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Towards a more effective, low-carbon energy system in China

Work in Progress 2021: The Sino-German Energy Transition Project (EnTrans)

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

dena German Energy Agency

Agora Energiewende

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1 About the Sino-German Energy Transition Project

China is the world's largest coal consumer and the country with the highest greenhouse gas emissions. To meet its climate goals, in particular its recent ambitious commitments to peak the country's carbon emissions before 2030 and to become carbon neutral by 2060, China needs to dramatically transform its energy system, away from fossil fuels and towards a flexible system based on renewable energy.

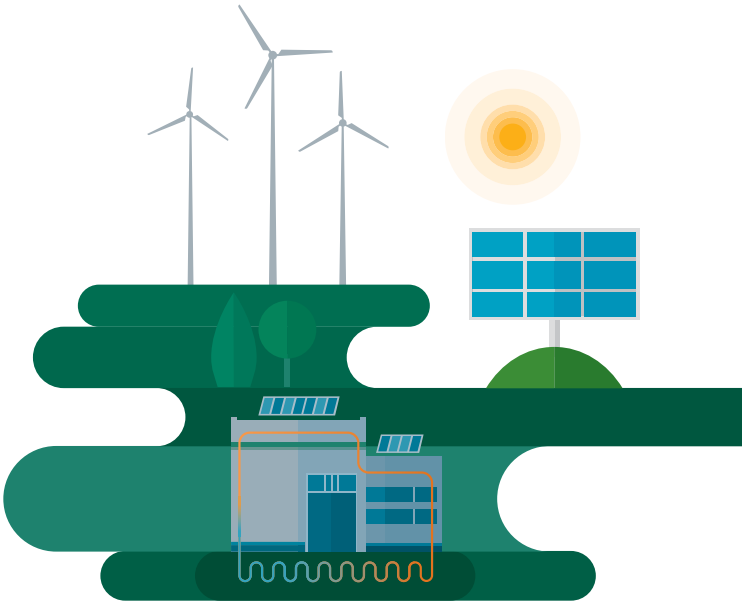
Exchanging know how and working together to advance a future without greenhouse gas emissions is essential to limiting global warming. Germany has set up Energy Partnerships to foster exchanges with countries striving to transform their energy systems. Commissioned by the German Federal Ministry for Economic Affairs and Energy (BMWi), the Sino-German Energy Transition Project is part of the Sino-German Energy Partnership and focusses on sharing German experiences with the energy transition and providing advice to the Chinese government and associated energy policy think tanks. In addition, valuable input from the Chinese partners will refine German practices and offer a different perspective on current and future approaches.

To carry out the project, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, the German Energy Agency (dena) and Agora Energiewende collaborate with the China Electric Power Planning and Engineering Institute (EPPEI), China Southern Power Grid (CSG), and the Institute for Applied Ecology at the Chinese Academy of Sciences (IAE).

MORE INFO

For more information about
the Sino-German Energy Transition Project (EnTrans),
read the project introduction brochure:

2 The Topics



The transition to a climate neutral energy system implies fundamental changes in the way energy is generated, integrated into the system, and consumed. These changes require the coupling of different sectors of the economy, and moving away from fossil energy generation towards power generation from variable renewables. This raises a number of challenges, particularly for an economy with growing energy needs like China.

The partners of the EnTrans project are working on topics central to meeting these challenges, ranging from distributed energy solutions and power market reforms, to tapping flexibility potentials, coupling the sectors using carbon-free hydrogen, and energy efficiency:

Distributed Energy	• Prosumer participation • Distributed solar and storage economics • Distributed solar economics and air pollution • Distributed renewables and system integration
Power Market Reform	• Flexibility and capacity adequacy
Sector Coupling	• Renewable and hydrogen: Hydrogen best practices and business cases • Renewable and hydrogen: Economies of scale for the green hydrogen supply chain • Renewable and mobility: High power charging in cities
Rural Energy Transition	• Exploit renewable energy potentials of Chinese rural areas
Provincial Energy Transition	• Promote the clean energy transition in China's coal regions
Grid Planning, Flexibility, Demand Side Management (DSM)	• Data centre flexibility for renewable integration
Energy Efficiency	• Demand side flexibility (DSF) and energy efficiency in the industry

In the following, detailed descriptions of the topics, their relevance to the Sino-German cooperation and planned outputs, such as workshops, analyses and technical studies are given.

2.1 Distributed Energy

Encouraging prosumer participation

OVERVIEW

This analysis will provide an overview of flexibility in distribution grids and describe the role of energy storage and demand side management (DSM) in a system with high renewable energy penetration. The goal is to develop policy recommendations that aim at improving the activation of flexibility and the engagement of decentralized storage and DSM by small consumers for the benefit of the energy system. While the focus of the research will lie on Germany and Europe, the policy recommendations can serve as a guide to policy makers everywhere, especially in China.

SIGNIFICANCE

In a future low-carbon energy system, a significant amount of power generation will be decentralized: private households and small businesses will operate renewable energy generation units connected to the low- and medium voltage grid. These prosumers contribute to the sustainability and security of the energy supply, but the volatility of renewable power generation, for example solar PV, gives rise to challenges with regard to network stability. DSM can partly balance production and demand fluctuations by switching demand loads on and off. Decentralized electricity storage plays a particularly important role, as it can serve as a technical flexibility tool and provide positive and negative balancing energy. Currently, however, the potential of these measures for providing flexibility is not fully used due to missing incentives. In a future renewable energy system, their activation will be essential for integrating renewables and keeping the grid stable.

METHODS

Dena will conduct a technical, commercial and regulatory analysis of decentralised storage and DSM based on current research and best practice examples. Together with a regulatory analysis of flexibility in distribution grids, this will set the foundation for developing policy recommendations.

OUTCOMES

Dena will summarise the central findings of the analysis in a technical report, which it will draw up in the first half of 2022. It will disseminate the findings to and discuss them with regulators, policy makers, DSOs as well as interested energy communities and small businesses in workshops to validate the results in the second half of 2022.

Distributed solar and storage economics

OVERVIEW

This internal, GIZ-led policy analysis and briefing paper illustrates the economics of distrusted solar and distributed energy storage through the internal rate of return (IRR) in cities with different time-of-use (TOU) prices and different solar irradiation. The GIZ analysis shows that solar PV paired with storage would be economically attractive for commercial customers in many regions of China at today's time-of-use electricity prices.

SIGNIFICANCE

Distributed energy is a central element of the low-carbon energy transition. In a distributed energy system, energy production and consumption will gradually shift from an extensive, central layout in which customers play a purely passive role, to one in which consumers and prosumers actively participate in energy production, storage, and demand response.

METHODS

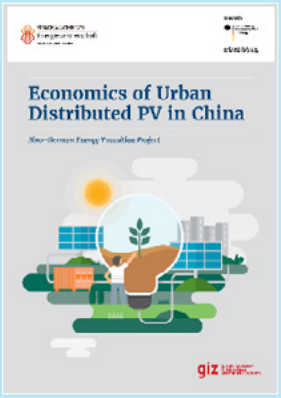
The study looks at 13 eastern Chinese cities because large, heavily populated, and economically prosperous coastal regions are likely to be the first to prioritise distributed solar energy as a strategy for early carbon peaking. Critical factors that affect the internal rate of return are local PV output, capital cost, local TOU prices, government subsidies, and the use of battery storage. The study models three different storage and battery scenarios to evaluate the economics of urban distributed solar in China and sensitivity to different factors.

OUTCOMES

The study will provide a map for distributed PV investment attractiveness given the internal rate of return (IRR) of the investment. Results distributed via blogs and website, and discussed at conference presentations.

MORE INFO

Download the study:



Enhancing economics of distributed solar by quantifying effects of air pollution

OVERVIEW

This GIZ-led research project aims to quantify the impact of air pollution on PV output at an urban location, with the aim of contributing to open-source models and tools for potential adopters of distributed solar as well as helping reduce the cost of financing and insuring small-scale solar projects in the developing world.

PARTNERS

GIZ is working with the China Academy of Sciences Institute of Atmospheric Physics and Envision Digital to implement the study.

ACTIVITIES

GIZ will hold a small, closed-door expert workshop in early 2022 to review the research results, aimed at a report and publication in 2022.

SIGNIFICANCE

Distributed energy is predominantly located in urban areas that face air quality challenges. The small scale of distributed solar projects makes extensive due diligence infeasible, meaning that such projects rely on industry knowledge and open-source tools for financing and insurance. Presently, there exists limited scientific knowledge in the public domain concerning the impact of air pollution, particularly particulates, on solar performance. Most publications in this field rely on satellite observations and modelling, not on physical experiments and ground-based observation.

METHODS

This project consists of a novel experiment that pairs data collected on the ground at urban sites in China with weather data to create an online tool for distributed solar project owners. The project can also enhance public awareness of the secondary benefits of policies to improve urban air quality.

OUTCOMES

GIZ and its cooperation partners aim to complete an open-source publication and web-based tool by the beginning of 2022.

Analysis of the role of distributed renewables in China's new electricity system

OVERVIEW

Renewable energy sources will play an increasingly important part in peaking China's national carbon emissions before 2030 and achieving carbon neutrality by 2060. In the context of new types of industrialization, digitalization, urbanization and developing modern agriculture, distributed renewables are expected to play an increasingly important role. The proposed project aims to explore the multi-dimensional characteristics of China's distributed renewables in terms of layouts, functions, formations, benefits, and costs. The authors will also draw from past experience and lessons in the European countries, especially Germany.

PARTNERS

Agora Energiewende, China Electric Power Planning and Engineering Institute (EPPEI), China Southern Grid Energy Development Research Institute, secretariat of Taiyuan Energy Low-Carbon Forum, Shanxi Energy Research Institute

ACTIVITIES

Europe-China dialogue on distributed renewables

SIGNIFICANCE

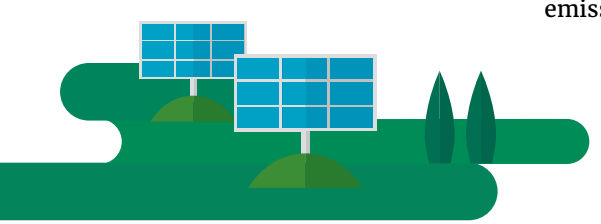
China has pledged to increase the installed capacity of wind and solar power generation from 510 GW as of 2020 to over 1200 GW by 2030, and plans to make renewables the main pillar of its electric power system. While China will continue to scale-up utility-scale wind and solar, distributed energy will become increasingly important. According to China's 14th Five-year Plan (2021-2025), distributed energy will be a focus for China's eastern and central regions. As many new factors such as digitalization, decarbonization, and technology contribute to the evolution of distributed renewables, studying China's distributed renewable development can help identify and prioritize policy options.

METHODS

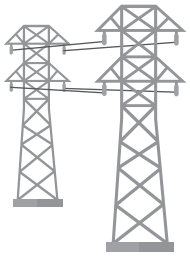
Following the conclusion of Europe-China Workshop on Clean Energy Transition in Taiyuan on 4 September 2021, which covered distributed renewable development, Agora Energiewende will analyze distributed renewables policies and practices in both China and Europe. The study will focus on new factors affecting distributed renewables in terms of technology, digitalization, markets and decarbonization. Furthermore, the study will evaluate China's distributed energy in terms of technology, costs, and benefits. Depending on additional need for in-depth policy exchange, the project may organize a follow-up Europe-China dialogue on distributed renewables in the months to come.

OUTCOMES

The project will publish research findings in 2022. The outcome of the project will contribute to clarifying the pathways of China's distributed renewables sector, assisting policymakers and regulators to gain an in-depth understanding of distributed renewables development and its role in peaking national carbon emissions and achieving carbon neutrality.



2.2 Power Market Reform



Flexibility and capacity adequacy

OVERVIEW

This analysis aims to quantify and compare the flexibility of electric power systems in China and Europe, and to compare methodologies planners use in each region to ensure the system's capacity is adequate to meet demand.

PARTNERS

To implement the analysis, the Energy Research Institute of the China National Development and Reform Commission has worked with the Danish Energy Agency (DEA) and GIZ to publish an initial study in 2020. In 2021 and 2022, dena and GIZ will work together with Germany-based Energynautics to develop quantitative estimates of flexibility for Germany and Europe and review capacity adequacy methodologies.

ACTIVITIES

Two policy reports (on flexibility and capacity adequacy) will be prepared. A series of workshops will take place in late 2021 and early 2022 to discuss the research output with project partners and Chinese stakeholders.

SIGNIFICANCE

In Europe, as coal and nuclear scale down and are replaced by variable sources of energy, flexibility and capacity adequacy are more important than ever — and more challenging to manage and plan. In China, where new coal plants are still the main solution for projected power shortages, system planners need to understand how power systems that scale back conventional generation can ensure flexibility and adequacy.

METHODS

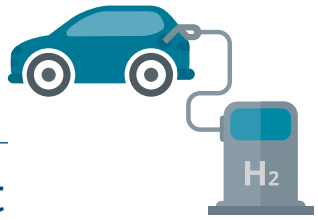
The research has two main components: flexibility and adequacy. The flexibility component will consist of both qualitative and quantitative analysis. The qualitative analysis will give an overview of the flexibility development path of the systems and different technologies and measures providing flexibility in China, Denmark and Germany. For the quantitative part, analysts will estimate and project past and future flexibility of key system elements in Germany, especially thermal plant ramp rates and minimum operating levels, and show how these characteristics will change until 2025. The Chinese project partners will use these metrics to perform modelling that can enable a comparison of system flexibility for Germany and other European regions along with the main regions of China.

The second component of the analysis will include a qualitative description and expert commentary on various capacity planning methodologies used by Transmission System Operators, grid planners, and regulators in Germany and other European countries.

OUTCOMES

The project aims to publish research in both 2021 and 2022 while making key experts available for discussion and input. The goal is to facilitate efforts in China and elsewhere to scale back construction of new coal plants to meet electricity demand growth by highlighting alternative flexibility solutions, and capacity adequacy planning methodologies.

2.3 Sector Coupling



Fostering renewable hydrogen development

OVERVIEW

This analysis investigates policies and regulatory frameworks to foster renewable hydrogen and the role of such frameworks in decarbonizing different sectors.

PARTNERS

In 2021, dena will work together with an external consultant to develop quantitative estimates of the economic viability of renewable hydrogen applications.

ACTIVITIES

A policy report will be prepared in 2021. Two workshops will take place in late 2021. In the first workshop, the project partners and Chinese stakeholders will discuss the feasibility of developing a hydrogen economy as well as questions about financing. In the second workshop, the project partners will present their results on the economic viability of renewable hydrogen applications and discuss them with German and Chinese stakeholders.

SIGNIFICANCE

Hydrogen is an essential component of a fully climate-neutral energy system, along with the expansion of renewable energy and electrification. Without hydrogen, it would be difficult to reach net zero emissions: some forms of transport, such as aviation and shipping, cannot be electrified, and several industrial processes cannot use electricity directly and need hydrogen as feedstock.

Energy efficiency and renewable electricity are prerequisites for a future hydrogen economy. With renewable energy becoming the predominant power source in some countries, and the electrification of transport and industry progressing, hydrogen has attracted the attention of policy makers around the world. The interest is driven by both supply and demand. Given forecasts of declining electrolysis costs and rising renewable electricity output, many experts believe renewable hydrogen will become commercially viable in the near future. Increasing climate ambitions and progress in reducing power sector emissions have shifted the attention of global policy makers towards the other sectors of the economy, where hydrogen can displace fossil fuels.

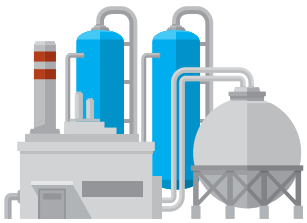
METHODS

A policy report will process current knowledge based on desktop research. Interviews with stakeholders will provide insights into the possibility of using electrolysers to provide system services and thus actively use hydrogen production for sector coupling. With the help of a consulting partner, the impact of technical standards and political measures on the cost competitiveness of hydrogen is quantified.

OUTCOMES

The results should enable policy makers to assess for which applications the use of hydrogen will be worthwhile in the future and how strongly this development depends on technical, economic and political decisions.

How to foster economies of scale for the green hydrogen supply chain



OVERVIEW

This project aims to identify how to realize economies of scale for the green hydrogen supply chains.

PARTNERS

Agora Energiewende, Shanghai Institute for International Studies, Energy Investment Committee of China Association of Investment

ACTIVITIES

Following the Europe-China Workshop on Clean Energy Transition in Taiyuan on 4 September 2021, which included hydrogen development, Agora Energiewende plans a follow-up workshop to assemble key Chinese and German/European experts in discussion of the green hydrogen economy. The workshop is expected to take place as a side event of the forthcoming China International Imports Expo 2021 in Shanghai. During the forthcoming workshop, presentations on pilot projects, experience sharing, and roundtable discussion will include representatives from the business community, industrial associations, research institutions and academia. Agora Energiewende will deliver a report that reflects key take-away messages from the workshop and provide additional research findings.

SIGNIFICANCE

Hydrogen made from renewable energy (known as green hydrogen) possesses great potential to decarbonize carbon-intensive industrial sectors like iron and steel, cement, and chemicals. Hydrogen metallurgy could help reduce carbon emissions by 90% compared with traditional blast furnace process. Hydrogen as a secondary energy source also possesses great potential to eliminate fossil fuel consumption in industrial sectors that require high temperature heat, which are primarily met by coal combustion in the Chinese context. Meanwhile, Germany has had several successful explorations in hydrogen direct reduced iron (DRI) and policy support to green hydrogen, which China could refer to when identifying the role of green hydrogen in decarbonizing its industrial sectors. Moreover, because the green hydrogen production technology is not commercialised yet, how to scale up green hydrogen is key for industrial decarbonization in China. By sharing the current development of green hydrogen in Europe and organizing discussions on how to foster economies of scale for the green hydrogen supply chain between Europe and China, this project aims to promote development of the industrial-scale green hydrogen economy.

METHODS

Through a workshop, experts from both Germany and China will present and discuss best practices in both countries. These may come from the steel sector where hydrogen could be used as reduction agent, or chemical sector where it is used as the raw material. When preparing for the event, for panellists to have in-depth discussions at the roundtable, hydrogen production development in the short and long term will be summarised and key questions for industrial use will be designed.

OUTCOMES

Agora will publish a brief report summarizing findings and take-home messages from the workshop with the aim of informing the international and Chinese audiences alike on how green hydrogen development may be stimulated to scale up in its full supply-chain in China.

High power charging in cities

OVERVIEW

Through this collaborative research, the Energy Transition project and its partners seek to determine best practices in facilitating the integration of EVs and its HPC infrastructure in urban areas. The research will specifically help German and Chinese think tanks inform NEA and BMWi and help contribute to the development of low-carbon aspects of policy planning.

PARTNERS

To implement the analysis, GIZ is cooperating with two research partners. Reiner Lemoine Institute (RLI) will carry out the German side of the study. The China Society of Automotive Engineers (SAE) will carry out the Chinese side of the study. The research is also supported by Electric Power Planning & Engineering Institute and China Southern Power Grid.

ACTIVITIES

The project will organize an interim results workshop in late 2021 and a final report launch event in 2022 to discuss the research output, together with project partners and Chinese stakeholders.

SIGNIFICANCE

Cities have a high potential for integrating renewable energy on a large scale and a fast uptake of innovation. High-power charging is a great way to help achieve RE integration. However, cities face challenges regarding distribution of space, since transport, residence, commerce and industry all compete for the same locations. Therefore, it is valuable to determine best-practice approaches in China and Germany on efficient HPC planning and investment, and to identify new technologies and business models to facilitate the implementation of high-power charging in urban areas. The study will also assist and advise cities in China and Germany to optimize investments on grid and charging infrastructure.

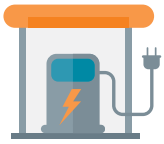
METHODS

The project plans to first conduct stakeholder interviews in both Germany and China, then analyse the response. Firstly, the interviews will cover a variety of stakeholders in the HPC industry, including fleet operators, authorities, bus operators, energy providers and grid companies. The interviews will focus on the interactions among stakeholders and plans to solve challenges that involve multi-stakeholder interactions, especially the demand of users. Secondly, the project will model usage scenarios to investigate the integration of RE and development pathways of HPC infrastructure. Based on the research results, the project will provide policy advice to both Berlin and Shenzhen governments in HPC development strategies.

OUTCOMES

The project aims to publish research in both 2021 and 2022 while making key experts available for discussion and input. The goal is to facilitate efforts in China and elsewhere to develop HPC infrastructure in an inclusive way and to identify challenges and possible solutions to the planning and setting up of HPC infrastructure.

2.4 Rural Energy Transition



OVERVIEW

For this research effort, the Sino-German Energy Transition Project has partnered up with researchers in China and Germany to gather data about self-sufficiency potentials and energy flows in villages in China and Germany, modelling their renewable energy potentials and energy demand. The German research activities also account for growing loads in local grids from electric vehicle charging and the flexibility potentials of vehicle-to-grid charging.

PARTNERS

In China, the Shenyang Institute of Applied Ecology of the China Academy of the Sciences is conducting surveys and modelling in five villages or counties. Data collection for modelling in Germany is conducted in the village of Schwaig, near the city of Munich in Bavaria by the University of Wuppertal and the Wuppertal Institute.

ACTIVITIES

Data collection has been ongoing as of mid-2021, analysis results are expected in the summer of 2021. The release of research reports and a dissemination workshop is planned for late 2021.

SIGNIFICANCE

Whereas in both Germany and China, most of the population live in cities, rural areas are an important part of the energy transition. They often have strong potential for a high degree of self-sufficiency through renewable energy. In China, research on the rural energy transition is still scarce relative to more city- or region-oriented research. At the same time, energy supply in villages often is still reliant on inefficient and polluting coal stoves, especially for heating and cooking, despite efforts to phase them out. This does not only have negative effects on the climate, but also on local air quality and resident health. Therefore, the unexploited renewable energy potentials of Chinese rural areas merit more research. In Germany, there are already many villages with a high degree of self-sufficiency in renewables. However, increasing electrification in transport and heating poses new challenges and opportunities that this research project examines.

METHODS

After selecting suitable villages, researchers in China and Germany gather survey data. Depending on the country, energy consumption, energy supply technologies applied in the household, and socio-demographic data is surveyed. In Germany, car ownership and usage patterns, as well as intended purchases of electric vehicles are taken into account. In addition to household survey data, public data and local administration data are gathered. Using this data, energy supply and demand are simulated in models and resulting energy flows are depicted in Sankey diagrams. Modelling in Germany also accounts for the expected surge in electrification in heating and transport by including scenarios for heat pumps and electric vehicles up to 2030 into the model. Importantly, research in Germany also examines the flexibility potential of vehicle-to-grid charging to provide power to the grid in times of low supply.

OUTCOMES

The project aims to publish research results in late 2021 and will discuss results on an expert workshop. The objective is to provide researchers and policymakers in China with scientific analyses of the potentials of rural areas for the energy transition. Research results in Germany feed into the German energy transition discussion as well, where especially the vehicle-to-grid aspect is a relatively novel topic. First modelling results from one Chinese village imply that the village could meet 63% of its externally sourced energy supply by exploiting its solar energy and biomass potentials.

2.5 Provincial Energy Transition

OVERVIEW

Shanxi is one of the most important coal producing regions in China. Since the foundation of the People's Republic of China in 1949, Shanxi has accounted for nearly one quarter of China's cumulative national coal production. Starting from 2019, Shanxi was designated by the State Council of China as the pilot region to experiment with comprehensive and revolutionary energy reform. To transfer German clean energy transition experience to Shanxi province, especially regarding the transition away from coal, Agora Energiewende will work with EPPEI to organize clean energy transition dialogues. Agora and GIZ have co-hosted a sub-forum during the Taiyuan International Low Carbon Energy Development Forum to discuss German clean energy transition experiences, and Agora Energiewende will design further capacity building activities targeting stakeholders in Shanxi and beyond.

PARTNERS

Agora Energiewende, China Electric Power Planning and Engineering Institute (EPPEI), China Southern Grid Energy Development Research Institute, secretariat of Taiyuan Energy Low-Carbon Forum, Shanxi Energy Research Institute

ACTIVITIES

On 15 April 2021, Agora and GIZ co-organized a Europe-China dialogue on transitions of coal regions to low carbon. Following the successful conclusion of the above event, Agora and GIZ also co-hosted a sub-forum during the high-level 2021 Taiyuan Energy Low-Carbon Development Forum on 4 September 2021, with emphasis on provincial coal transition, distributed renewables and green hydrogen. During the event, Agora signed a Memorandum of Understanding with the Taiyuan Energy Low-Carbon Development Forum and Shanxi Energy Research Institute on cooperation on energy transition.

SIGNIFICANCE

Energy transition in key regions is crucial to the success of the national transition. However, most of the exchanges and cooperation between China and Germany for now stays on the national level. To allow more practical interactions on the sub-national level, it is significant to take a closer look into the changes that coal regions of the two countries are undergoing. This project allows Agora to create an exchange channel between Shanxi and Germany and to share the energy transition experience and communicate views with stakeholders on both national and regional levels.

METHODS

Agora will organize various events, including online and offline public workshops and internal dialogues to discuss issues regarding regional transition, new dynamics for economic development in the context of China's 2030 and 2060 climate targets, the role of hydrogen in clean energy transition, role of distributed energy in building new power system with high RE integration, energy corporate strategies in coal-producing areas. The events will include two panel discussions between participants from EU and China, with speakers from provincial government, BMWi, think tanks, academia, coal corporates, industrial association, and consultants.

OUTCOMES

By engaging provincial actors, including government, research institutes, corporate sector in dialogues on regional coal transition, energy transformation and exchanging ideas and scenarios on achieving carbon neutrality, Agora will summarize the take-home messages from the events and deliver a summary report on provincial coal transition.

2.6 Grid planning, Flexibility, Demand Side Management (DSM)

Data centre flexibility for renewable integration

OVERVIEW

The Sino-German Energy Transition Project implementing partners dena and GIZ are working together with the Electric Power Planning and Engineering Institute (EPPEI) and experts from the North China Electric Power University and Greenpeace East Asia on technical options and business models for data centres to participate in the power market and deploy their flexibility and overall sector coupling potential. Researchers have conducted interviews with data centres, grid operators, and academics in China and Germany to identify the current situation and challenges. Based on the interviews, the researchers can identify best practices and share recommendations for improved policy and market conditions.

PARTNERS

In China, EPPEI coordinates and supports the research efforts. Consultants carried out research and interviews on the topic. GIZ conducted scoping research on the international situation and dena conducts interviews and analysis in Germany. A Germany-based research partner assesses successful business models in the area of data centre grid integration.

ACTIVITIES

The project and its partners finished background research in early 2021 and collected interview results from Germany and China in mid-2021.In two closed-door workshops, the report's interim results will be presented and discussed with German and Chinese stakeholders in September and November 2021. The results will be considered and integrated into the final report. A final release event of the studies will take place in the beginning of 2022.

SIGNIFICANCE

In 2018, data centres already accounted for 1% of global energy consumption. Depending on efficiency gains and growth of the computing industry, some studies project that data centres may make up 3-13% of the global energy consumption by 2030. Thus, data centres require the attention of energy transition research. Data centres offer significant flexibility potential, because they can shift their energy-intensive computations to times with lower loads and higher power availability. They also generate a lot of heat, which can be fed into district heating grids or nearby building heating systems. These and other technological options hold promise, but they require viable business models. Both in Germany and China, there remain major obstacles to realizing these business models. Thus, this research can make an important contribution to policy development and research in both countries by highlighting these challenges for policy makers and identifying possible solutions.

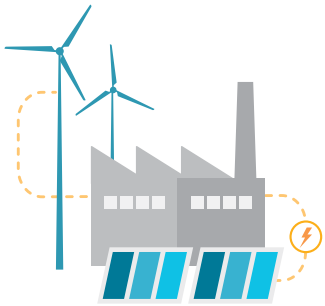
METHODS

Both in China and in Germany, researchers conduct interviews with data centre operators and researchers about technical options regarding flexibility, grid integration, efficiency, and market participation. The partners will summarise results in a report and discuss them with experts and policymakers.

OUTCOMES

The project aims to publish research results in late fall 2021 and discuss results through two expert workshops. This research effort aims to provide researchers and policymakers in China and Germany with practical experiences and practitioners' perspectives on data centre integration into the energy system of both countries, which points out current challenges and solutions. Thus, the project contributes to improving the framework conditions for data centres to bring their flexibility potentials into play.

2.7 Energy Efficiency



Integrating energy efficiency and demand side flexibility in the industry

OVERVIEW

The analysis aims to identify and evaluate the interdependencies between energy efficiency and demand side flexibility (DSF) in the industry and highlight best practices in Germany and China. The analysis will inform the development of an approach for an "efficient system optimum" that helps regulators prioritize measures of improving energy efficiency and exploiting DSF potentials in different industrial sectors.

PARTNERS

To identify and evaluate the interdependencies between energy efficiency and DSF in the industry, dena will gather experiences from aggregators and industrial companies that either have implemented DSF or have received DSF marketing offers from aggregators, but did not carry out the implementation. For the modelling of an efficient system optimum, dena will work with a partner with experience in energy system modelling and energy efficiency and DSF in the industry.

ACTIVITIES

Together with partners, dena will carry out interviews with, among others, industrial companies, research institutes and industry associations. A final policy report will be available during the course of 2022. In preparation, dena will organize two workshops. The first will bring together the project partners, German and Chinese stakeholders to discuss preliminary results of the efficient system optimum modelling and first key take-aways. The second workshop will focus on presenting the policy report and the results of the analysis.

SIGNIFICANCE

The interdependencies between energy efficiency and DSF in the industry are not yet thoroughly researched, but are important for an efficient system optimum and for regulators to design policy instruments accordingly. With this analysis we will cover the research gap by developing a concept for integrating the requirements of improving energy efficiency and exploiting DSF potentials in the industry (efficient system optimum), by analysing the profitability of DSF for end users, and by making proposals for suitable policy instruments for promoting energy efficiency and DSF in the industry.

METHODS

A policy report is prepared, which will process current knowledge based on desktop research. Interviews with industrial companies and other stakeholders will provide insights into the incentives and barriers of applying DSF in the industry as well as the interdependencies between energy efficiency and DSF. Together with a research institute, the interdependencies of the energy efficient optimum are modelled.

OUTCOMES

The aim is to inform Chinese and German energy policy makers, energy experts and grid planners on best practices for energy efficiency and DSF in the industry. This showcase will support policy makers in developing policies on energy efficiency and DSF, taking into account the interdependencies between the two measures.

3 The Experts

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