

Lifecycle of Projects in Refinery

Introduction

The intent of this article is to provide an insight on the Project Lifecycle in a Refinery, hereinafter called Company. Though the execution strategy may differ considerably, there are common meeting grounds. To start with, a project is the outcome of the following factors:

- Need to enhance production
- Upgrade technology to meet the changing market requirements
- Replace equipment/ portions outliving the life
- Replace any damaged equipment/ portion(s)
- Adherence to new environmental regulation(s)
- Adherence to new statutory regulation(s)

Detail of the above factors may be the subject in other article, but they influence the project execution. The other important point in the project execution is the type, which again may be broadly classified as follows:

- Construction of new facility which may include process units too
- Revamp of existing facility

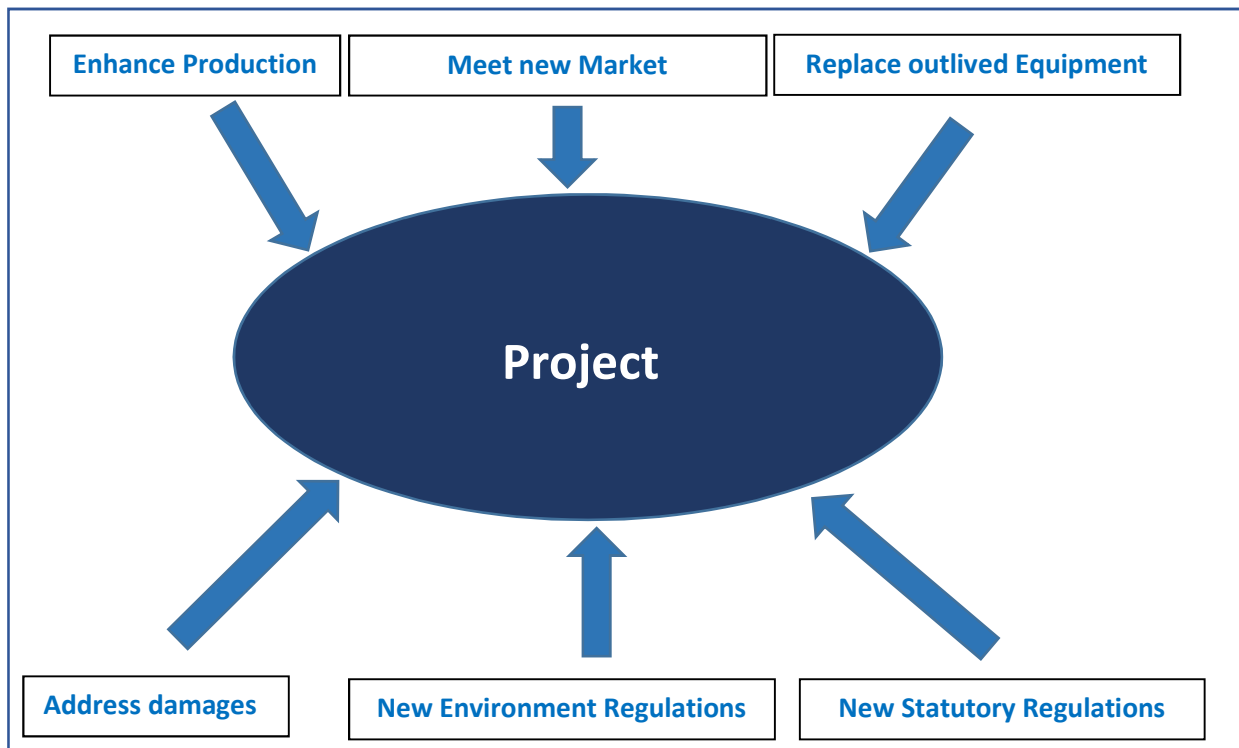


Figure 1: Factors influencing Project Initiation

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Stage Gate

In any big organization, the lifecycle of the project is structured and divided in different stages. These stages may or may not be aligned with the one provided by Project Management Institute (PMI). However, there are approvals required at to pass each stage and each organization has their own process for the same.

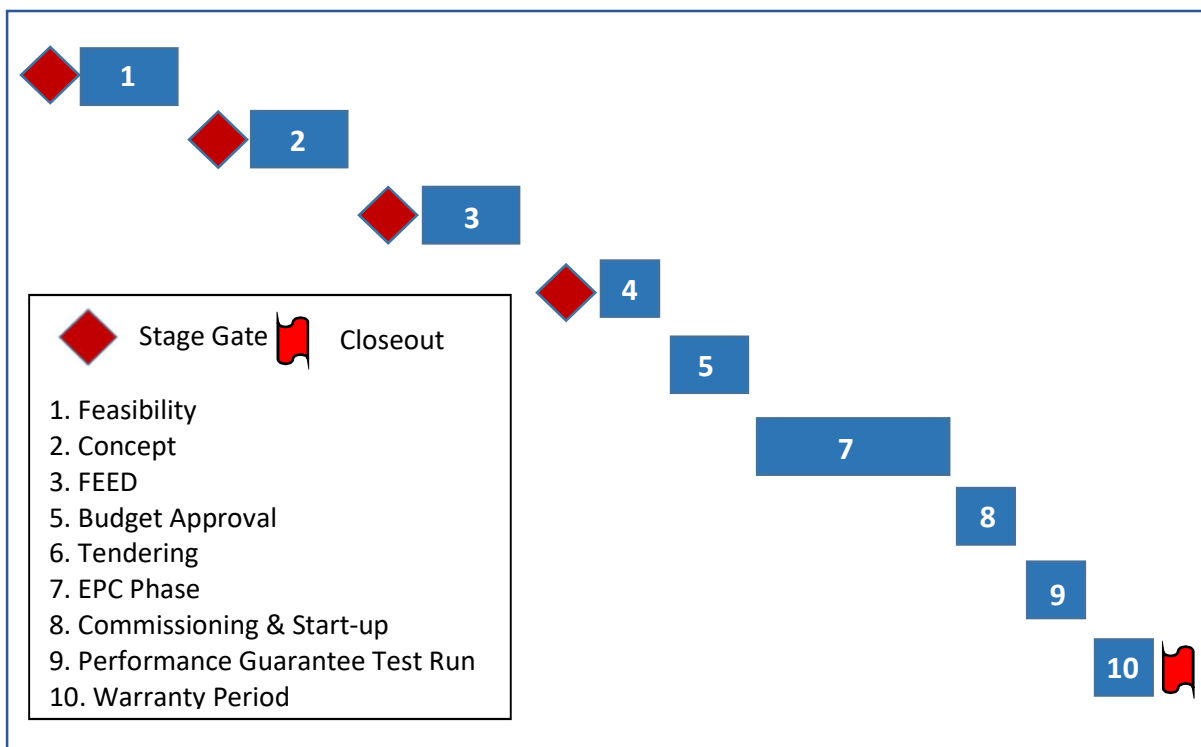


Figure 2: Stages of Project and Gates

Initiation

Any one or more than one factor may result in initiating of the project. The idea springs up at the relevant group, which may be the one handling marketing, production, maintenance, technical functions, environment or other statutory regulations.

Feasibility & Concept Design

When the idea of moving forward with the project is finalized, it is put for the appropriate approval, which weighs different pros and cons, which includes its feasibility and hence a prior study for the same is required. Feasibility study may be done in-house or through some specialized agency. Feasibility study may put across different options, and recommendation to follow one of them, or to drop the idea of the implementing the project itself. Feasibility study takes into various factors into

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consideration before putting forth the options and recommendation. The factor includes integration of the new facility/upgrade with the existing one, implementation cost, operating cost, etc. Duration of Feasibility study may run across few months. If the decision is to implement the project, execution strategy is finalized, followed by Concept firming. Concept design further develops on the accepted recommendation. This may include selection and lining up of technology licensor as an example. Concept design may be carried out in-house or by a specialized consultant. However, for a larger and complex project, it is always good to have specialized consultant. Concept design too take months to complete and it may or may not be more than six months. During this phase activities which may include signing of agreements with process licensor takes place.

FEED/Basic Engineering

Upon completion of Concept design, basic engineering/Front End Engineering and Design (FEED) is initiated. Here I would limit the discussion of site implementation by Engineering, Procurement & Construction (EPC) Contractor, though there are other methods like cost plus converted to fixed price, to be the part of other article.

In order to do the FEED, especially for the big or complex projects, a specialized Consultant is hired. The outcome of FEED is the Scope of Work (SOW), Invitation to Bid (ITB)/Invitation to Tender (ITT). The tender document encompasses the FEED within itself. Further, the outcome of the FEED is Total Installation Cost Estimate (TIC) and Execution Schedule. During the FEED, Hazop, other review are carried out. Duration of FEED is spread across several months, but generally do not exceed year in many cases. FEED is a very important stage and it comprises several important activities like different reviews and Hazop amongst others.

Budget Approval

As stated earlier, since we are discussing the site implementation by EPC Contractor, the next step after the FEED is to obtain the necessary budget for the same. Different organization have different process of budget approval. Generally, the Refineries keep a provision in their budget to carry out the project. The next phase of the project in this case is tendering. However, budget approval process run in parallel to tendering and complete earlier.

Tendering

Before elaborating on tendering, we need to discuss the PQ exercise, i.e. Pre-qualification of bidders. Different companies have different process but the exercise generally takes into consideration amongst others the experience in similar projects, financial stability, available resources etc. This exercise may be done at different point of time but any big company have their approved supplier or vendor and contractor list, which is the outcome of PQ process carried out earlier at different point of time. This exercise is dynamic and the list keeps updating regularly. However, in some companies or in some special cases, this exercise is done just prior to tendering, maybe in parallel to budget approval process.

Tendering start with review of the document and issue it for bidding/tendering after appropriate approvals. Tendering activities may follow different styles of the bidding processes. It may be single

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part bidding or two-part bidding in general. It is worth mentioning that all the contractors may not be eligible to participate in the tendering activities, rather only those who pre-qualified in PQ and/or the part of the approved list. After the issuance of tender, the qualified or approved bidders collect the document, maybe with a fee. After the collection by the bidders, they go through the same and note down the points to be clarified, which is done during Pre-Tendering/Pre-Bid Meeting. After the meeting, the bidders work on to prepare for submission of tender, which in itself is a complex exercise and include both technical and commercial. During this period, the bidders raise many queries and the Company side provide the response/clarifications. Then upon a certain defined time, bidding submission date is closed and all the bids are to be submitted by that time. Thereafter the bids are evaluated technically and commercially by Company. Upon completion of the evaluation, successful bidders are numbered as L1, L2, L3 and so on based on cost of bid starting from lowest. To be successful and bid to be considered, bidders are required to fulfil the technical requirements in the tender document. After the commercial/price part evaluation, which puts the bidders as L1, L2, L3 and so on, the evaluation is put up for appropriate approvals, to be followed by contract award to successful bidder. Contract award is followed by contract signing, where certain documents/bonds/guarantees are to be submitted as a pre-condition. After signing of the contract, the bidder is the contractor for execution, and in this case, the EPC Contractor. The tendering process takes months and in many cases exceeds six months.

Engineering, Procurement & Construction (EPC)

Next, EPC Contractor is called for kick-off meeting for execution, where the path-forward is finalized. The duration of the EPC Contract is in years and may vary from two to four years in many cases.

The EPC Phase is and sub-divided into Engineering, Procurement and Construction, in the sequence, though with overlap. At the start of the contract, EPC Contractor has to submit the resume of manpower for Company's approval. In parallel, the many project level documents are submitted for Company's approval and they include amongst others the schedule, report formats, execution plan, coordination procedures etc.

The EPC though start with Engineering, however, pre-cursor are the mobilization of resources, at Engineering Home Office, mainly design engineers, designers, draftsmen, procurement team etc. During the course of the Engineering, Procurement and Construction activities start. In order to start the Construction activities, manpower and equipment are mobilized, which maybe from specialized Sub-contractors. During the Engineering phase, many documents are generated for review/approval by Company. In this phase Model Review, Hazop and other review are carried out. Overlapped with Engineering, Procurement process starts. This process involves the Material Requisition (MR), Commercial Bid Evaluation (CBE), Technical Bid Evaluation (TBE), Purchase Order (PO), Delivery, and Material Receipt Inspection. A resource depended phase which overlaps Procurement and to an extent the Engineering is Construction. The Construction Phase starts with civil works and followed by other disciplines with overall. A major milestone in this phase is the Mechanical Completion, which is preceded by a walkdown, where after the completion of construction activities, built facilities are compared with the approved design/drawing and shortfalls are recorded as punch items, which are categorized based on the milestones by which they are to be closed. These milestones are Mechanical

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Completion (MC), Provisional Turnover (PTO), Turnover or Acceptance. Once the MC is achieved, which includes closure of punch items associated with it, Pre-commissioning activities starts. These activities includes Air Blowing, Water Flushing or Chemical Cleaning of Piping, Functional Test of Instruments, Gross Air Leak Test, Pump Run Test, Compressor Run Test, Tightness Test, System Dry-out, Catalyst Loading (as applicable) etc. Once the Pre-commissioning activities are completed and PTO is achieved, subject to closure of punch items associated with it. Upon PTO, a Pre Startup Safety Review (PSSR) is done. This PSSR may be before, after or overlap with PTO but should be before Commissioning & Start-up. In this PSSR too, punch items are generated and to be closed.

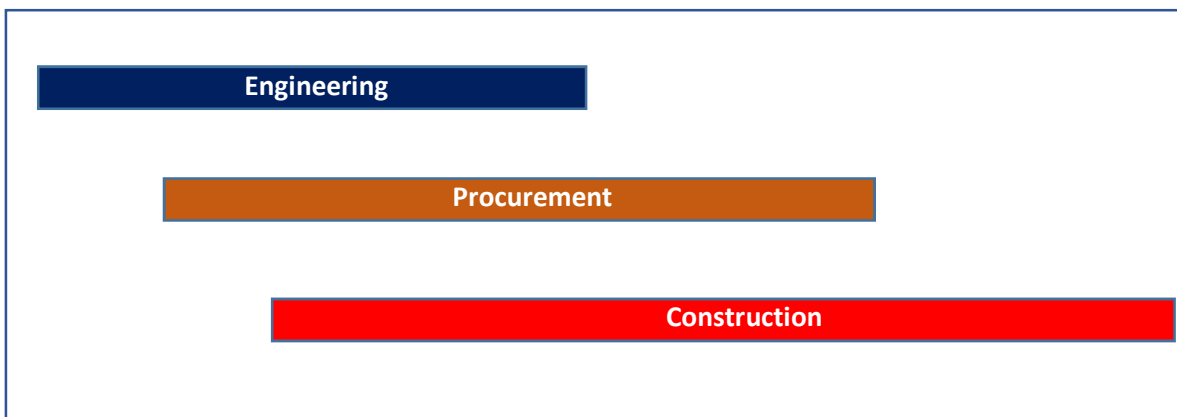


Figure 3: Depiction of EPC Phase

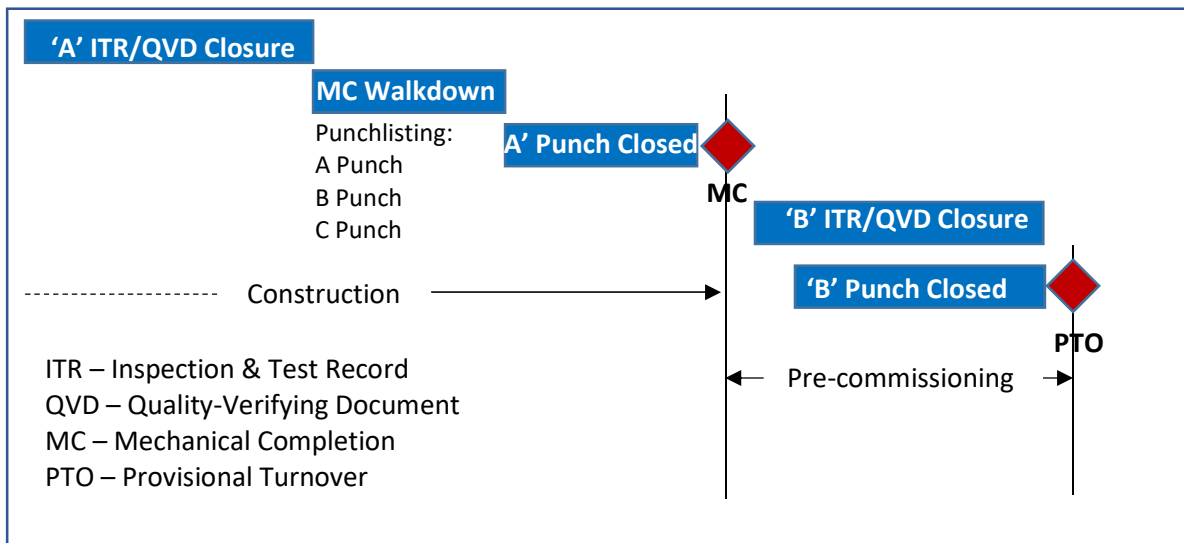


Figure 4: Mechanical Completion & Pre-commissioning

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Commissioning & Beyond to Closeout

Once PTO is achieved and PSSR is completed, Commissioning starts followed by the Startup of the facility. Commissioning and Startup (CSU) on case to case basis, depending on facility/unit type, may include utility line up, nitrogen high pressure and temperature leak test, inertization, cooling water circulation, amine circulation, diesel circulation, sulfiding agent package filling, catalyst wetting, catalyst sulfiding, Feed cut-in, reformer light up, flare light up etc. Upon the CSU when the facility is stabilized, the Turnover is achieved. This is followed by Performance Test, which when successful results in Acceptance of the Facility. However, in general, the defect liability period for Contractor extends twelve months beyond wherein the Final Acceptance of Facility is achieved and close-out is carried out.

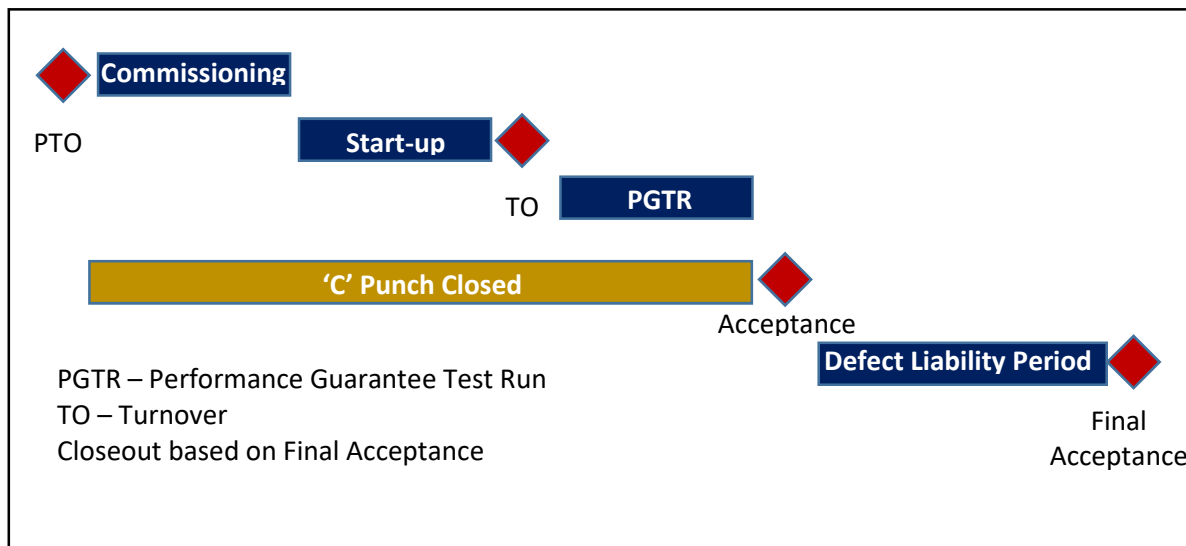


Figure 5: PTO to Closeout

Duration & Strategies

The total duration of project lifecycle right from the initiation to the closeout generally varies typically from 48 to 90 months (including 12 months post acceptance defect liability period). All the Refineries have their stage gate approval system and each phase viz., Feasibility, Concept Design, FEED stage has to be approved to move further to next phase. Strategy within EPC may vary as follows:

- Contractor do all activities until acceptance of facility.
- Contractor to do Commissioning & Start-up and support Performance Test.
- Contractor to do Commissioning and provide support for Start-up and Performance Test.
- Contractor to achieve PTO and then support onward activities including Commissioning.

Nevertheless, Contractor has to attend to any defect for a period of twelve months beyond acceptance of facility, during Defect Liability Period.

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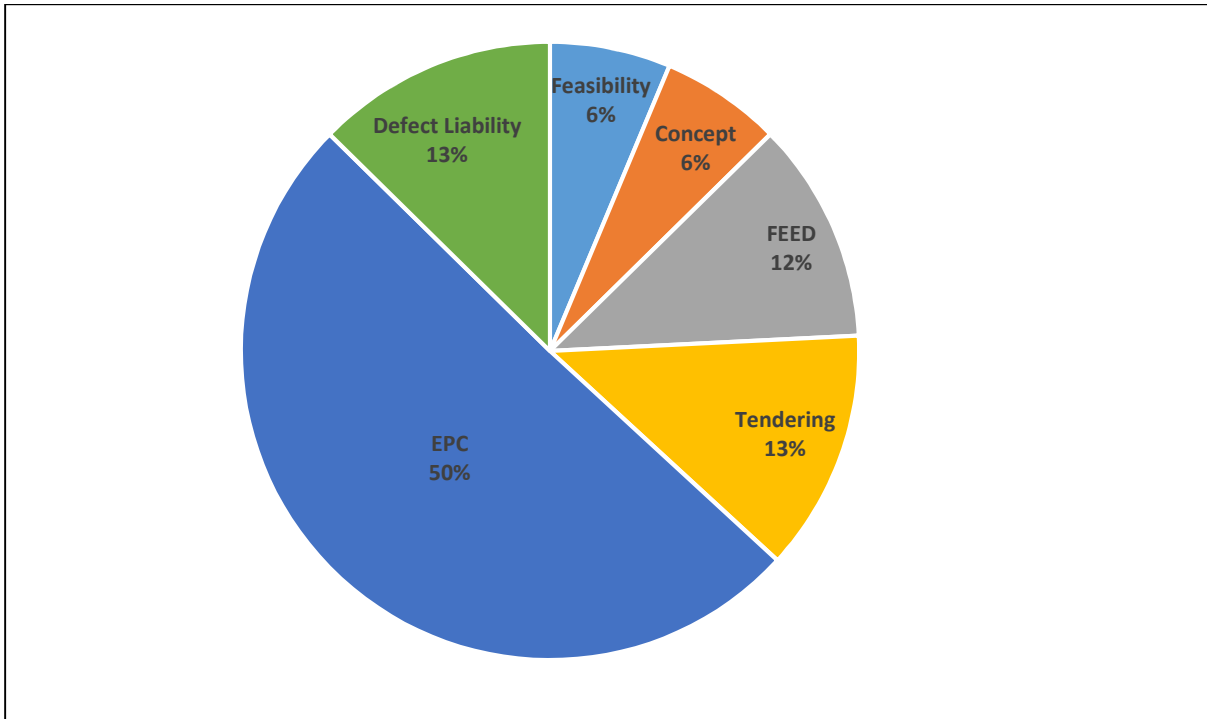


Figure 6: Total Lifecycle Duration Percentage with EPC Case (Typical)

Important Note

As stated at the start, this article is intended to provide insight into lifecycle of project in Refineries. Though it may be highly useful to a newcomer into this field, nevertheless, it would be useful for anyone in the field of Oil & Gas Projects. It is worth mentioning that majority of personnel in the Oil & Gas Project do not work with the client/owner/refineries and hence they just experience the execution phase, which in this article is based on EPC approach. There are people who works with Feasibility and FEED Consultant and their experience are limited unto those phases. Even those working with process technology licensors and vendors/suppliers are not well versed with the complete project lifecycle.

Hence, I have a firm belief that this article will enrich the knowledge of the people on how the project starts, maneuver and complete its journey. There are instances where I have selected a particular approach of implementation, like EPC for Contracts, but in the future articles, I would come up on the details of other options.

In the articles to come, I would discuss cost, contracting strategies and other relevant points.

I welcome queries, comments and feedbacks on the contact details given. However, please avoid calling on mobile as I may be at my workplace or sleeping at home, considering the time differences in various part of the world.