# THE FERTILIZER-ENERGY SUPPLY AND DEMAND SITUATION FOR WESTERN CANADA

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Agriculture in Western Canada is an energy-dependent industry. Vast acreages, a short growing season, relatively cool & dry climates, infertile soils and pest problems make it necessary to use machines, fertilizers & pesticides to farm economically.

It is possible that Agriculture accounts for about a third of the energy consumed in Western Canada. However, unlike most other uses, Agriculture is involved in re-cycling energy and not just throwing it away after using it. For every calorie of energy consumed in Agriculture it is estimated that about three are produced.

## The Ammonia Building Block

Nitrogen fertilizers require a source of hydrogen to combine with atmospheric nitrogen in making ammonia, the basic building block. Of the sources presently available as a supply of hydrogen (methane, electrolytic decomposition of water, coal gasification & others) the

least expensive one is methane - $CH_4$. About 95% of natural gas is methane. About 46,000 cu. ft. of natural gas are required to make one ton of ammonia nitrogen. Of this 61% is feedstock. The simplified chemical reactions are: $CH_4 + H_2O \longrightarrow 3H_2 + CO$

$$N_2 + 3H_2 \longrightarrow 2NH_3.$$

Heat is required in the ammonia manufacturing process and natural gas is the preferred energy source because it is convenient to use, clean, and relatively inexpensive. Oil and coal are realistic alternatives for the heat required. At the present time, about 39% of the natural gas used to make ammonia is consumed as heating fuel.

## Natural Gas

### Supply of Natural Gas in Western Canada 1973

billions of cubic feet - BCF

| Province | Production | Use | Balance | Export Eastern Canada | Export U.S.A. |
|---|---|---|---|---|---|
| B.C. | 319 | 112 | 207 | 0 | 207 |
| Alberta | 1,970 | 295 | 1,675 | 709 | 865 |
| Sask. | 70 | 97 | -27 | 0 | 0 |
| Manitoba | 0 | 74 | -74 | 0 | 0 |
| TOTALS | 2,359 | 578 | 1,781 | 709 | 1,072 |

While no figures are available to show the exact magnitude of natural gas reserves, they are considered ample for this rate of production for at least thirty (30) years. At that time, coal gasification technology should be adequate to use the vast reserves of coal as a source of methane.

Projected N Supply

As can be seen in Table 1 the projected production capacities for N fertilizers in Western Canada increase from 585,000 tons per year in 1975 to 2,601,000 in 1985. The associated natural gas requirements are as follows:

| | 1975 | 1980 | 1985 |
|---|---|---|---|
| N Projections - tons | 585,000 | 2,257,000 | 2,601,000 |
| Natural gas Needed - BCF | 26.9 | 103.8 | 119.6 |
| % Used Based on Alberta 1973 Production | 1.37 | 5.27 | 6.07 |

It can be seen that a relatively small part of the supply of natural gas is used for fertilizer nitrogen.

The Future

Since much of the future depends on political and not technical considerations, a quote is presented, for information purposes, from the Alberta Energy Resources

Conservation Board Report 74-V, page 21-22, published December 1974. ".....Based on the evidence at the hearing (June 1974) and the Board's own studies it believes there will be significant plant expansion of ethylene, ammonia, methanol, and their related products in Alberta. The evidence suggests that such development will occur intermittently during the forecast period but that a considerable increase in provincial gas requirement for petrochemical purposes would take place in the initial years of the forecast period. Although the Board believes that petrochemicals will be produced from a variety of feedstocks in the future, it expects natural gas to be the primary resource used by petrochemical plants to be developed for that production during the first ten (10) years of the forecast period.

The Board forecast assumes that some 2.5 billion pounds per year of ethylene capacity in Alberta will use natural gas as a fuel. It also assumes that six (6) world-scale ammonia plants and four (4) world-scale methanol plants will use natural gas as a fuel and a feedstock source. In addition, the Board expects that some derivative upgrading of these primary petrochemicals will take place in Alberta and has added appropriate gas volumes for such plants in its forecast."

The Board's forecast of natural gas requirements for petrochemical use in Alberta are:

| | | |
|---|---|---|
| | 1975 | 61 BCF |
| | 2004 | 239 BCF |
| 30 year | total | 6500 BCF |

The summary classification and volumes used are as follows:

Natural Gas Required - BCF

| | 1975 | 2004 | 30 Year Total |
|---|---|---|---|
| Residential & Commercial | 149 | 274 | 6,610 |
| Industrial (incl.petrochemical) | 234 | 364 | 11,436 |
| Transportation | 41 | 7 | 520 |
| Electricity Generation | 50 | 30 | 1,300 |
| TOTALS | 474 | 675 | 19,866 |

Conclusion

The allocation of natural gas for manufacturing nitrogen (and other) fertilizers will be more than ample for the projected potential requirements in Western and Eastern Canada.

The export of nitrogen fertilizers will grow and will be about one-half to two-thirds of production.

The net result of policies presently being developed and implemented will be more up-grading of the natural gas in Alberta and Western Canada and the exporting of manufactured products (see Table 2). This will mean that exports of natural gas to Eastern Canada and the U.S.A. will be materially reduced.

DISCUSSION

Question: Any tie in with phosphate rock import and potassium export?

Answer: Hard to negotiate using one as lever to increase supply of the other (phosphate rock). It may be possible to negotiate a proposal of this nature at the commercial company level.

Question: How is the world supply of phosphate rock?

Answer: No problem with supply, main problem - is it economical to mine in certain locations.

Question: What about supplies of phosphorus for spring '75?

Answer: There will be a shortage.

TABLE 1.

NITROGEN SUPPLY-DEMAND BALANCE FOR WESTERN CANADA

Thousands of tons of N for year ending 30 June

| Supply | 1975 | 1980 | 1985 |
|---|---|---|---|
| Existing Capacity | 650 | 650 | 650 |
| Approved additional capacity | - | 1,033 | 1,033 |
| Expected additional approved capacity | - | 689 | 1,033 |
| TOTAL CAPACITY | 650 | 2,372 | 2,716 |
| Process losses | 65 | 115 | 115 |
| TOTAL SUPPLY | 585 | 2,257 | 2,601 |
| (TOTAL CANADA) | (1,206) | (3,004) | (3,348) |
| Demand - Domestic | | | |
| Domestic Fertilizer | 365 | 645 | 920 |
| Domestic Industrial | 30 | 50 | 70 |
| TOTAL DOMESTIC | 395 | 695 | 990 |
| (TOTAL CANADA) | (845) | (1,401) | (1,845) |
| Available for Export from Western Canada | 190 | 1,562 | 1,611 |
| (Available for Export from Canada) | (361) | (1,603) | (1,503) |

## THE VALUE OF NATURAL GAS UP-GRADED AS A FERTILIZER AND USED IN AGRICULTURE

| | 920 cu. ft. Natural Gas for 40# N | → | 40# N applied per acre | → | Yield increase of 7 bu/A of Wheat | → | Milled into 308 lb. flour | → | Baked into 308 loaves of Bread |
|---|---|---|---|---|---|---|---|---|---|
| Unit Cost | 0.75 per M | | 0.15 per lb. | | 3.50 per bu. | | 0.17 per lb. | | 0.40 per loaf |
| Value | .69 | | 6.00 | | 24.50 | | 52.36 | | 123.20 |
| Factor | 1 | | 8.7 | | 35.5 | | 75.9 | | 178.6 |

TABLE 2