energies

Review

Incentive Mechanisms to Integrate More Renewable Energy in Electricity Markets in China

Shuangquan Liu [1], Yanxuan Huang [2,3], Yue Wang [2], Qizhuan Shao [1], Han Zhou [1], Jinwen Wang [2] and Cheng Chen [4,*]

1 Yunnan Power Grid Co., Ltd., Kunming 650011, China; liushuangquan@yn.csg.cn (S.L.)
2 School of Civil and Hydraulic Engineering, Huazhong University of Science and Technology, Wuhan 430074, China; jinwen.wang@hust.edu.cn (J.W.)
3 Yalong River Hydropower Development Co., Ltd., Chengdu 610051, China
4 Faculty of Electric Engineering, Kunming University of Science and Technology, Kunming 650504, China
* Correspondence: chencheng410@gmail.com

Abstract: China has made significant progress in developing renewable energy, but challenges in integrating variable sources like wind, solar, and hydro power persist. Existing research has a regional focus and lacks a comprehensive understanding of integration challenges in specific regions. Moreover, research concentrates on individual energy types rather than multiple sources. Addressing these challenges requires a deeper analysis of market rules, incentives, and mechanisms for integrating numerous renewable energy types. The existing research also overlooks crucial aspects like energy consumption, grid planning, and power market mechanisms. To promote renewable energy integration effectively, policymakers must address these interconnected factors through comprehensive investigations and research efforts. This study proposes tailored solutions to encourage integration in China based on international experiences, such as Brazil's contract markets and electricity redistribution mechanism, the Nordic spot market, and California's negative pricing mechanism. The strategies derived from global practices for China's renewable energy integration include diverse trading mechanisms, expanded contract markets, optimized local consumption, fortified grid infrastructure, and improved market mechanisms.

Keywords: renewable energy consumption; electricity market; market mechanism; spot market

Citation: Liu, S.; Huang, Y.; Wang, Y.; Shao, Q.; Zhou, H.; Wang, J.; Chen, C. Incentive Mechanisms to Integrate More Renewable Energy in Electricity Markets in China. *Energies* **2023**, *16*, 6573. https://doi.org/10.3390/en16186573

Academic Editor: Ignacio Mauleón

Received: 12 July 2023
Revised: 25 August 2023
Accepted: 27 August 2023
Published: 12 September 2023

1. Introduction

China is in a critical period of promoting the transition to renewable energy, as a meaningful way to ensure energy security and mitigate climate change. China has invested heavily in renewable energy for decades, with wind and solar power developing rapidly and hydropower capacity continuing to grow. Numerous previous works have reviewed issues in managing renewable energy in electricity markets in China.

The existing literature shows a regional imbalance in research focusing on renewable energy integration in China, with a predominant emphasis on the eastern regions and limited attention given to the integration of hydropower in Southwest China and wind and solar energy in Northwest China. For instance, Liu et al. (2018) discussed the curtailment of renewable energy in Northwest China and market-based solutions [1]. Similarly, He et al. (2016) reviewed a regulatory policy to promote renewable energy consumption in China, highlighting the challenges faced by different development phases [2]. Meanwhile, Cheng et al. (2018) discussed the architecture of Yunnan's hydropower-dominated electricity market, focusing on regional market elements [3]. This regional imbalance results in a lack of comprehensive understanding of the challenges and difficulties that regions like Northwest China and Southwest China face in integrating renewable energy effectively. Consequently, addressing these specific challenges and promoting renewable energy integration in these regions remains a pressing issue that requires further research and policy attention.

Furthermore, existing research tends to focus on integrating specific energy types, such as hydropower or wind integration, rather than considering integrating multiple renewable energy sources, which is a more prevalent and complex scenario. As Liu and Xu (2021) emphasized, developing appropriate market designs for including renewable energy in the electricity spot market remains an ongoing challenge [4]. This calls for a deeper analysis of the effects of different market rules on wind power producer behavior and the policy implications for a renewable-friendly spot market. Additionally, Punda et al. (2017) discussed integrating renewable energy sources in Southeast Europe, pointing out the importance of feed-in tariffs as a supporting mechanism for renewable energy development [5]. However, they also highlighted the need for a new, more sustainable, long-term model, such as the feed-in premium model for market performance, to encourage efficient renewable energy production. Hence, there is a need for more comprehensive investigations into the integration of numerous renewable energy types, considering different market mechanisms and incentives, to address practical challenges and enhance the understanding of this field.

Moreover, the existing research primarily emphasizes the integration of policies and mechanisms, while overlooking other crucial aspects, such as energy consumption, grid construction planning, new energy system development, and power market mechanisms. As highlighted by Guo et al. (2020), the power market reform in China requires comprehensive alignment with short-term markets, a greater role for independent regulation, compatibility with renewable energy, and interprovincial coordination [6]. Similarly, Zhang et al. (2018) emphasized the need for government regulation of renewable power generation and transmission in China's electricity market to address poor integration and increasing renewable energy curtailment [7]. A multilevel integration of these interconnected factors is pivotal to achieving effective implementation and marketization of renewable energy. This calls for comprehensive investigations and research efforts to develop a holistic understanding of the interactions and dynamics among these aspects. By addressing this notable gap in research, policymakers and stakeholders can ensure the successful integration and utilization of renewable energy in the evolving energy landscape.

This study overviews international practices of renewable energy integration, exploring cases from Brazil, the Nordic region, and the USA. From Brazil's innovative contract markets to the Nordic region's multifaceted spot market and the USA's creative pricing mechanisms, diverse strategies are examined. Drawing inspiration, tailored recommendations are presented for China, encompassing dynamic demand alignment, structured sustainability paths, enhanced grid security, localized consumption, and adaptable trading. This synthesis of global insights aims to guide China's unique journey in addressing renewable energy challenges. Figure 1 presents a diagrammatic sketch of the research.

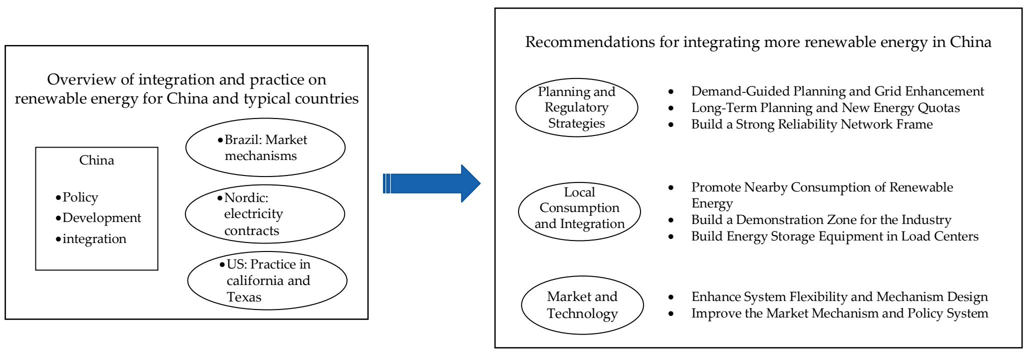

Figure 1. Diagrammatic sketch of the research.

2. Policy and Integration Situation of Renewable Energy in China

2.1. Policies to Encourage Consuming Renewable Energy

China's National Energy Administration (CNEA) issued the "Guidelines on establishing a target guidance system for the development and utilization of renewable energy" in March 2016, aiming to scientifically plan the targets for developing renewable energy to address increasingly prominent problems in integrating renewable energy. Then, it issued the "Implementation scheme to reduce the waste of hydro, wind and solar energies", "Clean energy integration action plan (2018, 2020)", and other documents to encourage taking active measures to promote high-quality development and adequate integration of renewable energy. In 2018, the CNEA solicited and discussed comments three times on the "Renewable energy power quota and assessment methods", indicating the transition of the energy-supporting policy of China from price-fixed electricity to a renewable energy quota system. In May 2019, the China National Development and Reform Commission (CNDRC) and the CNEA jointly issued a notice on "Establishing and improving the mechanism to ensure adequate integration of renewable energy", requiring regions at the provincial level to share responsibility for integrating renewable energy. In June 2022, the National Development and Reform Commission, the Energy Administration, and nine other departments jointly issued the "14th Five-Year Plan for Renewable Energy Development", anchoring the goals of carbon peak and carbon neutrality, clarifying the main directions and targets of renewable energy development during the 14th Five-Year Plan period, with the intent that renewable energy will change from the original incremental supplement of energy and electricity consumption to the main body of energy and electricity consumption increase [8].

2.2. Development of Renewable Energy

The installed capacity of renewable energy in China was 0.48 billion kW at the end of 2015. During the 13th Five-Year Plan period, China invested about CNY 2.5 trillion in renewable energy, making the country the largest renewable investor in the world and strongly promoting the optimization of China's energy structure. After steady year-by-year growth, it reached 1.063 billion kW for renewable energy by the end of 2021, increasing by up to 120% compared to 2015. Among the renewables, wind and solar power increased most significantly. The solar power growth rate increased by nearly 80% in 2016, the first year of the 13th Five-Year Plan, and wind power also reached its peak growth in 2020. Figure 2 illustrates the installed capacities (a) and growth rate (b) of renewable energy in China from 2015 to 2021 [9–15].

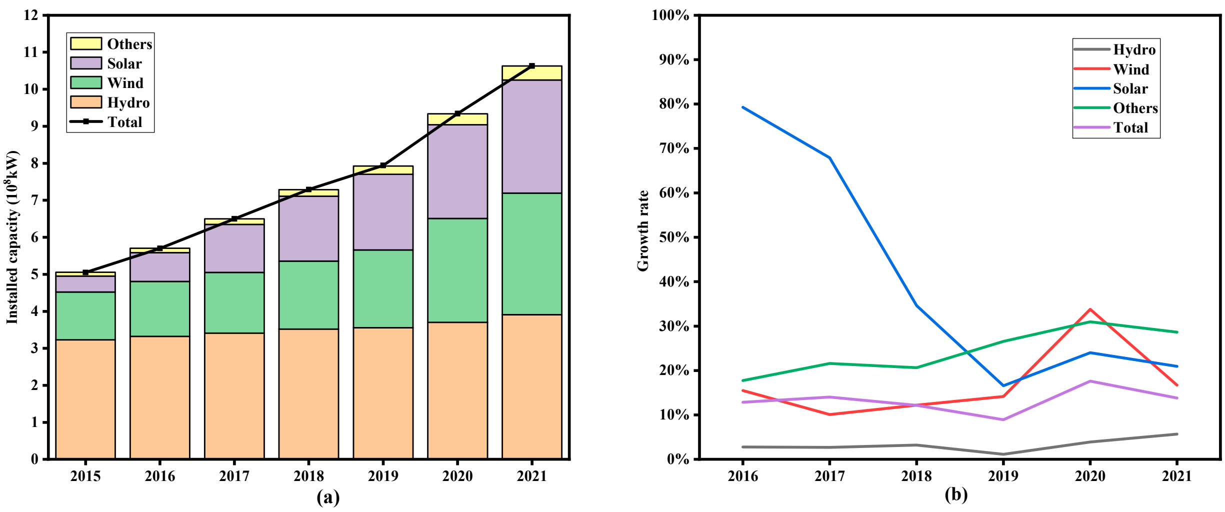

Figure 2. Installed capacities (**a**) and growth rate (**b**) of renewable energy in China from 2015 to 2021.

Figure 3 depicts the proportion of installed capacity for various energy sources in 2022. The proportion of renewable energy's installed capacity had increased to 47.3%. As the country with the largest renewable energy production capacity, China's utilization of renewable energy is constantly improving. In 2022, China produced 2.7 trillion kWh of renewable energy, with a year-on-year increase of 1.7%, accounting for 31.6%% of the total electricity generation [16]. By the end of July 2023, China's renewable installed capacity reached 1.32 billion kW, accounting for 48.7% of the total installed capacity, including 418 million kW of hydropower, 389 million kW of wind power, and 470 million kW of solar power [17]. The total installed capacity of hydro, wind, and solar power is the largest in the world, and the role of renewable energy in replacing fossil fuel energies is increasingly prominent.

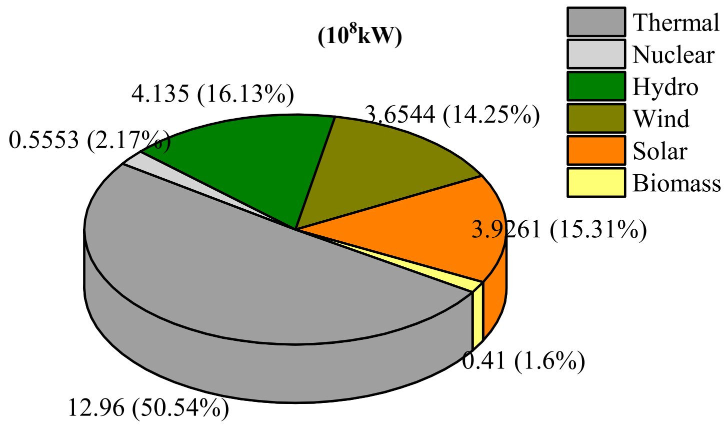

Figure 3. Proportion of installed capacity for various energy sources in 2022.

2.3. Integration of Renewable Energy

2.3.1. Hydropower

China is rich in hydropower resources, with the installed hydropower capacity accounting for more than 30% of the world's total. The hydropower resources are distributed unevenly over regions in the country, mainly concentrated in the southwest areas, especially in Yunnan and Sichuan Provinces. The current economic development and industrial structure make it possible to consume only a small part of hydropower production locally, and the construction of power grids is relatively lagging, leading to insufficient capacity in transmitting electric power across regions. Hydropower spillage is particularly massive in the southwest, where the installed capacity and production of hydropower keep growing. In 2016, Yunnan and Sichuan Provinces had 31.4 and 16.4 billion kWh of hydropower curtailment, respectively, accounting for about 96% of the total spillage in China [18].

In 2017, the CNDRC and CNEA jointly issued a "Notice on promoting hydropower integration in Southwest China" to effectively address hydropower curtailment problems in the southwest by planning and constructing more electric power transmission facilities and, at the same time, establishing and improving the market mechanisms to integrate more hydropower production. The amount of hydropower curtailed in Sichuan Province dropped to 9.2 billion kWh in 2019, falling for three consecutive years and reaching the lowest level in six years, and in 2021 9.444 billion kWh of abandoned hydropower was discarded—a year-on-year decrease of 22.6%, mainly attributable to a better trading mechanism in the electricity market and the full operation of UHV power transmission channels, especially the Fufeng and Binjin channels. In the same year, only 2.4 billion kWh of hydropower was curtailed in Yunnan Province, which fostered its power demand by vigorously supporting energy-intensive industries such as electrolytic aluminum and silicon plants, and at the same time promoting wider consumption of clean energy by selling more electricity across provinces through the market trading mechanism. Despite the decreasing hydropower curtailment rate in China over the years, challenges remain in effectively integrating hydropower energy, due to various factors, such as slowing economic growth and obstacles in delivery channels.

2.3.2. Wind Power

In 2020, the installed capacity of wind power connected to power grids increased by 71.7 million kW, up by 178% year on year, and the total installed capacity of wind power was 282 million kW, accounting for 10.4% of the total installed capacity in China. The wind power generation reached 466.5 billion kWh, up 15% year on year, accounting for 21.2% of the total generation. During the 13th Five-Year Plan period, the average utilization hours of wind power in China increased significantly, from 1728 h in 2015 to 2082 h in 2019, with a cumulative increase of 20.48%. Yunnan Province has the most average utilization hours of wind power in China, at 2808 h, followed by Fujian Province and Sichuan Province. Meanwhile, introducing renewable energy quotas and a moratorium on new wind power projects in areas with high wind curtailment has helped ease the wind curtailment and power rationing across the country. Figure 4 illustrates the new installed capacities, generations, curtailment, and curtailment rates of wind power during the 13th Five-Year Plan in China. New installed capacity and generation for wind power continued to increase constantly, while curtailment and the curtailment rate gradually reduced. The curtailment rate for wind power in 2020 reached to 3%, indicating that the consumption of wind power has continued to improve [14,19–22].

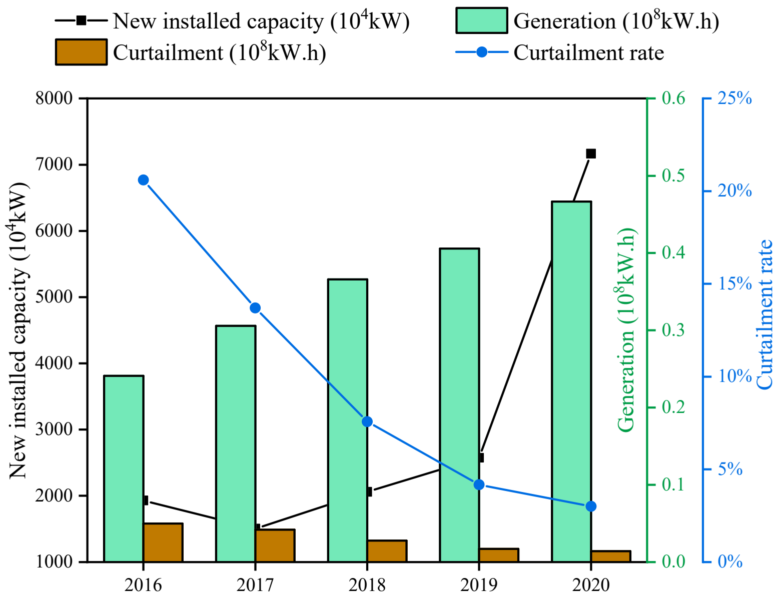

Figure 4. New installed capacities, generations, curtailment, and curtailment rates of wind power during the 13th Five-Year Plan in China.

At present, Northwest China is where most of the wind curtailments occur. In 2021, the wind power utilization rates in Xinjiang, Qinghai, and Inner Mongolia were 92.7%, 89.3%, and 91.1%, respectively, which are still far from the national average wind power utilization rate of 96.9%.

2.3.3. Solar Power

In 2021, China's new grid-connected photovoltaic power generation capacity was 54.88 million kilowatts, of which distributed photovoltaic installation added 29.28 million kilowatts, exceeding 50% for the first time, and the trend of centralized and distributed development of photovoltaic power generation is evident. The installed capacity of distributed photovoltaics exceeded 100 million kilowatts, accounting for about one-third of the total grid-connected installed capacity of photovoltaic power generation.

The government issued a "Notice on matters concerning solar power generation" in 2018 to control the construction scale of solar power projects and promote the integration of solar energy by strictly limiting and reducing price subsidies for new photovoltaic projects. China generated 224.3 billion kWh of solar energy in 2019, an increase of 89.5% compared with 2017. The average annual utilization of solar power was 1169 h, with a total of 4.6 billion kWh curtailed in 2019, and the curtailment rate dropped to 2%. Figure 5 illustrates the development and consumption of solar power during the 13th Five-Year Plan period. The new installed capacity and curtailment rate of solar power show a similar trend to that seen for wind [18,23–26].

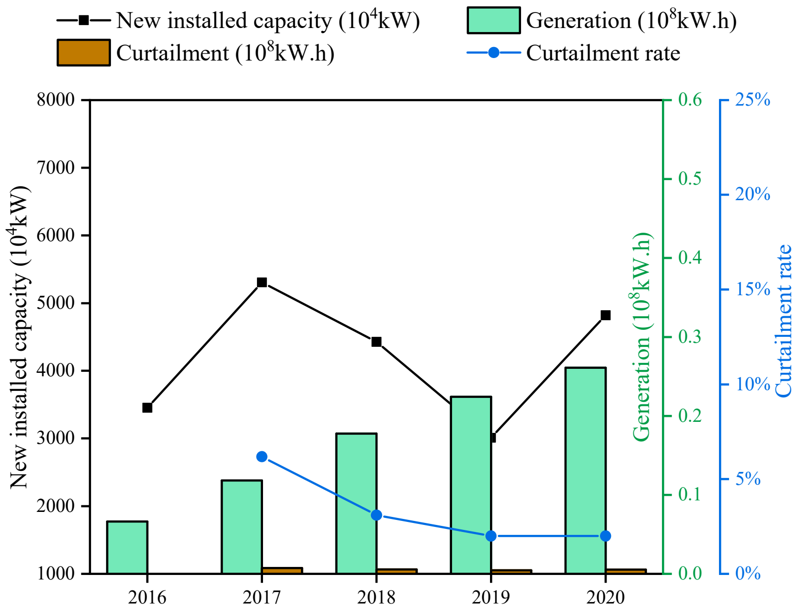

Figure 5. New installed capacities, generations, curtailment, and curtailment rates of solar power during the 13th Five-Year Plan in China.

3. International Practice to Integrate More Renewable Energy through Market Mechanisms

3.1. Brazil

3.1.1. Basic Situation of Brazilian Electric Power

Renewable energy dominates the energy structure of Brazil, which is particularly rich in hydropower resources. Brazil's installed hydropower capacity increased by 4919 MW in 2019, surpassing China to become the country with the largest newly installed hydropower capacity in the year, and reaching a total installed hydropower capacity of 109 million kW [27]. In 2019, Brazil generated 625.59 billion kWh of electricity, including 399.30 and 117.65 billion kWh from hydropower and other renewable energy sources, respectively, making 516.95 billion kWh in total from renewable energy sources, which accounted for 82.6% of the country's electricity generation [28].

The Brazilian transmission network comprises the National Interconnected System (SIN) and other isolated systems [29]. The SIN connects Brazil's major power stations to most of the country's electricity consumption areas, covering more than 95% of the population and delivering 98.3% of the electricity, while the isolated grid systems are scattered only in the northern Amazon region [30]. Like China, Brazil's power resources mismatch its load demand in distribution across regions, with resources abundant in North and Northeast Brazil, yet more than 80% of the load demand is in the South and Southeast–Midwest regions, where the cities of Rio and Sao Paulo are located, most of the power lines in Brazil are concentrated, and the extra high-voltage transmission lines are connected to large hydropower plants like Itaipu and Belo Monte [31].

3.1.2. Brazilian Market Mechanisms to Promote Renewable Energy Integration

The Brazilian government tried integrating more renewable energy by designing a better market structure and introducing a redistribution mechanism for electricity [32,33]. The Brazilian electric power system adopts the economic dispatch mode based on the principle of minimum cost and optimizes the operation of all power stations to make full use of hydropower resources. Power trading contracts are not considered in the dispatching process; that is, power trading and operation dispatching are isolated. The connection between power trading and operation dispatching is established through the "guaranteed capacity" and electricity redistribution mechanism, which guarantee the feasibility of unified economic dispatching under the competitive electricity selling market mechanism [34]. The electricity market in Brazil comprises the medium- and long-term contract market (MLTCM) and the short-term market, where the MLTCM is the major one that ensures that all electricity demands are met by the amount of electricity traded, in such a way as to ensure a stable power supply and fair and reasonable electricity prices. At the same time, it also means that distribution companies and power users do not need to participate in transactions in the short-term market, helping weaken the impact of price fluctuations on the market and greatly reducing the difficulty for the government to regulate the market. As a supplement to the medium- and long-term contracts market, the short-term market has a small share, mainly responsible for ensuring the balance between electricity supply and demand, as well as providing price signals. There are 69 hydropower stations in Brazil, with an installed capacity of 25,120 MW. However, as long as the availability rate assessed by the National Electric Power Dispatching Center of Brazil meets the requirements, the annual income of the power station will be calculated according to the preapproved yearly operating costs and technical transformation costs [35].

The MLTCM in Brazil can be divided into regulated and free contract markets [36,37]. In the regulated contract market, the power distribution enterprises represent small and medium-sized enterprises and ordinary users to participate in market transactions and sign long-term power purchase agreements to ensure meeting the electricity demand of these users, who are great in number and an electricity consumption accounting for more than 70% of the market trading amount. Public auctions are employed for transactions in the regulated contract market, where the distribution companies are required to submit the predicted load demand before power purchase, while the power exchange divides the power suppliers into the old and new ones. Newly commissioned power supplies are responsible for meeting the forecasted demand growth and need to take on greater market risks due to higher pressure to recover the investment cost. The demand-guided supply can avoid the difficulty of integrating renewable energy caused by the excessive growth of generating units. In the free contract market, both trading parties determine the transaction quantity and price of electricity through free negotiation to give full play to the role of the market in allocating resources. The free contract market generally has medium-term contracts of about five years, which are more flexible than long-term contracts of 20–30 years in the regulated contract market. Electricity users in the free contract market are classified into free users, who sign conventional power contracts, and special users, who can sign both conventional and non-conventional contracts. The government sets up non-conventional power contracts to encourage electricity purchasers, who enjoy government subsidies, to consume more emerging renewable energy, such as wind and solar.

An electricity redistribution mechanism is implemented to encourage complementary cooperation between rivers and among cascaded hydropower plants, reducing the uncertain impacts of hydrometeorological and other factors on the revenue of hydropower suppliers. All hydropower plants subject to the unified dispatch and planning under the National Dispatch Center (NDC) are required to implement the electricity redistribution mechanism, which, however, the others (primarily small hydropower plants) can choose to join or not. Under this mechanism, each hydropower plant declares its firm output according to the inflow forecast and available units, and the sum of the firm outputs of all power stations is determined as the guaranteed capacity of the system. The revenue of a hydropower plant no longer depends on how much energy it produces, but on the joint influence of the declared firm outputs and the overall power generation of the system [38]. If the total power output of all of the power stations is equal to the guaranteed capacity of the system, each hydropower plant will gain the revenue that matches its declared firm output. The NDC will redistribute electricity when there is a gap between the total power output and the guaranteed capacity of the system. In practice, the total power output in Brazil is most likely greater than the guaranteed capacity, presenting a status of surplus in generation. Under this mechanism, a hydropower plant will transfer its surplus power to the others that do not reach their firm outputs at the optimal price, which is extremely low since it is generally determined as the marginal operating cost. The surplus remaining after the transfer, if any, will be further redistributed pro rata to the firm power output declared by each hydropower plant and cleared in the short-term market at a deviation settlement price. The shortfall must be filled by non-hydropower energy purchased in the spot market if the firm power output cannot be ensured even after the redistribution. The electricity redistribution mechanism centralizes all of the hydropower outputs to form a guaranteed capacity to eliminate vicious competition among hydropower plants, promoting operational stability and integrating more hydropower production. The practice of the power market in Brazil provides valuable experiences for the power market construction in China, especially in provinces such as Yunnan and Sichuan, where hydropower predominates, and the rivers and cascaded hydropower plants are hydraulically and electrically coupled in complex relationships.

3.2. Nordic Countries

3.2.1. Overview of Electricity in the Nordic Region

The Nordic region comprises five countries: Sweden, Norway, Finland, Denmark, and Iceland. Except for Iceland, whose grid is relatively independently operated, the other four countries have established a transregional power market through power grid interconnection [39]. Nord Pool is the power exchange in charge of the market trading, while each of the four national grid companies is responsible for the power dispatch. The total installed capacity in the Nordic electricity market has reached 108 GW, and the total power generation in 2019 was 403.78 billion kWh. Figure 6 shows the Nordic countries' installed capacity, indicating apparent complementarity in the power structure until the end of 2020. At the start of 2022, the power supply in Norway had a total installed production capacity of 38,744 MW and a total normal annual production of 154.8 TWh. [40]. In recent years, Denmark has made great efforts to develop renewable energy, mainly in wind power, of which the generation in 2019 reached 16.15 billion kWh, accounting for 52.7% of the country's total electricity generation and surpassing a historical share of 50% for the first time. Sweden and Finland have diverse power structures [41], among which the installed capacity of hydro, thermal, and nuclear power in the country accounts for 41.5%, 22.6%, and 18.7 of the total installed capacity, respectively. The installed capacity of Finland is mainly thermal power, while there is a slight difference between hydropower and nuclear power, accounting for 52.4%, 19.1%, and 16.2, respectively. The four Nordic countries started designing their power grid interconnection very early, considering frequent transnational power transactions when the power grid construction was planned. Impressively, transmission congestion in the four Nordic countries is not a problem, due to the nationalization of power resources and central planning of power grid construction.

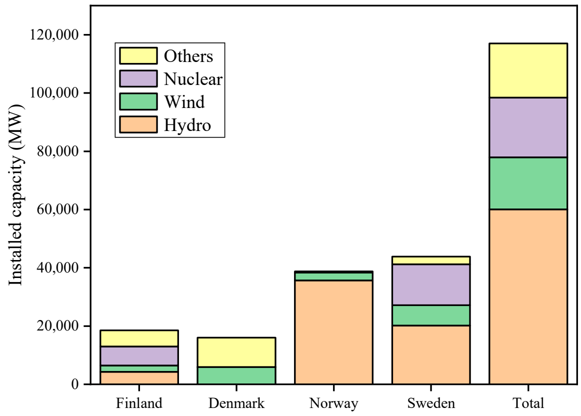

Figure 6. Installed capacity in Nordic countries until 2020.

3.2.2. Nordic Mechanisms to Promote Integrating More Renewable Energy

Unlike Brazil's electricity market, where primary electricity demand is met through medium- and long-term electricity contracts, the Nordic electricity market, after more than 20 years of development, has gradually formed a market mechanism mainly based on the spot market but supplemented by auxiliary service and financial markets [42–44]. The spot market includes the day-ahead, intraday and real-time markets, which complement one another, providing price signals to reflect the relationship between power supply and demand, and to offer a reference for trading in the financial market. The ancillary service market is primarily responsible for handling unexpected situations, including load forecasting deviation, equipment failure, and transmission congestion, to ensure power systems' safety and stability and provide services including peak-shaving, frequency modulation, reactive power compensation, spinning reserve, etc. Trading liquidity in the financial market is very high, involving various products that include forward contracts. Market participants can sign contracts according to their conditions to lock in part of returns in advance and alleviate the impact of price volatility in the spot market.

With the countries tightly connected and well coordinated, the Nordic electricity market mechanism has promoted the integration of renewable energy. The low marginal operating cost of wind power facilitates being effortlessly consumed in the day-ahead market, while competition in the market drives thermal units to participate in peak-shaving services by improving flexibility to improve the system's stability. In addition, the market can also compensate renewable energy units, such as hydropower units, for the loss of revenue due to the adjustment of their power outputs through the ancillary service and balancing redistribution markets. Specifically, these units can submit bids and be paid for the reserve capacity that they bid if they win. Additionally, after winning the bid for reserve capacity, the unit can still bid in the balancing redistribution market for its energy production, which will be paid at the marginal settlement price if the unit wins the bid again. Revenues from both reserve capacity and energy make renewable units more likely to profit and promote the integration of more renewable energy.

An excellent transnational mechanism in peak-shaving is crucial to integrate more renewable energy in the Nordic region. The units that are fast in starting up and flexible in peak-shaving, such as the combined heat and power (CHP) unit, can improve the system capacity in peak-shaving and load balancing, as well as the quick response to the variable and intermittent wind power in the Nordic region. A CHP unit converts electric energy into heat energy during periods when wind power would otherwise be curtailed, and the thermal storage facility, such as a heat storage boiler, can store the heat energy, which would be converted into electric power during peak hours when the demand is tight, thus creating space for integrating more renewable energy. The Nordic region achieves the transregional integration of renewable energy by adapting the market to the power supply structures of the four countries and entirely using the complementarity between wind and hydro power. Denmark, for instance, may have a wind power output surplus, which can be transferred to the other three countries through cross-border power transactions, reducing the hydropower outputs in Norway and Sweden and saving the thermal power in Finland. On the other hand, interconnected power grids can transmit hydropower from Norway and Sweden to Denmark in the event of low wind power output. This increases the scale of renewable energy integration and improves the stability of power systems in the four countries.

3.3. The United States

3.3.1. Electric Power Development in the USA

The United States of America (USA) is one of the global pioneers in starting electricity market reform and has seen success in implementing a quota system for renewable energy. Although there is no federal regulation of renewable quotas, more than 30 states in the United States have developed and implemented quotas and green certification systems according to their own development goals [45]. The USA had 290 GW of renewable installed capacity in 2021—more than the total capacity installed in the same year for traditional power from fossil fuels such as oil and coal—and the quota system played an essential role in this. By 2021, the installed capacity of renewable energy in the USA accounted for 27.26% of the total installed capacity of the country, among which wind, hydro, and solar power were the most important renewable energy sources, accounting for 8.51%, 8.41%, and 3.49%, respectively. California has aggressively pursued PV roof programs, taking the lead in the USA with 27.4 GW of installed PV capacity, while the PV capacity has grown by 350% over the past five years, accounting for 20% of the state's total in 2019 [46]. Unlike California, which has vigorously developed solar power generation, Texas is rich in wind power resources, with 23.86 million kilowatts of wind power capacity installed, ranking first among states in the USA [47] and generating 17.5% of the state's electricity in 2019. The power market in the USA is a regional power market represented by ISO/RTO [48], and the mechanisms to integrate renewable energy are very different across regions. This work selects two power markets with the highest percentage of wind and solar power in the USA—the CAISO in California and the ERCOT in Texas—to investigate the measures taken to promote the integration of renewable energy.

3.3.2. The Mechanisms in California to Promote More Renewable Energy Integration

The biggest challenge to integrating more renewable energy in California's CAISO electricity market is the oversupply that has reduced the system's flexibility [49]. Therefore, the CAISO implements a mechanism that allows power suppliers to bid at a negative price above a preset lower limit, and a power supplier can either take an active bid strategy or passively accept the one generated automatically by the system, which will be the lower limit by default to ensure its power production to be integrated at top priority. The energy price will drop to a negative value when the power supply is in excess, and the pricing mechanism in the market will drive the power suppliers to make timely responses to balance the supply with demand by adjusting their power output to avoid economic losses. At the same time, the negative electricity price serves as an incentive signal to encourage consumers to use more electricity and then promote renewable energy integration. The CAISO also encourages trading on the ramping capacity of a power supplier, which will be financially compensated for its service with flexibility.

Transiting from the day-ahead to the real-time market, there is a day-ahead quarterly trading market in California, aimed at eliminating the impacts of intermittent output from renewable power sources, which can be adjusted based on more accurate forecasts in favor of alleviating the curtailment of wind and solar power and ensuring the system's safe and stable operation [50].

3.3.3. The Mechanisms in Texas to Promote Renewable Energy Integration

The ERCOT power market in Texas has two significant problems in integrating renewable energy: the volatility of wind power output, which makes it challenging to accurately predict, and the isolation of power grids from other states, which more likely leads to transmission congestion. The ERCOT implements a regime to assess the deviation of power generation, aimed at addressing the difficulty of accurately predicting the wind power [51–54]. The market will start a punishment mechanism when there is a significant deviation between the expected and actual outputs. The ERCOT considers the difference in randomness among power outputs, implementing a 5% deviation assessment threshold for the conventional power output, which is much stricter than the 10% applied to renewable production. Specifically, any output below 110% of what is scheduled will not be assessed for punishment, so as to encourage the wind power suppliers to participate in market trading. As a national model for implementing the quota system, Texas has been ahead of its renewable energy development goals, which somewhat exacerbates the grid congestion. So, the Texas Legislature passed regional bills to make renewable energy more competitive by proposing to build high-voltage transmission lines in West Texas, ahead of schedule based on wind growth projections, to connect the wind-rich west to the power-hungry east. Wind curtailment in Texas, especially in the west, has been significantly reduced since the costly high-voltage transmission lines were constructed.

4. Some Comments on Integrating More Renewable Energy in China

China's pursuit of enhanced renewable energy integration can derive valuable insights from international practices, particularly those of Brazil, the USA, and the Nordic region. While requiring adaptations to align with China's unique market environment and energy structure, these practices offer multifaceted strategies for strategic refinement.

The comments and recommendations encompass three strategic categories: "Planning and Regulatory Strategies", "Local Consumption and Integration", and "Market Mechanisms and Technological Advancements", where the methods and mechanisms are uniquely adaptable to individual countries or regions. A comparison of methods and mechanisms among countries is illustrated in Table 1. The relationships between these categories and specific observations and recommendations are detailed in the following subsections.

Table 1. Comparison of methods and mechanisms among countries.

Aspect	China	Brazil	USA	Nordic Countries
4.1. Planning and Regulatory Strategies				
4.1.1. Demand-Guided Planning and Grid Enhancement.	Feasibility assessments for renewable energy deployment and alignment with actual demands.	Medium- and long-term contract markets.	State-level renewable energy quotas.	Data-driven cross-border energy trading.
4.1.2. Long-Term Planning and New Energy Quotas.	Renewable energy electricity quota system.	Long-term planning framework.	State-level renewable energy quotas.	Strategic planning for the energy transition.
4.1.3. Build a Strong Reliability Network Frame.	Enhancing grid structure and security.	High-voltage DC channel development.	Advanced grid management practices.	Expertise in high-voltage direct current.
4.2. Local Consumption and Integration				
4.2.1. Promote Nearby Consumption of Renewable Energy.	Nearby consumption and demand-side response.	Energy-intensive industries' proximity.	Residential photovoltaic power generation.	Localized energy storage solutions.
4.2.2. Build a Demonstration Zone for the Industry.	Development of renewable energy consumption industry zones.	Industry support and innovation.	PV roof programs for consumers.	Innovations in localized consumption.
4.2.3. Build Energy Storage Equipment in Load Centers.	Configuring energy storage for user-side consumption.	Energy storage integration in load centers.	Residential photovoltaic power generation.	Experience in energy storage solutions.
4.3. Market Mechanisms and Technological Advancements				
4.3.1. Enhancing System Flexibility and Mechanism Design.	New power system, flexible resources, and adjustable load technologies.	Advanced system flexibility and virtual power plants.	Demand-side response initiatives.	Nordic innovation in energy management.
4.3.2. Improve the Market Mechanism and Policy System.	Diversification of trading mechanisms and expansion of contract markets.	Market-oriented trading mechanisms.	Innovative trading patterns and scope.	Robust spot market and cross-border trading.

4.1. Planning and Regulatory Strategies

4.1.1. Demand-Guided Planning and Grid Enhancement

In pursuing a more integrated renewable energy landscape, China can benefit from feasibility assessments for renewable energy deployment and alignment with actual demands by blending two complementary strategies. Inspired by Brazil's focus on medium- and long-term contract markets, China can harmonize renewable energy deployment with dynamic demand, optimizing allocation and reducing waste. Simultaneously, drawing from the Nordic countries' data-driven cross-border energy trading, China can gain a data-rich foundation for informed decision-making, allowing for real-time resource allocation. By weaving these strategies together, China can forge an adaptive and efficient energy future where precision meets responsiveness, guided by insights from Brazil and the Nordic countries.

4.1.2. Long-Term Planning and New Energy Quotas

In shaping its trajectory toward a more integrated renewable energy landscape, China can embrace the renewable energy electricity quota system as a strategic cornerstone, drawing inspiration from Brazil and the USA. China can establish a systematic and strategic pathway towards sustainability by adopting Brazil's experience in long-term planning frameworks and emulating the USA's state-level renewable energy quotas. Brazil's planning expertise offers a valuable blueprint for orchestrating renewable energy development, while the USA's quota system provides a structured approach for steady progress. In synergy, these influences recommend the quota system as an optimal strategy for China, aligning with its unique energy landscape and offering a well-structured route toward achieving renewable energy goals.

4.1.3. Build a Strong Reliability Network Frame

Enhancing the grid structure and security, underscored by advanced grid technologies, will offer China a vantage point to establish a reliable and resilient energy infrastructure. Inspired by the experiences of the USA and the Nordic countries, a robust grid framework can be forged to accommodate the increasing demands of renewable energy integration. The power balances and seamless energy flow can also be well safeguarded by meticulously designing a network capable of managing energy fluctuations, incorporating high-voltage direct-current (HVDC) channels, and embracing adaptive grid management practices. This strategic alignment with grid modernization fortifies energy security and amplifies the efficacy of renewable energy deployment, thereby charting a course toward an energy landscape underpinned by stability, sustainability, and adaptability.

4.2. Local Consumption and Integration

4.2.1. Promote Nearby Consumption of Renewable Energy

Advancing nearby consumption and demand-side response presents a compelling pathway to optimize energy utilization. Drawing inspiration from Brazil's adeptness at clustering energy-intensive industries and the USA's innovative residential photovoltaic power generation initiatives, the potential for strategically positioning energy-intensive industries nearby renewable sources becomes evident. Simultaneously, incentivizing domestic users to embrace renewable energy systems can significantly contribute to energy efficiency. This dual-pronged approach enhances the economic viability of renewable energy and nurtures a resilient energy landscape. The convergence of strategic localization and demand-side responsiveness signifies a crucial endeavor in sculpting an energy future harmonizing sustainability and reliability.

4.2.2. Build a Demonstration Zone for the Industry

Developing specialized zones for the renewable energy consumption industry holds the potential to accelerate the adoption of clean energy practices. Brazil's pioneering industry support framework and the USA's localized photovoltaic power generation initiatives underscore the efficacy of nurturing innovation-driven industry clusters and localized energy generation hubs. By harnessing these insights, China can foster an ecosystem conducive to the growth of the renewable energy consumption sector, propelling economic growth while simultaneously advancing its transition to clean energy.

4.2.3. Build Energy Storage Equipment in Load Centers

Embracing energy storage solutions near to load centers presents a compelling trajectory for optimizing renewable energy integration to bolster grid resilience and energy reliability. The USA's emphasis on residential photovoltaic power generation, coupled with localized energy storage, showcases the viability of user-side consumption in enhancing grid stability. Drawing insights from Brazil's innovative industry support and the Nordic countries' data-driven energy practices, this approach harmonizes with a future-oriented energy landscape. A harmonious interplay can emerge by aligning user-side energy storage with the localized generation, fostering energy self-sufficiency, reducing grid vulnerabilities, and creating a sustainable energy paradigm that transcends geographical boundaries.

4.3. Market Mechanisms and Technological Advancements

4.3.1. Enhance System Flexibility and Mechanism Design

Promoting system flexibility through the implementation of adjustable load technologies and virtual power plants, informed by the USA's prioritization of demand-side response and the innovative energy management paradigms of the Nordic countries, underscores the potency of mechanisms enhancing system adaptability. This synergy, grounded in demand-side modulation and adaptive power distribution principles, can contribute to an agile energy landscape that transcends geographical distinctions. In combining these multifaceted insights, a trajectory towards sustainable energy will help foster an ecosystem where flexible mechanisms dynamically harmonize renewable energy supply with ever-changing demand dynamics.

4.3.2. Improve the Market Mechanism and Policy System

Advancing the energy market mechanism through diversifying trading mechanisms and expanding cross-border energy trading emerges as a pivotal strategy for optimizing renewable energy integration. This forward-looking approach, influenced by the Nordic countries' well-established spot market and their pioneering cross-border energy trading practices, underscores the efficacy of a dynamic market ecosystem. Drawing from the Nordic countries' model, encompassing a versatile spot market and cross-border trade, this strategy blends seamlessly with international best practices. The synergy between the Nordic countries' adeptness in trading mechanisms, their cross-border energy exchange, and China's quest for an adaptable market framework is evident.

5. Conclusions

China leads the world in developing renewable energy, ranking first in installed capacity and power generation. Although hydro, wind, and solar energy waste has been effectively alleviated in recent years, China is still facing a critical situation to integrate more renewable energy and initiate a new round of electricity reform to address these issues. This work reviews the practice and experiences in international countries, including the following:

(1) Brazil, which integrates renewable energy through medium- and long-term contract markets, free contract markets, and an electricity redistribution mechanism, enhancing cooperation among hydropower plants and reducing uncertainties in hydropower revenue.
(2) The Nordic system, which promotes renewable energy integration through a well-developed spot market with day-ahead, intraday, and real-time markets, an ancillary service market, financial markets, and transnational mechanisms for peak-shaving and power exchange.

(3) The USA, where California's CAISO electricity market implements a mechanism with negative pricing to balance excess power supply and encourage timely responses from suppliers, promoting renewable energy integration, while Texas's ERCOT uses deviation assessment and regional transmission line construction to address wind power unpredictability and grid congestion and advance renewable energy development goals.

The recommendations for China's enhanced integration of renewable energy encompass a multifaceted approach, drawing inspiration from global practices. China can align energy supply with dynamic demand by combining Brazil's demand-guided planning and the Nordic countries' data-driven cross-border trading, and can establish a structured path toward sustainability by emulating the USA's state-level quotas and the Nordic region's long-term planning. Strengthening grid security, inspired by the USA and the Nordic countries, complements these strategies. Promoting nearby consumption akin to Brazil and localized energy generation as inspired by the USA can optimize utilization. Embracing flexible mechanisms and diversified trading, as in the Nordic countries, can ensure adaptability in China's energy landscape. These recommendations combine insights from global practices into a tailored strategy for China's unique energy challenges.

Author Contributions: Conceptualization, S.L.; Validation, Y.W., H.Z. and C.C.; Formal analysis, Y.H. and J.W.; Investigation, Q.S. and H.Z.; Data curation, S.L. and H.Z.; Writing–original draft, Y.H.; Writing–review & editing, J.W. and C.C.; Visualization, Y.W.; Supervision, J.W.; Project administration, Q.S. and J.W.; Funding acquisition, S.L. All authors have read and agreed to the published version of the manuscript.

Funding: This paper/work is supported by the Science and Technology Program of China Southern Power Grid Co., Ltd. (Grant No. YNKJXM20210100), the Reserve Talents Program for Middle-aged and Young Leaders of Disciplines in Science and Technology of Yunnan Province, China (Grant No. 202105AC160014).

Data Availability Statement: Data availability is not applicable to this article as no new data were created or analyzed in this study.

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Liu, S.; Bie, Z.; Lin, J.; Wang, X. Curtailment of renewable energy in Northwest China and market-based solutions. *Energy Policy* **2018**, *123*, 494–502. [CrossRef]
2. He, Y.; Xu, Y.; Pang, Y.; Tian, H.; Wu, R. A regulatory policy to promote renewable energy consumption in China: Review and future evolutionary path. *Renew. Energy* **2016**, *89*, 695–705. [CrossRef]
3. Cheng, C.; Chen, F.; Li, G.; Ristić, B.; Mirchi, A.; Qiyu, T.; Madani, K. Reform and renewables in China: The architecture of Yunnan's hydropower dominated electricity market. *Renew. Sustain. Energy Rev.* **2018**, *94*, 682–693. [CrossRef]
4. Liu, T.; Xu, J. Equilibrium strategy based policy shifts towards the integration of wind power in spot electricity markets: A perspective from China. *Energy Policy* **2021**, *157*, 112482. [CrossRef]
5. Punda, L.; Capuder, T.; Pandžić, H.; Delimar, M. Integration of renewable energy sources in southeast Europe: A review of incentive mechanisms and feasibility of investments. *Renew. Sustain. Energy Rev.* **2017**, *71*, 77–88. [CrossRef]
6. Guo, H.; Davidson, M.R.; Chen, Q.; Zhang, D.; Jiang, N.; Xia, Q.; Kang, C.; Zhang, X. Power market reform in China: Motivations, progress, and recommendations. *Energy Policy* **2020**, *145*, 111717. [CrossRef]
7. Zhang, S.; Andrews-Speed, P.; Li, S. To what extent will China's ongoing electricity market reforms assist the integration of renewable energy? *Energy Policy* **2018**, *114*, 165–172. [CrossRef]
8. National Development and Reform Commission. China's 14th Five-Year Plans on Renewable Energy Development. Available online: https://www.ndrc.gov.cn/xxgk/zcfb/ghwb/202206/P020220602315308557623.pdf (accessed on 1 June 2022).
9. National Energy Administration. 2015 National Renewable Energy Power Development Monitoring and Evaluation Report. Available online: http://zfxxgk.nea.gov.cn/auto87/201608/t20160823_2289.htm (accessed on 16 August 2016).
10. National Energy Administration. 2016 National Renewable Energy Power Development Monitoring and Evaluation Report. Available online: http://zfxxgk.nea.gov.cn/auto87/201704/t20170418_2773.htm (accessed on 10 April 2017).
11. National Energy Administration. 2017 National Renewable Energy Power Development Monitoring and Evaluation Report. Available online: https://www.gov.cn/zhengce/zhengceku/2018-12/31/content_5433577.htm (accessed on 11 May 2018).
12. National Energy Administration. 2018 National Renewable Energy Power Development Monitoring and Evaluation Report. Available online: https://www.gov.cn/zhengce/zhengceku/2019-09/29/content_5434697.htm (accessed on 4 June 2019).

13. National Energy Administration. 2019 National Renewable Energy Power Development Monitoring and Evaluation Report. Available online: https://www.gov.cn/zhengce/zhengceku/2020-05/16/content_5512148.htm (accessed on 6 May 2020).
14. National Energy Administration. 2020 National Renewable Energy Power Development Monitoring and Evaluation Report. Available online: http://zfxxgk.nea.gov.cn/2021-06/20/c_1310039970.htm (accessed on 20 June 2021).
15. National Energy Administration. 2021 National Renewable Energy Power Development Monitoring and Evaluation Report. Available online: http://www.nea.gov.cn/2022-09/16/c_1310663387.htm (accessed on 16 September 2022).
16. National Development and Reform Commission. Development of Renewable Energy in China in 2022. Available online: https://www.ndrc.gov.cn/fggz/hjyzy/jnhnx/202302/t20230215_1348799.html (accessed on 15 February 2023).
17. National Energy Administration. China's Installed Capacity of Renewable Energy Exceeds that of Coal-Fired Power. Available online: https://www.gov.cn/lianbo/bumen/202307/content_6895756.htm (accessed on 31 July 2023).
18. National Energy Administration. China's Cumulative Installed Capacity of Renewable Energy Power Generation Has Exceeded 1 Billion Kilowatts. Available online: http://www.nea.gov.cn/2021-11/20/c_1310323021.htm (accessed on 20 November 2021).
19. National Energy Administration. Operation Status of Wind Power Grid Connection in 2016. Available online: https://www.gov.cn/xinwen/2017-01/29/content_5164027.htm (accessed on 29 February 2017).
20. National Energy Administration. Operation Status of wind Power Grid Connection in 2017. Available online: https://www.gov.cn/xinwen/2018-02/02/content_5263096.htm (accessed on 2 February 2018).
21. National Energy Administration. Operation Status of Wind Power Grid Connection in 2018. Available online: https://www.gov.cn/xinwen/2019-01/29/content_5361945.htm (accessed on 29 January 2019).
22. National Energy Administration. Operation Status of Wind Power Grid Connection in 2019. Available online: http://www.nea.gov.cn/2020-02/28/c_138827910.htm (accessed on 28 February 2020).
23. National Energy Administration. 2016 Solar Power Generation Statistics. Available online: http://www.nea.gov.cn/2017-02/04/c_136030860.htm (accessed on 4 February 2017).
24. National Energy Administration. In 2017, the Newly Installed Capacity of Photovoltaic Power Generation Reached 53.06 Million Kilowatts, Ranking First among Renewable Energy Sources. Available online: http://www.nea.gov.cn/2018-01/24/c_136920159.htm (accessed on 24 January 2018).
25. National Energy Administration. 2018 Solar Power Generation Statistics. Available online: http://www.nea.gov.cn/2019-03/19/c_137907428.htm (accessed on 19 March 2019).
26. National Energy Administration. 2019 Solar Power Generation Statistics. Available online: http://www.nea.gov.cn/2020-02/28/c_138827923.htm (accessed on 28 February 2020).
27. Feng, H. Research on Current Situation and Countermeasures of Renewable Energy Consumption in China. *China Electr. Equip. Ind.* **2017**, *10*, 6–19.
28. International Hydropower Association. 2020 Hydropower Status Report [EB/OL]. Available online: https://www.hydropower.org/statusreport (accessed on 11 July 2023).
29. BPSTATS. *BP Statistical Review of World Energy Statistical Review of World*, 69th ed.; BP Statistical Review of World Energy: London, UK, 2020.
30. Rego, E.E.; Parente, V. Brazilian experience in electricity auctions: Comparing outcomes from new and old energy auctions as well as the application of the hybrid Anglo-Dutch design. *Energy Policy* **2013**, *55*, 511–520. [CrossRef]
31. De Souza Dias, V.; Pereira da Luz, M.; Medero, G.M.; Tarley Ferreira Nascimento, D. An Overview of Hydropower Reservoirs in Brazil: Current Situation, Future Perspectives and Impacts of Climate Change. *Water* **2018**, *10*, 952. [CrossRef]
32. Qu, Q.; Sun, X.; Wang, X. Brief Introduction to the Mutual Economic Mechanism of Hydropower and Electricity in Brazil's Electricity Market. *China Power Enterp. Manag.* **2019**, *34*, 103–105.
33. Barroso, L.A.; Rudnick, H.; Moreno, R.; Bezerra, B. Ensuring Resource Adequacy with Auctions of Options and Forward Con-tracts. In Proceedings of the 2007 IEEE Power Engineering Society General Meeting, Tampa, FL, USA, 24–28 June 2007; pp. 1–6.
34. Liu, F.; Zhang, L.; Li, X.; Han, B. Brazil's Electricity Market Research: Electricity Market Reform Process and Market Trading Mechanism. *Proc. CSEE* **2020**, *40*, 2501–2514.
35. Ren, X.C. Brazil electricity price mechanism and its influence on hydropower project investment. *Technol. Mark.* **2020**, *27*, 153–154.
36. Martins Peixoto, G.; Bambirra Pereira, R.; da Silva Amorim, L.; Melo Machado-Coelho, T.; Luís Soares, G.; Guimarães Parma, G. Análise da Participação de Pequenas Centrais Hidrelétricas no Mecanismo de Realocação de Energia. In Proceedings of the Anais do 14º Simpósio Brasileiro de Automação Inteligente, Ouro Preto, Brazil, 27–30 October 2019.
37. Zhu, Y.; Chen, T. Research on Brazilian Electricity Market Transaction Mechanism and Its Enlightenment to China. *Electric. Power.* **2020**, *53*, 124–132.
38. Zhang, L.; Liu, F.; Wang, B.; Ding, W.; Chen, Q. Brazil's Electricity Market Research: The Internal Logic Analysis of Market Mechanism and its Enlightenment to China's Power Market Construction. *Proc. CSEE* **2020**, *40*, 3201–3214.
39. Lianjun, S.; Fang, H. Nordic power market and its operation. *Int. Electr. Power China* **2000**, *2*, 4–9.
40. Norsk Energiforsyning Kraftproduksjon Page. Available online: https://energifaktanorge.no/norsk-energiforsyning/kraftforsyningen/ (accessed on 11 July 2023).
41. Energimyndigheten. Nuläget på Elmarknaden [EB/OL]. Available online: http://www.energimyndigheten.se/om-oss/press/prenumerera/laget-pa-energimarknaderna/nulaget-pa-elmarknaden/ (accessed on 11 July 2023).

42. Bao, M.; Ding, Y.; Shao, C.; Song, Y. Review of Nordic Electricity Market and Its Suggestions for China. *Proc. CSEE* **2017**, *37*, 4881–4892+5207.
43. Zou, P.; Chen, Q.; Xia, Q.; He, C.; Ge, R. Logical analysis of electricity spot market design in foreign countries and enlightenment and policy suggestions for China. *Autom. Electr. Power Syst.* **2014**, *38*, 18–27.
44. Wangensten, I. *Power System Economics: The Nordic Electricity Market*; Tapir Academic Press: Trondheim, Norway, 2012.
45. Zhang, X.; Chen, Z.; Ma, Z.; Xia, Q.; Dai, X.J. Study on Electricity Market Trading System Adapting to Renewable Portfolio Standard. *Power Syst. Technol.* **2019**, *43*, 2682–2690.
46. California Energy Commission. California Installed Renewable Capacity Report [EB/OL]. Available online: https://www.energy.ca.gov/sites/default/files/2019-12/renewable_ada.pdf (accessed on 30 December 2019).
47. Ercot. 2019 Reports and Presentations [EB/OL]. Available online: http://www.ercot.co-m/news/presentations/2019 (accessed on 11 July 2023).
48. Xu, Z.; Zeng, M. Analysis on Electricity Market Development in US and Its Inspiration to Electricity Market Construction in China. *Power Syst. Technol.* **2011**, *35*, 161–166.
49. Yu, J.; Liu, Y.; Yang, J.; Gao, C.; Yang, Y.; Ding, Q. Analysis of Development of California Ancillary Service Market and Its Enlightenment to China's Power Market. *Power Syst. Technol.* **2019**, *43*, 2711–2717.
50. Woo, C.K.; Moore, J.; Schneiderman, B.; Ho, T.; Olson, A.; Alagappan, L.; Chawla, K.; Toyama, N.; Zarnikau, J. Merit-order effects of renewable energy and price divergence in California's day-ahead and real-time electricity markets. *Energy Policy* **2016**, *92*, 299–312. [CrossRef]
51. Orans, R.; Olson, A.; Moore, J.; Hargreaves, J.; Jones, R.; Kwok, G.; Kahrl, F.; Woo, C.K. Energy Imbalance Market Benefits in the West: A Case Study of PacifiCorp and CAISO. *Electr. J.* **2013**, *26*, 26–36. [CrossRef]
52. Sharma, S.; Annunzio, C.D.; Badri, S.; Huang, S.H.; Sarma, N.D.R.; Flores, I.; Blevins, B.; Surendran, R. ERCOT tools used to handle wind generation. In Proceedings of the 2012 IEEE Power and Energy Society General Meeting, San Diego, CA, USA, 22–26 July 2012; pp. 1–7.
53. Ge, J.; Zhang, L. Experiences in ERCOT market of Texas and a good reference for electricity market in China. *Electric. Power* **2004**, *12*, 17–21.
54. Wang, X.; Ma, L.; Qu, H. Market Mechanisms for Wind Generation in ERCOT Market and the Inspiration for China. *Electric. Power.* **2017**, *50*, 10–18+27.