

Technical Advisory Services Proposal for FSRU LNG Import Terminal



**September
2018**

Prepared by ISGEM



TECHNICAL ADVISORY SERVICES for
FSRU LNG IMPORT TERMINAL

TECHNICAL PROPOSAL

PART A



	TECHNICAL ADVISORY SERVICES for FSRU LNG IMPORT TERMINAL	
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Attachment : Related Introductions

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SUMMARY OF TECHNICAL SERVICE PROPOSAL

This proposal is submitted by ISGEM (“ISGEM”) in response to request by BOTAS (“COMPANY”) for Technical Advisory Services for FSRU LNG Import Terminal Development.

➤ Project Phase and Preliminary Plan

Preliminary - Plan	BASIC TASKS (Technical Advisory Services)
FSRU LNG Terminal (170,000kl) - 3MTPA sendout capacity	<ul style="list-style-type: none"> • Pre Study (LNG Market Introducing, etc) • Review of Feasibility Study • Site Selection • Cost Estimation (CAPEX / OPEX) • Conceptual Design • Others (OPTIONS)


To undertake BASIC TASKS during development stage, it is classified as follows.

Development Stage (BASIC TASK) : 5 months

Pre EPC / EPC Stage (OPTION) : Subject to COMPANY’s request

Scope of Works (Development Stage)	Duration(Months)				
	1	2	3	4	5
Pre-Study(LNG Market, etc)					
<i>Review – Feasibility Study (If Necessary)</i>					
Site Selection / Suitability Study					
Interim Report					
Cost Estimation(OPEX/CAPEX)					
Conceptual Design					
Final Report / Presentation					

* Note: Depending on COMPANY’s provided work progress and information, overall works schedule can be reduced through early deployment of ISGEM manpower.

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1. INTRODUCTION


This proposal is submitted by ISGEM (hereinafter referred to as “ISGEM” or “TECHNICAL ADVISOR”) in response to the request by BOTAS (hereinafter referred to as “COMPANY”) for Technical Advisory Services for FSRU LNG Import Terminal.

ISGEM is based in the Republic of TURKEY. ISGEM is further well established in providing various technical services including engineering, project management consultancy, technical advisory and operation for international LNG import terminal projects

ISGEM is pleased to present COMPANY with this proposal for technical advisory services for floating LNG Import Terminal located in Turkey (“Terminal”).

ISGEM will work closely with COMPANY on all technical and engineering matters related to the Terminal project execution in a timely manner and making sure in all material respects that the Terminal was implemented properly and can be safely and reliably operated.

The goal of the Service is to assist COMPANY to ensure that the design of the Terminal meets COMPANY’s technical requirements and compliance to engineering and design requirements, International Code and Standards and best engineering practices applicable to LNG import terminals.

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2. THE SCOPE OF WORKS FOR TECHNICAL SERVICES

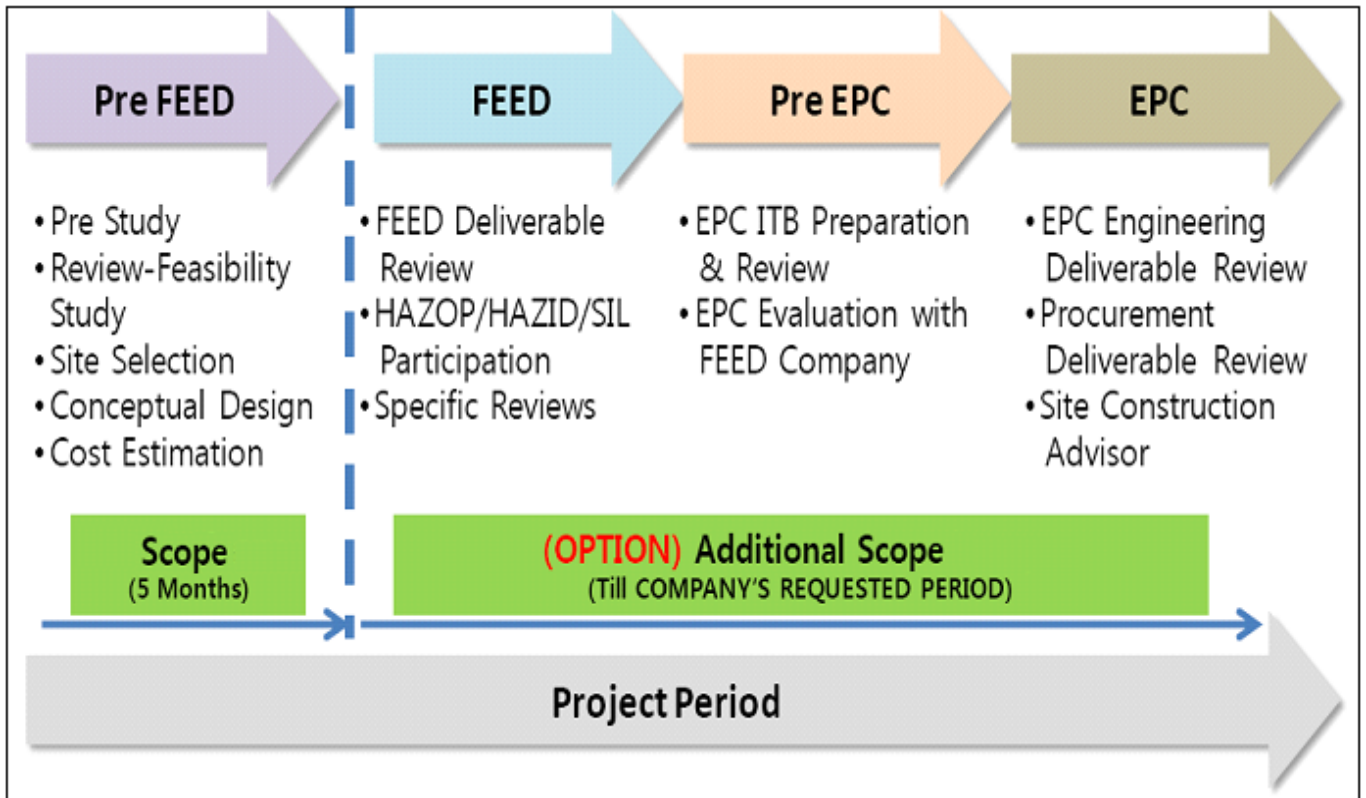
2.1 Understanding of COMPANY's need

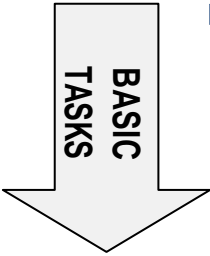
As ISGEM has been developing the LNG terminals, we believe the Company would follow the similar experience which ISGEM has gone through as a developer and operator of LNG import terminals. Also, ISGEM and the Company would share many unique characteristics as we have been experiencing historical challenge and progress. ISGEM is more than confident that ISGEM is in the better position than anybody else in terms of serving and satisfying the Company's needs with its extensive and various experiences and the similarity and common characteristics of both parties.

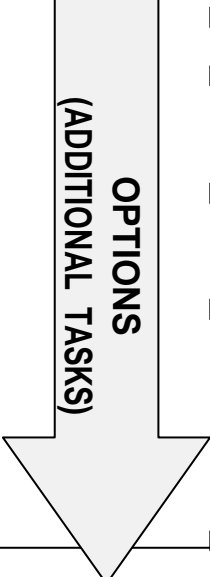
2.2 General Scope of Works of Technical Services


At this scope of works, ISGEM will provide the following services for COMPANY to meet the upcoming gas demand with most economic solution.

- **Overall LNG Market Status and Strategy**
- **General LNG Contract**
- **Review of Feasibility Study (If required)**
- **Site Selection**
- **Project Cost Estimation**
 - CAPEX /OPEX Estimation
- **General Concept of Floating LNG Receiving Terminal**
 - Comparison with FSRU and Onshore LNG Receiving Terminal
 - Comparison with FSRU and FSU
- **Conceptual Design of Typical FSRU Terminal**
 - FSRU Basis Terminal Design
 - Most Optimized Terminal Configuration
 - Comparison with FSRU and FSU Terminal



	<input type="checkbox"/> Development Stage (Priority Services)	<p>Pre Study</p> <p>Review - feasibility Study Review (Option)</p> <p>Report - Site Selection</p> <p>Report – Project Cost Estimation</p> <p>Report–Optimized Conceptual Design</p>

	<input type="checkbox"/> FEED Stage	Review of FEED Deliverables
	<input type="checkbox"/> EPC Tendering stage (Onshore & FSRU)	Review of EPC ITB Evaluation of EPC Bidders' Proposals
	<input type="checkbox"/> EPC Tendering stage (FSRU & Onshore)	Review of EPC ITB Evaluation of EPC Bidders' Proposals
	<input type="checkbox"/> EPC Execution stage (FSRU & Onshore)	Review of EPC Deliverables (PMC) Participation of EPC Activities (PMC) Supervising FSRU (New built or Conversion) Commissioning Activities
	<input type="checkbox"/> Operation Stage	

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2.3 Configuration of LNG Import Terminal

As COMPANY has informed ISGEM of planning the FSRU operation in Turkey, the LNG terminal will send out 3 MTPA of natural gas into the national pipe line network.

As there is any no conceptual design and terminal configuration, ISGEM considers that it is envisioned based on previous project experience and current FSRU project status.

It is anticipated that LNG carriers delivering LNG cargoes ranging in size up to Q-max will unload at the Terminal jetty. Floating Storage and Regasification Unit (FSRU) will have a working volume capacity of around 170,000m³. Facilities will be installed to enable natural gas to be supplied by FSRU and high pressured natural gas(HP NG) to be pumped and vaporized from the FSRU. And gas will be delivered to gas network to meet gas nomination.

To simply understand project development, COMPANY wants to initialize the FSRU since it rapidly meet gas consumption increase and minimize capital expenditure instead of onshore LNG receiving terminal.

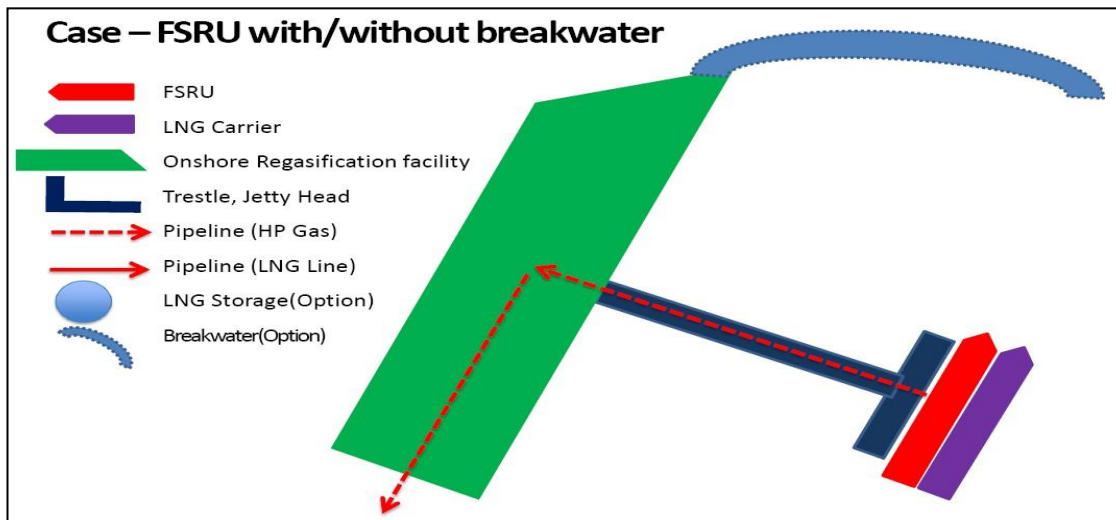
As the project is moving forward safely and recovered well for project expenditure. It may trigger to develop FSRU converted to onshore terminal.

Preliminary - Plan	Facilities
FSRU LNG Terminal (170,000kl) - 3MTPA send outcapacity	<ul style="list-style-type: none"> - Onshore Jetty - Linked with trestle & HP NG pipe line - Additional Onshore minimum infrastructure

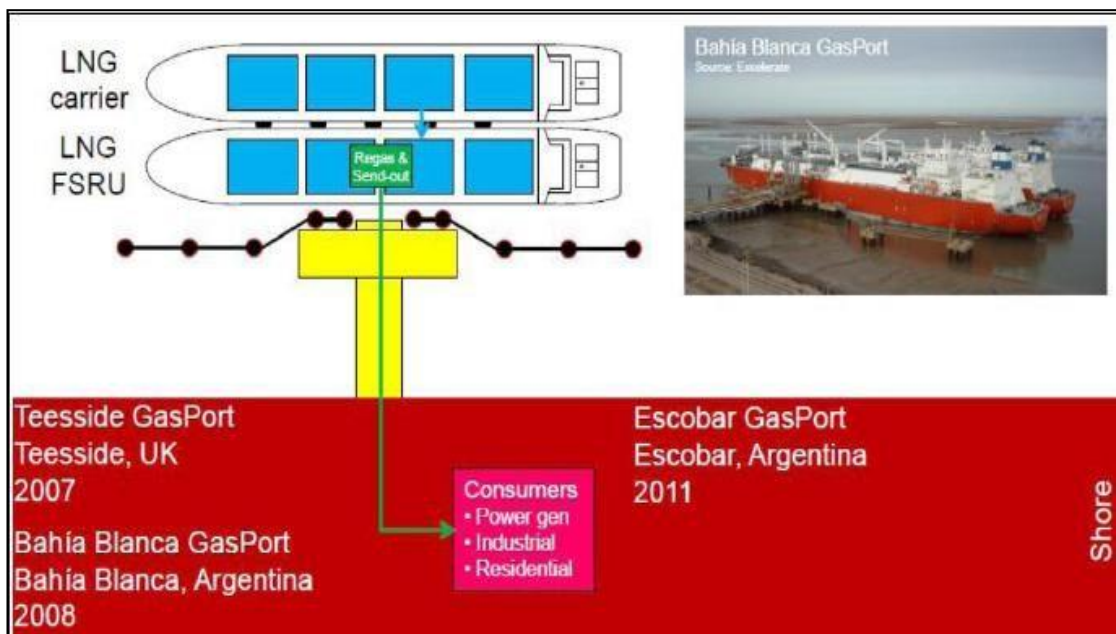
➤ **Floating LNG Receiving Terminal for 3MTPA gas sendout**


- A Floating LNG Storage and Regasification Unit (FSRU) – Conversion or New Build (It will be decided by commercial & technical bidding evaluation)
- FSRU and LNG carrier mooring to a jetty head, and LNG and gas transfer systems

<Basic concept layout (Preliminary) >



<Example of FSRU & LNG Terminal>



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2.4 Project Time Line

Since the project design concept is not defined yet, project duration can be diversified depending on feasibility study result (project requirement, site condition, technical specification, etc). For estimating the project time line, it can be feasibly considered time line as following cases;

Currently, the availability of FSRU shall be investigated with ship owners' deployment which is critical pass on the total duration. Government and local authority's approval for project acceptance is essential to estimate the duration.


To preliminarily estimate the project time, it is classified as following two cases.

Project Procedure		Duration (Assumed)	Remarks
Pre Supportive Works to COMPANY : site Selection & Conceptual Design		5 Months	Technical Service Period
FSRU Bidding		6 Months	
New Built	Ship building(FSRU)	24 Months	Till Delivery
Current Ship	Modification(FSRU)	12 Months	Till Delivery
EPC Bid Package & Bidding(Onshore)		6 Months	
EPC Construction (Onshore)		12 to 24 Months	Depending on site condition
Commissioning		1 Month	

2.5 Technical Service Requirement and its Objectives

The aim of this service is to provide all related project technical services to COMPANY for FSRU LNG import Terminal. The COMPANY intends to build and operate a state of the art LNG Import Terminal to import 3.0 MTPA of LNG for enhancing the supply of natural gas in Turkey.

- FSRU based (3.0 MTPA) with completion and gas send out by at least early 2019

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ISGEM fully understands to meet completion date for sending out natural gas, COMPANY requires the project to be implemented on a fast-track basis at an optimum cost with utmost adherence to HSE and quality requirements.


For expediting project initiative, development stage works shall be proposed by ISGEM in order to economically operate the terminal.

Tasks in the Scope of Services shall be undertaken by ISGEM' in accordance with ISGEM' in-house work instructions, project execution procedures and guidelines. ISGEM experts shall utilize their competence and knowledge of designing and operating LNG import terminals to the successful delivery of the Services requested by COMPANY and in accordance with the objective of the Project. Based on ISGEM knowledge management, lessons learnt and operational experience from previous LNG Import Terminals, ISGEM shall provide COMPANY Project Task Force with technical advices appropriately for the success of the project.

2.6 Out of Scope of Services

The followings are excluded from ISGEM Scope of Services

- Project Management/Administration and Project Control
- Commercial Advisory Services for the Project
- Government Information Support / Approval
- Soil Investigation (It will be implemented by FEED Contractor or EPC Contractor)

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3. METHODOLOGY STATEMENT

3.1 Overview

This section presents the methodology proposed by ISGEM to deliver the Scope of Services specified by COMPANY in the Request for Proposal for the Technical Advisory Services.

3.2 Basic Tasks for Technical Services

3.2.1 Task 1 – Task Preparation_


Project Kick Off Meeting

Once Technical Services awarded to ISGEM, Kick Off meeting will be held at COMPANY's office in Turkey. With fully assigned a Technical Manager and a Project Engineer, ISGEM will present overall project execution presentation at the meeting.

Project Familiarization

To perform its first task, ISGEM trusts the project familiarization stage would be very important for the successful execution of the contract. The following items will be given detailed attention:

- Review of COMPANY's specifications and requirements
- Review of proposed project structure and configuration
- National Gas Grid and Connection

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Overall LNG Market Status & General LNG Contract

With based ISGEM investigated information, ISGEM will deliver LNG market status and provide LNG contract procedure for understanding LNG value chain to COMPANY.


3.2.2 Task 2 – Feasibility Study (Review) – If Requested

In case of executed Feasibility Study, review of the F/S will be verified by ISGEM Basically, Feasibility Study is on a project plan submitted to the budget authority by the competent authority requesting execution of such study. The level of detail of a project plan depends on its nature. For verifying the feasibility study to ensure a concrete project plan, the study review team of ISGEM can contribute the overall time line and project cost with experienced ISGEM data and site condition.

Review works will be included in the overview of a feasibility study executed as follows:

- Background of LNG terminal necessity
- LNG Market, Supply Availability & Pricing
- Site Selection – Screening
- Site Screening & Initial Technical Option
- Commercial Structure
- LNG Procurement
- Conclusion & Recommendation

The site identification is normally driven by assessing a number of selection criteria. Once a site has been chosen, a rigorous review utilizing a multi-discipline team may prevent a decision that the owner will regret until the end of operations.

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Some of the site identification issues may impact project success including:

- Fully understanding government preferences in order to minimize approval time
- Offshore and onshore site and impact on technology limits
- Indigenous title and land ownership
- Environmental Constraints
- Need for a deep water harbor and unrestricted shipping access
- Impact of site works and material availability on project cost
- Access to supporting infrastructure (e.g. Airport, rail)

The experience has shown that a well chosen site can significantly reduce site preparation and marine costs.

3.2.3 Task 3 – Site Selection


As most fundamental level, site selection for LNG receiving terminal shall be decided on required gas market. Therefore, the site selection work is mainly influenced by the optimization of infrastructure cost, access to offtaker network and politics reasons as following purpose.

- For considering financial restriction (Conventional Terminal vs FSRU)
- To reduce CAPEX(EPC – Infrastructure, Site Preparation, Logistic Cost) and OPEX(Gas transition Cost and Marine Access Availability)
- To mitigate and/or avoid terminal operational HAZARD(Marine Access/QRA) and any environmental Issues
- To adopt political strategy (National Energy Security-Geographic Location)

➤ **Anticipated Site Selection Duration** *(Schedule to be tuned & agreed)*

▪ **Overall Work Period 12 weeks**

- 1 - 4 weeks Collecting Data

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- (a) Applicable codes and standards.
- (b) Project functional requirements:
 - LNG terminal throughput;
 - LNG import requirements;
 - gas send-out requirements at battery limit; and
 - future expansion.
- (c) LNG storage tank requirement (On board FSRU) :
 - storage size & LNG storage tank conceptual specification;
- (d) Outline of technical scope description:
 - layout;
 - main equipment list & utility summary; and
 - marine works.
- (e) Outline of Operational and Maintenance Philosophy.
- (f) Design Safety Philosophy.
- (g) Pre –Investment Philosophy

3.2.5 Task 5 - Project Cost Estimation


In general, cost estimation should be done in each project stage. The methodology can change with each stage becoming successively more accurate as supporting definition and deliverables increase.

Project cost is deemed as supportive works by COMPANY, estimators and related parties for achieving more accuracy data as each stage.

CAPEX Estimation

At conceptual design phase, the estimate can be developed using historical and benchmarking data for the relevant location, pro-rated to capacity by various methods.

Nevertheless, it can be approached with more accuracy through the data based on site selection and conceptual design.

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The objective of such an estimate is usually to provide one or more of the following:


- A rough indication of the economic feasibility before proceeding with the next phase;
- Preliminary comparison of alternatives;
- Assistance for budgeting; and
- Initial project planning and control.
- And it will provide basic information such as:
 - Type of plant (Jetty Type for FSRU / Onshore & Offshore layout)
 - Block diagram of the plant showing major process sections and utility systems;
 - Broad assumptions on site conditions, e.g. soil strength, restrictions on plot size; (Excluding soil investigation)
 - Preliminary plant layout; and
 - A brief general description of the project scope.

OPEX Estimation

The purpose and objective of this OPEX estimation is to provide a anticipated and precise insight to the OPEX structure for COMPANY's terminal and an estimate of the operating expenditure involved when operating the LNG terminal. Historical data and experience of comparable LNG terminals in ISGEM and international best practices in operating LNG terminals will be taken into account. It is therefore envisaged that COMPANY can use this OPEX estimation to plan regasification tariff with off taker as preliminary data and further optimize the OPEX during the operating life of the terminal.

3.3 (Option) Additional Tasks – Subject to COMPANY's Request

- FSRU / Onshore EPC Tendering
- Review on FEED / EPC / FSRU Deliverables
- Commissioning, Start up and Operational Support

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4. PROJECT EXECUTION

4.1 Preliminary Project Schedule

On the basis of LNG Import Terminal Project Pre-meeting dated on June 2016, main milestones of the project could be as follows;


- Project Starting Date : At least early 2017
- Conceptual Design by ISGEM (If awarded in late 2016) : Early 2017
- Commercial Operation Date : At least early 2019

It can vary depending on project strategy, site condition, etc

4.2 Overview Schedule for Technical Advisory Services

The Services will be composed of three stages. There are the Development Stage, Pre-EPC (FEED & EPC Tendering) and EPC Stage. The basic concept of the Services Stage is shown in the below.

Development Stage (PreFEED)	<i>FEED Stage & EPC Tendering</i>		<i>EPC Stage & FSRU Delivery</i>	
Till Early 2018	<i>FSRU New Built</i>	<i>2018 ~</i>	<i>FSRU New Built</i>	<i>2019 ~2021</i>
	<i>Current FSRU</i>	<i>2018 ~</i>	<i>Current FSRU</i>	<i>2019 ~2020</i>
<ul style="list-style-type: none"> • Review – Feasibility Study • Site Selection • Cost Estimation • Conceptual Design • Design optimization 	<ul style="list-style-type: none"> • Review of conceptual design • Risk and safety assessment • Basic engineering deliverables • Detailed engineering deliverables • Design review, HOZOP, SIL review, operability workshop 		<ul style="list-style-type: none"> • Detail Design review, HOZOP, SIL review, operability workshop • Attending FAT/SAT • Field engineering assistance • Commissioning, start up, operational support • Support for commissioning start up 	
BASIC TASKS	<i>OPTIONAL TASKS</i>		<i>OPTIONAL TASKS</i>	

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4.3 Technical Advisory Service Schedule

The Services will be implemented with two stages. There are the Development Stage, FEED and EPC Stage. The basic concept of the Services Stage is shown in the below.

- **Development Stage (BASIC TASK) : 5 months**
- **Pre EPC/EPC Stage (OPTION TASK): Till COD (Upon COMPANY's Request)**


Scope of Works (Development Stage)	Duration(Months)				
	1	2	3	4	5
Pre-Study(LNG Market, etc)	■				
<i>Review – Feasibility Study (If Necessary)</i>	■				
Site Selection / Suitability Study	■				
Interim Report			■		
Cost Estimation(OPEX/CAPEX)				■	
Conceptual Design		■			
Final Report / Presentation					■

*Note : Depending on COMPANY's provided work progress/information on Preliminary Feasibility Study and Site Selection, overall works schedule can be reduced through early deployment of ISGEM manpower.

4.4 Organization And Personnel Proposed

4.4.1 Overall Technical Services Scheme

Key personnel who have experienced in FEED and engineering of the LNG import terminals will be participated in this Services as Technical Advisors. This will help that design of the LNG Import Terminal meets COMPANY's technical requirements and compliance to engineering and design requirements specified in various Contracts, International Code and Standards and best engineering practices applicable to LNG import terminals.

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For the execution of this Service, ISGEM would like to propose Technical Manager and Project Engineer to be full time for Technical Services. On the other hand, Experts, specialists and engineers by disciplines who will review engineering documents in ISGEM Home office would be involved in ISGEM Home office from multi-discipline departments.


➤ **Key Personnel for Development Stage (BASIC TASKS)**

Discipline	Discipline	Months	Remarks
Technical Manager	Technical Services Management	5	InhouseBasis /Partial Site
Engineering Manager	Technical Services Support	5	InhouseBasis /Partial Site
Each Experts, Specialists, and Engineers	Special part Support	Spot	InhouseBasis /Partial Site

After completion of project development, ISGEM assigned personnel will be deployed at site and COMPANY's office. Its role and duration should be decided by COMPANY's request.

4.4.2 Organization of the Service

Overall project organization is shown in the below organization chart for LNG Import Terminal Technical Advisory Services. The organization of COMPANY Project Team shown in the below site organization chart for illustrative purpose will be composed and decided by COMPANY' own discretion.

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4.4.3 Roles and Responsibility

4.4.4 Key Personnel

The key positions in the management of the services are:


- Technical Manager (Full Time for BASIC TASK)
- Project Engineer (Full Time for BASIC TASK)
- Experts, Specialists, Engineers (SPOT SUPPORT for BASIC TASK)

4.4.5 Technical Manager

The Technical Manager is responsible for planning, managing, co-coordinating and monitoring the overall activities of the technical advisor organization to fulfill the wide variety of technical and engineering support to meet the COMPANY's requirements and objectives in the most efficient and effective manner.

Typical activities include, but not limited to the followings:

- Advise COMPANY's Project Manager on all technical matters related to the project
- Manager interface between different disciplines during the review process within ISGEM organization
- Manage technical interface with COMPANY's Consultant, parties and other Advisor (s) engaged by COMPANY in the Project;
- Monitor the progress of engineering and identify necessary actions;
- Lead design reviews and technical reviews etc on behalf of the Project Management Team
- Maintain the HSE action tracking system
- Review and approve concession requests, non conformance etc and respond to technical queries

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4.4.6 Project Engineer

The Project Engineer is responsible for the detail works under supervision of Technical Manager. Project Engineer will communicate with COMPANY's engineers related to the Services and respond to COMPANY's needs. Project Engineer would also carry out project progress and schedule review for the project and review QA/QC plan of the project.

In addition, Project Engineer would do ISGEM document control in Site office and other duties to be placed by Technical Manager and agreed between COMPANY and ISGEM.

4.4.7 Experts, Specialists and Engineers

Its' role will be provided for conceptual design and OPTOINAL tasks which will be implemented after COMPANY's request.

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4.5 Curriculum Vitae

All curriculum vitae (CV) of proposed personnel for technical advisory services are to be submitted to COMPANY in one month after Contract.

4.6 Project Coordination

4.6.1 Cooperation between COMPANY and ISGEM

ISGEM will work closely with COMPANY to obtain the design and engineering requirements and preferences. COMPANY will be kept informed of ISGEM activities and decisions. For this Service, ISGEM wishes to foster an harmonious working relationship with COMPANY for the objective of creating mutual interest in order to accomplish the project objectives.

4.6.2 Reporting

ISGEM will inform COMPANY of important consulting activities by means of conference calls, and provide with details of data and information, if necessary. Also, ISGEM will submit Monthly Reports on the work performed, indicating such work and time spent or its performance, areas of concern etc.

The monthly report shall be submitted to COMPANY Project Manager no later than 7th of the following month.