inures to the benefit of any private shareholder or individual;

(C) which does not participate in, or intervene in (including the publishing or distributing of statements) any political campaign on behalf of any candidate for public office; and

(D) no substantial part of the activities of which is carrying on propaganda, or otherwise attempting to influence legislation.

(e) For this purpose --

(A) "Technology transfer services" means (directly or by arranging for and supervising the performance by independent contractors) reviewing technology disclosures from qualified research organizations, obtaining patents or other legal protection for such technology, arranging for licensing, sale or other exploitation of such technology, collecting income and turning over the entire amount, less amounts agreed upon with the originating qualified research organization, to qualified research organizations and necessary ancillary services and research grants program administration services for the private foundation described in subsection (c).

(B) "Qualified research organization" means [an organization described in section 170(b)(1)(A) --

(a) which is exempt from taxation under section 501(a), or

(b) the income of which is excluded from taxation under section 115(a).

(C) "Research grants program" means securities and other investment assets with a value of at least $20 millions.

Sec. 2. This Act shall be effective upon the date of its enactment.

APPROACH 2(a)

Purpose To permit certain private foundations (Research Corporation) to make a substantial program related investment (PRI) in a non-profit organization that is either non-exempt or exempt under section 501(c)(4) of the Code.

[PRI]

Sec. 1.

(a) A qualified investment made by a qualified private foundation in a qualified technology transfer service organization shall be treated as a program related investment (as defined in section 4944 of the Internal Revenue Code of 1954) for the purposes of chapter 42 of the Code and shall not attract the tax imposed by section 507(a).

(b) For the purposes of subsection (a) --

(i) "Qualified investment" means a transfer by a qualified private foundation of (A) all of the patents, copyrights, know-how and other technology or rights thereto of the foundation and (B) investment assets not exceeding $35 million to a qualified technology transfer service organization in exchange for stock, debt or a combination thereof.

(ii) "Qualified private foundation" means --

(A) a private foundation which was incorporated before 1913;

(B) the principal purposes of the private foundation are to support research by, and to provide technology transfer services to, an organization described in section 170 (b)(1)(A) --

(I) which is exempt from taxation under section 501(a), or
(II) the income of which is excluded from taxation under section 115(a).

(iii) "Qualified technology transfer organization" means a corporation established after the date of enactment --

EXEMPTION $12 Million to a Qualified

(A) which is organized and operated solely to advance the public welfare through the provision of technology transfer services to qualified research organizations;

(B) which is

(I) exempt from tax under section 501(a) by reason of being described in section 501(c)(4), or

(II) no part of the net earnings of the corporation inures to the benefit of any private shareholder or individual other than the qualified private foundation, qualified research organizations or other organizations described in section 501(c)(3);

(C) which does not participate in, or intervene in (including the publishing or distributing of statements) any political campaign on behalf of any candidate for public office;

(D) no substantial part of the activities of which is carrying on propaganda, or otherwise attempting, to influence legislation; and

(E) upon the dissolution of which all of its net assets can be distributed only to qualified research organizations.

(iv) "Technology transfer services" means (directly or by arranging for and supervising the performance by independent contractors) reviewing technology disclosures from qualified research organizations, obtaining patents or other legal protection for such technology, arranging for licensing, sale or other exploitation of such technology, collecting income and turning over the entire amount, less amounts agreed upon with the originating qualified research organization, to the originating qualified research organization, and necessary ancillary services.

Sec. 2. This Act shall be effective upon the date of its enactment.

APPROACH 2(b)

Purpose: To amend the Internal Revenue Code with respect to program related investments made by Research Corporation in support of its principal purposes.

[sect. 4944(c)]

(c) EXCEPTION FOR PROGRAM RELATED INVESTMENTS. For purposes of this section, investments, the primary purpose of which is to accomplish one or more of the purposes described in section 170(c)(2)(B), and either (1) no significant purpose of which is the production of income or the appreciation of property, or (2) are made by a private foundation whose principal purposes are to support research by, and to provide technology transfer services to, organizations which are exempt from taxation under section 501(a) or the income of which is excluded from taxation under section 115(a), shall not be considered as investments which jeopardize the carrying out of exempt purposes.

APPROACH 3

Purpose: To amend the Internal Revenue Code to facilitate qualification of Research Corporation as a section 509(a)(2) public charity.

[sect. 509(a)(2)]

Sec. 1. Section 509(a)(2)(A)(ii) of the Internal Revenue Code of 1954 is amended to read as follows:

> "(ii) gross receipts from admissions, sales of merchandise, performance of services, or furnishing of facilities, in an activity which is not an unrelated trade or business (within the meaning of section 513), not including such receipts from any person, or from any bureau or similar agency of a governmental unit (as described in section 170(c)(1)), in any taxable year to the extent such receipts exceed the greater of $5,000 or 1 percent of the organization's support in such taxable year, and gross receipts, royalties, or other income from technology transfer activities."

Sec. 2. A new subsection (f) is added to section 509:

(f) Technology Transfer Activities, etc. --

For purposes of subsection (a)(2) --

(A) "Technology transfer activities" means (directly or by arranging for and supervising the performance by independent contractors) reviewing technology disclosures from qualified research organizations, obtaining patents or other legal protection for such technology, arranging for licensing, sale or other exploitation of such technology, collecting income and turning over the entire amount, less amounts agreed upon with the originating qualified research organization, to qualified research organizations and necessary ancillary services.

(B) "Qualified research organization" means an organization described in section 170(b)(1)(A) --

Sec. 3. A new subsection (f) is added to section 509:

(a) which is exempt from taxation under section 501(a), or

(b) the income of which is excluded from taxation under section 115(a).

Sec. 3. The Act shall be effective upon its date of enactment.

APPROACH 4

Purpose: To amend the Internal Revenue Code with respect to the types of organizations that will be exempt from private foundation status -- i.e., create a new category for which Research Corporation would qualify.

[sect. 509(a)]

____. Section 509(a) is amended as follows:

(a) The phrase "public safety" in subpart (4) is amended to read "public safety; or", and

(b) the following new subpart (5) is added:

"(5) (i) an organization which is organized and operated solely to provide technology transfer services [and to make grants in support of research in the physical sciences] to qualified research organizations.

(ii) For this purpose --

(A) "Technology transfer services" means (directly or by arranging for and supervising the performance by independent contractors) reviewing technology disclosures from qualified research organizations, obtaining patents or other legal protection for such technology, arranging for licensing, sale or other exploitation of such technology, collecting income and turning over the entire amount, less amounts agreed upon with the originating qualified research organization, to qualified research organizations and necessary ancillary services.

(B) "Qualified research organization" means an organization described in [clause (ii), (iii) or (iv) of] section 170(b)(1)(A) --

(a) which is exempt from taxation under section 501(a), or

(b) the income of which is excluded from taxation under section 115(a).

(B) "Technology transfer services" ...

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Jeter, Shirley STF ASST 1111	56649		

Structure "B"

APR 15 1983

PETRO-SYN CORP.

950 Third Avenue, 25th Floor
New York, New York 10022

(212) 355-3050
(800) 221-2646

Mr. George Stadler
Research Corp.
6840 East Broadway
Tucson, Arizona 85710

April 14, 1983

Dear Mr. Stadler,

As per our conversation today, I am sending you some information on the King-Wilkinson/Hoffman Process R&D project. Items enclosed include:

1. A reprint from "Oil and Gas Journal" 6/28/82..."SNG process is a potential CO_2 source."
2. A reprint from "The Houston Post" 12/20/81..."Single step coal gasification process."
3. "King-Wilkinson Tomorrow" a brochure describing the management capabilities of the company behind the process.
4. A few descriptive pages taken from an initial draft of a business plan that I am assembling for a possible Venture Capital deal on the same project.

I think that this will be a good start. After you read these documents, I would appreciate it if you would call me, so that we may discuss a possible course of action for a R&D limited partnership that would supply Direct Conversion, Inc. with the necessary (1,000,000 dollars) funds to develop this interesting technology.

As I said on the phone, Mr. King will only entertain a financing position with companies that have outstanding credentials. I will not be interested in any situations with a firm that can't sell a deal that they take on. Finally, concurrent with my exploration in the "tax shelter" area, potential Venture Capital and Federal sources are also being actively developed.

I look foward to hearing from you, and the possibility of working together on this project.

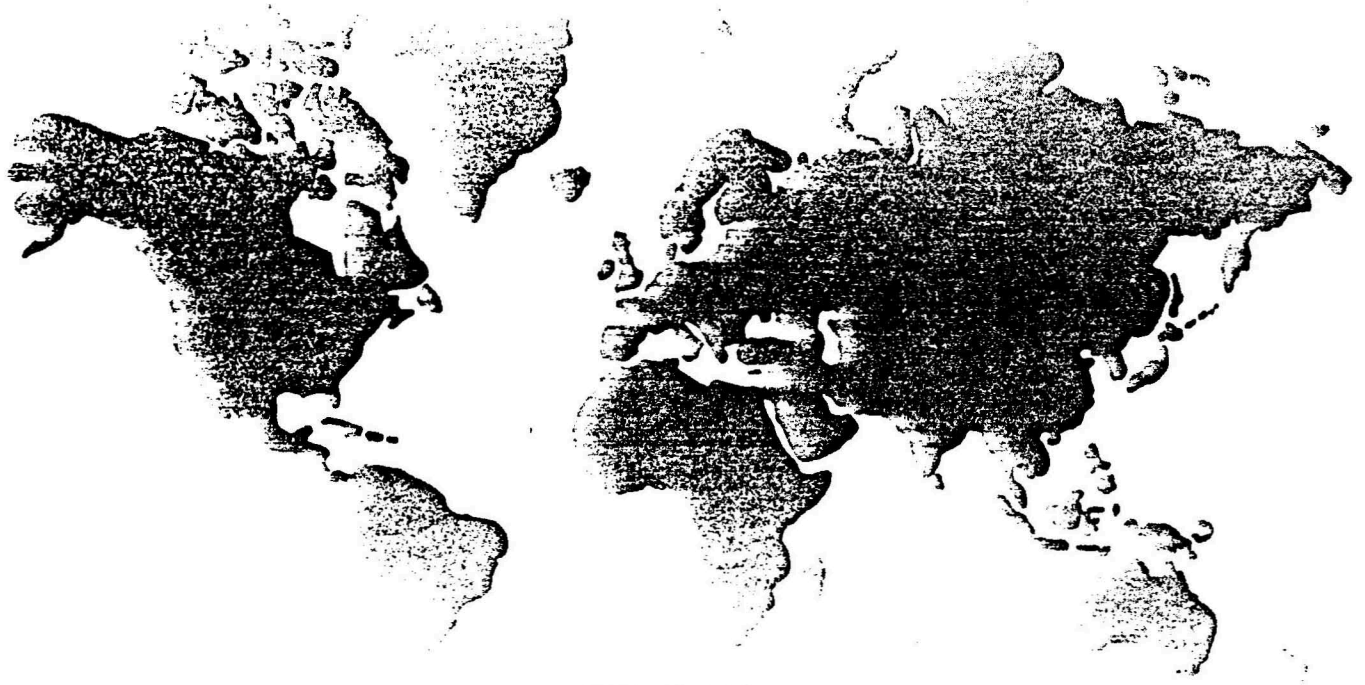
Sincerely yours,

James M. Aronson
President

would appreciate it if you would call me, so that we may discuss a possible



King-Wilkinson tomorrow



King-Wilkinson
KW

King-Wilkinson: a pioneer

In the mid-sixties Western Europe abounded in engineering companies, some offshoots of American multinationals, others purely European. All were eager to advise, design, survey and construct airports and cities, plants and refineries anywhere in the world.

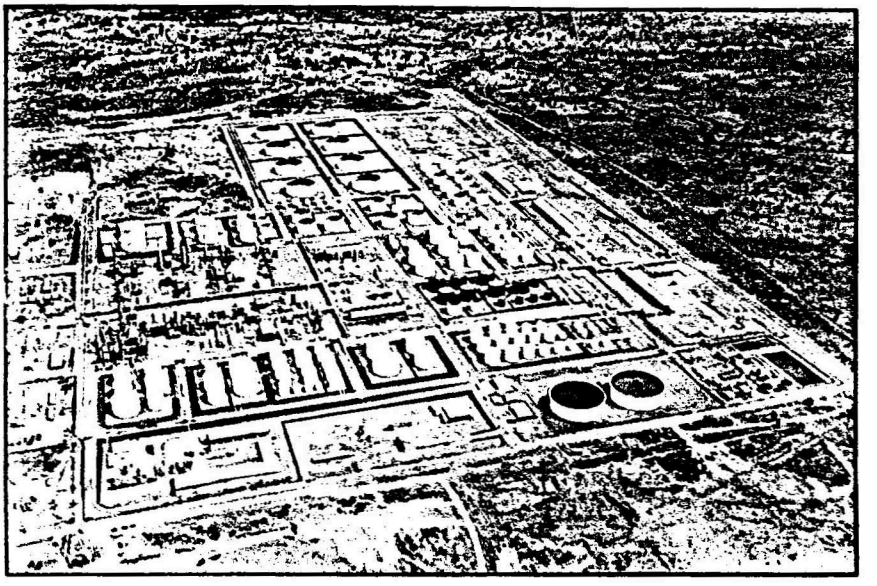
Personal and business friends wondered what prompted Robert A. King, after years in process engineering in two large companies in Europe and in the States, to set up yet another engineering company. After 20 years in process engineering business he felt that there is one link in this creative field that needs strengthening world-wide, **effective project management,** on behalf of the Owner – OPM

Indeed his own careful conclusions confirm the generally accepted assessment that 2/3 of the cost of a product is capital cost and this precious element is seldom properly monitored. Hence control of capital expenditure ought to top efficient OPM

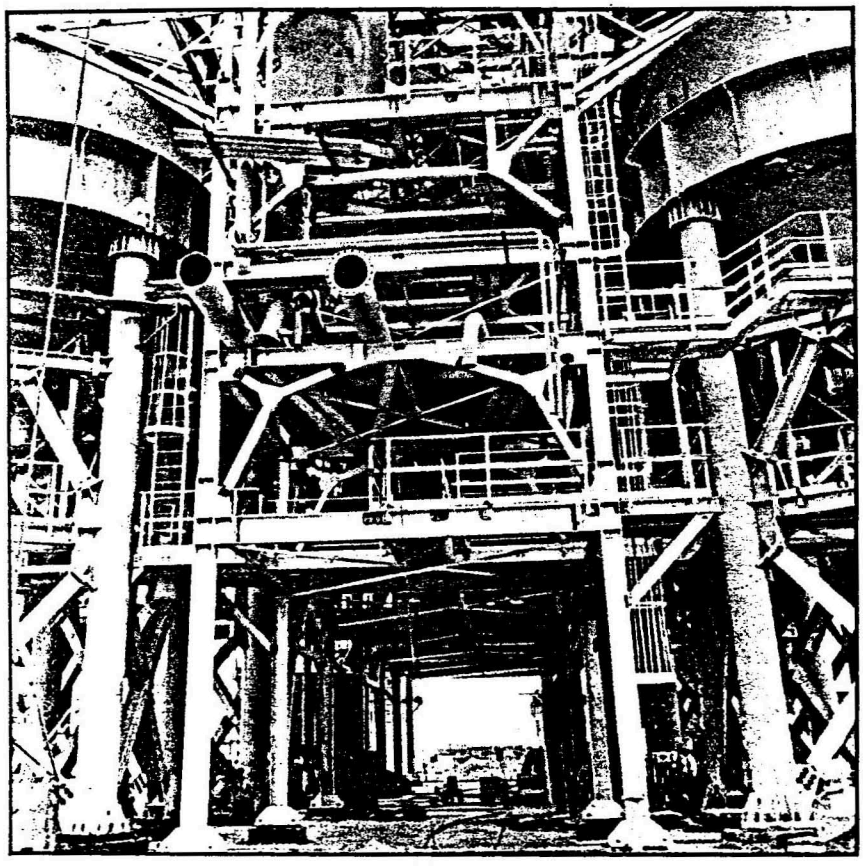
Another of Robert A. King's principles is that "overstaffing an engineering and construction project with poorly qualified personnel is throwing the Owner's money down the drain".

These principles have remained the guideline of K-W operations since 1964 when King-Wilkinson, Inc. was first registered in Oklahoma, U.S. and a year later an affiliate was set-up in The Hague, Netherlands.

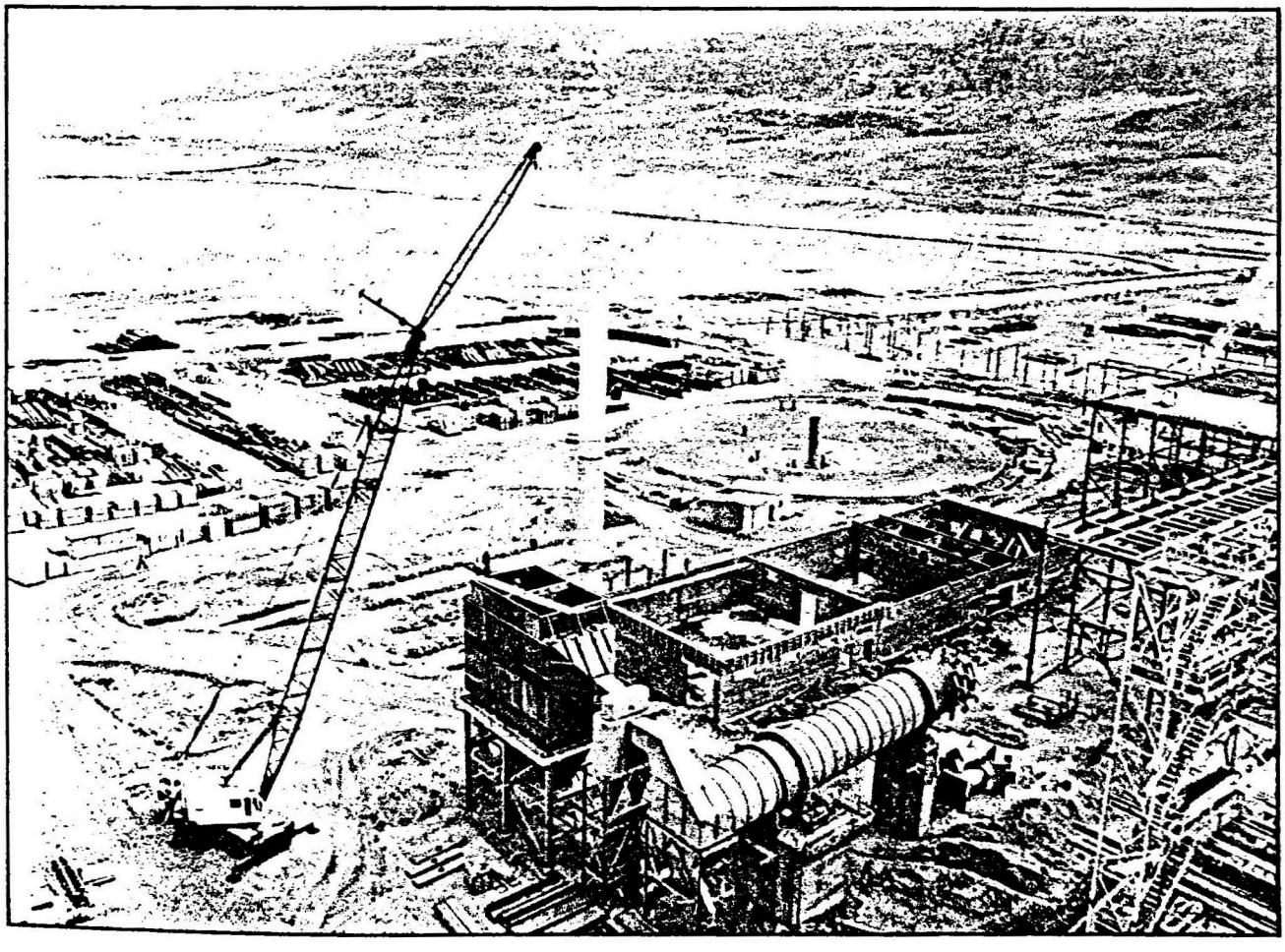
The underlying philosophy, applied with reasonable flexibility, and the experience of the last 15 years, have made King-Wilkinson the pioneer in professional OPM

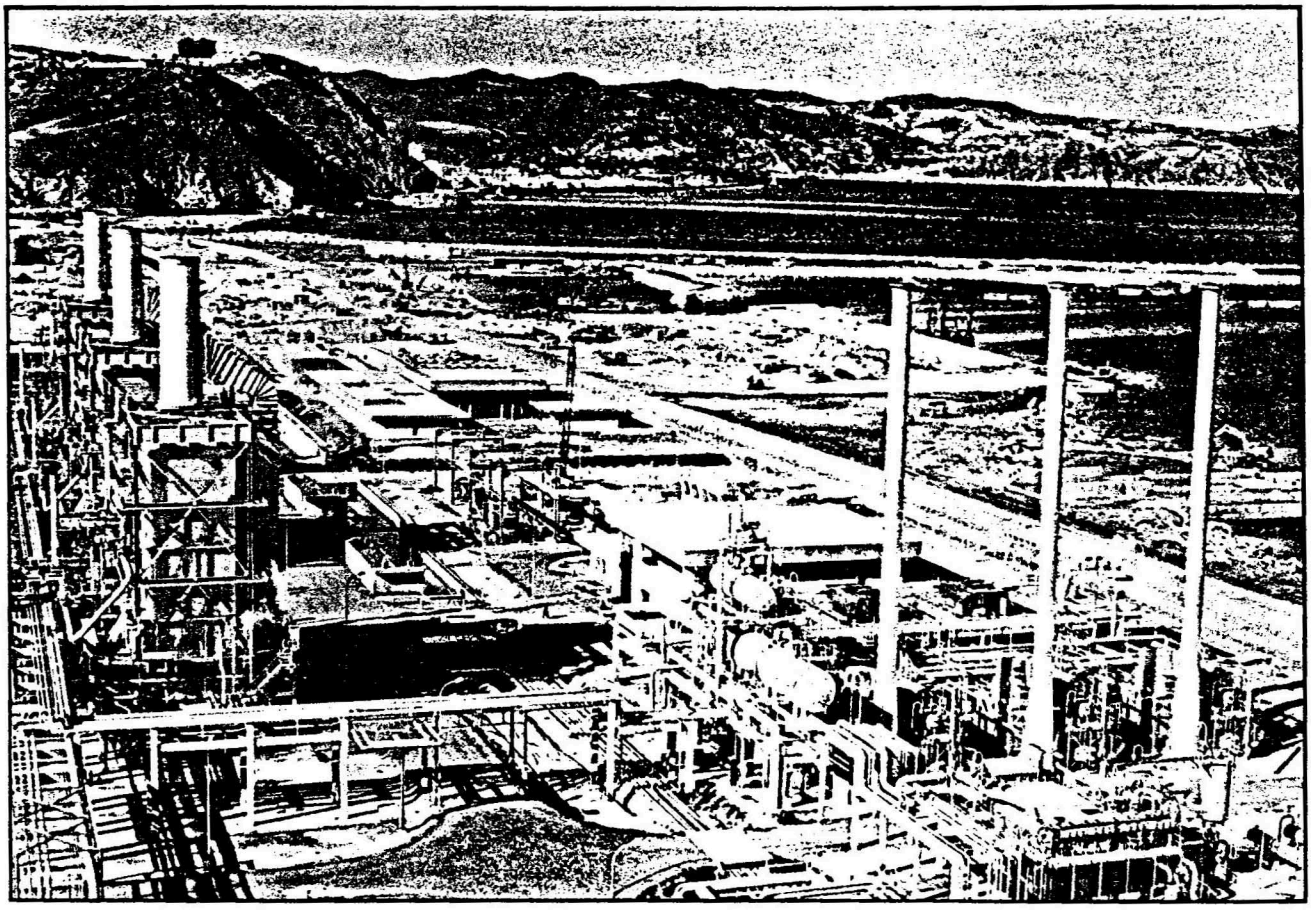


KADUNA Refinery for N.N.P.C., Nigeria



Potash Recovery Project , Jordan





LNG Plant, SKIKDA, for Sonotrach, Algeria

From its early days the GROUP specialised in furnishing TECHNICAL SERVICES to the Petroleum, other Energy and Process Industries,but above all PROCESS ENGINEERING and PROJECT CONTROL

Turnkey project responsibility is undertaken when requested by the Client.

King-Wilkinson has acquired a significant reputation in Contruction Supervision and Operations Management.

In the Middle East the world's largest combustion gas turbine driven power plant is being operated by a K-W team.

In the heart of Africa, having completed a comprehensive refinery complex, over a hundred K-W staff are assisting in start-up and plant management in addition to training local personnel.

In Algeria the GROUP is engaged, since the late sixties, in two widely different sophisticated base load LNG plants. At the same time K-W experts are supervising the construction of a 560 km long 48" gas pipe line.

OPM of LNG and LPG projects in the Far East placed K-W on the map of world experts on liquefied natural gas. Out of 15 major LNG base load projects K-W has been connected with 12.
From the wide vista of projects and recurring assignments world-wide, the following may be cited:

Crude Oil production	7 million BPD
Petroleum refining	10 major projects
Fertilizers	10 major projects
Petrochemicals	10 major projects

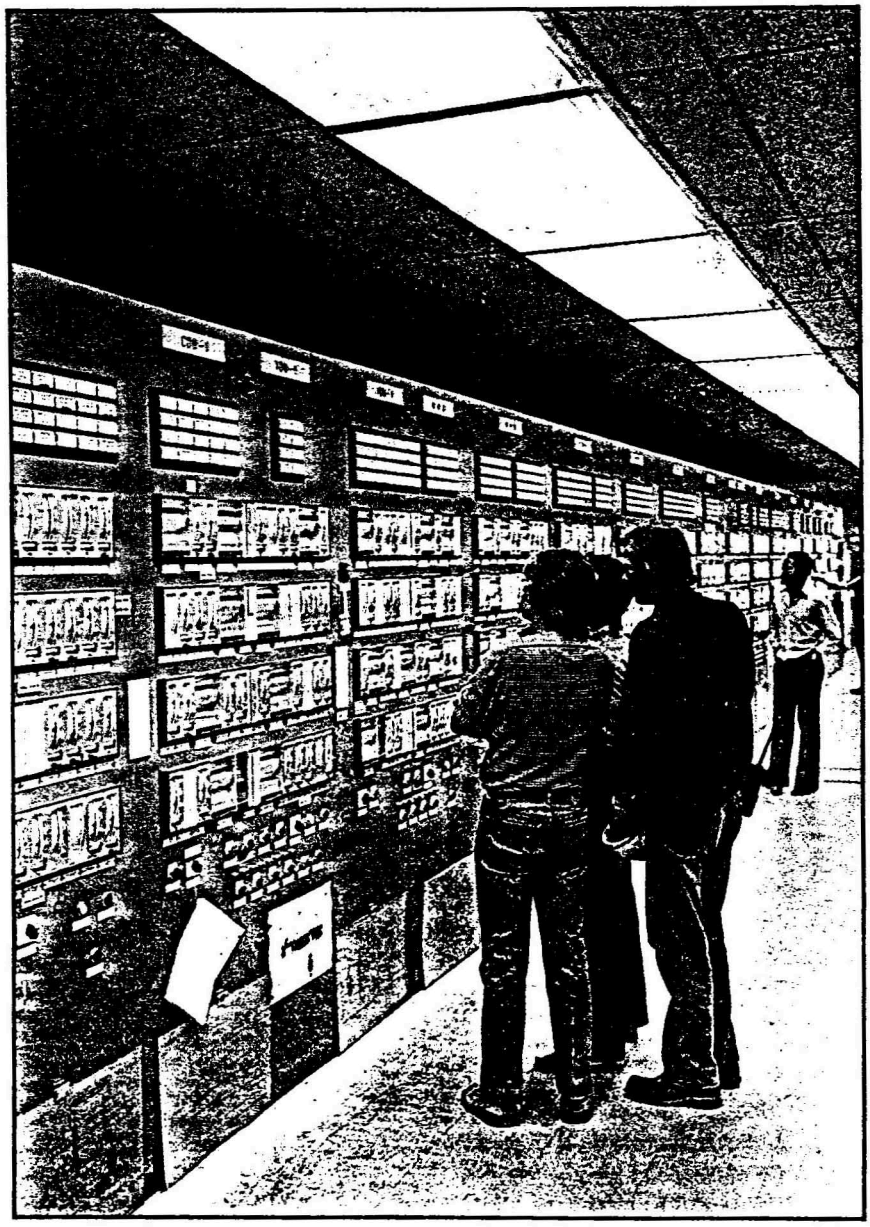
Foresight and alertness

In the early seventies when low priced oil was flowing freely to the West, the GROUP's Directors were already looking for further diversification.

Dr. Meadowes' warning "Limits to Growth", based on a report to the Club of Rome, was taken seriously and realistically.

The 1973 energy crisis provoked a fast reaction from King-Wilkinson management who made an early assessment of implications. The Company was one of the first to set up an energy conservation consultancy.

Electronic Age Control Room



• **Shale oil.** The world possesses major deposits of this mineral. Conversion techniques are somewhat analogous to treating coal and may well benefit by the admixture of heavy oil residue or petroleum coke.
The King-Wilkinson group are in a good position to survey available techniques and to assist in developing others. Processing of resultant products is largely routine work for our teams.

• **Upgrading of heavy oils.** This arises in the treatment of coal and shale conversion as well as of the extensive very viscous oil deposits and tar sands occurring in North and South America and some other areas. Such deposits are the fifth fossil fuel group and as difficult to exploit economically as coal and shale.

Additionally, the heavy residual oils remaining from some conventional process units, present an opportunity for up-grading treatment which the King-Wilkinson GROUP can well handle to produce saleable hydrocarbons. The GROUP has access to both laboratory and pilot plant facilities to test the responsiveness of specific residua.

• **"Synfuels"** originally used for various forms of synthetic crude from coal and its refined derivatives, has now a wider meaning of developing marketable products.

To the King-Wilkinson GROUP these operations present almost routine design and project work once the problems of producing usable feedstock from coal, shale or other non-petroleum base material have been overcome.

Treatment of "Biomass" both for gas or liquids and production of alcohols from grain, etc. (Gasohol) is in this category.

• **Gasoline additives.** Pressure to reduce the use of TEL for octane rating improvement has promoted research into a new generation of acceptable compounds without lead. King-Wilkinson has been in the forefront in evaluating several complex hydrocarbons for this purpose, backed up by recent and on-going laboratory work on yields and conversion rates.

Methanol and some alcohol additives to motor fuels are already gaining ground.



1980 KADUNA – Nigeria
Marking completion of the Refinery Complex



1980 MANAMA – Bahrain
Starting an Ammonia/Methanol Project

KING-WILKINSON

Houston, Texas
1981

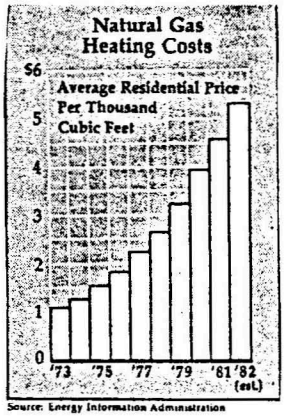
King-Wilkinson tomorrow will continue to stress independent professional services to owner clients for effective control of project costs, to achieve successful plant operation and operator training management.

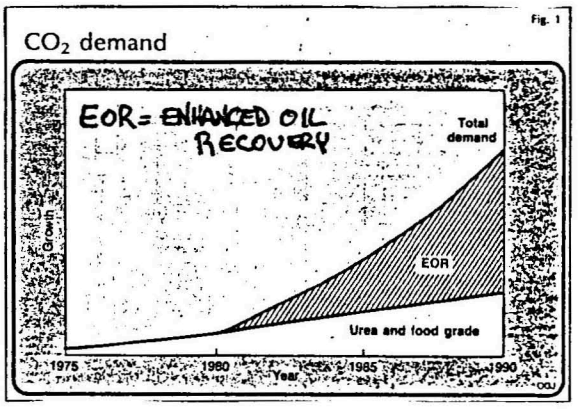
Robert A. King
President
King-Wilkinson, Inc.

STATEMENT OF PURPOSE

In 1964 Robert A. King formed King-Wilkinson, inc. (K-W), a privately held company with annual sales of $48,000,000. K-W is a firm employing 850 people dedicated to "effective project management," with four major engineering centers and five supporting subsidiaries operating on five continents. In 1982 King formed a sixth subsidiary, Direct Conversion, inc. (DCI) to develop a proprietary technology, the Hoffman Process (Process). The Process converts inexpensive and abundant coal into two very marketable commodities, Methane (CH_4, Pipeline Quality Gas) and Carbon Dioxide (CO_2).

This patented process was initially developed by Professor Edward J. Hoffman at the Natural Resources Research Institute of the University of Wyoming, in conjunction with a $600,000 grant from the Office of Coal Research in the early Seventies. With the recent and fierce escalation in the value and demand (see graphs below) for both of the process by-products (CH_4 & CO_2) the Process underwent intensive analysis by the engineering department of K-W. The formation of DCI was a





direct result of this study. Mr. King and Professor Hoffman are the major shareholders. To bring this project through the research and Development (R&D) phase and prepare it for commercialization, DCI will rely on the services of a competent and progressive Venture Capital organization. (see R&D section)

THIS WAS TAKEN FROM A ROUGH DRAFT OF THE BUSINESS PLAN (INFORMATION)

THE PROCESS

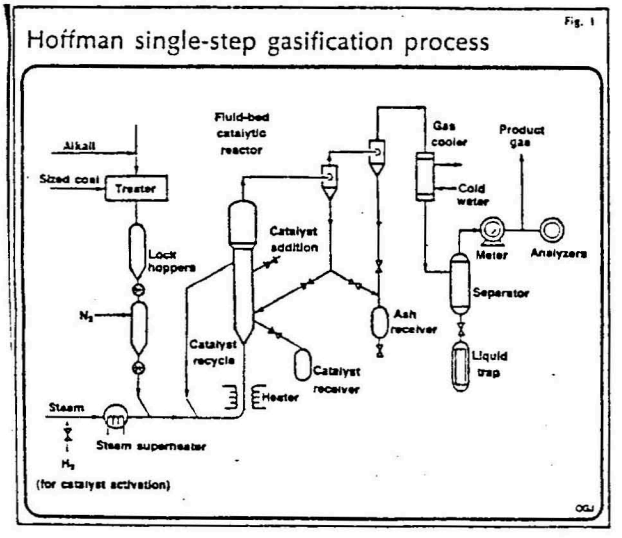
Description

Low grade, low cost fuel such as coal can be processed to yield high grade, high value gaseous or liquid fuels and CO_2. The Hoffman, Direct Conversion process is the most direct manifestation of this approach. In brief, this one-step, catalyzed conversion may be represented as:

$$2C + 2H_2O \text{ (steam)} \longrightarrow CH_4 + CO_2$$

Coal and steam are catalytically reacted to produce approximately equal proportions of Methane (pipeline quality gas) and CO_2.

In the process (fig 1) an entrained mixture of pulverized coal and alkali (sodium or potassium carbonate) in superheated steam is introduced into the bottom of an ebullating bed of catalyst particles. Reaction proceeds as the coal particles and alkali proceed upthrough and out of the bed.



Simplicity of operation is motivation for further process development. Only one stage of conversion is needed instead of the usual three: Gasification, C-O shift and Methanation.

Operating pressures are near atmospheric and reaction temperatures are around 1300°F. This permits the use of more conventional materials of construction.

Nickel catalysts are selective to methane formation. Iron catalysts could also produce hydrocarbon liquids in the liquified petroleum gas (LPG) and gasoline boiling ranges.

The alkali serves as a co-catalyst and also picks up sulfur from the decomposition of the coal. The alkali can be regenerated.

At the conditions used, nickel catalysts are resistant to sulfur poisoning. The equilibrium is away from sulfiding. Moreover, the alkali present reduces the sulfur (hydrogen sulfide) concentration in the gas phase which exists as a reducing atmosphere.

The conversion is autothermal or thermally neutral. For production of methane, the conversion is essentially in heat balance if the reactants, coal and steam, are at reaction temperature.

Autothermicity results in increased overall efficiencies and lower costs. Separation of CO_2 by known technologies leaves essentially methane. This product has a rating in excess of 900 BTU/SCF, qualifying as a full substitute for natural gas.

Process Economics

In this section we should develop the assumptions and subsequent projections on the final embodiment of a single skid-mounted plant. I would like to use my figures for a 200 TPD plant and I put them here for your inspection. In the final Business Plan these figures may also be relagated to the appendix. Any comments?.....

OPERATING COST ESTIMATE

200 TPD CH_4/CO_2 GENERATOR

(BASIS: 330 DAYS PER YEAR)

		PER ANNUM
FIXED		
Investment amortization (10%/year)		$ 550,000
Labor		475,000
Maintenance		300,000
Administration/Overhead		70,000
Taxes & Insurance		100,000
Working Capital		40,000
	Sub-Total	$ 1,535,000
VARIABLE		
Coal (400 TPD @ 12/Ton)		$ 1,584,000
Alkali (20 TPD @ $70/Ton)		462,000
Catalyst (2 RX Charge)		100,000
Chemicals, BFW Treatment		80,000
Waste Treatment		50,000
(i) Electricity (1600 KWH/Hr @ 4¢/KWH)		508,000
Electricity - H.P. CO_2/CH_4 Compression (1500 KWH/Hr)		476,000
	Sub-Total	$ 3,260,000
	TOTAL	$ 4,795,000

(i) Excludes requirement for high pressure CO_2 compression.

(ii) This estimate is based on generating 15,000 SCF each of CO_2 and methane per ton of low rank subbituminous coal containing 46% carbon. A higher rank steam coal can increase gas yields in proportion to its carbon content.

COST BREAKDOWN

200 TPD CH_4/CO_2 GENERATOR

FEEDSTOCK AND PRODUCTS		Daily Value
Coal Converted:	200 Tons per Day	
Coal for Steam Generation:	200 Tons per Day @ $12 per Ton	$ 4,800
Methane Produced:	3,000,000 SCF/D @ $4/MCF	12,000
Carbon Dioxide Produced	3,000,000 SCF/D @ $2.50/MCF (174 Ton/D @ 42.50/Ton)	1,500
		19,500
	NET	$ 14,700
Net Per Year		$4,851,000

OPERATING COSTS		Annual Basis
Plant Costs:	$5,500,000 amoritization over 10 years	$ 550,000
Operating Costs exclusive of Feedstock and Plant Cost		2,661,000
		$ 3,211,000

ESTIMATED COST SUMMARY

200 TPD CH_4/CO_2 GENERATOR

	Amount	$/Ton CO_2(i)
CAPITAL COST	$ 5,500,000	$ 95.79
ANNUAL OPERATING COST		
- Fixed	1,535,000	26.73
- Variable	3,260,000	56.77
	$ 4,795,000	$ 83.50
ANNUAL METHANE CREDIT (ii)	$ (3,960,000)	$ (68.97)
NET ANNUAL OPERATING COST	$ 835,000	$ 14.53

(i) Basis: 174 TPD CO_2 Generated for 330 days per year.

(ii) 3000 MCF/Day @ $4 /MCF.

THESE FIGURES WILL BE PUT INTO A MORE CONCISE AND EASIER TO UNDERSTAND FORMAT — Jud

RETURN ON INVESTMENT

Basis: @2.50 per MSCF or $42.50 per ton value for CO_2

$$ROI = \frac{(42.50 - 14.53)\ (174)\ (330)}{\$5,500,000} = 29.2\%$$

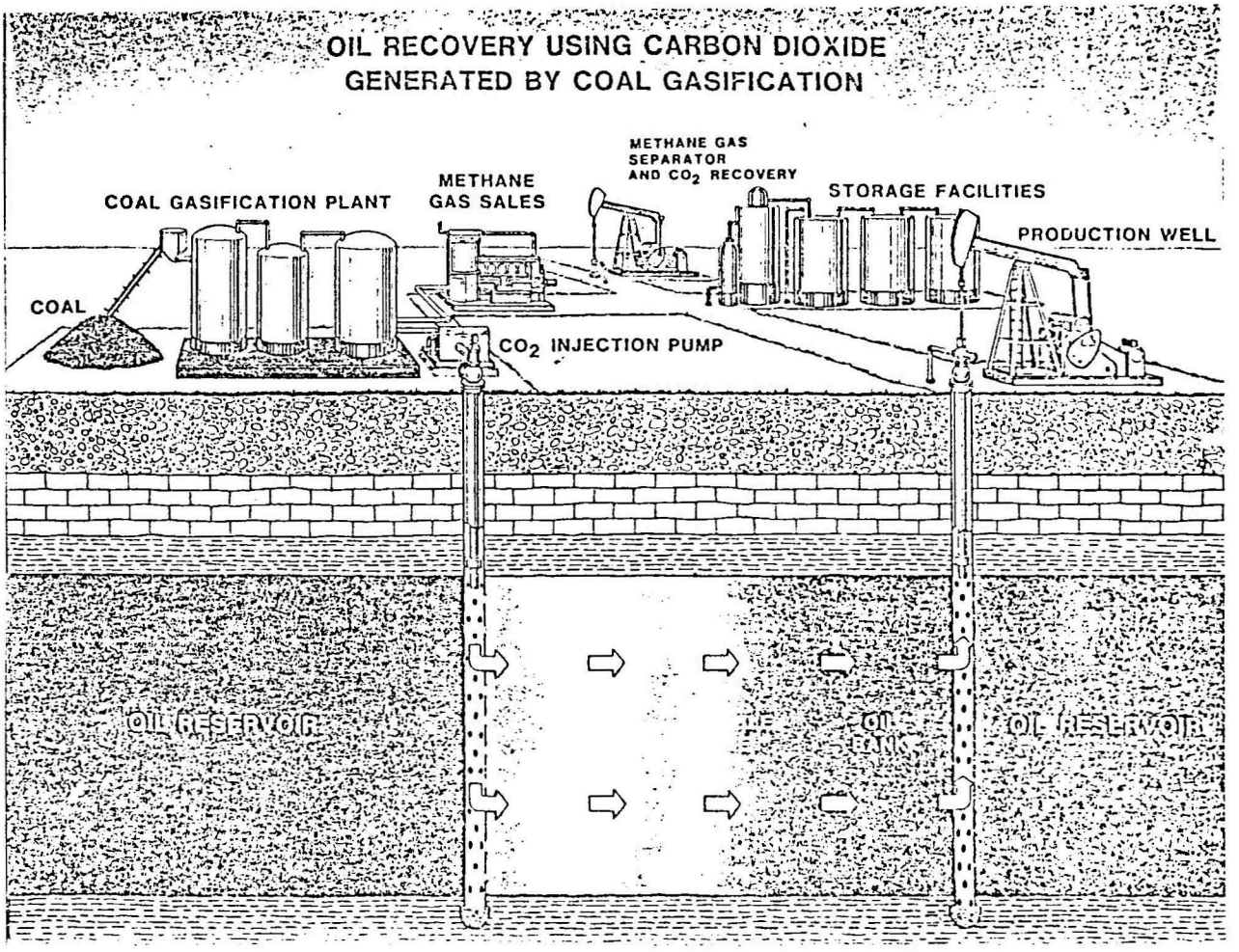
Advantages

This section will include a discussion of the following benefits:

Autothermal
No oxygen requirement
No NOX
50% Efficiency (worst case)
Relatively cheap catalyst cost
Patent protection
Simplicity

And most significantly:

Portability, the modular aspect. The final 200 TPD plants will be "skid-mounted" that is, they will be able to be moved by trucks. They can be placed in an oil field for EOR. This precludes any transportantion costs for CO_2. The CO_2 goes into the ground and oil comes out. Taken one step farther, it could be said that the units will produce oil and gas. Obviously, this portability aspect will allow easy shipment and set-up in a beverage facility also. We should have a discussion of CO_2 applications in this field with prices, high-purity modifications, and a simple discussion of the increasing need (especially for lite beer) in the beverage industry.



A smaller plant that still shows a significant return on investment will reduce risk. By employing the concept of pre-engineered, shop fabricated, and skid-mounted units, the high costs are avoided of individually engineered and field erected plants. The assembly line, so to speak, replaces the large custom-built

plant operations heretofore considered. Therefore "small is beautiful."

In point of reference, a small portable and packaged unit will process 200 tons per day of coal. The very large coal (syn-fuel) plants (either under construction or on hold due to oil price fluctuation) would process as much as 30,000 tons per day with multi billion dollar plant costs. It is not surprising that companies that own these plants are worried. A modular plant that can be stamped out reduces pressure (risk) and allows the technology to go through development despite temporary oil price reductions. The scale up can commence with mass production in a common assembly plant.

Methane and carbon dioxide, the upward trend. The second major advantage in support of the Process is the products it produces. In this portion of the plan we should have detailed explanations of the Natural gas picture and the deregulation of this industry. Also the use of our by-product, CO_2 in EOR and other industries and the tripling of the demand (1980-5) for this product, should be emphasized.

Combine the valuable product output with the portability aspects and it is easy to find many small applications (1 or 2 units) that will generate excellent ROI's. A good example is a New England Brewery that is paying retail prices for both natural gas and CO_2 for the production of "lite" beer (½ carbonated water).

Of course, as energy (oil) prices pick up there will be 100's of profitable installations. Methane will assume parity increases and EOR activity will accelerate at an even faster rate.

THE HOUSTON POST

SINGLE-STEP COAL GASIFICATION PROCESS

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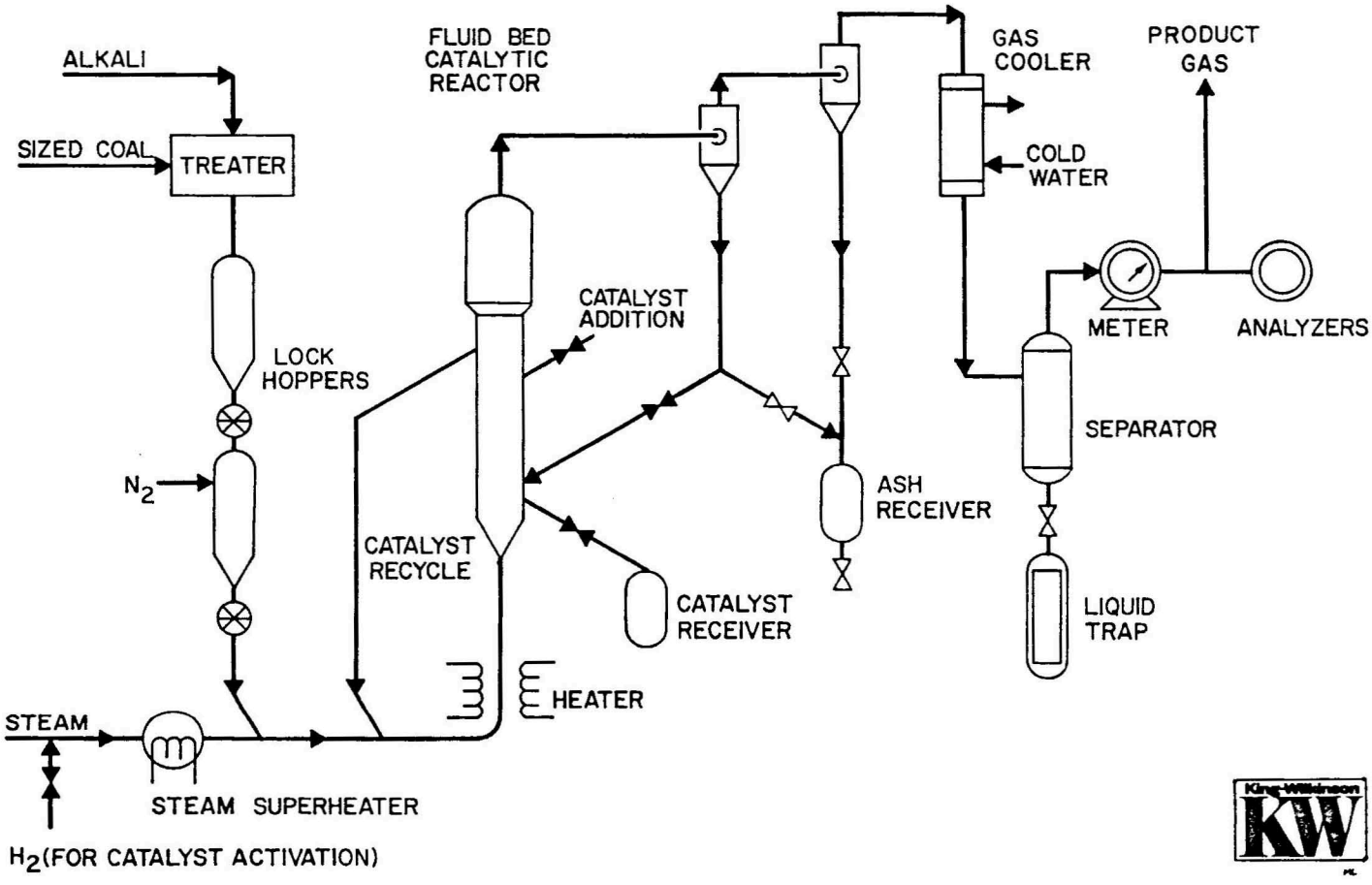
coal gasification process

SINGLE-STEP COAL GASIFICATION
PROCESS DEVELOPMENT UNIT FLOW SCHEME



In addition to coal, King said, lignite is an important potential raw material and the process may even be applicable to biomass. "It might have the potential to deal with heavy oil as well," he said. "But I'm not claiming that and it hasn't been tested to a great degree."

Because the alkaline substance in the catalyst soaks up sulfur during the conversion process, King said, it generates a "virtually sulfur-free fuel."

The first company to buy the process and put it into operation will get it on a no- or low-royalty rate, King said. He said his company "would expect to be involved at least in the conceptual engineering. It would be owned by the sponsor or group and we would be the technical arm to do conceptual and as much of the detailed work as the client would want."

"We have a lot of confidence in this process," King said.

However, he said, the fact that this country's "gas bubble" is proving greater than anticipated is "another deterrent" to development of synfuel projects.

Nonetheless, King said, "There's a vital need to continue small to medium scale development work on synthetic fuels to protect us in the future. Development work should not stop for national security reasons, if nothing else, regardless of the economy."

solvents, is the steam required for regeneration. Though varying with the particular process and concentration, this requirement is nevertheless considerable. While the high-BTU gas produced can be used to supply the steam, it is preferable from an economic standpoint to use low-cost coal in a packaged coal-fired boiler.

A recent development, the membrane separation of CO_2, may eliminate this difficulty. Membrane separations offer the potential of lower equipment cost, and at a fraction of the energy requirement.

The high-BTU gas product is saturated with water vapor. If marketed, it must be dried to pipeline specifications. Remote locations can compress the gas on-site for truck transport. There are other options, such as injecting the hot reactor effluent, both methane and carbon dioxide, with delayed separation and recovery.

With different catalysts, liquid synfuels can also be produced, and hydrogen cogenerated. Each option must be considered on its own merits for a particular application.

References

1. Hoffman, E.J., "One-step process makes pipeline gas," OGJ, Apr. 14, 1980, p. 154.
2. Hoffman, E.J., "Synfuels: The Problems and the Promise," Energon, Laramie, Wy., 1982.

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