

Benchmarking Study for Sustainable Oil and Gas Offshore Platform Decommissioning In Indonesia

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Abstract

This paper presents literature study for oil and gas offshore platform decommissioning in Indonesia and other country. The paper centralizes its explanation to regulatory, technical, and financial issues related to offshore platform decommissioning.

Benchmarking study is taken to compare progress of oil and gas offshore platform decommissioning in Indonesia with country such United State and international recommended practice. Comparison of cost estimation shows range of estimated cost for platform decommissioning options in Kalimantan Offshore Region and in Pacific Offshore California Sea Region (POSCR).

Keywords

Decommissioning, cease of production, fatigue life, reserve strength ratios (RSR), rig-to-reef

1. Introduction

Offshore platforms in Indonesia were built since 1970's. To current date, these platforms age have achieved two or three times of a platform standard economic life. An assessment to existing platform is required to determine whether it is still met fit-for-purpose criteria of an oil and gas platform according to industry standard and practice. This assessment is known as preliminary step in screening candidate of to-be-decommissioned offshore platform.

Despite of technical issue, offshore platform decommissioning also deals with strict regulatory and financing. Due to its location in the ocean, the oil and gas offshore operation (include platform facilities) is regulated by Continental Shelf (Geneva, 1958) and Law of the Sea (Montenegro, 1982) Convention. This brought concern to environmental impact of offshore platform decommissioning to ocean. With respect to the environmental impact, the offshore platform decommissioning removal options vary as per approved method by all related stakeholders. The method determines amount of fund needed for the execution.

2. Permit and Regulation

Indonesia

In Indonesia, decommissioning issue emerged first time in Decree No. 017/1974. Article 21 Clause 1 of the regulation stated that unused mining installation should be completely dismantled within the period stipulated by the General Director, by taking appropriate measures to ensure job security and the shipping lane [1].

Specific information for offshore platform decommissioning were not stated in year 1974 regulation yet. In 2010, Indonesia Oil and Gas Task Force (SKKMigas) released Code of Conduct (PTK) No. 040 about Abandonment and Site Restoration (ASR). One year later, Indonesia Government established Ministry Energy and Mineral Resource

Decree No. 01 which provided technical guidelines for oil and gas offshore installation decommissioning. Further, this decree is adopted as one of basis to determine method of platform decommissioning.

International Regulations

Due to its location in the ocean, United Nations (UN) Convention on the Continental Shelf (Geneva, 1958) and United Nations Convention on the Law of the Sea (Montego Bay, 1982) or also known as UNCLOS are applied to oil and gas offshore operation.

Article 5 Clause 5 of UN Convention on the Continental Shelf states that any installations which are abandoned or disused must be entirely removed [2]. Beside, Article 60 Clause 3 of UNCLOS [2] states that:

Any installations or structures (in the exclusive economic zone) which are abandoned or disused shall be removed to ensure safety of navigation, taking into account any generally accepted international standards established in this regard by the component international organization. Such removal shall also have due regard to fishing, the protection of marine environment and the rights and duties of the other states. Appropriate publicity shall be given to the depth, position, and dimensions of any installation or structures not entirely removed.

Both previous conventions are two major international agreement related to oil and gas offshore platform decommissioning. The generally accepted international standard provided in the Law of the Sea Convention which were issued in 1989 by the International Maritime Organization (IMO) [2]. The conventions established IMO Guidelines and Standards for Removal of the Offshore Installations and Structure on the Continental Shelf and in the Exclusive Economic Zone. The major points in the IMO Guidelines are:

1. The general principle is that all disused installations are required to be removed.
2. Installations in water depths of less than 75 meters or 100 meters after 1st January 1998, and weighting less than 4,000 ton should be removed unless:
 - a. Not technically feasible,
 - b. Involving extreme cost, or
 - c. Constituting unacceptable risk to personnel or the marine environment.
3. An unobstructed water column of 55 meters must be left in the event of a partial removal.
4. All installations after 1st January 1998 are to be designed and built so that their entire removal is feasible.

3. Technical

Indonesia

As stated in previous regulation issue section, technical guideline for oil and gas offshore installation decommissioning had been published in 2011. This technical guideline clearly stated how oil and gas operator in Indonesia should conduct the decommissioning, from planning, execution, to monitoring. Article 12 of the technical guideline mentioned obligations of the operator below in the decommissioning phase [1].

1. Conductor cutting 5 meters below mudline or parallel to seabed.
2. Topside facility removal by cutting welding connection between pile and topside support.
3. Pile cutting 5 meters below mudline or parallel to seabed.
4. Pipeline cutting above riser bend point and 3 meters from substructures footing.
5. Pipeline sealing and burial of its ends to 1 meter or by covering with protection material.
6. Waste storage in appointed location onshore.
7. Seabed clearing in radius 500 meters from the installation.

American Petroleum Institute (API)

In industry practice, offshore platform decommissioning is referred to API RP2A WSD Chapter 17 Assessment of Existing Platform. The assessment provides preliminary screening before an existing platform is justified as no longer

fit-for-purpose and can be proceed further for a decommissioning phase. The basis parameter of the assessment are fatigue life and reserve strength ratio (RSR).

The design fatigue life, L , in years should satisfy the following expressions.

$$L = SF_1L_1 + SF_2L_2 \quad [3]$$

Where:

L_1 = Initial in service period, years

L_2 = Planned service life at new location, years

$SF_1 = 2.0$ for minimum requirements. If the weld in a tubular connection is 100% NDE inspection in accordance with requirements and is upgraded if defects are found, SF_1 may be between zero and 2.0 selected on rational basis.

$SF_2 = 2.0$.

The API RP2A WSD Chapter 17 breaks down 6 components below for assessment of existing platform [3].

1. Platform selection. An existing platform shall undergo an assessment process to demonstrate its fitness for purpose if one or more of the following condition exist:
 - a. Addition of personnel or facilities such that the platform exposure level is changed to a more onerous level.
 - b. Increased loading on structure, such that the new combined environmental/operational design criteria or the level deemed acceptable by the most recent assessments.
 - c. Inadequate deck height, such that waves associated with previous or new criteria will impact the deck, and provided such action was not previously considered.
 - d. Damage or deterioration of a primary structural component found during inspections.
2. Categorization of platform structure by various levels of exposure according to life-safety and consequences of failure.

Categories for life-safety are as follows:

 - S-1 = manned-non-evacuated.
 - S-2 = manned-evacuated.
 - S-3 = unmanned.

Categories for consequences of failure are as follows:

 - C-1 = high consequence of failure.
 - C-2 = medium consequence of failure.
 - C-3 = low consequence of failure.
3. Condition assessment which is conducted through survey method on:
 - a. Topside, which only require the annual Level I survey.
 - b. Underwater, which should comprise a Level II survey (existing records or new survey) as a minimum.
 - c. Soil data, through sampling techniques and laboratory testing procedures. Pile-driving data may be used to provide additional insight on the soil profile at each pile location, and to infer the elevation of pile end bearing strata.
4. Design basis check. For all categories, a single vertical cylinder may be used to determine if the platform satisfies the reference level force.
5. Analysis check by two potential sequential analysis checks:
 - a. Design level analysis, may be evaluated using the design level procedures below:
 - Structural steel design. Damaged or repaired members may be evaluated using a rational, defensible engineering approach, including historical exposure or specialized procedures developed for that purpose.

- Connections, which require that joints be able to carry at least 50 percent of the yield stress for members and at least 50 percent of the yield stress for member loaded primarily in tensions, need to be met.
 - Fatigue, where Levels III and/or IV surveys are made. Adequate fatigue life may be demonstrated by means an analytical procedure as alternative.
- b. Ultimate strength analysis, may be determined using elastic methods, or inelastic methods, as desired or required.
6. Consideration mitigations, which are defined as modifications or operational procedures that reduce loads, increase capacities, or reduce exposure.

4. Financial

Indonesia

In Indonesia, offshore platform decommissioning activity is categorized as part of ASR. Hence, the platform decommissioning shall be financed by ASR fund mechanism. Code of Conduct (PTK) SKKMigas No. 040 about ASR states basis of assumptions to estimate the decommissioning cost [4]. Those are:

1. ASR is applicable to all asset which need the decommissioning for all production facilities and support.
2. ASR is conducted on cease of production phase of a field.
3. Cost estimation for ASR excludes calculation for exploration well.
4. Cost estimation is escalated to year of ASR plan.

PTK SKKMigas No. 040 also breaks down components of the ASR cost as follows:

1. Engineering design cost
2. Permit and regulatory cost
3. Well abandonment cost, except exploration well
4. Removal cost
5. Transportation cost
6. Storage cost
7. Site restoration cost

Furthermore, the ASR fund is paid by oil and gas operator each semester in US Dollar currency. For first field in the Work Region (WK), the ASR fund payment is started from beginning of production phase to its end of production according to field economic life. While, for second or next, the ASR fund is started from Plan of Development (POD) approval to end of production.

Percentage of ASR Fund from overall project cost is not stated in PTK SKKMigas No 040. The estimation of ASR Fund is left to operator's discretion.

A Join Study on 7 platforms located in Kalimantan Offshore Region with 29 already closed wells shows range of cost estimation for 4 platform decommissioning options in Indonesia [5].

Table 1. Range of Cost Estimation for Platform Decommissioning Options in Kalimantan Offshore Region [5]

No.	Description	Estimate Cost
1	Platform decommissioning method follows technical guidelines in Ministry of Energy and Mineral Resource Decree No. 01/2011. Conductors are cut five meters below the mudline.	USD 53 Million
2	Cut platform structures parallel to seabed.	USD 46 Million
3	In-situ rig to reef. Platform substructures are re-use as artificial reef in its origin location after well conductors, production facilities, and topside structures removal.	USD 31 Million
	Ex-situ rig to reef. Platform substructures are re-use as artificial reef in appointed location by Ministry of Marine and Fisheries outside its origin location after well conductors, production facilities, and topside structures removal.	USD 34 Million
4	Leave platform in place and plans to be periodically maintained.	USD 1.6 Million per year

The Join Study above was conducted by SKKMigas, Indonesia Oil and Gas General Director (Ditjen Migas), and Bandung Institute of Technology (ITB) in 2015.

United State

In 2004, Minerals Management Service (MMS) of United State released report of Offshore Facility Decommissioning Costs in Pacific Offshore California Sea Region (POCSR) [6]. This report is presented in charts below.



Figure 1. Oil and Gas Offshore Platform Decommissioning Cost in POCSR Year 2004 by Estimated Removal Tonnage [6]

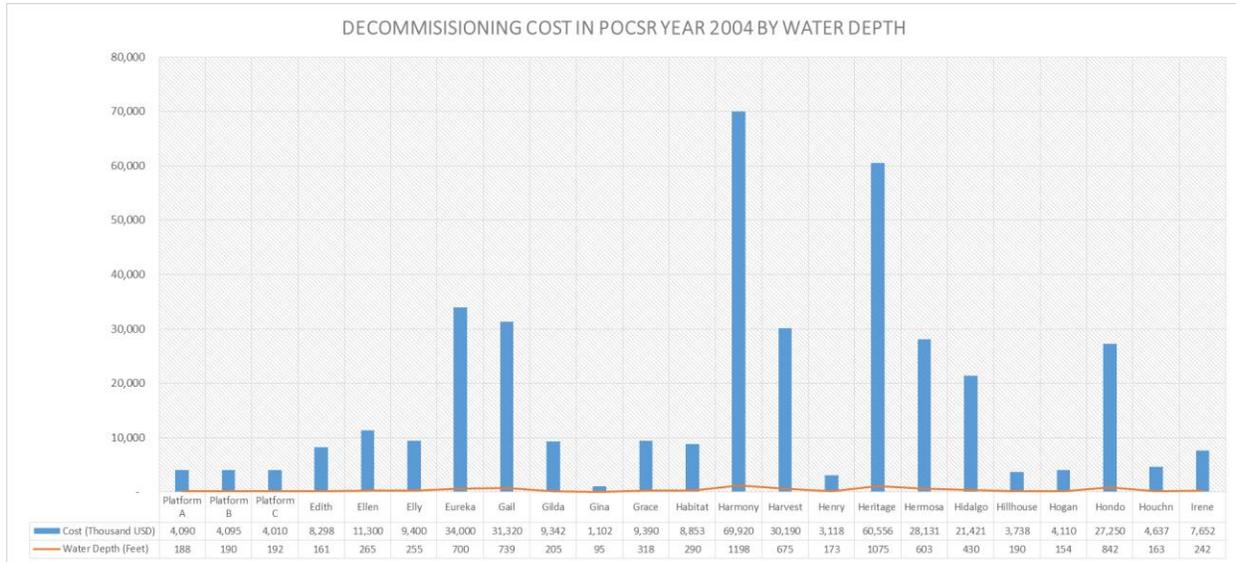


Figure 2. Oil and Gas Offshore Platform Decommissioning Cost in POCSR Year 2004 by Water Depth [6]

Decommissioning cost by removal chart shows 3 platforms with heaviest estimated removal tonnage have the highest decommissioning cost among others. Those platforms are Harmony (129,842K USD), Heritage (128,654K USD), and Hondo (77,052K USD). Decommissioning cost of those 3 platforms are also the highest compare to rest of platform by water depth.

Table 2. Summary of Oil and Gas Offshore Platform Decommissioning Cost in POCSR Year 2004

No.	Platform Name	Est. Removal Weight* (Tons)	Water Depth (Feet)	Estimate Cost (USD)
1	Harmony	69,920	1,198	129.842 Million
2	Heritage	60,556	1,075	128.654 Million
3	Hondo	27,250	842	77.52 Million

* Estimated Removal Weight includes the weight of the jacket, deck, piles, and conductors and assumes that they are removed to a depth of 15 feet below the mudline.

These informations reflect that the higher the estimated removal weight and the deeper the water depth of a platform, the higher the decommissioning cost. These two factors are considered to be primary concern in estimating cost for offshore platform decommissioning.

5. Conclusion

The literature study shows that Indonesia is already has provided relevant regulations, technical guideline, and the financing mechanism for offshore platform decommissioning. Until today, no informations regarding offshore platform decommissioning execution is documented in country. The practice is limited to Join Study which conducted by government organizations and University.

Consideration for economic risk is exclude from PTK SKKMigas No. 040/2011 as financial guideline for offshore platform decommissioning and API RP2A WSD as international recommended practice on how preliminary assessment for existing platform is conducted before decommissioning decision is taken. The determination of an acceptable level of economic risk is left to the operator’s discretion. This issue is suggested to be explored further in the future.

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Biographies

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