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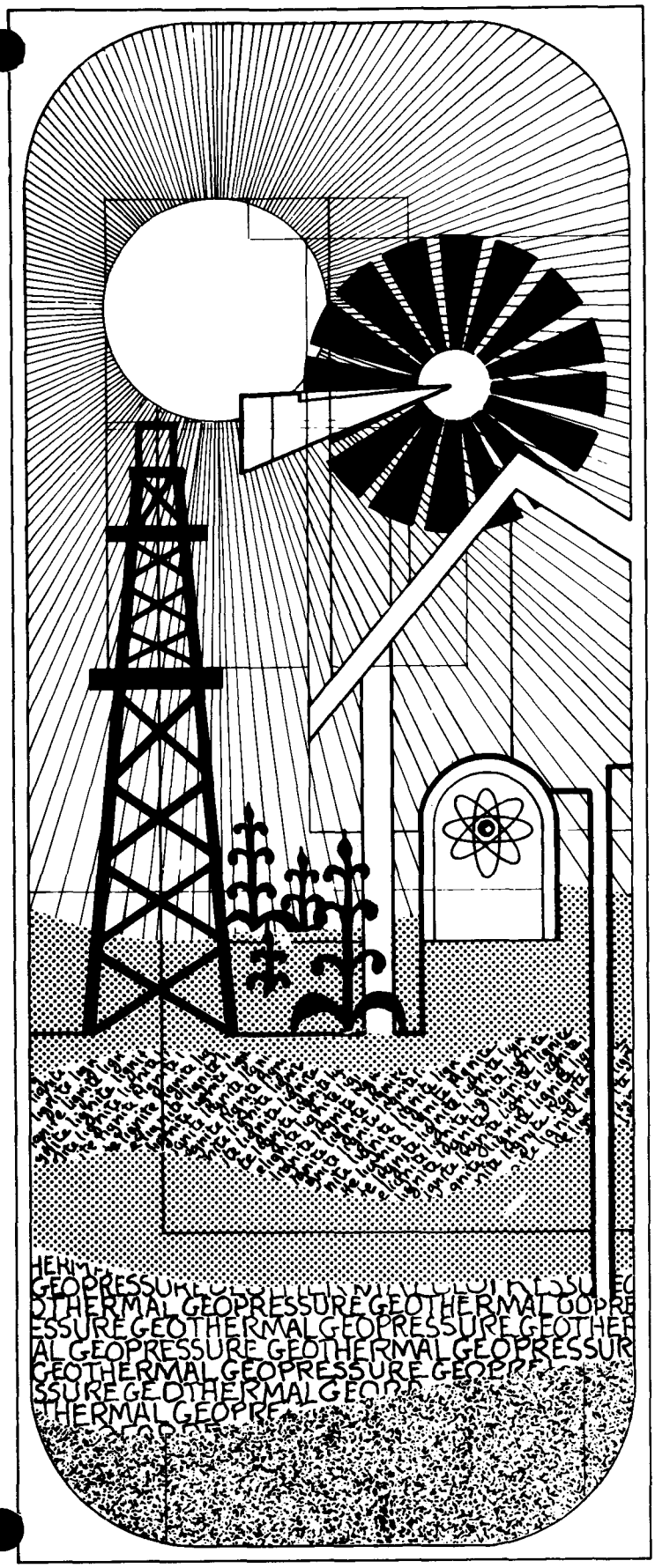

Texas Energy Development Fund

BIENNIAL REPORT

TENRAC/TD 82-001

TEXAS ENERGY & NATURAL RESOURCES ADVISORY COUNCIL

March 1981

MASTER

OPERATION

OF

TEXAS ENERGY DEVELOPMENT FUND

1980 - 81

A Staff Report

by the

Texas Energy and Natural Resources Advisory Council

February 1981

In fulfillment of statutory reporting requirement,

Article 4413(47b), Section 5,

Vernon's Texas Civil Statutes

EXECUTIVE SUMMARY

In a time of diminishing traditional domestic energy supplies and increasing energy demand, there is the recognized need to develop the use of alternate energy resources and methods of using these resources more efficiently, and TENRAC has been mandated to facilitate this development

Within the TENRAC organization, the Technology Development Division provides the staff support necessary for the monitoring of energy research, development, and demonstration (RD&D) activity, the identification of Texas energy RD&D needs, and the stimulation and support of both private and public efforts to respond to these needs. A central feature in this effort is the administration of energy development grant funds which, during the current biennium, amount to $3.75 million in state appropriations.

These funds have been administered under guidelines adopted by TENRAC (Appendix A) within the duly authorized agency work plan and budget, with specific funding decisions made by the Council itself. The decision-making process has called on the technical expertise and investigative efforts of many individuals, private and public institutions, specially convened task forces, and duly appointed TENRAC advisory committees.

A total of 43 solicitations for projects have been issued in the form of Statements of Program Intent (SPI's), which have resulted in the submission of 127 proposals for projects requesting $7,213,925 from energy development grant funds. Of this group 47 were authorized for funding resulting in commitment of $2,025,063. Including continuation projects TENRAC authorizations during the current biennium have led to contracts on projects valued at $5,705,384 and involving $2,732,465 in energy development grant funds. A total of 32 reports have been published to date (Appendix I) with four additional reports in various stages of the publication process.

Many energy development projects not funded under the energy development grant program have been provided with staff assistance in some form (see Appendix H for a partial listing) and have succeeded in proceeding to either private or federal funding, contributing to a broader range of energy development background and experience of great value to the state. Both energy development grant activity and staff support efforts with regard to non-funded projects have resulted in extensive additional benefits, some of which are described in the section of this report on page 15 and following.

On the basis of its previous experience and the recommendations of several advisory committees, TENRAC approved the concept of developing major energy development programs in areas of identified need which require more extensive funding commitments than is possible within the scope of the existing fund and/or which require a broader based cost-sharing effort with both private industry and federal government cooperation, and which in most cases require a longer development time than is encompassed within the usual biennial approach.

The comprehensive plan for alcohol fuels development in Texas brought together a wide range of state interests with the federal Office of Alcohol Fuels, leading to a more informed approach to alcohol fuels development in the state, with groundwork laid for expanding federal-state-private industry interaction in the area (see Appendix G).

The groundwork has also been laid for a major federal-state-private industry Texas lignite development program involving careful study of permitting, regulation, environmental protection, and socioeconomic impact mitigation together with a step-by-step deep basin lignite assessment, characterization, recovery process research, and experimental investigation of in situ gasification and other potential approaches to optimal recovery of the state's vast lignite resources with adequate and appropriate attention to matters of environmental concern (pages 11 and 12 of full report). Significant background for the development of the program has been provided by a TENRAC-sponsored Deep Basin Lignite Conference (Appendix E) and by the continuing development of the University Coal Research Consortium involving the University of Texas at Austin, Texas A&M University, the University of Houston and Texas Tech University, and open to the participation of other qualified academic institutions (pages 12-14 of the full report).

On the basis of TENRAC conceptual design, legislation has been developed which would provide for major programs in deep basin lignite development, atmospheric fluidized bed combustion of lignite, cellulose conversion, agriculturally derived fuels RD&D, solar electric repowering, and solar industrial process heat, in addition to the more limited research efforts within the general TENRAC budget.

In order to strengthen overall research reporting, coordination, evaluation and planning, a process has been set in motion for the development of a five-year Texas energy research plan involving the cooperative effort of TENRAC, the University of Texas at Austin, Texas A&M University, the University of Houston, and Texas Tech University (see Appendix F). The five-year plan developed in this manner would be updated in each subsequent biennium.

This executive summary provides a bird's eye view of the operation of the energy development fund to date and references the greater detail presented in the full report. It presents a record of significant accomplishment and points toward a more effective future which builds on the groundwork already made, not only in terms of project results, but also in terms of the developing decision-making framework.

The following table summarizes the energy development funding commitments to date in terms of the identified energy problem areas, and reflects also the level of matching funds attracted directly by the operation of the energy development fund.

FUNDING ANALYSIS OF AUTHORIZED
TEXAS ENERGY DEVELOPMENT PROJECTS (1980 - 1981)

January, 1981

	# of Projects	TENRAC Funding	Other Funding	Project Total
A. Energy Efficient Comfort Conditioning	20	606,912	601,797	1,208,709
B. Improved Controls for Maximizing Energy Efficiency	3	58,022	6,980	65,002
C. Energy Production from Renewable Energy Sources	13	850,659	1,207,104	2,057,763
D. Industrial and Electrical Generation Applications	19	692,247	408,869	1,101,117
E. Innovative Energy Technology Development Not Limited to Specific Problem Areas	1	2,897	-0-	2,897
F. Resource Assessment	8	220,376	559,414*	779,790
G. Texas Energy Policy Project	7	132,330	-0-	132,330
H. University Coal Research Consortium	4	169,500	188,754	358,254
TOTALS	75	2,732,465	2,972,918	5,705,384

*Does not include $32,522 provided by 3 utilities, Midtex Generation & Transmission Co-op, El Paso Electric Company, and Central & Southwest Fuels, Inc., as matching funds to Project #78-G-2-3.

AUTHORIZED PROJECTS - CONTRACT NEGOTIATIONS UNSUCCESSFUL

A.	80-C-5-2	97,500	349,500	447,000
B.	80-C-4-3	25,275	50,550	78,825
C.	80-S-3-4	70,279	70,279	140,558

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COUNCIL DECISIONS

All technology development activity of the council and its staff grows out of clear decisions on the part of the council in its duly constituted quarterly or called open meetings. It is therefore appropriate to indicate the actions taken by the council in order to track energy technology developments during the 1980-81 biennium.

September 6 TENRAC Meeting

At its September 6, 1979 meeting TENRAC confirmed the action of TEAC in committing $200,000 to the establishment of a University Coal Lab in Texas pursuant to the appropriate designation and funding by the U.S. Department of Energy (DOE). $50,000 was authorized for a West Texas Geothermal assessment subject to provision of $170,000 by DOE. Up to $20,000 was authorized for completion of several 1978-79 projects which required additional work and as a result had not been able to use all of the previously provided funds. In addition, the council approved an FY-80 budget which alloted $250,000 of energy development money for the Texas Energy Policy Project and anticipated the use of a like amount during FY-81. This was done to replace an approximate like amount of general revenue funding for TEPP allocated to operate the Fuel Allocation Office. The staff was directed to prepare adjusted guidelines for administration of technology development activity pursuant to the amended TENRAC legislation and subject to final council approval at its December meeting.

December 7 TENRAC Meeting

At its December meeting TENRAC approved the adjusted guidelines (Appendix A) published in the Texas Register on October 23, 1979, and to which no objections were raised during the period of public review and comment. In addition, the staff was authorized to negotiate for state investigation of lignite pelletizing processes ($40,000), for continuation of development of fluidized bed technology utilizing cotton gin trash ($70,000), and for state funding up to $250,000 in support of DOE siting of an Integrated Farm System Project in Texas in response to a proposal evaluated as acceptable under the adopted technology development evaluating procedures. Each of these would be subject to executive committee approval if negotiated before the next TENRAC meeting.

January 30 Executive Committee Meeting

On January 30, 1980, the executive committee approved the execution of contracts for cotton gin trash fluidized bed technology development and for investigation of lignite pelletizing with the necessary supporting consultant contracts, as envisioned in the December 7 TENRAC meeting.

February 22 TENRAC Meeting

At its February meeting TENRAC authorized the commitment of about $20,000 for studies on the impacts of the Fuel Use Act on the electric utility industry and on other Texas industry. In addition, $100,000 was authorized in support of DOE's location in Texas of a photovoltaic residential test facility and $150,000 was authorized as leveraging funds for locating potential DOE alcohol-diesel fuel investigations in Texas. Since DOE plans for siting of coal labs had been discontinued, TENRAC authorized the application of the previously committed $200,000 Coal Research Consortium which had been initiated in response to the coal lab solicitation.

On the basis of the significant contribution of previous advisory committees to both the council in general and technology development in particular, the establishment of advisory committees was authorized in the following subject areas: (1) coal and lignite, (2) solar, (3) petroleum and natural gas, (4) industrial and electrical fuel use, (5) energy efficiency, (6) agriculturally derived fuels, and (7) nuclear energy.

In addition, the council received with approval a staff analysis which anticipated approximately the following use of energy development funds:

PROJECT AREA	80-81 FUNDING LEVEL	
	$K	%
Lignite	800	21.3
Geothermal	200	5.3
Wind	200	5.3
Biomass	600	16.0
Solar	410	11.0
Conservation	675	18.0
Oil and Gas	70	1.9
Nuclear	15	0.4
TEPP	500	13.3
Innovative	130	3.5
Other (reports, monitors, RD&D prioritization)	150	4.0
	$3750K	100.0%

This analysis also called attention to the need for authority to carry forward funds into the following year and for reappropriation of unused balances in order to complete projects which need to extend beyond the biennium. This is very important for efficient use of state funds.

June 11 TENRAC Meeting

At its June meeting TENRAC approved the negotiation of contracts on 23 projects in amounts totaling up to $1,363,035 (see Appendix B) and agreed to the creation of the Texas Alcohol Fuels Coordinating Group to support the effort to obtain DOE funding of a Texas Comprehensive Plan on Alcohol Fuels Production Development with emphasis on the support functions to be provided by a Texas Alcohol Fuels Institute.

September 25 TENRAC Meeting

At its September 25, 1980 meeting, TENRAC approved funding of 22 projects in the lignite, solar, conservation, and wind areas (see Appendix C). The total budget of $846,410 included four projects which would go through the University Coal Research Consortium. The council approved the concept of amending the Texas Energy Development Act of 1977 to provide matching funds for specific large-scale demonstration or commercialization projects such as (1) development of a program for in situ gasification of Texas deep basin lignite, (2) industrial demonstration of fluidized bed combustion of lignite, (3) solar electric repowering, (4) solar industrial process steam, and (5) demonstration of cellulose conversion. In addition, the council received reports from the advisory committees on Solar Energy and Agriculturally Derived Fuels. The Advisory Committee on Solar Energy report presented a series of 25 recommendations with supporting textual material from its Resources and Technology subcommittee, and from its Institutional subcommittee. The committee recommended expansion of energy development funds, with a significant portion of the funding going to small businesses. The mandate of the energy development effort should be expanded to include information research and energy management planning, with increased emphasis on monitoring existing solar facilities, cooling and dehumidification, industrial solar applications and small concentrating solar collection systems. The committee also recommended that the TENRAC effort include more information transfer through the following: (1) development of information centers which would hold workshops, (2) design competitions in solar, (3) awards to builders utilizing outstanding solar designs, (4) extensive publications, (5) solar building demonstrations, and (6) establishment of a wind test center for voluntary certification of small wind systems and for information transfer to manufacturers and consumers.

The Advisory Committee on Agriculturally Derived Fuels reported that an additional $5 million should be appropriated for research and development of liquid fuels derived from renewable resources in Texas to be administered by TENRAC through the Energy Development Fund. The funds would be used to provide seed money to attract DOE money particularly and private sector money for various kinds of research products.

December 10 TENRAC Meeting

At its December meeting, TENRAC approved ten projects funded under the Energy Development Act. The ten projects consisted of one in the conservation area, four in lignite, three in biomass, one in wind, and one in solar. The total of TENRAC funding for the ten projects will amount to $315,000 (see Appendix D). The council reviewed legislation developed to accomplish the energy development purposes approved in concept at its September 25 meeting. While it did not choose to endorse specific legislation, the council reaffirmed its position in support of the concepts previously approved.

THE TECHNOLOGY DEVELOPMENT DECISION-MAKING PROCESS

In addition to broad-based staff effort and consultation with council members and staffs and identified technical expertise throughout the state and in federal

agencies and labs, both task forces and council advisory committees contribute to the technology development effort. While advisory committees serve several other functions in relation to the council, they typically include issues of energy technology development on their agenda.

Task Forces

1. Solar Technology Task Force - A solar task force was convened on November 5, 1979. The attendance of 23 represented state agencies, universities, industry, and consumers. The task force reviewed previously funded programs, then suggested and prioritized 14 areas for present funding. The task force also suggested that TENRAC provide patent assistance, participate in public rate hearings for sale of consumer produced electricity to utilities, open doors for project development outside of the Energy Development Fund, develop Congressional liaison to assist in DOE funding, and participate in DOE funded projects.

In addition, the task force recommended the formation of a permanent solar advisory committee to the council to serve as a roundtable for industry, consumers, academia, and policymakers; foresee potential problem areas and legal barriers; suggest policy areas for action; recommend research priorities and energy development grant selection criteria; and serve as a clearinghouse of practical scientific data and applications.

2. Conservation Technology Task Force - A conservation technology task force was convened on November 8, 1979. The attendance was 16, representing state agencies, academia, industry, and DOE. The task force reviewed previously funded programs, then suggested and prioritized 16 areas for present funding considerations. The task force also suggested an extensive effort to minimize energy consumption by existing systems; a significant research effort to close the gap between technical/economical feasibility and actual applications; and restriction of demonstration grants to concepts justified by adequate systems optimization. The task force felt that narrow focused solicitations were not as desirable as solicitations in a general area, with priority ranking by technical and peer evaluation, and that opportunities should be retained for unsolicited and innovative proposal consideration.

The task force also recommended the formation of a permanent conservation technology advisory committee to the council which would provide for interaction of policymakers with academia, industry, and consumers; delineate implementation barriers and special problem areas; recommend selection criteria and priorities for energy development grant funds; set up a clearinghouse of technical and practical information; and provide policy areas for consideration.

3. Wind Technology Task Force - A wind energy task force was convened on November 29, 1979. Eleven representatives from federal government, state government, academic institutions, industry, and research organizations including TENRAC staff were in attendance. The task force was briefed on previously funded TEAC wind programs and each representative was polled on the direction that future TENRAC programs should take. As a result, a general consensus was developed by the task force with respect to recommendations which in the task force's opinion should be forwarded to TENRAC.

The task force recommended that increased funding emphasis should be placed on appropriate TENRAC-sponsored wind energy projects; that the majority of TENRAC wind project funding should be applied toward wind energy use and systems development with some additional emphasis on resource assessment; and that wind energy interests should be represented on a TENRAC advisory committee so that wind energy can receive appropriate visibility along with the other alternative energy categories.

ADVISORY COMMITTEES

Advisory committees have been created by TEAC and then by TENRAC to bring back recommendations to the council concerning areas of special concern and including identification of desirable technology development priorities. The following section will attempt to present brief descriptions of committee efforts and technology development recommendations.

1. Advisory Committee on Lignite Research, Development and Demonstration - The Advisory Committee on Lignite Research, Development and Demonstration was formed in December 1978 under the chairmanship of Railroad Commissioner Mack Wallace and included three electric utility representatives, four industrial consumer representatives, one mining industry representative, three state university representatives, and two representatives of the general public. The committee was formed for the purpose of developing a comprehensive statement on the appropriate role of the state in supporting lignite research, development and demonstration (RD&D).

After three meetings of the full committee and several meetings of two subcommittees, on March 15, 1979, the final report of the committee was presented to and duly adopted by the council. The report concludes that Texas lignite RD&D priorities should relate to atmospheric fluidized bed combustion, medium Btu gasification, and in situ gasification with emphasis on process development, utilization and environmental controls.

The role of the public sector is identified as (1) basic and applied energy research, (2) research and development related to environmental and safety matters, (3) the development and compilation of needed public energy information, and (4) maintenance of a policy climate which facilitates the private sector's commercialization of new technologies. Risk sharing is considered appropriate when technologies are of significant public concern but have not reached the level of commercialization, but the private sector should occupy a major role in technology development and a primary role in technology demonstration. A major emphasis should be on public policy research in areas affecting the development of lignite technologies.

The report recognized grants, leveraging of third party funds, letters of encouragement, and information dissemination as mechanisms for state involvement, and encouraged greater emphasis on "soft" RD&D to provide information for decisionmaking related to "hard" RD&D. The work of the committee provides significant direction for the future energy RD&D activities of the council and a more concrete basis for the administration of the energy development fund in the lignite area.

2. Advisory Committee on Agriculturally Derived Fuels - This committee was originally created in December 1978 as a TEAC advisory committee with responsibility to (1) review the potential of various biomass energy resources available in Texas, (2) analyze economic costs and benefits of various conversion technologies available, (3) determine whether a long-range plan for developing biomass resources is required to coordinate the different aspects involved, (4) determine the salient features of such a development plan, (5) communicate with other local, state, and national entities engaged in related biomass energy programs, and (6) recommend to the council appropriate policy measures or responses to federal programs and policy. Texas Commissioner of Agriculture Reagan V. Brown was named chairman; Speaker Bill Clayton, General Land Office Commissioner Bob Armstrong, and other knowledgeable individuals from industry, state agencies, and universities also served on this committee.

Since the formation of this committee, important efforts have been undertaken to establish an atmosphere which will allow the development of Texas' biomass potential. In March of 1979, strong interest in alcohol production prompted this committee to study policy matters that would allow alcohol to be legally produced in Texas. It became evident that enabling legislation was needed to accomplish this objective; Commissioner Brown advised the council of the committee's findings, and the council responded with a supportive resolution. Consequently, the Legislature passed legislation allowing commercial production of alcohol for motor fuel use.

Other important actions of the committee involved investigation of other biomass related technologies which have potential for application in Texas. Briefings by Mr. Robert Soleta, Director of the National Gasohol Commission, Dr. Les Levine, DOE Policy Advisor, and numerous Texas experts provided valuable insight relevant to synthetic fuel development.

The committee sponsored a research oriented workshop in August 1979 to secure information from scientists who were actively engaged in research, development and demonstration. Input from these experts was solicited so that technical and policy oriented issues essential to the development of a biomass energy program could be identified. Recommendations for development or improvement of direct combustion, fermentation, gasification, anaerobic digestion, and petroculture technology were presented for consideration by the committee. Based on these recommendations, a report was prepared which called for the allocation of approximately $1 million out of the Energy Development Fund for biomass related research in the areas mentioned above. Furthermore, it was recommended that out of the $1 million, approximately 75% be allocated to stimulate significant demonstration projects, 15% be directed toward policy related research, and 10% be considered for development of energy crops. It was also recommended that emphasis be placed on information dissemination through on-farm demonstrations and clearinghouse activities.

The recommendations of the 1979 workshop indicated a strong need for continued biomass energy advisory input to Energy Development Act activities through TEAC's successor, TENRAC. At the February 22, 1980 meeting, Texas Commissioner of Agriculture Reagan V. Brown recommended that TENRAC continue the activities of the former advisory committee. The council approved this recommendation and Commissioner Brown was appointed to chair the renewed Advisory Committee on Agriculturally Derived Fuels. Seventeen members from various backgrounds were appointed to the committee.

This committee met several times during 1980 to develop recommendations regarding legislative action needed to accelerate the development of a fuel alcohol industry in Texas. At the September 25, 1980 TENRAC meeting, Commissioner Brown presented the following recommendations which were accepted:

1. Declare legislation relating to alcohol an emergency to speed legislative action.

2. Exempt five cents from the motor fuels tax for gasohol until December 31, 1986 and back out the exemption at a rate of one cent per year until the taxes on gasohol and gasoline are equal.

3. Charge permit fees for an alcohol production permit based on the quantity of production.

4. Recommend an additional $5 million for research and development of liquid fuels from renewable resources.

5. Create an alcohol fuels division within the Texas Department of Agriculture to establish standards for gasohol and prefabricated alcohol production equipment, promote alcohol fuels, serve as information clearinghouse, and establish liaison activities.

6. Recommend state agencies use at least ten percent of their fuel budget for alcohol fuels as they become competitive.

7. Amend the Alcoholic Beverage Code to allow alcohol manufacturing for multiple industrial uses, to allow alcohol manufacturers to also market industrial alcohol, to remove residency requirements for holders of manufacturers permits, and to allow obtaining of multiple permits for same premises when appropriately qualified.

8. Recommend funding of H.B. 1803 passed by the regular session of the 66th Legislature to provide $15 million for loans for alcohol plants.

3. Advisory Committee on Nuclear Energy - The Advisory Committee on Nuclear Energy was formed in December of 1978 under the chairmanship of Ms. Laura Keever and included council members Garrett Morris of the Public Utility Commission, Representative Joe Hanna, Senator Peyton McKnight, Mack Wallace of the Railroad Commission, Attorney General Mark White, and representatives of the electric utility industry, health physics professions, independent technical experts, environmental specialists, and consumer groups.

After many meetings, site visits, briefings, public hearings and extensive efforts by subcommittees on transportation, economics, front-end and back-end of the fuel cycle, a very comprehensive report was presented to the council at its December 1979 and February 1980 meetings, which were basically directed towards policy matters.

It was recognized that the federal government had primary responsibility in the area of nuclear research, development, and demonstration, and in general the report recommended the focus of state research on matters of policy development. It also recommended studying the potential impacts of a severance tax on the

uranium mining industry, urging federal government research and development of advanced reactor technologies, and encouraging research aimed at eventual development of a feasible method of transmuting long-lived radioisotopes into less harmful forms using a portion of the Energy Development Fund. A special report on low-level radioactive brokers was prepared and submitted to TENRAC in February 1980.

At its February 22, 1980 meeting TENRAC created a follow-on Advisory Committee on Nuclear Energy which is chaired by the Director of the Bureau of Economic Geology, Bill Fisher. This new committee held its initial meeting in July 1980. The primary order of business was the appointment of the Low-Level Radioactive Waste (LLW) Subcommittee chaired by Commissioner of Health Robert Bernstein, M.D.

The LLW Subcommittee investigated the various aspects of the LLW disposal issue and prepared a background report and a set of recommendations which were adopted by TENRAC on September 25, 1980. These recommendations are being incorporated in draft legislation for establishment of a Texas LLW Disposal Agency.

Two additional Subcommittees were appointed in September 1980. The Powerplant Operation Subcommittee will be chaired by John Kelly and will probably begin its activities in mid-1981. The High-Level Waste (HLW) Disposal Subcommittee, chaired by University of Texas Dean of Engineering Earnest Gloyna, will probably hold its initial meeting in early 1981.

4. Advisory Committee on Industrial and Electric Utility Fuel Use Policy - This advisory committee was chaired by Commissioner Moak Rollins of the Public Utility Commission, and included industrial and electric utility representatives along with others from the Texas Air Control Board (TACB), Consumers Union, and other environmental and energy specialists. This committee interacted with the research and development effort of TENRAC by utilizing staff research from both TENRAC and TACB and by contracting with Southwest Energy Associates, Inc., for additional economic analysis.

In addition to a number of policy recommendations particularly related to federal activity, the committee made several statements which provide a basis for technology development efforts.

The committee recommended that "synthetic fuels, especially gasified coal and alternatives, be developed in a timely manner." The report anticipates the possible commercial feasibility of coal gasification in 1990-95 particularly for industrial purposes and generating electric power. It also anticipates that "in many areas of the country, and for residential and some commercial uses, electricity generated by wind and solar devices can provide a meaningful offset to imported oil by decreasing the growth of demand for electricity generated by conventional means."

At a meeting in December 1980 the committee considered the issues surrounding the industrial use of various fuels and feedstocks. Existing and proposed environmental standards were discussed in light of the costs and availabilities of natural gas, fuel oil, and coal.

The committee recommended further research into the effects of alternative fuels and pollution abatement technologies on the industrial and economic growth of the Gulf Coast region of Texas. The research should also investigate the proposed changes in the Clean Air Act, the Natural Gas Policy Act, and the Powerplant and Industrial Fuel Use Act.

At issue for residents of Texas are the anticipated costs of electricity and natural gas as the energy industry operates in an environment free of price controls. At issue for businesses are the economic and environmental costs associated with price decontrol, possible crude oil import restrictions, and the development of the synthetic fuels industry.

As a general policy statement, the committee report indicates that "any project that has the effect of decreasing dependence on foreign oil should be considered as being desirable from a public policy perspective because of the national security problems of higher oil imports."

5. Advisory Committee on Solar and Wind Energies - The Advisory Committee on Solar and Wind Energies was formed under the chairmanship of Railroad Commissioner Mack Wallace and included two electric utility representatives, six university representatives, four representatives from state government, four industrial representatives, two architects, a banker, a lawyer, a builder, and three representatives of the general public. The committee was formed for the purpose of developing a comprehensive statement on the appropriate role of the State of Texas in supporting research, development, demonstration, commercialization, and information dissemination activities related to solar and wind energy.

After seven meetings and six public hearings for the full committee, and several meetings of two subcommittees, a final report of the committee was presented to the council on September 25, 1980. The report addresses (1) the likely importance of solar and wind energies in Texas' energy future, (2) Texas' solar needs over the next 25 years, (3) the appropriate role of the state in efforts to facilitate the development and acceptance of solar technologies, (4) effective mechanisms for state involvement, (5) level and timing of state involvement, and (6) supportive policies essential to the accomplishment of these objectives.

In the area of technology development, the committee recommends that TENRAC (1) work closely with Councils of Government, Solar Energy Centers, National Energy Laboratories, and DOE, including cost sharing with DOE on solar and wind projects, (2) establish a system of voluntary standards and ratings for solar collectors, wind machines and systems, (3) establish statewide licensing of solar installers, and (4) encourage the familiarity of architects with solar energy principles as part of the licensing/renewal program.

The committee also recommends expansion of energy development funds, with a significant portion of the funding going to businesses which are not large. The mandate of the energy development effort should be expanded to include information research and energy management planning, with increased emphasis on monitoring existing solar facilities, cooling and dehumidification, industrial solar applications and small concentrating solar collection systems.

The committee recommends that the TENRAC effort include more information transfer through the following: (1) development of information centers which would hold workshops, (2) design competitions in solar, (3) awards to builders utilizing outstanding solar designs, (4) extensive publications, (5) solar building demonstrations, and (6) establishment of a wind test center for voluntary certification of small wind systems and for information transfer to manufacturers and consumers.

The committee also developed institutional recommendations such as liberalizing tax incentives, providing loan advantages for solar and wind, developing model solar codes, recognizing solar and wind easements as legitimate property rights, and establishment of a continuing solar and wind advisory committee.

6. Advisory Committee on Coal and Lignite - At its February 22, 1980 meeting, TENRAC authorized establishment of an Advisory Committee on Coal and Lignite. Under the chairmanship of Representative Tom Craddick, the committee includes representatives from industry, academia, and the state regulatory agencies. The charge of this second committee was more general than that of the first committee, and included developing the State's role in facilitating the development and acceptance of coal mining and coal utilization technologies, and the recommendation of supportive policies essential to the accomplishment of these objectives.

The committee held its first meeting on October 24, 1980 and discussed the Final Report of the earlier Advisory Committee on Lignite Research, Development and Demonstration, and the Research Plan (April 1980) of the newly formed Texas University Coal Research Consortium (UCRC). A subcommittee was formed to examine and advise the UCRC on the most pertinent and urgent coal related research needs of the state. The chief purpose of the consortium is to encourage and coordinate university coal research that will ensure optimum utilization of the state's coal/lignite resources.

At its second meeting on February 25, 1981, the advisory committee adopted for recommendation to TENRAC a proposed Texas lignite development program as described below and agreed to develop a working committee to guide the study of lignite development environmental and socioeconomic needs and the implementation of improved approaches to permitting and regulatory facilities and mitigating impacts. In addition, the committee received with approval the subcommittee report relative to the operation of the University Coal Research Consortium.

Other Advisory Committees

In addition to the continuing advisory committees on agriculturally derived fuels, nuclear energy, and coal and lignite, which will bring further recommendations to the council, the following advisory committees have been established: (1) Advisory Committee on Petroleum and Natural Gas, Michael T. Halbouty, Chairman; and (2) Advisory Committee on Energy Efficiency, General Land Office Commissioner Bob Armstrong, Chairman. Potentially these committees will also bring technology development recommendations to the Council.

TEXAS LIGNITE DEVELOPMENT PROGRAM

During the efforts of the Governor's Energy Advisory Council, the Texas Energy Advisory Council, and the Texas Energy and Natural Resources Advisory Council, considerable attention has been directed towards the development of lignite as the most viable alternative energy in the near term. The report of the Advisory Committee on Lignite RD&D called attention to the need for state support of atmospheric fluidized bed combustion and deep basin lignite development. In addition, the committee encouraged state analysis and expediting of permitting and regulatory activities on both the state and federal level, together with environmental, safety, and natural resource protection.

On the basis of this interest, TENRAC has coordinated the development of a University Coal Research Consortium, has provided extensive initial funding for the consortium, and has approved the concept of major funding consideration for atmospheric fluidized bed combustion and deep basin lignite development. To provide necessary background for these efforts, a major conference on deep basin lignite has been conducted.

Additional details on the University Coal Research Consortium and the Deep Basin Lignite Conference are provided in the material that follows.

The program outlined for Texas lignite development is as follows:

I. Study of present permitting and related regulatory requirements applicable to surface mining and in situ gasification of lignite, review of alternative procedures for expedited permitting with reasonable environmental protection, and recommendation of potential adjustments in permitting approach and supporting legislation.

II. Development of a workable and effective framework for cooperative federal-state-local-industry evaluation and mitigation of socioeconomic impacts of lignite development.

III. Overall review of policy issues related to deep basin lignite and recommendations concerning official state policy positions and needed supporting legislation.

IV. Implementation of step-by-step deep basin lignite development program with appropriate public sector-private sector coordination which provides adequate protection of legitimate private sector proprietary information while developing the data necessary for the public sector to fulfill its reponsibility for environmental protection, for resource recovery optimization, and for effective socioeconomic impact management.

    1. Regional hydrogeological investigation. Accurately assess occurrence, extent, and nature of lignite resource in its hydrological setting.

    2. Regional deep drilling, logging, and coring of boreholes and chemical and physical characterization.

*3. Detailed investigation of geologic, hydrologic, and engineering data of potential field test sites.

*4. Two-hole tests with air and oxygen to assess operating and design parameters, hardware, linking alternatives, hydrology, subsidence, and instrumentation for multiple-hole field test and adequate environmental monitoring and protection.

*5. Design and implement multiple-hole field test for evaluating elements of commercial-scale operation and the potential environmental impacts with particular emphasis on ground water and subsidence impacts. Cost shared state, federal, private; operated by private industry.

6. Pilot to commercial-scale production facility funded and operated by private industry with monitoring and evaluation of environmental impacts with state and federal cooperation and development of methods of environmental protection and appropriate regulations.

* Starred items are subject to the caveat that they be carefully evaluated with a view to minimizing the application of state funds for these purposes.

University Coal Research Consortium

The council resolved at its February 22, 1980 meeting to establish the Texas University Coal Research Consortium (UCRC) to integrate, coordinate and encourage university coal research, and to allocate initial start-up funds of $200,000 for the purpose. The consortium, comprised of four major state universities, the University of Texas at Austin, Texas A&M University, the University of Houston, and Texas Tech University, was formally established on February 28, 1980 by a charter signed by the presidents of these universities and by the Executive Director of TENRAC. The charter also outlined the administrative structure of the consortium. The University of Texas at Austin was assigned the administrative and lead responsibility through a Director named for the purpose.

The UCRC has developed a comprehensive multi-year research plan embracing all aspects of coal research of relevance to Texas and aimed at contributing to optimum utilization of the state's coal and lignite resources. The research plan is presently under scrutiny by a subcommittee of the TENRAC Coal and Lignite Advisory Committee. This subcommittee is charged with the task of advising the UCRC on the priorities and the nature of the consortium's research programs. The recommendations of the subcommittee are expected shortly, and the active consortium research is expected to begin by September 1981 with the 1982-83 Energy Development Funds to be appropriated by the 67th Legislature.

At its September 25, 1980 meeting, TENRAC authorized expenditure of $169,500 for the purchase of capital equipment for the setting up of laboratory research facilities which will form the nucleus for the functioning of the consortium and also serve to attract federal and outside funds for university research.

At its February 25, 1981 meeting, the TENRAC Advisory Committee on Coal and Lignite received with approval the following advisory guidelines for operation of the consortium.

Despite the variation in background among UCRC subcommittee members, there was a consensus as to what research UCRC should follow, as illustrated by the following examples:

- State funded research areas should be those that result in information that is universally applicable to all sectors of society (legislators, regulators, industry, land owners, etc.).

- Emphasis should be placed on research in environmental and safety matters, on basic and applied energy research, and on the development and compilation of needed public energy information.

- UCRC research should cover those fundamental and basic areas which are not done by others such as private industry, and for which the universities are uniquely qualified.

- Research of a site-specific nature, and that aimed at developing commercial process and technological tools and techniques, should not be carried out at the universities with public funds.

  Those commenting opposed to substantial use of state funds or the state management of demonstration projects in the following areas: in situ gasification, improved combustion methods, mining technology, coal preparation and beneficiation, and electric utility technology needs.

- The state should not be financially involved in large-scale demonstrations or in commercialization; however, the state should have access to non-proprietary data needed to further constructive regulations.

Research directed towards facilitating more practical, cost-effective regulations was a high priority for nearly every member of the subcommittee.

- Prominent in the comments was the desire to establish a more realistic and balanced regulatory climate that will protect the environment and public interest, yet allow a fuller utilization of the state's near-surface and deep basin coal/lignite resources.

There was general support for research in the following areas:

- Deep basin lignite geology and depositional (geological and hydrological) environment.

- Deep basin lignite characterization.

- Deep basin lignite resource assessment and reserve estimates.

- Environmental effects and impacts on ground water hydrology associated with developing deep basin lignite.

All members agreed on the need for research (both policy related and laboratory) in environmental and safety areas such as:

- Study of cost effectiveness of existing environmental standards to facilitate powerplant conversion from natural gas to coal, and on the reduction of environmental barriers to such conversion.

- Updating the studies on the impact of the Federal Clean Air Act on the economic feasibility of using low versus high sulfur coals; on the effect of lignite characteristics on emission levels; on effect of ash resistivity and sulfur content on pollution control equipment performance.

- Physical and chemical characteristics of lignite affecting pollutant emission levels and control equipment performance, especially variations in ash resistivity and sulfur content.

- Effects/cause/cost of acid rainfall.

- Examination of alternate methods of mined land reclamation techniques.

Other research areas deserving additional attention:

- Impact assistance.

- Establishment of mining courses in university curriculums.

- Waste handling.

- Taxing policy.

- Transportation.

- Sharing private sector research with the public sector to facilitate a cooperative research approach.

- Lignite as a petrochemical feedstock.

TENRAC Conference on Deep Basin Lignite

This conference was organized by TENRAC staff and was held on February 5, 1981 in Austin to gather together experts, researchers and interested individuals from industry, academia and the federal and state government to discuss and delineate the technological and institutional needs for the development of the vast deep basin lignite resources of the state by the potentially attractive in situ gasification technology.

The conference was conducted with a keynote session devoted to presentations on Texas lignite resources, Texas experience in in situ gasification, and other aspects relating to the in situ gasification technology. This was followed by a task force session, where the participants met and thoroughly discussed with five task force teams the various issues and the RD&D needs, priorities, and the appropriate sectors (private or government) for implementation and funding in the development and commercialization of in situ gasification technology in the state. The five task

forces were: (1) Process R&D, Laboratory Testing, Modeling and Subsidence; (2) Site Selection, Characterization and Resource Definition; (3) Environmental, Permitting and Socioeconomic Aspects; (4) Field Testing and Hardware; and (5) Commercialization and Economics. The conclusions and recommendations of the task force teams will be developed in the form of a comprehensive development plan for the state which is hoped to provide a positive direction towards deep basin lignite development.

Currently under review is the draft executive summary of the conference, which is attached as Appendix E.

COMPREHENSIVE PLAN FOR ALCOHOL FUELS DEVELOPMENT IN TEXAS

In response to requests by the Governor and with the encouragement of DOE personnel, a comprehensive plan for alcohol fuels development in Texas was developed through the coordinated efforts of the TENRAC staff, the Texas Department of Agriculture, the Texas A&M University System, Texas Tech University, and Southwest Research Institute. The proposal anticipated about $7 million in federal funds as a match to about $1 million in state funds.

This plan has been coupled together with a proposal by Texas Tech University seeking the establishment of a Southwest Alcohol Fuels Institute. Strong support has been provided by the members of the Texas Congressional Delegation.

In order to facilitate the implementation of such a plan, the Texas Alcohol Fuels Development Coordinating Group was established, composed initially of those who participated in developing the plan but with provision for inclusion of additional members.

Although this proposal was not funded by DOE, it helped provide a forum to the federal government which identified Texas interests and capabilities. From this effort, several promising avenues of future program development have been identified. See Appendix G for details of the plan.

SPIN-OFFS FROM TENRAC ENERGY DEVELOPMENT ACTIVITY

The appropriation of $1.5 million in FY 1978 and 1979 and $3.75 million in FY 1980 and 1981 has enabled TENRAC to tackle some of the problems involved in the transition to alternate energy resources in a period of dramatically rising energy prices and decreasing traditional domestic energy supplies. These TENRAC efforts have opened the door to coordinating the focus of the state's research and development capabilities on matters of specific Texas interest and have expanded the state's ability to attract federal RD&D dollars. See Appendix G.

The following is a brief overview of TENRAC participation in the Texas move towards utilization of alternate energy resources and towards energy efficiency in some areas where rising energy prices result in the greatest impacts on the citizens

of the state. The presentation illustrates how a small amount of state funds can be used to assist in developing a stronger state focus in the energy R&D programs of the major state universities and how, over time, a maturing program and expanded effort can significantly impact the commercial and industrial scene as well.

Texas Five-Year Energy Research Plan

A review of the state's activities related to energy-related research, development and demonstration during the last several years leads to the conclusion that more effective planning and coordination could be accomplished through the development of a five-year energy research plan for the state which would be updated biennially in sufficient time to become the basis for the next biennium's funding request.

Staff representatives of Texas A&M University, Texas Tech University, the University of Houston, and the University of Texas met with TENRAC staff on January 5, 1981 to develop a basic outline for a meeting of top university administrative officials with the Governor and Lieutenant Governor on January 12, 1981. At the January 12 meeting, it was agreed to spell out in greater detail a process for arriving at a Texas Five-Year Energy Research Plan. Elements to be included would be (1) Reporting of Research Results, (2) Coordination of Certain Proposals for Federal Funding, (3) Five-Year Research Agenda, and (4) Outside Professional Review.

On February 9, the staff members met again to discuss the potential process. From this meeting, an initial program statement (Appendix F) has been drafted which is currently under review as a basis for carrying out the planning process to be completed by June of 1982.

Utilization of Alternate Resources

1. Lignite

Lignite represents a highly significant, immediately available resource for bridging the energy gap in transition from a natural gas and petroleum-based economy in Texas. Recent resource estimates indicate 23 billion tons of surface lignite (less than 200 feet) and 35 billion tons of deep basin lignite (200-2,000 feet). Coupled with an estimated 6.1 billion tons of bituminous, the coal resources in Texas are approximately 64 billion tons equivalent to 140 billion barrels of oil (approximately the same quantity as Texas' original oil in place).

Previous projects under the Energy Development Act provide current resource and reserve data (L-1-1) and show that a large portion of these reserves can be successfully utilized with environmental restrictions and within water supply constraints (L-4-7). Further, these studies provide a background for handling environmental impacts in terms of water supply and surface reclamation (L-2-3) and in terms of sulfur removal (L-3-5), and have provided additional information about the conversion of lignite to gas and liquid forms for both direct fuel and petrochemical feedstock purposes (L-3-1 and L-3-7).

These efforts have resulted in extensive lignite leasing activity, provided background support for DOE feasibility study grants of $6.6 million for Texas

applications under P.L. 96-126, and led to the development of the University Coal Research Consortium which will support the conversion to coal utilization. The Coal Research Consortium, directed by the University of Texas at Austin, will provide expanded ability to attract federal and private industry funds, support private utility and industrial development, and help obtain Texas' fair share of anticipated federal synfuel dollars.

2. Geothermal

There are three basic areas of Texas geothermal energy potential: the geopressured resources along the coast, the low temperature hydrothermal resources in central Texas, and the possibly higher temperature hydrothermal and hot rock resources of the Trans-Pecos region.

The needed investigation of coastal geopressured resources requires much greater funding than available under the Energy Development Act and has been strongly supported by DOE. However, TEAC support did attract DOE funding for analysis of commercialization opportunities (G-1-2) when adequate resource data is available. TEAC funds also attracted DOE and private funds for West Texas geothermal assessment (G-2-3) which is now leading to expanded efforts in that area and possible larger-scale geothermal resource confirmation and utilization projects.

In Marlin, less than $100,000 from TEAC has attracted over $600,000 for the first phase and $350,000 for the next phase in DOE funds for hospital space and water heating (G-3-1). This has contributed to DOE designation of Central Texas as a geothermal resource province, expanded DOE funding of geothermal resource assessment by the University of Texas Bureau of Economic Geology, a $1.7 million space and water heating project at Navarro College and Community Hospital, active consideration of a similar project at the rehabilitation hospital in Gonzales, and extensive commercial activity throughout the area (e.g., Chamber of Commerce Space Heating, waste grease recovery facility, commercial greenhouse, and school building space heating in Taylor).

The setting up of a state team, with a large share of DOE funds, for the promotion of greater hydrothermal resource utilization is presently under active consideration.

3. Biomass

Large quantities of biomass are available or potentially available for conversion to significant amounts of energy which could be in the form of gases, liquid fuels or heat. Manure, agricultural residues, forest wastes, surplus grain, and energy crops represent a few of the important sources of energy from Texas biomass. Previously, TEAC initiated two cotton gin trash combustion and gasification projects (B-1-1 and B-1-5) with efforts aimed at scale-up leading to commercial applications. This initial emphasis led to broadening and continuing combustion and gasification research, development and demonstration efforts through continued support of 78-B-1-1 and through consultation and coordination

efforts between combustion equipment manufacturers and potential biomass residue suppliers, specifically the cotton ginning industry. A strong possibility exists that because of these efforts, several larger commercial cotton gin trash to energy projects could be underway.

The existence of the Texas Energy Development Act has provided a mechanism for attracting national attention and the possibility of federal funding to a major alcohol fuels technology development program in Texas. The key to this attraction is TENRAC support and funding for the two major alcohol research and demonstration projects in the state at Texas A&M (80-B-1-1) and at Texas Tech (80-B-1-2). In addition to these efforts, TENRAC staff has provided technical information assistance to over ten large-scale alcohol production entities which have the potential of producing over 200 million gallons of ethanol per year. Several of these and other Texas biomass energy development groups have submitted proposals to the federal government for support; TENRAC staff has provided appropriate encouragement and recommendations to the federal government on these Texas projects.

In the fall of 1979, DOE issued a solicitation for Integrated Farm Energy System proposals. TENRAC issued a companion solicitation with the intent to leverage federal funds to Texas through an offer of $250,000 in state funds. Two Texas proposals were submitted and SumX Corporation of Austin was awarded a four-year contract amounting to $488,201. TENRAC funds were a significant factor in leveraging this important program to Texas. This project will integrate farm energy production potentials, such as methane and alcohol production, and energy demands so that a nearly energy self-sufficient farm will be demonstrated.

Because of the critical aspect of diesel fuel supply and demand in agriculture, TENRAC has supported two vegetable oil-diesel fuel substitution projects (80-B-4-3 and 80-B-4-4A). These two projects will assess the technical and economic feasibility of substituting sunflower oil and cottonseed oil in diesel farm engines.

TENRAC staff has brought together a consortium composed of Texas A&M, Texas Tech, University of Texas Lands, Exxon Enterprises and TENRAC to test the biomass energy production potential and feasibility of four abundant semi-arid plant species in the western half of the state (80-B-6-6). Preliminary indications are that strong energy and economic benefits could be realized by the state.

4. Solar

Major opportunities for utilization of direct solar resources include power generation and production of industrial process heat requiring development of lower cost heliostats to achieve economic feasibility, and making the expansion of the Texas solar industry of great significance. $35,000 from TEAC coupled with over $100,000 from Northrup, Inc. (S-5-5) led to a $1 million DOE contract for a "second generation" heliostat, a $310,000 DOE industrial process heat study for Arco, and University of Houston participation in repowering studies ("repowering" refers to partial conversion of oil and gas-fired boilers to solar to allow continued use of existing equipment). Five Texas projects are among 14 candidates for four DOE repowering sites (up to $150 million each) with possible requirement of over 16,000 heliostats. TENRAC is in a position to provide significant support in the effort to obtain DOE funding of one or more Texas repowering projects.

TENRAC staff is assisting in repowering studies being developed by El Paso Electric Company, Southwestern Public Service Company, Texas Electric Service Company, and West Texas Utilities Company. There is also staff participation in the Solar Energy Research Institute study of "Solar Electric Development Opportunities in the South Central Region" with potential location of a 100 Mw system near Austin. Current TENRAC funding includes a heliostat field optimization study (80-S-3-1) cost shared with Rockwell International and the University of Houston, and development of short cut methods for evaluating potential central receiver cogeneration applications (80-S-3-3).

Because of the need for non-residential solar heating, currently funded projects are: preheating of boiler feed water (80-S-9-2), both washing and drying in laundry operation (80-S-8-1), and distillation of fuel alcohol (80-S-4-1). Also, TENRAC is in a position to provide significant support in the efforts to obtain DOE funding for solar heating at U.S. Gypsum's plant in Sweetwater. In addition, TENRAC staff is cooperating in DOE's Modular Site Retrofit Program, which will lead to 30 solar process steam facilities in the southwestern United States, with the expectation of influencing the locations selected. One example of TENRAC staff's assistance is the searching of industrial boiler listings in West Texas for potential candidates. This involved sending out questionnaires to determine pressure and capacity distribution of boilers with adjacent area for solar collectors. DOE funding for the first of three cycles of this program would amount to $29.2 million from 1980 through 1986. One million dollars from Texas to be put into the construction of Texas-based facilities in FY 1983 and 1984 would help to capture more than a fair share of the facilities for Texas.

Because of the potential economic attractiveness of residential electricity through photovoltaics, the council authorized $100,000 toward the construction cost of a DOE funded $400,000 Residential Photovoltaic Experiment Station in Texas.

5. Wind

It has been estimated that Texas has almost one-eighth of the wind resources of the United States, and the Panhandle and Coastal Bend regions have some of the strongest wind resources in the nation. In the past, development of wind energy beyond water pumping has been slow to develop because of the lack of reliable wind resource data, and also because of the lack of adequate systems to supply today's energy needs. To help satisfy these needs, TEAC supported projects which mapped windpower availability (78-W-1-5), investigated a wind energy storage option (78-W-3-5), and demonstrated wind assisted irrigation (W-4-1). Data from these projects has provided needed information in response to over 500 requests and also provided a basis for future TENRAC activity.

TENRAC staff developed and administered for Texas the DOE Small Wind Energy Conversion Systems Field Evaluation Program. The objective of this program was to locate small wind turbines on a user's property to provide electrical power for the user and to provide excess power for the cooperating utility for the purpose of evaluating the performance and impacts of the system. Fifteen utilities from across the state expressed interest in this program and of these, six utilities cooperated by identifying potential sites. TENRAC staff evaluated these sites and selected sites proposed by the Brownsville Public Utilities Board and the Texas Electric Service Company.

TENRAC staff coordinated the formation of a consortium composed of Jay Carter Enterprises, Texas Electric Service Cooperative, West Texas State University, DOE and TENRAC to develop a 125 Kw wind turbine. DOE has expressed interest in this project and if negotiations are successful, project start-up may begin in 1981.

Because additional operational time was required to determine the reliability of the Wind-Assist and Off-Season Power Generation system, this project (78-W-4-1) was continued from the last biennium. Another significant wind project involved the installation and performance testing of a wind turbine in a stripper oil field to provide electrical energy for powering six oil well pumps (80-W-4-1).

Improving Efficiency in Energy Use

1. Space Cooling

A major energy consumer in Texas is space cooling in the residential and commercial sectors. Consumers in Texas are having great difficulty dealing with high electricity and natural gas costs. DOE "comfort conditioning" programs have not given adequate attention to cooling RD&D so that a state effort is required both to develop the technologies and to attract DOE interest. As evidence of lack of DOE interest in air conditioning, the Windfall Profits Tax bill provides for low income assistance for heating but not for cooling.

Cooling needs have been addressed by TEAC through laboratory investigation of dehumidification systems (C-1-2 and C-1-3), evaluation of indirect evaporative cooling (C-1-2 and C-2-4), demonstration of hybrid systems (C-3-1), and investigation of heat pump applications (C-4-2, C-6-1, and C-6-2). This background and continued research has provided the basis for development of current TENRAC funded demonstrations: cooling tower retrofit for commercial air conditioning (80-C-1-5), retrofit of evaporative cooling boost to standard commercial and residential air conditioning systems (80-S-7-2), integrated surface water heat pump system (80-C-2-1), commercial groundwater heat pump system (80-C-3-1), solar assisted heat pump systems (80-S-8-2 and 80-S-8-5), commercial cooling using off-peak power (80-C-5-1), and further development of dehumidification systems (80-S-1-1, 80-S-1-3, and 80-S-8-6). The groundwater heat pump studies have elicited a wide response which indicates the likelihood of greatly expanded commercialization assisted by previous and ongoing TENRAC efforts.

2. Irrigation

Texas irrigated agriculture is having a particularly difficult time dealing with rapidly rising natural gas and electricity prices. The mobile trickle irrigation system developed through matching of $25,000 from the Energy Development Act with $319,000 from DOE has now been chosen from ten candidates for a major DOE commercialization effort, with one modified system already installed and planned application to two million acres in 1981. Over 2,000 visitors have investigated the system and an Israeli firm is already tooling up for commercial production.

The capital investment for such a system is quite high. A preliminary investment analysis shows that economic justification of the system, based on

operating expenses (primarily energy expense), was marginal if a farmer's pumping capacity and pumping lift were low. Even though water savings on the order of 30 to 50 percent and energy savings of 30 to 60 percent are possible, the benefit to the farmer's short-term cash flow might not justify installation of the system, even though the long-term regional benefit of wide-scale adaptation would be very significant.

A proposed approach to this problem consists of designing and testing a completely adjustable dual-nozzle, multi-function, moving truss irrigation system capable of precision application of the full complement of agricultural chemicals, along with, or as a separate operation, irrigation. In addition, the system can be designed for the most effective application of commercial and experimental chemicals whose purpose is to reduce plant water stress by decreasing the water loss from soil and plants. A three-year investigation might be funded with $105,000 from federal funds, $146,000 from the Texas Agricultural Experiment Station, and $35,000 from TENRAC.

3. Cogeneration

The TENRAC funded project (80-S-3-3) to develop short-cut methods for evaluating potential central receiver cogeneration looks at the problem from the utility view, where the primary thrust is the generation of electricity, although the energy available as process heat is typically twice that of the electricity. The TENRAC staff is also participating in a study from the viewpoint of industry, where the main thrust is the production of heat for sulfur mining at Texasgulf Chemicals, and only as much electricity as can be used on-site is produced. Although this study uses central receiver technology, Texasgulf already has a fossil-fired cogeneration unit in successful operation at another facility.

PROJECT SOLICITATION AND NEGOTIATION

On the basis of the background described above and within the guidelines adopted for administration of funds appropriated under the Energy Development Act as amended, solicitations have been issued, proposals have been received and evaluated, projects have been recommended to and authorized by the council, and contracts have been negotiated as indicated in the summaries of solicitations, the summary of projects, and the funding analysis to date.

SUMMARY OF (80-81) ENERGY DEVELOPMENT SOLICITATIONS

January, 1981

SPI No.	SPI Subject	Date of Issuance	No. Proposals Received	TENRAC $ Requested	No. Projects Funded	TENRAC $
80-C-1	Improved Efficiency in Commercial and Residential HVAC Systems	12/14/79	6	$ 216,851	3	$ 126,346
80-C-2	Industrial Heat Pump Applications for Building and Water Heating	12/14/79	1	98,980	1	98,980
80-C-3	Nonresidential Groundwater Heat Pump Retrofit Demonstration	12/14/79	1	32,718	1	32,718
80-C-4	Retrofit Demonstration of Energy Conservation through Improved Controls	12/14/79	5	161,207	2	24,822
80-C-5	Thermal Storage for Large HVAC Systems	12/14/79	2	184,850	1	64,900
80-C-6	Development of Energy Efficient Irrigation Systems	12/14/79	1	44,870	0	-0-
80-C-7	Demonstrations of Innovative Energy Saving Improvements Appropriate for Retrofit to the Heat Rejection Portion of Freon Compression Air Conditioning Systems	10/1/80	2	53,360	1	33,810
78-C-6-II	Groundwater Heat Pump HVAC Demonstration	11/2/79	1	100,000	0	-0-
80-S-1	Solar-Powered Residential Comfort Conditioning in High Humidity Environment	12/12/79	4	165,276	2	51,992
80-S-2	Thermal Storage of Solar Energy Research and Development	12/12/79	2	151,975	0	-0-
80-S-3	Industrial Solar Applications Research or Demonstration	12/12/79	4	943,049	2	58,705
80-S-4	Agricultural Solar Applications Demonstration	12/12/79	2	103,171	1	49,499
80-S-5	Demonstration of Solar Lighting for Commercial Buildings	12/12/79	0	-0-	0	-0-
80-S-6	Establishment and Operation of Southwest Residential Photovoltaic Experiment Station	2/27/80	1	100,000	0	-0-
80-S-7	Documentation of Extent of Solar Energy Commercialization	3/12/80	2	140,310	0	-0-
80-S-8	RD&D Projects in Solar Energy Utilization	7/30/80	12	475,711	5	
80-S-9	Feasibility Studies for the Application of Solar Energy to Supply Heat for Industrial Processes	10/22/80	4	162,949	1	29,625
80-S-10	Establishment and Operation of a Southeast Residential Photovoltaic Experiment Station	1/13/81	2	100,000		
80-S-11	To Study the Cost Effectiveness of Various Solar Collector Options to Supply Heat for Industrial Processes in Texas	1/15/81				

SPI No.	SPI Subject	Date of Issuance	No. Proposals Received	TENRAC $ Requested	No. Projects Funded	TENRAC $
-B-1	Alcohol Demonstration Plant	12/21/79	6	901,718	2	399,800
80-B-2	Cellulose Feedstocks Availability	12/21/79	0	-0-	0	-0-
80-B-3	Energy Integrated Farm Systems Demonstration	10/19/79	2	250,000	1	81,793
80-B-4	Alternative Energy Liquid Fuel Utilization	9/22/80	5	171,005	2	100,000
80-B-5	Direct Utilization of Biomass Energy Feedstocks	9/22/80	2	100,000	0	-0-
80-B-6	Production Potential of Unconventional Biomass Feedstocks	9/22/80	6	269,919	1	33,333
80-W-1	Regional Texas Wind Resource Analysis	12/21/79	4	197,296	0	-0-
80-W-2	100 KW Wind Turbine Development	3/26/80	1	50,000	1	50,000
80-W-3	Encourage Advancement of Wind Energy Storage Technology by Developing and Demonstrating New Concepts	9/22/80	2	48.095	0	-0-
80-W-4	Develop and Demonstrate Methods of Integrating Wind Energy for other Applications which Require Direct Mechanical or Electrical Power	9/22/80	1	21,563	1	21,563
80-L-1	Study of Low Btu Fixed-Bed Gasification of Lignite Pellets	11/21/79	1	43,306	1	43,306
80-L-2	R&D of Advanced Technologies for the Use of Lignite as an Industrial Fuel	2/22/80	3	152,335	1	36,382
80-L-3	Demonstration of Advanced Technologies for Use of Lignite as an Industrial Fuel	2/22/80	1	100,000	1	100,000
80-L-4	Research and/or Development Related to Particulate Control Systems	2/22/80	0	-0-	0	-0-
80-L-5	RD&D Related to Disposal or Use of Lignite Utilization Solid Wastes	2/22/80	2	85,821	0	-0-
80-L-6	RD&D Related to Lignite Use Environmental Issues	2/22/80	4	133,141	2	90,381
80-L-7	Lignite R&D Assessing Deep Basin Resources, Characterizing Resources, or Responding to Resource Recovery and Utilization Needs	7/25/80	13	810,271	5	387,415
80-L-8	Demonstration of Advanced Technologies for Use of Texas Lignite	7/25/80	0	-0-	0	-0-
80-L-9	RD&D on Control Systems for Hazardous Pollutants and Particulates from Lignite Use	7/25/80	2	97,779	0	-0-

SPI No.	SPI Subject	Date of Issuance	No. Proposals Received	TENRAC $ Requested	No. Projects Funded	TENRAC $
80-L-10	RD&D on Disposal or Use of Lignite Solid Wastes	7/25/80	3	263,164	1	4,275
80-L-11	R&D on Lignite Environmental Issues	7/25/80	6	83,722	5	79,433
80-G-2	Technical Review, Coordination and Report Preparation on Trans-Pecos Geothermal	10/31/79	1	-0-	1	-0-
80-P-1	Regionalized Electricity Modeling	2/12/80	2	43,108	1	4,650
80-P-2	Study of Regional Impacts of Fuel Use Act on Gulf Coast Industry	5/7/80	8	156,405	1	19,944
	TOTALS		127	7,213,925	47	2,025,063

FUNDING ANALYSIS OF AUTHORIZED
TEXAS ENERGY DEVELOPMENT PROJECTS (1980 - 1981)

January, 1981

	# of Projects	TENRAC Funding	Other Funding	Project Total
A. Energy Efficient Comfort Conditioning	20	606,912	601,797	1,208,709
B. Improved Controls for Maximizing Energy Efficiency	3	58,022	6,980	65,002
C. Energy Production from Renewable Energy Sources	13	850,659	1,207,104	2,057,763
D. Industrial and Electrical Generation Applications	19	692,247	408,869	1,101,117
E. Innovative Energy Technology Development Not Limited to Specific Problem Areas	1	2,897	-0-	2,897
F. Resource Assessment	8	220,376	559,414*	779,790
G. Texas Energy Policy Project	7	132,330	-0-	132,330
H. University Coal Research Consortium	4	169,500	188,754	358,254
TOTALS	75	2,732,465	2,972,918	5,705,384

*Does not include $32,522 provided by 3 utilities, Midtex Generation & Transmission Co-op, El Paso Electric Company, and Central & Southwest Fuels, Inc., as matching funds to Project #78-G-2-3.

AUTHORIZED PROJECTS - CONTRACT NEGOTIATIONS UNSUCCESSFUL

A.	80-C-5-2	97,500	349,500	447,000
B.	80-C-4-5	25,275	50,550	78,825
C.	80-S-3-4	70,279	70,279	140,558

SUMMARY OF TEXAS ENERGY DEVELOPMENT PROJECTS (1980 - 1981)

January 1981

A. ENERGY EFFICIENT COMFORT CONDITIONING

Project #	Contract #	Project Title	Project Manager/ Contractor	Project Status	TENRAC Funding	Other Funding	Project Total
78-S-1-1	IAC (80-81)0773 0701	Investigation of a Passive Wall and Movable Roof	Mei/Lamar U.	Published	$ 1,600	-0-	$ 1,600
78-S-1-1	IAC (80-81)1248 0871	Ventilated Wall and Louvered Window Insolation Control	Mei/Lamar U.	Contracted	20,000	$ 28,965	48,965
78-S-1-5	IAC (80-81)0679 0705	Integrated Passive Solar Demonstration Porject	Garrison/UT-Austin	Draft Final 1/16/81	1,250	-0-	1,250
78-S-1-9		Low Cost Solar Heating and Cooling Retrofit Demonstration	Beyer/Southside Community Center	At Printer	312*	-0-	312*
78-S-1-3	IAC (80-81)0806 0703	Vapor Jet Compression Solar Cooling System	Holmes/TAMU	Draft Final 1/23/81	3,724	945	4,669
78-C-1-2	IAC (80-81)0807 0702	Desiccant Dehumidification Indirect Evaporative Cooler	Kettleborough/TAMU	Published	5,000	-0-	5,000
80-C-1-2	IAC (80-81)1252 0867	Improved Indirect Evaporative Cooling System	Dunn/Texas Tech	Contracted	33,380	5,950 IDC+7,990	47,320
80-C-1-5	0890	Improved Efficiency in Commercial, Residential HVAC	Green/Radian	Contracted	73,076	17,834	90,910
80-C-2-1	0891	Water to Air HVAC Demonstration	Aniol/River Gardens	Contracted	98,980	182,000	280,980
80-C-3-1	IAC (80-81)1312 0887	Non-Residential Ground-water Heat Pump Retrofit Demonstration	Hildebrandt/UH	Contracted	32,718	59,260 IDC+2,120	94,098
80-C-5-1	0873	Development and Demonstration of the Commercial AC-TES Concept	Bywaters/Bywaters & Associates	Contracted	43,300	21,600	64,900
80-S-1-1	IAC (80-81)1293 0884	Residential Solar Desiccant Dehumidification	Howell/UT-Austin	Contracted	23,422	10,527	33,949
80-S-1-3	0876	Modeling of Comfort Control through Dessicant Dehumidification in Passive Solar Buildings	Haves/Trinity U.	Contracted	28,570	-0-	28,570

*Not included in funding totals.

A. ENERGY EFFICIENT COMFORT CONDITIONING

Project #	Contract #	Project Title	Project Manager/ Contractor	Project Status	TENRAC Funding	Other Funding	Project Total
80-S-8-2	IAC (80-81)1699 0919	Investigation of Ground/ Solar Assisted Heat Pump Systems	Mei/Lamar U.	Contracted	$ 27,570	$ 42,177	$ 69,747
80-S-8-5	0921	Solar Assisted Heat Pump Demonstration	Wetzel/Girl Scouts	Contracted	50,000	77,155	127,155
80-S-8-6		Desiccant Dehumidification and Cooling with an Indirect Evaporative Cooler	Kettleborough/TAMU	Pending	28,739	25,542	54,281
80-S-8-8		Solar Energy Utilization	Knox/Comal County MHMR	Pending	29,773 Subject to DOE support	77,161	106,934
78-C-6-2c	IAC (80-81)1784 0938	Groundwater Heat Pump Design Development	Jones/UT-Austin	Contracted	10,000	3,025	13,025
78-S-6-13c		Modular Solar House Retrofit Project	Jenkins/TAMU	Pending	12,000	12,378	24,378
78-S-1-5c		Passive Solar Homes for Texas	Garrison/UT-Austin	Pending	50,000	19,968	69,968
80-C-7-2	0970	A Proposal for Controlled Testing of the Indirect Evaporative Cooling Retrofit Concept	Bywaters/Bywaters Assc.	Contracted	33,810	7,200	41,010

B. IMPROVED CONTROLS FOR MAXIMIZING ENERGY EFFICIENCY

Project #	Contract #	Project Title	Project Manager/ Contractor	Project Status	TENRAC Funding	Other Funding	Project Total
78-S-2-7	IAC (80-81)0653 0704	Monitoring of a Solar Heated and Cooled Apartment Building	Vliet/UT-Austin	Redrafted 1/16/81	$ 2,000	-0-	$ 2,000
78-S-2-7	IAC (80-81)1250 0704	Experimentally Demonstrated Design Features for Solar Heating and Cooling	Vliet/UT-Austin	Contracted	21,300	$ 5,780	27,080
80-C-4-4	0889	Improved Energy Efficiency in a Restaurant Through the Addition of Computer Control of Operations	Gerloff/Micon	Contracted	14,822	1,200	16,022
80-C-1-3	0920	Optimization of Heat Exchanger Performance for Minimum Energy Consumption in Air Conditioning Systems	Hart/Energy Engineering Associates, Inc.	Contracted	19,900	-0-	19,900
80-C-4-3	IAC (80-81)1777 0937	Development of Industrial Energy Conservation Software for Microcomputers	Schmidt/UT Austin	Contracted	10,000	38,629	48,629

SUMMARY OF TEXAS ENERGY DEVELOPMENT PROJECTS (1980 - 1981)

C. ENERGY PRODUCTION FROM RENEWABLE ENERGY SOURCES

Project #	Contract #	Project Title	Project Manager/ Contractor	Project Status	TENRAC Funding	Other Funding	Project Total
78-B-1-5	IAC (80-81)1031 0748	On Site Energy Production from Agricultural Residues	Hiler/TAMU	Continued from 78-79 Biennium	$ 70,000	$ 88,871	$158,871
80-B-1-1	IAC (80-81)1271 0881	Ethanol Production (Small Facilities)	Hiler/TAMU	Contracted	220,000	149,000 IDC+9,400	378,400
80-B-1-2	IAC (80-81)1259 0882	Test, Modify and Demonstrate Ethanol Conversion Technologies	Clements/ Texas Tech	Contracted	179,800	193,800	373,600
80-B-3-1		Integrated Farm System	Malish/SumX	Contracted	81,793	206,599	288,392
80-S-4-1	0875	Solar Distillation of Fuel Alcohol	Deffenbaugh/ SwRI	Contracted	49,499	-0-	49,499
80-W-2-1	Pending	Develop a 125 Kw Wind Generator	Carter/Jay Carter	Pending	50,000	150,000	200,000
80-P-3-1	IAC (80-81)1397 0893	Study Effect on Alcohol Production of Removal of State Tax on Gasohol	TAES	Draft Final Received	19,200		19,200
80-S-8-1	IAC (80-81)1719 0925	Demonstration Use of Solar Energy for Laundromat Washing and Drying	Whitacre/UT-El Paso	Contracted	12,000	54,490	66,490
78-W-4-1c	IAC (80-81)1718 0926	Wind Assist Irrigation and Off-Season Power Generation	Nelson/WTSU	Contracted	13,471	6,000	19,471
80-B-6-6A	IAC (80-81)1846 0962	Unconventional Plants for Biomass Feedstocks in Semi-Arid West Texas	Newton/TAMU	Contracted	16,667	53,858	70,525
80-B-6-6B	IAC (80-81)1843 0955	Unconventional Plants for Biomass Feedstocks in Semi-Arid West Texas	Goodin/TTU	Contracted	16,666	56,958	73,624
80-B-4-3	0966	Investigate the Utilization of Available Vegetable Oil as a Diesel Substitute in a Stock Diesel Engine	Staudt/SwRI	Contracted	50,000	135,000	185,000
80-B-4-4a		Economic and Engineering Evaluation of Plant Oils as a Diesel Fuel	Hiler/TAMU	Pending	50,000	75,728	125,728
80-W-4-1	IAC (80-81)1834 0952	Use of Wind Power to Assist in Stripper (Oil) Well Pumping	Gilmore/WTSU	Contracted	21,563	27,400	48,963

SUMMARY OF TEXAS ENERGY DEVELOPMENT PROJECTS (1980 - 1981)

January 1981

D. INDUSTRIAL AND ELECTRICAL GENERATION APPLICATIONS

Project #	Contract #	Project Title	Project Manager/ Contractor	Project Status	TENRAC Funding	Other Funding	Project Total
78-PCL	IAC (80-81)0055 0715	UCL Consortium Proposal Preparation	UT-Austin	Complete	$ 6,349	-0-	$ 6,349
80-L-2-1	IAC (80-81)1251 0869	Atmospheric Fluid Bed Combustion, Sulfur Removal	Edgar/UT-Austin	Contracted	36,382	$ 68,786	105,168
80-L-3-1	0878	Low-Btu Gasification Feasibility	Anis/BS&B	Contracted	100,000	150,000	250,000
80-L-6-3	IAC (80-81)1249 0870	Rain Quality in Lignite Burning Areas	Cooper/UT-Austin	Contracted	32,553	-0-	32,553
80-S-3-1	IAC (80-81)1614	Solar Repowering of an Electric Utility	Vant-Hull/UH	Contracted	3,000	6,004	9,004
80-S-3-3	IAC (80-81)1247 0872	Site Specific Economic Modeling of Solar Power Towers for Cogeneration of Electricity and Heat in Texas	Prengle/UH	Contracted	55,705	-0-	55,705
80-L-6-4	0877(Amended)	Environmental Impacts of Medium Btu Gasification	Petty/Radian	Contracted	57,828	-0-	57,828
80-L-1-1	IAC (80-81)1014 0747	Briquetting of Texas Lignite for Gasification	Colaluca/TEES	Contracted	32,078	6,360	38,438
80-L-1-1	0751	(Consultant)	Annis/BS&B	Contracted	9,728	-0-	9,728
80-L-1-1	0754	(Consultant)	Edgar/UT-Austin	Contracted	1,500	-0-	1,500
80-P-1-1	0863	Execute Computer Runs of the Regionalized Electricity Model	Baughman/Southwest Energy Associates	Published	1,950	-0-	1,950
80-P-1-1	0781	Regionalized Electricity	Baughman/Southwest	Published	3,700	-0-	3,700
80-P-2-5		Scoping Study of the Regional Impacts of the Powerplant and Industrial Fuel Use Act on Gulf Coast Industry	Hudson/Radian	Published	9,972	9,972	19,944
80-L-7-10	0930	Testing and Evaluation of Fluidized Bed Combustion of Texas Lignites	Owen/Radian Corp.	Contracted	214,649	55,000	269,649
80-L-10-2	0949	The Impact of RCRA (PL 94-580) on the Use or Disposal of Solid Wastes from Texas Lignite-Fired Utility Boilers	Smith/Raba-Kistner	Contracted	4,275	2,200	6,475

D. INDUSTRIAL AND ELECTRICAL GENERATION APPLICATIONS

Project #	Contract #	Project Title	Project Manager/ Contractor	Project Status	TENRAC Funding	Other Funding	Project Total
80-L-11-1	IAC (80-81)1758 0929	Leaching of Lignite Ash by Rain and Acid Rain	Bartsch/TTU	Contracted	15,039	5,072	20,111
80-L-11-2	IAC (80-81)1806 0946	Artificial Revegetation of Mine Spoils in Milam County	Haferkamp/TAMU	Contracted	9,296	9,486	18,782
80-L-11-4		A Study of the Determinants of Exploratory and Development Investment by Texas Lignite Firms	Rose/TAMU	Pending	13,268.75	5,228.75	18,497.50
80-L-11-6		Proposal to Investigate Acid Rain and Acid Rain Impacts	Levy/Espey, Huston & Assc.	Pending	11,525	10,931	22,456
80-L-7-13		Upgrading of the Fuel Value of Texas Lignite by Briquetting	Colaluca/TAMU	Pending	33,825	11,576	45,401
80-S-9-2	0947	Solar Energy to Supply Industrial Process Heat for the Spreckles Sugar Division of Amstar Corp.	Braun/Travis-Braun & Assc.	Contracted	29,625	29,625	59,250

E. INNOVATIVE ENERGY TECHNOLOGY DEVELOPMENT NOT LIMITED TO SPECIFIC PROBLEM AREAS

Project #	Contract #	Project Title	Project Manager/ Contractor	Project Status	TENRAC Funding	Other Funding	Project Total
78-S-5-4		Innovative Collector Testing	McKeen/TRM Inc.	Published	$ 2,897		$ 2,897

F. RESOURCE ASSESSMENT

Project #	Contract #	Project Title	Project Manager/ Contractor	Project Status	TENRAC Funding	Other Funding	Project Total
78-L-1-1	IAC (80-81)1347 0886	Printing of L-1-1 Final Report	UT-Austin	Contracted	$ 1,130	$ 1,245	$ 2,375
G-2-3	IAC (80-81)0899 0720	West Texas Geothermal Project	Henry/UT-Austin	Contracted	16,860	10,580	27,440
G-2-3*	IAC (80-81)0917 0727	West Texas Geothermal Project	Roy/UT-El Paso	Contracted	22,093	9,454	31,547
	IAC (80-81)1428 0892	West Texas Geothermal Project	Roy/UT-El Paso	Contracted	5,524	91,304	96,828
	IAC (80-81)1832 0951	West Texas Geothermal Project	Roy/UT-El Paso	Contracted	5,523	31,937	37,460
G-2-3	0728	West Texas Geothermal Project	Miklas/SwRI	Contracted	-0-	30,103	30,103

* $32,522 provided by 3 utilities. Midtex Generation & Transmission Coop., El Paso Electric Co.

SUMMARY OF TEXAS ENERGY DEVELOPMENT PROJECTS (1980 - 1981)

F. RESOURCE ASSESSMENT

Project #	Contract #	Project Title	Project Manager/ Contractor	Project Status	TENRAC Funding	Other Funding	Project Total
EPRI-1	IAC (80-81)0588 0716	Uncertainties in Coal Resource Assessment	van Rensburg/UT-Austin	Contracted	-0-	90,898	90,898
EPRI-2	IAC (80-81)1167 0793 (Amended)	Uncertainties in Coal Resource Assessment.	van Rensburg/UT-Austin	Contracted	-0-	175,071	175,071
80-L-7-2	IAC (80-81)1851 0963	Trace Element Characterization in Texas Lignites and Liquids Derived Therefrom	Zingaro/TAMU	Contracted	34,914	55,152	90,066
80-L-7-5	IAC (80-81)1754 0928	Characterization of Kinetic Parameters and Transport Properties of Texas Lignite	Mann/TTU	Contracted	24,019	13,746	37,815
80-L-7-9	IAC (80-81)1778 0936	Assessment of Lignite Exploitability in the Deep Basin of Texas	Kaiser/UT-Austin	Contracted	80,008	38,712	118,720
80-L-11-5	IAC (80-81)1835 0953	Hydrologic Site Selection for Mining of Deep Basin Lignite in Texas	Charbeneau/UT-Austin	Contracted	30,305	11,162	41,467

G. TEXAS ENERGY POLICY PROJECT

Project #	Contract #	Project Title	Project Manager/ Contractor	Project Status	TENRAC Funding	Other Funding	Project Total
TEPP-1	IAC (80-81)0737 0674	Modeling	Moore/TAMU	Contracted	$ 23,621	-0-	$ 23,621
TEPP-2	0772 0773 0774 0775 0776 0778 0780	TEPP National Advisory Board	Churchman Wood Johnson Halter Dantzig Avera Thrall	Contracted	10,445	-0-	10,445
TEPP-3	IAC (80-81)0799 0677	Survey of Regional Modeling	UT/Bureau of Business Research	Contracted	13,844	-0-	13,844
TEPP-4	IAC (80-81)1632	Modeling	Moore/TEES	Contracted	45,720	-0-	45,720
TEPP-5	IAC (80-81)1642	Chase Econometric Forecasting Service	Comptroller	Contracted	8,000	-0-	8,000

SUMMARY OF TEXAS ENERGY DEVELOPMENT PROJECTS (1980 - 1981)

January 1981

G. TEXAS ENERGY POLICY PROJECT (continued)

Project #	Contract #	Project Title	Project Manager/ Contractor	Project Status	TENRAC Funding	Other Funding	Project Total
TEPP-6	0913 0914 0915 0916	Academic Advisory Group	Kendrick Nelson Jonish Optimal Methods Inc.	Contracted	$ 28,000	-0-	$ 28,000
TEPP-7	0906 0940 0959	(Consultant)	Beck Eidman Lesher	Contracted	2,700	-0-	2,700

H. UNIVERSITY COAL RESEARCH CONSORTIUM EQUIPMENT

Project #	Contract #	Project Title	Project Manager/ Contractor	Project Status	TENRAC Funding	Other Funding	Project Total
UCRC-80-1		Coal Research Capital Equipment	Richardson/UOH	Contracted	$ 50,000	$ 50,000	$100,000
UCRC-80-2		A Proposal to Establish Coal Analytical Capabilities at the University of Texas at Austin	van Rensburg/UT-Austin	Contracted	50,000	50,000	100,000
UCRC-80-3		Part I. Transportation Characteristics of Texas Lignite in Slurry Pipelines Page II. Kinetics of Texas Lignite Char Gasification	Clements, Selim/ TTU	Contracted	19,500	19,500	39,000
UCRC-80-4		A Proposal for Laboratory Equipment for Lignite Research	Hoskins/TAMU	Contracted	50,000	69,254	119,254

APPENDIX A

ADMINISTRATIVE REGULATIONS

Texas Energy Development Fund

Texas Energy Development Fund
161.01.00.001-.006

The Texas Energy and Natural Resources Advisory Council has adopted the amendments to Rule 161.01.00.001-.006 with a minor change in the outline lettering scheme in Rule .002.

These amendments are adopted under the authority of Senate Bill 921, 66th Legislature, Regular Session, and Article 4413(47b), Sec. 6, V.A.C.S., as amended.

.001 Criteria for Funding

(a) On the basis of the language of the Energy Development Act, supra, and expressed concerns of energy policy makers, energy development contracts shall be awarded on the basis of the following general funding criteria:

(1) that projects have specific application to the energy needs of Texas;

(2) that projects bring energy technology closer to commercialization, and that the technology show promise for signficant contribution within the next 25 years, with preference for projects demonstrating current or near term economic feasibility;

(3) that the projects have the potential of drawing federal, private, or other outside participation, or of leading to subsequent support by such sources;

(4) that the projects neither be redundant nor substitute for existing funding; and

(5) that the projects fall within the scope of research, development, and demonstration related to alternate energy supplies and energy conservation technologies.

(b) In addition to these general criteria, funding of specific projects will be contingent upon meeting the standards set forth with regard to Solicitation and Submission of Proposals (Rule .002), and Evaluation and Selection of Proposals (Rule .003).

.002 Solicitation and Submission of Proposals.

(a) The procedure for solicitation and sumbission of proposals is based on consideration of (1) the kinds of problems being encountered in Texas to which energy RD&D might speak, (2) the levels of funding necessary to obtain significant results, and (3) the potential for stimulating participation by other agencies, organizations, or individuals.

(b) Proposal Priorities. Proposal Priorities will be established by internal assessment of energy-related RD&D needs and activities, by interaction with the council and related state agency personnel, and by open consultation with identified external experts and concerned citizens in the research areas of council interest. The proposal solicitation process will then be initiated on the basis of these established priorities.

(c) Proposal solicitation process. Proposals will be solicited by the issuance of "Statements of Program Intent" (SPI). Each SPI will include the following:

(1) description of project objective;

(2) description of funding considerations;

(3) explanation of review criteria and procedures;

(4) deadline and address for proposal submission;

(5) target date for contract award;

(6) detailed guidelines for proposal contents;

(7) designation of contact person for additional information;

(8) statement of contract terms and required completion date; and

(9) statement regarding proprietary information and patents.

All SPIs will be published in the Texas Register and will be distributed to state depository libraries, to appropriate journals and periodicals, and to a mailing list of those who indicate interest in receiving them. Notice of the availability of the SPIs will be communicated by news release through the Capitol Press and other appropriate media. Release of an SPI in no way guarantees that all or any of the funds designated will be awarded. The Council retains the right to make no award in the event that no acceptable proposal is submitted in a given area.

(d) Submission of proposals. The proposal format will be designed to insure sufficient information for evaluation, but the staff reserves the right to request further information if necessary. Voluminous proposals are neither necessary nor desired due to staff and budgetary limitations. Five to ten double-spaced typed pages, excluding appendices, should ordinarily be adequate. Unless otherwise indicated with regard to a specific solicitation, 10 copies of the full proposal must be received in the Energy Analysis and Development Division offices on or before the submission deadline for the proposal to receive consideration under a given solicitation. Proposals should address the following concerns:

(1) Project classification

(A) project title and number as listed in the specific SPI, or

(B) category title (e.g., solar, wind, lignite, etc.) if not addressing a specific identified project (in which case the proposal should include a statement of how the project meets the funding criteria outlined in Rule .001 above);

(2) discussion of how the proposer intends to fulfill the requirements of the project, including description of end product in detail - identifying existence of proprietary information and any subcontracts planned;

(3) availability of matching funds and/or services indicating amount and sources;

(4) verifiable resumes of principals and subcontractors (including names, addresses, and phone numbers) and a summary of pertinent experience of proposing organization;

(5) site(s) of proposed project;

(6) time schedule for work to be performed by principals and subcontractors;

(7) itemized cost breakdown, including profit margin and indication of application of matching funds;

(8) economic justification of the project including present costs and anticipated cost reductions or proposals for obtaining cost data;

(9) suggested monitoring procedures;

(10) other information as indicated by specific project descriptions; and

(11) clear identification of any proprietary information.

(e) Eligible proposers. In order to assure equitable distribution

of the funds and to avoid conflict of interest, the following criteria are established for acceptability of proposers:

(1) Texas-based proposers will be given priority consideration, and only in unusual circumstances will this priority be disregarded;

(2) projects to be conducted in Texas will be given priority consideration, and only in unusual circumstances will this priority be disregarded;

(3) individual members of the Council, TENRAC staff members, or their immediate families are not eligible; and

(4) members of the pool of technical experts are eligible to submit proposals in which case their participation in the evaluation process will be appropriately limited.

(f) Unsolicited proposals. Any proposal which is not responsive to a specific solicitation as described in Rule .002(c) is an unsolicited proposal provided it satisfies the general requirements of Rule .002(d). Unsolicited proposals will receive appropriate consideration within time and funding limitations in accordance with accepted evaluation and selection procedures (Rule .003).

(g) Preproposals. Funding inquiries which describe potential development projects but which do not satisfy the requirements for proposal submission will be considered preproposals which may become the basis of subsequent proposal solicitation or request for submission of an unsolicited proposal.

.003 Evaluation and Selection of Proposals.

(a) Upon receipt, proposals will be referred to the TENRAC staff member responsible for the related technology area. The responsible TENRAC staff member will review each proposal and will forward the proposals to an impartial group of technical experts (as described in Rule .003(b) below) for evaluation. The TENRAC staff will make every effort to obtain reviews for each proposal by at least one technically qualified person in each of the following fields: federal research and development, state agency, university, and private industry.

(b) A pool of technical experts will be selected by the director of the Energy Analysis and Development Division. Specific proposal evaluators will be selected from this pool by the responsible TENRAC staff member in consultation with the manager of the Technology Development Section. This selection will be made in a manner which will minimize conflicts of interest while maintaining the highest available level of expertise in the proposal area. Evaluators will be required to indicate potential conflicts of interest so that evaluations can be weighed accordingly. For protection of proprietary information, evaluators will sign statements of confidentiality.

(c) In addition to providing specific comments, each of the evaluators will rate the proposals in the following categories, where appropriate:

(1) degree to which the proposal is responsive to the Fund's overall purpose and funding criteria and/or the specific purpose of an individual solicitation;

(2) probability of significant energy contributions within 25 years;

(3) probability of demonstrating current or near term economic feasibility;

(4) significance to Texas;

(5) technical, economic and environmental merit of proposal;

(6) competence of project staff;

(7) reasonableness of proposed budget and time schedule;

(8) likely availability of matching funds or services;

(9) adequacy of proposed project monitoring procedures; and

(10) other information as may be required for a specific project.

(d) Each responsible TENRAC staff member will prepare for the Technology Development Review Committee a summary of all proposals submitted in his project area, a summary of the evaluations, and identification of potential conflicts of interest. This Committee will be composed of the Director of the Energy Analysis and Development Division and the Manager and professional staff members of the Technology Development Section.

(e) On the basis of this information and its own investigation, the Review Committee will submit to the Executive Director its recommendations with regard to each proposal. Upon approval of the Executive Director with appropriate concurrence of the Council, the Director of the Energy Analysis and Development Division will be authorized to enter into contract arrangements with the proposing party.

.004 Project Reporting Requirements. A contract technical monitor will be designated either from among the TENRAC staff or outside consultants for each contract. This person will be responsible for monitoring the progress of the contract to assure that the Texas Energy and Natural Resources

Advisory Council is receiving satisfactory performance of contract terms. Contract progress reports will be submitted by the contractor at scheduled intervals during the contract period. The requirements and dates for each progress report will be identified in the contract itself. In addition, the contractor will be required to submit within 30 days of project completion three copies of a draft final written report for review and evaluation. When agreement is reached as to final report form and content the contractor will be required to submit a camera-ready original and 25 copies of the final report which shall then be the basis for final payment authorization.

.005 Disbursement of Contracted Funds and Project Cost Accounting.

(a) Two vehicles for contracting will be used for contracts under the Energy Development Act. An "interagency contract" governed by the State Purchasing and General Services Commission will be used for contracting with state agencies and state universities. For private contractors, a "professional services" contract between the contractor and the Council will be drawn. In both instances, contracts entered into shall contain terms and conditions considered appropriate to protect the interests of the State and those of the contractor.

(b) State of Texas contractors will be paid on an actual cost reimbursement basis provided for by State Purchasing and General Services Commission rules and regulations. Private contractors will be paid on a fixed contract amount basis in most cases; however, consideration will be given to special circumstances requiring some other basis of compensation. Unless otherwise provided, payment for services rendered shall be upon completion of predetermined phases of the project and after certification by

the contract monitor. In instances in which more frequent payments are requested due to the nature of the work performed or the condition of the contractor, a case-by-case review will be made and appropriate accomodations provided when possible. State of Texas entities shall be reimbursed, based upon their actual costs incurred, upon submission and approval of proper invoices and supporting documentation. Other contractors shall be paid on the basis provided in the contract upon submission of proper vouchers. In each case, ten percent of the contract amount shall be retained for final payment until after receipt and acceptance of all required reports and documentation.

(c) Contractors shall maintain satisfactory financial accounts, books, papers, documents, and records, and shall make same available for examination and audit by the staff of TENRAC and other authorized representatives of the State. Such materials shall be retained by the contractor for three years following final payment and termination of the contract. Accounting by contractors shall be in a manner consistent with generally accepted accounting procedures.

.006 Dissemination of Results.

(a) Results of all projects completed under contract with the agency will be submitted in the form of a written report or other printed material (including data, charts, computer programs, maps, or drawings) which will then become public information. Contractors will be available for brief presentations of results as required by TENRAC. When the final result includes a demonstration, specific hardware or a proprietary process, provisions will

be made on a case-by-case basis. It is expected that machinery, buildings and building systems will be subject to a period of inspections or monitoring by the State or its designated representative or be made accessible to the public as appropriate. Specific provisions will be made in each contract to cover this contingency initially, as well as to establish eventual ownership at the conclusion of a period of monitoring and/or accessibility.

(b) In the event that federal, private, university of other state agency funding is also used for completion of a project, public availability of results, patent application authority, and terms for monitoring, inspection, and ownership will be negotiated with all the parties involved in accordance with applicable federal and state regulations.

(c) In the absence of statutory or contractual limitations, the contractor may apply for patents on any discoveries made through his project. If the contractor does not wish to make the application, he shall notify the contract monitor, and the State may request and receive title to the discovery. If the contractor receives a patent, the State of Texas shall be entitled to an irrevocable, nonexclusive, royalty-free license to use for governmental purposes under the patent.

Issued in Austin, Texas on December 10, 1979.

Milton L. Holloway
Director
Energy Analysis and Development Division

APPENDIX B

EDG PROJECTS RECOMMENDED FOR FUNDING

June 11, 1980

EDG PROJECTS RECOMMENDED FOR FUNDING (JUNE 11, 1980)

1. Projects to develop and demonstrate more energy efficient comfort conditioning to reduce a major energy comsumption use in Texas commercial and residential sectors.

SII #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-C-1-2	J. K. Dunn/ Texas Tech	$33,380	71	Develop indirect evaporative cooling systems for economic comparison with standard freon compression cooling.	Less expensive system may reduce energy use and operating cost for comfort conditioning, commercial and residential.
80-C-1-5	T. F. Green/ Radian Corp.	73,076	81	Demonstrate retrofit application of cooling tower to commercial air conditioning for improved performance and energy saving.	Will demonstrate method of retrofitting existing commercial air conditioning to improve efficiency and reduce costs.
80-C-2-1	L. J. Aniol & R. C. Brown/ River Gardens Intermediate Care Facility	$98,980	35	Demonstrate integrated system use of heat pumps to reject heat into or extract heat from circulatory river water for comfort conditioning and refrigeration.	Demonstrates improved efficiency and fuel cost savings with water-to-air heat pumps in combined cycle commercial systems with wide application.
80-C-3-1	A.F. Hildebrandt /University of Houston	$32,718	31	Demonstrate commercial ground water heat pump application and compare economically with existing air-to-air freon cooling.	Quantify energy and cost savings ot water-to-air heat pumps over air-to-air heat pumps in commercial application.
80-C-5-1	R. P. Bywaters/ Bywaters & Associates	43,300	67	Install and demonstrate commercial cooling systems using off peak power.	Improves operating efficiency of cooling units, reduces electric system peak load, reduces operating costs under time-of-day rates.

EDG PROJECTS RECOMMENDED FOR FUNDING (JUNE 11, 1980)

1. Projects to develop and demonstrate more energy efficient comfort conditioning to reduce a major energy comsumption use in Texas commercial and residential sectors. (Continued)

SPI #	Principal Inv/ Orgnization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-C-5-2	T. F. Green/ Radian Corp.	$97,500 conditional on $340,000 from U.S. DOE	22	Design, install, operate and evaluate prototype thermal storage system from optimization of alternative systems and phase change materials.	Determines and demonstrates effectiveness of energy storage for utilization in energy efficient systems.
80-S-1-1	J. R. Howell/ University of Texas	$23,422	69	Demonstrate in bench scale liquid desiccant dehumidification system as basis for conceptual design of prototype system.	Potentially reduces parasitic power rise and lowers regeneration temperature for lower cost solar applications.
80-S-1-3	P. Haves/ Trinity University	$28,570	100	Develop desiccant dehumidification model for coupling with passive solar applications.	Facilitates comfort conditioning in passive solar facilities by dehumidification in high humidity areas.
78-S-1-1	H. T. Mei/ Lamar University	$20,000	31	Comfort conditioning will be demonstrated for a unique ventilated wall and louvered window insolation control on a passive solar building.	Because of simplicity of construction, the ventilated wall has potential for economically attactive retrofit of cinder block buildings.

EDC PROJECTS RECOMMENDED FOR FUNDING (JUNE 11, 1980)

II. Projects to develop and demonstrate improved controls for maximizing energy efficiency of existing energy intensive operations.

SPI #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-C-4-4	G. Gerloff/ Micon Corp.	$14,822	92	Install microcomputer controls for optimizing energy efficiency in restaurant operation and evaluate system performance.	Energy savings can be demonstrated and applications multiplied through Texas Restaurant Association support.
80-C-4-5	J. M. Sanna/ Oscar Mayer Co.	$25,275	50	Install microcomputer for optimizing energy efficiency of commercial refrigeration units and evaluate system performance.	Any demonstrated energy savings from improved controls can be readily transferred to large numbers of similar systems.
78-S-2-7	G. C. Vliet/ University of Texas	$21,300	79	Design features, reliability, and control strategies to improve system performance will be experimentally demonstrated for a solar heated and cooled apartment building.	Operating experience and reliability information will be developed for an active solar system. Design modifications may lead to decreased capital cost, and improved performance will lead to lower operating costs.

EDG PROJECTS RECOMMENDED FOR FUNDING (JUNE 11, 1980)

III. Projects to develop and demonstrate energy production from renewable energy sources.

SPI #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-B-1-1	E. A. Hiler/ Texas A&M	$220,000	58	Install, test, demonstrate and optimize a small scale package still using various conventional feedstocks and alternate energy sources.	Gain Texas based experience in producing ethanol from conventional technology for the benefit of those who want to set up individual plants. Important regional demonstration for Central and South Texas.
80-B-1-2	S. R. Beck/ Texas Tech	$179,800	48	Integrate conventional ethanol production technology with advanced cellulose conversion technology (cotton gin trash, biomass, etc.) so that ethanol can be practically produced from both grain and cellulose.	Gain Texas based experience in producing ethanol from conventional and cellulose technology for the benefit of those who want to set up individual plants. Important regional demonstration for North and West Texas.
80-S-4-1	D.M. Deifenbaugh /Southwest Research Institute	$49,499	100	A solar collector, thermal storage, and alcohol distillation column will be explored experimentally to produce information to predict economic optimum and energy optimum conditions of operation.	Solar energy to distill fuel alcohol will greatly improve the energy yield/energy required ratio for fuel alcohol production, and can significantly reduce the use of natural gas for fuel alcohol production.
80-W-2-1	J. Carter/ Jay Carter Ent., Tesco, possibly U.S. DOE	$50,000	25	Develop and test a 125 kw wind turbine.	Provide assistance in developing Texas manufactured wind turbine which could have strong applications for irrigation, medium industry, schools, institutions, etc., at costs significantly lower than other commercial units.

ELG PROJECTS RECOMMENDED FOR FUNDING (JUNE 11, 1980)

IV. Projects related to use of alternate energy resources and improved energy efficiency in industrial and electric generation applications.

SPI #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-L-2-1	T. F. Edgar/ University of Texas at Austin	$36,382	35	Investigate natural sulfur retention characteristics of lignite ash during fluidized bed combustion. Operate and analyze data from continuous feed fluidized bed combustor, conduct laboratory ashing studies, simulate fluidized bed combustion via computer modeling.	Increase knowledge of the potential advantages of FBC of lignite. FBC may be of major importance in the use of lignite by industry and electric utilities.
80-L-3-1	G. E. Brewer/ Black, Sivalls & Bryson, Inc.	$100,000	40	Design fixed bed gasifier for conversion of lignite synthetic low BTU gas. Design to be based on installation of system at Elgin Butler Brick Company, Elgin, Texas.	Establish the feasibility of fixed bed gasification of lignite by small to medium size industry. Provides alternative to natural gas combustion.
80-L-6-3	H.B.H. Cooper/ University of Texas at Austin	$32,553	100	Investigate baseline composition and acidity of rainfall at selected sites in Texas, natural atmospheric assimilative capacity, and spatial and temporal variations in composition at sites.	Develop better understanding of existing rainfall composition and acidity in Texas. Better understand mechanism of rainfall acidification and potential contribution of lignite use.
80-L-6-4	R. L. Petty/ Radian Corp.	$53,474	100	Analyze comparative impacts of industrial use of lignite directly versus synthetic BTU gas from lignite. Analyze state regulatory posture regarding these alternate utilization options.	Establish the effects of existing state regulatory programs on synthetic fuel development in comparison to potential environmental impacts. Med BTU gas potentially of major importance to Texas industry.

EDG PROJECTS RECOMMENDED FOR FUNDING (JUNE 11, 1980)

IV. Projects related to use of alternate energy resources and improved energy efficiency in industrial and electric generation applications. (Continued)

SPI #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-S-3-1	L.L. Vant-Hull/ University of Houston	$3,000	33	Heliostat field optimization for a privately funded solar electric repowering study costing over $300,000.	U.S. DOE is committed to funding more than half of the cost ($100 million each) of two repowering installations. EDF support of the project will indicate that Texas is interested in having a solar repowering facility in Texas.
80-S-3-3	H. W. Prengle, Jr./University of Houston	$55,705	85	Develop a short cut method, based on empirical data presentation, for quick evaluation of Texas site specific costs of central receiver systems for cogeneration of electricity and process heat.	Cogeneration can reduce significantly the cost assigned to solar thermal electricity by using the rejected energy for process heat. A short cut evaluation will save much time over detailed specific cost calculations.
80-S-3-4	J. M. Sanna/ Oscar Mayer Co.	$70,279	50	Analysis and detailed design of a parabolic trough concentrating solar collector system to provide heat to cook meat. Installation phase to be considered later.	It is important to the development of moderate temperature solar energy in Texas that facilities be installed to demonstrate success and generate operating experience.

APPENDIX C

EDG PROJECTS RECOMMENDED FOR FUNDING

September 25, 1980

I. Projects to develop and demonstrate more energy efficient comfort conditioning to reduce a major energy consumption use in Texas commercial and residential sectors.

SPI #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-S-8-2	Mei/Lamar U.	$27,570	43	An existing groundwater heat pump system will have added: a return well, coils to exchange heat with earth, solar collectors, and a geothermal well. The wells and earth coils will be used as heat source, sink, and storage.	Direct comparison of cost effectiveness among groundwater heat pump, solar assisted heat pump, geothermal energy, and earth temperature energy for various energy storage configurations.
80-S-8-5	Nash/Girl Scouts	50,000	39	Domestic hot water and solar assisted heat pumps will be installed during expansion of existing building. Solar Engineering and D.P.& L. to report and study.	Only limited installations have been made of solar assisted heat pumps, so useful performance data will be obtained. The local utility will contribute to making a showplace visitor's center in the building (D.P.& L.)
80-S-8-6	Kettleborough/ Texas A&M	28,739	53	A small-scale demonstration unit incorporating solar regeneration of dehumidification desiccant coupled with indirect evaporative cooling will be used to experimentally verify the results of a design simulation study already completed.	The computer simulation program can be used with confidence for design purposes once its reliability has been established through experimental verification.
80-S-8-8	Deffenbaugh (SwRI)/Comal County MHMR Center	30,035 Subject to DOE support	23	An existing building will be renovated and retrofit to incorporate passive solar options and energy saving features, including the addition of evaporative coolers.	The passive solar and energy saving retrofit will be widely publicized. Performance data will be collected and evaluated. Potentially leverages extensive DOE funds.
78-C-6-2c	Jones/UT-Austin	10,000	77	To develop a technique by which parameterized results, obtained as in previous work, can be easily used to obtain economic attractiveness of groundwater heat pump systems in any part of Texas.	This will lead to quick and easy economic evaluation of candidate sites for groundwater heat pump systems.

I. Projects to develop and demonstrate more energy efficient comfort conditioning to reduce a major energy consumption use in Texas commercial and residential sectors. (Continued)

SPI #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
78-S-0-13c	Jenkins/ Texas A&M	$12,000	76	To compare performance under identical conditions of systems incorporating flat plate collectors of high individual rating against systems incorporating collectors of low individual ratings.	Previously funded work indicates that there may no significant difference in overall performance between systems with expensive, high rating collectors vs. systems with inexpensive, low rating collectors.
78-S-1-5c	Garrison/ UT-Austin	50,000*	42	Based on passive solar research funded by TENRAC, a passive solar residence will be designed for each of the eight climactic regions of Texas.	Examples of the application of TENRAC sponsored passive research to all parts of Texas should stimulate the building of residences incorporating new passive solar principles.
		*Up to $50,000 subject to satisfactory completion of evaluation.			

I. Projects to develop and demonstrate improved controls for maximizing energy efficiency of existing energy intensive operations.

SPI #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-C-1-3	Hart/Energy Engineering Associates, Inc.	$19,900	100	Develop a mathematical model and explore the economics of reducing air flow through HVAC systems, instead of raising chilled water temperature, as building control temperature is raised.	Preliminary calculations indicate that more energy can be saved by reducing air flow, but the comparative economics are presently unknown. There is no evidence that this control approach has been tried but technical evaluations strongly support the effort.

III. Projects to develop and demonstrate energy production from renewable energy sources.

SPI #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-S-8-1	Whitacre/ UT-El Paso	$12,000	17	Install solar powered laundromat on campus: clothes drying and water heating.	Moderately concentrating collectors produce heat for wash water and, uniquely, heat for drying clothes. This matches up with DOE appropriate technology partial funding.
78-W-4-1c	Nelson/WTSU	13,471	69	Extend operation of wind assist irrigation system to document annual energy production, operational reliability and maintenance requirements.	The project is being widely observed for potential applications. Additional operational experience and reliability testing are needed as a basis for consideration of other uses.

EDG PROJECTS RECOMMENDED FOR FUNDING (SEPTEMBER 25, 1980)

I. Projects related to use of alternate energy resources and improved energy efficiency in industrial and electric generation applications.

SPI #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-C-4-3	Schmidt/ UT-Austin	$ 10,000	28	Develop industrial energy conservation software for microcomputers.	The computer programs would be used by small industrial users, without the expertise to develop their own programs, to make calculations of parameters for manual control of energy systems to improve efficiency. Industrial matching funds and verbal expression indicate extensive small industry interest.
80-L-6-4*	Petty/Radian Corporation	4,354	100	Analyze environmental and regulatory impacts of the use of medium Btu gas from lignite vs. the direct combustion of lignite in the existing industries on the Gulf Coast.	This amendment will allow the added effort necessary to compare approaches to lignite use on the basis of end use consumption rather than on the basis of mine mouth production as previously proposed.
*This is small	addition to previously awarded		contract.		
80-L-7-10	Owen/Radian Corporation	218,764	80	Generate baseline data on the atmospheric fluidized bed combustion of Texas lignites, and evaluate the potential for this technology in the state.	Generate information and data that would hasten the commercialization of this promising alternate technology for industrial applications. There is strong indication that fluidized bed combustion will be the most efficient system for using lignite in small industrial boilers but no actual use data is available.
80-L-10-2	Smith/Raba-Kistner	25,150	71	Investigate the use and disposal of solid waste from lignite-fired utility boilers in the context of the Resource Conservation and Recovery Act.	Provide information, data and recommendations on the possible disposal options for lignite fly ash within the state. The results will be useful to decisionmakers in the selection of the most equitable disposal systems.
80-L-11-1	Bartsch/ Texas Tech U.	15,039	75	Investigate the effects of leaching of lignite ash piles by rain and acid rain.	Will provide data that would aid in the selection of control technology for water runoffs from lignite ash piles.

IV. Projects related to use of alternate energy resources and improved energy efficiency in industrial and electric generation applications. (Continued)

SPI #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-L-11-2	Haterkamp/ Texas A&M	$9,296	61	Field evaluation of artificial revegetation in lignite mine spoils in Milam County of Central Texas.	The results will be useful in the selection of plant species in the revegetation of reclaimed mine sites and landfills. It will also provide field information in support of environmental impact analyses related to major lignite utilization.

Projects to assess and characterize available resources.

SPI #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-L-7-2	Zingaro/ Texas A&M	$36,565	42	Characterize the trace elements present in Texas lignite by identifying their presence, and by determining their concentrations in Texas lignite deposits and in the ash produced by their combustion.	Provide a data base for Texas lignite. Help in identifying processing or control requirements in mitigating environmental impacts resulting from the use of Texas lignite.
80-L-7-5	Mann/Texas Tech U.	24,019	67	Investigate kinetic properties, mass and thermal transport properties of Texas lignites for industrially important conversion processes such as pyrolysis and gasification.	Provide kinetic and physical data on Texas lignites that would be useful in the design of processes such as pyrolysis, gasification and lignite-CO_2 reaction.
80-L-7-9	Kaiser/ UT-Austin	80,008	83	Evaluate the deep basin lignite resources in the state by establishing their hydrogeologic setting, and to characterize their chemical and physical properties.	Will provide a not hitherto available realistic estimate of the deep basin lignite resources, their quality analyses and locational environments. Expected to stimulate widespread interest leading to eventual exploitation.

VI. University Coal Research Consortium Equipment

SPI #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
UCRC-80-1	Richardson/UH	$50,000	50	Purchase equipment to set up laboratory facilities in the area of process research and development for coal/lignite gasification and liquefaction.	This equipment will strengthen the University of Houston's capability to carry out anticipated work under the University Coal Research Consortium.
UCRC-80-2	van Rensburg/ UT-Austin	50,000	50	Purchase equipment to establish laboratory facilities for coal/lignite analysis and characterization.	This equipment will strengthen the capability of the University of Texas to carry out anticipated work under the University Coal Research Consortium.
UCRC-80-3	Selim/Texas Tech U.	19,500	50	Purchase equipment to set up laboratory facilities in the area of lignite/coal slurry transportation lignite gasification kinetic studies.	This equipment will strengthen Texas Tech's capability to carry out anticipated work under the University Coal Research Consortium.
UCRC-80-4	Hoskins/ Texas A&M	50,000	42	Purchase equipment to set up laboratory facilities for process research and development related to recovery of deep basin lignite.	This equipment will strengthen the capability of Texas A&M to carry out anticipated work under the University Coal Research Consortium.

APPENDIX D

EDG PROJECTS RECOMMENDED FOR FUNDING

December 10, 1980

EDG PROJECT RECOMMENDED FOR FUNDING (DECEMBER 10, 1980)

1. Projects to develop and demonstrate more energy efficient comfort conditioning to reduce a major energy consumption use in Texas commercial and residential sectors.

PI #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-C-7-2	Jensen/ Bywaters & Associates	$33,810	82	Evaporative cooled air will be used as heat sink for condensers of a residential and a commercial freon compression cooling system to demonstrate the cost effectiveness of the configuration	The lower condensation temperature results in a need for less electricity per unit cooling, and because of its simplicity, the cost of the retrofit is expected to be attractive.

III. Projects to develop and demonstrate energy production from renewable energy sources.

TTI #	Principal Inv/ Organization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-B-4-3	Staudt/ SwRI	$50,000	27	Investigate the utilization of vegetable oil as a diesel substitute and/or an extender. A stock engine will be tested with vegetable oils to determine operational characteristics.	Vegetable oils have strong potential to substitute or extend diesel fuel supplies. Preliminary research on test engines have shown promising results; however, additi testing with stock diesel engines is required to determine the practical aspects of using vegetable oils as a diesel substitute.
80-B-4-4a	Lusas/ TAMU	$50,000	40	Conduct the economic and engineering evaluation of using various grades of vegetable oils as a diesel fuel substitute.	Processing requirements and combustion characteristics must be determined for vegetable oils so that an economical but acceptable fuel can be obtained. Furthermore, economic and market studies are important to determine additional sources of vegetable oils and to understand impacts on existing markets.
80-B-6-6	Newton/ TAMU Goodin/ Texas Tech	$33,333	23	Test the production feasibility of four arid and semi-arid plant species which are typical to the Western half of Texas on four strategically located sites in West Texas. The four species represent strong energy production potential from biomass.	Native species of biomass in the Western half of the state have a strong energy production potential and a significant income producing potential on lands which generally have low income producing value.
80-W-4-1	Gilmore/ WTSU	$21,562	44	Install and test a wind turbine at the site of six stripper wells with the purpose of supplying a majority of the electrical power to the pumpers	Successful intergration of this concept could improve the value of stripper wells since they generally produce small quantities of oil and electrical costs for pumping can be significant

IV. Projects related to use of alternate energy resources and improved energy efficiency in industrial and electric generation applications.

PI #	Principal Inv/ organization	Recommended Funding	TENRAC %	Project Objectives	Significance
80-L-7-13	Colaluca/ TAMU	$39,406	88	Develop optimum briquetting processes for upgrading the reactivity and fuel quality of texas lignite	The information developed could lead to potential means of utilization for excess lignite fines that may result at future synfuel plants based on Texas lignite in lump or non-pulverized form.
80-L-11-4	Rose/ TAMU	$15,883	86	Survey variables in lignite decision-making and recommend appropriate regulatory policy to facilitate lignite development	The policy recommendations from the study are aimed at stimulating and encouraging expansion of private investment activity in lignite mining and development in the state.
80-L-11-6	Levy/ Espey,Huston & Associates	$11,525	50	Analyze historical data on impacts of acid rain on soil, vegetation, ecology, and surface water to provide basic data for environmental protection in lignite development.	The project will develop an overall plan for the state which will provide the perspective on acid rain impacts, on whether acid rain will be a problem in Texas, and will assist concerned state agencies such as TDWR & TACB in adequately planning their monitoring/ research/ regulatory roles.
80-S-9-2	Braun/ Travis-Braun	$29,625	50	Determine technical and economic feasibility of non-concentrating solar collectors to heat boiler feed water to 180°F in a corn sweetener plant.	This will demonstrate a savings of natural gas for industrial use in an application which will not require concentrating solar collectors.

APPENDIX E

DEEP BASIN LIGNITE CONFERENCE

EXECUTIVE SUMMARY DRAFT

APPENDIX E

DEEP BASIN LIGNITE CONFERENCE EXECUTIVE SUMMARY DRAFT

OBJECTIVE OF THE CONFERENCE

The TENRAC Conference on Deep Basin Lignite was held in Austin on February 5, 1981. The objective of the conference was to gather together experts, researchers and interested individuals from industry, universities, and the state and federal governments to discuss and identify the technological and institutional obstacles and needs for the development of deep basin lignite resources of Texas by in situ gasification technology.

RATIONALE

The rationale for holding this conference stemmed from TENRAC's recognition of the need to stimulate private sector interest in the development of the deep basin lignite resources of Texas (found at depths greater than 200 feet below the surface). The resources of shallow surface mineable lignite in the state are mostly committed for electric utility power generation. Some large gasification projects are also under study based on conventional gasification technology which will utilize shallow lignite. Economics of scale dictate that these projects be of large capacity requiring high capital. Raising large capital for such projects is likely to become increasingly difficult in the future. In contrast, the deep basin lignite recovery by in situ gasification offers the possibility of smaller capacity plants to meet both electric power and liquid/gas synfuel needs. In situ gasification appears thus far to hold the greatest near-term potential among the several alternate recovery technologies that could be considered for the recovery of deep basin lignite deposits in the state. This is because its technology is reasonably mature and it has some environmental advantages over other extraction technologies. A limited industrial interest has been demonstrated in Texas through a number of small field tests. Widespread commercial interest in the technology appears to be lacking at the present time. The objective of the conference was to address issues and the inhibiting factors that are causing this lack of momentum and to outline an overall plan that identifies what needs to be (or can be) done by the State, legislature, private industry and universities to stimulate interest in and to facilitate development of the deep basin lignite.

FORMAT

A one-and-a-half-day conference was held with the morning session comprised of keynote lectures and an afternoon session devoted to discussion and deliberation on the detailed specific needs of Texas in order to achieve the overall objective. The afternoon session followed a workshop format, with the participants divided into five groups according to each individual's interest and expertise. These groups, or task forces, were: (1) Process R&D, Laboratory Testing, Modeling and Subsidence; (2) Site Selection, Characterization and Resource Definition; (3) Environmental, Permitting and

Socioeconomic Aspects; (4) Field Testing and Hardware; and (5) Commercialization and Economics.

In order to facilitate the conduct of the task force session, five task force coordinating teams were formed, each with a membership of four to seven persons drawn from a variety of backgrounds, including at least one person from industry, academia and DOE/state government. These coordinating teams were stationed at their respective tables and moderated the discussion with the conference participants who came to their table. The task force meeting sessions were sufficiently flexible as to permit movement of the participants from one task force to another in the course of the afternoon. The continuity at each task force table was provided by the coordinating team. The total number of outside participants in the conference was 58, of which 27 served in the task force coordinating teams.

The task force coordinating teams themselves met together one day before the conference to discuss the details of how the task force session should be conducted and any particular needs. They met once again on the day after the conference to summarize the task force session of the conference, to derive a perspective of the findings of all the task force groups, and to discuss overlaps between task force groups. This was done also to aid in the writing of the conference recommendations which are incorporated in this report and are summarized later in this section. These recommendations should be considered as the consensus of the persons who participated in the conference, and individual differences of opinion are possible.

SUMMARY AND RECOMMENDATIONS

The following is a summary of the findings of the five task force coordinating teams. It lists the various areas where knowledge is lacking at the present time and the type of action that is needed in order to augment existing knowledge in the Texas context and to achieve the overall objective of facilitating deep basin lignite development. The details are given in the report. The recommendations do not specifically mention funding needs and sources, research priorities (except in the field testing area), and training needs. These were discussed but an acceptable general consensus could not be reached.

1. Process R&D, Laboratory Testing, Modeling and Subsidence:

The key position of data base development, mathematical models and process analysis/design/scale-up were recognized in the overall commercialization of in situ gasification technology starting from laboratory studies. A list was made of the major obstacles and unknowns specifically in the task force area, and a matrix was developed that identified the need for developing mathematical models, for experimental work and physical property needs. This is presented in Table 1. It was the consensus of the group that a large amount of data are already available and that better models are desired with predictive power. Priorities were discussed but were not decided.

Table 1. Anticipated R&D and Modeling Needs for In Situ Gasification of Texas Lignite

Models Needed	Experiments Needed	Physical Property Needs
Subsidence, rock motion: - First generation model improvement - Second generation model improvment - Thermal effects/drying	- Mechanistic experiments (fracture mechanisms)	Required
Cavity growth: - Relationship of roof collapse to subsidence model - Relationships to the following: - Chemical properties of coal - Physical properties of coal/drying - Water influx, moisture - Heat losses - Slag formed - Flow dynamics - Operating conditions - Linkage method	- Barrel experiments - Channel experiments - Transport phenomena (natural convection) - Tracer tests	- Reaction kinetics, etc. required
Gas quality: - Pyrolysis effects		Required
Casing/piping survival: - Thermo-mechanical - Operating conditions	- Barrel experiments	
Instrumentation: - HFEM, H_2O, etc.		
Linkage: - Reverse combustion - Hydrofracture - Others	(e.g., Corlett's experiments)	Required
General "process" models: - Water influx model - Gas leakage model - Process control model		
Water quality: - Post-burn water quality - Convection/diffusion	- Vapor transport, source formation	

2. Site Selection, Characterization and Resource Definition:

There was general agreement that for in situ gasification, lignite seams with a minimum thickness of six feet and occurring at depths of between 200 and 1,000 feet should be the preferred raw material. Thicker seams of a lower grade (5,000 Btu/lb.) would be preferable over thinner seams of a higher grade (6,500 Btu/lb.) lignite. There was no consensus on the optimum ash content in the lignite for in situ gasification. Resource recovery will depend on seam thickness, with higher recoveries (up to 50%) possible for thick seams. For five to ten feet thick seams, an overall recovery factor of about 30% was considered realizable. It was felt that a resource base of six million tons will be required for a 20 Mw power plant with 30-year life based on low Btu (125 Btu/sq. ft.) gas produced by in situ gasification of a 6,500 Btu/lb. grade lignite with a 50% overall recovery factor.

High lignite seam permeabilities were preferred. For establishing reverse combustion linkage, a lower limit of 25 to 30 milliDarcies was suggested. If the seam is an aquifer, the upper limit may be set around 100 milliDarcies, since a much higher permeability may cause excessive water influx. The highest permeability is preferred at the bottom of the seam. Permeability ratio of horizontal to vertical of greater than unity was preferred ($K_H/K_V > 1$).

The overburden and underburden with low transmittivities and with as much thickness as can be found are preferred for in situ gasification. The hydraulic conductivity or permeability should preferably be smaller in the vertical direction than in the horizontal ($K_H/K_V > 1$). It was pointed out that in Texas, the overburden roof may tend to be weak with unknown bulking character. Mud or shale roofs were preferred.

Locating a gasifier near a recharge area was preferred because water flow lines diverge, and dispersion and attenuation are the greatest. The natural water flow being downward, the movement of pollutants upward into overlying aquifers is minimized, even though the risk of localized well pollution will increase. In a discharge area there is a distinct threat of surface water contamination. Aquifer orientation, while not a major concern, should preferably be perpendicular to ground water flow.

Structural simplicity was considered desirable. The steepness of the dip determines the resource recovery possible at a given budget. Gasification updip was preferred. It was agreed that highly faulted sites should be avoided. Faults tend to displace the seam, interconnect aquifers and compartmentalize a site. Delineation of faults is expensive due to the need for integrated program of borehole and reflection geophysics.

Work is needed in the areas of internal seam stratigraphy to promote efficient gasification path, seam definition and characterization, and characterization of the overburden and hydrological environment. Knowledge is needed of the general topography of the lignite containing areas to determine ground water aquifer recharge and discharge areas. It was felt that a large-scale field test alone can answer some of the questions such as the overburden behavior and needs, and aquifer contamination.

3. Environmental, Permitting and Socioeconomic Aspects:

General need was expressed for studying all the aspects of environmental effects possible by in situ gasification and using environmental criteria in site selection. For adequate environmental monitoring both during and after gasification pre-burn conditions, such as composition of surface and underground fluid streams, should be defined and evaluated for all potential sites. It was felt that TENRAC could take a leading role in funding such monitoring and in the dissemination of environmental information so gathered. It was contended that aquifer monitoring for a small number of (three to four) key organic pollutants would be adequate, while the choice of the inorganic key pollutants would be site-specific and should be made with care. Trace element analysis should be carried out on the lignite, lignite ash, leachate, and the gas. The possibility of the state's bearing the risk of pollution was considered but rejected.

It was felt that a critical analysis should be made of the existing applicable federal and state regulations, and permitting requirements that are applicable to in situ gasification. This should be aimed at identifying conflicts and gaps between them, and any bottlenecks that may exist in their smooth implementation. Consideration should be given to the preparation of a "permitting" manual which will outline the regulations, procedures and the standards of compliance.

It was felt that the state should educate the general public at the county and local government levels concerning the implications of in situ gasification. The precise nature of such an effort was not delineated, but it was felt that local news releases and "rotary club" talks would be preferable to public hearings. Data and information that may become available from the currently public funded in situ projects in the state may be made use of in preparing such presentations.

4. Field Testing and Hardware:

Two major aspects were identified: small-scale field testing and large-scale field testing. The factors to be studied in these testing programs are shown in Table 2.

The small-scale field testing will address critical questions that can be answered and will prepare the ground for industry to proceed with specific large-scale field tests and commercialization. The rationale for the small-scale tests will be to provide broad Texas-specific information of a general nature to a broad section of users such as industry and regulatory agencies, and not to directly assist in commercialization. It was felt that the large-scale testing was expensive and high-risk, and should be carried out preferably at a later time (after the results of the small tests are available). Large-scale tests should be undertaken by private companies who want to develop the know-how and expertise, and with only sufficient degree of state interest or involvement so as to obtain public information of environmental concern and regulatory value. While the small tests will provide the answers to the critical questions on in situ gasification of Texas lignite, remove uncertainties, and also provide the necessary experience, it was suggested that the ultimate focus should be on carrying out the large-scale tests which alone can establish commercial feasibility.

Table 2. Field Testing - Programs for Study

I. SMALL-SCALE TESTING

A. Hardware:

1. Oxygen injection/well completion
2. Well survival/failure analysis
3. Well transitions: production to injection or vice versa

B. Viable Linking Alternatives:

1. Directional drilling
2. Reverse combustion
   a. Hydrology
   b. Stress state
3. Electrolinking
4. Pneumatic/hydraulic linking

C. Study Process Mechanisms:

1. Effect of flow rates/pressures
2. Role of instrumentation
3. Role of hydrology
4. Role of subsidence

D. Small-Scale Operation Difficulties:

1. Eliminate design problems
2. Study erosion/corrosion (on small-time scales)
3. Develop instrumentation

E. Learn Unexpected Things

II. LARGE-SCALE TESTING

A. Multiple Row Resource Recovery

B. Gas Quality:

1. Ability to control/influence
2. Decline of heating value/average gas quality

C. Process Fundamentals:

1. Check hypotheses from small-scale tests

D. Assess Environmental Risks

1. Aquifer contamination and its propagation
2. Roof collapse (by postmortem drilling) and subsidence assessment.

E. Further Design of Surface Facilities

1. Long-term operations
2. Long-term materials testing

Time requirements were discussed with varying opinions. It was felt that in a five-year period, two small tests and one large test could be successfully carried out. Decisions regarding siting of these tests, whether in the same general area or scattered over the state, will affect the time requirements.

Priorities were discussed for the various factors to be studied in the field tests and are listed below:

High priority	:	Hardware/well design Linking Process fundamentals
Medium priority	:	Environmental risk Multi-well testing
Low priority	:	Resource recovery Average gas quality Operating curves Surface facilities

No priorities were assigned to resource characteristics and to process control.

5. Commercialization and Economics:

It was recognized that Texas has a gas-based economy and a stable sizeable nearby market for any synthetic gas that may be produced by such technologies as in situ or surface gasification. The major market demand could be for medium Btu gas to supply the existing consumers either as synthesis gas (for methanol or ammonia) or as chemical feedstock. The economics of upgrading the medium Btu gas into methane (equivalent to natural gas) and the corresponding energy loss will need to be studied. The impact of price regulation/deregulation on natural gas may also affect the attractiveness of medium Btu gas from lignite. Medium Btu synthesis gas was considered superior to methane as a feedstock for ammonia and methanol production. It was suggested that an in situ gasification facility used for steam generation and power generation could be integrated with a larger surface synfuel facility using surfaced mined lignite.

Both the driving forces and the constraining forces related to the commercialization of in situ gasification in Texas were identified. The driving forces include the following:

- Fuels Use Act mandates greater substitution of conventional gas and oil.
- Resource availability is abundant (ownership is in private sector).
- Strong economic growth is evident in the state.

- Natural gas decontrol and increasing world oil prices will favor lignite-based gas.

- Positive state attitude/encouragement exists.

- Regulatory philosophy and approach are conducive to industrial growth.

- Social attitudes are supportive of industry.

- Constructions costs are low.

- Adequate trained labor is available, mostly non-union.

- Limited federal land and limited PSD Class I areas exist representing ecologically sensitive areas.

- Weather is moderate, and hence a favorable factor.

The constraining forces in the commercialization are:

- Localized or limited demonstrated experience and knowledge in Texas (except with Texas Utilities, Inc.).

- Possible shortage of surface water availability in the region as it affects overall industrial development.

- Excessive groundwater availability, which is used for drinking.

- Potential groundwater (drinking water) contamination (Simsboro and Carrizo aquifers).

- Presently undefined regulations (RRC/TDWR) with regard to groundwater policy and mining policy.

A list was developed of priority activities that TENRAC could promote and fund and is provided in Table 3.

Table 3. Suggested TENRAC Priority Activities to Promote Commercialization of In Situ Gasification

- Carry out/fund geologic and environmental characterization at regional and state-wide level.

- Support field experiments in thinner seams to determine sensitivity of economics to seam thickness.

- Promote field tests: two or three well tests to clarify technical unkowns; multi-well test to demonstrate technical feasibility, reduce financial risk, and facilitate commercialization; possibly leverage federal funds into the Texas program.

- Facilitate regulatory clarification and resolution.

- Develop product processing and testing capability of state universities.

- Identify expertise base in component areas of the technology.

- Promote information transfer while safeguarding proprietary data.

- Promote development activity through verbal encouragement.

- Support education in in situ gasification technology in engineering/science/research/training.

APPENDIX F

FIVE-YEAR TEXAS

ENERGY RESEARCH PLAN DRAFT

APPENDIX F

FIVE-YEAR TEXAS ENERGY RESEARCH PLAN DRAFT

Introduction

The Texas Energy and Natural Resources Advisory Council in cooperation with the four major university campuses, Texas Tech, the University of Texas, Texas A&M and the University of Houston, will undertake a biennial exercise of writing a five-year research plan for basic and applied university-type energy research. The purpose of the five-year plan is to increase the extent of overall reporting of research results, coordination of a Texas response to certain large national energy research proposals, outside professional review of the overall state research effort, and the writing of a five-year research agenda. This planning activity is intended to improve the productivity of the state-wide effort in energy research. The first five-year plan will be completed by June 1982 in order to be useful in the budget review process of the next legislature.

Reporting of Research Results

In the long term, the five-year planning effort will evolve a better and more consistent reporting format for all major entities who seek state funding for energy research. In order to complete the first year's report, however, existing published or to be published reports will be used to write a report summarizing what has been learned through energy research programs during the last several years since the oil embargo of 1973, when the state began an intensified new energy research effort. This report will develop in simple terms a timely composite report of energy-related R&D, indicating what has been learned, what has been accomplished, and what are the further needs.

Coordination of Certain Proposals for Federal Funding

TENRAC will remain abreast of major solicitations from the Department of Energy or other federal entities in which it is clear that we are being asked to participate in a nation-wide competition for the location of a major research facility or major energy project. As appropriate, TENRAC staff will bring such proposals to the Council's attention and coordinate with interested university research entities in the state in order to produce a combined and coordinated response.

Five-Year Research Agenda

Working jointly with the universities, the TENRAC staff will develop a draft research agenda for the upcoming five years. The plan will identify technologies and problem areas which are of particular importance to the State of Texas in order to guide research interest by various research entities in the state. Such a research agenda will provide guidance for TENRAC's management of the Texas

Energy Development Fund, guidance to the federal government concerning the importance of various technologies and problem areas to the State of Texas, and guidance to individual researchers and research managers of various research entities on all of the university campuses in the state.

Outside Professional Review

In order to increase the credibility of Texas energy research and to obtain outside review, an out-of-state review team will become a part of the five-year planning effort. The purpose of the review team will be to respond to the five-year research agenda, pointing out imbalances, gaps or redundancies. In order to better determine the extent of work and capabilities currently existing in the state, this review team will selectively interview and review research programs of particular importance to the five-year research agenda. This professional review team will provide perspective from elsewhere in the nation, point out gaps and redundancies as well as strengths and low-productivity research efforts. The review team's activity will also provide increased nation-wide visibility for the research capabilities in Texas.

Timing

The five-year planning exercise will be conducted cooperatively by TENRAC and the four major university campuses working through the Energy Institute Directors. The group will complete the writing of a report on current research results during the spring and summer. We will alert the Council to any needed coordination of a Texas response to federal funding and identify a team of approximately five professionals elsewhere in the nation to serve on the professional review group during the summer and fall. The group will write the five-year research agenda during the fall of 1981 to be reviewed by the professional review team and all identifiable major energy-related research entities in the state with a view towards completing the entire exercise prior to budget submission in May or June of 1982.

APPENDIX G

COMPREHENSIVE PLAN FOR

ALCOHOL FUELS DEVELOPMENT IN TEXAS

APPENDIX G

COMPREHENSIVE PLAN FOR ALCOHOL FUELS DEVELOPMENT IN TEXAS

Prepared by the Texas Energy and Natural Resources Advisory Council

April 1, 1980

INTRODUCTION

As this country moves to a comprehensive energy program which utilizes every available energy option, alcohol fuels from renewable resources have been receiving renewed and increasing interest. President Carter's goals to produce 500 million gallons of ethanol by the end of 1981 and 12 billion gallons by the end of this decade are very ambitious. In order to achieve these goals, heavy reliance must be placed on federal-state cooperation. Texas has the capability and resources to be a major element in a national alcohol fuels program. With positive technical and economic development, Texas could be one of the major ethanol producers possibly as early as 1985.

At the present time, because of legal impediments, Texas is probably two years behind the leading alcohol producing states. While Texas has vast resources for producing alcohol fuels, plant capacity must be developed. With adequate incentives, Texas could be producing over 100 million gallons per year in about two years. Necessary elements in the development of this industry are (1) encouraging commercial development and (2) supporting commercial development through research, development, demonstration and certification functions. Texas intends to be a major partner with the federal government in administration of an alcohol fuels program. The State of Texas will consider allocating significant amounts of state funds in addition to committing state management and technical resources to appropriate alcohol fuels programs.

COMMERCIAL DEVELOPMENT

There is strong interest in the private sector in Texas to develop ethanol production facilities. The expertise, the interest and the resources are in place; however, a strong commitment by the federal government backed by adequate funding is lacking. Texas interests are moving ahead without commitment or assistance from the federal government; without enhanced capital funding assistance in this time of national economic uncertainty, the level of development in Texas will be limited primarily to those who have large and ready assets. Tight money policy and high interest rates are major disincentives to large-scale commercial development; industry is simply not willing to make large capital investment during periods of recession.

If President Carter's goal is even to be approached by the end of 1981, an aggressive and expeditious program must be set in motion by the federal government early in the summer of 1980. In order to set up crash programs to produce large quantities of ethanol, the federal government must waive some of the inflation fighting mechanisms to allow capital investments in the alcohol industry. The current monetary policy and crash ethanol production goals are simply not

compatible. If industry is to proceed aggressively, loan guarantee programs, low interest subsidies and grant programs are imperative. Current loan guarantee programs being administered by the federal government are helpful, but more money and lower interest rates are needed along with more aggressive administration if the desired level of production is to be realized. When the federal government implements its crash alcohol fuels program, it is of utmost importance that a plan for rapid screening of projects and expeditious delivery of funding assistance be developed. A sixty day turnaround on funding assistance applications should be established as a maximum. Proposal processing should commence early in the summer of 1980 for project completions in 1981 or early 1982.

A comprehensive commercial development program should involve both ethanol production capability and production equipment manufacture. Significant capital funding assistance is required in order for the industry to develop to its full potential. In order to accurately identify projects which need capital funding assistance, a survey will be conducted if this plan is accepted by DOE. A list of projects which have potential for early commercialization will be compiled containing: name of project, capital cost, estimated date of construction completion and production start up, annual production capacity and projected sales prices of products.

The following five general program elements have been identified as having the greatest potential for early commercialization:

I. Plant Retrofits for Ethanol Production.

Breweries, corn sweetener plants, sugar production plants, and fruit and vegetable processing plants have capabilities to divert some of their excess or idle capacity into ethanol production. There is reason to believe that as many as ten Texas facilities could apply under this consideration. This may present the most immediate opportunity for large-scale production in a short time frame. Estimated development grants: Federal $450,000, State $50,000. Estimated capital funding: $50,000,000.

II. Medium to Large-Scale Commercial Ethanol Production.

Between 10 and 20 medium to large-scale ethanol production plants are in some phase of serious consideration in Texas. It is anticipated that over 100 million gallons and possibly up to 200 million gallons of ethanol production capability could be on line in eighteen months to two years. The majority of this capacity would come from a few large plants; however, a larger number of medium-size plants could produce significant quantities of ethanol. Estimated capital funding: $300,000,000.

III. Small-Scale Satellite Ethanol Production.

Development of small-scale satellite ethanol production capabilities where farmers produce low proof alcohol and transport it to local 200 proof conversion plants may have strong and immediate potential in Texas. Up to 25,000,000 gallons per year could possibly be produced via this system by several hundred farmers or small farm groups. Grants are needed to support feasibility studies and logistical problem solving. Federal funding assistance is needed to facilitate capital development. Estimated development grants: Federal $450,000, State $50,000. Estimated capital funding: $50,000,000.

IV. Commercial Ethanol Production Plant Manufacture.

Texas based ethanol production plant manufacturing capabilities need development. Support of design, construction, testing, demonstration and manufacture of small to medium-size (less than 4000 gallons per day) alcohol production plants is essential. Primary interest should be placed on providing assistance to projects which are already in some stage of development. As many as ten qualified manufacturers might require assistance with each manufacturer producing at least 12 plants per year. Estimated development grants: Federal $450,000, State $50,000. Estimated capital funding: $10,000,000.

V. Cellulose Conversion Pilot Plant Development.

Cellulose conversion technology may be on the verge of commercialization; at least one technology may be progressing to a prototype plant in the next year. The large availability of cellulose makes Texas a prime location for such a plant. Several Texas municipalities and industries have expressed interest in a cooperative program to develop a cellulose conversion plant. If commercialization is to be accomplished more rapidly, strong government support will be required to offset uncertainties of this technology. Estimated development grants: Federal $2,250,000, State $250,000. Estimated capital funding: $2,500,000.

SUPPORT FUNCTIONS

Strong support functions are necessary to complement and assist commercial development and to assure an effective transition to significant long-term alcohol fuel production and use in the future. State research, development, demonstration, extension, and equipment design standards and certification are necessary to provide adequate support functions. Research and development activities are needed to diversify the potential sources of biomass which can be economically converted to alcohol, to increase the variety of uses for alcohol fuels after they are produced and to identify and find solutions to the long-term technical and economic problems which might impede widespread, long-term utilization of alcohol fuels. Demonstration activities are needed to provide realistic operating experience with alcohol production plants. Such experience is an important prerequisite in the decision making process of groups and individuals seriously considering commercial alcohol production. Extension activities are needed to develop and transfer to potential alcohol producers information they need to make rational decisions about their involvement in alcohol production and utilization and, where appropriate, to assist them in implementing this decision. Finally, equipment design standards and certification are necessary to insure effectiveness of equipment. Certification of small and medium-sized production equipment is necessary for the protection of buyers who do not have benefit of technical assistance.

The following support functions are necessary to complement and assist commercial development:

I. Alcohol Fuels Institute.

Texas has some of the strongest technical capabilities in the nation. Nationally reputable universities and private research institutions have expertise on line that could allow rapid implementation of a coordinated research program. A strong need exists to coordinate Texas research, development, demonstration and extension capabilities so that expertise can be maximized and duplication of efforts minimized.

A Texas Alcohol Fuels Institute composed of the Texas Energy and Natural Resources Advisory Council, major state universities with energy programs, private energy research institutions and other entities is the most appropriate mechanism to provide state coordination. The Institute would be charged specifically with the responsibilities of facilitating research and development on alcohol fuel subjects, tracking state of the art developments relevant to Texas needs, demonstrating conventional and advanced technology, and disseminating pertinent information through information services and statewide seminars.

Oversight of the Alcohol Fuels Institute should come from a policy advisory board composed of members from the various entities which make up the Institute, the Executive Director of the Texas Energy and Natural Resources Advisory Council, and representatives from the private sector. The Institute would take maximum advantage of personnel at Texas Tech University and in the Texas A&M University System, including the Texas Agricultural Experiment Station, Texas Agricultural Extension Service, Texas Engineering Extension Service and Energy Extension Service. The Texas Department of Agriculture also has capabilities through its seed, marketing and information divisions which could provide strong statewide support to the Institute. Capabilities from other interested public and private sector entities would also be utilized. Administrative personnel would be selected and approved by the advisory board.

Upon program initiation the Alcohol Fuels Institute shall prepare a long-term program plan with an annual strategy for meeting the plan's objectives. Inputs from appropriate outside groups will be sought to insure responsiveness to the legitimate needs of those elements of the Texas economy involved in alcohol fuel development, production, and use. Consideration would be given to the recommendations from the Texas Energy and Natural Resources Advisory Council Committee on Agriculturally Derived Fuels. Ultimate program development and research contracting to the various member entities would be recommended and approved by the advisory board. All programs would be submitted to the Department of Energy for final approval before implementation. The administrative staff would be responsible for executing approved contracts, for monitoring project performance, for serving as liaison between contractors, the advisory board and the Department of Energy, and for publishing final project reports.

The following areas have been identified as requiring immediate attention by the Alcohol Fuels Institute:

A. Ethanol Production Research and Development.

The production of ethanol from biomass is the first step in creating a major United States synthetic fuels industry. In order to provide the necessary technical support, ethanol production research must be conducted so that optimized systems and advanced technology can be implemented at the earliest possible juncture. Initial production research is proposed in the following areas:

1. Preprocessing of feedstocks - Since a strong potential exists for non-grain feedstocks in the future, feedstock preprocessing requirements should be determined for sweet sorghum, sugar beets, sweet potatoes, and culled fruits and vegetables. Various technologies are available that when coupled with ethanol production technology could lead to significant alcohol yield increases over present methods; these require investigation. Funding requirements: Federal $90,000, State $10,000.

2. Alternative process heat sources - Use of natural gas, oil and electricity to provide process heat for ethanol production is the basis of much criticism regarding the energy balance issue. Research and development of alternative energy sources for ethanol production processes can help resolve the energy balance issue and also help reduce the per gallon cost of ethanol. Biomass combustion and gasification (cotton gin trash, rice hulls, hay, wood wastes, municipal solid wastes, etc.), solar energy, geothermal energy and waste heat from other industries have significance in the development of this industry. Funding requirements: Federal $45,000, State $5,000.

3. Conventional process optimization - Many of the presently available ethanol production plants are designed and manufactured based on beverage alcohol technology. Conventional technology requires optimization to provide the most effective alcohol yields and the most marketable by-products. Simplicity of operation, safety factors and maintenance procedures should be developed with both small and large producers in mind. Development of optimized systems can also help reduce the energy demand of production and help improve the quality and quantity of products. Funding requirements: Federal $45,000, State $5,000.

4. By-product utilization - By-product recovery and utilization are important factors for small and large producers when considering economic and energy balance feasibility. Distiller's grain and solubles must be effectively recovered, processed, stored and marketed if a viable production system is to be realized. Carbon dioxide and by-product oils also have strong potential. Research must be conducted also with regard to by-product utilization. Funding requirements: Federal $45,000, State $5,000.

5. Cellulose conversion technology transfer - Important cellulose conversion research is being conducted at numerous laboratories across the country. It is of utmost importance that Texas monitor the research and be prepared to implement this technology when it

becomes feasible. Investigations are required to determine retrofit needs of Texas industry and to develop programs which would facilitate commercialization in both existing and new applications. Funding requirements: Federal $45,000, State $5,000.

B. Ethanol Demonstration Facilities.

Demonstration facilities are needed at strategically located sites across the state to provide public access to alcohol production technology and experience. It is important that these facilities be operated by competent staff members who have developed hands-on experience with the equipment. This would provide necessary contacts for individuals who have questions or problems with their own facilities. Between three and six facilities are required in Texas to provide this important service. Demonstration facilities would be used to demonstrate feedstock processing, plant design and plant operation procedures, and to train producers for proper operation of their own plants. Funding requirements: Federal $1,000,000, State $200,000.

C. Ethanol Use In Engines.

Farmers and other commercial users of petroleum fuels are vitally interested in different options for motor fuel substitution so that they can achieve a degree of energy independence. Ethanol may provide one option for straight or high percentage blends; however, extensive investigation is required.

Claims have been made that straight hydrous and anhydrous ethanol can be burned in a diesel engine. This type of misinformation could result in serious damage to an alcohol fuels program and could cause significant financial hardship to those who are unfortunate enough to believe this information. Research that investigates and develops use options and also provides consumer protection is important. Both short and long-term testing are necessary to determine the immediate feasibility and long-term effects of alcohol fuel use. The most promising short-term options for using straight alcohol in proofs of 200 or less should be immediately investigated and information from this research should be made available to farmers and business persons at the earliest possible time. Long-term testing on varying proofs of alcohol in typical engines is required so that continued use impacts can be determined.

Southwest Research Institute has an on-going engine fuel development and evaluation program that includes various types of alcohol. This capability in addition to capabilities of other Texas organizations could allow an important interface for the expansion of alcohol fuels engine testing. Funding requirements: Federal $150,000, State $50,000.

D. Ethanol Production and Use Impacts.

Many possible impacts of large-scale ethanol production and use can be visualized which are worthy of investigation. Particular attention should be directed toward impacts related to various levels of grain

and/or cellulose input (for both feedstock and process energy). Consideration should also be given to economic factors, environmental effects, labor impacts, social impacts, and legal and regulatory needs. This information would be crucial to the satisfactory development of state policy and legislation. Funding requirements: Federal $50,000, State $10,000.

E. Ethanol Conventional Feedstock Development.

Since long-term large-scale ethanol production depends on development of feedstocks other than grain, research and development are needed on specially suited ethanol feedstocks to enhance alcohol yields. Advanced work needs to be conducted on sweet sorghum, high starch grains, sugar beets, sugar cane, etc., with respect to Texas and regional concerns. Texas currently produces significant quantities of sorghums, sugar beets and sugar cane. A redirection of research especially in sorghums is needed to produce high starch and high sugar crops instead of high grain yields and high forage yields. Funding requirements: Federal $250,000, State $50,000.

F. Cellulose Feedstock Availability and Development.

In addition to specially developed starch and sugar crops, cellulose feedstocks have a strong potential in the long-term large-scale production scenario. In fact, when considering the limitation of grain and other crop feedstocks, cellulose conversion probably has the strongest potential. This is definitely true in Texas, where possibly over one billion gallons of ethanol could be produced annually from available cellulose if technology were available and on line.

It is important that Texas develop comprehensive information on cellulose feedstock availability and distribution so that utilization options can be evaluated and determined. Work is needed to compile available information and provide economic and technological data with respect to these options. Funding requirements: Federal $50,000, State $10,000.

G. Long-Term Ethanol Use Options.

The most immediate and obvious option for ethanol use is the automobile engine; however, in the long term, other uses such as in burners, jet turbines, external combustion engines and coal-alcohol mixtures may have important prospects. In some cases, tracking of the technology development will meet the needs of Texas. In the case of alcohol-coal mixtures, especially ethanol-coal (ethacoal), research is required to evaluate its transport and combustion properties from both economic and technical standpoints. Ethacoal is seen as an attractive long-term possibility because of Texas ethanol production capabilities and extensive lignite reserves. Funding requirements: Federal $250,000, State $50,000.

H. Integrated Ethanol Production.

Integrated production of ethanol has strong positive potential because of economic and energy balance considerations. Very positive complementary relationships can exist among cattle feedlots, swine operations, poultry operations and ethanol production facilities. Also strong ties may be developed for waste heat utilization from utilities, refineries and other industries. Successful integration depends heavily on the logistics involved in the integrated facilities. Research should be conducted to identify and solve these technical and economic factors. Funding requirements: Federal $40,000, State $10,000.

I. Ethanol Information Development and Dissemination.

Substantial amounts of technical and economic information about alcohol production are not readily available to persons interested in various aspects of alcohol production and utilization. It is important that this information be reviewed, regionalized and put in an appropriate format for distribution to various target audiences. Such audiences should include members of the financial community, public officials, potential investors, farmers, plant operators, petrochemical representatives, etc. Information should cover a broad array of issues including:

Criteria for the operation and design of production equipment,
Production and preprocessing of various feedstocks,
By-product processing and utilization,
Alternative energy sources,
Water requirements and effluent disposal,
Alcohol marketing and utilization,
Economics of feedstock production and alcohol manufacturing,
Regulatory and legal requirements,
Engine modification for alcohol use, etc.

After information has been developed for targeted audiences, appropriate dissemination becomes important. The media for this activity should take the form of technical and semi-technical publications, workshops, short courses, symposia and one-on-one contact. The Texas Agricultural Extension Service has the ability to accomplish these tasks in all 254 counties of Texas through county extension agents and area agricultural engineers. Funding requirements: Federal $200,000, State $25,000.

II. Alcohol Fuels Production and Utilization Equipment Certification Center.

Many manufacturers of small and medium scale alcohol production plants and manufacturers of retrofit kits for engines, boilers and furnaces are appearing across the country. There is danger that some of these will produce equipment that will prove to be unsatisfactory. An important need exists to develop, establish, and apply standards and certification procedures for this equipment. The Department of Energy is encouraged to provide leadership by supporting standards and certification for this segment of the alcohol fuels industry.

Several different factors must be considered concerning the functioning of a standards and certification program. It is of utmost importance that impartial and technically competent evaluators with established credentials be selected. Strong measures should also be provided to protect proprietary information. In addition, sound technical evaluation standards and protocol must be developed to establish fairness and credibility. Southwest Research Institute is well qualified to perform these important services and has expressed interest in doing so. Funding requirements: Federal $1,350,000, State $150,000.

PROGRAM MANAGEMENT

The Executive Director of the Texas Energy and Natural Resources Advisory Council will be responsible for oversight and coordination of the comprehensive plan. TENRAC will assume direct responsibility for administering development grants with consultation and approval from the federal government. The Alcohol Fuels Institute will be administered as previously explained. TENRAC will oversee the operation of the Certification Center with program execution potentially delegated to Southwest Research Institute.

With the cooperation of other involved parties, TENRAC will prepare and publish an annual report concerning the administration of this program. Individual reports will be prepared on projects of special interest.

BUDGET

The budget necessary for satisfactory implementation of this program is divided into two subsections to correspond to the areas addressed in this proposal - commercial development and support functions (See Table 1). Of course, over $400 million in capital funds are not anticipated or desired by the State of Texas; however, these funds are essential to the development of a competitive alcohol fuels industry in Texas. Federal programs must be put into place rapidly in order to allocate these funds in time for aggressive encouragement of early commercialization. The State of Texas could provide assistance in expediting funding processes by proposal screening and recommendation to the federal government.

The State of Texas does anticipate cooperative assistance from the federal government with development grants and support grants. Funding to initially support this activity is estimated at $7,235,000 for the federal government and $1,010,000 for the State of Texas. This amounts to 85%-15% cost sharing. This should be a highly desirable formula for the federal government since a 90%-10% split is often encountered. Also, since most of these programs carry importance for a much broader region than Texas, the federal government would probably fund many of the projects 100%. Ultimately, both the federal government and the State of Texas benefit from this program; the federal government saves on its level of funding allocation and the State of Texas is able to provide services that could not ordinarily be considered.

Commercial development grants are considered to be one-time allocations. Support functions are considered to be candidates for long-term commitments from the federal and state government.

CONCLUSION

Immediate commercial development is the key element in achieving President Carter's goals. In addition to direct commercialization efforts with regard to existing technologies, there must also be adequate support programs for further technology development and for meeting needs which arise in the commercialization process.

The State of Texas already has in place a parallel effort through the Texas Energy and Natural Resources Advisory Council and the Texas Energy Development Grant program. While state funding is nominal at this time, it could potentially be coupled with federal resources in a manner beneficial to both in the development of a program which could subsequently be expanded in Texas and possibly serve as a model for other states as well.

The program outlined should be considered as an initial effort; continued commitment over several years will be required for maximum potential to be achieved. The State of Texas is willing to commit funds and manpower to facilitate this program and is also willing to work cooperatively with the federal government on this effort.

Table 1. Budget Estimates for Comprehensive Alcohol Fuels Program

COMMERCIAL DEVELOPMENT

	Program Element	Capital Requirements	Development Grants Federal	Development Grants State
I.	Plant Retrofit	$ 50,000,000	$ 450,000	$ 50,000
II.	Medium-Large Plants	300,000,000	--------	-------
III.	Satellite Plants	50,000,000	450,000	50,000
IV.	Plant Manufacture	10,000,000	450,000	50,000
V.	Cellulose Conversion	2,500,000	2,250,000	250,000
	TOTAL-COMMERCIAL DEVELOPMENT	$412,500,000	$3,600,000	$ 400,000

SUPPORT FUNCTIONS

	Program Element	Initial Funding Requirements Federal	Initial Funding Requirements State	Subsequent Annual Funding Requirements Federal	Subsequent Annual Funding Requirements State
I.	Alcohol Fuels Institute				
	A. Ethanol R&D				
	1. Preprocessing	$ 90,000	$ 10,000		
	2. Alt. Process Heat Sources	45,000	5,000		
	3. Conventional Process Optimization	45,000	5,000		
	4. By-Product Utilization	45,000	5,000		
	5. Cellulose Conversion	45,000	5,000		
	SUB-TOTAL R&D	$ 270,000	$ 30,000		
	B. Ethanol Demonstration Facilities	1,000,000	200,000		
	C. Ethanol Use in Engines	150,000	50,000		
	D. Ethanol Production & Use Impacts	50,000	10,000		
	E. Conventional Feedstock Development	250,000	50,000		
	F. Cellulose Feedstock Availability	50,000	10,000		
	G. Long Term Use Option	250,000	50,000		
	H. Int. Ethanol Production	40,000	10,000		
	I. Ethanol Inf. Development & Diss.	200,000	25,000		
	Administration	25,000	25,000		
	SUB-TOTAL Alcohol Fuels Inst.	$2,285,000	$460,000	$1,000,000	$ 200,000
II.	Alcohol Fuels Equipment Certification Center	1,350,000	150,000	500,000	50,000
	TOTAL	$3,635,000	$610,000	$1,500,000	$ 250,000

TOTAL COMPREHENSIVE ALCOHOL FUELS PROGRAM RECAP.

	Capital Funding	Grants Federal	Grants State
COMMERCIAL DEVELOPMENT			
Capital Requirements	$412,500,000	-------	-----
Development Grants		$3,600,000	$ 400,000
SUPPORT FUNCTIONS			
Alcohol Fuels Institute		$2,285,000	$ 460,000
Alcohol Fuels Equipment Certification Center		1,350,000	150,000
TOTAL	$412,500,000	$7,235,000	$1,010,000

APPENDIX H

ASSISTANCE TO RD&D PROJECTS

APPENDIX H

Assistance to Major RD&D Projects

Texasgulf Solar Cogeneration - Ft. Stockton, Texas

General Electric Company contract with DOE/SFO.

April 1, 1980	-	Letter in support of proposal signed by Holloway.
December 3, 1980	-	Mauk attended Project Review Panel meeting in Schenectady.
February 11-12, 1981	-	Mauk attended DOE/Sandia project review in Ft. Stockton.
March-April 1981	-	Mauk will attend Project Review Panel meeting at Albuquerque.
June 1981	-	Mauk will review Final Report.
Fall 1981	-	DOE will release a Program Opportunity Notice.
Spring 1982	-	Texasgulf Chemicals Company will submit a proposal to DOE to build a facility to produce 2.5 Mw electricity and 21 Mw process heat. The facility will cost about $25 million, of which Texasgulf might propose to pay $3 million.

There will be seven candidates, of which DOE will probably fund one. A $1 million participation by Texas would greatly enhance the possibility of securing this facility for Texas.

Assistance to RD&D Projects

SumX Corporation - Austin, Texas

October 11, 1979	-	Letter of support signed by Holloway to DOE regarding Integrated Farm Energy Systems Proposal.
October 1979-October 1980	-	Contact with DOE to set up a cooperative agreement using EDA funds.
October 1980-Present	-	Coordination with DOE regarding the administration and supervision of the project.

Biomass Production Projects

The following is a list of biomass production projects which have received general assistance from TENRAC staff.

Name	Type of Assistance
Dr. William March Director of Interdisciplinary Research Texas Tech University Lubbock, Texas	Advice on development of a cotton gin trash combustion project
Raymond Watson Corporate Energy Control Anderson-Clayton Houston, Texas	Letter of support to DOE
Paul Davis Gulf Coast Waste Disposal Authority Houston, Texas	Letter of support to DOE
Jerry Griggs ERCO Houston, Texas	Contact regarding possibility of biomass gasifier demonstrated in Texas
Ray Anderson Temple-Eastex, Inc. Diboll, Texas	Letter of support to DOE ($627K awarded for feasibility study)
Frank Swartz American Recycling Corporation Arlington, Texas	Letter of support to encourage DOE Office of MSW to fund this project
Bert Wilhelm Wilhelm Corporation Dalhart, Texas	Letter of support to DOE for alcohol/diesel RD&D

Wind Production Projects

The following is a list of wind production projects which have received general assistance from TENRAC staff.

Name	Type of Assistance
Dr. Alessandra Lippucci Alternative Energy Division The Republic Group	General assistance regarding the placement of several 200 Kw wind turbine generators in Texas
Carl Nordquest SERI	General assistance regarding government programs and Texas situation

Ethanol Production Projects

The following is a list of alcohol production projects which have received general assistance from TENRAC staff.

Name	Size	Type of Assistance
J. E. Adcock, Jr. Adcocks Alcohol Fuels Route 1, Box 3B Venus, Texas 76084	Small	General assistance on government programs
AFS Research Corporation P. O. Box 1543 Waco, Texas 76307	Small	General assistance on government programs
Agriculture Energy Development Corporation P. O. Box 748 Round Rock, Texas 78664	Small	General assistance on government programs
Alcohol Technology, Inc. 231 East Cameron P. O. Box 1489 Rockdale, Texas 76567	Manufacturer	General assistance on government programs
American Cotton Growers P. O. Box 499 Crosbyton, Texas 79322	Large	General assistance on government programs
Amstar Corporation P. O. Box 169 Dimmitt, Texas 79027	Large 15,000,000 GPY	General assistance on government programs

Name	Size	Type of Assistance
Al Askew Agrihol Corporation Austin National Bank 2220 6th Street Austin, Texas 78701	Large 10,000,000 GPY	General assistance on government programs
Center for Energy Research Texas Tech University P. O. Box 4200 Lubbock, Texas 79409	Small	Funding and general assistance on government programs
Central Texas Grain Products Co-op Hutto, Texas 78634	Large 30,000,000 GPY	General assistance regarding government programs and Texas situation
Raymond Cowley Rio Grande Valley Sugar Growers, Inc. P. O. Drawer A Santa Rosa, Texas 78593	Large	General assistance regarding government programs and proposal development for USDA loan guarantee
Bill Franklin Sabor Refining Corpus Christi, Texas 78400	Large	General assistance on government programs and Texas situation
Paul Green Navarro Jr. College P. O. Box 1170 Corsicana, Texas 75110	Large 20,000,000 GPY	General assistance on government programs, Texas situation and letter of support to U.S. DOE
Harris Hospital Methodist 1300 W. Cannon Fort Worth, Texas 76102	Small	General information and information on government programs
F. Lee Hicks Lone Star Feedyard P. O. Box 308 Happy, Texas 79042	Medium	General information, information on government programs, and information on Texas situation
High Plains GPI Co-op, Inc. Muleshoe, Texas 79347	Large 30,000,000 GPY	General information on government programs and Texas situation
Neal Howell Hansford Feedyard, Inc. Spearman, Texas	Manufacturer	Letter of support to DOE

Name	Size	Type of Assistance
Mike Metcalf MAPCO Dumas, Texas 79029	Large	General information on government programs and Texas situation
Hondo Farmers Co-op c/o Gen. Kenneth Milam P. O. Box 30146 San Antonio, Texas 78285	Large	General information on government programs and Texas situation
Northwest Texas Grain Products Co-op Dumas, Texas 79029	Large	General information on government programs and Texas situation
Joe Pate P. O. Box A Plainview, Texas 79072	Large	General information on government programs and Texas situation
Charles Payne Diamond Shamrock Corporation Amarillo, Texas	Proposed manufacturer	General information on government programs and Texas situation
Thomas F. Phillips Best Incorporated 2215 West Highway McAllen, Texas 78501	Medium	General information on government programs and Texas situation
Tony Poulus Schlitz Brewery Milwaukee, Wisconson	Proposed manufacturer	General information on government programs and Texas situation
Charles L. Stanphill SBW Energy Corporation 1108 Redbud Ct. Arlington, Texas 76012	Manufacturer	Letter of support to DOE
Howard W. Stern AquaTec Development 8800 Fondren Houston, Texas 77074	Small	General information on Texas situation and letter of support to DOE
Stilp Corporation P. O. Box 26 Coupland, Texas 78615	Manufacturer	General information on government programs and Texas situation
Uvalde Farmers Co-op c/o Gen. Kenneth Milam P. O. Box 30146 San Antonio, Texas 78285	Large	General information on government programs and Texas situation

Name	Size	Type of Assistance
Gene William Central Texas Energy Supply Corporation P. O. Box 178 Brownwood, Texas 76801	Large	General information on government programs and Texas situation
Ed Wolley P. O. Box 274 Danburg, Texas 77534	Small	General information on government programs and Texas situation
Warren Maupin Marlin, Texas 76661	Small	General technical assistance, information on government programs, and general information

Assistance to Special Projects

U.S. DOE - Rockwell International Small Wind Energy Conversion Systems Field Evaluation Program

October 1979	-	Developed guidelines for site and wind unit selection.
December 1979	-	Selected sites and wind units. Brownsville (PUB) and Iowa Park (TESCO).
Spring 1980	-	Inspected sites with Rockwell International staff.
Fall 1980	-	Wind units installed.
October 1980	-	Brownsville unit visited by Avant and Rockwell International staff.
October 1980-Present	-	Continuing contact with utilities regarding wind turbine performance.

Over 25 individuals or utilities were contacted and participated in this program.

Report of the Advisory Committee on Agriculturally Derived Fuels to the Texas Energy and Natural Resources Advisory Council

Summer, Fall 1979	-	Preparation and review.
December 1979	-	Submitted to TENRAC.

Trip to Washington, D.C. and New York - Avant

October 28-November 1, 1979	- Wind Energy Conference.
	- Contacted biomass and wind officials in DOE and gasohol interests.
	- Inspected NYU cellulose conversion facility.

Comptroller's Office

November 20, 1979	- Avant provided comments on state property and sales tax exemption regulations from Comptroller's Office.

General - Gasohol

January 1980	- Avant prepared information publication on gasohol providing general discussion, references and contacts

Dr. Howard Coleman, U.S. DOE Office of Alcohol Fuels

February 1980	- Avant established contact.
March 11, 1980	- Avant set up meeting for Dr. Coleman with various state officials.
April 1, 1980	- Avant prepared proposal on comprehensive alcohol fuels program for Texas.
April 8-9, 1980	- Avant presented Alcohol Fuels Proposal to U.S. DOE in Washington.

General - Biomass and Wind Energies

May 7-8, 1980	- Avant traveled to Sandia Labs for inspection tour of wind facilities and to contact George Tennyson, U.S. DOE, concerning the Texas Wind Turbine Development Proposal and possibilities for a Wind Test Center. Also traveled to SERI for a briefing on solar, biomass and wind programs and possibilities for cooperation.

National Alcohol Fuels Commission

June 1980-Present	- Avant provided information on status of alcohol fuels in Texas.

Environmental Policy Institute

July 17, 1980
- Avant commented concerning synfuels plant impact on prime farm lands.
- Avant prepared letter for Governor's response.

Governor's Office

July 23, 1980
- Avant provided briefing on Updated Economic Situation of Gasohol for Governor Clements.

General - Alcohol Fuels

July 29, 1980
- Avant advised Texas alcohol fuels groups of U.S. DOE Alcohol Fuels Technology Grants through mass mail-out.

Farmers Home Admininstration Loan Guarantee Regulations

August 27, 1980
- Avant commented on proposed FmHA regulations concerning alcohol fuels loan guarantee programs.

U.S. DOE Loan Guarantee Regulations

September 10, 1980
- Avant commented on proposed U.S.DOE regulations concerning alcohol fuels loan guarantee programs.

McGraw-Hill Synfuels Publication

December 8, 1980
- Avant prepared information on Texas resources program support and regulations for the synfuels industry.

Peter Felker, University of California - Riverside, Mesquite Project Transfer to Texas

December 1979
- Avant contacted TAMU, TTU, TAI, Sul Ross, UT/El Paso concerning Dr. Felker's intended move and his design to find a university to support his project.

UNEP 3 Proposal - Electrified Automotive Vehicle Transportation System

Fall 1979
- Avant reviewed proposal for Governor Clements' comments in form of a letter of reply.

Fedil C. Porter, Waste Management, Inc. - Austin, Texas

February 8, 1980	-	Avant reviewed literature on product called Fertilaid regarding its energy conservation capabilities. Sent letter of acknowledgement but did not encourage submittal of a proposal to TENRAC.

Texas Gasohol Report, TENRAC-TAMU

Fall 1980	-	Avant reviewed, commented, wrote several sections on state impacts and technology applications.

Assistance to RD&D Projects in Coal/Lignite and Geothermal Areas

Contracted Projects

Uncertainties in coal resource assessment: Bureau of Economic Geology, University of Texas at Austin

June-July 1980	-	Rao reviewed interim report on the project prepared for the funding agency, Electric Power Research Institute (EPRI).
June 1980-February 1981	-	Review the monthly reports of the principal investigator, and preparation of overall monthly project status report for submission to EPRI. (Rao)

Uncontracted Projects and Special Issues

University Coal Research Consortium: University of Texas at Austin, Texas A&M University, University of Houston, and Texas Tech University

June 16, 1980	-	Rao met with UCRC Director for a briefing.
July 18, 1980 and September 11, 1980	-	Rao and Ray participated in the executive committee meetings.
October-November 1980	-	Rao and Ray coordinated to obtain specific plans on deep basin lignite development.
September 1980-February 1981	-	Rao arranged for purchase of TENRAC portion of UCRC equipment by the State Purchasing and General Services Commission.
November 1980-February 1981	-	Rao kept UCRC informed of various RD&D solicitations from such agencies as DOE, GRI, etc., and encouraged them to respond.

February 1981	-	Rao prepared a summary of comments and recommendations made by the TENRAC Coal and Lignite Advisory Subcommittee on UCRC on the April 1980 UCRC research plan.

Eleventh Biennial Lignite Symposium in San Antonio

November 1980-February 1981	-	Rao assisted in the organization of the symposium (scheduled in June 1981) and in the preparation of the conference brochure.

Transco's medium Btu gasification project in Robertson County

July 29, 1980	-	Rao attended an open public meeting organized by Transco at Franklin to inform about its medium Btu lignite gasification project, and about the DOE funded feasibility study underway.
October 2, 1980, January 9, 1981, and February 18, 1981	-	Rao and Ray met with Transco representative to learn of the progress of the project, and to provide continuing encouragement and possible assistance.

Republic of Texas Coal Company's in situ gasification feasibility study

December 9, 1980 and January 16, 1981	-	Rao and Ray attended briefing/technical meetings on the project.

Synfuels Development in General

August 22, 1980	-	Holloway, Rao, Ray and other TENRAC staff attended a briefing on Exxon's proposed commercial-sized medium Btu lignite gasification plant in east Texas.
October 20-21, 1980	-	Rao attended a preproposal conference of DOE at Washington,D.C. on DOE's alternative fuels solicitation (loan guarantees, purchase commitments and price guarantees). Met with DOE's Office of Gas personnel at Germantown.
October 6, 1980	-	Holloway, Rao and Ray visited the in situ gasification field test facility of Texas A&M University near Rockdale.
October 1980	-	Rao established contacts with Union Carbide Corporation and Celanese Chemicals to find out the details and status of their DOE funded coal/lignite gasification feasibility study projects in Texas.

September 3, 1980 and October 23, 1980	-	Rao and Ray met with Worley Engineering Company regarding their proposed low Btu lignite gasification project.
October 16, 1980	-	Rao and Ray met with Energy Resources Company regarding possible major application of atmospheric fluidized bed combustion technology for unconventional oil recovery from tar sands in southwest Texas.

APPENDIX I

EDF PROJECTS PUBLICATIONS LIST

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EDF PROJECTS PUBLICATIONS LIST

EDF-004 Project Status Reports - January 1979

EDF-005 Input-Output and Risk Analysis for a Regional Energy Development Bank - Weatherby, Jr., Kieschnick, Jr., Peach and Wieferman (Project #SP-1-2)

EDF-006 Solar Energy: An Economic Analysis, Parts I and II - Hill, Jonish and Teske (Project #SP-2-6)

EDF-008 Solid Fuels Conversion Costs for Texas - Coal and Lignite Utilization in Electric Power Generation and Other Industries - Singleton, Jr., Muthukrishnan, Taylor III, and Thompson (Project #SP-2-10)

EDF-009 Community-Level Impacts Projection System (CLIPS) - Monts and Bareiss (Project #SP-3-6)

EDF-011 Integrated Assessment of Texas Lignite Development, Volume I - Technical Analysis (Project #L-4-7)

EDF-011 Integrated Assessment of Texas Lignite Development, Volume II - Policy Analysis (Project #L-4-7)

EDF-013 Investigation of the Conservation Potential of Residential Heat Pumps with Thermal Energy Storage (Project #C-4-2)

EDF-014 Groundwater Heat Pump HVAC Demonstration Project, Phase I - Design Development (Project #C-6-1)

EDF-015 Development and Demonstration of Low Cost Heliostats - Northrup, Incorporated (Project #S-5-5)

EDF-016 A Consumer's Guide for Wind Energy in Texas - Nelson (Project #W-1-5)

EDF-017 Demonstration of Solar Energy Conversion of Agricultural or Industrial Wastes of Fuels - Dow Chemical Company (Project #B-0-2)

EDF-018 Alternative Energy Sources for Agricultural Applications Including Gasification of Fibrous Residues - Parker (Project #B-1-1)

EDF-019 Economic Feasibility for the Conversion of Texas Lignite to Petrochemical Feedstocks - Richardson (Project #L-3-1)

EDF-020 Systems Analysis of the Texas Gulf Coast Geopressured Resources - Zinn (Project #G-1-2)

EDF-021 Feasibility Analysis of a Regional Energy Development Bank - Hazleton (Project #SP-1-3)

EDF-022 Wind Assist Irrigation and Off-Season Power Generation - Gilmore, Nelson, Starcher and Barieau (Project #W-4-1)

EDF-023 Geothermal Exploration in Trans-Pecos, Texas - Roy and Taylor (Project #G-2-3)

EDF-024 Investigation of a Passive Wall and a Movable Roof of a Test Building -Mei (Project #S-1-1)

EDF-025 Energy Conservation Through Improved Irrigation System Design and Methods - Lyle (Project #C-5-2)

EDF-026 Low-Cost Solar Heating and Cooling Retrofit Demonstration - Beyer (Project #S-1-9)

EDF-027 Demonstration of a Low-Cost, Indirect Evaporative Cooling System - Dunn (Project #C-2-4)

EDF-028 Supersorbent Polymers for Dehumidification - Tock (Project #C-1-3)

EDF-029 Demonstration Ice Storage with Waste Heat Recovery Project - Shipper (Project #C-3-1)

EDF-030 Desiccant Dehumidification and Cooling with an Indirect Evaporative Cooler - Kettleborough (Project #C-1-2)

EDF-031 A CHARGAS Process: A Process for the Optimal Utilization of Lignite - Attar (Project #L-3-7)

EDF-032 Lignite Resources in Texas - Kaiser, Ayers, Jr. and La Brie (Project #L-1-1)

EDF-033 Torbett-Hutchings-Smith Memorial Hospital Geothermal System Demonstration at Marlin, Texas - Radian Corporation (Project #G-3-1)

EDF-034 Analysis of Sulfur Removal by Natural Sorbents in Texas Lignite Ash During Fluidized Bed Combustion - Edgar (Project #L-3-5)

EDF-035 Development of a Variable Loading Switch for Wind Turbines - Pinkston and Harris (Project #78-W-3-5)

EDF-036 Modular Solar House Retrofit Project - Jenkins (Project #78-S-0-13)

EDF-037 Testing of Innovative Collector - McKeen (Project #78-S-5-4)

EDF-038 Groundwater-Source Heat Pump Design Development for Texas, Volume I - Resource - Jones, et al (Project #78-C-6-2)

EDF-038 Groundwater-Source Heat Pump Design Development for Texas, Volume II - Applicability - Jones, et al (Project #78-C-6-2)

EDF-038 Groundwater-Source Heat Pump Design Development for Texas, Volume III - Economics and Summary - Jones, et al (Project #78-C-6-2)