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Ocean Energy Management Policy in China

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Abstract:

Ocean Energy (OE) industry would contribute to the sustainable development in China. However, Chinese OE industry is still in early stage. Effective policy system is needed to accumulate the industrialization. This article mainly focuses on OE policies and is intended to render constructive suggestions for the establishment and reform of Chinese OE policy system. An overview of current policy status both in the nations possessing relatively mature OE industry and in China is given. Based on the overview, the corresponding policy improvement measures are commended, including launching an accurately long-termed national OE development roadmap and special law, polishing up feed-in tariffs and subsidy system, introducing renewable tradable renewable certificate system.

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1. Introduction

Ocean Energy (OE) is usually defined as the renewable energy (RE) that exists in the sea and originates from the tide-generating forces from the moon and other celestial bodies to the earth and solar radiation, mainly including wave, tidal barrier, tidal current, ocean thermal and salinity gradient energy.

As the second-largest energy consumer, China is confronted with the challenge of continuously increasing energy demand that, up to 2020, will amount to at least 4 billion tons of standard coal. Chinese government has been committed to developing REs, setting ambitious targets that the annual consumption of REs in 2020 will be up to 0.74 billion tons of standard coal and the proportion of non-fossil energy consumption accounting for the primary energy consumption will reach to 20% in 2030. Fortunately, China possesses abundant OE resources, which is

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potentially over 1000GW. The development of OE industry is conducive to reducing GHG emission from energy utilization and avoiding energy shortage in coastal provinces.

OE industry did not actually emerge in China until the government realized the exploitation and utility of REs is the passport to achieving sustainable development and issued a series of policies to nurture the young sector in 2006 (Fig1). In spite of the outstanding progress made, Chinese OE industry is still in its infancy.

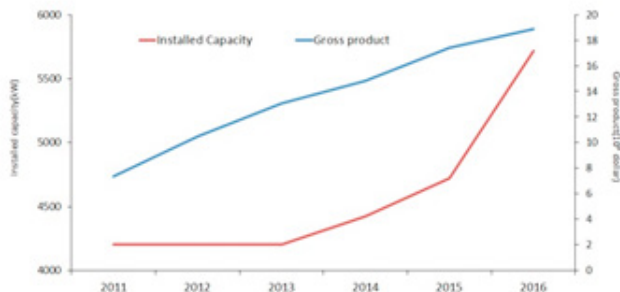


Fig1 The installed capacity of commissioning OE power station and the gross product of OE industry in China

More importantly, China is presently lack of effective and comprehensive OE industry policy system, which spells the industry management less efficient and will inhibit its further development. It is of great significance to explore the flaws of current Chinese OE policy system and determine corresponding improvement measures for the sector’s future progress in this nation.

2. OE Policy in Other Nations

2.1 National strategy

The development and utilization of OE has been emphasized in recent decade by a growing number of nations in response to climate change and depleting fossil-fuel supplies. Many countries have launched the roadmap regarding OE (Table 1).

Table1 OE industry development roadmap in some nations

Nation	Released Time	File Name	Content Summary
U.S.A	2010	United States Marine Hydrokinetic Renewable Energy Technology Roadmap:2010	Describe the development target, deployment scheme and business strategy regarding the OE in the U.S.A from 2010 to 2030.
Canada	2011	Canada’s Marine Renewable Energy Technology Roadmap	Declare Canada’s total power generation growth targets and the development plan of technological service in OE sector.
Korea	2015	Mid-Term and Long Term Clean Energy Development Plan 2015-2025	Set out national vision, long term goal, strategy, and an action plan for the Korean OE development for the period between 2015 and 2025.

2.2 Specific laws

The Marine and Hydrokinetic Renewable Energy Act of 2013(S 1419) has been introduced and recommended by the Senate Energy and Natural Resources Committee in the United States of America, a bill conducted to advance the research, development and demonstration of OE technologies.

2.3 Renewables Portfolio Standards (RPS)

RPS is a regulation supported by laws that enforces electricity providers to render certain amounts of power harnessed by REs, and has been introduced in OE sectors by some EU members, Korea and some coastal states in US. In this policy, suppliers could receive certificates by purchasing power from OE power generating companies and then submit them to the authority concerned to demonstrate their compliance with their regulatory obligations.

2.4 Environmental Impact Assessment (EIA)

OE projects may destroy local environment in its lifetime, phenomena happening during the construction and operation of some world-famously commissioning tidal barrier power stations. For wave and tidal energy electricity power generation devices, though their negatively environmental impacts have not been fully understood yet, a few researches has revealed the deployment of these machines poses potential threat to local ecological system. To prevent latent environmental problems, EIA system has been recently accepted from nation to nation.

2.5 Public funding program

Recognizing the fact that current private investment is insufficient to leading domestic OE sector to maturity independently, numerous nations have launched public funding programs, the money of which ultimately derives from government tax revenue as well as individual donation and that are administrated by public bodies to directly support the institutions and corporations for OE activities. The status of public funding program in some countries is shown in Table 2.

Table2 The status of public funding program in some nations

Nation	The status of public funding program
France	Environment and Energy Agency (ADEME) and National Research Agency (ANR) are two major agencies managing national OE public funding. In 2016, ANR awarded financing to 9 OE projects.
UK	Marine Renewables Commercialization Fund (MRCF) is a special fund administrated by the Carbon Trust to accelerate Scottish OE industry to actualize commercialization. Marine Renewables Providing Fund(MRPF) is a \$ 28.12million fund managed by the Carbon Trust to help build, install and operate full scale OE prototypes. Renewable Energy Investment Fund(REIF) has invested over \$ 40 million for innovative OE schemes.
USA	Department of Energy (DOE) Water Power Technologies Office Marine and Hydrokinetic Program play a distinct role in annually allocating capital to OE sector. The total public funding from 2008 to 2016 approximately reaches \$ 286.7million.

Public funding program utilizes state financial power to prevent OE subject capital chain from rupture, ensuring the subjects to be continuously carried forward. In the case of UK, from 2002 to 2012, almost \$ 295million was spent by the government through varieties of public funding programs on institutions engaging in OE sectors.

2.6 Tax preference

Tax lever is another important government management measure to OE industry, including tax exemption and tax abatement. For example, the OE corporations in UK is free of the Climate Change Levy (CCL).In the United States, the Federal Production Tax Credit (PTC) provides a 1.1cents/kW • h tax credit for OE technologies, and the Business Energy Investment Tax Credit (ITC) allows tidal energy projects to choose a tax credit equal to 10% of capital expenditures in lieu of the PTC.

2.7 Feed-in tariff

As a kind of incentive policy that stimulates the expansion of OE power generation, feed-in tariff system is adopted by several countries in Europe as well as Korea and Canada. This market push strategy entitles the developers in these countries to a stable sale outlet for the electricity harnessed from the sea at lower cost (Table 3). Some of these nations set time limit for power companies to enjoy this system, which could impel investors to improve their technologies after tariff payment is over so that the overall OE technology would constantly advance.

Table 3 OE feed-in tariff rates and electricity price in different countries

Country	Rates of Feed-in Tariff(\$ /kW • h)	Electricity Price(¥ /kW • h)	Duration(years)
France	0.16	0.148	15-20
Korea	0.042-0.053(for tidal energy with dam)	0.042-0.41	15
Canada	0.48(for community-owned, smaller scale developments under Community Feed-in Tariff Program)	0.1	20
	0.28-0.42(for larger scale development projects)		15

3 Present Policy System in Chinese OE Sector

3.1 National strategy

In August 2012, 12th Five-Year Plan for Renewable Energy was issued and it is the first time that the general development goal of OE industry was involved in the National Five-Year Plan of China, which marks Chinese government has regarded developing OE industry as a national strategy. In December 2016, the Marine Renewable Energy Development Plan of “13th National Five-Year Plan” is introduced and delivers the new general development target and prior projects of Chinese OE sector by 2020.

3.2 Compulsory acquisition

It is responsible for grid enterprises to render acquisition to the electricity from OE power station in China. The National Development and Reform Commission of China (NDRC) published Renewable Energy Generation Full of Affordable Acquisition Management Approach in 2016, in order to further accelerate the this system to be actually feasible in REs power generation sector.

3.3 EIA system

According to Technical Guidelines for Environmental Impact Assessment of Marine Engineering, any construction subject of OE power station and auxiliary facility concerned in China is required to undergo EIA. The impacts of OE engineering to water quality, sediment, ecology environment, and topography are mandatorily covered in the assessment, whereas atmospheric and radioactive environment and environmental accident are contained optionally.

3.4 Public funding program

Chinese government set OE Special Funds in 2010, a public funding program specially supporting domestic OE projects. By launching this fund, the government significantly increases the amount of fund to OE projects and the number of the bodies accessing the capital. From 2010 to 2018, about \$ 180 million from the fund has been spent on more than 100 OE projects.

3.5 Tax preference

The key equipment or the whole set of tidal and wave energy devices enjoy import tariff exemption in China. The

corporations devoted to OE technology research and development are exempted 15% of their income taxes. And the enterprises that invest the key OE programs supported by the government could offset a portion of the enterprise income tax payable in proportion to the amount of investment.

3.6 Fixed feed-in tariffs

Related Regulations of Electricity Generation Using Renewable Energy, issued by the National Development and Reform Commission, allows the OE developers in China to enjoy fixed feed-in tariffs. The average feed-in tariff rate of Jiangxia and Haishan power stations, two major commissioning tidal barrier power stations in China, is presently \$ 228/MW • h, a selling price higher than that of any other energy at home(Fig2). But the calculation methods of OE selling price, the way of subsidies for fixed price differentials, the main rights and obligations between power generation companies and power grid enterprises still need to be further clarified.

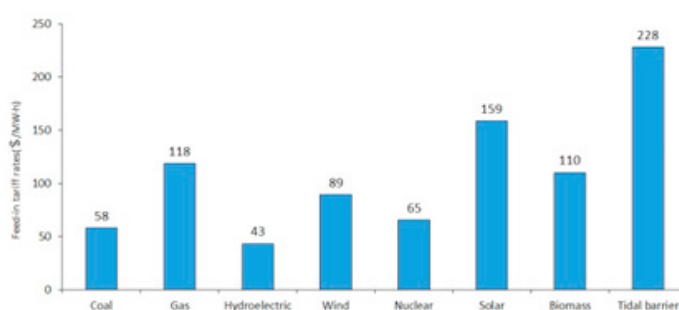


Fig.2. The average Feed-in Tariff rate of various energy power in 2015

4. The Flaws in Recent Chinese OE Policy System

4.1 Absence in Long-term development plan

Marine Renewable Energy Development Plan of “13th National Five-Year Plan” currently acts as the national strategy guiding Chinese OE industry advancement to 2020. The Plan separates OE from other REs and exclusively formulates its development frameworks for the first time. Furthermore, the contents of the Plan regarding development targets and primary projects are more explicit than former OE national strategies. All these characters above reflect Chinese government has a deeper understanding toward its OE sector and a greater ambition on this field. The lifespan of the Plan, nevertheless, is relative short, compared with the OE national strategies in many other countries.

4.2 Lack of special law

There is still no special law oriented to the OE industry in China, and the administration to this sector is primarily based on the Renewable Energy Law at present. But the Law is just a legal framework and none of its provisions is keyed to OE industry.

4.3 Deficient values of selling price in feed-in tariff system

In the feed-in tariff system of Chinese OE sector, apart from the undefined rights and obligations between power companies and grid enterprises, the unclear calculation approach of electricity price is the primary challenge. The electricity power selling price of an OE power station is controlled by local government other than electricity market, which often violates supply-demand mechanism in the market (Table 4).

Table 4 The feed-in tariff implementation status of commissioning tidal barrier power stations in China

Name	Feed-in tariffs (\$ /kW · h)	Be profitable by power selling price	Other sources of revenue
Jiangxia	0.387	No	Aquaculture, agricultural and tourism
Haishan	0.069	No	Aquaculture

4.4 Imperfect subsidy system

Subsidy system is a pivotal method to narrow down the gap between cost and income for many RE companies. Lots of subsidy policies have been introduced in wind, solar and biomass energy sector and explicit policies vary from energy to energy. These different subsidy systems have contributed to a sustained growth in installed capacity, on-grid generation and power projects in each RE sectors.

OE technology innovation is a decades-long development process and investment capital-intensive field, and manufacturers usually cannot make certain their devices to be beneficially competitive in the future market. Without investment subsidy, domestic private companies would refuse to mobilize their capital into this sector under the pressure of high risk of financial shortage and confined financing channels.

5. Discussion

5.1 The cause of the Oe policy defects in China

Insufficient Technological Readiness: Chinese OE industry emerges relative late in the world, and most of its OE power generation devices are still in design and test phase. Few OE technology developed has so far achieved the level of technological readiness sufficient to ensure commercialization of the technology or required to be competitive with other REs. Consequently, a majority of OE devices have not been deployed on a large scale right now.

High Cost and Uncertainty of Research and Innovation: OE device innovation activities typically take several years to undergo a series of steps in a development chain, and require splendid funding at each stage. Meanwhile, OE technological researches are haunted with huge uncertainties and design decisions are difficult to reverse, which makes investors and innovators probably reap no reward from their intellectual effort.

Immature Market: At initial stage of OE industry, because there are few OE manufactures and developers existing, and the number of OE projects is limited, neither the supply and demand network in equipment manufacture industry nor the standards of converter designs and their components have been established, yielding the MER manufacture market unformed. Market-pull instruments are of no effect under this circumstance.

5.2 Improvement measures

Launch Long-term National OE Development Roadmap: Since a long-termed development plan oriented to OE industry is urgently needed in China, it is necessary for the government to launch a long-term national OE roadmap. The plan should not merely declare the targets of installed capacity increase, research and innovation activities and demonstration projects needed to be deployed, but also show the OE market development aim and policy reform trend.

Optimize Feed-in Tariff System: Besides to raising the current feed-in tariffs rate to an appropriate level that could bring commissioning OE power stations profits, the government could consider adopting feed-in tariff digression system for the projects under design, particularly assuming BOT operational mode. In the system that has been implemented by German in offshore wind industry, the power station could originally enjoy higher feed-in tariff rate for a spell, then the selling price will decline gradually until it reaches to a certain level. This mechanism could force the developers to upgrade their technologies and realize cost reduction in the OE power generation field.

Polish up Subsidy System: Explicit investment subsidy keyed to the companies that mobilize capital to innovate and manufacture power generation devices and the power selling price subsidy granted for the enterprises operating OE power stations should be identified. It is noteworthy that, nonetheless, the essential purpose of the subsidy is to encourage private capital into OE field and create some competitively strong companies devoted to OE devices innovation and manufacture or power station operating management, other than to blindly increase the number of the enterprises and production.

Implement Tradable Renewable Certificate System: TRC system will be launched in solar and wind power industry on July 1, 2017, in which the government issues the certificates to qualified projects, who may sell them to interested parties. If this policy works well, it is an opportunity for NDRC to extend it into OE industry in the forthcoming future.

Conclusion

By reviewing the status of the OE policy both in the countries with relatively developed OE industry and in China, combined with the effect background of policy implementation, the flaws of current OE policy system in China has been revealed. Some key policies, such as accurately long-termed development plan, special law and information publicity strategy are still absent, and several market incentive strategies, including special fund system, subsidy system and feed-in tariff system, are incomplete and have shown limitation during the course of implementation.

These flaws mainly derive from insufficient technology readiness, high cost and uncertainty of research and innovation movement, immature market, and absence in former policy and long periodical of policy-making process. The government needs to issue an accurately and flexibly long-termed national OE development roadmap to guide the whole industry's advancement. Meanwhile, as market incentive strategies improvement measures, Marine Renewable Energy Funds system needs to be more transparent in recipient-select proceed and be more fair to private company applicants; feed-in tariff digression system and TRC system are worth to be introduced; and investment subsidy and power generation subsidy strategies need to be polished.

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