



Remarks of J. V. House, Acting Administrator  
Alaska Power Administration, U. S. Department of the Interior  
for the House Special Energy Committee Hearing  
Alaska State Legislature, February 28, 1974

I sincerely appreciate the opportunity to participate in these hearings. My comments will be addressed to the State's power systems needs and alternatives, and for the most part on some of the longer range alternatives. I must stress that my views are not intended as a formal expression of Interior Department views on the very important matters under consideration by the Committee.

Chairman Hartig has suggested the Committee would be interested in a presentation formed around Alaska's electric power systems, present and future, the State's hydroelectric potentials, Devil Canyon Project, and Snettisham Project.

My agency, the Alaska Power Administration, has headquarters in Juneau. Our assignments include planning for water and power development, operation, maintenance, and power marketing for Federal hydro projects in Alaska. APA and its predecessor (Alaska District Office, Bureau of Reclamation) have been involved in power studies in Alaska, principally hydroelectric and transmission studies, since 1948. A fairly comprehensive evaluation of statewide hydro potential is one result of our studies. We believe our planning contributions will be useful to all agencies in analyzing the energy problems of the State.

## Effects of Energy Crisis

There have been some fairly tight fuel supply situations for some power systems, but so far as I am aware, no one has actually had to cut back power production because of fuel shortage.

I have heard reports from several of the utility systems that winter peaks for 1973-1974 have been significantly below that anticipated. We do not yet have good statistics on the amounts of reduced loads, or the extent to which they reflect conservation measures. Some utilities are actively encouraging conservation; others may be more concerned about the loss of revenue.

Many utilities are looking at a need for rate increases because of the rapid increase in diesel fuel costs, and higher costs to the electric customers will probably become a fact for most Alaska power systems. Diesel electric production costs for some of the larger Southeast Alaska cities are now up to about 3 cents per kilowatt-hour.

Any changes in values for Alyeska pipeline fuels will surely affect power systems planning for areas along the pipeline route.

## Alaska Power Survey

One of our current programs is a major contribution to a revised Alaska Power Survey, sponsored by the Federal Power Commission. It is a study of potential Alaska power system needs and alternatives through the year 2000, in addition to a current inventory of existing

facilities. This work is in progress under four Alaska Advisory Committees to FPC, with participation from the utility systems, several State and Federal agencies, and representatives of consumer and environmental groups.

Draft reports of three advisory committees have been furnished to your Committee. They cover economics and load projection, resources and generation, and environmental and consumer aspects.

Points developed in the Power Survey work to date include:

1. Statewide Alaska power requirements are growing at an average rate of around 12 percent per year (doubling every 6 years). The current national growth rate is approximately seven percent per year. This rapid growth covers a period during which there was a surprisingly small increase in industrial power use. The pipeline related activities, and other near future developments, indicate this rapid increase will continue at least for the balance of this decade.

2. The present total statewide installed generating capacity is approximately one million kilowatts. Over 70 percent of this is in the Railbelt area. New statewide capacity required between now and the year 2000 will be in the range of 3.2 to 10.5 million kilowatts, depending upon whether you assume minimum or intensive industrial development. In terms of energy, the electric requirements by the year 2000 is estimated to be in the range of 15 to 58 billion kilowatthours. Since Alaskans are generally becoming accustomed to thinking in terms of oil, this is

equivalent to 25 to 100 million barrels of oil per year if used for power generation.

3. Nearly all recent growth has been supplied by additional oil- and gas-fired generators. Between 1965 and 1972 dependency of Alaska power systems on oil and natural gas rose from 36 percent to 60 percent. The percentage will likely be about 90 by 1980 because of lead time needed for the alternatives. The implication is that 1980 fuel requirements will be three to four times present use levels.

4. In view of recent developments, we probably will be looking at cost incentives, as well as resource allocation incentives, to change this trend. The coal and hydro alternatives certainly are receiving a great deal of new interest. Nuclear power is probably further in the future for Alaska, and other energy sources, such as geothermal and solar power, will remain uncertain for quite some time because of technical and economic problems.

5. Cook Inlet and the Railbelt generally are blessed with very attractive oil, gas and hydro alternatives. Most of the rest of the State is pretty well locked into diesel-fired generation with few alternatives, and consequently is facing some very disturbing cost increases.

Short term alternatives seem pretty well limited to conservation actions. There is opportunity to put the larger power systems of the Railbelt on a coal and hydro energy basis within roughly ten years,

if priorities are attached to developing these alternatives. Similarly, Southeast Alaska could be shifted to a hydro energy basis. The implication would include substantially increased investment, significant fuel savings, and new environmental considerations.

Coal plants, hydro projects, and new transmission grids involve a much different range of environmental factors than the existing diesel- and natural-gas-fired plants.

A further option is the concept of an all-electric economy, with energy derived from coal, hydro, and eventually nuclear power.

#### Hydro Potentials .

Another of the reports furnished to the Energy Committee includes the March 1973 report of the Hydroelectric Task Force for the Alaska Power Survey. It includes the inventory summary of 76 "more favorable" hydro sites. The inventory list represents results of a careful screening out of literally hundreds of other potential sites on the basis of size, cost, and other factors.

With minor modifications, the inventory list appears in FPC's "Hydroelectric Power Resources of the United States, Developed and Undeveloped," January 1, 1968. The FPC report shows 84 Alaska sites with potential capacity of 32,511,100 kilowatts, and annual energy of 172.5 billion kilowatthours. This energy amounts to 36.2 percent of the nation's undeveloped waterpower. Elimination of the smaller sites with potentials

of less than one billion kilowatthours per year reduces the FPC list to 21 projects with an annual energy potential of 123.5 billion kilowatthours representing 55 percent of the U. S. total in such larger sites.

There are many steps between a physical inventory and a determination of projects that are desirable elements of long range plans for Alaska. The basic multi-purpose studies that could provide such answers remain to be done.

The inventory represents a very wide range of resources values. Several projects such as Yukon-Taiya, Rampart, Wood Canyon, Wood-chopper, and Susitna are known to rank among the most important undeveloped hydroelectric resources of the nation. Others have relatively small energy potential, and are essentially of local significance only. Many are not economically justifiable under current costs and evaluation criteria; many would have significant benefits for purposes other than power.

It is clear that the hydro potential is a major, long range renewable energy option for Alaska. This is not the case for most of the rest of the nation.

Current interest in Alaska hydro development focuses on Devil Canyon on the Susitna River, and several smaller projects that would serve Southeast and Gulf Coast cities. Further remarks on Devil Canyon will follow.

Ketchikan, Metlakatla, Wrangell, Petersburg, Sitka, and Kodiak are among the cities looking at local hydro projects. The interest is a direct result of the changed fuels situation, both higher cost and concern for long range fuel availability.

We have completed feasibility studies on several of the more promising projects such as Thomas Bay near Petersburg, Lake Grace and Swan Lake near Ketchikan, and Takatz Creek near Sitka. Several other projects are under study by consultants for the cities.

These projects involve sizeable investments, but economics are basically favorable for the best ones in view of the changed fuels situation. I do not believe anyone expects these projects will be constructed without State or Federal assistance in financing.

#### Snettisham

The first phase of the 70,000-kilowatt Snettisham Project near Juneau started initial commercial operation on December 1, 1973. The first phase consists of two 23,350-kilowatt generators, a 44-mile transmission line to the Juneau area, and the Juneau Substation. The plant is operated by remote control from Juneau.

The current situation involves a major transmission line failure, with loss of three towers between Taku Inlet and Juneau. I expect a decision by the Corps of Engineers next week on actions to restore service. Controlling factors are high wind and ice loading involving a relatively

short line segment. We need to have assured reliability before next winter's operations.

We will have some surplus energy at Snettisham for several years, and once reasonable reliability is attained, we will actively explore ways of using the extra renewable energy to reduce dependency on oil.

### Devil Canyon

Most of you are aware of the renewed interest in hydroelectric development on the Upper Susitna River Basin. The Alaska Congressional delegation has introduced legislation on the Devil Canyon and Denali units, and the FY 1974 supplemental appropriations bill provides a start for detailed investigations of the Upper Susitna potential. Alaska Power Administration will be working very closely with the Corps of Engineers on the studies.

The Bureau of Reclamation completed a favorable feasibility report on the Devil Canyon Project in 1961, but presentation of the report to the Congress was deferred pending actions on the Rampart Project. Subsequent studies by the Bureau of Reclamation, Alaska Power Administration, and others confirm that Devil Canyon and other potential units of the Upper Susitna Project are among the most favorable potential power sources for Alaska's Railbelt area.

A 1973 resolution by the Alaska State Legislature requested update of the 1961 report. As a part of the Power Survey work, we initiated

a review of the plans and estimates in late summer, 1973. The review will be covered in a status report on the project--a draft will be available in March 1974.

While many details remain to be worked out, the plan is to complete the engineering, economic and environmental studies needed for a new feasibility report in about two years, or roughly by the end of Fy 1976. The report will probably cover the Devil Canyon and Denali units and related transmission facilities.

It is expected that initial development of Devil Canyon and Denali could provide 600 MW of power, and 2.9 billion kilowatts per year of firm energy to Alaska's Railbelt. Full development of the Upper Susitna would include two more dams--Vee and Watana--for a total of about 1,600 MW, and 7 billion kilowatts per year.

Should authorizing legislation be enacted, the time frame for environmental studies would be about the same, but work on design details would be somewhat accelerated.

MEETING  
HOUSE SPECIAL COMMITTEE ON ENERGY  
February 28, 1974

Present at the meeting were Chairman Bob Hartig, Speaker of the House Tom Fink, Representatives Mildred Banfield, Terry Gardiner and Phillip Guy; J. V. House and Bob Cross from the Alaska Power Administration.

The meeting was called to order at 5:05 p.m. by Chairman Bob Hartig. Mr. Hartig introduced Jim House and Bob Cross who were going to speak on the hydroelectric potentials in the State and the hydroelectric proposal on Devil's Canyon.

Mr. House gave his testimony (copy attached) and a question and answer period followed. Mr. House passed out copies of maps at Mr. Hartig's request.

FINK: At Snettisham, the 70,000 kilowatts, what is the potential of Snettisham?

HOUSE: That is the potential roughly.

FINK: That is all you ever get out of it. There is not enough water for additional...

HOUSE: That is correct. There are projects nearby that may warrant consideration in future dates, Lake Dorothy, as an example.

FINK: What is the loss of power, like in the 44 mile transmission, what percentage do you use in...

HOUSE: Ten percent is the strong figure, seven per cent is probably more correct under full load conditions.

FINK: They have means of taking power a long, long ways yet or they still can't do it?

HOUSE: No.

FINK: Can you have 1,000 miles of transmission line or do you lose all the power from one end to the other?

HOUSE: No, you can transmit power long distances with transformation to higher voltages and the losses increase accordingly.

FINK: Can you have a 400 or 500 mile line?

HOUSE: Probably the longest single line in service is the Pacific Northwest - California inter-tie, which I believe is about 1800 miles. That direct current has an advantage in that these losses are only related to the resistance of the wires so you get more power at the same voltage as needed to increase the wire. With alternating current there are other factors concerned with reducing the efficiency.

FINK: What is the kilowatt usage in the general area? Normal usage? I'm trying to compare it to 70,000 kilowatts. Do you use something less than 70,000?

HOUSE: At present the total Juneau load, including the Valley, is under 20,000 at the peak.

FINK: You have a lot of surplus then. I'm trying to find out, for example, if there is any reason that you can take power from Snettisham to other communities in Southeast Alaska.

HOUSE: Several years ago we gave consideration to that, particularly when we were studying the feasibility of using direct current and submarine cables. We considered the cables to Sitka, for instance, but in spite of this surplus that you made reference to, just under normal utility growth without any industrial development to speak of in the City, within 13 years that 70,000 will be fully used in Juneau.

FINK: You mentioned that we had a problem with three poles or something and that you've got to make it stable by next winter. Are you going to be able to accomplish that? What are you going to have to do to make it stable?

HOUSE: I can't say at the moment, fortunately it's the Corps' problem. They have called a meeting for next Tuesday in Anchorage with the specialists from Bonneville. Franz Nagel will, at my invitation, attend the meeting. We will have one man there. We have three phases in mind: No. 1, restoring service, following the icing period for this spring and summer. That will be an emergency measure and will probably have some limited capacity, not limited to the extent that it will affect Juneau. It's going to take time to fully analyze the requirements to make a line that can withstand the tremendous forces that we're up against up on the ridge. Hopefully, they can reinforce that to the extent that they would feel and everyone concerned would feel reasonably safe the following winter - that will be a goal. But for the ultimate revision of the system, which they acknowledge is necessary, may require a relocation of the line off of the top of that barren ridge where we get the tremendous ice from slush storms and it's up at 2,000 feet where freezing is always a problem. The conductors build up in ice. So far we've seen up to five inches and the same appears on the towers, which is a problem. The Corps felt confident that the information they had available, their design should have been adequate but has proved otherwise.

FINK: How long a strip is this?

HOUSE: The area of concern is roughly two miles.

FINK: They don't want to put this underground for two miles?

HOUSE: That is solid rock up there, that would be a problem.

FINK: They have built miles of road through rock.

HOUSE: I wouldn't say that they would rule it out but...

FINK: If it were on line and reliable, the whole Juneau area could go that power and they wouldn't use any fuel for electricity.

HOUSE: That was our goal, right.

FINK: You're not sure there has been enough interest from the federal government that they are going to do it this summer?

HOUSE: I wouldn't want to say, it's the Corps' problem and they wouldn't want to commit themselves until they have consulted with the experts.

CROSS: There's no question that they intend to get it back on line, it's just a matter of how to make it work.

FINK: They have in mind of putting it so they don't have any more weather problem. Not just putting it up and letting it break down again next winter. I think this is one thing that we are supposed to do, if we can push anybody to make that a reliable line - we'd like to do it or I'd like to do it.

HOUSE: Believe me, I had a session with Franz Nagel and Bill C. yesterday and they pointed out the seriousness of it from their standpoint, but they have their problems. In addition to taking over the 60-year old A. J. facility, which they hope to modernize as fast as money and time will allow, they have built their organization around on the assumption that Snettisham power would be available. Fortunately, we did enter into an operating contract with them which permits them to use their extra men and our substation and our operators. At the present time, since we are out of service, these men are somewhat surplus to their needs. To relieve them of this, we've invited them to send these men down to Snettisham to get acquainted with the power plant at the site. Under certain circumstances, they might need to operate from there. That would be an unusual circumstance.

FINK: If you had on line 46,000 kilowatts and you're using less than 20, so you have more than enough to take care of your requirements in this area.

HOUSE: For a couple of years anyway. With those two units and the third unit scheduled for availability the winter of '77 and '78.

FINK: Is that being worked on now?

HOUSE: Yes.

FINK: Do you have money for that?

HOUSE: Yes, the Corps does.

BANFIELD: It is my understanding that those towers up there, three of them just collapsed.

HOUSE: I wish I could say that that is all they did. They sort of disintegrated.

BANFIELD: The point I'm making is that if something can happen environmentally so that they can put those towers lower down. There is always going to be this probability that during a large part of the year, we're going to be without power. Which means that the local light company will have to increase their diesel so that they are always going to have enough to provide and this intends to increase the local rates. We're

not only buying Snettisham but we are also having to pay for all this equipment that we have to have when the lines are down.

HOUSE: That is a point well made, Millie, I'd like to explain it just a little bit. Early in the consideration of the design, we considered double circuit or two independent lines between Snettisham and Juneau. There were two possible routes: one our present route, basically along the shore line beyond Taku, and the other one is up over the ice cap. It makes me shudder to think of it today, but there were two things that came to mind on that. The two lines would basically be exposed to the same atmospheric conditions and the probability of losing both of them at once or close together was quite high. We discussed this with the light company and an extra line would have cost another eight million dollars which, when added to the cost of the project, the project, the rate structure - it was Mr. Nagel's - he concurred on our recommendation that the reserve capacity be provided in the Juneau area. He agreed to that and I think it was good judgment under extreme conditions.

FINK: The two miles under the ground, would that solve the problem?

HOUSE: First, I wouldn't want to say with any assurance that the two miles would do it, that would be a minimum.

FINK: Three miles. It seems rather inconsequential when you talk about electric generation for this whole community, two, three or four miles, it seems you wouldn't have to carry it very far either.

HOUSE: That is a very good point and I think they will consider it.

BANFIELD: How about having the towers closer to the water?

HOUSE: There is this point, it may not be too valid either, when you think about it. Generally, underground service is more reliable but if you have a problem you've got a bigger one; you'd better dig it all up again and find the fault. It is not quite as obvious where the trouble is.

FINK: All these power projects, they are all 10 years delay at the earliest, aren't they?

HOUSE: Ten years is the minimum time for a Devil Canyon type project, yes.

FINK: What about things like the ones in Ketchikan, Metlakatla...

HOUSE: I put those in the same category, you have to get authorization, funds, environmental statements. We figure on the Susitna, a two-year study. A year of which will be just environmental impact.

FINK: The stuff you mentioned on the railbelt, it would appear to me that the railbelt hydro with the coal and gas and oil that's there, it looks to me like it isn't nearly as important as being in areas like this where the oil and gas are.

HOUSE: We feel we are in a very favorable position with the gas and the potential oil, the beluga coal, the Healy coal, it's just a question

as to what the attitude is going to be concerning the best use of that gas and oil under the present energy picture. As far as beluga is concerned, the Chugach Electric has a very good contract with three oil companies there for 200 billion cubic feet and I understand it's been extended for another 180-190 billion at a very favorable rate. The original contract started out, I believe, at 60 mills or .16¢ per million cubic feet, escalating one cent every five years. Now, Mr. Schultz told me he has a similar deal on the balance of that supply over there, but in 1984 the reservoir is going to be dry so he's going to have to go elsewhere. He's going to put his last unit in 1984, probably another 50 megawatt gas turbine but there will be no point in his adding units after that because the supply just won't be there at any price.

FINK: No new supplies...He's got many, many years of gas.

HOUSE: Twenty years is the maximum. At that time they claim that the reservoir in that particular site will be dry.

FINK: You're talking about an awful lot of additional power then. He said with the present power you could go 50 years.

HOUSE: That's probably true, he's planning on building that up to 450,000 kilowatts which is a lot of units when you start staggering the price...

FINK: When they put another 70 on this summer, it's still a lot more than what we're using.

HOUSE: So the next question is the other gas supply price is completely unknown to me as to what that might be. The City of Anchorage is depending heavily on gas. They're buying it the same as you and I on a day-to-day basis. It's interruptible gas. They're paying .39¢ for it and the gas company can shut them off at any time which would mean they would have to convert to oil.

FINK: Yes, but there will be additional gas coming in. If I had a choice of where they're going to spend federal money for hydroelectric, I wouldn't spend it on the railbelt, I would spend it where there is not coal and gas. I'm talking about today's problem. The problem is taken care of for 25 years in the Anchorage area.

HOUSE: Don't forget it takes 10 years to develop something like that and you should be ready for it. Now there's two things in the Susitna project, if authorized expeditiously, would become available about the time that the CDA gases are beginning to dwindle. It would pick up the load that will grow between now and then and it should become fully loaded very shortly after completion, which is an important thing in the hydroelectric development, the earlier you can load it, the better off. Now if we can load Snettisham within a year or so, we can probably take six or seven mills off the cost of that power just by the fact that we wouldn't be paying interest on this construction money for so many years.

FINK: Well, I can see, like Eklutna was the greatest thing but now it's the highest priced power we have in the area as far as Anchorage

is concerned. We've got oil, gas and coal, it seems to me for 20 years we've got no problem, what I'm worried about is your problems.

HOUSE: We realize that and we are going to take a look at all of these potential hydro sites in Southeast Alaska. Incidentally, Bob met with Ketchikan a few weeks ago and Metlakatla also. They're very concerned their fuel costs are going up to where their production cost is going to be in the order of 30 mills or 3¢ a kilowatt hour. A re-evaluation of our \_\_\_\_\_ in Ketchikan, which is 20,000 kilowatts on a quick escalation, present day prices and new interest rate will probably be 26 mills, so it's still not going to be a bargain. These are expensive projects; however, cost is not quite as big a factor as it was a few years ago.

GARDINER: I just was wondering on the Snettisham project, you've got 44 miles in and right now, the first winter when everything is brand new, and as strong as it's ever going to be, you've fallen down for whatever reasons. Is there any reason to think that there might not be other areas in 15 - 20 years from now when all the metal has had a lot of stress, freezing action may have kicked out the cement and the anchors and all kinds of things can happen over that kind of time period, that there would be other sections...?

HOUSE: Most of our problem have been the last eight miles out here. There are vulnerable areas on the rest of the line, although it's not exposed to the cold temperatures, it's down nearest sea level, the winds are not as erratic or as strong, we do have certain snow slide exposure. We know where our snow slides have been, it doesn't mean that they might not appear in a new spot, so we've taken extra precautions in those areas and try to stay above them and have been prepared to expand the width of any known snow slide area. We've had one problem from the far side and that was a contractual deficiency in that he didn't make up a connector right and it came apart, but those things are to be expected. There's no guarantee there won't be other problems. Aluminum power, unless it is physically destroyed, should last a long time and doesn't require painting. They can be replaced by helicopter or in segments in any part of them.

GARDINER: Was it the main reason it came down, the wind or was it the ice or...

HOUSE: No one has been able to be up there when these conditions are occurring. Although we do have some mountaineering types who would be willing to go up and camp under the thing and actually observe what takes place under these extreme conditions. It would be very beneficial. I wouldn't want to do it.

GARDINER: I was wondering, it seems to me as if last winter hasn't exactly been the worst winter that Juneau has seen.

HOUSE: It probably has not, although it might have been an unusual one in respect to this sleeting condition. There isn't a normal amount of snow, that's true. The winds in Juneau haven't been too bad.

GARDINER: I was just thinking that two years ago there was a couple of storms up to 100 mile winds and that is to be expected.

HOUSE: I might point out it's been a long time since we've had three snow slides between here and Thane that we had this year.

GARDINER: If you wait long enough, one of them will happen (storms and all). Everybody thought the design was good enough that this wouldn't happen. Now they're thinking if that one went, maybe there are other areas that are...

HOUSE: We are very well aware of that, we are thoroughly embarrassed. Engineering-wise you ought to be able to accomplish almost anything these days but if going underground or going around the problem is the best solution, I hope that's the way they go.

HARTIG: Do you see any plans to develop large hydroelectric systems in Alaska for the possibility of transporting electrical energy to the south 48, in view of the energy crisis and all?

HOUSE: No, no plans. I might say in passing that at the request of Senator Stevens about three years ago, we made a real rough study of what the result would be if we converted to Prudhoe Bay oil or gas to electric power and bulk transported it to the Pacific Northwest. It is actually feasible to transmit energy by electric wire but it's not the most efficient way of doing it, according to most authorities. It didn't wind up at a price that Bonneville was excited about at the time. Today, they would buy it at any price.

HARTIG: A lot of things have changed in the last few years to a point where we're talking about shipping out natural gas from the LNG plant. I read recently that in North Dakota, the possibility of burning coal and shipping electrical power by using underground lines and current to the East Coast. Are you familiar with that?

HOUSE: Not that particular one, no. We will see a lot of direct current in the future. It is characteristic that it doesn't lend itself to what we were trying to do here at Snettisham, deliver a bulk load of power per load. The characteristics of the conversion and the conversion system is such it's more suitable to tie two systems together. A fault in one system doesn't transmit to the other one through direct current, you can control that. But you do have to have an alternating current source at each end of considerable magnitude.

HARTIG: What type power generation were you thinking about in the areas of Ketchikan, Metlakatla, Wrangell and Petersburg, Sitka and Kodiak?

HOUSE: Would you like to discuss those, Bob?

HARTIG: Do you have a dam situation similar to ...?

CROSS: Small hydro project similar to Snettisham, most of them somewhat smaller and most of them quite close to the cities that are involved and that is about the only alternative that we're aware of...

HOUSE: There are serious considerations in rebuilding their s plant that was destroyed in the flood several years ago. But up until then, they were getting ready to order more diesels. They still have to do that.

HARTIG: The cost factors, are they comparable do you think, when you build a dam and if you have need for additional power it would still be cheaper than it would be to continue to increase your fuel generating source?

CROSS: It appears that way unless something would come about to bring the diesel fuel costs back down...(can't hear)

HARTIG: I think that in light of the way fuel costs are going, I don't think we can look to see remarkable decreases in that so we ought to look at these things. Is the Eklutna, is that at full peak now?

HOUSE: The Eklutna project, since gas came in, has taken on a different operating mode. In fact, we have an agreement with the utilities that they will use Eklutna in such manner as will best fit into their gas turbine operation. Now gas turbines have a characteristic of being very inefficient unless they are nearly fully loaded so they can't run a gas turbine alone at a 25 per cent load to pick up a peak so they are using the Eklutna plant to shave the peaks off the daily load. Also, with no load at all, we keep both units running so that if they have a fault, there's 30,000 kilowatts there than can instantly pick it up. However, the areawide system has grown to a point that Eklutna is rather small potatoes compared to the rest of the system, so it's not as effective in that way. It is effective in controlling the frequency. The Eklutna plant, as small as it is, actually controls the frequency and they appreciate it because hydro characteristics have that advantage. No, it is not fully loaded. We're in our fifth year of below normal inflow in Eklutna Lake. The last two or three years we've been going right down to the rocks and as of the end of December this year, we are better than 200,000 short on our normal income for the fiscal year. We've discussed this with the utilities just last week and we told them our regular payment study still shows pay up at the end of the 50th year with a very small surplus but this low water year will probably show a deficit next year. They were not particularly concerned. I urged them to take all they could between now and the end of the year to make the picture a little better because we do have to send this into the Federal Power Commission. Every five years they review it and if we cannot demonstrate that the project was paying its own way, you have to increase the rates. They're anxious to get the best use of it for their purpose.

FINK: Doesn't NEA take most of that power now?

HOUSE: No. The City of Anchorage has a 16,000 kilowatt contract. Chugach has nine thousand and NEA has five thousand.

FINK: Are they taking it or are they giving that power to NEA?

HOUSE: No. The City of Anchorage has an agreement with NEA that they will wheel over our line their needs beyond our contract. Contractually we can only deliver them 5,000 - the cities have been making up the difference. Chugach is in the process of building a new line from Beluga around the Knik Arm into Palmer and eventually tie into our line. At that point, I'm sure there will be an agreement between Chugach and NEA to take up the reserves and it's legal for us to transfer their allotment to C.A. if it's mutually agreeable.

FINK: I understand that Chugach was using very little of it and letting NEA take the power. Chugach has a surplus right now...

HOUSE: No, they have no connection with NEA except through our system and at the moment the City is furnishing NEA with their additional requirements.

FINK: Doesn't it go the same route from Eklutna to Palmer?

HOUSE: Right, it does not.

FINK: Can't you say that Eklutna power is going there and they are keeping their own power...

HOUSE: An exchange basis, yes. If you want to look at it that way. The full NEA requirements is possibly at a given moment coming from Eklutna but that's that much less that we have to push into Anchorage to Chugach from the City so it's a trade-off.

GUY: Your remarks indicate that the power requirement's growth rate increased substantially at a time when industrial power use had not increased that much. What factors were used in the consideration of the growth rate needs?

HOUSE: That 12 per cent is a historical growth rate. Now from there, we made straight line projection. We've modified them for the future to show a considerable industrial growth, mining, timber and what have you and we've shown a more conservative industrial growth rate. No one is in a position to tell us exactly what is going to happen in the future. With these books that we passed out, there are projections showing all three possible ranges - it varies a long ways.

GUY: Mr. Chairman, let me try it this way. What were the more dominate factors in the growth redetermination?

HARTIG: Are you asking if industry, in other words, if industry comes in, is that what you want to know?

GUY: I'm looking at the power requirement for this remark.

HOUSE: I would say basically residential up till now, with commercial added on, relatively small amount of industrial load.

GUY: O.k., thank you. One or two other questions. What size of a community would the one billion kilowatt an hour per year power source support? I notice that a good number of potential sites have been eliminated by FPC.

HOUSE: Not necessarily eliminated by FPC, they're eliminated from their massive report sites that do not have at least a billion kilowatt hours, the cost per kilowatt hour would be prohibitive.

FINK: I think Adak power is something like 60 mills.

GUY: I think in some villages they have a monthly minimum and anything over a certain amount is an additional cost.

FINK: What I'm talking about is their cost production. It seems to me the average cost is something like 60 mills which is terribly high

compared to, for example, Anchorage, and I was wondering how these...

CROSS: It's even higher than the 60 mills.

FINK: It is and you're saying that these power things he's asking about is even higher than that.

CROSS: No, no, I think we have too many figures....

HOUSE: What I'm saying is a one billion kilowatt an hour is a pretty big one and the smaller ones would be quite a bit more expensive to get it than the big ones.

FINK: I suspect he's asking questions relating to Adak power?

GUY: I wasn't necessarily thinking about Adak but I was thinking of how much power these quotations eliminated sites that may be able to provide to certain communities.

CROSS: We didn't mean to eliminate the sites, we were just making a comparison of the very large projects. We didn't mean to say that they were eliminated.

GUY: Are the names of the sites going to be shown in the last map?

HOUSE: There is considerable recent costs data, various sized plants, localities, types of fuel.

RANDOLPH: It seems unfortunate that the energy situation outside, that we in Alaska are dependent upon petroleum energy as we are. The Snettisham thing and everything worked out fine, which you explained, would have pretty well taken care of Juneau, with hydroelectric power to eliminate at least the use of petroleum here. In Anchorage and Fairbanks, which are the other two major population centers, it seems that with some more foresight, we could have been much more dependent upon coal in Fairbanks than we are now. The same thing is probably true with relation to gas in Anchorage. For the real short run, the pipeline is going to be on line before too long and we can take our royalty oil and probably supply our energy needs that way for the whole State, even with your projections here. In the year 2,000, our royalty oil will still pretty well handle our total energy requirement. What I'm getting at is, in the very short runs in the next four years, could Snettisham hopefully get back on line here in Juneau? Could the gas development in Cook Inlet be increased in Anchorage so the potential will be relying much more heavily on the gas for energy in Anchorage and in the Cook Inlet and could the coal within that time frame be utilized more efficiently or effectively in Fairbanks?

CROSS: I think that any way that you go in the short-range that you are talking about that oil and gas is all that you could use. It'll probably take quite a bit more than four years to put a new coal plant on line. It takes longer than that. So it will be natural gas and fuel oils for the railbelt for several years to come.

RANDOLPH: Is Fairbanks using what coal generation capacity is there plus the oil generation until we get the oil or gas coming through the pipeline?

CROSS: Mr. Becker (?) would probably have a better idea on how long it would take to bring a new plant on but it is probably more like six seven or eight for one that is not very big.

RANDOLPH: In the Anchorage area, is there any potential there, providing more of their energy requirements from natural gas than is presently being done.

CROSS: Yes, and with the very good gas contacts the Chugach Electric Association has, that does allow for several years more growth.

FINK: How is this gas and oil produced, except at Eklutna? Everything in Anchorage. Occasionally they use fuel but gas must be first.

RANDOLPH: How about the heating?

CROSS: They use gas heat, too...

FINK: They do have a problem because they've got to build to capacity line.

HOUSE: Distribution is the problem in the Anchorage area, the pipeline.

RANDOLPH: Well, the pipeline between Kenai and Anchorage is the big problem. Is there adequate, economical-compared to hydro power-available in the Anchorage area from gas for the next 20 or 30 years?

HOUSE: There is still some coal research to be done. They can afford the cost of cleaning the gas up so that it's environmentally acceptable. It's not high quality coal, although I understand it's not as low as sulphur, although sulphur is not a big problem. I'm sure those fields are going to be developed one way or another either for gassification or direct burning in power plants.

HARTIG: I think Monday we will have Mr. Fackler on the hot seat and these are questions you'd better direct to him.

RANDOLPH: I think that the answer is that either one of those resources is physically plenty big for the power requirements. Is it conceivable that Alaska will be an exporter of energy other than petroleum and gas energy.

HOUSE: I think it's pretty slim, yes, because it's not the cheapest way to move energy.

RANDOLPH: But certainly bulk coal shipments or something like that could very likely happen.

CROSS: The coal enrichment process works pretty well, there's a lot of coal, there's 20 per cent moisture and 20 per cent ash.

HARTIG: Is it possible to store electrical power into fuel cells?

HOUSE: This is a theory, it's been practically developed, production of hydrogen. They tell me that you can produce hydrogen chemically cheaper than you can hydroelectric but there are a lot of dreamers that consider using our large hydro sites to convert electroletically the water into hydrogen and then transporting it to the use facility by the pipeline or barge or what have you. At the moment it's not

economical but it's a way of moving electrical energy by another conversion process.

FINK: Beluga, I think, is generating at about four mills, is that right? I get a comparison of...

HOUSE: They ought to include in the cost of the actual production cost, what I think is in the neighborhood of five mills or possibly a little more. Then when you add on the investment cost, they don't turn down their nose at our 9.3 mill Eklutna power.

FINK: I understand they really don't like it, they use it because it's a high cost power, they only use what they have to, so they tell me.

HOUSE: Try to get one of them to let his allotment go to somebody else.

FINK: What's your computation of the Healy power? I'm just trying to make some comparisons.

CROSS: The Healy power delivered in Fairbanks is well over 20 mills.

FINK: What is Snettisham delivered in Juneau?

HOUSE: 15.6 mills.

FINK: And Adak uses over 60 mills in their average. That figure sticks in my mind, that's what the manager said is 60 mills...

FINK: The \_\_\_\_\_, do you know what the City of Anchorage cost is?

HOUSE: That's a controversial number and I heard from just one side that the Public Utilities Commission...on just what they were quoting on the cost of power and, their production cost which did not include the financing of the investment, so I think it's crowding 12 mills.

FINK: Are they charging 12 mills? I didn't know they were charging that much.

HOUSE: Yes, they are one of the higher ...

CROSS: The rates started out at more like 3-1/2¢ brought down to 2-1/2¢.

HOUSE: Ketchikan, I believe, still has the cheapest power in the State. Although it is coming up faster than the Chugach power.

CROSS: Anchorage's first hundred kilowatt hours is 4-1/4¢....

FINK: What's Ketchikan power cost?

CROSS: Down in Ketchikan, they're estimating that in two months from now their diesel production costs will go over 3¢ a kilowatt hour - 30 mills.

FINK: What was Anchorage - 4-1/2¢ 4-1/4¢

CROSS: I think Chugach is something like four mills at Beluga. and about six mills in town.

FINK: Ketchikan is 30? Fairbanks is what?

CROSS: It is over 20.

FINK: I'm surprised that Healy coal is 20 mills, that seems high to me.

CROSS: You have to have a pretty sizable coal plant before you get it down.

FINK: And if you get Juneau up to 70 utilization, that cost will go down?

HOUSE: No, that rate is a long-term rate. We absorb losses until the project is fully loaded to keep the rate constant unless there are outside influences or unusual replacements. It is the rate that is set to carry through the full 50-year period. But this first year obviously...

GARDINER: I guess I got this whole thing mixed up, you're talking about which power is cheaper than which and it doesn't make any sense to me. You said Ketchikan was the cheapest in the State.

CROSS: Ketchikan had some of the most favorable rates to the customer of any place in the State, mainly because of some old hydro plants that have been paid off. Recently they've been having to put in diesel engines and their diesel production costs are up higher than their rate structure right now...

GARDINER: So it doesn't have the cheapest power any more?

HOUSE: I doubt it.

GARDINER: You're talking about 30 mills, that's production cost, that's how much it cost them to produce electricity. That's the diesel,... so averaged together it's less than 30 mills. I just wondered because they've gone up 40 per cent last year and they're going up 15 more.

FINK: We have a reverse situation in Anchorage, the old generation is keeping the cost of power up, the new generation is much cheaper...

CROSS: I don't want to sound argumentive on it but there are a lot of figures floating around the State that are lower than the actual cost. Here's a table that we passed through all the utilities and we didn't get any adverse comments on it. This is just cost for adding machinery and buying fuels on it, 22 of future Alaska power supply (page 99 of that report). In the range of the cheapest fuels that are available in the Anchorage area now, the average actual cost range is over seven mills and, as Jim mentioned earlier, the costs that are paid in the City of Anchorage, higher gas costs, it's 10, 11 or 12 mills per kilowatt hour and if there is a significant cost increase on gas then those costs will go up higher, too.

FINK: Well, part of the City's raise is because Chugach is still paying the old \_\_\_\_\_. The Beluga power is a hell of a lot cheaper than anything else.

CROSS: I'm sure that's true because of their very low fuel cost.

FINK: Are there a lot of hydro projects in the south 48 than can be developed...that are asking for federal money, I presume there are. Is it fully well utilized?

HOUSE: Fully well utilized, yes. The Pacific Northwest still has some sites but they are controversial.

FINK: So if Alaska is asking for money for hydro, are we going to have a lot of competition for that hydro development?

HOUSE: Well, if you want my personal opinion, I think that we have a pretty good chance.

FINK: The problems with power generation, for example, with coal and you can have them down here, if Congress were to suspend a couple of the environmental laws for a few years, what kind of difference would that make in the energy picture in Alaska? The use of coal, the use of putting lines through forests, burying lines or...

CROSS: In terms of what will happen within the next couple of years, I don't think it would make much difference. There are certainly things that would ease the problem that Chugach has in getting all their approvals for their new transmission facilities to move to Knik Arms. I don't believe it would make all that much difference.

FINK: Wouldn't it make coal any easier to use?

CROSS: Well, we don't have plants that can use coal. The time for designing and ordering for the coal plants is several years. The minimum is five years.

HOUSE: That's what Golden Valley there is thinking it will take five or six years to put in a new coal-fired plant.

FINK: And by then, is it anticipated that it will be competitive with crude oil?

HOUSE: Well, I don't know the pipeline runs right through town. Depends on what you assume for the cost of the fuel for the pipeline...

FINK: Is Fairbanks going ahead with some more 90-mile power...

CROSS: The latest plans that we have seen were some very large gas turbines located close to the pipeline and they plan on using pipeline fuels.. They are going to import crude.

GUY: Mr. House, I noticed that in your map that one undeveloped power sources on the Kuskokwim - Crooked Creek, will that mean building the dam on the Kuskokwim River..?

CROSS: That one would be the dam on the Kuskokwim River, yes. It's never been proposed, it's just identified as...

GUY: Are there, we're looking at this potential power shortage. Are there, has there been developed power sources in places similar to the climate here?

CROSS: Yes, mostly in Russia and northern Canada. There are some very high north power projects in both those countries.

GUY: Does the construction of a dam change the river flow substantially or is it...?

CROSS: Yes, it would change. Usually more flow in the winter and less flow in the summer below the dam.

GUY: What does it do to the river ice?

CROSS: In places where I've seen it in the winter the ice forms at a higher stage than it would than a river in the natural conditions. The ice is at somewhat a higher level and all winter long, the water flows under the ice.

GUY: You're holding back the water source with a dam, it would seem logical that the water behind the dam would be higher than the power below the dam.

CROSS: Below the dam to make the power during the winter, you release quite a bit of water and in the river below the dam, there is more water in the winter than would be without the dam.

HOUSE: It regulates the flow.

HARTIG: I have a question that maybe is not fair to ask you. Have you done any work at all on generating power by virtue of the use of tides? Have you read anything about that at all?

HOUSE: We have some material in the library that we've read...

CROSS: There have been several brief articles on tidal power, mainly in Cook Inlet, and there is a huge potential but it would be tremendously expensive to develop. Back in about 1965 or '66, we worked out some rough quantities and cost estimates on a plan for a rise across the forelands to produce tidal power, and it was out of reason as to cost.

HARTIG: Do you plan to build a dam the same as you would otherwise... so you have problems with fish and everything else.

BANFIELD: Senator Stevens asked to have a study on Rampart Dam. Do you think that this follows that we will get Rampart Dam?

HOUSE: No, there is too much going against it environmentally... Native corporations.

FINK: You have on this map quite a few little black spots in the Westward, there seems to be naturally high power, unless they find some natural gas or oil, they are going to continue to be in the high cost area.

CROSS: It's an unfortunate fact that the rest of the State that is using gas for hydro power are Southcenter and Southeast. There are a couple of very good large sites on the Copper River (can't hear)... Most of the other sites that are in the Westward, there are physical potentials and not too bad but they are really quite expensive and they're too large probably for roads that might develop in the next 20 or 30 years...

FINK: When you say it's expensive in the cost of power, you're even comparing that to the already high cost of power?

CROSS: It would be a very high cost, yes. Right now there aren't any power requirements in that area that would be anywhere big enough to justify considering a large hydro plant.

FINK: Well, any kind of a hydro plant.

CROSS: A small hydro plant up there would be worse than the diesel. Besides there are small villages.

BANFIELD: Does that mean the transportation costs to make it more costly?

CROSS: It's a combination of that but it is really....

HOUSE: The amount of machinery for kilowatt costs.

CROSS: To buy a diesel engine big enough to serve a small village, it would be very expensive...

GARDINER: One thing I can see with the price of electricity going up. That's one reason why there wouldn't be much demand. You can't economically justify using the electricity for any type for commercial or industrial use if it's that costly.

BANFIELD: What about the \_\_\_\_\_ operation?

HOUSE: That has very serious fish problems.

CROSS: This has large potential, big reservoir and, as Jim said, it has environmental problems -- nothing as serious as Rampart.

BANFIELD: Is that the one that the Canadians are thinking about...

CROSS: I think the Canadians were thinking about developing this further...

FINK: But if somebody wanted power...

CROSS: The \_\_\_\_\_ operation is a very large operation, it's maybe 40 per cent as large as Rampart.

HOUSE: It's a Grand Cooley type project, if you can visualize that.

FINK: Do you people have any suggestions for getting more power into the bush in the Westward?

HOUSE: No.

CROSS: We've been searching but we haven't found very much.

FINK: You talk about wheeling power down in the south 48. If somebody found power in the Fairbanks area, is it economical to wheel it out to the bush?

CROSS: It becomes economical to wheel power long distances when you do large amounts of it.

FINK: Then you don't see any large amounts right now?

CROSS: If a combination of mining and some other industries occurs in an area near some villages, there will be spin-off in lower energy costs to the villages, certainly. For the small communities in the bush, I'm not aware that anybody has come up with anything good yet.

GARDINER: Does Barrow generate their electricity from gas?

CROSS: Yes, Barrow and Wainwright, I believe.

HARTIG: That's the most feasible way of doing it; now, if you've got gas or fuel oil, you use that and you just keep building it up...  
(noise interference)

FINK: Is anyone trying to project when this fusion...or solar power might be available?

CROSS: I can't give you a good figure on it, the trade journals give anywhere from 1991 for most of them but beyond 2,000 for most of them.

FINK: For solar?

CROSS: For fusion.

HOUSE: For generation, I think it's in that range for direct house heating, it may come much earlier.

BANFIELD: There must be something I don't understand about solar and that is, how can we have it here in Alaska when we have the long nights. Have it in the summer and then store it...?

CROSS: It's obviously much easier to use it in a place where there is sun.

HOUSE: You would have to tie it into some other system that just uses a supplement.

FINK: It seems to me that I have read that some large organizations are working on other than this peak stuff, using tremendous amounts of batteries and storage to level out...It's probably still experimental but it seems to me that they thought this was the big answer to store out -- to take care of the peak times and they thought they had some kind of new batteries...

HOUSE: I heard in World War II that they are going to have a life-time battery but...

CROSS: It's been a very complex, large land requirements, large investment requirements to get the storage business done, very expensive, but the concept is good.

FINK: Is there a significant loss of efficiency if you go into a fuel cell from that back out, do you lose energy in the process?

CROSS: You do, but I don't know how much.

FINK: The problem now is, these things kick out so much power that you don't use and then you have peak time and you've got to have peak coverage.

HOUSE: Earlier there were some questions about the cost of power around the State. I finally found it in the book here, page 51, of the Future Alaska Power Supply. The source is 1971 from the report of the Alaska Public Utility Commission and just to kind of skim over them (you realize this is 1971) by taking a typical load of 500 kilowatt hours per month, which I think is probably typical for a home of eight, this is a monthly bill now. The City of Anchorage - \$13 at that time, at Ketchikan it was \$11.25 and it goes on up to \$100. Juneau is \$20.80, Fairbanks City is \$22.50 and urban is \$27.50, municipal versus Golden Valley.

HARTIG: As an energy expert, what do you see in the future, we go from gas and fuel generated by electrical power and then what? I mean do you see fusion being the ultimate...

HOUSE: I think nuclear, of course. I spent 10 years with the Atomic Energy Commission so I don't have all the hangups on the dangers of nuclear power. I think nuclear is going to be the next major source. I don't know that much about fusion...

GARDINER: What's the best answer for the bush or isn't there any good answers, they're going to pay high prices.

HOUSE: They are making good progress, I think they were doing a fabulous job in the villages that they electrified but the oil situation must have them really concerned now.

FINK: They made a request for substantial increases in State payments before the oil went up so they are talking about our paying more money. They indicated they were going to sweat before the price went up... They are talking about minerals that have no relationship to usage.

BANFIELD: There isn't anything that you see that can help you then?

HARTIG: How about maybe a letter to the Corps of Engineers then and let them know we are anxious to save fuel and we'd like to get this project on the road -- full power from Snettisham so we can relieve some of the fuel problems here in town.

FINK: Making a resolution would be better than a letter.

HOUSE: No harm in either a resolution or a letter but there is no question in my mind that from the top down, the word has been passed to get this thing straightened out.

BANFIELD: Well, it must have been an embarrassment to say the least. Would it help to suggest that we wouldn't mind if they took less -- more harmful environmental route.

HOUSE: This is ultimately going to confront us. If we have to come down into the trees, we're going to have trouble with the Forest Service; we're going to have trouble with property owners. It's costly to clear the area but you only do that once. I don't like to encourage waiving environmental laws until we know we have to. I think it's done us all some good even though it has cost us money.

HARTIG: How about support for the Devil's Canyon. I think the State would benefit from it. The fact that it is a renewable resource, except for the disturbance of the existing environment, it's environmentally pure. It's centrally located between Fairbanks and Anchorage which undoubtedly will prefer a long time to come the hub of activity. Cost has yet to be proven. I don't think anybody can make a determination until the Corps' complete cost studies and we get the reaction of the utilities as to how they can use it. In other words, what the marketability is going to be. Incidentally, March 13, we are having an initial meeting with the Corps sponsored by the Corps. We've invited all of the concerned utilities, municipalities, one or two environmentalists, the federal and state agencies that will be involved in the environmental aspect of it to get a briefing. Hopefully, to point out the problems that we are going to be faced with, the area in which the power will be required and fully loaded, any alternatives that appear in the picture. It's not strictly a public meeting but if any of you feel it will be beneficial for you, it will be held at the District Engineer office in Anchorage, 1:00 o'clock. This is basically technical meeting to see what the problems are and review the design. There will be public meetings in the future by the Corps.

FINK: At what rate does Deveil Canyon have to produce at to be economically viable. What price per mill? per unit?

HOUSE: I'd say 15 mills would be acceptable at the delivered.

FINK: That's todays standards, something equivalent 10 years from now...

HOUSE: 9.3 at Anchorage and Palmer.

FINK: You figure you can go up 60 per cent and still be competitive because of increased costs?

CROSS: Because of the alternative that will be available at that time. It looks like that will be fairly cheap power at that time.

HOUSE: I don't think Eklutna will be abandoned when the power costs will be absorbed into the overall wholesaler's rate. It's going to be a mixture of costs of power. There will always be a certain number of gas turbines required for standby reserve. Base load plants and the peaking plants have to be all factored into the ultimate rate that the wholesaler uses.

GARDINER: If you do consider several things, the fact that we have oil here, we aren't the only ones using energy around and it would be kind of hard to export electricity as such. Even though it may not be cheaper than petroleum, considering what the State has to pay for its getting its own royalty oil. It may make some sense that we just want to produce our electricity one way because we can export oil for a lot of money and sell it for a lot of money. As opposed to your idea of thinking that it wouldn't make much sense to use hydroelectric there because you can get that natural gas cheaper. Especially when you're looking at the State's royalty.

FINK: Nobody is going to take hydro power if they can't get it as cheap as the other produced power.

GARDINER: We're talking about if the State was using royalty oil in the future.

FINK: Well, I'm talking about market value. You put market under electric generation and you sell it, in either case you get the same amount of money on the oil.

HOUSE: I think he hit on the peak question on what the ultimate price of oil is going to be and what is going to be the permitted use, if there are any restrictions.

BANFIELD: Maybe they won't let us use our natural gas.

HARTIG: You were saying earlier if we were producing Snettisham at full load, it wouldn't necessarily mean that the price would go down in town here.

HOUSE: Loads under the projected rate. If Marcona had gone in at Speel River and immediately bought all the surplus power, we could afford the overall price brought down. The fact that we have to pay 3-1/2 per cent interest on this 80 million dollar investment for 10 years before it's all fully producing power holds the rate up there.

HARTIG: It wouldn't be if we were to encourage the Corps of Engineers to take immediate action to get that line on so we could do without the fuel. We wouldn't be doing a disservice to the Juneauites by increasing the costs of their power. It would increase it but it wouldn't decrease it. A lot would stay the same except we would be saving fuel. Is that generally what will happen?

CROSS: I think that's true. The difference is a month or so.

HOUSE: The rate is established subject to review every five years so we will not raise it before the five-year period.

HARTIG: Are the small nuclear plants, would something like that be feasible in the village for electrical generation?

HOUSE: We considered a 1,000 megawatts was the minimum economical size for a nuclear plant. You have to get pretty large sizes before a nuclear plant is competitive.

(change tape area)

A discussion was held on nuclear reactors. Mr. House said Fort Greeley had a nuclear reactor which is what you would need for a village the size of 600 - 800 people, with a capacity of two megawatts. That was discontinued because it was too expensive.

Mr. Cross also added that most reactors down south are made for 500 - 1,000 megawatt capacity.

There were no more questions. Mr. Hartig said he appreciated all the information given by Mr. House and Mr. Cross.

The meeting adjourned at 7:00 p.m.