

Business Technology Choice

Decision-making process of company entering business with technology licensed from overseas

BY LOU POTEPA*

I shall discuss the decision of Northern Natural Gas to enter the polypropylene business via its wholly-owned subsidiary Northern Petrochemical Company using technology licensed from BSAF (a major German chemical company) at a total project cost in excess of \$100 million. Moving forward with the project through the development phases required the formulation of a unique conceptual strategy, verification of the viability of the strategy through extensive investigation of markets and technologies, consummation of a licensing arrangement for



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acquisition of technology and, finally, obtaining approval for funds for a very highly sophisticated project from the senior management and board of a company some outsiders characterize as a conservative midwestern pipeline utility. The ramifications of the foregoing will be clear in the context of three of the major project risk factors, namely:

1. The U.S. market for polypropylene was being supplied in 1974 (the time the decision was made) by nine firmly entrenched producers including a dominant supplier. Moreover, several companies, in addition to Northern Petrochemical Company, were threatening entry.

2. The technology under consideration for license had been developed only through early pilot plant and preliminary semi-commercial stages.

3. The license situation in the polypropylene business is extremely complicated because of the multitude of patents, licenses, infringement suits, counter-suits, etc. that had developed over the period of time since polypropylene was first commercialized.

I will elaborate on the first two of these risk factors and in the presence of so many learned practitioners of the trade avoid, like the plague, the legal issues involved in the third.

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For those not familiar with Northern Petrochemical and/or polypropylene, I'll provide a little background. NPC is a relative newcomer to the petrochemical business having started the full range of operations at its \$350-million complex located at Morris, Illinois in the latter half of 1972. The company was built on the feedstock base available from Northern Natural Gas's liquid extraction operations. Our major products are Peak® antifreeze and Norchem LDPE resins — we are about a 10% supply factor in both of these product areas. In addition to these two major products several other petrochemicals are co-produced at the Morris complex — the most important of these being propylene. Propylene is precursor of and building block for polypropylene.

Polypropylene from the time of its commercial introduction in the early 1960s through 1973 had experienced an annual compounded growth rate of 15-20% based on its utility in many diverse applications. For example, polypropylene replaces jute as a carpet backing material, cellophane as a packaging film, rubber in battery cases, nylon as a carpet and upholstery fabric, die-cast metals in structural applications, etc.

It has been obvious for several years to those in the polymer production and fabrication businesses that based on a widely expanded availability of propylene in the late 1970s and early 1980s, polypropylene consumption would continue to grow not only in competition with increasingly scarce natural materials but also vis-a-vis other plastics such as polystyrene and ABS which are based on more supply-limited and therefore more costly benzene feedstocks. Additionally, the impact of the energy crisis was foreseen as accelerating the use of all suitable plastics in automobile components. In particular, polypropylene with its combination of properties and low cost would benefit from this development as fender liners, heater housings, door panels, cowlings, air ducts, kick panels and seat structures were converted to polypropylene as the preferred material of construction. Moreover, in the future, advanced fabrication techniques for conversion of polypropylene into new products would be developed at a faster rate as Europeans who had lagged in the application of polypropylene became large-volume producers and convertors.

STRATEGY

Before getting into specific comments on the formulation of NPC's polypropylene strategy, it is instructive to convey our general philosophy regarding entry into new business areas. First, there must be a reasonable prospect for achieving excellent profitabil-

ity in the new area. Second, our participation in target segments within the business must be sufficiently intensive for NPC to be a significant supply factor. Third, NPC will use creative and constructive approaches to new business areas. It is our intent to both have a competitive edge and contribute significantly to the growth and prosperity of the markets we serve.

This latter point is very important and I'd like to illustrate it by briefly mentioning NPC's entry into the low density polyethylene (LDPE) business. In 1968, NPC identified the use of LDPE resins in trash can liner and leaf bag applications as having high growth potential. We reasoned that introducing new technology into the U.S. to produce resins that would have certain superior film properties could both stimulate potential market growth and position NPC as a leader in an important future segment of the business. On this basis, we licensed foreign technology and at some considerable risk built a 500-million pound-per-year plant which would allow us to produce resins which could be drawn to minimum film thicknesses while still exhibiting excellent impact strength.

The success of this move can be seen from the fact that the NPC resin was ideally suited for an application which grew from virtually no volume to an 800-million pound-per-year application that absorbed a significant amount of our new plant capacity. Our entry into the business was clearly constructive in that we served a growing need in the market and, in fact, intensified that growth with a supply of resin having properties which enhanced acceptance of the final consumer product.

Nature of Business

Having set the stage with the foregoing background and philosophy, we'll now consider the nature of the polypropylene business and NPC's approach to tapping what we consider an opportunity in that business.

It is useful to think of the polypropylene market as divided in two segments — one consuming an unmodified or homopolymer polypropylene and the second using polypropylene copolymers which are primarily propylene but which have small quantities of ethylene incorporated to achieve special properties. The homopolymer segment is about 85% of the total market and encompasses use in applications such as carpet backing, packaging film, appliance moldings and fibers. The smaller copolymer segment is a specialty market which includes products such as battery cases, luggage, and high-clarity bottles.

The polypropylene business is intensely competitive. It is dominated by a company having both strong captive and trade sales market positions. Other companies in the business have clearly defined niches — some involving extensive captive downstream operations. Pricing has always been very competitively set at levels to encourage applications growth and, to the extent legally possible, discourage merely opportunistic entry by potential competitors. In spite of the historic pricing situation, however, it has been evident that petrochemical producers having new olefin crackers — specifically the major oil companies which co-produce large volumes of propylene — have a very strong inclination, if not a compulsion, to consider building downstream polypropylene production facilities.

On balance, in 1974 when the investment decision was made, it was NPC's opinion that in spite of the difficult competitive situation and the prospect of temporary excess producer capacity, the opportunity in the business outweighed the risks because of polypropylene's intrinsically outstanding physical properties and the favorable economics of polypropylene vis-a-vis other competitive materials.

In formulating our polypropylene strategy, we distilled all of the philosophy, information on the competitive environment, perceptions of the market, accumulated experience, etc. into several key points culminating in a specific overall objective:

1. Producing and selling homopolymer resins in direct competition with entrenched suppliers at a scale of operations limited by our supply of propylene feedstock would be marginally profitable, at best.

2. Due to the intensely cultivated market positions held by the competition, it would be highly undesirable to market a mix of products having "me-too" properties.

3. A portion of the polypropylene resin supplied from conventional processes could be displaced in the market if a new polypropylene resin family with step-up characteristics was available.

4. Market projections indicated that major inroads would be possible against metals and other types of polymers if polypropylene's low-temperature properties — particularly impact strength, stiffness and brittleness — were improved.

5. A combination of enhanced properties and favorable production costs would make polypropylene a preferred raw material in automotive component fabrication where the material's low density would favorably affect weight reduction programs.

6. Continued improvement of polypropylene performance and cost effectiveness would certainly lead to special, unique applications in the long term.

The conclusion from the preceding points was that achieving an objective of producing and marketing unique copolymer resins produced at costs not significantly higher than homopolymer costs would be a successful basis for entering and participating in the polypropylene business. This approach would allow NPC to participate in upgrading present and building new applications, minimize direct competition, become a sizable and significant factor in supplying target market segments and, most importantly, earn profits commensurate with the large project investment. The critical element in accomplishing these ends was clearly the identification and acquisition of technology having both the product and cost characteristics basic to the objective.

TECHNOLOGY INVESTIGATION

Starting from our well-defined project objective, we began the task of identifying technology with the capability of producing copolymer resins at high-yield and therefore low-cost synthesis conditions. Considering this specific interest in copolymers, there was an obvious list of companies for us to contact regarding the possibility of licensing technology. The list was naturally headed by Hercules, the largest producer of polypropylene. Another prominent candidate was the

Rexene Division of Dart Industries which was known to operate a process having excellent copolymer capabilities. Also to be contacted was Phillips Petroleum which had adapted its HDPE loop reactor technology to polypropylene and had reputedly developed a continuous process for copolymer production.

Unfortunately, after intensive discussion with these leading U.S. companies, we were forced to the conclusion that no satisfactory arrangement could be worked out with any of the three. Hercules looked favorably on our inquiry on the basis that some of its customers were looking for a second source of supply for certain unique Hercules resins. From a strategic viewpoint, we decided that this approach was not acceptable. Living in the shadow of the industry giant would give us little control over our future development and destiny. On the other hand, Rexene viewed NPC's potential entry quite negatively and outright rejected our request for license consideration because it didn't want another competitor, especially one serving as a second source for its type of resins. Finally, we were unable to work out a mutually satisfactory arrangement with Phillips because it had not yet commercialized aspects of production that NPC considered critical and it was not enthusiastic about licensing developmental copolymer technology. It is apparent that had NPC been limited to domestic technology license possibilities, the polypropylene project could well have been dead at this point.

Worldwide Search

Having had excellent experience with foreign technology in our LDPE project, however, we decided to expand the scope of investigation to a worldwide basis and drew up another list of possible licensors. At the head of this list was Tokoyama Soda, a major Japanese chemical producer, which had recently diversified into polypropylene production via the development of a liquid pool synthesis reactor similar to that used by Rexene. The Belgian company Solvay was included as it had just announced a major catalyst breakthrough and the potential of its new development had to be investigated. Mitsubishi Petrochemical Company had for many years been a leading producer of polypropylene copolymers which are used extensively in Japan. It was an obvious prospective licensor. Due to its significant technology and patent position, Montedison was on the new list. Additionally, BASF which previously licensed us the LDPE technology used at NPC's Morris complex made us aware of its pre-commercialization and development efforts in polypropylene and thereby became a candidate. When our contacts were finally completed, the pursuit of technology capable of uniquely positioning Northern Petrochemical Company in the U.S. domestic polypropylene business had put us into contact with 18 companies in six countries.

A detailed discussion of our findings during the evaluation program is beyond the scope of this paper but there are two points I'd like to mention. First, from a technology viewpoint, it was an interesting experience to investigate 18 different approaches to making a single basic product. As you may know, the entire polypropylene business evolved from a single break-

through in technology, namely, the discovery of stereo specific catalysts. A common technological thread, therefore, runs through all of the processes we looked at, but the extensive variations on the theme developed over the 10 to 15 years following the basic discovery were quite a revelation. Second, the key determinants in the selection process were product performance tests at prospective customers' shops and the demonstration of process capability to make the sought-after copolymer resins at high-yield synthesis conditions. Many thousands of pounds of resins for important applications were run to determine the basic compatibility of foreign resins with U.S. converting equipment and end-product performance requirements. These field tests were a very effective screen which reduced the number of acceptable licensor candidates dramatically.

Unfortunately, of the candidates remaining, none had fully commercialized advanced copolymer production and it was therefore incumbent on them to share research and development data and, further, make special plant test runs to satisfy our requests for additional information. Without getting into detail, I'll say that we concluded the vapor phase process being developed by BASF had the greatest potential relative to the sought-after copolymer resins. Furthermore, since the BASF process was the only commercial vapor phase process for polypropylene in the world, this technology afforded NPC not only copolymer capability but also the possibility of unique specialty products.

LICENSE CONSIDERATIONS

I am sure that it is already quite evident to you that the conclusion that only one technology would allow NPC to suitably implement our polypropylene business strategy made the successful negotiation of a comprehensive licensing agreement quite critical. Also, at first blush it might appear that a negotiation between NPC and BASF would be "a walk in the park" because of the very close relationship that had developed between the two companies by way of the LDPE license and ongoing technology exchange agreements. As we all know, however, it is a fundamental law of nature that if something is truly important it will present an opportunity for a little character building. In this instance, it became quite apparent after the initial step in our negotiation ritual — the first exchange of agreement drafts — that a wide gulf existed between the two companies' positions. The crux of the difference was that BASF wanted to license only that technology that had been successfully demonstrated in the semi-commercial plant and NPC was most interested in the potential of promising developments still in the pilot plant stages. From its viewpoint, BASF considered its offer to license semicommercial technology a major concession. This represented a major shift from its corporate policy but was not, in its view, to result in more exposure to BASF than any of its conventional arrangements. NPC, on the other hand, wanted not only the latest pilot plant advancements but also a commitment from BASF to an active development program to achieve our commercial production objectives.

As is often the case in negotiations, there was a basic

difference in the perceptions held by the two sides. Due to the significant lag in market and product development in Europe compared with the U.S., BASF did not fully understand the basis for our interest in copolymers. From NPC's side, we couldn't understand the BASF reluctance to intensify its development effort in this area because in supporting our interests it would put itself in position to capitalize on the unique product opportunities offered by the vapor phase technology.

Needless to say, translating the preceding monumental differences and the myriad of considerations related to the complex overall patent situation in polypropylene into a mutually-acceptable agreement was a substantial risk. Negotiations nearly collapsed at one critical point and we were about to accept the fact that 18 months of extensive and costly development efforts and, more importantly, a promising future business opportunity had to be aborted. Subsequent to the crisis, it took nearly four months of effort but, in the end, a highly satisfactory agreement reflecting each party's risks, rights and commitments was worked out. This accomplishment, in my view, was possible in large degree because of the solid respect that had grown between the two companies in their roles as licensor and licensee during the preceding years in the LDPE business.

GENERALIZATIONS

At this juncture, before wrapping up with some comments on the process of obtaining the polypropylene project approval and the current status of our entry into the business, I'd like to make several generalizations about world-wide technology transfer — some of which are obvious from what has been already said. For a company such as NPC which has demanding conceptual criteria for entry into new business areas but an agonizingly limited technological base, it is of critical importance that foreign technology licensing be possible for the following main reasons:

1. Unique products and processes having broad commercial potential develop in various areas of the world as a result of differing market applications needs.
2. For any number of reasons, R&D activities and, consequently, technology advancements might be greatly accelerated in one country or region relative to others.
3. Foreign companies not concerned with the potential competitive aspects of maintaining market position are considerably more willing to license their technology to either a company seeking entry into a business or one looking to broaden its existing position.
4. Companies who are not competitors in the domestic marketplace can be induced to license breakthrough technology and not simply that which has already been thoroughly exploited.
5. A meaningful continuing exchange of technical and market information is possible between licensor and licensee who are not competitors. This exchange is quite important for the licensee to develop the ultimate understanding of the acquired technology.
6. The philosophy behind establishing contract terms and conditions, royalty fees, etc. is markedly influenced by competitive business considerations. In

general, the foreign companies we have dealt with who were not prospective domestic competitors have had more acceptable philosophies.

I can confidently say after having been involved with not only polypropylene technology acquisition but also the licensing of both tubular and autoclave technology for LDPE production that there is no question regarding the critical importance of these factors in NPC's efforts at achieving a significant and profitable position in the polymer business.

PROJECT APPROVAL

Translating the conceptual business strategy that we had developed into a market plan with a detailed product mix and comprehensive prospective customer list gave us the basis to prepare an earnings forecast. A forecast which indicated that upon reaching commercial maturity the proposed polypropylene venture would be highly profitable. We therefore submitted the project for capital appropriation approval stressing the following points:

1. NPC was building on the firm foundation already established in the polymers business.
2. Market demand for polypropylene would continue to increase based on its high utility and low cost.
3. Technology was available to us which would position NPC with specialty products from an advanced, highly-competitive process.
4. The technology was being acquired from a company which had already proved its competence and commitment to NPC as a licensor.

The strength of the foregoing points and the clarity of the strategy which met the criteria for profitability potential, significant business positioning and constructive entry into new markets was evident to NNG's top management and Board of Directors. Also, the exhaustive nature of the investigative and analytical efforts required by the technology selection program we had completed made a substantial impact on our management during the capital funding reviews as we literally "had the book" on the polypropylene business on a worldwide basis. The comprehensive program had paid off in strategy formulation, technology acquisition and project appropriations approval. All that remains is the "bottom line" — how the project actually develops relative to our plan.

PRESENT STATUS

Our initial project approval was granted in September 1974 and construction funds authorized one year later. As of now, the commercial plant has been operational for about six months and I am pleased to say that the project is developing according to plan.

Admittedly external factors, most importantly, much more aggressive building of new production facilities by others than had been fully anticipated have impacted somewhat on the timing of our expectations. But the basic wisdom of our business strategy and technology choice is being verified. In summary, business strategy based on worldwide technology selection is proving to be an important factor in NPC's growth and development.