

Will There Always be Too Many Refineries?

By W. Laney Littlejohn*

Even the most casual observer of the petroleum refining industry will have noticed that, for years, perhaps even a couple of decades, returns in the industry as a whole have been quite low relative to most measures of the cost of capital. Most refiners would probably regard this as a gross understatement and would prefer terms like “abysmal” or “disastrous” to describe the economic condition of the industry. Only a year ago, at the 1999 NPRA meeting in San Antonio, NPRA Chairman Robert H. Campbell (Chairman and CEO of Sun Co., Inc.) took advantage of the previous day’s motion picture Academy Award announcements by remarking, “If there had been a category for the longest running ‘horror show,’ the U. S. refining industry would have been on the short list of favorites to win the Oscar.”

Except for short periods of time associated with unusual weather conditions or temporary disruptions of one sort or another, gross refining margins (the difference between sale value of products and the cost of crude oil) have been far below levels which would provide economic justification for the construction of refining capacity. Despite this, construction of new refineries has continued as has expansion of existing refineries. The obvious question is, “Why?”

The refining industry, like other process industries, is characterized by lumpy investment with lagged effect. Economies of scale dictate that new capacity be brought onstream in sizable lumps; engineering and construction requirements are such that three or four years may elapse between the decision to build and the date a facility comes on line. In such an industry, it seems reasonable to expect cyclical behavior of margins and profits. When profits are high, investment in new capacity is attractive, and companies initiate construction of new plants. When these plants are built, the industry suddenly finds itself faced with excess capacity, margins decline toward the level of variable operating costs, and profits decline accordingly. Investment in new capacity then comes to a halt until such time as the combination of market growth and retirement of existing plants is sufficient to remove the excess capacity condition. Then the cycle begins again.

Lumps and lags, however, do not explain the persistence of low returns in petroleum refining. Nor do they explain why worldwide refining capacity has been rising despite low returns. Something else must be afoot. Perhaps there is something fundamentally amiss in the process by which refiners reach decisions to add capacity. Perhaps there are peculiar factors impinging upon the decision process which create an inherent tendency toward excess capacity. If so, there will always be too many refineries.

In what follows, we examine these questions with a combination of casual empiricism and rocking-chair cogitation. We present no data, graphs or charts, and we fit no equations, for we do not wish to reach conclusions that might be dependent upon the peculiarities of the history of the oil industry in the 1980s and 1990s. Only by examining the investment decision process itself can we hope to shed light on the question posed by the title, “Will there always be too many refineries?”

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Capacity Data – Inherently Flawed

The first order of business in the typical evaluation of a potential refining investment is to determine whether there appears to be “room” for another refinery. One typically does so by comparing projections of product demand to existing capacity, plus capacity under construction, plus some portion (which is conveniently subject to the analyst’s discretion) of announced refinery projects which are not yet underway.

Unfortunately, the capacity data employed for the purpose are fundamentally flawed. They are systematically biased downward by several factors: (1) overdesign, (2) “capacity creep”, and (3) “upgrade expansion.”

By “overdesign,” we mean simply that the actual capacity of a refinery, or its units separately, is substantially in excess of its stated or nameplate capacity. Some of the reasons are simple and obvious. No engineer instructed to design a 200 mbd (thousand barrels per day) refinery is going to risk a design which might achieve only 190. Accordingly, he builds in some slack in the basic design, then adds a bit more by making an overly liberal allowance for down time. Additionally, in the interests of flexibility of crude slate, the designer may want to make sure that the unit can achieve its nameplate capacity with crude oils of different gravities. Then, if the refinery runs crudes or blends in the middle of the design range, throughput well above nameplate can be achieved. Thus, the day a refinery is built, its capacity is likely to be well in excess of the nominal capacity (which is reported to governments, trade associations, and journals and then used by planners).

After a refinery is built, capacity is subject to “creep.” During operation at or near capacity, “bottlenecks” are discovered, some of which can be removed by relatively minor and inexpensive modifications. Subsequent to one “debottlenecking” action, another is discovered and removed. Capacity creeps up, slowly but inexorably. But the capacity numbers used by industry observers and planners are not adjusted.

Finally, there is what we call the “upgrade expansion” phenomenon. Changes in product specifications, changes in the relative prices of different products, or changes in the availability and relative prices of different crude oils may induce or force the execution of refinery “upgrade” projects, such as adding cracking capacity, various sorts of reforming units, or desulfurization. Though these are commonly stated to be upgrades rather than expansions, they are seldom executed without positive impact on the refinery’s maximum throughput.

The result of these phenomena is obvious. Refinery planners and analysts start into the problem with a systematically overstated estimate of the market justification for future capacity.

Strategic Investments

It is not infrequent that one hears an investment which is otherwise questionable described as “strategic.” In instances where refineries have been so described, we have never been able to figure out what “strategy” was being implemented by the “strategic” investment, partnership, or alliance. Accordingly, we have reached the conclusion that “strategic” is a synonym for “it does not make economic sense but we want to do it anyway.”

Vertical Integration

Oil producers, both companies and countries, frequently

entertain the notion that integration into the downstream (refining and marketing) offers benefits over and above the profitability of the refining and marketing activity themselves. Accordingly, they may be willing to pay a premium for refining assets or undertake refinery projects which, in and of themselves, appear to provide an unacceptably low rate of return.

The benefits of vertical integration are elusive and probably illusory. The notion of a “guaranteed outlet for crude oil,” which has led more than one producing nation into the downstream is, by and large, a red herring. Crude oil is a fungible commodity, the demand for which is invariant with respect to the ownership of refineries. Consequently, the combinations of prices and output available to the crude oil exporter are not changed one barrel by the acquisition of refineries.

Portfolio theorists and investment bankers (who like to earn large sums from mergers and acquisitions) tell us that crude oil prices and refining margins are negatively correlated. Adding refining assets to a crude producer’s folio reduces the variance of income from the portfolio, so the producer should be willing to pay a premium for refining assets. We are yet to see a convincing empirical demonstration of this effect. Additionally, given that the variance of crude oil prices is several times the variance of refining margins, it is not clear that the large producer can gain very much by restructuring his portfolio.

Traditional theory of vertical integration suggests that it has value and occurs because it reduces transactions costs between the various segments of the business. However, modern communications and trading practices have resulted in transactions costs in crude markets which are probably lower than the managerial costs associated with vertical integration, so this argument is without compelling force.

In certain situations, the notion of asset specificity may provide legitimate economic foundation for vertical integration, but such arguments are limited to a few cases, such as extremely heavy or otherwise unusual crude oils which require specialized refining facilities.

Nevertheless, and whatever the true merits, perceived benefits from vertical integration serve to act as another force toward excess investment in refining capacity.

Refineries in Developing Nations

Decisions to build refineries in oil-importing developing nations usually involve governments, which almost necessarily implies a bias toward building refineries that do not make economic sense. (If they did make economic sense, the government would not need to be involved in the first place.) Governmental objectives related to economic growth and employment are the more obvious factors here, but one will even hear the argument that building refineries will save foreign exchange by substituting crude oil imports for more expensive product imports. Issues of national security may even come onto the table; it is “riskier” to be an importer of products than an importer of crude oil. To put some icing on the cake, governments may adopt regulatory schemes designed to protect domestic refineries, higher import duties on products than on crude oil, or even outright prohibition of product imports. (Some of these considerations are not limited to developing nations: witness Japan).

Even if a refinery of some sort could be economically justified, there are biases toward building too big and too

soon. Official forecasts of economic growth and the associated growth in product consumption are usually optimistic. More seriously, the size of the refinery is usually chosen based on domestic requirements for one or two products (e.g., middle distillates); excess output of other products (e.g., naphtha and fuel oil) can be exported. Finally, considerations of economies of scale are likely to lead decision makers to increase the size even further; products in excess of domestic requirements can be exported.

If several countries in a region behave in this fashion, the outcome is obvious. Each nation winds up covering its own domestic product requirements and trying to export to the others. Readers will probably recognize this as a reasonable description of the current situation in South and Southeast Asia.

Animal Spirits

Economists like to think of investment decisions as being based on carefully executed net present value calculations, but there are good reasons to believe that spontaneous optimism plays the larger role. In the words of John Maynard Keynes:

“Most, probably, of our decisions to do something positive, the full consequences of which will be drawn out over many days to come, can only be taken as a result of animal spirits – of a spontaneous urge to action rather than inaction, and not as the outcome of a weighted average of quantitative benefits multiplied by quantitative probabilities. Enterprise only pretends to itself to be mainly actuated by the statements in its own prospectus, however candid and sincere. Only a little more than an expedition to the South Pole, is it based on an exact calculation of benefits to come.”

“If we build it they will come.”

An aside is in order. We do not wish to imply that “animal spirits” are not socially useful. For optimists are the portion of society which make decisions to build things, and build them. If economists were entrusted with investment decisions, we would all (but many fewer of us) still be living in mud huts.

Merry-go-round Economics

In the corporate world (and even in some governmental circles), animal spirits are not allowed to run totally unchecked. People who sit in board rooms still want to see numbers – cash flow projections, net present values, internal rates of return, and sensitivity analyses – before putting the stamp of approval on a proposal to build a refinery. So it is worth while to examine how this is done.

Projecting cash flows for a proposed refinery requires that one project crude oil and product prices or, more relevant, differences between crude oil prices and product prices. This is typically done in the following fashion. It is assumed that, in the long run, prices of refined products will exceed crude oil prices by an amount sufficient to justify building and operating refineries, i.e., that the margin between refined product sales revenues and crude costs will be enough to cover operating costs plus capital costs, including an appropriate rate of return. This assumption, together with estimates of the cost of building and operating various process units, is then used to calculate a set of “long-run” differences between the prices of various products and crude oil. This, of

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course, amounts to assuming that refining will be profitable, and then calculating the prices required to make it profitable.

Current (at the time of projection) price differentials may be smaller than this (because of excess capacity in the industry), but this need not be a matter of concern. At the feasibility study stage, a refinery is still four years or more away from operation. Capacity data (discussed above) and consumption forecasts will almost always show a “shortage” of capacity by the time the refinery under study comes onstream. An assumption that product price differentials will widen to the long-run level is justified.

The product and crude price projections derived above are then used in the discounted cash flow analysis of the project under study. Voilà. The project turns out to be profitable. It turns out to have the same internal rate of return that was assumed to project prices in the first place.

The circularity of this reasoning is so obvious that little further comment is required. Refinery projects appear profitable because they are assumed to be profitable.

Summary and Conclusions

The above description of the decision-making process may be summarized as follows. Animal spirits provide the basic motivating force for building refineries. Justification is provided by fundamentally flawed capacity data and projections, supplemented by questionable arguments regarding the benefits of vertical integration, “strategic” considerations and, in the case of developing nations, vague ideas about the contribution of refineries to economic growth, employment and trade balances. Finally, decisions to build are made based on economic analysis performed in a fashion which guarantees apparent profitability.

Yes, Virginia, there will always be too many refineries.

A Note from the Norwegian Affiliate

The Norwegian Affiliate currently comprises around 100 active members. Over the past year the affiliate has organised four half day seminars covering selected issues of the energy scene.

- In June the seminar covered the restructuring of the oil industry, implications for the Norwegian oil industry, the Norwegian authorities and the service industry. Kris Jacobsen of the Norwegian brokerage house, Pareto, provided the financial analyst perspective, while Karen Sund of the Norwegian consultancy ECON provided the societal perspective.
- In October the seminar looked at European gas prices and breaking the oil link. Gas and power, one industry or two. Presentations were made by Peter Hughes and Simon Blakey of CERA.
- In December the seminar covered reflections following the presentation of the Norwegian white paper on greenhouse gas policies. Introductory observations from COP 5, were made by Harald Dovland Norwegian Ministry of the Environment. The leader of the committee followed with a presentation summarising the recommendations, before Halfdan Wiig director of the Norwegian consultancy INSA concluded by drawing the implications for energy markets and investment risks.

- In March the subject was how to handle the growing Norwegian power deficiency. Research Director Torstein Bye from Statistics Norway introduced by pointing to the large amount of excess capacity in continental Europe that can easily be transmitted through existing cables. The forward prices on the Nordic power exchange, do not show any signs of reaching levels that justify new capacity additions within the next 6-10 years. While agreeing with the current outlook concerning the need for new domestic expansions, Lars Hjermmann, the Director of the Norwegian Gas Power company Naturkraft, pointed to the long lead times associated with significant capacity expansions. It would, therefore, be imprudent not to start making the necessary preparations

The affiliate is currently organising the first European IAEE conference on the topic of integration of the European Energy markets. High level speakers include Mr. Olav Fjell, CEO of Statoil, Mr. James Hoecker, chairman of the FERC, Professor Victor Norman of the Norwegian school of Economics and Business Administration, Professor William Hogan of Harvard University, Professor Richard Green of the University of Hull and Professor Frank A Wolak of Stanford University. For more information please refer to the internet site of the Foundation for Research in Economics and Business Administration, <http://www.snf.no>

The members of the board of the Norwegian affiliate of the IAEE comprise representatives of various elements of the Norwegian energy sector, resulting from a long term strategy of bringing together a wide range of interests with the aim of enhancing the exchange of insights and ideas in an informal atmosphere. Board members include:

- Øystein Håland: Chairman. Currently manager of the department of economic evaluation in Statoil’s European Gas business. His career in Statoil includes a 5 year experience with corporate strategy and 2 years as a petroleum economist in Statoil’s E&P business. oejh@statoil.com
- Tore Nilsson, Vice Chairman, Senior Associate with CERA Norway. tnilsson@cera.com
- Ellen Cathrine Rasmussen, treasurer, gas marketer in Norsk Hydro. Previous posts include 4 years with the Ministry of Industry and Trade in Norway and 2 years with Statistics Norway. ellen.cathrine.rasmussen@hydro.com
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