

2009 Frost & Sullivan Growth Excellence Awards
Excellence in Innovation

Perisai Petroleum Teknologi Bhd

The 2009 Frost & Sullivan Award for Excellence in Innovation in the Asia Pacific oil and gas production technologies market is presented to Perisai Petroleum Teknologi Bhd (Perisai). The award is presented in recognition of Perisai's continued excellence in the field of product innovation, which has propelled the company as a strong Value Creating Technology Company in the ASEAN region.

Perisai Petroleum Teknologi Bhd (Perisai) is a value creating technology provider with more than 100 patents, granted or pending, owned directly or via licensing in a number of countries worldwide, of which 30 are co-owned with PETRONAS. Perisai provides proprietary solutions for topsides to subsea, from greenfields to abandonment, with a focus on long-term customer satisfaction.

The group has witnessed significant growth in the past few years in terms of revenues and profits. In 2007, the group's revenues were RM 37.7 million with a Profit after Tax (PAT) of RM 1.8 million. In 2008, the revenues increased by 93.1 percent to reach figures of RM 72.8 million and Profit after Tax (PAT) grew by 777.8 percent to reach RM 15.8 million.

The company has evolved from a basic technology player to a high-technology solution provider for pipe laying, decommissioning of uneconomic facilities, marginal field development and subsea technologies. It is introducing Mobile Offshore Production and Storage Unit (MOPSU) in 2011, which is a breakthrough in offshore production and storage technology.

- § MOPSU is designed as a self-installing re-locatable platform for use in water depths up to 120 metres (m), with its own integrated production storage of up to 200,000 barrels provided in the foundation mat, capable of supporting drilling, production and off-loading of crude oil or condensate to shuttle tankers.
- § The International patent pending MOPSU is a breakthrough set of new technology in the Oil & Gas Sector. The current MOPSU is designed as a self installing re-locatable platform for use in water depths ranging from 25 m to 80 m. It brings together, in an all-new integrated design, production storage of up to 200,000 barrels provided in the foundation mat, capable of supporting drilling, production and off-loading of crude oil or condensate to shuttle tankers

- a totally new cost-effective method for developing small and marginal fields in shallow waters.
- § Unlike other systems that rely on drilling rigs, wellhead platforms, pipelines or a floating storage and offloading vessel, the MOPSU uses modular drilling units, integrated storage and a detachable drilling template with the entire system (with the exception of the detachable drilling template) being fully recoverable and reusable.
- § This technology will provide oil and gas companies' versatile and scalable solutions for small and marginal field developments and set new paradigms in design of cost-effective systems and structures.

Innovative Element of the Product

MOPSU comes in a low-cost single-installation integrated unit, which combines the features of conventional remote field development technology. A single MOPSU is capable of replacing the combined services of Jackup drilling rig, well-head platform, Mobile Offshore Production Unit (MOPU) and Floating Storage and Offloading (FSO) vessel.

The unique advantages of MOPSU are as under:

- § **Early Production system:** Drilling and well appraisal, including extended well testing can be performed with this configuration and production during this period can be stored and offloaded to shuttle tankers. Based on the results obtained from the testing, recoverable reserves can be computed and full scale development strategy can be formulated. This will then determine the number of wells to be drilled and optimal process facilities required, making it a fit-for-purpose solution. If results of the appraisal and testing do not warrant a production facility at site, the Drill Stem Test string can be retrieved and the MOPSU, including the drilling template, can be redeployed to another suitable area.
- § **Minimum CAPEX and OPEX:** Typically, conventional wellhead platforms are constructed based on assumptions on the likely outcomes of ultimate hydrocarbon recovery. This method has often resulted in over design and sub-optimized platforms resulting in unnecessary capital expenditure for the field owner / operator. Considerable savings can be achieved by deploying the MOPSU instead of installing a conventional wellhead platform for operation in conjunction with a MOPU and FSO. Immediate CAPEX savings can be realized as heavy lift vessels or jack-up rigs are not required for the installation of the MOPSU and the MOPSU site-installed Detachable Wellhead Platform (M_DWHP). The integral crude and condensate storage and offloading facilities eliminate the

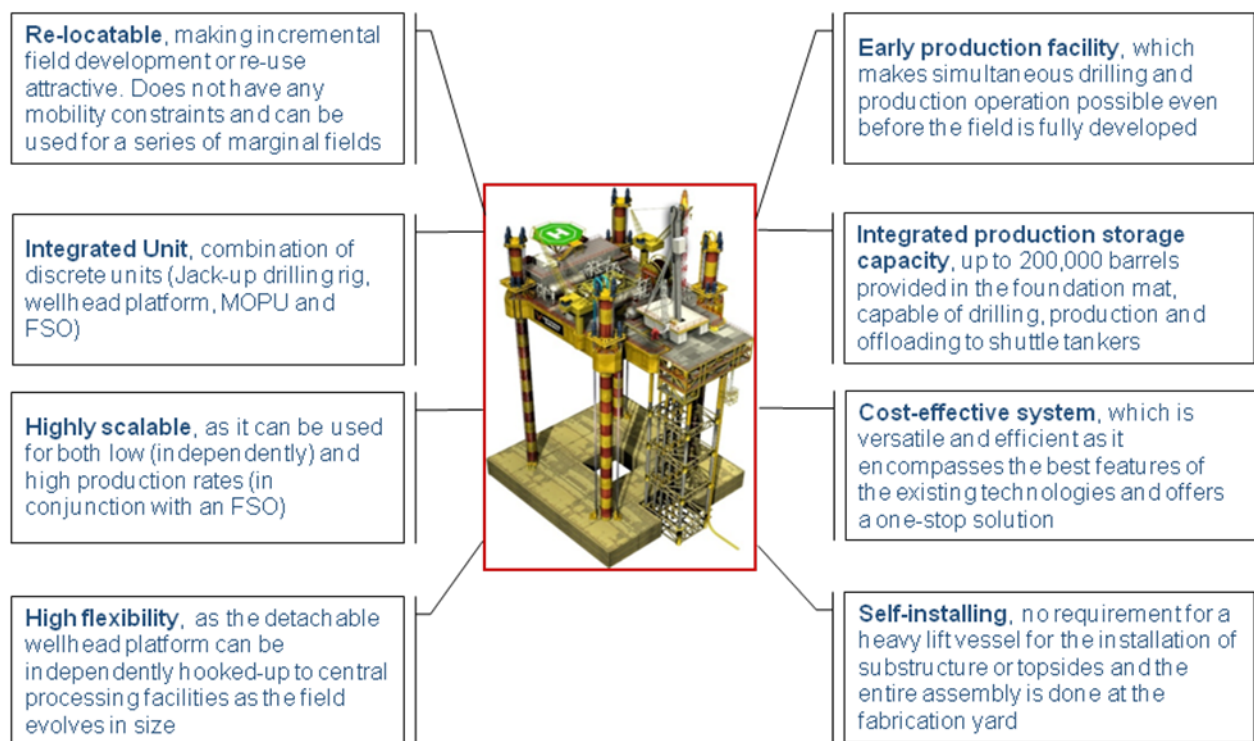
need to install pipelines or deploy an FSO. Savings can also be achieved in OPEX since there are no pipelines or FSO to operate and maintain and less coordination as all the facilities are being accommodated on a single platform. At the end of field life, huge savings can be recognized since abandonment of the production and storage facility involves only jacking and mooring operations.

- § **Scalable:** For low production rates the MOPSU can be used independently. For higher production rates, especially in the initial years, it can be used in conjunction with an FSO, which will be demobilized when the production declines.
- § **Flexible:** If the field is found to produce above initial expectation or if other hydrocarbon deposits are found to be present in close proximity, then the wellhead platform, which is an integral part of the MOPSU can be detached easily from the MOPSU and independently hooked-up to central processing facilities or pipeline network as the field evolves in size.

Chart 1.1 shows the unique capabilities of MOPSU technology in the Asia Pacific oil and gas production technologies market in 2009

Chart 1.1

Oil and Gas Production Technologies Market: Unique Capabilities of MOPSU Technology (Asia Pacific), 2009



Source: Frost & Sullivan

Leverage of Leading Edge Technologies

The tables provided below highlight the competitive benefits of MOPSU technology over similar technologies and establish the unique advantages of MOPSU over other technologies in terms of performance, cost effectiveness and technical specifications.

Figure 1.1 shows the comparison of MOPSU with MOPU (Stor), MOPU, Semi-submersible, Tarpon System and FPSO

Figure 1.1

Oil and Gas Production Technologies Market: Comparison of MOPSU with MOPU (Stor), MOPU, Semi-submersible, Tarpon System and FPSO (Asia Pacific), 2009

PARAMETERS	TECHNOLOGY					
	MOPSU	MOPU (Stor)	MOPU	Semi – submersible	Tarpon System	FPSO
Depth	Up to 120 meters (with Mark II)	Up to 150 meters	Up to 80 meters	More than 180 meters	Up to 110 meters	Both Deep / shallow water
Storage facility	Yes	Yes	No	Limited	No	Yes
Average Deck Space	Over 1800sqm	Approx 2500 sqm	Approx 900 sqm	Over 4500 sqm	Approx 500 sqm	8000 sqm (max)
Number of wells	Up to 32 wells	Up to 12 wells	8-10 max	Up to 30 wells	Up to 6 wells	Up to 10 wells
Assembly	Done at fabrication yard	Onsite	Done at fabrication yard	Onsite	Onsite	Done at fabrication yard
No. of legs / redundancy	4 / Yes	3 / No	3 / No	4 / No	1 / No	NA

Well access	Yes	Yes	Yes	Limited	Yes	No
Daily Rental rates	\$69,900 per day	\$100,000 per day	\$32,900 per day	\$700,000 per day	NA	\$160,000 per day
Wellhead platform	Detachable wellhead platform	Requires independent wellhead platform	Requires independent wellhead platform	Requires independent wellhead platform	Requires independent wellhead platform	NA

Source: Frost & Sullivan

Table 1.2: Continued

PARAMETERS	TECHNOLOGY					
	MOPSU	MOPU (Stor)	MOPU	Semi – submersible	Tarpon System	FPSO
Re-locatable	Yes. Can be used for a series of marginal fields. Does not have any mobility constraints	No. The Caisson is fixed, which restricts MOPUStor's movement	No. Supported directly on seabed	Limited. Bulky structure.	No. Supported directly on seabed	Limited, but can be used for a series of marginal fields
Scalability	High. Can be used for both low and high production rates	Medium	Medium	Low	High	Low
Flexibility	High. With detachable wellhead platform which can be hooked-up to central processing facilities	Medium	Low	Low	Low	Medium

Efficiency	High	Low	Medium	Medium	Low	Medium
Early production facility	Yes. While full field development is being planned	No	Yes. Can be utilized for early, temporary and permanent production applications	No	No	No

Source: Frost & Sullivan

Figure 1.2 shows the comparison of MOPSU with Sevan Stabilized Platform, ACE Platform, Lift Boat and SEPU

Figure 1.2

Oil and Gas Production Technologies Market: Comparison of MOPSU with Sevan Stabilized Platform, ACE Platform, Lift Boat and SEPU

PARAMETERS	TECHNOLOGY				
	MOPSU	Sevan Stabilized Platform	ACE platform	Lift Boat	SEPU
Depth	Up to 120 meters (with Mark II)	Both Deep / shallow water	Up to 100 meters	60-70 meters	Up to 85 meters
Storage facility	Yes	Yes	No	No	No
Average Deck Space	Over 1800sqm	2800 to 8800 sqm	3040 sqm	1022 sqm	2800 sqm
Number of wells	Up to 32 wells	Up to 10 wells	Up to 8 wells	Up to 6 wells	Up to 10 wells
Assembly	Done at fabrication yard	Done at fabrication yard	Done at fabrication yard	Done at fabrication yard	Done at fabrication yard

No. of legs / redundancy	4 / Yes	NA	4 / Yes	3 / No	4 / No
Well access	Yes	Limited	Yes	Limited	Limited
Daily Rental rates	\$69,900 per day	\$99,400 per day (SSP 300)	\$45,000 per day	\$80,000 to \$100,000 per day	NA (Under contracting stage)
Wellhead platform	Detachable wellhead platform	NA	Detachable wellhead platform	Requires independent wellhead platform	Requires independent wellhead platform

Source: Frost & Sullivan

Table 1.2: Continued

PARAMETERS	TECHNOLOGY				
	MOPSU	Sevan Stabilized Platform	ACE platform	Lift Boat	SEPU
Re-locatable	Yes. Can be used for a series of marginal fields. Does not have any mobility constraints	Limited, but can be used for a series of marginal fields	Yes, making incremental field development or re-use attractive	No	Yes
Scalability rating	High. Can be used for both low and high production rates	Medium	High	Low	Low
Flexibility	High. With detachable wellhead platform which can be hooked-up to central processing facilities	Low	High	Low	Low
Efficiency	High	Medium	Low	Medium	Medium

Early production facility	Yes. While full field development is being planned	No	No	No	Yes. Simultaneous drilling and production operation possible
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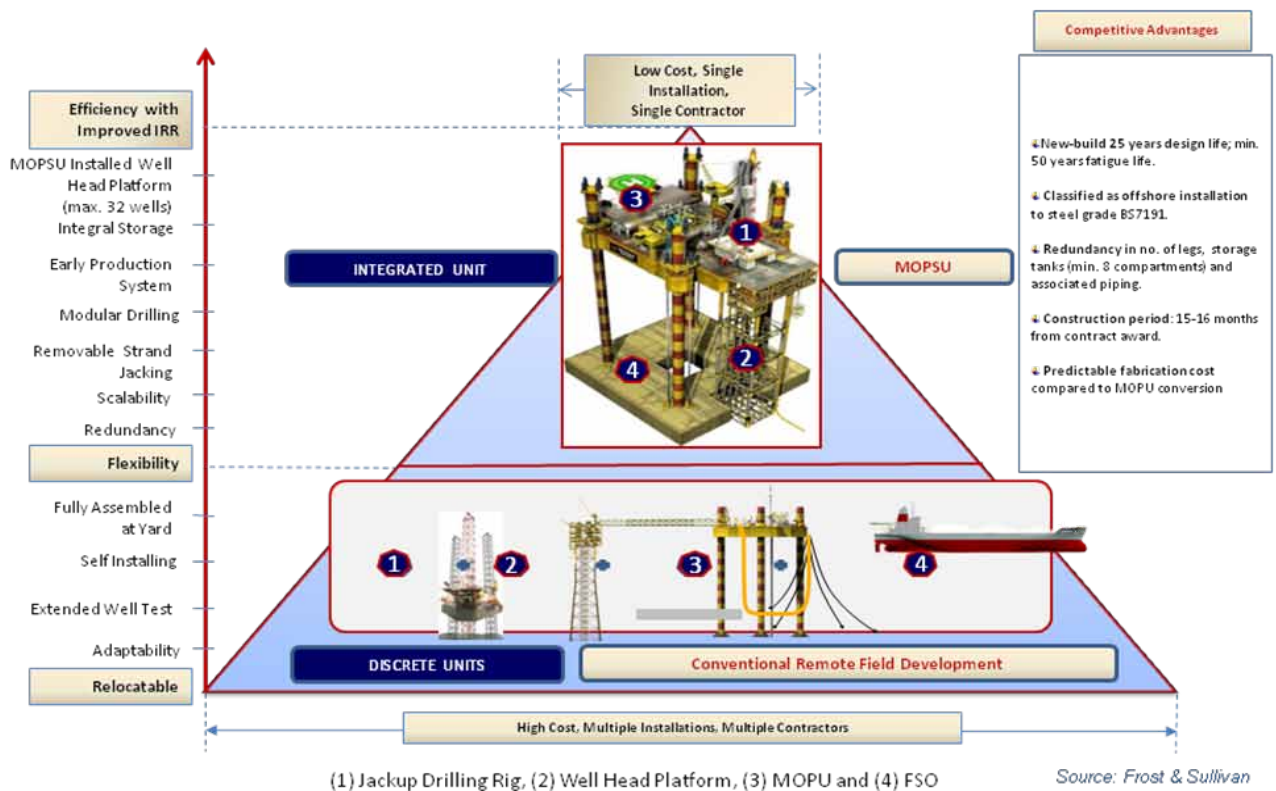
Source: Frost & Sullivan

Value-added Benefits

Chart 1.2 highlights the unique value proposition of MOPSU technology as compared to the combined conventional field development technique (Jackup drilling rig + Wellhead platform + MOPU + FSO). Unlike others systems that rely on drilling rigs, wellhead platforms, pipelines or a Floating Storage and Offloading vessel, the MOPSU uses modular drilling units, integrated storage and a detachable drilling template with the entire system fully recoverable and reusable.

Chart 1.2

Oil and Gas Production Technologies Market: Unique Value Proposition of MOPSU Technology as Compared to the Combined Conventional Field Development Technique (Jackup drilling rig + Wellhead platform + MOPU + FSO).



Source: Frost & Sullivan

Source: Frost & Sullivan

In addition to this, the significant benefits of MOPSU technology are as under:

- § Immediate CAPEX savings on wellhead platform and pipeline/FSO
- § Self-installing – No requirement for Heavy Lift Vessels for the installation of substructure and topsides
- § Facilitates extended well testing and early production
- § Fully assembled at fabrication yard / quayside and wet-towed to offshore site
- § Re-locatable, making incremental field development or re-use attractive, with negligible environmental impact
- § Integral production storage provided in the foundation mat
- § Drilling can be done with modular drilling rig, tender assisted rig or jack-up
- § Modular drilling rig is suitable for both exploration and production
- § Self-supporting detachable wellhead platform for attachment to conventional platforms or to pipeline network if further development is envisaged
- § Fixed installation which floats only during mobilization and demobilization, therefore no requirement for marine classification
- § Packaged equipment philosophy to develop topsides facilities, allowing flexibility to change processes
- § Removable strand jack system is used to lower the mat and to elevate the deck, eliminating the need for permanent jack-houses, which require periodical maintenance
- § Platform-deployed mooring hawser and crude transfer system for offloading to shuttle tankers; no subsea offloading connections

Increased Customer Value

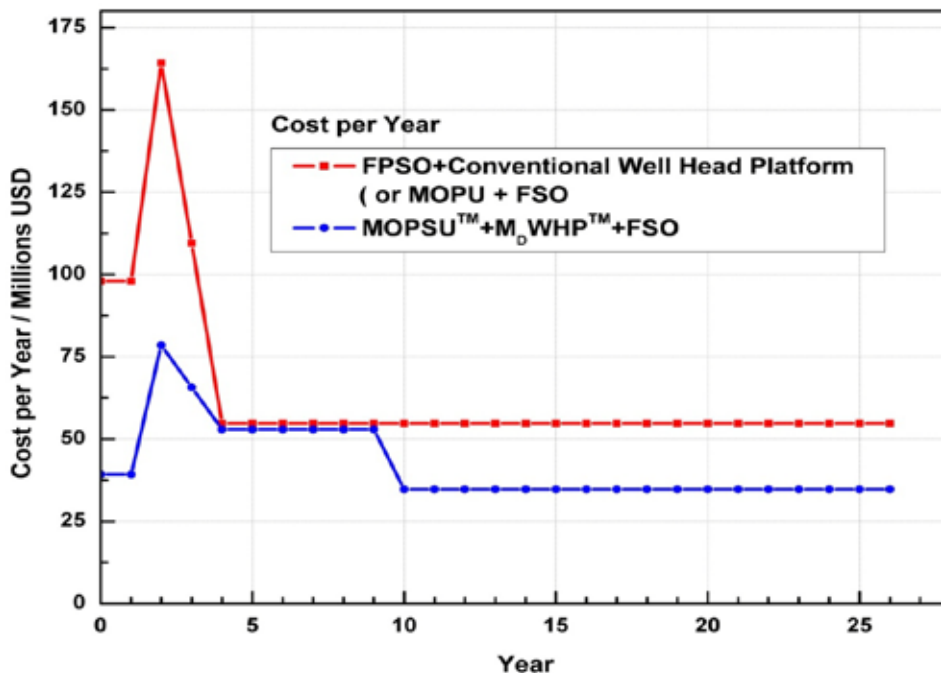
For the customers of MOPSU technology, the main benefit is the decrease in investment for field development. MOPSU is a highly economical innovative solution for all types of field development viz. large-field, medium field and small field.

§ It is a highly cost-effective solution, which is technologically advanced compared to conventional methods of field development. Chart 1.3 compares the yearly cost between MOPSU and traditional technologies for a large field with a peak production rate of around 35,000 barrels per day. When oil production declines below 10000 bbd (year 10) FSO used with MOPSU can be demobilized and produced oil can be stored in MOPSU integrated storage facility, reducing the cost of the technology. The two set of technologies are as under:

- FPSO + Conventional Well Head Platform (or MOPU + FSO) and
- MOPSU + M_DWHP (No FSO is required)

Chart 1.3

Oil and Gas Production Technologies Market: Comparison of Yearly Cost between MOPSU and Traditional Technologies for a Large Field with a Peak Production Rate of around 35,000 barrels per day.

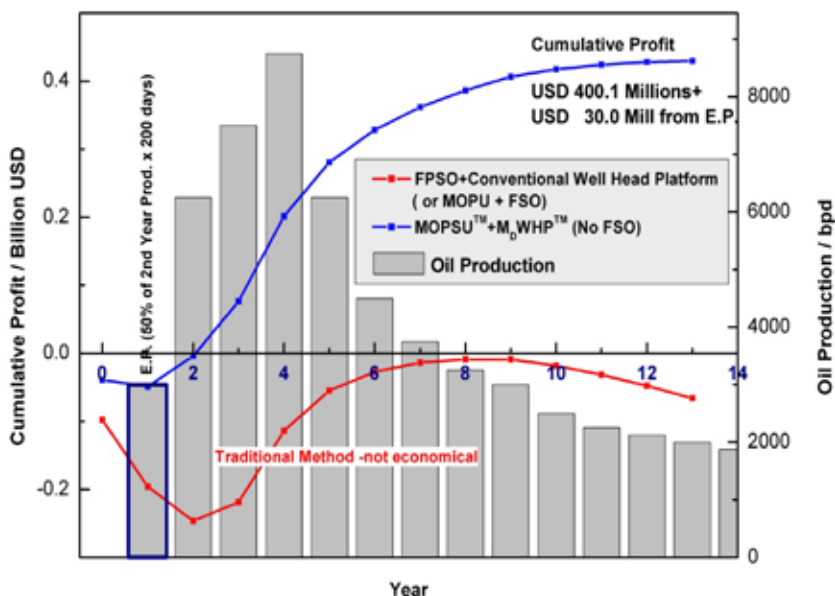


Source: Perisai

§ The development of Marginal fields is an upcoming trend in the upstream oil and gas sector. Oil and gas companies are seeking to minimize financial risk and accelerate return on investment. Lacking the confidence to go directly from a two-day well to full-field development, operators use extended well tests to deliver comprehensive, dynamic data and reduce economic uncertainty. When unwilling to wait for installation of conventional infrastructure, they are using low-cost, reusable production systems to speed up cash flow and cost-effectively bring marginal fields on-stream. MOPSU is the perfect product for marginal field development where it is uneconomical to use traditional methods for field development. Chart 1.4 compares the cumulative profits between two different set of technologies and clearly establishes the financial benefits of using MOPSU over other conventional technologies for a small field with a peak production rate of around 8,750 barrels per day. It does not make sense to use conventional technology for small fields as the cumulative profits are never positive. MOPSU is the perfect product innovation in this case where it easily counters the industry challenge of small field development.

Chart 1.4

Oil and Gas Production Technologies Market: Comparison of Cumulative Profits between Two Different Set of Technologies for a Small Field with a Peak Production Rate of around 8,750 barrels per day.



Assumptions

MOPSU Development Method	
MDWHP Cost	(1 unit)
MOPSU CAPEX	
Total Instalation and HUC Cost	
Total	39.25 Mill
Traditional Development Method	
Traditional Wellhead Platform	(1 unit)
FPSO CAPEX	
Instalation and HUC Cost	
Total	98.00 Mill
Description	Daily rate (USD)
MOPSU (200000 barrels)	65000
FSO (400000 barrels)	25000
MOPSU Drilling	70000
FPSO	150000
Jackup Drilling	300000
Production	35000
O&M	20000

Source: Perisai

- § In addition to this, MOPSU is the technologically advanced and innovative solution for large field (35,000 barrels per day) development and medium field (17,500 barrels per day) development. The additional profit with an upstream company can gain by using MOPSU is around 17 percent for large field development, while an additional profit of 34.7 percent can be realized for medium field development. The comparison has been carried out between the two sets of technologies which are as under:
- FPSO + Conventional Well Head Platform (or MOPU + FSO) and
 - MOPSU + M_DWHP + FSO

Customer Acquisition / Penetration Potential

- § With crude oil prices reaching \$70 a barrel, it offers tremendous opportunities for developing marginal fields
- § The countries in Asia Pacific which are most promising in terms of marginal field development are:
- Malaysia
 - Indonesia
 - Thailand
 - Vietnam
 - India
- § Government incentives play a key role in the development of marginal fields effectively and beneficially. Under such circumstances, new and advanced ways of exploring marginal fields like MOPSU technology play a key role
- § The cost of the technology becomes important to make a project viable. MOPSU offers state-of-the-art technology in a highly price-competitive market
- § The primary objective of any project developer is to draw out oil in the cheapest possible way and ensure a healthy return on investment. MOPSU brings in significant benefits for its customers and provides an economical solution for marginal field development
- § The value proposition offered by MOPSU technology includes providing a cheaper alternative to conventional platforms for marginal fields and is capable of faster commissioning and faster route to first oil or gas

Figure 1.3 shows the marginal field development plans in the Asia-Pacific region.

Figure 1.3

Oil and Gas Production Technologies Market: Marginal Field Development Plans in the Asia-Pacific Region

SR. NO.	COUNTRY	MARGINAL FIELDS	OUTLOOK
1.	MALAYSIA	90 hotspots have been identified	Development outlook very positive due to thrust from PETRONAS
2.	INDONESIA	160 oil and gas fields	Development outlook positive. Government has identified 100 marginal oil fields and 60 marginal gas fields for development
3.	THAILAND	40 oil and gas fields	Positive outlook. Under current fiscal regime (Thailand III), marginal fields are attracting more investors
4.	VIETNAM	20 oil and gas fields	Positive outlook. The government is developing the marginal fields in Cuu Long basin in an effort to boost production
5.	AUSTRALIA	40 oil and gas fields	Positive outlook. New innovative concepts have been developed to explore marginal fields which are economically viable
6.	NEW ZEALAND	Around 10 oil and gas fields	Positive outlook. Government is keen on rapid developed of smaller, economically marginal fields to meet the country's energy deficit
7.	INDIA	165 new and marginal fields	Positive outlook. 44 fields have been monetized and about 90 fields are in the process of being put on production
8.	CHINA	Around 30 oil and gas fields	Moderate outlook. China's progress on marginal fields has been restricted because of unfavorable PSC conditions and tight government control

Conclusion

The competitive advantage of MOPSU technology lies in its unique value proposition which includes the following major differentiating points (over other technologies):

- Early production facility
- Easily re-locatable
- High scalability and flexibility
- Cost-effective system
- Versatility and high efficiency
- Self-installing
- Comes with integrated production storage system

Discovery of large oil & gas fields are becoming rarer. In order to maintain current production levels, countries in the Asia Pacific are looking at viable solutions for developing marginal fields.

The MOPSU technology makes development of marginal fields cost effective and economically viable.

Award Description

The Frost & Sullivan Excellence in Innovation Award is presented each year to the company that has demonstrated measured excellence in new, innovative product or product line within its industry. The recipient company has shown innovation by launching a broad line of emerging products.

Award Methodology

Frost & Sullivan has more than 1,500 analysts, strategists, visionaries and growth consultants, covering more than 300 industry segments and 1000 technologies across 80 countries. Every year, we track more than 250,000 companies to identify best practices and excellence across a variety of facets, ranging from growth strategy and competitive strategy to customer satisfaction and technology innovation. The research process utilized to determine best practices in the industry involves collecting information - based on predetermined measurement criteria unique to each award category - through extensive primary research with industry experts, market participants, end-users, and other value chain players, and supplementing that with reliable secondary information as well as our own ongoing proprietary industry research. The collected data is analyzed against formulated criteria, which are weighted as appropriate based on the type of industry and market conditions. The potential award candidates are then short-listed and ranked across the criteria based on a set of qualitative and quantitative measurements, with the award being bestowed on the company that is ranked number one among all industry participants.

Measurement Criteria

The recipient of this Award has excelled based on one or more of the following criteria:

- Innovative Element of the Product
- Leverage on leading edge technologies
- Value added features/benefits
- Increased customer value
- Customer acquisition/penetration potential

About Best Practices

Frost & Sullivan Best Practices Awards recognize companies in a variety of regional and global markets for demonstrating outstanding achievement and superior performance in areas such as leadership, technological innovation, customer service, and strategic product development. Industry analysts compare market participants and measure performance through in-depth interviews, analysis, and extensive secondary research in order to identify best practices in the industry. awards.frost.com

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