

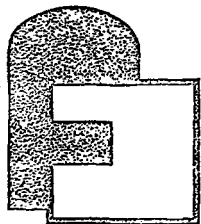
TECHNOLOGY TRANSFER

C. BOURY

NOTES

ET

DOCUMENTS



FRAMATOME

Conférence présentée par Framatome

ENERGY AND POWER PLANTS TRADE FAIR ENERGY POWER PLANTS



ENERGY AND POWER PLANTS

AHOY-ROTTERDAM

TECHNOLOGY TRANSFER

SEPTEMBER 11TH, 1986

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I - INTRODUCTION

In response to the 1973 world oil crisis, France launched a vast nuclear energy program, providing for the construction of a large number of Nuclear Power Plants of the Pressurised Water Reactor type including both 900 MWe and 1300 MWe standardized units. This program has been up dated and includes now 1450 MWe units.

The execution of this program, including engineering, procurement, construction and startup activities, has required a tremendous effort from the French industry.

The results of this effort with over 38 operating units as of mid 1986, with another 17 under construction or on order are the witness of the mastery and competence acquired by our country in the nuclear field. Its experience and related know-how, built up over the last 12 years, make the French nuclear industry able to offer its assistance to other countries, wishing to develop their own nuclear technology.

I.1 - Standardization

The magnitude of the French nuclear program led Framatome to opt for a "standard plant design".

The company has developed a number of standard plant models ; each plant unit in given series is virtually identical to the standard design. This gives the customer :

- benefit of serie production ;
- lower unit costs ;
- interchangeability of the key plant components.

This approach, unique in the world, has made it possible to mobilize Framatome human resurces in engineering and its industrial capabilities to the highest level of effectiveness.

Standard plant design can be applied in many fields, among other :

- . Design
- . Safety
- . Fabrication
- . Erection and commissioning

Standardization provides many advantages, such as :

- fewer design deviations and production nonconformances ;
- shorter construction schedules.

It is, as well, a decisive factor for :

- highly improved equipment reliability, and
- simplified maintenance and servicing, along with a rational spare parts management.

Finally, standardization makes possible more effective and less costly operating personnel training.

1.2 - Leading effect for Framatome suppliers

Most of the suppliers associated with the French nuclear program, have found, like Framatome that their traditional production systems were not suited to the demands of this program with regard to the production of a large number of standardized components.

They have realized that product design more suited to series production techniques is essential. They have also been forced to admit the difficulties of meeting nuclear quality requirements when fabricating nuclear and conventional components in the same shop. Consequently, they found it necessary to set up dedicated production facilities for nuclear components, as Framatome has done.

As the French program developed, the manufacturing capacities of Framatome and its associated suppliers were quickly expanded.

The table below shows the total production to date for the major components fabricated by Framatome and these associated suppliers.

ITEM	Total Production Thru (July.01 , 1986)
PRESSURE VESSELS	61
STEAM GENERATORS	170
PRESSURIZERS	50
REACTOR INTERNALS	53
IN CORE INSTRUMENTATION	63
REACTOR COOLANT PUMPS	197
CONTROL ROD DRIVE	
MECHANISMS	3082

II - HEAT CAN FRAMATOME OFFER IN THE FIELD OF TECHNOLOGY TRANSFER ?

II.1- Introduction

Framatome's unique blend of expertise in metallurgy, heavy and medium fabrication, heavy and light engineering, as well as process, electrical, instrumentation and control system design, combined with its considerable R & D capability and the resources of its associated companies, gives it unparalleled mastery in nuclear technology, both as architect engineer for complete nuclear islands, and as heavy component designer and manufacturer.

Today, Framatome is the world's largest nuclear power plant heavy components manufacturer, still having a significant manufacturing load for the coming years.

As a consequence, its design and manufacturing techniques are kept up to date, making it possible to offer unrivalled know how to potential receivers of technology transfer.

These are numerous ways in which Framatome can assist these receivers with their own nuclear power plant programs. Discussed below are only the most important ones.

II.2 - Engineering

Framatome has developed extensive nuclear power plant engineering know-how, covering the entire nuclear island and all the engineering activities from basic design up to and including detailed design of subsystems such as piping, cabling and ventilation.

This technology is maintained through an extensive in-house R & D program and frequent technical exchanges with other industrial groups, both in France and abroad. The engineering and R & D know how may be used for the benefit of foreign parties according to tailor-made cooperation agreements.

II.3 - Manufacturing

Framatome's manufacturing facilities are ultramodern, all of them being state-of-the art.

The experience in planning and designing fabrication facilities can be made available as-is to other companies.

Framatome has been able to build the required facilities quickly and to manufacture highly competitive products because it had to :

- study and optimize the best layouts for its facilities in order to prevent any problem raised between conventional and nuclear manufacturing activities.

- . select appropriate manufacturing equipment and tools through rigorous selection process.

Its component design and manufacturing know-how, including manufacturing traveller sheet, welding and non destructive examination procedures can be easily transferred in its totality or adopted to meet the needs of potential technology transfer receiver.

II.4 - Organization

The company organization at Framatome, as well as the organizational structure under which its associated companies do business, is closely geared to meet stringent quality requirements.

II.5 - Training

Framatome has successful in-house training programs extending to all employees, at all levels of responsibility. The success of these programs is evidenced by the ability of the company staff to build record numbers of reactors simultaneously, while adhering to high standards of good workmanship, strict safety and quality specifications, and tight deadlines.

II.6 - Manpower

The company's well-trained and motivated staff have shown the skill and the willingness to solve the most difficult technical, organizational and labour problems. Moreover, this expertise has already been applied to other companies, in France and abroad, to enable them to tackle particularly demanding tasks.

II.7 - Quality

Nuclear quality production could be advantageous to companies interested in entering the nuclear field or other markets in which such a "label" is a plus.

III - EXPORT ORIENTED PHILOSOPHY

A certain number of factors are essential for successful transfer of technology.

1. A national nuclear program decided by national authorities and which justifies the transfer.
2. A transfer process tailored to suit the receiver.
3. Mutual confidence between the transferer and the receiver with active participation of both parties.
4. Realism, particularly in the objectives aimed for by the receiver.
5. A conviction on the part of the receiver that transfer of technology is an important and worthwhile investment, for which he is prepared to do the investments required to ensure the best results.

Technology transfer is not a side issue but represents a major commitment on the part of the transferer as well as on the part of the receiver. The process of transferring technology is particularly important and delicate when the technology transferred is complex and in continuous evolution as is the case with nuclear technology.

IV - IMPLEMENTATION OF TECHNOLOGY THROUGH LOCAL INDUSTRIAL PARTICIPATION

IV.1 - Adaptation to each supplier

Each technology transfer agreement has to be tailored.

According to :

- the involvement of the industrial receivers in national decision,
- their motivations,
- their technology level.

Nevertheless, it is possible to propose some general rules for approaching foreign countries wishing a collaboration in nuclear field.

IV.2 - The following approach is generally recommended

1/ A preliminary survey of existing production and engineering capabilities is carried out.

2/ A feasibility study is performed, to determine the soundness of technical and economic objectives and the ability to meet local project requirements.

3/ For each prospective source of supply :

- the products and services to be provided locally are identified,
- a construction of new facilities or modernization of existing ones are decided ;
- a preliminary package of typical production documents is sent to the receiver to aid in laying out and fitting out production facility.

- technical assistance is provided by Framatome experts in the following areas :

- . placement of purchase orders for machine tools ;
- . plant layout design ;
- . internal organization to nuclear standards ;
- . shop personnel training ;
- . welding procedure and welder qualification ;
- . fabrication procedure and welder qualification ;
- . preliminary tests ;
- . initial startup document preparation ;
- . early production planning.

4/ For possible engineering organization :

- engineering activities are identified ;
- and action plan is drawn up to meet quality assurance and technical capability requirements ;
- a first information package is provided to help local team preparation ;
- technical assistance during preparation is provided.

In parallel with local assistance :

- . Framatome provides training in France of receivers engineers and technicians,
- . Framatome conducts initial quality assurance audits ;

On the basis of these audits, deviations from requirements, if any, are corrected and additional training is recommended as necessary.

Following these preliminary phases, Framatome continues to provide technical assistance in the form as agreed upon in the selected transfer mode.

IV.3 Extension to Framatome's usual suppliers

The same technology transfer philosophy is shared by all Framatome suppliers and associated companies throughout the French nuclear industry.

Transfer of technology by Framatome suppliers (such as valves, piping, pumps...) can be organized and coordinated by Framatome in order to achieve the most efficient transfer.

IV.4 - Mode of transfer

Technology transfer can be provided through either :

- . A Licence Agreement

or

- . A coproduction program

or

- . Subcontracting.

In any case, technical assistance can be provided in the form of Framatome resident engineers assigned full time to a specific workshop or on case to case basis for a specific activity.

V - A SUCCESSFUL EXAMPLE OF TECHNOLOGY TRANSFER BETWEEN
FRANCE AND THE REPUBLIC OF KOREA

FRAMATOME / KOREA HEAVY INDUSTRIES CORPORATION

A typical example of the successful implementation of Framatome technology transfer philosophy is our collaboration with the Korean firm Korea Heavy Industries Corporation (KHIC).

Under the terms of the contract awarded to Framatome for the supply of 2 Nuclear Islands for the KNU 9 & 10 nuclear power station, the government of the Republic of Korea, through the Korean Electric Power Company (KEPCO), requested substantial localization of the manufacturing activities.

KHIC was designated by the government to handle local manufacture, because of its large and modern fabricating facilities.

The localization concerned partial or total manufacturing of the following mechanical equipment.

1. Reactor pressure vessels
2. Pressurizers
3. Steam generators
4. Accumulators
5. Boron Injection tanks
6. Tanks built in shop
7. In-shop prefabricated tanks
8. BNI heat exchangers
9. Evaporation and gas stripping units
10. Filters
11. Demineralizers
12. Heavy handling equipment (including the polar crane)
13. Heavy component supports
14. Reactor vessel head lifting rig
15. Reactor coolant piping
16. Ventilation equipment
17. Lower and upper internal storage stands
18. Spent fuel racks
19. Solid waste treatment equipment
20. Chillers
21. Seal rings
22. C.R.D.M. supports.

A separate technical assistance agreement was signed between Framatome and KHIC. Assistance was tailored to the type of components to be manufactured and the scope of works to be performed by KHIC.

Framatome also set up a preliminary manufacturing and quality control program.

One year before the start of manufacturing operations, three experienced Framatome engineers were assigned full time at the KHIC factory.

Framatome proposed and set up a customized training program.

Under Framatome guidance, an extensive qualification program was set up, for quality, welding and fabrication procedures, welders and inspectors.

A complete technical data package was provided to KHIC to enable its engineers to familiarize themselves quickly with quality control, manufacturing and testing operations.

In fact, Framatome resident engineers, advised and assisted KHIC engineers, technicians and other professionals in all key organisational and production activities.

A one-year technical assistance program was required before any formal approval for nuclear fabrication could be delivered to KHIC.

A careful preparation and a strong follow-up of the work prevented the occurrence of critical situations.

Framatome is confident that the lessons learned in this successful technology transfer and more generally the total experience gained in the realization of the RND 9 & 10 project can be applied with success to other similar projects.

VI - AN OUTLINE OF POSSIBLE TECHNOLOGY TRANSFER TO DUTCH INDUSTRY

First contacts and visits of facilities of a number of prominent Dutch companies have provided Framatome with a sound assessment of the potentialities of the Dutch industry.

The existing high technology level of dutch industry was demonstrated thanks to strong experience in a number of areas, like :

- shipbuilding, petrochemical and offshore construction ;
- military hardware supplies
- conventional boiler equipment construction
- aeronautics, ... etc.

and in many other areas to which a high quality level must be achieved.

Also it must be taken into consideration that a significant role was played, by some of the companies visited, in the construction of the first nuclear power plants in the Netherlands as well as for other manufacturing activities engaged in foreign ventures for the supply of nuclear equipment such as :

- reactor vessels
- reactor internals
- pumps
- heat exchangers.

There is no doubt that Dutch industry can supply a large part of equipment and services. Therefore Framatome's approach in transferring technology would be different from the one used for a country with far less industrial experience.

In the Dutch approach, a close cooperation would be developed between the industries of our two countries by combining the special skills of Dutch industry with specific techniques which have been developed by the French industry for the last 12 years in the course of implementation of French Nuclear Power Plant Program.

Cooperation would be improved through visits to prospective suppliers, to evaluate in one hand :

- . manufacturing facilities and work force
- . existing technical know-how
- . experience records

and to improve, on the other hand, the understanding of the local suppliers of the Framatome equipment for which local participation is considered.

This preliminary phase could then lead to visits to :

- the French manufacturing facilities or
- French Nuclear Power Plants in which the equipment is installed.

This first phase enables Framatome to draw-up a preliminary list for which Dutch participation is likely to be considered.

Prospective suppliers would then be provided with preliminary bid request packages for the concerned equipment, to allow :

1. To perform a complete feasibility study including a review of the scope of engineering and fabrication services required for each selected equipment item.
2. To evaluate the schedule and means required to implement a manufacturing program :
 - structure and organization to be setup
 - qualification of personnel
 - layout and equipment for manufacturing
 - technical constraints in regard of safety rules, standards and construction code requirements
 - set up of a quality assurance program.

3. To determine the manufacturing cost.
4. To evaluate technical assistance and/or related training required.

In which areas could Framatome provide its expertise

- specific welding technics or critical manufacturing processes
- quality assurance organization and shop implementation
- shop lay out
- optimization of new investment in establishing additional facilities needs or machinery or other equipment
- qualified source of supply for raw material
- etc...

In all cases an open and pragmatic way of cooperation.

VII - CONCLUSION

Technology transfer is part of Framatome's basic export policy. We are very positive about it. Setting up the right environment and conditions, such as detailed evaluation of receivers needs, tailor-made agreements and mutual willingness and realism of both parties, is essential in order to achieve the best chances of success.

With regard to the Netherlands, which has a highly developed industry, evaluation of actual needs to mutual satisfaction of both parties, must be carried out in order to arrive to the most optimal situation, with the objective of optimum local content in mind.