PRELIMINARY FEASIBILITY
OF AN
UNDERSEA CABLE LINKING
MOLOKAI AND MAUI

December 1983

CH2M HILL P17434.A0

EXECUTIVE SUMMARY

The purpose of this preliminary feasibility study of an undersea cable linking Molokai and Maui is to explore in greater detail the feasibility of such a cable. CH2M HILL's previous study, "A Preliminary Overview of Power Supply Alternatives for Molokai," concluded that an undersea cable could provide the lowest cost power to Molokai, assuming the cost of the cable was supported by electric ratepayers on both Molokai and Maui.

This study further addresses the technical feasibility of a cable, the availability of a power supply from Maui, the possible methods of financing the cable, and the economics of the cable.

Conclusions

- An undersea cable linking the two islands electrically is technically feasible.
- The cable and associated connections are estimated to cost about $15 million in 1983 dollars.
- The annual cost of the cable is estimated to be $3,121,000 in 1983 dollars.
- The most likely financing mechanism is conventional utility financing, utilizing tax-exempt special purpose revenue bonds for the long term debt portion.
- Financing a project of this size should not be overly difficult. In contrast, a cable link between the Big Island and Oahu could cost $500 million, the sheer size of which would present a financing challenge.
- The cost effect, if the costs are spread on a kilowatt hour (kWh) basis between Maui and Molokai, is 0.6 cents per kWh ($0.006). This represents about 5 percent of Maui Electric's present revenue per kWh.
- The realistic lead time for cable installation is 4 years.
- The method or combination of financing used will determine if the costs of the cable are borne by taxpayers (general obligation bonds) or electric ratepayers (utility financing). The methods used will also determine the annual cost of the cable.

- Our discussions with Molokai Electric indicate that while it is unable to participate in financing the cable, it would consider purchasing power over the cable.

- Our discussions with the Maui Electric Company and Hawaiian Electric Company indicate that they are willing to consider involvement in a cable and in providing power to Molokai.

- The environmental considerations of a cable do not appear to include "fatal flaws" that would prevent cable installation.

- There is sufficient generation on Maui to serve the present Molokai loads. Serving Molokai from Maui would create a need for additional generation capacity on Maui approximately one year ahead of present schedules. Additional generation is presently scheduled on Maui in 1992.

- For the foreseeable future the Maui generation will be oil and oil/bagasse fired.

- At the present time, there do not appear to be overriding technical concerns about system operations and stability resulting from serving Molokai from Maui. Loss of load on Molokai from a cable outage would not cascade into a system outage on Maui.

- In the long-run, a cable connecting to a larger generation system could enhance the development of renewable resources on Molokai, particularly wind power.

- The attractiveness of a cable to Molokai depends on a comparison of the cost of wholesale power delivered over the cable and the cost of generation on Molokai. In order for a cable to be attractive, only a limited portion of the cost of the cable can be borne by Molokai electric rates.

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INTRODUCTION

Authorization

This preliminary feasibility study of an undersea cable linking Maui and Molokai to provide electric service to the citizens of Molokai was conducted under a contract with The Research Corporation of the University of Hawaii. The fee for this work was $10,000 with a report to be submitted by November 30, 1983.

Purpose and Scope

The purpose of this study is to address the issues surrounding the development of a Maui to Molokai undersea cable to provide electric power to Molokai. A previous study by CH2M HILL of the power supply alternatives available to Molokai concluded that an undersea cable was the lowest-cost alternative to Molokai provided the costs of the cable could be spread over the ratepayers of both Molokai and Maui. This previous study did not go beyond a brief analysis of the technical feasibility of a cable and an estimate of its costs. This study is intended to review the economic issues surrounding development of a cable.

The scope of work included the following tasks:

1. Technical feasibility of a cable(s)
2. The ability of generation on Maui to provide power to Molokai
3. The possible methods of financing the undersea cable
4. The regulatory and rate-setting aspects of a cable
5. The economics of an undersea cable
6. A brief report

Cost Estimates

The cost estimates used in this analysis are order-of-magnitude estimates as defined by the American Association of Cost Estimators. These estimates have been prepared without the benefit of detailed engineering analysis, plans, or specifications. The expected accuracy of the estimates can range from 30 percent less than to 50 percent more than the true cost. Cost estimates provided to us by others were judged for reasonableness.

Acknowledgements

We wish to thank the numerous organizations, state agencies, and individuals who assisted us during our study. A list of those individuals with whom we met or discussed this project is included in the Appendix.

BACKGROUND

Biomass Plant

The Molokai Electric Company, Limited (Molokai Electric), built and briefly operated a biomass-fueled generation plant to meet the power supply needs of Molokai. The plant was brought online in April 1982 and operated for a number of months. The main generator suffered damage in November 1982 and the plant has not operated since. It is Molokai Electric's intention to return the plant to service in 1986. The plant would be fueled by wood chips with a coal backup.

Molokai Electric's retail rates are the highest in the islands. Based on calendar year 1982, the average revenue per kilowatt-hour of sales is 22.7 cents. This compares with approximately 13.4 cents on Maui.

Molokai Electric is presently unable to attract significant amounts of new capital. As a result, it is unable to finance its need for additional facilities resulting from growth, new customers, or obsolescence of its existing plant.

Previous Study

During the operation of the biomass plant, the power supply was very unreliable. This, combined with the high rates, led to the State Department of Planning and Economic Development (DPED) authorizing CH2M HILL's previous study of power supply alternatives for Molokai. This study concluded that an undersea cable could provide the lowest cost power to Molokai, assuming the cost of the cable was supported by electric ratepayers on both Molokai and Maui. Because electricity sales on Maui are over 20 times those on Molokai, the cost of the cable would be spread over a much larger base than if the costs are only borne by ratepayers of Molokai.

At this time, it is expected that Molokai Electric will resume operation of the biomass plant, fueling it with wood chips and coal. The electric rate disparity between Molokai and the other islands will continue. Hopefully, the plant's operation will be reliable and the history of outages, which occurred during its prior operation, will not be repeated.

The high electric rates will encourage end users to reduce their usage and separate from the Molokai Electric system. A recent study, Molokai Water Systems Plan for the Maui County Department of Water Supply, concluded that the cost of diesel-driven pumps is only about one-half the cost of electrically-driven pumps. As a result Molokai Electric may face a very slow load growth, if any. In fact, loads may decrease, resulting in the need for even higher rates in order to recover the system's fixed costs.

Molokai Electric will continue to charge its present high rates. The ratepayers of Molokai would continue to pay prices for a product that could be delivered by others cheaper, either through diesel generation on Molokai or an undersea cable.

If an undersea cable is constructed, it could provide power at a cost less than Molokai's present power production expense. This would allow power to be profitably sold at a rate that is below Molokai Electric's present retail rates. This might result in greater electrical-load growth on Molokai than could be expected without the cable.

A cable would also allow development of renewable resources on Molokai without the reliability risks that now exist. This might allow Molokai's large wind potential to be harnessed. Greater economics-of-scale would also be available, allowing generation units to be larger and therefore less costly per kilowatt of capacity.

An undersea cable and the resulting access to a potentially less costly power source could, however, result in tremendous pressure for lower rates on Molokai. Lower rates would place severe financial strain on Molokai Electric.

Present Study

This brief study further addresses the technical feasibility of a cable, the availability of a power supply from Maui, the possible methods of financing the cable, and the economics of the cable.

TECHNICAL FEASIBILITY OF UNDERSEA CABLE

Previous Work

A limited amount of work has been done on the technical feasibility of an undersea cable between Maui and Molokai. The principal published effort is a report, A Study of the Feasibility of Linking the Islands of Maui, Molokai, and Lanai with Submarine Electrical Power Cables, Hawaii Natural Energy Institute (HNEI), H. H. Hwang and Bryan Young. This report relied heavily on work done by Sumitomo Electric, Ltd., for Maui Electric. CH2M HILL's study of power supply alternatives for Molokai utilized this report and updated cost estimates from Sumitomo. Maui Electric periodically reviews the economics of an undersea cable for the three islands.

HDWC Program

Currently underway is the Hawaiian Deep Water Electrical Transmission Cable Demonstration (HDWC) Program. This program is a research, development, and demonstration program being conducted to determine the technical and economic feasibility of an inter-island undersea cable system. The program is still in the early phases. At this point, the program is directed at the link between the Big Island and Oahu. This link involves depths, 7,000 feet, and a length, 150 miles, that are beyond existing cable technology. The program hopes to develop and demonstrate a cable suitable for the application. Because of the distances involved and system operating needs, the use of direct current (dc) technology for this link appears to be very attractive.

Preliminary reports on this program have concluded that a Maui to Molokai cable is well within existing technology and technically feasible, and therefore the federal and state effort is concentrating on extending the state-of-the-art for the Big Island to Oahu link.

The Maui to Molokai crossing, Pailolo Channel, is approximately 840 feet deep and 10 miles long. There are deeper and longer cables in service today in Japan, Scandinavia, and British Columbia. The conclusion is that the Maui to Molokai cable link is technically feasible.

Cable Concept

The undersea cable concept used for the cost estimate in this report consists of two 69-kV 3-phase ac, 2/0 copper, oil-filled cables lying on the seabed. Two cables were assumed for reliability and continuity of service considerations. The cable manufacturer involved in the HDWC Program, Pirelli Cable Corporation, indicates that a 3-phase 2/0 conductor cable is the smallest conductor size available at 69 kV for this type of application. Cables smaller than this may not be able to handle the mechanical stresses involved in installation.

At 69 kV, this size cable can carry 30 MVA of power, which is significantly greater than the approximate 5 MVA of load now on Molokai. This excess capacity provides for a great deal of load growth on Molokai and also for the possibility of Molokai exporting large amounts of power from the development of wind generation on the island.

The assumed route is from D. T. Fleming Park on Maui to a landing point about 0.5 miles northeast of Honoulimaloo on Molokai (see Figure 1). The tidal current is estimated to be 0.3 knots and the sea bed is presumed to be sand, sand-gravel, and sand-shell. The route conditions were assumed without the benefit of any route surveys. Actual conditions might be different and could have some effect on the cost of a cable installation.

A much longer route from D. T. Fleming Park to Kaunakakai may be attractive because the costs of overland transmission facilities on Molokai appear to be comparable with those of the undersea cable.

The time between a commitment to install an undersea cable and the in-service date is estimated at 2 to 6 years. Once a cable order is placed, delivery time would be 9 to 12 months. The cable would be manufactured in one continuous length and probably loaded directly onto the cable-laying vessel at the factory. There are existing cable-laying vessels in the world capable of handling this weight and length of cable.

Cable life is estimated to be approximately 40 years.

The cable corridor or seabed right-of-way could range from 100 feet to 1,000 feet, depending on seabed conditions, cable protection considerations (dragging anchors), and the need for working space for cable repair. The greater the space between the two cables, the less the chance that a single incident would damage both cables. Maintenance requirements are expected to be limited. Annual visual inspections would be needed.

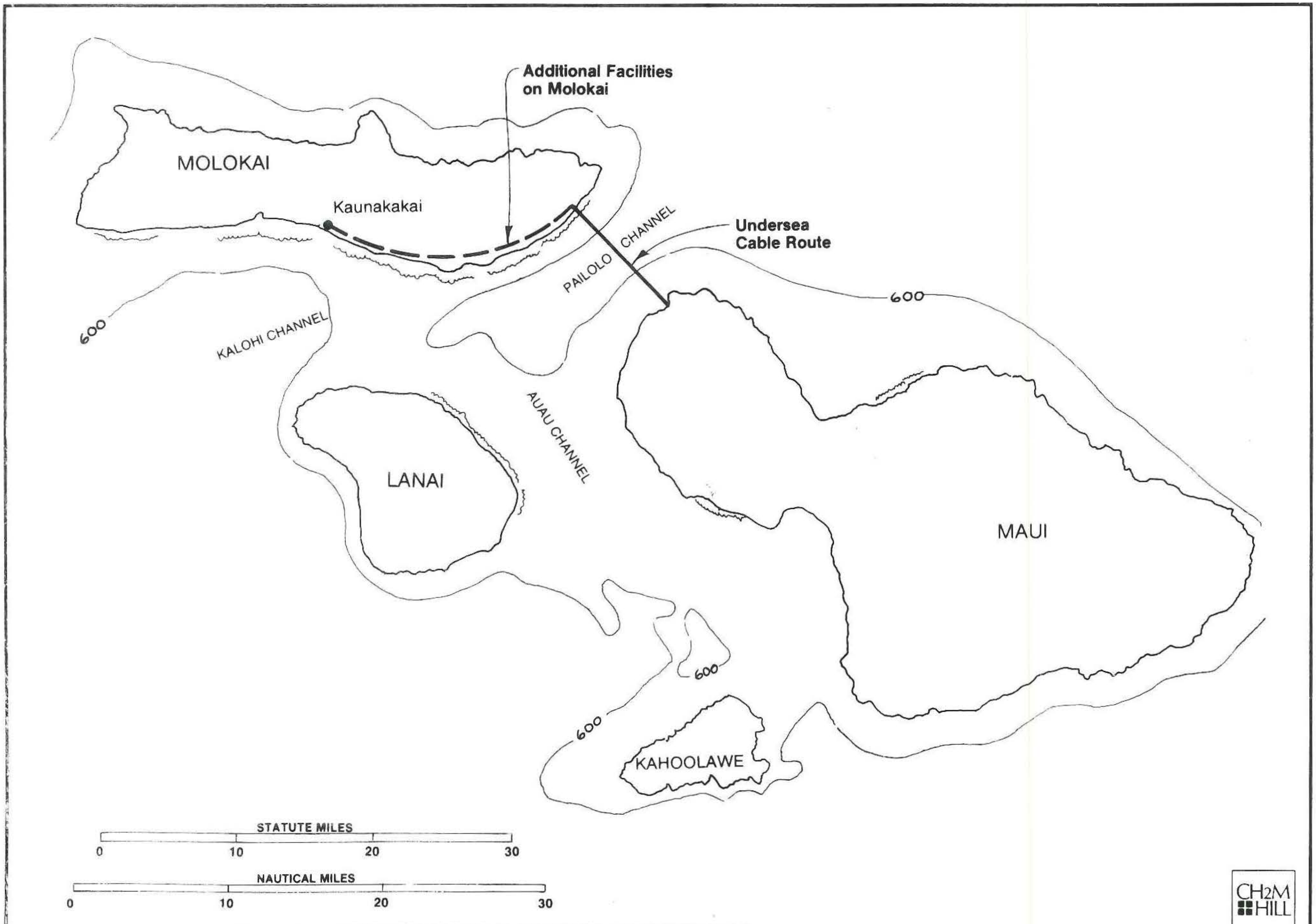

Figure 1 UNDERSEA CABLE PROJECT LOCATION MAP

Before a commitment is made to install an undersea cable, a great deal of technical work needs to be done. This work would resolve such concerns as:

- Concept--Lanai might be included as part of a loop.
- Route--It may be less expensive to install a longer cable to Kaunakakai than to build overhead transmission lines on Molokai.
- Three-phase versus single-phase cables.
- Buried cable installation versus on the seabed.
- Cable load carrying ability--This is a combination of voltage, conductor size, and conductor length.
- Type of cable to be used (oil-filled, solid dielectric, impregnated paper).
- Physical and electrical interconnection to existing facilities.

Once these questions are resolved, an undersea route survey would be needed.

Environmental Considerations

It appears that an undersea cable will involve the following environmental considerations:

- The routing, location, and appearance of onshore facilities
- The seabed conditions encountered along the cable route (sand, coral, etc.) and the extent of modifications necessary to it
- Possible restrictions on activities over the cable corridor
- Possible effects on whales

None of these are anticipated to be "fatal flaws" to an undersea cable.

CABLE BENEFITS

Installation of an undersea cable would provide a number of benefits to Molokai and Maui. The immediate advantage of an undersea cable is the availability of an economic reliable power supply from Maui. This power supply would allow the generation on Molokai to be evaluated on its competitiveness with power from Maui via the cable.

Perhaps the most important benefit is Molokai's access to greater economies of scale in power generation and utility operation. A cable would provide access to the much larger base of generation on Maui, which because of its size, has operating economies not available to Molokai. The cable could allow a significant reduction in the staff needed on Molokai to operate the electric generation and distribution systems. The power plant staff would no longer be needed. The office functions could, by and large, be shifted to Maui. Distribution operation and maintenance staff would need to be maintained on Molokai. Overall, salary costs could be reduced by up to 50 percent.

The ability to develop and utilize the potential nonfirm renewable resources on Molokai would be greatly increased. These potential resources, particularly wind, could be developed to the extent that power can be exported to Maui. Without this export market, the wind resource on Molokai would probably not be developed in the forseeable future.

It must be kept in mind, however, that there is a practical limit to the amount of wind energy that the Maui Electric system can absorb without negatively affecting system stability. This limit is estimated to be about 5 to 10 percent of Maui Electric's loads.

A cable would allow the existing Molokai diesel units to be removed from service and rehabilitated, if appropriate, so that they could continue to provide either firm or standby generation if the cable is out of service. This would, however, require staff on Molokai to operate and maintain the units.

An improved power supply would reduce the incentives for larger customers on Molokai to turn to self-generation.

POWER SUPPLY

As was discussed in our previous report, an undersea cable would provide an access to a reliable, economic power supply from Maui. The following discussion briefly addresses the ability of Maui Electric to provide this power supply.

Table 1 compares the electric loads and generation on Maui and Molokai.

Table 1
MAUI AND MOLOKAI LOADS AND GENERATION

	Maui	Molokai	Total
Peak demand (MW)	95	5	100
Annual energy generation (millions of kWh)	482	23	505
Generation capacity (MW)	110.3	8.7	119.0

Maui Electric's peak demand is 95 MW, and its annual energy generation is approximately 482 million kilowatt-hours. Installed generation capacity is 110 MW. Loads on Molokai are a peak of approximately 5 MW; energy requirements are approximately 23 million kilowatt-hours annually. These are 5 percent of Maui Electric's loads.

The existing generation of Maui Electric is heavily dominated by oil-fueled generation. Based on 1980 figures, 70 percent of the generation capacity was oil fueled. An additional 27 percent of the capacity was fueled with an oil-bagasse mixture. Fifty-nine percent of the energy generated was from oil, and an additional 36 percent was oil-bagasse. In the short-run, generation on Maui to serve Molokai would be expected to be oil and oil/bagasse based.

The average fuel cost of generation on Maui is approximately 7.2 cents per kilowatt-hour.

Loads on Maui and Molokai tend to follow the same general pattern; that is, the systems tend to peak at about the same time. Because of this, if Maui Electric were to provide Molokai's power supply, its load would see an immediate 5 percent growth. This amount of growth is comparable with that normally experienced by Maui Electric every 2 to 4 years.

Maui Electric presently plans to add generating capacity about 1992. If it were serving Molokai loads, this schedule might be shortened by one year. Given the present relative size of the loads on Molokai and the generation capacity on Maui, it is not expected that there would be system stability problems if there were a sudden loss of the Molokai loads. Sudden loss of the Molokai loads would not be expected to cause generators on Maui to overspeed and to be taken out of service by protective devices. A cascading effect resulting in outages on Maui would not be expected to occur.

However, if at some time in the future, loads on Molokai were to assume a larger portion of the generation on Maui, stability problems might occur. A possible solution would be to have firm power generation on Molokai.

COST ESTIMATE

Based on the HNEI report, our previous report, and recent cost estimates from cable manufacturers, the estimated direct construction cost of the cable installation is shown below. The effects of potential inflation have not been included.

Table 2

CAPITAL COST ESTIMATE FOR UNDERSEA CABLE
TWO 3-PHASE CABLES (JANUARY 1983 DOLLARS x 1,000)

Undersea cable		
Cable	$ 2,800	
Accessories	250	
Installation	3,000	
Undersea route survey	110	
Subtotal		$ 6,160
Interconnection facilities		
Maui	1,500	
Molokai	5,500	
Subtotal		7,000
Taxes	300	
Engineering	400	
Allowance for funds used during construction	500	
Contingency	1,000	
Subtotal		2,200
TOTAL ESTIMATED CAPITAL COST		$15,360
Load carrying capability--MVA	30	
Cost per kVA	$512	
Transmitted MVA	5	
Cost per transmitted kVA	$3,072	

FINANCING THE UNDERSEA CABLE

Depending upon the entity or entities which eventually undertake the project, the undersea cable could be financed in a number of ways using a combination of options. We have considered the following options.

Special Purpose Tax-Exempt Revenue Bonds

One option is to do the financing with special purpose tax-exempt revenue bonds. These bonds would be issued under the existing state program, HRS, Chapter 39A, Part VI. Use of this type of bond financing would require a two-thirds approval of the legislature. These bonds would not be a general obligation of the State, but would be issued by the State Department of Budget and Finance, under a project agreement, unconditionally obligating the project party, an electric utility regulated by the Public Utilities Commission, to pay the principal and interest on the bonds and other expenses associated with the bonds.

The bonds would be exempt from federal income taxes under the local furnishing of electric energy exemption for industrial development bonds. The exemption requires (1) the owner or operator must be obligated to furnish electric energy to all persons within its service area who desire electric service, and (2) it must reasonably be expected that such a facility will serve or be available to a large segment of the general public in the service area. The facility must also be depreciable, transmit energy, be in the business of furnishing electric energy, and provide service to no more than two contiguous counties. The proposed cable appears to meet these tests and would, therefore, qualify for the exemption.

The U.S. Congress is considering increased limitations on the use of tax-exempt industrial development bonds. At this time it is difficult to predict what, if any, additional restrictions may be applied.

The bonds would also be exempt from state and county income taxes.

By state law, the term of the bonds is not to exceed 30 years.

Tax-exempt financing now costs in the range of 9 to 10.5 percent for thirty-year securities. The stronger the public agency issuing the bonds, the higher the bond rating; the higher the rating, the lower the cost.

It is probably safe to assume that this type of bonding would shave two percentage points or more from the cost of capital to the project. Hawaiian Electric has indicated that this option is more attractive than conventional utility financing discussed below.

State/County General Obligation Bonds

Both the state and the county are able to issue general obligation (GO) bonds to finance such undertakings as are authorized by the legislature or the county council. Voter approval is not required. GO bonds would be backed by the full faith and credit of the state or county and would be a first charge on the general fund. The bonds would be exempt from state, county, and municipal taxation. It is also expected that the bonds would be exempt from federal taxes under the local furnishing of electricity exclusion.

Because the bonds would be tax-exempt and backed by the full faith and credit of the state or county, the bonds should enjoy a higher rating and lower interest rate than revenue bonds. This cost advantage is estimated to be between zero and one-half percent.

State or county revenue bonds would be almost identical in nature and cost to a special purpose bond and are therefore felt to be essentially the same.

Conventional Utility Financing

If an investor-owned utility, such as the Maui Electric Company, were to undertake the building and financing of the project, it would presumably be funded through conventional utility financing. Typically, this involves a mix of long-term debt, short-term debt, preferred stock, and common stock. The long-term debt would preferably be special purpose revenue bonds. Conventional long-term utility 30-year mortgage bonds would currently cost between 12 and 13 percent.

Leasing

Because of changes in the federal tax laws in 1981 and 1982, there are, under certain highly technical regulations, opportunities for certain energy-related, and other, types of development, as specified by Congress, to benefit from exceptionally low financing costs through the use of the sale and leaseback mechanism. This involves financing and ownership of a project by individual investors seeking tax shelters, who lease the facility back to the operator. The lease fee incorporates a capital cost component which reflects a partial sharing of the tax benefits, and can produce lower financing costs to the operator than would otherwise be the case. Because a cable project would be eligible for only a 10 percent tax credit, this option is not considered a strong one.

CH2M HILL has investigated a number of such arrangements under various conditions. We have usually found that they require careful scrutiny by a reputable underwriter familiar with the regulations. We have conducted no such investigation, but it should be looked into when the project is nearer the financing stage. This type of financing can be done with either a private or public agency operator, under conditions defined by the regulations, and could result in a one or two point advantage over the other two options described above.

CH2M HILL has often found it beneficial to enlist the counsel of a financial adviser early on in the planning of a facility such as the proposed submarine cable. Early involvement permits the financial advisor to have input to the planning process which can help avoid costly mistakes in the structuring of the enterprise.

Tax Credits

The undersea cable would be eligible for a 10 percent investment tax credit. It would not be eligible for an "energy tax credit". This 10 percent credit would be deducted directly from any federal income tax liability that the project sponsor might have. The usefulness of this tax credit will be a consideration in determining which is the best financing method.

Grants

There is also the possibility that the cable might be eligible for, or able to attract, a federal grant. No existing grant programs have been identified that might be potential sources of funds. As a result, it is assumed that a grant would not be available.

REA

The undersea cable is not eligible for assistance under the Rural Electrification Administration. The REA will lend money for facilities only to extend service to unserved customers.

Discussion

The cable could be financed completely by any one of the above methods, or by a combination of them. The effective cost of financing for the project will be dependent on which method or combination of methods is used. If GO bonds are used, the principal and interest due on the bonds, plus any associated bond costs would not be charged to the project. This would, in effect, reduce the annual cost of the project that would be recovered through electric rates. The GO bond costs would be recovered through the tax revenues of the state or county.

The most likely method of financing the cable appears to be utility financing using the utility's normal debt equity or capital structure. Special purpose tax-exempt revenue bonds would be used for the long-term debt portion of the financing. State or county participation is not felt to have a high likelihood.

HDWC Program Study

As part of the overall HDWC Program effort, the Department of Planning and Economic Development has also authorized a small study effort to look into the legal, permitting, institutional and financing considerations of a cable from the Big Island to Oahu. This effort is being done by a legal firm and an investment banking firm. Their report is expected to be complete by the end of March and may shed more light on how a Molokai to Maui cable might be financed.

NEED FOR SINGLE-UTILITY OWNERSHIP

If the cable is financed by Maui Electric, it is necessary that there be a single-utility ownership and approach to ratemaking for both islands. This single-utility approach allows the spreading of the cable costs over a much larger base than just Molokai.

Single-utility ownership would allow the cost of the cable to be spread over all of the customers of the two islands. This is the ratemaking policy currently being used for service to the more remote areas on Maui, such as Hana. Electric customers in Hana pay the same electric rates as customers in Wailuku, Kahului, Makena, and Honokohau. The cost of the facilities that serve only those customers is not allocated directly to them.

If there continue to be two separate utility companies, we do not believe this policy is practical. With two utility companies, the cost of the cable would have to be allocated between them. This would be done on the basis of cost-of-service and, in our opinion, would result in the entire cost of the cable being assigned to Molokai.

Given a single utility, we do not believe that the PUC would have difficulty in approving a ratemaking approach that includes Maui ratepayers supporting the cost of the cable, especially given the relatively small effects on ratepayers as will be shown later. However, until such a proposal is actually brought before the PUC, it is difficult to state what the Commission's position would be.

PROJECT ECONOMICS

Based on the cost estimate for an undersea cable on page 10, the annual costs of the project have been developed and the sensitivity of these costs to changes in various parameters computed.

Assumptions

The basic assumptions used in the analysis are:

- The cost estimate is based on January 1983 dollars. The effects of inflation have not been included.
- The cable would be entirely financed by Maui Electric using the following capital structure and cost of money.

Type of Capital	Percent of Total	Cost (percent/yr)
Long-term debt	48%	10.5% (before tax)
Preferred stock	12	13.5 (after tax)
Common stock	40	15.0 (after tax)
	100%	

- Book depreciation would be over 30 years.
- Tax depreciation would be on a declining balance method utilizing a factor of 1.5 over 15 years. The first year's depreciation is one-half of a full year, or 5 percent.
- The cable depreciable investment would be eligible for a 10 percent investment tax credit (ITC).
- The ITC would be amortized over 30 years.
- There would be an annual $800,000 reduction in Molokai Electric salaries as a result of purchasing power from Maui.
- Maui Electric would carry an increased fuel oil inventory of $200,000. This is approximately one month's reserve for Molokai loads. This inventory would be included in Maui Electric's rate base.
- The federal income tax rate is 46 percent.
- The following state and local tax and fee rates apply for each dollar of revenue:

Public service company taxes	5.89%
Public utility commission fees	0.25
Franchise taxes	1.00

- A state income tax of 6.0459435% on net income.
- Annual energy sales on Molokai and Maui are:

Molokai	23 million kWh's
Maui	482 million kWh's

Annual Cost

Table 3 develops the estimated first year annual costs of the cable. It should be noted that the investment tax credit (ITC) in the first year results in a tax-credit carryover to Maui Electric. With or without the ITC, however, the annual costs would be the same for the cable.

Table 3
UNDERSEA CABLE ANNUAL COSTS[a]
(1983 $ x 1,000)

Operation and maintenance	$ 65	
Depreciation	512	
Interest on debt	784	
Labor savings	(800)	
Subtotal		$ 561
Taxes:		
Federal income	(731)	
Deferred tax depreciation	256	
ITC	1,536	
Amortization of ITC	(51)	
Public service company	184	
PUC fees	8	
Franchise	31	
State income tax	141	
Subtotal		1,374
After tax return to equity		1,186
TOTAL ANNUAL COST		$3,121
Cost per kWh:		
Molokai	13.6¢	
Molokai and Maui	0.6¢	
Wholesale cost of power per kWh	7.0¢	
Total cost per kWh (¢):[a]		
Molokai	20.6¢	
Molokai and Maui	7.6¢	

[a] Does not include transmission, distribution, customer related, or other costs that would be included in a retail rate. These costs could range from 2 to 6 cents per kWh.

Sensitivity Analysis

Table 4 summarizes the results of several analyses that were done to test the sensitivity of the results to various changes in capital cost, the cost of money, and the depreciation period.

Table 4
SENSITIVITY ANALYSIS SUMMARY
CABLE COST ONLY

	Capital Cost Variation -25%	Capital Cost Variation 50%	Overall Cost of Money 1%	Cost of Long-term Debt 1%	40-Year Depreciation
Annual cost ($ x 1,000)	$2,144	$5,079	$3,374	$3,201	$2,983
Cost (¢/kWh)					
Molokai only	9.3	22.1	14.7	13.9	13.0
Molokai and Maui	0.4	1.0	0.7	0.6	0.6

Table 5 indicates the effects of shifting the cable costs between Molokai and Maui. It can be seen that the cost per kWh of the cable to Molokai could range from 13.4 cents per kWh to zero cents per kWh. The costs to Maui could, correspondingly, range from zero cents per kWh to 0.64 cents. Each one cent on Molokai represents 0.048 cents on Maui; conversely, each one cent on Maui represents 20.96 cents on Molokai.

Table 5
EFFECTS OF COST SHARING BETWEEN MOLOKAI AND MAUI

Cost Basis (%) Molokai	Cost Basis (%) Maui	Cost per kWh (¢) Molokai	Cost per kWh (¢) Maui	Percent of Present Maui Rate - 13.4¢
100%	0	13.6¢	0	-
75	25%	10.2	0.16¢	1.2%
50	50	6.8	0.32	2.4
25	75	3.4	0.48	3.6
5	95	0.7	0.62	4.6
0	100	0	0.64	4.8

Any decision on how the costs should be shared is beyond the scope of this report.

APPENDIX

RESOURCE CONTACTS

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