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APPENDIX 1

GLOSSARY OF TERMS USED IN THE PETROLEUM INDUSTRY

Absorption – The penetration of one substance into another, e.g. the taking up of moisture by blotting paper or the solution of a gas in a liquid.

Acetylene – Colourless gas, C_2H_2, generated by action of water on calcium carbide, or by pyrolysis of natural gas or hydrocarbon. The basis of manufacture of vinyl chloride, neoprene synthetic rubber, trichloromethylene, acrylonitrile, vinyl acetate, acetylene black, electrically conductive rubber, plastics, etc.

Acid-Treatment (oil well) – In limestone formations, freedom of movement of fluid towards the well depends upon fissuring and/or permeability. Hydrochloric acid is employed to enlarge these production channels due to the ease with which it will attack the limestone.

Acrylic – Broad term covering materials manufactured from methyl methacrylate.

Additive – An agent used for imparting new, or for improving existing, characteristics of oils.

Adsorption – The taking up of a liquid or gas on the surface of a solid, e.g. the removal of very light liquid petroleum from natural gas by passage over activated carbon whereby the liquid is separated on to the surface of the carbon.

Aerosol – A suspension of fine solid or liquid particles in air or gas, e.g. smoke or fog.

Aliphatic Hydrocarbons – Hydrocarbons in which the carbon-hydrogen groupings are arranged in open chains which may be branched. The term includes paraffins and olefins and provides a distinction from aromatics and naphthenes which have some at least of their carbon atoms arranged in closed chains or rings.

Alkylation – A process in which hydrocarbons with a branched chain or ring structure combine catalytically with an unsaturated hydrocarbon. For example, *iso*-butane combines with butene, in the presence of sulphuric acid, to yield *iso*-octane.

Amorphous Wax – *See* Microcrystalline Wax.

Amyl Nitrate – A liquid compound, $C_5H_{11}NO_3$, used as an additive in diesel fuel to improve its ignition qualities.

Aniline Point – The lowest temperature at which the oil under test is completely miscible with an equal volume of aniline, *see* Diesel Index.

Anticline (geological) – An earth-fold in which the strata are uplifted in the form of an arch.

Anti-Knock Value – *See* Octane Number.

Antioxidant – A substance which when added in small amounts to petroleum products will delay or inhibit undesirable changes such as the formation of gum, sludge and acidity which are brought about by oxidation.

A.P.I. – American Petroleum Institute.

A.P.I. Gravity – An arbitrary scale adopted by the American Petroleum Institute for expressing the specific gravity (*q.v.*) of oils. Its relation to specific gravity is as follows:

$$°\text{API} = \frac{141{\cdot}5}{\text{Specific Gravity at } 60\,°\text{F.}} - 131{\cdot}5$$

Aromatics – A group of hydrocarbons, of which benzene is the parent. They are called "aromatics" because many of their derivatives have sweet or aromatic odours. These hydrocarbons are of relatively high specific gravity and possess good solvent properties. Certain aromatics have valuable anti-knock characteristics. Typical aromatics are: benzene, toluene, xylene.

Asphalt – Natural or mechanical mixtures in which bitumen is associated with inert mineral matter. The term is normally qualified by indication of type or origin, e.g., lake asphalt, natural asphalt, etc. In the United States this term is generally used to describe the material known in the United Kingdom as Asphaltic Bitumen or Bitumen (*q.v.*).

Asphaltic Bitumen – *See* Bitumen.

sphaltic Cement – Asphalt or bitumen, or blends of these with one another or with flux oils, such that the product is a binder having cementing qualities suitable for the manufacture of asphalt pavements, mastics, etc.

S.T.M. – American Society for Testing Materials. This organisation is responsible for the issue of many of the standard methods used in the petroleum industry.

tmospheric Pressure – 1. The pressure of air. 2. More specifically, the pressure of the air at sea-level. 3. As a standard, the pressure at which the mercury barometer stands at 760 mm or 30 in. (equivalent to approximately 14·7 p.s.i.).

utofining – A fixed-bed catalytic process for desulphurising distillates. The pelleted catalyst is cobalt-molybdate on alumina and may be regenerated in place. Hydrogen for desulphurising is produced in the process.

viation Spirit (or Aviation Gasoline – Avgas) – Special blended grades of spirit suitable for use in aircraft engines. These fuels have high anti-knock ratings, high stability, and high overall volatility and low freezing-points.

arrel – A common unit of measurement of liquids in the petroleum industry; it equals 42 U.S. standard gallons or 35 Imperial gallons.

atching Oils – Petroleum of heavy gas oil or light lubricating oil type used in the jute industry to facilitate spinning by lubricating the fibres.

auxite – Mineral matter, essentially hydrated aluminium oxide, formed by the chemical weathering of igneous rocks; used as a treating agent in refining.

entonite – The clay mineral montmorillonite, a magnesium-aluminium silicate. Used in the refinery as a treating agent, in drilling as a mud component, and in greases.

enzene – A pure aromatic hydrocarbon (*q.v.*) of characteristic odour occurring in significant proportions in certain Far Eastern crude oils, but usually obtained in the U.K. as a by-product of the coal-gas industry.

enzine – Straight-run petroleum spirit boiling within the range 80–130 °C.

Benzole – A mixture, predominantly composed of aromatic hydrocarbons obtained as a by-product of the carbonisation of coal, either from coal gas by absorption or from coal tar by distillation. This mixture, after washing and rectification to concentrate the benzene and eliminate undesirable constituents to any desired extent, is classified in Great Britain according to purity as "Motor Benzole", "Industrial Benzole", "90's Benzole", "Pure Benzole" and "Pure Benzole for Nitration". Recognised specifications for these British grades are issued by the National Benzole Association.

Bitumen or Asphaltic Bitumen – Black to dark brown solid or semi-solid organic material which gradually liquefies when heated. These materials are usually obtained as residues from the vacuum distillation of petroleum. *See also* Blown Bitumen.

Bituminous Mastic (Bitumastic) – Mixtures of bitumen with inert fillers of fine mesh.

Black Oils – A general term applied to the heavier and darker coloured petroleum products such as heavy diesel fuel, fuel oil and some cylinder stocks (*q.v.*). It is used mainly in connection with shipping and storage; a black oil tanker is one used for carrying "black oils" and which would require cleaning before being used for "white oils".

Blending – Intimate mixing of the various components in the preparation of a product to meet a given specification.

Bloom – The bloom of an oil is its colour by reflected light when this differs from its colour by transmitted light. Many petroleum oils which appear red or yellow by transmitted light exhibit a blue or green bloom.

Blown Bitumen – A semi-solid or solid oxidised product obtained primarily by bubbling air through hot liquid bitumen, with a resultant increase in the melting-point and a modification of other physical properties.

Blow-out Preventer – A special hydraulically operated gland-like device, employing synthetic rubber, designed for use when drilling, to maintain pressure control of the drilling fluid.

Blown Oil – Fatty oil, of which the viscosity has been increased by blowing with air at an elevated temperature.

Boiling Range – Distillation range (*q.v.*).

Bottled Gas – Ordinarily butane or propane, or butane-propane mixtures, liquefied and bottled under pressure for domestic use.

Bottoms – The residue from a distillation of petroleum or the liquid layer left in a tank or similar container after draining to the level of the pump suction.

Bottom-Hole Differential Pressure – The difference between the reservoir pressure and the pressure at the bottom of a producing well is known as the B.H.D.P. The magnitude of this pressure difference determines the rate of flow of fluid towards the well-bore.

Bottom Settlings – Sludge collected at the bottom of tanks or other oil containers which comprises an emulsified mixture of oil and water and sometimes wax, asphalt and mud.

Boundary Lubrication – A state of lubrication existing when conditions of bearings, design, feed, load, and method of application of the lubricant do not permit the formation of a separating lubricant film by hydrodynamic action. Under these conditions, adsorption of the lubricant or of some of the active components of the lubricant upon the bearing surface, or the formation of low-shear-strength chemical compounds by the reaction of the components of the lubricant with the bearing surfaces, reduces the metallic contact and determines the character of the frictional resistance.

Breathing – The movement of gas (oil vapour or air) in and out of the vent lines of storage tanks as a result of alternate heating and cooling.

Bright Stock – A lubricating oil of high viscosity prepared from a cylinder stock by further refining, e.g. solvent deasphalting, dewaxing, acid treatment and/or earth treatment.

Bringing In (oil well) – On completion of drilling and after withdrawal of the drill pipe (*q.v.*), the back-pressure on the producing formation is reduced by bailing down the mud (*q.v.*) or by displacing it with a fluid of lower specific gravity, until the oil can overcome the static head and flow into the well. This is termed "bringing the well in".

B.S. & W. – "Bottom settlings and water" comprises the solids and aqueous solutions which may be present in an oil and which are separable therefrom by means of gravity or the centrifuge.

B.Th.U. – British Thermal Unit. The heat required to raise the temperature of 1 lb. of water through 1 °F.

Bubble Cap – An inverted cup with a notched or slotted periphery to disperse the vapour in small bubbles beneath the surface of the liquid on the bubble plate in a distillation column.

Bund – An earthwork or wall surrounding a tank or tanks to retain the contents in the event of a fracture of the tank.

Bunker Fuel – Any fuel oil or diesel fuel taken into the bunkers of ships.

Bunker "C" Fuel Oil – A heavy residual fuel oil used by ships, industry and for large-scale heating installations.

Butane – Commercial butane is a mixture of gaseous paraffins, mainly *normal*-butane and *iso*-butane (both C_4H_{10}). When blended into gasoline in small quantities it improves volatility and octane number. Butane can be stored under pressure as a liquid at atmospheric temperatures and as "bottled gas" it is widely used for cooking and domestic heating.

Cable Drilling – In this system, the rock is penetrated by percussion of a bit on bottom, the bit being suspended on a wire-line and the necessary motion imparted by a beam pivoted at the centre and usually termed a "walking-beam".

Calorie – The amount of heat required to raise the temperature of 1 gram of water through 1 °C. The kilogram calorie (i.e. 1,000 calories or 3·97 B.Th.U.) is also employed, particularly in engineering.

Calorific Value – The amount of heat obtainable by the complete combustion of unit weight of fuel. It is normally expressed as calories per gram or B.Th.U.s per pound, the latter being numerically 1·8 times the former. The higher or gross calorific value represents the total amount of heat of combustion. This total includes the latent heat of condensation of the water vapour produced by the combustion. Owing to the fact that the water vapour is not usually condensed under practical conditions of combustion, the "lower" or net calorific value, which excludes the latent heat of condensation of the water vapour, is a better guide to the amount of useful heat obtainable from the fuel.

Cap-Rock – An impervious layer, e.g. clay, which overlies a reservoir-rock (*q.v.*) and prevents wholesale leakage of petroleum to the surface.

Carbon Black – A substantially pure form of finely divided carbon usually produced from liquid or gaseous hydrocarbons by controlled combustion with restricted air supply. It is used as a filler in the rubber industry, being specially valuable by virtue of the improved wearing quality which it imparts to tyre rubbers. Smaller quantities are used as pigment in printing inks and paints.

Cased Products – Manufactured petroleum products which, in order to avoid the difficulties of bulk distribution and storage, are packed and sold in containers.

Casing – The steel lining of a well, the main purposes of which are to prevent caving of the sides of the well, to exclude water or gas from the well and to provide means for the control of well pressures and oil production.

Casing Perforation – To complete an oil-well it is usually necessary to perforate the last (production) string of casing cemented in the borehole, opposite the oil-bearing formation in order to allow the oil to flow into the well. In earlier days this was accomplished by lowering into the well, on an electrical cable, a gun perforator designed to shoot a number of steel bullets horizontally through the casing at intervals (usually) of six inches or a foot. The gun perforator firing steel bullets has been superseded by a tool made up of a number of explosive shaped charges linked together. The shaped charges are more reliable and penetrate several inches into the rock after perforating the casing, giving better channels of flow for the oil and gas.

Casing-Shoe – A steel sleeve protecting the lower end of the casing string when being inserted into the well. Often provided with a drillable back-pressure valve, when it is called a cement float-shoe.

Casinghead Gasoline – *See* Natural Gasoline.

Catalyst – A substance which accelerates or changes the course of a reaction without itself undergoing any chemical change.

Cat-Head (drilling) – A small spool rotated by the draw-works (*q.v.*) on which a manila line is wound and used for making-up or backing-off the tool joints on the derrick floor. The operation is similar to that of a capstan.

Ceresin – A hard, brittle wax obtained by purifying ozokerite (*q.v.*). The commercial product is nearly always adulterated with paraffin waxes. *See* Petroleum Ceresin and Microcrystalline Wax.

Cetane Number – A means of expressing the ignition quality of a diesel fuel. It is defined as the percentage by volume of cetane in a mixture of cetane and methyl naphthalene which has the same ignition quality when used in an engine as the fuel under test.

Christmas-Tree – The complete assembly of valves and connections at the well-head.

Clean Oil Vessels – Sometimes referred to as "White Oil Vessels". This term is applied to ships employed in carrying refined products, namely aviation spirit, motor spirit, kerosines and some grades of gas oil.

Compounding – A blending operation usually involving the addition of fatty oils to mineral lubricating oils.

Compression Ignition – Ignition in a diesel engine, in which the heat of compression ignites the fuel, in contrast to the spark ignition in a petrol engine.

Core – In rotary drilling, special bits are employed when required to cut cylindrical samples of the formations penetrated. These samples, known as "cores", are examined to obtain geological information.

Corrosion Fatigue – Metal fatigue accompanied and aggravated by corrosion.

Cracking – A process in which the feedstock is subjected to a high temperature for a limited time with the object of increasing the yield of light products, e.g. gasoline, at the expense of the heavier. Cracking processes are also the source of the olefins which are the intermediates in the manufacture of many petroleum chemicals. Sometimes a substance which promotes reaction, i.e. a catalyst is present. This has the effect of reducing the temperature at which cracking takes place and gives greater control over the reaction.

Cracking, Catalytic – A cracking process in which a catalyst is used to promote reaction.

Cracking, Thermal – A cracking process in which no catalyst is used to promote reaction, cracking being effected purely by the application of heat and pressure.

Crown-Block – An assembly of wire-line sheaves corresponding to the sheaves of the travelling block (*q.v.*) carrying the steel line on which the travelling block is suspended. It is mounted on the top of the derrick (*q.v.*).

Crude Assay – A procedure for determining the general distillation characteristics and other quality information of a crude oil.

Crude Oil – The oil produced from an underground reservoir, after being freed of any gas which may have been dissolved in it under reservoir conditions, but before any other operation has been performed on it. In the oil industry, simply termed "crude".

Cutback – Bitumen which has been rendered liquid by the addition of a suitable diluent such as white spirit, kerosine, or creosote. It is used as a means of incorporating bitumen with road-metal.

Cylinder Stock – Dark-coloured residual lubricating oil of high viscosity used as the basis of steam cylinder oil.

Deadweight Tonnage – *See* Tonnage (Ships).

Deasphalting – The removal of asphaltic constituents from residual stock for lubricating oil manufacture. It is a solvent refining process in which the asphalt is precipitated, usually by liquid propane.

Dehydrogenation – The removal of hydrogen from a chemical compound; for example, the removal of two hydrogen atoms from butane to make butylene, and the further removal of hydrogen to make butadiene.

Derrick – A steel pylon-like structure usually of sufficient height to permit the withdrawal of at least three connected 30 ft. lengths of drill pipe and capable of supporting the maximum load likely to be experienced during the drilling of the well.

D.E.R.V. Fuel – A term applied in the United Kingdom to types of gas oil suitable for use as a fuel for high-speed compression ignition engines. The term is an abbreviation of "Diesel Engine Road Vehicle".

Desalting – Removal of mineral salts (mostly chlorides) from crude oils.

Desulphurisation – The removal of sulphur or sulphur compounds from crude oil or its products.

Detergent Oil – A lubricating oil possessing special sludge-dispersing properties and used in some internal-combustion engines. These properties are usually conferred on the oil by the incorporation of special additives. A detergent oil has the ability to hold sludge particles in suspension as well as to promote engine cleanliness.

Dewaxing – The removal of waxes from lubricating oil stocks, now usually carried out by filtration at low temperature of a mixture of the oil and a solvent such as M.E.K. (methyl ethyl ketone).

Diesel Fuel – A general term covering oils used as fuel in diesel and other compression ignition engines. This term usually applies to fuels suitable for those engines of the industrial and marine type which have a low or medium rotational speed, and which are not so critical of fuel quality as are high-speed engines. Fuels for the latter need special descriptions, e.g. High-Speed Diesel Fuel, Automotive Gas Oil, or D.E.R.V. Fuel (*q.v.*).

Diesel Index – This is a figure calculated from the aniline point and specific gravity which is used as a rough indication of the ignition quality of a diesel fuel.

Dipping – The procedure employed to measure the depth of oil in a container – such as a tank. Measurements are normally made with a graduated steel tape, dip-stick, or dip-rod.

Dirty Oil Vessels – Sometimes referred to as "Black Oil Vessels". This term is applied to ships employed in carrying crude oils, fuel and diesel oils and some grades of gas oil.

Distillate – A product obtained by condensing the vapours evolved when a liquid is boiled and collecting the condensate in a receiver which is separate from the boiling vessel.

Distillation Range – A single pure substance has one definite boiling-point at a given pressure. A mixture of substances will, however, exhibit a range of temperatures over which boiling or distillation commences, proceeds and finishes. This range of temperature, usually determined at atmospheric pressure by means of standard apparatus, is termed the "distillation" or "boiling" range.

Doctor Test – A test for the presence in light distillates of a particular type of sulphur compound known as "mercaptans". The sample is shaken with a solution of sodium plumbite. If perceptible quantities of mercaptans are present the solution becomes brown and the sample is known as "doctor

positive". The coloration developed usually indicates inadequate sweetening.

Draw-Works (drilling) – An elaborated winch-type machine with cable-drums. Used for raising and lowering the travelling block (*q.v.*).

Drill Pipe – The steel pipe used for carrying and rotating the drilling tools and for permitting the circulation of the lubricating mud.

Drilling in (oil well) – A term applied to the operation of drilling into or in the actual producing formation.

Dry Gas – Petroleum gas from which the more easily liquefiable components have been removed, either naturally or by processing.

Earth Wax – *See* Ozokerite.

Edge-Water – The body of water underlying the oil and/or gas accumulation in anticlinal (*q.v.*) or similar structures.

Emulsifiable Bitumen – Bitumen to which compounds have been added in order to render it easily emulsifiable with water.

Emulsion – A dispersion of fine particles of one liquid in another. The tendency to do this is called "emulsibility".

Ethyl Fluid – The proprietary name for a brand of anti-knock compound containing tetra ethyl lead (*q.v.*) as the active constituent.

Extract – During solvent refining (*q.v.*) processes, other than dewaxing or deasphalting, part of the feedstock passes into solution in the solvent and is subsequently recovered by evaporating off the solvent. This fraction is the extract; it is generally aromatic in character (*cf.* Raffinate *q.v.*).

Extreme-Pressure Lubricant – A term which is applied to a lubricating oil or grease which contains a substance or substances specifically introduced to increase film strength, i.e. to increase the ability of an oil or grease to maintain the surfaces of highly loaded gears in a satisfactory condition.

Fault (geological) – A fracture along which the rocks on one side are displaced relatively to those on the other.

Fishing (drilling) – Operations concerned with the recovery of any piece of equipment lost in the hole; hence any such object is called a "fish".

Fixed-bed operation – A type of refinery operation in which the catalyst remains stationary in the reactor. The catalyst may be regenerated in place periodically.

Flash Point – The lowest temperature at which vapours arising from the oil will ignite momentarily (i.e. flash) on application of a flame under specified conditions.

Floating Roof – A special tank roof which floats upon the oil.

Fluid-bed Operation – A type of refinery operation based on the tendency of finely divided powders to settle in a gas stream of low velocity. The fluidised-powder technique involves suspending the finely divided powder in an upward-flowing stream of gas. This suspension has most of the characteristics associated with a true liquid and it can flow through pipes and valves, and will develop hydrostatic heads which allow it to flow from one vessel to another.

Flushing Oil – An oil or compound designed to remove used oil, decomposition products and dirt from lubrication passages, crankcase surfaces and moving parts of engines reached by the lubrication system.

Flux Oil – An oil of low volatility suitable for blending with bitumen, or with asphalt, to yield a product of softer consistency or greater fluidity. Selected residual fuel oils may be used for this purpose.

Fractional Distillation – *See* Fractionation.

Fractionation – A distillation process in which the distillate is collected as a number of separate fractions each having a different boiling range.

Fuel Oil – A general term applied to an oil used for the production of power or heat. In a more restricted sense it is applied to any petroleum product that is burnt under boilers or in industrial furnaces. These oils are normally residues, but blends of distillates and residues are also used as fuel oil. The wider term "Liquid Fuel" is sometimes used, but the term "Fuel Oil" is preferred.

Furfural extraction – A single-solvent process in which furfural (the aldehyde C_4H_3OCHO) is used to remove aromatic, naphthenic, olefinic and unstable hydrocarbons from a lubricating oil charge stock, thereby improving viscosity index and stability characteristics.

Gas Oil – A petroleum distillate having a viscosity and distillation range intermediate between those of kerosine and light lubricating oil. Its main uses are in the manufacture of gas for enriching ("carburetting") water gas, as a wash oil in the extraction of benzole from coal gas, and as a burner fuel in certain heating installations. Suitable gas oils are also used as fuels for high-speed diesel engines. (*See* D.E.R.V. Fuel.)

Gas-Oil Level or Contact (oilfield) – The level, referred to a convenient datum (usually sea-level), of the interface between a gas accumulation and the oil accumulation below it.

Gas/Oil Ratio (oilfield) – The quantity of gas produced with the oil, usually expressed as cubic feet per barrel of oil or as volumes of gas per volume of oil. Abbreviation: G.O.R.

Gasoline – A refined petroleum distillate, normally boiling within the limits of 30–200 °C and suitable for use as a fuel in spark-ignited internal-combustion engines. It is the normal term used in the U.S.A. to denote motor spirit (motor gasoline or just "gas") and aviation spirit (aviation gasoline or "Avgas"). In the UK "gasoline" normally denotes a petroleum spirit of distillation range 30–100 °C.

Gas Saturation Pressure (Bubble Point) – The pressure at which the dissolved gas content of the oil will begin to come out of solution at any given temperature.

Gear Oil – An oil suitable for the lubrication of gears. Gear oils vary in characteristics according to their specific application.

Geothermal Gradient (geological) – A measure of rise of rock temperature with depth below the surface. Usually expressed as °F per 1,000 ft.

Go-Devil – A device for cleaning out the bore of a pipe. It consists of a piston-type scraper which is usually pumped through the line.

Gravity – A common abbreviation usually meaning specific gravity (*q.v.*) in the UK and A.P.I. gravity (*q.v.*) in the USA.

H.D. Oil – The letters H.D. denote Heavy Duty, and have reference to the fact that these lubricating oils were originally developed for use in certain types of high-speed diesel engines and spark ignition engines subject to high piston and crankcase temperatures. H.D. oils combine the properties of detergency, resistance to oxidation, and relative freedom from corrosive action on alloy-type bearings. Normally H.D. oils contain special additives which confer those properties.

Heat Exchanger – Apparatus for transferring heat from one fluid to another. Specifically, a piece of equipment having a tubular piping arrangement which effects the transfer of heat from a hot to a relatively cool material by conduction through the tube walls.

Holiday – A term commonly used to indicate a portion of a surface unintentionally left uncoated.

Horton Sphere – A spherical, pressure-type tank used to store volatile liquids. Its purpose is to prevent excessive evaporation loss which occurs when such products are placed in conventional storage tanks.

Hydraulic Fluid – A fluid supplied for use in hydraulic systems. Low viscosity, low rate of change of viscosity with temperature, and low pour point (*q.v.*) are desirable characteristics. Hydraulic fluids may be of petroleum or non-petroleum origin.

Hydrocarbon Fermentation – The use of hydrocarbons as the source of carbon for the growth of micro-organisms. The term also extends to the use of hydrocarbons in processes where the primary objective is the production of an excretion product or specific internal component of the micro-organism.

C_3 Hydrocarbons – Any of the hydrocarbons of which the molecule contains three carbon atoms (propane and propylene).

C_4 Hydrocarbons – Any of the hydrocarbons of which the molecule contains four carbon atoms (butanes, butylenes and butadiene).

Hydrocracking – A process combining cracking, or pyrolysis, with hydrogenation. Feedstocks can include crude oils, residua, petroleum tars, and asphalts.

Hydrodesulphurisation – A desulphurisation process in which the oil is heated with hydrogen.

Hydrofining – A fixed-bed catalytic process to desulphurise and hydrogenate a wide range of charge stocks from gases to waxes. The catalyst consists of cobalt and molybdenum oxides on an extruded alumina support and may be regenerated *in situ* with air and steam, or flue gas.

Hypoid Lubricants – Types of extreme-pressure lubricants (*q.v.*) used for the lubrication of hypoid gears.

I.B.P. – Initial boiling-point. The temperature at which the first drop of distillate falls from the condenser during a laboratory distillation test.

Illuminating Oil – A petroleum fraction suitable for use in wick-fed or mantle-type lamps. Normally the term is synonymous with kerosine.

Inclinometer – In drilling operations, it is important to maintain the well-bore as near the vertical as possible. Special instruments, known as "inclinometers", have been devised to determine the magnitude and direction of deviations.

Inhibitor – A substance the addition of which in small amounts in a petroleum product prevents or retards undesirable changes taking place in the quality of the product, or in the condition of the equipment in which the product is used. In general, the essential function of inhibitors is to prevent or retard oxidation. Examples of uses include the delaying of gum formation in stored gasolines and of colour change in lubricating oils; the prevention of corrosion is also included, e.g. rust prevention by inhibitors in turbine oils.

Insulating Oil – Suitable petroleum distillates of low volatility and viscosity used for cooling and insulating purposes in electrical equipment such as circuit breakers, switches, transformers, etc.

I.P. – Institute of Petroleum. The official British organisation which deals with petroleum technology and with the standardisation of methods of test for petroleum.

Isomer – A compound having the same chemical composition and molecular weight as another but possessing a different molecular structure. The term is frequently used to differentiate branch-chain from straight-chain hydrocarbons.

Jet Engine – An engine which converts fuel and air into a fast-moving stream of hot gases which effects propulsion of the device of which the engine is a part.

Kelly (drilling) – A square hollow shaft of length slightly greater than that of the sections of drill-pipe (*q.v.*), which engages in the rotary table (*q.v.*), imparting rotation to the drill-pipe.

Kerosine – A refined petroleum distillate intermediate in volatility between gasoline and gas oil. Its distillation range generally falls within the limits of 150 °C and 300 °C. Its main uses are as an illuminant, for heating purposes, and as a fuel for certain types of internal-combustion engines. In the UK commonly but correctly termed "paraffin" or "paraffin oil"; the spelling "kerosene" is now officially obsolete. (*See* Power Kerosine.)

Killing a Well – The tendency of a well to flow can be overcome by filling the well-bore with fluid of suitable specific gravity, usually mud (*q.v.*).

Knock – The noise associated with self-ignition of a portion of the fuel-air mixture in the engine cylinder, ahead of the flame front.

Lake Asphalt – Natural asphaltic material occurring in surface deposits.

Lead Response – The increase in octane number of a motor or aviation spirit due to the addition of unit quantity of tetraethyl lead. Certain constituents, notably sulphur compounds, reduce lead response.

Light Distillate – A term lacking precise meaning, but commonly applied to distillates the final boiling-point of which does not exceed 300 °C.

Liquefied Gas – Light hydrocarbon material, gaseous at atmospheric temperature and pressure, held in the liquid state by pressure to facilitate storage, transport, and handling. Commercial liquefied gas consists essentially of either propane or butane, or mixtures thereof.

Manifold – A piping arrangement which allows one stream of liquid or gas to be divided into two or more streams, or which allows several streams to be collected into one.

Mercaptan – One of the organic compounds having the general formula R—SH, meaning that the thiol group, —SH, is attached to a radical such as CH_3, C_2H_5, etc. The simpler mercaptans have strong, repulsive, garlic-like odours which become less pronounced with increasing molecular weight and higher boiling points.

Methane – A light, odourless, flammable gas, CH_4; the first member of the paraffin series C_nH_{2n+2}; boiling point −151·4 °C. It is the chief constituent of natural gas. It is also often produced by the

partial decay of plants in swamps, so that its occurrence is not uncommonly misinterpreted as an indication of the presence of petroleum.

Middle Distillate – One of the distillates obtained between kerosine and lubricating oil fractions in the refining processes. These include light fuel oils and diesel fuel.

Motor Spirit – The normal British term used to indicate a fuel for spark-ignited internal-combustion engines, having an approximate distillate range of 30 °C to 200 °C. Equivalent terms are "gasoline", "petrol" and "motor fuel".

Mud (drilling) – In rotary drilling it is essential to remove the cuttings from the hole by circulating suitable pumpable fluids. These are usually mixtures of water and very finely divided material such as special clays, shales, barytes, etc.

Mud-Ring – When porous formation is encountered in rotary drilling, water may be lost from the drilling mud by filtration, leaving a ring of solid material on the walls of the hole at the point of filtration or repression.

Naphtha – A cut covering the end of the motor spirit and beginning of the kerosine range and frequently used as a feedstock for reforming processes. It is also known as "heavy benzine" or "heavy gasoline".

Naphthenates – The salts of naphthenic acids. Their uses include service as paint driers and as wood and textile preservatives.

Naphthenes – *See* Naphthenic Hydrocarbons.

Naphthenic Acids – Organic acids found in crude oils from certain sources. They have a characteristic unpleasant odour. Their main use is for the preparation of naphthenates (*q.v.*).

Naphthenic Hydrocarbons – Saturated hydrocarbons containing at least one closed ring of carbon atoms. The monocyclic ones, i.e. those containing one ring, have the formula C_nH_{2n}.

Natural Asphalts – Mixtures occurring in nature in which bitumen is associated with inert mineral matter.

Natural Gas – Gas found in certain localities issuing from the earth under pressure and often produced in association with crude petroleum, when it acts as an important factor in the recovery of the latter. Natural gas is usually classified as "wet" or "dry", depending on whether the proportions of gasoline constituents which it contains are large or small.

Natural Gas is also referred to as "Casinghead Gas".

Natural Gasoline – A low-boiling liquid petroleum product extracted from natural gas. In its "wild" or unstabilised condition it contains fairly high proportions of propane and butanes. The propane and part of the butanes are removed by certain processes, yielding a stabilised gasoline suitable for blending with other gasoline.

Natural Gasoline is sometimes referred to as "Casinghead Gasoline".

Observation Well – Special wells may be drilled in selected locations to allow observation of fluid levels, changes of pressure, etc. within the reservoir, as production proceeds.

Octane Number – The octane number of a gasoline is a measure of its anti-knock value. The higher the octane number, the higher the anti-knock quality of the gasoline.

This quality is determined in a standard engine by matching for detonation the gasoline under test against a mixture of *iso*-octane and *normal*-heptane, both pure hydrocarbons, the percentage by volume of *iso*-octane in that mixture being noted as the octane number. (See p. 172 for more detail).

Oil Shale – A rock of sedimentary origin, with an ash content of more than 33 per cent; the contained organic matter yields oil when destructively distilled, but not appreciably when extracted with the ordinary solvents for petroleum.

Permeability – The degree to which a rock will allow liquid or gas to pass through it.

Petroleum Ether – A special boiling-point spirit (*q.v.*) of high volatility and narrow distillation range, e.g. 40-60 °C or 60-80 °C, used in the extraction of edible oils, etc., and for laboratory analytical work.

Petroleum Resins – Solid or semi-solid resinous products obtained mainly by the distillation of special crude oils or lubricating oil extracts. They are used as substitutes for natural resins in paints, etc. where asphaltic bitumen would be unsuitable because of its dark colour.

P.F.D. (Primary Flash Distillate) – The total distillate from the primary column. This is subsequently separated into gas and gasoline, the latter being blended into motor spirit.

Pitch – This is a generic term covering materials obtained as residues from the distillation of coal tar. It should not be used to describe petroleum products.

Platforming – A refining process using a platinum-containing catalyst which includes 0·1 to 8·0 per cent of fluorine or chlorine on an alumina base.

Polymerisation – The combination of identical molecules to form larger molecules, known as "polymers". Typical polymers range from di*iso*butylene, a light liquid, to poly*iso*butylene, a rubber-like material.

Polymers – *See* Polymerisation.

Porosity (geological) – The proportion of a rock's total volume occupied by the voids between the mineral grains.

Pour Point – The pour point of a petroleum oil is the lowest temperature at which the oil will pour or flow when it is chilled without disturbance under prescribed conditions.

Power Kerosine – A volatile kerosine with distillation limits essentially between 150 °C and 260 °C and of good anti-knock value. It is used as a fuel for some spark-ignited engines, e.g. tractors, and is alternatively known as "Vaporising Oil".

Pressure Distillate – The untreated distillate product of thermal cracking (*q.v.*).

Propane – A hydrocarbon gas (C_3H_8), useful for heating and metal cutting and flame-welding purposes. It can be stored under pressure as a liquid at atmospheric temperatures but is more volatile than butane, and high pressures are required to keep it in liquid form. By reason of its chemical composition it is classed as a C_3 hydrocarbon (*q.v.*).

Raffinate – The refined product resulting from a solvent refining process (*cf.* Extract, *q.v.*).

Recycling (oilfield) – The practice of returning to the underground reservoirs such refinery products as are temporarily out of market balance.

Recycling (refining) – The procedure of recirculating those portions of a feedstock which have passed unchanged through a refining process. The term is also used to describe the continuous returning of unwanted by-products to the process.

Reforming – A process in which straight-run feedstocks, e.g. benzines or naphthas, are subjected to high temperatures and pressures with the object of changing their chemical structure in such a way as to increase their octane number (*cf.* Cracking *q.v.*).

Reforming, Catalytic – Reforming in which reaction is promoted by a catalyst.

Reforming, Thermal – Reforming without the use of a catalyst.

Reid Vapour Pressure – The vapour pressure (*q.v.*) of petroleum products, e.g. motor spirit, measured at 100 °F in the Reid apparatus and reported in pounds per square inch.

Repressuring (oilfield) – The injection of gas into a reservoir for the purpose of maintaining or restoring reservoir pressure.

Reservoir-Rock (geological) – A porous and permeable rock, e.g. sandstone or limestone, which contains petroleum in quantity.

Residue (Residuum) – The material remaining as unevaporated liquid or solid from processes involving distillation or cracking.

Road Oil – An oil intended for cold application to road surfaces for binding and waterproofing purposes. Petroleum residues and light cutbacks (*q.v.*) are among the products used as road oils.

Rotary Drilling – In this system, the rock formation is penetrated by a rotating bit connected to a hollow drill-pipe (*q.v.*) through which fluid is pumped to convey the rock cuttings to surface.

Rotary Table – A heavy geared circular steel body having a square hole cut at its centre, for engaging and rotating the drilling string. The table rotates in the horizontal plane and is normally driven by chains from the draw-works (*q.v.*).

Seepage (geological) – Prolonged erosion of the formations overlying a petroleum accumulation may permit gas and/or oil to seep to the surface.

Shale Oil – The distillate obtained when oil shale is heated in retorts.

Shooting (oil well) – In order to facilitate the flow of oil towards the well-bore, explosive charges are sometimes lowered into the well and fired opposite the producing formation with a view to fracturing or shattering it.

Show (drilling) – An indication of the presence of gas, oil or water in the formations penetrated during drilling.

Side-Tracking – Difficult fishing operations (*q.v.*) sometimes necessitate the deflection of the borehole to avoid the fish. The operation, carried out by means of a whipstock (*q.v.*) and special drilling tools, is known as "side-tracking".

Single-Flash – A term applied to the sudden release of gases and/or vapours from oil as opposed to removal in a number of stages.

Sludge – (*a*) Acid Sludge. Material of high specific gravity formed during the chemical refining treatment of oils by sulphuric acid, and usually separable by settling or centrifuging. Also known as Acid Tar.

(*b*) Engine Sludge. The insoluble degradation product of lubricating oils and/or fuels, formed during their use in internal-combustion engines and deposited from the oil on to engine parts outside the combustion space. Water may or may not be present in such material.

(*c*) Tank Sludge. Material which collects at the bottom of storage tanks containing crude oils, residues, or other petroleum products. Such sludge usually contains water (*see* B.S. & W.).

Slush Pump – The pump used for circulating the drilling fluid.

Solar Oil – The term formerly applied to gas oil (*q.v.*). The term derives from the original use of a light distillate oil for the production of illuminating gas by direct cracking.

Soluble Cutting Oil – A blend of mineral oil and emulsifiers. When mixed with water in the right proportions it forms a dispersion suitable for use as a cutting fluid for metals, e.g. on a lathe.

Solvent Extraction – Processes in which solvents are used to dissolve out undesirable constituents, e.g. the removal of aromatics from kerosine by extraction with liquid sulphur dioxide.

Solvent Refining – Processes in which solvents are used to eliminate undesirable constituents either by dissolving them out, i.e. solvent extraction, or by precipitating them as in solvent dewaxing and solvent deasphalting.

Sour Crude – Crude oil containing appreciable amounts of hydrogen sulphide and mercaptans.

Sour Gas – Hydrocarbon gas containing undesirable sulphur compounds, sulphuretted hydrogen and methyl mercaptan.

Special Boiling-Point Spirit – A petroleum solvent fractionally distilled to specially selected distillation characteristics. Such distillates are normally manufactured from well-refined straight-run naphthas. The various volatilities are designed to enable a suitable grade to be chosen for any particular industrial purpose.

Specific Gravity – The ratio of the weight of a given volume of substance to the weight of an equal volume of water at the same specified temperature, normally 60 °F.

Spindle Oil – Originally used to describe a stable low-viscosity oil used in the lubrication of textile spindles. The term now includes any low-viscosity mineral lubricating oil.

Stabilised Gasoline – Gasoline after subjection to fractionation by which the vapour pressure has been reduced to a specified maximum. (*See also* Natural Gasoline.)

Steam Cylinder Oil – Oil used to lubricate the cylinders of steam-engines. Usually dark, viscous petroleum oils of high flash point, sometimes compounded with fatty oil.

Straight Run – Produced directly from crude oil by distillation but not cracked or reformed.

Structure – When used in petroleum geology, this term is usually understood to denote a fairly large arching or flexure of rocks in a sedimentary series such that conditions favourable for the accumulation and trapping of oil and gas could be present. The majority of oil geologists would probably equate structure with an anticlinal or domal situation with dimensions of at least several miles. In the pure geological sense the term is applied to the texture or form of rocks involving dimensions of inches or feet – a quite different conception altogether.

Sweet – Products which give a negative result in the Doctor Test (*q.v.*).

Sweet Gas – Hydrocarbon gas free from sulphur compounds.

Sweetening – Any treatment which renders a sour product sweet (*q.v.*), e.g. Doctor Treatment, Hypochlorite Treatment or Copper Sweetening.

Swivel (drilling) – A connection made to the top of the kelly (*q.v.*) through which the drilling fluid is pumped. A heavy steel link (the bail) is used to suspend the drilling string from the hook while internal thrust-races and glands permit rotation of the bottom connection.

Syncline (geological) – An earth-fold in which the strata are depressed in the form of a basin.

Tar – A term sometimes used to describe heavy liquid residues derived from petroleum processes. The word "tar" usually indicates the black viscous liquid resulting from the distillation of solid material such as coal or wood.

T.E.L. – Tetra Ethyl Lead (*q.v.*).

Tetra Ethyl Lead – A colourless stable liquid obtained commercially by the action of lead-sodium alloy on ethyl chloride. When added in small proportions to motor spirit it increases the octane number (*q.v.*). For this purpose, tetra ethyl lead is used in the form of ethyl fluid.

Tonnage (ships) – By international agreement, Merchant vessels are measured in tons of 100 cu. ft., the resultant tonnage being termed Gross Tonnage. Deductions are made from this figure in respect of engine-room and bunker spaces, accommodation, etc. to arrive at the Net Register Tonnage. In the commercial employment of Merchant vessels, particularly tankers, the tonnage figure usually referred to is the Deadweight Tonnage. This figure represents the total carrying capacity of the ship in tons of 2,240 lb. when loaded to summer marks, viz. when loaded to the appropriate freeboard during the summer season. To arrive at the weight of cargo carried, it is necessary to deduct bunkers, stores, water, etc. While there is not necessarily any relationship between the Deadweight Tonnage and the Gross or Net Tonnage – in the case of tankers the approximate summer deadweight figure may be taken as two and a half times the Net Register Tonnage. Conversely the Gross Tonnage may be taken as approximately two-thirds of the Deadweight Tonnage.

Topped Crude – Crude oil from which some of the lighter constituents have been removed by distillation.

Topping Plant – Distillation equipment employed for the removal of the volatile fractions of an oil.

Transformer Oil – A well-refined pale petroleum distillate of low viscosity, resistant to oxidation under conditions of use. Used in transformers for cooling and for electrical insulation.

Travelling Block – An assembly of wire-line sheaves to which is attached a heavy steel hook used in conjunction with the crown-block (*q.v.*) to obtain mechanical advantage in raising or lowering the drilling string or casing.

Treatments – Somewhat loosely used to cover all those refining operations where small proportions of undesirable constituents are removed from products by chemical or physical means, e.g. acid treatment and sweetening (*q.v.*).

Turbine Oil – A well-refined specially selected petroleum distillate or mixture of such with a bright stock. Used for the lubrication of steam turbines. These oils show high resistance to emulsification with water and to oxidation under conditions of use.

T.V.O. (Tractor Vaporising Oil) – The trade name of the vaporising oil or power kerosine sold by Shell-Mex and BP Ltd.

Ullage – The empty space above the liquid in a tank or similar container. It is estimated by measuring the distance from the top of the container to the surface of the liquid held in the container.

Uplift – The total quantity of fuel supplied to an aircraft at one refuelling.

Vaporising Oil – *See* Power Kerosine.

Vapour Pressure – The pressure exerted by the vapour escaping from a liquid. As the temperature of the liquid rises its vapour pressure increases; eventually it exceeds the pressure of the confining atmosphere and the liquid boils. In the petroleum industry vapour pressures are usually reported as "Reid Vapour Pressure" (*q.v.*).

Visbreaking – Viscosity breaking; lowering or "breaking" the viscosity of residue by cracking at relatively low temperatures.

Viscosity – That property of a fluid which determines its rate of flow. As the temperature of a fluid is increased its viscosity decreases and it therefore flows more readily.

Viscosity Index – An arbitrary number used to characterise the rate at which the viscosity of a lubricating oil changes with changing temperature. Oils of high viscosity index exhibit relatively small change of viscosity with changing temperature and vice versa.

Volatility – The ease with which a product begins to vaporise. Volatile substances have relatively high vapour pressures and therefore boil at relatively low temperatures.

Wash Oils – Petroleum fractions employed for the absorption of the heavier easily liquefiable components of a mixture of gases.

Weathering – A term applied to the loss of light petroleum fractions by exposure of the oil containing them to the atmosphere.

Wet Gas – A gas mixture containing easily liquefiable components.

Wetting Agent – A substance which, when added in small amounts to a liquid, increases the rate at which that liquid spreads across a surface or penetrates porous material.

Whipstock – In drilling operations it may be necessary to deflect the direction of a borehole. This is accomplished by inserting a long cylindrical steel billet with a tapering face cut at the desired angle to the vertical, from which the bit is deflected when drilling is resumed.

White Oils – A term applied to oils substantially colourless and without bloom made from light lubricating oils by a drastic process of refining. They have various uses, such as for medicinal purposes and in the manufacture of toilet preparations. The term is also used in the expression of "White Oil Ships", in which case, light-coloured petroleum products up to gas oil are meant.

White Products – A term applied to the more volatile petroleum products, such as gasoline, white spirit, kerosine (*q.v.*). It is not to be confused with the term "White Oils".

White Spirit – A refined distillate intermediate in distillation range between gasoline and kerosine (i.e. with a distillation range of about 150–200 °C). It is used as a paint thinner and for dry cleaning, etc. The term "mineral turpentine" or "turpentine substitute" is sometimes used for white spirit, but is not recommended, owing to possible confusion with gum turpentine. In the USA the term "petroleum spirits" is used for white spirit.

Wild-Cat – A term used to indicate a well which has been drilled without a complete geological exploration of the locality.

Wild Gasoline – This indicates a light petroleum spirit containing appreciable quantities of material which are normally gaseous at atmospheric temperatures and pressures, i.e. an unstabilised gasoline.

Work-over (oil well) – A term applied to any operation performed on a well subsequent to completion.

Xylene – Colourless liquid, $C_6H_4(CH_3)_2$, of the aromatic group of hydrocarbons made by the catalytic reforming of certain naphthenic petroleum fractions. Used as high-octane motor and aviation spirit blending agents, solvents, and chemical intermediates. Isomers are metaxylene, orthoxylene and paraxylene.

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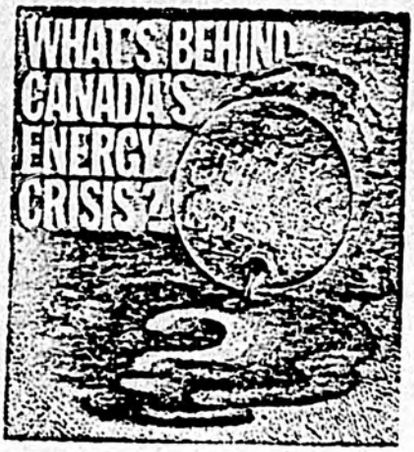

omar

Beverly Isenson
Executive Director

The Organization for the Management of Alaska's Resources, Inc.

Suite 101C, 445 W. 4th Ave.
(907) 278-9615

Box 516
Anchorage, Alaska 99510

Canada's energy crisis:

A bizarre tale of bungling

By DAVID CRANE
Star political editor

A diverse group of Canadians will crowd into the ornate ballroom of Ottawa's Chateau Laurier hotel later this month for a meeting that will vitally affect this nation's future.

The group will include Indians and Eskimos, lawyers, scientists, financiers, engineers, government officials and oil and gas executives.

They will be assembling—on Oct. 27—for the opening session of National Energy Board hearings into proposals for a natural gas pipeline to be built at a cost of billions of dollars along the Mackenzie River valley in Canada's far North.

Many of those who turn up on opening day will probably spend much of the next 12 months there. That's how long it is expected to take the energy board to work its way through the complicated and controversial proposals for the biggest investment project in Canada's history.

Behind the pipeline controversy—and Canada's sudden transition from an apparently energy-rich nation to one searching anxiously for new oil and gas reserves—lies a bizarre tale of bungling and hypocrisy in Ottawa, of how the Trudeau government grossly miscalculated Canada's energy resources, of how it exercised power, not in Canada's interest, but in the interests of the U.S. and the oil and gas industry.

Parliament often didn't know

This is what emerges from confidential government files made available to The Star. This new material, along with information already on the public record, shows how a number of far-reaching decisions on energy policy were made in Ottawa between 1968 and 1972, though Parliament and the public were only dimly aware of what was going on. Much of the material is based on The National Interest, a new book by Prof. Edward Dosman, chairman of the political science department at York University, to be published by McClelland and Stewart later this year.

The material shows how the Trudeau government, while paying lip service to native rights and concern for the environment, was pressing hard for resource development, largely under foreign ownership and subsidized under generous tax and other concessions.

It was in 1968, after Atlantic Richfield Co. sent out the dramatic news of a major oil and gas find at Prudhoe Bay in Alaska, that the Trudeau government became aware of the North and its possibilities.

The Alaskan discovery, although no one realized it at the time, would soon have a far-reaching impact on future Canadian energy policy.

A seemingly unlimited supply

Canada reacted by promoting a more rapid export of existing oil and gas reserves, pushing hard for a continental energy policy, with rapid pipeline development in the North and accelerated oil and gas exploration.

The Trudeau cabinet accepted the oil and gas reserve figures of the Canadian Petroleum Association, which showed the country with a seemingly unlimited supply of oil and gas, and feared the new Alaskan discoveries would curtail sales of Canadian energy to the United States.

By actively promoting northern pipelines the cabinet and Ottawa's senior civil servants believed they could more closely link Canada's oil and gas reserves into the U.S. market.

During the crucial 1963-1973 period the public was kept in the dark on the key decisions being made in Ottawa, while behind closed doors senior government officials and the oil and gas industry collaborated to develop oil and gas in the North for the U.S. energy market.

Glowing industry estimates

Over the five-year period, Ottawa:

—Decided Canada would need oil and gas pipelines along the Mackenzie Valley, carrying both Alaskan and Canadian oil and gas, to assure a market for northern Canadian oil and gas in the United States.

—Talked to the Nixon administration about long-term commitments of Canadian oil and gas to the U.S. market. Canadian concerns about adequate supplies for this country's needs were discounted in favor of glowing estimates from the Canadian Petroleum Association. In 1970 the government approved the largest natural gas export contract in Canadian history.

—Committed hundreds of millions of dollars in public money to facilitate the construction of oil and gas pipelines.

—Showed itself willing to ignore environmental risks in the delicate ecology of the North in its single-minded bid to accelerate oil and gas exploitation in the Arctic Circle.

—Rejected demands by native people for settlement of their long-standing land claims before pipelines were built and oil and gas flowed, and showed little concern for Indian and Eskimo fears of loss of their traditional way of life, their culture and other social problems arising from massive resource development in the north.

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—Hesitated in asserting Canadian sovereignty in the Arctic because it did not want to upset Washington.

From 1968 to 1973 the Trudeau government worked to make northern Canada a part of the North American economy.

Gross misreading

Believing in the existence of a vast treasurehouse of resource riches, the government pushed for increases in Canadian oil and gas exports to the United States.

Today, Canada finds itself faced with the prospect of oil and natural gas shortages before long, mainly because of Ottawa's gross misreading of Canada's energy situation in the late 1960s and early 1970s. And it is the consumer who now must pay the price.

The big U.S. oil discoveries in Alaska caught Ottawa unprepared.

Senior officials and cabinet ministers responsible for energy feared Canadian oil exports to the United States would be drastically reduced. To counter this, they made reckless proposals to the Nixon administration that Alaskan oil be carried through a Canadian pipeline to the U.S. midwest.

This way, they hoped, the search for oil would accelerate in the Canadian north and the United States would agree to import more Canadian oil as well.

Whether by agreement or not, the construction of an oil pipeline would integrate Canada's northern oil revision of the late 1950s, northern sources into U.S. markets.

In spite of Canada's own interest in northern development dating back to at least John Diefenbaker's northern vision of the late 1950s, northern development policy in Canada in 1968 was a mess.

The big international oil companies had staked claims to most of the geophysically attractive land and offshore regions.

But there was no plan for northern development. Instead there was administrative chaos, a distinct lack of cabinet interest and a vague hope that exceedingly generous incentives for exploration and development would eventually lead to massive resource development.

The cabinet got most of its advice from the Advisory Committee on Northern Development, a committee of senior civil servants under the chairmanship of the deputy minister of Indian Affairs and Northern Development. Between 1964 and 1969 it met only five times.

The Department of Indian Affairs and Northern Development had the most direct responsibility for the north. But it suffered from conflicts of interest.

It was supposed to be concerned with the needs of the native people in the north and with the protection of the northern environment, on the one hand, and with promoting resource development on the other. Senior officials of the department, as well as their minister, Jean Chretien, were mainly concerned with resource development.

The department saw its job as assisting the petroleum and mining companies in the north, leaving the setting of investment priorities to private industry. This way, the department hoped, jobs and economic activity would be created in the north and the natives would be happy.

As a result of this philosophy, the oil and gas industry gained enormous leverage in Ottawa's policy process. It had access to confidential information and government thinking that was denied other groups, including Parliament itself.

At the same time, the oil and gas industry gained the active collaboration of goverment officials in Indian Affairs and Northern Development, Energy, Mines and Resources, Transport and the National Energy Board, in assisting and approving their projects.

So when the northern oil rush began, an ill-prepared Trudeau cabinet and senior government officials were confronted by sophisticated big-league oil and gas companies controlled mainly in the United States, and by an ambitious Nixon administration that wanted a continental energy deal with Canada.

As a first step the government had to find some new way to deal with northern oil and gas policies.

In December, 1968, the government announced the establishment of the Task Force on Northern Oil Development. Its chairman was to be the deputy minister of Energy, Mines and Resources.

Named senator

At the time this was Claude Isbister (today he is chairman of Ontario's one-man royal commission into investigating oil prices). After May, 1970 it was Jack Austin, an ambitious Vancouver mining lawyer who recently was named a senator after being rejected by the government as a candidate to head Canada's government-owned oil company, Petro-Can. (Maurice Strong, currently head of the United Nations Environment Secretariat, is now expected to head Petro-Can.)

The other members of the task force included Robert Howland, chairman of the National Energy Board, Digby Hunt, assistant deputy minister of Indian Affairs and Northern Development, and Gerald Stoner, deputy minister of Transport. Robert Shaw, deputy minister of the Department of the Environment joined later.

The job of the task force was to plot Canada's reaction to the Alaska oil and gas rush.

It became incredibly powerful, but no one in Ottawa worried about its inherent conflicts of interest. For example, Howland was a member of the task force secretly urging strong efforts by Canada to get oil and pipelines built through Canada. Yet as chairman of the National Energy Board, he would have to hold impartial public hearings to determine whether such a pipeline should be built.

The task force, for the next four years, became the main source of energy policy proposals for the Trudeau cabinet. It was also the main contact between the government and the oil and gas industry. All of its work was secret.

The task force was created in an atmosphere of panic. The influential Interdepartmental Committee on Oil, responsible for energy relations with the United States, believed the Alaskan oil discoveries represented a serious threat to the Canadian oil industry and might even allow the United States to achieve near self-sufficiency in oil.

If this happened, it was feared, it would drastically reduce Canadian oil exports to the United States and lead to a drastic reduction of oil and gas industry investment in Canada.

The underlying assumption by the experts in Ottawa in 1968 was that Canada had plentiful oil supplies and that the country's most urgent need was to find export markets for its oil.

Yet in 1974, Ottawa would be forced to impose export controls on oil because the country faced the prospect of shortages.

The chief objective of Canadian energy policy was to overcome U.S. oil import restrictions.

Thus Canada argued with Washington that it was a reliable and secure source of long-term oil supplies. And, starting in 1969, Canada linked future supplies of natural gas, which the U.S. needed, with oil exports. More U.S. oil purchases, Canada argued, would lead to more oil and gas exploration and hence additional Canadian natural gas for the United States.

Two markets

Canadian oil policy since 1961 had divided the country into two markets. One, to the west of the Ottawa Valley, could use only Canadian oil from the western provinces. The other, east of the Ottawa Valley, used imported oil from Venezuela and the Middle East.

Unless Canada changed its oil policy to ship western oil to Quebec, the only other outlet for prairie production was the U.S. market. Canada opted for policies to boost oil exports and decided against shipping Canadian oil east to Montreal and Quebec City.

It was against this background that the task force set to work on four assignments.

The first, under Howland's direction, was to assess the feasibility of an oil pipeline from Alaska to the United States through the Mackenzie Valley.

The second, under Stoner at Transport, was to assess the feasibility of using oil tankers to carry crude oil to the United States and Europe through Canada's northwest passage.

The third, under Energy, Mines and Resources and assisted by the energy board, was to assess the impact of Alaska's oil discoveries on North America's oil supply and demand outlook, including the impact on Canada's oil industry.

The fourth, under Gordon Taylor of Finance, was to assess the costs and benefits to Canada of different energy policies.

But, in fact, the chief purpose of the task force quickly became the promotion of a Mackenzie Valley corridor for oil and gas pipelines.

And this in turn became the principal objective of both Canadian energy policy and Canada's plans for northern development.

The thinking was that if a trans-Canada route for Alaska's oil was chosen, it would improve Canada's bargaining position with the United States, even though it would lock Canada even more closely into a continental energy arrangement.

Within five years, as Canada's shortage of energy resources became evident, these considerations would be irrelevant.

But in 1968-1972 they were all-important. No one in Ottawa had time for anyone who had second thoughts about what turned out to be a tragically flawed policy.

Meantime, Prime Minister Pierre Trudeau had visited Washington in March, 1969 where he and President Nixon arranged for senior Canadian and U.S. officials to hold further discussions on energy.

The stage thus was set for Canada's all-out efforts to promote oil and gas pipelines down the Mackenzie Valley and to promote massive development of oil and gas reserves in the north.

Six years later Mr. Justice Tom Berger, sitting at the head of an inquiry in northern Canada into the social and environmental impacts of a natural gas pipeline, was to suddenly realize what in fact the government had asked him to study—not simply the impact of a gas pipeline on the Mackenzie Valley, but plans for a series of gas and oil pipelines that would be built, one after the other, over the next 15 years.

Under present plans by the oil and gas industry, an application for an oil pipeline will probably be filed in 1976, with construction to start as soon as the first natural gas pipeline is built. After that the capacity of the first gas pipeline would be expanded, creating through looping a second gas pipeline. Then it would be time to loop the oil pipeline, thus creating a second oil pipeline.

Up to 2 years

What this means, Berger said at his own hearings late this summer, is that the North would face "a construction project that might well last over a period of 10 or 15 or even 20 years.

But nobody had ever asked the northerners if this was what they wanted or asked the public, through Parliament, whether this was really in the national interest.

Those decisions had already been made by a handful of senior civil servants and members of the Trudeau cabinet.

THEY MADE THE BIG DECISIONS ON NORTHERN OIL, GAS POLICY

oe Greene, Minister of Ener- Mines and Resources until ly 1972, favored a continental and gas deal with the United tes. He feared Canada would e out if it imposed stiff condi- s on exports. The tough job once said, is "getting sales." had unbounded faith in the nadian Petroleum Associa- n's estimate of seemingly end- s oil and gas reserves. Greene, w a senator, was replaced by nald Macdonald, who contin- these policies until it became ar they were wrong.

• Jean Chretien, Minister of Indian Affairs and Northern Development until early this year, spent much of his time seeking European and U.S. investment to speed northern development. He caught the pipeline fever early, and described plans for oil and gas pipelines as "an adventure of social and economic impact rivalling the construction of the Canadian Pacific Railway." In a speech in Dallas seeking foreign U.S. oil investment he said, "the Canadian North can be regarded as one of the underdeveloped regions of the world."

• Robert Howland, former chairman of the National Energy Board, was responsible for impartial hearings on oil and gas pipelines. He also looked after Canadian oil exports to the United States, played a crucial role in the Task Force on Northern Oil Development, was part of the senior civil service team that tried to persuade the U.S. oil and gas industry to build pipelines along the Mackenzie Valley, and advised the cabinet on energy policy. He resigned in 1973 at about the time the federal cabinet realized the country was following the wrong energy plicies.

ack Austin, former deputy ster of Energy Mines and ources, who headed the Task e on Northern Oil Develop- t and pushed aggressively for hern oil and gas pipelines. In eech to the Canadian Bar As- ation not long before he was ed the job, Austin termed the hatian voyage through the idian north "a grave threat e well-being of the Cana- oil and natural gas industry to the confidence of those in da who believe in continen- concept of natural resource ng."

• Digby Hunt, assistant deputy minister of Indian Affairs and Northern Development, was responsible for northern resource development, northern environment and social planning in the north. Hunt is also a director of Panarctic Oils Ltd., the government-controlled oil and gas exploration company. He has favored oil and gas development over environmental and native issues. He was also a member of the Task Force on Northern Development.

(4)

Canada feared to tell U.S. North is ours

★ A few years ago, Canada's oil and gas resources seemed almost limitless and Ottawa was trying to sell more to the United States.

Today, we're cutting back oil sales to the U.S. and Canada is suddenly aware we may not have enough oil and gas for our own use during the 1970's.

Why? How could Ottawa have been so wrong? Confidential government files, recently available to The Star, show how the Trudeau government grossly miscalculated in estimating Canada's energy resources, and exercised power, not in Canada's interest, but in the interests of the U.S. and the oil and gas industry.

This is the second in a series. Much of the material in it is based on The National Interest, a book by Professor Edgar Dosman, a York University political scientist, to be published later this year by McClelland and Stewart.

By DAVID CRANE
Star political editor

No issue illustrates more clearly how ill-prepared Ottawa was to deal with the challenge of the North after the huge Alaska oil finds in 1968 than the sovereignty crisis that emerged soon afterwards in Canadian-American relations.

The sovereignty issue was quickly create a major strain in relations with the United States, one that the new Trudeau government and Ottawa's senior civil servants did not know how to cope with.

The challenge came with the announcement by Humble Oil late in 1968 that it planned to send the tanker Manhattan through the Northwest Passage the following summer to test the feasibility of moving Alaska oil to the U.S. east coast in tankers. Moreover, the U.S. Coast Guard announced that it would participate in the project.

Lacked clear view

Canada had no contingency plan to deal with this challenge. The External Affairs Department lacked a clear view of Canadian sovereignty in the North, although the department had been highly sensitive to the big U.S. presence in there since 1945.

The Advisory Committee on Northern Development, a key group of senior civil servants who advised the cabinet on northern policy, had anticipated the problem.

At a meeting in December, 1967, it had noted the accelerating hunt for oil and gas on Arctic lands and said this hunt would spread to northern waters as well. It saw that Canada had no controls on northern shipping and planned to set up a committee with the Departments of External Affairs and Defence to study this but the committee never met.

At another meeting, in June 1968, the advisory committee saw the Alaska oil discoveries as good news for Canada and was pleased by U.S. Coast Guard interest in the North.

But at a meeting a few months later, in December, 1968, these key officials who advised the cabinet on the north realized that Canada was facing a challenge to its sovereignty and that no one knew how to deal with it.

The crisis itself was caused by the U.S. Coast Guard decision to send an icebreaker with the Manhattan, without seeking permission from the Canadian government. It was one matter for the oil companies to send a tanker through the Northwest Passage. It was quite another for the U.S. government to do so.

The immediate response of the Trudeau government was to suggest to the U.S., through the External Affairs Department, that it apply for permission to send its Coast Guard vessel through the Northwest Passage.

Ignored suggestion

But the United States ignored Canada's suggestion, since a request for permission would imply acceptance of Canada's sovereignty.

The United States viewed the Northwest Passage as an international strait linking the Atlantic and Pacific Oceans, an important waterway that formed part of the high seas that could be used by its navy and commercial fleet. Canada saw the passage as an internal Canadian waterway.

In the U.S. view, no country had sovereignty more than three miles from shore, and this included the Arctic.

At the December 1968, meeting of the Advisory Committee on Northern Development, senior officials worked out a strategy for the cabinet: Canada should try to ensure sovereignty by co-operating with the United States and trying to become part of the project. One step would include the use of the Canadian icebreaker, the John A. Macdonald, in the Manhattan voyage.

The officials also suggested that Canada propose the use of Coast Guard vessels from both countries in each other's waters.

Ottawa's senior officials wanted to avoid a direct confrontation with the Nixon administration over the sovereignty issue, as well as to avoid within Canada any suggestion there was a challenge to Canadian sovereignty in the Manhattan voyage.

Moreover, concern over future oil sales to the United States made Ottawa wary over getting into an open dispute.

But Ottawa was now faced with a dilemma. Talks between the two countries seemed out of the question since they would be most likely to lead to confrontation.

In a sense, External Affairs hoped the issue might just go away. By achieving a reasonable level of Canadian participation in the Manhattan voyage it was hoped it could protect Canada's interests without direct diplomatic exchanges.

Ottawa believed the working relationships with the U.S. oil companies and Coast Guard could be taken as positive signs that the United States accepted Canada's jurisdiction, although the U.S. state department was explicitly to reject this notion.

Questions certain

But Ottawa had to deal with Parliament as well. With all the publicity surrounding the Manhattan voyage, questions were bound to be asked.

And they were. However, the cabinet decided to deny the existence of a challenge and to reassure the public instead.

An article by an Arctic expert published in The Globe and Mail in February, 1969, suggesting that the government was being inactive in the face of a direct challenge from the United States, caused near panic in External Affairs.

To prepare for a flurry of questions in the House of Commons, External Affairs worked out a set of answers for Mitchell Sharp, the minister. He was advised to restrict himself to three points:

- He should say he was not aware of any U.S. attempt to discourage Canadian participation in the Manhattan project.
- He should say there was no foundation for any suggestion the United States was challenging Canadian sovereignty in the Manhattan trials.
- He should point out that the U.S. oil industry had requested the co-operation of Canadian authorities.

One unforeseen result was that Washington interpreted this kind of approach as a sign of weakness on the government's part, which to the Nixon administration meant that Canada might be willing to compromise. If Canada had wanted to assert its sovereignty, it would have done so from the start, Washington probably reasoned. By delaying, it showed its fear of the United States.

At about this time External Affairs circulated a set of confidential briefing notes to the Trudeau cabinet and senior officials.

Diefenbaker stand

These notes referred to the stand former prime minister John Diefenbaker had taken in 1958 on the North, when his government had said: "The waters between the islands, and the areas beyond, are looked upon as our own, and there is no doubt in the minds of this government, nor do I think in the minds of former governments of Canada, that this is national terrain."

They also referred to former prime minister Lester Pearson's unsuccessful bid, in 1964, to establish Canadian sovereignty, clearly over the Arctic waters.

According to the briefing material, the U.S. state department had now? Uncertainty was not confined to the government's senior officials.

The cabinet and the Liberal caucus in Parliament were uncertain. They knew the Canadian public would emphatically reject a "North American Arctic."

Thus the search was on for a minimal Canadian position, one that would retain the concept of Canadian Arctic waters without producing a serious strain in Canadian-U.S. relations.

Through the early months of 1969 it became increasingly clear the Trudeau government would have to say something. There was continued U.S. silence toward Canadian signals for co-operation and there was growing awareness of the issue in Canada.

Finally, on May 15, 1969, Trudeau in the House of Commons stated Canada's position. But it was a weak speech and at one point appeared to back away from Diefenbaker's 1958 assertion of sovereignty over Arctic waters.

Trudeau told the MPs: "Not all countries would accept the view that waters between the islands of the archipelago are internal waters over which Canada has full sovereignty."

Opposition MPs were astounded that Trudeau would admit to any doubt over Canada's sovereignty.

"The contrary view," Trudeau said, "is indeed that Canada's sovereignty extends only to the territorial sea around each island."

MPs were surprised as well by his implied invitation of a challenge to Canadian sovereignty when he said differences of opinion would have to be settled "not on an arbitrary basis but with due regard for the principles of established international law."

Trudeau's speech outlined Canadian support for the importance of the Manhattan voyage in opening the North and the importance for Canada of learning more about northern navigation. The speech gave the clear impression that Canada and the United States were working closely together on the project.

The main lines

The following month, on June 23, External Affairs transmitted the main lines of the Trudeau speech to the U.S. state department through the U.S. embassy in Ottawa.

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The note stated explicitly that Canada's sovereignty was not affected by the Manhattan voyage and repeated Trudeau's expectations of mutual benefits as well as looking forward to a cordial future of Canadian-U.S. relations. The note also stated Canada would support oil and gas exploration in the North.

The note avoided any indication that Canada had perceived any U.S. state department actions which could be interpreted as questioning Canadian sovereignty. The note reasserted Diefenbaker's 1958 stand but pointedly refrained from a formal statement of Canadian sovereignty over Canadian Arctic waters and the Northwest Passage.

External Affairs had hoped there would be no U.S. reply to its note. That could have closed the issue. But there was a reply. And it was a shock.

In a message that was clear and uncompromising, the U.S. state department said the United States would not recognize Canadian jurisdiction over Arctic waters beyond the three-mile limit, although it recognized all of Canada's land claims in the North including the continental shelf.

The United States took the position Trudeau had invited in his May 15 speech: International principles of the law of the sea, the state department said, included the right of innocent passage, and freedom of the high seas applied to Arctic waters as well.

The state department, under direct orders from the White House, firmly rejected the Canadian view that waters between the islands were internal Canadian waters. The United States said it would insist on the right of unrestricted free transit through the Northwest Passage.

The Northwest Passage, the state department continued in blunt language, was an international strait where freedom of navigation applied. The United States would reject any unilateral extension of maritime jurisdiction by Canada.

The U.S. note clearly put Ottawa on the spot. Ottawa's gamble that it could bluff its way through the situation without direct Canada-U.S. confrontation had flopped.

But Ottawa could not stay silent, lest this might indicate it was backing away from Canada's 1958 stand and recognizing the legitimacy of the U.S. position.

External Affairs groped for a reply, and the cabinet could not agree on a policy. But there was a subtle shift in vocabulary. From the fall of 1969 on, Ottawa officials talked of "jurisdiction" instead of "sovereignty." (In fact, by spring of 1970, officials no longer talked even of maintaining Canadian jurisdiction. Instead, they spoke of "extending Canadian jurisdiction.")

On Aug. 8, 1969, External Affairs sent a long memorandum to Canadian embassies around the world in an effort to patch up the May 15 statement in which Trudeau appeared to backtrack on Canada's northern sovereignty claims.

The memorandum reiterated that U.S. and British oil companies were interested in using tankers in the Northwest Passage, that the U.S. Coast Guard and military personnel would participate in the Manhattan voyage, and that Canada was cooperating.

But it went on to say: "While the oil companies concerned have sought the co-operation of the Canadian government in the project, appropriate U.S. authorities have failed to formally request consent for, or to provide requisitive notifications of U.S. Coast Guard icebreaker participation in the project."

The equivalent

However, External Affairs told the embassies, Canada was treating consultations between the two coast guards as the equivalent of notification.

Furthermore, Canada was taking the view that the Manhattan voyage was a private matter, in spite of the presence of the U.S. Coast Guard.

In September, 1969, Sharp, continuing the government's "no crisis" stance, contended that Canada was closely involved in the Manhattan experiment. "It is wholly misleading, therefore, to portray the Manhattan passage as a test of Canada's sovereignty in the Arctic. The issue simply does not arise," he wrote in a newspaper article.

The same month Trudeau told high-school students in northern Ontario: "We're not going to stand up now and say flatly it (the Northwest Passage) is ours. We'd have to shoot at the Manhattan to back up the claim and start a war with the world."

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In January, 1970, the cabinet agreed. This permitted a government presence without undermining private enterprise in the North.

Meanwhile, External Affairs was still wrestling with the problem of how to respond to the U.S. state department's uncompromising note rejecting Canadian sovereignty over the waters of the Northwest Passage and referring to "the North American Arctic."

Early in 1970, after work by its legal division, External Affairs proposed that Canada simply extend its territorial sea from three miles to 12 miles. This would effectively assert Canadian sovereignty in the Northwest Passage and could be done through a simple amendment to the Territorial Sea and Fishing Force Act.

It was also a convenient approach because the 12-mile limit has already gained widespread acceptance in the international community. External Affairs expected the United States would contend that Canada could not claim jurisdiction over "international" straits, but the department doubted the United States would go to court over it.

This approach was firmly rejected by Trudeau's own aides. They argued that the United States would be more willing to accept anti-pollution legislation as a method of protecting Canadian jurisdiction than an extension of Canada's territorial sea from 3 miles to a 12-mile limit. And the recent oil tanker spill at Chedabucto Bay, N.S., reminded Canadians of the damage caused by oil spills.

This approach was attractive to the Departments of Indian Affairs and Northern Development and Fisheries and Forestry (about to be reorganized as the Department of the Environment).

Trudeau's office felt the anti-pollution approach would be attractive to other countries and would have some public support in the United States. It was also an easy way to avoid public debate on the sovereignty issue itself.

The crunch came early in 1970 with the second voyage of the Manhattan. The public was demanding a clear Canadian statement, and with the two strategies in conflict Trudeau finally resolved the issue by adopting both.

On April 8, 1970, as the Manhattan entered Arctic waters for the second time, he introduced legislation implementing the 12-mile limit and at the same time brought in the Arctic Waters Pollution Prevention Act, giving Canada jurisdiction in northern waters for 100 miles off shore to deal with pollution.

Before the legislation was introduced in Parliament there was frantic activity behind the scenes.

Quickly dispatched

By the first week of March, the U.S. embassy learned through its Ottawa contacts that the Trudeau government planned legislation "to extend Canadian jurisdiction," although there was still no diplomatic note saying so. On March 6, Canadian officials were quickly dispatched to Washington to explain Canadian plans.

On March 10, Nixon responded by slashing Canadian oil shipments in the eastern and central U.S., from 537,000 barrels a day in the early part of 1970 to 395,000 barrels a day for the period March 1 to Dec. 31.

Canada's External Affairs Department was not surprised. If the U.S. wanted to teach Canada a lesson, it could easily do so by cutting back on oil purchases.

Nixon's own task force on oil policy had already recommended, in 1969, a reduction in Canadian oil shipments, effective July 1, 1970, pending state department negotiations over "measures looking toward a freer exchange of petroleum, natural gas and other energy resources between the two countries."

On March 11, 1970, External Affairs notified the United States of the measures Canada planned to deal with sovereignty in the Arctic.

A few days later, on March 17, an angry Richard Nixon telephoned Trudeau to object to Canada's plans. Nixon told Trudeau not to do it and said "It would raise troubles in Washington."

Trudeau said he had no choice, that he had to respond to nationalist political pressures.

Nixon said he was aware of the "political pressures" but said he had hoped for "co-operative action" from Canada. The U.S. president said he planned to send a top-level team to Ottawa to discuss the issue.

That team, led by Alexis Johnson of the state department, arrived in Ottawa March 20. The delegation included officials from state, the department of the navy, transportation and the coast guard.

From about 10.30 in the morning until 7.30 at night the Americans argued with various Canadians, including External Affairs Minister Sharp, his under-secretary of state, Ed Ritchie, Treasury Board President Bud Drury, and officials from Indian Affairs and Northern Development and other key departments.

Firmly opposed

According to confidential Canadian government minutes of that day's meetings, the U.S. delegation said it was firmly opposed to what Canada was doing, not only because of the precedent it was setting, but also because of the serious implications for U.S. and Canadian defence in the North due to the restrictions that would be imposed on the movement of U.S. Navy warships.

The meeting in itself ended in a stalemate. But the confrontation had sent shock waves through Canadian-American relations.

The issue, and Nixon's actions on oil, had demonstrated Canada's vulnerability in trade relations between the two countries. For his part, Nixon seemed personally enraged by Trudeau's handling of the issue.

Yet a few months later the issue appeared to evaporate. The reason: In October, 1970, Humble Oil announced the end of the Manhattan experiment. The oil industry felt the time was not yet ripe for the use of tankers in the North.

With that, Canada turned its efforts to re-establishing energy relations with the United States and to developing its own plans for oil and gas development in the North—including pipelines—as part of the future energy supply base of the United States.

Yet the challenge to Canadian sovereignty remains. Since the Manhattan experiment, the U.S. Coast Guard has embarked on a program to build powerful new icebreakers and one, the Polar Star, is about ready for use.

Should there be another Middle East oil embargo, one contingency plan for the United States would be to ship Alaskan oil through the Northwest Passage by tanker to its major east coast centres. Would it seek Canadian permission first? That remains to be seen.

In the meantime, Canada has yet to build its own more powerful icebreakers in the North and is likely yet again to postpone spending on northern surveillance aircraft.

'Buy our oil' was Ottawa's plea to U.S.

(9)

Oct. 14

By DAVID CRANE
Star political editor

From 1968 until 1972 the Trudeau government had one long-term objective in its oil policy: To sell as much as possible to the United States.

The government and senior civil servants pursued this policy in three ways:

• They embarked on negotiations with the United States for a continental energy policy that would remove all barriers, such as U.S. oil import quotas, to the flow of Canadian oil into the United States.

• The government campaigned long and hard to have Alaska's new-found oil carried in a pipeline along Canada's Mackenzie Valley instead of one across Alaska. It was hoped this would link Canada's oil reserves more closely into U.S. markets.

• The government, late in 1970, increased natural gas exports, which the United States desperately wanted, and linked future gas supplies to U.S. willingness to buy more Canadian oil.

The Alaskan oil find caused panic in Ottawa. There was fear of stagnation in Canada's oil and gas industry. After 1972, it was felt, this country would face a severe cut in oil shipments to the United States.

In late 1968, the cabinet committee on planning and priorities quickly drew together terms of reference for the new Task Force on Northern Oil Development, to deal with the whole problem of northern oil and gas, pipelines, Canadian strategies for negotiations with the United States and the role of tankers in the Northwest Passage.

Its chairman was the deputy Minister of Energy and its other members included the chairman of the National Energy Board and the deputy minister of Indian Affairs

Enormous power

The task force became enormously powerful because it was the main source of oil policy for the cabinet and the main link between the government and the oil and gas industry.

On March 25, 1969, a month after U.S. and British oil companies in Alaska announced plans for a pipeline across Alaska and a tanker link to the U.S. west coast, the task force presented its first memo to cabinet.

It saw four possibilities as a result of the Alaska oil finds.

These were: The pipeline across Alaska; a line from Seattle, Washington, to Chicago to complement the trans-Alaska line; a Canadian alternative along the Mackenzie Valley, and an extension to Quebec of the Canadian pipeline which already carried Alberta oil to Ontario.

The task force rejected the notion of extending Canada's existing pipeline system east to Quebec, and embarked instead on a cost-comparison study of the trans-Alaska and Mackenzie Valley alternatives.

At the same time, Prime Minister Trudeau headed for Washington to meet then U.S. president Nixon and to discuss Canada-U.S. energy relations, including northern sovereignty, pipelines, U.S. oil import restrictions and the possibilities of a Canada-U.S. energy agreement.

Embark on talks

The two agreed that they should embark on talks, in Trudeau's words, "to permit the encouragement and development of oil resources in Canada."

Speaking to reporters of Canada's desire to increase oil sales, Trudeau said: "I think we have arguments for the United States in the sense that our oil is not only cheaper, (than other U.S. oil imports) but it is more secure in terms of defence in any future conflict. It is continental oil. It is more easy of access. And if we do not continue exploring and discovering new sources of oil, there might come a time when there will be an oil gap that we won't be able to fill on this continent."

Talks between the two countries began a few days later.

In the meantime, another crucial committee in Ottawa, the Interdepartmental Committee on Oil Policy, added its voice to those calling for more oil sales. This committee, made up of the chairman of the National Energy Board (Robert Howland), the under-secretary of state for external affairs (Marcel Cadieux) and the deputy minister of energy, mines and resources (Claude Isbister), was responsible for advising the cabinet on Canada-U.S. energy relations.

In August, 1969, it told the Trudeau cabinet that Canada should continue its policy of importing cheaper foreign oil into eastern Canada while requiring the rest of the country, including Ontario, to use more expensive Canadian oil carried by pipeline from Alberta and Saskatchewan.

Redouble efforts

What this meant, the committee said, was that Canada should redouble its efforts to sell more prairie oil to the United States and should seek talks with the United States to lower U.S. oil import quotas.

In February 1970, Nixon published his own task force report on oil import policy, which recommended easier access for Canadian oil, but only after negotiations on a broad energy agreement.

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Nixon said all members of his task force agreed "that a unique degree of security can be afforded by moving toward an integrated North American energy market." And he announced: "I have directed the Department of State to continue to examine with Canada measures looking toward a freer exchange of petroleum, natural gas and other energy resources between the two countries."

A second Task Force report to cabinet in April, 1970, repeated Canadian fears about the loss of the U.S. oil market.

Yet an appendix to the report referred to the growing gap between future U.S. oil needs and oil supplies that could only be filled by imports from Canada and other countries. Thus Canada was prepared to rush into deals with the United States to sell more oil while the government's own studies showed it would have growing bargaining power in the future.

Meanwhile, the task force in Ottawa was pressing on with its efforts to get an oil pipeline along the Mackenzie Valley.

Operating by '75

By August 1970, the cabinet had given approval in principle to oil and gas pipelines down the Mackenzie Valley.

The enthusiasm for the project—although there had been no study of either the environmental or economic impact—is captured in a government document that boasted: "A second great era of new oil and gas pipeline construction may soon begin in Canada."

The government was convinced that a Mackenzie Valley gas pipeline would be built and that it probably would be in operation by 1975. But the task force, headed by Jack Austin, since May 1970 deputy minister of energy, mines and resources, wanted an oil pipeline as well.

There were two big problems: The Nixon administration did not want the Canadian route and the U.S. oil industry didn't either.

The task force and the Trudeau cabinet believed that by offering easier environmental standards and the added lure of long-term access to Canadian oil and gas—as well as by lobbying with Midwest states that would benefit directly—they still might get the pipeline.

Another factor they believed was working in their favor was the series of delays to the oil industry's plans for a trans-Alaska oil pipeline.

In early 1971 the Canadian Embassy in Washington, while concluding that U.S. oil executives still favored the trans-Alaska route, maintained this was mainly for political reasons. Embassy officials also contended that the oil industry might opt for the Canadian route if that meant a quicker decision.

External Affairs emphasized, though, that there would have to be a Canada-U.S. energy agreement covering not only the terms under which pipelines for oil and gas would operate but also providing for long-term U.S. access to Canada's oil and gas reserves in the North.

This was spelled out in a March 9, 1971, memo from the Canadian Embassy in Washington to the External Affairs Department in Ottawa, when Ottawa was trying to decide what strategy to pursue to get an oil pipeline.

"In this context one hears the frequent comment that the corporate interests could scarcely be expected to pursue the Canadian alternative in the absence of an inter-governmental agreement sufficiently definitive to permit the companies to plan realistically," the embassy said.

The embassy went on to say: "At the same time, there is recognition that the oil and gas potential of Canada's northern reaches would have to be given consideration in any bilateral agreement."

In other words, as part of the deal to get an oil pipeline through Canada, the Canadian government would have to be willing to make a long-term commitment for United States access to northern Canadian oil and gas reserves.

In the same month, a State Department memorandum concurred in the need for a formal treaty between the two countries to protect the corporate business interests of the oil industry. But that memo also spelled out many of the difficulties that would arise in trying to build binding guarantees into a treaty.

Strong opposition

There was strong opposition to the Trans-Alaska route from environmentalists in Washington. In Canada, west-coast MPs were critical of the Alaska route because of the threat of oil pollution in the Strait of Juan de Fuca.

In February, 1971, Canada requested talks with the United States on the pollution threat.

Under the trans-Alaska pipeline plan, oil would be carried west across Alaska by pipeline to the port of Valdez. From there, it would be carried to various west coast refineries, including one at Cherry Point, Wash., which could be reached only through the tricky Strait of Juan de Fuca between the state of Washington and British Columbia.

External Affairs Minister Mitchell Sharp argued in task force and other discussions that Canada's strategy should be to protest about the threat of pollution and wait for the United States and the oil industry to initiate talks on the Mackenzie Valley route.

Other cabinet ministers, such as Energy Minister Joe Greene and Environment Minister Jack Davis, favored a direct, formal proposal to the Nixon administration in favor of the Canadian route.

Both Greene and Davis contended the Canadian route was environmentally safe although no research had been done on the impact of a pipeline carrying hot oil through permafrost.

While privately and publicly the government was actively promoting a multi-billion dollar oil pipeline down the Mackenzie Valley, it could not document claims it was making to the United States that such a pipeline would be environmentally sound and cheaper than the proposed trans-Alaska one.

While Ottawa tried to find a way to bluff through the fact that it had done no research, Canadian-U.S. economic relations were quickly moving to a broader confrontation.

10% surcharge

In August, 1971, President Nixon announced emergency economic measures to bolster the U.S. economy and protect the dollar.

These included a 10 per cent surcharge on all U.S. imports.

The Trudeau government reacted in shock and disbelief. Canadian officials became all the more anxious to secure the U.S. market for Canadian oil.

Thus by September, 1971, the mood in Ottawa was to press more strongly for an oil pipeline through Canada. But how?

At the end of August, the Canadian embassy in Washington had reported to External Affairs that there was still U.S. interest in the Canadian route.

Gerry Stoner, the deputy minister of transport and a member of the task force, contended the task force did not have enough reliable information on such matters as probable oil and gas reserves in the North, the concessions that Canada would have to make to the United States to get the Canadian route accepted, the techniques of building a hot oil pipeline in the Mackenzie Delta, the economic impact on Canada of such a huge project, the availability of Canadian capital or the degree of opposition from native groups.

Stoner implied that Canada was making claims, in public and in private, it simply could not back up. Not the least of these was the Canadian assurance that the National Energy Board and the cabinet could come up with a quick decision on a pipeline application.

All of these issues, Stoner contended, needed much more research before an oil pipeline could be aggressively promoted.

But this approach was rejected by other senior civil servants, led by Austin of Energy, Mines and Resources and by the Trudeau cabinet as well.

A strong push for a more aggressive campaign to promote the Canadian route came from Austin and senior aides in Trudeau's office.

They convinced External Affairs undersecretary Ed Ritchie first, and then won support from Simon Reisman, deputy minister of finance, James Grandy, deputy minister of industry, trade and commerce, and Gordon Robertson, clerk of the Privy Council office.

On Oct. 23, 1971, the Interdepartmental Committee on Oil, which looked after Canadian-U.S. energy relations, made the following recommendation to cabinet: "That the Secretary of State for External Affairs communicate with the United States and advise publicly that we were seeking the opportunity of discussing the Canadian alternative with U.S. government officials."

Canadian officials were aware of the possible implications for Canadian-U.S. relations. Austin had pointed out, in a letter to Ritchie dated Sept. 9, 1971, that "it would amount to joining issue in a major controversy within the framework of U.S. domestic politics and Canadian-American relations."

In his letter to Ritchie, Austin said the Americans might resent this approach as intervention in their own politics. "Would the political costs be too high, whatever resulted?" he asked. In the end, neither Ritchie nor Austin seemed to think so.

Austin listed several arguments in favor of pushing for the oil pipeline. These included the development of Canadian oil reserves in the north, extra oil exports, jobs, and the use of Canadian materials.

Danger to dollar

He also listed arguments against the oil pipeline. These included additional U.S. dependence on Canada, concessions on environmental protection and the balance of payments impact. The project could push up the value of the Canadian dollar, hurting other Canadian industries. "Is Kierans right?" Austin asked. It was Communications Minister Eric Kierans who had raised the danger to the Canadian dollar.

But with the cabinet decision made to push harder for a U.S. deal to move Alaskan oil down the Mackenzie Valley, some crucial decisions on Canada-U.S. relations now had to be made by cabinet.

These included:

- Arrangements under which Canada would be used as a land bridge—through the Mackenzie Valley and the prairie provinces to the U.S. Midwest—for a strategic U.S. commodity. Canada's national security would be affected but it was assumed Canadians would accept this since the costs would be outweighed by the benefits of more secure export markets for Canadian oil and gas.
- Canadian long-term oil commitments to the United States. Canada would have to make some kind of oil commitment from existing reserves since the chief rationale for a Canadian oil pipeline was not the danger of west coast oil pollution but the promotion of Canadian exports.
- The commitment of future oil and gas reserves in the North to U.S. markets. This was another concession Canada would have to make to get the oil pipeline.

There were, of course, other issues to deal with. An oil pipeline would raise new questions about Canada's national priorities. The cabinet and the task force had agreed in 1970 that a gas pipeline would be built but an oil pipeline as well would greatly enlarge the requirements for manpower, financing

Formal pact

Thus, in the fall of 1971, wi
Trudeau government in publ
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Nixon's 10-per-cent import
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actively considering a fo
energy-sharing arrangement
the United States.

The opening of negotiation
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It would also mean that
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Donald Macdonald in the
time, had made it clear—in
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minister in February, 1972—
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That effort came in a letter
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May 5, 1972.

The letter offered the
States a commitment for
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supply. A year later Canada
clamp controls on Canadian
ports.

Macdonald also claimed
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with an application filed by th
of this year."

In many respects, the Mac
letter was extraordinary in
claims.

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Canada was only starting on its environmental research. There was no agreement on right-of-way, no settlement of native land claims. The finance department's economic impact study was not yet completed. (Completed later in the year, it questioned the value of a gas pipeline, let alone an oil line as well.)

And there was nothing to back up Macdonald's claim that the National Energy Board could quickly approve an oil pipeline application (except perhaps the fact that its chairman wanted oil and gas pipelines built).

The United States, for its part, quickly saw that Macdonald could not deliver what he was offering.

John Irwin, the U.S. undersecretary of state, told the Canadian Embassy in Washington he doubted that Canada could really deliver the promises contained in Macdonald's letter. For example, he asked, how could Canada make far-reaching oil commitments to the United States? The U.S. was concerned about an energy shortage in the fall but already knew there was not much Canada could do to help.

Rejects proposal

Canada's hopes for the oil pipeline ended in 1972, after Morton rejected the Canadian proposal. But the cabinet still pursued it, or at least paid lip service to it in Parliament for another year. At least External Affairs Minister Mitchell Sharp did. He told the Commons in July 1973: "We have only begun to fight."

Once the word had been received from Morton, however, the task force switched its full attention to plans for a gas pipeline down the Mackenzie Valley.

Executives from the Mackenzie Valley Pipeline Research Group gave Ottawa officials a final report, on Dec. 19, 1972, on their research into a Mackenzie Valley oil pipeline. They contended the project was feasible and could be built later if more oil was found in the Mackenzie Delta or Alaska. Since then, the oil industry and U.S. officials have kept alive the prospect of an oil pipeline down the Mackenzie Valley while the oil industry has stepped up its oil search in the Mackenzie Delta and Alaska.

WEDNESDAY: How Canada promoted the Mackenzie Valley gas pipeline.

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OCT. 15

Canada was told it had oil to last 923 years

By DAVID CRANE
Star political editor

In 1970 the Trudeau government made two key decisions that paved the way for a natural gas pipeline along the Mackenzie Valley in Canada's far North.

In August, it gave approval in principle to a multi-billion-dollar natural gas pipeline when it published its guidelines on pipelines in the North. This was the green light industry had been waiting for.

In September, it approved the largest single gas export license in Canadian history and, in the process, shifted the focus of future gas development to the far North in the Mackenzie Delta and Beaufort Sea.

The two decisions were linked, part of Canada's over-all strategy to increase oil and gas sales to the United States and to accelerate development of potential oil and gas reserves in the North.

Massive oil and gas finds in Alaska in 1968 had made the cabinet afraid that Canada would lose a big share of its oil market in the United States.

Big push

Although natural gas policies were not making headlines in Canada, the big push for pipelines and exports really got under way in 1970.

In particular, the oil and gas industry began to lobby for clear direction and policy from Ottawa on pipelines, especially a gas pipeline. There was confidence that applications could be ready by early 1971 with actual construction under way in the winter 1972-73. This confidence was particularly strong in the Department of Indian Affairs and Northern Development.

There were talks between Canada and the United States on natural gas exports and pipelines. By this time the United States was beginning to experience natural gas shortages.

Sensing the danger of policy drift in Canada, on April 8, 1970, Gerry Stoner, the deputy minister of transport, sent a letter to Gordon Robertson, clerk of the Privy Council Office and senior aide to Prime Minister Pierre Trudeau, proposing a meeting of Ottawa's inner core of deputy ministers, to take place in the Privy Council Office, to discuss the government's policy on pipelines.

On May 12 a meeting was convened with Marshall Crowe, then a senior adviser to Trudeau on energy and economic policy, as chairman.

(Shortly afterwards Crowe left Trudeau's office to become president of the Canada Development Corp. While there he organized the CDC's participation in Canadian Arctic Gas, which wants to build a Mackenzie Valley gas pipeline. Crowe sat on the management and tax, finance and accounting committees of the Arctic Gas project. Today he is chairman of the National Energy Board which begins hearings on the gas pipeline Oct. 27.

The meeting chaired by Crowe really came about because a number of officials were worried about a lack of policy on the North.

Among those attending ... Claude Isbister, deputy mini... energy, Douglas Fraser of t... tional Energy Board, M... Strong, representing the soo... born Canada Development ... Digby Hunt of Indian Affair... Northern Development, Sto... Transport, Gordon Taylor ... nance and Norman Gilchrist, ... dent of Northern Transportati... Ltd., a Crown-owned compan... provided shipping services ... Mackenzie River.

Growing pressu...

Gilchrist stressed that the g... ment had to decide how it wan... handle an application for a gas... line and said there was gr... pressure from industry for a g... ment policy. Fraser responde... the energy board was already ... ing with the consortia.

Stoner wondered whether the ... ernment should encourage a ... line, but Fraser indicated the... for speedy action, contendin... liquefaction technology was ... developed fast.

Hunt told the meeting tha... government would have to pr... transportation for pipeline con... tion and said that his depart... was planning a highway alon... Mackenzie.

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Strong said that the government would have to consider Canadian control and the possibility of Canadian direct participation through a government-owned corporation.

At the same time, Strong said, the government owed it to industry to set out its philosophic stance.

Crowe proposed that the task force take on the question of government policy, with representation from the Privy Council as well. Out of this emerged a joint working group from the Task Force on Northern Oil Development and the Interdepartmental Committee on Oil.

In the minds of Ottawa officials a gas pipeline was in the national interest and would help Canada-U.S. relations. All that remained was to draft the pipeline guidelines and get the cabinet to adopt them.

On June 17, 1970, a working group was set up to advise the cabinet on the terms and conditions under which oil and gas pipelines could be built.

By late July, a draft set of guidelines had been produced, proposing a single Mackenzie Valley corridor with one gas pipeline and one oil pipeline. There were provisions for Canadian ownership, Canadian content, jobs for native people and respect for the environment.

Energy Minister Joe Greene was pushing hard for Canadian ownership. At an earlier meeting with officials of TransCanada PipeLines, Greene said he would prefer to invest public funds rather than see Canadians lose equity control.

Added incentive

Surprisingly the guideline that said there should be "a substantial opportunity" for Canadian ownership caused some of the longest arguments. At a meeting of the working group on July 16 one official said "it could be construed as another facet of fairly excessive nationalism."

On Aug. 13, Greene and Jean Chretien, minister of Indian affairs and Northern Development, outlined the guidelines to a press conference. Greene also indicated that the three gas pipeline groups should consider merging.

"We're saying to them: 'Get together, boys, and find a common corridor, or only one of you is going to be in the ball game.'"

The oil and gas industry now had what it wanted: A commitment from the Canadian government on the gas pipeline, at least in principle. It could now get on with the details of its pipeline planning. This, in turn, would give an added incentive to oil and gas exploration in the North.

At the same time, the government was looking closely at the gas export issue, as the National Energy Board wound up its hearings from companies seeking approval to export another 8.9 trillion cubic feet of gas to the United States. The export hearing was the biggest in the energy board's history.

Energy relations

The decision was bound to affect the tone of Canadian-U.S. energy relations.

Canada was well aware of the U.S. desire to see the exports approved, and was anxious to mend its fences with the United States after the sovereignty crisis in the Arctic and President Nixon's abrupt reduction in Canadian oil shipments to the United States.

By 1970 the National Energy Board itself appeared to have established close links with the U.S. Federal Power Commission and was closely involved in talks on future gas exports and a Mackenzie Valley gas pipeline.

In a June 9 speech FPC chairman John Nassikis praised the close working relationship between the two agencies and spoke of FPC and State Department efforts to develop "a common energy policy" with Canada.

"The formulation of a common energy policy with Canada offers promising potential for additional natural gas from Canadian gas reserves as well as Alaskan gas reserves via a pipeline across Canada to the vast mid-continent market," he said.

There was a feeling in Canada that the country had an almost endless reserve of oil and gas that should be developed and sold as rapidly as possible.

Probably no government statement illustrated more clearly the government's belief in Canada's inexhaustible natural gas supplies than a comment in early August, 1970, by Jean-Luc Pepin, minister of industry, trade and commerce and former energy minister.

Talking about applications before the National Energy Board to export a record volume of gas, Pepin said: "It would be crazy to sit on it. In maybe 25 to 50 years we'll be heating ourselves from the rays of the sun and then we'd kick ourselves in the pants for not capitalizing on what we had when gas and oil was a current commodity."

Moreover, Pepin said, if the gas exports went ahead, "then we're in for the next round. The decision will condition the whole energy situation between Canada and the United States."

On Sept. 29, 1970, Energy Minister Greene announced the Trudeau cabinet had approved the largest gas export license in Canadian history—8.3 trillion cubic feet to be exported over a 15- to 20-year period.

Moreover, while the National Energy Board and the cabinet found it had to refuse permits to export another 2.6 trillion cubic feet, Greene held out the prospect of additional future gas supplies for the United States if the U.S. would ease its restrictions on Canadian oil shipments.

"The discovery of oil and gas are intimately related," he said. "Exploration and discovery depend on adequate markets for oil and gas both in Canada and the United States."

Barely two months later a high-powered U.S. delegation to Ottawa, led by U.S. Secretary of State William Rogers, announced a sharp increase in Canadian oil purchases in 1971.

A communique said that "arrangements should be worked out quickly to permit in subsequent years full and unimpeded access to U.S. markets of Canadian crude oil and petroleum products, surplus to Canadian commercial and security arrangements."

Big money

The gas export decision, by squeezing to the limit Canada's accessible and cheap reserves, shifted the focus of exploration and development to the North and provided the encouragement the oil and gas industry wanted to spend big money to develop future oil and gas reserves.

The stage was set for the big push to develop the Mackenzie Delta and get on with the job of building the Mackenzie Valley gas pipeline.

The decision to tie the Canadian North into the North American economy had been made. Development was to be pushed and Canada-U.S. energy talks were to continue in order to link the northern reserves into the U.S. energy market.

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The big job now was to get the competing pipeline groups to merge into a single consortium, to work out the government support for the project and to establish the ground rules for a hearing expected as early as 1971.

Through 1971, the illusion of unlimited oil and gas reserves continued in spite of growing doubts by some Canadians and the resignation, on April 29, of Eric Kierans from the cabinet.

In a speech to the American Petroleum Institute on May 19, Energy Minister Greene said: "The reserves from which we presently draw our supplies are judged to be sufficient for 20 years for oil and 30 years for gas."

Shortly afterwards, Greene, in a June 2 speech to the Canadian Institute of Mining and Metallurgy, said: "Canada's total oil reserves were 469 billion barrels at the end of 1970 while total natural gas reserves were 725 trillion cubic feet. At 1970 rates of production, these reserves represent 923 years' supply for oil and 392 years for gas."

Urgent reply

The speeches brought an urgent response from Bruce Willson, president of Union Gas Co. In a July 8 letter to Greene, he said: "In my judgment both of these statements are inaccurate and quite misleading."

Willson said Union was already having trouble obtaining gas for its customers in southwestern Ontario while, he said, "gas producers and others in public utterances have somehow managed to create the illusion that Canada has such large volumes of oil and gas available, that there is no supply problem."

Willson went on to warn, prophetically as it turned out: "Unless the gas industry and the governments involved in regulating it do a better job in the future, Canada will be faced with the same type of energy crisis which currently confronts the United States."

Greene remained confident. In a letter to Willson July 29, he asserted: "I would hasten to assure you that the figures which I quoted are considered reasonable not only by the National Energy Board but by the industry as well."

The energy minister rejected outright the notion of possible future shortages caused by inadequate reserves. "The current problem of supply, as I see it, is one primarily of existing pipeline capacity limitations and of contractual surplus, rather than one of insufficient

Yet the figures Greene quoted were from the Canadian Petroleum Association, not the government, since the government had none of its own.

Same figures

Last year, former cabinet minister Eric Kierans charged that these same figures had been used by the National Energy Board to convince the cabinet to approve the massive 1970 gas export.

"It is the day on which, in bitter retrospect, I must candidly confess that we in the cabinet were misled," Kierans said.

When Willson received Greene's reply, he was not satisfied, and he wrote back to Greene Aug. 17 stating that neither his company nor the Canadian Gas Association had ever supported the Canadian Petroleum Association's figures for planning purposes.

The people in the industry who stood by the figures, Willson contended, were the oil and gas producers. But these people, Willson said, "psychologically and from a financial point of view, are very heavily biased in favor of the most rapid and profitable exploitation of resources." In fact, most producers were foreign-controlled while many distributors, such as Union Gas, were Canadian-controlled.

Willson contended that Canada was already facing a gas shortage. The last major gas discovery in Canada had been in 1967-68, while "the Western Canadian gas producers which, as I have mentioned, have their own specific interests, have succeeded in creating a shortage by contracting virtually all established gas reserves to U.S.-owned export companies."

Before the end of 1971, the National Energy Board was in fact turning down new applications to export Canadian gas. The country, it found, no longer had gas available to export.

After this decision the issue of Canadian oil and gas reserves was hotly debated within the Task Force on Northern Oil Development that advised the cabinet. But neither the task force nor the energy board had any independent means of calculating Canada's reserves. This meant the officials had to rely on industry.

Poor returns

In the end, in April of 1972, the task force decided to accept the most optimistic forecasts and concluded that northern natural gas supplies in the Mackenzie Delta "must and will" relieve the restrictions on further exports imposed by the energy board.

Yet in these discussions there was still no concern voiced over the fact that Canada would be spending large sums of money to facilitate extra exports of gas to the United States, while Canada would get very little in return in taxes, royalties and other revenues.

If Canada was to export more gas to the United States, a new gas pipeline along the Mackenzie Valley was even more urgently needed. But there was one stumbling block: Two competing groups wanted to build the line.

A hearing to choose between two groups would take much longer to handle than a hearing on one application.

Government pressure mounted on the two pipeline groups to merge.

In a speech to the Canadian Gas Association on May 29, 1972, Energy Minister Donald Macdonald said: "I am hopeful that industry itself may come forward with one proposal which combines the best features of all the projects now being prepared. This is a challenge that requires and deserves the best kind of industrial diplomacy." About two weeks later the two groups merged to form Canadian Arctic Gas.

At the same time, Macdonald implied that gas was being discovered at a much faster rate than had been thought. Speaking of the progress being made in proving up Mackenzie Delta gas reserves, he said, "It may well be that the initial gas pipeline may be founded on Canadian gas reserves alone."

As it turned out, proving up of reserves has been much slower than either the federal government or the oil and gas industry had expected. In January this year Canadian Arctic Gas Pipeline Ltd. estimated delta reserves at 6.5 trillion cubic feet, less than half the estimate made by government officials in 1971-72.

The fourth report to cabinet from the task force, in July 1972, stated: "The weight of public opinion in Canada is generally in favor of northern pipeline development."

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It went on to state: "The accompanying memo analyzes many factors, alternatives and related policy matters concerned in the expectation that a gas pipeline will be built over northern Canada during the middle years of the decade."

The memo dealt with such factors as Canadian content and ownership, and raised the question of what sort of hearings would be held.

Attached, without any comment whatever, was a preliminary draft of a Finance Department economic impact study which warned that such a project would cause many problems for Canada, bring far fewer jobs than expected and raise a number of serious problems.

Optimism ended

A later meeting of the task force, on Sept. 6, 1972, showed there was still no concern over the Finance Department study. The task force was still expecting an application in the near future, officials were satisfied everything was on schedule, and the government was working closely with Canadian Arctic Gas.

The only concern, voiced by deputy energy minister Jack Austin, was that partial reports or deliberate leaks from individual departments could lead to "misrepresentation and inaccurate publicity" that could be damaging to the Liberals in the Oct. 8 federal election.

But the optimism of the task force would soon end. The October election produced a minority government which severely challenged the Trudeau government's handling of energy.

And at a Dec. 14 meeting of the task force, with the final impact study ready, the mood had totally changed.

All of a sudden there was real concern within the government and growing public questioning of the gas pipeline project. If Canada would not gain much, why build the pipeline?

By then the thrust of the pipeline was shifting to emphasis on future Canadian gas needs, although in early 1973 it was still expected that Canadian gas from the Mackenzie Delta would go primarily to the United States.

In a speech in Washington on Feb. 27, William Wilder, chairman of Canadian Arctic Gas, said half the gas in the proposed pipeline would come from Alaska and half from the Mackenzie Delta in Canada.

Within reach

Wilder told the Washington audience that he expected the National Energy Board to treat new gas reserves in the Mackenzie Delta as proven and within economic reach.

"We believe that when this is done, there will be a clear exportable surplus which will allow the granting of export applications which will accompany our pipeline application." In fact, both Imperial Oil and Gulf Oil had made arrangements to export more than $5 billion worth of natural gas to the U.S. utilities from the Mackenzie Delta.

By then, the government was clearly on the defensive. Signs of a Canadian natural gas shortage were becoming ominous. Parliament suspected that the government might be trying to push the pipeline through without first determining it was in the national interest.

It would take all the careful planning and manoeuvring of the task force and, later, of the Department of Indian Affairs and Northern Development, to make sure the pipeline was built.

That is what the National Energy Board has to decide when it begins hearings Oct. 27.

THURSDAY: How the federal government tried to push through resource development in the North before settling native land claims and other issues.

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Ottawa tried to slip pipeline past natives

OCT. 16

By DAVID CRANE
Star political editor

In its pursuit of oil and gas pipelines to link Canada's northern oil and gas supplies to the U.S. energy market, the federal government quickly decided that the problems of northern native peoples would not be allowed to stand in the way.

That message came through clearly in public statements by the government, the secret files of government committees and the cabinet itself, and the government's own actions in response to the Eskimos, Indians and Metis of the North.

The government strategy, summed up in meetings of the Task Force on Northern Oil Development, was to get pipelines built as quickly as possible, before native groups could organize effectively.

In the meantime, it was hoped, pipeline jobs for native peoples would divide native organizations—even though most jobs would last only a short time and the social impact of such a massive project would devastate the culture, traditional livelihood and communities of the northern people.

Not consulted

Native peoples were not consulted on government efforts to develop oil and gas, or other natural resources.

Decisions on where and how exploration would take place or pipelines would be built were made privately by Ottawa and the oil and gas industry.

Decisions on the all-weather Mackenzie Valley highway route were made secretly by Ottawa, after determining what route would most please the oil and gas industry.

And the routes of oil and gas pipelines were to be chosen by the oil and gas industry, in consultation with Ottawa, but not the native peoples.

The chief architect of this policy was the Department of Indian Affairs and Northern Development. Traditionally, the department viewed the Indians and Eskimos as wards of the government. It did not readily accept the notion that natives in the North should help plan the future of the North. Nor did it at first recognize their right to make claims at all.

Native groups in the North believe they have "aboriginal rights" there: In other words, that they have a right to keep or be paid for lands they have used from time immemorial and for which they have never been properly compensated.

Want to be paid

If other people want to take out oil and gas and build pipelines and highways to move it, then the native people believe they should be paid and should be assured that their own way of life will not be wiped out in the process.

The Indian Affairs Department saw things differently: Natives were seen as beneficiaries of an ambitious system of assistance, which, as it spread, made them more and more dependent on the government. As far as the department was concerned, its own job was to produce jobs for native people as a by-product of the opening of the North.

Development, of course, not people, was the main concern of the department. That philosophy was shared by its minister, Jean Chretien, and apparently by his successor, Judd Buchanan.

In the crucial period from 1970 to 1972, native peoples and environmentalists quickly came to be seen in Ottawa as the enemy, as people who could mess up the carefully laid plans of government and industry to open northern oil and gas reserves and link them to U.S. markets.

Exploration crews were arriving in traditional hunting and fishing areas with the approval of Ottawa but with no warning to the natives, let alone consultation.

Inuvik's example

Experience at Inuvik, the largest Canadian community within the Arctic Circle and a pivotal town should the pipelines be built, was already showing what Ottawa-planned-life could mean to natives.

Eskimos had been brought from their villages to jobs in the community. Since these were mainly just part-time, the Eskimos ended up on welfare and alcohol. The taste of the white man's life made some unwilling to go back to the tiny villages. Suicide and mental illness increased. Children were seperated from their parents to be sent to government-run boarding schools.

With the big oil and gas discoveries in Alaska in 1968, the native

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people in the North realized they had to organize, that their very survival could be at stake. They were encouraged and inspired by the new-found political power of the Alaska Native Federation.

But attitudes in the U.S. were much different.

The federal government there froze Alaskan land allotments after the huge oil and gas discoveries at Prudhoe Bay, until native claims were settled. It was clear that no pipeline would be built until the claims were settled, and the oil and gas industry realized that it would have to support a native claims settlement if it wanted to proceed with its own plans.

In Canada, the government tried to delay a settlement, with Prime Minister Pierre Trudeau at first, in a 1969 speech, rejecting out of hand the notion of aboriginal rights of the native peoples. When that strategy failed, the Canadian government made it clear that a pipeline could be built before a settlement.

Key treaties

Two key treaties with Indians existed in the North. Both came into being after major resource discoveries there.

The two treaties, known as 8 and 11, covered about 400,000 square miles of the Northwest Territories. Treaty 8 was signed in 1899, three years after the discovery of gold in the Yukon; Treaty 11 was signed in 1921, a year after Imperial Oil found oil at Norman Wells, N.W.T. Both treaties were initiated by Ottawa to restrict possible native claims to land and resources.

Between 1968 and 1971, several native groups organized in Canada's North. These included the Yukon Native Brotherhood, the Committee for Original Peoples' Entitlement, the Indian Brotherhood of the N.W.T., the Inuit Tapirisat and the Yukon Association of Non-Status Indians.

In this period, although the northern natives were becoming increasingly concerned about their fate, the federal resource planners showed nothing but indifference.

Ottawa's only reference to northern natives in the 1970 northern pipeline guidelines was the provision that northerners must be trained and employed in construction and operation.

But the natives knew they should be wary even about the promise of jobs. At the time the 1970 guidelines were published, Panarctic Oils Ltd., the Arctic Islands, employed only six Eskimos.

Nor were white men's jobs what many native people wanted. They wanted to settle their land claims and make their own decisions on their future.

Yet that company was controlled by the federal government and included senior civil servants from Ottawa on its board of directors.

When the Alaskan native claims were settled, in December, 1971, Canada's native groups were enormously encouraged.

The Alaskan settlement, a milestone in the history of U.S. relations with its Indian and Eskimo populations, gave its native people 40 million acres of land, a $462.5 million cash settlement and the promise of an additional $500 million in future mineral rights.

To Ottawa's horror, the Alaskan settlement became a benchmark for Canada's native groups, and Alaskan native organizers lent their assistance to Canadian groups. Moreover, some 900 natives of Ilingit descent in the Yukon would share in the Alaskan settlement.

In 1972 the task force decided to seek full cabinet approval for its tactic of delaying negotiations with native groups until the pipelines were built and oil and gas development well under way.

The civil servants, led by Jack Austin, deputy energy minister, and Digby Hunt, assistant deputy minister of Indian affairs and northern development, refused to consider losing the time that would be necessary for lengthy negotiations.

Concern 'unforeseen'

A report of a task force committee on May 16 noted that expansion of the northern pipeline guidelines "has progressed more slowly than anticipated due to unforeseen developments such as the concerns of the Indian people."

In a confidential report to the cabinet in July, 1972, the task force stated clearly that the settlement of native claims was not a prerequisite to approval of pipeline applications because pipeline construction did not prejudice native claims.

The officials said the government should commit itself to nothing more than "consultation" and "the protection of the rights of northern residents."

At the same time, the officials said, the native people in the Canadian North should not be encouraged to expect a settlement like that in Alaska.

The Trudeau cabinet agreed with this strategy of holding the native proposals of the task force on July 14, 1972.

In the meantime, Ottawa hoped, Canadian Arctic Gas would file its pipeline application quickly and the National Energy Board would approve it before a confrontation developed.

One problem was that the native peoples themselves were growing restless and there was an increase in public interest in the North. That year, James Wah-Shee, president of the Northwest Territories Indian Brotherhood, warned: "No settlement, no Mackenzie Valley pipeline."

At Inuvik, Oblate priest Joseph Adam, a missionary in the Arctic for 35 years, told Energy Minister Donald Macdonald that native people were frustrated enough to blow up the pipeline if it was built.

"These people have a right to their aboriginal rights," Adam said. "If people in the south won't understand that, the native people in the North won't let the oil go out."

In Parliament, Yukon MP Erik Nielsen presented a petition on behalf of the Old Crow band of 200 Loucheaux Indians, who have lived for centuries on the banks of the Porcupine River, about 80 miles north of the Arctic Circle.

The Indians, who wanted protection of their muskrat trapping grounds on the Old Crow flats as well as settlement of their land claims, threatened to block the pipeline in the courts.

"We want the government to settle our claims and we don't want our trapping and hunting activities disturbed," band chief Charlie Abel said. "These things are very, very important to us."

The government was adamant in its position. Although he now acknowledged that northern natives were entitled to some settlement, Chretien said at a June, 1972, press conference that construction of a pipeline could begin before any settlement because the Indian Act gave the government the power to proceed with such projects.

Among senior civil servants there

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public interest in the North would make it difficult to keep "politics" out of northern development. It would also threaten the close and cosy arrangements by big government and big business to develop the North without public scrutiny.

In particular, Ottawa felt that it had to conceal the decisions in principle already reached with the oil and gas industry. If those were made public, they would disclose the extent to which the federal government, through the task force, was collaborating with industry in the North.

Priorities ignored

Moreover, should the native people discover that Ottawa was not honoring the priorities set out in the official development plan for the North—Canada's North 1970-1980—the political repercussions could only spell trouble for the senior civil servants and the cabinet.

Thus the native people, like the environmentalists, had to be given the impression everything possible was being done to protect their interests. Announcements were made of assistance for research and legal expenses, while, behind the scenes, Ottawa pushed to have the pipeline built as soon as possible.

The birth of the official development plan itself demonstrated that tactic.

During 1970, the cabinet did not want to be bothered with a discussion of development policies; indeed Chretien had to wait through most of the year merely to have it consider some proposals in November.

Pipelines, oil and gas exports to the U.S. and sovereignty were the real northern issues in the eyes of Ottawa's senior civil servants and the Trudeau cabinet.

Once those were settled, it was a matter of working out with the oil and gas pipelines in the North, administration in the U.S. exactly how the resources of the North would be integrated into the North American economy through oil and gas pipelines and export commitments.

Kept secret

On July 15, 1971, the cabinet approved a northern development policy.

In November, 1971, it was agreed the document should not be made public, in spite of earlier promises, "for it would only create more disquiet among the northern people."

publish the plan, and in March, 1972, Canada's North 1970-1980 was presented to the Commons Committee on Indian Affairs and Northern Development as the official northern development policy of the Trudeau government.

In it, the government said that a review of northern development policies had taken place during the past year in which "the government affirmed that the needs of the people in the North are more important than resource development and that the maintenance of ecological balance is essential."

There was no mention of the land claims issue.

Nor were the government's claims that it wanted to protect the environment convincing. In April, 1972, immediately after the publication of the new policy on the North, Prime Minister Trudeau announced his ambitious election-eve plan for an all-weather highway through the Mackenzie Delta.

The native peoples had not been consulted on its route and no environmental study had been carried out beforehand. Later, when severe environmental problems were shown to exist, the federal Department of the Environment was forbidden to delay the highway project.

The route was challenged by some native groups. And it became clear that the role of the new highway was not to serve native communities but to give the oil and gas industry and the Nixon administration evidence of the Canadian government's commitment to development of oil and gas pipelines in the North. Today the highway ends abruptly at Fort Wrigley, one of the first native communities to oppose the project because it did not want tourists and other groups driving into the community.

Similarly, in December, 1972, the federal government gave approval in principle for offshore drilling in the Beaufort Sea without consulting native groups whose hunting lands were nearby. Moreover, in spite of the fact that the Beaufort Sea represented one of the most sensitive oil and gas exploration zones anywhere, no government agency had studied the environmental hazards.

Policy a sham

The government's new northern development policy was a sham, and both the government and the native peoples knew it. Nothing had changed the desire of the Departments of Indian Affairs, Energy, and Mines and Resources and of the National Energy Board to get a pipeline built as soon as possible.

The real thrust of northern planning remained the same, exercised through the confidential relationships built up between the oil and gas industry and senior officials in these departments.

After 1970 the intensity of these relationships grew. The oil and gas industry persuaded senior officials in Ottawa that their assumptions — the need for oil and gas exports, a large role for foreign capital, the consortium approach to development—were valid. Excluded from the discussions were the public, people from the North, members of Parliament and the press.

Neither Ottawa's senior officials nor the cabinet wanted anyone from the outside questioning their plans.

In other words, industry and government would plan northern development. The native people were to be "protected," but not consulted or listened to.

Couldn't see it

Officials at the top of Indian Affairs and Northern Development could not accept the idea of native people as owners and managers of their historical lands. Instead, they were seen as dependents who needed welfare or jobs.

This meant, for example, that changes in Canadian oil and gas land regulations were worked out between the government and the oil and gas industry in secret. Yet these revisions spell out the conditions under which oil and gas is extracted from the North, including royalty rates.

Similarly, the $300 million in transport facilities required for construction of a Mackenzie Valley pipeline required industry-government collaboration well in advance of National Energy Board hearings.

Chretien's policy statement in 1972, then, was merely some advice to administrators in the North to pay a little more attention to the native people themselves.

It took a political upset in the October, 1972, federal election to give the northern natives even a vestige of hope that their interests

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Inquiry called

When Trudeau returned to Ottawa with a minority government he was forced to do things he had not planned to do. One such act was the appointment of a B.C. judge, Tom Berger, to hold a special inquiry in the North on pipeline projects.

This has given the native people a forum in which they could spell out their concerns, although it could not deal specifically with the land issue.

When Berger completes his report, probably next year, he will have to chance to state in clear terms the problems and needs of the native people.

Will Ottawa listen? Possibly not. Scarcely had the Berger Commission begun its hearings this year than the government said it might have to make a pipeline decision before the inquiry's work was done.

FRIDAY: How the federal government tried to override opposition from environmentalists in the North.

FRI., OCT. 17

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Files show Ottawa put oil above ecology

By DAVID CRANE
Star political editor

By 1970 the Trudeau government's commitment to oil and gas pipelines in the North was so strong that the cabinet and senior civil servants were convinced they could stonewall questions about the environment. They were confident that industry could be trusted to protect the fragile ecology.

Their main concern was to get the pipelines built in order to increase Canadian oil and gas sales to the United States and accelerated development of the North.

Moreover, there was a firm belief in Ottawa that environmentalists would not create difficulties if pipelines were built fairly quickly, because Canadians concerned about the subject were not yet as well organized or financed as those in the U.S.

Senior officials within the government made it clear that Canada was willing to impose less stringent environmental standards than the United States if that meant the pipelines would be built through Canada instead of across Alaska.

Ottawa's willingness to trade off environmental standards for pipeline investments in the North is documented in confidential records of the Task Force on Northern Oil Development, a committee of senior civil servants; and in confidential documents of the cabinet and other government bodies.

For instance, during a meeting May 12, 1970, hastily called by Marshall Crowe of the Privy Council Office to discuss northern pipelines, Digby Hunt, assistant deputy minister of Indian affairs and northern development, said Canada could be less stringent in its environmental standards than the U.S. in Alaska.

Ironically, throughout 1969 and 1970, it was left to U.S. government officials in Washington and to U.S. oil company executives to warn the task force that pipelines through Canada would encounter the same sort of environmental opposition that faced the Trans-Alaska oil pipeline.

Generate interest

In fact, the task force decided in 1969 and 1970 not to initiate any research on possible hazards of oil and gas pipeline construction and operation in the North. It feared such research might generate too much public interest and might rally opposition to the plan of linking Northern oil and gas to U.S. markets through new pipelines.

This strategy had a drawback: In the absence of Canadian environmental research, Washington simply did not believe Energy Minister Joe Greene, Environment Minister Jack Davis, External Affairs Minister Mitchell Sharp or, later, Energy Minister Donald Macdonald when they claimed that the Mackenzie Valley was ecologically safer than the Trans-Alaska route for a hot oil pipeline and a cold natural-gas pipeline.

At times, it seemed that the Trudeau government was even less concerned about environmental safeguards than was the oil and gas industry. From 1968 through 1970 the industry tried, without success, to persuade Ottawa to spell out its environmental standards for pipelines to be built down the Mackenzie Valley.

On Aug. 13, 1970, the Trudeau government published a set of guidelines for oil and gas pipelines in the North. But all the guidelines said about the environment was that the oil and gas industry would have to satisfy the National Energy Board that proper safeguards would be followed during pipeline construction and operation.

These guidelines, approved by the cabinet, made no mention of environmental standards, criteria or data for the National Energy Board or anyone else to follow.

Inherent conflict

This approach reflected not only Ottawa's policy of build-now, worry-later, but the inherent conflict within Indian Affairs and Northern Development among its responsibilities to develop the North, protect the northern environment and look after the interests of the native people.

The weakness of the 1970 guidelines does not mean environmental concerns were ignored altogether. A small subcommittee on ecological problems was set up by Jack Austin, deputy minister of energy, mines and resources and chairman, after May 1970, of the task force, and Robert Howland, chairman of the National Energy Board and of the task force's pipeline committee.

One reason was that although Austin did not want to spend a great deal of time dealing with ecological problems, he did not want the task force to lose control of environmental policies, a potentially hot issue.

But the new subcommittee had no research staff and did not request any funds for research.

Canadian Gas Arctic, one of the forerunners of the Canadian Arctic Gas group whose application is pending now to build a gas pipeline down the Mackenzie Valley, established a body called the Environment Protection Board to carry out research to support its own application. The task force was satisfied this research would be good enough for the government.

The task force still was counting on a quick application and hearing for a gas pipeline: Approval at the deputy-minister level by mid-1971, follow-up hearings before the National Energy Board that fall. By June, 1972, the hearings could be wrapped up, and with the necessary construction permits and right-of-way in hand, construction of a gas pipeline could begin in the fall of 1972.

But in 1971, with MPs and other groups asking more and more questions, senior government officials came reluctantly to the view that their plans for oil and gas pipelines could ultimately face tough environmentalist opposition.

The task force decided to replace its small subcommittee with a new environmental committee to head off public concern. On March 17, Austin asked Robert Shaw, deputy minister of the new Department of the Environment (still operating under its old name of Fisheries and Forestry) to be chairman.

The task force had been caught by surprise when, in the spring of 1971, Austin received a letter from Jack Davis, minister of the environment.

Davis said he had read the winter issue of the Canadian Wildlife Federation newsletter and he agreed with its claims that the task force was misleading the Canadian public into believing the government was conducting large-scale research of its own into the environmental problems of northern pipeline construction.

Shaw's committee never met.

Instead, in June, the task force proposed a more ambitious program, including a new social and environmental committee, along with an advisory group of outside experts to work with the task force on environmental and social programs in the North.

The cabinet memorandum setting up the new committee and advisory group made it clear that this was an attempt to allay growing public suspicions that environmental problems were not receiving much attention from the government.

The advisory group was to include representatives from about 20 organizations, such as the Canadian Wildlife Federation, Imperial Oil Ltd., the Canadian Arctic Resources Committee, the Canadian Pipeline Advisory Committee and an Eskimo brotherhood Inuit Tapisirat.

But it would not have access to government research; it would have a very small budget, and it would meet only on rare occasions and always at the discretion of Indian Affairs and Northern Development. In fact it never met.

Reflecting the panic over anticipated opposition, the new committee sought, in addition to $5 million committed in May, 1971, another $10 million for a three-year crash program of environmental research in the North.

This was a remarkable change in attitude. But the truth was that the new committee had not worked out any research priorities among a long list of projects hastily thrown together at the last minute and simply appended to the cabinet memorandum.

Political pressure

The program was approved by the cabinet although a number of senior officials had serious misgivings. But it was felt that political pressure could become so great that any kind of environmental research should be approved, regardless of its great value.

Until the fall of 1972, the main worry within the task force was that public groups such as the Canadian Arctic Resources Committee and Pollution Probe of the University of Toronto, along with various "trouble-makers" within the Departments of the Environment and of Indian Affairs and Northern Development, might try to use the same tactics to halt or delay a Mackenzie Valley pipeline that U.S. environmentalists had used to delay the Trans-Alaska line.

A set of expanded guidelines drafted by the task force's new social-environmental committee and tabled in the Commons by Jean Chretien, minister of Indian affairs and northern development, June 23, 1972, were hastily drafted, gave little evidence of detailed government research and read more like a code of good environmental behavior than a set of standards to be followed by engineers in the field.

The task force simply did not have enough reliable data available to draft adequate standards. Indeed, the first guideline asked the very question the guidelines were supposed to answer.

It stated that "a pipeline should be constructed, operated and abandoned in keeping with good engineering practice to ensure its safety and integrity, in the interests of good environmental management and the reduction of environmental damage."

The guidelines did not define "good environmental management."

During 1972, government lawyers were also raising the question whether the National Energy Board had the power to deal with environmental and social questions in its hearings. The National Energy Board Act was silent on this, except for an umbrella clause empowering it to consider the public interest.

In 1971 the energy board requested, in a memorandum to cabinet, amendments to its legislation specifically setting out its power to examine environmental problems when dealing with pipeline applications.

But a memorandum to Environment Minister Davis from his deputy minister, Shaw, dated Feb. 8, 1972, showed there was little support for such amendments.

Threw roadblock

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"I understand that the Honorable Jean Chretien threw a roadblock at this Memorandum to Cabinet on the grounds that consideration of the environmental impact of a pipeline in the Territories was the exclusive responsibility of Indian Affairs and Northern Development," Shaw wrote.

Later that month Shaw received a letter from Robert Howland, chairman of the National Energy Board, requesting Shaw to speak to Davis about the role of the board so that Davis might in turn try to change Chretien's mind.

Howland also made it clear that the energy board needed its own small environmental staff, although this was being blocked by the Treasury Board. The pipeline hearing would not be a one-shot deal, Howland stressed.

"It is inherent in the circumstances of continuous pipeline expansion that the board will constantly need the (environmental) staff competence we envisage," Howland wrote Shaw. In other words, once the first pipelines were built, there would be an ongoing expansion of their capacity as the flow of oil and gas from the North increased.

Other projects in the North reflected the government's disposition to downplay environmental problems if they interfered with the oil and gas industry.

One example was the plan to push ahead construction of an all-weather highway north through the Mackenzie Valley to Inuvik and on to Tuktoyaktuk.

Prime Minister Trudeau announced it at Edmonton April 28, 1972, just four days after Chretien sent a confidential memo to cabinet recommending the project and one day after the Cabinet gave approval.

'Dissident voices'

Trudeau said in Edmonton: "Before we build them . . . we must be equally certain that these facilities will not lead to ecological devastation or disregard for the lifestyle and treaty claims of the original inhabitants of the North."

Yet construction was to start right away, in spite of the fact that Ottawa had done no environmental research on the impact of an all-weather road through permafrost and in spite of the objections of native groups, who quickly saw that the main reason for building the road then was not to aid their communities but to assist pipeline construction and emphasize the government's commitment to pipelines.

In his memorandum to cabinet Chretien anticipated "a backlash of dissident voices . . . from environmentalists" about the road, but he proposed a strategy to split any opposition.

He proposed that a separate statement on settlement of two Indian treaties be made simultaneously with the highway announcement.

Summing up the reasons for accelerated construction of the highway—before environmental impact studies had been made and in spite of an admitted shortage of gravel—Chretien told the cabinet: "As a means of realizing the potential benefits of an all-weather highway down the Mackenzie Valley for pipeline construction, of indicating Canada's interest in a very positive way in the construction of oil and gas pipelines through Canadian territory and of providing a focus for northern development, the continuation of construction of the Mackenzie Highway to Inuvik should be commenced immediately and pushed through to rapid completion."

To sell the highway to Canadians, Chretien recommended that the cabinet present it as "the kind of project that has considerable emotional appeal, similar to that offered by the CPR in the late 1800s, in the development of Canada's last frontier."

Chretien recommended against consulting the caucus "at this stage." Back-bench Liberal MPs were to be told no more than the general public.

The decision to push on with the highway was crucial in the government's pipeline planning. It was a big expenditure — the cost was estimated at about $100 million then and now is close to $200 million — but it was a clear signal to the Nixon administration in the U.S. and to the oil and gas industry that Ottawa wanted to push ahead with oil and gas pipelines as rapidly as possible. It was a clear victory for the task force. (Today, the highway has run out of money and ends uncompleted on the outskirts of Fort Wrigley.)

Individual scientists working for Canadian Gas Arctic's Environment Protection Board wrote to the federal government June 6, 1972, requesting that an environmental impact study be made and published on the Mackenzie Highway.

On Aug. 28 the government replied that it would not publish such a statement.

Offshore pools

To this day the Department of Indian Affairs and Northern Development has refused to publish the environmental research it was forced to carry out on the highway.

A second area where government lack of concern was visible was in the Beaufort Sea. As oil and gas companies pushed on with their exploration in the Mackenzie Delta it became evident that big pools of oil and gas might exist offshore.

In December, 1972, at a private meeting between oil and gas companies and senior government officials representatives of the oil and gas industry requested approval in principle to commence offshore drilling.

A draft memorandum to cabinet was prepared by a committee from Indian Affairs and Northern Development set up in February the following year. The draft memorandum said the environmental risks were low, although no environmental research had been done and no research was proposed.

A final draft, considered by the cabinet in July, 1973, gave Indian Affairs and Northern Development authority to license offshore drilling.

However, the cabinet also called for a modest environmental research program, with offshore drilling to start in 1975. Disagreements over shared costs of the research between government and industry have delayed drilling to 1976, although Imperial Oil has been permitted to start drilling from a man-made island offshore.

Warning of the dangers of well-blowouts, Douglas Pimlott, of the Canadian Arctic Resources Committee, expert on the North, said last year that the oil and gas industry and Indian Affairs and Northern

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Development were pushing ahead with offshore drilling in the Beaufort Sea "in advance of the development of adequate technology for Arctic operations because the companies involved are rushing to prove reserves so that the construction of a gas and possibly an oil pipeline can be justified to the National Energy Board before the end of this decade."

What then is the government's record on environmental protection of the far North?

At the beginning of the 1970s the Ottawa government clearly was unprepared to deal with the matter.

But to admit as much would have delayed pipeline plans, a course unacceptable both to the task force of senior civil servants and to the cabinet.

So a different strategy was devised: Instead of a government-sponsored environmental impact statement similar to that required in the United States, the Canadian government would leave research to the oil and gas industry.

In the meantime, government guidelines would be set out that would give the appearance of concern. These came in 1970 and 1972.

When cracks appeared in this strategy, the government still determined that pipeline plans would not be blocked by environmental issues.

A hastily drafted program of government research was launched and critics of the government were dismissed as members of the radical fringe of Canadian politics.

Well-known Canadian scientists and academics found themselves under strong pressure from senior civil servants to drop their support for groups such as the Canadian Arctic Resources Committee, which was pressing for much fuller environmental and social studies of proposed pipelines, the Mackenzie Highway and offshore drilling in the Beaufort Sea.

Yet in the end the government has had to bow at least part way to environmental pressures, although the Department of Indian Affairs and Northern Development has successfully blocked a weak-hearted and largely ineffectual Department of the Environment from taking a hard look at ecological issues.

The appointment of a commission in 1974 under B.C. judge Tom Berger to hold land-use hearings brought environmental issues into the open.

No guarantee

Even so, the government has refused to publish environmental data on the Mackenzie Highway, has attempted to cut back government funds for environmentalist groups appearing before the Berger Commission, has prevented the Berger Commission from looking at the environmental impact of the gas-gathering and processing systems that must be built through the Mackenzie Delta to supply the pipeline, and has tried to act as if the pipeline were a single project to be considered in isolation instead of the first of a series of pipelines.

There is no guarantee the government will listen to the Berger Commission's report.

There is no evidence it is about to alter its philosophy of the past five years.

SATURDAY: What have we learned from our energy bungling?

SAT. OCT. 18

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The oil mess: What has Ottawa learned?

By DAVID CRANE
Star political editor

Within the past 12 months the National Energy Board and the Department of Energy, Mines and Resources have had to admit to the country that the government's energy policy has been based on the false premise of abundant oil and natural gas.

In October, 1974, the energy board reported that Canada would become a net importer of oil by 1977. In fact, Canada is in that position already, with a declining level of oil production.

In May, 1975, the energy board reported that Canada would face natural gas shortages this decade. They could come as early as next winter.

How did the Trudeau government come to bungle the country's energy policy so badly? Just five years earlier, Trade Minister Jean-Luc Pepin (just this week appointed chairman of the Anti-Inflation Review Board), had declared that Canada had so much oil and gas "it would be crazy to sit on it."

In part, the energy mess was the result of a series of errors of judgment by cabinet ministers and senior officials.

Direct result

But it was more than that. Canada's energy crisis is the direct consequence of the way big government and big business work closely together on major issues of public policy.

After oil and gas were found in Alaska in 1968, it was clear that Canada would have to weigh the consequences for its own energy policies.

But instead of defining the broad public interest, the government subordinated Canada's energy resources—as well as the native people and the fragile environment of the North—to the immediate interests of Canadian-U.S. relations and to largely foreign-owned oil and gas producers.

The record of the Trudeau government since 1968 shows:

- The government and its advisers completely miscalculated Canada's oil and gas reserves and needs, relying instead on the fanciful figures of the Canadian Petroleum Association, which represents the country's oil and gas producers, most of them foreign-controlled. This led the cabinet and senior civil servants to sell Canada's proved and cheaper reserves of oil and gas to the United States as rapidly as possible.
- The cabinet proclaimed sovereignty in the Arctic waters, after hesitating for several years, but has done little since to affirm it.
- The Department of Indian Affairs and Northern Development shut the northern Indians and Eskimos out of much of the policy planning in the North, while paying lip service to participation. At the same time the department hoped that oil and gas pipelines could be pushed through before native groups could organize to settle their land claims.

More research

- Senior officials responsible for the North decided to rely on the oil and gas industry to deal with environmental research, while attempting to discredit public environmental groups who wanted much more independent research. At the same time the Department of Indian Affairs and Northern Development succeeded in blocking the Department of the Environment from assuming responsibility for protecting the ecological balance of the North.

Late in 1972, the federal cabinet, the National Energy Board, the Department of Energy, Mines and Resources and the Department of Indian Affairs and Northern Development suddenly discovered their whole approach since 1968 had been wrong. But they still didn't realize the true dimensions of the problem.

That would not come for another 13 months to two years.

There is little evidence that Ottawa has learned from its bungling of 1968 to 1972—except to take a more sophisticated approach in dealing with native groups and public-interest organizations.

A look at some key policy areas today — Arctic sovereignty, energy, northern development, the role of native people, environmental protection and the policy-making process itself — shows little has changed.

Behind the facade of clever civil servants and powerful cabinet ministers, the indecision and delay on tough policy questions is unchanged.

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One key example is the government's failure to follow up the issue of sovereignty in the North.

After introducing legislation in April, 1970, to deal with the sovereignty crisis in Arctic waters, the Trudeau government realized it would have to strengthen its presence in the North to demonstrate Canadian sovereignty.

In July, 1970, the cabinet directed the Department of National Defence to determine the role of Canadian Armed Forces in the North.

By January, 1971, the Defence Department was able to present a draft report on northern sovereignty to Ottawa's senior civil servants. Surprisingly, Defence saw few problems or threats and endorsed what it viewed as Canada's open-door attitude to other countries using the North.

"No other state covets or seeks to deprive Canada of any part of its territory or seeks to reduce or deny to Canada its political independence," the report said.

"To the extent that Canada's national jurisdiction is disputed by other states, the disputes centre on areas into which that jurisdiction has recently been extended beyond the limits traditionally recognized by international law and are mainly with states with which Canada is allied or enjoys friendly relations and which consequently are unlikely to use physical force to impose their will on Canada."

Here, of course, Defence was referring to the U.S. rejection of Canadian sovereignty claims in the North. It did not see a threat from the U.S. navy or Coast Guard using their own armed polar icebreakers to escort oil tankers through the Northwest Passage at some future date.

"It has been noteworthy," Defence went on to say, "that the departments and agencies consulted believe that, within their specific areas of responsibility, Canadian laws and regulations and the means which they employ to enforce them are for the most part adequate to protect Canadian national interests."

Defence noted approvingly that "Canadian policies as expressed in the body of statute law and in Canadian regulations manifest almost no xenophobia."

In fact, it said in classic understatement, "there is little of the desire to exclude foreigners from the territory and economic activity of the nation that has been a classic characteristic of most modern states."

Top priority

The main recommendation of the Defence Department, when it made its final report to the cabinet in May, 1971, was that the Departments of Defence and Transport should work closely together to improve Canada's surveillance and control of the North.

To be sure, subsequent government defence policy statements have stressed that protection of Canadian sovereignty in the North is one of the top priorities of Canadian defence policy.

But there has been little follow-through, due in part to budgetary restrictions in defence spending and reliance on outdated equipment. For a while last year, Defence suspended altogether its already feeble air surveillance program in the North. Budgetary reasons were cited.

The situation was summed up in a brief to the cabinet this year from the Naval Officers' Associations of Canada and was underlined by the failure of Canadian authorities, for a month, to detect a Polish vessel in Canada's Arctic waters.

The United States could challenge Canadian sovereignty in the future as Alaskan oil production is increased, according to the naval association. It said that the Bering Strait is too shallow for tankers and that if the United States wants to move Alaska oil to the oil-hungry east coast, tankers must go through the Northwest Passage.

Huge tankers

It pointed to discussions last year by U.S. marine engineers and U.S. government officials of a possible plan to build as many as 62 huge ice-breaking tankers, each capable of carrying 240,000 tons of oil, that would be able to make the 9,200-mile round trip between Alaska and Cape May, New Jersey, through the Northwest Passage, in just 20 days.

"Canada maintains no continuous surveillance of the eastern or two western entrances to this waterway," the naval association reminded the cabinet in April.

Another sign to the world that Canada intended to stake its sovereignty claim in the North would have been a government program to design and construct polar icebreakers.

In April, 1970, the Task Force on Northern Oil Development told the Trudeau cabinet that Canada urgently needed icebreakers to maintain its sovereignty claims in the Arctic. The new anti-pollution law in Arctic waters made it essential that Canada be able to intercept foreign vessels even in very difficult ice conditions, the task force said.

And, it warned, the outcome of the next challenge to Canadian sovereignty in the North could depend on Canada's capability to enforce its Arctic legislation rather than its legal skills in the International Court of Justice.

In the meantime, the U.S. Coast Guard had embarked on its own crash program of polar icebreaker construction. The program may have been helped by data gathered on the voyage of the tanker Manhattan through the Northwest Passage in 1969.

Canada has failed to obtain information from the voyage, in spite of icebreaker and other help it provided at the time.

The decision to withhold the information was apparently made by Exxon Corp., parent of Imperial Oil. But the real reasons may have run deeper than corporate secrecy.

Claude Isbister, while still deputy minister of energy, told a meeting of senior Ottawa officials May 12, 1970, that the U.S. navy might be helping pay for the Manhattan voyage.

In any event, Canada made several attempts to get research information from the Manhattan voyage.

In a letter to Humble Oil, an Exxon affiliate, in early 1972, for example, Ottawa wrote, "Of course we appreciate the need to keep some material confidential, and we can assure you that all materials sent to us will be so treated."

In spite of this pledge, nothing was forthcoming.

Polar icebreaker

Not until mid-1974 did the government finally approve the funding of research into polar icebreakers by a Montreal firm. The money is only for the design stage, and the federal government will have to decide in 1978 whether it wants to build the ships. If so, they would not be delivered before 1982.

Nor has there been a real change in government attitudes toward environmentalists or native people, although Indian Affairs and Northern Development now recognizes that challenges from both these groups have been more effective than they were expected to be.

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After the 1972 election resulted in a minority Trudeau government and the apparent collapse of government energy strategy, the cabinet and senior civil servants decided reluctantly to hold a special set of pipeline hearings in the North. There are also normal National Energy Board hearings that begin Oct. 27.

The hearings, under Mr. Justice Tom Berger of the B.C. Supreme Court, are into the environmental, social and regional economic impact of a gas pipeline proposed by Canadian Arctic Gas Pipeline Ltd. along the Mackenzie Valley. (A second application, from Foothills Pipeline, was made after Arctic Gas.)

It was Berger's job to determine under what conditions a pipeline right of way should be granted. Yet the very day in March this year that Berger began his hearings, the government seemed to have some doubts.

On March 3, New Democratic Party energy critic Tommy Douglas asked acting prime minister Mitchell Sharp whether the government would promise to withhold a decision on a gas pipeline until Berger had completed his report.

"I can give no such a categorical assurance. It would depend a great deal on the nature of the report to be presented by Mr. Justice Berger," Sharp replied.

On March 11, Energy Minister Donald Macdonald attempted to give an impression the government was still undecided whether or not the gas pipeline would be built. "There were no attempts by this government to make any judgment on the Mackenzie Valley pipeline before the National Energy Board, reports," he told the Commons.

Budget slashed

Yet on Jan. 18, Jean Chretien, as minister of Indian Affairs and Northern Development, had declared: "This government, after carefully weighing all the factors involved, has come to the conclusion that a gas pipeline down the Mackenzie Valley is in the national interest."

Scarcely a month after the Berger hearings had begun, the new minister of Indian affairs and northern development, Judd Buchanan, slashed the budgets of native groups appearing before the Berger commission and eliminated funding of public environmental groups altogether.

Buchanan said that the Canadian Arctic Resources Committee and the environmental research it was co-ordinating could be supported from Berger's own budget, although in February he had sent a memo to the commission telling it not to do so.

This move, coming shortly after Sharp's rebuff in the Commons, almost killed the Berger hearings.

In the public uproar that followed, funds were found in the Berger commission's budget. The amount of money involved: $145,000, or just over half the amount spent recently on the champagne festivities to open Mirabel airport outside Montreal.

Moreover, the boomtown philosophy that remains in the Department of Northern Development promises a future pattern of boom-bust cycles.

One example is the development of a lead-zinc mine at Strathcona Sound on Baffin Island in the eastern Arctic. The foreign-owned Mineral Resources International Ltd. has been given permission—and help—by Indian Affairs to open a mine that will supply raw concentrates for the metals industry in Europe.

Cabinet order

Before the project was approved, there was virtually no social or environmental research by the government in spite of a Dec. 20, 1973, cabinet order that there should be an impact study on such projects and a pledge by Chretien on March 28, 1972, that government support for such projects would be based on a full assessment of their economic and social impact.

When he announced government support for the project last year, Chretien stated the government's primary objective was to ensure jobs for Baffin Island natives and to give them a voice in planning a project. Yet there has been little involvement of local people in the planning and they were not sure they wanted to become miners.

One factor that concerns the native people a great deal is the lack of clear answers to environmental problems.

The new mine may create 275,000 tons of tailings or wastes each year, containing dissolved poisonous metals, such as lead and arsenic. These will have to be disposed of in the land or in the waters of Strathcona Sound.

What does Canada gain from su a project, which it attracts w generous tax incentives and s ports with public funds?

Another example of the w development overrides environm tal concerns in the North can found in an internal memo circui ed within the Department of Environment by one of its officia In it he complains about efforts Indian Affairs and Northern Dev opment to prevent the Departm of the Environment from playing active role in the North.

In one case in the memo, dian Affairs called a meet through one of its committees to cuss an application by Imperial which wanted to start construct immediately in the Beaufort of an offshore oil- and gas-drill island, and to start drilling ab Dec. 1.

Environment said it would be p pared to comment on Imperi application by Aug. 15. On Aug. Indian Affairs went ahead and sued the permit.

"This example illustrates the l of acceptance of Environment's r in the North and the lack of m than superficial concern about environmental aspects of devel ment," the official commented.

Energy policy has been no m reassuring. Much of the informat on this point will come out at tional Energy Board hearings int Mackenzie Valley gas pipeline t begin Oct. 27.

The first issue will be the role the board itself and its chairm Marshall Crowe.

Easiest answer

When the hearings open, Cro will respond to suggestions that may have a conflict of interest cause he has served as presiden the Canada Development Co While at the CDC, Crowe arran its participation in Canadian Ar Gas Pipeline and had served on pipeline consortium's managem committee and its tax, finance accounting committee.

The easiest answer would be Crowe to step down from the he ings and let someone else from board fill in for him.

But the issue may go deeper t that. Questions may be raised ab the impartiality of the board its since it has been heavily involve promoting a gas pipeline since at 1969. And this conflict arises fr the curious legislation setting up board. The board has a double-l reled responsibility: To cond

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In recent years the board has played an important role in formulating energy policy. In the eyes of some critics, it should have to answer for policy mistakes.

The sudden change from a natural gas surplus to an anticipated shortage is a case point, one that will be hotly debated at the pipeline hearings.

By the end of 1974, as Bruce Willson of Union Gas told a National Energy Board hearing on Canada's natural gas supplies, the country was faced with the prospect of "decreasing supplies at ever-increasing prices."

"This is just not good enough for a country which, until very recently at least, was touted as having gas reserves sufficient to meet its own needs for literally hundreds of years into the future," he said.

In 1973, National Energy Board vice-chairman Douglas Fraser stated that western reserves were "ample to cover" Canadian deliverability requirements until the end of the 1980s or into the early 1990s," while Energy Minister Donald Macdonald's energy white paper the same year said, "the present volume of reserves is sufficient to meet export commitments and growing Canadian demands in the areas now served through the 1980s."

Yet by last year the situation had changed so drastically that the National Energy Board was compelled to hold new public hearings to determine Canada's natural gas supplies and needs.

Verne Horte, president of Canadian Arctic Gas Pipeline, declared last year: "Unless new reserves of Canadian gas are developed more rapidly, we believe that most, if not all, of the Mackenzie Delta gas will be required by Canadian consumers."

In fact Canadian Arctic Gas says it had spotted Canadas' impending gas shortage by 1972. But it had to convince the government.

Open system

Finally this year, the energy board was forced to report that Canada in fact faces the prospect of gas shortages in the near future.

Where does the country go from here?

The answer does not lie just in getting better people in Ottawa to make better decisions, although that would certainly help.

The real answer lies in a more open system of policy-making, one that gives Parliament and the public more information and more access to policy-planning within the government.

In too many instances the cabinet and senior civil servants were unwilling to disclose their plans to the public and, even worse, they dismissed critics as people who were unionists or who were just not able to make responsible judgments because they did not have access to all the facts.

In many respects, the critics were treated in the same way as U.S. critics of the Viet Nam war.

But if Canada is to have a fresh approach to decision-making, and to have an open policy-making process that defines the public interest in broader terms, there will have to be a remarkable change in attitude not only on the part of the top cabinet ministers but also on that of senior civil servants.

Of that, there seems virtually no prospect.

In the meantime, Ottawa's bungling of energy policy stands as one of the great political scandals of recent years.

But one other question remains: Even though the government mishandled energy, environment and native claims issues, does Canada, and hence Ontario, face a natural gas shortage?

If it does, and this will have to be shown at the Energy Board hearings, then Canada will probably need a Mackenzie Valley gas pipeline. But not for the reasons originally planned a few years ago.

Last of a series

PLEASE NOTE: THE FOLLOWING PAGES WERE TREATED AS A UNIT IN THE ORIGINAL DOCUMENT.

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PETROLEUM ENGINEERS and GEOLOGISTS

3430 ENTEX BUILDING
1200 MILAM STREET
HOUSTON, TEXAS 77002
AREA 713/227-3127
CABLE: KEPPET TELEX: 762-324

January 18, 1977

Senate President John Rader
Alaska State Legislature
Pouch V
Juneau, Alaska 99811

Dear Senator Rader:

Please find enclosed a copy of a speech I gave a couple of weeks ago here in Houston to a group of end users who are seeking to acquire natural gas for their own account due to the crisis-proportion energy shortage.

I would like for you to put in the record that indeed a critical energy shortage does exist in the United States and this shortage is going to get worse before it gets better. It is imperative for the survival of the United States that we continue to find oil and gas in a free market environment. In addition, we should all vigorously oppose divestiture of the major oil companies. Price controls and divestiture would surely kill any semblance of future energy independence. I believe that by a study of the facts and figures in the attached paper, the conclusions are irrefutable.

We appreciate this opportunity to submit this written evidence.

Sincerely yours,

KEPLINGER AND ASSOCIATES, INC.

H. F. Keplinger

H. F. Keplinger, President

HFK:bam

Enclosure

EXHIBIT XIV

AN EXAMPLE OF
ULTIMATE AND REMAINING RESERVE ESTIMATES
IN THE LIFE OF A GAS WELL

	Initial Volumetric Estimate				Mid-Life (No Decline)				Production on Decline			
			% Increase				% Increase				% Increase	
	A	B	Inc.	Cum.	A	B	Inc.	Cum.	A	B	Inc.	Cum.
Pore Volume Calculations												
Porosity - Percent	20	22	10	10								
Connate Water - Percent	35	30	8	18								
Initial Pressure - Psia	3,000	3,000	-	18								
Initial Supercompressibility	.905	.905	-	18								
Pressure Base Psia	14.65	14.65	-	18								
Reservoir Temperature - Deg. F.	200	200	-	18								
Temperature Base - Deg. F.	60	60	-	18								
Initial Gas in Place - Mcf/Ac. Ft.	1,010	1,196	18	18								
Recovery Factor	.70	.75	7	27								
Calculated Gas Recovery - Mcf/Ac. Ft.	707	897	27	27								
Drainage Volume Calculations												
Net Pay at Well - Feet	20	20	-	-	20	20	-	-				
Est. Average Net Pay Over Drainage Area - Feet	17.5	20	14	14	17.5	17.5	-	-				
Est. Drainage Area - Acres	240	320	33	52	240	240	-	-				
Drainage Volume - Acre Feet	4,200	6,400	52	52	4,200	4,200	-	-				
Estimated Ultimate Recovery - MMcf	2,969	5,741	93	93	2,969	3,767	27	27	2,969	3,339	12	12
Reserves At End of Report Period												
Estimated Ultimate Recovery - MMcf	2,969	5,741	93	93	2,969	3,767	27	27	2,969	3,339	12	12
Cumulative Production - MMcf	-0-	-0-	-	-	1,440	1,440	-	-	2,544	2,544	-	-
Estimated Remaining Reserves - MMcf	2,969	5,741	93	93	1,529	2,327	52	52	425	795	87	87

KEPLINGER and Associates, inc.—
PETROLEUM ENGINEERS and GEOLOGISTS

3430 ENTEX BUILDING
1200 MILAM STREET
HOUSTON, TEXAS 77002
AREA 713/227-3127
CABLE: KEPPET TELEX: 762-324

NATURAL GAS ACQUISITION

Prepared by

H. F. Keplinger

for the

"ACQUIRING NATURAL GAS CONFERENCE"

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Houston, Texas

NATURAL GAS ACQUISITION

By: H. F. Keplinger
Keplinger and Associates, Inc.
Houston, Texas - Tulsa, Oklahoma
January, 1977

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NATURAL GAS ACQUISITION

By: H. F. Keplinger
Keplinger and Associates, Inc.
Houston, Texas - Tulsa, Oklahoma
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It is indeed a pleasure to speak to you today concerning types of programs for acquisition of natural gas. The importance of natural gas as a future energy source cannot be overemphasized. Natural gas, sometimes referred to as the perfect energy source, is our most widely used domestic energy resource and will continue to be for many years to come. It supplies approximately one-third of our energy needs and, more important to those of us gathered here, it is a primary source of energy for American industry in that it supplies approximately 47% of our industrial needs.

It may be of interest to you to see graphically an overview of the natural gas distribution system in the U.S. Exhibit I is based on 1974 data from a Bureau of Mines survey. You will note that the total supply of gas was 24.3 trillion cubic feet. After deducting storage injection, fuel use and losses, there was a total of 19.1 trillion cubic feet available for delivery to customers. This was divided between the interstate pipelines, which transported 12.4 trillion cubic feet, and the intrastate pipelines and producers which delivered 6.7 trillion cubic feet. Interstate sales to direct customers totaled 1.0 trillion cubic feet, and interstate sales through distributors totaled 11.4 trillion cubic feet.

The natural gas industry is essentially composed of three segments: first, gas supply, i.e., the exploration for and production of natural gas at a field

level and/or gas supply acquired by negotiated gas purchase contracts; second, the transportation of that gas to industrial and residential distribution points through gas gathering and transmission pipelines; and, third, marketing which consists of the sale and distribution of that gas to the end users. All other gas company departments such as finance, accounting, geological, engineering, legal, land and right-of-way, pipeline, compressor, gas measurement, and dispatching are, or should be, incidental to performing the three basic functions of the company, i.e., gas supply, transportation, and marketing. The increasing shortage of natural gas has forced many natural gas pipelines, distribution companies and end users to become more involved in the gas supply segment of the industry by actively engaging in direct exploration, development and production, either on their own or in combination with oil and gas producers.

INTERSTATE NATURAL GAS SUPPLY SHORTAGES

Before discussing the various methods of acquiring natural gas, I think it is appropriate that we place the natural gas supply situation in the U.S. into perspective.

THE PROBLEM

The FPC has released statistics for 1975 indicating that a decline in natural gas reserves committed to interstate pipelines has occurred for the eighth consecutive year. During 1974, total domestic natural gas reserves dedicated to interstate pipelines declined about 13.8 Tcf, or about 10.3%. Based on

Form 15 annual reports filed by 60 interstate pipeline companies, dedicated domestic reserves fell from 120.5 Tcf at the end of 1974 to 108.4 Tcf at the end of 1975, or by approximately 10%. This drop resulted from reserve adjustments amounting to 95 Bcf, coupled with gas withdrawals of 12.1 Tcf. Pipeline production and purchases of 12.1 Tcf in 1975 compares to the 1974 volume of 13.0 Tcf. The reserve life index, or reserve to production ratio, for interstate pipeline reserves declined from 9.3 years at the end of 1974 to 9.0 years at the end of 1975. This decline will continue to persist and accelerate unless proper price incentives are given to the industry.

THE EFFECTS

The FPC expects curtailments for the 1976-1977 heating season to increase by 26.7% over last winter. Reports filed by 29 of 52 pipelines show that the companies are predicting they will fall almost 3.8 Tcf below contracted deliveries which total 14.5 Tcf. Last year's actual figures show that pipelines were unable to deliver nearly 3 Tcf of 14.1 Tcf total demand. This is exactly what was predicted at this meeting last year.

The FPC completed a series of hearings in December involving expected curtailments by 19 pipelines. The companies were asked to project what effect a severe winter would have on their gas supplies. A report on the hearings concluded that "under normal weather conditions, markets served by 18 of the pipelines will experience relatively minor difficulties in absorbing projected curtailments with minimal adverse effects such as production losses or unemployment during the coming winter season." The nineteenth pipeline, Transco, which expects a 47% shortfall, did not have enough information about the end

use customers of its distribution companies to reach any conclusions. The FPC said it intends to monitor Transco's situation and seek reopening of the proceedings, if necessary. The Commission noted that United Gas Pipe Line Co. is predicting over 46% curtailment this winter, with a 7% cutback to industrial customers and a 7% shortfall in Priority 1 gas. None of United's direct industrials are expected to be totally curtailed and United is making all efforts to assist customers with potential problems through emergency purchases, Order 539 arrangements and locating alternate fuel supplies.

THE RESULTS

The following chart (Exhibit II), taken from Chemical Week, shows the states that will suffer from curtailments this winter. As you can see, there are seven states that will be curtailed 40% or more, seven states that will be curtailed between 25% and 40%, and 23 states that will be curtailed 10% to 25%. It is estimated that between November 1 and March 31 the interstate pipelines will only be able to deliver 77.6% of the gas that has been contracted for by local utilities and the pipelines' other directly served customers in 47 states. Last winter's gas shipments amounted to 81.9% of the total obligated volume.

During the past two years while fuel shortages in the industrial northeast and in North Carolina contributed more unemployment to an already serious recession, the recession was hardly felt in Texas. This is because the new supply of intrastate gas ensured jobs and generated business expansion and provided 200,000 Texas farmers with 880,000 tons of fertilizer a year. This

was accomplished by high, unregulated intrastate gas prices and the associated increase in drilling activity. The output of petrochemical plants in Texas and Louisiana creates 7.3 million jobs as those products flow into the country's industrial complex. I don't want to belabor the future problems involved with curtailment, but in a recent report issued by the FPC, they estimate that a 15% reduction in petrochemical output would result in a loss of 1.6 million jobs throughout the nation and the loss of $70 billion in industrial production value. The textile industry alone is said to provide one out of eight jobs in the nation and is heavily dependent on synthetic fibers made from petrochemicals. Governor Rhodes of Ohio said that his state lost 61 million man-hours of employment last winter because of gas shortages. In North Carolina they are worried about the loss of 71,000 jobs if adequate natural gas is not available to them.

THE CAUSE

Exhibit III is a summary of the prices now allowed by the FPC. You will note that prior to January 1, 1973, the price varies for old gas from $.3325/Mcf for large producers to $.3938/Mcf for small producers in all areas except the Permian Basin and Rocky Mountains. For old gas drilled prior to January 1, 1973, either dedicated to interstate commerce after January 1, 1973, or subject to new contracts which replace contracts expiring on their own terms after January 1, 1973, the price, plus BTU adjustments and other allowances, is $.5942/Mcf for large producers and $.7713/Mcf for small producers. For gas drilled after January 1, 1973, but prior to January 1, 1975, the price is $1.0507/Mcf for large producers and $1.3647/Mcf for small producers. For wells drilled after January 1, 1975, the price for new gas is $1.6075/Mcf

for both large and small producers. We have assumed a BTU content of 1030, and a pressure base of 14.73.

I would like for you to compare these numbers to the summary price data shown in an FPC staff report for new and renegotiated intrastate contracts for the second quarter of 1976 (Exhibit IV). The weighted average price of new intrastate contracts executed during this period was $1.59 per Mcf. The weighted average price for renegotiated or amended contracts in the second quarter of 1976 was $1.66 per Mcf. The second quarter volumes represented by the two groups of contracts were 116 Bcf and 125 Bcf, respectively. You will note on Exhibit IV that the highest price paid was $2.34 per Mcf and the lowest was $0.15 per Mcf.

Another interesting note is that on the Texas Gulf Coast over 96% of the gas was sold at prices above $1.50 per Mcf. It is obvious that even with the new Order 770-A allowing $1.42 for new gas, the disparity between interstate and intrastate still plagues the industry. The average price paid in 1975 by interstate pipeline companies was 42.3¢/Mcf. This was 13.5¢/Mcf higher than the average 1974 price of 28.8¢/Mcf. The interstate pipeline companies surveyed by the FPC accounted for about 60% of all natural gas produced and marketed in the U.S. in 1975.

A PARTIAL SOLUTION

Deregulation of the wellhead price of natural gas will be essential if interstate pipelines are ever to compete with intrastate pipelines for meaningful reserves of natural gas. One can only hope that 1977 will see the deregulation of natural gas which would allow for increased drilling budgets and the

possibility of the interstate pipelines competing more effectively for new gas. This would certainly help end users in being assured of future supplies.

Some signs for deregulation are encouraging, as indicated by President-elect Carter's letters to Governors Boren and Briscoe in which he stated that he favored immediate deregulation of natural gas. However, his language is now changing in that he has added the word "temporary" and recently said, "In the long run, temporary deregulation of natural gas prices probably is advisable, leaving into effect existing contracts which extend in many instances beyond the year 2000." There is still great political pressure not to deregulate the price of natural gas. It is interesting to note that Exxon, number one in interstate gas sales in the U.S. with 965 Bcf in 1975, estimates that only 8% of their 1977 natural gas production would be affected by the recent FPC ruling increasing wellhead prices. One can see that the higher prices of natural gas would not immediately affect the overall average price as much as some critics might think.

With or without deregulation, we feel that prices for natural gas will continue to rise. I would like to point this out by citing a recent FPC application, CP77-100, filed by Tenneco Atlantic Pipeline Co. (TAPCO). TAPCO is to construct some $546 million worth of facilities to import 1,140,000 Mcf/D from Canada to resell to its parent company, Tennessee Gas Pipeline, at an estimated $4.57/Mcf. The total cost of this project is in excess of $2 billion. This gas is to be purchased from Algeria at a July 1, 1975 cost of $1.30 per million BTU's, f.o.b. Algerian ports, and is subject to escalation to reflect the value of the U.S. currency relative to the currency of six European countries as provided in the contract. This contract is for a period of 20 years com-

mencing in 1981. The facilities that TAPCO proposes to construct consist of 391 miles of 30-inch line from Canada to New York, another 107 miles of 30-inch line extending to Tennessee's main line in Pennsylvania, together with the appropriate terminals, cryogenic tankers, vaporization facilities, etc. TAPCO estimates that the 1984 cost of this gas will be competitive with its projected 1984 price of No. 2 fuel oil, which is the most commonly used fuel for requirements of Priority 1 and 2 customers. In support of this project, TAPCO noted that Tennessee is presently curtailing service into Priority 2 and, beginning the 1981-82 winter season, estimates curtailment of Priority 1 service without the supplemental gas involved herein. Moreover, even with this gas, Tennessee will be required to curtail Priority 2 to at least 1986.

Gentlemen, when you figure what the actual cost of this gas will be in 1981-1985 dollars to the end customer, the number is indeed staggering. We could cite numerous other examples of projected increases in gas prices but I think it is obvious that prices will continue to escalate.

It is interesting to note that, on the same day that TAPCO filed its application, the FPC denied a petition to revise limited term and emergency purchase provisions by a group of agricultural and industrial customers and United Gas Pipe Line Co. In its petition, United stressed that the FPC may be forced to deal with a natural gas shortage of crisis proportion during the 1976-77 winter heating season, but that significant additional volumes of gas could be available in time to help this coming winter if the Commission granted a more flexible limited term and emergency procedure authority.

The Commission denied these petitions stating that the new national rate of $1.42 would help encourage increased drilling activity and place interstate pipelines in a more competitive position to secure supplies from the onshore market; further stating that the Commission does not want to establish procedures which have a "band-aid effect" in dealing with the natural gas crisis and that such measures have proved to provide solely temporary help to the curtailed interstate pipeline systems rather than any long-term benefit.

Thus, on one hand we have an application for a future supply of gas costing $4.57 and involving a $2 billion investment, which will probably be approved, while on the other hand, we have a petition turned down that would enable a pipeline company to acquire an immediate supply of natural gas at a cost of $1.50-2.00 per Mcf.

It should be noted though, that on many occasions in recent years the FPC, realizing that a gas shortage does exist, has helped the pipeline companies to acquire new gas reserves for the interstate market by allowing new gas acquisition methods, such as raising prices as demonstrated by 770-A.

THE ROLE OF THE END USER

It is obvious that most interstate natural gas companies do not have sufficient reserves under the present gas pricing systems and it is doubtful that they will be able to obtain sufficient additional gas in the future to fulfill many of their existing contracts. If you purchase gas directly from an interstate pipeline company you are subject to curtailments and have no guarantee of a long-term supply. Therefore, it becomes increasingly important

for you, the end user, to acquire energy for your own account. I will outline in a general way the opportunities for and the methods by which companies such as yours might get into the gas supply segment of the natural gas industry and secure your long-term energy supply needs.

OPPORTUNITIES

In 1956 the industry was drilling some 60,000 wells per year and 2,800 drilling rigs were operating. By 1971, before the Arab oil embargo, the number of rigs had dropped to only 975 and we drilled less than 28,000 wells. More than 10,000 independent operators went out of business in those 15 years. Today there are approximately 7,000 natural gas producers outside of major companies with 300 of them being classified as major independents and the remainder as small independents. Attention is called to the fact that independent producers drilled approximately 90% of all of the oil and gas wells drilled in the United States in 1975, and that approximately 54% of the new natural gas and oil reserves found last year were attributed to independents. Due to the recent price incentives, drilling has increased considerably and there are presently some 1,800 rigs working. Obviously, the only way that more gas reserves can be found is by drilling more wells, and this requires significant capital. This situation affords an excellent opportunity for the end user to strike equitable contracts with the oil and gas producer.

In addition to the traditional major and independent oil and gas producers, pipeline companies are becoming actively involved in exploration, development and production activities. Although most pipelines are and will continue to be in curtailment for the foreseeable future, it is incorrect to

say that they are not trying to find adequate supplies for their customers. Exhibit V shows the growth in direct exploration and production expenditures by six large gas transmission companies. As you can see, they spent an estimated $302 million in 1976 for lease acquisition, drilling, and development. This figure is nearly double the $170.5 million these firms spent in 1975. The outlay of five of these companies for this year is estimated to be $358 million. This does not include lease sale participations or spending by a newly acquired producing subsidiary of one of the pipelines. All pipelines are indicating a plan to continue strong exploration programs in 1977 and through the foreseeable future. Most pipeline companies have had exploration departments for a number of years but it is only in recent years that they have become relatively active. Transco, for instance, is estimating that its total 1976 exploration expenditure was $93 million. This is more than triple the $30 million it spent in 1975, and it has budgeted $144 million for exploration and development in 1977, almost five times the expenditure in 1975. Panhandle Eastern is also conducting a heavy exploration and production program. It spent $85 million in 1976, including some $34 million in bonuses for an interest in four tracts in the Baltimore Canyon. Panhandle estimates they will spend $75 million next year, not including any lease sale expenditures.

I could cite many more examples of the other major pipelines trying to acquire gas reserves by conducting their own exploration programs, but the point is that these pipelines will continue to be a major force in the finding, producing and selling of interstate natural gas. All pipelines are indicating gradual and steady improvement in their reserve life index decline. In addition, pipeline exploration will probably be stimulated by

the FPC's new penalty on advance payments to producers. In its Order 770-A, the FPC set out a schedule for penalizing producers who accept advance payments from pipelines. It is expected that most producers will reject pipeline advance payments in the future. This necessitates that pipelines will have to go into exploration themselves in order to develop new supplies of gas.

But as the pipelines expend more money for exploration they, of necessity, need to program ways of funding their exploration projects. This money can only be obtained by off balance sheet financing. Debt payments may claim a greater and greater share of earnings and that makes the companies a less attractive proposition in today's financial markets. It would appear that many of these gas projects may prove exceedingly difficult for the companies to finance. This situation presents an opportunity for the end user to participate in exploration and development programs with the pipeline companies by supplying the needed capital.

ACQUISTION BY THE END USER

Aside from purchasing gas from a gas transmission or distribution company, there are three other ways in which an energy user can acquire gas. One is to purchase it directly at the wellhead from the companies owning the gas. The second is to actively participate in an exploration program, either on your own, through a pipeline company involved in exploration, or through a major or independent producer. The third way is to buy already discovered oil and gas in the ground and thus become a producer of natural gas. All of these methods require either a transportation agreement to be made with one of the existing gas pipeline companies or construction of appropriate

facilities to get the gas to the desired market location. There are advantages and disadvantages to all of these methods of acquiring gas for your own account and it is upon this aspect of the problem that I would like to focus our attention.

METHOD I

PURCHASE AT THE WELLHEAD

The first method mentioned - buying the gas on a contract basis at the wellhead - is perhaps the easiest method in that you do not have the risks, technical problems and costs associated with the exploration and development programs. However, there is the risk that the reserves you pay for may not be there as a result of inaccurate gas reserve and deliverability estimates. Moreover, as you may be aware, most gas sellers these days are very hesitant to sign long-term contracts with purchasers and, in addition, all of the contracts that we see today have price renegotiation and escalation clauses. It is, therefore, almost impossible to secure a long-term supply at a fixed price or an established weighted average price. We have all seen many companies with long-term contracts that have not been able to maintain sufficient gas supplies to honor those contracts due to gas shortages and inadequate prices. These uncertainties, of course, make it very difficult to program the economics of an energy-using company to make it competitive in the future.

There have been many agreements for purchasing gas at the wellhead which have been certificated under FPC Orders based on Opinions 533 and 533-A. The following is an example of a recent 533 sale along a major pipeline.

The gas was sold for $1.95 per million BTU's with a yearly renegotiation provision. If your company were to purchase the gas at this price, it would be limited to a short-term contract and would pay the $1.95/Mcf with an estimated 15¢/Mcf price escalation per year. Assuming gathering charges of 10¢/Mcf, a pipeline charge of 23¢/Mcf, and an estimated delivery charge of 25¢/Mcf, the gas would cost $2.53/Mcf in the first year, and $2.68/Mcf in the second year.

METHOD II

PARTICIPATION IN EXPLORATION

The second approach to acquiring natural gas is to enter into the exploration phase of the oil and gas business, either by forming your own exploration and production staff, or by entering into exploration arrangements with existing oil and gas companies, either majors or independents. One of the main disadvantages of trying to start an exploration program on your own is that the corporate commitment of time and money involved might be significant compared to the results of the drilling program. In addition, it is very difficult in these competitive times to find qualified technical personnel. Therefore, most companies have preferred to enter into some type of arrangement with existing oil and gas exploration companies.

In general, these arrangements are that the energy user will pay a certain amount of overhead to the oil and gas company, which we will call the operator. The energy user will also pay some or all of the acreage and seismic costs involved in the exploration venture, and a majority of the drilling and completion costs involved in the exploration program. In return for supplying

this capital, the company will receive a percentage of the oil and gas reserves that are found and, in addition, will have a call at competitive prices on the operator's share of the reserves. As compensation, the operator is usually carried for an interest. The advantages of this type of program are that the end user is able to immediately acquire the expertise of an existing organization and conceivably will be able to find oil and gas more quickly and at a substantially reduced cost compared to buying it at the wellhead. The major disadvantage, of course, is that the program will be unsuccessful if oil and gas are not discovered in economic quantities. Another disadvantage is that reserves discovered may be remote from point of use. We feel that these risks can be reduced by carefully selecting an operator who has had good experience in finding oil and gas reserves and by doing what we call "spreading the risk". In this way you spread the dollars that you want to invest over a wide range of prospects, thus avoiding the law of gamblers ruin, or "putting all your eggs in one basket". By carefully selecting a good operator and evaluating the exploration program, you can reduce the risk of not finding oil and gas. The question then becomes, "how much oil and gas will be found at what price". We have seen many companies come in on a short-term basis (one or two years), be unsuccessful, and get out of the oil and gas exploration business altogether after a bad experience. It is our experience that if a company decides to go into the exploration business, it should plan a long-term run at it to adequately spread the risk and participate in enough oil and gas prospects so that the law of averages will be working for the company. It is essential, however, that each exploration program be looked at in great detail on a prospect basis. Since geological factors can vary so much between prospects there are very few general standards against which the merits of each prospect can be measured.

Also, there are practical problems involved with the exploration for and production of natural gas. The number of wells required for the exploration and development of gas fields must be planned and judged on a field by field basis. In addition, the rate of deliverability of gas from any given reservoir will vary according to differing reservoir conditions. The forecasting of gas deliverabilities from new fields can be a very arduous task. It is important to take into consideration the maximum efficient rate of production; that is, the rate that the well can produce without causing damage to the reservoir and ultimately recover the maximum amount of reserves.

The ability of a given reservoir to produce natural gas is subject to many variables which are present in nature and which cannot be controlled by the producer. Because of the uncertainties occasioned by the nature of natural gas deposits, the contracts between the producer and the buyer have to be tailored to take these problems into account. In the past, many contracts were made for periods of 20 years or longer, mainly to ensure an adequate supply to finance the major pipelines. The situation has since changed dramatically and we seldom see long-term contracts now, as most have yearly renegotiation clauses.

Examples of Exploration Participation Programs

1) There are many companies today that are drilling for their own energy supplies. Quoting from Business Week, Cleveland's Park-Ohio Industries Inc., when warned by East Ohio Gas Co. that it faced curtailments as high as 60%, had two possible alternatives; one was to shut down their Drop Forge Division,

which was consuming approximately one billion cubic feet of natural gas annually, or to go find the energy and try to keep it operating. Park-Ohio launched its own $4.5 million drilling program and made the company potentially self-sufficient. They are now doubling the size of their drilling commitment to nearly $9 million. If its projections are accurate, Park-Ohio will get its money back in less than two years.

Chicago-based Stone Container Corp. has been drilling gas wells near its paperboard plant in Ohio. They figure their cost of new gas at less than $1.50/Mcf. Stone estimates that the plant is already saving more than $1,500 a day even though only five wells are on production. General Motors has drilled more than 100 wells near its Lordstown assembly plant. This is not to say that all industrial investors have been successful. Investing in the oil exploration game, as you know, is very risky. The risk can be diminished by the use of competent, technical personnel and, more importantly, by "Lady Luck."

2) An example of how one exploration company entered into an exploration venture with industrial users is as follows:

Their agreement calls for an expenditure of some $12 million, from which the industrial users pay overhead, leasehold, seismic and dry hole costs. Funds required to complete an initial well on a prospect and for development wells are provided by the participating companies, in

addition to the exploration budget. Based on their past experience, they will spend $15-16 million in 1977. Of this amount, probably $2-3 million will be invested in unevaluated prospects at year-end.

The exploration company is reimbursed for overhead on an actual cost basis subject to audit by the participating companies. However, they have guaranteed that the overhead will not exceed a certain level, which is $950,000 for 1977. The exploration company has the full authority to spend the exploratory funds up the point of drilling the initial exploratory well on a prospect; i.e., to buy the necessary leasehold, buy seismic data or do original shooting, and to make the other investments necessary to bring a prospect up to the point of drilling; at which time they submit to the investing companies their recommendation to drill, farm-out, etc. The participating companies retain a consultant who reviews their prospect reports and makes a recommendation.

The program's risk investment (leasehold, seismic, dry hole costs) in any one prospect is limited to $800,000. When the risk is in excess of this level, they seek other companies to participate, generally on the basis of one-third to earn a quarter interest at the casing point. The participating companies benefit from this promotion.

After a prospect pays out (including an overhead allocation), the exploration company owns 25% of the program's working interest and is obligated for its proportionate share of all expenditures and revenue to date from this point.

The following six exhibits are the initial presentations made by the exploration company to the investor companies several years ago. It should be emphasized that these projections do not indicate the success or the failure of this program but were merely the company's best-guess estimates as to the amount of reserves which they felt could be found by the projected expenditures of $20 million for exploration and $13 million for development (Exhibit VI). The total five-year investment is $18,690,000 after taxes. As shown on Exhibit VII, the gross reserves which they have projected are 267 Bcf of gas and 6.7 million barrels of condensate. Using prices of $1.25/Mcf of gas and $7.50/barrel of condensate, less operating costs and all taxes, the return on investment would be 4.68/1. On the following Exhibit VIII you can see that in the fifth year the gross production was projected to be 73 MMcf per day. They calculate that the gross gas delivered to the investor's plant would cost 68.2¢/Mcf, which included buying the partners' and royalty gas at $1.25/Mcf plus a cost of 29.7¢/Mcf for the investor's gas (Exhibit IX). Under this program, the

projected debt capacity would increase to over $20 million in the sixth year while the loan value was estimated to be 40% of the remaining net operating income (Exhibit X). Exhibit XI shows a return on investment, after federal income tax, which varies from 16% to 30%. As you can see, this program, if it worked out as projected, would be a successful venture. As we have cautioned, there can be no guarantee that any exploration program will be successful but the chances of success can be improved by doing business with a technically competent firm that enjoys a good reputation in the industry.

3) Another example of how investor funds can be used is as follows: the investor furnishes all the intangible drilling costs which enables the investor to take a 100% deduction for tax purposes. For this contribution, the investors eventually receive 60% of the production found. The exploration company provides the capital dollars for tangible expenses and then receives 40% of the production found. The exploration company receives a 9% management fee; however, this is not paid unless commercial production is found. Furthermore, this structure means that all the investors' dollars are used to find new reserves. This particular program spends 70% on low-risk projects and 30% on high-risk projects.

After the drilling program is complete, the company then goes to the bank to borrow non-recourse money on the basis of the proven reserves. The reserves are the collateral for the loans. (Some general lending criteria used by banks are presented in Addendum I to this paper.) These loans can then be reinvested to find more oil and gas should the investor so desire. Based on actual numbers, the average return on investment for programs in each of the last four years is projected to be 2.86 to 1, with an average payout of approximately four to five years. Again, it is recommended that a company play the averages and plan to stay in the exploration business for at least a five-year period.

4) As mentioned earlier, another avenue for investing in exploration programs lies with interstate pipeline companies. Because of their new exploration and production ventures there is need for outside investment capital. This provides an opportunity for an end user to secure energy for his own account by participating in these programs where the end user will supply the needed capital, with the pipeline company being the operator. An example of this is a recent purchase of offshore leases by a major gas transmission company in which they expended over a hundred million dollars, having had several outside investors in the group.

In summary, your company should be made thoroughly aware of the pitfalls of exploration and be prepared for substantial losses if the program is not successful. You should take into account your tax position, the corporate desire to enter into the oil and gas business, and the corporate resolve to go through several years of disappointing exploration results, if necessary. It should also be kept in mind that the exploration business is keenly competitive in the United States today and will grow increasingly more competitive as many industries begin to feel the energy shortage. One thing is clear -- the competition is never going to be less than it is today.

METHOD III

RESERVE PURCHASES

The third method of acquiring gas is to purchase existing reserves in the ground. One advantage of this method is that it is often possible to calculate with reasonable accuracy the proved reserve potential using sophisticated engineering and geological methods. However, in cases of semi-proved reserves, this may be very difficult to do. In addition, initial volumetric gas reserve estimates are sometimes inaccurate and difficult to make due to a variety of technical reasons. Obtaining oil and gas reserves by acquisition is also an extremely competitive business as there are many domestic companies who have been doing this for many years and have developed very sophisticated evaluation programs and contacts in the industry. Any company acquiring gas reserves by acquisition for the first time should exercise caution as to who made the appraisals and how the reserves were determined. The price a com-

pany pays for reserves is based upon the engineering report. You will find that there can be a wide range of reserve estimates as reserves from different engineering reports can vary as much as 100%. A discussion of engineering reports and reserve determination is presented as Addendum II to this paper.

We estimate that the going price for acquiring gas in the ground is approximately $.50 to $.80 per Mcf and the price of oil in the ground from $4.00 to $8.00 per barrel. Much depends on where the oil or gas is located, the surety of the reserves, and the life of the reserves. As an index of recent transactions, we have set out several examples of purchases that have occurred within the last year in Exhibit XII. In order to convert the oil to gas equivalent, we would suggest that you use an average price of between $11.00 and $12.00 per barrel for oil, and $1.30 to $1.50 per Mcf for gas, or a ratio of 7/1 on a BTU basis. There have been a number of similar transactions made in recent years involving the same economics. Most of these acquisitions are structured on a 2-to-1 return on investment and/or a 15+% rate of return before taxes and perhaps a 10+% rate of return after taxes. It is possible at this time to borrow 70-80% of the purchase price through normal lending institutions such as the larger banks and/or insurance companies.

It is our feeling that due to the energy shortage that exists here in the United States, the price for oil and gas in the ground will increase substantially over the next ten years and reserves will become more difficult to purchase. In addition, more of the acquisition packages will probably include a great deal of undeveloped acreage and a company will probably be faced with having to pay something for what is commonly referred to in

the industry as "romance" in order to finalize a transaction. However, if you have a strong acquisition program and approach it from a businesslike standpoint - that is, not only being concerned with securing call on the oil and gas, but also making sure that each project is economically sound in its own right - you can be successful in securing adequate supplies of gas.

It is also possible to get a call on oil and gas reserves by giving the operator a prepayment to be used for exploration and development work, for future development at his discretion, or for recoupment of costs in developing the reserves. In recent years there have been large sums of money paid to operators to finance their exploration or development programs in return for a call on the gas. Sometimes the advance payments are recoverable out of a percentage of the production. End user prepayments to operators are not subject to Order 770-A penalties as are pipeline company prepayments to operators.

Example Reserves Purchase

I would like to take you through a hypothetical example of what it might cost to purchase the gas needed for a petrochemical plant in the Gulf Coast area. The assumptions are that the plant uses 250 MMcf of gas per day. Based on an average life of 10-15 years, a company would have to acquire reserves in the range of 1 to 1.5 trillion cubic feet. We estimate that a program of this nature could be completed within a 3- to 7-year time period at an average cost of approximately $.60/Mcf, or between $500 million and one billion dollars. It is difficult to predict how much per year a company could acquire, but we

estimate that something in the range of 20 to 50 MMcf per day per year would be obtainable. It should be kept in mind, however, that some of these purchases would involve buying existing companies whose gas may be in other areas of the United States or whose gas is already dedicated to other markets but, presumably, it would be possible to trade some of this gas for gas in the desired area. If the plant is located in the East, then appropriate transporation arrangements would be necessary.

Example Transportation Agreements

1) An interesting certification occurred in December of 1976 concerning transportation of gas purchased in place by an industrial consumer. The FPC issued certificates to Transcontinental and United Gas Pipe Line to transport up to 3,500 Mcf per day for New Jersey Zinc Co. The gas will be used by New Jersey Zinc for processing purposes and as feedstock at its zinc smelting plant in New Jersey.

The instant transactions differ somewhat from most other transportation proposals in that the gas involved was purchased in-place by New Jersey Zinc. Zinc advised that the seller, Trident Oil & Gas Corp. et al., refused to sell the gas on a conventional basis. Accordingly, Zinc entered into an agreement with Trident et al. to purchase in-place approximately 4.8 Bcf of reserves underlying six wells in Winn Parish, North Louisiana at a total price of $3.2

million. Zinc computed the unit price at $1.37/Mcf in the first year and at $1.48/Mcf over the estimated eight-year life of the reserves.

The Commission stated that transportation of industry-owned gas is beyond the scope of Order No. 533, which established a policy to encourage interstate pipeline transportation of natural gas directly purchased by curtailed industrial (non-resale) customers for high priority usage. However, the Commission granted the requested transportation certificates pursuant to Section 7 of the Act after a review to "carefully scrutinize the availability of the subject reserves to the intrastate market." The FPC noted an affidavit from Trident stating that the subject reserves (absent the sale of New Jersey Zinc) would not have been dedicated to interstate commerce because of refund obligations imposed by the D. C. Circuit with respect to Opinion No. 770 prices, and an affidavit from Zinc stating that it would arrange to sell the gas in intrastate commerce if the instant transportation applications were denied.

Trident agreed to construct a gathering system to connect the subject gas to a point on United's line in Caldwell Parish, Louisiana. United will charge 20.52¢/Mcf for delivery to Transco. Transco will transport the gas to the distributor supplier of New Jersey Zinc at an initial rate of 22¢/Mcf, plus retention of 4.4% of the volumes received as makeup for compressor fuel and line loss.

2) A few weeks earlier, on November 24, 1976, the FPC set a hearing on transportation of up to 3,317 Mcf/D proposed by Texas Gas Transmission Corp. for National Steel Corp. and Southwire Company on the ground that the gas involved was needed by National-Southwire to offset volumes being curtailed by a nonjurisdictional supplier and hence was beyond the scope of Order No. 533. At the same time, however, the Commission granted Texas Gas temporary authorization to provide the transportation service because of indicated cutbacks in operations by National-Southwire at their plant in Hawesville, Kentucky, and a consequent loss of more than 425 jobs if additional gas were not obtained.

These are examples of two of the recent transactions which lead us to believe that in the future it will be easier for an end user to move its own gas to its plant through various methods, either with or without deregulation.

There is a great deal of competition in buying reserves or buying companies with oil and gas reserves. Some of this competition comes from production-purchasing fund companies. An example of the structure of one of the larger production-purchasing fund companies is as follows:

Assume that the limited partners' investment is $100.00. The sales commission is $7.00; general overhead and administrative expenses is $6.00; the management fee is $15.00; thus, the net partnership capital available

prior to the general partners' investment is $72.00. The general partners then invest $9.00, bringing the total partnership capital available to $81.00. The partnership then borrows an additional $81.00 from a bank to be used for the property acquisition. Thus, the total funds available are $162.00. After the production purchase, all costs and revenues are shared 85% by the limited partnership and 15% by the general partners. In other words, the general partner has been carried for 15% and has reinvested 60% of its 15% management fee (9%).

This particular fund attempts to get an 11% to 14% rate of return before tax and a payout period of around 5 years, with a final return on investment to the limited partner of 1.8 to 2.5/1. This is typical of some of the competition that is in the marketplace today for acquiring oil and gas reserves.

SUMMARY

We have discussed several ways of acquiring natural gas. I believe the important thing to put in perspective is that there is an energy shortage and a company that needs energy for its business has to think about developing its own reliable energy source. Energy is going to become increasingly more difficult to obtain even at higher prices. There are many good operators, both majors and independents, and pipeline companies who are actively pursuing oil and gas exploration and acquisition programs. These companies need investment capital. I think you will find there are ample opportunities to get into the oil and gas business. It should be

restated, however, that there is substantial risk involved in securing your own energy sources and that these risks should be carefully evaluated from an economic, legal, and corporate standpoint. I have only briefly touched on the implications of governmental intervention into the energy business as it is very difficult to predict what will happen in the future. However, governmental intervention and regulation is the law of the land. It has to be dealt with and accepted for what it is. This is a factor that should also enter into your corporate planning for acquiring gas reserves.

You might ask yourself, being an end user, why good oil and gas investment opportunities would be submitted to your companies. I think the answer to this is that there is simply not enough capital in the oil industry to internally finance all of its needs. Some years ago most majors and large independents were able to finance themselves through internal cash flow. This is no longer possible in all cases. Because of federal controls and taxes, many oil and gas companys' cash flows simply do not generate enough capital to carry out their total exploration needs. We feel that a balanced program of acquiring gas reserves is to approach the problem utilizing all three methods: first, to buy gas at the wellhead from producers; second, to also explore for oil and gas on a long-term basis; and, third, to purchase oil and gas reserves in the ground. I would also suggest a minimum program of five years. By proper corporate planning and the utilization of good, competent technical people, companies such as yourselves should be able to adequately ensure your energy needs in the difficult years that lie ahead for our country.

Energy is the lifeblood of our industrial nation. It is a resource without which all of our other resources are of no avail. This nation with its factories, its transportation, and its standard of living, moves basically on petroleum. You industrial users have a significant stake in securing and controlling your future energy supplies for your companies. There is no short-term solution to our energy dilemma. Over the long-term, perhaps by the turn of the century, solar and other types of exotic energy will be used. While we will continue to use more coal, we will still be dependent on foreign and domestic oil and gas in the foreseeable future. There are large quantities of natural gas still to be found in this country but it is going to require more wildcat drilling, deeper drilling, development of low reserve areas, offshore drilling, and frontier drilling of wells. Each of these programs are more expensive than ever and will result in higher priced natural gas and oil.

The ingenuity of the oil and gas industry, if allowed to operate in a free enterprise market, together with adequate capital from companies such as your own, should be able to meet the challenge. I think the future holds many interesting and innovative arrangements that will be made by the end users in securing their own supply of natural gas.

ADDENDUM I

BANK FINANCING CRITERIA

It is usually possible to borrow money against proved reserves from banks or other lending institutions. As a rule of thumb, if the reserves can be classified in a good proved category, a bank will usually make a loan utilizing various criteria or empirical tests as set out below. No single test is overriding and the loan is usually a composite or average of the various approaches.

1. Banks normally limit the maximum loan to 50% of the discounted cash flow from the proved producing reserves, operated under existing conditions, predicated on generally accepted reservoir engineering approaches.

   The discounted cash flow is derived by applying present worth factors to the projected operating profit, employing a present worth discount rate of 2% over the prevailing prime rate. Projected operating profit on an annualized basis is the result of forecasting the future oil and gas production applicable to the interest involved and multiplying by the respective crude oil and gas prices to reflect an operating revenue. The operating revenue is reduced to account for ad valorem and severance taxes, and also for the required expenses to operate the properties to an economic limit. This yields the operating profit which is discounted as noted above.

2. A second criterion is to limit the total loan so that 50% of the initially forecast future net operating profit will be remaining at payout of the loan.

3. A further consideration is the ratio of the loan to fair market value. In this connection, a bank attempts to limit the loan to a maximum of 80% to 85% of the estimated fair market value which, in turn, is normally considered to be some percentage of the discounted cash flow. The logic behind this criterion is to permit the bank to sell the property, if the occasion should arise, for a price equal to or greater than the loan. This provides the basis for also requiring a minimum equity position of 15% to 20% in the package.

Over and above the empirical tests summarized above, it is obvious that intuitive judgement must also be exercised. This might be construed as a reliability factor based upon the qualitative aspects of the engineering study; such as the accuracy of the various parameters used in the volumetric calculations, the consistency in the performance trends of the properties, or the diversification involved.

ADDENDUM II

RESERVE ESTIMATES

The price a company pays for reserves is based upon the engineering report. You will find that there can be a wide range of reserve estimates as reserves from different engineering reports can vary as much as 100%. I would like to briefly discuss engineering reports and reserve estimates, and present an example on reserve variance.

The engineering report is a compilation of the reserve estimates and associated economics for all properties of interest to the buyer or seller in any given transaction. In preparing these reports, we utilize all of the pertinent geological, engineering, and economic data available in the company's files, and supplement this with data from our files or from published information sources when necessary.

Reserve estimates are prepared from widely spaced samples and readings from a reservoir. Because of the number of factors which must be considered in preparing these estimates, and because each estimator must make judgments based on his own experience, any two estimates for a particular reservoir derived by the same methods may not correspond exactly.

We can establish reserves by several methods such as analogy, volumetric calculations, material balance, and well performance. We have prepared Exhibit XIII which will show when we use the various methods.

Assume that this chart represents one well. As in most things, the more information available to an engineer, the more accurate his reserve esti-

mates will be. It is important to remember that the more properties or wells that are included in a reserve report, the better balance we will have, with the "plus and minus" of various estimates tending to approach what the true ultimate production will be.

Point "A": Geological Period. This is the point where we do not have proved reserves. Reserves are calculated before the well is drilled. Reserves assigned here are based on what the geologist thinks of the potential reservoir thickness, areal extent, depth, etc., along with analogy to other reservoirs of a similar nature. This is the time when the reserves assigned to the reservoirs are seen to vary the most. It is a period of high hopes and great expectations, and usually the estimates are too optimistic.

Point "B": Initial Completion. Here we have some data developed by drilling the well: logs, flow tests, fluid analyses, reservoir temperature and pressure. We can now do some volumetric calculations and estimate proved reserves. The reserves established here are subject to interpretation by the reservoir engineer, due to many unknowns concerning the reservoir's ability to produce and to the areal extent of the reservoir. The accuracy is also heavily dependent upon reliable geological and well information, along with the experience of the geologist and reservoir engineer.

Between Points "B" and "C", Material Balance calculations can be made. The material balance equation tries to take into account all things

happening in the reservoir - oil, gas and water produced, change in pressure, expansion of all phases, etc.

Point "C": Mid-life, or after sufficient production history has developed a trend. This is where we use decline curves, rate cumulative curves, water cut curves, or pressure versus cumulative curves for the estimation of reserves. At this time we have much more reliable information and the degree of ability to predict the ultimate recovery is improving.

Point "D": Economic Limit. This is the point at which all oil and/or gas has been produced through primary means and the ultimate recovery is known. This is a very simplified drawing and explanation. Secondary recovery operations may have started and that would complicate the reserve calculations.

In general, the range of reserve estimates we see on an individual property will depend upon the completeness and accuracy of available data and, to some extent, upon the experience of the engineer.

It is a mystery to most people why reserve estimates from two engineers of equal capability can deviate so much. I would like to take you through an example of how such a difference can come about. The following is an example calculation of reserves at three stages in the life of a gas well: the initial volumetric reserve calculation, the mid-life volumetric reserve calculation, and the calculation of reserves after the well is on

decline with considerable production history behind us. This information is summarized on Exhibit XIV.

The basic assumed parameters and discussion of this example are as follows:

1. The example shown is limited to "minor" or "reasonable" variations in interpreting various reservoir characteristics with the variations being a reflection of judgment or best-guess parameters.

2. In general, this example of a gas well is analogous to an oil well in that only those variables common to oil or gas well analysis are considered.

3. Economics are not considered.

4. Note the difference between "ultimate recoverable reserves" and "remaining recoverable" reserves. In the example, the increases in Appraisal "B" over Appraisal "A" at the three stages of production are as follows:

Stage	% Increase Ultimate Rec. Reserves	% Increase Remaining Rec. Reserves
Volumetric	93	93
Mid-Life	27	52
Decline	12	87

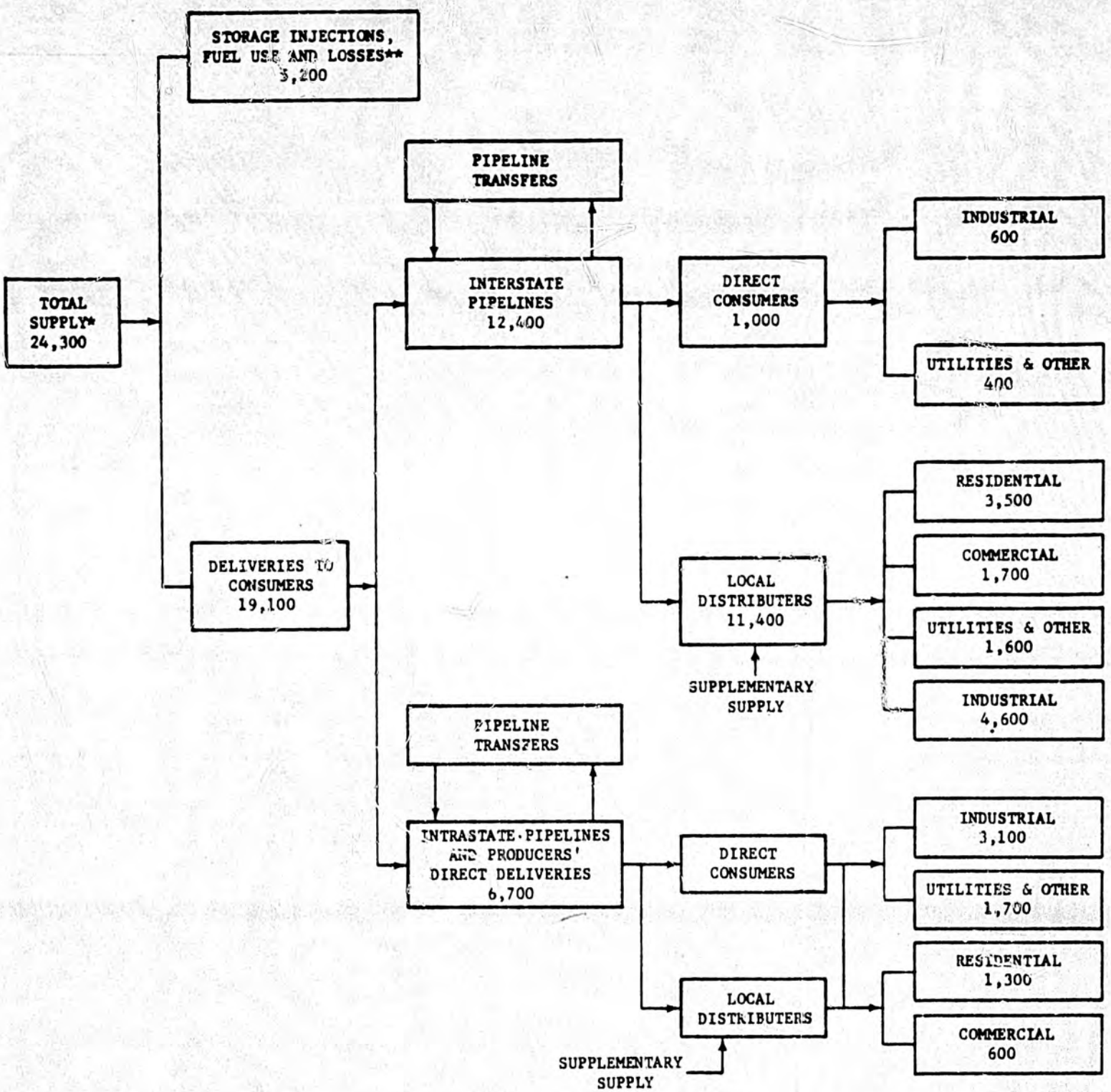
In general, even though the percentage change in remaining recoverable reserves is large, the magnitude of the difference in reserves decreases as more data becomes available, and the economic impact is lessened considerably.

Stage	Remain. Rec. Reserves "A" - MMcf	Remain. Rec. Reserves "B" - MMcf	Difference B-A - MMcf
Volumetric	2,969	5,741	2,772
Mid-Life	1,529	2,327	798
Decline	425	795	370

The reserves that we project are neither optimistic nor pessimistic, but what we believe can reasonably be expected from the property under the economic and operating conditions that prevail at the time of the study. We have found in the vast majority of cases that accurate, reliable reserve calculations can be made through proper engineering and geological assumptions, accumulation of adequate data, and familiarity with the geological and reservoir characteristics of the area.

EXHIBIT I

OVERVIEW OF U.S. NATURAL GAS SYSTEM, IN BCF



* Supply includes U.S. marketed production, withdrawals from storage, and imports.

** Gas for such purposes as lease and plant fuel, pipeline compressor fuel, extraction loss, and transmission losses.

Note: Amount delivered to interstate pipelines and amount delivered to intrastate pipelines are estimated.

Source: Based primarily on data from "Natural Gas Production and Consumption: 1974" (Washington, D.C.: Bureau of Mines, Mineral Industry Surveys, 1975).

EXHIBIT II

1976-77 CURTAILMENTS

(Pipeliners Pinpoint The Shortages)*

Winter Deficiency 40% or More	Winter Deficiency 25-40%	Winter Deficiency 10-25%	Winter Deficiency 0-10%
Arizona	Florida	Alabama	Alaska(2)
Arkansas	Indiana	California	Colorado
Delaware	Kansas	Connecticut	Georgia
Louisiana(1)	New Jersey	Delaware	Hawaii(2)
Mississippi	New Mexico(1)	District of Columbia	Maine
Nevada	Ohio	Idaho	Massachusetts
North Carolina	Pennsylvania	Illinois	Michigan
		Iowa	Montana
		Kentucky	New Hampshire
		Maryland	North Dakota
		Minnesota	South Dakota.
		Missouri	Utah
		Nebraska	Vermont(2)
		New York	Wisconsin
		Oklahoma(1)	
		Oregon	
		Rhode Island	
		South Carolina	
		Tennessee	
		Texas(1)	
		Washington	
		West Virginia	
		Wyoming	

*Example of how "shortage" or "deficiency" is computed: interstate pipeline companies have previously contracted to supply 100 million cu. ft. of natural gas to customers in a certain state between Nov. 1, 1976, and March 31, 1977, but now find that they will be able to deliver only 70 million cu. ft. In that case the anticipated deficiency would be 30%.

(1) Industrial customers are primarily supplied on an intrastate basis.

(2) Not supplied by interstate transmission companies. Source: Federal Power Commission.

REGULATED GAS PRICES
AS OF JANUARY 1, 1977

	Large Producers	Small Producers(a)
OLD GAS - PRIOR TO 1/1/73 - FPC OPINIONS #749 and #742-A		
Base Price(b)	$ .2950	$ .3500(d)
Add state severance taxes - assume Texas - 7.5%(c)	.0239	.0284
Add BTU adjustment - assume 1030 BTU	.0096	.0114
Add gathering allowance - assume Texas Gulf Coast(e)	.0040	.0040
	$ .3325	$ .3938
OLD GAS - PRIOR TO 1/1/73 (Dedicated to Interstate Commerce After 1/1/73 or Subject to New Contracts Which Replace Contracts Expiring on Their Own Term After 1/1/73) - FPC OPINIONS #699-H and #770-A		
Base Price(b)	$ .5300	$ .5300
Add small producers allowance (130%)	-	.1590
Add state severance taxes - assume Texas - 7.5%(c)	.0430	.0559
Add BTU adjustment - assume 1030 BTU	.0172	.0224
Add gathering allowance - assume Texas Gulf Coast(e)	.0040	.0040
	$ .5942	.7713
1973-1974 VINTAGE GAS (From Wells Drilled(f) 1/1/73 but Prior to 1/1/75) - FPC OPINION #770-A		
Base Price(b)(g)	$ .9400	$ .9400
Add small producers allowance (130%)	-	.2820
Add state severance taxes - assume Texas - 7.5%(c)	.0762	.0991
Add BTU adjustment - assume 1030 BTU	.0305	.0396
Add gathering allowance - assume Texas Gulf Coast(e)	.0040	.0040
	$ 1.0507	$ 1.3647
NEW GAS (From Wells Drilled(f) After 1/1/75 - FPC OPINION #770-A		
Base Price(b)(h)	$ 1.4400	$ 1.4400
Add small producers allowance (130%) - does not apply	-	-
Add state severance taxes - assume Texas - 7.5%(c)	.1168	.1168
Add BTU adjustment - assume 1030 BTU	.0467	.0467
Add gathering allowance - assume Texas Gulf Coast(e)	.0040	.0040
	$ 1.6075	$ 1.6075

(a) Small producer - 10,000,000 Mcf per year or less
(b) Unless prior area rate is higher
(c) Tax reimbursement calculated as follows (per Opinion #699 - App. D)
[.2950 ÷ (1 - .075)] - .2950 = .0239
Basic formula applies to all rates
(d) Permian Basin and Rocky Mountain Area = $.4050
(e) Gathering allowance varies with area
(f) Spud-date controls
(g) Subject to 1¢ per year escalation
(h) Subject to 1¢ per quarter escalation

EXHIBIT IV

SECOND QUARTER 1976 INTRASTATE PRICES

(Prepared by FPC Staff)

	New Contracts				Renegotiated Contracts			
	April	May	June	April-June	April	May	June	April-June
Price								
High ($/MCF)	2.16	2.01	2.04	2.16	2.09	2.34	2.18	2.34
Average ($/MCF)	0.51	0.15	0.29	0.15	0.18	0.16	0.49	0.16
Low ($/MCF)	1.73	1.39	1.67	1.59	1.22	1.83	1.71	1.66
Percent Contract Volumes Sold Between:								
$2.01 - $2.50	16.10	0.20	4.70	7.40	2.90	5.10	21.30	9.30
$1.51 - $2.00	61.70	52.80	79.60	62.50	29.80	90.50	56.50	66.70
$1.01 - $1.50	20.00	42.90	14.90	27.50	29.50	0.80	14.70	11.50
$0.51 - $1.00	2.20	4.10	0.30	2.50	36.90	3.30	4.20	11.30
$0.00 - $0.50	-	-	0.50	0.10	0.90	0.30	3.30	1.20
Contract Volumes (BCF)	45.30	44.00	27.00	116.30	28.70	59.90	36.70	125.30

Summary price data by FPC pricing area for three months, April - June 1976, are below:

New Contracts

	Appal.-Ill.	Other S.W.	South La.	Texas Gulf Coast	Permian Basin	Hugoton-Anadarko	Rocky Mt.	Other
Price								
High ($/MCF)	-	1.64	1.90	2.16	1.96	1.95	0.77	1.95
Average ($/MCF)	-	1.16	1.50	1.98	1.35	1.61	0.76	1.35
Low ($/MCF)	-	0.70	0.98	0.45	0.51	0.15	0.76	1.22
Percent Contract Volumes Sold Between:								
$2.01 - $2.50	-	-	-	42.90	-	-	-	-
$1.51 - $2.00	-	12.40	23.00	53.60	34.90	95.90	-	21.20
$1.01 - $1.50	-	83.20	74.10	2.50	34.60	3.00	-	78.80
$0.51 - $1.00	-	4.40	2.90	0.30	30.50	1.10	100.00	-
$0.00 - $0.50	-	-	-	0.70	-	-	-	-
Contract Volumes (BCF)	-	3.80	12.30	20.20	4.40	54.90	0.30	20.30

Renegotiated Contracts

	Appal.-Ill.	Other S. W.	South La.	Texas Gulf Coast	Permian Basin	Hugoton-Anadarko	Rocky Mt.	Other
Price								
High ($/MCF)	0.75	2.09	1.61	2.18	2.34	1.98	1.08	1.90
Average ($/MCF)	0.75	0.79	1.46	2.00	1.45	1.56	0.85	0.71
Low ($/MCF)	0.75	0.16	0.59	1.11	0.49	0.18	0.52	0.60
Percent Contract Volumes Sold Between:								
$2.01 - $2.50	-	3.40	-	14.30	16.10	-	-	-
$1.51 - $2.00	-	4.50	43.60	85.50	27.90	92.30	-	8.60
$1.01 - $1.50	-	-	51.60	0.20	48.70	4.10	57.90	-
$0.51 - $1.00	100.00	92.00	4.80	-	0.20	2.00	42.10	91.40
$0.00 - $0.50	-	0.10	-	-	7.10	1.60	-	-
Contract Volumes (BCF)	0.04	12.70	9.00	59.20	17.30	25.40	0.20	1.50

EXHIBIT V

EXPLORATION AND PRODUCTION EXPENDITURES BY SIX LARGE PIPELINE COMPANIES

(Growth in direct E&P by six large lines)(1)

Company	Total Expenditures(2) 1975	1976	1977
Transco Inc.	$ 29,577,000	$ 93,207,000	$ 143,741,000
Consolidated Natural Gas Co.	64,811,000	78,735,000	92,555,000
Panhandle Eastern	40,000,000(3)	85-90,000,000	75,000,000(4)
Florida Gas Exploration Co.(5)	9,000,000	13,000,000	22,000,000
Northern Natural Gas Co.	22,700,000	20,000,000	25,000,000
United Gas Pipe Line(6)	4,500,000	7,000,000	-

(1) Amounts do not include advance payments.

(2) Expenditures for 1976 and 1977 are estimates.

(3) Annual average for 1970-75.

(4) Estimate does not include possible lease-sale participation.

(5) Affiliate of Florida Gas Transmission Co.

(6) Figures do not include Cotton Petroleum.

EXHIBIT VI

PROJECTED FIVE YEAR BUDGET
($1,000)

	YEAR OF EXPENDITURE						
EXPLORATION	1	2	3	4	5	6	TOTAL
Drilling	$2,100	$2,475	$2,875	$3,250	$3,725	-	$14,425
Leasehold	450	500	500	600	600	-	2,650
Geophysical	150	225	300	300	300	-	1,275
Overhead	300	300	325	350	375	-	1,650
TOTAL	$3,000	$3,500	$4,000	$4,500	$5,000		$20,000
DEVELOPMENT	-	$2,025	$2,350	$2,650	$3,000	$3,350	$13,375
TOTAL	$3,000	$5,525	$6,350	$7,150	$8,000	$3,350	$33,375
CURRENT YEAR TAX DEDUCTIONS	$2,640	$4,862	$5,588	$6,292	$7,040	$2,948	$29,370
REDUCTION OF TAXES PAYABLE (50%)	$1,320	$2,431	$2,794	$3,146	$3,520	$1,474	$14,685
NET INVESTMENT (AFTER TAXES)	$1,680	$3,094	$3,556	$4,004	$4,480	$1,876	$18,690

EXHIBIT VII

PROJECTED ECONOMIC RESULTS

Gross Reserves		
Natural Gas, Billion Cubic Feet		267
Condensate, Barrels		6,700,000
Net Reserves Owned by _____		
Natural Gas, Billion Cubic Feet		164.2
Condensate, Barrels		4,120,000
Net Cash Flow to _____		
$1,000		
Revenue		
Gas @ $1.25/MCF	$205,250	
Condensate @ $7.50	30,900	$ 236,150
Less: Production Taxes (11%)	$ 25,976	
Operating Expenses	11,807	$ 37,783
Net Operating Income		$ 143,014
Less: Statutory Depletion (22%)	$ 51,953	
Depreciation	3,400	$ 55,353
Taxable Operating Income		$ 143,014
Less: Income Taxes @50%	$ 71,507	
Plus: Current Year Deductions	29,370	$ (42,137)
Net Income (After Tax)		$ 100,877
Plus: Depletion & Depreciation		55,353
Net Cash Flow (After Taxes)		$ 156,230
Investment		$ 33,375
Net Cash Flow Per $ Invested (After Taxes)		$4.68
Discounted Cash Flow Rate of Return (After Taxes)		Exceeds 50%
Investment Per Net Equivalent MCF (Pre-Tax)		$0.177

EXHIBIT VIII

PROJECTED GAS SUPPLY

	YEAR						
	1	2	3	4	5	6	TOTAL
PROSPECTS DRILLED	8	9	11	12	13	-	53
DISCOVERIES	1	1	2	1	2	-	7
DEVELOPMENT WELLS							
Productive	-	3	3	4	3	5	18
Dry Holes	-	2	2	2	2	3	11
GROSS RESERVES (BCF)							
RESERVES PROVED	10.7	42.8	53.5	53.5	53.5	53.5	267.5
LESS: Production	NIL	4.0	8.7	14.6	20.2	26.8	74.3
RESERVES (END OF YEAR)	10.7	49.5	94.3	133.2	166.5	193.2	193.2
PRODUCTION RATE @ END OF YEAR (MMCF/DAY)	NIL	22	46	67	73	73	N/A
PRODUCTION NET TO _____ (MMCF/DAY)	NIL	16	31	45	50	50	N/A

EXHIBIT IX

PROJECTED DELIVERED GAS COST
($1,000)

	Gross Gas	Net Gas
Transportation @5¢ per MCF	$ 13,350	$ 8,210
Investment of _____	33,375	33,375
Purchase of Royalty and _____ Gas (@ $1.25)	128,500	-
Lease Operating Expenses & Production Taxes	37,783	37,783
Less: Condensate Revenue	(30,900)	(30,900)
Total Cost of 267 (164.2 Net) Billion Cubic Feet of Gas Delivered to _____	$182,108	$48,768
Plant Delivered Cost Per MCF	68.2¢	29.7¢

EXHIBIT X

PROJECTED DEBT CAPACITY
($1,000).

	1	2	3	4	5	6
REMAINING NET RESERVES @ FIRST OF YEAR (BCF)	-	7.8	33.6	63.9	90.3	112.9
LOAN VALUE PER MCF	-	$ 0.48	$ 0.48	$ 0.48	$ 0.48	$ 0.48
LOAN VALUE @ FIRST OF YEAR	-	$3,744	$16,128	$30,672	$43,344	$54,192
PROJECTED INVESTMENT	$3,000	$5,525	$ 6,350	$ 7,150	$ 8,000	$ 3,350
CUMULATIVE INVESTMENT	$3,000	$8,525	$14,875	$22,025	$30,025	$33,375
LESS: CUMULATIVE DEBT	-	3,744	14,875	22,025	30,025	33,375
CUMULATIVE EQUITY INVESTMENT	3,000	4,781	-	-	-	-
EXCESS DEBT CAPACITY	$ -	$ -	$ 1,253	$ 8,647	$13,319	$20,817

NOTE: LOAN VALUE IS ESTIMATED TO BE 40% OF REMAINING NET OPERATING INCOME.

EXHIBIT XI

PROJECTED FINANCIAL EARNINGS
($1,000)

	1	2	3	4	5	6
PROVEN REMAINING NET RESERVES (BCF)	7.8	36.5	69.8	100.2	125.9	148.0
CUMULATIVE INVESTMENT	$3,000	$8,525	$14,875	$22,025	$30,025	$33,375
LESS: RESERVE	-0-	-0-	677	1,877	3,867	6,657
NET INVESTMENT	3,000	8,525	14,198	20,148	26,158	26,718
DEPLETION & DEPRECIATION RATE (¢/MCF)	N/A	23.4	20.3	20.1	20.8	18.0
NET PRODUCTION (BCF)	NIL	2.9	5.9	9.9	13.0	17.0
REVENUE	NIL	$4,170	$ 8,484	$14,236	$18,694	$24,446
LESS: PRODUCTION TAXES	NIL	459	933	1,566	2,056	2,689
OPERATING EXPENSES	NIL	209	424	712	935	1,223
DEPLETION & DEPRECIATION	NIL	677	1,200	1,990	2,700	3,069
NET EARNINGS (BFIT)	-0-	$2,825	$ 5,927	$ 9,968	$13,003	$17,465
LESS: INCOME TAXES (50%)	-0-	1,412	2,963	4,984	6,501	8,732
NET EARNINGS	-0-	$1,413	$ 2,964	$ 4,984	$ 6,502	$ 8,733
RETURN ON NET INVESTMENT (AFIT)	N/A	16.6%	20.9%	24.7%	24.8%	32.6%

EXHIBIT XII

RECENT PRODUCTION PURCHASES

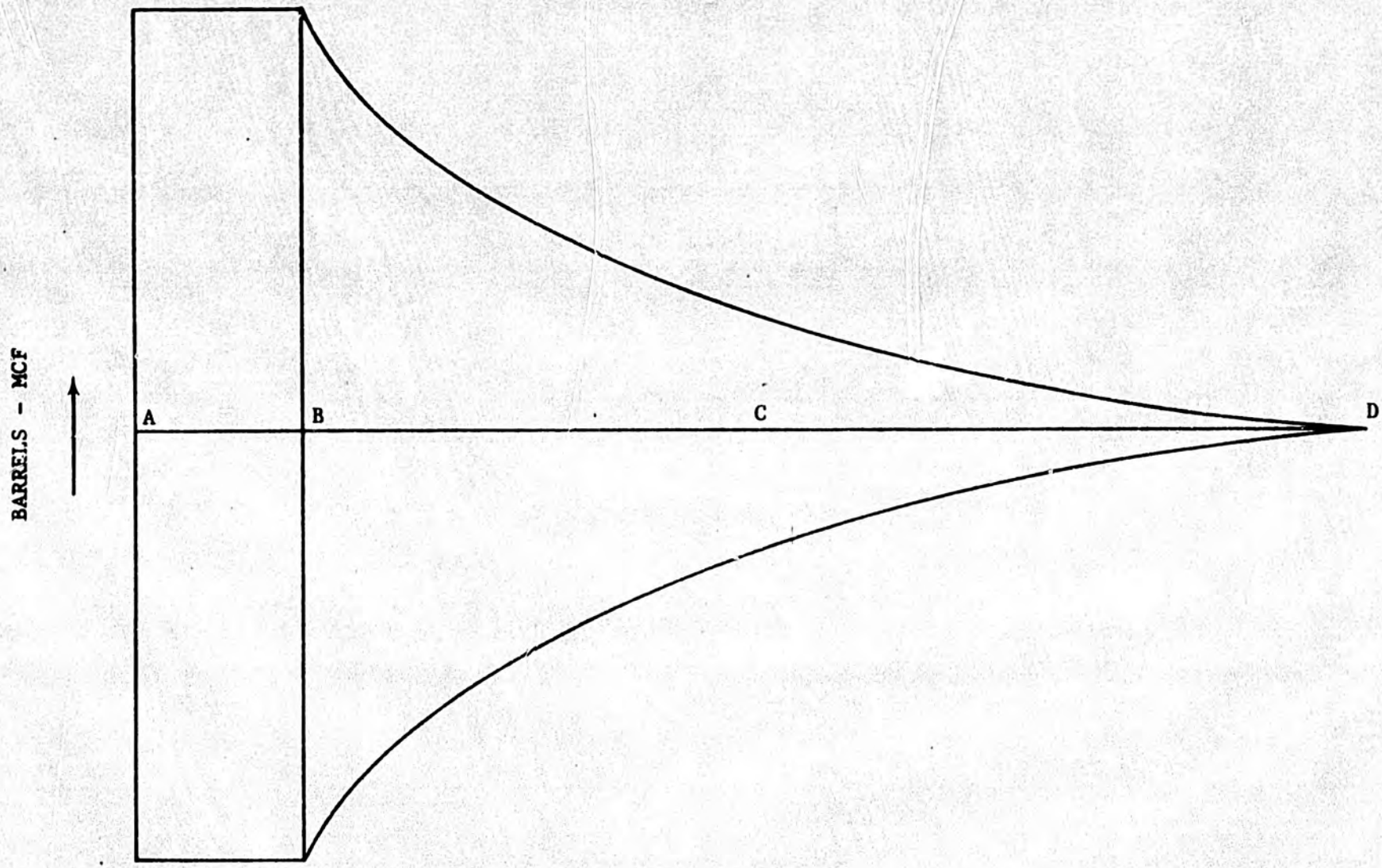
	Net Reserves		Net Production		
	Oil, Bbls.*	Gas, MMcf*	BOPD	Mcf/D	Price Paid
I.	8,000,000	160,000	3,200	55,000	$130,000,000
II.	35,000,000	190,000	12,000	40,000	160,000,000
III.	4,000,000	18,000	1,250	8,500	30,000,000
IV.	2,000,000	35,000	1,000	9,000	18,000,000

* Most of these reserve numbers include varying degrees of probable and possible reserves.

EXHIBIT XIII

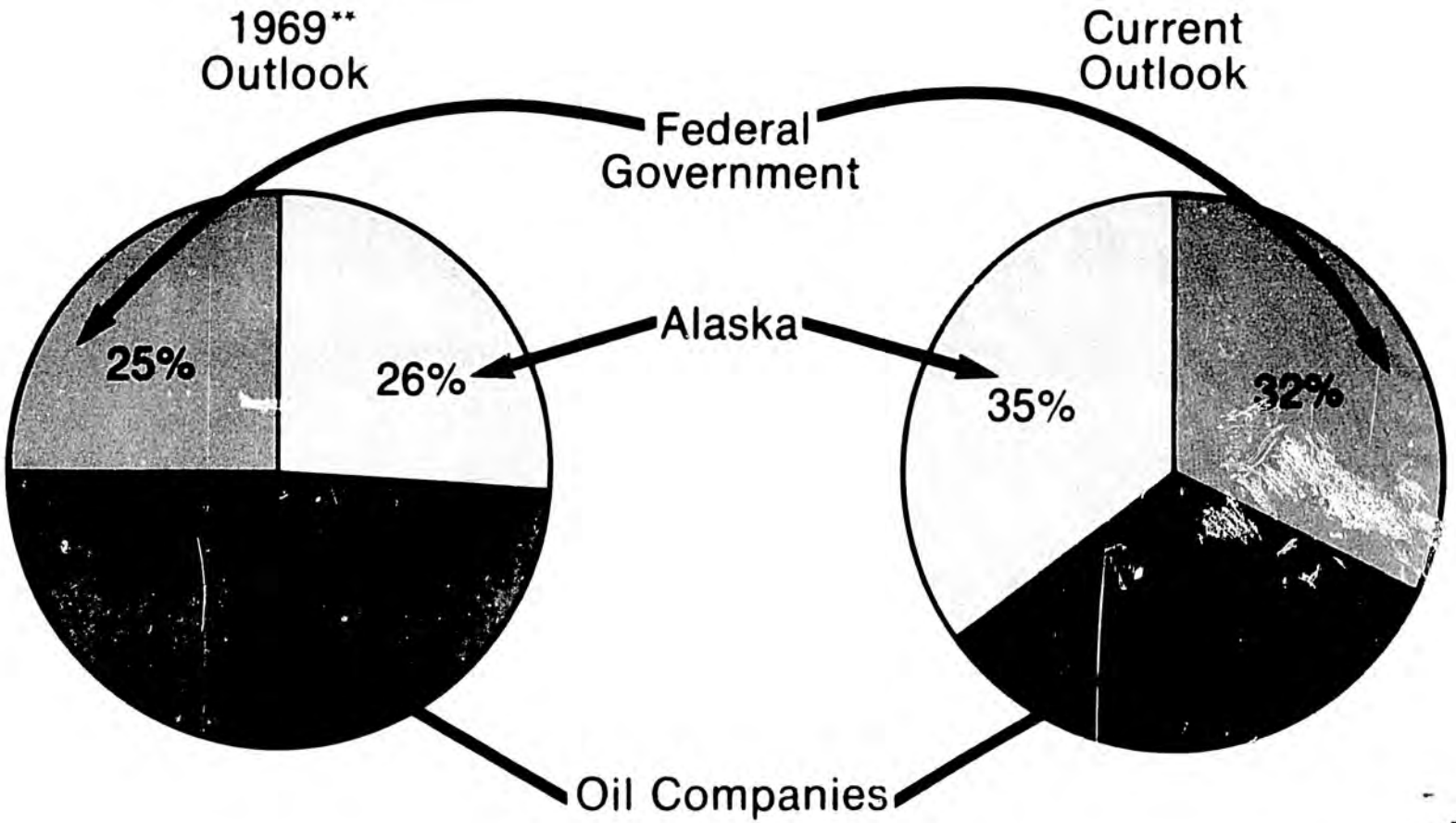
RANGE OF RECOVERY ESTIMATES

INDIVIDUAL WELL



PLEASE NOTE: THE PRECEDING PAGES WERE TREATED AS A UNIT IN THE ORIGINAL DOCUMENT.

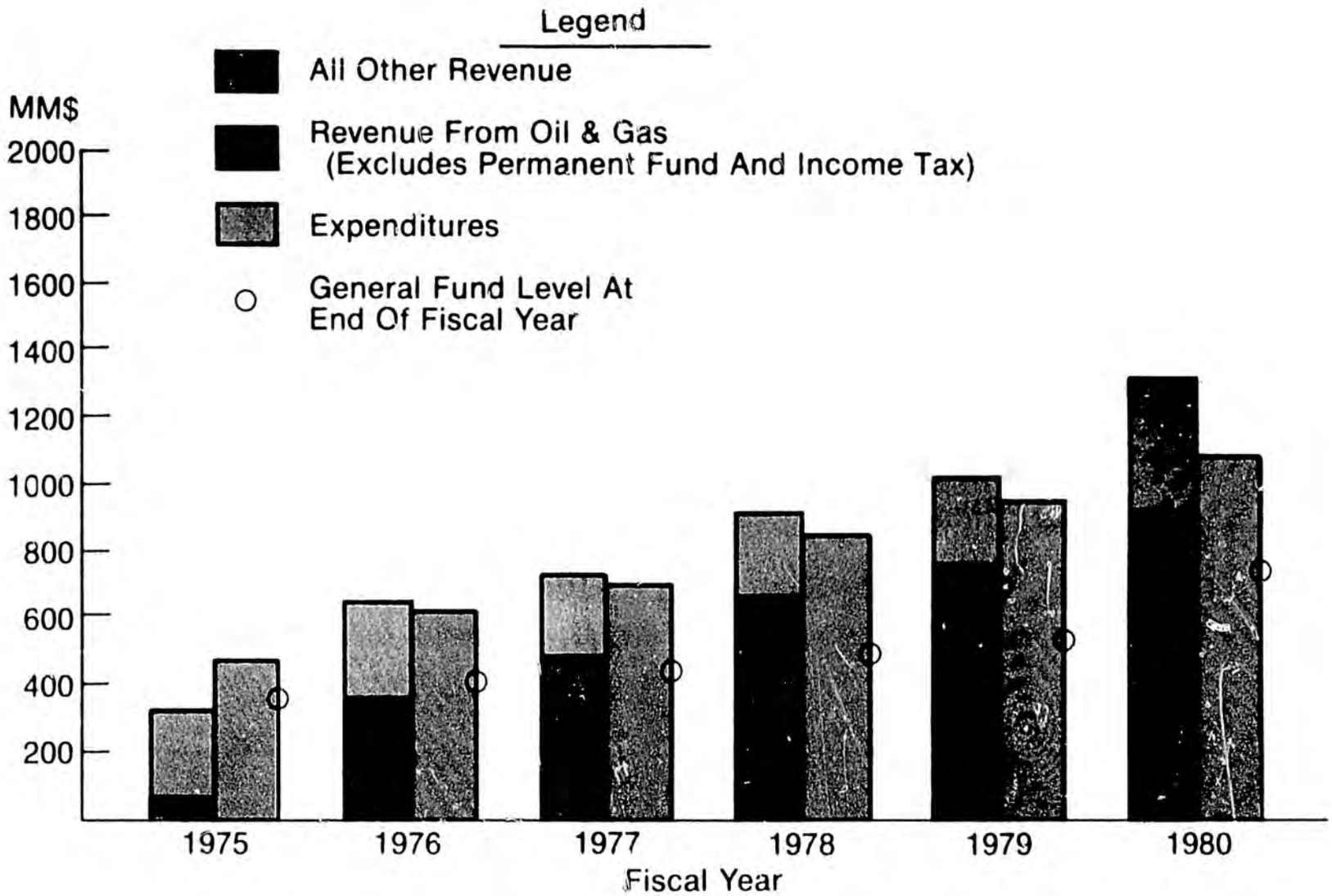
Distribution Of Prudhoe Bay Field Level Income*



*Field level revenues for the life of the field less investments and operating expenses.

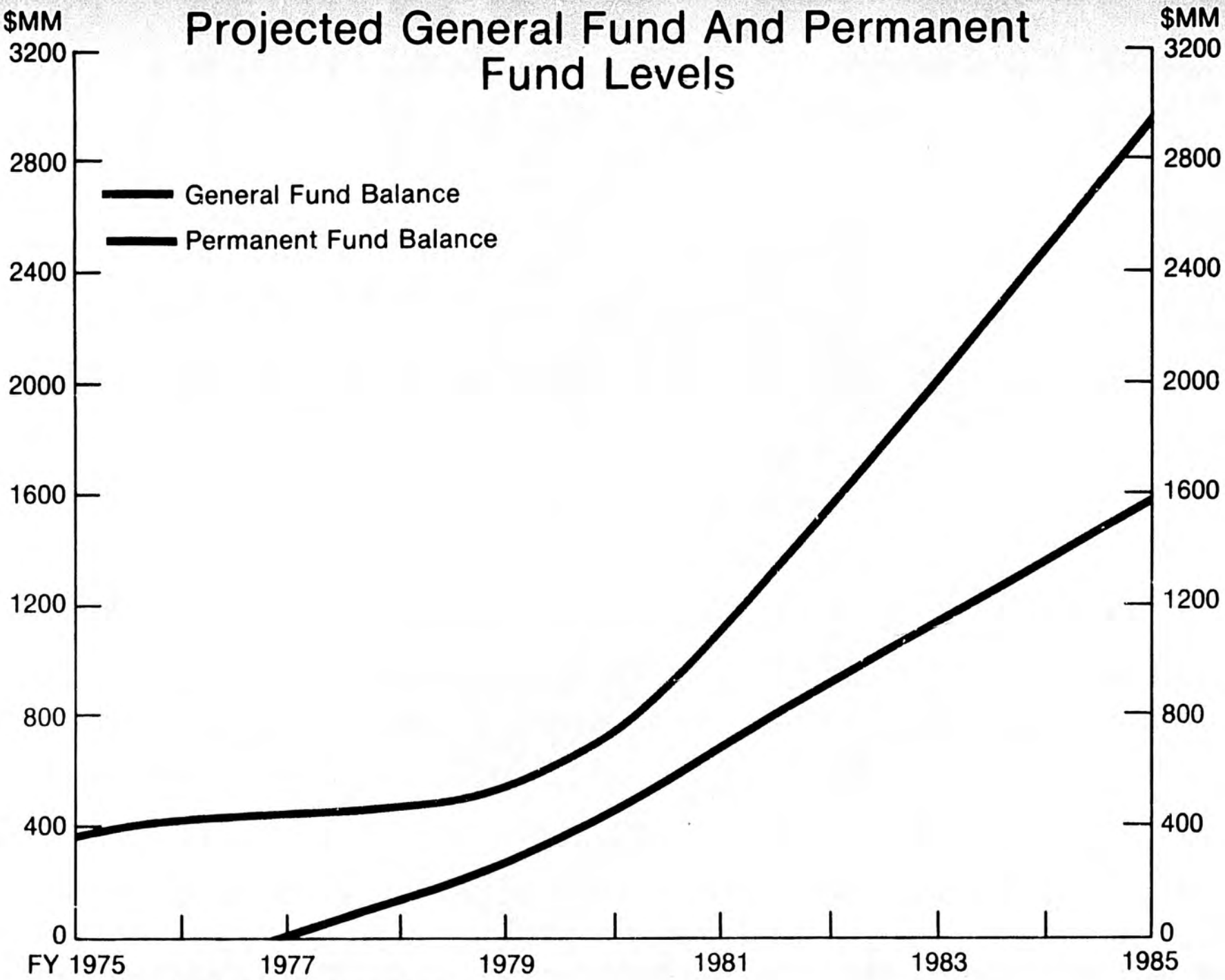
**Date of major lease sale by the state of Alaska

Estimates Of State Of Alaska's Revenues, Expenditures And General Fund Level*



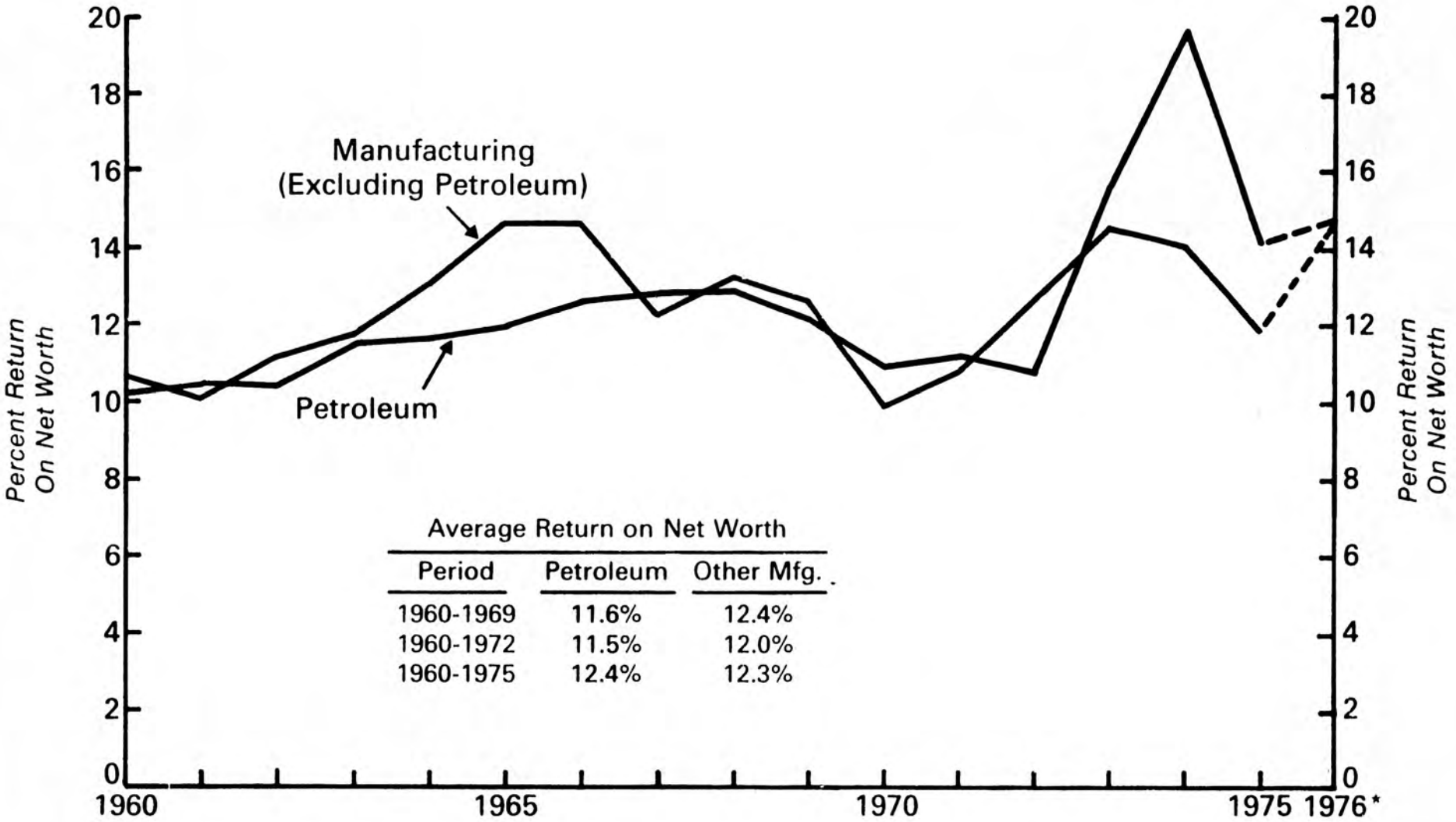
Projections By The Legislative Affairs Agency Dated 5/26/76

Projected General Fund And Permanent Fund Levels



Source: Legislative Affairs Agency
State of Alaska (May 26, 1976)

Petroleum Industry Returns Historically About Equal To All Other Manufacturing



Average Return on Net Worth

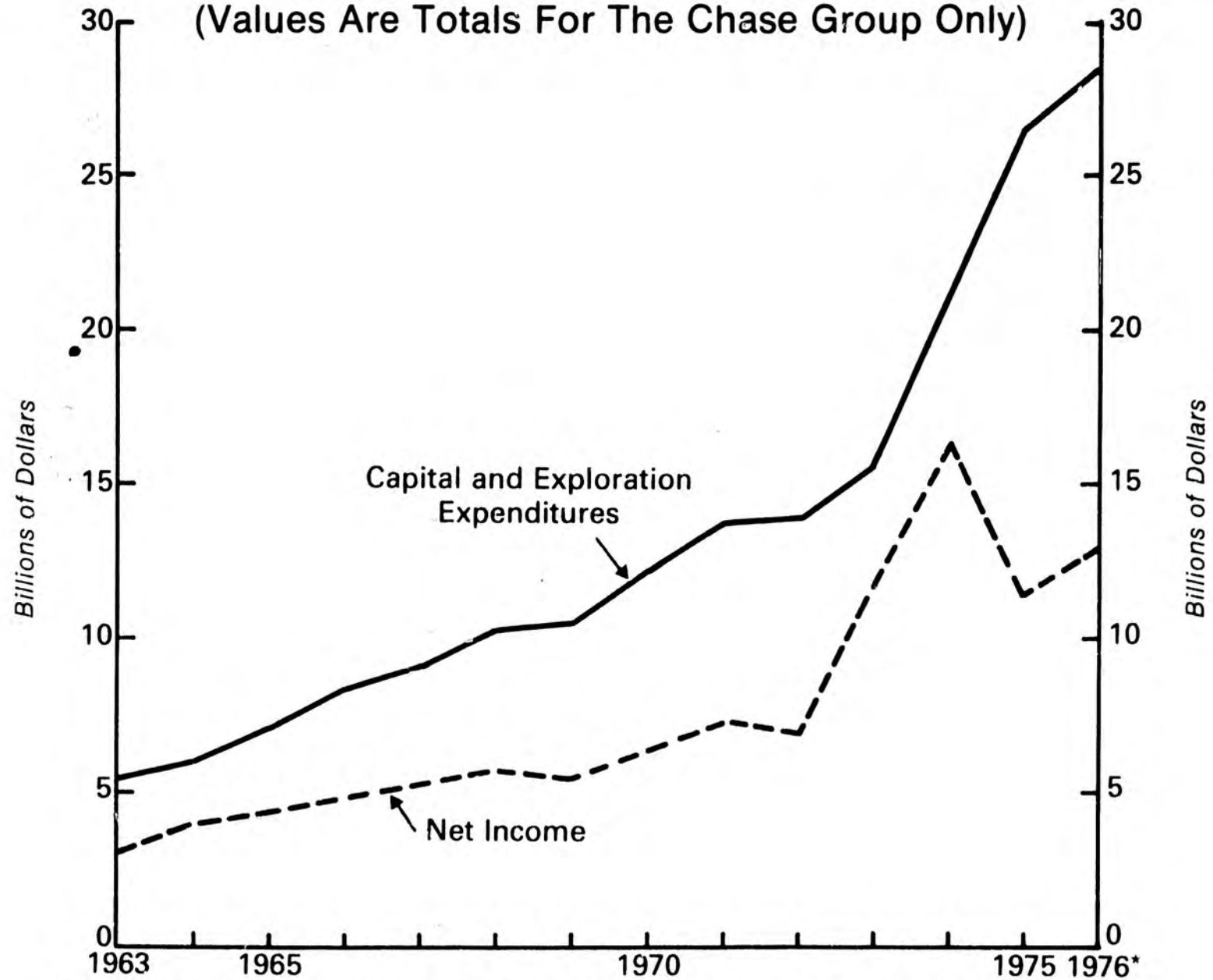
Period	Petroleum	Other Mfg.
1960-1969	11.6%	12.4%
1960-1972	11.5%	12.0%
1960-1975	12.4%	12.3%

**Estimate based upon 6 months 1976 FTC data*
Source: First National City Bank

A-5.1
B-2.1

Worldwide Petroleum Industry Investments Have Historically Been Greater Than Profit Levels

(Values Are Totals For The Chase Group Only)



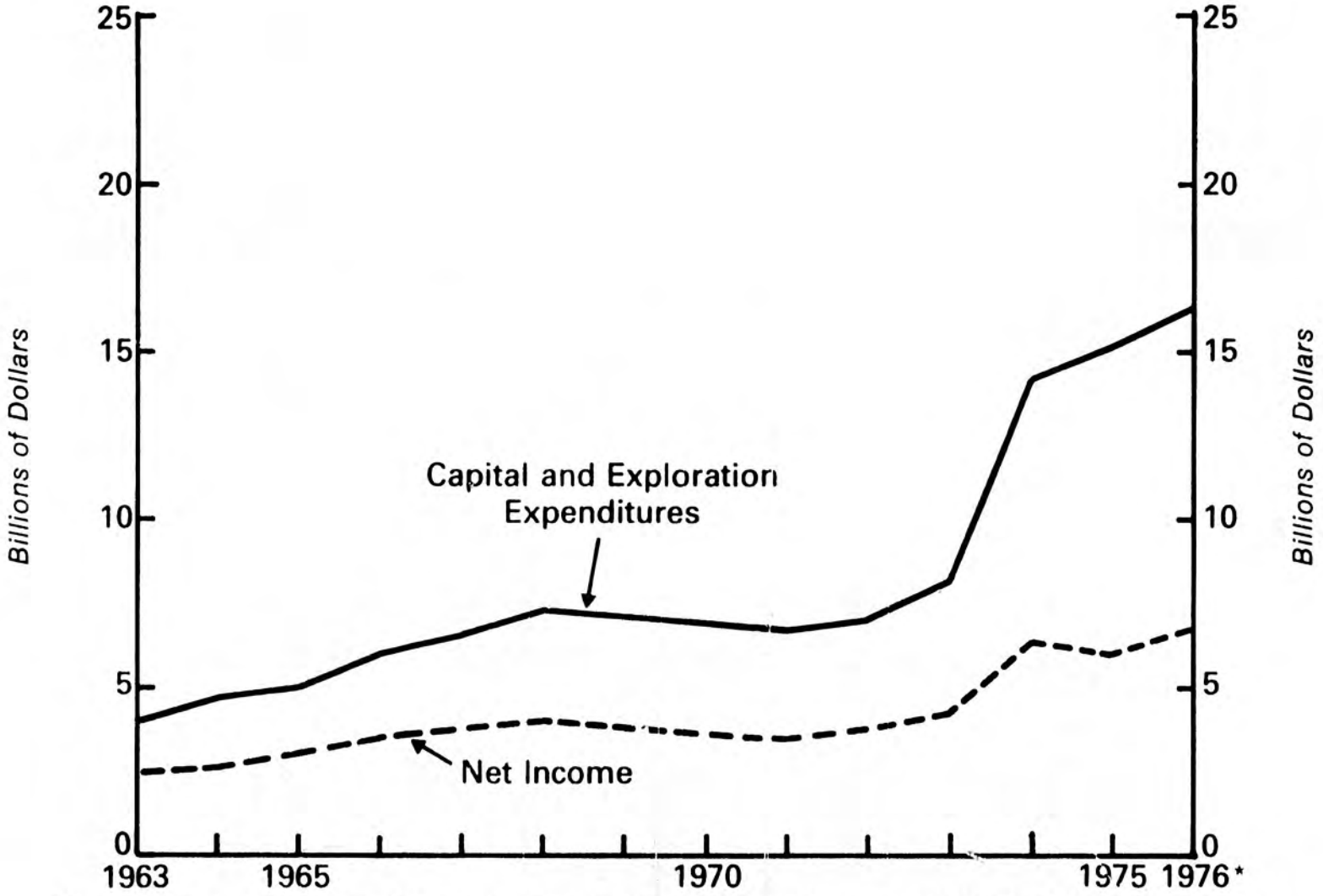
Source: Chase Manhattan Study of a Group of Petroleum Companies Which Constitute a Major Portion of the Industry

**1976 Estimated Based Upon 9 Months Preliminary Results*

B-2.4
A-5.3

Domestic Petroleum Industry Investments Have Historically Been Greater Than Profit Levels

(Values Are Totals For The Chase Group Only)

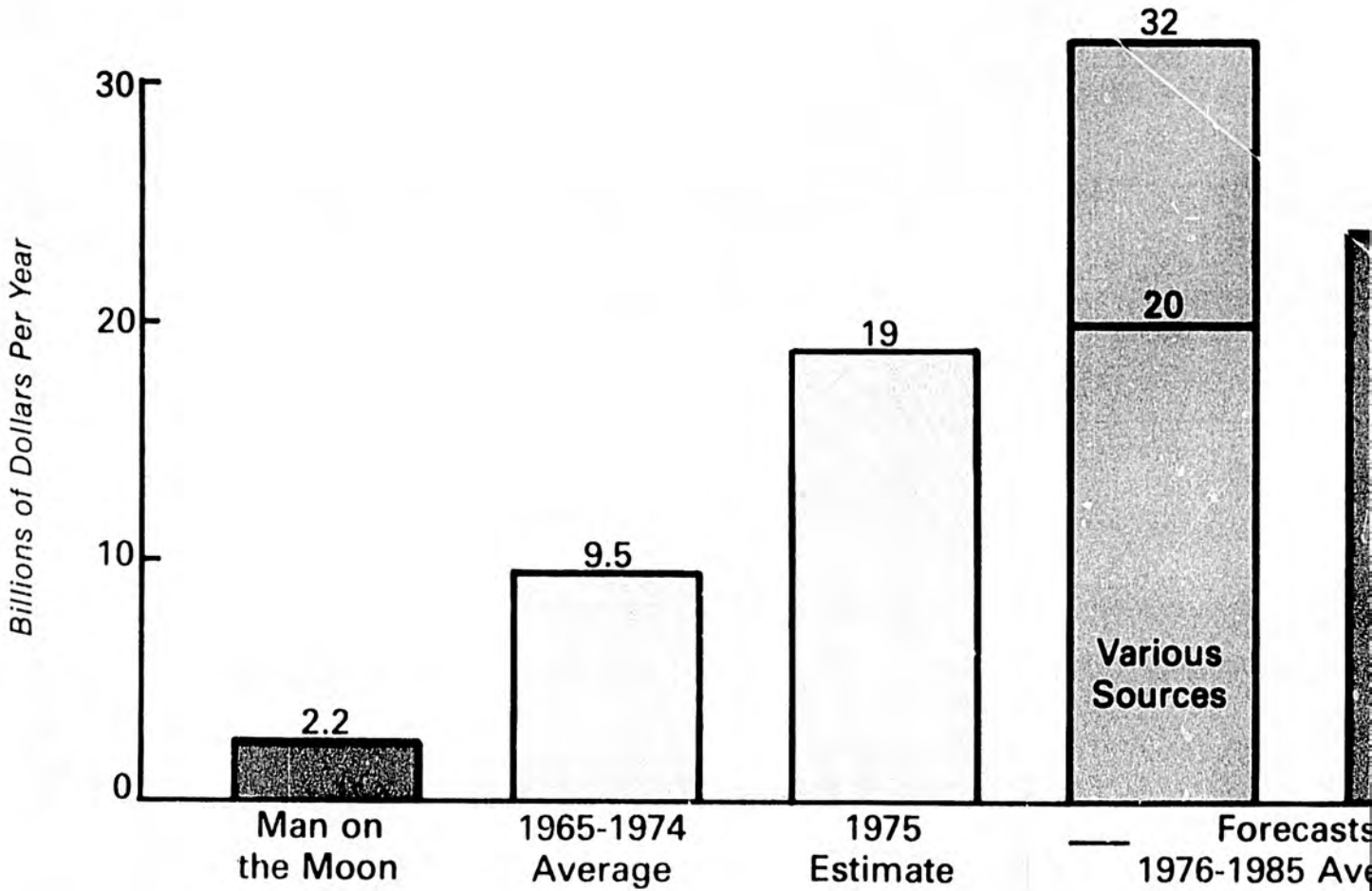


Source: Chase Manhattan Study of a Group of Petroleum Companies Which Constitute a Major Portion of the Industry

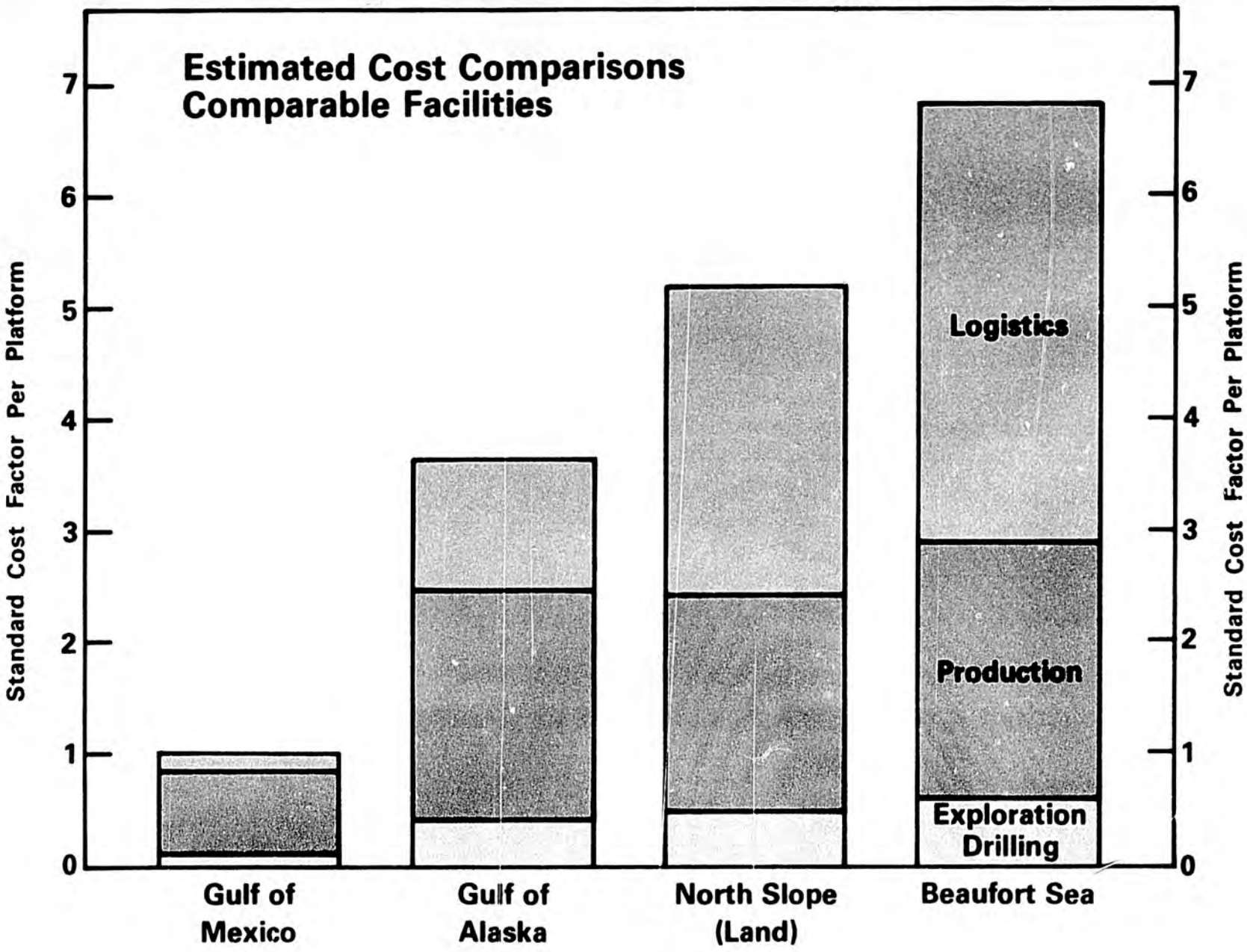
**1976 Estimates Based Upon 9 Months Preliminary Results*

B-2.5
A-5.4

Domestic Capital Expenditures For Oil And G
Are Forecast To Increase Over The Next Dec



B-2.6:


Estimated Cost Comparisons
Comparable Facilities
Standard Cost Factor Per Platform
0
1
2
3
4
5
6
7
Logistics
Production
Exploration Drilling
Gulf of Mexico
Gulf of Alaska
North Slope (Land)
Beaufort Sea