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White Rose Extension Project in Newfoundland

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ABSTRACT

The White Rose Extension Project is pursued by Husky Energy, and it will be completed by 2016 or 2017. The project is mainly used by extending the field of White Rose platform. There are two options to finish this project well. One option is using the wellhead platform to further extend the field; the other one is using much more subsea drill to finish this task. Unfortunately, Husky Energy does not decide which one should be applied for the project.

The wellhead platform is more stable and safe than subsea drill in the White Rose field. Because the wellhead platform is fixed at the offshore site, it will not be affected seriously by kinds of environmental conditions. Subsea drill will be much more dangerous in the harsh environment of the White Rose field. No matter how good the wellhead platform is, it has a terrible problem which cannot be avoided. Because the designed wellhead platform will be too large, it will cost too much work hours and money. It is not easy to decide which option will be the better one.

The following details will provide the advantage, disadvantage and challenge for these two options. The paper will also provide which option should be a better choice for such significant White Rose Extension Project.

1 INTRODUCTION

The Jeanne d'Arc Basin fields of the Grand Banks are mainly Hibernia, White Rose and Terra Nova as shown in the Figure 1. They are large and developed offshore fields in the Newfoundland and Labrador. Those fields belong to shallow water area with about 80 to 110 meters depth. The average produced range of those fields is approximately 350,000 barrels of light oil every day. Those fields are creating large revenue for the Newfoundland and Labrador as shown in the Figure 2. Some new fields in the Jeanne d'Arc Basin are also developing such as Hebron and White Rose Extension [1]. The Canadian Coastal Guard or oil companies such as Husky and Suncor need to consider the staff safety in the harsh environmental conditions.

Figure 1: Offshore Fields in the Jeanne d'Arc Basin from Ref. [1]

The climate change in the Grand Banks was normally caused by the loss of multiyear sea ice. Packs of sea ice played a significant role as preventing the Grand Banks temperature from the sunlight heat. The melting of sea ice resulted in higher temperature around the Grand Banks. Warm water around the sea ice was moved by the currents of the Grand Banks, which resulted in critical change of climate. Sea ice has dynamic characteristics caused by wind action or temperature fluctuation. Base on the age classification, sea ice mainly consists of young ice, first-year sea ice and old sea ice (multiyear ice). First year ice does not have growth which is more than one year, but it must be thicker than young ice. The age of multiyear ice must be more than one year old, which means one melting season must be passed.

The information below is temperature statistics for air and sea surface in Jeanne d'Arc Basin. The highest air temperature of Jeanne d'Arc Basin is approximately 21.6 degrees Celsius in summer time, and the lowest air temperature is around -10.7 degrees Celsius in winter time. The highest sea surface temperature of Jeanne d'Arc Basin is approximately around 20.6 degrees Celsius in summer time, and the lowest temperature of ocean surface is around -2.8 degrees Celsius in winter time [2].

Jeanne d'Arc Basin Daily Average and Annual Production 2008

Modified after C-NLOPB

Jeanne d'Arc Basin	Total Production Oil (bo)	Daily Average Production oil (bopd)	Total Production Gas (Bcf)	Daily Average Production Gas (MMcfd)
Hibernia	50,732,530	138,613.5	85,0	232.2
Terra Nova	37,550,268	102,596.3	59.7	163.2
White Rose	36,962,453	100,990.3	31,3	85.5
Total	125,245,251	342,200	176,0	480.9

Gross revenue @ US $97 per barrel (Brent) = *US $12,148,808,747*

Figure 2: Offshore Fields Gross Revenue from Ref. [1]

2 PROJECT OPTIONS

Husky Energy is considering a option of White Rose Extension Project (WREP), in order to expand the White Rose offshore field in the Grand Banks. The option of WREP shall be a wellhead platform (WHP) or subsea drills, or combined option. Arup Inc. is working on the Concrete Gravity Substructure (CGS) of the WHP, and Wood Group PSN is concentrating the topside design of the WHP. Technip and Subsea 7 is working on the subsea development. The wellhead platform is more stable and safe than subsea drill in the White Rose field. Because the wellhead platform is fixed at the offshore site, it will not be affected seriously by kinds of environmental conditions. Subsea drill will be much more dangerous in the harsh environment of the White Rose field.

2.1 Wellhead Platform Option

The CGS of the WHP shown in Figure 3 is will be floated out of casting basin and towed to an inshore deepwater mating site for topsides mating. The beginning condition will be floating out the CGS of the dock, while end condition will be touching down the CGS to be installed at the offshore site. The ballasting system is designed to reliably control and monitor the floating draft of the CGS during the installation sequence. The topside of the WHP shall have a capacity of more than 120 workers. The topside shall be mated with the CGS in the offshore site after construction.

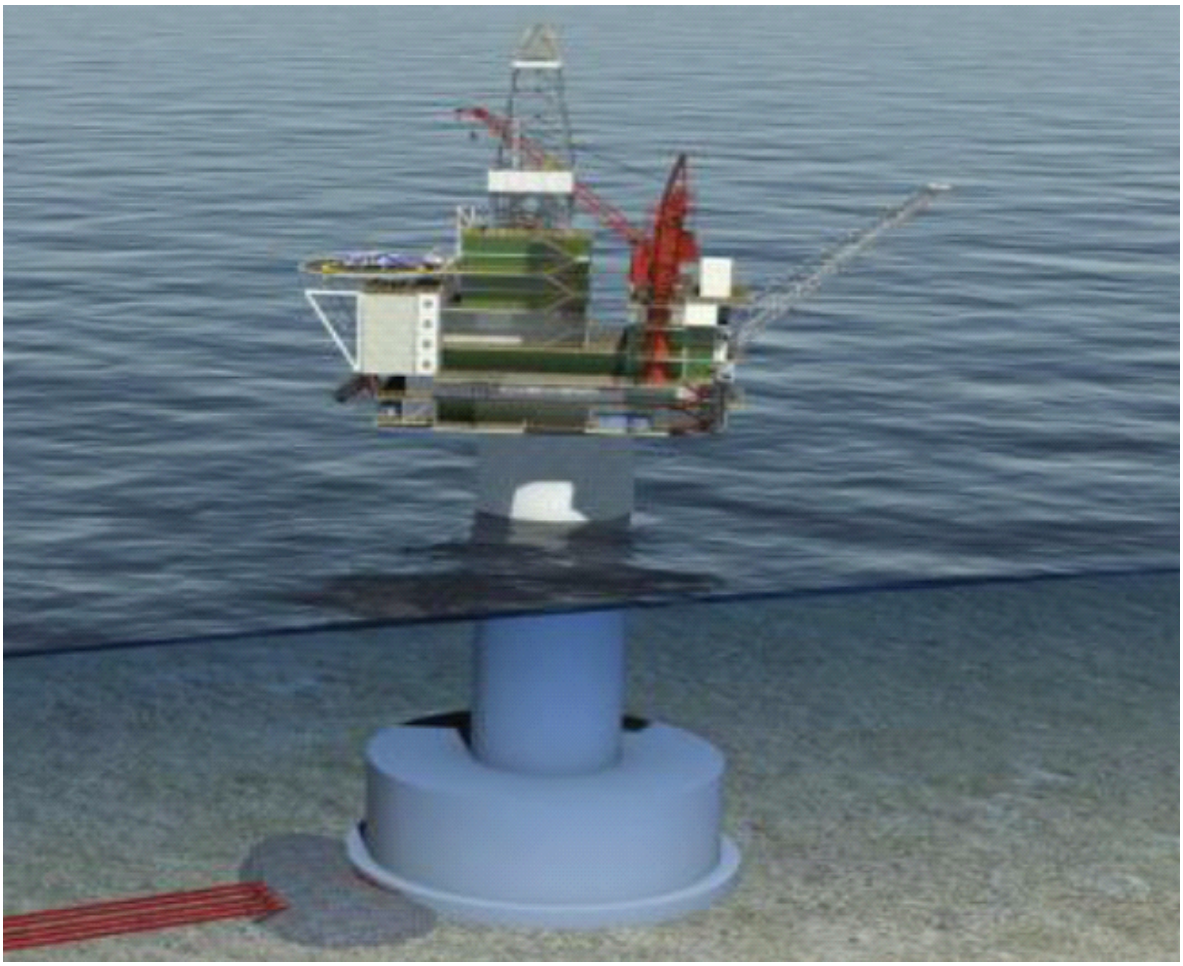

Figure 3: Wellhead Platform Layout from Ref. [3]

2.2 Subsea Drills Option

The option of subsea drills shall be added four new drill centers to the existing Floating Production Storage Offloading (FPSO) vessel. The connection between new drill centers and the existing FPSO is to be determined. The connection shall be such a difficult issue for the development option.

3 PROJECT DESCRIPTION

The WREP shall be dominated in wellhead platform or subsea drill centers or combined option. More information and details are provided in the following sections.

3.1 Wellhead Platform

The CGS of the WHP will be floating out of the dock at Argentia of Newfoundland. The Argentia owns multiple industrial companies and facilities for the construction of the CGS. The construction of the CGS normally needs to consider the site preparation, water supply and power supply. The construction of the CGS shown in Figure 4 shall be followed the order as ballasting cells,

the base caisson, 24 open cells and a central shaft. The CGS has no ability to store oil, so it shall be tied back to the existing FPSO vessel.

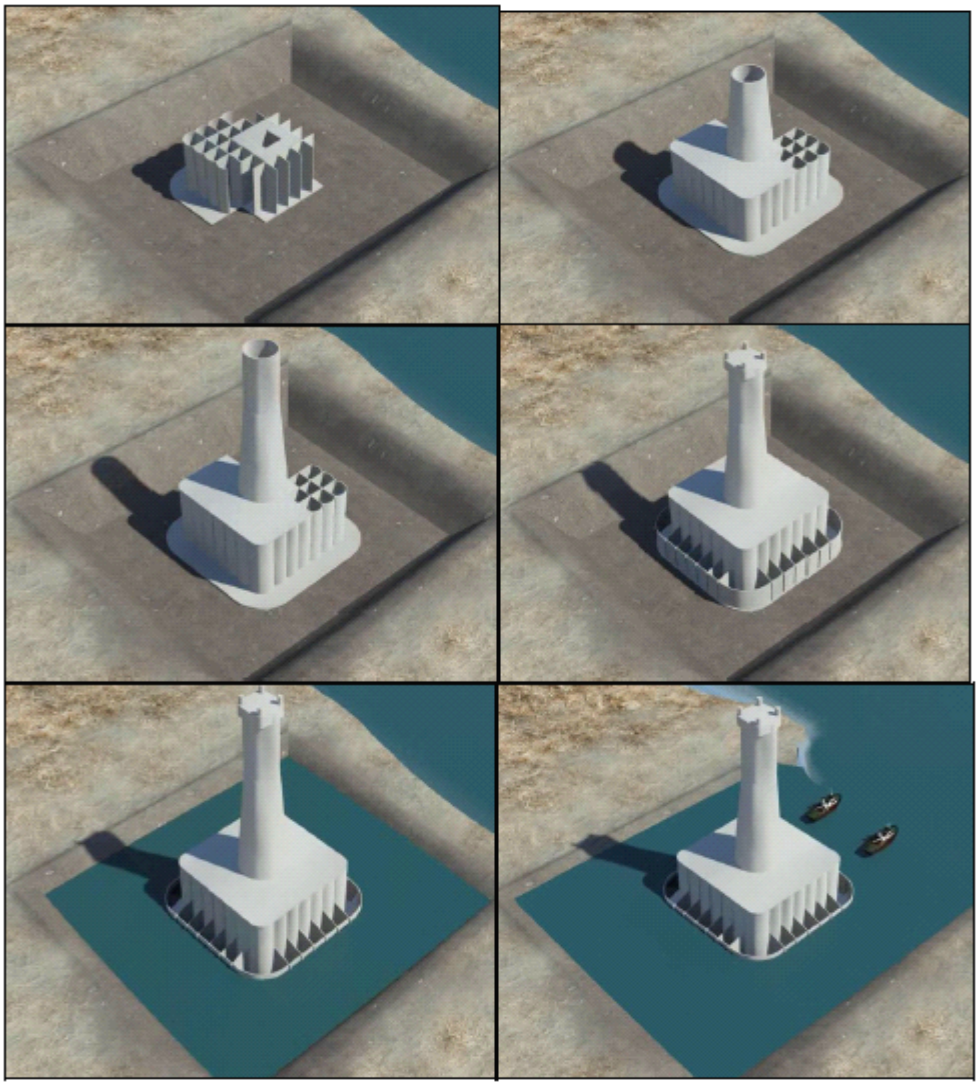

Figure 4: CGS Construction Layout from Ref. [3]

3.2 Subsea Drill Centers

The subsea drills option shall only have offshore activities. Installation and maintenance shall be developed by remotely operated vehicles. The connection between new drill centers and the existing FPSO is to be determined. The Figure 5 below is shown as the arrangement of subsea drill centers. One potential drill center shall be connected with the existing northern drill center. Another potential drill center shall be connected with the existing North amethyst drill center. Two remaining new drill center shall be tied back to the existing central drill center. Moreover, the subsea drills option must be satisfied in an environmental assessment.

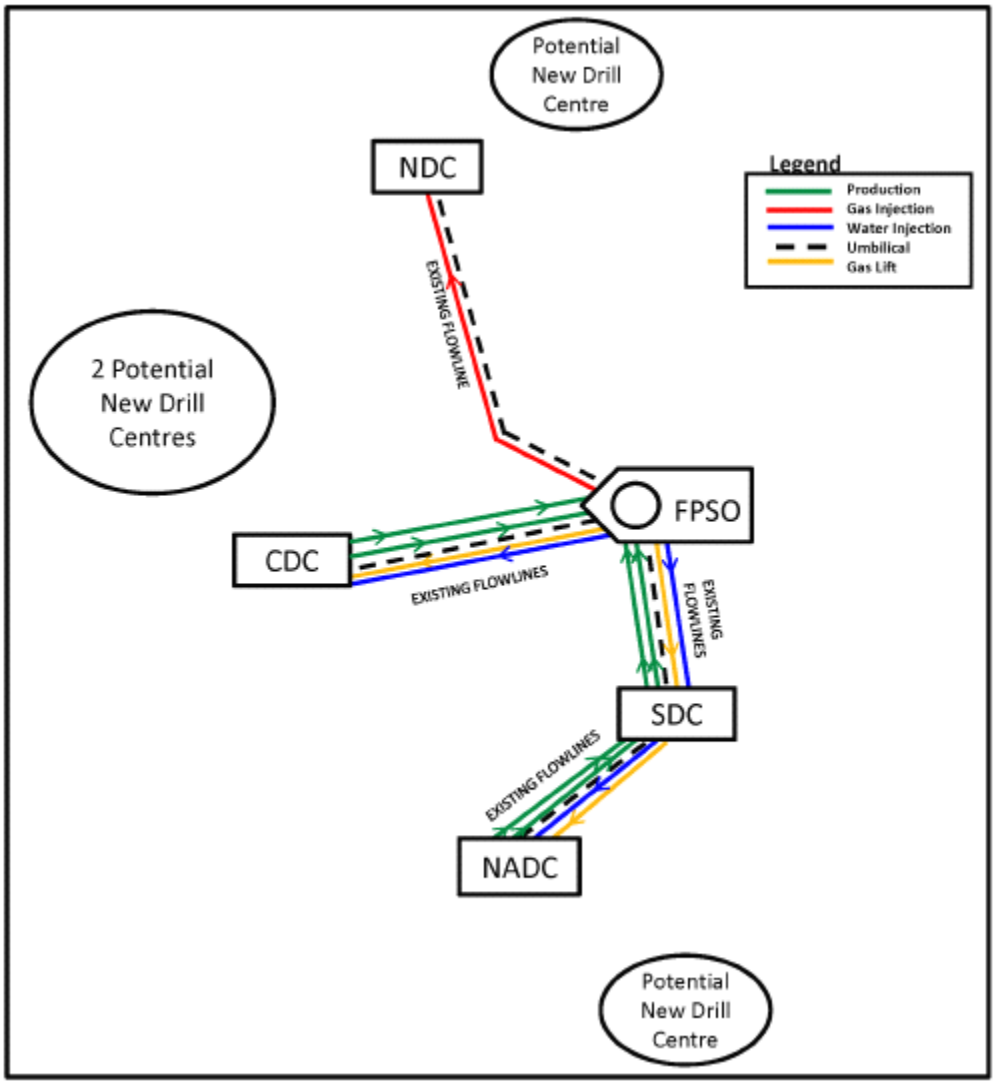

Figure 5: Subsea Drills Option Layout from Ref. [3]

4 OPTIONS DISCUSSION

The options discussion is used to determine which option is the better one. The following sections will be comparing these two options in different ways.

4.1 Project Schedule

The design and construction of the WHP option shall be finished in 2016 or 2017, and the first oil of the WHP option shall be approximately in 2017. The design and construction of the subsea drills option shall be completed in 2015 or 2016, and the first oil of the subsea drills option shall be approximately in 2016. For the project schedule, the WHP option has one more year than the subsea drills option.

4.2 Cost

For construction, the person-hours of WHP option is approximately 8500, and the person hours of CGS design and construction is about 1600000. For operation, WHP shall own at least 120 persons to work on the topside of the CGS. For construction, the person-hours of Subsea drills option is approximately 500000. For operation, the subsea drills option shall have little or no any more employment [3]. For the cost issue, the subsea drills option is more advanced than the WHP option.

4.3 Pollution

For WHP option, the construction of the CGS will produce concrete waste and water pollution. In addition, the WHP option has more potential activities, so it will develop much more potential pollution than subsea drills option does. For subsea drills option, the potential issue of oil spill is to be considered because of unexpected seismic problem or extensive corrosion. Sea water and fish species shall be affected seriously [3]. For subsea dills option, the possibility of oil spill is much higher. If oil spill happens, it might be as serious as the oil spill event of the BP Exploration. Therefore, the subsea drills option shall take over much more potential risk and pollution.

4.4 Corrosion

For subsea drills option, large safety and financial incidents of pipelines are related with corrosion problems. Corrosion is one of the most serious issues in the pipeline systems with oil and gas. It costs plenty of money every year. In onshore and offshore pipelines, corrosion is the large percent of causes in the serious incidents. During different stages of pipeline design, corrosion issue must be considered. The existing methods of resisting corrosion are good enough, but most of them are very expensive. The most common method to resist internal corrosion is dehydration, because it can mitigate condensation so as to reduce the corrosive reaction. Dehydration method is not only used in internal pipeline with gas, but also used in internal pipeline with liquid. Other methods for internal pipeline are inhibitors, buffering, cleaning pigs, biocides. Coating is traditional and valuable method of resisting corrosion, but it is a very expensive method. Concrete coating is always used for offshore pipelines in order to prevent corrosion issues [4]. For WHP option, the CGS is obviously made of concrete, and concrete material is able to reduce or mitigate the corrosion issue. During different stages of CGS design, corrosion issue shall be little to be considered.

4.5 Employment Effect

Although the WHP option has more cost about design and construction, it shall provide much more employment opportunities than subsea drills option. It means that the WHP option shall greatly promote the economic development of the Newfoundland and Labrador. The WHP option almost contains all the engineering fields such as electrical, mechanical, civil, processing and naval engineerings. The WHP option shall provide more job positions for those workers of Newfoundland and Labrador, especially for those new graduates from Memorial University.

5 CONCLUSION

The paper has shown the comparison between WHP option and subsea drills option. The WHP is more stable and safe than subsea drill in the White Rose field, and it will not be affected seriously by harsh environmental conditions. Although the WHP option has less advantage about initial cost, it shall

have less total cost including potential corrosion cost and oil spill cost. During different stages of CGS design, corrosion issue shall be little to be considered. In addition, the WHP option shall provide much more employment opportunities. Therefore, Husky Energy should decide that the WHP option shall be applied for such significant White Rose Extension project.

6 REFERENCE

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