MANAGEMENT ISSUES FOR TURN-KEY POWER PROJECTS FOR THE FEDERAL COMMISSION OF ELECTRICITY IN MEXICO

by

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ABSTRACT

The economic crisis in Mexico at the end of 1994, affected the credit capabilities of the country, forcing the nation to a reduction of investment in infrastructure projects. The Mexican government reduced the assignment of government funds for a variety of construction projects.

At the same time the fast and accelerated growth of the population, demanding services, as well as the increasing reliance on competitive markets, increased urbanization and the challenges faced by infrastructure in Mexico during the last years, trade globalization and liberalization, have combined to enhance the requirements for the development of infrastructure projects.

To face this difficult situation, the Mexican government will need to implement new policies in which the private sector will be encouraged to participate in the development of infrastructure to make up for the lack of infrastructure investment in recent years. This private participation is taking on an important relevance, especially today, with the Mexican entrance to a global market through NAFTA.

The "Turn-key" scheme for the Federal Commission of Electricity (CFE), is based on the belief that energy and power projects can be self-financed without compromising government funds for the investment. In a "Turn-key" project, a prime organization (contractor, consortium or joint venture), is contracted to design, fabricate, transport, erect, and start up a facility, until the delivery of the plant to the CFE is ready for commercial operation.

This thesis covers the different management aspects involved in the "Turn-key" mechanism. If correctly applied, these aspects can lead a power project to a successful completion.
Acknowledgments

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Chapter 1. General Issues

1.1 Overview

The economic crisis in Mexico at the end of 1994, affected the credit capabilities of the country, forcing the nation to a reduction of investment in infrastructure projects. In addition, the Mexican government diminished the assignment of government funds for a variety of construction projects, from housing to power projects. At the same time, the fast and accelerated growth of the population, the increasing reliance on competitive markets, faster changes in demand patterns (increase in the demand for services), increased urbanization and the challenges faced by infrastructure in Mexico during the last year's trade globalization and liberalization, have combined to enhance the requirements for the development of infrastructure projects.

To face this difficult situation, the Mexican government will need to implement new policies in which the private sector will be encouraged to participate in the development of infrastructure to make up for the lack of infrastructure investment in recent years. This private participation is taking on an important relevance, especially today, with the Mexican entrance to a global market through NAFTA. The country must provide a large network of services supported by solid infrastructure to be competitive, reactivate the private investments, bring to the country foreign capital and achieve with it long lasting and sound development.

With respect to electric energy, the Turn Key concept will be fundamental to cover the lack of investment that the country has had in this area. The "Turn Key" scheme for the Federal Commission of Electricity (CFE)\(^1\) is based on the belief that energy and power projects can be self-financed without compromising government funds for the investment. The implementation of the scheme and the consolidation of the project is made by a developer, generally a private investor, who negotiates with the government authorities and the financial agents to create a complete package from a technical, legal and financial point of view.

These types of projects can be divided into three stages: promotion, construction and operation. During the first stage, the developer designs a scheme that will allow him to

\(^1\) Originally: Comision Federal de Electricidad (CFE)
obtain the financial resources needed to build the project through his own investment and/or through credits given by financial institutions.

The second stage is the construction of the project including the necessary testing of the equipment being installed. The testing is being made according to the technical specifications of the CFE.

In the final stage the CFE is going to operate the power plant paying the developer a rent that will be specified in the leasing contract that has previously being signed by all the parties. That contract, permits the coverage of the service and amortization of the credits, and the return of the capital that was invested.

1.2 The actual status of the Mexican construction industry

Mexico has a vast territorial extension and its population is one of the largest in the world, occupying the tenth place. The structure of the population has been gradually changing from a rural to a preponderant urban one (57.4%); thus the needs for infrastructure works are increasing day by day. This tells us that the Mexican constructors will face a huge infrastructure demand. With regard to power, they will need to develop an industrial capacity that can double the installed capacity of power generation from 26 million kilowatts to 50 million.

1.2.1 Employment and Construction Status: The type of technology employed by the national construction industry is labor intensive. This permits the industry to generate a bigger proportion of jobs in relation to its participation within the national GNP. (The construction industry participated with about 5% of the Mexican GNP, and generated on average 9.44% of the total employments in Mexico between 1980 and 1993).

The international construction companies that are starting to work in Mexico are highly capital intensive, which means that the low cost Mexican labor doesn't represent a competitive factor for the local companies. More over, the usage of capital intensive technologies causes the production or efficiency ratio per employee to be much higher in

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3 Mexican Situation in 1993. CNIC, Economic and Statistics Department.
4 Op.Cit
the United States than in Mexico; with respect to the United States the relation is approximately 16.5 to 1, and with Canada, 12.7 to 1. On the other hand, the costs of qualified labor in the USA are four times the Mexican ones and for non-qualified labor the number is 11 times bigger. However, these cost differences are compensated far by the technology being used and by the degree of capacity of the labor, whose availability is relatively abundant for the American and Canadian companies.

The demand of infrastructure power mega-projects using the "turn-key" concept and the development of concessions, require advanced state-of-the-art technologies that look for a capital intensive profile, therefore, the Mexican companies will be forced to incorporate into their work processes, technological developments in order to compete with highly capitalized international competitors.

1.2.2 Technology Status
As mentioned before, to have an advanced technology represents a competitive advantage because it means the possibility to produce more with less resources. During the last couple of years the Mexican construction industry has suffered a huge lag in its development of new technology, particularly in design engineering, construction methods, application of materials and specialized construction equipment. This problem was created because of the low pace of economic activity in the country and also because of the protectionist system of the government.

Surrounded by this negative environment, Mexican construction companies will need to develop the capability to make associations, pacts and alliances with highly competitive organizations. The stronger and larger construction companies in Mexico must be the first movers to undertake the initiative to develop a process of technological assimilation in three main aspects:

Methods.- the generalized use of computers and computer software allows the companies to decrease their costs and provide an extended variety of offers in construction projects.

Equipment.- The use of high tech equipment as for example climbing cranes, hydraulic action equipment, etc., can make the companies much more competitive, and efficient.

Materials.- The usage of new materials to reduce costs and increase their useful life and durability is becoming of vital importance in today's construction. The use of plastics
could be an example because of its great field of applications, its hardness, its great corrosion resistance and its easy installation.

According to Benjamin et al. the interaction of two variables, Information Technology economics (IT 30-40 percent improvement in cost performance) and a challenging business environment has generated what might be called "the economic imperative of Information Technology". Organizations that don't take advantage of the growing opportunities provided by IT are likely to slip behind in the competitive business world. Most of the attention of today's construction firms focuses on using IT to improve the organization's impact in the marketplace. These companies have great opportunities to improve key internal operations by using for example electronic or voice mail for improved communications. There are a lot of reasons why IT will influence the construction organization structure and give it competitive advantage, but before listing them I want to point that according to Irwig et al. the proper design and implementation of an IT system in a construction firm should include as a prerequisite a detailed examination of the organization's current and anticipated situation, especially its environment and its objectives and organizational strategy in addressing this environment.

Reasons why a Construction firm should improve its IT systems (to obtain competitive advantage)5:

* IT (E-mail e.g.) helps to improve coordination between the firm's value chain interdependent activities. The way in which one activity is performed affects the cost or effectiveness of other activities. Careful management of linkages is a source of competitive advantage.
* IT is changing the ways companies operate. It affects the process by which companies create products.
* IT improves the communication and coordination of the interdependencies that exist between a company value chain and those of its suppliers, channels, and buyers gaining competitive advantage by optimizing these links. They create strong impact on bargaining relationships between suppliers and buyers
* IT generates more data and permits the capture of information that was not available before.

5See Michael Porter's Competitive Advantage. Free Press Publications
* IT systems allow companies to coordinate value activities in far geographic locations (e.g. E-mail improves communications between headquarters and job sites).

* IT expands the scope of industries in which a company must compete.

* IT systems tend to tie companies closely to their suppliers and buyers because of the raise of switching costs.

* Automation and flexibility are achieved simultaneously, a pairing that changes the pattern of rivalry among competitors.

* IT can help in the strategy implementation process. Reporting systems can track progress toward milestones and success factors.

1.2.3 Finance Status

The cost of capital and the credit availability are the two main factors that affect the competitiveness of the Mexican enterprises and particularly the construction companies. The commercial banks present certain restrictions to provide continuity to the credit applications, specially for the construction sector because it presents very special conditions; its activities are close related to the public sector. The public sector constitutes a very important work provider for the construction companies (during the last decade about 46% of the total production was assigned to the public sector), therefore it creates a big liquidity problem for the companies. This happens because of the public sector's lack of efficiency with respect to the on time payment of the project's estimations. This delay brings about that the companies don't have the necessary liquidity to settle their acquired obligations with financial and credit institutions. This situation provokes the lack of interest to support the construction sector, by not considering the companies as credit worthy.

If we compare the interest rates between USA and Mexico, we can see that there is a considerable difference in the financing cost that prevails in each country. In 1994 the financing cost for the American enterprises was about 14%, meanwhile for the Mexican companies represented about 24.1%, more than 10 points over the American (after december's devaluation, the cost of financing for Mexican companies rose to aprox. 80%). This difference in the rates represents an enormous disadvantage for the Mexican companies since it prolongs the recovery period of the investment (see table 1).6

6Department of Economics and Statistics, CNIC.
Therefore, the access to international credits is starting to be viewed as an indispensable option for the Mexican contractors and developers, especially now, when the international "turn key" bidding tend to include the financing aspect, generally long term, as a condition to the project assignment.

1.2.4 The Globalization Status
In the past the Mexican economy was characterized for having protectionist policies with the national industry. The construction sector was developing under the same economic scheme. Some of the protectionist practices were:

* A restricted policy to contract only local companies, especially with regard to public investment.
* The direct foreign investment in the local construction enterprises was limited to a maximum of 49%.
* Only the local contractors had a direct access to the complete project information causing a lack of transparency in the assignment of the projects.
* The bids for a project were organized under incomplete executive project schemes and with a reduced number of project concepts (Incomplete information that occasioned delays and modifications).
* The international contractors ran into obstacles when negotiating the permits with the government.

Since 1985 there has been a change in the direction of the government policies; the orientation was pointing to the development of free market economic processes, starting with the gradual reduction of tariff rates and the elimination of tariff barriers. With this new economic opening, the Mexican construction industry has been progressively more exposed to international competition, and now that the NAFTA has been approved, the Mexican companies must confront more experienced companies that compete in a more dynamic environment and that count with a variety of unique financing, fiscal, technological and promoting options that provide competitive advantages.

The impact that NAFTA has brought to the Mexican economy will bring more changes to the ones that have already been experimented (the economic opening and the Mexican

7"Los Servicios de la industria de la Construccion ante los Escenarios Futuros de Apertura y Globalizacion"
exposure to international competition). Speaking of the construction sector, the US construction industry is 14 times as big as the Mexican one, thus, US firms have the opportunity to reach economies of scale that represent an important advantage with respect to the resources being used. This situation provides them with better conditions to access capital markets, either local or foreign. This changing environment will force the Mexican entrepreneur to necessarily change his attitude as well as the institutional and productive structures to perform with efficiency in a market where the competition tends to develop within an international specifications framework.

The local contractor and/or developer, must develop his capacities and be able to integrate and form strategic alliances with the world's best organizations. He will take advantage of his knowledge of the local markets to create a competitive advantage that till now, has been poorly exploited; he needs to transform the company from only a contractor to an innovator, creating value added, and developing its own demand. An aggressive attitude will also be necessary with respect to marketing and sales of the services that the company can provide in domestic and international markets.

The challenge for the government is to create the right macro economic conditions that ease the active development of the construction enterprises. It will need to increase the speed of the deregulation process and must establish conditions that permit a lower cost of the money to facilitate the financing.

1.3 The Electricity in Mexico and the role of the CFE.

Legal Framework

According to the constitution it is established that the only entity that can distribute the electric energy in Mexico as a public service is the CFE, but Mexico intends now to support the participation of the private sector to cover the expansion needs of this sector. The CFE operates under the direction of the Energy, Mines and Industry Ministry. an institution that is in charge of the administration of the energy resources of the country; the Finance Ministry, approves the tariffs that are proposed by the CFE; and the Trade Ministry is responsible for the approval of all the agreements dealing with the supply of energy.
Actual Situation
At the end of 1994, the installed capacity of electricity in Mexico was of 32,862 MW\(^8\). The actual consumption is 54% industrial, 24% domestic, 9% commercial, 6% agricultural, 4% for services and 3% for export. The rapid demographic growth and the economic expansion of the country will bring as a result, the need to double the actual capacity of electricity for the next 10 years.

In December 1992 the Mexican government reformed the "Electric Energy as a Public Service" law. The corresponding regulations were published the 31st of May 1993 and its most relevant aspect is that the private investors have the possibility to participate in all the power expansion programs.

At the moment there are four basic models in which the private sector can be involved in the development of independent power; these are:

* **Self Supply:** This is the generation of electric energy exclusively to cover the specific needs for the own industrial or commercial facilities of the producer.

* **Cogeneration:** These plants produce electricity and also steam or other type of thermal energy for use in industrial or commercial facilities. Any excessive energy being produced must be sold to the CFE since it is prohibited that the producer distributes himself the energy to the final consumers.

* **Small Producers:** They generate less than 30 MW and can give service to small rural or remote areas in accordance to what is established in the corresponding regulations.

* **Independent Production of Power:** An independent power producer can build, have in property and operate a power plant and sell the energy produced to the CFE.

During the last three years, the CFE has started to develop non-government funded projects structured as BLT's (Build-Lease-Transfer), in which the developer must finance and build the facilities using the "turn key" scheme, lease the installations to the CFE and, at the end of the leasing contract, transfer the plant to the CFE. In accordance with the Intestate Commission for Expenditures and Financing, the CFE has developed bidding procedures for non-government funded projects. The invitations to participate are given to a minimum of 5 contestants. The offers must include the following points:

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\(^8\) "Programa de Unidades Generadoras del Sector Electrico", CFE Programming Sub-Direction
1) Fixed prices for foreign components quoted in foreign currency (only the labor and the national components are subjects to escalations).
2) Total costs, including interests incurred for the construction.
3) Maintenance costs (including spare parts) and mayor capital investments that the CFE must cover during the leasing period.
4) Federal importation taxes.
5) Lease payments.
6) Technical guarantees with respect to the performance of the equipment.

Neither the financing, nor the guarantees (performance bonds, insurance, etc.) for this type of projects will be supplied by the CFE or the Mexican government.

The energy needs of the country and the desire to capture foreign capital and technology to face these needs have created a great number of interesting opportunities for the private generation of power in Mexico. However, there still exist some administrative and legal issues that represent significantly challenges for this type of participation. Mexico must increase its power transmission infrastructure to facilitate the growth of capacity generation. Nowadays the CFE is studying different schemes to involve the private sector in the expansion of its transmission network. A complete list of all the current and future projects planned from 1993 till the year 2001 by the CFE is provided in figures 1 to 8 at the end of this chapter.

The principal challenge will be to achieve that the legal framework that is developing can be flexible enough and that the commercial and financial risk can be minimized so that a slow growth in the capacity of power generation and transmission in Mexico, does not paralyze the global economic growth of the country and its participation in the global markets and NAFTA.

1.4 The Challenge: The Transition from Public to Private

For a period of Mexican history, the private sector was perceived as parasitical and inimical to economic development by the region's major economists. That period is now over. A new one is beginning in which the private sector will be expected to play an ever increasing role in economic development.
Before this transition started to take form, Mexico's government opted for state directed development strategies. This phenomenon was not limited to Mexico, but to the whole of Latin America and many other parts of the world. Not surprisingly, those opting for state controlled and directed economic growth also opted to have their electric power generation in government hands. 'The industry in most of the developing world became dominated by large, monolithic government controlled, owned and operated electric utilities'. This was the status of the industry until recently. In Mexico the former pattern of ownership and operation of power generation and transmission is starting to change and with this the power sector will be benefited from the increased exposure to the discipline of the market place.

According to Everett Santos, almost everyone is now aware that privatization is both widespread and accelerating. Financing the transition from public to private ownership is an issue of great discussion today, not only in Mexico, but also throughout whole Latin America and Eastern Europe. In the 90's this trend towards privatization will continue to expand by country and by sector. The energy sector which includes power generation in all its different classifications, is particularly noteworthy as it provides a vital link for industrial production, and its maintenance and expansion requires a substantial capital inflow.

Now it is time to revise the way in which the infrastructure is being financed. Public entities and institutions have proven their inability to deliver reliable and high quality services at low cost. Worse still, the pricing of the services they provide, e.g. electricity, has promoted a misallocation of scarce resources that encourage inefficient industrial development.

The Mexican state-managed economy is giving way to a more market-oriented economy. A renewed interest in the private sector is flourishing in the country. A great number of international financial institutions are in a unique position to capture the momentum and promote the move towards financially sound, market driven economies. From its start the Mexican privatization program has made a remarkable progress. The TelMex telephone company and the Cananea copper mine (the world's 10th largest) were the first to be under the privatization program. It is hoped that the private sector will apply capital resources and provide disciplined management so that the initial success can be sustained

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over the long term. Further opportunities are being assessed which include Build-Own-Operate -Transfer "BOOT" type concessions and its derivatives in the infrastructure area.

Within a world economy that is primarily private sector oriented, financial institutions and organizations, such as the World Bank or the Interamerican Development Bank (IDB) will need to change. Their support must facilitate and encourage international private sector financing of energy projects. They also will need to be sensitive and selective in assisting the private energy sector or they risk "crowding out" international private sector financing, thereby retarding the Mexico's reemergence to the international capital markets. In the case of large power and energy investments with long gestation periods, innovative financial schemes will be required if projects are to become realities.

According to the World Bank there are five priority areas of attention that the countries must follow in this privatization era:

(1) pricing reform, to promote and sustain the use of energy efficient policies, processes and technologies.

(2) fundamental institutional and regulatory reform, including greater private sector involvement.

(3) creation of efficient and competitive markets.

(4) measures to address non-market barriers, including dedicated energy efficiency institutions.

(5) technology transfer, which the Bank's work has demonstrated occurs most rapidly through the private sector.

Country commitment is seen as essential to the success of energy efficiency efforts, and bank lending will be focused on countries with clear obligations in this area.

1.5 The Role of the Government

The Mexican government also faces an important responsibility in promoting power projects. In order to attract lenders, developers and contractors, the Mexican government must create an environment conducive to private power production. Measures to be considered include: (1) creation of laws which allow for private ownership of electricity.

10 Op. Cit. 9
generating facilities, (2) establishment of tariff rates for electricity which allow recovery of actual costs and a reasonable return, and (3) establishment of an efficient regulatory and/or contractual framework for addressing issues such as availability of hard currency, import controls and tariffs, and repatriation of profits.

In a more detailed framework the four major incentives that the government must follow are:

A. Development Agreement: The Mexican government may wish to consider entering into a comprehensive development agreement with the project owner prior to procurement of financing, offering prospective lenders a degree of certainty on issues of concern and providing an efficient "one-stop" agreement on government related issues. Such an agreement settle issues access to foreign exchange, relief from import restrictions, compliance with the Mexican labor laws, promptness in providing permits and licenses, support when granting or liberating land, ensure that the product generated by the project will be commercialized, and any permitting issues which might be outstanding, such as environmental permits, which regulate a plant's emission levels. Such an agreement might be executed simultaneously with any long-term electricity purchase contract with the CFE, and with fuel supply and transportation arrangements. Comprehensive resolution of such a broad range of issues at the early stage of development would contribute to prompt and efficient completion of the project. In addition, the project would be better able to procure commercial bank financing if the lenders have confidence in the certainty of project arrangements.

B. Relief from Import Restrictions: Since private electricity producers will probably need to import components of the generating plant and other equipment during the construction phase, and import spare parts on an on going basis, the host country government should assure that such items are not subject to import restrictions, and may even wish to consider the waiver of any import tariffs which may be incurred as an added incentive to the developer and to the lenders.

C. Labor Policies: Both lenders and developers will probably require that qualified expatriate personnel necessary to construct and operate a project be granted work permits for the period in which their skill are required by the project. If Mexico is eager that its

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11 Interview with Fernando Favela, Infrastructure Director, CFE
own people have access to skilled positions within a project, agreements might be negotiated which balance the project's requirements for experienced, skilled personnel with the need to create opportunities for Mexican citizens.

D. The Government as Client: Mexico's government in its role as client must support the project according to the next two actions: (1) The prompt and punctual payment of the rents or tariffs established by the leasing contract or in a product purchase and (2) the authorization of price increases due to changes or variations in the project specifications.
Power Projects under construction or scheduled from 1993 to 2001 in Mexico

Installed Capacity in this Period: 16,041 MW

Figure 1  
Hydroelectric Power Plants
Additional Capacity: 3,032 MW

Under Construction or Finished: Huites (400 MW), Aguamilpa (960 MW), Agua Prieta (240 MW), Zimapan (280 MW).

In Program: Tecate (60 MW), Xuchiles (240 MW), Temascal II (200 MW), Chilatan (28 MW), La Parota (624 MW).

Annual Capacity Increase (MW)

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Figure 2  
Oil Power Plants
Additional Capacity: 2,495 MW

Under Construction or Finished: Topolobampo II (320 MW), A. Lopez Mateos (1400 MW).

In Program: P. San Carlos (37.5 MW), Pto. Libertad (700 MW), Punta Prieta (37.5 MW).

Annual Capacity Increase (MW)

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Figure 3  Combined Cycle Power Plants
Additional Capacity: 1,519 MW

Finished: F. Carrillo Puerto (80 MW).
In Program: Rosarito TG (600 MW), Samalayuca II (519 MW), Merida III (320 MW).

Figure 4  Dual Power Plants
Additional Capacity: 6,700 MW

Under Construction or Finished: Petacalco (2,100 MW).
In Program: Puerto Altamira II (2,600 MW), Colmi (1,300 MW), Dos Bocas (700 MW).
Figure 5  
**Carbo-Electric Power Plants**

*Additional Capacity: 1,400 MW*

*Finished: Carbon II (1,400 MW)*.

![Graph showing annual capacity increase for Carbo-Electric Power Plants](image)

**Annual Capacity Increase (MW)**

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Figure 6  
**Geothermal Power Plants**

*Additional Capacity: 220 MW*

*Under Construction or Finished: Los Humeros (15 MW), Los Azufres (5 MW)*.

*In Program: Cerro Prieto III (80 MW), La Primavera (40 MW), El Chino (40 MW), Maritaro (40 MW)*.

![Graph showing annual capacity increase for Geothermal Power Plants](image)

**Annual Capacity Increase (MW)**

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</table>
Figure 7  
**Nuclear Power Plants**  
Additional Capacity: 675 MW  

**Finished:** Laguna Verde (675 MW).

![Annual Capacity Increase (MW)](chart)

Figure 8  
**Total Capacity**  
December 2001 (43,108 MW)

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<table>
<thead>
<tr>
<th>Total Capacity December 2001</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nuclear</td>
</tr>
<tr>
<td>Geothermal</td>
</tr>
<tr>
<td>Carbo-Electric</td>
</tr>
<tr>
<td>Turbogas</td>
</tr>
<tr>
<td>Dual</td>
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<tr>
<td>Combined Cycle</td>
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<tr>
<td>Internal Combustion</td>
</tr>
<tr>
<td>Oil (Steam)</td>
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<tr>
<td>Hydroelectric</td>
</tr>
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</table>
Table 1  Financing Cost 1994  
(percentages)

<table>
<thead>
<tr>
<th>Financing Cost for an American Contractor</th>
<th>Financing Cost for a Mexican Contractor</th>
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</thead>
<tbody>
<tr>
<td>6.0</td>
<td>3.0</td>
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</tbody>
</table>

Note: The calculation of the Mexican risk is determined by Standard & Poor's analysis. The total financing cost for a Mexican Contractor after the Economic Crisis rose to approx. 80%.
Chapter 2 Technical Aspects

2.1 Interpretation
A "turn-key" contract is based on the concept of a single contractor who is totally responsible for the engineering and procurement services, supply of materials and equipment, civil and electro-mechanical work, tests and start-up of a facility that meets the performance levels/goals established in the contract. This responsibility will stand, until the power plant is ready for commercial operation.

2.1.1 Bidding Basis: The success of a "Turn-Key" project depends heavily on the established basis for bidding, this defines the scope of the project by pre-establishing the range of procurement and the characteristics and technical specifications of the facility. This definition allows the "Turn-Key" contract to incorporate the owners needs.
In the case of the CFE, the bidding basis for the technical part of the project, normally include the following items:\textsuperscript{12}

1. Project Definition
2. Extent of Procurement
   A) Additional Basic Engineering Services
   B) Detail Engineering and Procurement Services
   C) Equipment, Instruments and Materials
   D) Structures and Buildings
   E) Shipments, Transportation and Storage
   F) Civil, Mechanical and Electrical Construction
   G) Testing and Start-up
   H) Capacity Testing and Behavior
3. General Design Criteria
4. Civil Works Description and Design; Foundations, Structures and Buildings
5. Design and Description of Mechanical, Electrical and Control Systems
6. Specifications of Principal and Support Equipment
7. Procedures and Requirements for Civil Works Construction (Foundations, Structures and Buildings)
8. Procedures and Requirements for the construction and placement of Equipment, Mechanical and Electrical Components and Instrumentation

\textsuperscript{12} Ing. Ernesto Rios Montero, Vicepresident Bufets Industrial, Lecture for Projects for the CFE Congress
9. Quality Control Procedures and Requirements
10. Requirements regarding Environmental Equilibrium and Protection
11. Procedures and Requirements for the Set-up tests; Verifications, Behavior and Guarantees
12. Specific Drawings related to the Project: e.g. Cycle Diagrams, Piping Diagrams and Instrumentation, and Basic Control Diagrams.

The previous documents correspond to the basic data of the power project that permit the preparation of the technical offer, and in case of the granting of the contract, they can be refined to integrate the basic engineering of the project.

The contract in its execution includes the following stages: Complementary Basic Engineering, Detail and Procurement Engineering Services, Equipment and Materials Supply, Civil and Electro-mechanical Construction, Tests and Start-up and Guarantees. Next I will briefly describe each of them.

2.1.2 Additional Basic Engineering and Detail Engineering Services

In this phase of the project all the basic technical data provided by the CFE, is refined by the contractor by incorporating the information that allows to publish it in a definite form, and by updating documents such as piping and instrumentation diagrams, equipment and control specifications, drawings, etc. In a parallel way, the elaboration of all the documents that will be necessary for the construction of the facilities and for the manufacturing of the equipment and supply of materials as well as the start of the requisitions needed by the contractor to proceed to the procurement of the necessary equipment and materials should be started.

In this stage of the project and because of the type of contract, that involves full responsibility for the contractor, it is of vital importance to establish in advance which documents require the approval of the client and which ones are going to be sent to him in an informative way. The client keeps the right to verify that all the documents comply with the specifications and technical requirements of the project. It is worth to be mentioned that the number of documents subject to approval should be the minimum necessary to take advantage of the benefits that a "turn-key" project provides.
The documents that must be approved and the time that is essential for that approval will be established in the Procedures Manual of the Project that is distributed at the start of the works.

2.1.3 Supply of Equipment and Materials

A fundamental part of the scope of a "turn-key" contract, corresponds to the supply of the equipment, instruments and materials for the project. The technical characteristics of the equipment and instruments are established in the project's basic engineering; with regard to the materials, these are defined in the corresponding detail engineering. It is important to mention that in the case of the equipment and instruments, a list of suppliers approved by the owner, must be established; the contractor will have the freedom to select from that list, the suppliers he needs.

With respect to the materials, they are selected in accordance to the specifications previously established and can be purchased based on the program or schedule of the project.

In the case of the CFE, all the activities concerning with the quality control for those materials, are performed by the contractor by following the procedures approved by the quality control laboratory of the CFE and are described in the Procedures Manual of the Project.

2.1.4 Civil and Electro mechanical Construction and Quality Control

In this stage of the project it's important to mention that since we are dealing with a "turn-key" contract, the contractor has full responsibility, bringing the direct intervention of the owner/client with the execution of the works, to a minor role.

The supervision function and the vigilance for the compliance of the technical requirements of the project must be performed through an established quality control program that guarantees the fulfillment of the specifications, and of the technical and construction procedures.
It will be imperative to define in this program those activities that will need to be approved (waiting points), the specific construction procedures and the tests that must be realized to guarantee the compliance of the quality required.

In general, we can consider, that this procedures have already been established for some projects in Mexico, however they can be improved with the experience that is being acquired in the development of this type of contracts and by taking into consideration those aspects that the CFE is willing to supervise; also by taking into account the conditions and characteristics of the corresponding contract and the objectives that the general program of the project establishes.

For each project, the CFE will need to establish a program that complies with the local standards and the international codes in effect during the realization of this type of projects.

2.1.5 Tests and Start-Up

After the construction of the facilities has been completed, the "turn-key" contract considers the performance of the testing and start-up of the unit. This phase of the project is executed by the contractor in accordance with the procedures and requirements for testing, start-up, verification, behavior and guarantees, established by CFE and in conformity with the operation and start-up manuals that must be prepared taking in consideration the recommendations of the suppliers and manufacturers of the equipment and instrumentation, and the requirements defined in the basic engineering of the project.

Since this final stage of the project corresponds to the physical delivery of the facilities (after being tested and proved), for its commercial operation, it will require for its successful achievement of a tight and organized collaboration between the parties involved in the project, so that the delivery of the power plant is being made according to the contracting conditions previously established.

The contractor who is in charge of the performance of a "turn-key" project, must manage the technical/administrative execution of it, in order to guarantee that the facility will be delivered to the client on time and with the specified quality. Since the "turn-key" projects that the CFE is trying to develop are very complex, the management of the technical
aspects will require a special attention in order to efficiently utilize the resources, that the CFE and the contractor can provide and to take advantage of the benefits of a "turn-key" scheme.

2.2 Technical Evaluation

2.2.1 Background

The operation of "turn-key" contracts has been developing within a framework that is totally different than how it should be from a technical and economic point of view as well as from a legal and administrative one. With regard to this comment, it's important to mention the issues that should or have already been changing:

a) Technical Specifications
The first specifications that were made, didn't count with an operative experience feedback for a proper application to the CFE's projects. This was extensive to all Thermal and Hydroelectric power plants, as well as to the Substations and Transmission Lines. The actual design criteria will add new requirements to meet environmental regulations that the Mexican government is establishing for atmospheric discharge and residual waste issues, making the basic engineering and the utilities design engineering more complex than before.

b) Economic Aspects
The economic analysis of a project has always been studying the basic costs involved in its development by comparing them with the costs of other similar facilities and/or bids. Nowadays, careful reviews will become necessary to verify the fulfillment of the technical specifications. This will allow a more complete comparative technical-economical study of the bids and the selection of the most adequate according to the design criteria.

The advantage of counting nowadays with statistics and feedback information of the costs and reference parameters for the CFE facilities improves and favors the analysis, although in some special applications, it will be required to do a more detailed analysis that guarantees the quality of the equipment and materials to be installed in the project.
c) Legal Aspects
This issues are going to be deeply discussed in chapter 4, but it worths a mention, that a very important aspect to be considered for future applications is the need to count from the beginning of the project with a basic and adequate legal framework that can be used during the bidding process.

2.2.2 The Integration of the Bid General Specifications

During the first two "turn-key" projects that were implemented in Mexico, the integration process for the necessary documentation was gradually established and took as a guideline the general specifications issued for the Public Works bidding by the CFE. However the results that were obtained, are forcing the CFE to a revision of some fundamental aspects; the most relevant are:

1) The adaptation of the legal and financial reference frameworks to the actual conditions and trends of the construction industry.

2) The adaptation of the technical specifications in such a way that its content is based on the following points:

   a) total description of the project
   b) basic engineering corresponding to the project
   c) definition of the supply and procurement scope
   d) technical and economic questionnaires and guarantees required by the CFE

These points must be updated or modified, so that the technical parameters that are of compulsory fulfillment can be known by the bidders to avoid any doubt. At the same time these points will need to be provided in an integrated way with the technical specifications, and with the evaluation and penalty factors that rule during this stage, so that the bidders know from the beginning, those factors and based on their accepted values, they understand the scope of the penalties in which they could fall into during their participation in the project.
2.2.3 Evaluation and Penalization

Evaluation Basis

The principal purpose of these criteria is to provide the most important concepts that are applied to the evaluation of the bids, and that must be taken into account for its preparation and optimization. However, the CFE keeps the right to apply other additional concepts derived from the bidding analysis.\textsuperscript{13}

The evaluation is being made by means of the analysis and verification of the conditions that are stipulated in the specifications and by determining the leveled cost of the kilowatt/hour that is generated, taking into account the differences due to the offered financial costs.

To determine the differences in the operation costs, maintenance or others, the applicable values and factors must be used and in special cases they will be determined by the CFE.

The CFE establishes as a general rule that the Net Present Value factor has a corresponding Annual Interest Rate of 12% and a useful economic life of 30 years.

The bidders must also comply, concerning the equipment and permanent installation materials, with what it is stipulated in the technical specifications. If there is any disagreement, the action that provides a better result for the CFE will be applied.

The evaluation is only being made to the offers that comply with the specifications, those who carry major deviations will be disqualified.

Some important issues that the bidders must consider because they are fundamental for the evaluation of their proposals are:

Supply Scope

In order that the proposal can be taken into consideration, the scope of the supply and its information must be complete and adequate in all its aspects. In case of modifications, substitutions, or minor deviations, its acceptance will be based on the CFE final resolution, and in such a case, the necessary adjustments, that permit the comparative analysis with the other bids, will be made.

\textsuperscript{13} Amor Parera Bahi, Thermal Projects Coordinator CFE, Technical Evaluation, Turn-Key Power Projects Congress 1993
Commercial Operation Dates
The offers whose commercial operation dates surpass the ones required by the CFE, will be automatically disqualified. There will be no premiums for early commercial operation dates to those required by the CFE, and their benefits will come from the financial evaluation that is obtained.
In case of a parity of circumstances, the closest operation date will receive preference.

National Manufacturing Integration
In the supply of a power plant, under the "turn-key" scheme, there is no credit given for a majority in the percentage of national integration, however in a similarity of circumstances, the proposal with a dominant national integration, will receive preference.

Experience
During the evaluation of the bids, the manufacturer's experience with regard to the type of equipment or instrumentation being requested is strongly considered. Offers that don't show the bidder's satisfactory experience with respect to similar "turn-key" power projects, will be disqualified.

Consumption
In the evaluation of the bids, the consumption of fuel and the net thermal unitary consumption of the unit will be utilized and reviewed. The consumption of water, will also be considered.

Investment Cost
It is the total cost, affected by the financial analysis. It includes, foreign and domestic supplies, costs of the systems and/or equipment, engineering costs, construction, installation, start-up costs, as well as the freight of equipment and materials to the site, that is necessary to integrate the units according to the specifications.

Spare Parts Consumption
Starting with the annual consumption of spare parts that is pointed out in the bid, it can be estimated the Net Present Value (NPV) of the spare parts that are going to be necessary during the life of the power plant. Additional costs to comply with the specified spare
parts will be added, and additional recommended spare parts will be taken into consideration.

**Salaries**
The NPV for the cost of the salaries that will be necessary for the operations and maintenance personnel during the life of the power plant will be estimated.

**Kilowatt/Hour Cost**
The formula that must be utilized to integrate this cost is the following:\(^{14}\)

\[
\text{KW cost} = \frac{(\text{I.C.} + \text{Annual Operations Costs}) \text{ at a Present Value}}{\text{P.F.} \times \text{T.N.C.} \times \text{N.P.V. factor} \times \text{Hr.}}
\]

where:

- **Annual Operation Costs at a present value** = Costs for fuel consumption + hydrogen and treated water consumption + spare parts + salaries.
- **I.C.** = Investment Cost affected by the financial analysis
- **P.F.** = Power Plant Factor
- **T.N.C.** = Total Nominal Capacity
- **NPV** = Net Present Value factor
- **Hr.** = Annual Hours (8760)

\(^{14}\) OP. Cit 13
Penalties
In the case that the Power Plant or any of the equipment (or parts of them), don't meet with the guarantees and standards offered, or if the winning bidder, fails to any of the commitments established, the corresponding penalties will be applied, according to the basis that are going to be described, and taking into consideration, that these don't limit in any way the right of the CFE to reject all or any of the equipment or parts of them, if necessary. It's worth to be mentioned that no cash credit or premium will be given to the supplier for any improvement achieved over the guaranteed values.

Delivery of the Drawings, Instructions and Technical Data
The CFE will apply a penalty equivalent to 0.7% of the total value of the order for each week of delay if the supplier fails to timely deliver the necessary information that permits the CFE to review and verify if the design and manufacture of the equipment for the power plant is being realized according to how it was established in the supplier offer, and in the CFE purchase order. The supplier is obliged to send project plans, final equipment specifications, manufacturing plans and, operation and maintenance instructions in an appropriate form.

Delay in the Commercial Operation
If the commercial operation date for each unit is delayed because of causes attributed to the chosen bidder, he will be required to pay to the CFE a quantity equivalent to 1.4% of the total value of the involved contract, for each week of delay with respect to what it is stated in this specification.

Penalty Maximums
The maximum of a penalty that can be applied due to delays in the delivery of drawings, instructions and technical data, and because of delays in the dates of commercial operation of each power unit is of 20% of the value of the order.
The maximum of a penalty that can be applied for differences in the net unitary thermal consumption, deficiencies in the unit capacity, and excess in the water and chemical substances consumption can sum also 20% of the value of the order.
The previous remarks, mean that together the maximum of penalties that can be applied to the selected bidder could ascend up to 40% of the total value of the contract.
It will be optional for the CFE, to accept the Units, if the deficiencies exceed 20%\textsuperscript{15}; the CFE can opt either to require the unit's repair or modifications, or to perform those reparations, charging the bidder the corresponding bills.; the CFE will also have the power to completely reject the installations.

The modifications, must be subject to the approval of the CFE as well as its respective schedule. In case of a repetition of a test, because of the doubt of one of the parties, the respective cost will be absorbed and covered by the party that requested it. If a party reasonably requests a verification, then the other part will pay for that test.
If in order to correct the fulfillment of the guaranteed parameters, additional modifications or verifications are necessary, the costs of them will be absorbed by the bidder.

**Economic Factors and Parameters for Evaluation\textsuperscript{16}**

a) Useful life of the power plant

b) Interest rate

c) Power plant factor

d) Total net present value

e) Leveled cost of diesel at the evaluation date

f) Leveled cost of fuel at the evaluation date

g) Water consumption factor

h) Maintenance cost

**Principal Factors for Penalization**

a) factor for differences in the net capacity guaranteed for each turbo-generator

b) factor for differences in the unitary thermal consumption

c) factor for differences in water consumption

The evaluation and penalization factors to be calculated, are based on the controlled exchange rate and the national price index for the producer indicated by the Banco the Mexico\textsuperscript{17}, in effect at the date of the bid or negotiation.

In case that any penalization proceeds, it must be actualized according to the following equation:

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\textsuperscript{15} Op. Cit 13

\textsuperscript{16} * Proyectos Llave en Mano para la CFE, CNIC, 1993

\textsuperscript{17} Banco de Mexico is the Mexican bank that enacts the price indexes for the construction industry.
$AP = SP \frac{(NI \times NPI_1)}{NPI_0} + \frac{(IP \times ER_1)}{ER_0}$

where:

- **AP** = Applicable Penalization
- **SP** = Specified Penalization
- **NI** = National Integration (%)
- **IP** = Imported Portion (%)
- **NPI_1** = National Producers Price Index at the moment of making effective the penalization according to the data provided by the Mexican Bank
- **NPI_0** = National Producers Price Index at the date of the bid or negotiation
- **ER_1** = Controlled Exchange Rate at the moment of making effective the penalization
- **EP_0** = Controlled Exchange Rate at the date of the bid or negotiation

**Capacity of the Power Plant**
If a turbo generator (gas or steam) is not capable to generate in a continuous form the net nominal power guaranteed, a penalty for each KW of difference will be applied according to what it is indicated in the specifications.

**Unitary Thermal Consumption**
If when effecting the behavior tests, the UTC guaranteed value for each generation unit is not being accomplished, a penalty to the selected bidder will be applied, for each Kj/KWH in excess, in conformity with the specifications.

**Water and Chemical Substances Consumption**
If the consumption of water or chemical substances results superior to the values instituted the CFE will concede a reasonable time to the supplier, to effect the changes, modifications or adjustments necessary in order to obtain the guaranteed values.
If after that period of time the consumptions are still above the guaranteed ones, the CFE will apply an economic sanction (considering a 30 years useful life and based on the market prices of the substances or products whose consumptions are above normal).

**Modifications Charges**

The behavior penalties will be applied till the chosen bidder exhausts the possibilities to correct the systems and equipment.

### 2.3 The Coordination of the Projects

Mexico is moving into Global Economy; this combined with population growth, has created gigantic demand for electric power.

The "turn-key" concept, doesn't apply the traditional coordination processes that other types of contracting methods use. Some of the contracting mechanisms to meet the electric power demand are: traditional processes (these are not sufficient), "turn-key" (this mechanism is the topic of this thesis and is the scheme that is becoming most popular among power projects), and Build Operate Transfer (BOT, an emerging privatization mechanism). I will only discuss the "turn-key" concept, however, a summarized explanation of the different contracting strategies available for infrastructure projects, with its advantages and disadvantages, is provided in [appendix 1](#) at the end of this thesis.

Coordination between all the different activities will be fundamental for the success of the "turn key" project. The main difficulties that the parties will encounter for the coordination of the project will be:

1. Usually, the civil design requires a series of geotechnical studies whose realization takes more time than the time available for the bidding process.
2. It is difficult to obtain the financing for the civil works through the bidding, and if obtained, it usually is not much favorable; with the equipment occurs the opposite. To add to this point, it is important to cite that in the majority of the power mega-projects, the larger part of the cost corresponds to the civil works, thus it will be critical to coordinate the civil works and the equipment supply and installation.
3- The civil works are always subject to more and larger unforeseen problems and risks, which difficulties the precise definition of the scope and conditions for the financing.

4- The coordination between the equipment responsible suppliers and/or associates is usually difficult and complex, giving as a result that frequently, the client must discuss and negotiate, with each of the associates, with a variety of criteria, norms, and mentalities. To add the civil works contractor to that list, will not bring any advantage to the coordination process.

The management of the project starts properly after the verdict has been made and the selected bidder is known; this management consists of the coordination and control of the activities of the project.

In order to execute the different controls of the project: advance of the works, quality, manufacturing, instalation, testing, and start-up, different areas, internal and external to the CFE, are required. All these areas interact between them and the management of the project will consist on an adequate coordination and control of all the activities that are involved.

A proposed Control and Coordination Matrix can be seen in table 2 at the end of this chapter.18

The principal diagonal of the matrix, indicates the main responsibilities specific for each area or party related to the "turn-key" project. In the other cells of the matrix, it will be indicated the flow of information and requirements of each of the areas with the rest of them.

2.3.1 Responsibilities and Activities of each Area

Project Headquarters (CFE)
* Executes the general coordination of the project.
* Receives and distributes the information (letters, memories, plans, reports, etc.) generated in all the areas in order to achieve the adequate and opportune participation of them with respect to their responsibilities.

18 Federico Schroeder, Hydroelectric Project Coordinator, CFE. Project Management Congress, CNIC 1993
General Construction Field Office
* It is in charge of the installation supervision, evaluates its planning, procedures and advance, and authorizes the corresponding payments.
* Verifies the arrival of the equipment at the job site.
* Revises and accords with the equipment manufacturers and suppliers their installation projects, and gives legal support for the land use.
* Participates with the production areas and with the quality lab, by providing support during the tests, and start-up.
* All the previous points are based on the information that this party receives from the CFE headquarters.

Equipment Manufacturer and Supplier
* Performs the engineering, manufacturing, shipment, installation, tests, and start-up of the equipment.
* Delivers to the project headquarters all the technical information of the project.
* Accords with the general field office everything related to infrastructure (programs, planning and procedures), for the installation.
* Receives the project supervision in its factory to ease the supervision of the manufacturing progression.
* Sends to the quality department, quality assurance plans and guidebooks.
* Discusses with the engineering departments all the technical aspects.
* Solicits support from the procurement consultant to speed up the importation deals.

Project Supervision
* Supervises the manufacturing course, and informs of it to the project headquarters, the general field office and the quality department.
* Gives technical support to the field office.

Quality Department
* Performs the quality control audits.
* Provides support to the project headquarters and the field office in quality control issues.
* Takes part in the start-up stage with specialized personnel.
Civil and Electro-mechanical engineering Departments
* Review all the technical information from the manufacturer, to verify the fulfillment of its scope, specifications and quality.
* Carry out the coordination between the electro-mechanical and civil design, which is responsability of the CFE. They report the results to the headquarters.

Procurement Consultant
* Gives support to the importation transactions, and to the shipment of equipment in Mexican territory.

Production Department
* Knows the general settlements for the equipment and utilities and provides opinions and experiences that can improve the safety and performance of the power plant.
* Participates in the start-up with specialized personnel, that later will operate the power plant.
Table 2 Power Plant Coordination Matrix

<table>
<thead>
<tr>
<th>To the area:</th>
<th>Project Headq.</th>
<th>General Field Office</th>
<th>Equipment Manufacturer &amp; Supplier</th>
<th>Project Supervision</th>
<th>Quality Control</th>
<th>Civil and Electro-mech. Departments</th>
<th>Procurement Consult.</th>
<th>Production Department</th>
</tr>
</thead>
<tbody>
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<td>Equipment Manufacturer &amp; Supplier</td>
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<td>Project Supervision</td>
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The explanation of the different responsibilities and interactions of the project’s areas would be as following:
Main Diagonal (Responsibilities for each area):

1) General Coordination, verification of the contract accomplishment.
2) Construction and installation of the plant, payments control.
3) Engineering, manufacturing, freightage, installation and testing of the equipment.
4) Schedule supervision, manufacturing and installation supervision.
5) Quality control.
6) Support and technical advise for the design, manufacturing, construction, and start up of the plant.
7) Supervise the shipment of the foreign equipment to Mexico
8) Knows all the operation and maintenance details of the project.

Interactions between different areas:

1.2) Engineering provision, technical support at the job site.
1.3) Dispatch and request of information, instructions to the suppliers.
1.4) Sends the supervision to supervise the manufacturing advance.
1.5) Calls for support and requests audits.
1.6) Sends all the technical information to be reviewed.
1.7) Calls for support with regard to customs and shipment issues.
1.8) Informs about the project's development.
2.1) Requests for technical support and information.
2.3) Supports the installation process, payments authorizations.
2.4) Solicits technical support.
2.5) Requests quality assurance support.
2.6) Requests technical support through the Project's Headquarters.
2.7) Idem 2.6
2.8) Informs about the equipment's installation.
3.1) Sends technical and commercial information.
3.2) Supports the establishment of installation procedures and programs, asks for payment authorizations.
3.4) Permits the access to the factories for advance supervision.
3.5) Sends quality control manuals and plans.
3.6) Technical issues discussion
3.7) Calls for support in importation negotiations.
3.8) Receives personnel for the start up.
4.1) Reports the project's advances.
4.2) Informs about the progression of the project, supervises the contractor's activities.
4.3) Supervises the manufacturing and installations advance.
5.1-5.6) Supports the quality assurance of the project.
5.8) Supervises the start up phase of the project.
6.1) Provide technical support in all phases of the project.
6.2) Provides technical support in installation issues.
6.3) Supervise the design and characteristics of the project's equipment.
6.5) Emits the equipment specifications and provides technical explanations.
6.8) Provides technical support during the start up.
7.1-7.3) Provides orientation with regard to importation transactions.
8.1) Accords operative procedures during design and construction.
8.2) Receives the plant for commercial operation.
8.3-8.6) Participates in the start up phase.
Chapter 3 Financial Aspects

3.1 Introduction
The term "project finance" generally refers to the financing of a project in which the lenders look principally to cash flow generated by the operation of the project for the source of funds from which the loans will be repaid; the assets of the project, including the project agreements and cash flow, become the collateral for the loans.

For Mexico, which has an immense demand for electricity, limited recourse financing is a promising vehicle for attracting the capital necessary to address this demand. Limited recourse financing is a financing arrangement, where the lender can require the borrower to repay only in special conditions that are spelled out in the loan agreement itself, and otherwise must look to the collateral as a source of repayment. However, with the opportunities, come a wide range of practical and legal complexities which must be resolved in order for the project to be successful.

Mexican project financing in many ways is more complicated than U.S. domestic project financing. In addition to those issues that a financial institution would commonly expect to encounter in connection with domestic project financing, additional documentation will be required to address certain of those issues unique to Mexican financing.

A preliminary hurdle which must be overcome for a project to be successful is the distinct background and experience of the sponsors, on one hand the developer, who will be supplying equity and structuring and negotiating key project documents, and on the other hand, the international lenders who will be providing the debt financing for the project.

In many cases, the developers of the projects will be those companies, and individuals at those organizations that have a long experience in negotiating with commercial banks and are used to the division of risks and rewards between developers and lenders.

At the international lending institutions, and in particular at the commercial banks, the lending officer for the transaction may be a project finance banker familiar with the U.S. or European markets, but in many cases his "partner" within the bank, and almost certainly his credit committee and senior management, will place greater emphasis on the experience of the bank in Mexico.

Although the major players in any power project being considered around the world (be it the United States, Europe, Southeast Asia or Latin America), will be the same\textsuperscript{20}, the expectations and requirements of the parties will be very different depending on the jurisdiction in which the project is located. Sponsors must accept that they have to bring more to the table and accept more stringent financing requirements in Mexico, than in the case of the U.S. market. Commercial bankers at the same time must recognize that they are dealing with strong international developers and cannot just view the project as a traditional financing in Mexico. The best way of bridging this expectation gap is to combine the lessons learned in the U.S. power market, with the experience in lending to Latin American countries, and with this try to restructure the debt and create new investment vehicles for doing business in Mexico.

3.2 Financing Sources

A very important factor for the consolidation of the "turn-key" project is the cost of financing. With the object to minimize this cost it will be absolutely necessary to choose the best combination of financial instruments available in the market, either domestic or foreign. It will be important to distinguish all the risks of the project and clearly establish their coverage, in order to provide confidence to the investor (risk issues will be covered in chapter 4 of this thesis). A larger coverage of the risks when structuring the project, will provide the developer with better conditions in the contracted credits. During its construction phase, the project will be subject to more risks than at any other phase, thus its financing through the financial markets will be less feasible, unless some additional guarantees can assure security to the investors, as for example the prestige of the promotion enterprises.

Some of the financing options that are available in the market are:

3.2.1 Export-Import Banks (Eximbank)

For the majority of the Mexican Power Projects, it will be necessary to import electro-mechanical equipment. This process permits the access to foreign funds, encouraging foreign commercial relationships.

\textsuperscript{20} Op.Cit.19
The Export-Import Bank (Eximbank) is the only U.S. government agency dedicated to financing and facilitating U.S. exports. Eximbank loans provide competitive, fixed rate financing for U.S. export sales facing foreign competition backed with subsidized official financing. The loan and guarantee programs cover up to 85% of the U.S. export value and have repayment terms of one year or more. Dealing with risk, Eximbank charges a front-end exposure fee, assessed on each disbursement of a loan by Eximbank or the guaranteed or intermediary lender. Exposure fees, which are adjusted periodically, vary according to the term of the loan, the classification of the borrower or guarantor, and the borrowers country.

Eximbank operations generally conform to five basic principles21:

1) Loans are made for the specific purpose of financing U.S. exports of goods and services. If a U.S. export item contains foreign-made components, Eximbank will cover up to 100% of the U.S. content of exports provided that the total amount financed or guaranteed does not exceed 85% of the total price of the item and that the total U.S. content accounts for at least half of the contract price.

2) Eximbank will not provide financing unless private capital is unavailable in the amounts required. It supplements, rather than competes with private capital.

3) Loans must have reasonable assurance of repayment and must be for projects that have a favorable impact on the country's economic and social well being. The host government must be aware of, and not object to, the project.

4) Fees and premiums charged for guarantees and insurance are based on the risks covered.

5) In authorizing loans and other financial assistance, Eximbank is obliged to take into account any adverse effects on the U.S. economy or balance of payments that might occur.

This type of credits offer attractive conditions that provide a solid financing to the structures of the "turn-key" projects.

21 Alan C. Shapiro, Multinational Financial Management, 319.
3.2.2 Commercial Paper
During the construction phase of the project, commercial paper is issued to finance the project, expenditures and generated interests during that period. Commercial paper is a short-term unsecured promissory note that is generally sold by large corporations on a discount basis to institutional investors and to other corporations. Because commercial paper is unsecured and bears only the name of the issuer, the market has been dominated generally by the largest and most creditworthy companies.\textsuperscript{22}

There are three major non interest costs associated with using commercial paper as a source of short term funds: (1) back-up lines of credit, (2) fees to commercial banks, and (3) rating service fees. In most cases, issuers back their paper 100\% with lines of credit from commercial banks. Because its average maturity is very short, commercial paper poses the risk that an issuer might not be able to pay off or roll over maturing paper. Consequently, issuers use back-up lines as insurance against periods of financial stress or tight money, when lenders ration money directly rather than raise interest rates. Another cost associated with issuing commercial paper is fees paid to the large commercial banks that act as issuing and paying agents for the paper issuers and handle all the associated paper work.

At the beginning of the leasing of the power plant the commercial paper short term debt will be restructured with the emission of Ordinary Participation Certificates. This documents are designed specially for the long term financing of infrastructure projects, and offer better conditions with respect to the interest rates and amortization maturity, than the commercial paper.

3.2.3 Bonds Exterior Placement
A great interest in the international markets, exists from the institutional investors in acquiring infrastructure projects bonds in Mexico, because of the auspicious growing perspective of the country. By acquiring this type of debt, the project developer will secure an advantageous maturity, up to 12 years, and also a competitive interest rate that offers lesser costs than in the national markets.

\textsuperscript{22} Op. Cit. 21, 290
3.2.4 SWAPS
In recent years, a market has developed that enables investors to purchase the external
debt of less-developed countries (LDCs) to acquire equity or domestic currency in those
same countries. The market for LDC debt-equity swaps, as the transactions are called, has
grown rapidly over the past few years. Six major debtor nations- Chile, Brazil, Mexico,
Venezuela, Argentina, and the Philippines- have initiated debt swap programs.23

Swaps can be quite complex, but the basics are fairly simple. For several years, European
and regional U.S. commercial banks have been selling troubled LDC loans in the so called
secondary market- an informal network of large banks, big multinational corporations, and
some Wall Street investment banks that trade loans of troubled debtor nations over the
telephone, telex or fax. The loans trade at deep discounts to their face value, reflecting the
market's opinion that they will not be repaid in full. The Mexican debt sold last year at
about 45% of its face value.

As we mentioned, under a debt-equity program, the firm or developer will buy Mexican
debt on the secondary loan market at a discount and swap it into local equity. Although
such programs are still in their infancy, debt-equity swaps can provide cheap financing for
expanding infrastructure and for retiring local debt in hard-pressed countries.

3.2.5 Commercial Bank Financing

To obtain the corresponding funding for a power project, and because of its enormous
cost, it might be necessary to syndicate the credit, whose cost is nowadays, bigger than the
cost of the previous options. The developer can assist to a commercial bank in order to
obtain a bridge loan24 for the construction period during the formalization or negotiation
of the long term credit.

3.2.6 Leasing

A Leasing Financial Institution can be contracted to receive and administer the credits
obtained, and to procure the resources that still are required. This option brings a higher
cost, however, it permits that a specialized institution administers the monetary resources.

23 Op. Cit. 21, 617
24 Bridge loan: short term loan, also called a swing loan, made in anticipation of intermediate-term or long-term financing.
Nowadays developers and contractors must be concerned of the needs and complexities of the power "turn-key" projects in Mexico; they will need to destine resources that support this scheme by planing and creating new financing mechanisms. By joining creativity and financial engineering skills as fundamental elements, they will create feasible sound structures that permit the attraction of funds, giving continuity to the growing rhythm that Mexico requires.

3.3 Credit Documentation

Credit Agreement

The credit agreement is the basic legal document in a loan transaction. The typical credit agreement will set forth the basic terms of the loan, including its maturity, interest rates and fees. It will also include provisions that address yield and capital protection, submission to jurisdiction, choice of law and the appointment and authority of the agent. The credit agreement in a project financing, however, differs from those found in other transactions in its scope and in the complexity of its conditions precedent, representations, covenants and events of default.

The credit agreement will provide that the lenders will make loans to the borrower to finance the construction of the project subject to specific conditions precedent\(^\text{25}\)

i) The conditions precedent to the initial advance are designed to ensure that (A) the project will be economically and technically viable and in compliance with all applicable laws and governmental permits, (B) the project and credit documents are in full force and effect and enforceable against the parties thereto and (C) the security arrangements are adequate and effective.

ii) The conditions precedent to each subsequent construction loan drawdown are designed (A) to ensure that construction is proceeding as scheduled and according to specifications and (B) to identify emerging problems such as project cost overruns and the existence of liens against the project. Unlike most other loan agreements, the loan drawdown schedule is often tied directly to the progress under the construction contract,

\(^{25}\) Private Power in Latin America, Lessons from the U.S. experience, Milbank, Tweed, Hadley & McCloy
which each drawdown requiring an independent engineer's certificate that certain "milestones" have been achieved or alternatively, that a percentage of construction has been achieved.

iii) The conditions precedent to conversion from a "construction" to a "term" loan are designed to ensure that the facility, as constructed, will continue to be viable and in compliance with all applicable laws and permits.

The credit agreement for a project financing will contain all of the covenants typical in any financing, such as covenant to provide financial information and notice of any default; maintain legal existence; pay taxes; comply with laws; and permit inspection. Typical negative covenants will also be included prohibiting additional debt, liens on the project and fundamental changes of the borrower such as merger, dissolution or sale of all or substantially all of its assets. In addition to these basic covenants, the lenders should impose other covenants relating to the project such as covenants to construct and operate the project in accordance with agreed standards; to enforce the project agreements; and to refrain from amending or modifying existing project contracts or entering into new project agreements.

The credit agreement will contain events of default that are common to all financings, such as the failure to pay principal, interest and fees when due; breach of covenants; misrepresentations by the borrower; and the insolvency or bankruptcy of the borrower. The credit agreement will also contain additional events of default related to project financings that address any change in the structure of the project by reason of breaches of covenants contained in the project contracts; misrepresentations by the various parties to the project contracts; material changes in law or governmental authorizations; and failure to complete the project or commence operations by a date certain.

The credit agreement will set forth the usual remedies afforded a secured lender, including the right to cancel the commitment, to accelerate the maturity of the loans and to exercise the rights of a secured creditor under the collateral security agreements. The credit agreement in a project financing may also include additional remedies that permit the lender to assume the construction and operation of the project. It is advisable, however, to consult with environmental specialists and Mexican counsel to ensure that these remedies do not result in unintended environmental liability for lenders or expose the lenders to other risks under the Mexican laws.
Security Documentation
In general the lenders will want an assignment and security interest in all contract rights and other assets that are required to construct, supply fuel for, purchase the output of, and operate and maintain the facility as contemplated by the initial project agreement. Additionally, the lenders will require an assignment of all of the project’s revenues and all of the borrower’s other tangible and intangible property rights, including, among other things, insurance policies, governmental permits and technical licenses.

In order to create a private power industry through use of project finance, Mexico’s legal and financial frameworks must allow for foreclosure by the lenders following a default, and a subsequent sale of the project in order to recover loan proceeds. If lenders are uncertain about their ability to foreclose on a project, alternate collateralizing may be needed, perhaps through government guarantees or recourse to the developer’s assets and credit.

In almost all project financings, the lenders will take a mortgage on the project facility and on the land on which the facility is located (including all rights-of-ways and easements necessary to operate the project). The security arrangements relating to this part of the collateral will generally be governed by Mexican law and custom. Mexico has various types of mortgages and pledges with respect to real estate, hard assets and intangibles. In addition, in Mexico a trust arrangement (for "turn-key" projects) may be preferable in which the trust holds actual ownership of the project for the benefit of first the lenders and second the equity participants.

Consents
Each party to a principal project agreement will be asked to execute a consent to the collateral assignment of such contract to the lenders ensuring that the assigned contract will be enforceable and transferable by the lender. Consents are viewed by lenders as essential credit documents and may result in protracted negotiations with third parties.

Intercreditor Agreements
Many Mexican project financings involve more than one lender or lending group. Lending groups often may include, international banks, multilateral agencies, bilateral agencies and governmental agencies or Mexican banks. Since the action of a single lender or lending
group (in seizing collateral, bringing legal action against the borrower or the like) may prejudice all lenders, the lenders often will wish to enter into an intercreditor agreement. Such an agreement might restrict the right of any particular lender or lending group to accelerate its debt, seize collateral, sue the borrower, initiate bankruptcy proceedings, set off bank deposits or take other action that would prejudice the project without the agreement of a designated percentage of all of the lenders.

Project Documentation
Since the ability of a project to produce revenues is essential to any successful project financing, particular attention must be paid to the project agreements. Each of the underlying project agreements necessary to construct and operate a project must be sufficient to support the project financing. A more detailed study of the project documentation and contracts will be discussed in Chapter 5 of this thesis.

Power Sales Agreements
The electricity purchase contract plays a central role in the financeability of power projects in Mexico. Such agreements are usually executed prior to negotiations with prospective lenders, since lenders will require advance assurance of a reliable revenue stream as the source of debt service. Through the capacity and energy charges under the electricity purchase contract, the developer is able to recover fixed charges (construction costs, including debt service and equity return) and operating costs, such as fuel charges (including adjustments for increased costs). In Mexico, a long-term power sales contract with the CFE will be central to the development of a project, provided that lenders and developers will be able to get comfortable with the utility's ability to perform.

Fuel Supply and Transportation
Lenders and institutions in the project finance market will usually not enter into transactions without assurance that the project will have access to reliable fuel supplies, thus the project's sponsors must demonstrate to lenders that adequate capacity exists on the necessary pipelines to satisfy transportation needs for the term of the loans.

Construction Agreements and Completion Guarantees
The lenders support the "turn-key" concept since the construction risks of the project, to the extent possible, are shifted to the contractor. The most critical element of a "turn-key"
construction contract is the scope of work. This scope should be broad enough to ensure that the contractor is obligated to furnish a complete facility that is capable of meeting the project requirements. In order to control the project's total cost, the work under the construction contract should be completed on a fixed price basis. The power project may never be completed if the construction price increases substantially since there is usually a fixed amount of money available (through debt and equity) to complete the project and pay interest during construction. To mitigate this risk, lenders are generally willing to pay a significant premium for a "turn-key" construction agreement. The contractor will also be asked to ensure the integrity of the completion schedule by agreeing to delay damages and performance guarantees.

3.4 Financing Guarantees

3.4.1 Background
The new Mexican government is starting with Enesto Zedillo's administration a new process of important structural reforms to achieve the economic recovery of the country. The economic stabilization program is based on 4 fundamental aspects: a) Fiscal Discipline, b) aggressive deregulation in the economic activities, c) privatization, and d) a commercial opening program.
Dealing with this new environment, it will be absolutely necessary an investment growth. The CFE must develop innovative schemes that reflect the creativity, dynamism and experience of the groups interested in participating.

3.4.2 The Players
In the development of "turn-key" projects, a great variety of participants have influence in the general and specific aspects of the projects. The main players are:

1) General Government.- Plans, directs, and promotes the development of these projects.
2) CFE.- Arranges and convokes projects of specific nature; supervises the development of the projects.

26 Jose Antonio Alvarez del Castillo, General Director Assistant, Seficor Financing Group, Lecturer for the Financing of Infrastructure in Mexico Congress 1993.
3) Commercial Banks.- Accord the financial support policies based on their capacity to grant loans.

4) Development Banks.- Orient and propose support programs for the projects.

5) Financial Staff.- Analyses, structures and suggests financial schemes

6) Contractor.- Organizes, develops, proposes schemes to obtain the project and of course is in charge of the construction of the plants.

A detailed discussion of the players and the contracts in which they are involved is included in chapter 5 where all the legal issues of the "turn-key" projects are covered.

3.4.3 Guarantees

The financial guarantees are key aspects for this type of projects, however it will be also critical to consider the sources for the repayment that the CFE will utilize. It must be taken into consideration if at the delivery of the project, the CFE will utilize: a) resources that come from the operation of the plant, b) fiscal resources, or c) World Bank resources, in which case the verification of the annual assignments of this institution will be required.

The financial institutions that participate with the financing for the "turn-key" projects try to count with the following guarantees:

Traditional Guarantees:

I. Project Performance Bonds, with respect to:
   a) Term in which the project must be finished (schedule)
   b) Quality
   c) Values and Standards to be followed during the construction

II. Fixed assets, basically construction equipment

III. Pact of rights and obligations transfer (at the end and delivery of the plant) by the CFE

IV. Contractors collateral in proportion to their participation in the construction of the project.

V. CFE will be able to supplant itself as the creditor of the banks by compromise, starting the day of the reception of the plant. The terms of the negotiation can be:
a) long term from 5 to 10 years
b) by total reimbursement of the project at the reception

**Non Traditional Guarantees**

I. When the "turn-key" project generates revenues, agreements with the financial creditors can be established, to transfer the net flows of the operation of the plant in their favor.

II. Another alternative could be the possibility to utilize the Brady Bonds that some Mexican banks have, as a collateral guarantee with foreign financial institutions.

It will be the responsibility of contractors, Government and financial entities to design and improve with creativity new formulas that represent adequate guarantees and risks for this type of projects.

**3.5 Financial Evaluation**

The basic framework to make a sound financial evaluation of the Power Project during the bidding process will require the application and study of the following four points:

1) Detailed analysis of the proposal that is presented
2) Credit offers supported with agreement letters from the Banks or financing entities
3) A clearly definition of the terms and conditions of the credits:
   * currency
   * rates
   * terms
   * commissions, fees and expenditures
   * insurance and guarantees
   * interest financing
4) Disposition calendar according to the schedule and program of the project

During the financial evaluation of the offers, three basic aspects must be analyzed:

1) Calculation of the cost of the credits (Internal Rate of Return of the financing)
2) Calculation of the Net Present Value of the cash flows of the offers
3) Feasibility to obtain the financing for the project
It is very important to mention that each of the credits to be contracted, must be authorized by the Mexican Finance Ministry. The Ministry will authorize the credits from its term and conditions point of view, as well as from the legal clauses of the contract. After analyzing and comparing the project's financial proposals, a dictate of the best financial proposal is emitted and sent to the CFE's construction direction in order to continue with the total evaluation of the project.
Chapter 4 Risk Management Aspects

4.1 General Issues
Before starting with the risk aspects discussion, I would like to cite, that the main theories and ideas presented in this chapter are a summary of Flanagan and Norman's "Risk Management and Construction" book. Some information should also be attributed to other sources (see footnotes), as well as to the presentations that were made at the "Managing Construction Risks in Independent Power Projects" Congress in New York (June 1992).

Power construction projects have an abundance of risk, contractors cope with it and owners pay for it. The construction industry is subject to more risk and uncertainty than many other industries and in Mexico, the trend (dealing with "turn-key power projects) is to allocate the risk on the contractor side and lessen risk on government. The process of taking a "turn-key" project from initial investment appraisal to completion and into use is complex and entails time-consuming design and production processes. It requires a multitude of people with different skills and interests and the co-ordination of a wide range of disparate, yet interrelated, activities. Such complexity moreover, is compounded by many external, uncontrollable factors.\footnote{Lifson and Shafer, Decision and Risk Analysis for Construction Management} Competition forces bids that may not return a profit. Suppliers raise prices and sometimes do not deliver as promised. Employees want more money, may make mistakes, show up late, and strike. The weather may turn bad on a project with firm completion date.

Faced with such threats to profits and security, project developers, financial institutions and construction managers must make decisions, and they must make their decisions in spite of additional unpleasant facts of life.

1. Construction problems are \textit{complex}. The elements of the problems are numerous, and the interrelationships among the elements are extremely complicated.
2. Relationships between elements of a problem may be higher \textit{nonlinear}; changes in the elements may not be related by simple proportionality.
3. The elements of the problem are \textit{uncertain}. Construction managers cannot know for sure what the future holds in store for them (e.g., weather,
availability and costs of labor or materials, interpretation of pertinent ordinances and contract documents), and may not be sure of the past or the present (e.g., geology of site location).

4. The situation is dynamic. Conditions are continuously changing; equilibrium is rarely encountered.

5. Human value systems are integral essential elements of construction problems. Although managers would prefer to deal only with physical and economic factors, they are beset with higher level complexities, non-linearities, uncertainties, and change introduced by conflicting human needs and desires.

Decision and risk analysis will not, of course, make the environment of the project parties any friendlier. Competition will not relax its pressures, suppliers will not lower prices and cease being late in deliveries, employees will not accept lower wages, and the weather will not always be fair over a project just because management decides to apply "risk management".

Furthermore, decision and risk analysis will not provide hard, objective data where none exists (it will not do the job of research and development), nor will assure the successful outcome of all decisions. What these risk issues can do for the people involved in the power project is to provide them with the concepts, language, and an organizing framework for systematically dealing with the complexities, non-linearities, uncertainties, dynamics, and value systems inherently present in their decision problems. They will help managers also in identifying, eliciting, and processing judgmental information elements along with objective data in reaching a decision.

Application of the methods and techniques of decision and risk analysis does assure the following essential ingredients of effective management:

1. Decisions are compatible with project policies, goals, and objectives.
2. Evaluation of decision alternatives is consistent from alternative to alternative.
3. The results of technical analysis and computational activities are consistent with management's view of the problem situation.
4. The factors on which a decision is based can be readily reviewed, discussed, and communicated.

In view of the inherent risks in construction, it is surprising that the managerial techniques used to identify, analyze and respond to risk have been applied in the industry only during the last decade. Most people would agree that risk plays a crucial role in business decision-making: the risk of loss tempers the pursuit of return. There is less agreement about what constitutes risk. It is well-publicised and much talked about, and yet intangible. Risk can manifest itself in numerous ways, varying over time and across activities. Essentially, it stems from uncertainty, which in turn is caused by lack of information.

The concept of risk can be applied to nearly every human decision-making action of which the consequences are uncertain. This uncertainty arises because an essential characteristic of decision-making is its orientation towards the future- a future which by its very nature is uncertain.

4.2 Risk and Construction

The two most important questions are whether the returns on the project justify the risks, and the extent of the loss if everything goes wrong. Clearly the decision-maker's perception of risk is more likely to be influenced by the probability of a loss and the amount of that loss than by a variance in the gamble. Thus the techniques for quantifying risk as an aid to decision-making have become more important. These techniques must be based on a proper understanding, both of the terms involved and of other basic concepts such as why, given exactly the same situation and information concerning a proposal, two people may come to different decisions.

It might be argued that these considerations apply to investment in financial markets but have little to do with the apparently more "real" environment of the construction industry. Nothing could be further from the truth. The individuals involved in the industry form two groups: "principals" or "owners" (e.g. CFE) who commission construction and "agents" or "contractors" who undertake the various activities that produce buildings, energy projects, dams, etc. These groups are, of course, heterogeneous. In general, an owner can be anyone from a government department or a major development company to an individual
householder. Agents include professionals such as architects, engineers, surveyors, general contractors, and a wide range of specialist subcontractors and suppliers.

It is easy for the developer or the financial institution to see the relevance of risk management. An owner or developer, in using the construction industry, is making an investment decision: the decision to commission an important hydroelectric or other type of "turn-key" project. The capital committed could, instead be invested in government bonds or some market portfolio of financial assets. The decision to invest in a power project must, therefore, provide a risk/return profile which is competitive with the best that the financial markets can provide.

For the agents, the argument is not so straightforward but is equally valid. An agent bidding for the relevant part of a power plant "turn-key" project is committing resources—labour and capital— that have other potential uses. Money may have to be borrowed, or reserves used, to cover a gap between income and expenditure, while profit, if it is made, will arise at some time in the future. With regard to the agent's own financial resources being used, the same considerations arise as those outlined above for principals in that the agent could invest his resources in financial markets instead. Where the agent is borrowing or committing tangible resources such as labor, a comparison must be made between potential return and the cost of borrowing, and/or between potential return on this project and potential return on the projects that could otherwise be undertaken. Once again, effective risk management requires comparison of risk/return profiles.

We are moving to an era where risk has to be identified, analyzed and apportioned much more openly and professionally. Despite the apparently obvious nature of this remarks, it remains the case that most risk identification and appraisal carried out in the property and construction industry is poor in comparison with the quality of analysis used in, say, the money market. This cannot continue. Increased integration between financial and real sectors of the economy, and major capital commitments in the building industry, means that the poor quality of risk management in construction has perhaps a greater significance at present than at any other time since the 1970's.
Pundits have argued that there are four ways to tackle risk in the construction industry (according to Flanagan and Norman) 28:

* "the umbrella approach" where you must allow for every possible eventuality by adding a large risk premium at the price;
* "the ostrich approach" where you bury your head in the sand and assume everything will be all right, that somehow you will muddle through;
* "the intuitive approach" that says don't trust all the fancy analysis, trust your intuition and gut feel;
* "the brute force approach" that focuses on the uncontrollable risk and says we can force things to be controlled, which of course they cannot.

Few companies today can survive on these approaches, clients are demanding more and everybody is becoming more conscious of the risk they are carrying. Risk management aims to ensure that all that can be done, will be done to ensure the project objectives are achieved. Once a risk is identified and defined, it ceases to be a risk, it becomes a management problem.

4.2.1 Typical Risks in Construction

Typical risks on a power "turn-key" project include:

* failure to complete within the stipulated design and construction time.
* failure to obtain the expected outline planning, detailed planning or building code/regulation approvals within the time allowed in the design program.
* unforeseen adverse ground conditions delaying the project.
* exceptionally inclement weather delaying the project.
* strike by the labor force.
* unexpected price rises for labor and materials.
* failure to let to a tenant upon completion.
* an accident to an operative on site causing physical injury.
* latent defects occurring in the structure through poor workmanship
* *force majeure* (flood, earthquake, etc.).

28 Flanagan and Norman, Risk Management and Construction
* a claim from the contractor for loss and expense caused by the late production of design details by the design team.
* local law issues
* political and currency risks
* failure to complete the project within the client's budget allowance.

It is important to distinguish the sources of risk from their effects. Ultimately, all risk encountered on a project is related to one or more of the following:

* failure to keep within the cost budget/forecast/estimate/tender.
* failure to keep within the time stipulated for the approvals, design, construction and occupancy.
* failure to meet the required technical standards for quality, function, fitness for purpose, safety and environmental preservation.

In most situations, the effect of adverse events will be financial loss. The task of the professional advisers, contractors, specialists contractors and suppliers is to identify the discrete sources of risk which can cause failure to occur, and to develop a risk management strategy that provides for the most appropriate organization to carry that risk.

4.3 Developing a Risk Management Framework

The process of risk management is broken down into the risk management system in figure 9 which shows the sequence for dealing with risk. Naturally the risk management system must be applied to each option under consideration. Generally, the stages are:

Risk Identification: Identify the source and type of risks.
Risk Classification: Consider the type of risk and its effect on the person or organization.
Risk Analysis: Evaluate the consequences associated with the type of risk, or combination of risks, by using analytical techniques. Asses the impact of risk by using various risk measurement techniques like probability analysis, sensitivity analysis, scenario analysis, simulations, comparing options etc.
Risk Attitude: Any decision about risk will be affected by the attitude of the person or organization making the decision.

Risk Response: Consider how the risk should be managed by either transferring it to another party or retaining it.

Figure 9 The risk management framework\textsuperscript{29}

Proper allocation of risk must consider the ability to absorb the risk and the incentives being offered to carry it. For instance, when pricing for the earth moving of an energy construction project, the contractor will have available the site investigation and bore hole reports as well as any geological information. The specification calls for the contractor to make due allowance for excavation in any ground condition he encounters. Incomplete knowledge of the site geology and the possibility of unforeseen ground conditions poses great risks to the contractor. Part of that risk will have to be transferred to the works contractor. However, a defensive position will be taken by adding a risk premium and inflating the unit price rates, thus hopefully covering the risk being retained. In this situation there is some transferred risk and some retained.

The response to, or the allocation of risk can take any of four basic forms, as shown in figure 10. Figure 11 shows the approach to risk response on a construction project.

\textsuperscript{29} Op. Cit. 28
On lump sum "turn key" contracts, clients are passing more risk to contractors and trade contractors. We have to be explicit and courageous when we take risk and not just gripe about them. Clients have to accept that risk and reward go hand in hand. Risk response actions must not be viewed as wasted costs, but as investments that generate returns. Listed below are some of the fundamental principles which govern the allocation of risk:

* which party can best control the events that may lead to the risk occurring.
* which party can best manage the risk if it occurs.
* whether or not is preferable for the client (CFE) to retain an involvement in the management of the risk.
* which party should carry the risk if it cannot be controlled.
* whether the premium to be charged by the transferee is likely to be reasonable and acceptable.
* whether the transferee is likely to be able to sustain the consequences if the risk occurs.
whether if the risk is transferred, it leads to the possibility of risks of a different nature being transferred back to the client.

4.3.1 Contract Strategy

The development of a contract strategy is an important task for the client or his project manager. It comprises a thorough assessment of the choices available for both the execution and management of the design, construction and operation processes. Any proposal submitted for sanction by the client should contain clear proposals for risk response policies. Such proposals must be fully developed by the time tender documents are issued. Some of these may be technical, such as the need for further site investigation or field study before finalizing design or placing construction contracts. If this prove impracticable or are not accepted then the tolerance associated with the estimate must be increased. Even so, the client should demand that all the risks have been considered and accounted for in some way. There should also be proposals (admittedly more time-consuming to prepare) which make clear the managerial policies for the reduction or transfer of risk, and the control or retained risk. This will usually involve a proposal that the power project be dealt with by a specific strategy, such as a management contract or target cost contract. Insurance proposals will require special attention on some projects too. The decisions taken during the development of a contract strategy clearly affect the responsibilities of those involved in the project. They influence the control of design, construction, and commissioning and hence the coordination of the parties, they allocate risk and define policies for risk management, and they define the extent of control transferred to contractors. Thus they affect all of the crucial factors in a project: cost, time, and quality.

Reaching an appropriate contract strategy for a project requires careful consideration of:

* the choice of type of contract
* how the contractor should be selected eg. select competition, negotiation.
* the choice of organizational structure to control design, construction, and their interface.
* the selection of the content, extent and sequencing of the work packages.

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31 Randy White, Insurance Considerations for Power Producers in Latin America, Congress 1992
* selection and preparation of tender documents, including the Conditions of Contract, the primary vehicle for the allocation of risk between client and contractor.

Lack of attention to risk at the contract strategy stage can produce very unpleasant surprises that can lead to later protracted dispute. For example when contractors are faced with managing major contract risks the outcome of both the tenders and the final contract durations and prices are often disturbingly out of line with initial expectations. The parties to the contract are also frequently at odds over the interpretation of risk allocation in the contract and the responsibility for managing the risks (or carrying the consequences of the risk). In the USA, the rapid growth in the "claims industry", with its use of arbitration and litigation, testifies to this fact.

Over the years many project managers have come to the conclusion that traditional types of project organization, types of contract and conditions of contract are inappropriate for today's high risk, highly complex "turn-key" projects. Tailor-made approaches to contract strategy, which promote active management of a risk by all parties, are increasingly being seen as more suitable. A report in the USA has suggested that a considerable percentage of the project cost may be saved by choice of the most appropriate type of contract alone. Hayes et al and Perry et al have emphasized the benefits of unconventional approaches in dealing with high risk projects. The opportunity to manage risk through contract strategy decisions should not be undervalued. Perry has studied the concept of contract strategy taking into account the influence of risk and has developed a systematic methodology for the preparation of a contract strategy.

Conditions of contract can make a valuable contribution to risk management if they contain the following characteristics:

* clear definitions of risk and their allocations.
* improved incentives linked to risk allocation.
* flexibility for different allocation of risk between the parties.
* strong emphasis on good management practice, particularly in working to time.
There is another very important effect of such development of traditional conditions of contract: a reduction in the incidence of disputes and the amounts of money under dispute. This is such a millstone around the neck of the construction industry that any possible means of eliminating it is worthy of pursuit.

**Figure 12** shows in simplified form who carries the risk in the various types of contract used in the building industry. **Figure 13** shows a list of sources from the viewpoint of the general contractor at the tender stage. The aim of the list is to identify the risk and the offsetting tactic needed to ensure the risk is adequately covered.

**Figure 12**

Who carries the risk in the various types of contracts

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32 Hayes, Perry and Thompson. Management Contracting, CIRIA Report
4.4 The Owner Controlled Insurance Program used at the Central Artery Project in Boston and its application to the "Turn-key" concept.\textsuperscript{34}

One of the tactics that the parties involved in a construction project employ to deal with risks and offset them is to buy an insurance. Traditionally, in construction projects, the method of arranging insurance coverage is by requiring all the participants (e.g., construction contractors, subcontractors, design consultants, management consultants, etc.) to procure separately its own array of stipulated insurance coverages. This old method brings many disadvantages like:

* coverages provided separately by each project participant may not be project specific.
* coverage can be eroded by aggregate losses from other projects.
* cross litigation is also commonplace in defending insurance claims.

\textsuperscript{33} Op. Cit. 32
\textsuperscript{34} From Peter Zuk, Lecturer at the Massachusetts Institute of Technology, Course: Management of Large Scale Systems.
* there is no economy of scale that derives from a coordinated response to claims.
* the effectiveness of insurer sponsored safety and loss prevention is diminished because no one insurance carrier is responsible for the total project.

For this reason, it is important for the CFE and financial institutions to recognize that insurance procured independently by each participant may be considerably more costly than if a single policy is procured through one company covering all participants for a given risk.

Many of today's mega-projects have construction budgets exceeding $50,000,000. When projects exceed this amount and satisfy other criteria owners should and will consider an Owner Controlled Insurance Program (OCIP) in order to simplify insurance arrangements, while saving on overall insurance costs for the project.

Under an OCIP or wrap-up the owner purchases the Public Liability and Worker's Compensation, and, possibly, the Professional Liability and Builder's Risk for the project team. All contractors and designers of any tier covered by the program deduct insurance from their costs to avoid duplication of cost and coverage. Policies are typically arranged for project term; rates are negotiated at inception and, where possible, the program is noncancelable except for nonpayment of premium.

Because of its size, complexity (more than 75 prime contractors that interface with each other) and dynamic environment that surrounds it, the CA/T Project presents an ideal situation for the application of an OCIP. The major benefits of an OCIP to the Artery nowadays and to "turn-key" power projects for the future might be:

* substantially reduce insurance and administrative costs of the project.
* ensure broad and uniform insurance coverage for all parties.
* provide more effective coordinated loss control (control by the owner) and loss prevention activities than conventional approaches.

35 Interview with Anthony E. Batelle, Chief Legal Counsel, Central Artery Project, Boston 1994
* centralize all claims investigation and settlements with an eye to eliminating or reducing time consuming and potentially costly disputes among the parties.
* the opportunity to implement more ambitious and coordinated loss prevention, control and safety programs.
* enhanced opportunities for MBE/DBE participation.

In addition it is also worth to be mentioned that the CA/T is adopting a variation of the OCIP, which involves wrapping up each line of insurance independently rather than in a single, global wrap-up. The additional advantage of this approach is that the coverage within each line of insurance can be analyzed and procured independently and then tailored in the policy endorsements to the risk presented and coverage provided.

In comparison to the advantages, the disadvantages are minimum, but they must also be considered:

* OCIP imposes an additional administrative burden upon the entity that has the risk management responsibility.
* it will be necessary to have a specially trained staff to manage the program.
* the services of specialized counsel may be required.
* an OCIP will involve the participants in profoundly new claims and administration processes with which they will be unfamiliar, and the contractor will lose control of its destiny to some extent.

Although "bulk buying" of insurance can provide premium cost savings, many of the financial benefits of a wrap-up arise out of the ability to realize savings from better then expected loss experience: the program is often written subject to loss retentions that are substantially higher than the parties would individually select. However, substantial retentions are possible only where there are large workers compensation and general liability premiums associated with the given project.

Whether $50,000,000 (or another number ) is the minimum contract price required to make a wrap-up, the preferred option on a construction project depends upon a number of factors : the hard cost labor content of the project (which in the first place affects the
workers compensation premium), the territory (and location within that territory), the nature of the project, the complexity of the project, the length of the project, the relationships among the parties and the financial strength of the owner/developer.

Engineering project management has a vital role to play in risk management. In the work leading up to approval of funds, project managers can contribute to sound economic appraisal by producing realistic estimates of cost and time, which are based on a clearly defined standard of the quality of work and operational requirements. During the project its role is to ensure that these targets of cost, time and performance are met.

A summary of the risk management is as follows:

* risks have to be identified, classified and analyzed before any response is made.

* an identified risk is not a risk, is a management problem.

* beware of using solely the intuitive approach or "gut feel" to manage risk.

* risk management needs to be continuous from the start till the end of a "turn-key" project.

* a poorly defined risk structure will breed more risk.

* use both a wide angle lens and a zoom lens for your vision of what could happen in the future.

* use both creative and negative brainstorming, don’t use the ostrich approach.

* always have a contingency plan to cope with the worst eventuality.

* risk management systems should not be complicated or burdensome, they need to be integrated into a firm’s daily operations.

* have an open-minded approach to innovative solutions to problems.

* never risk more than you can afford to lose

**Basic factors related to risk in contracts**

* what is the exposure inherent in the contract.

* who is most capable of handling that exposure.

* who has the responsibility for that exposure.

* who has the power to make sure that responsibility is carried out.
* what has been done to take account of the uncontrollable risks.
* to what extent have the risks been transferred.

Finally and to close the chapter I would like to mention that in a "turn-key" project, the contractor assumes the risks involved in the project and is responsible for his own insurance, however, if the CFE, is developing or participating in the construction of multiple projects, at the same time, the OCIP approach used for insurance coverage should be strongly considered.
Chapter 5 Legal Aspects

5.1 Introduction
The concept of a risk/reward profile for any project is overused as an expression, oft misunderstood in application, but nonetheless vital to the development of a successful project financing. For the developer, the balance of risk and reward must take into account the appetite and ambition of the developer and the developer's professional and financial ability to deal with adversity from those choices. More important, however, the developer must take into account the appetites, ambitions and risk averse orientation of the financing community, for it is this community, more than any other, that will dictate the project's operational flexibility and the developer's economic returns.36

Nowhere is this tension more evident than in the developer/sponsor's decision as how to address pre-completion risks of a project, including whether or not to pursue a turnkey contract for the construction of a power project.
Allocation of risks in a construction situation, through contract language in the construction contract and through various financial products such as bonds and insurance, is at best an imperfect process. Large construction power projects involve so many factual assumptions and uncertainties that Murphy's Law--anything that can go wrong will go wrong--often prevails.37 A negotiated, well written "turn-key" contract and customized performance bond and applicable insurance policies are a good starting point. The interplay between these documents is important for owners and lenders to have assurance that a project will be successfully completed and financially viable.

5.1.1 Drafting Turnkey Contracts to Cover Construction Risks
Much thought is usually devoted to resolving problems ahead of time through the construction contract. Appropriate warranties are included in the contract to make the contractor solely responsible for all work of the project (Construction and Performance of the unit), thus, if the contractor fails to any of the commitments established, the corresponding penalties will be applied as discussed in chapter 2. Any force majeure excuses are narrowly tailored so the contractor cannot readily avoid its responsibilities. The "turn-key" contract often contains liquidated damages clauses, performance bond

requirements, and performance tests to enhance the owner's position. Additional elements of a good turnkey contract include an accurate scope of work description, fixed price provisions, evidence of the contractor's adequate financial capacity, a reasonable but strict project schedule and assumptions of the risk of site conditions.

5.2 The Contract for Turnkey Power Projects
Contracting a power plant for the CFE is a very complex act, because a combination of different types of contracts are involved, under the regulation of the Mexican civil and administrative codes. Some of these contracts are: the construction contract (either public or private); the purchase agreement (defined by the Federal Law); and the service supply agreement.

Pursuant to the power plant "turn-key" contract, the contractor/supplier assumes direct responsibility for the total execution of the project, including the accomplishment of the works from its design and engineering phase; the obtainment of permits or licenses; the manufacturing, supply and installation of structures, equipment and other components; the testing; and all activities necessary till the start up of the unit is concluded. The contract also includes other additional and related issues such as the storage, custody, and conservation of all the construction elements of the project; in summary, all the necessary activities for the construction, installation, delivery and start up of the contracted unit, completed and ready for its commercial operation.

Before analyzing the legal and normative analysis of the contract itself and its applicable regulations and basic requirements, it is necessary to comment on the complexity of the Legal-Financial scheme that limits the contract. This scheme constitutes an innovation in the way of contracting for power mega-projects, either public or private.

The following is an analysis of the different parties involved in this Legal-Financial scheme. See table 3 at the end of the chapter:

First, we have the interested government organization or entity (in this case the CFE), that attempts to increase the investment in power infrastructure projects without exposing or involving government funds (following the current Mexican re-orientation policy of public resources). At the same time, the CFE wants to contract just one participant or a
consortium of contractors, that is entirely responsible for the total execution of the project, from its design and engineering phase to its final delivery for commercial operation. All the process will observe certain CFE's specifications, and will be subject to the CFE's technical supervision.

The second party will be the different contractors, suppliers and service providers that will participate in the project; these players will be committed to join efforts as well as goods and services to develop the project. They will integrate as a consortium generally under a Joint Venture Agreement form. This agreement is necessary, because the Mexican legal system does not contemplate the creation of a consortium or temporary firm merger with own legal status.

The joint venture presents, however, the problem for the CFE to limit the responsibility for the execution of the plant to the joint venture representative; therefore, additional "solidary responsibility" clauses for the contract will be required, as well as coordination mechanisms and particular pacts between the different associates to allocate responsibilities.

The third party involved is the financial entity. Under the new "turn-key" scheme, the objective will be that the projects can be financed by international institutions such as the World Bank, or by other foreign financing sources, including international equipment manufacturers and suppliers. This mode of financing must be made to avoid the utilization of government funds, and also to decrease the public debt.

Another objective will be to guarantee the financing only with the project's assets, avoiding, therefore, any federal government guarantee. Finally, it will be looked that the source of repayment comes from the project itself.

To implement the desired financial scheme, a Trust will be utilized to obtain and manage the necessary resources for the project. The Trust has also the objective of entering into a "turn-key" contract with the consortium or with the contractors/suppliers representative, commending the coordination and technical supervision of the project to the CFE.

The Trust will assume ownership of the plant once it is finished, in guarantee for the trustees (the financial entities and the CFE). The Trust will at the same time enter into a leasing contract with the CFE to utilize and operate the power plant once the project is
ready for commercial operation and will apply the revenues from the leasing to pay the credits.
As long as the Trust is managing the plant, the assets of the unit will serve as the payment guarantee for the financial institutions, in case that the CFE fails with its leasing obligations.
At the end of the lease, a Mexican bank as a fiduciary institution will transfer the property to the CFE.

Summarizing, the parties involved in the legal-financial scheme of a "turn-key" contract are:

A) The Promotion Entity (CFE)
B) The Contractors/Suppliers Consortium
C) The Financial Entity
D) The Trust and Fiduciary Institution.

The diagram (table 3) also shows the main legal agreements that are created between the parties involved in the project. The main contracts and agreements are:

1. Joint Venture Agreement between the construction contractors and suppliers involved in the project.

2. Trust, established with the participation of the promotion entity (CFE) as a trustee. The CFE will make the land available to the consortium to build and install the contracted unit, and will receive the power plant at the end of the construction phase.

The financial entity will also be a trustee in guarantee of the credits that is providing to the project. Finally, a Mexican Bank will participate as a Fiduciary Institution,\textsuperscript{38} owner of the fiduciary property of the power plant. The Ministry of Finance will revise and approve the creation of this Trust.

\textsuperscript{38} Fiduciary: Person, company, or association holding assets in trust for a beneficiary. The fiduciary is charged with the responsibility of investing the money wisely for the beneficiary's benefit.
3. Credit Contract, that is made between the financing entity/entities and the fiduciary institution (representing the Trust) to finance the project.

4. "Turn-key" Contract, that is made between the Trust and the contractor and/or construction consortium, in solidary form, through a common representative. The CFE is appointed in this agreement by the fiduciary to be responsible for the technical supervision of the project. The supervision tasks that the CFE must perform include the supervision of technical specifications, detail engineering, civil works, supplies and utilities, installation of the equipment, invoice authorizations, estimations, quality control and the reception of the finished unit and other acts previously established in the contract. The contractors will guarantee the fulfillment of their obligations by contracting insurance and performance bonds from authorized institutions.

5. Leasing agreement entered into by fiduciary institution as lessor and the CFE as lessee, for the utilization of the contracted unit. To start its utilization, the plant must be correctly delivered and ready for commercial operation. The leasing fee will be determined by the National Appraisal Commission and will be applied to the repayment of the loans. It is important to mention that operation and maintenance clauses will be written in the contract for the leasing period.

Besides the technical and financial advantages that derive from the "turn-key" concept, the following innovations from a legal perspective are extremely interesting:

1. A fiduciary relation between the Promoter (CFE) and the different contractors, suppliers and service providers, which eases the coordination during the project's development and ensures better contracting conditions.

2. Ensures the transference of the property to the CFE when the investment is amortized, in execution of the Trust.
3. Permits the development of private financed projects without compromising
government resources or CFE funds.

4. Guarantees the repayment of the loans to the lenders, with the revenues that
come from the rents under the leasing contract. If the plant does not
generate sufficient revenues to cover the repayment of the loans, the CFE
will make up the differences (with the project's assets as a guarantee), but
this will seldomly occur, since detailed and extensive feasibility studies are
made before deciding to build a plant.

5. The guarantee for the credits obtained to finance the power plant is restricted
to the assets of the project, without a collateral or obligation from the
Mexican government (the government is not at risk).

6. Guarantees to the contractors and other project participants a timely flow of
resources to pay the goods and services that are provided.

7. Permits to the CFE an adequate coordination and supervision of the project,
as established by the Trust.

8. Provides to all the project participants, through the Trust, a complete
transparency and confidence with regard to the application of the resources
managed by the Trust.

The "turn-key" scheme previously described, must be designed with creativity and will be
improved as the entities involved gain experience in these type of projects. However, its
important to mention some of the difficulties that result not precisely from the scheme, but
from its lack of updating from a legal perspective:

A) Lack of specific regulation for the "turn-key" contracts.
The contract is now regulated, using regulations that are applicable to other
"similar" type of contracts (construction contracts, supply contracts, service
contracts), but they don't cover specific issues of the "turn-key" concept. A
new regulation for this innovative way of contracting must be created.
B) The consortium will need to have its own legal personality. Nowadays, this problem is solved using joint venture agreements, but as I discussed, these agreements generate representation and responsibility disputes.

C) The joint responsibility that the participating entities have with the CFE. The responsibility that the CFE demands, creates a heavy load, specially for those associates with a reduced or limited participation in the project. As I mentioned before, particular pacts between the associates of the joint venture should be created, to establish a proportionate share of liability according to their project participation.

Referring to its public or private nature, we can say that we are dealing with a private contract, because the public entity (CFE) does not take part in a direct form in the contract. The entity that represents the Trust in the "turn-key" agreement is the fiduciary institution. The CFE will participate just as a technical supervisor of the project; however, since the power projects are destined to support a public service, they are regulated by "Public Works" regulations and laws, as well as by the "Purchase, Leasing, and Service Supply" law.

5.2.1 The Object of the Contract

The objective of the contract is constituted mainly of two parts:

A) The contractor's or consortium's obligations which are:

Performance Obligations: The construction of the civil works, the installation, testing and set up of the power plant, including the performance of additional related services.

Providing Obligations: The procurement and supply of goods and equipment necessary for the unit.
B) The Trust obligation which is the correct management of the resources and the repayment of the loans.

Finally it's important to mention that till the final acceptance of the power plant, the risk for losses or construction and equipment damage will be assumed by the contractor/consortium.

5.3 Norms and Interpretation
The modernization that the country requires, involves a major activity in all aspects of the Mexican economy and a larger private investment to encourage Mexico's development. Thus, the policy to be followed is to stimulate and increase those investments by fixing norms that provide security and productivity to them.

One of the main problems that the private or public infrastructure investor faces, is to verify the profitability of the investment. With adequate control procedures, the risks can be detected and decreased, providing more possibilities to quantify the benefits of the investment; thus the execution of this type of works, must be based on profitable projects, that fulfill the objectives that are fixed by the National Development Plan and satisfy the infrastructure requirements that the country demands.

To determine the feasibility of the projects being developed under the "turn-key" scheme, the Inter-secretarial Commission for Expenditures and Financing has established the following criteria of evaluation. This criteria will be applied to the regulations that will establish the applicable norms for the projects to be executed under the "turn-key" concept (without using government funds): 39

* The projects must have a high priority and profitability and it is also imperative that the projects have a short-term execution period.

* The payments made by the public sector should not occur immediately, and if possible, they should not start until the projects are in commercial operation.

* The private sector foreign financing must be a priority. The construction of the plants should not be financed by the Mexican Development and/or Commercial banks.

* The collaterals from the public sector to the private sector should not be permitted.

* When the CFE invites contractors to bid (request for proposals) for a power project, those who present a proposal should include in their bids the amount of domestic content of the project. The bidder who commits to use a larger domestic portion, will have an advantage over the other competitors.

* An inquiry prior to the request for proposals should be made in order to verify if there will be enough bidders.

* The CFE must be sure that the selected bidder has the necessary resources to execute the works by means of the corresponding guarantees.

Because of the huge interest that the CFE has in developing projects using this type of mechanism (turn-key scheme), particular norms and criteria must be established to deal with them.

The Inter-secretarial Commission for Budgeting and Expenditures, based on the experience obtained in the development of previous projects, has set, in the case of the CFE, a basic normative scheme with the following important points:40

a) The leasing operations will be made only with fiduciaries or financial institutions approved by the Mexican Ministry of Finance.

b) The CFE must entertain bids with include the participation of the main equipment manufacturers, financial groups, and/or contractors that are able

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40 Op.Cit. 39
to carry out this type of power project. The CFE must extend invitations to bid to a minimum of 5 interested groups.

e) The selected bidder will be fully and directly responsible for the execution of the project.

d) A Trust or Leasing Authority will be established for improved management of the resources involved in the project.

e) A leasing agreement will be made between the fiduciary institution and the promoter (CFE). This contract will be subject to the condition that the CFE must receive the plant ready for its commercial operation and at its entire satisfaction.

f) It will be CFE's responsibility to obtain the environmental permits or authorizations for the project. The CFE must negotiate with the Ministry of Social Development all the issues related to the environmental and social impact of the power plant. The contractor, then, will satisfy all the CFE's environmental and social requirements. With regard to the use of public property (land), the CFE will follow the National Goods Laws.

g) The bidder proposal must contain fixed prices for the foreign components quoted in foreign currency. The domestic labor, and components of national manufacturing will be subject to price escalation. For each project, the CFE will designate a minimum percentage of national origin. This percentage will be accorded with the Ministry of Commerce and Industrial Development.

h) At the end of the leasing term, according to the leasing agreement, and after the accorded payments have been made, the fiduciary institution will freely transfer the property to the CFE.

i) The selected bidder must include in his offer the total value of the project, including the interests generated during the construction period.
j) The proposals must not consider any government's or public agencies collateral.

k) The value of the rents to be paid by the CFE during the leasing period will be established by the National Appraisal Commission, in accordance with the financial conditions approved by the Ministry of Finance.

l) The offers must include the maintenance expenditures and the major capital investments that the CFE will need to make during the leasing period. This issues endorse the guarantees and efficiency of the plant's principal equipment.

m) All the financial conditions, and the fiscal regime applicable to the taxes must be approved by the Ministry of Finance.

Finally, it will be necessary for the successful development of this type of projects, to use a process of totally transparency that guarantees better contracting conditions, and promotes a healthy competition between the different contractors.
Table 3 Legal-Financial Scheme of a "Turn-key" Contract

1. Joint Venture Agreement
   Common Representation

2. Trust in Contract Form

3. Trust and Fiduciary Institution

4. Credit $

5. Leasing

4. Payment

(c) Financial Institutions

(A) Promoter Entity (CFE)

(B) Consortium Contractors & Suppliers
Chapter 6 Administrative Aspects

6.1 Project Management Needs
The supervision and control of a contract (turn-key or any other type), is considered a function that the Project Manager (PM) performs from the beginning (pre-construction stages), till the last phases of a power project. The PM will deal with different aspects of the project, from general issues, to particular and specific problems, where even the most simple detail is important. The PM will work as the owner's business and technical advisor to coordinate the project, deal with the consortium, facilitate the construction and eliminate potential conflicts. The quality assurance will be another responsibility of the PM. In the case of the "turn-key" power projects, the Trust will designate an organization unit of the CFE to perform the PM duties. In this chapter the CFE will be named PM.

6.1.1 General Issues
The CFE in its role as PM, will face different responsibilities as the Trust's technical representative. Some of the PM responsibilities will be to require the contractor to fulfill the obligations that he has acquired when signing the "turn-key" contract; to design and supervise the correct application of quality assurance and control programs to the materials and equipment, as well as to the labor that is involved in the project; and to deal with safety issues.

The PM services comprise an "assorted menu" of activities, thus the Trust can determine, which combination of activities will provide more benefit to the project. The PM will serve as a technical supervisor (reviewing that the project meets the technical specifications), as well as a business supervisor (reviewing schedule, cost, modifications and claims issues).

The PM works as a Trust's agent, therefore it won't be involved in functions inherent to the project as for example, providing design or construction services, etc. All the project contracts will be signed by the Trust, and the CFE as PM will coordinate and link all the parties involved in the project, from a technical and business perspective.

Some of the principal advantages of having the CFE as a project manager are:
1) Because of its experience and capacity in the development of power projects, the CFE will apply equilibrium and objectivity in the generation of technical alternatives during the decision making process.

2) The CFE has an absolute familiarity with the everyday Mexican construction industry practices and policies.

3) Technology Transfer is derived from the CFE's experience, because of its intervention in innumerable power projects.

4) Possibility to use temporary skilled human resources with experience in this type of projects.

The services that the Project Management (PM) provides, cover most of the phases of the project. When the power plant is ready for commercial operation, the CFE will start with its responsibility as project lessee (to operate the plant under a leasing agreement with the Trust) and finish its duties as project manager. The phases where the CFE will perform as a PM for the Trust will be:

1) Pre-design
2) Design
3) Construction
4) Set Up and Start Up

In the first two cases the PM can contribute with experiences and organize interdisciplinary groups, achieving by means of Value Engineering, important savings for the Project. In the construction phase the PM will supervise and control the different tasks performed by the contractor/consortium, and will provide technical assistance if the contractor requires it. During the start-up phase the PM will check if the plant is ready for commercial operation.

The functions that are generally performed by the CFE as PM in this type of project are:
Cost Control: During the design process, the PM, can perform different pre-estimations of the cost, polishing the basic budget or even the final budget of the project. The PM can also analyze different proposals and evaluate if their output corresponds to what the markets and experience dictate.

The power plant's approved budget must be controlled according to the project's cash flow, trying always to optimize the resources involved by applying a value engineering approach.

According to Peter Zuk 41 project cost control techniques are not hard to install if these steps are followed:

1) break the comprehensive cost summary into work packages.
2) devise commitment reports for "technical" decision makers.
3) act on early, approximate report data.
4) concentrate talent on major problems and opportunities.

To enable the project manager to judge when costs are getting out of control and to decisively take the needed corrective action, he must be able to assess the approximate cost effect of each technical decision. In other words, he must have cost commitment reports at each decision stage.

With the aid of a detailed cost breakdown and current information on cost commitment, the project manager is able, even after the project is underway, to take people off less important activities in order to concentrate more effort where it will do the most good in reducing costs.

Value Engineering: The PM can call for interdisciplinary meetings with experts. These experts, will constructively criticize the design and construction methods and procedures, in order to reduce costs.

According to Miles, the name value analysis, or value engineering, has been applied to a problem-solving system for the achievement of lower costs. It is a problem-solving system implemented by the use of techniques, a body of knowledge, and a group of learned skills.

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41 Peter Zuk is Lecturer of the course: Management of Large Scale Systems at the Massachusetts Institute of Technology and Project Director for the Central Artery Tunnel Project in Boston.
It is an organized creative approach that has for its purpose the efficient identification of unnecessary cost, i.e., cost that provides neither quality nor use nor life nor appearance nor customer features. When applied to products, this approach assists in the orderly utilization of better approaches, alternative materials, new processes, and abilities of special suppliers. It focuses engineering, manufacturing and purchasing attention on one objective—equivalent performance for lower cost. Having this focus, it provides step-by-step procedures for accomplishing its objectives efficiently and with assurance.

According to Tenah, the fundamentals of value engineering for infrastructure projects are:

**Function:** In value engineering, the function is defined as the specific purpose or use intended for something. It describes what must be achieved. For value engineering studies, this function is usually described in the simplest form possible, usually in only two words: "support weight", "prevent corrosion", and "conduct current" are typical expressions of function.

**Worth:** "Worth" refers to the least cost required to provide the functions that are required by the user of the finished project. Worth is established by comparison, such as comparing it with the cost of its functional equivalent.

**Cost:** "Cost" is the total amount of money required to obtain and use the functions that have been specified. For the seller, this is the total cost in connection with the product. For the owner, the total cost of ownership includes not only the purchase price of the product, but the cost of including it in the inventory for its total usable life. This cost may also include a proportional share of expenditures for development, engineering, testing, spare parts and various items of overhead expense.

**Value:** "Value" is the relationship of worth to cost as realized by the owner, based upon his needs and resources in any given situation. The ratio of worth to cost is the principal measure of value. Thus a "value equation" may be used to arrive at a Value Index as follows:
Value Index = \textbf{Worth} = \textbf{Utility} \\
\textit{Cost} \quad \textit{Cost}

The value may be increased by doing any of the following:

1) Improve the utility of something with no change in cost  
2) Retain the same utility for less cost, or  
3) Combine improved utility with less cost.

Optimum value is obtained when all utility criteria are met at the lowest overall cost.

**Philosophy:** If something does not what it is intended to do, no amount of cost reduction will improve its value. Any cost reduction action that sacrifices the need utility of something actually reduces its value to the owner. However, costs incurred to increase the functional capacity of something beyond that which is needed amounts to "gilding the lily" and provides little actual value to the owner. Therefore, anything less than the necessary functional capacity is unacceptable; anything more is unnecessary and wasteful.

**Decision Making:** In order to decrease the risk of taking unilateral decisions, the participation of the CFE as PM will be an efficient help in the generation of alternatives, risk evaluation and flow of information in the decision making process.

**Program Management:** This will be a fundamental function for the PM. This function will provide valuable information for the decision making, and will point out the project tendencies with regard to the meeting and fulfillment of critical project dates scheduled in the main program. 
This function will specify, the occurrence probability ranges for milestone events, with respect to the time.
The main controls that will be used in program management are: arrow diagrams, critical path schedule, responsibility schedule, scheduling plot curves, engineering-construction status report, engineering-construction critical activities, etc.
**Progress Reporting:** Contracts require the prime contractor/consortium to submit a schedule of activity and periodically update the schedule reflecting actual progress. This requirement is normally stated in the general conditions as follows (Halpin and Woodhead):

The contractor shall within such a time as determined by the Trust's representative, after the date of commencement of work, prepare and submit to the PM for approval a practicable schedule, showing the order in which the contractor proposes to carry on the work, the day on which he will start the several salient features (including procurement of materials, plant, and equipment) and the contemplated dates for completing the same. The schedule shall be in the form of a progress chart of suitable scale to indicate appropriately the percentage of work scheduled for completion at any time. The contractor shall revise the schedule as necessary to keep it current, shall enter on the chart the actual progress at the end of such intervals as directed by the PM, and shall immediately deliver to the PM three copies thereof.

**Information:** The project's documentation will be another task of the PM. The PM, must design an information system that enables the contractor, to timely count with the data, that will be necessary for the execution of the project. It will also provide the adequate information, that the Trust demands, with regard to the general behavior of the process. The information system must be based on compatible computer software packages. The system will consider the possibility to use electronic files that permit the PM to create or continue the development of knowledge or expert systems, that will be an invaluable documentation (feedback) in the near future. The establishment of an adequate system that keeps track of the project, will be also useful when dealing with change orders, and for the final delivery and transfer of the project.

**Risk:** The PM can help with the identification of certain risks, that could have repercussion in the final cost of the project.

**Contract Management:** The PM will participate in contracting issues such as the evaluation of the bidders, or the consultants, contractors and suppliers selection. The PM acts as an advisor during the design of the contracts, because later, it will supervise the correct fulfillment of the obligations contracted by the contractor and act as
a mediator in any arbitration that could eventually happen; however, the role of the PM, will be to avoid any dispute between different parties, by negotiating or resolving the conflicts beforehand.
In general, the PM will supervise the correct observation of the contract during the construction phase, specially those clauses that because of their complexity, could escape from the understanding of the parties involved.

**Quality Control**: The quality control and assurance is part of a process that was created when the first Nuclear Plant was developed, and now has expanded to the construction industry in general. The PM will look not only at the quality control of equipment and materials, but to the quality of the construction system itself.

The quality assurance programs must be documents that represent commitments and procedures; they must also involve and develop a field and inspection staff with an intrinsic sense for quality. They will strictly perform their duties according to the quality norms that are specified and that are not always the same for all the projects. A more detailed discussion about quality issues will be discussed in the second part of this chapter.

All the issues discussed so far, implicate the generic activities of a Project Management, such as administer, advise, support, estimate, review, consult, coordinate, document, evaluate, facilitate, plan, report, and program, spending for this tasks the most modem planning and control techniques. The CFE will also give its best effort and work with professionalism, in order to successfully carry out its role as technical supervisor.

6.2 Quality Control

Quality is defined as the inherent characteristics that an object has, and that permit its classification as better, equal or worse than another similar object. Years ago, quality control was applied as a means to guarantee that the pieces produced through a process could fulfill a specific design. The results obtained by applying quality control, were not always satisfactory, thus people started to search for a more complete and efficient methodology, that could produce better results.

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After analyzing the processes and techniques utilized in the construction industry, Quality Assurance emerged as a method to improve the constructive and operative processes of the industry.

6.2.1 Quality Management at the CFE

The CFE as a promoter, will look that in every construction process, cost, schedule and quality are fulfilled as previously planned. As soon as the "turn-key" contract of a power project is initiated, the contractor will assume total responsibility of the design, manufacturing, supply, construction, testing and start up of the plant, thus will be responsible for the quality of the product that will be delivered. The CFE will establish a plan that certifies the accomplishment of the project works as well as the quality of the entire power plant. The plan will be written, and signed by all the parties involved in the "turn-key" contract.

In order to achieve the establishment of the quality requirements that will govern the construction process, the existent specifications and international norms generated by different organizations will be reviewed. Some of them are: 43

MON = Mexican Official Norms
ANSI = American National Standard Institute
ASME = American Society of Mechanical Engineers
ASQC = American Society for Quality Control
ASTM = American Society for Testing of Materials
ISO = International Standardization Organization
CFR = Code of Federal Regulation

After reviewing the different norms, the applicable requirements will be transferred to the contracts.

A fundamental tool in order to successfully achieve that the works are executed according to the technical and quality requirements established by the CFE, will be the development and introduction of a "Quality Assurance Program".

This program will have as an objective the establishment of quality policies that will rule the construction works, and will be complemented with the necessary operative procedures to perform all the quality related activities.

The Quality Program looks at the functions and responsibilities of the personnel that will be involved in the construction process, the way in which the personnel is organized, the lines of authority and communication between different areas and the form by which the quality will be executed.

It is important to mention that the CFE will promote and demand (with the support of its quality control department) the establishment of this type of quality programs for the power projects to be developed. To support this issue, the CFE will require the consortium to establish "Quality Assurance System Manuals" as well as the adequate organization for its application. It will be also important to establish construction procedures in a way that they clearly consider the quality controls to be applied, as well as a health and safety plan for the people involved in the project.

The quality obtained from the different construction tasks performed in a project will heavily depend on the equipment to be utilized, thus this equipment must be the adequate, and in excellent conditions. A constant evaluation of the equipment will be critical to obtain a high quality product. The organization, the technical staff, the labor, and the tools, and in general all what is involved in the construction process, are also part of the project's quality, and therefore, subject to evaluation.

6.2.2 Quality Audits
The Construction Department at the CFE will be responsible for all the quality issues of power projects; it will maintain a constant vigilance of all the construction activities by means of a permanent program of quality audits. The "Experimental Engineering Department" (EED), and the "Quality Control Lab" (QCL), both parts of the CFE, will support the Construction Department with the realization of quality audits to the civil and

\[44 \text{ Op.Cit. 43}\]
electro-mechanical works. The audits will be done with the participation of members from these three areas.

The object of these audits, will be to verify that the consortium's quality system is effectively implemented and to correct and advise the contractor if deficiencies are detected.

The establishment of the different programs, manuals and controls discussed in this chapter will permit a constant development of the construction programs without time losses or unnecessary costs. The CFE will stimulate and watch its implementation, and constantly intervene in the development of the programs with the idea of being preventive instead of corrective.

6.2.3 The Quality Committee
The consortium should establish a Quality Committee to ensure that all the quality requirements are correctly fulfilled. The quality committee would be formed with a representative from each of the firms that constitute the consortium.

The committee will have the authority to intervene in all the problems and negotiations related to the quality of the project (to meet the quality requirements established by the PM) and the field offices of all the companies involved in the construction of the plant, will imperatively follow all the decisions made by the committee.

The organization of the committee's personnel will be defined before starting the construction phase and will have the authority to:

* Start actions to prevent nonconformity occurrences.
* Identify and record any quality problem.
* Start, recommend and promote solutions.
* Limit, stop or control the development of a process, till the unsatisfactory condition is corrected.
* Compare its results with the PM's quality control unit

The Quality Committee will have as main objectives:
* Verify that each member of the consortium has established a quality control system according to the contract.
* Verify that all the consortium members apply their quality control systems.
* Verify that the consortium members begin actions to prevent, instead of correct quality problems.
* Watch that enough inspections are executed. The inspections must be made with a trained personnel to obtain the quality desired.
* Verify that each consortium's member foresees solutions through adequate procedures.
* Corroborate that each member applies and follows an approved solution.

The committee will have a responsible for each part of the construction process (civil works, metal structures, kettle, mechanical, electrical and turbines) and its scope will not include the manufacturing of the equipment.

The committee will meet every month in an ordinary meeting to review the consortium's quality control systems and to verify their correct application. The quality committee, through its representative, must present a quality report to the CFE on a monthly basis.

### 6.3 Modifications to the Project

"Turn-key" power plants are very complex projects, thus, it should be foreseen the possibility to make necessary modifications to the project. The advantage, with regard to this issue, is that in this type of projects, the modifications are executed under the responsibility of just one contractor or consortium.

Taking into account the consequences that are occasioned when changes are made during the execution of a project, I will discuss the most important concepts with respect to project's modifications.

Any modification subsequent to the basic engineering phase of a power project, should be evaluated or considered as a change that might affect the contracting conditions of the project. The conditions will be affected because soon after the basic engineering phase, and during the detail engineering, the acquisition of materials and manufacturing of equipment is started.
Any change will affect the construction process of a power plant, thus the next repercussions should be considered:

- a) Time of Delivery
- b) Additional Costs
- c) Performance Parameters (Guaranteed Technical Values)
- d) Feasibility

**Time of Delivery:** Any modification that leads to a delay in the execution of the project, will have negative repercussions for the promoter, financial institutions and contractors.

**Additional Costs:** Any change generates additional costs for the project.

**Performance Parameters:** According to the specification and contract, the supplier must guarantee the technical values, specified for any system or for the total project. Modifications that don't correspond to the technical standards, should not be executed.

**Feasibility:** A very important parameter for the feasibility of a change implementation will be the progress that each of the construction stages have.

**6.3.1 Procedures for the Changes Implementation:**
Contract clauses that permit the client to keep the right to request modifications at any time during the execution of the contract, should be carefully analyzed with respect to the five points previously discussed.
In the case of modifications that involve changes in the delivery programs, the evaluation of technical and commercial consequences will be fundamental to analyze if the execution of those changes is justified.

In order to reduce project modifications to a minimum, the CFE should provide the following procedures:

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* Very detailed technical and commercial specifications.
* A precise definition of the construction site.
* A clear and detailed explanation of all clauses and issues involved in the project; this should occur at the basic engineering stage of the project.

Finally, before making any decision, possible modifications should be analyzed for the following:

* whether or not the activity is on the critical path
* the progression of the works at the time of the modification
* the financial ceiling
* technical consequences
* change in the delivery terms
Chapter 7. Conclusions

"Turn-Key" power projects can be defined to be those wherein a prime organization (contractor, consortium, joint venture) is contracted to design, fabricate, transport, erect, and start up a power plant for an owner or end user. The "Turn-key" approach is an infrastructure contracting mechanism, that although new, looks very promising for the CFE.

"Turn-key" projects can be both frustrating and satisfying at the same time and can enhance or diminish very readily a company's reputation and monetary resources because of the high risks associated with them. Some of the advantages and disadvantages are identified that can be expected to be encountered when a company undertakes a "turn-key" project. A variety of procedures will be recommended to reduce the disadvantages and increase control over the project.

Advantages:
We can conclude that the main advantages that the "turn key" approach provides are:

1. Technical Simplification, because it eases the engineering coordination process. The owner only has to deal with one entity and is able to delegate total site responsibility, including safety, to one entity.

2. Administrative Simplification; there is just one bidding process for the whole project's package. A separate selection process for the contractor is eliminated.

3. Less risk for default since the contractor puts all its interest and care for the timely delivery of the project in order to accomplish the overall completion of the facility.

4. Better financing conditions. (Besides the construction, the systems and minor equipment of the plant are covered). The price including financing can be used to maximize the project value by the use of a cap, and can provide and incentive to finish since the team is carrying the financing costs.
5. The "Turn-key" approach permits the attraction of non-government funds that represent attractive investments in the development of energy infrastructure projects.

6. The method allows a fastrack schedule.

7. The "turn-key" scheme encourages technology transfer and favors the introduction of state-of-the-art processes and equipment with a strict control over their environmental impact.

8. Teamwork between the different parties involved in the project is enhanced during design and construction.

9. Promotes the development of high capacity and skilled human resources for the design and construction of plants that the CFE is willing to develop.

Realizing that the advantages of power project "turn-key" contracting are accompanied by a number of disadvantages, potential pitfalls include:

1. **Lack of its own particular scheme and specific regulations:**
   The power projects contracts are now regulated, using regulations that are applicable to other similar "turn-key" contracts (toll roads, mining, etc.), but they don't cover specific issues that the power projects require.

   A specific regulation for power "turn-key" projects must be created. The experience and feedback from previous projects will be fundamental to design its own structure, and the parties involved in these type of projects should create a commission that designs and determines the specific regulations for power projects under the "turn-key" scheme.

2. **Lack of owner input into the design:**
   In a fixed-price "turn-key" project, owner input into the design after the contract is signed will represent a cost increase unless a work scope

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46 David J. Langford, Stephen J. Gosoroski and Gregory M. Graves, Burns & McDonnell, 1990
decrease can be proved. It is crucial that owner input occur during the bid process.

For various reasons, definition of the owners requirements prior to award of a contract is difficult. These reasons include the fact that the entire plant must be considered, decisions may not be supported by studies, details of bidders' proposals may not be known, etc. It will be crucial that discussions proceed with each bidder as soon as possible. The bid review period must include a complete plant review. The owner's requirements should be viewed as the conditions necessary for the unit.

3. **Lack of a defined plant and a defined plant quality level:**
   Plant quality is difficult to assess until plant design is complete. Usually, bidders are reluctant to spend money to define a proposal in detail until after they have a contract.

   It is the owner's best interest to have the plant completely defined, so that unacceptable features can be modified while the bidders are still competing. Another issue is that besides plant guarantees, the contract should include component guarantees to require unit performance in off-normal conditions. Wider guarantee conditions for the components provides margins for upset or off-normal conditions.

   With respect to modifications, a formal procedure to support and document change requests should be instituted to minimize future disputes. The "turn-key" contract can provide for modifications. Should the owner require changes, the contract should include disclosure provisions and change order clauses.

4. **Inadequate cost control:**
   The fixed schedule and price which accompany the "turn-key" power contract may promote design shortcuts and inadequate equipment. A detailed contract with a good reference unit should minimize design shortcuts and poor equipment. The project payment basis should be
structured on actual progress. Progress payment for actual work completed allows the owner to refuse payment for work which does not comply with the contract.

5. **Lack of adequate quality assurance programs:**
   To ensure that the quality of the unit proposed is maintained throughout the project, the "turn-key" contract should:
   * adequately document commitments made
   * provide for reviews of the design and construction process
   * provide for reviews of equipment procurement
   * require construction testing and as-built information as work proceeds
   * require checkout and testing of individual systems
   * require unit performance testing and performance testing of components
   * require the establishment of a quality committee by the consortium

   Early identification of non-compliance should minimize compliance costs.

6. **Lack of adequate documentation:**
   By its nature, the "turn-key" contract does not require as much documentation as is required in other types of contracts. The primary responsibility of a contractor's engineer is to get the project built, not to provide information on operations for the owner's review.

   Construction information can be issued fairly informally, and to ensure that the "turn-key" contractor provides adequate project documentation, the contract should require:

   * System design specifications
   * Equipment and material procurement specifications
   * Construction specifications
   * Complete specifications, design drawings, manufacturer's drawings, as-built information, and equipment instruction books.
The contract must also include operating instructions, start-up instructions, maintenance procedures, engineering reference manuals and video operating instructions.

7. Lack of a quantified risk allocation between the parties:
A significant benefit of the "turn-key" approach is the transfer of risk to the contractor. Escalation, equipment delivery and custody, unit performance, construction coordination, etc. are transferred to the contractor. This transfer of risks must be explicitly defined or the responsibility transfer may not be evident if problems occur.

All risk allocation items should be individually addressed in the contract.

8. Lack of an acceptable dispute resolution procedure:
A reasonable dispute resolution procedure should be incorporated into the contract to ensure that disputes do not result in work stoppage. Often the cost impact of a delay exceeds the amount disputed.

9. Insufficient contract language:
One of the pitfalls of "turn-key" contracting is the task of adequately defining the agreement from a technical and commercial point of view.

The best scenario is to have a "turn-key" contract document ready for signing upon contract award. Agreement on actual contract language requires compromises in negotiation positions. The "turn-key" contract should be approached as a total project agreement and the entire scope of project obligations should be addressed. The owner should view the "turn-key" contract as his final opportunity to obtain contractor concessions from a position of strength, and should attempt to define the agreement accordingly.
10. Lack of a proportionate liability between the consortium associates:
The joint responsibility that the participating entities have with the CFE creates a heavy load, especially for those associates with a reduced or limited participation in the project. The share of liability should be proportionate to the share of their financial participation.

11. Inadequate identification of electricity users: If the CFE is allowed to maintain control of the entire transmission system, then, there can be no effective competition in the power industry. A lack of identification of potential electricity users could derive in insufficient project revenues to cover the repayment of the loans.

Private companies would presumably enjoy easy access to the transmission network and would be able to sell power to the public in a competitive environment. A private firm could better identify the end users and thus take advantage of user fee schemes.

Each of the potential "turn-key" project pitfalls addressed above, if not properly covered in the "turn key" contract, can lead to disputes regarding the intent of the parties. The structure of the Request for Proposals (RFP) largely determines whether the owner is able to capture the advantages and minimize the disadvantages in the final "turn-key" agreement. A detailed and specific RFP generally results in an increase in proposal quality. The scope of the proposal (total power plant); assumptions of escalation risk (by contractor); terms of payment; required performance guarantees; and schedule constraints should be clearly defined in the RFP.

A well defined RFP will result in an equitable marketplace for all bidders and a better facility for the utility.

Appendix 1

This appendix provides a summarized explanation of alternative contracting strategies available for infrastructure projects, as well as its advantages and disadvantages. This valuable information was given to the Center for Construction Research and Education's students by Chris Gordon, lecturer of Innovative Contracting Strategies at the Massachusetts Institute of Technology, during the spring term 1995. The "turn-key" approach is not discussed in this appendix since it is the topic of the whole thesis.

I. General Contractor (Traditional Method): A single business entity acting as the contractor in complete and sole charge of the field operations, including the marshalling and allocation of manpower, equipment, and materials (Clough 1981,4)

If the General Contractor is working for a fixed price the main advantages and disadvantages are:

**Advantages**
1. Owner can select from wide range of Design Professionals.
2. Design Professional is independent and can monitor the work with owners interests in mind. i.e. fiduciary relationship.
3. Owner has freedom during design phase to make changes and explore alternatives.
4. Contract is awarded when design is complete so contractor's price or bid should be accurate.
5. Owner can delegate total site construction responsibility to one entity.
6. Total cost know at start of construction.
7. The use of General Contractor is well established and understood by owners, contractors, and the courts, and ample documents and case law exists.

**Disadvantages**
1. Separation of design and construction deprives owner of contractor's planning knowledge, for such things as value engineering and constructibility.
2. A fixed price and separate design professions can create an adversary relationship between the owner, contractor, and design professional. The fixed price has created a zero-sum-game in which anything gained by the owner is lost by the contractor and vice versa.

3. Making design changes during construction is often expensive and difficult for the owner.

4. The linear nature of waiting to start construction until the design and contract award is done, makes for the most lengthy process.

5. The owner normally has no share in any savings the contractor may find during the construction process.

If the General Contractor is working for a reimbursable price the main advantages and disadvantages are (only those advantages and disadvantages that are different from those listed for GC working for a fixed price are listed here):

**Advantages**

1. The design documents do not need to be complete before the contractor is selected. This allows the contractor to be involved in the pre-construction planning and the use of a fasttrack schedule.

2. Changes are easier, provided the portion of the work has not yet been awarded to a subcontractor.

**Disadvantages**

1. Less price accountability, and possibly less efficiency exists. The contractor has no motivation to limit cost.

2. The total price is not known until the end. This can be mitigated by establishing a GMP or fixed price after the documents are complete, but at that point the competitive forces are not as strong on the contractor. (The GMP will be discussed later)

**II. Construction Manager:** A single business entity acting as a construction consultant to the owner and project manager, either for a fixed fee or a fee as a percentage of the cost.
Advantages
1. Allows fastrack schedule, since the individual contracts can be awarded as soon as the documents are complete.
2. Allows flexibility for changes.
3. Potential for adversary relationship between the contractor, owner, and design professional is reduced.
4. CM can be on the team during the design process providing pre-construction services such as estimating, scheduling, constructibility analysis, value engineering, and labor issues.
5. CM can be chosen as a professional service by qualifications, even for public projects, while the majority of the work is still competitively bid.
6. Allows owner direct access to the materials and sub-contractor markets to realize savings from bid packaging and contract types. Also can provide portfolio effect by reducing owners dependance on one large contractor (Gilbreath).

Disadvantages
1. Total cost and schedule are normally not known, nor guaranteed at the start of construction. The exception is if the project is not fastracked.
2. CM has an unusually important role in the success of the project. Poor bid packaging, resulting in "gaps" between contracts, or inadequate site management, can result in costly and unpleasant chaos.

III. Design Build: A single business entity that performs both the design and construction of the project. The team can be one company or a partnership of firms.

If the design-build team is working for a fixed price:

Advantages
1. The total cost and schedule is known before the start of design and construction.
2. Teamwork between the designer and contractor is enhanced.
3. The owner has no liability for change orders, unless the scope or site conditions change.
4. The owner deals with only one entity.
5. The owner is able to delegate total site responsibility, including safety, to one entity.
6. The method allows a fastrack schedule.
7. A separate selection process for the contractor is eliminated.

Disadvantages
1. Making design changes is often expensive and difficult for the owner.
2. The owner has lost some flexibility in, and control over the detailed design process.
3. The owner has lost the design professional's fiduciary relationship.
4. The owner must be knowledgeable to establish the initial parameters and monitor the process.
5. Often an honorarium is paid to the proposing teams.
6. The owner is entirely dependant on one entity.

If the design-build team is working for a reimbursable price (only those advantages and disadvantages that are different from "fixed price"):

Advantages
1. Changes are easier to handle.
2. Selection can be only on qualifications.

Disadvantages
1. Less accountability, and possibly less efficiency, exists. The owner must be very involved.
2. The total cost may not be known until the end.

IV. Multiple Primes: More than one contractor holding contracts directly with the owner to perform specific parts of the same project. The contractors can be general contractors overseeing various trades, or subcontractors performing one trade. The owner is
responsible for overall project management and coordination, replacing a general contractor or a construction manager.

Advantages
1. Allows fast track schedule, since the individual contracts can be awarded as soon as the documents are complete.
2. Allows flexibility for changes.
3. Allows owner direct access to the materials and the sub-contractor markets to realize savings from bid packaging and contract types. Portfolio effect (Gilbreath).

Disadvantages
1. Total cost and schedule are normally not known, nor guaranteed, at the start of construction. The exception is if the project is not fastracked.
2. The owner must be heavily involved and knowledgeable about construction.
3. The project does not have pre-construction services from a contractor, such as estimating, constructibility analysis, and value engineering.

V. Build Operate Transfer (BOT): One business entity performs the design, construction, construction and long-term financing, and temporary operation of the project. At the end of the operation period, which can be many years, operation of the project is transferred to the owner.

Advantages
1. The financial arrangement and schedule is known before the start of design and construction.
2. Teamwork between the designer, contractor, and operator during design and construction is enhanced.
3. The owner has no liability for change orders.
4. The owner only has to deal with one entity.
5. The owner is able to delegate total site responsibility, including safety, to one entity.
6. The owner is able to delegate total operation responsibility to one entity.
7. The method allows a fastrack schedule.
8. A separate selection process for the contractor and arrangements or operation are eliminated.
9. The owner can delegate financing responsibilities.
10. Potentially introduces new technologies and management techniques to a region, and trains its residents.

Disadvantages
1. Making design changes is often difficult.
2. The owner has lost some flexibility in, and control over the detail design process.
3. The owner has lost the design professional's fiduciary relationship.
4. The owner must be knowledgeable to establish initial parameters.
5. The owner is entirely dependant on one entity.
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