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ENERGY CONSERVATION

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GRID-CONNECTED ICES: PRELIMINARY FEASIBILITY ANALYSIS AND EVALUATION

Final Report. Volume 1. Executive Summary

June 30, 1977

Work Performed Under Contract No. EC-77-C-02-4214

de Laureal Engineers, Incorporated
New Orleans, Louisiana

ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION

Division of Buildings and Community Systems

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GRID-CONNECTED ICES
PRELIMINARY FEASIBILITY ANALYSIS & EVALUATION

FOR

U.S. ENERGY RESEARCH & DEVELOPMENT ADMINISTRATION

FINAL REPORT

JUNE 30, 1977

VOLUME I OF III

EXECUTIVE SUMMARY

HEALTH EDUCATION AUTHORITY OF LOUISIANA

NEW ORLEANS PUBLIC SERVICE INCORPORATED

DE LAUREAL ENGINEERS, INC.

ORR - SCHELEN - MAYERON AND ASSOCIATES, INC.

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INTRODUCTION

de laureal Engineers, Inc. has performed the work of Phase I, Preliminary Feasibility Analysis and Evaluation, as required by Contract No. EC-77-C-02-4214 with the United States Energy Research and Development Administration (ERDA) for the demonstration of a Grid-Connected Integrated Community Energy System (ICES).

The contract work included a preliminary energy supply/demand assessment of the Demonstration Community, a preliminary feasibility analysis and conceptual design of a candidate Demonstration System, preliminary assessment of institutional factors, preparation of a detailed work management plan for subsequent phases of the demonstration program, firming-up of commitments from participating parties, and reporting thereon.

The Consortium involved in preparation of the Phase I work included de Laureal Engineers, Inc. and Orr-Schelen-Mayeron and Associates, Inc., the consulting engineers; New Orleans Public Service Inc. (NOPSI), the utility company; and the Health Education Authority of Louisiana (HEAL), representing the Demonstration Community.

The Demonstration Community for this program is identified as the HEAL Complex -- a 43-acre medical complex of hospitals, clinics, research facilities and educational facilities.

The work performed by the de Laureal Consortium was concluded with positive results. This study has further indicated that a central ICES plant producing steam, chilled water and by-product electricity to serve the HEAL Complex is technically and economically feasible to the extent that Phase II, Detailed Feasibility and Preliminary Design, should be implemented.

It should be noted that, although the same Consortium members will be retained, HEAL will assume the lead and the Contractor role with respect to ERDA for Phase II and subsequent phases of the program.

The report is presented in three volumes:

Volume I - Executive Summary

Volume II - Report Text

Volume III - Appendices

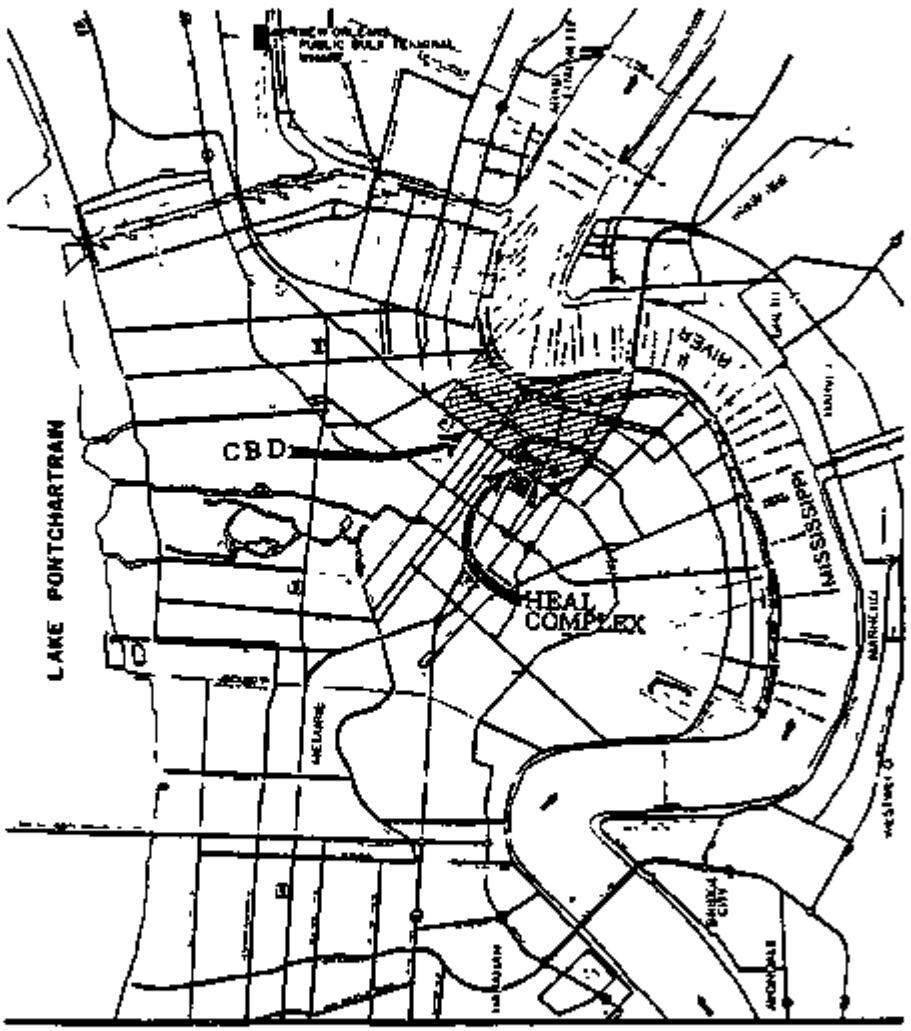
TASK I - PRELIMINARY ENERGY ANALYSIS

Demonstration Community

The Health Education Authority of Louisiana (HEAL) Complex, a state organization located on the fringe of the central business district of New Orleans, as shown in Figure I-1, is the Demonstration Community. The HEAL Complex is a group of hospitals, clinics, research facilities and medical education facilities. Primary member institutions are Charity Hospital of Louisiana, Louisiana State University (LSU) Medical Center, Tulane University Medical Center; secondary member institutions are the Veterans Administration Hospital and the Eye, Ear, Nose and Throat Hospital. Figure I-2 lists the existing buildings in the HEAL Complex. The composite site plan of the Demonstration Community, Figure I-3, illustrates the relative locations of the existing structures with respect to each other. HEAL is immediately adjacent to the New Orleans Civic Center and to the Louisiana Superdome.

Energy utilities presently used by the buildings are natural gas and electricity, supplied by New Orleans Public Service Incorporated (NOPSI). All existing buildings have chilled water systems for comfort cooling and gas-fired steam or hot water systems for heating requirements.

The Demonstration Community is located within a short distance from all primary transportation systems, assuring capability



MASTER SITE LOCATION MAP

SCALE (APPROX.)

EXHIBIT VII

MEAL COMPLEX - EXISTING BUILDINGS

FIGURE I-2

NO.	NAME
1	Charity - Main Hosp.
1a	Charity - Dibert Radiation Therapy Center
2	Charity - Contagion Unit
3	Charity - La Peyre/Miltenberger
4	Education Building (Leased to LSU by Charity)
5	Charity - Dibert Clinic Services
6	Charity - Women's Pavilion (OB - GYN)
7	Charity - Student Nurses Res.
8	Charity - School of Nursing
9	Charity - Maintenance Shop
10	Charity - Warehouse Building
11	Charity - Laundry Building
12	Charity - Power House
13	Charity - Building Service & Garage
14	Eye, Ear, Nose & Throat Hospital
15	LSU - School of Medicine
16	LSU - Residence Hall
17	LSU - Medical Education Building (Basic Science)
18	Veterans Administration (V.A.) - Hospital and Annex Building
19	V.A. - Hospital Bldg.
20	V.A. - Research
21	V.A. - Laundry, Boiler and Animal House
22	Tulane - School of Medicine
23	Tulane University - Teaching Hospital and Ambulatory Teaching Facility
24	Tulane - Environmental Medicine

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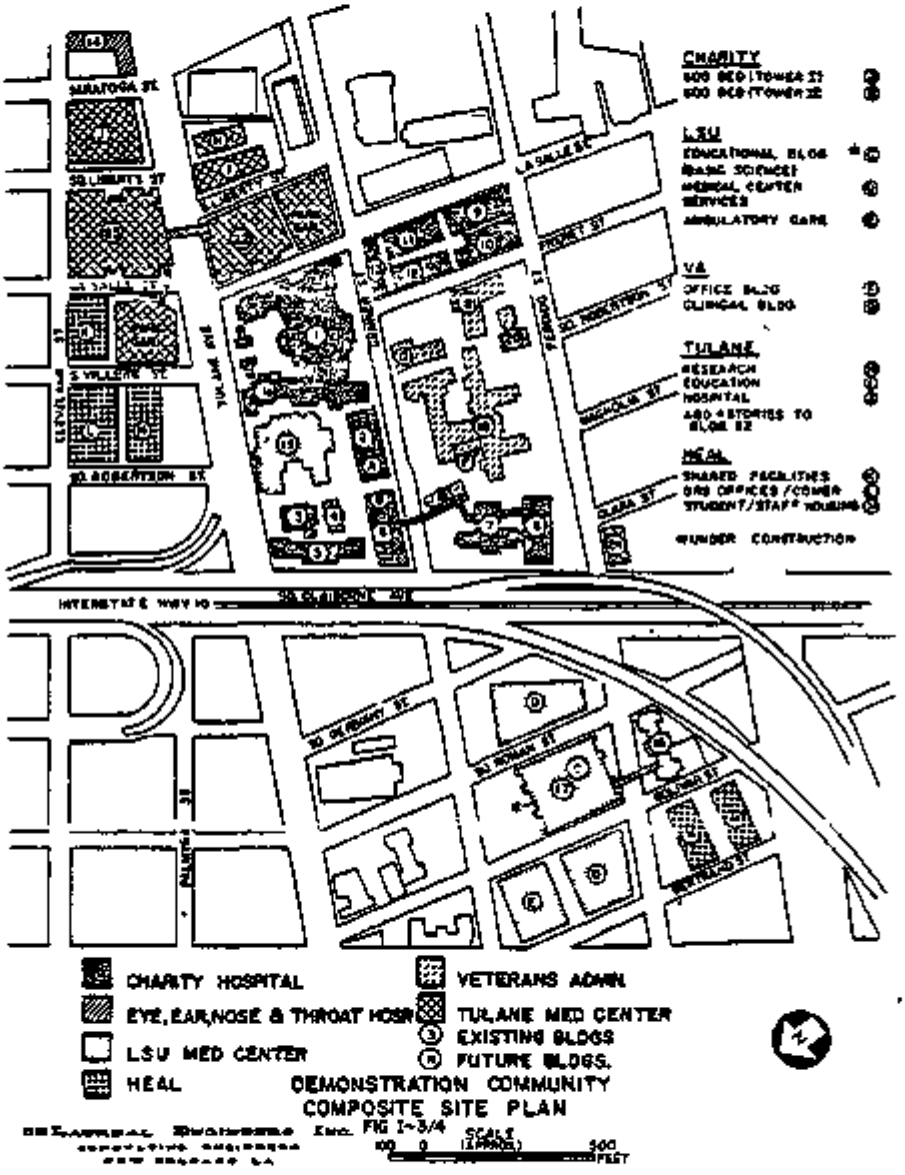

CHARITY
LSU
VA
TULANE
HEAL
NUMBER CONSTRUCTION
CHARITY HOSPITAL
EYE, EAR, NOSE & THROAT HOSP
LSU MED CENTER
HEAL
VETERANS ADMIN
TULANE MED CENTER
EXISTING BLDGS
FUTURE BLDGS.
DEMONSTRATION COMMUNITY
COMPOSITE SITE PLAN
FIG I-3/4
SCALE
500
FEET

for current and future importation and delivery of coal, the primary fuel for the ICES plant.

Future Growth of Demonstration Community

The HEAL master plan will double the existing facilities. Some older buildings will be razed and will be replaced by larger, modern facilities. Overhead first-, second- and third-level plazas and concourses or walkways are planned.

The future planned growth of the HEAL Complex is shown on Figure I-4.

The HEAL Complex is planned to develop in accordance with the following schedule:

	Area, Sq. Ft.
Existing Facilities	3,683,000
New Construction thru 1985	838,000
Sub-Total, year 1985	4,521,000
New Construction, 1985-1995	3,167,450
Total, year 1995	7,688,450

The thermal service demand capacities for the ICES central plant are based on requirements through 1985. Incremental development of demand for the two thermal utilities are:

	Steam, Pounds/Hour	Air Conditioning Tons
Existing Buildings	116,140	8,210
Future, thru 1985	40,910	4,050
Total, thru 1985	157,050	12,260

Demand Profiles

Service demand data and profiles were developed for electrical, steam and air conditioning requirements for existing buildings and for near-future demands anticipated for the NEAL Complex within the next eight to ten years and were used as the basis for establishing system service demands for the two candidate ICES Demonstration Systems.

Energy demand data and profiles were developed for the existing buildings only, indicating requirements for electricity and for gas, as fuel.

Peak thermal service demands are: 12,260 tons of air conditioning, occurring in the summer; 157,050 pounds of steam per hour, occurring in the winter.

Peak energy demands occur in the summer, and, in equivalent million BTU per hour are: electricity, 57.00; gas, 159.00; total, 216.00.

No non-building energy services are involved.

Conventional Energy System

A. Plant System-1, Conventional

The Conventional Energy System is defined as a conventional central heating/cooling plant with no electric generation. It utilizes more conventional steam pressures and temperatures, less expensive

equipment and is coal-fired, with oil standby. This plant system is included only as a basis of evaluation with Plant Systems 3 and 4 and is not offered as a candidate system.

B. Plant System-2, Existing

This plant system is also conventional in nature in that it currently exists and is composed of eight individual plants serving the member institutions forming the HEAL Complex, and also considers similar plant systems for the buildings planned for construction in the near future. These plants generate steam at relatively low pressures and temperatures and provide cooling effect by means of steam turbine driven and electric driven chilled water generating equipment. Fuel is basically interruptible gas.

C. Estimated Construction Costs

Plant System-1 (Conventional)	$20,829,600 (1)
Plant System-2 (Existing)	$11,586,350 (2)

(1) Includes 10% for escalation

(2) Based on 1977 replacement values

Candidate ICES

A. Plant System-3

This plant system produces high-pressure, high-temperature steam, which passes through a steam

turbine driving an electric generator and then to the steam distribution system for use in the various institutional buildings, and also generates by-product electric power to be fed into the NOPSI grid system. The power will be variable and directly dependent upon the steam generated to serve the community building systems. This plant will be coal-fired, with No. 2 fuel oil as an alternate standby fuel.

The plant will be complete with 100% standby boiler capacity, one turbine-generator and standard auxiliary equipment, including staged feed water heating to maximize system efficiency. The coal and ash handling and storage facilities on site will be totally enclosed to minimize fugitive dust, noise and unsightliness. At the gas exit of the boilers primary dust collectors, economizers and bag filters or electrostatic precipitators will be provided to clean up the gas prior to discharge, with a single radial stack approximately 300 feet above grade. The plant will provide space for offices, locker rooms, maintenance shops and storage for spare parts and either allow space for expansion or be so arranged that incremental space can be added at a later date as needed. The steam to the distribution system serving the MEAL buildings will be provided from the turbine generator exhaust header at approximately

185 psig and 575° superheat, and if necessary, will be desuperheated prior to entrance into the distribution system.

Necessary water treatment equipment will be provided as required.

8. Plant System-4

This plant system is basically similar to Plant System-3 as described but, in addition, will also provide cooling effect to the community. The cooling effect will be generated by steam turbine driven centrifugal compressors taking steam from the exhaust header of the steam turbine generator set. As in the case of Plant System-3, this arrangement provides for a heat sink during the cooling season, the difference being that with Plant System-3 the cooling effect is accomplished by equipment installed in the community plants, whereas Plant System-4 produces cooling effect at the ICES plant and provides for chilled water distribution to the community -- much in the same manner as the steam distribution system.

Plant System-4 would require a larger facility than Plant System-3 to house the refrigeration equipment and provide for the necessary cooling towers which would be mounted on the roof portion of the plant

over the refrigeration equipment and enclosed with an architectural treatment. All other features of the plant would be substantially as described for Plant System-3.

C. Electrical Generation

The candidate demonstration plants will produce electrical power as a by-product, as differentiated from the primary thermal utilities of steam and chilled water, and therefore will not be provided with standby or split load capacity for electrical generation. If two turbine generators were provided at approximately 5500 KW capacity each, the cost of the equipment would increase to approximately $220 per KW, or $1,210,000 each, versus $1,575,000 for the single 11,220 KW unit, and would be difficult to justify economically. The reliability of this type of equipment is very high and normally less than 10 days to two weeks down time is required every two to five years.

D. Heat Balances

Basic load data for the existing facilities and for the anticipated near-future construction were analyzed with load data projected for maximum heating day, maximum cooling day, and average annual values, as shown in Figure I-5, Utility Service Summary.

Heat balances developed for Plant Systems-3, and -4 are summarized in Figure I-6. From this summary it is seen that Plant System-4 has the highest fuel input; however, compared to Plant System-3 for maximum heating days it provides 1,450 tons and 400 KW more than Plant System-3. This additional delivered energy which might be provided by Plant System-3 would require a fuel input of 34.4×10^6 BTU, which is in excess of the difference of fuel input for the two systems: consequently, Plant System-4 is more fuel efficient than Plant System-3. This is true for each heat balance comparison of Plant System-4 vs. Plant System-3.

Also Plant System-4 compares favorably with conventional Plant System-1. The largest fuel input difference occurs on a maximum heating day. Both plant systems provide the same thermal requirements; however, Plant System-4 provides 9,500 KW of electrical energy in addition to the other services. The fuel input difference equals 41.1×10^6 BTU, or 4,230 BTU/KW, generated. A comparison of values for the two maximum cooling day heat balances for Plant System-4 indicates the advantages of plant operation at 1250#/950F vs. 850#/900 F, as an additional 2,000 KW are generated for a fuel input difference of 6.3×10^6 BTU, or 3,150 BTU/KW.

Plant System-4 is apparently the preferred system from the standpoint of thermal efficiency.

FIGURE I-5

UTILITY SERVICE SUMMARY

Institution	(1) Steam System		Cooling System	
	(2) Demand Lbs/Hr.	Annual Lbs x 10^3	Demand Tons	(3) Annual Tons x 10^3
Eye, Ear, Nose, and Throat Hospital	1,140	3,600	200	600
L.S.U Medical Complex	52,080	101,000	3,265	9,795
Tulane Medical Complex	37,200	165,400	4,120	12,360
Veterans Administration Hospital	20,630	59,000	1,500	4,500
Charity Hospital	46,000	189,000	(4)8,175	(4)8,525
Total	157,050	518,000	12,260	36,780
Design Capacity	150,000	518,000	12,000	27,000

(1) Includes all steam and hot water requirements for all building functions except turbine-drive air conditioning equipment.

(2) Maximum Winter day demand at 7:00 A.M.

(3) Based on 3000 equivalent full load hours.

(4) Includes future conversion of existing local DX systems to chilled water served by central plant.

FIGURE I-6

HEAT BALANCE SUMMARY

Load Condition	Steam Generated #/hr.	Cooling Effect, Tons	Megawatts Generated	Fuel Input, BTU/hr. x 10^6
Plant System -1 (270 psi sat. - No Electrical Generation)				
Max. Heating Day	218,675	3,850	-	279.3
Max. Cooling Day	240,240	10,625	-	303.6
Average Annual	119,505	3,850	-	152.9
Plant System- 3 (1250#/950F - No Cooling Effect)				
Max. Heating Day	189,356	2,400	9.1	304.5
Max. Cooling Day	190,777	7,200	9.2	306.7
Average Annual	99,185	2,534	3.8	159.9
Plant System -4 (1250#/950F - with Cooling Effect)				
Max. Heating Day	198,480	3,850	9.5	320.4
Max. Cooling Day	190,050	10,625	9.2	305.5
* Max. Cooling Day	188,242	10,625	7.2	299.2
Average Annual	102,858	3,850	4.1	164.2

* This heat balance appears for comparative information only, using steam at 850 psi and 900F.

E. Distribution Piping Systems

For Plant System-3, the distribution system for steam and condensate return will be run elevated above ground, coincident, wherever possible, with planned elevated interconnecting pedestrianways between HEAL Complex buildings. It will be welded construction, seamless, Schedule 40 steel pipe for steam; Schedule 80 for condensate return. Insulation will be calcium silicate with aluminum protective cover. Meters and valves will be provided in branches to all buildings.

Pressure reducing stations will be provided where required. The system mains and branches will accommodate steam demands for present requirements, as well as for possible conversions to steam-energized air conditioning chillers in those buildings that now are equipped with motor-driven chillers.

For Plant System-4, the steam and condensate distribution system described under Plant System-3 will be the same. In addition, piping systems for chilled water supply and return will be installed, following the same routing as for the steam system. This piping will be welded construction, seamless, Schedule 40 steel. Insulation will be equivalent of 2-inch urethane, with vapor barrier and aluminum protective

cover. Meters, mixing valves and isolating valves will be installed in each building's branch line.

Estimated Costs for Piping Distribution Systems:

	Steam	Condensate	Chilled Water	Total
Plant System-3	$305,000	$222,000	--	$ 527,000
Plant System-4	305,000	222,000	$960,000	$1,487,000

F. Construction Costs for Plant Systems

Estimated construction costs for Plant Systems-1, -3 and -4 are summarized below and include 10 per cent for escalation. Total costs are:

Plant System-1	$20,829,600
Plant System-3	17,263,000
Plant System-4	24,079,500

G. Owning and Operating Costs

The following summary of estimated annual owning and operating costs is presented for the three Plant Systems that were studied. The first costs represent estimated plant costs as well as estimated utility distribution costs, with the exception of electrical tie to grid.

SUMMARY OF ANNUAL OWNING - OPERATING COST COMPARISON

	Plant System-1 Conventional	Plant System-3 Power, Steam	Plant System-4 Power, Steam, Cooling
Initial Capital Outlay (1)	$22,316,000	$17,790,000	$26,566,500
Fixed Costs (2)	2,181,334	1,764,835	2,487,501

SUMMARY OF ANNUAL OWNING - OPERATING COST COMPARISON (Continued)

	Plant System-1 Conventional	Plant System-3 Power, Steam	Plant System-4 Power, Steam, Cooling
Operating Costs	$ 3,122,999	$ 4,380,127	$ 3,281,023
Management Fee (3)	562,139	501,930	590,584
Total Annual Owning & Operating Costs	5,866,472	6,646,892	6,359,108

(1) Plant system and distribution system only; land costs not included.

(2) Interest on land purchase of $4,000,000 included.

(3) Management Fee calculated at 18% of Operating Costs

H. Estimated Annual Revenues

Annual revenues were estimated for the three plant systems, as follows:

SALES REVENUES

	Plant System-1	Plant System-3	Plant System-4
Steam	$ 1,942,500	$ 3,191,250	$ 1,942,500
Cooling	4,440,000	--	4,440,000
Electricity	--	665,760	718,230
Total Plant Revenues	$ 6,382,500	$ 3,857,010	$ 7,100,730

Based on these revenue figures and the values for owning and operating costs,

* Plant System-1 shows a surplus of $516,028 per year;

* Plant System-3 shows a deficit of $2,789,882 per year;

* Plant System-4 shows a surplus of $741,622 per year.

Plant System-4 is the most economically feasible.

* Surplus and deficit figures are presented only to illustrate relative economics among the three systems. Product selling rates will reflect the effect of actual owning and operating costs.

I. Relative Plant Efficiencies

On the basis of heat input vs. heat output, relative efficiencies for the three plant systems are:

ENERGY INPUT VS. ENERGY OUTPUT

Equivalent BTU/Hour x 10^6

	Plant System-1	Plant System-3	Plant System-4
Average Hourly Input			
Fuel	152.90	159.30	164.20
Electrical	4.20	1.13	4.12
Total	157.10	160.43	168.32
Average Hourly Output			
Cooling	46.20	--	46.20
Steam	71.07	105.50	71.07
Electric	--	13.00	14.00
Total	117.27	118.50	131.27
Efficiency: $\frac{\text{Output}}{\text{Input}}$	0.746	0.738	0.780

Plant System-4 is the most efficient.

Electrical Power Distribution

The electrical distribution facilities within the Demonstration Community are all owned, operated and maintained by NOPSI. The distribution facilities are all underground and each facility within the HEAL Complex is supplied by a primary and a standby electrical circuit. There will be no changes made to these

facilities, and NOPSI will continue to serve the electrical requirements of the buildings in the HEAL Complex.

From the ICES Demonstration Plant, NOPSI will install a 13.8kV circuit in an existing underground duct bank. A spare duct line will be used for the entire route except for the final entrance into the proposed ICES site. The circuit will terminate in Derbigny Substation, less than 3/4 of a mile from the proposed ICES site.

The ICES circuit will represent a generation source to the NOPSI system and will require that data consisting of MWh, MVARh and KVh be measured and transmitted to the Middle South Operating Center in Pine Bluff, Arkansas. These meters will also record the data needed to credit the thermal system for the electricity received by the grid.

Projection of Benefits to be Derived from Electrical Energy Generation by ICES

It is estimated that 35,916 MW hours will be generated annually as by-product power by the proposed ICES Plant; deducting the estimated 10,000 MW hours required by the plant will leave a net surplus of 25,916 MW hours available to the grid. Implementation of the ICES central plant will eliminate the individual cooling plants from the HEAL buildings, thereby providing an estimated reduction of approximately 20,000 MW hours annually from the Community's present power requirements and resulting

in a reduction of the summer/winter peak ratio from its current value of 1.52 to an estimated 1.27.

This power is generated at less than 4,000 BTU per KW hr. heat rate, which is extremely energy efficient. This energy efficiency is a direct result of the integrated nature of the community energy system as compared with conventional power plants, which would reject otherwise useful heat to the environment.

Chilled Water System

Retrofitting existing refrigeration equipment in the HEAL Complex buildings can be done with the newer, larger machines. These newer, larger machines might also be considered for reconnecting into the ICES plant's chilled water return system, thereby lowering the return water temperature and reducing the ICES plant peak requirements.

The proposed single ICES central plant has advantages over the three semi-localized plants within the HEAL Complex as indicated in the HEAL master plan with respect to lower operating cost and more efficient fuel utilization.

A comparison was made between a chilled water plant system utilizing steam turbine drive centrifugal equipment and one utilizing combinations of turbine drive centrifugal equipment and absorption-type machines, both standard and two-stage, on a partial load (67 per cent) basis. The combination centrifugal

and two-stage absorption system showed a slight advantage over the straight centrifugal system with respect to BTU/ton ratings, with the combination centrifugal and standard absorption system showing the highest rating. On the basis of first cost the straight centrifugal system was better than either combination by approximately 20 per cent.

There are indications that the operation of combination systems is very difficult to maintain at optimum settings of load distributions between the machines at constantly varying load conditions, and the partial load steam rate tends to approach that of straight absorption as the load is decreased below 67 percent, leading to overall higher steam rates. It is therefore not recommended that further consideration be given to either combination refrigeration system configuration.

Conclusions and Recommendations with Respect to Candidate ICES Systems

Plant System-4 (Power, Steam, Cooling) is superior to Plant System-3 (Power, Steam) with respect to thermal efficiency and with respect to owning/operating economics. With ERDA concurrence, Plant System-4 was selected as the ICES Demonstration System for this program.

TASK II - PRELIMINARY INSTITUTIONAL ASSESSMENT

Institutional Survey

The preliminary institutional survey indicates that the work of Phases II and III of the Demonstration Program be performed within the framework of a systematic, scheduled, step-by-step, review process throughout planning and design.

Public agencies that have authority and regulation of different elements of the Demonstration Program are:

A. City of New Orleans
   1. Planning Advisory Committee
   2. City Planning Commission
   3. Department of Safety and Permits
   4. Sewerage and Water Board
   5. Department of Utilities
   6. Department of Streets
   7. Commission Council
   8. Mayor's Advisory Committee on Aesthetics

B. State of Louisiana
   1. Board of Health
      a) Air Control Commission
      b) Stream Control Commission
   2. Fire Marshal
   3. Rating and Fire Prevention Bureau

4. Bonding Commission

C. Federal

1. Securities and Exchange Commission
2. Environmental Protection Agency
3. Occupational Safety and Health Administration

With respect to the regulations of the above mentioned agencies, it is not anticipated that there will be any significant constraints to the construction and operation of the proposed ICES system.

In addition to the public agencies, two citizens' groups - - American Lung Association of Louisiana and the Ecology Center of New Orleans - - were contacted in order to present the ICES concept to them and to solicit their cooperation and advice and to avoid conflicts with their areas of concern. Both organizations have expressed a strong interest in the ICES program and have asked to be kept informed of its progress and development. In addition, the Ecology Center can contribute directly to the program as a sub-consultant with respect to such matters as pollution control.

Taxes

HEAL is a non-profit state agency and is exempt from payment of city, state and federal taxes. NOPSI, as lessee and operator, would pay no personal property or ad valorem taxes. Normal taxes on items such as payroll, supplies, etc., would be levied.

Labor

No labor problems are anticipated. Operating forces would be provided by NOPSI from the existing staff of experienced power plant personnel.

Dissemination of Information

The public will receive detailed information about the ICES project, including the elements of energy conservation and environmental protection. The program will be presented by means of newspaper articles, television announcements, public hearings and technical reports and bulletins. A proposed schedule for dissemination of information is presented in Figure II-1.

Environmental Impact

Environmental impact statements are required and will be prepared during Phases II and III. A tentative assessment of the impact of the proposed ICES system on the existing environment is summarized in Figure II-2 and suggests that clean air and noise will be two areas of interest for investigation and evaluation in Phase II. In general, the ICES project should have no significant elements of permanent adverse impact on the existing environment.

Legal Matters

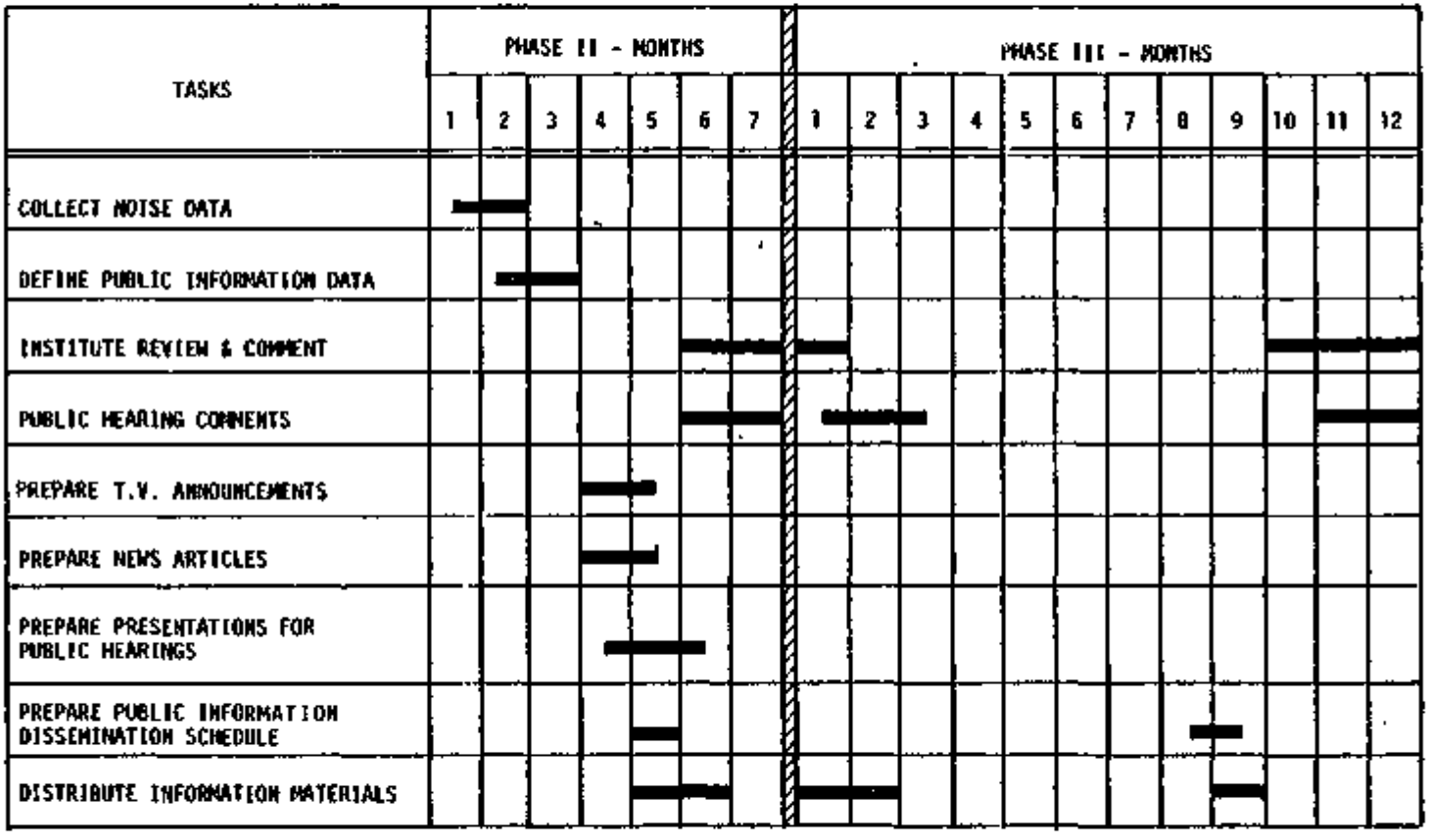
Legal matters were explored by general counsel and financial

counsel for HEAL as the owner, and by NOPSI's legal department with respect to NOPSI as the lessee and operator of the ICES system.

With respect to HEAL, it appears that clarification of status with respect to ownership of a public utility will be required; that its contracts must be submitted to the Commission of the Department of Administration, Executive Department, State of Louisiana, for review and approval; that two basic conditions of a plan of finance for the project would include the requirement that HEAL is legally authorized to undertake such a project and to issue revenue bonds to finance it, and that any revenue bonds so issued will be tax exempt under applicable income tax laws.

With respect to NOPSI, authorization from the Securities and Exchange Commission appears to be necessary for NOPSI participation in the project.

No unsolvable problems are anticipated with legal matters.



ES-2-9

FIGURE II-1

DEMONSTRATION PROGRAM - SCHEDULE FOR DISSEMINATION OF INFORMATION

FIGURE II-2

ENVIRONMENTAL IMPACT

SUMMARY ASSESSMENT

	FAVORABLE IMPACT	PERMANENT ADVERSE IMPACT
• Policies	Area's Economic Conditions Programs of Other Agencies Future Land Utilization	Construction Noise (Temporary)
• Transportation	Consistent with Existing Services	None
• Clean Air	Compliance with all Standards	Minimal (If Any)
• Noise	To Be Determined in Phase II	Minimal (If Any)
• Water Pollution	Pretreatment of Disposal Water	None
• Land Use	Aesthetically Pleasing Compatible with Existing	None
• Safety	Compliance with Regulations	None

TASK III - CONCEPTUAL DESIGN

System Concept

Steam produced at the ICES plant at 1250 psi/950°F by a coal-fired boiler will drive a 11,220 KW non-condensing turbine generator. Steam exhausted from the turbine generator at 185 psi will be used by turbine driven centrifugal refrigeration machines to produce chilled water, which will be distributed to the HEAL institutional buildings for comfort cooling; 185 psi steam will also be distributed to those same buildings for their heating requirements. A flow diagram of the system appears on the drawing labelled Figure III-1.

Equipment Ratings

The primary equipment - - turbine generator, boilers, refrigeration machines - - have the following ratings:

EQUIPMENT	UNIT CAPACITY	QUANTITY
Turbine Generator	11,220 KW	1
Boiler	225,000 #/Hour	2 (1)
Refrigeration Machine	5,000 Tons	3 (1)

(1) Includes one standby unit.

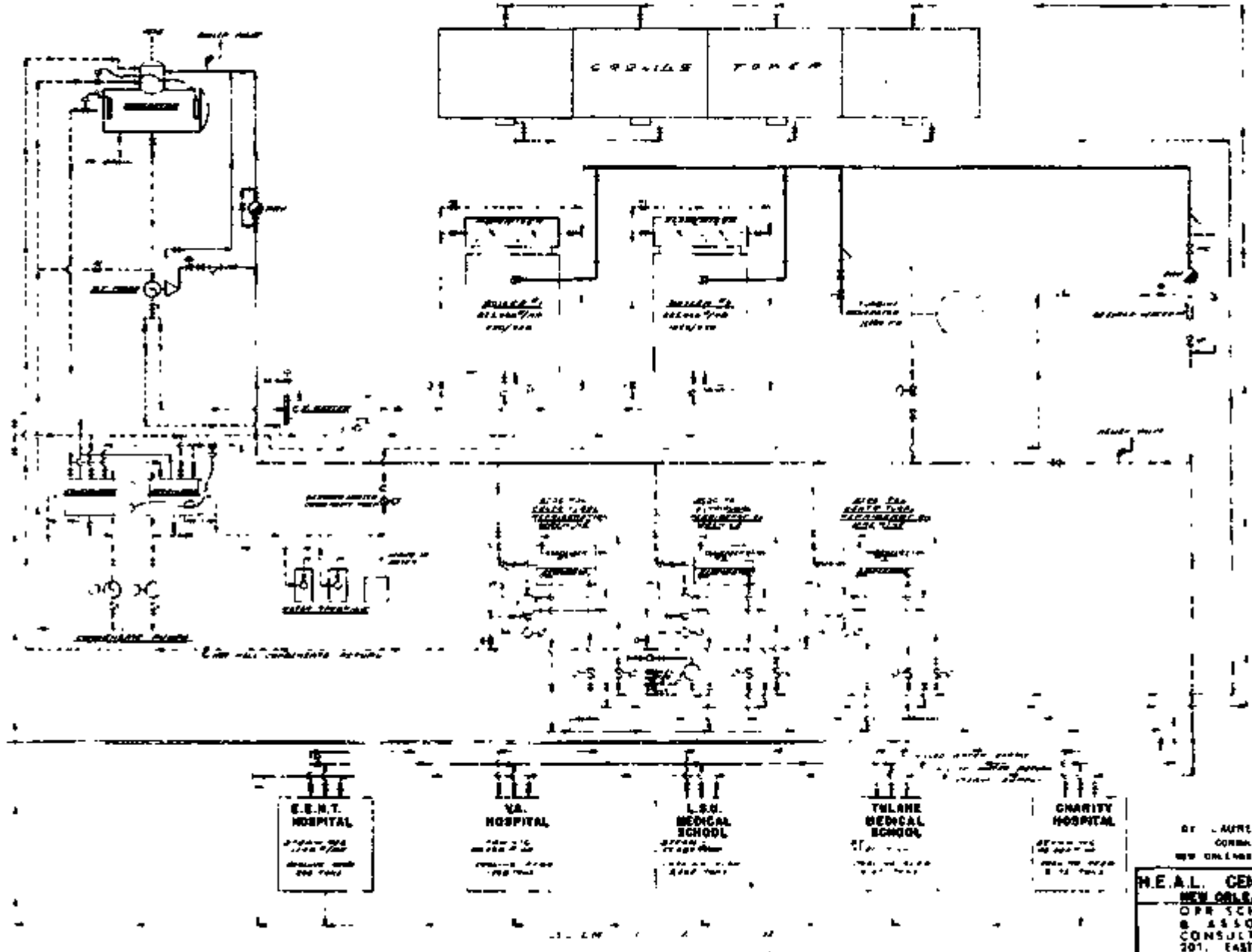
Plant Layout

Figures III-2 and III-3 show the operating level plan of the proposed plant and a section through the building. Coal and ash handling facilities are completely enclosed. A drive-through arrangement for coal delivery will allow the coal to be dumped without being exposed to public view. Louvered wall sections will enclose the cooling tower space to provide control of noise and visibility. Space will be reserved in the plant building for future installation of additional machinery to accommodate the developing demands of the expanding HEAL complex.

Fuel

Coal will be the primary fuel. Because storage facilities are available within ten miles of the ICES plant site, the requirement for on-site coal storage will be limited to a five-day supply at maximum demand.

Oil will be the standby fuel. Underground storage will be provided on the site for a three-day supply.



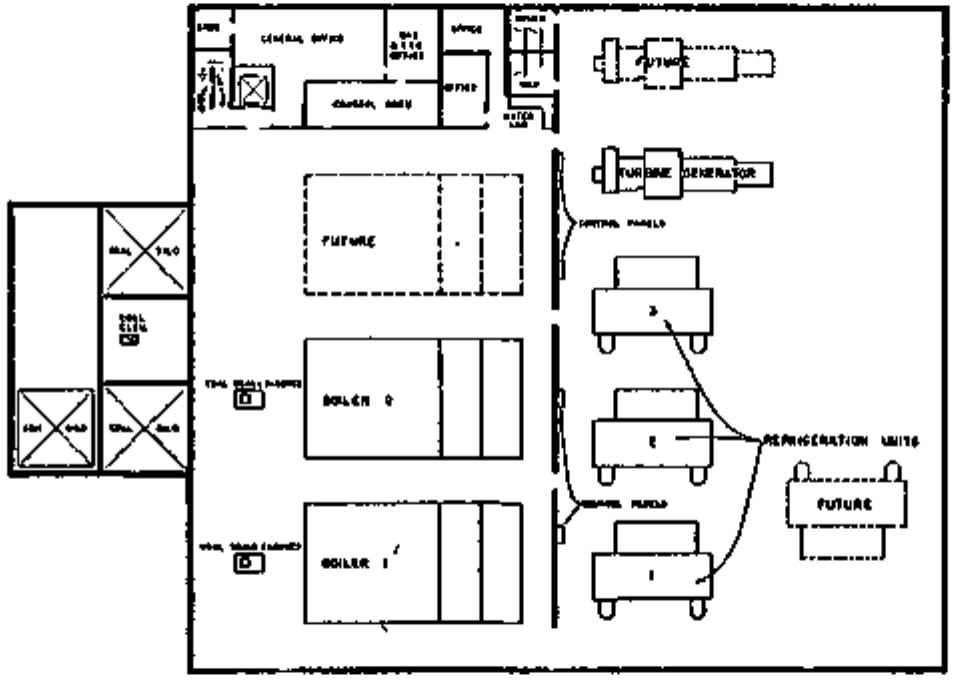
FLOW DIAGRAM - PROPOSED

ES-3-3

H.E.A.L. CENTRAL FACILITY
NEW ORLEANS LOUISIANA

OPP SCHELEN MAYERON & ASSOCIATES INC
CONSULTING ENGINEERS
201 EAST HENNEPIN AVE
MINNEAPOLIS, MINNESOTA 55413

FIG III-1



OPERATING LEVEL PROPOSED PLANT

FIG. III-2

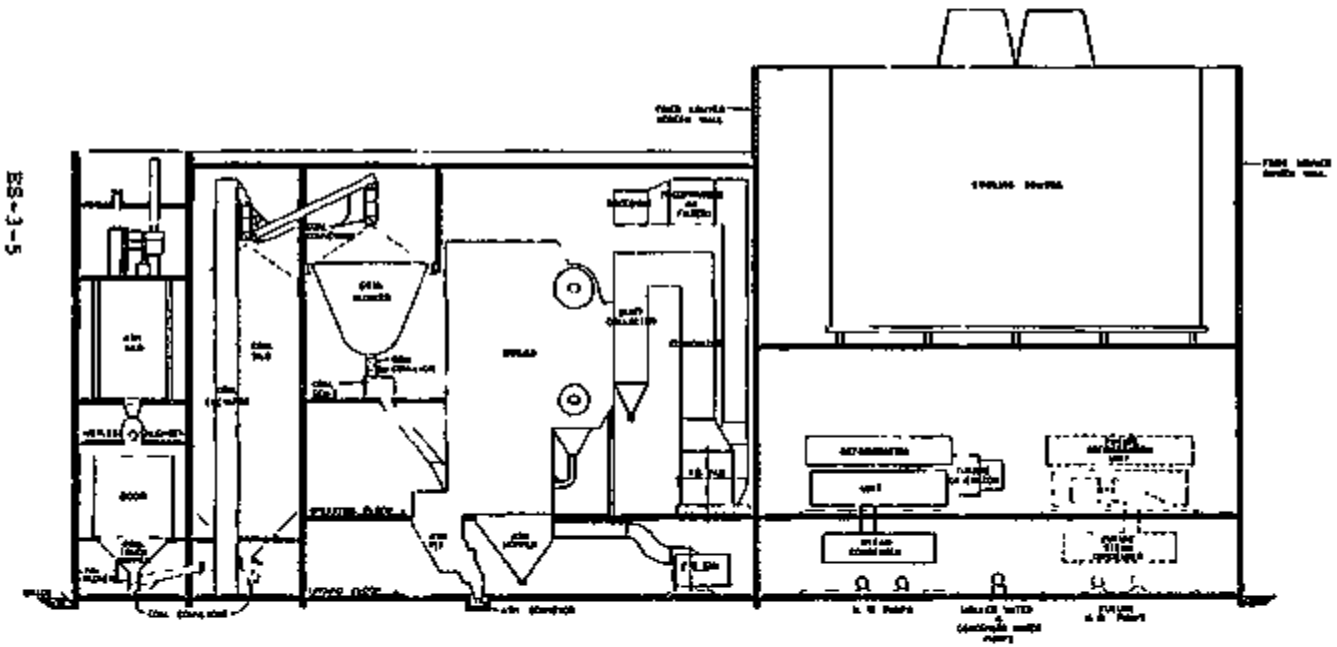


FIG III — 3

SECTION THRU PLANT

TASK IV - FIRMING-UP OF COMMITMENTS

Site Selection

Availability of two sites in the immediate vicinity of the HEAL Complex of adequate size for the Demonstration System's central plant facility was confirmed at a probable unit cost between $50 and $60 per square foot.

Rights-Of-Way

Probable difficulties that might arise in providing rights-of-way on property owned by one institution to accommodate the service distribution systems that may cross over the property of another institution were considered, and it was concluded that no problems existed other than routine matters.

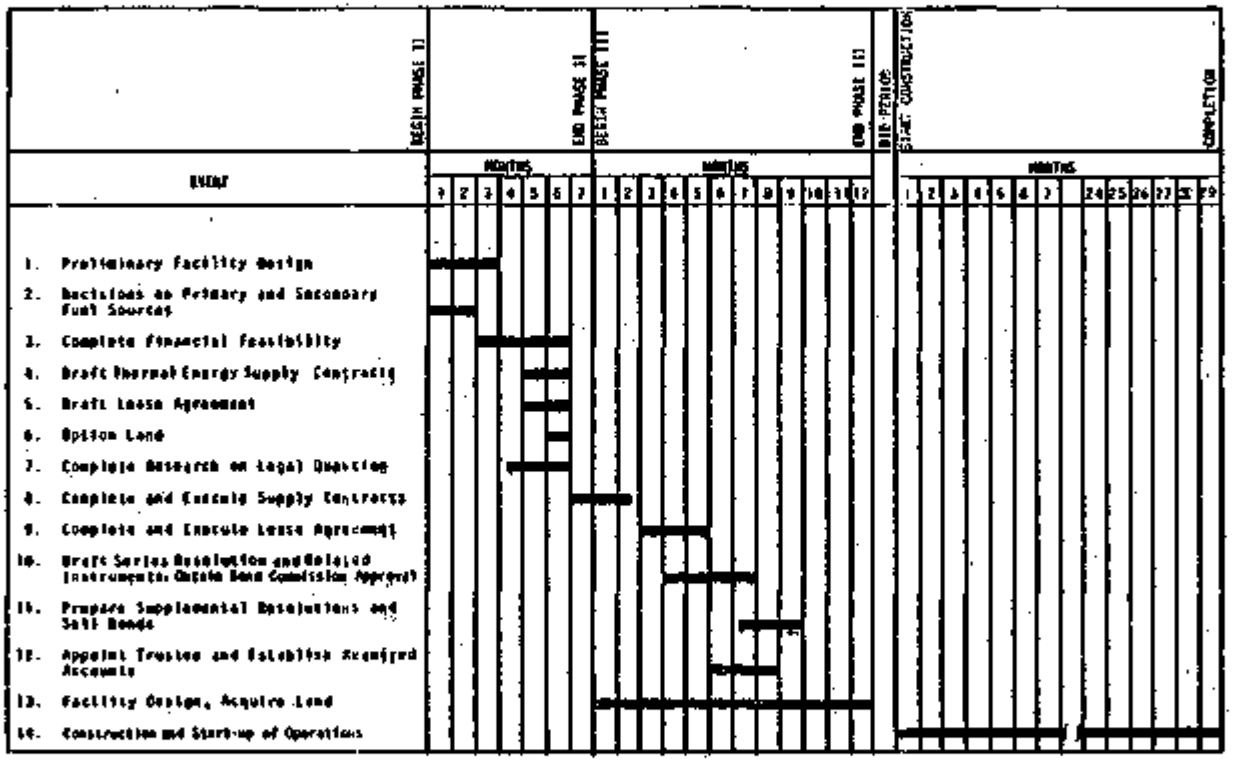
Financing

Financing of the proposed Demonstration System will be possible through the use of HEAL's tax-free bonding authority, subject to favorable conditions with respect to HEAL's position as a nonprovider of public utility services, financial feasibility of the program, negotiation of long-term supply contracts between NOPSI and user institutions, marketability of HEAL's revenue bond issue, establishment of the tax-free status and legality of the proposed bond issue. A proposed time table for financing is shown in Figure IV-1, Grid-Connected ICES Project, Financial Time Schedule.

FIG IV-1

GRID - CONNECTED ICES PROJECT

FINANCIAL TIME SCHEDULE



Ownership

Land for the ICES facility will be acquired and owned by HEAL. HEAL will own the plant and piping systems. Steam, chilled water and electricity produced by the plant will be owned by NOPSI, who will also own, operate and maintain all electric distribution facilities within the HEAL Complex. NOPSI will lease from HEAL the plant facility and piping and other associated systems, and will also operate and maintain them. Commitment of HEAL and NOPSI to the program beyond Phase II depends upon the verification, in Phase II, of its economic feasibility. Copies of excerpted letters from HEAL (Figure IV-2) and NOPSI (Figure IV-3) indicate their relationship to the ICES program.

Terms of Grid Connection

Electricity produced by the ICES plant will be fed into the NOPSI electric system. The value to NOPSI of the electric energy produced by the Central Plant will be credited, at an estimated rate of approximately 2¢ per KW hour, to the charges made for the steam and chilled water service. The steam and chilled water furnished by the ICES plant will be restricted to institutions located within the HEAL Complex and will be rendered pursuant to private contracts independently negotiated by NOPSI with each such institution.

Each participating HEAL institution has indicated its plan to participate in the ICES project and intent to purchase the steam and chilled water utilities produced subject to Phase II verification of economically feasible rates.

Fuel Availability

New Orleans has adequate rail and water facilities for bringing coal into the area. A terminal located on a prominent waterway approximately ten miles from the ICES plant site has facilities for unloading and stockpiling coal and can also load trucks for delivery of the coal to the ICES plant. Compliance coal is available at an estimated cost of $1.60 per million BTU.

Air Pollution Limitation

Design and construction of the plant will include systems and components to insure compliance with applicable standards and regulations pertaining to clean air requirements.

Supplementary Statements of Commitment

Statements from HEAL, de Laureal Engineers, Inc., and Orr-Schelen-Mayeron & Associates, Inc. - Figures IV-4, IV-5, IV-6 - establish the commitment with respect to all necessary engineering services through all remaining phases of the program.

State of Louisiana

HEALTH EDUCATION AUTHORITY OF LOUISIANA
[illegible] • 238 LOYOLA AVENUE • STATE OFFICE BUILDING
NEW ORLEANS, LOUISIANA 70112

EDWIN EDWARDS
Governor

STREUBY L. DRUMM
Chairman

May 10, 1977

U. S. Energy Research and
Development Administration
9800 South Cass Avenue
Argonne, Illinois 60439

Attention: Mr. J. C. Rodoussakis

Subject: ERDA "ICES" Project

Gentlemen:

This letter is a statement setting forth the role of the [illegible] (HEAL) and its relationship with New [illegible] (NOPSI) and de Laureal Engineers, Inc. with participation in the proposed Integrated Community Energy System demonstration project sponsored by the U. S. Energy Research and Development Administration. An expression of HEAL's intent to proceed with this project, subject to all pertinent laws and adequate resolution of all remaining legal questions, is hereby submitted.

INTRODUCTION:

HEAL will serve as the prime contractor on Phase II, and subsequent phases of this project, it it proves feasible. Resources of NOPSI, de Laureal and, as necessary, associated firms will be drawn upon in the design, architectural and engineering phases of this project. Should this project go forward to conclusion the costs of such services covering all phases of such work are to be included in cost reimbursement agreements with ERDA and/or included in the final financing structure to be financed through HEAL revenue, tax free bonds. NOPSI has committed itself to cooperate with HEAL through Phase II of the subject project, and to participate with HEAL in the implementation of this project if the Phase II study indicates to its satisfaction that the project is feasible. In this connection, we attach a copy of a May 11, 1977 letter from NOPSI to HEAL which sets forth the above referenced commitments of NOPSI.

[illegible] de Laureal Engineers, Inc. [illegible] "Phase I" report of this project as [illegible] (Plant), is to be located directly [illegible] x, in New Orleans. The Co[illegible] arrangement between HEAL and NOPSI, it will be made clear that NOPSI shall be the owner of all steam, chilled water and electricity produced by the Plant as well as all electric distribution facilities located within the Louisiana Medical Complex and that nothing in the lease shall be construed to place HEAL in the position of a public utility.

The Institutions, their present require[illegible] [illegible] Institutions are generally as set forth in the publi[illegible] prepared by de Laureal Engineers, In[illegible]

FIGURE IV-2

E5-4-5

Very truly yours,

HEALTH EDUCATION AUTHORITY
OF LOUISIANA

By _____
Streuby L. Drumm

Title Chairman

Health Education Authority of Louisiana
Room 213 Louisiana State Office Building
325 Loyola Avenue
New Orleans, Louisiana 70112

Attention: Mr. Vernon D. Seifert

Gentlemen:

NEW ORLEANS PUBLIC SERVICE INC.

CHARLES J. SIMMOTT
VICE PRESIDENT

May 11, 1977

expressed
Laur
actual
with some of
meetings and past communi-
committed to participating in the ERDA
the results of the study will have to serve
determining the nature of our ultimate participation
ject."

More recently, on April 12, 1977, in a letter from Mr. W. C. Nelson, our Vice President and General Counsel, to de Laureal Engineers, Inc., expressing a legal opinion on certain aspects of the project, it was stated as follows:

> "NOPSI's participation in the project would be for it to lease (as lessee), operate and maintain the Central Plant and the steam and chilled water piping from the Plant to institutions in the HEAL Complex. Any electricity produced by the Plant would be fed into the NOPSI electric system and NOPSI would own, operate and maintain all electric distribution facilities. The Plant and steam and chilled water piping would be owned by HEAL, but the steam, chilled water and electricity produced by the Plant would be owned by NOPSI. The steam and chilled water service furnished by NOPSI would be restricted to institutions located within the HEAL Complex and would be rendered pursuant to private contracts independently negotiated by NOPSI with each such institution. The value to NOPSI of the electric energy produced by the Central Plant will be credited to the charges made for the steam and chilled water service. Under no circumstances will NOPSI permit its participation in the project to place any burden on its electric and gas customers."

The purpose of this letter is to confirm to HEAL our commitment within the framework of the above quoted paragraphs to cooperate with it through Phase II of the subject project, and to participate with HEAL in the implementation of the subject project if the Phase II study indicates to our satisfaction that the project is feasible. In the event we are satisfied that the project is feasible, we would anticipate that the lease referred to above would extend over the useful life of the Central Plant.

Sincerely,

Charles J Simmott

CJS/edh
cc: Mr. W. D. de Laureal, Sr.
de Laureal Engineers, Inc.

Figure IV-3

ES-4-6

State of Louisiana

HEALTH EDUCATION AUTHORITY OF LOUISIANA
ROOM 219 • 820 LOYOLA AVENUE • STATE OFFICE BUILDING
NEW ORLEANS, LOUISIANA 70113

EDWIN EDWARDS
Governor

STREUBY L. DRUMM
Chairman

May 11, 1977

Mr. W. D. de Laureal, Sr.
de Laureal Engineers, Inc.
1512 International Trade Mart
No. Two Canal Street
New Orleans, La. 70130

Dear Mr. de Laureal:

We have very much appreciated the opportunity to work with you in the development of the "Phase I" elements in our proposed Integrated Community Energy System demonstration project sponsored by the U.S. Energy Research and Development Administration.

As a result of your very deep involvement in this project, in concert with your associated firm Orr-Schelen-Mayeron Associates, it would seem most appropriate for us to plan to continue to work with your firms in the future phases of this project, up through satisfactory completion of construction and start-up operations.

You are aware, of course, of the need to comply with all provisions of the public bid laws of the State of Louisiana. It will be necessary for the Authority to fulfill these requirements, however, there is reason to believe that the specific nature of this project will provide opportunities to fulfill these requirements while continuing to work with you and your associated firm, as outlined above.

We look forward to this opportunity with considerable enthusiasm.

Cordially,

Streuby L. Drumm

Streuby L. Drumm

cc: Mr. George Kiefer

Figure IV-4

E5-4-7

DE LAURÉAL ENGINEERS
INC.

CONSULTING ENGINEERS

1615 INTERNATIONAL TRADE MART • 2 CANAL STREET • NEW ORLEANS 70130 • 522-0128

May 10, 1977

Health Education Authority of Louisiana
213 State Office Bldg.
325 Loyola Avenue
New Orleans, La. 70112

ATTENTION: Mr. Streuby L. Drumm, Chairman

SUBJECT: Grid-Connected ICES for HEAL Community

Gentlemen:

The firm of de Laureal Engineers, Inc. reaffirms its commitment to the continuity of the ERDA - sponsored grid-connected ICES program for the HEAL community and will participate in providing HEAL all necessary engineering services through all phases of the program.

Also, we will have Orr-Schelen-Mayeron and Associates, Inc. and any other needed consultants associated with us to work hand in glove with HEAL and NOPSI until completion of construction and the testing of the project.

Very truly yours,

DE LAUREAL ENGINEERS, INC.

W. David de Laureal, Sr.
President

Figure IV-5

ORR-SCHELEN-MAYERON & ASSOCIATES, INC.

Consulting Engineers
Land Surveyors

May 3, 1977

Mr. Dave deLaureal
deLaureal Engineers, Inc.
1512 International Trade Mart
New Orleans, Louisiana 70130

Dear Mr. deLaureal:

This is to confirm our agreement as a subcontractor to deLaureal Engineers in regards to the Grid Ices Project.

OSM will continue to participate in the Demonstration of a Grid-Connected Integrated Community Energy System for U. S. Energy Resource and Development Administration for the Heal Community in New Orleans from phase 2 through 6 as our services are required.

Yours very truly,

ORR-SCHELEN-MAYERON
& ASSOCIATES, INC.

C. H. Goldsmith, P.E.
Senior Vice President

CHG/jet

Figure IV-6

ES-4-9

2021 East Hennepin Avenue • Suite 238 • Minneapolis, Minnesota 55413 • 612/331-8660

TASK V - DETAILED WORK MANAGEMENT PLAN

Individual Work Packages

Work tasks for all remaining phases of the Demonstration Program were identified and are shown in Figure V-1, Grid-Connected ICES Demonstration Program Schedule. Tasks were developed from the phase requirements set forth in ERDA RFP No. E(11-1)-P-76-0016.

PERT Charts

PERT network charts were prepared for the various phases of the program. Figure V-2, PERT NETWORK PHASE IV THRU VI, covers construction, test, operation and performance, with the critical path indicated by the heavy arrows.

Demonstration Program Schedule

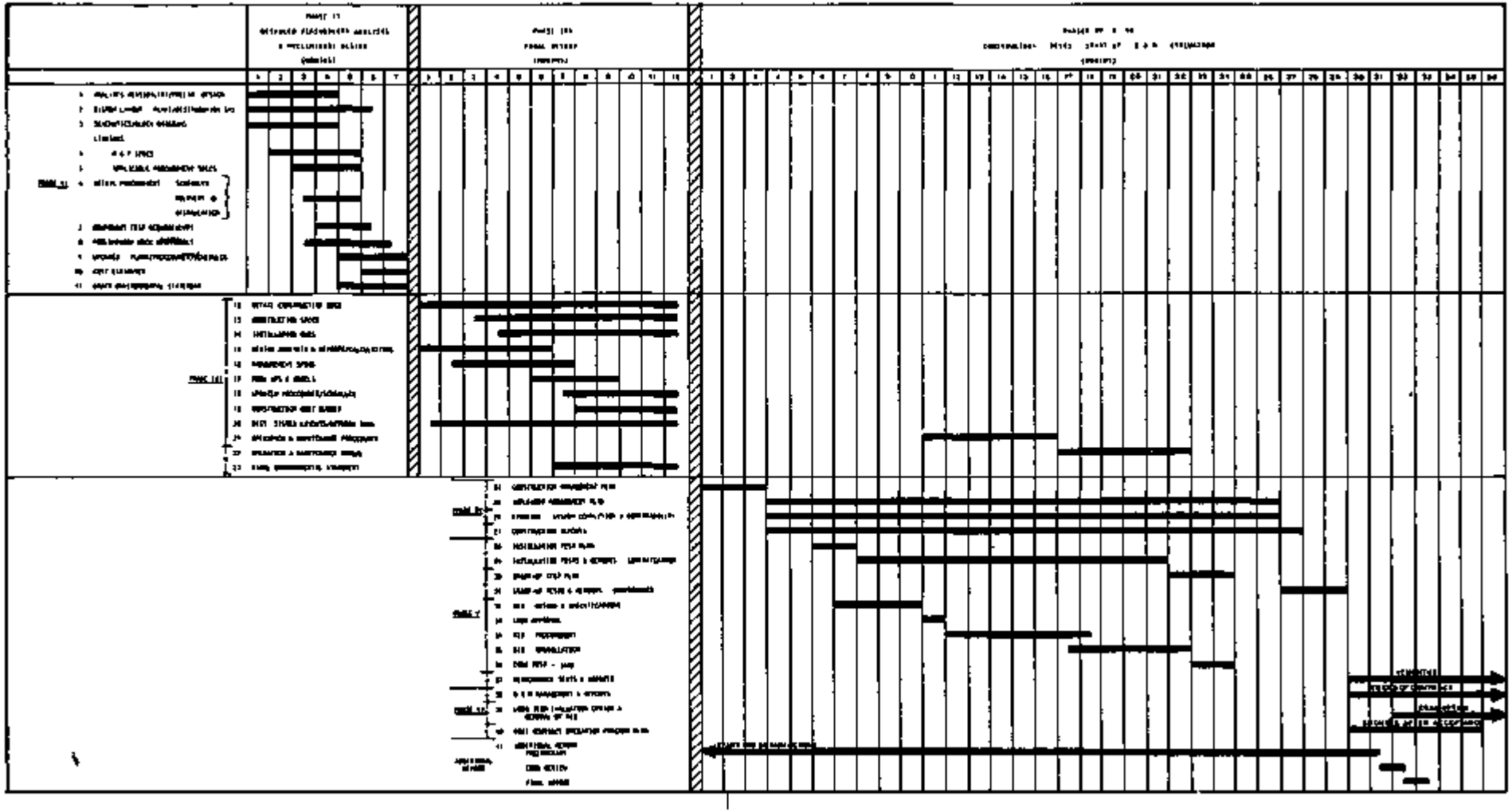
Figure V-1, referred to earlier, serves as a milestone chart and indicates time phases for each of the work tasks.

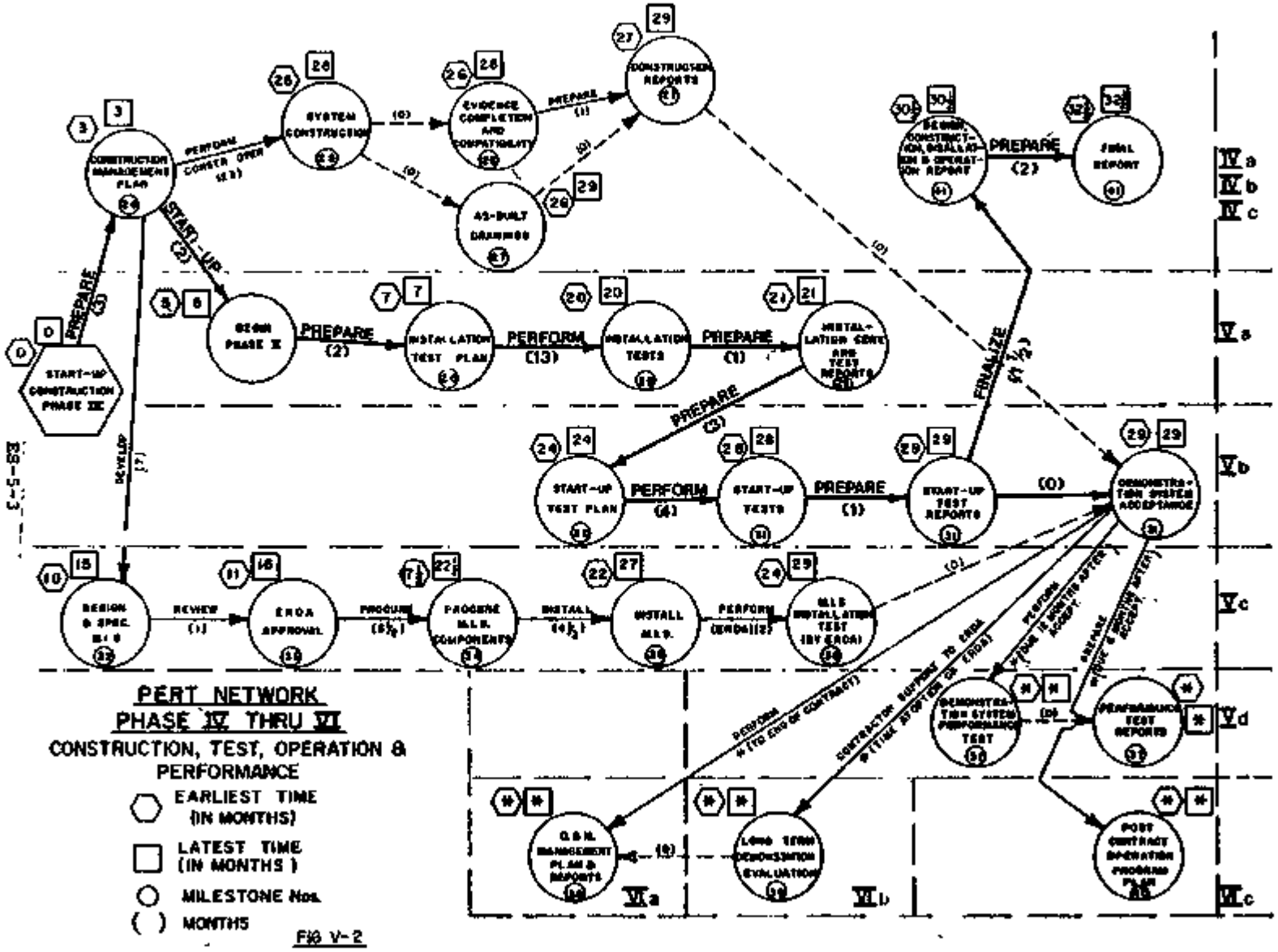
Cost Estimates

Cost estimates for the Demonstration Program were prepared for each phase and are summarized in Fig. V-3, which also includes costs by phases for construction and for requested ERDA funding. Total construction cost is $26,391,500;

FIG V-1

GRID CONNECTED ICES
DEMONSTRATION PROGRAM SCHEDULE





ES-5-3

PERT NETWORK
PHASE IV THRU VI
CONSTRUCTION, TEST, OPERATION & PERFORMANCE

- EARLIEST TIME (IN MONTHS)
- LATEST TIME (IN MONTHS)
- MILESTONE Nos.
- ( ) MONTHS

Fig V-2

total Demonstration Program cost is $2,820,301; total requested ERDA funding is $1,820,750. Figures do not include land cost, estimated at $4,000,000.

Organization Charts

Organization charts were prepared for the Project Management Team and for each of the team members. Figure V-4, Grid-Connected ICES Project Management Team, establishes HEAL in the role of Contractor for the remainder of the program and identifies other team members.

Manpower Schedules

Manpower Schedules with key personnel were developed, by phases, for each task. Following is a summary of effort, by phases:

PHASE	LEVEL OF EFFORT, MAN-MONTHS
II. Detailed Feasibility Analysis & Preliminary Design	93.29
III. Final Design, Operation & Maintenance Procedures	232.14
IV. Construction & Construction Management	145.26
V. Tests for Installation, Start-Up, MIS & Performance	43.80
VI. Operation & Maintenance Management, Long Term Evaluation	15.00 *
Additional Report - Installation & Start-Up	18.20
TOTAL	547.69

* Per Year

FIGURE V-3

TOTAL ESTIMATED PROJECT COSTS (1)

PHASE		CONSTRUCTION	DEMONSTRATION PROGRAM	REQUESTED ERDA FUNDING
II	Detailed Feasibility & Preliminary Design	- - - - -	$ 533,610	$ 533,610
III	Final Design	- - - - -	1,259,735	123,886
IV	Construction	$25,566,500(2) 725,000(3)	633,797	736,200
V	Tests; MIS Procurement & Installation	100,000(4)	240,505	274,400
VI	O&M Management; Long-Term Evaluation Post-Contract Operation	- - - - -	64,512(5)	64,512(5)
	Installation & Start-Up Report	- - - - -	88,142	88,142
TOTALS		$26,391,500	$2,820,301	$1,820,750

(1) Does not include land cost, estimated at $4,000,000.

(2) Does not include ERDA-funded construction costs. See Notes (3) and (4) below.

(3) Electrical grid-connected subsystem estimated cost.

(4) MIS estimated cost.

(5) Estimated cost for one year; same estimated cost for each additional year.

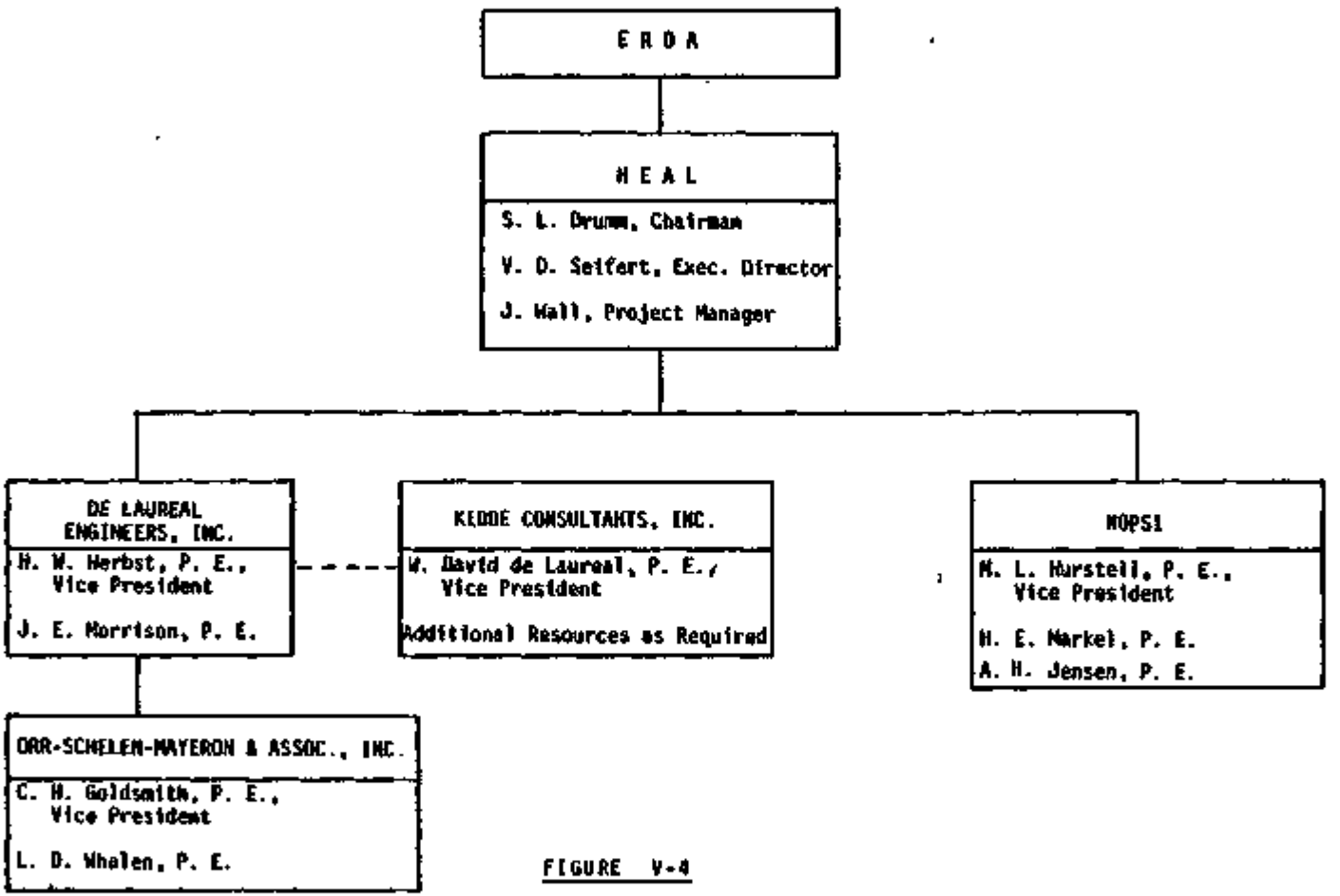


FIGURE V-4

GRID - CONNECTED ICES

PROJECT MANAGEMENT TEAM