/n1146285/n1146352/n3054355/n3057542/n3057544/c3634672/content.html

market. Harmonisation at regional or international level can facilitate trade while progressing energy efficiency as promoted by PEEREA Article 7, consistent with the provisions of the ECT and hence WTO rules. In accordance with Article 7(1) of PEEREA, '*Contracting Parties shall encourage commercial trade and cooperation in energy efficient and environmentally sound technologies, energy-related services and management practices*'. Article 8 (2)(c), however, elevates the importance of energy efficiency standards and states that '*domestic programmes may include activities such as the definition of standards designed to improve the efficiency of energy using equipment, and efforts to harmonise these internationally to avoid trade distortions*'. Related to this, China engages in cooperative efforts through the WTO, APEC and the China-EU Energy Dialogue, among other fora.

Efficient and green buildings

In 2017, buildings consumption accounted for 18.35% of the nation's total final energy consumption.[22] The average annual growth rate of energy consumption by buildings has followed a declining trend from 11.9% during the 10th FYP to about 6% in the 11th/12th FYPs due to successful implementation of policies and measures.[23] From 1986 to 2015, some 44 new or revised building energy efficiency related standards have been issued by MOHURD, the MOF and State Council.[24] China has recently moved towards using outcome-based targets, to complement other codes and measures, in order to strengthen the energy efficiency performance of buildings once commissioned and in operation.

China strongly promotes 'green buildings', which by definition takes a holistic approach to improving many environmental aspects of buildings including energy efficiency. In order to facilitate implementation of China's Green Building Development Strategy by better guiding industry on development of ultra-low energy buildings and green buildings, MORHURD issued the Passive Ultra-Low Energy Green Building Technical Guidelines (Residential Buildings) in 2015.[25] MOHURD also issued the 13th FYP for Building Energy Conservation and Green Building Development in 2017 with the ambition to increase the proportion of urban green buildings area in the total area of new buildings to 50% by 2020 and to build more than 10 million m^2 of ultra-low energy building (ULEB) or nearly zero-energy building (NZEB) demonstration projects by 2020.[26]

Green Transport

China is making strong progress in developing and implementing clean transportation policy and is moving into a leadership role on international climate policy for transportation. The 12th/13th FYPs have resulted in a series of documents to guide the industry and to set the sector's goals for energy conservation and emissions reduction. Energy efficiency improvements in transport are primarily driven by energy security concerns and emissions reduction requirements for CO_2 and other pollutants damaging to health and the environment. By 2020, China aims to reduce the CO_2 emissions intensity of transportation by 7% compared with 2015,[27] achieve a 30% public transport share in large cities[28] and attain

22 Annual Report on China's Energy Development 2017, EPPEI, April 2018.

23 Available at: http://www.cnelc.com/text/1/171109/AD100768889_2.html

24 A comparison of building energy codes in the US, Germany and China-their impact on achieving net zero energy goals, Hu Ming, ACEEE Summer Study on Energy Efficiency in Buildings, 2018.

25 See MOHURD website: http://www.mohurd.gov.cn/wjfb/201511/t20151113_225589.html

26 See MOHURD website: http://www.mohurd.gov.cn/wjfb/201703/t20170314_230978.html

27 See MOT website:
http://www.mot.gov.cn/zhengcejiedu/quanmiansrtjlsjtfz/xiangguanzhengce/201712/t20171206_2945939.html

28 See GOC website: http://www.gov.cn/zhengce/content/2017-01/05/content_5156789.htm

a share greater than 70% for 'green' travel in the central areas of large and medium-sized cities.[29]

Fuel economy standards for light duty vehicles (LDVs) were first introduced in China in 2004 and have been tightened over time. New 'Phase 4' standards require an overall fleet-average fuel consumption of 5l/100km, equivalent to approximately 120g/km CO_2 for new passenger cars in 2020.[30] The latest standards for heavy duty vehicles (HDVs) of weight exceeding 3,500 kg with diesel and gasoline engines, will go into effect on 1st July 2019.[31]

China's New Energy Vehicle (NEV) credits mandate,[32] to apply from april 2018, and the Electric Vehicle Subsidy Programme, amended in 2018 to incentivise higher battery energy density (i.e. longer range), are helping to drive demand for electric vehicles. These interventions build on previous Electric Vehicle (EV) support policies that have already delivered impressive results. In 2017, around a half of global sales of EVs were in China (approximately 777,000 cars).[33] These sales added to already significant stocks as China has 40% of the global total stock of EVs and more than 99% of both electric bus and two-wheeler stocks.[34]

Promotion of advanced technologies – Top Runner

Aligned with PEEREA Article 7 on promoting energy efficiency technology, China is strongly promoting advanced technologies through its Top Runner initiative. In December 2014, NDRC and other ministries jointly formulated the Implementation Plan for Energy Efficiency Top Runner System,[35] similar to the Top Runner scheme introduced in Japan in 1999. This provides a long-term mechanism promoting best in class standards and provides opportunities to use incentives to continuously improve energy efficiency.

Access to capital markets

Article 6(2) of PEEREA states, *'Contracting Parties shall endeavour to take advantage of and promote access to private capital markets and existing international financing institutions in order to facilitate investments in improving energy efficiency and in environmental protection related to energy efficiency'*. In 2017 at global level, green bonds issued primarily for energy efficiency uses exceeded, for the first time, the value of those issued primarily for renewable and other energy uses.[36] The global value of green bonds issued primarily for energy efficiency uses nearly tripled to USD 47 billion.[37] China is currently a world leader in green finance and hosts the second largest green bond market in the world. According to the Climate Bonds Initiative, total green bond issuance from China reached USD 37.1 billion (CNY 248.6 billion) in 2017, 4.5% up on the previous year. According to a recent analysis of China's capital markets by ASIFMA[38] – Asia Securities Industry & Financial Markets Association - China provides multiple channels of access to its markets for different categories of foreign investors at different stages of their engagement with China but still more could be done to increase access for foreign firms.

29 *See MOT website: http://www.mot.gov.cn/zhengcejiedu/quanmiansrtjlsjtfz/xiangguanzhengce/201712/t20171206_2945939.html*
30 *See SAC website: http://std.sacinfo.org.cn/gnoc/queryInfo?id=4BD19EBD1906A1B840BDF3915E4FA2D6*
31 *See SAC website: http://std.sacinfo.org.cn/gnoc/queryInfo?id=153BDDECD555A1A284326BAB2F3F0771*
32 *See GOC website: http://www.gov.cn/xinwen/2017-09/28/content_5228217.htm*
33 *See MIIT website: http://www.miit.gov.cn/n1146290/n1146402/n1146455/c6011721/content.html*
34 *Global EV Outlook 2018: Towards cross-modal electrification, IEA, 2018.*
35 *See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbtz/201501/t20150108_659703.html*
36 *See IEA website: https://www.iea.org/wei2018/*
37 *Ibid.*
38 *China's Capital markets: Continuing to Navigate the Road Ahead, ASIFMA, March 2018.*

Cooperation on energy efficiency

One of the three main objectives of the PEEREA (Article 1(2)(c)) is to foster cooperation in the field of energy efficiency by providing a framework for the development of cooperative and coordinated action. Cooperation between Contracting Parties may take any appropriate form and many areas are listed in PEEREA's Annex (Article 9). Contracting Parties are expected to cooperate and assist each other in developing and implementing energy efficiency policies, laws and regulations, taking into account differences in adverse effects and abatement costs between Contracting Parties (PEEREA Article 3(1)(5)). Cooperative and coordinated action is also to take into account relevant principles adopted in international agreements, aimed at protection and improvement of the environment, to which Contracting Parities are parties (PEEREA Article 3(7)), such as the Paris Agreement.

International cooperation

China is involved in a number of significant international bilateral and multilateral international initiatives aimed at facilitating cooperation between participating countries on energy efficiency. Bilateral cooperative arrangements for energy efficiency are in place with the EU, the LAS, the US and Germany.

The G20 platform has provided China with an important opportunity to demonstrate strong international leadership in the field of energy efficiency. During its presidency of the G20 in 2016, China established the G20 Energy Efficiency Leading Programme,[39] which is intended to provide a comprehensive, flexible, and adequately-resourced framework for strengthened voluntary collaboration on energy efficiency among G20 members and beyond. The programme raised the scope and ambition of the previous activity in place, the G20 Energy Efficiency Action Plan, by taking a longer term view and expanding the number of areas for cooperation from 6 to 11.

Regional cooperation

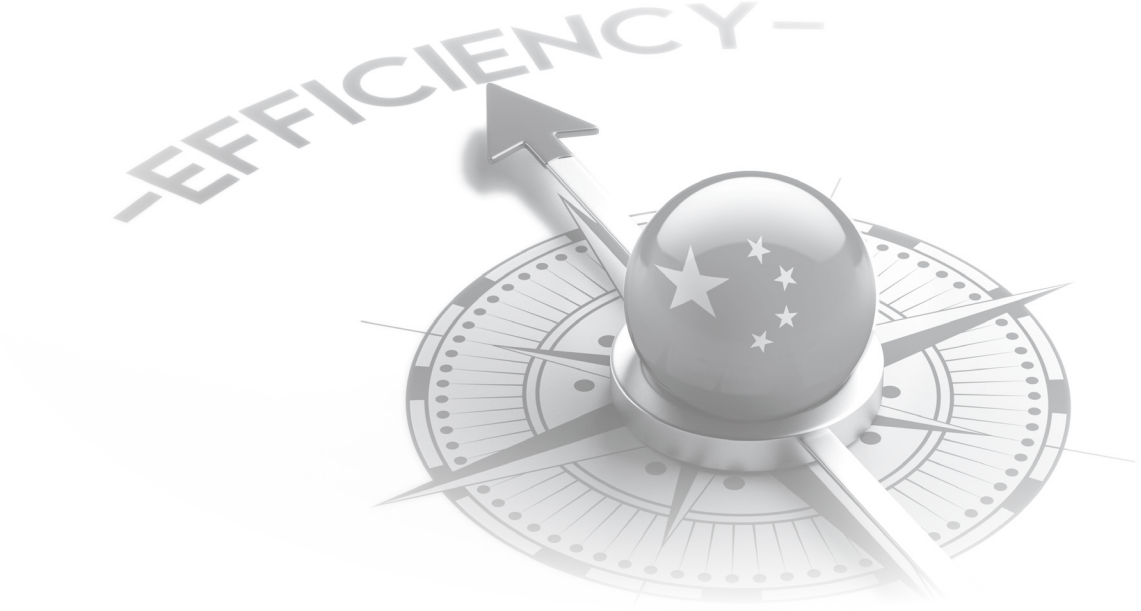
At the regional level, China is committed to carrying out energy cooperation under the Belt and Road Initiative (BRI), boosting energy resources development and energy infrastructure construction involving the countries of the region that represent some 63% of the global population. The BRI, through its roles in trade integration and regional cooperation, may promote energy efficiency convergence among countries.[40] Since 1991, China has regularly participated in the multilateral energy cooperation mechanism under the framework of the APEC,[41] including its Expert Group on Energy Efficiency & Conservation (EGEE&C). APEC has set a 45% energy intensity improvement goal to be achieved by 2035 (baseline 2005).[42]

39 Available at: https://ipeec.org/upload/publication_related_language/pdf/481.pdf

40 Energy efficiency convergence across countries in the context of China's Belt and Road initiative, Lei Han et al.,Applied Energy, Volume 213, 1 March 2018. Available at: https://www.sciencedirect.com/science/article/pii/S0306261918300308

41 See NEA website: http://zfxxgk.nea.gov.cn/auto88/201707/t20170724_2832.htm

42 See APEC website: https://www.apec.org/Publications/2017/12/Gaps-Assessment--on-APEC-Energy-Efficiency-and-Conservation-Work



内容概要

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简介

2015年5月，中国在荷兰海牙签署国际能源宪章政治宣言，成为能源宪章会议观察员国。观察员国通过将其法定的监管框架与能源宪章条约（ECT）和能源效率与有关环境方面的协议（PEEREA）条款保持一致，在加入能源宪章条约方面取得进展。观察员国加入ECT通常代表同时认可PEEREA。

PEEREA是一项政治协议，其重点是通过有效的能源市场和以市场为导向的价格形成，有效的政策措施以及与其他缔约方的合作协议，切实履行改善能效与可持续发展的政治承诺。PEEREA提供能效发展项目指导，指明合作领域，提供合作与协调行动发展的框架。

中国能源效率报告详细介绍中国能效政策与PEEREA的一致性。有效一致将有助于中国顺利加入PEEREA和ECT。

能源行业和能效领域雄心勃勃的整体愿景

PEEREA制定了应当支持一国能源政策、能源行业发展和改善能源效率战略方向的原则。将提高能源效率“作为一种重要的能源来源”，并作为减少能源系统对环境负面影响的手段。鼓励缔约方在制定能效政策和方案时，“采用涵盖整个能源领域的整体方法”。为实现能效改善而创建的框架条件也应基于有效的能源市场、以市场为导向的价格形成以及全面反映环境成本与利益。

中国发展能源系统的愿景显然采用整体方法，旨在实现智能、优化、清洁和低碳能源体系，通过技术“革命”和创新以及市场设计，实现需求侧和供给侧转型。中国对能源行业的发展愿景体现于“生态文明”，“四个革命，一个合作”和“一带一路倡议”的远见卓识中。

《能源发展战略行动计划（2014-2020）》和《能源发展“十三五”规划（2016-2020）》是提供实施上述能源发展愿景总体蓝图和行动方案的重要文件；“能效”一词是上述两个文件的重要特征。

机构：职能配置和协调

中国有许多政府部门支持能效，并在支持能效工作方面彼此独立，发挥着不同作用。明确职责和部门间有效协调是制定和实施有效能效政策的先决条件。PEEREA第4条关于责任的划分与协调规定，“每一缔约方应努力确保能效政策在责任当局内部得到充分协调。”

国家发展和改革委员会（NDRC）作为隶属于国务院的宏观调控机构，根据能效领域相关法律法规，协调各部委和部门间权责义务。国家能源局（NEA）是国家发展和改革委员会的直属机构，负责管理能源行业节能和资源综合利用。国家能源局内设能源节约和科技装备司负责具体工作。2013年，国家能源局和国家电力监管委员会整合后，国家能源局也负责能源行业监管。其他部委分别负责工业、交通和建筑行业节能和能效政策实施，指导能效技术研究，制定能效标准和提供实施能效政策的资金保障。

五年总体规划（FYP）和目标在推动各责任部委、部门、地方政府和其他机构间合作和协调方面发挥重要作用。例如：《“十三五”节能减排综合工作方案》明确了牵头部门和参与部门的主要任务。有效建立和协调一致的五年规划周期、清晰界定和明确提出的目标以及能够监测进展情况的指标，有益于政策和方案的审查和规划。这种做法也与PEEREA第5条完全一致，该条规定缔约方应当制定对所有利益相关方透明的能效战略和政策目标。

另一个重要的协调机制是国务院于2007年6月成立“国家应对气候变化及节能减排工作领导小组”（以下简称领导小组）[43]，作为应对气候变化、能源节约和减少温室气体排放等能源政策制定和实施的全国协调机构。国家发展和改革委员会负责领导小组具体工作。

全面反映环境成本和效益的原则

虽然以市场为导向的价格形成是能源宪章条约的基本原则之一，但众所周知，政策干预有时是解决市场失灵或障碍的必要条件。环境保护和改善能源效率尤其如此。这是建立PEEREA帮助和指导各国制定这方面政策的原因。然而，制定此类政策的指导原则是，干预措施应以市场为基础，旨在尽量减少市场扭曲。例如，碳交易、碳税和能效义务（EEO）是与此原则相一致的措施。到目前为止，中国大部分节能是通过行业能效义务实现的。

中国即将推出碳交易计划，这将在一定程度上实现ECT第19条规定的原则，即污染者应当承担污染成本。从2011年提出碳交易概念，2013年启动碳交易试点开始，中国历经很长时间建立碳交易计划，预计从2020年起，中国的碳市场将成为世界最大的碳市场，将为污染者和能源消费者提供有效的价格信号，为政府提供资金用于支持其能源部门转型，包括能源效率计划。

PEEREA承认能效的多重效益与实现可持续发展相关，特别是减少温室气体排放以减缓气候变化和其他空气污染物导致地貌和生态系统酸化。实际上，能效提升可以带来许多益处，并可能获取这些益处的价值。[44] 有证据表明，能效的多重效益正在获得越来越广泛的认可，一些战略和政策尝试获取这些效益并利用协同效应。例如，将环境、能源和区域发展问题纳入气候变化减缓背景的意图记载于中国国家自主贡献（INDCs）中。能源行业改革，包括提高能源效率，是中国大气污染防治行动计划（2013 – 2017）组成部分。[45]

可持续发展和尊重国际环境协定的原则

PEEREA一项既定目标是“促进符合可持续发展的能效政策”。自2015年通过联合国《2030年可持续发展议程》以及17项可持续发展目标（SDGs）以来，公开发表的研究表明可持续发展目标第7号关于能源与其他可持续发展目标之间的相互作用，由于能效具有多重效益，潜在地发挥着非常重要的作用。[46] 中国对改善能效孜孜不倦地追求有助于实现其他可持续发展目标。《中国落实2030年可持续发展议程进展报告》充分说明，中国在实现可持续发展目标行动中，能源行业改革包括提高能效的核心作用。[47]

PEEREA第3条概括的基本原则是“缔约方的合作和协同行动应致力于改善和保护环境，同时对国际协议中采用的相关原则加以考虑。”中国作为《巴黎协定》的早期缔约方，在应对减缓气候变化挑战方面显示出强大的全球领导力。[48] 大多数国家必须继续评估和执行其减少温室气体排放的承诺，通过全球集体努力（目前有些落后）实现《巴黎协定》目标。中国近来采取了一些雄心勃勃的措施，通过改善能效展示其在能源领域气候行动领导力。例如，中国是继日本和美国之后世界上第三个采用重型车辆燃油消耗标准的国家。另一个例子是中国从2018年4月起施行新能源汽车（NEV）积分管理办法[49]。

43 参见中国政府网站*: http://www.moh.gov.cn/bgt/gwywj2/201808/0f34b4c58a2e46ca9a3f7061e6556c6c.shtml*

44 参见国际能源署网站：*http://www.iea.org/publications/freepublications/publication/Multiple_Benefits_of_Energy_Efficiency.pdf*

45 资料来源：*http://www.sustainabletransport.org/wo-content/uploads/2017/08/National-Action-Plan-of-Air-Pollution-Control.pdf*

46 参见：*Connecting the Sustainable Development Goals by their energy inter-linkages, McCollum et al, IIASA, WP-17-006.* 资料来源*: http://pure.iiasa.ac.at/id/eprint/14567/1/WP-17-006.pdf; Global exposure and vulnerability to multi-sector development and climate change hotspots, Edward Byers et al, 2018, Environmental Research Letters 13 055012*。

47 参见中国政府网站：*http://www.fmprc.gov.cn/web/ziliao_674904/zt_674979/dnzt_674981/qtzt/2030kcxfzyc_686343/P020170824650025885740.pdf*

48 中国是批准《巴黎协定》的第*23*个国家。参见：*http://www.sohu.com/a/113515731_220090*

49 参见：*https://www.theicct.org/publications/china-nev-mandate-final-policy-update-20180111*

基于市场的方法，融资和私营部门参与

PEEREA一个关键目标是，缔约方将通过采取基于有效能源市场，以市场为导向的价格形成以及在整个能源系统中更全面地反映环境成本和效益的方法，为促进能源效率建立框架条件。[50] PEEREA认为这对提高能源效率和相关环境保护至关重要，强调私营部门应当在开展节能方面发挥重要作用（参见PEEREA序言）。

在能源市场设计方面，中国长期以来一直致力于建立更加开放和竞争的市场，体现以供需为基础的能源资源价格。[51] 虽然进展缓慢，煤炭的价格比石油、天然气和电力价格的自由化进展要快，但是改革一直在持续推进。《能源发展“十三五”规划》[52]旨在实现市场化改革，合理化价格体系，消除制度障碍，建立公平竞争的能源市场体系。中国在采取价格和财政激励措施影响消费者行为方面取得一些成功的经验，包括用于管理高峰电力需求分时电价和推广小排量汽车的消费税。

中国努力发展节能服务产业为实施PEEREA有关经济效率和运用市场机制原则（第3条（2）（a）和第3条（3）），鼓励私营部门参与（第3条（6）和第8条（2）（d））和能源效率融资（第3条（2）（c），第6条，第8条（2）（f））提供了一个优秀范例。一直以来，中国已将能源强度降低目标应用于能源密集型产业－本质上是通过履行能效义务－创造能效服务需求。2016年全球能源服务市场268亿美元，增长了12%，其中，中国占全球收入的60%以上，足以证明中国能源服务产业的成功发展。[53]

《能源发展“十三五”规划（2016-2020）》阐明中国完善能效市场的努力将持续深化。随着时间推移，中国在能效投资方面，成功地增加了私人融资相对于公共财政的份额。私人融资份额从2011年的76%增长到2014年的近90%。“十三五”规划表明，中国将继续鼓励这种基于市场的转型，包括节能服务公司、为节能服务公司提供融资风险担保，以及为能效提供专用贷款额度。

中国用于支持能效计划的公共资金往往直接来自中央政府预算。即将开始的碳交易计划可能会提供用于能效的资金。中国一直成功地获得世界银行、全球环境基金和亚洲开发银行等国际金融机构的资金和技术支持。

虽然大多数投资目前来自国内，但中国对外国投资者开放。近年来，由于重要的监管和立法的完善，中国对外国投资者的投资环境有了较大改善。[54] 随着其他国家能效市场的发展，中国的节能服务公司可能会适当寻找海外机会。

中国的能效政策、战略和规划

中国拥有相对完善的能效政策框架，与PEEREA第5条规定的具有清晰的目标和指标，努力实施和完善实现节能目标的政策框架保持一致。中国已将自己定位为提高能效的世界领导者，并且未来将继续沿着这个方向前进。根据国际能源署能效政策进展指数[55]，中国占世界2000-2016年政策总进度的一半以上，与其他国家相比，2011-2015年国家政策进展的改善率极高。

近来于2016年修订的《节约能源法》为节能和能效提供广泛的法律框架。它规定政府机构及有关部门、用能企业和用能设备制造商的责任和义务。节约能源法还详细说明

50 参见能源宪章条约（第*19*条）和*PEEREA*（第*1*条（*2*）（*b*）和第*3*条（*2*）（*a*））。

51 参见国家发改委网站*: http://www.ndrc.gov.cn/fzgggz/tzgg/ggkx/201504/t20150409_676931.html*
参见中国政府网站*: http://www.gov.cn/zhengce/2017-05/21/content_5195683.htm*

52 《能源发展 “十三五”规划》, 国家发改委、国家能源局，*2016*年*12*月。

53 参见国际能源署网站：*http://www.iea.org/publications/freepublications/publication/Energy_Efficiency_2017.pdf*

54 *China Investment Report, Energy Charter Secretariat, 2017*年。

55 国际能源署能效政策进展指数（*EPPI*）用以测量强制性能效政策在覆盖范围和实际落实情况方面的进展。*EPPI*涵盖七种终端能源用途：空间制冷、空间供暖、电器、水加热、工业电机、照明、轻型汽车和重型汽车。有关方法论的详细介绍，参见国际能源署网站*: http://www.iea.org/publications/freepublications/publication/Energy_Efficiency_2017.pdf*

提高能效和节约能源的具体机制，如禁止生产、进口和销售不符合强制性能效标准的用能产品和设备，对落后的耗能过高的用能产品实行淘汰制度，实行能效标识管理和固定资产投资项目节能评估和审查制度。[56]

当前推动能效的政策改革源于上述《能源发展战略行动计划（2014-2020）》和《能源发展“十三五”规划（2016-2020）》。《能源发展“十三五”规划（2016-2020）》继续采用“十二五”规划（2011－2015）引入的方法，即对能源消费总量和能源强度实施“双控”，提出2020年相对于2015年的目标：

- 能源消耗总量控制在50亿吨标准煤以内；
- 单位国内生产总值能耗（吨标准煤/万元）降低15%。

在五年规划的基础上，《能源生产和消费革命战略（2016-2030）》，提出2030年的长期愿景，这对于需要把握政策变化速度的投资者来说非常重要。该战略提出明确的目标，到2030年，能源消耗总量将控制在60亿吨标准煤以内。到2030年，中国预计单位国内生产总值能耗达到目前世界平均水平，中国主要工业产品能源效率达到国际领先水平。

上述战略规划是不同行业能效行动计划的基础：包括燃煤机组升级和改造、工业绿色发展、绿色建筑和绿色交通。此外，在同一时间（至2020年）实施的还有《节能中长期专项规划》和《“十三五”全民节能行动计划》。前者专注于工业、建筑和交通领域提出一系列宏观节能目标，而后者强调公众参与，提高意识和能力建设，以促进工业、建筑、交通行业，以及公共机构和其他重点用能单位能效水平提高。

工业能源效率义务

迄今为止，中国实现的大部分节能来自工业。这些节能主要源于强制性目标“TOP 10,000”计划推动，该计划于2006年推出，并于2011年扩展至涵盖16,000多家大型高耗能企业。[57] 节能目标分解到各省市，地方政府负责完成节能目标，并有权为企业设定目标，进行强制性审计，监督进展情况和实施处罚。能效基金为参与该计划的企业提供支持，政府通过财政和资金奖励以及提供培训支持能源服务公司发展。中国的“领跑者”计划，通过为一些高耗能行业确定能效领先产品水平和基准，作为“TOP 10,000”计划的补充。例如，遴选出2017年行业能效“领跑者”19家企业，涵盖钢铁、乙烯、合成氨、水泥、平板玻璃和电解铝等领域。[58]

近年来，工业部门通过一系列行动持续改善工业能源效率，如化解过剩产能，管控和减少能源消耗，燃煤小机组退役和淘汰落后产能。从2012年到2016年，规模以上企业单位工业增加值（即生产率）能耗下降29.5%，2017年比上一年下降4.6%。[59] 由于能效投资，2014年大型工业部门和制造业分别节约成本180亿美元和109亿美元。[60]

展望未来，《工业绿色发展规划（2016-2020）》[61]和《“十三五”节能减排综合工作方案》提出目标，到2020年，规模以上工业企业单位增加值能耗比2015年降低18%。[62] 能效改善将为实现2020年目标作出重要贡献，预计经济结构调整是实现节能计划的重要推动力。

56 参见国家能源局网站：*http://www.nea.gov.cn/2017-11/03/c_136725225.htm*
57 参见国际能源署网站：*https://www.iea.org/newsroom/news/2016/october/energy-efficiency-market-report-2016.html*
58 参见工信部网站: *http://www.miit.gov.cn/n1146295/n1652858/n1652930/n4509607/c6226963/content.html*
59 资料来源: *https://baijiahao.baidu.com/s?id=1603708256898198852&wfr=spider&for=pc*
60 参见国际能源署网站：*https://www.iea.org/newsroom/news/2016/october/energy-efficiency-market-report-2016.html*
61 参见工信部网站：*http://www.miit.gov.cn/n1146295/n1652858/n1652930/n3757016/c5143553/content.html*
62 参见中国政府网站:*http://www.gov.cn/zhengce/content/2017-01/05/content_5156789.htm*

最低能效标准和贸易

自“十二五”以来，中国已制修定了包括工业设备、家用电器、照明设备、办公设备在内的54项终端用能产品能效标准，以及包括钢铁、有色金属、建筑材料、石化、电力等高耗能行业在内的73项单位产品能耗限额标准。[63]

最低能效标准是通过从市场中淘汰低效用能设备、产品和工艺来提高地区和国际能效的强有力工具。由PEEREA第7条推动的能效改善，有利于区域或国际贸易，与ECT条款和WTO规则相一致。根据PEEREA第7条（1），“缔约方应鼓励在节能技术、有效环保技术、能源相关服务和管理实践上的商品贸易和商业合作。”而第8条（2）（c）提升了能效标准的重要性，并指出“国内项目可能包括诸如为提高用能设备效率而设计的标准，以及在国际范围内为避免贸易畸形发展所作出的努力释义。”中国加入世贸组织、亚太经合组织， 参与中欧能源对话以及其他论坛合作与此相关。

绿色节能建筑

2017年，建筑物占全国能源消耗总量的18.35%。[64] 由于政策和措施的成功实施，建筑能耗的年均增长率呈现下降趋势，从“十五”期间11.9%下降到“十一五”和“十二五”时期6%左右。[65] 从1986年到2015年，住房和城乡建设部、财政部和国务院共发布约44项制修定的建筑节能相关标准。[66] 中国最近采用以结果为基础的目标作为其他准则和措施的补充，进而强化建筑物投入使用后的能效性能。

中国大力推广“绿色建筑”，定义为采用整体方法改善包括能效在内的建筑物环境影响因素。通过指导超低能耗建筑和绿色建筑行业发展，以便更好地实施中国绿色建筑发展战略，住房和城乡建设部于2015年印发《被动式超低能耗绿色建筑技术导则（居住建筑）》。[67]2017年，住房和城乡建设部印发《建筑节能与绿色建筑发展“十三五”规划》提出，到2020年，城镇新建建筑中绿色建筑面积比重超过50%；超低能耗建筑（ULEB）、近零能耗建筑（NZEB）示范项目超过一千万平方米。[68]

绿色交通

中国在制定和实施清洁交通政策方面取得很大进展，在国际环境交通政策中发挥领导作用。“十二五”和“十三五”规划，发布一系列行业指导文件以确定行业节能减排目标。交通领域能效改善主要是源于能源安全问题以及影响健康和环境的二氧化碳和其他污染物减排要求。到2020年，中国的目标是交通运输二氧化碳排放强度比2015年下降7%[69]，大城市公共交通分担率达到30%[70]，大中城市中心城区“绿色”出行比例达到70%以上[71]。

轻型汽车（LDVs）燃油经济性标准于2004年在中国首次提出，并且随着时间的推移政策逐渐收紧。新修订的第四阶段油耗限值标准要求，到2020年，新增乘用车平均燃料消耗量降至5.0升/百公里，相当于行驶每公里大约排放120克二氧化碳。[72] 柴油和汽油发动机重量超过3,500千克重型汽车（HDVs）最新标准将于2019年7月1日起实施。[73]

63 参见工信部网站：*http://www.miit.gov.cn/n1146285/n1146352/n3054355/n3057542/n3057544/c3634672/content.html*

64 中国能源发展报告*2017*, 电力规划设计总院, *2018*年*4*月。

65 资料来源：*http://www.cnelc.com/text/1/171109/AD100768889_2.html*

66 *A comparison of building energy codes in the US, Germany and China-their impact on achieving net zero energy goals, Hu Ming, ACEEE Summer Study on Energy Efficiency in Buildings, 2018*年。

67 参见住建部网站：*http://www.mohurd.gov.cn/wjfb/201511/t20151113_225589.html*

68 参见住建部网站：*http://www.mohurd.gov.cn/wjfb/201703/t20170314_230978.html*

69 参见交通部网站：*http://www.mot.gov.cn/zhengcejiedu/quanmiansrtjlsjtfz/xiangguanzhengce/201712/t20171206_2945939.html*

70 参见中国政府网站：*http://www.gov.cn/zhengce/content/2017-01/05/content_5156789.htm*

71 参见交通部网站：*http://www.mot.gov.cn/zhengcejiedu/quanmiansrtjlsjtfz/xiangguanzhengce/201712/t20171206_2945939.html*

72 参见国家标准委网站：*http://std.sacinfo.org.cn/gnoc/queryInfo?id=4BD19EBD1906A1B840BDF3915E4FA2D6*

73 参见国家标准委网站：*http://std.sacinfo.org.cn/gnoc/queryInfo?id=153BDDECD555A1A284326BAB2F3F0771*

中国的新能源汽车（NEV）积分管理办法[74]　从2018年4月起施行。2018年修订的电动汽车补贴方案，以激励更高的电池能量密度（即更远的行程），有助于推动对电动汽车（EV）的需求。这些干预措施建立在先前的电动汽车支持政策基础之上。2017年，全球一半左右电动汽车销量来自中国（约777,000辆）[75]。这些销售再加上已有大量库存，中国占全球电动汽车总存量的40％以及电动公交车和两轮车存量的99％以上。[76]

推广先进技术 – 领跑者

与PEEREA第7条关于促进能效技术一致，中国通过“领跑者”计划大力推广先进技术。2014年12月，国家发改委等部委共同制定《能效“领跑者”制度实施方案》[77]，类似于1999年日本推出的“领跑者”计划。该方案建立推广先进标准的长效机制，提供使用激励机制不断提高能效的机会。

资本市场准入

PEEREA第6条（2）规定，“缔约方应致力于充分利用并促进对私人资本市场和现有国际金融机构的利用，目的是促进对提高能源效率和与节能相关的环境保护的投资”。从全球来看，2017年主要用于能源效率的绿色债券首次超过主要用于可再生能源和其他能源用途的绿色债券。[78] 全球主要用于能效的绿色债券价值几乎增加了两倍，达到470亿美元。[79] 中国目前是绿色金融的全球领导者，拥有全球第二大绿色债券市场。根据环境债券发行计划，2017年中国绿色债券发行总额达到371亿美元（人民币2,486亿元），同比增长4.5％。根据亚洲证券业与金融市场协会（ASIFMA）[80]近期对中国资本市场的分析，在不同阶段中国为不同类型的外国投资者提供多种渠道进入中国市场，但仍可以更加放开外国公司的准入。

能效合作

PEEREA三个主要目标之一（第1条（2）（c））是通过提供发展合作和协调行动的框架，促进能效领域的合作。缔约方之间的合作可以采取任何适当的形式，许多领域列示在PEEREA附录（第9条）中。缔约方期望在制定和实施能效政策、法律法规方面相互合作和协助，同时考虑到缔约方之间在不利影响和减排成本上的差异（PEEREA第3条（1）（5））。合作和协调行动还应考虑到旨在保护和改善环境的国际协议中采用的相关原则，缔约方是指（PEEREA第3条（7））约定的缔约方，例如《巴黎协定》。

国际合作

中国参与一系列重要的双边和多边国际倡议，旨在促进参与国之间在能源效率领域的合作。与欧盟、阿盟、美国和德国建立了能效领域的双边合作协议。

G20平台为中国提供在能源效率领域展示强大国际领导地位的重要机会。2016年，在G20担任主席国期间，中国建立《G20能效引领计划》[81]，旨在为G20成员及更多国家之间加强能源效率自愿合作提供全面、灵活且资源充足的框架。该计划从长远考虑，将《G20能效行动计划》的合作领域从6个扩大到11个，扩大了之前的活动范围和目标。

74 参见中国政府网站：*http://www.gov.cn/xinwen/2017-09/28/content_5228217.htm*
75 参见工信部网站：*http://www.miit.gov.cn/n1146290/n1146402/n1146455/c6011721/content.html*
76 *Global EV Outlook 2018: Towards cross-modal electrification, IEA, 2018*年。
77 参见国家发改委网站：*http://www.ndrc.gov.cn/zcfb/zcfbtz/201501/t20150108_659703.html*
78 参见国际能源署网站：*https://www.iea.org/wei2018/*
79 同上。
80 *China's Capital Markets: Continuing to Navigate the Road Ahead*，*ASIFMA*，*2018*年*3*月。
81 资料来源*: https://ipeec.org/upload/publication_related_language/pdf/481.pdf*

区域合作

在区域层面，中国致力于在“一带一路倡议（BRI）”下开展能源合作，推动能源资源开发和能源基础设施建设，这一倡议代表着占全球人口约63%的国家区域。“一带一路倡议”通过其在贸易一体化和区域合作中的作用，可以促进各国之间的能效融合。[82] 自1991年以来，中国积极参加亚太经合组织框架下多边能源合作机制，[83] 包括亚太经合组织能效及节能专家组（APEC EGEE&C）。亚太经合组织目标是到2035年能源强度降低45%（以2005年为基准）。[84]

82 Energy efficiency convergence across countries in the context of China's Belt and Road initiative, Lei Han et al., Applied Energy, 第*213*卷, *2018*年*3*月*1*日。资料来源：*https://www.sciencedirect.com/science/article/pii/S0306261918300308*

83 参见国家能源局网站：*http://zfxxgk.nea.gov.cn/auto88/201707/t20170724_2832.htm*

84 参见亚太经合组织网站：*https://www.apec.org/Publications/2017/12/Gaps-Assessment--on-APEC-Energy-Efficiency-and-Conservation-Work*

1. INTRODUCTION AND BACKGROUND

1. Introduction and background

1.1 Purpose of the report

China became an Observer to the Energy Charter Conference when it signed the International Energy Charter political declaration in The Hague, Netherlands, in May 2015. Observer countries progress towards accession to the ECT by aligning their legal and regulatory frameworks with the provisions of the Energy Charter Treaty (ECT) and the Protocol on Energy Efficiency and Related Environmental Aspects (PEEREA). When Observer countries accede to the ECT they typically ratify the PEEREA at the same time.

China's Energy Efficiency Report details the extent of alignment of China's energy efficiency policy with the PEEREA. Effective alignment will facilitate the country's smooth accession to the PEEREA and the Energy Charter Treaty (ECT).

The PEEREA is a political agreement and its focus is on practical implementation of political commitment to improve energy efficiency consistent with sustainable development through efficient energy markets and market-based approaches, effective policies and measures, and through cooperation with other Contracting Parties to the Protocol. In accordance with Article 1, the Protocol defines policy principles for the promotion of energy efficiency as 'a considerable source of energy' and as a means to reduce adverse environmental impacts of energy systems. The Protocol provides guidance on the development of energy efficiency programmes, indicates areas of cooperation and provides a framework for the development of cooperative and coordinated action.

The substantive aspects of the Protocol relating to energy efficiency are set out in seven articles:

Article 3 Basic Principles

Article 4 Division of Responsibility and Coordination

Article 5 Strategies and Policy Aims

Article 6 Financing and Financial Incentives

Article 7 Promotion of Energy Efficient Technology

Article 8 Domestic Programmes

Article 9 Areas of Cooperation

Once Observers become Contracting Parties to the ECT, they become Members of the Energy Charter Conference, which is the decision-making body of the International Energy Charter. Member countries are entitled to request the support of the Energy Charter Secretariat in conducting an In-Depth Energy Efficiency Review[85] of their country involving peer review by representatives of several other member countries and the Secretariat. The key outcome of the peer review process is high-level recommendations to help the country improve energy efficiency.

This report aims to provide a snapshot of the current state of play for energy efficiency in China; it does not aim to analyse the current situation and propose recommendations for improvement. Once China accedes to the ECT and acquires member status, the country would become eligible to benefit from an In-Depth Energy Efficiency Review.

85 For further information regarding the In-Depth Energy Efficiency Review process, see: https://energycharter.org/what-we-do/energy-efficiency/energy-efficiency-country-reviews/

1.2 The Context of China

1.2.1 Geography, topography and climate

China, located in eastern Asia on the western Pacific Rim, has a total land area of approximately 9.6 million km^2, accounting for near to 7% of the world's land area and 25% of that of Asia. Only Russia and Canada have larger land surface areas. China shares its land border with 14 countries. China has a continental coastline of over 18,000 km – formed by the Bohai Sea, Yellow Sea, East China Sea and South China Sea – as well as an island coastline of over 14,000 km and an inland sea and coastal waters area of about 4.7 million km^2.

The vast terrain of China is diverse and includes majestic plateaus, rolling mountains, plains, low hills and basins. The Qinghai-Tibet Plateau with an average altitude of over 4,500 meters is the highest prairie in the world. The Yangtze River with a total length of 6,300 km is the longest river in Asia. China covers a wide range of climatic zones, including tropical, subtropical and temperate zones. These various forms of topography and diverse climate types provide for rich biodiversity and also provide a variety of conditions for the development of China's agriculture and industries.

1.2.2 Ethnicity and population

China is a unified multi-ethnic country, with 56 ethnic groups throughout the country. The Han population is the largest with about 92% of the total population and the remaining population is distributed in 55 other ethnic groups that include the Mongolian, Hui, Tibetan and Uygur communities.

China is the world's most populous country and currently has a population of about 1.39 billion as of the end of 2017.[86] The geographic distribution of the population is unbalanced with greater population concentration in economically developed areas along the eastern coast, whereas inland areas in the west are sparsely populated.

Table 1 The context of China

Official name	People's Republic of China
Location	Eastern Asia
National day	1st October 1949
Total area	9.6 million km^2
Total population	1.39 billion
Language	Chinese
Capital	Beijing
Ethnicity	56 ethnic groups
Political system	People's Congress System
Currency	Chinese Yuan (CNY) Renminbi
Major energy resource	Coal, petroleum, natural gas, hydropower

86 See NBS website: http://www.stats.gov.cn/tjsj/ndsj/

1.2.3 Political and institutional governance

China's administrative divisions are provinces, autonomous regions and municipalities, with 23 provinces, 5 autonomous regions and 4 municipalities directly under the Central Government, as well as 2 special administrative regions (Hong Kong and Macao).[87]

There are four branches of power in China: the National People's Congress (NPC) – the supreme legislative body; the Central Committee of the Communist Party of China (CPC Central Committee) – the founding and the only governing political party; the State Council – the supreme executive body responsible for state administration, accountable to the NPC; and the Chinese People's Political Consultative Conference (CPPCC) – a political advisory body consisting of delegates from a range of political parties and organisations, as well as independent members. These four branches exist at both the central and the local levels, and work in parallel with each other.

1.2.4 Economic context

China is the largest developing country in the world by its geography and population size. In recent years, China's economic development has made very rapid progress. From 2013 to 2017, China's GDP increased from CNY 54 trillion to CNY 82.7 trillion, with an average annual growth rate of 7.1%, with its share of the world economy increasing from 11.4% to around 15% and contributing more than 30% to world economic growth.[88] From 2011 to 2016, the annual growth rate of GDP showed a downward trend.[89] The slowdown reflects China's transition from resource-intensive economic and industrial growth to a 'New Normal' of slower but higher quality growth that is more stable and orientated towards sustainable development.

China's supply-side structural reforms for the energy sector play an important role in achieving this 'New Normal' by accelerating the optimisation of the country's economic structure through strategies that will improve the quality and efficiency of the supply system, actively support emerging industries and transform or upgrade traditional industries, and promote the development of advanced manufacturing through implementation of the 'Made in China 2025'[90] strategy.

China implements a proactive fiscal policy and a prudent monetary policy, involving drastic reductions of taxes and fees and adjustments in distribution of fiscal expenditure in order to ensure basic livelihoods and key projects. The fiscal deficit rate has been kept below 3% by strengthening government debt management.[91] In 2017, the Government of China viewed that the main objectives and tasks of its economic and social development were fully completed and performance was higher than expected. The GDP grew by 6.9%, the income of residents increased by 7.3%, the fiscal revenue increased by 7.4%, the import and export increased by 14.2% and the actual use of foreign capital was USD 136.3 billion, which was the highest level ever recorded in China.[92] This was the result of a series of major policy effects in the past years and China's pursuit of economic development with increasing coordination of economic objectives focussed on growth, quality, structure and efficiency.

87 *See GOC website: http://www.gov.cn/test/2005-06/15/content_18253.htm*
88 *See GOC website: http://www.gov.cn/premier/2018-03/22/content_5276608.htm*
89 *China Energy Statistical Yearbook 2017, NBS, December 2017.*
90 *See GOC website: http://www.gov.cn/premier/2017-08/10/content_5216727.htm*
91 *See GOC website: http://www.gov.cn/premier/2018-03/22/content_5276608.htm*
92 *Ibid.*

1.2.5 Investment context

China has been opening up its economy to the rest of the world since 1978. In recent years its commitment to facilitating international collaboration and overseas investment has strengthened, with considerable activity in the energy sector. There are three main forms of entities through which foreign investors can invest in China: Chinese-foreign equity joint ventures; Chinese-foreign contractual joint ventures; and wholly foreign-owned enterprises.[93] China has considerably improved its domestic investment environment and enhanced the ease of doing business for foreign investors, including measures to improve its intellectual property rights regime and to liberalise capital flows.[94]

According to the World Investment Report 2018 of the International Energy Agency (IEA), China is the largest destination of energy investment, taking over one-fifth of the global total. China's energy investment is increasingly driven by low-carbon electricity supply and networks, and energy efficiency.[95]

China's outward foreign direct investment (OFDI) has been increasing significantly and is driven by Government policy. China's OFDI is focussed on the construction of cross-border electricity transmission and the upgrading of power grids as China has a strong desire to create a network of energy infrastructure with Central Asia, South Caucasus, Middle East, Europe, Africa and Latin America.

In 2013, China launched its Belt and Road Initiative (BRI), which for the energy sector aims at boosting the interconnectivity of energy infrastructure, strengthening inter-regional cooperation in energy resource exploitation, encouraging energy infrastructure projects, facilitating energy project financing, and developing new energy technology. To support the BRI, China has set up the Silk Road Fund and has established 11 free trade pilot zones. The establishment of the Asian Infrastructure Investment Bank (AIIB) was also driven by China.

Since October 2016, foreign investment has shifted from the 'approval system' to the 'negative list management system'.[96] China grants foreign investors national treatment in the pre-establishment phase under its Pre-Establishment National Treatment (PENT) supplemented by a Negative List policy. This means that all the foreign investors, whose activities are not listed on the negative (i.e. restrictive or prohibited) list, will be granted treatment which is no less favourable than that granted to domestic investors starting from the pre-establishment stage. The 2018 edition of the Special Management Measures for Foreign Investment Access (Negative List) greatly eased market access, and open measures were launched for 22 areas. For example, since 28th July 2018, the construction and operation of power grid and gas stations, usually controlled by the Chinese party, have been removed from the list, as were restrictions on the ratio of foreign-invested shares in the manufacture of new energy vehicles.[97]

1.3 Energy market structure and regulation

The fundamental law of energy, referred to as the Energy Law, was launched in 2005 but has not been enacted yet as the draft has had to be revised in order to keep pace with the fast-changing situation. China's existing laws for the energy sector, which have been enacted separately, include: Electric Power Law, Law of Coal, Renewable Energy Law, Energy Conservation Law,

93 China Investment Report, Energy Charter Secretariat, 2017.

94 Ibid.

95 See IEA website: https://www.iea.org/wei2018/

96 See MOC website: http://www.mofcom.gov.cn/article/b/c/201610/20161001404973.shtml

97 See NDRC website: http://wzs.ndrc.gov.cn/wstz/wstzgk/201806/t20180629_890808.html

See MOC website: http://www.mofcom.gov.cn/article/b/f/201806/20180602760432.shtml

and Oil and Gas Pipeline Protection Law. With progress in energy system development and reforms, some of these laws, such as the Electric Power Law, formulated more than 30 years ago, urgently need to be updated to meet China's present and future needs.

The challenges associated with managing the monopoly power of major players in the energy industry and the segmentation of regional markets hinder reform efforts concerning the development of China's energy sector. A unified and open modern energy market system enabling competition is not yet well established despite attempts to achieve this. Efficient price formation mechanisms for energy sources have yet to be established (see 2.4.1); without such mechanisms it is not possible to achieve efficient prices that properly reflect market supply and demand, scarcity or availability of energy resources or capacity, and environmental costs and benefits.

1.3.1 Coal

Coal is China's main source of energy, accounting for 69.8% of primary energy production and 62% of total energy consumption in 2016.[98] The Department for Coal under the National Energy Administration (NEA) is responsible for the development and reform of the coal industry and implementation of relevant policies.[99]

For a long time, China's coal market incorporated both non-competitive planned coal and competitively priced coal based on supply and demand. The former, under the guidance of the Government, involved planned production of coal and the selling of it at prices significantly lower than the market price based on supply and demand. In parallel with the latter, competitively priced coal was introduced when the coal market was gradually liberalised from 1993 with the issuance of a guiding price for coal, introduced in 1996 and phased out in 2002.[100] The 'two-track' pricing mechanism was eventually abolished in 2013 when the existence of regulated prices for planned coal came to an end.[101] As part of the liberalisation process, national and regional coal trading centres have been established.

At present, coal is the energy resource with the highest degree of liberalisation within China's energy sector. In 2015, the top 8 coal enterprises accounted for less than 35% of total national coal production. A significant number of these private coal companies, however, possess outdated capacity, use inferior production technology and lack company management mechanisms.[102] Recognising that coal supply exceeds coal demand, the State Council issued the documents in February 2016, in order to promote industrial upgrading and efficient development of the coal sector.[103]

1.3.2 Oil and gas

The Department for Oil and Gas under the NEA leads the overall formulation of development plans for the oil and gas sector and the reform of the oil and gas system.[104] Although China has a relatively well-established oil and gas industry and its market scale is expanding, the openness of oil and gas markets has lagged far behind the pace of development of the country's economy and of oil and gas industries both at home and abroad. A high degree of

98 China Energy Statistical Yearbook 2017, NBS, December 2017.
99 See NEA website: http://www.nea.gov.cn/sjzz/mts/index.htm
100 Available at: http://www.chinanews.com/ny/2012/12-28/4446417.shtml
101 Available at: http://finance.people.com.cn/n/2012/1226/c70846-20017103.html
102 China Investment Report, Energy Charter Secretariat, 2017.
103 See GOC website: http://www.gov.cn/zhengce/content/2016-02/05/content_5039686.htm
104 See NEA website: http://www.nea.gov.cn/sjzz/yqs/index.htm

monopoly characterises the oil and gas market as China's oil and gas sectors are dominated by three major state-owned enterprises. Three state-owned oil companies – China National Petroleum Corporation (CNPC), China National Offshore Oil Corporation (CNOOC) and Sinopec Group – largely control the country's domestic oil and gas resources, infrastructure, major sales channels, as well as import and export quotas. The market is, however, gradually opening up to foreign-funded and private-owned enterprises.[105]

In China, crude oil prices are determined by the enterprises themselves with reference to the international market, while refined oil prices are implemented in the Government guidance price or government pricing, including the setting of price ceilings for gasoline and diesel for each province.[106] For the formulation of the price of natural gas terminals, China implements government pricing and government-guided pricing management. The price of natural gas terminals is managed by the local price authority.[107] Local governments determine the price of natural gas terminals in addition to the cost of natural gas and other factors that affect the lives of residents. In June 2013, in order to gradually rationalise the price of natural gas, ensure reliable supply and improve the efficiency of resource utilisation, the National Development Reform Commission (NDRC) put forward a price adjustment plan based on the experience of pilot regions.[108]

The first national energy trading centre, the Shanghai Petroleum and Natural Gas Exchange (SHPGX), was set up in the Shanghai Free Trade Zone (FTZ) in March 2015 and officially started operations in November 2016.[109] The Centre is expected to serve as an important platform for petroleum and gas trading as well as a price hub for the Asia-Pacific region and potentially for the global market. The volume of natural gas trading has exceeded 30 billion m^3 since the Centre began its trial operations in July 2015.[110]

In order to accelerate the opening up of the market, to promote competition and establish a fair and open oil and gas market system, the State Council issued the Opinions on Deepening the Reform of the Oil and Gas System in May 2017.[111] It deployed eight key tasks to promote the sustained and efficient development of the oil and gas industry, covering almost the entire industrial chain including exploration and development, import and export management, pipeline operations, production and supply capacity, pricing mechanisms, state-owned enterprises' reform, oil and gas reserves as well as safety and environmental protection.

1.3.3 Electricity

The electricity sector is monopolised by two major power grid companies (the State Grid Corporation and China Southern Power Grid) and five major power generation corporations (see Figure 1), which are all state-owned enterprises. Several government authorities are involved in regulatory oversight of the electricity sector. The three Departments of Electricity, Nuclear Power and New Energy, all under the NEA, are responsible for managing the sector's development and reform, formulating development plans and policies and ensuring their implementation.[112] There also exist regulatory bodies, such as the Department of Power

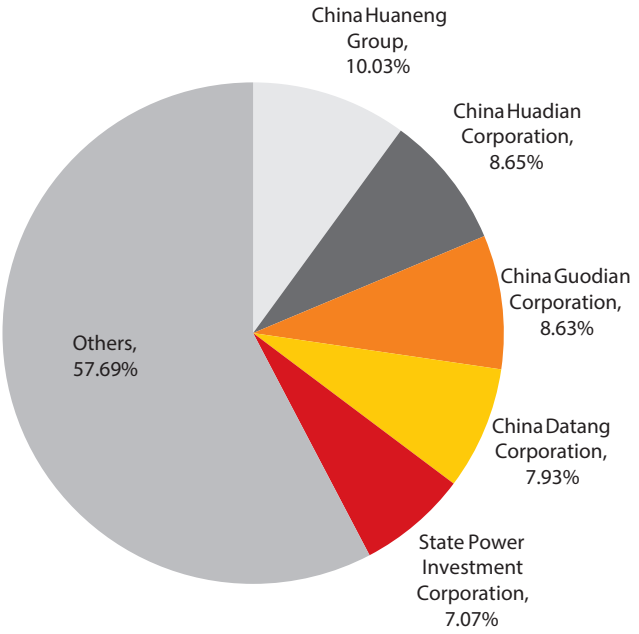
105 Available at: http://jjckb.xinhuanet.com/2011-03/24/content_295991.htm
106 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbtz/200905/t20090508_277522.html
107 See NDRC website: http://www.ndrc.gov.cn/fzgggz/jggl/zcfg/201112/t20111227_452988.html
108 See NDRC website: http://www.ndrc.gov.cn/fzgggz/jggl/zcfg/201306/t20130628_748405.html
109 Available at: http://www.xinhuanet.com/fortune/2016-11/26/c_1119995874.htm
110 See CNOOC website: http://www.cnooc.com.cn/art/2016/11/27/art_191_2466551.html
111 See GOC website: http://www.gov.cn/zhengce/2017-05/21/content_5195683.htm
112 See NEA website: http://www.nea.gov.cn/

Safety Regulation and the Department of Market Regulation, also under the NEA, which are responsible for developing and supervising policies and measures for power operation safety; developing and regulating the functioning of electricity market.[113]

The Price Department, under the NDRC, regulates prices for generated electricity, transmission and distribution, and sales prices. The Bureau of Economic Operations Adjustment of the NDRC is responsible for developing power generation plans. There exists integration of transmission, distribution and energy sales, with no transparent separation of transmission and distribution electricity prices. Power grid companies earn profits from the retail sales minus the wholesale electricity purchase price and the cost of developing, maintaining and operating the network.

In order to break up the monopolies and to realise effective competition both in power generation and retail sales, China is in the process of market-oriented reform of the electric power system. In March 2015, the State Council issued the Opinions on Future Deepening the Reform of Electric Power System.[114] Proposed reforms involve the introduction of separate establishment of electricity prices for transmission and distribution approved by the Government according to the 'permitted cost plus reasonable return'.[115] The Government also aims to let consumers drive the electricity sales market and to encourage new market entrants.

Figure 1 Power generation groups' market share, by installed capacity in China, 2016[116]



113 Ibid.
114 See NDRC website: http://tgs.ndrc.gov.cn/zywj/201601/t20160129_773852.html
115 See NDRC website: http://jgs.ndrc.gov.cn/zcfg/201504/t20150416_688233.html
116 Available at: http://news.bjx.com.cn/html/20170125/805707.shtml

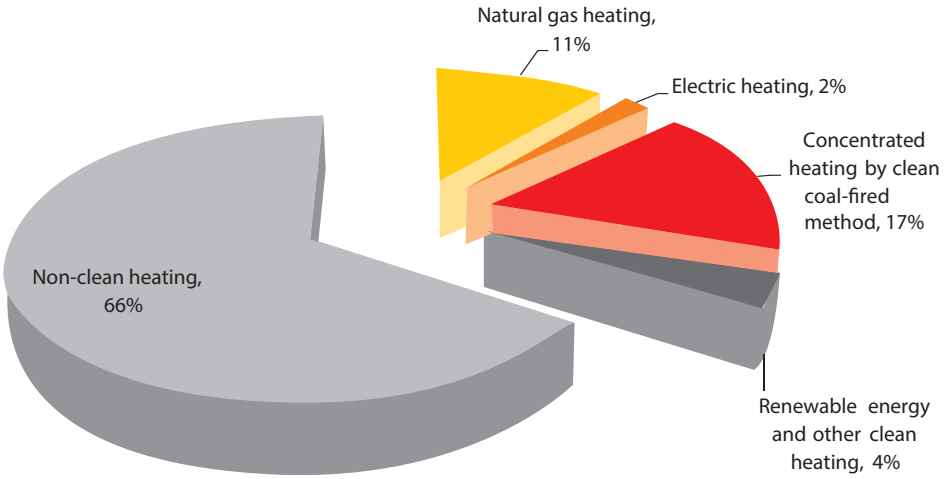
1.3.4 Heating

China has the largest district heating system in the world, reaching 312,000 km as of the end of 2016, with 74.6% located in cities and 25.4% in counties.[117] At present, unabated coal is still the main fuel used for heating production though some cities are implementing fuel-switching projects, replacing coal with gas, driven by policies pursuing environmental protection objectives, particularly improvement of air quality.

The total buildings area of China is around 60.6 billion m^2 as of 2016.[118] Heating loads are highest per square metre in northern China where average temperatures are relatively low and winters are severely cold. As of the end of 2016, the total heating area of buildings in northern China was about 20.6 billion m^2, with 68.4% of this area located in urban and 31.6% in rural areas. Of this total, areas using clean heating account for about 34%. The heating composition in northern China is dominated by non-clean fuel sources, primarily coal, as shown in Figure 2.

The average energy consumption for heating in the northern region is approximately 22 kgce/m^2, with more intensive energy consumption in rural areas at 27 kgce/m^2 compared with 19 kgce/m^2 in urban areas.[119] The Winter Clean Heating Plan for Northern China (2017-2021), for which air pollution reduction is a major driver, aims to reduce the average overall energy consumption to below 15 kgce/m^2. The Plan will also drive switching to cleaner fuels as it aims to increase the share of heating produced from cleaner fuels in the northern regions to 50% by 2019 and to 70% by 2021, replacing 150 Mt of scattered coal.[120] The Plan was jointly launched by 10 government agencies including the NDRC and the NEA, demonstrating strong commitment to institutional coordination.

Figure 2 Heating composition in northern China, 2016[121]



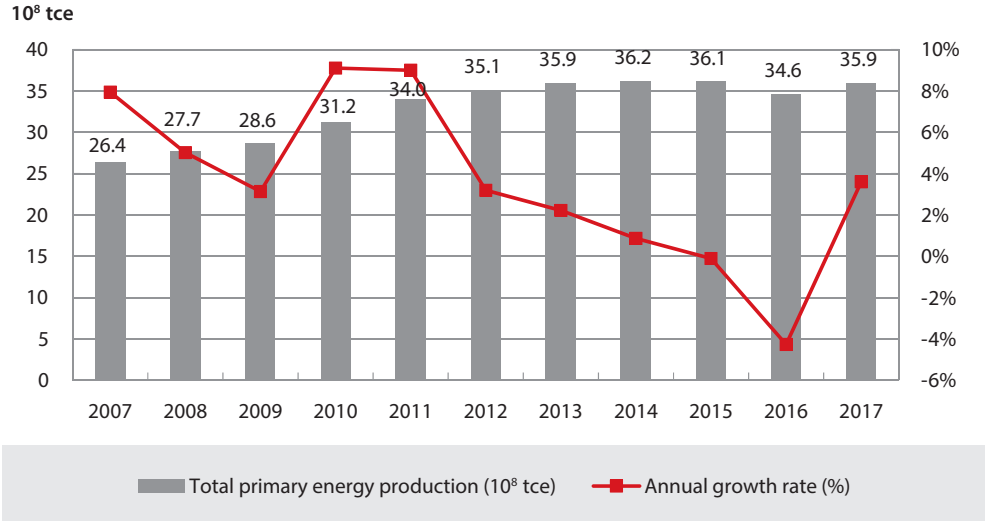
117 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbtz/201712/t20171220_871052.html
118 Annual Report on China's Energy Development 2016, EPPEI, March 2017.
119 See NDRC website:http://www.ndrc.gov.cn/zcfb/zcfbtz/201712/t20171220_871052.html
120 Ibid.
121 Ibid.

1.4 Energy supply and demand

1.4.1 Primary energy supply

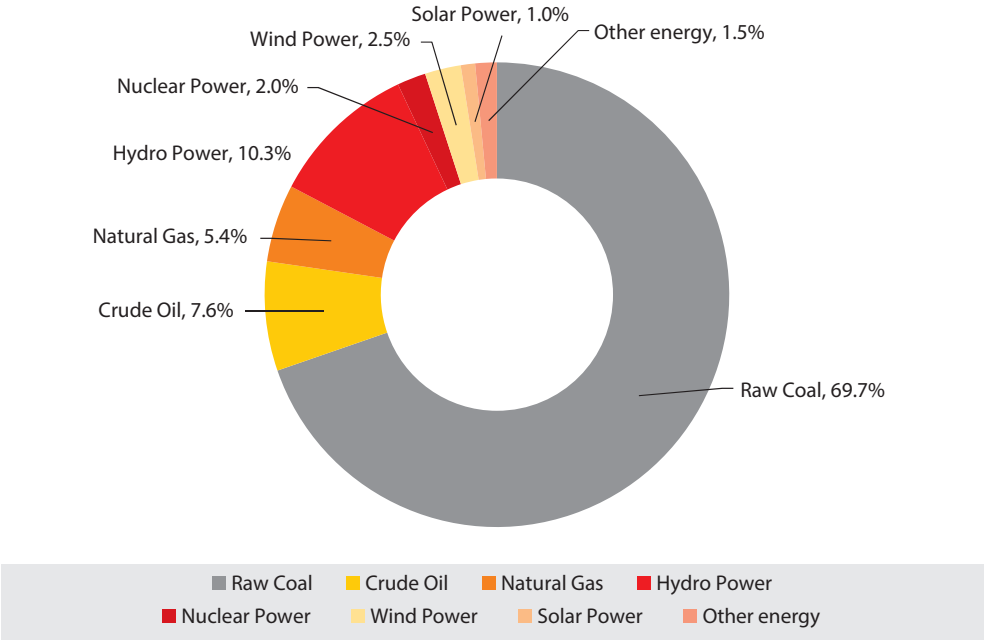
China is one of the largest energy producers in the world, and total primary energy production was around 3.5 Gtce per year since 2011 (see Figure 3).[122] In 2017, the national primary energy production totalled 3.59 Gtce, an increase of 3.6% compared with 2016, which breaks down as follows: raw coal, 69.7%; crude oil, 7.6%; natural gas, 5.4%; and non-fossil 17.3% (see Figure 4).[123]

Figure 3 Total primary energy production and annual growth rate in China, 2007-2017[124]



122 *China Energy Statistical Yearbook 2017, NBS, December 2017.*
123 *Annual Report on China's Energy Development 2017, EPPEI, April 2018.*
124 *China Energy Statistical Yearbook 2017, NBS, December 2017.*
Annual Report on China's Energy Development 2017, EPPEI, April 2018.

Figure 4 Primary energy production and composition in China, 2017[125]



1.4.1.1 Coal

China is rich in fossil-based energy resources, predominately coal. In 2017, the output of raw coal was 3.52 Gt, up 3.3% on the previous year.[126] This was the first rise since 2014 following three consecutive years (2014-2016) of decline.[127]

The changes in coal supply are largely driven by economic structural change and energy, environmental and economic policies. There has been a shift to slower economic growth and less energy-intensive production. Supply-side structural reform of the coal industry aims to eliminate outdated and excess coal production capacity. Since 2016, the Government of China has issued Opinions on the Development of Coal Industry by Resolving Excess Production Capacity and Shaking off Poverty, and embarked upon withdrawing about 500 Mt of capacity and is reducing or reorganising a further 500 Mt by 2018-2020.[128]

The capacity utilisation efficiency of coal industry reached 68.2% in 2017, increasing by 8.7% relative to 2016.[129] Raw coal production is gradually concentrating in areas with relatively better resource conditions and competitiveness. As of the end of June 2017, the number of coal mines with production safety licenses reached 4,271, providing a combined production capacity of 3.41 Gt per year.[130]

125 Ibid.
126 Annual Report on China's Energy Development 2017, EPPEI, April 2018.
127 China Energy Statistical Yearbook 2017, NBS, December 2017.
128 See GOC website:http://www.gov.cn/zhengce/content/2016-02/05/content_5039686.htm
129 Annual Report on China's Energy Development 2017, EPPEI, April 2018.
130 See NEA website: http://zfxxgk.nea.gov.cn/auto85/201711/t20171108_3045.htm

Despite these structural changes, China's coal output increased to 1,747.2 Mtoe in 2017, accounting for 46.4% of global total output.[131] China has been a net importer of coal since 2009 due to its continuously rising coal demand, output restrictions on coal and transport issues,[132] with net imports reaching 270 Mt in 2017, increasing 6.1% relative to 2016.[133] This trend is expected to continue in the future.

1.4.1.2 Oil and natural gas

Proven oil and natural gas resources are relatively limited and scarce in China compared with coal. Oil shale, coal-bed methane and other unconventional fossil energy reserves have greater potential. China's crude oil output in 2017 was about 190 Mt, down 4.1% compared with the previous year.[134] Due to the decline in domestic crude oil production and rapid growth in refining capacity, China's crude oil imports totalled 422.1 Mt in 2017, increasing 10.3% relative to 2016, with 43.6% of the imports coming from the Middle East.[135] Since 2017, China has been the largest crude oil importer in the world and currently has an external dependence of 69%.[136]

Due to the implementation of environmental protection policy, China's demand for natural gas continues to rise, driving increases in output and imports. The output of natural gas was 148 billion m^3 in 2017, an increase of 8.2% relative to the previous year, while over the same time period the output of unconventional natural gas was 15.5 billion m^3, up 11.5%. China's natural gas imports continue to increase and reached 92 billion m^3 (via pipeline – 39.4 billion m^3; LNG – 52.6 billion m^3) in 2017, an increase of 28% relative to 2016.[137] LNG imports exceeded those of South Korea (51.3 billion m^3) in 2017, making China the second largest importer in the world, with an external dependence of 38%.[138] China's natural gas has gradually moved from solely domestic production to multi-channel foreign supply. Today China's natural gas comes from land-based pipelines and liquefied natural gas (LNG). It is estimated that China will soon surpass Japan (113.9 billion m^3 in 2017) to become the largest gas importer of the world.[139]

1.4.1.3 Electricity

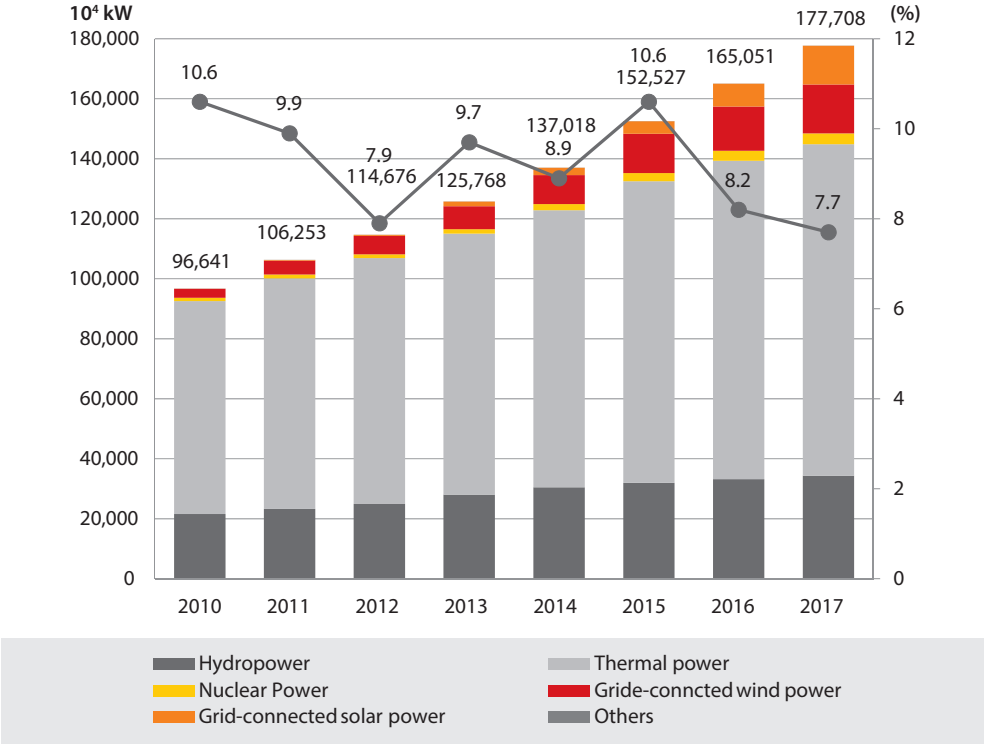
China has been the largest electricity producer in the world since 2011, with this trend set to continue. As of the end of 2017, China ranked first in the world for total installed power generating capacity, with 1,777.08 GW, up 7.7% relative to the previous year, consisting of: thermal power, 1,104.95 GW (+4.1%); hydropower, 343.59 GW (+3.5%); grid-connected wind power, 163.25 GW (+10.7%); grid-connected solar power, 129.42 GW (+69.6%); nuclear power, 35.82 GW (+6.5%). [140] The national installed capacity per capita is 1.28 kW in 2017, exceeding the world average.[141]

National power generation was 6,417.1 TWh in 2017, up 6.5% relative to the previous year. Electricity generated from non-fossil energy sources accounted for 30.3% of total power generation in 2017, increasing 10.1% compared with 2016.[142]

131 World Energy Statistical Review 2018, BP, June 2018.
132 Available at: http://business.sohu.com/20091207/n268725181.shtml
133 Annual Report on China's Energy Development 2017, EPPEI, April 2018.
134 Ibid.
135 World Energy Statistical Review 2018, BP, June 2018.
136 Annual Report on China's Energy Development 2017, EPPEI, April 2018.
137 World Energy Statistical Review 2018, BP, June 2018.
138 Ibid.
139 Ibid.
140 China Power Industry Annual Development Report 2018, CEC, July 2018.
141 Ibid.
142 Ibid.

The scale of the power grid has developed steadily, and the transmission capacity across provinces has increased significantly in recent years. At the end of 2017, the national trans-regional transmission capacity reached 130 GW, of which the AC-DC network cross-region transmission capacity exceeded 110 GW.[143]

Figure 5 Installed capacity and composition of electric power in China, 2010-2017[144]



1.4.1.4 Renewable energy

Renewable energy development in China is based on the key objective to continuously increase the proportion of renewable energy in total energy consumption by accelerating the development and use of renewable energy sources such as hydropower, wind power, solar energy and biomass energy. In 2017, China's renewable energy generation increased by 25 Mtoe, setting a new record in Chinese history.[145] In 2017, electricity generated from renewable energy sources (with change relative to 2016) included: hydro, 1194.5 TWh (+1.7%); wind, 305.7 TWh, (+26.3%); solar, 118.2 TWh (+78.6%); and biomass, 79.4 TWh (+22.7%).[146]

The composition of installed power generation is continuously changing and the geographic location of new energy power generation continues to shift to the middle and the east of

143 Ibid.
144 China Power Industry Annual Development Report 2018, CEC, July 2018.
145 World Energy Statistical Review 2018, BP, June 2018.
146 Annual Report on China's Energy Development 2017, EPPEI, April 2018.

China. The installed power generation capacity of non-fossil energy was 688.65 GW as of the end of 2017, accounting for 38.8% of the total power generation capacity, up 2.2% and 11.7% respectively compared with 2016 and 2010. Newly added non-fossil power generation capacity was 90.44 GW, accounting for 68.9% of the annual total installed power generation, an increase of 3.6% over the previous year.[147]

The recent expansion in installed power generation capacity based on renewable energy sources has served to reduce the carbon intensity and environmental performance of the energy mix, easing environmental pollution. However, electricity generated from renewable energy sources is sometimes curtailed and does not reach energy consumers due to a number of reasons. The Government of China has taken steps to improve the situation including: accelerating the construction of transmission lines for cross-regional transport of renewable energy; making more efficient use of existing transmission capacity; implementing a renewable energy power quota system; encouraging renewable energy to participate in market-based transactions; improving cross-regional renewable energy power dispatch technical support system; optimising grid dispatch operations; and improving demand-side response capability.[148] As a result, the situation has improved though efforts need to continue. According to available data, the ratio of wind and solar powered electricity curtailed declined by 5.0% and 4.3% respectively in 2017 relative to 2016.[149]

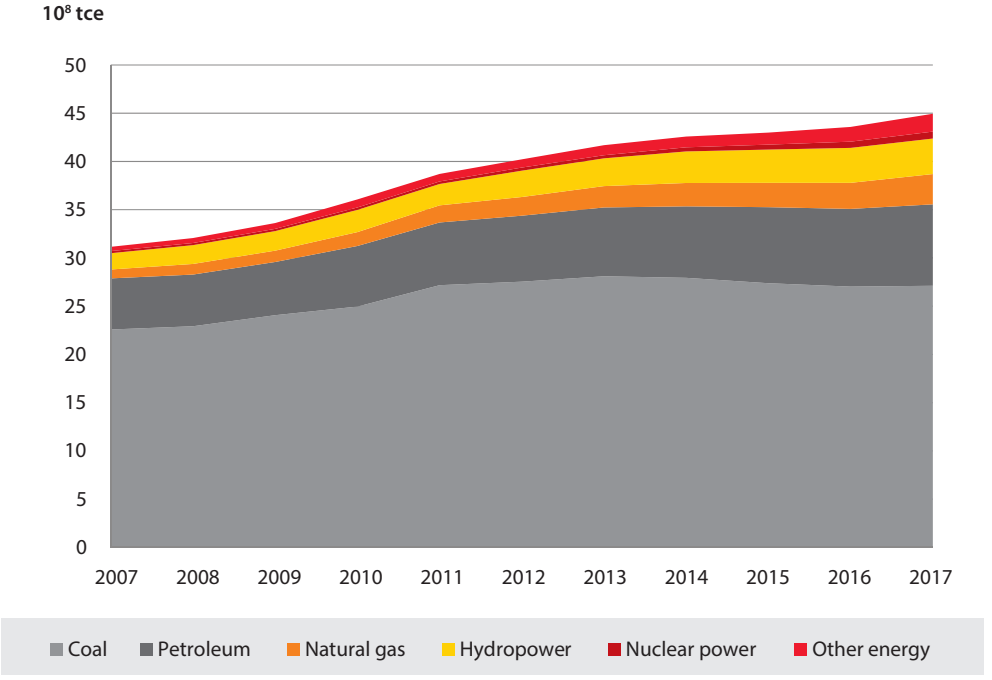
1.4.2 Energy demand and energy intensity

1.4.2.1 Energy demand

China is the world's largest energy consumer, accounting for 23.2% of global energy consumption and 33.6% of global energy consumption growth in 2017.[150] China has ranked first in global energy growth for 17 consecutive years since 2001.[151] China's total primary energy consumption was 4.49 Gtce in 2017, an increase of 2.9% relative to the previous year.[152] Coal dominates China's energy consumption, accounting for 60.4% of total primary energy consumption in 2017.[153] The share of coal consumption in total primary consumption (TPC) has continuously decreased since 2011, accounting for 70.2% in 2011[154] (see Figure 6).

147 *Ibid.*
148 *See GOC website: http://www.gov.cn/xinwen/2017-11/14/content_5239536.htm*
149 *Available at: http://news.bjx.com.cn/html/20180111/873488.shtml*
150 *World Energy Statistical Review 2018, BP, June 2018.*
151 *Ibid.*
152 *Annual Report on China's Energy Development 2017, EPPEI, April 2018.*
153 *Ibid.*
154 *China Energy Statistical Yearbook 2017, NBS, December 2017.*

Figure 6 Total primary energy consumption by fuel in China, 2007-2017[155]



Non-fossil energy and natural gas account for most of China's energy consumption growth, accounting for 13.8% and 7% respectively in total primary energy consumption (TPC) in 2017.[156] China is the world's biggest driver of global natural gas consumption, accounting for 15.1% of the world's natural gas consumption and 32.6% of the world's natural gas consumption growth in 2017.[157] The proportion of China's natural gas consumption has been continuously increasing since 2005, accounting for 2.4% in TPC in 2005.[158]

China has also led global renewable energy consumption, accounting for 21.9% of total global renewable energy consumption and 36.0% of global renewable energy consumption growth in 2017.[159] Among non-fossil energy sources, China's solar energy consumption is the fastest growing, reaching a growth rate of 76% in 2017, followed by biomass energy and wind energy, with growth rates of 25% and 21% respectively. Hydropower increased by 0.5% in 2017; its lowest growth rate since 2012.[160]

155 China Energy Statistical Yearbook 2017, NBS, December 2017.
Annual Report on China's Energy Development 2017, EPPEI, April 2018.
156 Annual Report on China's Energy Development 2017, EPPEI, April 2018.
157 World Energy Statistical Review 2018, BP, June 2018.
158 China Energy Statistical Yearbook 2017, NBS, December 2017.
159 World Energy Statistical Review 2018, BP, June 2018.
160 Ibid.

1.4.2.2 Energy intensity

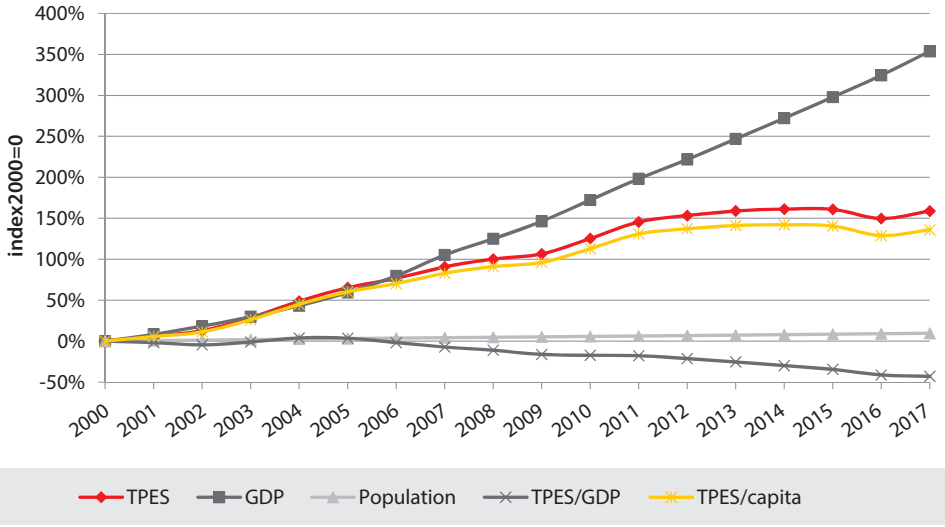
According to the IEA, China has improved its energy intensity over time at an average rate of 2.2% per year from 2003-2013.[161] In recent years, the improvement rate has increased significantly and reached 4.8% in 2014, 5.6% in 2015,[162] 5.2% in 2016[163] and 3.7% in 2017.[164] China's current energy intensity targets of the 13th FYP aim to improve energy intensity by a further 15% below 2020 relative to 2015.[165] If this target is achieved, energy intensity will have improved by 44% between 2005 and 2020.[166]

Due to the significant improvements in energy intensity, total primary energy supply is much less than it would be otherwise. With the high GDP growth, energy demand has dramatically increased due to greater wealth per capita and consequently greater demand for energy services. The 5-year annual average growth rate of GDP from 2013 to 2017 was 7.1%.[167] Without the energy intensity improvement achieved between 2013 and 2015, electricity consumption would have grown by more than 800 TWh in 2015 compared with the actual growth of 259 TWh.[168] Energy intensity improvements combined with growth in energy production from renewable energy sources and nuclear have served to reduce the share of coal in the energy mix.

Figure 7 shows that the TPES per capita increased from 2000 to 2014[169] reflecting a rise in living standards and increased per capita consumption of energy services. TPES plateaued during 2014 and 2015 at around 3.6 Gtce before declining in 2016, though it is now increasing again since 2017. Over the same time period, TPES per GDP has steadily decreased demonstrating a clear decoupling of TPES from GDP. The 5-year annual average energy consumption per GDP from 2012 to 2017 was 0.61 tce/CNY 10,000 and the annual rate of decline during this time was about 3.6%.[170] For 2018, the forecasted GDP growth rate will be around 6.5%, and energy consumption will be about 4.57 Gtce such that energy consumption per GDP is expected to continue to decline at a rate of above 3%.[171]

161 See IEA website: https://www.iea.org/newsroom/news/2016/october/energy-efficiency-market-report-2016.html
162 Ibid.
163 See IEA website: https://www.iea.org/newsroom/news/2016/october/energy-efficiency-market-report-2016.html
164 Annual Report on China's Energy Development 2017, EPPEI, April 2018.
165 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbtz/201701/t20170117_835278.html
166 See IEA website: https://www.iea.org/newsroom/news/2016/october/energy-efficiency-market-report-2016.html
167 See GOC website: http://www.gov.cn/premier/2018-03/22/content_5276608.htm
168 See IEA website: https://www.iea.org/newsroom/news/2016/october/energy-efficiency-market-report-2016.html
169 China Energy Statistical Yearbook 2017, NBS, December 2017.
170 Annual Report on China's Energy Development 2017, EPPEI, April 2018.
171 Ibid.

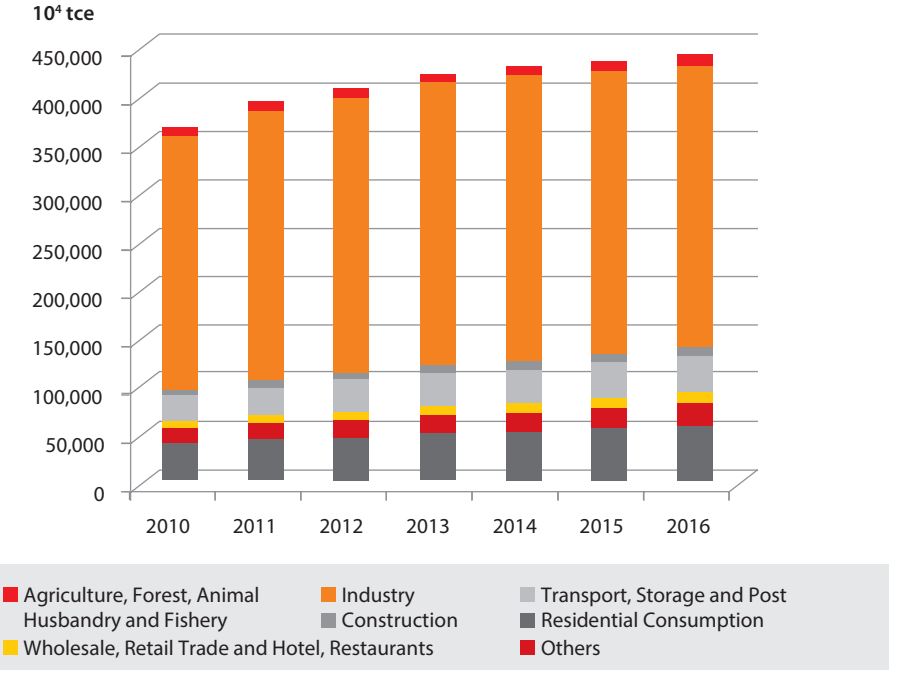
Figure 7 TPES, population, GDP and major energy efficiency indicators in China, 2000-2017[172]



According to China's National Bureau of Statistics, energy is predominantly used in the industrial sector, accounting for about two thirds of China's total energy demand (see Figure 8). The second most important sector in terms of energy consumption is the residential sector, which accounts for just above 10% of total energy demand, followed by the transport sector, which accounts for about 9%.[173] The combined energy consumption of these three sectors accounts for more than 85% of China's total energy consumption.

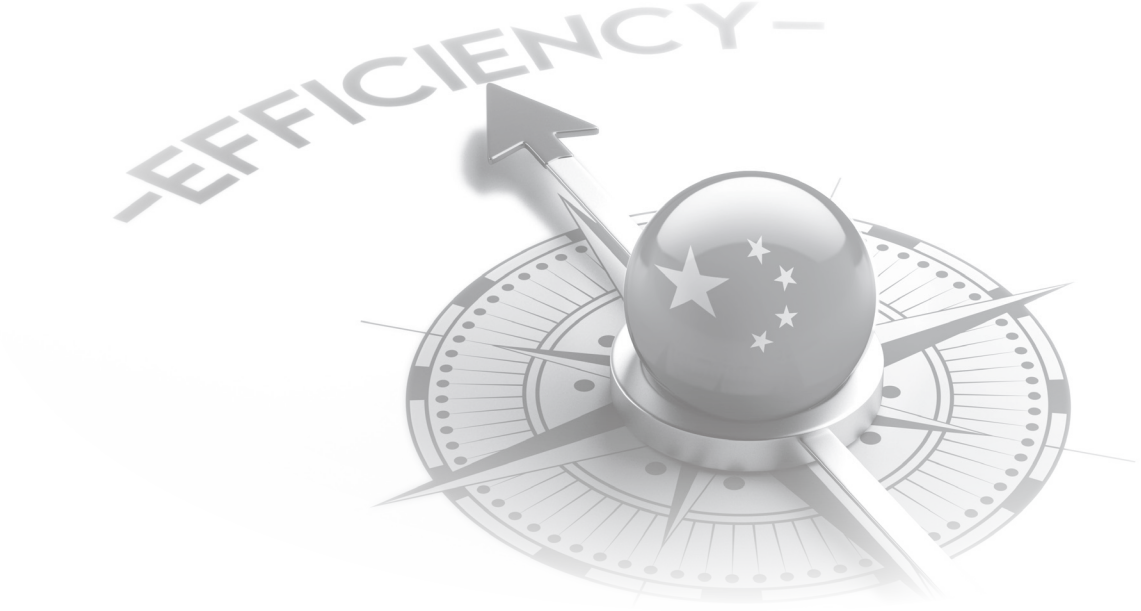
172 China Energy Statistical Yearbook 2017, National Bureau of Statistics, December 2017. Annual Report on China's Energy Development 2017, EPPEI, April 2018.
173 Ibid.

Figure 8 Total final energy consumption by sector in China, 2010-2016[174]



Energy efficiency improvements are difficult to disentangle from the growth of China's economy and energy system. However, the IEA attempts to reveal energy efficiency's role by application of a decomposition analysis of energy demand, which analyses the contributions of economic activity, sector structure and energy efficiency improvements over time.[175] The IEA concludes that energy efficiency and productivity improvements are the primary factor explaining the growing gap between total final energy consumption and activity levels since 2006. The decomposition analysis reveals that the drivers of energy demand changed over time with energy intensity worsening between 2000 and 2005, due to significant growth in the industrial sector in the absence of energy efficiency policies, before dramatically improving from 2006 with implementation of the energy efficiency measures of the 11th FYP. The energy consumption per unit of value-added (i.e. productivity) in the industry/services/agriculture sector improved by 19% between 2000 and 2014 with particularly marked improvements in the pulp and paper (53%), cement (35%), services (34%) and chemicals (20%) sub-sectors.[176] The efficiency of residential heating has improved steadily since 2000. Energy consumption by the transport sector, however, has increased over time. Structural changes with a shift towards greater ownership and use of larger personal vehicles and increasing volumes of freight moved by road vehicles relative to other means of transport are increasingly important factors contributing to growth in the transport sector's final energy consumption.

174 Ibid.
175 See IEA website: https://www.iea.org/newsroom/news/2016/october/energy-efficiency-market-report-2016.html
176 Ibid.



2. CHINA'S ENERGY POLICY AND LEGAL FRAMEWORKS

2. China's energy policy and legal frameworks

China's Energy Policy recognises that China aims to achieve comprehensive, balanced and sustainable development of its economy, society and ecology. It is an important strategic task of the Government of China to build a modern energy industry which is secure, stable, economically efficient and based on clean and sustainable energy resources. China continues to strengthen its efforts in energy conservation and emissions reduction through greater energy efficiency.[177]

2.1 Legal framework of the energy sector

The legal framework for the energy sector is well developed and based on a hierarchy of national laws, ministerial regulations, guiding opinions, measures, procedures, local rules and regulations. The national laws are broad in nature, establishing a legal foundation for the sector and requiring infrequent amendment, whereas the secondary regulations and rules are used to implement strategic reforms and policy change.

The long-established laws that underpin the organisation, development and functioning of the energy sector are specific to electric power, coal, renewable energy and energy conservation. They have been amended over time, adapting to development and changing context. The law on oil and gas pipeline protection was established relatively recently in 2010. The key laws of the energy sector are set out below in Table 2.

Table 2 Summary of China's existing laws for the energy sector[178]

Legislation	Effective Date	Target
Law on Electric Power	01/04/1996	To protect and promote the development of the power industry, protect the legitimate rights and interests of investors, operators and customers, and ensure the safe operation of electric power.
Law on the Coal Industry	01/12/1996	To rationally develop and use coal resources, standardise coal production and business activities, promote and ensure the development of the coal industry.
Law on Energy Conservation	01/01/1998	To promote energy conservation by all sectors of the society, increase energy efficiency, protect and improve the environment, promote comprehensive balanced and sustainable economic and social development.
Law on Renewable Energy	01/01/2006	To promote the development and use of renewable energy, increase energy supply, improve energy structure, ensure energy security, protect the environment and achieve sustainable economic and social development.
Law on Oil and Gas Pipeline Protection	01/10/2010	To protect oil and natural gas pipelines, ensure the safety of petroleum and natural gas transportation, and maintain state energy security and public safety.

177 See GOC website: http://www.scio.gov.cn/zfbps/ndhf/2012/Document/1233790/1233790.htm
178 See NEA website: http://www.nea.gov.cn/nyflfg/index.htm

2.2 China's energy challenges and drivers of energy policy

In developing its energy sector, China faces a number of challenges. These include the continued growth of energy consumption compared with natural resource constraints, the inefficient use of energy, energy security concerns, the harmful environmental and health impacts of the energy cycle, and a legal framework that lags behind the needs of energy system reform. Each of these challenges is further elaborated below.

2.2.1 Continuing growth of energy consumption and resource constraints

China is a developing country with the largest population in the world. The country's per-capita energy consumption is at a relatively low level compared to other countries of the world. With the continued rapid development of the economy and rising living standards, however, energy consumption could dramatically increase in the absence of strong energy efficiency policies, placing increasing pressure on available energy resources.

China is rich in coal resources and hence China's energy consumption is dominated by coal, accounting for 60.4% of China's total primary energy consumption in 2017.[179] China is the largest coal consumer in the world, accounting for 50.7% of the world's total coal consumption in 2017.[180] Due to environmental concerns and supply side reform, China is implementing environmental protection measures, including energy efficiency improvements, which are driving a reduction in the consumption of coal. At the same time, the consumption of oil and gas is increasing and raising concerns regarding the availability of these energy resources and dependency on imports. China's external dependence on crude oil reached 69% in 2017.[181]

2.2.2 Inefficient use of energy

As detailed in section 1.4.2, energy consumption per unit of GDP is much higher compared to many developed countries and some newly industrialised countries but is rapidly improving. China's TPES/GDP in 2015 was 0.334 toe/USD 1000, falling 33% relative to 2005. Despite this impressive decline, China's TPES/GDP in 2015 was nearly three times that of OECD countries and double the global average.[182]

China's industrial sector is very large, energy-intensive and has traditionally employed inefficient processes and technologies. The energy consumption of six major highly energy-intensive industries, such as petroleum, chemicals, ferrous and non-ferrous metals, non-metallic mineral products, electric and heat power, accounted for 50% of China's total energy demand in 2016.[183] Poor energy efficiency performance results in high energy consumption per unit of GDP and reflects the energy-intensive mode of development and the irrational industrial structure in China. Improved energy efficiency delivers, among other benefits, improvements in industrial productivity and competitiveness, reduced energy imports and improved energy security as well as reduced harmful environmental and health impacts giving rise to better quality of life.

2.2.3 Harmful environmental and health impacts

The production of energy based on the combustion of fossil fuels, particularly involving coal and unsustainable use of biomass results in emissions of harmful pollutants to the air, land and water, causing direct harmful impacts on ecosystems and human health. The discharge

179 Annual Report on China's Energy Development 2017, EPPEI, April 2018.
180 World Energy Statistical Review 2018, BP, June 2018.
181 Annual Report on China's Energy Development 2017, EPPEI, April 2018.
182 China Energy Statistical Yearbook 2017, NBS, December 2017.
183 Ibid.

of carbon dioxide (CO_2), sulphur dioxide (SO_2), nitrogen oxides (NOx) and toxic heavy metals remains high, and emissions of ozone and particulate matter (PM 2.5) are increasing.

As a rapidly developing country, China recognises that it faces the dual tasks of achieving economic growth while ensuring environmental protection. In June 2013, the State Council held an executive meeting and determined to take ten measures for the prevention and control of atmospheric pollution. In September, the Action Plan for Air Pollution Prevention and Control was issued, proposing targets for improved air quality, specific measures and progress indicators.[184] On 1st January 2016, the Law on Prevention and Control of Atmospheric Pollution came into force, setting down the total discharge of key atmospheric pollutants to be controlled by the Government.[185] The State Council also released the Opinion on Comprehensively Strengthening Ecological Environmental Protection, Resolutely Fighting against the Pollution in June 2018, aiming to strengthen environmental governance. The Opinion set environmental quality targets for 2020 relating to air, water, and soil and forest protection.[186]

2.2.4 Energy security concerns

The Government of China regards the country's degree of dependence on foreign energy sources as being too high and considers the reserve system to be in need of improvement. As China's crude oil output growth is significantly lower than growth in crude oil consumption, import dependence has soared in recent years and China is vulnerable to oil supply shortage. China's total consumption of energy from imports in 2017 was equivalent to 900 Mtce, accounting for 20% of the total energy consumption, and split as follows: 67% crude oil; 14% natural gas; 19% coal.[187]

Marine transportation of petroleum and cross-border pipeline transmission of oil and gas face increasing security risks. About 80% of imported energy is currently transported through the Malacca Strait, giving rise to energy security concerns, which are often referred to as the 'Malacca Dilemma'.[188] Frequent price fluctuations in the international energy market make it more difficult to guarantee domestic energy supply at affordable prices.

2.2.5 Legal framework lag

The development of the energy sector must be based on law and so evolution of the legal framework must keep pace with the rapidly changing context and the need for timely reforms. China has recognised the energy sector's need for a fundamental law and so, with the participation of 15 ministries, introduced a draft Energy Law[189] in 2005. This new law, which defines the legal norms that regulate institutional and social relations in energy sector development and management, has not yet been promulgated and neither has the Energy Regulation Ordinance. China's evolving Energy Policy should have been accompanied with the new Energy Law. Furthermore, necessary amendments of existing laws such as the Electricity Law and Coal Law have not been timely developed.

2.3 China's Energy Policy

With continued growth in economic development and energy demand, China has recently become the largest producing and consuming country in the world. Domestic economic

184 See MEP website: http://zfs.mep.gov.cn/fg/gwyw/201309/t20130912_260045.shtml
185 See GOC website: http://www.gov.cn/xinwen/2014-12/22/content_2795230.htm; http://www.gov.cn/xinwen/2015-08/28/content_2921557.htm
186 See GOC website: http://www.gov.cn/zhengce/2018-06/24/content_5300953.htm
187 Annual Report on China's Energy Development 2017, EPPEI, April 2018.
188 Available at: http://guoqing.china.com.cn/2014-12/11/content_34290377_2.htm
189 Available at : http://www.sohu.com/a/30745904_134609

development, alongside a fast-changing international energy landscape and significant technological progress presents major opportunities for China to develop an affordable, clean, low-carbon, efficient and optimised energy system. The opportunities, however, can only be realised through ambitious and effective policies.

China published its Energy Policy in October 2012,[190] which sets out the country's strategic energy issues. This was followed soon after by President Xi Jinping's landmark speech that set out China's strategy of 'Four Revolutions and One Cooperation' for energy security development. Around the same time, the Government unprecedentedly developed a series of high-level energy policies to guide development of the energy sector over the next 10 to 20 years.

2.3.1 Four Revolutions and One Cooperation Strategic Vision (2014)

On 13th June 2014, President Xi Jinping delivered a landmark speech, setting out China's strategy of 'Four Revolutions and One Cooperation' for energy security development in the 6th meeting of the Central Financial and Economic Leading Group.[191] 'Four Revolutions and One Cooperation' is centred on the following key themes: promoting the 'energy consumption revolution' involving suppression of irrational energy consumption; promoting the 'energy supply revolution' by establishing greater diversity in China's energy supply; promoting the 'energy technology revolution' by driving industrial upgrading; promoting the 'energy system revolution' with the fast-tracking of energy sector development; and comprehensively strengthening international cooperation to achieve energy security under open conditions. This was the first time that the Government of China had held a special meeting on energy security issues since the founding of the People's Republic of China, marking China's entry into a new revolutionary era of energy production and consumption.[192] The 'Four Revolutions and One Cooperation' vision effectively places the management of energy consumption on an equal footing to development of supply.

2.3.2 Strategic Action Plan for Energy Development (2014-2020)

In June 2014, the State Council issued the Strategic Action Plan for Energy Development (2014-2020) to clarify the strategic tasks of China's energy development and the targets related to building a clean, efficient, safe and sustainable modern energy system.[193] An unified, open and modern energy market system, enabling competition, is expected to be formed by 2020. The five key tasks of the Action Plan are:

- **Enhance the ability of energy independence:** promote clean and efficient development and use of coal, steadily increase domestic oil production, vigorously develop natural gas, actively develop energy substitution, and strengthen the capacity of reserve emergency response.
- **Promote the energy consumption revolution:** strictly control the excessive growth of energy consumption, focus on implementing energy efficiency improvement plans, and promote the transformation of urban and rural energy use.
- **Optimise the energy mix:** reduce the proportion of coal consumption, increase the proportion of natural gas consumption, safely develop nuclear power, and vigorously develop renewable energy.

190 See GOC website: http://www.gov.cn/jrzg/2012-10/24/content_2250377.htm
191 Available at: http://www.xinhuanet.com/politics/2014-06/13/c_1111139161.htm
192 Available at: http://finance.ifeng.com/a/20141231/13400444_0.shtml
193 See NEA website: http://www.nea.gov.cn/2014-12/03/c_133830458.htm
See GOC website: http://www.gov.cn/xinwen/2014-11/19/content_2780748.htm

- **Expand international cooperation in energy fields:** deepen bilateral and multilateral cooperation in international energy, establish a regional energy trading market, and actively participate in global energy governance.
- **Promote energy science and technology innovation:** clarify the strategic direction and key points of energy science and technology innovation, focus on major science and technology projects, drive independent innovation by major projects, and accelerate the construction of an energy science and technology innovation system.

2.3.3 The 13th Five-Year Plan for Energy Development (2016-2020)

Since the mid-1950s China has developed Five-Year Plans, which are a series of highly strategic social and economic development initiatives; they consist of an overarching and high-level Outline and a series of sub-plans to achieve it. In December 2016, the National Development and Reform Commission (NDRC) and the National Energy Administration (NEA) jointly released the 13th Five-Year Plan (FYP) for Energy Development[194] together with sub-plans for coal, electric power, petroleum, natural gas and renewable energy among others, in order to comply with and deliver the Outline of the13th Five-Year Plan.[195] These plans also consider factors such as safety, resources, environment, technology and the economy.

The 13th Five-Year Plan for Energy Development mainly sets out the guiding ideology, basic principles, development goals, major tasks and policy measures for energy development in China. It is the overall blueprint and programme of action for energy development during the13th Five-Year time period, and fully embodies the basic national policy of 'Four Revolutions and One Cooperation' for energy development. The key tasks for energy development in the 13th FYP are summarised as follows:[196]

- Focus on optimising the energy system: improve the overall efficiency of the energy system; optimise the layout of energy development; strengthen the capacity-building of power system peak-shaving; implement responsive capacity enhancement projects on the demand side; promote integration and optimisation of energy production and supply; and build a smart energy system with multi-energy complementarity and coordination in supply and demand.
- Promote the energy consumption revolution: adhere to giving priority to energy conservation; strengthen guidance and restraint mechanisms; curb unreasonable energy consumption; improve the level of cleanliness of energy consumption; and gradually build an efficient, clean, low-carbon and social energy model.
- Promote the energy supply revolution: promote the structural reform of the energy supply side; take the promotion of the clean and efficient development and use of fossil fuels, such as coal, as the primary task of energy transformation and development; actively develop non-fossil energy; strengthen the construction of energy transmission and distribution networks and emergency reserve facilities; and strive to improve the quality and efficiency of the energy supply system.
- Promote the energy technology revolution: in-depth implementation of innovation-driven development strategy to accelerate the development of major energy technology research, key equipment manufacturing and main demonstration projects; accelerate the

194 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbtz/201701/t20170117_835278.html
195 See NPC website: http://www.npc.gov.cn/wxzl/gongbao/2016-07/08/content_1993756.htm
196 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbtz/201701/t20170117_835278.html

technological revolution in the energy sector; realise the transformation from a major energy-consuming country to a powerful nation in energy based on advanced science and technology.

- Promote the energy system revolution: adhere to the direction of market-oriented reforms; rationalise the price system; deepen the reform of major areas of energy; strive to eliminate institutional barriers; and build fair competition in the energy market system.
- Strengthen international energy cooperation: co-ordinate domestic and international affairs; make full use of domestic and international resources to implement the strategy of opening up markets and cooperation for energy in a holistic way; seize the opportunity of building the Belt and Road initiative; promote the connectivity of energy infrastructure; increase international production capacity cooperation; and actively participate in global energy governance.
- Achieve shared energy development: comprehensively promote the implementation of preferential energy projects to ordinary people; strive to improve energy infrastructure; accurately implement energy poverty alleviation projects; effectively raise the level of universal energy services; and achieve universal energy sharing.

Based on the general requirements of the 13th FYP for Energy Development and the characteristics of different energy industries, various sub-plans for the energy industry have been formulated. The sub-plans are specific to coal, [197] electric power,[198] petroleum,[199] natural gas,[200] renewable energy [201] (see Annex 1) and the 13th FYPs for energy conservation[202] cover industrial, transport and building sectors (see Annex 2). The sub-plans have clear objectives and detail the measures and measurable indicators that will ensure realisation of the 13th FYP for Energy Development. The indicators are summarised in Table 3.

197 See NDRC website: http://www.ndrc.gov.cn/fzgggz/fzgh/ghwb/gjjgh/201706/t20170605_850004.html
198 See NDRC website: http://www.ndrc.gov.cn/fzgggz/fzgh/ghwb/gjjgh/201706/t20170605_849994.html
199 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbghwb/201701/t20170119_835567.html
200 Ibid.
201 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbtz/201612/t20161216_830264.html
202

Table 3 The main indicators of the 13th Five-Year Plan for Energy Development[203]

Categories	Indicators	Units	2015	2020	Average annual rate of change [total difference for 2016-2020]	Attributes
Total energy	Primary energy supply	10^8 tce	36.2	40	2.0%	expected
	Total installed power generation capacity	10^8 kW	15.3	20	5.5%	expected
	Total energy consumption	10^8 tce	43	<50	<3%	expected
	Total coal consumption	10^8 tons of raw coal	39.6	41	0.7%	expected
	Total electricity consumption	PWh	5.69	6.8-7.2	3.6-4.8%	expected
Energy security	Energy self-sufficiency rate	%	84	>80		expected
Energy mix	Share of non-fossil installed power capacity in total installed capacity	%	35	39	[4pp]	expected
	Share of non-fossil electricity generation in total electricity generation	%	27	31	[4pp]	expected
	Share of non-fossil energy consumption in total energy consumption	%	12	15	[3pp]	binding
	Share of natural gas consumption in total energy consumption	%	5.9	10	[4.1pp]	expected
	Share of coal consumption in total energy consumption	%	64	58	[-6pp]	binding
	Share of coal used for electricity generation in total coal consumption	%	49	55	[6pp]	expected
Energy Efficiency	Energy consumption per unit of GDP	%	_	_	[15pp]	binding
	Efficiency of coal consumption of coal-fired power units	gce/kWh	318	<310		binding
	Network losses	%	6.64	<6.5		expected
Environmental protection in energy sector	CO_2 emissions per unit of GDP	%	_	_	[18pp]	binding

203 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbtz/201701/t20170117_835278.html

2.3.4 Energy Supply and Consumption Revolution Strategy (2016-2030)

The Energy Supply and Consumption Revolution Strategy (2016-2030)[204] outlines the comprehensive strategic deployment of China's energy revolution over a longer timeframe of 15 years, which has important practical significance. The Strategy takes into account the fact that China's energy development enters into a new domain, transitioning from total quantity expansion to quality improvement. The Strategy reflects the need to respect the constraints of limited resources and the environment's carrying capacity, requiring the setting and achievement of long-term sustainable development goals.

The 13th Five-Year Plan for Energy Development (2016-2020), released ahead of this strategy, proposed to implement 'Dual Control' both on total energy consumption and energy intensity by 2020. Building on this basis, the Strategy proposes further energy revolution goals to be achieved by 2030. From 2021 to 2030, the use of renewable energy, natural gas and nuclear energy is expected to grow, and the consumption of high-carbon fossil energy is expected to greatly reduce. By 2030, China expects that the total energy consumption will be capped at 6 Gtce, non-fossil energy and natural gas will account for about 20% and 15% of total energy consumption respectively, and new energy demand will mainly rely on clean and sustainable energy. CO_2 emissions will peak around 2030 though China will strive to ensure they peak as soon as possible while CO_2 emissions per unit of GDP will reduce in the range of 60%-65% compared with 2005. The energy consumption per unit of GDP will reach the current global average while the energy efficiency performance levels of China's main industrial products will be among the most advanced in the world.[205]

2.4 Energy pricing policy

Prices are important for encouraging consumers to consume energy efficiently and to make choices in favour of sustainable energy. Prices should internalise external costs, reflecting the costs of damages done to the environment and society by pollution caused by the actions of any market actor. Efficient prices are crucial to the business case for investing to improve energy efficiency.

Market-orientated price formation and the 'polluter pays' principle are enshrined in all Energy Charter legal instruments and political declarations. The political commitment to this principle is fully set out in the preamble to the PEEREA:[206]

'Convinced that energy prices should reflect as far as possible a competitive market, ensuring market-oriented price formation, including fuller reflection of environmental costs and benefits, and recognising that such price formation is vital to progress in energy efficiency and associated environmental protection.'

2.4.1 Market-orientated price formation and price regulation

China's current pricing mechanism applied to coal, oil, gas, and electricity is a limited market regulation mechanism. The main benchmark for the price adjustment of thermal coal, refined oil, natural gas and electricity is determined by the Government and referred to as the 'governmental pricing' or 'government guidance price'. More consideration, however, is being given to the supply and demand factors of international and domestic markets and the possibility of using an alternative market-orientated pricing mechanism to overcome the shortfalls of the current price mechanism.

204 See NDRC website:http://www.ndrc.gov.cn/zcfb/zcfbtz/201704/t20170425_845284.html
205 Ibid.
206 Available at: https://energycharter.org/fileadmin/DocumentsMedia/Legal/ECTC-en.pdf

2.4.1.1 Coal pricing

As explained in section 1.3.1, China's coal market was partially competitive for a long time but is now the most liberalised of all energy sub-sectors. Electricity pricing, however, remained regulated, which has been problematic when the demand for coal increases and coal prices consequently increase. To address the issue, the NDRC issued in December 2004 the 'coal-electricity price linkage' mechanism[207] whereby the price of electricity fluctuates to reflect price changes in coal. Since 2013, coal enterprises and power generation companies establish contracts and negotiate prices independently of one another.[208] More recently in December 2015, the NDRC issued the Notice on Improving the Coal-Electricity Price Linkage Mechanism[209] in order to promote coordinated development of the coal and electric power industries while improving the market-oriented reform of electricity prices.[210]

2.4.1.2 Oil and gas pricing

Since December 2005, the Government of China implemented a government-guided price for natural gas.[211] A 'dual track system' is applied to gas prices such that market-based pricing co-exists with state-controlled pricing. For example, the prices of unconventional natural gas sources such as shale gas, coalbed methane, and coal-to-gas were liberalised in 2013, and in September 2014 for LNG, while other conventional natural gas sources are still priced by the Government.

Since the Shanghai Petroleum and Natural Gas Exchange (SHPGX) was set up in 2015, China has built a natural gas direct trading platform and the scale of transactions has expanded over time. However, due to the lack of reform of the oil and gas system, the gas pipeline network has not been separated, the competitive market has not yet fully formed and the gas price is still regulated. As yet, the current natural gas trading centre cannot form the market benchmark price.

The pricing of pipeline gas is applied differently to non-residential gas consumers and residential gas consumers. During times of peak gas demand and high gas imports, particularly in cold winters, the price of non-residential gas varies according to supply and demand, while residential gas consumption is regulated by the Government and cannot float in the same way. This 'dual-track system' has caused issues in cold winters when gas prices have been high. In May 2018, the NDRC issued the Notice on Rationalising the Price of Residential Gas Stations, which introduced: changes to price control of residential gas, from the highest gas station price to the benchmark gas station price; establishment of a flexible price mechanism reflecting changes in supply and demand; implementation of a seasonal price difference policy; and encouragement of market-based trading.[212]

The State Council issued the Opinions on Deepening the Reform of the Oil and Gas System in May 2017, which identified reform of the pricing mechanism of oil and gas products as one of the main tasks and proposed to: improve the price formation mechanism for refined oil and retain the Government's control over abnormal price fluctuations of market-determined prices; further liberalise non-residential gas prices and improve the residential gas pricing

207 See NEA website: http://www.nea.gov.cn/2011-08/17/c_131054427.htm
208 See GOC website: http://www.gov.cn/zhengce/content/2012-12/25/content_2643.htm
209 See NDRC website: http://www.ndrc.gov.cn/fzgggz/jggl/zcfg/201512/t20151231_770457.html
210 See GOC website: http://www.gov.cn/xinwen/2015-10/15/content_2947548.htm
211 See GOC website: http://www.gov.cn/fwxx/sh/2005-12/27/content_138097.htm
212 See NDRC website:http://www.ndrc.gov.cn/fzgggz/jggl/zcfg/201805/t20180525_887252.html

mechanism; accelerate the construction of oil and gas trading platforms in accordance with laws and regulations; encourage qualified market participants to participate in transactions and form prices through market competition; strengthen the pipeline transportation cost and price regulation; and scientifically formulate the pipeline transportation price according to the principle of 'permitting cost plus reasonable income'.[213]

2.4.1.3 Electricity pricing

In general, China's electricity pricing is orientated around three tariffs determined by Government for the three different parts of the value chain: power generation side; transmission and distribution; electricity sales. The responsibility for formulating the electricity price belongs to the National Development and Reform Commission.[214] In March 2005, the NDRC developed and released the interim management measures for the above tariffs[215] according to the Programme of Reform of the Electricity Tariff issued by the State Council.[216]

The power generation tariff is set by the Government according to the principle of reasonable compensation of costs, income and taxation over the economic lifecycle of power generation. Prices can vary for different power plants or units depending on how polluting they are. Since 2004, China had in place a unified on-grid price level for coal-fired generating units operating in various locations. In order to reduce SO_2 emissions and to encourage electric power enterprises to invest in pollution control, an electricity price of CNY 0.015/kWh was available to coal-fired units fitted with desulfurisation equipment. Later, similar action was taken to reduce NO_X emissions as the NDRC conducted a trial for a denitration electricity tariff. This tariff, set at CNY 0.008/kWh, was available to coal-fired generating units fitted with denitration equipment. The tariff was applied nationwide from January 2013.[217]

In March 2015, the State Council released the Opinions on Further Deepening the Reform of the Electric Power System,[218] which included proposals for electricity tariff reform. Shortly afterwards, in April 2015, the Notice to Accelerate the Reform of Transmission and Distribution Prices was released by the NDRC, requesting the local NDRC and Price Bureau's direct supervision of transmission and distribution revenues, costs and prices based on power grid assets. Up until that point, utilities' revenues were largely the difference between the utilities' electricity costs and sales, in the absence of regulatory scrutiny of costs.[219] In November 2015, the NDRC and NEA issued the Implementation Opinions on the Reform of the Transmission and Distribution Price.[220] In March and September 2016, the NDRC issued two consecutive documents to expand pilot regions and promote price reforms for transmission and distribution nationwide.[221]

The sales price of electricity, set by the Government of China, is composed of power generation purchase costs, including electricity losses in the transmission and distribution networks, transmission and distribution network development and operation costs and Government

213 See GOC website: http://www.gov.cn/zhengce/2017-05/21/content_5195683.htm
214 See NDRC website: http://jgs.ndrc.gov.cn/jgsz/
215 See NDRC website:http://www.ndrc.gov.cn/fzgggz/jggl/zcfg/200505/t20050527_4698.html
216 Available at: http://www.51wf.com/print-law?id=1104686
217 See NDRC website:http://www.ndrc.gov.cn/rdzt/2012xxgkgz/jgsfxxgk/201301/t20130110_522711.html
218 See NDRC website: http://tgs.ndrc.gov.cn/zywj/201601/t20160129_773852.html
219 See NDRC website :http://jgs.ndrc.gov.cn/zcfg/201504/t20150416_688233.html
220 See NDRC website:http://www.ndrc.gov.cn/zcfb/zcfbtz/201511/t20151130_760016.html
221 See NDRC website:http://www.ndrc.gov.cn/zcfb/zcfbtz/201603/t20160314_792666.html
See NDRC website:http://www.ndrc.gov.cn/zcfb/zcfbtz/201611/t20161110_826066.html

funds. The electricity sales prices are classified according to the user. In the future, electricity prices or tariffs are to be applied to three categories of users: residential; agricultural production; industry, business and others.[222] Different types of tariff are applied to different categories of electricity consumer to promote economic structural change and to encourage consumers, particularly industrial consumers, to implement energy-saving technological improvements and upgrading (see Table 4). Since June 2004, a differential electricity price has been applied to energy-intensive industries, along with a surcharge for poor energy efficiency performance.[223] Since September 2006, the scope of implementation of differential electricity pricing policy has been expanded from 6 to 8 industrial consumer categories.[224] Soon after, in September 2007, steps were taken to use the revenues from the pricing policy in order to further reinforce the policy's aims, by channelling the revenues to the provincial financial budget in order to support local economic restructuring, energy conservation and emissions reduction.[225]

Table 4 Electricity pricing measures and the scope of application in China[226]

Pricing methods	Meaning	The scope of application
Flat-rate tariff	Based on actual electricity consumption.	All three consumer categories: residential, agricultural production, general industry, business and others.
Two-part tariff	Electricity prices are divided into two components, with one part based on the actual electricity consumption and the other part based on the customer's maximum capacity or maximum energy demand.	Large-scale industry
Multi-step electricity price (inclining block rates)	Electricity prices are based on a ladder pricing structure with price increments linked to increase in electricity consumption.	Residents
Peak and valley electricity charges	There are different levels of electricity prices for the peak, valley and usual intervals of energy demand.	Large-scale industry electricity; regenerative electric boiler; electricity storage, ice (water), refrigeration, electric air conditioner; general industry and business with capacity of 100 kVA and above.
Differential electricity price	Linked to the level of energy consumption; higher electricity prices are applied to the high energy-consuming industries.	Energy-intensive enterprises listed in national 'elimination' and 'restriction' categories;[227] energy consumption per unit of product exceeding the energy consumption standard for enterprises[228]
Punitive electricity price	Surcharges levied on electricity for regulating enterprises' behaviour.	Ultra-inefficient products; ultra-inefficient enterprises.

222 See NDRC website:http://www.ndrc.gov.cn/zcfb/zcfbtz/201306/t20130609_545076.html
223 See NDRC website:http://www.ndrc.gov.cn/zwfwzx/zfdj/jggg/200511/t20051110_128915.html
224 See GOC website: http://www.gov.cn/zwgk/2006-09/22/content_396258.htm
225 See NDRC website:http://www.ndrc.gov.cn/fzgggz/jggl/zcfg/200710/t20071010_164078.html
226 Available at: http://news.bjx.com.cn/html/20170509/824361-3.shtml
227 See GOC website: http://www.gov.cn/zwgk/2006-09/22/content_396258.htm
228 See GOC website: http://www.gov.cn/zhengce/content/2015-04/04/content_9575.htm

2.4.2 Carbon trading pricing

While market-orientated price formation is one of fundamental principles of the Energy Charter Treaty, it is well recognised that policy interventions are sometimes necessary to address market failures or barriers. This is particularly the case for environmental protection and for improving energy efficiency, which is why a dedicated Protocol was established to guide countries in developing policies on these aspects. A core guiding principle for the development of such policies, however, is that interventions should be market-based and designed to minimise market distortions. For example, carbon trading, carbon taxation and Energy Efficiency Obligations (EEOs) are measures that align well with this principle.

In October 2011, the NDRC agreed with Beijing and 6 provinces to carry out a carbon emissions trading pilot scheme with the aim of controlling Greenhouse Gas emissions at a relatively low cost.[229] In order to ensure the orderly development of emissions reduction trading activities and to mobilise society's participation, the NDRC issued the Interim Measures for the Management of Greenhouse Gas Voluntary Emission Reduction in June 2012.[230] In June 2013, China's first carbon emissions quota trading market was launched in Shenzhen. At the end of 2014, the cumulative trading quota of seven pilot regions (see Table 5) was 30.53 Mt of CO_2, with a turnover of CNY 814 million.[231] The purpose of the pilot carbon trading schemes was to obtain experience of building a united national market and training experts. The rules and systems for each pilot region were developed by local governments.

229 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbtz/201201/t20120113_456506.html

230 Available at: http://www.tanjiaoyi.com/article-7590-1.html

231 China Energy Conservation and Emission Reduction Development Report 2015, CIECCPA and CECEP, December 2015.

Table 5 Carbon market management and financial innovation initiatives in 7 pilot regions in China[232]

Pilot regions	Financial innovation initiatives
Shenzhen	Introduced the first carbon trading law in China. Individual investors can participate in the investment. It initiated the first issuance of carbon bonds, the first green structural deposits, the issuance of quota custody rules and signed the first carbon asset trusteeship service agreement.
Shanghai	Integrated the credit management of carbon trading into the social credit management platform, and introduced the first pledged loan on CCER in China.
Beijing	Introduced administrative punishment discretion, a carbon emission rights offset management method, the market regulation of operation programmes and applied the most comprehensive carbon intensity standards. Launched the first cross-regional carbon market and signed the first financial agreement for carbon emission quota repurchase.
Guangdong	Introduced auctions as a method of quota allocation and established a low-carbon development fund by use of quota auction revenue.
Tianjin	First to launch carbon neutral CCER and led to the first domestic enterprises to buy CCER based on performance of transaction.
Hubei	Diversified investor composition with the participation of the first foreign-funded entity. Signed the largest scale carbon financial credit and the first carbon asset pledged loan project in China. Released the first fund for the 'carbon emission rights special asset management plan' regulated by authorities, and promulgated the quota custody rules and completed the first quota trusteeship in China.
Chongqing	The only pilot region where enterprises submit their allocation quotas on a yearly basis upon which free allocation is based. The Government controls the total quotas and the allocation of the quotas declared by the enterprises. The total amount of the benchmark quota is determined based on the historical emissions level of the enterprise (grandfathering), and is reduced by a certain percentage year by year.

In order to promote the establishment of a national carbon emissions trading market, the NDRC released the Interim Measures for the Management of Carbon Emissions Trading in December 2014,[235] drafted a National Carbon Emissions Trading Regulation[236] and submitted it to the State Council for consideration in December 2015.[237] With the agreement of the State Council, the NDRC issued the Market Construction Scheme for National Carbon Emission Trading (applicable to the power generation sector only) in December 2017.[238] This document relates to the set up of a nationwide carbon emissions trading system in the power generation industry (including co-generation of heat and power), gradually expanding the industries of participating in the carbon market, increasing transaction options. According to the Plan for Establishment of the National Carbon Market, the trial operation and improvement stage will take place during 2017-2020, and full implementation will be after 2020.[239]

232 Ibid.
233 See NDRC website: http://www.ndrc.gov.cn/dffgwdt/201409/t20140928_626928.html
234 Available at: http://www.tanpaifang.com/tanjiaoyisuo/2014/0505/31864.html
235 See GOC website: http://www.gov.cn/gongbao/content/2015/content_2818456.htm
236 Available at: http://www.tanpaifang.com/zhengcefagui/2016/032951731.html
237 Available at: http://www.tanpaifang.com/tanguwen/2016/0119/50133.html
238 See NDRC website: http://www.ndrc.gov.cn/gzdt/201712/t20171220_871134.html
239 Available at: http://news.sina.com.cn/o/2017-12-14/doc-ifyptfcn0457349.shtml

At present, various supporting policies for the carbon emissions trading system are being formulated in China, which will also help speed up the promulgation of the Interim Regulations on the Management of National Carbon Emissions Trading. The policies include corporate emissions reporting, market transactions and establishment of a verification agency.

2.4.3 Renewable energy subsidies

The ultimate goal of the Law on Renewable Energy is to ensure that renewable energy is eventually independent of subsidies and able to participate competitively in energy markets. Currently, China continues to support its renewable energy sector as it is still growing, technologies continue to evolve and costs continue to decline. However, China intends to phase out subsidies.

Tariffs for renewable energy power generation are determined by the Government according to the characteristics of different types of renewable energy power generation and the situation in different regions. The cost in purchasing renewable energy is higher than for conventional energy sources. The renewable energy electricity tariffs paid to generators are based on the coal-fired electricity tariff plus the renewable energy subsidies.[240] The additional cost of renewable energy, covered by subsidies, is levied as a renewable energy surcharge on retail electricity tariffs.[241]

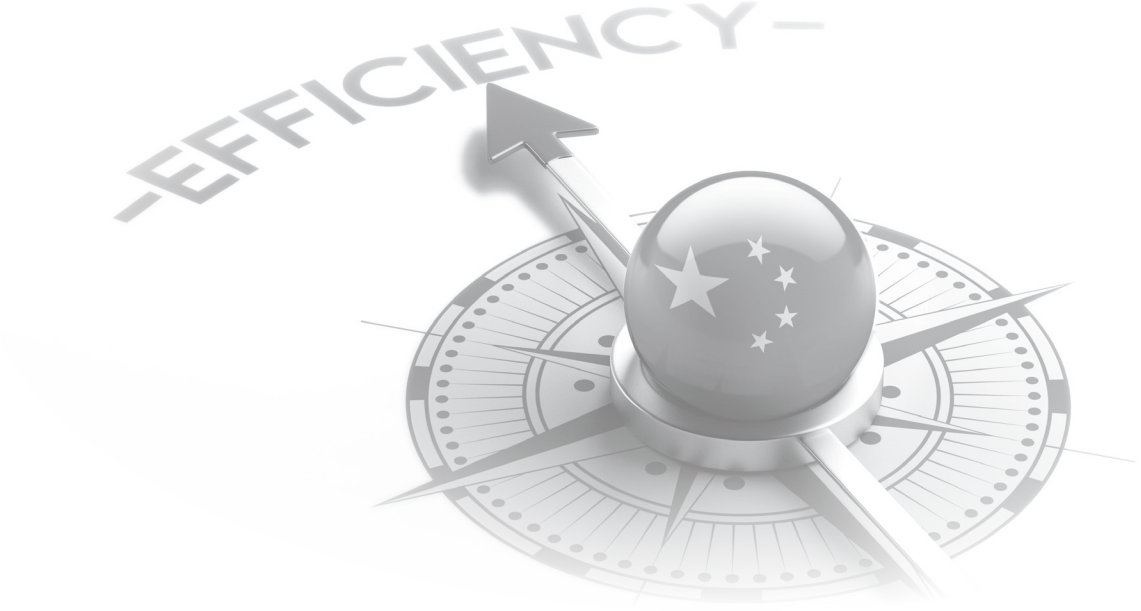
The Renewable Energy Development Fund has been established to promote the development and utilisation of renewable energy by collecting and disbursing funds to support renewable energy generators. The main source of the Fund is public financial budget for Government and levies through the renewable energy surcharge.[242] Since the renewable energy surcharge was implemented in 2006, it has undergone several adjustments from its starting point at CNY 0.001/kWh to the current rate of CNY 0.019/kWh. The surcharge rate is consistently increasing despite the cost reduction being achieved by the industry each year, reflecting the rapid development and expansion of the renewable energy sector in China and the associated accumulating subsidies needed to support it. The Government focuses on improving the policy support and phasing out subsidies and the issue of, insufficient funds. Another issue that needs to be addressed relates to the lag in the Government's payment of subsidies to investors due to lengthy approval and payment processes involving several institutions.[243] It is also recognised that energy efficiency plays a key role in keeping energy bills affordable as retail prices rise.

240 See NDRC website: http://www.ndrc.gov.cn/fzgggz/jggl/zcfg/200601/t20060120_57586.html

241 See NEA website: http://www.nea.gov.cn/2017-11/02/c_136722869.htm

242 See MOF website: http://zhs.mof.gov.cn/zhengwuxinxi/zhengcefabu/201112/t20111212_614767.html

243 Available at: https://wenku.baidu.com/view/10a805155fbfc77da369b11c.html



3. INSTITUTIONS, RESPONSIBILITIES AND COORDINATION

3. Institutions, responsibilities and coordination

Article 4 of the PEEREA on Division of Responsibility and Coordination states, *'Each Contracting Party shall formulate strategies to ensure that energy efficiency polices are coordinated among all of its responsible authorities.'* This chapter elaborates upon the roles and responsibilities of governmental authorities, agencies and non-governmental actors with responsibility for developing and implementing energy efficiency policies, programmes and measures. The final section gives close attention to how these institutions are coordinated.

3.1 Government departments supporting energy efficiency in China

There exist many different government agencies, independent of one another, playing different roles in supporting China's energy efficiency efforts. The NDRC, an agency of the State Council and a macro-control department, takes the lead in formulating strategic direction of national policies. The National Energy Administration (NEA) is a subordinate agency, operating directly under the NDRC, responsible for managing China's energy affairs and policy. The Ministry of Industry and Information Technology (MIIT) is mainly responsible for the implementation of energy conservation and energy efficiency in the industrial sector while the Ministry of Science and Technology (MOST) provides guidance on energy efficiency research in terms of technology. The Ministry of Ecology and Environment (MEE)[244] leads formulation of energy conservation and environmental protection standards and supervision of their implementation. The Ministry of Finance (MOF) provides financial support for the implementation of energy efficiency policies.

3.1.1 National Development and Reform Commission (NDRC)

The NDRC is one of the agencies of the State Council. It is a macro-control department that formulates and organises the implementation of national economic and social development strategies, medium and long-term plans, as well as annual plans to comprehensively coordinate economic and social development. The NRDC essentially guides and promotes the reform of the overall economic system.[245] The Resource Conservation and Environmental Protection Division of the NDRC is responsible for comprehensively analysing major strategic issues to ensure coordinated development of China's economy, society, resources and environment in order to achieve sustainable development.[246]

3.1.2 National Energy Administration (NEA)

The NEA was established in 2008 as a subordinate agency directly under the NDRC. It is mainly responsible for the following: analysing and proposing energy development strategies; formulating energy development plans and policies and organizing their implementation; drawing up energy laws and regulations; promoting the reform of the energy system; formulating relevant reform programmes; and coordinating major issues in energy sector.

Until 2013, the body responsible for regulating the power sector was the State Power Regulatory Commission of the People's Republic of China (SERC),[247] established in 2003. In order to promote energy sector reform and development and to strengthen regulation and administration, it was proposed to integrate the functions of SERC into the NEA in 2013.[248]

244 According to the institutional reform plan of the State Council in March 2018, the responsibilities of the Ministry of Environmental Protection (MEP) were integrated to form the Ministry of Ecology and Environment (MEE).

245 See NDRC website: http://www.ndrc.gov.cn/zwfwzx/jj/

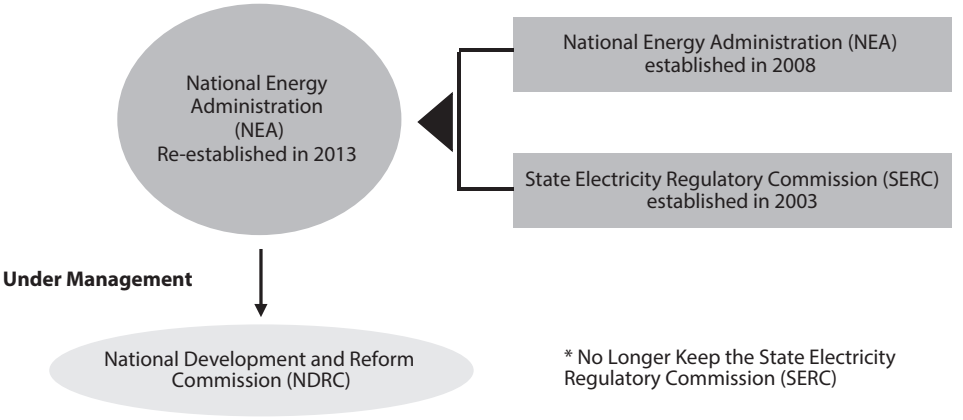
246 See NDRC website: http://hzs.ndrc.gov.cn/newjgsz/

247 More precisely, SERC exercised the function of administrative enforcement and uniformly performed the duties of nationwide electricity regulatory responsibilities in accordance with laws and regulations.

248 See NEA website: http://www.nea.gov.cn/gjnyj/index.htm

Following the merger, the main responsibilities of the re-established NEA are to formulate and organise the implementation of energy sector development strategies, plans and policies, to study and put forward proposals for reform of the energy system and to be responsible for energy sector regulation (see Figure 9).

Figure 9 Reorganisation of the National Energy Administration, 2013



The NEA is also responsible for the management of energy conservation and comprehensive use of energy resources in China's energy industry. The Energy Conservation, Technology and Equipment Department, overseen by the NEA, is specifically responsible for guiding the Government's policy on energy conservation and comprehensive use of resources in the energy sector. It also undertakes scientific and technological progress and equipment-related work, and organises the formulation of energy industry standards (except for the coal industry).[250]

In the field of energy conservation and environmental protection, the government capability is steadily increasing in response to the series of energy conservation policies that have been formulated and the increasingly stringent legal restrictions that have been established. Meanwhile, the central government has increased the allocation of the state budget for energy conservation and environmental protection industries and has created special funds that can be used for various activities and measures, including those relating to environmental protection, energy conservation and use, pollution emission reduction, renewable energy and the circular economy.

3.1.3 Ministry of Industry and Information Technology (MIIT)

MIIT is mainly responsible for formulating and implementing industrial planning and industrial policies and standards. The Ministry also monitors the daily operation of industrial sectors, promotes the development of technological development and innovation, coordinates and safeguards national information security.[251]

249 Available at:
https://baike.baidu.com/item/National Energy Administration of People's Republic of China/7667546?fr=aladdin
250 See NEA websites: http://www.nea.gov.cn/sjzz/kjs/index.htm
251 See MIIT website: http://www.miit.gov.cn/

3.1.4 Ministry of Transport (MOT)

MOT is mainly responsible for formulating of comprehensive transport development strategies and policies, drafting of transport laws and regulations, formulating science and technology policies, technical standards and norms for the transportation industry.[252] The MOT is also responsible for the development and implementation of the 13th FYP for Transport Energy Conservation and Environmental Protection (see Annex 4).

3.1.5 Ministry of Housing and Urban-Rural Development (MOHURD)

MOHURD is mainly responsible for establishing the system of engineering and construction standards, formulating policies and plans for promoting energy conservation in buildings, developing and publishing national standards and building sector standards and supervising the implementation of building energy conservation measures.[253]

3.1.6 Ministry of Science and Technology (MOST)

MOST is mainly responsible for studying macro-strategies for the development of science and technology. The Ministry also formulates guidelines, policies, laws and regulations to promote science and technology in economic and social development. The Ministry conducts research and analyses in order to identify priority areas for science and technology development.[254]

3.1.7 Ministry of Ecology and Environment (MEE)

MEE is responsible for formulating and implementing environmental protection plans, policies and standards, organising the compilation of environmental function zoning, supervising and managing environmental pollution control, coordinating and resolving major environmental protection issues.[255]

3.1.8 Ministry of Finance (MOF)

MOF is mainly responsible for formulating and implementing China's fiscal and taxation development strategies, plans, policies and reform programmes. The Ministry conducts analysis and undertakes forecasting of the macro-economic situation. It also participates in the formulation of various macro-economic policies and puts forward proposals of fiscal and taxation policies to implement macro-economic control and comprehensively balance social and financial resources.[256]

3.2 Non-Government Organisations (NGOs) Supporting Energy Efficiency in China

There are many non-government organisations supporting energy efficiency in China. These organisations carry out a wide variety of activities to support energy efficiency. The main NGOs are mentioned below.

3.2.1 China Electricity Council (CEC)

CEC is a joint organisation representing enterprises and institutions of the electric power industry. It is a non-profit corporate social group. It currently has 79 executive director units, 175 director units, 990 member units, 9 professional sub-councils and 1 professional committee and has direct management of 11 national professional associations.[257]

252 See MOT website: http://www.mot.gov.cn/jiaotonggaikuang/201510/t20151015_1902308.html
253 See MOHURD website: http://www.mohurd.gov.cn/gyjsb/zyzz/index.html
254 See MOST website: http://www.most.gov.cn/
255 See MEE website: http://www.zhb.gov.cn/
256 See MOF website: http://www.mof.gov.cn/zhengwuxinxi/benbugaikuang/bbzn/
257 See CEC website: http://www.cec.org.cn/zdljj.html

CEC work relating to energy efficiency involves:[258]

- organising of statistics relating to electric power environmental protection and resource conservation;
- researching and participating in the formulation of relevant laws, regulations and policies in the field of environmental protection and resource conservation;
- promoting electric power environmental protection, resource conservation and international exchanges and cooperation;
- conducting technical consultations relating to environmental protection and resource conservation in the power sector.

3.2.2 China Energy Conservation Association (CECA)

Established in 1989, CECA is a national community organisation registered by the Ministry of Civil Affairs in the field of energy conservation, with 6 functional departments, 15 professional committees and 3 industry alliances. CECA's business scope covers electric power, coal, petroleum, railways, transportation, construction, nonferrous metals, environmental protection and other sectors.[259]

CECA's mission is to save energy, improve energy efficiency, and promote the comprehensive use of resources and environmental protection. CECA conducts research and provides information, training and consultation services.[260]

3.2.3 China Economize Environmentalist Industry Association (CEEIA)

CEEIA is a national and social organisation that provides services and conducts certain management functions. It aims to reflect the voice of enterprises and safeguard the rights and interests of enterprises. It also endeavours to help the Government to promote technological progress and industrial upgrading, improving industrial development.[261]

CEEIA is mainly responsible for:[262]

- energy conservation and environmental protection products and their evaluation, selection and certification;
- organising industry technology exchange and cooperation; and
- organising training on energy-saving and environmental protection technologies and management.

3.2.4 ESCO Committee of China Energy Conservation Association (EMCA)

EMCA was established in December 2003, approved by the Ministry of Civil Affairs. It is an energy conservation service association with the support of NDRC, MOF, World Bank and the Global Environment Facility. It aims to promote the market-oriented energy conservation mechanism of Energy Performance Contracts, to cultivate and lead the development of the national energy-saving service industry.[263]

258 Ibid.
259 See CECA website: http://www.cecaweb.org.cn/home/column.php?portal_id=1&column_id=9&column_group=&column_type=4&parent_id=8
260 Ibid.
261 See CEEIA website: http://www.eeps.org.cn/about/index.html
262 Ibid.
263 See EMCA website: http://about.emca.cn

EMCA's main purposes are to:[264]

- promote Energy Performance Contracting and energy conservation mechanisms;
- support the Energy Service Companies to grow rapidly;
- promote the sustainable development of China's energy-saving service industry.

In May 2015, the Sino-US Energy Performance Contracting Management Demonstration Project Working Group was set up. EMCA was the lead agency of the working group and responsible for organising and promoting cooperation between the China and US energy efficiency and energy-saving service industries.[265]

3.2.5 China Industrial Energy Conservation and Clean Production Association (CIECCPA)

CIECCPA is a national association registered by the Ministry of Civil Affairs and under the guidance of MIIT. There are more than 400 members of key energy-consuming enterprises in the industrial sub-sectors of metallurgy, construction materials, iron and steel, electric power, water, scientific research institutes and service organisations.[266]

CIECCPA conducts the following activities on energy efficiency:[267]

- annual publication of the China Energy Conservation and Emission Reduction Industry Development Report;
- hosting of exhibitions, trade events and forums relating to energy conservation and environmental protection for the promotion of technologies and equipment;
- carrying out the evaluation of MIIT's Construction Demonstration Project of Energy Management Centres for Industries;
- construction and operation of the Industrial Energy Conservation and Emission Reduction Information Monitoring System.

3.3 Coordination mechanisms and processes

The opportunities to improve energy efficiency lie across the whole economy and so involve many industries, building, transport and other sectors. Improving energy efficiency also has strong interactions and synergies with all elements of the environment including land, water, air, the urban environment and so on. Improving energy efficiency gives rise to co-benefits in addition to lower energy bills, including reduced fuel poverty, improved air quality, optimised energy supply capacity, increased jobs and more. To capture the benefits of energy efficiency, several ministries or departments must be involved, including those responsible for energy system planning, air quality, water quality, employment, industrial development, poverty reduction and urban regeneration.

At present, the NDRC coordinates ministries and departments with allocated powers, responsibilities, functions and duties in accordance with the laws and regulations that have relevance to energy efficiency. An important coordinating mechanisms is the National Climate Change Leading Group (hereinafter referred to as the Leading Group), which acts as the national coordinating body for policy development and implementation relating to climate change, energy conservation and greenhouse gas emissions reduction, and it also issues

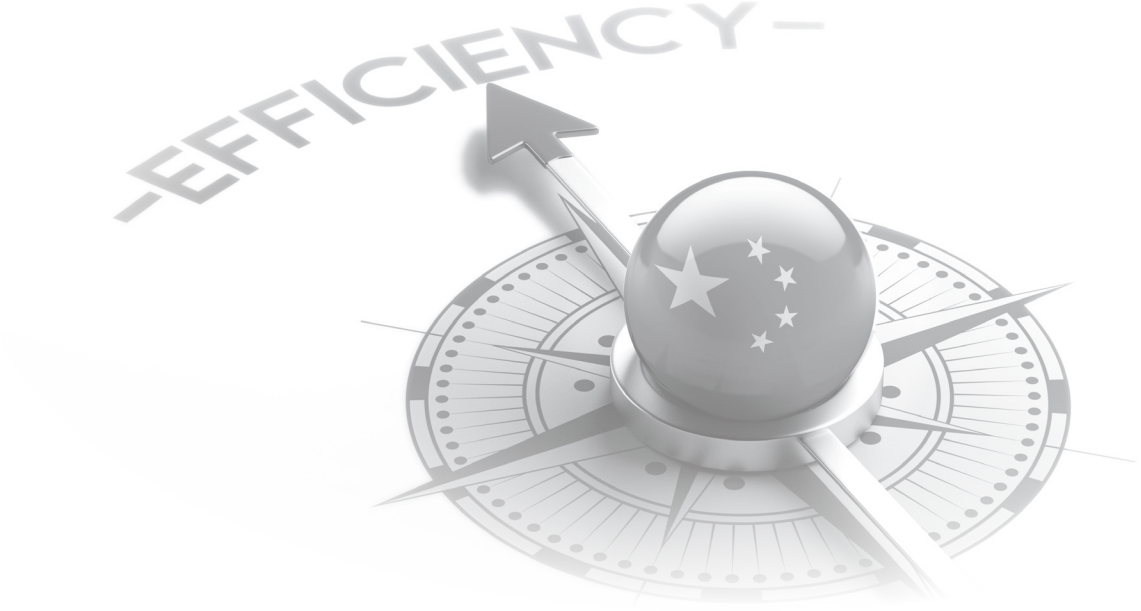
264 Ibid.
265 Available at: http://www.sohu.com/a/82602820_131990
266 See CIECCPA website: http://www.cieccpa.org/1070.html
267 Ibid.

guidelines and formulates policy. The NDRC is responsible for the specific work of the Leading Group, which was set up by the State Council in June 2007.[268] The leader of the Leading Group is Primer of the State Council and members are Ministers in all sectors.

Targets play an important role in driving the cooperation and the need for coordination of the various responsible Ministries, departments and other actors. For example, the Comprehensive Programme for the 13th FYP for Energy Conservation and Emissions Reduction was issued by the State Council in December 2016. It proposed targets for total energy consumption and energy intensity in all provinces of China as well as energy conservation targets for major industries and sectors. In accordance with the 13th FYP's requirements, the provincial people's governments shall immediately deploy the 13th FYP for Energy Conservation and Emissions Reduction in the regions of China and further clarify the relevant departmental responsibilities, division of labour and progress requirements. Each of the tasks in the above mentioned the 13th FYP specifies the leading department and participating departments.

The work of many energy conservation associations in China complement the activities of central and provincial governments. With their expertise and professional knowledge, they play an important role in promoting energy efficiency policy, exchanging information, providing training and capacity-building, conducting relevant research and development and facilitating international cooperation. Some of these organisations are official think-tanks supported by the Government, with specific objectives to support the Government's decision-making, policy development and policy implementation.

268 See GOC website: http://www.moh.gov.cn/bgt/gwywj2/201808/0f34b4c58a2e46ca9a3f7061e6556c6c.shtml



4. CHINA'S ENERGY EFFICIENCY LEGAL AND POLICY FRAMEWORK

4. China's energy efficiency legal and policy framework

A country's energy policy and strategic direction for development of the energy sector should be based on sound principles. The same is true for developing energy efficiency policies. Article 3 of PEEREA sets out a series of principles to guide Contracting Parties in developing their energy efficiency policies:

- cooperation and solidarity with consideration of differences in adverse effects and abatement costs between Contracting Parties;
- a holistic approach that encompasses the whole energy cycle;
- a focus on cost-effectiveness and economic efficiency;
- the development and implementation of both short and long term measures;
- recognition of the vital role of the private sector and the importance of stakeholder cooperation and engagement;
- consideration of international agreements on environmental protection;
- use of work and expertise of international organisations and avoidance of duplication.

According to Article 5 of the PEEREA, Contracting Parties are to formulate energy efficiency strategies and policy aims that are transparent to all interested parties. Article 3 requires that the principles underpinning these policies and legal and regulatory frameworks should promote, inter alia:

- efficient functioning of market mechanisms including market-orientated price formation and a fuller reflection of environmental costs and benefits;
- reduction of barriers to energy efficiency, thus stimulating investments;
- mechanisms for financing energy efficiency initiatives;
- education and awareness;
- dissemination and transfer of technologies;
- transparency of legal and regulatory frameworks.

Article 8 of PEEREA on Domestic Programmes, details particular energy efficiency programmes and measures that can be used as appropriate to achieve energy efficiency improvements. These measures or areas include energy supply and demand modelling, policy impact assessments, energy efficiency standards, private sector engagement, financing, technology promotion, information provision and specialised bodies, cogeneration and district heat, as well as institutional and legal infrastructures. The majority of these topics are covered in sections below. Financing, private sector engagement, institutions and energy efficiency policy and legislation are covered in separate chapters.

4.1 The Law on Energy Conservation

The Law on Energy Conservation which first entered into force in 1998, established the legal framework to encourage China's citizens to save energy, improve energy efficiency, protect the environment and to promote comprehensive, coordinated and sustainable economic and social development. It was amended and improved twice, in 2007 and 2016.[269]

269 See GOC website: http://www.gov.cn/xinwen/2016-07/03/content_5087719.htm

The Law on Energy Conservation includes the following aspects:

- stipulate the responsibilities and obligations that governmental bodies and relevant departments at all levels should play in energy conservation, including planning, technical and economic policies, strengthening management and supervision, and promoting technological progress;
- stipulate the responsibilities and obligations of energy-consuming entities, especially key energy-consuming entities, to use energy rationally, including complying with the relevant legal systems, energy conservation policies, norms and standards, and fulfilling their energy conservation obligations;
- stipulate the units and individuals that produce equipment for energy-using products and their responsibilities and obligations in energy efficiency quality management and promotion of advanced energy-using products;
- establish several important systems for promoting energy conservation, such as: prohibition of the production, import and sale of products that do not meet the Mandatory Energy Efficiency Standard; the phase-out system for outdated and inefficient products and equipment; energy-efficiency labelling management; and the energy conservation assessment and review system for fixed asset investment projects.

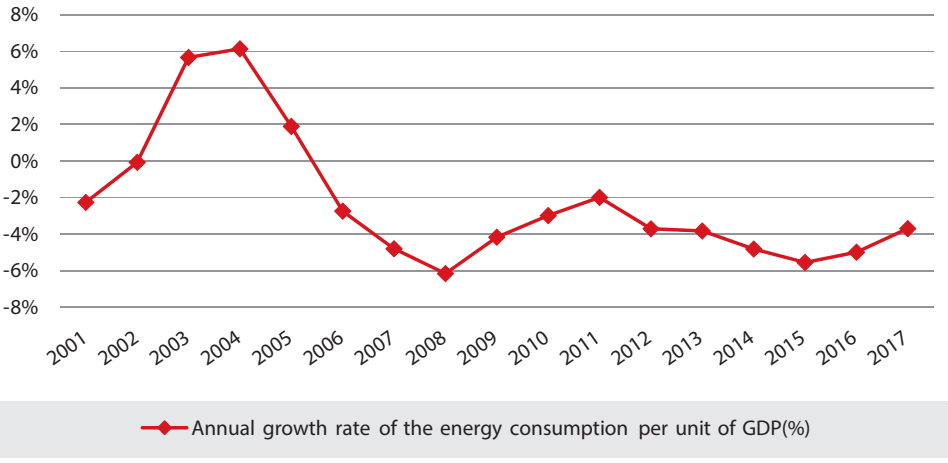
4.2 National energy intensity targets

Between 2000 and 2015, China's energy intensity improved by 30% with energy efficiency policy playing an important role in the later part of this timeframe (see section1.4.2).[270] Annual energy intensity improvement rates are significant with energy intensity falling by 5.2% in 2016, reflecting strong economic growth with minimal increase in energy demand.[271] Due to the sheer size of China's economy, China's achievements significantly impact global energy intensity trends and global energy markets. Without China, the fall in global energy intensity in 2016 would have been only 1.1% instead of 1.8% actually achieved.[272]

Prior to the 11th FYP (2006-2010), the Government of China set energy efficiency policy on a sector-by-sector basis. The first time that a target for energy efficiency was introduced in high-level, binding documents was in 2006 with the issuance of the Outline of the 11th FYP for National Economy and Social Development, which proposed that the energy consumption per unit of GDP should drop by 20% by 2010 relative to 2005.[273] The 12th FYP for Energy Development (2011-2015) introduced 'Dual Control' of energy intensity and total consumption. Total energy consumption of China reached 4 Gtce in 2015, while energy consumption per unit of GDP decreased by 16% compared with 2010.[274] Indeed, China's annual growth rate in energy consumption per unit of GDP has been negative since 2006 as illustrated in Figure 10.

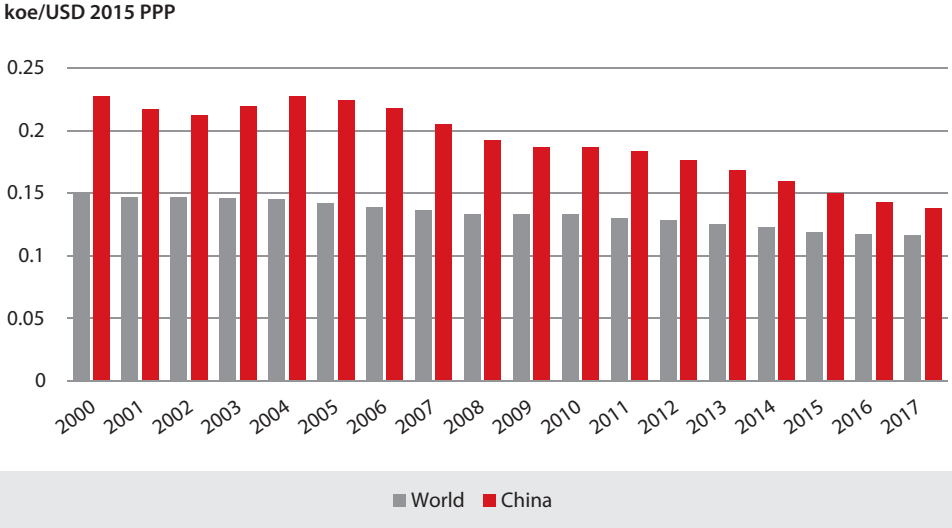
270 See IEA website: https://www.iea.org/newsroom/news/2016/october/energy-efficiency-market-report-2016.html
271 See IEA website: http://www.iea.org/publications/freepublications/publication/Energy_Efficiency_2017.pdf
272 Ibid.
273 See NPC website: http://www.npc.gov.cn/wxzl/gongbao/2006-03/18/content_5347869.htm
274 See GOC website: http://www.gov.cn/zwgk/2013-01/23/content_2318554.htm

Figure 10 China's annual growth rate in energy consumption per unit of GDP, 2001-2017[275]



While policy has been key to improving energy efficiency, much potential still remains as China's starting point was highly inefficient. This is illustrated by the fact that in 2015, China accounted for 23% of global energy consumption and 34% of the net increase in global energy consumption[276] but China's GDP accounted for 11.8% of global GDP.[277] In 2017, China's energy intensity was still above world average as illustrated in Figure 11, but the gap is narrowing year by year.

Figure 11 China's energy intensity compared with world average, 2000-2017[278]



275 China Energy Statistics Yearbook 2017, NBS, December 2017.
Annual Report on China's Energy Development 2017, EPPEI, April 2018.
276 Statistical Review on World Energy 2016, BP, June 2016.
277 China Energy Statistics Yearbook 2017, NBS, December 2017.
278 Available at:https://yearbook.enerdata.net/total-energy/world-energy-intensity-gdp-data.html

4.3 The 13th FYP: Energy efficiency and energy sector development

China is committed to building upon and continuing its progress in improving energy efficiency, which is why improving energy efficiency and managing energy consumption is integral to the 13th FYP for Energy Development (2016-2020). The Government of China aims to develop the energy sector in order to achieve specific outcomes relating to social, environmental and economic development such as greater industrial productivity, improved air quality and climate change mitigation among others. Energy efficiency can contribute to achieving all these outcomes and more. Targets have been set in the 13th FYP for Energy Development to motivate and measure progress towards such outcomes. Targets have also been set for the means to achieve these outcomes, including improving energy efficiency, increasing the renewable energy share and reducing the coal-fired share of total power capacity.

In order to achieve the goals of the 13th FYP for Energy Development, the NRDC and other ministries released a series of 13th FYPs that are closely interlinked, incorporating some common targets and indicators, and in which energy efficiency and energy conservation play an important role.

The 13th FYP for Energy Development aims to develop the energy sector such that by 2020:[279]

- total energy consumption is capped at 5 Gtce;
- the proportion of non-fossil energy in total energy consumption is increased to above 15%;
- the existing installed capacity of coal-fired power is capped at 1.1 TW;
- energy consumption per unit of GDP is reduced by 15% relative to 2015;
- CO_2 emissions per unit of GDP are reduced by 18% compared with 2015.

The 13th FYP for Energy Development puts forward the main ways to develop the energy system in an efficient and optimal way including through the following strategies: effectively address overcapacity by improving the utilisation efficiency of current production capacity and strictly controlling build of new production capacity, particularly of new coal-fired power projects; address the shortage of needed energy infrastructure capacity; and promote the coal-fired units of lowest emissions and the energy-saving transformation.

In June 2014, the State Council released the Strategic Action Plan for Energy Development, which adheres to the strategic principle of 'conversation, cleaning and safety' and aims to accelerate the construction of a clean, efficient, safe and sustainable modern energy system. Stemming from this Strategic Action Plan are a series of sectoral action plans designed to improve energy efficiency in coal-fired power units, industry, buildings and transport (see Table 6).

279 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbtz/201701/t20170117_835278.html

Table 6 Energy efficiency action plans in the Strategic Action Plan for Energy Development (2014-2020)[280]

Action Plans	Main objectives
Upgrading and Renovation of **Coal-fired Power Units**	Implementation of the upgrading and renovation of old coal-fired units' energy conservation and emission reduction upgrades. Units in operation with installed capacity of 600 MW and above (except for air-cooled units) strive to reduce coal consumption to about 300gce/kWh by 2020.
Industry Energy Conservation	Strict restrictions on high energy-consuming industries and the expansion of overcapacity industries, speeding up the elimination of inefficient production capacity, the implementation of ten key energy-saving projects, energy-saving and low-carbon action for 10,000 enterprises. Implement energy efficiency improvement plans for key energy-consuming equipment such as motors, internal combustion engines and boilers, and promote the use of surplus heat and pressure in industrial enterprises. In-depth promotion of demand-side management in the industrial sector, active development of efficient boilers and high-efficiency electric motors, promotion of energy efficiency of end-use energy products and energy efficiency of key energy-consuming industries. Conscientiously carry out environmental impact assessment and energy conversation assessment review on new projects.
Green **Building**	Strengthen planning for building energy use, implement energy efficiency improvement projects in buildings, promote energy efficiency design standards for 75% of residential buildings as soon as possible, accelerate green building construction and renovation of existing buildings, implement energy consumption quotas for public buildings and green buildings rating and labelling system, vigorously promote energy-saving electrical appliances and green lighting, and actively promote the construction of new energy city. Vigorously develop the concepts of the low-carbon eco-city and green eco-city and by 2020, urban green buildings should account for 50% of new buildings. Accelerate the reform of heat metering, ensure that heat metering in existing buildings is retrofitted and consumers are charged based on metred heat.
Green **Transport**	Improve the planning of the integrated transport system and speed up the construction of the integrated transport system. Actively promote clean energy vehicles and marine industrialisation, improve vehicle fuel economy standards and environmental standards. Accelerate the development of resource-saving and environment-friendly modes of transport such as rail transit and water transport, and promote the construction of inter-city railways in major urban agglomerations. Vigorously develop urban public transport, strengthen urban pedestrian and bicycle transport systems, increase the share of public transport and non-motorised transport.

4.4 The Special Plan for Medium and Long-Term Energy Conservation

In November 2004, the NDRC published the Medium and Long-Term Special Plan for Energy Conservation.[281] The Special Plan is designed to: promote energy conservation and consumption reduction in all sectors of society; improve energy efficiency; speed up the building of an

280 See GOC website:http://www.gov.cn/zhengce/content/2014-11/19/content_9222.htm
281 See NDRC website:http://www.ndrc.gov.cn/fzgggz/hjbh/jnjs/200507/t20050711_45823.html

energy-saving society; and to relieve energy constraints and environmental pressures. The Special Plan is an important part of China's medium and long-term development plan for energy and provides the basis and guidance for medium and long-term energy conservation efforts and projects.

The Special Plan proposes a series of macro energy-saving targets such as reducing energy consumption per unit of GDP to 1.54 tce/ CNY 10,000 by 2020 and establishing an average annual energy-saving rate of 3% from 2003 to 2020 such that the total energy-saving capacity will be 1.4 Gtce.[282] The Special Plan identifies 3 key sectors, 10 projects and 10 specific measures in energy conservation. The three key sectors focus on energy conservation in industry, transport and buildings.

Energy conservation is a long-term and strategic policy for China's economic and social development. The Special Plan points out that the main reasons for the low efficiency in energy use are rapid economic growth, irrational industrial structure, outdated and inefficient technical equipment and poor energy management.

4.5 The 13th FYP for National Energy Conservation Action

The NDRC and other ministries jointly released the 13th Five-Year Plan for National Energy Conservation Action[283] in December 2016. The Action Plan proposes 10 energy conservation actions, involving public participation, that aim to improve energy conservation and to achieve the 13th FYP targets relating to energy consumption per unit of GDP and total energy consumption.

The Action Plan aims to build a framework of action focusing on national participation in energy conservation by promoting key energy-saving projects and sound economic incentives, establishing a market-oriented energy-saving mechanism and fostering energy conservation awareness among China's population. It will promote the improvement of energy efficiency levels in the industrial, building and transport sectors, public institutions and other key energy-intensive sectors.

4.6 Main energy efficiency measures

4.6.1 Strong obligations and incentives for energy-intensive industry

According to the IEA, the majority of energy savings achieved in China have come from industry. These energy savings have largely been driven by a mandatory target-based programme – TOP 10,000 – which was introduced in 2006 and expanded in 2011 to cover more than 16,000 of the largest energy-intensive companies.[284] An energy-saving target is shared across provinces and cities with local governments being responsible for meeting their quota of energy savings and having the powers to set targets for firms, conduct mandatory audits, monitor progress and apply penalties. An energy efficiency fund supports the enterprises involved in this programme and the Government assists by supporting the ESCO industry, providing fiscal and financial incentives and providing training.

China's Top Runner programme complements the TOP 10,000 programme by identifying high energy-efficiency product models and benchmarks for some energy-intensive industrial sectors. As a result, the energy savings achieved from 2011 to 2014 were 216 Mtoe annually.[285]

282 Ibid.

283 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbtz/201701/t20170105_834480.html

284 See IEA website: https://www.iea.org/newsroom/news/2016/october/energy-efficiency-market-report-2016.html

285 Ibid.

In order to establish energy efficiency benchmarks, the NDRC and other ministries jointly issued the Implementation Plan for the Energy Efficiency Top Runner System in December 2014.[286] According to this Plan, 19 Top Runners were in place for industrial production of steel, ethylene, synthesis ammonia, cement, plate glass and electrolytic aluminium in 2017. [287] The Management Measures for Energy Conservation of Key Energy-use Unit was implemented on 1st May 2018.[288]

In recent years, the industrial sectors have been able to improve industrial energy efficiency through a series of actions such as phasing out excess production capacity, inspection and reduction in energy consumption and decommissioning small coal-fired power units and outdated production capacity. From 2012 to 2016, the energy consumption associated with the added value (i.e. productivity) of the designated industrial enterprises reduced by 29.5% and in 2017 decreased by 4.6% relative to the previous year.[289] Avoided costs in large industry sectors and manufacturing industries in 2014 due to energy efficiency investments were USD 18 billion and USD 10.9 billion respectively.[290]The Management Measures for Industry Energy Conservation went into force on 30 June 2016.[291]

Looking to the future, economic restructuring with a shift from energy-intensive heavy industry towards lighter and higher value industry and services is expected to significantly impact energy use by industry. The goals set out in the 13th Five-Year Plan for Energy Conservation and Emission Reduction target an 18% energy productivity improvement in the energy consumption of value-added industrial enterprises above the designated level by 2020 relative to 2015.[292] While energy efficiency will make an important contribution to achieving the 2020 target, economic restructuring is expected to account for a large share of the planned energy savings.

4.6.2 Regulation of utilities

4.6.2.1 Power sector

According to China's 13th FYP for Electric Power Development, China's main objectives to improve energy efficiency in the power sector include: promoting the development of clean coal and electricity; rational planning and construction of heat and power co-generation; developing natural gas power generation in an orderly manner; vigorously developing renewable energy; accelerating the construction of smart grids; actively promoting demand-side management (DSM) in order to improve system efficiency; reduce line losses in transmission power; and improve efficiency of electricity consumption.[293]

Regulation of utility revenues

The market structure of the electricity sector is set out in section 1.3.3. China is in the process of implementing reforms in the power sector as set out in the Opinions on Future Deepening the Reform of Electric Power System.[294] The proposed reforms involve the introduction of

286 See MIIT website: http://www.miit.gov.cn/n1146295/n1652858/n1652930/n3757016/c3763984/content.html
287 See MIIT website: http://www.miit.gov.cn/n1146295/n1652858/n1652930/n4509607/c6226963/content.html
288 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbl/201803/t20180321_879962.html
289 Available at: https://baijiahao.baidu.com/s?id=1603708256898198852&wfr=spider&for=pc
290 See IEA website: https://www.iea.org/newsroom/news/2016/october/energy-efficiency-market-report-2016.html
291 See GOC website: http://www.gov.cn/xinwen/2016-05/17/content_5073959.htm
292 See GOC website: http://www.gov.cn/zhengce/content/2017-01/05/content_5156789.htm
293 See NDRC website: http://www.ndrc.gov.cn/fzgggz/fzgh/ghwb/gjjgh/201706/t20170605_849994.html
294 See NDRC website: http://tgs.ndrc.gov.cn/zywj/201601/t20160129_773852.html

separate establishment of electricity prices for transmission and distribution approved by the Government according to the regulatory approach of 'permitted cost plus reasonable return'.[295] This approach is potentially a significant step forwards with regards to promoting energy efficiency and DSM, as the way in which a power grid company's (i.e. utility) revenues are determined, adjusted and collected (through tariffs) can incentivise the utilities to reduce costs and deliver public policy goals through improved energy efficiency and DSM. China has established an Energy Efficiency Obligation (EEO) on the two major grid companies and a grid company-owned ESCO exists but rate design and mechanisms could be further developed to ensure the grid companies are highly motivated to employ energy efficiency and DSM as power system resources in grid development and operation.[296]

Electrical losses

In 2017, the total electricity network losses were 6.48%, down by 0.01pp relative to the previous year.[297] The power grid companies have continuously strengthened electricity losses management by implementing technical measures such as phasing out high-loss distribution transformers and promoting the use of energy-saving wires and fittings.

Demand response and DSM

China is gradually enabling and realising demand response and demand-side management (DSM) opportunities in its power sector.

The Measures for Administration of Electric Power Demand Side firstly came into effect on 1st January 2011,[298] in order to improve the efficiency of electricity utilisation and to promote the optimal allocation of electric power resources. The document defines power demand-side management (DSM) and clarifies that the NDRC is responsible for the nation's electrical DSM. Some management and incentive measures are listed for enabling electrical DSM including establishment of annual electricity saving indicators of the grid enterprises in each province (autonomous region and municipality) and the power load monitoring capability of power grid enterprises. The provisions of these quantitative indicators greatly increased the operability of the Measures for Administration of Electric Power Demand Side and enabled rapid development to the extent that the accumulated electricity saved over four years from 2012 to 2016 was 55.3 GWh and the electrical capacity saving was 12.68 GW.[299] Furthermore, comprehensive pilot schemes in 4 cities explored advanced applications of electrical DSM and the role that fiscal funds and support measures for technological and institutional innovation can play in enabling DSM.

In 2015, the State Council released Opinions on Further Deepening the Reform of the Electric Power System. This document makes several references to improving demand side management and energy efficiency management through application of modern information technology and facilitation of electric energy services. Shortly after, in 2016, the 13th Five-Year Plan for Electric Power Development (2016-2020)[300] was released, placing emphasis on greatly improving the demand-side response capability of the power sector. The FYP also stated that when considering options to increase power supply, demand-side management measures should also be considered and prioritised.

295 See NDRC website: http://jgs.ndrc.gov.cn/zcfg/201504/t20150416_688233.html
296 Available at: https://www.raponline.org/wp-content/uploads/2017/10/crossley-wang-policy-regulation-energy-efficiency-resource-china-2017.pdf
297 China Power Industry Annual Development Report 2018, CEC, July 2018.
298 See NDRC website: http://bgt.ndrc.gov.cn/zcfb/201011/t20101116_498818.html
299 See NDRC website: http://www.ndrc.gov.cn/gzdt/201709/t20170926_861661.html
300 See NDRC website: http://www.ndrc.gov.cn/fzgggz/fzgh/ghwb/gjjgh/201706/t20170605_849994.html

Focusing on industry's contribution to DSM during the 13th FYP timeframe, MIIT launched a Special Action Plan for Power DSM in the Industry Sector (2016-2020) in August 2016. This Special Action Plan serves as a guide for industrial enterprises in their efforts to deliver DSM.[301] In order to support technological innovation and improve the R&D, production, promotion and application of power DSM products, technologies, processes and equipment, the MIIT has established a catalogue of reference products (technologies) for power DSM in the national industrial sector. In July 2017, the first catalogue was published for a total of 22 products (technologies).[302] In October 2017, MIIT formulated the Interim Measures for the Promotion of Reference Products (Technology) for Power DSM in the Industrial Sector.[303]

In September 2017, the Government amended the Measures for Administration of Electric Power Demand Side, first introduced in 2010. The amendments aimed to further the role of electrical DSM in promoting the energy consumption revolution in accordance with the structural reform requirements of the supply side.[304] The new version stipulates that power grid enterprises, power service organisations, power sales enterprises and power users are all important implementation entities for power DSM, emphasising the need to fully mobilise users to participate in DSM. The measures also focus on the integration of demand response resources into power operation scheduling, and the establishment of economic incentive mechanisms to compensate participants and to help coordinate the interaction between demand response and renewable energy power consumption.

Energy resource planning

China places considerable importance on the organized and coordinated physical planning of the electricity sector. The 1996 Electricity Law gives planning an important role and in 2016, the NEA introduced the Methods for the Management of Electric Power Planning.[305] The latter emphasises the importance of electricity planning for supporting decision-making based on evidence and science. It also prescribes new planning processes, roles, and responsibilities. Major opportunities to improve energy efficiency and broader system efficiency for least cost sustainable energy system development can be realised through effective planning. Identifying and realising these opportunities, however, requires using appropriate quantitative tools for rigorous economic assessment and decision-making.[306]

Energy efficiency and coal

In recent years, the Government of China has intervened to reduce the share of coal in the power mix with some success (see Figure 12). Many small and inefficient coal-fired power plants have been targeted for decommissioning and inefficient coal mines have been closed down.

For the first time, the 13th Five-Year Plan for Energy Development prioritises reduction of coal consumption and the capping of total energy consumption. Consequently, the share of coal consumption in total consumption is expected to further reduce from 64% in 2015 to 58% in

301 See GOC website: http://www.gov.cn/xinwen/2016-09/01/content_5104483.htm
302 See MIIT website: http://www.miit.gov.cn/n1146295/n1146592/n3917132/n4061694/c5727126/content.html
303 See MIIT website: http://www.miit.gov.cn/n1146285/n1146352/n3054355/n3057511/n3057513/c5872507/content.html
304 See NDRC website: http://www.ndrc.gov.cn/gzdt/201709/t20170926_861661.html
305 See NEA website: http://zfxxgk.nea.gov.cn/auto84/201606/t20160606_2258.htm
306 Policy Brief on Power Sector Planning: US Experience and Recommendations for China, NRDC/RAP, 2017. Available at: https://www.raponline.org/wp-content/uploads/2018/04/rap_nrdc_power_sector_planning_us_experience_recommendations_china_2017_nov.pdf

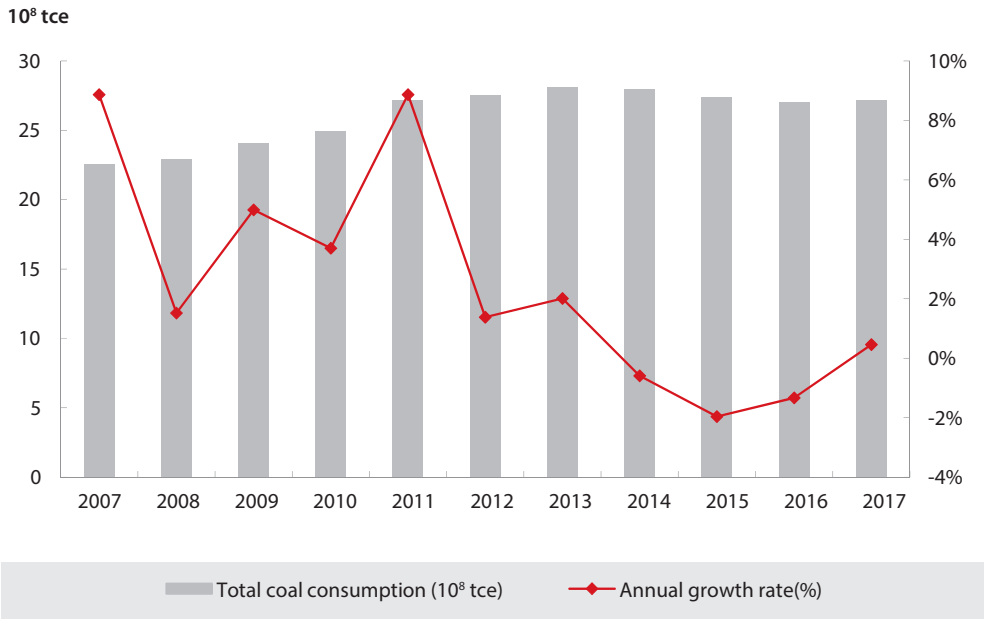
2020.[307] The impact of coal consumption control falls on the economically developed provinces (municipalities) and a key implementing approach is through the prevention of air pollution.

The Action Plan for Coal-fired Power Unit Upgrading and Renovation of Energy Conservation and Emission Reduction (2014-2020)[308] is one of the energy efficiency action plans introduced under the Strategic Action Plan for Energy Development (see Table 6), which applies during the 13th FYP timeframe, 2014-2020. Implementation of this Action plan involves the upgrading and renovation of old coal-fired units' energy conservation and emission reduction upgrades. Units in operation with installed capacity of 600 MW and above (except for air-cooled units) are to strive to reduce coal consumption to about 300 gce/kWh by 2020.[309]

Coal will still be the main fuel for power generation during the 13th FYP period but the development direction of coal use will be towards centralised, efficient and clean combustion in order to achieve the goal of reducing coal consumption.[310]

The IEA estimates that the avoided costs in thermal power generation in 2014 from energy efficiency investments in power plants were USD 6.9 billion. Between 2000 and 2014, it is estimated that China avoided some 702 TWh of energy consumption and avoided the build of 273GW of power generation capacity that would have cost in the region of USD 230 billion.[311]

Figure 12 Total coal consumption and annual growth rate in China, 2007-2017[312]



307 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbtz/201701/t20170117_835278.html
308 See NEA website: http://www.nea.gov.cn/2014-09/22/c_133661923.htm
309 See GOC website: http://www.gov.cn/zhengce/content/2014-11/19/content_9222.htm
310 See NDRC website: http://www.ndrc.gov.cn/fzgggz/fzgh/ghwb/gjjgh/201706/t20170605_850004.html
311 See IEA website: https://www.iea.org/newsroom/news/2016/october/energy-efficiency-market-report-2016.html
312 China Energy Statistical Yearbook 2017, NBS, December 2017.
Annual Report on China's Energy Development 2017, EPPEI, April 2018.

4.6.2.2 Waste heat recovery and use

There exist an abundance of waste heat resources in industry and this presents huge potential to save energy. Waste heat recovery and use is an effective way to save energy and is now recognised as an energy resource. In recent years, the Government of China introduced many policies to encourage enterprises to recycle waste heat.

In 2006, the NDRC issues two important documents relevant to saving energy through the management of waste heat: Special Plan for Medium and Long-Term Energy Conservation;[313] and the Implementation Opinions on Ten Key Energy-Saving Projects in the 11th Five-Year Plan.[314] Both documents set out clear requirements for waste heat and pressure utilisation engineering, to be implemented during the 11th FYP timeframe.

The Interim Measures for the Administration of Financial Reward Funds for Energy-Saving Technology Reform was issued in 2007 and then modified in June 2011.[315] This document stipulates that the waste heat and pressure reduction project is one of the energy-saving technological transformation projects benefiting from financial incentives. The 13th FYP for Energy Conservation and Emission Reduction promotes the use of solar energy, shallow geothermal energy, air thermal energy and industrial waste heat to reduce the energy demand of buildings.[316]

In recent years, some cities in north China explored the use of recycled industrial waste heat for urban heating and achieved remarkable results. The cost of using industrial waste heat is much lower compared to heating based on coal and natural gas, with investments being both economically and technically feasible. The Waste Heat Project Implementation Plan for Residential Heating, issued in October 2015, proposed to reduce coal-fired heating by more than 2 billion m^2 and reduce the raw coal for heating by more than 50 Mt through switching to waste heat sources by 2020.[317]

The 13th FYP for Energy Development strengthens measures to enable the recovery and comprehensive use of energy resources such as waste heat and residual pressure, industrial by-products and household garbage.

4.6.3 Product policy, MEPS and labelling

For many years, China has had in place a solid legal foundation to support the development and enforcement of energy efficiency standards and labels. The General Administration of Quality, Supervision, Inspection, and Quarantine (AQSIQ),[318] as directed by the State Council, is responsible for developing, promulgating and enforcing energy efficiency standards and labels for appliances. However, effective monitoring and enforcement of efficiency standards and labels for different appliance types have been challenging for the Government to achieve.[319] While penalties are applicable, lack of third party verification was a key factor upon which China was marked down by the RISE assessment for the 'minimum energy efficiency performance standards' indicator, resulting in a moderate score of 58% for the indicator.[320]

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313 Available at: http://www.china.com.cn/chinese/PI-c/713341.htm

314 See GOC website: http://www.gov.cn/zwgk/2006-08/02/content_352716.htm

315 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbqt/201107/t20110701_421413.html

316 See GOC website: http://www.gov.cn/zhengce/content/2017-01/05/content_5156789.htm

317 See NDRC website:http://www.ndrc.gov.cn/zcfb/zcfbtz/201511/t20151104_757519.html

318 In March 2018, according to the State Council's institutional reform plan, the responsibilities of the General Administration of Quality Supervision, Inspection and Quarantine (AQSIQ) were subsumed under the State Administration for Market Regulation.

319 Status of China's Energy Efficiency Standards and Labels for Appliances and International Collaboration, N. Zou,2008, LBNL.

320 An initiative supported by the World Bank, SE4ALL, ESMAP and Climate Investment Funds.
Available at: http://rise.esmap.org/country/china

In August 2004, the NDRC and the AQSIQ jointly formulated and issued the Measures for the Energy Efficiency Labels Management concerning implementation of an energy efficiency labelling system.[321] In order to strengthen energy conservation management, promote energy-saving technology development, improve energy efficiency and promote energy-efficient products, the Measures for the Energy Efficiency Labelling Management was amended and came into effect on 1st June 2016.[322] It stipulates implementation of energy efficiency label management for energy-using products with high energy-saving potential and wide use in the economy. The specific products are subject to catalogue management, testing and determined energy efficiency rating according to the mandatory national standards for energy efficiency.

In December 2014, NDRC and other ministries jointly formulated the Implementation Plan for Energy Efficiency Top Runner System,[323] similar to the Top Runner scheme introduced in Japan in 1999. The Top Runner programme aims to promote energy conservation and emissions reduction, and provides a long-term mechanism for continuously improving energy efficiency. The programme also involves setting stringent energy efficiency standards for products. Manufacturers that do not comply by a specified date can be penalised. In addition, competitive reverse auction[324] are used by the Government for the procurement of least cost energy services incorporating Top Runner requirements.

Since the 12th FYP, China has released and amended Minimum Energy Performance Standards (MEPS) for 54 end-use energy-consuming products including industrial equipment, household appliances, lighting equipment and office equipment.[325] MEPS have also been issued for a further 73 products on a per unit of product basis that includes the main energy-intensive industries, such as steel, non-ferrous metals, building materials, petrochemicals and electric power.[326]

The operating efficiency of coal-fired industrial boilers has been targeted by the 13th Five-Year Plan with the goal of increasing boiler efficiency by 5% over the 13th FYP timeframe. By 2020, the efficiency of newly-produced coal-fired boilers is to be no less than 80% and that of gas-fired boilers should not be less than 92%.[327]

4.6.4 Consumer empowerment and smart meters

The 13th FYP for Energy Development proposes to accelerate the development of smart energy by implementing intelligent transformation of energy supply and consumption. The Plan envisions deep integration of new technologies in the fields of energy, information and materials and the coordination of infrastructure associated with energy, communications and transportation. Measures include promotion of energy monitoring, energy metering, efficient dispatch and intelligent energy management systems. The Plan also proposes to accelerate the development of smart grids, actively promote the construction of intelligent substations and dispatch systems, expand the application scope of smart metering facilities such as smart meters, intelligent information systems and intelligent energy-using facilities, and improve the ability of the grid to interact with both power generation and energy consumers. Also part of the strategy are price reforms that will encourage demand response and measures to support the power sector in making greater use of DSM (see also sections 2.4 and 4.7.2.1).

321 See GOC website: http://www.gov.cn/gongbao/content/2005/content_64207.htm

322 See NDRC website:http://www.ndrc.gov.cn/zcfb/zcfbl/201603/t20160308_792230.html

323 See NDRC website: http://www.ndrc.gov.cn/zcfb/zcfbtz/201501/t20150108_659703.html

324 A reverse auction is a type of auction in which the roles of buyer and seller are reversed. In an ordinary auction buyers compete to obtain goods or services by offering increasingly higher prices. In a reverse auction, the sellers compete to obtain business from the buyer (i.e. Government of China) and prices will typically decrease as the sellers underbid each other.

325 See MIIT website: http://www.miit.gov.cn/n1146285/n1146352/n3054355/n3057542/n3057544/c3634672/content.html

326 Ibid.

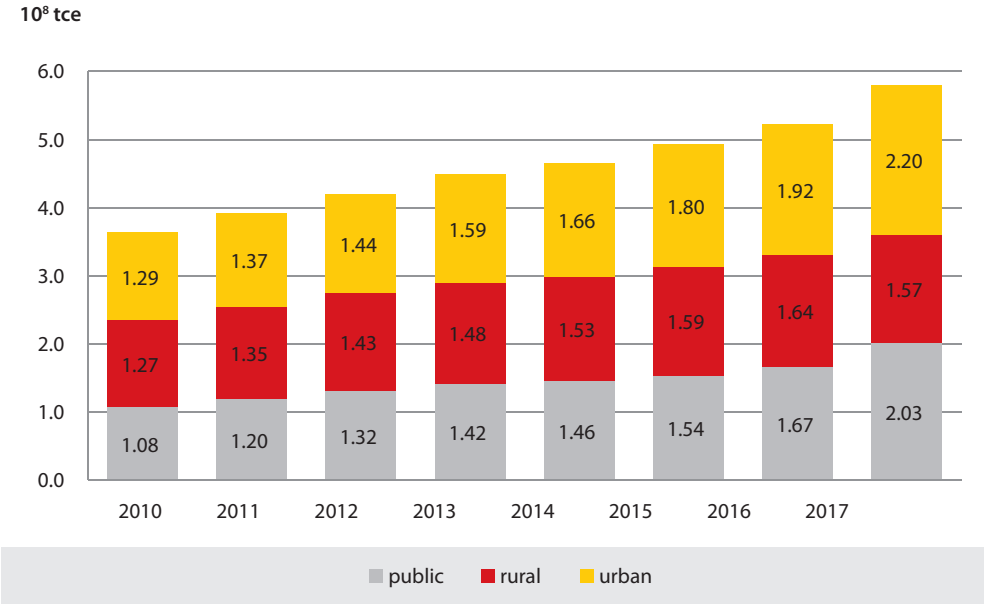
327 See GOC website: http://www.gov.cn/zhengce/content/2017-01/05/content_5156789.htm

4.6.5 Energy efficiency of buildings

Energy consumption trends in buildings

From 2010 to 2017, the total energy consumption of China's buildings followed a continuous growth trend (see Figure 13). However, the average annual growth rate has continually declined from 11.9% during the 10th FYP (2001-2005) to about 6% in the 11th (2006-2010) /12th (2011-2015) FYPs.[328]

Figure 13 Energy consumption in building in China, 2010-2017[329]



In 2017, the total final energy consumption by China's buildings was 580 Mtce, increasing 6.7% relative to 2016, accounting for 18.35% of the nation's total final energy consumption.[330] Public buildings and urban dwellings are the main driving force for the growth in energy demand of buildings. Of final energy used in buildings in 2017, about 40% was used for heating and cooling, 27% for cooking and hot water and 33% for others.[331] It is clear that improving the energy efficiency performance of buildings is of great significance for reducing energy consumption in China.

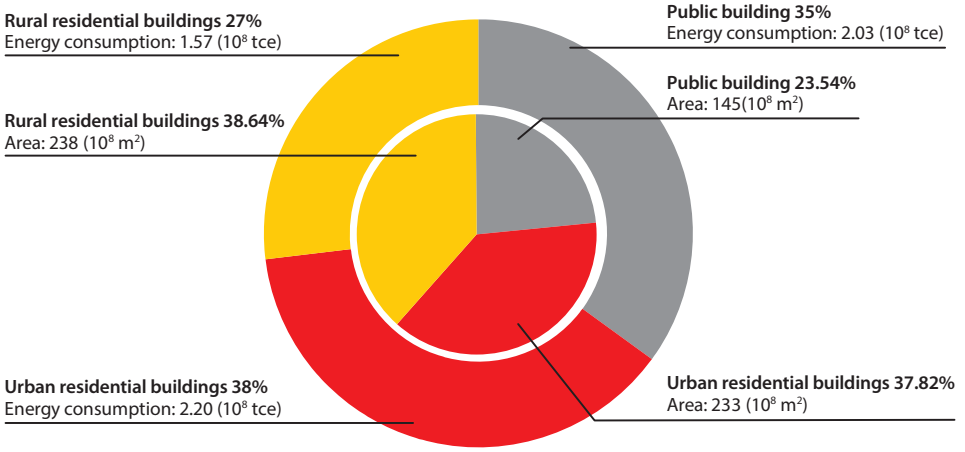
In 2017, final energy used by China's buildings was primarily electricity, accounting for 40%, followed by coal and natural gas, accounting for 19% and 14% respectively. The share of coal consumption in the energy mix used by buildings is declining.[332]

In 2017, the total energy consumption of buildings was split across rural residential, public

328 Available at: http://www.cnelc.com/text/1/171109/AD100768889_2.html
329 Annual Report on China's Energy Development 2016, EPPEI, March 2017.
Annual Report on China's Energy Development 2017, EPPEI, April 2018.
330 Annual Report on China's Energy Development 2017, EPPEI, April 2018.
331 Ibid.
332 Ibid.

buildings and urban residential according to a ratio of 1 : 1.3 : 1.4 (see Figure 14). The area of buildings by type is: 23.8 billion m^2, rural residential; 23.3 billion m^2, urban residential; and 14.5 billion m^2, public buildings (see Figure 14).

Figure 14 The composition of energy consumption in buildings in China, 2017[333]



Energy efficiency policy for buildings

The RISE[334] assessment for China, published in 2017, issued a score for energy efficiency of 68%.[335] Of the various sub-indicators, 'building energy codes' was China's poorest-performing sub-indicator, with a score of 40%.[336] The following areas were identified as needing attention: update of the building code and provisions for regular updates; an effective compliance system; third party verification assessment; mandatory standardised rating or labelling system for the energy performance of existing buildings; and building performance information disclosure at point of sale or lease. Since the assessment, China has already made progress in addressing some of the points identified.

The energy efficiency of China's building stock has improved over time due to strengthening policy, particularly more recently in the context of the 'construction of ecological civilization' vision. Since 1986, China has issued a number of building codes for new construction, setting out design standards by building type and climatic zone. From 1986 to 2015, some 44 new or revised building energy efficiency related standards have been issued by MOHURD, the MOF and State Council.[337] Of notable impact was the Code for Acceptance of Energy Efficient Building Construction, introduced in 2007, which raised energy efficiency standards to an equal status with safety standards, as compliance with these standards would need to be achieved ahead

333 Ibid.

334 RISE is a set of indicators to help compare national policy and regulatory frameworks for sustainable energy. With 27 indicators covering 111 countries and representing 96% of the world population, RISE provides a reference point to help policymakers benchmark their sector policy and regulatory framework against those of regional and global peers, and a powerful tool to help develop policies and regulations that advance sustainable energy goals. RISE is developed and supported by the World Bank, SE4ALL, CIF and ESMAP.
See the RISE website for China's profile: http://rise.esmap.org/country/china

335 Available at: http://rise.esmap.org/country/china

336 Ibid.

337 A comparison of building energy codes in the US, Germany and China – their impact on achieving net zero energy goals, Ming Hu, ACEEE Summer Study on Energy Efficiency in Buildings, 2018.

of final acceptance of a construction project.[338] The current building code for new buildings was issued in 2013. More recently, the Green Building Action Plan[339] was introduced in 2013 to promote green eco-city construction in the building sector, including large-scale developments.

In order to help implement China's Green Building Development Strategy and better guide the development of ultra-low energy buildings and green buildings, the Passive Ultra-Low Energy Green Building Technical Guidelines (Residential Buildings) were issued by MOHURD in 2015.[340] MOHURD also issued the 13th FYP for Building Energy Conservation and Green Building Development in 2017, incorporating the aspirational targets: increase the proportion of urban green buildings area in the total area of new buildings to 50% by 2020; more than 10 million m^2 of ultra-low energy building (ULEB) or nearly zero-energy building (NZEB) demonstration projects to be built by 2020.[341] A number of measureable indicators was set out in the Plan (see Table 7), some of which are binding.

Table 7 Main indicators in the13th FYP for Building Energy Conservation and Green Building Development[342]

Main Indicators	Cumulative growth rate (%)	Attribute
Energy efficiency improvement of new urban buildings (%)	20	binding
Share of green urban buildings in new buildings (%)	30	binding
Share of green building materials used in new urban buildings (%)	40	expected
Implementation of energy-saving renovation in existing residential buildings (10^8 m^2)	5	binding
Implementation of energy-saving renovation in public buildings (10^8 m^2)	1	binding
Decrease of average heating energy intensity in residential buildings in northern cities per unit area (%)	-15	expected
Decrease of the energy intensity in the existing public urban buildings (%)	-5	expected
Increase the use of renewable energy in urban buildings (%)	2	expected
Share of energy-efficient buildings in existing urban residential buildings (%)	20	expected
Share of the implementation of energy-saving measures for developed areas and rural residential buildings in key areas (%)	10	expected

338 Ibid.

339 See GOC website: http://www.gov.cn/zwgk/2013-01/06/content_2305793.htm

340 See MOHURD website: http://www.mohurd.gov.cn/wjfb/201511/t20151113_225589.html

341 See MOHURD website:http://www.mohurd.gov.cn/wjfb/201703/t20170314_230978.html

342 Ibid.

Building energy efficiency codes

Since 2000, MOHURD[343] has issued and successfully implemented the Compulsory Provisions for Engineering Construction Standards, for urban and rural planning, urban construction, and housing construction covering all major types of construction. MOHURD also promulgated Regulations of Mandatory Standards for the Implementation of Engineering Construction,[344] clarifying that the mandatory standards for engineering construction must refer to mandatory provisions directly related to engineering quality, safety, health and environmental protection. These building standards have been revised and updated several times, in 2002, 2009 and 2013. Mandatory Standards for Energy Efficiency apply to new buildings in accordance with the Compulsory Provisions for Engineering Construction Standards (Building), issued in 2013.[345] The mandatory standards for engineering construction are technical and regulatory documents, providing the technical basis for project quality management. Mandatory provisions play an important role in ensuring the quality, safety and standardisation of China's construction market.

Green buildings criteria

China has a relatively large and well-developed market for green buildings due to the introduction, starting in 2013, of a number of policy measures and efforts to develop 'green building' evaluation criteria (see Table 8). Green building evaluation standards are divided into national standards and local standards.

The Evaluation Standard for Green Building (GB/T 50378-2014), introduced in 2014 and in effect since 1st January 2015, provides for a design evaluation and an operation evaluation to help ensure the building meets the targets it was designed to achieve.[346] The holistic evaluation index system for green buildings consists of seven indicators and each indicator is given a different weight coefficient; the green buildings' ratings are based on the total score of the indicators, explained in more detail in Annex 3. The Green Building Evaluation Standard has been used to award subsidies to compliant public projects. The Leadership for Energy and Environmental Design (LEED) system, a points-based system similar to the Green Building Evaluation Standard, is also used in China, though mainly for commercial projects (e.g. offices, retail shops).[347]

There has been a need to standardise the management of green building evaluation criteria. In order to facilitate this and to help implement the Green Building Action Plan, the Notice on Further Regulating the Management of Green Building Evaluation was issued by the MOHURD in December 2017. This builds on existing evaluation provisions and sets out requirements relating to: the establishment of the territorial management system of the green building evaluation label; the implementation of third-party evaluation; the standard evaluation label management method; strict publicity management of the evaluation labels; establishing credit management system; strengthening the quality supervision of evaluation labels; strengthening the evaluation information statistics; and improving the unified evaluation labels management system.[348]

343 In March 2008, according to the institutional reform plan of the State Council, the Ministry of Construction (MOC) became the Ministry of Housing and Urban-Rural Development (MOHURD).

344 See GOC website: http://www.gov.cn/gongbao/content/2001/content_60816.htm

345 Compulsory Provisions of Engineering Construction Standards: Building (2013), Chapter 4-building energy efficiency, Compulsory Provisions Coordinating Committee for Ministry of Housing and Urban-Rural Development, 2013.

346 Available at: https://wenku.baidu.com/view/4a91e070a55177232f60ddccda38376baf1fe085.html

347 China's Road to Net Zero Energy, Connelly et al, ACEEE Summer Study on Energy Efficiency in Buildings, 2018.

348 See MOHURD website: http://www.mohurd.gov.cn/wjfb/201712/t20171221_234466.html

By the end of 2016, more than 20,000 green building standard projects had been completed, covering an area of more than 500 million m^2.[349] The provinces are supporting the expansion of green building with financial incentives and preferential lending rates.[350] In accordance with the 13th FYP, the proportion of urban green buildings area in the total area of new buildings is to increase to 50%.[351]

All new buildings of public institutions comply with green building standards (see section 4.6.5). China is promoting energy-saving reforms for public institutions through Energy Performance Contracting (EPC), and is actively promoting governmental institutions to purchase EPC services. The 13th FYP aims that by 2020, the energy consumption per unit floor area of public buildings and per capita energy consumption of public institutions will be 10% and 11% lower compared to 2015 respectively.[352]

Table 8 Green building evaluation standards (national standards)[353]

National standards	Code	Issued
Evaluation Standard for Green Building	GB/T 50378-2014	01/ 2015
Evaluation Standard for Green Industrial Building	GB/T 50878-2013	03/2014
Evaluation Standard for Green Office Building	GB/T 50908-2013	05/2014
Evaluation Standard for Green Construction Projects	GB/T 50640-2010	10/2011
Green Code for Construction Projects	GB/T 50905-2014	10/2014
Evaluation Standard for Green Hospital Building	GB/T 51153-2015	08/2016
Evaluation Standard for Green Campus	CSUS/GBC04-2013	04/2013
Evaluation Standard for Green Store Building	GB/T51100-2015	12/2015
Technical Guidelines for Green Low-income Housing	Trial	01/2014
Evaluation Standard for Urban Lighting Energy Conservation	JGJ/T307-2013	02/2014
Evaluation Standard for Green Ecological City	GB/T51255-2017	04/2018
Technical Standard for Green Building Compliance Check	CSUS/GBC 05-2014	07/2014
Green Evaluation Standard for Existing Building Renovation	GB/T51141-2015	08/2016

Outcome-based codes and nearly zero-energy buildings

In addition to the Green Building Evaluation Standard and LEED mentioned above, China has moved towards developing outcome and performance-based codes as well as a Nearly Zero-Energy Building (NZEB)[354] Standard and Certification that will be used in combination with current building codes and green building rating systems.[355] These outcome-based codes are intended to help improve the actual energy efficiency performance of buildings as so often this falls well below the design standard, as proven by considerable international experience. China's outcome-based targets are set by climate zone with the required level at 50% and the

349 China's Road to Net Zero Energy, Connelly et al, ACEEE Summer Study on Energy Efficiency in Buildings, 2018.
350 Ibid.
351 See MOHURD website: http://www.mohurd.gov.cn/wjfb/201703/t20170314_230978.html
352 See GOC website: http://www.gov.cn/zhengce/content/2017-01/05/content_5156789.htm
353 Available at: https://baijiahao.baidu.com/s?id=1585440403342171490&wfr=spider&for=pc
354 Certified NZEB are in line with the Green Building Evaluation Standard and produce their own sustainable energy on a net annual basis.
355 China's Road to Net Zero Energy, Connelly et al, ACEEE Summer Study on Energy Efficiency in Buildings, 2018.

recommended level at 75% below surveyed performance.[356] The required value, measured each year, must be achieved by the building while projects achieving the recommended value can be regarded as best practice demonstration projects.

China is also implementing a Top-Runner action to promote advanced standards for buildings, with pilot projects being conducted to achieve ultra-low and nearly zero-energy consumption in buildings in accordance with the 13th FYP. The FYP also states that the total area of NZEB should be 10 million m^2 by 2020.[357] While MOHURD had achieved an impressive 100 NZEB projects across all climate zones in China by 2015,[358] analysis by the US-China Clean Energy Research Centre (CERC) Building Energy Efficiency Consortium suggests a more comprehensive strategy is needed if the 13th FYP NZEB goal is to be achieved.

District heating in northern China

In northern China, winters are severely cold, many houses are located in rural areas, the incidence of fuel poverty is more concentrated compared to urban areas, and the combustion of solid fuel in inefficient stoves is an important contributor to poor indoor and outdoor air quality. In northern China, coal combustion is the main source of heat energy, accounting for about 83% of the total heating area.[359]

In December 2017, the NDRC and other ministries jointly issued the Winter Clean Heating Plan for Northern China (2017-2021). The Plan requires that by 2019, the clean heating rate in the northern region will reach 50%, which will replace 74 Mt of scattered-burned coal (including low efficiency small coal-fired boilers). By 2021, the clean heating rate in the northern region is to reach 70%, replacing 150 Mt of scattered-burned coal. By 2021, the Plan aims to reduce the average overall energy consumption of the heating system to below 15 kgce/m^2, and the proportion of existing high energy performance residential buildings in the northern urban areas is to rise to 80%.[360]

The Government provides subsidies to support heat metering and energy-saving renovation of existing residential buildings in the north of China, as well as construction of renewable energy facilities in buildings and green buildings.[361]

4.6.6 Transport

China is the world's largest market for new light-duty and heavy-duty vehicles (LDVs and HDVs) and seven of the world's largest container ports are located in China.[362] China is making strong progress in developing and implementing clean transportation policy and is moving into a leadership role on international climate policy for transportation. The 13th FYP for Transport Energy Conservation and Environmental Protection emphasised to adhere to the coordinated development of transportation while vigorously promoting energy conservation, environmental protection and carbon reduction.[363] Since the 12th FYP, Government departments relevant to the transportation industry have released a series of documents to guide the industry and to set the sector's goals for energy conservation and emissions reduction and the related major tasks and measures to be achieved (see Annex 4).

356 Ibid.
357 See MOHURD website: http://www.mohurd.gov.cn/wjfb/201703/t20170314_230978.html
358 China's Road to Net Zero Energy, Connelly et al, ACEEE Summer Study on Energy Efficiency in Buildings, 2018.
359 See GOC website: http://www.gov.cn/xinwen/2017-12/20/content_5248855.htm
360 Ibid.
361 See GOC website: http://www.gov.cn/zwgk/2013-01/06/content_2305793.htm
362 Available at: https://www.theicct.org/china
363 See GOC website: http://www.gov.cn/xinwen/2016-06/13/content_5081488.htm

Improvements to monitoring and statistics

Since 2011, the Ministry of Transport has officially implemented a statistical monitoring and reporting system for transportation energy consumption, and has implemented monitoring requirements for private enterprises operating in all transport subsectors. In June 2014, the MOT proposed a framework for a Green Transport System[364] and introduced the Implementation Opinions of 2014-2015 Action Plan for the Development of Low-Carbon Energy Conservation and Emission Reduction in Transport Industry. [365] With this, the statistical monitoring system for energy conservation, emissions reduction and climate change mitigation measures was established, the construction of the transportation environmental monitoring network was promoted in an orderly manner, and the General Plan for National Highway and Waterway Transportation Environmental Monitoring Network was completed.[366]

Progress and targets

The 13th FYP for Transportation Energy Conservation and Environmental Protection sets out a number of objectives to be achieved by 2020 (see Table 9).

Table 9 Objectives of the 13th FYP for Transport Energy Conservation and Environmental Protection

Fields	Indicators	2020 targets (relative to 2015)	Attribute
Energy saving and carbon reduction	Energy consumption and carbon emissions intensity	Bus energy consumption per unit of transport will decrease by 2.1%, and CO_2 emissions will decrease by 2.6%	expected
		Truck energy consumption per unit of transport will decrease by 6.8%, and CO_2 emissions will decrease by 8%	expected
		Vessel energy consumption per unit of transport will decrease by 6%, and CO_2 emissions will decrease by 7%	expected
		Urban passenger vehicle energy consumption per unit of transport will decrease by 10%, and CO_2 emission will decrease12.5%	expected
		Port energy consumption per unit of transport will decrease by 2% and CO_2 emissions will decrease by 2%	expected
	Energy mix	Stock of clean fuel vehicle for highway transport will grow 50%	expected
		Proportion of LNG in energy consumption of inland transport will grow 200%	expected
Pollution prevention	Major pollutant emission	The annual total emissions of vessels' SOx and NOx and PM in the Beijing-Tianjin-Hebei, Yangtze River Delta and Pearl River Delta regions will decrease by 65%, 20%, and 30% respectively	expected
	Pollution emergency handling capacity	Comprehensive control and removal of 1,000 tonnes of oil in 50 nautical miles of China's coastal area per oil spill accident (for high risk areas, the indicator is 10,000 tonnes)	expected

364 Available at: http://www.legaldaily.com.cn/index/content/2014-06/09/content_5583606.htm?node=20908
365 See MOT website: http://zizhan.mot.gov.cn/zfxxgk/bnssj/zcfgs/201412/t20141216_1744377.html
366 See MOT website: http://zizhan.mot.gov.cn/zfxxgk/bnssj/zhghs/201508/t20150806_1859958.html

Public transport and mass transport

China actively encourages the public to use travel modes of relatively low environmental impact, such as buses and subways, cycling and walking. China is implementing a bus promotion strategy to help realise its 'bus city' concept and new measures give priority to buses on the road. Urban bus routes are being extended to the suburbs and public transport coverage is being extended.[367] The physical infrastructure for public transport is being rapidly developed, including urban rail transit, bus lanes, and rapid transit systems. Steps are being taken to strengthen the construction of urban slow-moving systems such as bicycle lanes and pedestrian trails in order to improve bicycle and pedestrian travel conditions.

Through the 13th FYP, China aims to reduce the CO_2 emissions intensity of transport by 7% compared with 2015,[368] and achieve a 30% public transport share in large cities,[369] and the proportion of 'green' travel in the central areas of large and medium-sized cities is to be greater than 70% by 2020.[370]

Cleaner fuels and powertrains

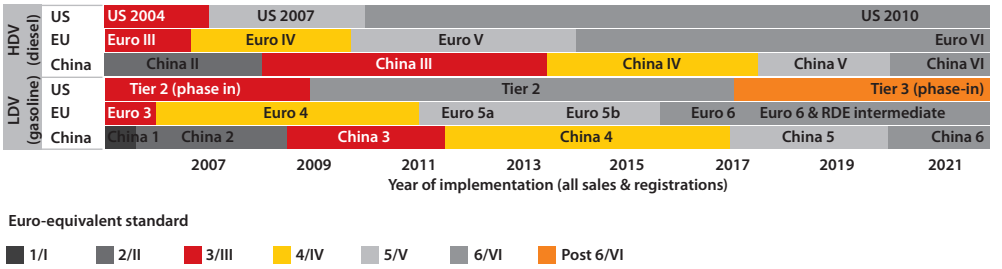
China has a long history of promoting high-performing energy-saving and environmentally-friendly vehicles. This includes vehicles powered by electricity, renewable energy or natural gas (CNG/LNG). The progress that China has made in introducing standards to reduce emissions from LDV and HDVs has been significant compared to other regions of the world and China is fast catching up with advanced economies, as illustrated in Figure 15.

In March 2015, the Implementation Opinions on Accelerating the Application of New Energy Vehicles was issued by the MOT, promoting the use of vehicles powered by alternative powertrains and fuels in the urban passenger transport.[371]

Refineries were upgraded in order to produce oil of improved quality to address air pollution from vehicles combusting gasoline and diesel.[372] In order to accelerate the supply of clean oil products and to improve oil quality, refining companies made investments of around CNY 68 billion in technology upgrades.[373] The pollution standards for criteria pollutants such as NOx and PM, applying to vehicles using gasoline and diesel fuels, have been tightened up over time (See Figure 15).

367 See MOT website: http://www.mot.gov.cn/zhengcejiedu/quanmiansrtjlsjtfz/xiangguanzhengce/201712/t20171206_2945939.html
368 Ibid.
369 See GOC website: http://www.gov.cn/zhengce/content/2017-01/05/content_5156789.htm
370 See MOT website: http://www.mot.gov.cn/zhengcejiedu/quanmiansrtjlsjtfz/xiangguanzhengce/201712/t20171206_2945939.html
371 See GOC website:http://www.gov.cn/gongbao/content/2015/content_2883248.htm
372 See NDRC website: http://www.ndrc.gov.cn/gzdt/201505/t20150507_691028.html
http://www.ndrc.gov.cn/zcfb/zcfbtz/201602/t20160225_790200.html
373 See GOC website:http://www.gov.cn/guowuyuan/2015-04/28/content_2854625.htm

Figure 15 Timelines for LDV and HDV emissions standards implementation in China, EU, US[374]



Vehicle fuel economy and CO_2 standards

According to the 13th FYP for Development of Modern Comprehensive Transport System, the CO_2 emissions intensity of China's transportation is to decline 7% by 2020 relative to 2015.[375] China's increasingly more stringent fuel economy standards for vehicles will make an important contribution to achieving this goal.

Fuel economy standards for LDVs were first introduced in China in 2004 and have been tightened over time. As a means to implement the Plan for Energy-Saving and New Energy Vehicle Industry Development (2012–2020),[376] MIIT introduced the Phase 4 standard for domestic and imported new passenger cars in December 2014, and came into effect in January 2016.[377] The standards require an overall fleet-average fuel consumption of 5l/100km,[378] equivalent to approximately 120g/km CO_2, for new passenger cars in 2020 as measured over the New European Driving Cycle (NEDC). While considerable energy efficiency improvements and CO_2 emissions reductions have been achieved with the help of standards, the gains are being offset to some extent by consumer preferences with the growth in the market share of larger, heavier cars with more powerful engines.

In China, HDVs currently represent about 10% of the new vehicle market but they account for nearly 50% of China's total on-road fuel use.[379] Earliest regulation of the fuel economy of HDVs dates back to 2012; China was the third country in the world, following Japan and the United States, to adopt fuel consumption standards for HDVs. The latest fuel consumption standards, Stage 3, released on February 2018, will regulate HDVs of weight exceeding 3500 kg with diesel and gasoline engines and will go into effect on 1st July 2019.[380]

EV support policies

China has also introduced a New Energy Vehicle (NEV) credits mandate,[381] to apply from 2019, and the Electric Vehicle Subsidy Programme, amended in 2018, to incentivise higher battery energy density (i.e. longer range); these initiatives are helping to drive demand for electric vehicles. These interventions build on previous Electric Vehicle (EV) support policies that have already delivered impressive results. In 2017, around a half of global sales of NEV were in China

374 *Available at: https://www.theicct.org/blogs/staff/latest-step-forward-on-china-vehicle-emissions-regulation*
375 *See GOC website: http://www.gov.cn/zhengce/content/2017-02/28/content_5171345.htm*
376 *See GOC website: http://www.gov.cn/zwgk/2012-07/09/content_2179032.htm*
377 *See MIIT website: http://www.miit.gov.cn/newweb/n1146285/n1146352/n3054355/n3057585/n3057589/c3616946/content.html*
378 *Ibid.*
379 *See ICCT website: https://www.theicct.org/publications/stage-3-china-fuel-consumption-standard-commercial-heavy-duty-vehicles*
380 *See SAC website: http://std.sacinfo.org.cn/gnoc/queryInfor?id=153BDDECD555A1A284326BAB2F3F0771*
381 *See GOC website: http://www.gov.cn/xinwen/2017-09/28/content_5228217.htm*

(approximately 777,000 cars).[382] These sales added to already significant stocks as China has around 40% of the global total stock of EVs and more than 99% of both electric bus and two-wheeler stocks.[383] By 2020, the new energy and clean energy vehicles in the transport industry will reach 600,000 in China.[384]

Use of fiscal measures

China has also employed fiscal measures as part of its strategy to curb pollution from vehicles. A consumption tax was introduced in 1994, with three tax bands according to the size of engine capacity: <1.0 litre, 3% tax; 1.0 to 2.2 litres, 5% tax; and ≥2.2 litres, 8% tax. Light off-road vehicles with an engine capacity of less than 2.4 litres are subject to a 5% tax rate. Since 1st September 2008, the automobile consumption tax has been adjusted to combine cars and off-road vehicles into a single category of passenger cars. At the same time, adjustments to the tax bands have also been made, with focus on increasing the tax burden for large capacity engines, high energy consuming cars and off-road vehicles. At the same time, the tax burden on vehicles of smaller engine capacity has reduced and incentives have been introduced to encourage the use of vehicles of smaller engine capacity. The Ministry of Finance (MOF) and the State Administration of Taxation (SAT) have also adjusted the consumption tax on the import of small cars – starting 1st December 2016 – in order to influence more efficient fuel consumption, regulate income distribution, promote energy conservation and reduction emissions.[385]

Table 10 Car consumption tax rate in China[386]

Engine capacity	Tax rate (%)
≤1.0 litre	1%
1.0 litre<engine capacity≤1.5 litre	3%
1.5 litre<engine capacity≤2.0 litre	5%
2.0 litre<engine capacity≤2.5 litre	9%
2.5 litre<engine capacity≤3.0 litre	12%
3.0 litre<engine capacity≤4.0 litre	25%
Engine capacity>4.0 litre	40%

Subsidies for cleaner, more efficient vehicles

In April 2015, four ministries – MOF, MOST, MIIT and NDRC – issued the Notice on the Financial Subsidy Policy for the Promotion and Application of New Energy Vehicles in 2016-2020, the central government subsidises the purchase of new energy vehicles and implements the Generalised System of Preference (GSP).[387] Since January 2017, the standard of the new energy vehicle subsidies has been adjusted, various factors are to be considered in the setting and adjustment of subsidies including: battery production cost, technological progress, vehicle driving range, battery/whole vehicle weight ratio, battery performance, battery capacity, energy density, charging rate, fuel economy. The central and local subsidy caps are set

382 See MIIT website: http://www.miit.gov.cn/n1146290/n1146402/n1146455/c6011721/content.html
383 Global EV Outlook 2018: Towards cross-modal electrification, IEA, 2018.
384 See MOT website: http://www.mot.gov.cn/zhengcejiedu/quanmiansrtjlsjtfz/xiangguanzhengce/201712/t20171206_2945939.html
385 Available at: http://www.chinatax.gov.cn/n810341/n810755/c2394994/content.html
386 Available at: http://tax.rednet.cn/c/2016/12/06/4155656.htm
387 See MOF website: http://jjs.mof.gov.cn/zhengwuxinxi/zhengcefagui/201504/t20150429_1224515.thm

separately, and the local financial subsidies must not exceed 50% of the central government's subsidies of each vehicle.[388]

In February 2018, the above four ministries issued the Notice on Adjusting and Improving the Financial Subsidy Policy for the Promotion and Application of New Energy Vehicles.[389] The new policy encourages the advanced technology using in electric vehicle, and promotes vehicle enterprises to improve energy efficiency.

4.6.7 Top Runner: Promotion of leading technologies

In December 2014, the NDRC and other ministries jointly formulated the Implementation Plan on Energy Efficiency 'Top Runner' System[390] to provide a long-term mechanism for continuously improving energy efficiency. The Plan provides that the NDRC coordinates activities with other relevant ministries to formulate incentive policies and to encourage technology research and development for the promotion of energy-efficient 'Top Runner' products. In December 2015, the MIIT, NDRC and AQSIQ developed implementation rules to select the 'Top Runners' that have the most advanced level of energy efficiency in the energy-intensive industry.[391]

The Photovoltaic Top Runner provides a good example to illustrate application of the Top Runner System. In 2015, the NEA issued the Opinions on Promoting the Application and Industrial Upgrade of Advanced Photovoltaic Technology Products,[392] aiming to: strengthen the market's guidance on technology; provide strict market access standards for photovoltaic products; strengthen the certification of photovoltaic products; adopt differentiated market access standards; support advanced technology products to expand the market; and accelerate the elimination of inefficient and outdated technologies and products.

The Photovoltaic Top Runner also promotes the application and industrial upgrading of advanced photovoltaic technology products, and strengthens the management of photovoltaic products and engineering quality. The NEA arranges the specific market scale for implementation of the 'Top Runner' programme each year, builds a new advanced technology demonstration project for photovoltaic power generation that requires the project to adopt advanced technology products. In 2015, the performance of the Top Runners advanced technology products were higher compared with the Regulations for Photovoltaic Manufacturing Industry.[393]

4.7 Multiple benefits and energy efficiency integration into other policy areas

An important principle of the ECT and the PEEREA is creating the conditions that enable a fuller reflection of environmental costs and benefits. Energy efficiency gives rise to a number of co-benefits in addition to money saved because of reduced energy consumption. These benefits are numerous and include avoided build of more expensive energy supply capacity, avoided reinforcement of electrical or gas distribution networks, improved air and water quality, climate change mitigation, reduced (fuel) poverty as well as benefits associated with growth of the energy services industry, including job creation.[394]

China has taken steps to integrate energy efficiency policy into its other policy areas in order to capture the co-benefits of energy efficiency. Some examples are outlined below.

388 See GOC website: http://www.gov.cn/xinwen/2016-12/30/content_5154971.htm#1
389 Available at: http://www.sohu.com/a/223471228_236016https://baijiahao.baidu.com/s?id=1592281172884327326&wfr=spider&for=pc
390 See NDRC website:http://www.ndrc.gov.cn/zcfb/zcfbtz/201501/t20150108_659703.html
391 See MIIT website: http://www.miit.gov.cn/n1146285/n1146352/n3054355/n3057542/n3057545/c4451612/content.html
392 See NEA website: http://zfxxgk.nea.gov.cn/auto87/201506/t20150608_1935.htm
393 Available at: http://www.sohu.com/a/147365884_418320
394 Capturing the Multiple Benefits of Energy Efficiency, IEA, 2014.

4.7.1 Sustainable Development

The Sustainable Development Goals (SDGs) are a set of new development goals that will continue to guide global development work for 2015-2030 after the Millennium Development Goals expire. On 25th September 2015, the United Nations Sustainable Development Summit was held at the headquarters in New York. The 193 member states of the United Nations formally adopted 17 sustainable development goals at the summit. The SDGs aim to comprehensively address the world's developmental challenges in an integrated and inclusive manner with attention to the social, economic and environmental dimensions.

SDG No. 7 relates to energy with the objective to ensure access to affordable, reliable, sustainable and modern energy for all. [395] The core objectives of SDG No. 7 are:

- ensuring universal access to modern energy services;
- doubling the share of renewable energy in the global energy mix;
- doubling the global rate of improvement in energy efficiency.

Targets and indicators have been defined[396] by the UN to measure progress and the SE4ALL non-government organisation was set up to actively support countries in their efforts to achieve SDG No.7. The Global Tracking Framework (GTF) was set up to monitor the progress that countries are making towards the goals.[397] The progress report is issued every two years. In 2017, China scored as follows against the GTF indicators: 100% population have access to electricity; 59% population have access to clean cooking; renewable energy was 12% of total final energy consumption; and energy efficiency was 6.69 MJ/USD 2011 PPP compared to a global average of 5.27 MJ/USD 2011 PPP.[398]

Another important and related initiative, Regulatory Indicators for Sustainable Energy (RISE),[399] was launched in 2017 by SE4ALL, the World Bank, ESMAP and CIF, to help countries improve their regulatory conditions for the purposes of achieving the three objectives of SDG 7.[400] The RISE assessment scored China as follows: 81%, overall score; 100%, energy access; 74%, renewable energy; and 68%, energy efficiency.[401] There are strong interlinkages between the SDG for Energy and the other SDGs, giving rise to synergistic opportunities. This is particularly the case for energy efficiency, given its multiple benefits.[402]

China has recently updated its sustainable development strategy, titled Opinion on Comprehensively Strengthening Ecological Environmental Protection, Resolutely Fight against Pollution, which was released by the State Council on 16th June 2018. Many of this strategy's objectives relate to saving energy, promoting uptake of sustainable energy and retiring or reducing inefficient products or polluting energy sources, for example:[403]

- develop energy-saving and environmental service industries;
- promote energy performance contracting (EPC);
- promote comprehensive energy resource conservation;

395 See the UN website: https://sustainabledevelopment.un.org/?menu=1300
396 Seethe UN website: https://sustainabledevelopment.un.org/sdg7
397 See ESMAP website: https://trackingsdg7.esmap.org/
398 See ESMAP website: https://trackingsdg7.esmap.org/country/china
399 See RISE website: http://rise.worldbank.org/
400 Ibid.
401 See RISE website: http://rise.worldbank.org/country/china
402 Available at: http://iopscience.iop.org/article/10.1088/1748-9326/aaafe3
403 See GOC website: http://www.gov.cn/zhengce/2018-06/24/content_5300953.htm

- strengthen 'Dual Control' actions on total energy consumption and intensity;
- significantly reduce energy consumption in key industries and enterprises;
- increase the proportion of newly-built green buildings to northern heating areas;
- speed up the implementation of the FYP for clean heating in the northern region;
- promote the energy-saving renovation of existing residential buildings;
- encourage use of waste heat and shallow geothermal energy for heating;
- greatly improve on public transport and encourage green travel such as bicycles and walking;
- speed up the elimination of old and inefficient cars and encourage the use of clean energy vehicles and ships;
- enable bulk coal management and coal consumption reduction and substitution;
- increase the use of clean energy and widen the channels for clean energy consumption;
- implement the full-scale acquisition of renewable energy;
- safe and efficient development of nuclear power.

4.7.2 Air quality

Improving air quality has become an increasingly important policy objective for China in recent years. Worsening air pollution has been a negative effect of China's rapid economic development that has been fuelled by an energy mix dominated by coal. Controlling air pollution and air quality management is one of the top priorities addressed by China's 'Ecological Civilisation' strategy. The development and implementation of policy has improved over time with notable impact in recent years.[404] The recent success is due to a shift towards an outcome-orientated and regional approach with improvements in data collection and enforcement.[405]

Energy sector reforms, including improved energy efficiency, were integral to China's Action Plan on Air Pollution Control (2013-2017)[406] and the Action Plan on the Protection of the Blue Sky (2018-2020).[407] An important measure developed by the NDRC, MEP and NEA to help to implement this Action Plan was the Action Plan for Upgrade and Renovation of Coal-fired Power Units for Energy Conservation and Emission Reduction (2014-2020), which involves improving the energy efficiency of coal-fired power units.[408] China's efforts continue to ramp up, as in March 2018, the minister of MEE announced that air quality targets would be further tightened, though the means by which this will be achieved is yet to be defined.[409] China is, however, developing both price and quantity type market instruments.

In December 2016, the State Council published the 13th Five-Year Plan for Energy Conservation and Emission Reduction, which sets the following targets of high relevance to tackling air quality issues through measures that include improved energy efficiency: [410]

404 Air Pollution Control Policies in China: A Retrospective and Prospects, Yana Jin, Henrik Andersson, and Shiqiu Zhang, published in International Journal Environ Res Public Health. 2016 Dec; 13(12): 1219.
405 Ibid.
406 Available at: http://www.jingbian.gov.cn/gk/zfwj/gwywj/41211.htm
407 See GOC website: http://www.gov.cn/xinwen/2018-07/03/content_5303212.htm
408 See NDRC website: http://www.ndrc.gov.cn/gzdt/201409/t20140919_626240.html
409 Available at: https://af.reuters.com/article/africaTech/idAFB9N1P700W
410 See GOC website: http://www.gov.cn/zhengce/content/2017-01/05/content_5156789.htm

- the national energy consumption per CNY 10,000 of GDP is to decline by 15% by 2020 compared to 2015;
- the total energy consumption will be limited to no more than 5 Gtce by 2020;
- the national total chemical oxygen demand (COD), ammonia nitrogen, sulphur dioxide (SO_2), nitrogen oxides (NO_X) and volatile organic compounds (VOCs) emissions will be decreased by 10%, 10%, 15%, 15% and above 10% respectively by 2020 relative to 2015.

In January 2017, MEP formulated the Technical Policy on Pollution Control by Thermal Power Plants to further improve technologies in pollution control and management systems, including improved energy efficiency.[411]

4.7.3 Climate change mitigation

Improved efficiency of the whole energy system plays a key role in China's strategy to mitigate climate change. On 27th October 2016, the State Council released the13th FYP for Control of Greenhouse Gas Emissions,[412] which incorporates mitigation measures related to energy efficiency. The Plan aims for CO_2 emissions to peak as soon as possible or by 2030 and also aims to reduce CO_2 emissions per unit of GDP by 18% by 2020 relative to 2015. A series of sub-targets have been put forward to achieve this goal including that total energy consumption will be capped at 5 Gtce and the energy consumption per unit of GDP will drop by 15% by 2020 relative to 2015.[413] Other sub-targets of relevance to energy efficiency, to be achieved by 2020 relative to 2015, include:[414]

- CO_2 emissions per unit of industrial added value of will decrease by 22%;
- the proportion of urban green buildings in new buildings will reach 50%;
- CO_2 emissions per unit of urban passenger transport will decrease by 12.5%.

4.7.4 Capacity and planning

Major opportunities to improve energy efficiency and broader system efficiency for least cost sustainable energy system development can be realized through effective planning. Permanent demand reduction and temporary demand reduction through load management, particularly at peak times, can provide very cost effective power system capacity. Identifying the opportunities that energy efficiency and DSM can provide, however, requires using appropriate quantitative tools for rigorous economic assessment and decision-making.[415] In addition, power market reforms and effective interventions or mechanisms are needed to unlock the benefits identified in the planning process. As set out in section 4.6.2.1, China has made progress in this area, particularly in recent years.

4.8 Energy efficiency in cities and regions

Due to the imbalance of regional economic development in China, there are large differences in energy consumption in different regions. Energy consumption per unit of GDP is lowest in the east and highest in the west. From 2010 to 2014, energy intensity in the eastern, central and western regions improved as illustrated in Table 11. The largest improvement during this

411 See MEE website:http://www.zhb.gov.cn/gkml/hbb/bgg/201701/t20170117_394809.htm
412 See GOC website:http://www.gov.cn/zhengce/content/2016-11/04/content_5128619.htm
413 Ibid.
414 Ibid.
415 Available at: https://www.raponline.org/wp-content/uploads/2018/04/rap_nrdc_power_sector_planning_us_experience_recommendations_china_2017_nov.pdf

time period was in the western region due to its higher starting point compared to the other regions.

Disaggregating further, the municipality of Beijing had particularly low energy consumption per unit of GDP, while the Shanxi province, located in middle of China, had the highest. This is explained by the fact that energy intensity improved in all municipalities and provinces of China from 2010 to 2014, except in the two provinces of Sichuan and Shanxi, located in the western and middle regions of China respectively.

In July 2018, the NBS, NDRC and NEA jointly issued the Announcement on Indicators for Energy Consumption Reduction of Provinces in 2017. It showed that the national energy consumption per CNY 10,000 of GDP fell by 3.7% in 2017 compared with the previous year and total energy consumption increased by 2.9%.[416]

Since the tertiary industry's demand for energy per unit value added is smaller than that of the secondary industry, which is mainly industrial manufacturing and construction, energy consumption can reflect the regional economic structure to some extent. Energy efficiency improvements, however, seem to be taking place across the whole economy and all regions as in 2017, the energy consumption per unit of GDP reduced in 29 provinces (autonomous regions and municipalities).

Table 11 provides evidence of progress that has been made by the provinces in improving energy efficiency. In 2017, Henan, Guizhou, Shandong, and Tianjin were the highest performing provinces in terms of energy consumption reduction per CNY 10,000, while Hubei, Jiangxi, and Jiangsu ranked fifth. Among them, the energy consumption per CNY 10,000 in the Henan province was reduced by the greatest amount, 7.9%. The growth rate of total energy consumption in Tianjin, Henan and Shandong was negative, and Tianjin's total energy consumption decreased by the most, at 2.8%.[417]

416 See NBS website:http://www.stats.gov.cn/tjsj/zxfb/201807/t20180719_1610865.html
417 Ibid.

Table 11 Regional energy consumption and energy intensity targets and indicators, 2010-2020[418]

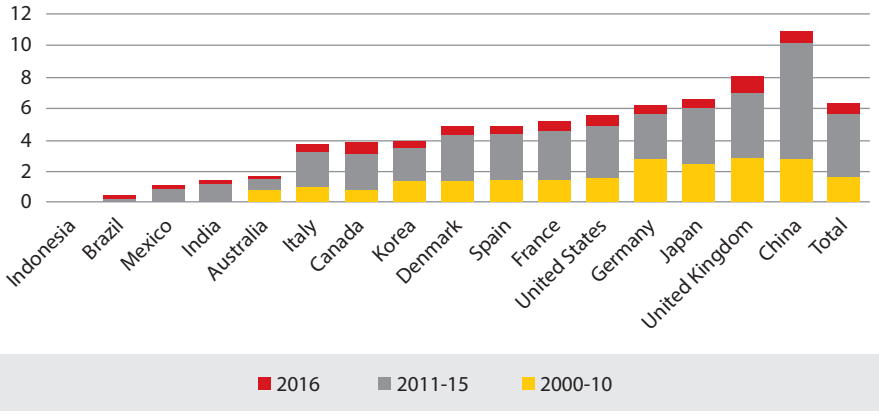
Region	City	2010 (tce/ 10^4 yuan)	2014 (tce/ 10^4 yuan)	13th FYP target of energy intensity reduction (%)	2015 total energy consumption (10^4 tce)	13th FYP target of energy consumption increase (10^4 tce)	2017 energy consumption per CNY 10, 000 regional GDP (%)	2017 total energy consumption growth rate relative to 2016 (%)
East region	Beijing	0.49	0.35	17	6853	800	-3.99	2.5
	Tianjin	0.71	0.60	17	8260	1040	-6.24	-2.8
	Hebei	1.35	1.06	17	29395	3390	-4.42	2.0
	Shanghai	0.65	0.50	17	11387	970	-5.28	1.3
	Jiangsu	0.62	0.49	17	30235	3480	-5.54	1.2
	Zhejiang	0.61	0.50	17	19610	2380	-3.74	3.7
	Fujian	0.67	0.54	16	12180	2320	-3.50	4.3
	Shandong	1.02	0.68	17	37945	4070	-6.94	-0.1
	Guangdong	0.66	0.49	17	30145	3650	-3.74	3.5
	Hainan	0.66	0.61	10	1938	660	-2.03	4.8
Central Region	Shanxi	1.50	1.53	15	19384	3010	-3.37	3.4
	Anhui	0.78	0.59	16	12332	1870	-5.28	2.8
	Jiangxi	0.66	0.57	16	8440	1510	-5.54	2.8
	Henan	0.93	0.77	16	23161	3540	-7.90	-0.8
	Hubei	0.95	0.80	16	16404	2500	-5.54	1.8
	Hunan	0.93	0.74	16	15469	2380	-5.24	2.3
West region	Neimenggu	1.62	1.22	14	18927	3570	-1.57	2.4
	Guangxi	0.83	0.65	14	9761	1840	-3.39	3.6
	Chongqing	0.90	0.81	16	8934	1660	-5.12	3.7
	Sichuan	0.87	1.03	16	19888	3020	-5.18	2.5
	Guizhou	1.78	1.49	14	9948	1850	-7.01	2.5
	Yunnan	1.20	0.67	14	10357	1940	-4.92	4.1
	Xizang	/	/	10	/	/	/	/
	Shanxi	0.88	0.73	15	11716	2170	-4.19	3.4
	Gansu	1.44	1.22	14	7523	1430	-0.75	2.8
	Qinghai	1.90	1.74	10	4134	1120	-4.71	2.2
	Ningxia	2.21	1.49	14	5405	1500	7.65	16.0
	Xinjiang	1.52	/	10	15651	3540	-0.89	6.7
North-east region	Liaoning	1.08	0.85	15	21667	3550	-1.61	2.5
	Jilin	0.94	0.67	15	8142	1360	-5.00	0.0
	Heilongjiang	0.93	0.81	15	12126	1880	-4.02	2.1

418 China Energy Conservation and Emission Reduction Development Report 2015, CIECCPA and CECEP, December 2015.
See GOC website: http://www.gov.cn/zhengce/content/2017-01/05/content_5156789.htm
See NBS website:http://www.stats.gov.cn/tjsj/zxfb/201807/t20180719_1610865.html

4.9 Evidence of progress in improving energy efficiency

According to the IEA's efficiency policy progress index,[419] China has been a world leader in developing and implementing energy efficiency policy over the past two decades. Since the 11th FYP for Energy Development[420], beginning in 2006, China has used the reduction of energy consumption per unit of GDP as a binding indicator for its economic and social development. Binding sectoral targets for industry have been a major driver in delivering significant industrial energy savings. China accounted for more than half of the world's total policy progress from 2000 to 2016 and the country's rate of improvement in policy progress was extremely high during the period 2011-2015 relative to other countries (see Figure 16). However, China's starting point was extremely inefficient, so there was plenty of 'low-hanging fruits' available to capture. The improvements achieved, however, would not have been possible in the absence of strong policies and measures.

Figure 16 IEA's Policy Progress Index for energy efficiency, 2000-2016[421]



As mentioned earlier, China is rated as a 'good performer' against the Regulatory Indicators for Sustainable Development (RISE) – developed and supported by the World Bank, SE4ALL, CIF and ESMAP. These indicators assess countries' policy and regulatory support for each of the three pillars of sustainable energy—access to modern energy, energy efficiency, and renewable energy. In the 2017 assessment, China's score for energy efficiency was 68%, which is higher than scores achieved by countries such as Japan, Spain, Sweden and Switzerland. The areas identified as needing improvement include provision of information for energy consumers so they can better understand their energy consumption, incentives and obligations for the public sector as well as use of third party verification and compliance mechanisms.

419 The IEA Efficiency Policy Progress Index (EPPI) combines coverage and strength of codes and standards into single index for measuring overall policy progress. The EPPI covers seven energy end-uses: space cooling, space heating, appliances, water heating, industrial motors, lighting, LDVs and HDVs. For detail on methodology, see IEA website: http://www.iea.org/publications/freepublications/publication/Energy_Efficiency_2017.pdf

420 See NEA website: http://www.nea.gov.cn/2007-04/11/c_131215360.htm

421 See IEA website: http://www.iea.org/publications/freepublications/publication/Energy_Efficiency_2017.pdf

5. PRIVATE SECTOR ENGAGEMENT

5. Private sector engagement

5.1 Investment trends and conditions

Global energy sector investment reached USD 1.8 trillion in 2017; a fifth of this took place in China, primarily in low-carbon electricity supply and networks, and energy efficiency.[422] For the 3rd consecutive year, China has remained the largest destination of energy investment since 2015.[423] In 2016, global investment in energy efficiency increased by 9% to USD 231 billion, representing 13.6% of total energy sector investment.[424] China accounted for just over a quarter of global energy efficiency investment and for most of the energy efficiency investment growth as China's investment in energy efficiency increased by 24% relative to 2015,[425] and China's attention to this sector started to move overseas in 2017.[426]

China's outward foreign direct investment (OFDI) reached USD 120.1 billion in 2017, including the direct investment in the countries along the 'Belt and Road' of USD 14.4 billion.[427] China has become the world's leader in the field of clean energy investment. China's total investment in overseas clean energy projects exceeded USD 44 billion in 2017, a significant increase from the USD 32 billion in 2016, and the annual growth rate reached 37.5%.[428] China has massively invested in renewable energy, energy efficiency and electric vehicles, and is becoming a global leader in the financing of clean energy technology. For example, China is by far the largest market for smart meters globally as the country aggressively seeks significant energy efficiency gains. There are many major financial institutions supporting China's overseas energy investment ambitions, such as Asian Infrastructure Investment Bank (AIIB), and New Development Bank (NDB) and the Silk Road Fund (SRF).[429]

Investment conditions in China for foreign investors have improved considerably in recent years due to significant regulatory and legislative efforts by the Government of China.[430] There are three main forms of entities through which foreign investors can establish investment in China: Chinese-foreign equity joint ventures, Chinese-foreign contractual joint ventures, and wholly foreign-owned enterprises. In addition, Chinese-Foreign Cooperative Exploitation is a form of foreign investment that allows international collaborative exploitation of resources in the energy sector. The Government issues 'five-in-one business licenses' for both domestic and foreign investors, which has largely streamlined and simplified the business registration procedure. China has also improved its intellectual property rights (IPRs) regime and taken steps to liberalise capital flows.

China intends to grant foreign investors national treatment in the pre-establishment phase under its Pre-Establishment National Treatment (PENT) supplemented by a Negative List policy. Foreign investors conducting activities that are not listed will be granted treatment which is no less favourable than that granted to domestic investors, starting from the pre-establishment stage. Foreign-Invested Enterprises (FIEs) also receive compensation in case of expropriation.

422 See IEA website: https://webstore.iea.org/world-energy-investment-2018
423 World Energy Investment 2016-2018, IEA, July 2016-2018.
424 See IEA website: http://www.iea.org/publications/freepublications/publication/Energy_Efficiency_2017.pdf
425 Ibid.
426 See IEEFA website: http://ieefa.org/wp-content/uploads/2018/01/China-Review-2017.pdf
427 See NBS website: http://www.stats.gov.cn/tjsj/zxfb/201802/t20180228_1585631.html
428 See IEEFA website: http://ieefa.org/wp-content/uploads/2018/01/China-Review-2017.pdf
429 Ibid.
430 China Investment Report, Energy Charter Secretariat, 2017.

5.2 The 13th FYPs: private sector engagement and energy

In December 2016, four ministries -NDRC, MOST, MIIT and MEP - jointly issued the 13th Five-Year Plan for the Development of Energy Conservation and Environmental Protection Industry.[431] The main objectives are of this FYP are that by 2020: the energy conservation and environmental protection industry will develop rapidly; the quality and efficiency of the industry will be significantly improved; the market share of energy-efficient and environment-friendly products will increase; a number of core technologies will make breakthroughs; an institutional policy system conductive to the development of energy conservation and environmental protection industries will be basically formed; the energy conservation and environmental protection industry will become a pillar industry of the national economy with the added value reaching over 3% of China's GDP.[432]

In 2016, MIIT formulated the Industrial Green Development Plan (2016-2020)[433] to improve the efficiency of industrial energy use and reduce the operation costs of enterprises. It comprehensively promotes the technological transformation of traditional industries to improve energy efficiency, the implementation of mandatory energy performance standards and the establishment and development of a long-term mechanism to enhance energy efficiency.

In the same year, the MIIT published the Measures for the Administration of Industrial Energy Conservation[434] to promote and support the development of the energy conservation industry and the Green Manufacture Project Implementation Guideline (2016-2020)[435] to integrate the concept of green development throughout industrial processes. By 2020, it is envisaged that the green development promotion mechanism for industry will have been fully implemented and that the green manufacturing industry will be a new engine of economic growth, enabling China to achieve a new competitive edge in international markets.

5.3 Development of the ESCO industry

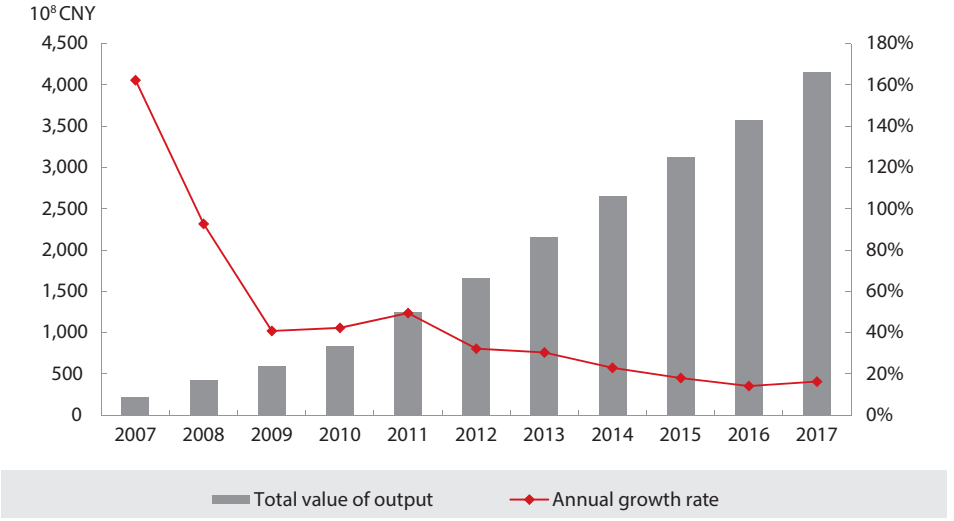
China's efforts to nurture energy service companies (ESCOs) and to create favourable conditions for their development started long ago in the 1990s. In 1997, the NDRC, the Global Environment Facility and the World Bank jointly developed and implemented the World Bank / GEF China Energy Conservation Promotion Project in order to demonstrate ESCO models in Beijing, Liaoning and Shandong provinces.[436] It has taken a while for the ESCO industry to become fully established but year on year investment has been increasing. China's efforts to support its ESCO industry continue as the Government remains strongly committed to developing market-based approaches. The 13th FYP for the Development of Energy Conservation and Environmental Protection Industry (2016-2020) clearly aims to strengthen China's energy efficiency markets and the ESCO industry.

The global energy services market expanded by 12% to USD 26.8 billion in 2016 with China accounting for over 60% of global revenues.[437] ESCO activity in China is concentrated in the industrial sector, reflecting strong obligations and incentives placed on energy-intensive industrial companies.

431 See NDRC website: http://hzs.ndrc.gov.cn/newzwxx/201612/t20161226_832641.html
432 Ibid.
433 See MIIT website: http://www.miit.gov.cn/n1146285/n1146352/n3054355/n3057267/n3057272/c5118197/content.html
434 See MIIT website: http://www.miit.gov.cn/n1146285/n1146352/n3054355/n3057542/n3057544/c4776245/content.html
435 See MIIT website: http://www.miit.gov.cn/n1146285/n1146352/n3054355/n3057542/n3057545/c5256301/content.html
436 Available at: http://www.chyxx.com/industry/201606/422336.html
437 See IEA website: https://www.iea.org/publications/freepublications/publication/Energy_Efficiency_2017.pdf

China's ESCO industry has rapidly developed over the last decade. According to the ESCO Committee of China Energy Conservation Association (EMCA) statistics, as of the end of 2017, there were 6,137 enterprises engaged in energy-saving services with 685,000 employees. The ESCO industries had a total value of CNY 414.8 billion and an investment of CNY 111.34 billion in energy performance contracting (EPC) in 2017, resulting in annual energy savings of 38 Mtce and an annual CO_2 emissions reduction of above 100 Mt. [438] It is estimated that by 2020, the total value of China's energy-saving service industry will reach CNY 600 billion.[439]

Figure 17 Total value of output and annual growth rate of ESCO industry in China, 2007-2017[440]



438 Available at: http://huanbao.bjx.com.cn/news/20180201/878324.shtml
439 Available at: http://www.fdi.gov.cn/1800000121_21_100586_0_7.html
440 Available at: http://huanbao.bjx.com.cn/news/20160727/755586-2.shtml; http://huanbao.bjx.com.cn/news/20180201/878324.shtml

6. FINANCING AND FINANCIAL INCENTIVES

6. Financing and Financial Incentives

In summary, Article 6 of PEEREA on financing and financial incentives states that Contracting Parties shall encourage the following:

- implementation of new approaches and methods for financing and to promote Third Party Financing; and
- taking advantage of and promoting access to private capital markets and existing international finance institutions.

Contracting Parties may also provide fiscal or financial incentives to energy users to facilitate market penetration of energy efficient products and services while ensuring transparency and minimising the distortion of international markets.

6.1 Financing through ESCOs

The ESCO model primarily employed in China is the 'guaranteed savings' model, also known as Energy Performance Contracting (EPC), whereby the host facility pays the ESCO in return for guaranteed energy savings. Typically in China, the host facility, not the ESCO, finances the investment using the energy cost savings to repay the loans. When the ESCO is involved in financing the investment, it is a 'shared savings model'. China's approach has tended to focus on industry and single energy efficiency technologies. Strong energy efficiency policy and an ESCO accreditation scheme have been important enablers[441]. For example, in 2010, the MOF and NDRC jointly issued the Management Measures of Fiscal Reward Funds for EPC Projects[442] regarding, among other things, the incentives and payment conditions for ESCOs, the reward criteria and payments methods, fund application and allocation, supervision and penalties.

6.2 Domestic sources of funding for Energy Efficiency

6.2.1Central government funds and leveraging private finance

Until now, China's investment and financing of energy efficiency has largely been based on a model of using central government funds to drive social investment. In recent years, however, there has been a move towards market-based approaches and using public finance to more effectively leverage private finance. From 2006 to 2010, total investment in energy efficiency in China was CNY 846,625 million. Just under 18% of this total came directly from central or local government while a significant share of around 58% was provided by banks through green credit funds (see Table 12). Just over three quarters of this investment was channelled into investments to improve the energy efficiency of industry (see Table 13).

441 See WB website: https://openknowledge.worldbank.org/bitstream/handle/10986/23949/Fostering0the00or0energy0efficiency.pdf?sequence=5
442 See MOF website: http://www.mof.gov.cn/zhengwuxinxi/caizhengwengao/2010nianwengao/wengao6/201009/t20100903_337231.html

Table 12 The sources of energy efficiency investment funds, 2006-2010[443]

Investment source	Million CNY	Proportion
Government investment:	149,697	17.68%
Central government	101,653	12.01%
Local government	48,044	5.67%
Non-government finance:	696,928	82.32%
Energy-consuming enterprises	169,000	19.96%
Bank's green credit funds	488,425	57.69%
Energy-saving industries	20,520	2.42%
International agency supports	17,983	2.13%
Others (Equity financing, trust, factoring)	1,000	0.12%
Total investment	846,625	100%

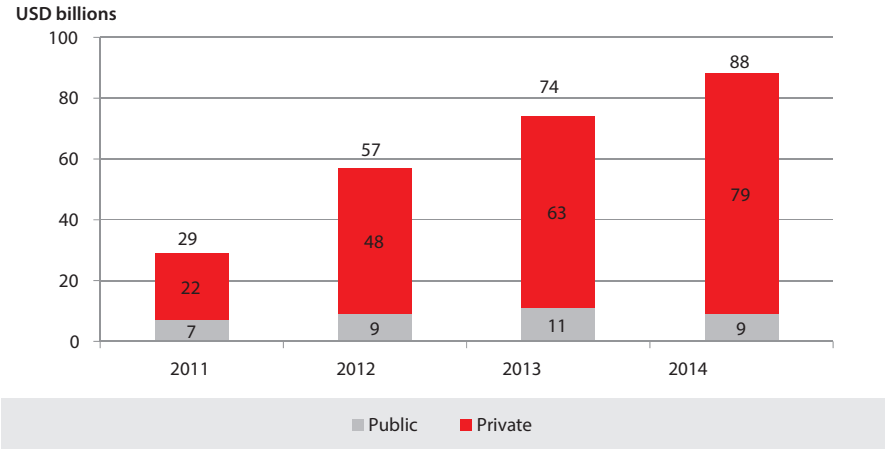
Table 13 Energy efficiency investment uses and energy-saving capacity, 2006-2010[444]

Investment uses	Million CNY	Proportion	Energy savings (10^4 tce)
Project	804,211	95%	33,190
Industry	648,722	76.62%	30,793
Building	102,700	12.13%	1,197
Transport	52,789	6.24%	1,200
Research	42,414	5%	800
Total investment	846,625	100%	33,990

In the next phase of investment, from 2011-2014, total investments in energy efficiency in China increased substantially year by year from just under USD 30 billion in 2011 to just under USD 90 billion in 2014 (see Figure 18). What is notable is the growth in share of private finance relative to public finance; the share of private finance grew from 76% in 2011 to near 90% in 2014.

443 China 's Energy Efficiency Investment Progress Report 2010, Dai Yande, XiongHuawen, and Jiao Jian, 2011.
444 Ibid.

Figure 18 Financial investment in energy efficiency by source, 2011-2014[445]



The 13th FYP sets out the Government's intention to shift further away from providing direct government subsidies for energy-efficient investment and towards using market-based approaches such as ESCOs, risk guarantees for ESCO financing, and mainstreaming energy efficiency lending through dedicated credit lines.

6.2.2 China Clean Development Mechanism Fund (CCDMF)

The Government of China attaches great importance to climate change issues and actively participates in international cooperation on climate change through the UNFCCC. As a signatory of the Kyoto Protocol, China is able to engage in the Clean Development Mechanism (CDM)[446], one of the flexible mechanisms defined in the Kyoto Protocol, established in 2007. In August 2006, the State Council approved the establishment of the CCDMF and its Management Centre. The Management Measures for CCDMF was jointly promulgated by NDRC and 7 other ministries in September 2010.

Sources of the CCDMF include:

1) income earned from the transfer of greenhouse gas emission reductions through CDM projects owned by the state;

2) the Fund's operating income;

3) donations from domestic and foreign institutions, organisations and individuals;

4) other sources.

CCDMF's business focuses on grants and investments. It uses grants to support activities in climate-related capacity building and promotion of public awareness. Its investments mainly support industrial activities contributing to addressing climate change. The CDM Fund develops wealth management activities through bank deposits and purchase of treasury bonds, financial bonds and corporate bonds, among others.[447]

445 See IEA website:https://www.iea.org/newsroom/news/2016/october/energy-efficiency-market-report-2016.html

446 The Clean Development Mechanism (CDM) of the Kyoto Protocol allows developed countries to undertake GHG emissions reduction projects in developing countries such as China to offset their own domestic emissions. Each CDM project generates Certified Emissions Reduction (CER) units, where one CER is equivalent to one tonne of carbon dioxide (CO_2) or its equivalent for the other GHGs.CER units can be traded or sold.

447 See CDM fund website: http://www.cdmfund.org/eng/gywmE/index.jhtml

The use of the CCDMF takes the form of grants and loans. As of 31st December 2015, a total of CNY 1125 million of grant funds was allocated to support 522 projects involving national and local approaches to climate change and low carbon development policy research, capacity building and information, including China's carbon market mechanism research and pilot regions.[448] Since 2011, some 210 projects have been reviewed and approved, covering 25 provinces (municipalities and autonomous regions), with the loan funds reaching a total of CNY 13,036 million, leveraging non-governmental funds of CNY 64,043 million.[449] The CCDMF supports industrial activities that contribute to climate change benefits through loans and gives priority to supporting low-carbon projects.

6.3 International finance

International finance institutions (IFIs) actively promote and lead energy efficiency financing in China. Through dedicated energy efficiency finance programmes, IFIs provide funds to finance a number of energy efficiency projects. In many cases, the funds can revolve since the IFI project loan terms are much longer than the repayment terms of the projects. The IFIs funds are typically provided through the Government of China to domestic banks for project on-lending.[450]

6.3.1 World Bank (WB)

The WB has established a long-term engagement in the energy efficiency and renewable energy sectors in China, and played a significant and active role in promoting energy efficiency. In the mid-1990s, under a project co-funded by the Global Environment Facility (GEF), the WB established three pilot Chinese ESCOs. From 2003 to 2010, the WB also supported the China Investment & Guarantee Co. Ltd. (I&G) by offering an ESCO guarantee product.[451] Over the past two decades, the WB has been working with China to help it move toward more market-based approaches for energy conservation under a programme that ran from 2008 to 2011 and that involved: set up of China Energy Efficiency Financing (CEEF), supported by the Bank and the Global Environment Facility, which aims to promote energy savings and emissions reductions; improve energy efficiency financing market mechanisms and systems; improve the energy-saving technological-transformation ability of large and medium-sized industrial enterprises; and strengthening of the Government of China's energy policy, planning and implementation capacity.[452]

In March 2016, the WB approved a USD 500 million loan to China to support Innovative Financing for Air Pollution Control in the Jing-Jin-Ji region.[453] The initiative aims to reduce air pollutants and carbon emissions through increasing energy efficiency and clean energy, with a focus on the Jing-Jin-Ji and neighbouring regions. The total investment of the programme, USD 1.4 billion, is to be implemented over a period of six years from 2016 to 2022.[454] The sources of the investment comprise USD 500 million from the WB, USD 500 million from the HuaXia Bank and an additional USD 400 million equity contribution from sub-project borrowers.[455] This

448 See CDM fund website: http://www.cdmfund.org/zh/gywm/index.jhtml
449 Ibid.
450 China energy efficiency financing landscape report, IIP, October 2012.
451 Ibid.
452 Ibid.
453 Available at:
http://www.shihang.org/zh/news/press-release/2016/03/22/world-bank-to-support-chinas-war-on-air-pollution
454 Ibid.
455 Ibid.

programme will contribute to achieving the results of the State Council's Action Plan for Air Pollution Control and help mainstream green financing in banks.

6.3.2 Global Environment Facility (GEF)

In February 2013, the GEF established a policy framework to alleviate traffic congestion and reduce greenhouse gas (GHG) emissions in large cities in China primarily through public transport development and travel demand management. The project, referred to as the Large City Congestion and Carbon Reduction Project, involved testing a policy framework in pilot cities so as to demonstrate its local and global benefits.[456]

In March 2017, the GEF granted USD 17.8 million to China to support developing market-based energy efficiency programmes in China. The objective of the funded project – referred to as the Preparation of Establishing Measurement and Verification System for Energy Efficiency Project – is to establish a measurement and verification system for energy savings in preparation for the application of market-based mechanisms.[457] In addition, this project will support the implementation of two major World Bank-financed operations, the Innovative Financing for Air Pollution Control in Jing-Jin-Ji Programme and the Hebei Pollution Prevention and Control Programme, by undertaking marketing and business development for green energy financing, providing analytical studies, technical assistance and training, verifying results by independent and credible third parties, and disseminating lessons learned.[458]

6.3.3 Asian Development Bank (ADB)

The ADB was founded in 1966 and currently has 67 members, 48 of which are from the Asia and Pacific regions. The ADB, headquartered in Manila, the capital of the Philippines, is committed to reducing poverty in the Asia-Pacific region through inclusive economic growth, environmental sustainability and regional integration.

In 2008, the ADB and the Dalkia Group signed a multi-project loan agreement to finance a series of district heating, cooling and cogeneration projects in China in order to improve energy efficiency and reduce air pollution.[459] Under the agreement, ADB's financial support includes a loan of CNY 1.4 billion (USD 201.3 million) provided by ADB itself and an additional CNY 1.4 billion of loans provided by international banks or local banks under an engagement agreement with the ADB. This is the first residential energy project supported by ADB private-sector loans.[460]

The ADB has implemented three energy efficiency loan projects in three provinces: Guangdong (2009), Shandong (2011) and Hebei (2012). ADB loans provide CNY 680 million to each respective provincial government and funds are re-lent to Energy Efficiency Projects (EEPs) through a financial intermediary that manages and reuses the funds during the 15-year loan term.[461]

In 2014, the ADB signed a memorandum of understanding (MOU) on climate change issues with the NDRC and another on promoting sustainable green development with the MEP. Over

456 See WB website: http://documents.worldbank.org/curated/en/385621468019463050/China-GEF-Large-City-Congestion-and-Carbon-Reduction-Project

457 See WB website: http://projects.worldbank.org/P132748/establish-mv-system-energy-efficiency-china?lang=en&tab=overview

458 See WB website: http://www.worldbank.org/en/news/press-release/2017/03/16/gef-to-support-implementation-of-chinas-energy-efficiency-and-environment-programmes

459 Available at: http://intl.ce.cn/specials/zxgjzh/200806/20/t20080620_15894144.shtml

460 Ibid.

461 China energy efficiency financing landscape report, IIP, October 2012.

5 years, the financial support will assist China in mitigating climate change, including piloting low-carbon economic zones, improving energy efficiency and clean coal technology, and piloting emissions trading schemes. The ADB will also help China to manage air, water and soil pollution, achieve sustainable management of wetlands, rivers, lakes and forests, mitigate land degradation, conserve biodiversity to protect the environment, and advance innovation in these areas.[462]

In December 2015, the ADB approved a USD 300 million policy loan to China. It was the first time ADB provided policy loans to help China solve air pollution problems that have long plagued the capital and surrounding areas. The initiative also intended to help the Government of China achieve its UNFCCC Paris Agreement commitments by reducing coal consumption in these regions, including through energy efficiency measures.[463] The capital region refers to Beijing, Tianjin and Hebei (Beijing-Tianjin-Hebei), with a total population of about 109 million, and with its regional GDP accounting for 10% of national GDP.[464] Due to industrial and urban development and the proliferation of motor vehicles, unprecedented developments in the region have led to severe air pollution.

Shanxi Energy Efficiency and Environmental Improvement Project was implemented in 2016. The total investment of the project is CNY 1.06 billion, of which ADB loans are USD 100 million. The project has achieved multiple benefits in social, economic and environmental areas including: more than 25,000 jobs; 6.34 million m^2 of newly-added central heating area; and 2,300 poor people have also received heating bill reductions. At the same time, the projects improve the energy efficiency of heating facilities. From 2014 to 2016, the total heating income of the projects was about CNY 230 million and saved coal about 39,000 tonnes.[465] The environmental monitoring results show that during the heating season from 2014 to 2016, the project achieved the expected contribution to improve the air quality of the project area. The number of Class II air quality compliance days in the project area increased by 15%-20%.[466]

6.3.4 Silk Road Fund (SRF)

China set up the SRF in 2014 to directly support its Belt and Road Initiative. The SRF invests in a wide range of sectors within the framework of the One Belt One Road Initiative, including infrastructure, energy resources, industrial capacity cooperation and financial cooperation. It is jointly funded by the China Foreign Exchange Reserve (CFER), the China Investment Corporation (CIC), the China Export-Import Bank (CEIB), and the China Development Bank (CDB).[467]

The first phase of the SRF involved USD 10 billion capital; foreign exchange reserves contributed USD 6.5 billion through its investment platform, and CIC, CEIB and CDB also invested USD 1.5 billion, USD 1.5 billion and USD 500 million respectively.[468] In May 2017, China's President Xi Jinping announced at the opening ceremony of the Belt and Road International Cooperation

462 See ADB website: https://www.adb.org/zh/news/adb-president-assures-prc-vice-premier-strong-support-reforms-environment-and-poverty-reduction

463 See ADB website:
https://www.adb.org/zh/news/first-adb-policy-based-loan-prc-supports-air-pollution-control-beijing-capital-region

464 Ibid.

465 See GOC website: http://www.sxscz.gov.cn/www/2017-12-29/201712291029495023.html

466 Ibid.

467 See SRF website: http://www.silkroadfund.com.cn/cnweb/19854/19858/index.html

468 Ibid.

Summit that China will support the Belt and Road Initiative by increasing the capital of the SRF by CNY 100 billion in order to strengthen its ability to provide multi-currency and sustainable financial support for Belt and Road projects.[469]

469 *Available at: http://www.xinhuanet.com/2017-05/14/c_1120969677.htm*

7. TRADE AND ENERGY EFFICIENCY

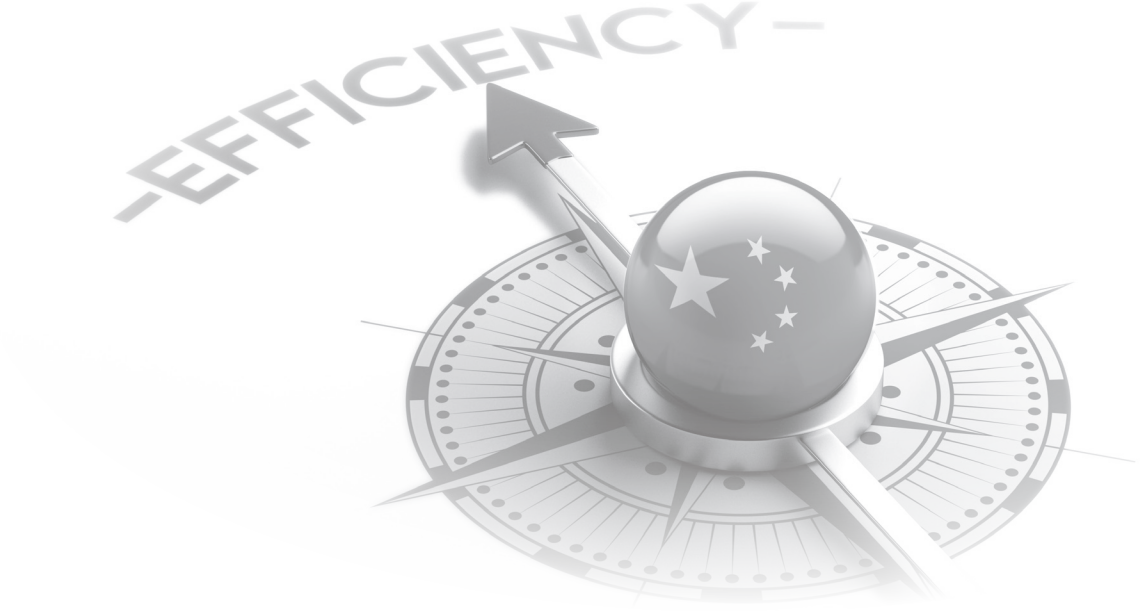
7. Trade and energy efficiency

PEEREA is consistent with the provisions of the ECT on trade and these in turn are consistent with WTO rules. In accordance with Article 7(1) of PEEREA, Contracting Parties shall encourage commercial trade and cooperation in energy efficient and environmentally sound technologies, energy-related services and management practices. Article 8(2)(c), however, elevates the importance of energy efficiency standards and states that domestic programmes may include activities such as the definition of standards designed to improve the efficiency of energy using equipment, and efforts to harmonise these internationally to avoid trade distortions.

China participates in cooperation efforts to facilitate trade in sustainable energy-related goods. An example is the Environmental Good Agreement (EGA).[470] The EGA negotiations, facilitated by the WTO and formally launched in July 2014, brought together Australia, Canada, China, Costa Rica, Chinese Taipei, the European Union, Hong Kong (China), Japan, Korea, New Zealand, Norway, Switzerland, Singapore, United States, Israel, Turkey and Iceland.[471] The purpose of EGA is to eliminate tariffs on a number of important environment-related products, including energy efficiency products. Unfortunately, the last EGA ministerial meeting was held in December 2016[472] and activity has since slowed down.

Minimum Energy Performance Standards or Requirements (MEPS and MEPRs) are key instruments to improve energy efficiency across regions and internationally by removing the most inefficient energy-using equipment, products and processes from the market. Harmonisation at regional or international level can facilitate trade while progressing energy efficiency. Since the 12th FYP, China has released and amended MEPS in place for 54 end-use energy-consuming products and MEPS for a further 73 products on per unit of product basis.[473] China engages through APEC with countries of the Asia-Pacific region and multi-lateral organisations on harmonization of standards, labelling and testing procedures[474] as well as other for a such as the China-EU Energy Dialogue.[475]

470 See EC website: http://trade.ec.europa.eu/doclib/press/index.cfm?id=1116
471 See WTO website: https://www.wto.org/english/tratop_e/envir_e/ega_e.htm
472 See EC website: http://trade.ec.europa.eu/doclib/press/index.cfm?id=1595
473 See MIIT website: http://www.miit.gov.cn/n1146295/n1652858/n1652930/n4509607/c6226963/content.html
474 See APEC website: https://www.apec.org/Publications/2017/12/Gaps-Assessment--on-APEC-Energy-Efficiency-and-Conservation-Work
475 See EC website: https://ec.europa.eu/energy/en/topics/international-cooperation/china



8. INTERNATIONAL AND REGIONAL COOPERATION

8. International and regional cooperation

According to Article 9 of the PEEREA, cooperation between Contracting Parties on energy efficiency can take any form and a long list of possible areas is provided in the Annex to the Protocol.

8.1 International Cooperation

China is strongly committed to deepening energy cooperation under the One Belt and One Road Initiative, boosting energy resources' development and energy infrastructure construction involving the countries of the Belt and Road Initiative. The aim is to promote common development of all countries along geographical demarcation, so adding new momentum to the world's economic recovery, prosperity and sustainable development. The total population of countries in the Belt and Road region is about 4.4 billion, accounting for about 63% of the global population. Most countries involved have emerging and developing economies with a total economic output of about USD 21 trillion, accounting for 29% of the global total.[476]

China is pursuing a revolution in energy supply and consumption and is committed to inclusive international energy cooperation in order to achieve energy security in open conditions. In China's view, energy efficiency is a priority aspect of energy strategy and an important area for international cooperation.

In June 2015, China submitted the Enhanced Actions on Climate Change – China's Intended Nationally Determined Contributions (INDCs) to Secretariat of the UNFCCC, setting forth four major goal[477] to demonstrate China's determination in tackling climate change.[478] In September 2016, the China's National People's Congress (NPC) Standing Committee approved China's accession to the Paris Agreement.[479] China became the 23rd Party to ratify the agreement.[480]

China actively participates in global energy governance and successfully held the Symposium of International Cooperation in the Belt and Road Summit in May 2017, on the topic of strengthening international cooperation, building the Belt and Road together, and realising win-win development.[481] The NDRC and the NEA jointly released the Vision and Actions of Energy Cooperation on Silk Road Economic Belt and the 21st Century Maritime Silk Road in May 2017, outlining seven key cooperation areas including energy investment and energy production, energy infrastructure interconnection, so as to promote the construction of the Belt and Road.[482]

8.1.1 G20 Energy Efficiency Action Plan (EEAP)

The G20 Energy Efficiency Action Plan aims to enhance voluntary, energy-efficient cooperation in a flexible manner. It allows countries to choose the activities that best reflect their national priorities, to share knowledge, experience and resources.[483] The plan includes: improving energy efficiency and the emissions performance of transport; speeding up the opening up of new ways to improve the energy efficiency of network equipment; increasing the flow of

476 *Available at: http://www.chinanews.com/cj/2014/10-21/6699000.shtml*

477 *The four major goals to be achieved by 2030 relative to 2005 are: (1) to lower carbon dioxide emissions per unit of GDP by 60% to 65%; (2) to increase the share of non-fossil fuels in primary energy consumption to around 20%;(3) to increase the forest stock volume by around 4.5 billion m^3;(4)to achieving the peaking of CO_2 emissions around 2030, and making the best effort to peak early.*

478 *Available at: http://www.chinanews.com/gn/2015/06-30/7375825.shtml*

479 *Available at: http://www.xinhuanet.com/politics/2016-09/03/c_1119505844.htm*

480 *Available at: http://www.sohu.com/a/113515731_220090*

481 *Available at: http://politics.people.com.cn/GB/8198/412403/*

482 *See NEA website: http://www.nea.gov.cn/2017-05/12/c_136277473.htm*

483 *Available at: http://intl.ce.cn/specials/zxgjzh/201504/15/t20150415_5118847.shtml*

capital in energy efficiency investments; improving the specifications and performance of buildings; enhancing industrial energy management and making industrial processes more energy efficient.

8.1.2 G20 Energy Efficiency Leading Programme (EELP)

Based on the G20 EEAP proposed in 2014, international cooperation in energy efficiency is voluntarily expanded from 6 key areas to 11 key areas, such as transportation, networking equipment, energy efficiency financing, building energy efficiency, energy management and power generation, TOPTENs,[484] the SSuper-Efficient Equipment and Appliance Deployment (SEAD), the District Energy System (DES), the energy efficiency knowledge sharing framework, end-use data and energy efficiency metrics.[485] China currently leads the TOPTENs and DES work streams.

The EELP provides a framework for long-term energy efficiency cooperation of the G20and has expanded the field of voluntary cooperation on energy efficiency. The EELP was explicitly adopted in the Beijing Declaration of the Energy Ministers' Meeting in 2016. The EELP reflects China's changing role in international cooperation on energy efficiency, from participant to leader.

8.1.3 China-EU Energy Dialogue

China-EU Energy Dialogue is an intergovernmental energy exchange and cooperation mechanism established between China and the EU under the China-EU Memorandum of Understanding on Energy, Transport and Strategic Dialogue signed in 2005, and has been held seven times so far.[486]

After the China-EU Energy Joint Statement was signed in November 2013, then China-EU Energy Cooperation Roadmap (2016-2020) was signed in July 2016. In June2017, the two parties held the 7th energy dialogue and signed the Work Plan of Implementation of the China-EU Energy Cooperation Roadmap (2017-2018). Agreed areas of focus included energy policy, energy efficiency standards, low-carbon energy technologies, renewable energy, energy regulation, energy networks, etc.

In July 2018, the China-EU Joint Statement on Climate Change and Clean Energy was signed. China and the EU are committed to implementing the 2030 Agenda for Sustainable Development to promote the reduction of global greenhouse gas emissions, climate adaptation and sustainable development. The two parties will focus on further strengthening cooperation in long-term greenhouse gas low-emission development strategies, carbon emissions trading, energy efficiency, clean energy, low-emission transport, low-carbon city, climate change related technology and sustainable energy project investment. In terms of energy efficiency, it was agreed to expand bilateral cooperation in energy efficiency labelling, MEPS for electrical appliances, and buildings' energy efficiency, in order to benchmark against international standards.[487]

484 Available at: http://www.top10.cn/

485 Available at: http://www.sohu.com/a/100393723_131990

486 See NEA website: http://obor.nea.gov.cn/v_practice/toPictureDetails.html?channelId=1088

487 Available at: http://www.in-en.com/article/html/energy-2272200.shtml

8.1.4 China - Central and Eastern Europe Energy Project Dialogue and Cooperation Centre

The China-Central and Eastern Europe Energy Project Dialogue and Cooperation Centre was jointly hosted by two non-government organisations (the Romanian Energy Centre and the Democratic Research Centre), which were commissioned by the Romanian Ministry of Energy and the Ministry of Foreign Affairs.[488]

In November 2017, the China-CEEC (Central and Eastern Europe Countries) Energy Exposition and Forum was held. Participants discussed the issues of strengthening energy cooperation in China-Central and Eastern Europe, building a modern, efficient and sustainable global energy structure and adopted the Ministerial Statement of Joint Research on China-Central and Eastern Europe Energy Cooperation and the White Paper on China-Central and Eastern Europe Energy Cooperation.

In June 2018, the first technical exchange meeting of China-Central and Eastern Europe energy cooperation was held in Beijing. Representatives of governments and enterprises from China and Central and Eastern Europe also held round-table dialogues on topics such as energy development planning and energy policy in Central and Eastern Europe, and discussed key directions and main models of China-Central and Eastern Europe energy project cooperation.[489]

In July 2018, the 7th meeting of leaders of China-Central and Eastern Europe was held. The China-Central and Eastern European Countries Cooperation Budapest Outline was effectively adopted and implemented. Energy cooperation was one of the key points emphasised by the leaders of the participating countries. Many key words in this Outline refer to environmental protection and sustainable energy, indicating that countries have reached consensus on strengthening cooperation in energy and environmental protection and comprehensively promoting the path of sustainable and low-carbon development.[490]

8.1.5 China-League of Arab States (LAS) Clean Energy Training Centre

In May 2017, the NDRC and the NEA officially released the Vision and Action for Promoting Energy Cooperation between the Silk Road Economic Belt and the 21st Century Maritime Silk Road, which includes the proposal to establish the physical entity of the China-LAS Clean Energy Centre.[491]

In July 2018, the 8th Ministerial Meeting of the China-Arab States Cooperation Forum was held in Beijing.[492] The two sides signed the Beijing Declaration to propose pragmatic cooperation in the fields of oil and gas, electricity, nuclear energy, renewable energy, and energy efficiency.[493] The NEA and the LAS Secretariat also signed the Agreement on the Establishment of the China-LAS Clean Energy Training Centre. According to the Agreement, the two parties will work together to establish the China-LAS Clean Energy Training Centre in Beijing, and organise training programmes on energy-related topics such as photovoltaics, solar thermal, wind power and smart grids.[494]

488 Available at: http://www.in-en.com/article/html/energy-2272200.shtml
489 See NEA website: http://www.nea.gov.cn/2018-06/13/c_137251374.htm
490 Available at: http://www.in-en.com/article/html/energy-2272200.shtml
491 See NEA website: http://www.nea.gov.cn/2017-05/12/c_136277473.htm
492 See GOC website: http://www.gov.cn/guowuyuan/2018-07/11/content_5305518.htm
493 Available at: https://www.casetf.org/xwzx1/2709.html
494 Available at: http://www.cspplaza.com/article-12773-1.html

8.1.6 Sino-US Energy Efficiency Forum

The Sino-US Energy Efficiency Forum is a specific measure for implementing the energy efficiency action plan developed within the framework resulting from the Sino-US strategic and economic dialogue and the 10-year cooperation between China and the United States on energy and environment. The forum is held annually and hosted in turn by the two countries.[495]

Since the 7th Sino-US Energy Efficiency Forum in 2016, both parties have been actively promoting the implementation of 15 projects to achieve annual energy savings of nearly 10^5 tce. In October 2017, the 8th Sino-US Energy Efficiency Forum signed a new commercial and technical cooperation document in recognition of the EPC pilot project, and both parties will further strengthen cooperation in energy efficiency.

8.1.7 Sino-German Working Group and Energy Efficiency Forum

The Sino-German Working Group was established in 2006 to promote the development of energy efficient buildings in China. The group consists of key personnel from the Ministry of Construction of the two countries, the German Energy Agency, the Construction Science and Technology Industrial Development Centre (CSTC) and the China Society for Urban Studies (CSUS).[496] Bilateral cooperation exists in three areas: energy saving in urban areas; energy efficiency in networks; and energy conservation in key energy-consuming units. Both countries have conducted pilot projects in the establishment of energy efficient urban systems, promoted energy efficiency network teams and organized experts from both countries to implement an energy-saving diagnosis of key energy-consuming units.

Held jointly by the NDRC and the Federal Ministry of Economics and Energy, the Sino-German Energy Efficiency Forum is a concrete move to deepen energy efficiency cooperation within the framework of the Sino-German Economic and Technical Cooperation Forum.[497] Since its launch in 2009, the Sino-German energy efficiency cooperation project has conducted energy efficiency assessments for many enterprises and public service units in China, provided detailed energy efficiency diagnosis reports and recommended practical energy efficiency improvement methods for enterprises in different industries in China.

8.2 Regional Cooperation

China is located in the east of Asia, the Pacific West Bank, and is one of the APEC member countries. China is committed to promoting energy cooperation in Asia and building a mutually beneficial and win-win Asian energy relationship.

8.2.1 Asia-Pacific Economic Cooperation (APEC)

Since 1991, China has regularly participated in the multilateral energy cooperation mechanism under the framework of the Asia-Pacific Economic Cooperation (APEC) and is playing an increasingly active role.[498] APEC energy cooperation practices are steadily advancing and becoming increasingly diversified, covering energy efficiency and energy savings, new energy and renewable energy, energy transportation and infrastructure, energy information and data sharing, energy supply disruption emergency mechanism and clean fossil energy technologies. With the gradual progress of the cooperation process, APEC energy cooperation is becoming

495 Available at: http://www.sohu.com/a/198050960_267106

496 Available at: https://www.prnasia.com/story/95237-1.shtml

497 See NDRC website: http://www.ndrc.gov.cn/xwzx/xwfb/201404/t20140422_608310.html

498 See NEA website: http://zfxxgk.nea.gov.cn/auto88/201707/t20170724_2832.htm

well established and is based upon sound and flexible cooperation principles.[499]

The 15th APEC Leaders' Informal Meeting in Sydney in 2007 reached a consensus on reducing energy intensity by 25%in the Asia-Pacific region by 2030 relative to 2005.[500] As a result, the APEC economies have set goals and plans for improving energy efficiency in the context of the overall standard and their own conditions.

Despite the success in building the Asian energy cooperation mechanism, some challenges do exist as the development level of the member countries varies significantly. Energy cooperation is also influenced by many factors such as the domestic political system, energy market structure, geopolitics, culture and ideology which vary considerably across the countries of Asia.

8.2.2 APEC Expert Group on Energy Efficiency & Conservation (APEC EGEE&C)

Cooperation through APEC is supported by well-functioning governance and institutional arrangements, with formal meetings of high-level leadership through to working group level. APEC's Expert Group on Energy Efficiency & Conservation (EGEE&C), part of the APEC Energy Working Group (EWG), is one of the most active expert groups under the APEC framework.

At present the objectives of the EGEE&C for 2014-2018 are:

- collaborate on product and system standards that enhance energy efficiency and clean energy deployment, while exchanging information on the impact of such standards;
- facilitate the exchange of best practices in low carbon policies and tools among APEC Member Economies to promote the development of sustainable communities across the region and to achieve progress towards the goal of reducing APEC's aggregate energy intensity by 45% from 2005 levels by 2035;
- develop the human resource base and inform energy consumers within the APEC Member Economies to improve their analytical, technical, operational, and policy capacity in the area of energy efficiency and overall energy literacy;
- support the development and commercialisation of energy efficiency technologies in the areas of power generation and distribution, industry, transport, buildings, and appliances(with particular attention to smart buildings);
- strengthen the reliability, adaptability, and interoperability of electric grids in the APEC region.

A gap assessment was recently carried out in relation to evaluating APEC's past progress and identifying existing gaps in order to provide input to APEC's future strategic activities that can help the Member Economies achieve APEC's 45% energy intensity improvement goal.[501]

8.2.3 East Asia Summit (EAS) Clean Energy Forum

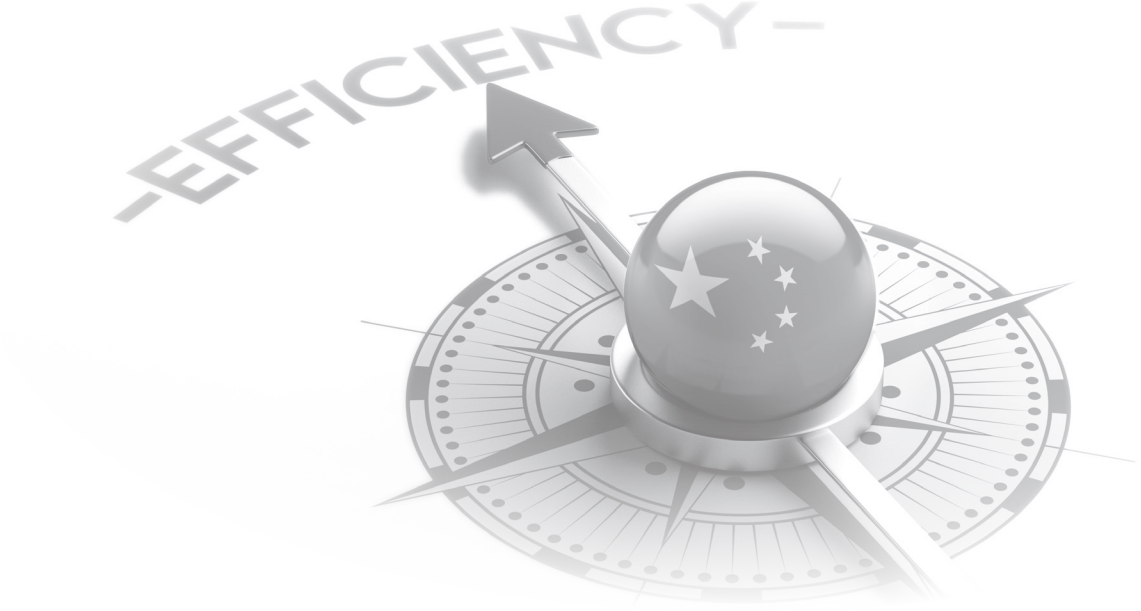
The EAS Clean Energy Forum is a professional conference based in East Asia under the framework of the East Asia Summit that looks to the future and focuses on clean energy. It is co-hosted by the NEA and the Association of Southeast Asian Nations (ASEAN) Energy

499 APEC Energy Cooperation Research: Analysis on Participation and Role of China, Wang Hongjun, 2009.
500 Available at: http://news.163.com/07/0909/16/3NVBS2P1000120GU.html
501 See APEC website:
https://www.apec.org/Publications/2017/12/Gaps-Assessment--on-APEC-Energy-Efficiency-and-Conservation-Work

Centre,[502] and China actively implements the Programme of the China-ASEAN Clean Energy Capacity Building.[503]

The 3rd EAS Clean Energy Forum was held in July 2017 with the theme of 'deepening pragmatic cooperation, promoting win-win cooperation and building a green, interconnected, inclusive and diverse regional energy system'. Conference delegates shared their achievements and experiences of clean energy development, and discussed the future of clean energy development.

502 See NEA website: http://obor.nea.gov.cn/v_practice/toPictureDetails.html?channelId=1088
503 See NEA website: http://www.nea.gov.cn/2017-05/12/c_136277473.htm



ANNEXES

Annex 1 The 13th FYP for key energy sub-plans

Sub-plans	Main objectives	Key measures
The 13th FYP for **Coal Industry** Development	• Speed up the optimisation and upgrading of coal structure. • Promote coal clean production and efficient use. • Promote energy conservation and emission reduction in key coal-consuming industries.	• Study and amend the 'Law on Coal', improve the legal system. • Establish a coal production capacity monitoring and pre-control system, and fully implement the registration and announcement system. • Improve financial support, guide financial institutions to give credit support to competitive and high-quality core coal enterprises.
The 13th FYP for **Electric Power** Development	• Actively develop hydropower, vigorously develop new energy sources, safely develop nuclear power and orderly development of natural gas power generation, and accelerate the transformation and upgrading of coal-fired power units to promote clean and orderly development. • Implement energy substitution and optimise energy consumption structure. • Improve central heating, and gradually replace the small coal-fired boilers.	• Amend the Law on Electric Power, promulgate the Nuclear Power Management Regulations, and establish a power legal system to regulate government behaviour and market behaviour. • Increase financial resources to support the construction of power project information management system, enhance information disclosure and transparency. • Research and formulate early warning mechanism for the whole industrial chain of electric power covering planning and construction, investment and operation, credit finance and equipment manufacturing.
The 13th FYP for **Petroleum** Development	• Promote the construction of crude oil and refined oil pipeline networks. • Speed up the building of oil reserve capacity. • Adhere to the economical use of oil. • Vigorously develop clean and alternative energy.	• Improve the national petroleum planning system, study and formulate the 'Measures for the Administration of Oil and Gas Planning'. • Strengthen the investment and construction of infrastructure such as pipeline networks to promote connectivity. • Deepen the reform of the oil and gas system.
The 13th FYP for **Natural Gas** Development	• Speed up the construction of natural gas pipelines. • Accelerate the construction of gas storage facilities and improve the capacity of peak regulation reserves. • Cultivate natural gas markets and promote efficient use.	• Promote the separation of transportation and sales of natural gas pipelines. • Improve the corporate governance structure of state-owned oil and gas enterprises, increase efficiency and vitality. • Strengthen infrastructure construction, e.g. pipeline network, gas storage.

Sub-plans	Main objectives	Key measures
The 13th FYP for **Renewable Energy** Development	• Active and steady development of hydropower. • Coordinate and promote the development of wind power • Promote the diversification of solar power. • Accelerate the development of biomass energy and use of geothermal energy.	• Establish a goal-oriented management system for the development and use of renewable energy. • Implement renewable energy power generation in full purchase • Establish a renewable energy .green certification trading mechanism • Strengthen the regulation of renewable energy.
The 13th FYP for **Wind Power** Development	• Solve the problem of wind power consumption • Enhance the level of development and use of wind power in the eastern and southern regions • Improve the wind power industry management system • Establish the market competition mechanism	• Improve the annual development programme management mechanism • The implementation of a full protection of the acquisition system • Strengthen the operation of consumer regulation supervision • Innovative Price and Subsidy Mechanism
The 13th FYP for **Hydropower** Development	• Large-scale base construction, small and medium-sized river basin development, pumped storage construction • Ecological environmental Protection, integrated river basin management • Hydropower technology and equipment development	• Strict infrastructure management procedures • Implement corporate responsibility to ensure the safety of production and operations • Strengthen government regulation • Strengthen tracking analysis and project evaluation
The 13th FYP for **Solar Energy** Development	• Optimize the layout of photovoltaic power plants • Promote the industrialization of solar thermal power • Based on local conditions to promote solar heating • Demonstration of new energy micro-grid application • Speeding up technological innovation and industrial upgrading	• Improve the planning lead and project configuration management • Establishment of solar energy monitoring and evaluation system • Improve solar power market mechanisms and support supplementary power grid construction • Strengthen the solar energy industry standard system • Innovative Investment and Financing Models and Financial Services

Annex 2 The 13th FYP for energy conservation in key sectors

The 13th FYPs	Main objectives	Key measures
The 13th FYP for **National** Energy Conservation	• Realize the targets of total energy consumption and energy intensity in the13th FYP for Energy Development • Put energy conservation throughout the process of economic and social development. • Promote national wide and all the people participate in the energy conservation.	• Promote energy-saving products • Improve energy efficiency in industry, building and transport sectors, especially in key energy-intensive enterprises • Public institution leads in the energy conservation activities • Double expansion of the energy-saving service industry • Develop the energy-saving technology and projects
The 13th FYP for Green Development of **Industry**	• Improve the energy efficiency in industry sectors • Improve the efficiency of the resource use • Improve the clean production, reduce SO_2, NO_X , COD and ammonia nitrogen emissions • Develop green manufacture industry and establish the green manufacture system	• Develop high value-added, low-consumption, low-emission products, and promote the energy-saving technologies • Carry out clean production technology transformation • Comprehensive use of industrial solid waste • reduce GHG, promote low carbon transformation in key sectors
The 13th FYP for the Development of **Transport** Energy Conservation and Environmental Protection	• Drop the energy intensity and carbon emission intensity • Integrate the ecological protection into the transport construction • Reduce the total emission of SO_2, NO_X and PM from vessels in key regions • Improve the resource saving and recycling in transport sector	• Optimize the development of the public transport and smart transport system, improve the energy efficiency of transport equipment • Strengthen ecological protection in new-built transport infrastructure • Save land in transport construction, and effectively use construction waste after harmless treatment • Improve the green transportation regulations and standard system
The 13th FYP for **Building** Energy Conservation and Green **Building** Development	• Enhance the proportion of green building in urban • Decline the overall energy intensity of the building • Improve the building energy consumption structure • Improve the green development level of the construction sector	• Upgrade building energy efficiency standards • Improve the existing building energy conservation and promote the development of green building • Promote renewable energy application in the building • Promote energy conservation in rural building
The 13th FYP for Energy Conservation and Environmental Protection **Industry**	• Expand the scale of the energy conservation and environmental Protection industry • Increase the market share of energy-saving and environmental protection equipment products • Increased industrial concentration and increased competitiveness.	• Improve the supply of technical equipment and carry out evaluation of green equipment certification • Promote innovation in energy conservation and environmental protection service mode • Implement major projects in energy conservation and environmental protection, and resource recycling, promote green products

Annex 3 Green buildings evaluation index and weight coefficients

The Ministry of Housing Urban-Rural Development (MOHURD) released the Assessment Standard for Green Building (GB/T 50378-2014) on 15 April 2014, which came into effect on 1 January 2015.[504] The evaluation of green buildings is divided into design evaluation and operation evaluation. The evaluation index system for green buildings consists of seven indicators; each indicator is given a different weight coefficient. Green buildings' ratings are based on the total score of the indicators.

Indicators	Design Evaluation		Operation Evaluation	
	Residential buildings	Public buildings	Residential buildings	Public buildings
Land saving and outdoor environment (W_1)	0.21	0.16	0.17	0.13
Energy saving and energy use (W_2)	0.24	0.28	0.19	0.23
Water saving and use of water resources (W_3)	0.20	0.18	0.16	0.14
Materials saving and use of materials resources (W_4)	0.17	0.19	0.14	0.15
Indoor environmental quality (W_5)	0.18	0.19	0.14	0.15
Construction management (W_6)	_	_	0.10	0.10
Operation management (W_7)	_	_	0.10	0.10

Note: Construction and operation management are not included in design evaluation.

$$\sum Q=Q_1W_1+Q_2W_2+Q_3W_3+Q_4W_4+Q_5W_5+Q_6W_6+Q_7W_7+Q_8$$

The total score ($\sum Q$) of the seven indicators of the evaluation index system is 100 points. Q_1, Q_2, Q_3, Q_4, Q_5, Q_6 and Q_7 represent the respective scores of the seven categories of indicators. These are multiplied by the weighting coefficients (W). Q_8 represents the scores of additional items. Additional points include performance improvement and innovation.

Each item corresponding to the W item has a rating item Q. For example, corresponding to the 'Land saving and outdoor environment (W_1)', Q_1 includes 4 parts, i.e. land use, outdoor environment, transportation facilities and public services, site design and site ecology. Each part has more detailed items and grading is separate for residential buildings and public buildings.

504 See MOHURD website: http://www.mohurd.gov.cn/wjfb/201508/t20150829_224219.html

Annex 4 Transport industry energy conservation and emissions reduction documents (2011-2017)

Documents	Issued
Plan for Building the Low-Carbon Transport System in pilot cities	02/2011
The 12th FYP for Highway and Waterway Transport Energy Conservation and Emission Reduction	06/2011
The 12th FYP for Waterway Transport Industry Overall Promotion and Implementation of Energy Conversation and Emission Reduction	08/2011
Guiding Opinions on Building the Low-Carbon Transport System	08/2011
The 12th FYP for Highway and Waterway Transport Environmental Protection	01/2012
The 12th FYP for Railway Energy Conservation	04/2012
The Action Plan for Transport Industry against Climate Change	09/2012
The 12th FYP for Greenhouse Gas Emission Control of Transport Industry	09/2012
Guiding Opinions on Accelerating the Development of Green, Cyclical and Low-Carbon Transport	05/2013
The 13th FYP for Transport Energy Conservation and Environmental Protection	05/2016
The 13th FYP for the Development of Modern Comprehensive Transport System	02/2017
Opinions on Comprehensively and Deeply Promoting the Development of Green Transport	11/2017

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