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Survey Report on Environmental Protection and Sustainable Development of Daqing Oilfield in China and Area A Oilfield in Egypt

Li Yuheng

Beijing National Day School, Beijing, China, 100039

Abstract: *This report compares and analyzes the environmental protection and sustainable development practices of Daqing Oilfield in China and Area A Oilfield in Egypt. Daqing Oilfield focuses on hybrid production of oil, electricity, and gas, sewage reinjection systems, and industrial transformation toward clean energy and tourism. It also promotes global environmental technologies through international projects. Area A Oilfield emphasizes detailed management, such as waste recycling competitions, standardized warehouse management, and three-dimensional development of salt mining, wind power, and oil exploitation, while investing in community welfare to integrate with local sustainability. Both demonstrate innovative environmental strategies, with Daqing advised to optimize equipment management and learn from Area A's meticulous practices.*

Keywords: *Daqing Oilfield; Area A Oilfield; Environmental Protection; Sustainable Development; Industrial Transformation; Delicacy Management*

1. Introduction

Ecological environmental protection in oil and gas fields serves as the environmental foundation for the development of the oil and gas industry and is vital to the sustainable utilization of oil and gas resources[1].In an era defined by climate urgency and the imperative for low-carbon transition, the oil and gas industry faces unprecedented challenges in reconciling resource extraction with environmental sustainability. This study examines two contrasting yet emblematic case studies: Daqing Oilfield in China, a legacy energy hub undergoing industrial reinvention, and Area A Oilfield in Egypt, a compact yet innovative operation in a fragile desert ecosystem. By analyzing their approaches to clean energy integration, waste management, community engagement, and operational efficiency, this report aims to distill actionable strategies for achieving "green growth" in the petroleum sector. Through on-site observations, stakeholder interviews, and comparative analysis, we explore how these oilfields balance economic imperatives with ecological responsibility, offering insights for global energy stakeholders navigating the dual goals of cost optimization and sustainable development.

2. Brief Introduction

China's Daqing Oilfield is located in the Songnen Plain of Heilongjiang Province. It was established in 1959 [2]. In 1976, its annual crude oil production reached 50 million tons, and it maintained stable production for the subsequent 27 years.

Egypt Area A oilfield locates in the west bank of the Red Sea and Egyptian eastern desert area. which was discovered in 1958 and achieved production plateau of approximate 100,000 barrels per day in 1970s, continuously been developed through depletion methods till nowadays.

3. Survey Target

I visited Daqing Oilfield and Area A Oilfield to feel and deeply understand their main projects and environmental protection methods. By observing and analyzing from holistic and multiple angles, I revealed the diversification, innovation, and uniqueness of environmental protection methods in both oilfields and analyzed their positive and negative effects on oilfield operation costs optimization and sustainable developments.

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4. Persons Interviewed

We interviewed staff such as Mr. Xie Feng, Mr. Xu Yang, and Mr. Di Baiying, who are working on site in Daqing Oilfield, to deeply understand the oilfield environmental protection strategy and implementation, and its future sustainable developments as well.

Afterwards, we visited Mr. Fareed Aly Yehia Hussein, Mr. Ahmed Rabie, Mr. Mohamad Atwa, Mr. Kamel Al Sawi and other responsible personnel in Egypt Area A Oilfield to understand about their environmental protection work, sustainable developments and growing with the community around the oilfield. At same time, we also visited the community close to the oilfield such as the women skill training center, kindergarten & school, and hospital to evaluate the contribution and effects from oil field environmental protection efforts.

5. Survey Methods

The survey methods include observation, interview, discussion, photos & videos collection and etc,. to ensure the comprehensiveness and accuracy of the information and data, through site visiting and obtaining firsthand data, which shall be the solid foundation for this survey report.

6. Survey Results

6.1. Daqing Environmental Protection Measurements and Urban Transformation Strategies

6.1.1 Environmental Protection Measurements in the Development Processes of Daqing Oilfield

Daqing Oilfield has made significant contributions to the national economic development and energy security[3].As an important energy base in China and even the world, Daqing Oilfield actively seeks a development path that balances industrialize transformation and environmental protection to cope with declining production challenges. Among all policies, the hybrid production of oil, electricity and gas has become one of the major outstanding models in Daqing Oilfield. Nowadays, when you visit Daqing, also known as oil city of China, you can see not only beam pumping units everywhere, but also wind turbines and solar panels, spreading across fields. You can often see these fantastic scenes of oil production facilities and clean energy equipment coexisting in the same oilfield Daqing. Due to the declining production of oil, the government has decided to achieve transformation from traditional industry to clean energy, so that these newborn clean energies to replace the declining oil industry. Since 2020, Daqing has been working for the transition from the oil industry to clean energy: wind power and photovoltaics being the main components. At the same time, Daqing Oilfield is also increasing its natural gas production year by year to compensate for the decline in oil production ability. It is expected that the production of new energy and natural gas in Daqing oilfield will exceed 50% of the total output value by 2050.

The managers of Daqing Oilfield attach to the importance of the standardized management of traditional petroleum production processes, which is also important to protect the ecological environment and achieve sustainable development. Daqing Oilfield is achieving green energy transformation, at same time, conducting standard process for oil production as well. During the interview, I also learned that Daqing Oilfield has multiple environmental requirements for the staff during the oil production processes. The principle of "dust should not fall to the ground" is one of the important measurements. Due to the necessary usage of many chemicals as oil drilling aids in the process of oil exploitation, including polypropylene substances, humic acid, etc., which can harm the soil and can also cause environmental pollution, the above-mentioned principle can effectively ensure the environment is not polluted during the production of oil. This kind of delicacy management effectively reduces air and soil pollution and protects the ecological environment. In addition, the managers of Daqing Oilfield have implemented the principle of "covering the machinery with cloth" for the mechanical equipment used in the mining process. This principle aims to prevent machines from causing large amounts of dust to flow around during operations, thereby reducing air pollution to the surrounding environment. As a result, Daqing Oilfield has effectively reduced dust pollution during the production process and ensured the air quality in the production area.

The reuse of sewage is also an environmental protection method that effectively reduces the impact of oilfield development on the environment and promotes the recycling of water resources, achieving both economic and environmental targets. Around the oil field, you can see not only rows of windmills

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standing tall, but also find many stations equipped with water tanks, which are the sewage re-injection system. We can know from the local staff that these base stations are an important structure of the Daqing Oilfield sewage re-injection system. The wastewater generated from oil extraction is filtered by these base stations to remove harmful substances and re-injected the qualified water into the underground. This approach not only avoids direct discharge of sewage from polluting surface water and groundwater but also reduces the environmental pressure and treatment costs caused by sewage discharge. More important is that sewage re-injection helps to restore formation pressure, sustains oilfield production stability and reduces the risk of surface sinking, protects the stability of geological structures around the oil field.

6.1.2 Daqing Oilfield is leading the city's clean energy transformation

Because of continuously rising oil exploitation costs and increasing environmental protection pressure, managers of Daqing Oilfield recognized the limitations of solo oil industry structure. In this situation, Daqing Oilfield of CNPC, as a leading local enterprise, has led the city to start an industrial transformation strategy. In the past 20 years, it is understood that the government of Daqing has pushed its industrial center towards tourism and environmental protection industries. Daqing is known as the "City of Lakes" due to its location on the Songnen Plain, where flat terrain, abundant water sources, and extensive wetland areas are widespread. It has inherent advantages in developing tourism and can also reduce environmental pollution. At the same time, Daqing had abundant population resources and had introduced clean energy factories from multiple enterprises such as Volvo, thereby reducing both the degree of environmental pollution and the unemployment rates.

6.1.3 The Global Impact of Daqing Oilfield

The influence of Daqing is no longer limited in Daqing, China. Over past decades, Daqing Oilfield of CNPC has expanded its footprints to multiple regions including Sudan, Iraq etc., These international projects not only bring new development opportunities to Daqing Oilfield but also add new forces and funds into the development of the local energy industry. Technicians of Daqing Oilfield of CNPC have also brought various environmental protection technologies to more regions around the world, thereby promoting better and more comprehensive environmental protections in oil fields in many parts of the world.

6.2 A New Model for Environmental Protection Management and Regional Development of Area A Oilfield in Egypt

6.2.1 The resource management in Area A achieves innovation and efficiency

- Smart conversion of household waste reflects the perfect combination of creativity and practicality.

At the camp of Area A oilfield, you can not only observe various caravans made of containers, but also some " masterpieces" made of steel bars and iron sheets. After entering the gate of the camp, you will find a pavilion made of wood block and ropes that used to be tied to trucks. At the entrance of the pavilion, there is a flamingo made of steel legs and plastic body. Furthermore, you can also see wooden tables made of cable bearings and chairs made of empty oil drums. According to workers, Area A oilfield holds a competition every year, where everyone comes up with innovative ideas to utilize old resources to make something. Over the past few years, they have been able to save more than $40,000 annually.

- Standardized warehouse management, to achieve the perfect combination of refinement and science.

From the warehouse management of Area A oilfield, they achieve high efficiency and cost saving target. The internal display of the warehouse is well designed, the material clearly classified, all items in the warehouse well-arranged according to categories. From small nuts to large beam pumping units, all kinds of materials have fixed storage locations. Moreover, the warehouse also has a special refrigeration storage unit for rubber, plastic, and engine oil which are easily damaged by heat. This refined management can ensure the safety and availability of materials and reduce operating costs and improve overall work efficiency.

- A new model of the stereoscopic development of Area A Oilfield.

The three-dimensional development of salt mining, wind power, and oil exploitation has become a unique scenery in Area A oilfield. Due to its location close to the Red Sea, Area A oilfield is lower than sea level and seawater flows into the basin, forming small salt lakes. When driving along the oil field, you can find many excavators remotely digging out the salt crystal from the basin and transporting them to the distant salt field. Besides, there is windy all year round. Rows of standing windmills can be seen

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on the high ground beside the oil field, rapidly rotating to provide clean energy to support the entire oil field and surrounding towns and cities.

6.2.2 Safety management and environmental protection while production, delicacy creates green oil fields

During the operation of Area A oilfield in Egypt, safety and environmental protection are the first priority, which is not only reflected in the comprehensive protection of employees' personal safety but also focused on every part of the entire production process. Through a series of meticulous measurements, Area A oilfield has set up an efficient, safe, and environmentally friendly production system. During the on-site safety introduction at the camp, I learned that the base requires employees to arrive at their destination before the sun sets, especially when transporting crude oil or driving outside. It is fully considered the safety hazards that may be caused by night work. The implementation of this regulation not only protects the safety of the staff but also prevents the oil tanker from tipping over and causing crude oil spills to pollute the environment. Regarding the oil storage tanks management, it also reflects the sense of responsibility and profession of Area A oil field in Egypt. When visiting the temporary oil storage tank, the staff showed the fire fighting and cooling system of the tank and insisted that they need to ensure his system is working and prevent other tanks catching fire when one oil tank is on fire and causing large scale pollution.

Analysis of survey results:

Daqing Oilfield and Area A Oilfield have demonstrated their unique strategies and achievements in environmental protection, but both showed an elevated level of attention towards environmental protection.

1) Comprehensive and wide-ranging environmental protection strategies of Daqing Oilfield. First, Production process environmental protection and industrial structure optimization. Daqing Oilfield not only implements environmental protection measures in the production process to reduce pollution emissions, but also actively adjusts the industrial structure, promotes industrial upgrading, and shifts to a more green and low-carbon development model. Second, green development from a global perspective: The environmental practices of Daqing Oilfield are not limited to the Daqing region of China, but also radiate to Daqing International projects

2) For Area A Oilfield, their delicacy management and daily environmentally friendly protection is their eye-catching movement. At first, attention to detail: Area A oilfield pays attention to every small detail of daily operation, and through delicacy management, makes the environmental protection system of the entire oilfield more stable and efficient. Secondly, waste recycling and reuse: By recycling the waste generated by the oilfield and exploring ways to reuse it, Area A oilfield realizes the maximum utilization of resources, reduces the negative impact on the environment, not only reduces the operation cost, but also enhances the social responsibility of the enterprise. Finally, the combination of space utilization and new energy, through reasonable planning of operation areas and installation of new energy equipment such as wind power facilities, not only improves the efficiency of land use, but also reduces the dependence on traditional energy, and further promotes the green development of oil fields.

In summary, both Daqing Oilfield and Area A Oilfield in Egypt have demonstrated a high sense of responsibility and innovation in their respective environmental practices.

Conclusion and Suggestions:

In the development process of Daqing Oilfield, there are indeed problems such as excessive drilling equipment and idle pumping units. These problems cause waste of resources, and environmental effects. In response to these problems, Daqing Oilfield can take a series of measures to increase energy saving and environmental protection in the future and strive to become a model of oil and industrial city. There are some suggestions as follows: Daqing Oilfield can refine drilling equipment management, regularly evaluate, and maintain drilling equipment, to ensure it is in the best working condition to avoid shutdown and idling due to equipment failure. They can also distribute oil extraction equipment based on the oilfield development plan and production capacity, to avoid resource waste caused by over configuration.

The advantages and reference significance of Egypt's Area A Oilfield lie in that, although its management area is small and problems are less obvious—with every pumping unit in operation and those from discontinued oil wells being recycled—its meticulous management and emphasis on daily environmental protection practices are worth learning from for Daqing Oilfield. Daqing Oilfield can learn from its management philosophy of starting small and paying attention to details and integrating environmental protection into every link of daily production.

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Area A oil field in Egypt also attaches great importance to the public welfare investment with the surrounding cities, through the donation of women workers training centers, kindergartens, schools, hospitals, pay attention to girls' education, women's equal employment, as well as medical and health care, for the sustainable and stable development of the oil field, providing a steady stream of human support, to integrate the sustainable development of the oilfield and the community.

7. Conclusion

Daqing Oilfield and Area A Oilfield have shown distinct yet effective approaches to environmental protection and sustainable development. Daqing's large-scale industrial transformation and global influence highlight its role in green energy transition, though challenges like equipment idling require refined management. Area A's focus on granular operational details, resource recycling, and community integration offers a model for integrating environmental responsibility with local development. Together, their practices underscore the importance of balancing economic growth with ecological stewardship, providing valuable insights for the global oil industry.

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