MEMBERS PRESENT: Chairman Dini
Vice Chairman Schofield
Mr. Craddock
Mr. DuBois
Mr. Jeffrey
Mr. May
Mr. Mello
Mr. Nicholas
Mr. Polish
Mr. Prengaman
Mr. Redelsperger

MEMBERS ABSENT: None

GUESTS PRESENT: Mr. Chuck King, Central Telephone
Mr. Stephen M. Wood, Legislative Counsel Bureau - Audit
Mr. John R. Crossley, Legislative Counsel Bureau - Audit
Mr. G. P. Etcheverry, Nevada League of Cities
Mr. J. Cathcart, City of North Las Vegas
Mr. B. Hulett, Press
Mr. Randy Townsend, Coalition for Affordable Energy
Mr. Kelly Jackson, Nevada Department of Energy
Ms. Barbra M. Reedy, Nevada Society of Architects
Mr. Clark J. Guild, Jr., Southwest Gas Corp.
Ms. Sharon Cleary, Nevada Assoc. of Realtors
Ms. Peggy Twedt, League of Women Voters
Ms. Julie Oelsner, Assemblyman Dini's Intern
Mr. Sam Hohmann, Legislative Counsel Bureau

TESTIFIERS: Mr. John R. Crossley, LCB, Audit
Mr. Steven Wood, LCB, Audit
Mrs. Peggy Westall, Assemblyman
Mr. Nicholas J. Horn, Assemblyman
Mr. Randy Townsend
Mr. Chuck King
Mr. Heber Hardy, Chairman, Public Service Commission
Mr. Kelly Jackson
Ms. Peggy Twedt

Chairman Dini called the meeting to order at 8:04 A.M. He suggested starting the hearing with AB 35 - Removes obsolete or unused provisions of law relating to veterans and AB 36 - Increases bond of and provides fee for commissioner for veteran affairs.

Since the Commissioner for Veteran Affairs is not here to testify, Mr. Dini asked if there was anyone from the Legislative Counsel Bureau - Audit Department, who wished to speak.

Mr. John Crossley, the Legislative auditor. He indicated that portions of both bills are from their audit report and with him to explain them, is Mr. Steve Wood, the in-charge auditor on the audit.

Mr. Wood stated that two of the amendments to these bills resulted from the audit for the Commissioner of Veteran Affairs dated February 15, 1980. For AB-35, a recommendation was made for the abolishment of the petty cash account, which is currently contained in NRS-417.142c and appears on Lines 9 through 11 in AB-35. For AB-36, a recommendation is made that the veterans' relief fund be categorized as a special revenue fund and that appears on Line 16 on Page 2 of AB-36. Both recommendations were as a result of the audit. The rest of the amendments of these two bills were not as a result of our audit.

Mr. Dini asked if there were any questions from the committee.

Mr. Schofield questioned the wording on Lines 20 and 21, as appearing repetitive. It was established after some discussion that the wording was the same as shown in the statutes. Mr. Wood further clarified it by saying that the Commissioner can only act as a guardian for a person whose personal property does not exceed those values, exclusive of money derived from federal sources, such as social security or veteran's compensation benefits.

Mr. Dini again asked if anyone was here from the Commissioner for Veteran Affairs office. There was not. He advised the committee that the resolutions would then be discussed.

Mrs. Westall and Mr. Horn indicated they would testify regarding ACR 5, ACR 6, ACR 7, ACR 8 and ACR 9 together because, basically, all five resolutions were approved by the interim sub-committee and they all relate to the very same topic. He indicated that the recent increases and cost of energy to customers and public utilities have demonstrated the need for conservation of energy and the desirability to resort to untapped and alternative sources of energy, as well as alternative means of conserving energy.

Mrs. Westall stated that the first paragraph of each of them gives the reasons as stated by Mr. Horn as to why we would like these approved. We hope that these will offer some positive ways to go about conserving energy and to help bring down the cost of energy. In the testimony before the interim sub-committee the Nevada Department of Energy stressed the importance of the

legislative support for stricter energy conservation standards in new building. A session or two ago, we passed some of the laws concerning this, but I think we need to be a little more aggressive about it. An affirmative legislative policy could make the task of adopting stricter standards easier for the energy agency. The outcome of the adoption of such standards will be buildings which consume less energy whether they are commercial or residential. Ultimately, this should lead to a decrease in demand for energy, as well as for additional generating facilities, which I am sure would help to bring down the costs. Although construction costs will be necessarily increased, the cost of construction and energy consumption over the life of the building should be reduced.

Mr. Horn indicated that this testimony basically is what ACR 5 addresses.

Mr. Horn stated that ACR 6 encourages local governing bodies to adopt building and subdivision regulations which promote the use of alternative sources of energy. It encourages local entities to allow permits and reduce local taxes which would stimulate investment in alternatives and thus reduce utility energy consumption.

Mr. Redelsperger felt that his concern was that we are adopting stricter standards and giving more regulations to the construction industry which is troubledright now. I was wondering if in the long run this isn't going to add to the cost of new buildings and construction. I agree with ACR 7 when you are talking about incentives to encourage local agencies.

Mr. Horn agreed with Mr. Redelsperger with his concern and indicated that the resolution is intended to be an encouragement. We are not actually adopting regulations. We are not passing laws. We are not enforcing stricter regulations. We are encouraging local governments and governing bodies to explore the possibility of promoting some alternative sources of energy by doing such things as allowing permits and reducing local taxes and other forms of stimulating investment.

Mrs. Westall said that they were also looking at the long term of it because over the life of a building, it would pay for itself. And because the resources are dwindling, we feel that you have to look at the long term of it.

Mr. Redelsperger asked if it wouldn't serve the same purpose where we've got adopt regulations if we had provide incentives? (ACR 6, Line 6)

Mr. Horn stated that we could if it pleases the committee.

Mr. Jeffrey indicated he did not agree. He said that local government now has the right by ordinance to do that now.

The idea may encourage the local agencies to do it by ordinance but the thing that concerns me about providing incentives is that the incentive is already there in lowering energy costs over a period of years to recapture the investment. I think you have to look at that and compare the person who is putting the additional money in a building and reaping the benefits because of lower energy costs. Insulation pays for itself very fast, anyway. If you get into a full scale program of this type, the person who is living in the older home because he probably can't afford to buy a newer home that has the higher standards is paying for the incentives and is also paying the higher power bills, so he is making a double payment there because of circumstances beyond his control.

Mr. Horn said that the true value of this, Mr. Chairman, is to let local government know that the legislature is in favor of encouraging public utilities and local government entities to get involved in conserving energy.

Mrs. Westall indicated that some of the local entities have ordinances where you cannot use solar energy. You have to use only the normal ones.

Mr. Horn indicated that ACR 7 is an encouragement. Mrs. Westall emphasized that this resolution speaks of things that the Public Service Commission can do to help to provide incentives or things they might do to stop incentives, such as if they had severe standby charges, discriminatory line charges or penalties for selling excess energy back to the utilities.

Mr. Horn stated that ACR 8 encourages public utilities to investigate alternative sources of energy. Basically, public utility examination of the feasibility of spreading the demand for energy from times when the demand has historically been the highest to times when it has been the lowest, can reduce demands for power at the time of peak use and service and alternative to construction of new power plant generating facilities.

Mrs. Westall said that ACR 9 has to do with public utilities making loans to the consumers so that they might improve the insulation in their homes, including other features, for more energy efficiency. We realize that all of these have a lot of the problems with them that would have to be worked out but we hope that it will urge all of the different entities involved to investigate and, perhaps, push a little harder in all of these areas. This is the reason that they are ACR's and not bills.

Mr. Horn indicated that in California they are providing low cost or no cost loans to consumers, particularly in the areas of blankets for the water heaters, at very low interest rates with the idea that if they conserve energy and they have

conserved enough energy, they would, therefore, not have to construct another power plant. It is, therefore, to the advantage of utility companies to loan the consumer money. We had testimony in our committee that the local power companies here in the State of Nevada were very much in favor of it.

Mrs. Westall indicated that the Public Service Commission is looking at adopting the peak load and pricing time of day rates, inverted rates.

Mr. Schofield asked if the utility companies seem to be in total favor of using meters for peak periods for residential homes on appliances and giving reduced rates.

Mr. Horn stated that they were very much encouraged by this type of thing and have tried several experiments in Southern Nevada where they have asked for volunteers to allow their airconditioners to be shut off during peak periods without inconveniencing them. They indicated that they would rather not build any more power plants and hoped that the customer could utilize the energy we have and would be delighted to pass along the savings.

Mrs. Westall said that we need more of the public relations here with the public because I don't think they realize how much of a difference it can make if they utilized the peak hours.

Mr. Mello indicated that he wondered about the need for some of this. I would think and what it appears what we are doing is saying, we, the legislators would like to inform you we have energy problems and I would hope that everybody would know that by now. I would think that the Department of Energy would accept the standards and make the regulations without us telling them that we would like for you to do that.

Mr. Horn said that for some reason when the Legislature becomes involved, maybe the Department of Energy and the Public Service Commission and the utilities seem to listen a little more than if the Legislature doesn't become involved.

Mr. Mello said that he knows that my city fathers are getting a little tired of having the Legislature telling them how to do their job they are elected to do.

Mr. Horn indicated that if they did the job that was satisfactory to you, then we probably wouldn't have to tell them.

Mr. Mello asked if we know that they are not already doing this in some cities.

Mrs. Westall commented that perhaps the effect that the resolution has could be a warning that next session it may be a BDR.

Mr. Dini asked if they felt in discussions with the utilities that they are moving in the right direction, or did they feel that the utilities were just floating around. It looks to me like Sierra Pacific is looking at more power plants, i.e., like Valmy II, in Elko, tied in with White Pine. Where are the utilities in this state going?

Mrs. Westall indicated that we ought to show them the direction that we feel is the right one, and it takes the cooperation of the people, as well as the utilities and the Public Service Commission. It has to be a team effort. And these resolutions are to, hopefully, urge all of the entities to pursue this course.

Mr. Dini asked if the committee got a lot of testimony on solar energy.

Mrs. Westall answered: Yes, quite a bit, and it seems to be rather successful and moving forward. Again, we need to encourage these sorts of alternative energies.

Mr. Horn indicated that right now the costs are high and we have to work it out so that the costs can come down. It looks like it really can be a viable source of energy.

Mr. Redelsperger asked if there was much testimony on geothermal sources.

Mrs. Westall stated that, as opposed to solar, there are only a few areas that are able to use the geothermal.

Mr. Mello commented that between Carson City and Reno, there are some homes using geothermal applications.

Mr. Jeffrey asked about their comments regarding some political subdivisions that had restrictions on solar and geothermal uses.

Mrs. Westall answered that the ordinances mandate that they shall have a certain type of heater or other appliance. Some regulations seem to exclude solar uses. We hope that these restrictions will be loosened some so that contractors can feel that they have a viable alternative without having to fight.

In answer to Mr. Jeffrey's question as to why solar use was being restricted, Mrs. Westall stated it was probably because it was not fully developed. However, we need to move faster in some of these areas than we have been.

Mr. DuBois stated that in the matter of low interest rates, a number of utilities in the country, for example, San Diego Gas and Electric, have had this program for a number of years. Have the utilities here in Nevada started a pilot program or discussed or considered it, or is it being held up for some reason.

Mr. Randloph Townsend, Chairman of the Coalition for Affordable Energy testified next, and a copy of his testimony is attached hereto as EXHIBIT A. Testimony on ACR 9 is attached hereto as EXHIBIT B.

Mr. Prengaman asked: How do the plans work? Do you make application to the utility and you specify what you want, what type of improvement you are interested in and then they loan you the money and it is paid back through your bill?

Mr. Townsend answered that it is designed primarily (by design of the state). In some cases, in California, Oregon and Washington, different methods of payback are used. For example, taking a case of weatherization for $1,000, the money would not have to be paid back until such time as the home was sold based on the average time a home was held, and in the state of California, at that time, it was seven years. In seven years, it was deemed that you should pay back or attempt to pay back that loan. That would be up to the Legislature to decide, which would be the best method for the needs of our people.

Mr. Chuck King, representing Central Telephone, was the next testifier on ACR 9. He indicated he wished to offer an amendment on Line 7. The change would be: "That public utilities in the State of Nevada are urged...", would be changed to read: "That gas and electric public utilities in the State of Nevada are urged...". Central Telephone is not in the business of providing energy sources and this wording might be miscontrued. A copy of the proposed change is attached hereto as EXHIBIT C.

Mr. May asked if a utility were to receive a resolution from the Legislature, what real effect would it have upon them. How would they react.

Mr. King answered that he thought that most utilities would take this as a signal that something needs to be done and if they don't do it voluntarily, that a law might follow.

Mr. Heber P. Hardy, Chairman of the Public Service Commission was the next testifier, who appeared in general support of the resolutions and possibly in a slightly different form, he indicated.

Mr. Hardy referred to BDR 58-383*, Section 35, Pages 15 and 16 regarding the cooperative relationship with the Department of Energy that the Public Service Commission would have in a manner consistent with the state's needs and consistent with the productive use of the state's renewable sources of energy, including, but not limited to geo-thermal energy, solar energy and wind. He indicated that it was his feeling that the Legislature created the Department of Energy basically to be most concerned about energy sources, conservation, and that they have the full opportunity to make presentations before the Commissions, recommendations as to what direction we should take. There is a hearing set for February 26-27 to consider a joint rule by the Public Service Commission and the Department of Energy. This is an opportunity for the state to come up with their own residential conservation service program. It is a public hearing. The proposal will include rules which will enforce whatever subsequent rule is adopted so that the Public Service Commission can carry out the final rule. This rule will include that the utilities will provide an energy audit, the first time free of charge to the particular customer. The utility will be involved in helping to arrange loans, helping to arrange for installation of energy saving devices or equipment and helping the customer to arrange repayment of the loan. This does not go as far as some would like. However, this is a very controversial area. Some people might feel that the Public Service Commission would be in conflict with banks or other lending institutions.

Mr. Hardy also indicated that if the Legislature chooses to adopt the recommended statement of mission, as I have indicated to you, I think it will accomplish the same purpose as the resolutions and it would be right in our statute and be the law, as opposed to being merely a resolution. I would suggest that the public utilities have not been idle. I think they dragged their feet for some time, but I don't think quite as much as they used to. Their initial concern was that it wasn't their responsibility, but I think they are becoming convinced that they have to play a part in it. I think we have to go as far as necessary to get a good policy for conservation of energy without infringing upon the rights of other people.

He further stated that we will have to consider time of use rates. In Las Vegas, we have not only increased the demand charge during peak hours, but we now have an increased energy rate during that same period of time.

*AB 58

You can do this with large customers becuase you do have to have special metering. A great potential is in the residential area, but so far, the information we have received indicates that it is still at this point cost-prohibitive. Some people, on their own, because of high utility rates, have already made substantial investments and some consideration to them may be due.

Mr. Hardy further stated that if it can be shown that there is a benefit to the customer who has already made his own investment, it certainly is in the public interest that these types of programs be considered. All customers are contributing to the building, for example, of Valmy II. However, the customers pay for that plant sooner or later. It's a matter of whether it is during construction of the plant or later after it goes into service. The customers, please understand, are not contributing the capital, as such, they are simply paying in the rates for the cost of the money to build that particular plant, not the direct capital contribution.

Mr. DuBois asked Mr. Hardy if he knew how cost-effective the programs have been in California. Mr. Hardy said it is a controversial matter and it depends on who you talk to.

Mr. Polish asked if nuclear energy has been discussed as a possible source.

Mr. Hardy stated that Sierra Pacific, in concert with certain California utilities, have made a preliminary study as to whether there should be a joint effort to build a nuclear plant somewhere in Nevada. They have determined that it is not feasible to build a site in Nevada and nothing is being considered by any utility in Nevada for any nuclear plant in the state of Nevada. I, personally, have the view that it should not be discounted or eliminated as a potential source of energy for the future.

Mr. Hardy also indicated that Arkansas has taken the lead in load management programs and it has also been successful in Las Vegas.

Mr. DuBois asked if the utilities are coming to you with plans or do you find you have to push them. Mr. Hardy said that they are not as innovative as they should be. In Washington and Oregon, the utilities have taken the initiative and that is why there are where they are today. We welcome the Department of Energy to come in and present a proposal to us. If the Governor's proposal, which we are supporting 100%, is adopted by the Legislature, then there would be an independent agency representing consumers, which we hope would be a fruitful source of innovation.

Mr. Kelly Jackson of the Department of Energy spoke next. He said that generally the department supports all of the resolutions that are before the committee today. We believe that they can make a contribution in providing some legislative direction to the Nevada Department of Energy and the Public Service Commission in carrying out the duties that are assigned to us by statute.

He made a couple of observations on ACR 5. Generally, we have an energy conservation standard in effect now that apply to all new buildings. The standards are minimum in nature; basically R-19 in the ceiling, R-11 in the walls and some limitations on glazing - a requirement for double glazing. We believe that we are at a point in time where, in fact, it would be economical for people who are purchasing new structures to have buildings constructed to a higher level of thermal efficiency than they are presently getting. As the law is set up now, local governmental entities have the responsibility of enforcing standards that we adopt and there may be some problem in local entities effectively assuming the enforcement end of it. Mr. Jeffrey raised a question regarding line extension issues, this was a suggestion that our agency made before the special committee that was addressing the Public Service Commission during the session.

Regarding ACR 6, we have requested a bill which does provide more detailed guidance to local governmental entities regarding the development of zoning and planning processes to insure that energy conservation renewable resource development is taken into consideration.

Mr. Dini asked if Mr. Jackson had the staff to develop these standards. Mr. Jackson indicated that he did.

Mr. DuBois asked how do the present codes stack up against the new federal codes for public buildings.

Mr. Jackson stated that our standards, in a percentage, may be 5% to 20%, depending on the specific structure, less stringent than the depth standards for large structures. There would be no impact on residential structures.

Ms. Peggy Twedt spoke on behalf of the League of Women Voters in supporting the resolutions presented. A copy of her testimony is attached hereto as EXHIBIT D. She further noted, in answer to a question by Mr. Redelsperger, that in the area east of Fallon, three or four test wells are being drilled by major oil companies for geo-thermal, so it seems like it has potential in the state.

Mr. Dini stated that the biggest problem we have in geothermal is federal control of public lands.

Mr. Dini recessed the meeting for fifteen minutes at 9:25 A.M.

Chairman Dini called the meeting back to order at 9:45 A.M.

Mr. Dini asked for a vote on AB-35, which he said came from the Legislative Counsel Bureau and is a clean up bill from one of our audits.

Mr. Craddock moved to pass the bill. Mr. Prengaman seconded. Committee voted a DO PASS.

On AB-36, Mr. Nicholas indicated he would like to know more about the bill. During the recess, several of the committee members talked to the auditors about this bill and they were informed that there have been problems in the past in the bookkeeping procedures. Mr. Nicholas said he would like to talk to the commissioner further.

Mr. Dini appointed Mr. Nicholas as a one-man committee to look into it.

Following is the vote on the resolutions:

ACR-5 Mr. Jeffrey moved to pass the resolution.
Mr. Nicholas seconded.
Committee voted a DO PASS.

ACR-6 Mr. Craddock moved to pass the resolution.
Mr. Schofield seconded.
Committee voted a DO PASS.

ACR-7 Mr. Schofield moved to pass the resolution.
Mr. Nicholas seconded.
Committee voted a DO PASS.

ACR-8 Mr. Polish moved to pass the resolution.
Mr. Schofield seconded.
Committee voted a DO PASS

ACR-9 Mr. Schofield asked that before the vote, the motion include an amendment to correct Line 7 to read: "That gas and electric public utilities..." instead of: "That public utilities..."

Motion was seconded.
Committee voted an AMENDMENT AND DO PASS.

Mr. Nicholas raised the question that he might have a potential conflict of interest in being a one-man committee on AB-36 and asked if he might have a second member on the committee. Mr. Polish was asked to serve.

Mr. Dini announced that on February 4, 1981 we would have the public hearing on the Initiative Petition and the Public Service Commission. He asked Mr. Mello, who is the chairman of the sub-committee, if he had any plans.

Mr. Mello answered that the sub-committee planned to listen to the input from the general public and go from there. He said he had taken the liberty to speak to the Research Division and they are working on a plan similar to the plan we have with Nevada Industrial Commission. We will be finding out, he said, what qualifications a director in other states has. Also, what type of appointments serve at the pleasure of the Governor or if they are term appointments.

Mr. Mello asked the Chairman if he would direct the staff to set up separate folders in which to incorporate all of our energy papers.

Mr. Dini asked Mr. Mello if he anticipated meetings during the next week on the proposals, as there is a forty-day limitation. Mr. Mello indicated that the research was due in one week.

Mr. Dini adjourned the meeting at 10:10 A.M.

Respectfully submitted,

Lucille Hill
Assembly Attache

ASSEMBLY GOVERNMENT AFFAIRS COMMITTEE

GUEST LIST

Date February 3, 1981

PLEASE PRINT YOUR NAME	PLEASE PRINT REPRESENTING:	I WISH TO SPEAK FOR	AGAINST	BILL NO.
CHUCK KING	CENTRAL TELEPHONE	✓		ACR 9
STEPHEN M. WOOD	LCB - AUDIT	✓		AB 35 & 36
John R Crossley	LCB - Audit	✓		AB 35-36
G.P. Etcheverry	NEV League of Cities			
Assistant	City of Virginia City			
B. Mullett	Press			
L Townsend	Asst. for Off. Energy			
Kelly Jackson	Nevada DOE	✓		
Bob Loux	Nev Dept of Energy			
BARBRA M. REEDY	NEVADA SOCIETY OF ARCHITECTS			
Clark J Guild, Jr	Southwest Gas Corp			
SHARON CLEARY	NEVADA ASSOC of REALTORS			
Peggy Tweedt	League of Women Voters	✓		
Susan Olsen	Assembly Man Dennis Nolan			
Sam Lohmann	LCB			

Exhibit A

Coalition for Affordable Energy

P.O. Box 10034 • Reno, NV 89510 • (702) 786-1455, 826-7333

Comments of Randolph Townsend, Chairman, Coalition for Affordable Energy before the Nevada State Assembly, Committee on Government Affairs

Hon. Joseph E. Dini, Jr., Chairman

February 3, 1981

Re: ACR 9

MR. CHAIRMAN, MEMBERS OF THE COMMITTEE, AND HONORED GUESTS. FOR THE RECORD, I AM RANDOLPH TOWNSEND, CHAIRMAN OF THE COALITION FOR AFFORDABLE ENERGY, AND I THANK YOU FOR THE OPPORTUNITY TO COME BEFORE YOU THIS MORNING.

WE SUBMITTED TO COMMITTEE STAFF YESTERDAY COPIES OF THREE PIECES OF TESTIMONY BEFORE THREE DIFFERENT STATE PUBLIC SERVICE COMMISSIONS ON THE SO-CALLED OREGON PLAN. ACR 9, WHICH IS BEFORE YOU TODAY, HAS ITS GENESIS IN THE OREGON PLAN.

PACIFIC POWER AND LIGHT, AN OREGON-BASED UTILITY, PRESENTED A PLAN BEFORE THE PUBLIC UTILITY COMMISSION OF OREGON. SIMPLY PUT, THE UTILITY'S OWN STUDY SHOWED, AND I QUOTE, "THERE ARE INVESTMENTS WHICH CAN BE MADE ON THE CUSTOMER'S PREMISES THAT SAVE ENERGY AND CAPACITY AT LESS EXPENSE THAN THE COST TO OUR CUSTOMERS OF NEW ELECTRIC PLANT."*

THE PLAN WAS A REVOLUTIONARY CONCEPT, AND IT WAS ADOPTED BY THE OREGON PUBLIC UTILITY COMMISSION. ON OCTOBER 6, 1978, THE WASHINGTON UTILITIES COMMISSION ADOPTED SIMILAR RULES GOVERNING THREE WASHINGTON STATE UTILITIES. YOU HAVE SUBMISSIONS BEFORE THE WASHINGTON AND OREGON UTILITIES BEFORE YOU TODAY. IN ADDITION, YOU HAVE THE TESTIMONY OF DR. DAVID SCHWARTZ OF BETHESDA, MARYLAND, BEFORE THE PUBLIC UTILITIES COMMISSION OF CALIFORNIA ON THE SAME SUBJECT. DR. SCHWARTZ WILL COME BEFORE THIS COMMITTEE TOMORROW MORNING WITH RESPECT TO CONSUMER ADVOCACY ISSUES.

THE OREGON PLAN IS BASED ON THE CONCEPT THAT IT CAN COST LESS TO FUND WEATHERIZATION OF BUILDINGS THAN IT CAN COST TO BUILD NEW UTILITY PLANTS. IT IS A FASCINATING IDEA. THE UTILITIES INVOLVED HAVE BEEN MANDATED TO FUND ZERO TO 6% LOANS TO HOMEOWNERS TO PAY FOR THE PROGRAM. THE FUNDS HAVE BEEN GENERATED BY THE

UTILITIES, OFTEN IN CONJUNCTION WITH LOCAL FINANCIAL INSTITUTIONS. IN SOME CASES, AS IN THE STATE OF MARYLAND, PRIVATE CONSUMER GROUPS AND SAVINGS AND LOANS FORMED A COALITION TO PERFORM THIS FUNCTION WITHOUT INVOLVING THE UTILITIES.

THE PLAN DESERVES STUDY. TO BE VERY HONEST, IT IS A CONTROVERSIAL CONCEPT. UTILITY ADVOCATES ARE SPLIT ON THE ISSUE. SOME FEEL THAT UTILITIES HAVE NO PLACE IN SUCH PROGRAMS, AS THEIR PAST TRACK RECORDS INDICATE THEY WILL ONLY SEIZE THE OPPORTUNITY TO PROFIT FROM IT. DR. SCHWARTZ,IN HIS CALIFORNIA TESTIMONY, ALLUDES TO SOME OF THE PERCEIVED PROBLEMS OF UTILITY INVOLVEMENT.

OREGON IS A STATE IN WHICH THERE IS A LOT OF HYDROPOWER AVAILABLE. HYDROPOWER IS BY AND LARGE CHEAPER THAN THAT WHICH IS GENERATED BY OIL, SUCH AS AT TRACY AND FORT CHURCHILL, OR BY COAL, AS WILL BE GENERATED BY VALMY I. IT IS FASCINATING TO NOTE THAT WITH THESE BEING THE FACTS OF POWER GENERATION IN NEVADA, AND WITH LOTS OF NEW PLANTS ON THE DRAWING BOARDS, THIS PLAN MAY BE ADAPTABLE TO OUR STATE.

BEFORE YOU IS A RECENT NEWSPAPER ARTICLE IN WHICH SIERRA PACIFIC POWER PRESIDENT JOSEPH GREMBAN BEMOANS THE PROSPECT OF NOT BEING ABLE TO FUND VALMY II BECAUSE OF HIS COMPANY'S EMBATTLED RATE OF RETURN. PERHAPS WITH AN ADAPTATION OF THE OREGON PLAN, HE WILL NOT NEED TO CONTINUE WITH PLANS TO BUILD VALMY II. PERHAPS SIERRA PACIFIC AND PACIFIC GAS AND ELECTRIC COULD ALSO FORGET ABOUT THEIR PROPOSED COAL-FIRED DINOSAUR PLANNED FOR THE WINECUP RANCH IN ELKO.

PERHAPS THE SPECTER OF ACID RAIN FOR NORTHERN NEVADA CAN BE AVOIDED BY LOOKING LONG AND HARD AT THIS NEW IDEA.

CERTAINLY THE PUBLIC SERVICE COMMISSION OF NEVADA HAS THE MANDATE AND THE POWER TO INVESTIGATE AND PUT SUCH A PLAN TOGETHER.

BASED UPON THE PSC'S TRACK RECORD, I THINK THERE IS A STRONG CASE TO BE MADE FOR DOUBTING THAT ANY NEW IDEAS WILL EVER SINK IN.

PERHAPS STUDY WILL SHOW THIS PLAN IS NOT RIGHT FOR NEVADA'S NEEDS. IT IS BASED UPON PLANT COST AVOIDANCE, AND DESPITE PUBLIC UTILITY PROTESTATIONS THAT THE ARABS AND THE CANADIANS ARE TO BLAME, THE SINGLE BIGGEST COST OF UTILITY RATE INCREASES INVOLVES THE CONSTANT EXPANSION OF PLANTS, WHETHER NEEDED OR NOT.

IT WILL TAKE A STRONG COMMITMENT TO CONSERVATION BY THE UTILITIES AND STRONG OVERSIGHT BY THE COMMISSION TO MAKE SURE THAT UNNECESSARY GENERATING PLANTS ARE REMOVED FROM UTILITY CONSTRUCTION PROGRAMS IN THE FUTURE.

THE IDEA IS WORTH PURSUING. YOU MAY DECIDE IT IS WORTH THE FORMATION OF AN INTERIM STUDY COMMITTEE TO MAKE RECOMMENDATIONS TO THE 62ND SESSION OF THE NEVADA LEGISLATURE ON THE FEASIBILITY OF THIS IDEA. I URGE YOU TO CONSIDER THAT.

NEVADA HAS BEEN ACCUSED OF BEING IN THE STONE AGE WHERE UTILITY REGULATION IS CONCERNED. LET'S NOT BE AFRAID OF NEW IDEAS THAT WOULD MAKE NEVADA A FORERUNNER OF THINGS TO COME. IT IS AN OPPORTUNITY THAT FUTURE GENERATIONS WILL THANK YOU FOR.

AND I THANK YOU FOR THE OPPORTUNITY TO COME BEFORE YOU TODAY, AND I WOULD LIKE TO REQUEST THAT A COPY OF THIS TESTIMONY AND SUBMISSIONS, AS WELL AS THE MINUTES OF THE HEARINGS ON THIS SUBJECT, BE FOREWARDED TO SENATOR WILSON'S COMMERCE AND LABOR COMMITTEE WHICH IS CURRENTLY REVIEWING PUBLIC SERVICE COMMISSION OF NEVADA JURISDICTION.

-30-

Local

Finances might delay Valmy project

By SUSAN VOYLES

The North Valmy II power plant, which was scheduled to begin operating in late 1984, may be postponed unless Sierra Pacific Power Company's financial picture improves, company president Joe Gremban said Monday.

Gremban told media executives at a luncheon meeting that company profits are not enough to cover the financing costs involved in raising money for construction of the plant, for which plans began as far back as 1974.

Skyrocketing interest costs would require the company to pay high dividends to compete for new stock and bond issues, which would pay for plant construction, Gremban said.

The upshot is the company may ask for a general rate increase to raise its rate of return to the 15 percent level recently authorized by the Nevada Public Service Commission. And even that, Gremban said, would not be enough to cover financing costs at today's interest rates.

Raising company profits to the maximum level allowed by the commission would cost ratepayers $27 million, based on last year's budget. For the average residential customer with a $500 a year bill, the extra cost would amount to $63.

The alternative — delaying plant construction — would mean that Valmy II would cost customers $10 million in higher construction costs each year the project is postponed, Gremban said.

Gremban would not say how long the project could be delayed — only that it would be indefinite. The company holds a construction permit for the project and actual construction would take about four years. Construction would have to begin immediately for the plant to begin operations in late 1984, as planned.

In addition, construction delays mean that customers will continue to pay high fuel bills. Coal-fired Valmy I and II are meant to replace the more expensive oil and natural gas now used to generate 60 percent of the company's electricity. (The rest of the company's electricity is purchased from other companies.)

Although Valmy I is expected to be completed by year-end, it won't significantly change the future make-up of the company's supply picture because of increased energy demands from mining and new population growth, even though the pace of newcomers is expected to slacken, Gremban said.

The two plants, between Battle Mountain and Winnemucca, would have a combined capacity of 500 megawatts and cost $413 million, with the costs and output being equally shared with Idaho Power Co.

A spokesman for Idaho Power Co. was unaware of Sierra Pacific's possible plans to postpone construction. He said his company would have no choice but to go along with Sierra Pacific, but he declined to comment further until he talked with Sierra Pacific officials.

The public service commission ruled this fall that interest costs related to Valmy I construction could no longer be passed on to customers until the plant is completed. Interst costs will come from company profits. The ruling, if not appealed, sets a precedent for Valmy II construction.

Stockbroker John Heward, Dean Witter vice president in Reno, said Sierra Pacific would not be alone as public utilities across the country have delayed new projects because of the high cost of money.

"Most utilites are delaying plants in hopes that interest rates will come down and then go to the debt market," Heward said.

Sierra Pacific, for example, paid 14⅝ percent interest on $30 million worth of bonds issued this fall to complete Valmy I.

Heward added that Sierra Pacific bond and stock holders are now given a fair return for their investment. But any new issues would dilute dividend payments unless the company's profits are allowed to increase, he said.

The company currently has 11,315,000 shares of outstanding common stock, 1,381,000 preferred stock and $238 million debt or outstanding bonds, Heward said.

As of September, the company had assets of $41.4 million and $32.8 million in liabilities.

The common stock currently sells for 11⅞, a low for the last 12 months, Heward said. The high has been 14½. Quarterly dividends total $1.46 a share a year, providing a 12.3 percent return.

He added that a common stock sale of 1.5 million shares last spring sold very quickly.

Asked why Sierra Pacific recently bought 250,000 acres near Elko for a power plant to be built in the late 1980s, Gremban explained that the land was purchased by a company subsidiary, with the money coming from company stockholders.

Gremban said earlier this month that it takes at least 10 years to develop a power plant and the company wanted to be assured it would have the land and water available. The ranch lands were purchased for $10 million.

In another money-related matter, Gremban said he hopes the service commission will consider allowing the power company to pass on interest costs related to its deferred fuel costs.

Nevada law allows the company to ask for a rate increase to cover fuel adjustments for the previous six-month period. However, interest costs incurred in paying those bills before they're covered by a rate increase is not allowed.

ACR 9

Valmy II power plant faces delay

By SUSAN VOYLES

The North Valmy II power plant, which was scheduled to begin operating in late 1984, might have to be postponed unless Sierra Pacific Power Co.'s financial picture improves, company president Joe Gremban said Monday.

Gremban said the company's rate of return is not sufficient to cover finance costs in raising money for construction of the plant, for which plans began as far back as 1974. In addition, skyrocketing interest costs within the last year require the company to pay higher dividends to compete for new stock and bond holders, he said.

"We're taking another hard look it," Gremban said of Valmy II during a luncheon meeting with about a dozen Northern Nevada news executives in the Sparks Nugget.

"Based on a 9.4 percent equity, we're going to have a difficult time in financing and we might have to postpone it — but we'd much rather keep on schedule," Gremban said.

The company recently was authorized a 15 percent rate of return by the Nevada Public Service Commission. However, the company has revenues to provide for only a 9.4 percent return, which includes both retained earnings and dividend payments, Gremban said. For last year, that 9.4 percent represents almost $17 million of a $180 million budget.

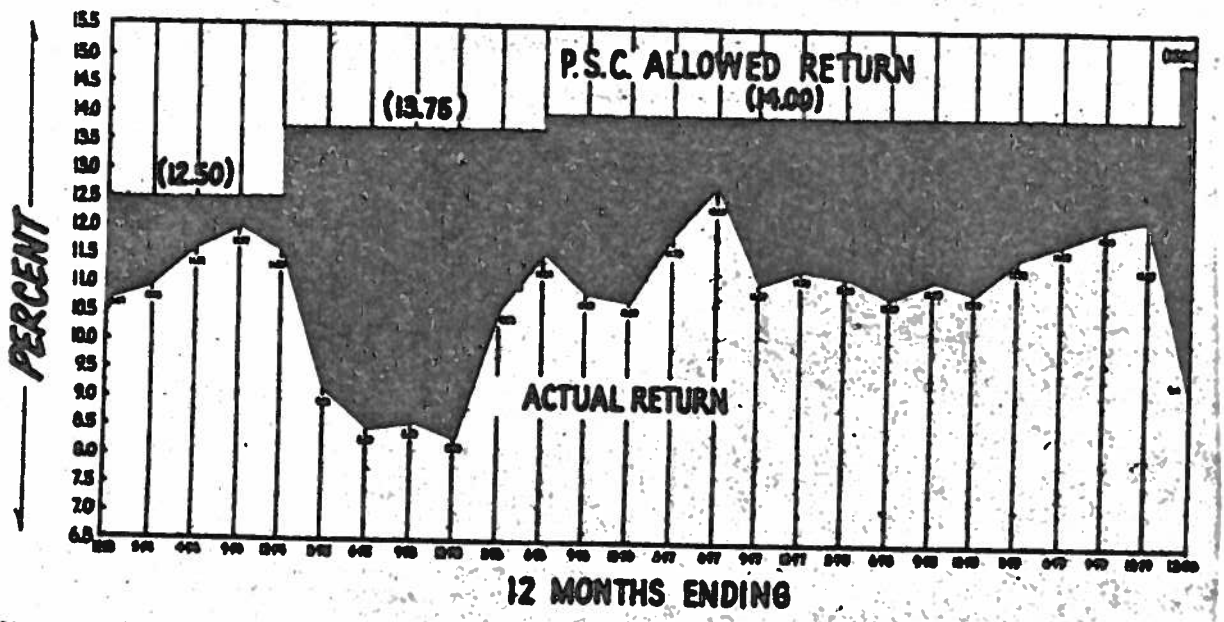
Retained earning are profits kept by the company. Dividends are profits returned to stock or bond holders.

In addition, the commission ruled this fall that the company could no longer pass on financing costs for construction of Valmy I until it comes on line, which is expected late this year.

The ruling, if not appealed, means the company would have to pay interest costs related to Valmy II construction out of earnings. For example, Sierra Pacific is paying 14⅝ percent interest on $30 million worth of bonds issued this fall to build Valmy I.

The upshot is the company may ask for a general rate increase to raise its rate of return to the authorized level. And even that, Gremban said, would

(Please see VALMY, P. 5)



Sierra Pacific Power Co's return on common equity compared with the allowed rate of return: From 1974 to 1980, Sierra Pacific Power Co. president Joe Gremban said, the company's rate of return, which includes retained earnings and dividends, has hardly matched the level the company is allowed to retain. In the last seven years, stockholders have received $20 million less than what they were allowed (represented by the gray shaded area), and attracting new stockholders will be difficult unless company revenues are increased, he said.

Valmy

(Continued from Page 1)

not be enough to cover the capital costs involved.

The alternative is that Valmy II could be postponed, costing customers $10 million in higher construction costs each year the project is delayed, Gremban said. He would not say how long the project could be delayed — only that it would be indefinite.

In the meantime, customers will continue to pay high fuel bills. Coal-fired Valmy II is meant to replace the more expensive oil and natural gas now used to generate 60 percent of the company's electricity.

Although Valmy I would have an immediate effect, it won't significantly change the future make-up of the company's supply picture because of increased demand from mining and new population growth, even though the pace of newcomers is expected to slow, Gremban said.

The two plants, between Battle Mountain and Winnemucca, would have a combined capacity of 500 megawatts and cost $413 million, with the costs and output being equally shared with Idaho Power Co.

Gremban also was asked why Sierra Pacific just bought 250,000 acres near Elko for a power plant to be built in the late 1980s. He explained that the land was purchased by a company subsidiary, with the money coming from company stockholders.

Gremban said earlier this month that it takes a least 10 years to develop a power plant and the company wanted to be assured it would have the land and water available. The ranch lands were purchased for $10 million.

In another money-related matter, Gremban said he hopes the service commission will consider allowing the power company to pass on interest costs related to its deferred fuel costs.

Nevada law allows the company to ask for a rate increase to cover fuel adjustments for the previous six-month period. However, interest costs incurred in paying those bills before they're covered by a rate increase is not allowed and the money comes from the company's rate of return.

Last year, interest costs at 20 percent interest or more cost the company between $5 million and $6 million, said Joe McKibben, company financial vice president.

If the interest cost were allowed to be passed on to customers, it would add only about $7 to their yearly bills, McKibben said.

Exhibit B

Joe Dini

ACR 9

VICTOR ATIYEH
GOVERNOR

PUBLIC UTILITY COMMISSIONER OF OREGON

LABOR & INDUSTRIES BUILDING, SALEM OREGON 97310 PHONE (503) 378-6117

November 13, 1980

Andrew Barbano
Coalition for Affordable Energy
2615 Hiko Avenue
Reno, Nevada 89512

In response to your telephone call of November 10, enclosed you will find a copy of testimony presented before the PUC by an employee of Pacific Power and Light Company. I believe this is the "study" for which you were searching.

Please note that this is not a PUC document, but rather one produced by a PP&L employee. The PUC does not support or deny the data therein.

If I can be of further assistance to you, please feel free to call upon me.

Anthony G. White
Residential Conservation
Coordinator

Encl.

As corrected

Exhibit 3-T

BEFORE THE PUBLIC UTILITY COMMISSIONER

OF THE STATE OF OREGON

PACIFIC POWER & LIGHT COMPANY

Proposed Residential Energy Efficiency Rider

Proposed Testimony of

John Shue

App.....Pro. _____ Intvr._____

Exhibit No. 3-T Case_____

H. Id. _____ In. Evd. _____

Q. Please state your name, business address and present employment.

A. My name is John Shue; my business address is 920 S. W. Sixth Avenue, Portland, Oregon, where I am employed by Pacific Power & Light Company as Supervisor of Rate, Load and Policy Research.

Q. Please briefly describe your education and past employment.

A. I graduated with highest honors in economics and a minor in finance from California State College at Los Angeles in 1967. The next three years I attended the University of Rochester under an NDEA fellowship, receiving an M.A. in economics and, while serving as a Lecturer, completed all course work and comprehensive examination requirements for the Ph.D. in economics. During the period 1971 to 1974, I was appointed to a position as an Assistant Professor of Economics at the College of Racine, Wisconsin. I served as Chairman of the Economics Program, President of the Faculty Senate and taught undergraduate courses, including price theory, energy economics and corporate finance, and graduate courses for the MBA program, including managerial economics. In August of 1974 I accepted the position of Economic Analyst with Pacific Power & Light. I was promoted to the position of Economist in 1975. I assumed my present position with Pacific in March 1977.

Q. Would you please briefly outline your areas of responsibility in your present position.

A. I am responsible for the supervision of activities which identify and analyze economic issues in the areas of pricing, costing, including the conceptual definition of LRIC, as well as supervising

load and cost/benefit studies in the areas of conservation and load management. I also direct the Company's customer and load research activities, which includes the design and acquisition of a data base from a sample metering program and the construction of models of the daily load patterns of customers and customer classes.

Q. What is the purpose of your testimony?

A. To illustrate the type of benefit/cost analysis that Pacific proposes to utilize in its weatherization program and to present an estimate of the program's costs and benefits.

Q. What is the economic rationale behind the plan?

A. Quite simply, there are investments which can be made on the customer's premises that save energy and capacity at less expense than the cost to our customers of new electric plant.

Q. What is the potential savings in new plant costs?

A. In Oregon rate hearings during the past four years (UF 3074, 3150, 3232, 3351) the Company and the PUC have carefully studied and have developed long-run incremental cost (LRIC) studies that we believe correctly reflect Pacific's costs in today's dollars of serving added load. The Commissioner has ruled that these studies reflect the Company's costs and has used them as a basis for allocating the revenue requirement to customer classes. These cost studies can be adapted to reflect the savings attainable if conservation is used as a substitute for new production plant.

Table 3-1, which is based upon the LRIC study submitted in the Company's most recent Oregon rate filing, UF-3351, derives a

1978 cost of 42 mills per kwh for residential space heating energy and capacity that could be saved with added insulation, and a similar cost of 35 mills per kwh for electric water heating.

Q. How can the 42 mills/kwh, which is a 1978 cost, be used to evaluate the benefits of added insulation which will save energy and capacity for many years?

A. Even though it is stated in 1978 dollars, the 42 mills is a forward looking cost because our LRIC studies utilize the Company's plans for new plant and associated expenses in the next ten years. Cost projections beyond that period are generally derived from these same cost figures.

A straightforward calculation of the potential lifetime gross savings of weatherization, exclusive of weatherization costs, expressed in 1978 dollars would be to multiply the LRIC of 42 mills times the annual savings in kwhs, times the average life of the investment, say 25 years. This methodology is correct if the decision is viewed as a choice between putting in insulation today, or committing electric plant investment today which will be sufficient to produce the capacity and energy that could have been saved. The LRIC of 42 mills per kwh is conceptually correct for this purpose.

Alternatively, the decision to insulate could be viewed as having an effect on the Company's investment program in such a way as to reduce the plant completed in each year of the life of the insulation. In this case, the escalation in the cost of new plant in future years above the 42 mills needs to be estimated

and then the future savings needs to be discounted to a present value at a rate appropriate to our ratepayers. If we make the assumption, which I believe is reasonable, that the price escalation and discount rates are approximately equal, then the results of this method of calculation will be identical to the one suggested above.

Q. How does Pacific propose that the cost of conservation options in the program be calculated?

A. The program provides weatherization services at no initial cost to the customer and the customer repays the cost, without interest, at the time the home is sold. The cost to be borne by all ratepayers is Pacific's carrying costs until repayment. The present value of these carrying costs plus the eventual repayment by program participants should be compared with the lifetime savings in new plant costs.

Although Pacific intends to seek low cost financing through recently passed Oregon legislation to lower the cost of the program to our customers, the analysis in this testimony assumes that the weatherization program is financed with the Company's regular capital structure. In making a calculation of the carrying cost of the program, we utilized the Company's capital structure, debt and equity costs from the aforementioned LRIC study which resulted in a 10.6% incremental cost of capital and a combined federal and state income tax rate on equity of 52%.

An informal survey of local residential mortgage bankers indicates that the average life of a mortgage is generally given

as 7 1/2 years. However, a 7 1/2 year average life clearly does not mean that all dwellings will turn over in that time because many will change hands several times while others remain with the original owner for decades. A reasonably conservative assumption is that our average program participant will transfer ownership in 7 1/2 years.

Using the above assumptions for a one dollar expenditure on space heating weatherization in 1978, the present value of the carrying costs and the repayment by the program participant in 7 1/2 years, discounted at the Company's cost of capital, is $1.53. This procedure is analogous to treatment of an investment expenditure for new electric plant in the LRIC study.

Q. How would the benefit/cost analysis be applied to specific dwellings?

A. Each of the dwelling's components--ceilings, floors, windows, doors--would be evaluated separately. The cost of upgrading the insulating quality of a component to various levels would be increased by 53% to reflect the present value of the expenditure, including carrying costs. This would be compared against 42 mills per kw of annual savings times 25 years. The upgraded insulation level that yielded the greatest difference of saving in excess of cost would be chosen. The resulting weatherization would be optimal in that options cheaper than the cost of new plant would be exercised.

Q. Why was a 25-year life used?

A. Our load and customer studies indicate that our average

electrically heated single-family home is now 14 years old. In an informal survey of local residential mortgage practices, we found that most 20 and many 30-year old homes qualify for 25-30 year mortgages. While we are not aware of any detailed analysis or forecast of dwelling life appropriate to our service territory, we believe that the average electrically heated dwelling currently connected will be there for an average of at least 25 additional years.

Q. What are the approximate costs of such a program?

A. Assuming full participation by qualified customers there would be approximately $80 million in weatherization expenditures on 77,150 homes. Each year 387 million kwhs would be saved at a lifetime cost, including Pacific's carrying cost (present valued), of 15.64 mills per kwh as compared to 42 mills per kwh for new electric plant. This translates into an average weatherization expenditure of approximately $1,000 per dwelling and an annual saving of over 5,000 kwhs per home.

Table 3-2 of the accompanying exhibit presents a detailed estimate of the costs and saving for our service territory in Oregon.

In addition to the electric space heat weatherization, an expenditure is included for wrapping all electric water heaters located in unheated space. The Company proposes that this be done by Company personnel at the time of the Home Energy Analysis. The large amount of potential saving available, and the high administrative costs associated with requiring repayment of

the cost (estimated to average less than $25), justify supplying the wrapping at no direct cost to the customer.

Q. What is the source of the data used to estimate the number of dwellings that require upgrading?

A. As part of a residential load study, detailed heat loss estimates were completed for approximately 100 single-family dwellings in Oregon. This information was utilized, along with some data from a study recently completed by Portland General entitled "The Insulation Picture in PGE Country."

Q. What is the source of data on the weatherization costs?

A. They are based on our recent survey of Portland area insulation and storm window installers. The costs reflect the retail rate for doing a single installation and would probably exceed Pacific's costs to the extent that contractors would have no advertising or marketing costs, and could achieve a constant volume without the normal seasonal swings. However, Pacific will have administrative costs roughly equal to these potential savings so that the current retail rates are a reasonable estimate.

Q. Can these current costs be relied upon given the recent sharp rise in insulation costs and the fact that Pacific will be substantially increasing the demand for insulation and related services.

A. Given a low level of price sensitivity for insulation in new homes and Pacific's added demand, there is certainly danger of bidding up the price for the available supply. We have been assured by major suppliers that an adequate supply will be forthcoming in the

next five years. If Pacific manages its rate of installations with a view towards short run market conditions, we see no reason to expect further sharp increases in program costs as the result of the program.

Q. Was it assumed in your estimates that the dwellings will be optimally upgraded? For example, is R-41 in the ceilings optimal using the benefit/cost analysis outlined?

A. Roughly, yes. However, some strong caveats about the specifics in the table should be offered. While R-41 is optimal for the ceiling if we consider only the program costs and the estimated kwh savings, there are other factors not incorporated in the analysis such as the absence of a vapor barrier in the ceiling or adequate attic ventilation which might substantially lower that recommendation for many dwellings. In addition, there are peculiarities in many dwellings which may make upgrading too expensive despite the saving. While some attempt has been made to adjust our data for such factors, it will be possible to estimate of the potential savings with precision only when we have experience evaluating dwellings against the benefit/cost analysis.

Q. The analysis presented thus far focuses on the benefits to all ratepayers--both program participants and nonparticipants. Since program participants receive both the benefits of direct conservation and share the benefits of needing less new electric plant, how can we be sure that nonparticipants also benefit?

A. Pacific should only undertake a weatherization program if it does not disadvantage the nonparticipant group. Adhering to the

benefit/cost analysis will assure us that the total revenue requirement will be less in the long run, but the kwhs over which the revenue is spread will also be less than if the weatherization program is not implemented. A paradoxical result can occur in which the revenue per kwh rises despite the fact that the total revenue requirement is less. Since the nonparticipant customer benefits only if the rate per kwh is less than it would have otherwise been, he can be disadvantaged even if the weatherization program benefits all customers taken as a total group. Page 3-3 illustrates an example of this anomaly where the average cost of the weatherization program per kwh saved is 25 mills, far less than the incremental cost of 42 mills, and yet the nonparticipant group would be better off if the weatherization program were not implemented and higher cost electric plant were built. Page 3-4 of the exhibit reduces the example to a model which indicates that the average lifetime cost of the weatherization must be below 18 mills per kwh saved for nonparticipants to benefit. Fortunately, the anticipated average lifetime cost of the insulation and weatherization is significantly below that figure.

In calculating the lifetime cost of weatherization per kwh saved, it must be noted that only Pacific's carrying cost is added to the revenue requirement in place of expensive new electric plant because the participants repay the weatherization loan. Assuming that the average repayment is 7 1/2 years after the weatherization, the present value of that dollar cuts the

average cost figure of ~~14.93~~ 15.64 mills per kwh reported on Table 3-2 of the exhibit to ~~10.93~~ 11.52 mills per kwh saved by weatherization. Clearly nonparticipant customers will benefit as this is substantially below the 18 mill break-even point.

Q. Does this complete your testimony?

A. Yes it does.

SIERRA ENERGY GROUP
Appropriate Energy Systems—Consultation and Design
P. O. BOX 14037 • RENO, NEVADA 89507 • (702) 322-2314

ACR 9

January 2, 1981

Mr. Randolph Townsend
2125 Parkridge Circle
Reno, NV 89509

Dear Randy:

Enclosed is testimony before the Washington Utilities Commission on a plan that is currently operating in Oregon. It is the system that I spoke to you and Andy about where the utility is required to provide no-interest loans for conservation instead of build new plants.

If you want to discuss this option further, please give me a call.

Sincerely,

Jon Wellinghoff
Senior Consultant

JW:jam

Enclosure

COLORADO ENERGY ADVOCACY OFFICE
1020 15th Street, #300
Denver, Colorado 80203

(303) 832-3291
(303) 892-1435

December 18, 1980

Jon Wellinghoff
Sierra Energy Group
P.O. Box 14037
Reno, Nevada 89507

Dear Jon:

Enclosed are the Washington materials on energy conservation you requested. It was good to meet last week in Austin and I hope this information helps.

Yours truly,

Bruce

D. Bruce Coles
Attorney at Law

DBC/rs

Encl.

Before the

UTILITIES AND TRANSPORTATION COMMISSION

of the

STATE OF WASHINGTON

CAUSE NO. U-80-10

Testimony of

RAY CZAHAR

on behalf of

PEOPLES ORGANIZATION FOR WASHINGTON ENERGY RESOURCES
(POWER)

September 12, 1980

EVERGREEN LEGAL SERVICES
200 Alaska Building
Seattle, WA 98104
(206) 464-5911

DIRECT TESTIMONY
OF
RAY CZAHAR

Q: Please state your name and business address.

A: My name is Ray Czahar. My business address is 455 Golden Gate Avenue, San Francisco, California, 94102.

Q: By whom and in what position are you employed?

A: I am employed by the California Public Utilities Commission as an economic analyst. It should be made clear that I am not testifying as a member of the California Public Utilities Commission, which has no connection with these proceedings. However, nothing I am saying here is, to the best of my knowledge, inconsistent with positions I have taken before that Commission.

Q: Briefly outline your education and work experience.

A: I received a Bachelor of Arts Degree in Economics and a Bachelor of Science Degree in Accounting from Golden Gate University in San Francisco. I am a Certified Public Accountant in California.

From 1969 to 1973 I was employed by Raymond Morrison and Knudsen as a budget analyst. From 1974 to date I have been employed by the California Public Utilities Commission. I have testified on numerous occasions before the California Public Utilties Commission, California Energy Commission and the California State Legislature in the areas of finance, accounting, resource plan evaluation, rate of return and

regulatory policy.

In addition I have testified before the Federal Energy Regulatory Commission and its predecessor the Federal Power Commission, the Illinois Commerce Commission, the Maine Public Utilities Commission, and the Massachusetts Department of Public Utilities.

Q: What is the purpose of your testimony?

A: I have been asked by Power to evaluate the conservation program suggested by Mr. Goldstien, against the rules governing Puget Sound Power and Light's (Puget) weatherization program and to determine if the conservation program and each program element is cost effective from the standpoint of participating and non-participating ratepayers.

Q: What is your understanding of the accounting and ratemaking rules which govern Pugets' current conservation program?

A: In its October 6, 1978 order on the applications of Pacific Power and Light, Washington Water and Power and Puget Sound Power and Light, the Washington Utilities and Transportation Commission approved the requests of all three electric utilities to institute a utility financed conservation program. The Washington Commission's order requires that the utility capitalize conservation loans on its books of account and reduce the capital balance when loans are repaid. Conservation loans become due and payable in no more than 10 years, or when the participating ratepayer sells or transfers title to his/her home. The utility conservation

loan is interest free and the participating ratepayer is only obligated to return to the utility the principal amount of the conservation loan.

The balance of conservation loans outstanding are included in the utility's rate base and earn the utility's authorized rate of return. In the case of Puget, it requested and received authority to capitalize program costs, other than the cost of capital, and to amortize these program costs over a ten year period.

Puget's program is available to residential single family and duplex homeowners using electricity for space heating as of October 7, 1978. Commercial and industrial customers are included for lighting and cooling improvements.

Q: What is the criteria used to determine whether or not a specific piece of hardware is to be included in the utility's conservation financing program.

A: From my reading of the Washington's Utilities and Transportation Commission's order of October 6, 1978 and Puget's own description of the order, it appears that the cost of energy saved from the utility's conservation financing program should be at a level that would be at least a "break-even" for non-participating ratepayers. It should of course produce saving for participating ratepayers. In other words the utility conservation investment programs should be "cost effective" to all affected parties.

Q: Please explain the term "cost effective" as it applies to Puget's conservation program.

A: Let me first start with a definition of cost effectiveness. Simply stated a program or investment is cost effective if the benefits exceed the cost. In the case of an electric utility a conservation program is cost effective if the cost of saving electricity through a conservation investment is less than the marginal cost of supply. In other words the net present value of the utility's revenue requirement, over some specified period of time would have to be less with conservation investments than with investments in more traditional supply options to make a program cost effective from the utility's standpoint.

Even if a conservation program passes the test of being cost effective to the utility, which include all ratepayers, it is of little value unless the program is beneficial to the individual ratepayer who must make the decision to participate in the conservation program. However, the participating customer will probably view the benefits of the program based on his own costs and benefits. For the participant in Puget's conservation investment program his/her costs are the payment to Puget at some point in the future for the conservation hardware installed. The benefits are the savings as reflected in his/her electric bill. If the benefits of reduced electric bills are greater than the cost of future payment to Puget a rational ratepayer should become a program participant. In making a choice of whether or not to participate in Puget's program a ratepayer should consider the benefits of interest free money and the increasing future price of electricity.

Finally, consideration should be given to the so-called "non-participating" ratepayer. A non-participating ratepayer is one who either chooses not to participate in the program because he/she does not see the benefits outweighing the costs, or cannot participate in the program because the program was not designed to include all ratepayers. In addition ratepayers may have already made their own investments in conservation.

In order to assure the non-participant that he will not subsidize his neighbors' insulation retrofit through his electric rates the concept of a cost effectiveness limit was established. If the cost of saying electricity via a utility conservation program is limited to the difference between the marginal cost of additional electric supply and the average revenue or rate on the system, non-participanting customer will be assured that they will pay no more than if the utility had in fact made the investment in additional electric supply.

It should be stated that the cost effectiveness criteria discussed above is a limited means of measuring costs and benefits because it fails to consider certain costs and benefits which are not usually accounted for within the firm's costing and pricing formula. Society as a whole including the utility, its ratepayer and every member of the community have a stake in the choices between increasing the supply of electricity solely through conventional means and/or through the process of encouraging and financing greater efficiency. In addition it would seem reasonable to give some recognition to the inherent superiority enjoyed by certain applications of

conservation measures over traditional electric supply programs. As an example conservation devices can be deplayed rapidly. This is in contrast to the long lead times now required to bring on line coal and nuclear plants. In addition a utility is in a better cash flow position, on a comparative basis by making conservation investments to meet part of its supply needs than would be the case if it depended totally on long lead-time conventional electric supply. This should lead to a lower rish value for each dollar invested and should therefore be reflected in the utility's cost of capital and eventually in the rates charged to consumers.

Q: Have you evaluated Mr. Goldstein's proposals regarding enhanced levels of utility investment in conservation hardware?

A: Yes. A computer model was devised that would process each of Mr. Goldstein's program elements. Schedule 1 of Exhibit _____, (RJC-1) shows the 21 items of conservation hardware recommended by Mr. Goldstein along with the total units of potential market penetration, cost per unit in January, 1980 dollars as well as the estimated annual Kwh savings per unit and units life the expected life of the unit.

Q: What other variables are used by the model?

A: Besides the conservation hardware characteristics the model needs information on the following:

1. Cost of Capital Including Income Taxes
2. Discount Rate
3. Energy Escalation Rate

4. Escalation Rate of Conservation Devices

5. Maximum Loan Period

6. Percentage of Houses Sold Each Year

7. Annual Market Penetration Rate of Conservation Device

Q: Would you explain the values you have assigned to each variable used in the model.

A: Listed below is each variable name and its assigned value and a brief explanation of the rationale behind its use.

1. Cost of Capital Including Income Taxes - 17.1%

The basic cost of the program, as prescribed by the Washington Utilities and Transportation Commission (WUTC) is the carrying cost of outstanding conservation loans. The unpaid loan balance is included in Puget's rate base and earns Puget's authorized rate of return. The overall weighted cost of capital for Puget as authorized by the WUTC in Cause U-78-21 was _____%, which included an allowance on common equity of 13%. Assuming that Puget will have to raise new capital to fund an expanded conservation program I have used marginal borrowing rates of 10% for both long-term debt and preferred stock and an allowance on common equity of 13%. Schedule 2 of Exhibit ____ (RJC-1) shows the derivation of both the weighted after-tax and pre-tax cost of capital used in evaluating the expanded conservation program.

2. Discount Rate - 11.05%

The discount rate is assumed to be the same for

both Puget and its ratepayers and is equal to the after-tax cost of capital as shown on Schedule 2 of Exhibit ____, (RJC-1). The discount rate is used to determine both the net present value of Puget's revenue requirement for the conservation program and the net present value of energy savings used to determine life cycle conservation costs.

3. Energy Escalation Rate - 8%

The energy escalation rate is the assumed annual average increase in the price of electricity in Puget's system. The discount rate and the energy escalation rate are interrelated in that we assume that the value of a KWH saved through the conservation measure is equal to its price at some point in the future. By discounting the value of future energy savings back to today's value (Net Present Value) at the assumed discount rate we can express the net present value of energy on the same basis as program costs are expressed.

4. Escalation Rate of Conservation Devices - 9%

I have assumed that the cost of each device will advance at an average compound rate of 9%.

5. Maximum Loan Period - 10 years

This is the maximum period prescribed by the WUTC for interest free conservation loans.

6. Percentage of Homes Sold Each Year

When a residence is sold the note which secures the conservation loan becomes due and payable. The cash flow from note payments is used to reduce the current year's financing requirements. Sales are assumed to occur equally

throughout the year.

The following is a list of the year by year rate of assumed housing turnover which was used in the model.

Yr.1	Yr.2	Yr.3	Yr.4	Yr.5	Yr.6	Yr.7	Yr.8	Yr.9	Yr.10
1%	4%	10%	15%	20%	30%	10%	5%	2%	1%

7. Annual Market Penetration Rates

It was assumed that the number of retrofits would occur in equal annual increments. In order to test the conservation program's sensitivity, in the areas of annual capital requirements and energy savings, we used a 6 year and 10 year market penetration rate.

Q: Would you describe the results of your cost effectiveness analysis of Mr. Goldstein's recommended conservation program.

A: On Schedule 3 of Exhibit ____ (RJC-1) I show the summary of the revenue requirements and energy savings for each of the 21 conservation measures analyzed by Mr. Goldstein.

Each flow of revenue requirement and energy saving is discounted to present value. The net present value of the revenue requirement is divided by the net present value of the energy savings to yield the "cost per unit of energy saved".

As an example, on page 1 of Schedule 3 of Exhibit ____ (RJC-1), we show the revenue requirement for and the energy savings of ceiling insulation retrofits R0 to R19. The net present value of the revenue requirement is approximately $2 million. The net present value of the energy saved is 953.5 gigawatt hours. 1/

1/ A gigawatt hour is 1 million kilowatt hours.

The cost per KWH saved is found by dividing $2 million by 953.5 gigawatt hours or 2.0977 mills per KWH. This result should be compared to the cost effectiveness limit. In the case of Puget, a cost effectiveness limit of 22 mills per KWH was established in Cause No. U-78-45. Therefore all ratepayers would benefit from the retrofit of homes within Puget's service territory who currently use electric space heating and do not have ceiling insulation.

Table 1 below summarizes all 21 conservation devices in order of their cost effectiveness.

Table 1 indicates that super low flow showerheads (program No. 17) and wall insulation RO-R38 (program No. 6) are clearly not cost effective when measured against the 22 mill limit. Heat pump retrofit for base board heating appears to be nominally cost effective.

The average cost of all kilowatt hours captured by the measures in Mr. Goldstein's program is 12.3 mills per kilowatt hour.

Q: Absent from your analysis of program costs are certain utility overhead costs incidental to the management of the program. How should these costs be factored into the cost of energy saved?

A: Allocation of overhead costs to each item or device would be an exercise in futility. I believe the proper method of measuring the impacts of the utility's overhead costs should be on a total program basis. As an example, if it were estimated that a certain amount of costs will be incurred by the

TABLE 1

Program Number	Description	Cost/KWH Saved (Mills/KWH)
15	Low Flow Shower Head	1.4
16	Low Flow Plumbing	1.6
5	Wall Insulation RO-R19	1.7
1	Ceiling Insulation RO-49	2.1
9	Infiltration Reduction	2.7
18	Wash. Machine Incentive	7.9
11	Heat Pump - Space Heating 2/	8.2
21	Refrigerator Incentive	8.2
7	Floor Insulation RO-R38	9.7
2	Ceiling Insulation R11-R22	10.5
13	Heat Pump - Space Heating 3/	10.9
19	Dishwasher Incentive	13.0
20	Storm Doors	13.7
3	Ceiling Insulation R19-R49	13.9
8	Glazing 1-3 Panes	17.1
4	Ceiling Insulation R19-49	17.8
20	Fluorescent Fixtures	18.0
12	Heat Pump Space Heating 4/	21.6
14	Heat Pump Space Heating 5/	24.1
17	Super Low Flow Showerhead	32.7
6	Wall Insulation RO-R38	55.7
	Average Cost All Programs	12.3

2/ Install on furnace replacement.
3/ Install on replacement of baseboard heater.
4/ Retrofit of electric furnace.
5/ Retrofit of baseboard heating.

utility to manage the program these costs should be added to the average cost per kilowatt hour saved.

Q: You had previously mentioned that you have performed a sensitivity analysis of the speed at which the utility could retrofit existing residences for conservation hardware. What are the results of that analysis?

A: Exhibit ____, (RJC-1), Schedule 4 shows the year by year capital requirements of Puget for Mr. Goldstein's program for each of the following options:

1. All program elements are enacted within a 6 year period.
2. All program elements are enacted within a 10 year period.
3. All program elements except No. 17, and No. 6 are enacted within a 10 year period.

The extension of the program's completion from six to ten years reduces the annual capital requirement by 40% from $129 million to $77 million. Another dramatic reduction in the annual and total amounts of additional capital that must be raised to support the program are achieved when wall insulation retrofit and super low flow showerhead devices are eliminated from the program. Again the annual capital requirements of the program are reduced by 50% to approximately $42 million per year.

Q. How was the cost effectiveness of the program impacted by the elimination of wall insulation retrofits and super low flow showerheads?

//

A. As was the case with capital requirements the overall cost per kilowatt hour of energy saved was reduced significantly from about 12.3 mills to 7.9 mills.

I would therefore recommend that program elements 6, wall insulation, and 17 super low flow shower heads not be included in a more comprhensive conservation program. Also an allowance of a 10-year period for the program's completion would better fit the financing capabilities of Puget.

In addition the overall cost level is far below the 22 mill cost effective limit. The situation could be viewed as an opportunity to capture conserved energy from groups of ratepayers who would not normally participate in this type of program. These groups may include landlords and low income ratepayers who might only be stimulated by a utility grant program.

Q. How much capital does Puget need to fund its current construction program and how would the full implementation of a more comprehensive program impact on Puget's capital requirements?

A. According to the August 7, 1980 common stock prospectus, Puget will spend approximately $400 million per year on its construction program (excluding AFUDC) over the next four years.[6/] If the measures analyzed by Mr. Goldstein are implemented it would add about 10% per year to the utility's construction program.

5/ Does not include the costs of coolstrip units 3 and 4 and combustion turbines.

Q. What action would you recommend the WUTC take in light of the low cost of energy that could be obtained from a more vigorous conservation program by Puget?

A. The first step would be to update Schedule 83 to include other conservation measures such as those analyzed by Mr. Goldstein.

The second step would be an order in this to require Puget to file a program to implement these measures.

Q. Does this conclude your direct testimony?

A. Yes.

PUGET SOUND POWER AND LIGHT
CONSERVATION PROGRAM ELEMENTS

Program No.	Item	Total Units	Cost Per Unit (1/1/80 $)	Annual Savings Per Unit (Kwh)	Life of Unit (Years)
		(a)	(b)	(c)	(d)
1	Ceiling Insulation				
	R0 - R49	5,300	$ 690	11,000	25
2	R11 - R49	15,900	575	1,830	25
3	R15 - R49	37,200	532	1,280	25
4	R19 - R49	19,800	490	920	25
	Wall Insulation				
5	R0 - R19	10,670	343	6,429	25
6	R11 - R38	89,300	1,900	1,140	25
	Floor Insulation				
7	R0 - R38	12,400	800	2,750	25
	Glazing				
8	From 1 to 3 Panes	57,600	2,100	4,100	25
9	Infiltration Reduction	169,700	200	2,500	25
10	Storm Doors	72,900	100	244	25
	Heat Pumps - Electric Furnance				
11	Install on Furnance Replacement	20,200	675	4,050	15
12	Retrofit	20,200	1,780	4,050	15
	Heat Pumps - Baseboard Heating				
13	Install on Replacement	9,500	805	3,630	15
14	Retrofit	9,500	1,780	3,630	15
	Water Heating				
15	Low Flow Shower Heads	350,400	15	425	20
16	Plumbing for Low Flow	350,400	25	600	20
17	Super Low Flow Shower Heads	350,400	400	480	20
	Incentive for Efficient:				
18	Clothes Washer	177,100	50	375	12
19	Dishwasher	138,200	50	200	14
20	Florescent Fixtures	916,000	30	115	10
21	Incentive for Efficient Refrigerators	229,000	125	600	20

PUGET SOUND POWER AND LIGHT

COST OF CAPITAL

Item	Ratio	Cost %	Weighted Cost	Gross Return Inc. Income Tax 1/
	(a)	(b)	(c)	(d)
Long-Term Debt	50%	10%	5.00%	5.00%
Preferred Stock	15	10	1.50	3.00
Common Equity	35	13	4.55	9.10
	100%		11.05%	17.10%

1/ Assumes a 50% marginal income tax rate.

PROGRAM 1 CEILING INSULATION R.O. - R 49.

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS
(THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 56.23	$ 0.00	$ 56.23	4858.31	4724.88
1982	171.49	0.00	171.49	14574.95	13785.34
1983	289.17	0.00	289.17	24291.58	22344.54
1984	403.24	0.00	403.24	34008.20	30423.18
1985	507.69	0.00	507.69	43724.84	38041.20
1986	593.15	0.00	593.15	53441.47	45217.83
1987	569.26	0.00	569.26	58299.78	47973.73
1988	444.20	0.00	444.20	58299.78	46656.13
1989	317.25	0.00	317.25	58299.78	45374.71
1990	200.99	0.00	200.99	58299.78	44128.49
1991	105.90	0.00	105.90	58299.78	42916.51
1992	48.74	0.00	48.74	58299.78	41737.80
1993	24.55	0.00	24.55	58299.78	40591.47
1994	12.47	0.00	12.47	58299.78	39476.62
1995	5.97	0.00	5.97	58299.78	38392.39
1996	1.75	0.00	1.75	58299.78	37337.95
1997	0.00	0.00	0.00	58299.78	36312.45
1998	0.00	0.00	0.00	58299.78	35315.13
1999	0.00	0.00	0.00	58299.78	34345.20
2000	0.00	0.00	0.00	58299.78	33401.91
2001	0.00	0.00	0.00	58299.78	32484.52
2002	0.00	0.00	0.00	58299.78	31592.33
2003	0.00	0.00	0.00	58299.78	30724.65
2004	0.00	0.00	0.00	58299.78	29880.80
2005	0.00	0.00	0.00	58299.78	29060.12
2006	0.00	0.00	0.00	53441.47	25906.81
2007	0.00	0.00	0.00	43724.84	20614.32
2008	0.00	0.00	0.00	34008.20	15593.00
2009	0.00	0.00	0.00	24291.58	10831.96
2010	0.00	0.00	0.00	14574.95	6320.67
2011	0.00	0.00	0.00	4858.31	2049.03
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NET PRESENT WORTH:			$ 2000.27		953555.60

COST PER UNIT OF ENERGY SAVED = 2.0977 MILLS PER KWH

PROGRAM 2 CEILING INSULATION R11 - R49 .

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS
(THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 140.59	0.00	$ 140.59	2424.75	2358.15
1982	428.73	0.00	428.73	7274.25	6880.16
1983	722.93	0.00	722.93	12123.75	11152.00
1984	1008.10	0.00	1008.10	16973.25	15183.99
1985	1269.23	0.00	1269.23	21822.75	18986.09
1986	1482.87	0.00	1482.87	26672.25	22567.89
1987	1423.15	0.00	1423.15	29097.00	23943.34
1988	1110.51	0.00	1110.51	29097.00	23285.74
1989	793.13	0.00	793.13	29097.00	22646.19
1990	502.47	0.00	502.47	29097.00	22024.21
1991	264.74	0.00	264.74	29097.00	21419.32
1992	121.86	0.00	121.86	29097.00	20831.04
1993	61.38	0.00	61.38	29097.00	20258.91
1994	31.18	0.00	31.18	29097.00	19702.50
1995	14.93	0.00	14.93	29097.00	19161.37
1996	4.37	0.00	4.37	29097.00	18635.10
1997	0.00	0.00	0.00	29097.00	18123.29
1998	0.00	0.00	0.00	29097.00	17625.53
1999	0.00	0.00	0.00	29097.00	17141.44
2000	0.00	0.00	0.00	29097.00	16670.65
2001	0.00	0.00	0.00	29097.00	16212.79
2002	0.00	0.00	0.00	29097.00	15767.51
2003	0.00	0.00	0.00	29097.00	15334.45
2004	0.00	0.00	0.00	29097.00	14913.29
2005	0.00	0.00	0.00	29097.00	14503.70
2006	0.00	0.00	0.00	26672.25	12929.90
2007	0.00	0.00	0.00	21822.75	10288.46
2008	0.00	0.00	0.00	16973.25	7782.36
2009	0.00	0.00	0.00	12123.75	5406.15
2010	0.00	0.00	0.00	7274.25	3154.60
2011	0.00	0.00	0.00	2424.75	1022.65
NET PRESENT WORTH:			$ 5000.69		475912.70

COST PER UNIT OF ENERGY SAVED = 10.5076 MILLS PER KWH

PROGRAM 3 CEILING INSULATION R15 - R49

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS (THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 304.32	0.00	$ 304.32	3968.00	3859.02
1982	928.05	0.00	928.05	11904.00	11259.09
1983	1564.89	0.00	1564.89	19840.00	18249.77
1984	2182.19	0.00	2182.19	27776.00	24847.95
1985	2747.46	0.00	2747.46	35712.00	31069.93
1986	3209.91	0.00	3209.91	43648.00	36931.39
1987	3080.64	0.00	3080.64	47616.00	39182.25
1988	2403.88	0.00	2403.88	47616.00	38106.11
1989	1716.86	0.00	1716.86	47616.00	37059.53
1990	1087.68	0.00	1087.68	47616.00	36041.68
1991	573.08	0.00	573.08	47616.00	35051.80
1992	263.78	0.00	263.78	47616.00	34089.10
1993	132.87	0.00	132.87	47616.00	33152.84
1994	67.49	0.00	67.49	47616.00	32242.30
1995	32.33	0.00	32.33	47616.00	31356.76
1996	9.46	0.00	9.46	47616.00	30495.55
1997	0.00	0.00	0.00	47616.00	29657.98
1998	0.00	0.00	0.00	47616.00	28843.43
1999	0.00	0.00	0.00	47616.00	28051.24
2000	0.00	0.00	0.00	47616.00	27280.81
2001	0.00	0.00	0.00	47616.00	26531.54
2002	0.00	0.00	0.00	47616.00	25802.85
2003	0.00	0.00	0.00	47616.00	25094.18
2004	0.00	0.00	0.00	47616.00	24404.97
2005	0.00	0.00	0.00	47616.00	23734.68
2006	0.00	0.00	0.00	43648.00	21159.24
2007	0.00	0.00	0.00	35712.00	16836.62
2008	0.00	0.00	0.00	27776.00	12735.49
2009	0.00	0.00	0.00	19840.00	8846.94
2010	0.00	0.00	0.00	11904.00	5162.37
2011	0.00	0.00	0.00	3968.00	1673.53
NET PRESENT WORTH:			$ 10824.78		778811.00

PROGRAM 4 - CEILING INSULATION R19 - R49

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS (THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 149.19	0.00	$ 149.19	1518.00	1476.31
1982	454.97	0.00	454.97	4554.00	4307.28
1983	767.17	0.00	767.17	7590.00	6981.64
1984	1069.79	0.00	1069.79	10626.00	9505.84
1985	1346.91	0.00	1346.91	13662.00	11886.13
1986	1573.62	0.00	1573.62	16698.00	14128.49
1987	1510.25	0.00	1510.25	18216.00	14989.58
1988	1178.47	0.00	1178.47	18216.00	14577.89
1989	841.67	0.00	841.67	18216.00	14177.51
1990	533.22	0.00	533.22	18216.00	13788.12
1991	280.95	0.00	280.95	18216.00	13409.43
1992	129.32	0.00	129.32	18216.00	13041.14
1993	65.14	0.00	65.14	18216.00	12682.97
1994	33.09	0.00	33.09	18216.00	12334.63
1995	15.85	0.00	15.85	18216.00	11995.86
1996	4.64	0.00	4.64	18216.00	11666.39
1997	0.00	0.00	0.00	18216.00	11345.97
1998	0.00	0.00	0.00	18216.00	11034.36
1999	0.00	0.00	0.00	18216.00	10731.30
2000	0.00	0.00	0.00	18216.00	10436.56
2001	0.00	0.00	0.00	18216.00	10149.92
2002	0.00	0.00	0.00	18216.00	9871.15
2003	0.00	0.00	0.00	18216.00	9600.04
2004	0.00	0.00	0.00	18216.00	9336.37
2005	0.00	0.00	0.00	18216.00	9079.95
2006	0.00	0.00	0.00	16698.00	8094.69
2007	0.00	0.00	0.00	13662.00	6441.03
2008	0.00	0.00	0.00	10626.00	4872.10
2009	0.00	0.00	0.00	7590.00	3384.49
2010	0.00	0.00	0.00	4554.00	1974.92
2011	0.00	0.00	0.00	1518.00	640.23
NET PRESENT WORTH:			$ 5306.72		297942.30

COST PER UNIT OF ENERGY SAVED = 17.8112 MILLS PER KWH

PROGRAM 5 WALL INSULATION RO - R19

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS (THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 56.28	0.00	$ 56.28	5716.44	5559.44
1982	171.62	0.00	171.62	17149.33	16220.25
1983	289.39	0.00	289.39	28582.21	26291.26
1984	403.55	0.00	403.55	40015.09	35796.84
1985	508.08	0.00	508.08	51447.98	44760.44
1986	593.60	0.00	593.60	62880.86	53204.67
1987	569.70	0.00	569.70	68597.30	56447.35
1988	444.55	0.00	444.55	68597.30	54897.02
1989	317.50	0.00	317.50	68597.30	53389.27
1990	201.14	0.00	201.14	68597.30	51922.93
1991	105.98	0.00	105.98	68597.30	50496.86
1992	48.78	0.00	48.78	68597.30	49109.97
1993	24.57	0.00	24.57	68597.30	47761.15
1994	12.48	0.00	12.48	68597.30	46449.39
1995	5.98	0.00	5.98	68597.30	45173.66
1996	1.75	0.00	1.75	68597.30	43932.96
1997	0.00	0.00	0.00	68597.30	42726.34
1998	0.00	0.00	0.00	68597.30	41552.86
1999	0.00	0.00	0.00	68597.30	40411.61
2000	0.00	0.00	0.00	68597.30	39301.70
2001	0.00	0.00	0.00	68597.30	38222.27
2002	0.00	0.00	0.00	68597.30	37172.50
2003	0.00	0.00	0.00	68597.30	36151.55
2004	0.00	0.00	0.00	68597.30	35158.65
2005	0.00	0.00	0.00	68597.30	34193.02
2006	0.00	0.00	0.00	62880.86	30482.75
2007	0.00	0.00	0.00	51447.98	24255.44
2008	0.00	0.00	0.00	40015.09	18347.21
2009	0.00	0.00	0.00	28582.21	12745.21
2010	0.00	0.00	0.00	17149.33	7437.10
2011	0.00	0.00	0.00	5716.44	2410.95
NET PRESENT WORTH:			$ 2001.81		1121983.00

PROGRAM 6 WALL INSULATION R11 - R38

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS (THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 2609.04	0.00	$ 2609.04	8483.50	8250.50
1982	7956.53	0.00	7956.53	25450.50	24071.70
1983	13416.34	0.00	13416.34	42417.49	39017.60
1984	18708.68	0.00	18708.68	59384.49	53124.38
1985	23554.94	0.00	23554.94	76351.49	66426.84
1986	27519.67	0.00	27519.67	93318.48	78958.52
1987	26411.43	0.00	26411.43	101802.00	83770.83
1988	20609.30	0.00	20609.30	101802.00	81470.06
1989	14719.28	0.00	14719.28	101802.00	79232.48
1990	9325.05	0.00	9325.05	101802.00	77056.35
1991	4913.21	0.00	4913.21	101802.00	74940.00
1992	2261.52	0.00	2261.52	101802.00	72881.76
1993	1139.11	0.00	1139.11	101802.00	70880.06
1994	578.65	0.00	578.65	101802.00	68933.33
1995	277.15	0.00	277.15	101802.00	67040.08
1996	81.10	0.00	81.10	101802.00	65198.82
1997	0.00	0.00	0.00	101802.00	63408.13
1998	0.00	0.00	0.00	101802.00	61666.62
1999	0.00	0.00	0.00	101802.00	59972.94
2000	0.00	0.00	0.00	101802.00	58325.78
2001	0.00	0.00	0.00	101802.00	56723.86
2002	0.00	0.00	0.00	101802.00	55165.94
2003	0.00	0.00	0.00	101802.00	53650.80
2004	0.00	0.00	0.00	101802.00	52177.28
2005	0.00	0.00	0.00	101802.00	50744.24
2006	0.00	0.00	0.00	93318.48	45237.99
2007	0.00	0.00	0.00	76351.49	35996.34
2008	0.00	0.00	0.00	59384.49	27228.22
2009	0.00	0.00	0.00	42417.50	18914.56
2010	0.00	0.00	0.00	25450.50	11037.04
2011	0.00	0.00	0.00	8483.50	3577.97
NET PRESENT WORTH:			$ 92804.60		1665081.00

COST PER UNIT OF ENERGY SAVED = 55.7358 MILLS PER KWH

PROGRAM 7 FLOOR INSULATION RO - R38

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS (THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 305.08	0.00	$ 305.08	5683.33	5527.24
1982	930.38	0.00	930.38	17049.99	16126.29
1983	1568.81	0.00	1568.81	28416.65	26138.97
1984	2187.66	0.00	2187.66	39783.30	35589.48
1985	2754.35	0.00	2754.35	51149.97	44501.17
1986	3217.95	0.00	3217.95	62516.62	52896.48
1987	3088.36	0.00	3088.36	68199.95	56120.37
1988	2409.90	0.00	2409.90	68199.95	54579.02
1989	1721.17	0.00	1721.17	68199.95	53080.01
1990	1090.40	0.00	1090.40	68199.95	51622.17
1991	574.52	0.00	574.52	68199.95	50204.36
1992	264.45	0.00	264.45	68199.95	48825.49
1993	133.20	0.00	133.20	68199.95	47484.50
1994	67.66	0.00	67.66	68199.95	46180.33
1995	32.41	0.00	32.41	68199.95	44911.99
1996	9.48	0.00	9.48	68199.95	43678.48
1997	0.00	0.00	0.00	68199.95	42478.85
1998	0.00	0.00	0.00	68199.95	41312.16
1999	0.00	0.00	0.00	68199.95	40177.52
2000	0.00	0.00	0.00	68199.95	39074.04
2001	0.00	0.00	0.00	68199.95	38000.87
2002	0.00	0.00	0.00	68199.95	36957.18
2003	0.00	0.00	0.00	68199.95	35942.14
2004	0.00	0.00	0.00	68199.95	34955.00
2005	0.00	0.00	0.00	68199.95	33994.95
2006	0.00	0.00	0.00	62516.62	30306.18
2007	0.00	0.00	0.00	51149.97	24114.94
2008	0.00	0.00	0.00	39783.30	18240.93
2009	0.00	0.00	0.00	28416.65	12671.38
2010	0.00	0.00	0.00	17049.99	7394.02
2011	0.00	0.00	0.00	5683.33	2396.98
NET PRESENT WORTH:			$ 10851.90		1115484.00

PROGRAM 8 GLAZING FROM 1 - 3 PANES

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS
(THOUSANDS)

	GROSS RETURN	AOM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 1860.02	0.00	$ 1860.02	19680.00	19139.49
1982	5672.32	0.00	5672.32	59040.00	55841.46
1983	9564.69	0.00	9564.69	98400.00	90512.95
1984	13337.67	0.00	13337.67	137760.00	123237.80
1985	16792.64	0.00	16792.64	177120.00	154096.80
1986	19619.14	0.00	19619.14	216480.00	183167.80
1987	18829.06	0.00	18829.06	236160.00	194331.30
1988	14692.65	0.00	14692.65	236160.00	188994.00
1989	10493.57	0.00	10493.57	236160.00	183803.30
1990	6647.95	0.00	6647.95	236160.00	178755.10
1991	3502.70	0.00	3502.70	236160.00	173845.60
1992	1612.27	0.00	1612.27	236160.00	169070.90
1993	812.09	0.00	812.09	236160.00	164427.40
1994	412.53	0.00	412.53	236160.00	159911.40
1995	197.58	0.00	197.58	236160.00	155519.40
1996	57.82	0.00	57.82	236160.00	151248.10
1997	0.00	0.00	0.00	236160.00	147094.00
1998	0.00	0.00	0.00	236160.00	143054.10
1999	0.00	0.00	0.00	236160.00	139125.10
2000	0.00	0.00	0.00	236160.00	135304.00
2001	0.00	0.00	0.00	236160.00	131587.90
2002	0.00	0.00	0.00	236160.00	127973.80
2003	0.00	0.00	0.00	236160.00	124459.00
2004	0.00	0.00	0.00	236160.00	121040.70
2005	0.00	0.00	0.00	236160.00	117716.40
2006	0.00	0.00	0.00	216480.00	104943.00
2007	0.00	0.00	0.00	177120.00	83504.23
2008	0.00	0.00	0.00	137760.00	63163.94
2009	0.00	0.00	0.00	98400.00	43877.95
2010	0.00	0.00	0.00	59040.00	25603.71
2011	0.00	0.00	0.00	19680.00	8300.17
NET PRESENT WORTH:			$ 66161.65		3862651.00

COST PER UNIT OF ENERGY SAVED AT 10% WITH 0 KWH

PROGRAM 9 INFILTRATION REDUCTION

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS (THOUSANDS)

	GROSS RETURN	AOM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 521.90	0.00	$ 521.90	35354.16	34383.16
1982	1591.59	0.00	1591.59	106062.50	100316.50
1983	2683.74	0.00	2683.74	176770.80	162602.10
1984	3742.40	0.00	3742.40	247479.20	221390.80
1985	4711.82	0.00	4711.82	318187.50	276827.50
1986	5504.91	0.00	5504.91	388895.80	329052.00
1987	5283.22	0.00	5283.22	424250.00	349106.80
1988	4122.59	0.00	4122.59	424250.00	339518.60
1989	2944.38	0.00	2944.38	424250.00	330193.70
1990	1865.34	0.00	1865.34	424250.00	321124.90
1991	982.82	0.00	982.82	424250.00	312305.20
1992	452.38	0.00	452.38	424250.00	303727.70
1993	227.86	0.00	227.86	424250.00	295385.80
1994	115.75	0.00	115.75	424250.00	287273.00
1995	55.44	0.00	55.44	424250.00	279383.10
1996	16.22	0.00	16.22	424250.00	271709.80
1997	0.00	0.00	0.00	424250.00	264247.30
1998	0.00	0.00	0.00	424250.00	256989.70
1999	0.00	0.00	0.00	424250.00	249931.40
2000	0.00	0.00	0.00	424250.00	243067.10
2001	0.00	0.00	0.00	424250.00	236391.20
2002	0.00	0.00	0.00	424250.00	229898.70
2003	0.00	0.00	0.00	424250.00	223584.50
2004	0.00	0.00	0.00	424250.00	217443.80
2005	0.00	0.00	0.00	424250.00	211471.70
2006	0.00	0.00	0.00	388895.80	188525.00
2007	0.00	0.00	0.00	318187.50	150011.30
2008	0.00	0.00	0.00	247479.20	113470.90
2009	0.00	0.00	0.00	176770.80	78824.61
2010	0.00	0.00	0.00	106062.50	45995.81
2011	0.00	0.00	0.00	35354.16	14910.85
NET PRESENT WORTH:			$ 18564.21		6939065.00

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PROGRAM 10 STORM DOORS

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS
(THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 112.10	0.00	$ 112.10	1482.30	1441.59
1982	341.86	0.00	341.86	4446.90	4205.99
1983	576.44	0.00	576.44	7411.50	6817.45
1984	803.83	0.00	803.83	10376.10	9282.29
1985	1012.06	0.00	1012.06	13340.70	11606.59
1986	1182.40	0.00	1182.40	16305.30	13796.22
1987	1134.79	0.00	1134.79	17787.60	14637.06
1988	885.49	0.00	885.49	17787.60	14235.05
1989	632.42	0.00	632.42	17787.60	13844.09
1990	400.66	0.00	400.66	17787.60	13463.86
1991	211.10	0.00	211.10	17787.60	13094.07
1992	97.17	0.00	97.17	17787.60	12734.44
1993	48.94	0.00	48.94	17787.60	12384.69
1994	24.86	0.00	24.86	17787.60	12044.54
1995	11.91	0.00	11.91	17787.60	11713.74
1996	3.48	0.00	3.48	17787.60	11392.02
1997	0.00	0.00	0.00	17787.60	11079.14
1998	0.00	0.00	0.00	17787.60	10774.85
1999	0.00	0.00	0.00	17787.60	10478.92
2000	0.00	0.00	0.00	17787.60	10191.11
2001	0.00	0.00	0.00	17787.60	9911.22
2002	0.00	0.00	0.00	17787.60	9639.00
2003	0.00	0.00	0.00	17787.60	9374.27
2004	0.00	0.00	0.00	17787.60	9116.80
2005	0.00	0.00	0.00	17787.60	8866.41
2006	0.00	0.00	0.00	16305.30	7904.32
2007	0.00	0.00	0.00	13340.70	6289.55
2008	0.00	0.00	0.00	10376.10	4757.52
2009	0.00	0.00	0.00	7411.50	3304.89
2010	0.00	0.00	0.00	4446.90	1928.47
2011	0.00	0.00	0.00	1482.30	625.17
NET PRESENT WORTH:			$ 3987.42		290935.30

PROGRAM 11 HEAT PUMP SPACE HEATING - INSTALLED ON REPLACEMENT OF ELECTRIC FURNACE

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS
(THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 209.67	0.00	$ 209.67	6817.51	6630.26
1982	639.40	0.00	639.40	20452.52	19344.49
1983	1078.16	0.00	1078.16	34087.53	31355.32
1984	1503.47	0.00	1503.47	47722.55	42691.80
1985	1892.92	0.00	1892.92	61357.56	53381.92
1986	2211.53	0.00	2211.53	74992.58	63452.63
1987	2122.47	0.00	2122.47	81810.08	67319.88
1988	1656.20	0.00	1656.20	81810.08	65470.94
1989	1182.87	0.00	1182.87	81810.09	63672.77
1990	749.38	0.00	749.38	81810.08	61924.00
1991	394.84	0.00	394.84	81810.08	60223.25
1992	181.74	0.00	181.74	81810.08	58569.22
1993	91.54	0.00	91.54	81810.08	56960.61
1994	46.50	0.00	46.50	81810.08	55396.18
1995	22.27	0.00	22.27	81810.08	53874.73
1996	6.52	0.00	6.52	74992.58	48028.80
1997	0.00	0.00	0.00	61357.56	38217.02
1998	0.00	0.00	0.00	47722.55	28907.97
1999	0.00	0.00	0.00	34087.53	20081.43
2000	0.00	0.00	0.00	20452.52	11717.94
2001	0.00	0.00	0.00	6817.51	3798.70
NET PRESENT WORTH:			$ 7457.96		911019.80

COST PER UNIT OF ENERGY SAVED = 8.1864 MILLS PER KWH

PROGRAM 12 HEAT PUMP SPACE HEATING - RETROFIT OF ELECTRIC FURNACE

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS (THOUSANDS)

	GROSS RETURN	AOH.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 552.90	0.00	$ 552.90	6817.51	6630.26
1982	1686.13	0.00	1686.13	20452.52	19344.49
1983	2843.16	0.00	2843.16	34087.53	31355.32
1984	3964.70	0.00	3964.70	47722.55	42691.80
1985	4991.70	0.00	4991.70	61357.56	53381.92
1986	5831.90	0.00	5831.90	74992.58	63452.63
1987	5597.04	0.00	5597.04	81810.08	67319.88
1988	4367.47	0.00	4367.47	81810.08	65470.94
1989	3119.27	0.00	3119.27	81810.08	63672.77
1990	1976.14	0.00	1976.14	81810.08	61924.00
1991	1041.20	0.00	1041.20	81810.08	60223.25
1992	479.26	0.00	479.26	81810.08	58569.22
1993	241.40	0.00	241.40	81810.08	56960.61
1994	122.63	0.00	122.63	81810.08	55396.18
1995	58.73	0.00	58.73	81810.08	53874.73
1996	17.19	0.00	17.19	74992.58	48028.80
1997	0.00	0.00	0.00	61357.56	38217.02
1998	0.00	0.00	0.00	47722.55	28907.97
1999	0.00	0.00	0.00	34087.53	20081.43
2000	0.00	0.00	0.00	20452.52	11717.94
2001	0.00	0.00	0.00	6817.51	3798.70
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NET PRESENT WORTH:			$ 19666.92		911019.80

COST PER UNIT OF ENERGY SAVED = 21.5878 MILLS PER KWH

PROGRAM 13 HEAT PUMP SPACE HEATING - INSTALLED
ON REPLACEMENT OF BASEBOARD HEATER

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS
(THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED kWh	PRESENT WORTH OF ENERGY SAVED
1981	$ 117.60	0.00	$ 117.60	2873.74	2794.82
1982	358.62	0.00	358.62	8621.23	8154.17
1983	604.71	0.00	604.71	14368.72	13217.02
1984	843.25	0.00	843.25	20116.21	17995.63
1985	1061.68	0.00	1061.68	25863.70	22501.77
1986	1240.39	0.00	1240.39	31611.18	26746.81
1987	1190.43	0.00	1190.43	34484.93	28376.96
1988	928.92	0.00	928.92	34484.93	27597.58
1989	663.44	0.00	663.44	34484.93	26839.62
1990	420.30	0.00	420.30	34484.93	26102.47
1991	221.45	0.00	221.45	34484.93	25385.56
1992	101.93	0.00	101.93	34484.93	24688.34
1993	51.34	0.00	51.34	34484.93	24010.27
1994	26.08	0.00	26.08	34484.93	23350.83
1995	12.49	0.00	12.49	34484.93	22709.50
1996	3.66	0.00	3.66	31611.18	20245.30
1997	0.00	0.00	0.00	25863.70	16109.40
1998	0.00	0.00	0.00	20116.21	12185.41
1999	0.00	0.00	0.00	14368.72	8464.81
2000	0.00	0.00	0.00	8621.23	4939.39
2001	0.00	0.00	0.00	2873.74	1601.24
NET PRESENT WORTH:			$ 4182.95		384017.00

COST PER UNIT OF ENERGY SAVED = 10.8926 MILLS PER KWH

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PROGRAM 14 HEAT PUMP SPACE HEATING - RETROFIT OF BASEBOARD HEATER

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS (THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 260.03	0.00	$ 260.03	2873.74	2794.82
1982	792.98	0.00	792.98	8621.23	8154.17
1983	1337.12	0.00	1337.12	14368.72	13217.02
1984	1864.58	0.00	1864.58	20116.21	17995.63
1985	2347.58	0.00	2347.58	25863.70	22501.77
1986	2742.72	0.00	2742.72	31611.18	26746.81
1987	2632.26	0.00	2632.26	34484.93	28376.96
1988	2054.00	0.00	2054.00	34484.93	27597.58
1989	1466.98	0.00	1466.98	34484.93	26839.62
1990	929.37	0.00	929.37	34484.93	26102.47
1991	489.67	0.00	489.67	34484.93	25385.56
1992	225.39	0.00	225.39	34484.93	24688.34
1993	113.53	0.00	113.53	34484.93	24010.27
1994	57.67	0.00	57.67	34484.93	23350.83
1995	27.62	0.00	27.62	34484.93	22709.50
1996	8.08	0.00	8.08	31611.18	20245.30
1997	0.00	0.00	0.00	25863.70	16109.40
1998	0.00	0.00	0.00	20116.21	12185.41
1999	0.00	0.00	0.00	14368.72	8464.81
2000	0.00	0.00	0.00	8621.23	4939.39
2001	0.00	0.00	0.00	2873.74	1601.24
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NET PRESENT WORTH:			$ 9249.26		384017.00

COST PER UNIT OF ENERGY SAVED = 24.0856 MILLS PER KWH

PROGRAM 15 WATER HEATING LOW FLOW SHOWER HEADS

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS (THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 80.82	0.00	$ 80.82	12410.00	12069.16
1982	246.48	0.00	246.48	37230.00	35213.04
1983	415.61	0.00	415.61	62050.00	57076.51
1984	579.55	0.00	579.55	86870.00	77712.47
1985	729.68	0.00	729.68	111690.00	97171.83
1986	852.50	0.00	852.50	136510.00	115503.70
1987	818.17	0.00	818.17	148920.00	122543.30
1988	638.43	0.00	638.43	148920.00	119177.60
1989	455.97	0.00	455.97	148920.00	115904.40
1990	288.87	0.00	288.87	148920.00	112721.10
1991	152.20	0.00	152.20	148920.00	109625.20
1992	70.06	0.00	70.06	148920.00	106614.30
1993	35.29	0.00	35.29	148920.00	103686.20
1994	17.93	0.00	17.93	148920.00	100838.40
1995	8.59	0.00	8.59	148920.00	98068.90
1996	2.51	0.00	2.51	148920.00	95375.42
1997	0.00	0.00	0.00	148920.00	92755.94
1998	0.00	0.00	0.00	148920.00	90208.39
1999	0.00	0.00	0.00	148920.00	87730.81
2000	0.00	0.00	0.00	148920.00	85321.27
2001	0.00	0.00	0.00	136510.00	76063.10
2002	0.00	0.00	0.00	111690.00	60524.20
2003	0.00	0.00	0.00	86870.00	45781.47
2004	0.00	0.00	0.00	62050.00	31802.92
2005	0.00	0.00	0.00	37230.00	18557.67
2006	0.00	0.00	0.00	12410.00	6015.99
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NET PRESENT WORTH:			$ 2874.88		2074063.00

COST PER UNIT OF ENERGY SAVED = 1.3861 MILLS PER KWH

PROGRAM 16 WATER HEATING PLUMBING LOW FLOW

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS
(THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 134.70	0.00	$ 134.70	17520.00	17038.81
1982	410.79	0.00	410.79	52560.00	49712.52
1983	692.68	0.00	692.68	87600.00	80578.61
1984	965.92	0.00	965.92	122640.00	109711.70
1985	1216.13	0.00	1216.13	157680.00	137183.80
1986	1420.83	0.00	1420.83	192720.00	163064.00
1987	1363.61	0.00	1363.61	210240.00	173002.30
1988	1064.05	0.00	1064.05	210240.00	168250.80
1989	759.95	0.00	759.95	210240.00	163629.80
1990	481.45	0.00	481.45	210240.00	159135.70
1991	253.67	0.00	253.67	210240.00	154765.00
1992	116.76	0.00	116.76	210240.00	150514.40
1993	58.81	0.00	58.81	210240.00	146380.50
1994	29.88	0.00	29.88	210240.00	142360.10
1995	14.31	0.00	14.31	210240.00	138450.20
1996	4.19	0.00	4.19	210240.00	134647.70
1997	0.00	0.00	0.00	210240.00	130949.60
1998	0.00	0.00	0.00	210240.00	127353.00
1999	0.00	0.00	0.00	210240.00	123855.30
2000	0.00	0.00	0.00	210240.00	120453.60
2001	0.00	0.00	0.00	192720.00	107383.20
2002	0.00	0.00	0.00	157680.00	85445.92
2003	0.00	0.00	0.00	122640.00	64632.68
2004	0.00	0.00	0.00	87600.00	44898.24
2005	0.00	0.00	0.00	52560.00	26199.07
2006	0.00	0.00	0.00	17520.00	8493.17
NET PRESENT WORTH:			$ 4791.47		2928090.00

COST PER UNIT OF ENERGY SAVED = 1.6364 MILLS PER KWH

PROGRAM 17 WATER HEATING - SUPER LOW FLOW SHOWER HEADS

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS
(THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 2155.26	0.00	$ 2155.26	14016.00	13631.05
1982	6572.69	0.00	6572.69	42048.00	39770.02
1983	11082.90	0.00	11082.90	70080.01	64462.88
1984	15454.76	0.00	15454.76	98112.00	87769.38
1985	19458.13	0.00	19458.13	126144.00	109747.00
1986	22733.29	0.00	22733.29	154176.00	130451.20
1987	21817.80	0.00	21817.80	168192.00	138401.80
1988	17024.81	0.00	17024.81	168192.00	134600.60
1989	12159.22	0.00	12159.22	168192.00	130903.30
1990	7703.18	0.00	7703.18	168192.00	127308.50
1991	4058.68	0.00	4058.68	168192.00	123812.00
1992	1868.18	0.00	1868.18	168192.00	120411.50
1993	940.99	0.00	940.99	168192.00	117104.40
1994	478.01	0.00	478.01	168192.00	113888.10
1995	228.94	0.00	228.94	168192.00	110760.20
1996	66.99	0.00	66.99	168192.00	107718.10
1997	0.00	0.00	0.00	168192.00	104759.60
1998	0.00	0.00	0.00	168192.00	101882.40
1999	0.00	0.00	0.00	168192.00	99084.21
2000	0.00	0.00	0.00	168192.00	96362.85
2001	0.00	0.00	0.00	154176.00	85906.55
2002	0.00	0.00	0.00	126144.00	68356.74
2003	0.00	0.00	0.00	98112.00	51706.14
2004	0.00	0.00	0.00	70080.01	35918.59
2005	0.00	0.00	0.00	42048.00	20959.25
2006	0.00	0.00	0.00	14016.00	6794.54
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NET PRESENT WORTH:			$ 76663.51		2342472.00

COST PER UNIT OF ENERGY SAVED = 32.7276 MILLS PER KWH

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PROGRAM 18 WATER HEATING - INCENTIVE FOR EFFICIENT WASHING MACHINES

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS (THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 136.16	0.00	$ 136.16	5534.38	5382.37
1982	415.25	0.00	415.25	16603.13	15703.64
1983	700.19	0.00	700.19	27671.88	25453.90
1984	976.40	0.00	976.40	38740.63	34656.72
1985	1229.32	0.00	1229.32	49809.38	43334.84
1986	1436.24	0.00	1436.24	60878.13	51510.12
1987	1378.40	0.00	1378.40	66412.51	54649.52
1988	1075.59	0.00	1075.59	66412.51	53148.58
1989	768.19	0.00	768.19	66412.51	51688.85
1990	486.67	0.00	486.67	66412.51	50269.21
1991	256.42	0.00	256.42	66412.51	48888.56
1992	118.03	0.00	118.03	66412.51	47545.84
1993	59.45	0.00	59.45	60878.13	42386.65
1994	30.20	0.00	30.20	49809.38	33727.50
1995	14.46	0.00	14.46	38740.63	25512.03
1996	4.23	0.00	4.23	27671.88	17722.38
1997	0.00	0.00	0.00	16603.13	10341.38
1998	0.00	0.00	0.00	5534.38	3352.45
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NET PRESENT WORTH:			$ 4843.43		615274.50

COST PER UNIT OF ENERGY SAVED = 7.8720 MILLS PER KWH

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PROGRAM 19 WATER HEATING - INCENTIVE FOR EFFICIENT DISHWASHERS

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS (THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED Kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 106.26	0.00	$ 106.26	2303.33	2240.07
1982	324.04	0.00	324.04	6910.00	6535.64
1983	546.40	0.00	546.40	11516.67	10593.57
1984	761.93	0.00	761.93	16123.33	14423.67
1985	959.30	0.00	959.30	20730.00	18035.38
1986	1120.77	0.00	1120.77	25336.66	21437.83
1987	1075.63	0.00	1075.63	27640.00	22744.40
1988	839.34	0.00	839.34	27640.00	22119.73
1989	599.46	0.00	599.46	27640.00	21512.21
1990	379.77	0.00	379.77	27640.00	20921.37
1991	200.10	0.00	200.10	27640.00	20346.77
1992	92.10	0.00	92.10	27640.00	19787.94
1993	46.39	0.00	46.39	27640.00	19244.46
1994	23.57	0.00	23.57	27640.00	18715.91
1995	11.29	0.00	11.29	25336.66	16685.06
1996	3.30	0.00	3.30	20730.00	13276.47
1997	0.00	0.00	0.00	16123.33	10042.54
1998	0.00	0.00	0.00	11516.67	6976.23
1999	0.00	0.00	0.00	6910.00	4070.77
2000	0.00	0.00	0.00	2303.33	1319.66
NET PRESENT WORTH:			$ 3779.57		291029.70

COST PER UNIT OF ENERGY SAVED = 12.9869 MILLS PER KWH

PROGRAM 20 LIGHTING - FLORESCENT FIXTURES

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS (THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 422.56	0.00	$ 422.56	8778.34	8537.24
1982	1288.65	0.00	1288.65	26335.01	24908.29
1983	2172.93	0.00	2172.93	43891.68	40373.63
1984	3030.09	0.00	3030.09	61448.35	54970.68
1985	3814.99	0.00	3814.99	79005.03	68735.45
1986	4457.13	0.00	4457.13	96561.69	81702.66
1987	4277.63	0.00	4277.63	105340.00	86682.20
1988	3337.91	0.00	3337.91	105340.00	84301.47
1989	2383.96	0.00	2383.96	105340.00	81986.13
1990	1510.30	0.00	1510.30	105340.00	79734.38
1991	795.75	0.00	795.75	96561.69	71082.43
1992	366.28	0.00	366.28	79005.03	56561.04
1993	184.49	0.00	184.49	61448.35	42783.67
1994	93.72	0.00	93.72	43891.68	29720.44
1995	44.89	0.00	44.89	26335.01	17342.50
1996	13.13	0.00	13.13	8778.34	5622.06
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NET PRESENT WORTH:			$ 15030.77		835044.40

COST PER UNIT OF ENERGY SAVED = 18.0000 MILLS PER KWH

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PROGRAM 21 REFRIDGERATORS - INCENTIVE FOR EFFICIENCY

SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS
(THOUSANDS)

	GROSS RETURN	ADM.& GEN. EXPENSE	GROSS REV. REQMT.	NOMINAL ENERGY SAVED kwh	PRESENT WORTH OF ENERGY SAVED
1981	$ 440.17	0.00	$ 440.17	11450.00	11135.53
1982	1342.35	0.00	1342.35	34350.00	32489.07
1983	2263.47	0.00	2263.47	57250.01	52661.25
1984	3156.34	0.00	3156.34	80150.01	71700.87
1985	3973.95	0.00	3973.95	103050.00	89654.91
1986	4642.84	0.00	4642.84	125950.00	106568.70
1987	4455.87	0.00	4455.87	137400.00	113063.70
1988	3476.99	0.00	3476.99	137400.00	109958.40
1989	2483.29	0.00	2483.29	137400.00	106938.40
1990	1573.23	0.00	1573.23	137400.00	104001.30
1991	828.91	0.00	828.91	137400.00	101144.90
1992	381.54	0.00	381.54	137400.00	98366.99
1993	192.18	0.00	192.18	137400.00	95665.33
1994	97.62	0.00	97.62	137400.00	93037.88
1995	46.76	0.00	46.76	137400.00	90482.59
1996	13.68	0.00	13.68	137400.00	87997.48
1997	0.00	0.00	0.00	137400.00	85580.63
1998	0.00	0.00	0.00	137400.00	83230.15
1999	0.00	0.00	0.00	137400.00	80944.23
2000	0.00	0.00	0.00	137400.00	78721.09
2001	0.00	0.00	0.00	125950.00	70179.10
2002	0.00	0.00	0.00	103050.00	55842.23
2003	0.00	0.00	0.00	80150.01	42239.97
2004	0.00	0.00	0.00	57250.01	29342.75
2005	0.00	0.00	0.00	34350.00	17122.11
2006	0.00	0.00	0.00	11450.00	5550.62
NET PRESENT WORTH:			$ 15657.06		1913621.00

COST PER UNIT OF ENERGY SAVED = 8.1819 MILLS PER KWH

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SUMMARY OF REVENUE REQUIREMENTS AND ENERGY SAVINGS:
PROGRAMS 1 - 21 SUMMED
(THOUSANDS)

	GROSS REV. REQMT.	PRESENT WORTH OF ENERGY SAVED Kwh
1981	$ 10730.90	175604.20
1982	32724.92	512343.60
1983	55180.90	830453.40
1984	76948.08	1130703.00
1985	96880.58	1413833.00
1986	113187.30	1680558.00
1987	108629.20	1782984.00
1988	84765.27	1734014.00
1989	60539.82	1686389.00
1990	38353.55	1640072.00
1991	20207.86	1588566.00
1992	9301.55	1532367.00
1993	4685.11	1474203.00
1994	2379.98	1414331.00
1995	1139.89	1355118.00
1996	333.55	1284203.00
1997	0.00	1209556.00
1998	0.00	1143358.00
1999	0.00	1083145.00
2000	0.00	1028547.00
2001	0.00	946547.90
2002	0.00	850010.10
2003	0.00	768275.90
2004	0.00	690390.30
2005	0.00	616203.30
2006	0.00	502344.20
2007	0.00	378352.30
2008	0.00	286191.70
2009	0.00	198808.10
2010	0.00	116008.70
2011	0.00	37607.51
	$ 381701.90	31091090.00

COST PER UNIT OF ENERGY SAVED 12.2760 MILLS PER KWH

PUGET SOUND POWER AND LIGHT
CONSERVATION PROGRAM
ANNUAL NET CAPITAL REQUIREMENTS
($ MILLIONS)

	Capital Requirements		
	6-Year Penetration: 21 Programs	10-Year Penetration: 21 Programs	10-Year Penetration 1/: 19 Programs
	(a)	(b)	(c)
Year 1	$ 123.7	$ 74.2	$ 40.8
2	129.9	77.9	42.8
3	129.0	77.4	42.6
4	121.9	73.2	40.2
5	107.9	64.7	35.6
6	80.1	48.1	26.4
7	(132.7)	44.9	24.7
8	(142.5)	45.2	24.8
9	(136.8)	47.8	26.2
10	(119.0)	51.3	28.2
11	(90.3)	(121.3)	(66.7)
12	(35.5)	(125.1)	(68.8)
13	(17.7)	(118.6)	(65.2)
14	(8.8)	(102.7)	(56.4)
15	(5.5)	(76.4)	(42.0)
16	(3.8)	(30.1)	(16.5)
17	0	(15.0)	(8.3)
18		(7.5)	(4.1)
19		(4.6)	(2.5)
20		(3.3)	(1.8)
21		0	0

1/ Excluding Programs Nos. 6 and 17.

Before the

UTILITIES AND TRANSPORTATION COMMISSION

of the

STATE OF WASHINGTON

CAUSE NO. U-80-10

Testimony of

DAVID B. GOLDSTEIN

on behalf of

PEOPLES ORGANIZATION FOR WASHINGTON ENERGY RESOURCES
(POWER)

September 12, 1980

EVERGREEN LEGAL SERVICES
200 Alaska Building
Seattle, WA 98104
(206) 464-5911

Q. Please state your name and address.

A. My name is David B. Goldstein. My address is 1240 Washington Street, San Francisco, California.

Q. Have you prepared an exhibit which displays your experience in energy conservation?

A. Yes, it is attached as Exhibit (DBG-1). Since that exhibit was prepared, I have begun work as the senior scientist of the San Francisco office of Natural Resources Defense Council.

Q. Have you previously testified before a state regulatory commission?

A. Yes. I have testified before the California Public Utilities Commission and the California Energy Commission concerning electric load forecasting and concerning building and appliance efficiency standards.

Q. What is the purpose of your testimony?

A. POWER has asked me to analyze Puget's conservation program to determine whether Puget is maximizing the implementation of cost-effective conservation measures. My testimony presents additional conservation measures along with those described by Puget and displays the system-wide savings potential. It also gives simple theoretical calculations of cost-effectiveness for these measures. Ray Czahar will use these costs and savings in his testimony to determine more precisely the cost of the conservation program to Puget and to its customers, using standard utility accounting techniques, and using the program elements of Puget Power & Light

Q. Why should conservation be a concern of an electric utility?

A. Conservation can provide utilities with an alternate way of meeting future electricity or fuel needs which is often cheaper and quicker than constructing conventional supply facilities. Puget Sound Power and Light has recognized this potential tradeoff by establishing a program to assist its customers in making conservation investments in their homes and businesses.

But unlike conventional sources of supply, conservation is not monolithic. A number of different measures can be undertaken, each at different cost and each with different payback. One method of rank-ordering conservation measures is by the "cost of conserved energy" - the amortized annual cost of the conservation investment divided by the annual energy savings, levelized over the life of the investment.[1/]

Q. Please summarize your analysis of Puget's conservation program.

A. Puget has chosen to provide financing for all measures with a cost of conserved energy below 22 mills per kilowatt-hour (kwh), which will result in a program expected to save about 400 million kwh/yr for its residential customers. In this testimony, I will present evidence on how a wider range of measures, or a greater effort in the extent of implementation of the same measures, will result in a savings of over 1600 million kwh/yr using only measures which have a cost of conserved energy below 22 mills per kilowatt-hour. If the cost criterion is relaxed to 70 mills per residential kilowatt-hour, which is roughly the level of cost of new power supplies, and is below the present tail-block rates charged by Pacific Gas and Electric in

California (88 mills/kwh), the list of residential measures expands to include savings of over 2 billion kwh/yr from the residential sector.

Since some measures on the list have a cost substantially less than 22 mills per kwh, the average cost of the program is much less than the cost of the expensive measures. Even the larger, 2-billion-kwh per year program has an average cost of about 16 mills per kwh saved.

In addition to this residential program, Puget's commercial audit can be expanded to include delamping or reducing lighting levels in commercial buildings. Most commercial buildings presently have light levels considerably in excess of current recommendations. Reducing light levels to conform to present recommended practice would save Puget an extra 225 million kwh/yr.

Q. Why do your recommendations differ from Puget's?

A. The differences between my recommendations and Puget's are due to three factors. First, Puget does not attempt to find the cost-minimizing insulation for their climate and electricity cost criterion, they simply recommend insulating up to code levels. But optimizing insulation levels - that is, adding insulation until the last inch is no longer cost-justified, produces higher levels of insulation than Puget is recommending, along with greater savings.

The second difference between my results and Puget's concerns data on costs and savings. In some cases, Puget has supplied cost or savings estimates which look unrealistic.

Comparing them to other sources of data sometimes results in increased savings and sometimes in decreases, but in a few key places, the difference in assumptions changes whether a given measure is cost-effective. The best example of this is for multiple glazing of windows.

The third difference is the expansion of the range of measures to be considered. The conservation measures recommended herein are summarized in Table I. As shown in the table, a number of measures (e.g., infiltration reduction) with tremendous savings are contained in the table which are not on Puget's list. Other measures not included by Puget are heat pump retrofits, lighting retrofits, and appliance efficiency improvements (on replacement). In addition, another feasible measure - heat pump water heaters - is not included on either Puget's list or on ours. I have omitted it because of the limited commercial production of heat pump water heaters at present, but in a year or two, these devices should be available in sufficient numbers to justify their inclusion.

Q. Do you assume higher market penetrations than Puget assumes?

A. One area in which my calculations do not disagree with Puget's is in the number of units available for retrofit. I have not seen the basis on which Puget based their estimates of the number of candidates available. In some cases (e.g., increasing attic insulation from R-19), it appears that there is a much greater potential than Puget believes, but in general Puget's estimates look reasonable.

Although I do not change the number of potential

candidates, I will often change the projected saturation of the conservation investment. The rationale for increased saturation compared to Puget is that some of our measures have higher cost savings, and are therefore more likely to be undertaken.

Q. Please summarize the measures in your program and their impact.

A. Table I lists the cost of conserved energy for each measure in mills per kilowatt hour. The calculation is done by simply dividing the capital cost of the conservation measure by the product of annual energy savings and lifetime of the measure. This is equivalent to the discounted present value of investment costs per unit of energy savings, under the assumption that the discount rate equals the rate of electricity cost escalation. Lifetimes used are the estimated lifetimes of the equipment, up to a maximum of 25 years.

Puget increases capital costs by a factor of 1.13 for the cost-effectiveness calculation, apparently to account for administrative costs. I think that this procedure is incorrect, because administrative costs should not vary with the extent of conservation used, but rather with the number of homes inspected or the number of loans approved. Administrative expenses should be added to the cost of the whole program, not to the cost of an individual measure. Thus Table I lists cost-effectiveness as calculated without this factor.

While investment decisions can be best made by ranking

conservation measures by their cost to savings ratios,[2] understanding them is easiest if they are organized by end use.

Q. Please elaborate on Table I.

A. I will discuss space heating measures first.

Puget's recommendation is to bring attic insulation up to current code levels of R-30. But establishing a cost-effective conservation program requires that the optimum insulation level be determined by the program manager, based on the cost assumptions and savings estimates. I will show next that using Puget's cost assumptions and an electric rate of 22 mills per kwh leads to an optimum insulation level of R-49.

Energy savings from insulation can be calculated for the Puget Sound area by the formula

Energy used = $(U_{\text{before insulation}} - U_{\text{after insulation}}) \times A \times$ 24 hours/day x degree days

where U is the conductance of the area in question (the attic in this case) in Btu/^{o}F - ft^2 - hr

A is the area in ft^2

and degree days has a value of about 5000 for the Puget Sound area.

Although this formula is only approximate, comparison of its predictions with those of a more detailed, computerized building energy analysis model show excellent agreement.[3]

To use this formula, note that $U = 1/R_{\text{total}}$ where R_{total} is the R-value of the element under consideration. For an attic, R_{total} is equal to the R-value of the insulation

plus 3, where 3 is the R-value of an uninsulated attic (Puget's calculations appear to ignore this extra R-3). Thus the R-value of an "R-19" attic is 22, so U is 1/22. This formula can be used to predict the energy savings from going from a given R-value to the next choice. We can thus calculate the savings on going from R-19 to R-30, from R-30 to R-38, from R-38 to R-49, etc.

These savings can be compared to costs. Puget's cost assumptions are consistent with the following formula:

insulation cost (per square foot) = \$0.175 + \$0.007 x R

where R is the increase in R-value

This formula is intuitively appealing and plausible - it says that it costs 17½¢ per square foot to get a contractor out to look at your attic; plus 7 mills per square foot for each R-value he adds.

To find the optimum insulation to add, once the contractor gets there, one compares the marginal savings from adding the next level of insulation to the marginal cost - 7 mills per ft^2 of R-1. The last step which is cost-justified is R-38 to R-49, so we adopt R-49 as the optimum. Table I looks at the cost of conserved energy in going from various initial insulation levels to R-49. All levels studied are cost-effective, with the cost per kwh saved greatest for the cases with the least insulation. However, R-19 to R-49 is cost-justified; whereas R-19 to R-30 is not. This occurs because the cost of dragging the contractor to the building site is too large to be covered by the savings from adding only R-11. In contrast,

the cost of adding an extra R-19 to get R-49 is not large (once the contractor is there) compared to the savings.

To be conservative, I have increased the cost of an extra R-value in Table I about 50% from Puget's estimate to correspond with the cost of adding an extra R-1 in a new house in Seattle, as given in Ref. 4. Note that all the measures still fall below 22 mills/kwh even at this higher cost level. These savings estimates and Puget's are based on an assumed 1000 square feet of attic per house. I assume that attic insulation retrofits are applicable to the same number of houses as Puget assumes, except that for the last case - R-19 to R-49 - we take a feasibility factor of 90%.

Q. Please continue your discussion of space heating measures, focussing next on wall insulation.

A. I will discuss two types of wall insulation measures: taking uninsulated walls to R-11, which involves drilling holes between the wood studs, filling the cavities with cellulose insulation (or other loose material insulation), and then sealing the holes; and adding R-7 to insulated walls by putting foam board between the studs and the siding.

The former measure applies only to houses with uninsulated walls, which Puget estimates to number 14,000. Of these, only three-fourths are assumed to participate in the program, presumably because the hole-drilling process may cause a degradation in the appearance of the house. I will accept Puget's estimates of the cost, savings, and applicability

of this measure, although I suspect that Puget may find somewhat more candidates for this job than it expects. For example, in California, a large fraction of respondents to a survey on insulation levels indicated that they had wall insulation when in fact almost none of the houses in that region had insulated walls at the time of the survey.[5]

The second measure - adding rigid insulating sheathing - is a relatively expensive measure. It requires removing the existing siding from the house, nailing insulating sheathing to the studs, and then re-siding the house. The estimated cost in Table I, $1900, includes both the cost of installing the insulation[4] and the cost of new siding.[6] Including both costs, the price of conserved energy is 67 mills per kilowatt-hour. However, most of the cost is in re-siding, not insulating. The sheathing insulation (assumed to be R-7, equivalent to 1¼ inches of styrofoam) costs only $500 installed, while the siding is $1400.

Realistically, this measure should be implemented when the homeowner wants to replace his siding anyway. In this case, the only extra cost is for the insulation itself, which is $500. If this measure is employed only when the owner re-sides his house, the cost of conserved energy drops to 17.5 mills/kwh, and so it is cost-effective.

The potential market for this measure includes essentially all of Puget's electrically-heated customers, since wall insulation in excess of R-11 is rare. The saturation of electric resistance space heating in Puget's territory

is 39%, according to the utility's surveys, so 39% of its 458,000 customers, or 178,000, are potentially eligible for this retrofit. I assume that all of them can actually perform this retrofit over the life of the current program.

Q. Please discuss floor insulation measures.

A. As in the case of attic insulation, floor insulation should be added until an optimum is reached. Floor insulation costs more than attic insulation because of the increased effort needed by the installer, but the cost of an extra unit of material is the same. Thus the optimum floor insulation should be roughly as thick as the optimum attic insulation.

Considered more carefully, though, the optimum calls for slightly less insulation in the crawl space because the R-value of the uninsulated crawl space is higher than that of an uninsulated attic. Calculations on the prototype used by the U.S. Department of Energy in establishing performance standards for new buildings [7,8] suggest that an uninsulated crawl space has a thermal resistance of about R-10. Thus, the optimal floor insulation is R-38. However, the higher base (uninsulated) R-value implies that savings from crawl space insulation are less than Puget predicts.

Table I gives our estimate of energy savings from crawl space insulation to R-38. I assume that the cost is equal to Puget's cost for R-19 plus the cost of increasing floors by R-19 in new-house crawl spaces. Despite the reduced savings prediction, the measure still has a cost

of conserved energy less than 12 mills/kwh.

Applicability of the measure is taken as the same as Puget's estimate.

Q. Please analyze Puget's recommendations on multiple glazing.

A. Puget's recommendations in the glazing area also do not result in minimum life cycle costs. Optimal glazing in the Pacific Northwest is triple, so retrofits should consider the replacement of single-pane windows by triple-pane, or the use of retrofit double-pane storm windows over existing glazing. (Adding a third pane to windows presently double-glazed is not cost-effective, however.)

In addition, Puget's estimate of the cost of storm windows appears excessive. Their predictions are consistent with costs of about $10.00 per square foot of glass. Yet the National Association of Home Builders Research Foundation estimates that installing storm windows in a new home costs only $2.50 per square foot in the Seattle area.[4/] They estimate that new triple-pane windows cost less than $8.50 per square foot including installation. It is unreasonable to expect that new triple glazing installed in a hole in a wall in a new house (including builder overhead and profit) is cheaper than adding one pane of glass in retrofit. While Puget's cost estimate may be valid in some individual cases, it is unreasonable to expect that it represents the lowest bid they could obtain for a typical house.

In fact, there is a tremendous variation in costs presently run for multiple glazing, due to variations

in quality and also due to the fact that, at present, manufactured windows, which come only in standard sizes, are less than half the price of custom-sized premium windows. For those houses with standard-sized windows, going to triple pane is cost-effective and should be undertaken. In cases where the window is odd-sized, triple-pane may cost as much as $15 per square foot, increasing the cost of condensed energy to 30 mills or so per kilowatt-hour.

The values in Table I use a cost estimate of $10.50 per square foot for triple glazing, which assumes a $2 per square foot premium for a retrofit case compared to a new house. This is a conservative estimate, since retrofit double-pane storms should be cheaper. Since the measure is cost-effective, we assume it is applicable to all the homes which Puget says currently have single pane windows. But to allow for expensive oddly-shaped windows, we assume a feasibility factor of 3/4..

Q. Please discuss measures to reduce infiltration.

A. Puget already lists some infiltration-reduction techniques: caulking and weatherstripping of windows. But research on infiltration performed at Princeton University and Lawrence Berkeley Laboratory has shown that most infiltration occurs not around windows where it is expected, but through hidden, large holes in the structure, such as the area around heating ducts, plumbing connections, ventilation ducts, light fixtures, and around wall mouldings. These leakage sources are relatively easy to fix once they are found, and experiments at Princeton and Berkeley have shown

that typical houses can be tightened sufficiently to reduce their air leakage rate by 0.25 to 0.40 air changes per hour (ach).

Finding the leakage sources requires house-by-house testing. The procedure for leak detection is found in Ref. 9; it involves pressurizing the house with a fan and using a smoke source to detect leaks. One way of accomplishing this is to install a window fan in the window of the house to be tested, and sealing the fan mounting with plastic. The fan is turned on and forces air into the house. This air must escape somehow; so it exits through the leaks.

The experimenter then walks around the house looking for prospective leak sources, using a smoke source (e.g., a cigarette) and watching for where the smoke is drawn rapidly out of the house. Where leaks are detected, they can be easily and cheaply sealed by stuffing them with fiberglass or by using foam or caulk for the smaller leaks.

A more sophisticated version of this procedure uses pressure and air flow meters to monitor the increase in tightness as leaks are sealed. This is also described in Ref. 9.

Sealing air leaks should be applicable for all 178,600 of Puget's electric heat customers,; we have also included a feasibility factor of .95. The cost consists almost entirely of labor to perform the heat detection tasks: I estimate 2 testers spending ½ day per house at $20 per hour each, for a labor cost of $160. Materials cost is negligible, but we have rounded the cost up to $200 to account

for labor. Note the extremely high cost-effectiveness of this measure - conserved energy costs only 3 mills per kwh. Also note the overall magnitude of savings - over 400 million kwh/yr. Individual unit savings were obtained by scaling up the computer simulations in Ref. 3 to a 1300-ft^2 assumed average house size and then scaling the savings from infiltration reduction to an assumed average savings of 0.25 ach.

Q. Are heat pumps a viable part of a conservation plan?

A. Yes. In many cases, heat pumps can be substituted for existing electric furnaces as a cost-effective conservation measure. The cheapest way to implement this measure is to install a heat pump as a replacement for an electric furnace which needs to be replaced anyway. In this case, all the ducts are present already and the cost of heat pump purchase and installation need only be compared to the cost of replacing the electric furnace. The incremental costs of the heat pump are then only $675, according to cost estimates for equipment in Ref. 10 and installation cost estimates in Ref. 4.

Savings can be estimated using the seasonal COP of the heat pump. The COP of an electric furnace is 1.0. Analysis of high-efficiency heat pumps for a Pacific Northwest climate (Portland) performed by Oak Ridge National Laboratory and described in Ref.'s 8 and 11, show that the seasonal COP of a heat pump is 2.08. Thus the heat pump uses 1/2.08 times as much electricity as the electric furnace. Energy savings are estimated by applying this reduction to an estimate of the average

energy consumption for space heating in the Puget area. I use 7800 kwh/yr for the existing space heating use, which is derived from looking at the difference in annual energy consumption between Puget's space heat and water heat customers and that of water-heat-only customer and adjusting this difference for the differences in appliance and hot water energy use which can be explained by the different appliance saturations and household sizes between the groups. This method tends to understate space heating use, because some of the differences which appear to be likely to exist cannot be quantified. My estimate of annual savings from the high-efficiency heat pump - 4050 kwh/yr - are thus conservatively low.

For the case of replacing an electric furnace already in need of replacement with a heat pump, this measure is cost-effective compared to 22 mills/kwh electricity. Three other cases are examined with lower cost-effectiveness - from 26 to 44 mills per kwh saved. These are: retrofitting a heat pump for a presently-working electric furnace, substituting a heat pump for electric baseboards in need of replacement, and substituting a heat pump for working strip heaters. In the last two cases, the costs are higher due to the need to install ducts, and the energy use of the heat pumps is increased due to 10% duct heat losses. The results are shown in Table I.

The number of potential retrofits is all of Puget's electrically heated customers. We assume a feasibility factor of 1/3. Electric heat is apportioned among furnaces

and baseboards using the proportions reported in Ref. 4 for new construction in the state of Washington. Note that the heat pump measure is most effective for those homeowners who are unable for one reason or another to employ the insulation retrofits.

Q. Now that you have discussed each aspect of space heating conservation measures, what is your analysis of water heating?

A. Water heating energy can be reduced by three methods: improving the efficiency of the water heater, increasing the efficiency of hot water use, or simply reducing the usage of hot water (e.g., using cold water laundry). I will analyze only the first two types of measure: however, Puget has studied only the first.

I concur with Puget on the savings per unit from water heater insulation. However, I feel that this measure should be applicable to all of Puget's 389,300 water heater customers with a feasibility factor of 90%. This measure is cheap - about 3½ mills/kwh - and easy to do.

Beyond this, the most promising measure is to replace electric resistance water heaters with heat pumps. This measure, while not fully commercial at the moment, should be available in reasonable quantities after a few years. The COP is likely to range from 1.8 to 2.0, with an incremental cost of about $400. At the lower COP and assuming that hot water heater energy use averages 4700 kwh per year for Puget's users (who have higher rates of appliance ownership than average), the cost of conserved energy over a ten-

year life is 19 mills/kwh.

Besides improving the performance of the water heater, several measures are available to reduce hot water use inefficiency. The cheapest at 2 mills per kwh conserved is low-flow plumbing - showerheads and sink fittings. Low-flow showerheads are designed to produce high water velocity and the feeling of a "strong" shower, as distinct from flow restrictors which reduce both water flow rate and velocity, and are thus less acceptable to people. The cost assumption of $25 is conservatively high, since most low-flow showerheads are only $5-$10 each. I have assumed a 50% reduction in shower flow rates; based on rough estimates of shower usage[12/] I predict a savings of half of the 1200 kwh/yr that a typical household of the size in Puget's territory (2.66 people) uses. Since Puget's customers appear to be better off financially than average, this consumption estimate (and thus the savings estimate) is probably biased low. Total savings from this measure, assumed to apply to 90% of Puget's hot water customers, total over 200 million kwh/yr.

This savings figure, and the cost of conserved energy, are so impressive that we next consider the use of more elaborate low-flow showers. For about $400 installed, one can currently purchase a compressed-air driven showerhead that reduces energy consumption by 90% compared to a regular shower (including the electricity to run the pump). It produces a very "heavy" feeling shower, at least as strong-feeling as conventional showerheads. While $400 sounds like

a ridiculous price to pay for a showerhead, we can compute the cost of conserved energy due to installing this device, and find that it saves energy at 42 mills per kwh compared to a low-flow shower. Compared to a conventional shower, the savings are less than 19 mills per kwh. Electrically-supplied hot water is thus seen to be very expensive, justifying exotic conservation measures.

Realistically, this option of super-low-flow showers is not likely to be applicable to everyone because of the wide range of shower usage. But it appears to make good economic sense for high water users. To calculate its impact, we assume that at 42 mills it is universally applicable (which it is on the average). I would also note that since these units are not in wide use at present, it may take a few years before large quantities of them can be obtained.

The remaining conservation measures involve the use of more efficient clothes washers and dishwashers. The lowest-energy-use appliances currently on the market use 30% less water than average,[12/] so we have assumed that the hot water use from these appliances, calculated in Ref. 12, can be cut by 30%. I have assumed that these efficient appliances cost $50 more than conventional ones with the same features, and that Puget could finance this differential when the homeowner replaces his appliances. I assume that half of the market is eligible for this measure over a ten-year program, where the full market consists of that faction of Puget's electric water heater customer which owns

clothes washers (91%) or dishwashers (71%).

Q. What conservation measures are appropriate for lighting?

A. Substantial energy savings can be made by replacing incandescent lights with fluorescent. These savings do not usually occur in practice, however, because the three-times higher efficiency of fluorescents is often compensated by the use of three-times-brighter fixtures. Many people object to this bright lighting in their homes, and therefore claim that they dislike fluorescent light.

But my experience shows that attractive fluorescent lighting systems can be designed and installed that avoid the problems associated in people's minds with fluorescent light, that by choosing 1/3 of the normal incandescent wattage, the other 2/3 represents energy savings. Some ways of avoiding the potential problems of residential fluorescents are discussed in Ref. 13.

Calculating costs of conserved energy is a little more complicated than for other options because of the variety of choices available. Consider a prototype fixture which presently uses 3 60-watt light bulbs, and consider replacing it with a $30 fixture using a 22-watt and a 32-watt circline lamps. Wattage of the fluorescents, including ballasts, is 65, so savings are 115 W. Assuming that the most cost-effective, heaviest-used fixtures are the prime candidates for replacement take an average usage of 1000 hours per year to get a savings of 115 kwh/yr. Light bulbs last 1000 hours, so over a 10-year period we have to replace 3 60-watt bulbs 9 times for about $.69 each or $18.60

total. In contrast, fluorescent lights last 7000-12000 hours. Using the lower figure to be conservative, we need 3/7 of a replacement of 2 bulbs at $7 each, or $6 for fluorescent bulb replacement. Thus the measure costs $30 less $12.60 in net avoided bulb replacements and saves 115 kwh/yr at a cost of 15 mills/kwh. I assume two fixtures per house are used heavily enough to justify this conversion, which means that 360 kwh/yr of incandescent light energy per household out of a total of about 1300 kwh/yr[14/] is converted.

Q. How do refrigerators fit into a conservation program?

A. Because of the wide range of efficiencies available in new refrigerators of any given size and feature class, substantial amounts of energy can be saved by purchasing the most efficient new refrigerator available when a new refrigerator is needed.[15/] This measure saves 600 kwh/yr on the average,[2/] at an incremental cost of $125 or less.[16/] The increment, if financed by Puget, would buy energy at 10 mills/kwh. I assume it would apply to half of Puget's customers over 10 years.

Puget can take two types of steps concerning appliance efficiencies. The first, as mentioned, is to finance the incremental costs between an efficient appliance and a standard one. The second is to promote the marketing of more efficient appliances through labels and through cooperation with appliance dealers. Some California utilities are presently taking the latter approach.

Q. Your testimony so far has covered residential conservation.

What recommendation do you make for commercial lighting?

A. While Puget currently has a program to replace low-efficiency light sources with higher-efficiency ones, no mention is made in their audits of the possibility of reducing lighting levels. Yet lighting levels in common use in offices, schools, and stores are generally far higher than what is needed to assure safety and productivity.

Light levels in commercial buildings are generally 10 to 100 times brighter than in residences. The rationale behind these high light levels is that brighter lighting is supposed to encourage more productivity or more sales. But even proponents of the theory linking light levels to productivity will concede that the need to conserve energy and save energy costs must be balanced against the incremental gains expected in productivity. Current building codes strike a compromise at about 2 watts per square foot. But typical newer buildings use 3-5 watts per square foot. Delamping down to 2 w/ft^2 is cheap and easy,[2/] and saves roughly 1/3 of the energy use.

For a rough estimate of the savings from this measure, I assume that 3/4 of the square feet of offices, schools, and stores in Puget's territory can be delamped by 1 watt per square foot. Using data from Seattle, we find 16.71 kwh of electricity use for square foot of commercial space.[17/] Since Puget has 3.211×10^9 kwh/yr of commercial sales, this leads to an estimate of 192 million square feet of commercial space. Seattle has 54% of its total commercial space in stores, offices, and schools, so we

apply this estimate to Puget's territory to get 104 million square feet of space to which delamping is applicable. We assume a 75% implementation rate to get a potential savings of 1 w/ft^2 x 78 million ft^2 or 78 MW of power. This results, at 3700 hours/yr, is 234 million kwh/yr of energy savings.

Delamping is probably not a reasonable measure to involve in a financing plan, because the costs to the user are so low that subsidy isn't needed, and because it would be hard to document the savings. But it is certainly a measure which can be strongly encouraged in Puget's audits, which is not the case at present.

Q. Please state your conclusions.

A. By attempting to minimize life-cycle costs, Puget could construct a conservation program that goes considerably beyond the scope of the program that they have proposed. The expansion of the program involves several different types of measures: increasing the use of techniques already studied (e.g., using triple-pane windows instead of double, or using thicker insulation), finding new measures, and considering new end uses.

I have discussed the details of an expanded conservation program that would be applicable to Puget. The expanded program will save money for Puget and for its customers, because the cost of the conservation measures is lower than the cost of electricity supply options.

Conservation should be seen not as a stop-gap measure to get Puget through a crisis until new thermal powerplants

are available, but as a more economically sound alternate to investment in new electricity supplies. Insulation and efficient appliances can not only be installed more quickly than power plants, but they are cheaper to buy and maintain. A house insulated today will still be saving energy 25 years from now, so conservation will replace rather than delay power plan construction.

An expanded conservation program makes sense not only because cost-effective options exist, but also because it ~~is cheaper to take a house all the way to its optimum~~ insulation ~~in one step~~ than to ~~retrofit~~ it once and then re-retrofit later. Puget's data sources and my own both show that there is an "overhead" cost in beginning an insulation or glazing job. Thus if an inadequate job is done it may not pay to re-retrofit the building to optimal standards. In contrast, if the job is done all at once, it is cheaper to obtain higher levels of efficiency. Expanding Puget's program will assure that the retrofit houses will continue to be saving economically ~~appropriate~~ amounts of energy throughout their remaining lives. It will also minimize the costs that Puget will incur in reliably meeting the electrical needs of its customers.

Q. Does this complete your testimony?

A. Yes.

TABLE I - COSTS AND SAVINGS OF AN EXPANDED CONSERVATION PROGRAM

Retrofit	# of Retrofits (10^3)	Cost/ Retrofit ($)	Total Cost $\$ \times 10^6$	Savings/ Retrofit kwh/year	Cost/ Savings mills/kwh	Annual Savings 10^6 kwh/yr
Ceiling Insulation						
R0--R49	5.3	690	3.66	11,000	2.5	58.3
R11--R49	15.9	575	9.14	1,830	12.6	29.1
R15--R49	37.2	532	19.79	1,280	16.6	47.6
R19--R49	19.8	490	9.7	920	21.3	18.2
Wall Insulation						
R0—R-11	10.67	343	3.66	6,429	2	68.6
R11-R18	89.3	1900	169.7 (t)	1,140	67	101.8 (t)
Floors						
R0-R-38	12.4	800	9.92	2,750	11.6	34.1
Glazing						
1--3	57.6	2100	121.0	4,100	20.5	236.2
Infiltration Reduction						
	169.7	200	33.9	2,500	3	424.2
Storm doors	72.9	100	7.29	244	16	17.8
Heat pumps						
Electric Furnace-heated houses						
Install on Replacement	20.2	675	13.6	4,050	21	82.0
Retrofit	20.2	1780	36.0 (t)	4,050	39	82 (t)
Baseload-Heated Houses						
Install on Replacement	9.5	805	7.6 (t)	3,630	26	34.5 (t)
Retrofit	9.5	1780	16.9 (t)	3,630	44	34.5 (t)

TABLE I (Continued)

Retrofit	# of Retrofits (10)	Cost/ Retrofit ($)	Total Cost $x10	Savings Retrofit kwh/year	Cost Savings mills/kwh	Annual Savings 10 kwh/yr
Hot Water						
Jacket Insulation	350.4	15	5.26	425	3.5	148.9
Low-flow plumbing	350.4	25	8.76	600	2	210.2
Super low-flow	350.4	400	140.2(t)	480	42	168.2(t)
Efficient washers	177.1	50	8.86	375	11	66.4
Efficient dishwashers	138.2	50	6.91	200	18	27.6
Lighting						
Fluorescent fixtures	916	30	27.5	115	15	105.3
Refrigerators						
Choose more efficient	229	125	28.6	600	10	137.4
Total Program						
22 mills/kwh			317.6		~ 9*	1712
all measures			687.9		~16*	2087

(t) Not cost-effective at 22 mills/kwh.

*Approximate cost-savings = cost/20 yrs. savings. Actual lifetimes vary from 10 to 25 yrs. Administrative costs are not included in this figure.

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EXHIBIT (DBG)

GOLDSTEIN
May 1980

PERSONAL VITA

Exhibit _____ (DBG-1)
WUTC U-80-10

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Personal Data

Social Security -

Education

A.B., Physics, 1973, University of California, Berkeley
Ph.D., Physics, 1978, University of California, Berkeley

Professional Experience

11/78 - Present

Staff Scientist (Physicist) at Lawrence Berkeley Laboratory. Major projects were:

1) Technical manager for a project which provided analysis for the derivation of residential building energy performance standards for the U.S. Department of Energy. This project involved the development of methodology and assumptions to most equitably compute energy budgets which represent minima in life-cycle cost for Houses in different climates of the U.S. and the communication of assumptions and results to DOE and its contractors. Supervised a programmer in the use of the DOE-2 and TWOZONE computerized building energy analysis models. Project was under the direction of Mark Levine.

2) Research on the theoretical aspects of building energy modelling, with emphasis on analytic approaches to passive solar building modelling. Developed hand-calculator routines for design-day temperature prediction in passive solar buildings, and simplified methods of describing building parameters. Project was under the direction of Sam Berman.

3) Construction of a scenario for reducing U.S. energy consumption in residential buildings over the period 1980-2000, based on conservation measures which minimize life cycle cost. The report addressess both the technical conservation measures and the policy changes needed to approach the projections in the scenario. The project was part of a study on national energy policy, directed by Dennis Hayes at SERI for John Sawhill at the Department of Energy. The Buildings sector report was directed by Art Rosenfeld at LBL.

10/78: Consultant for Natural Resources Defense Council, San Francisco office. Worked on a scenario for high energy conservation in California; modelled results of a conservation program for residential and commercial building energy use for 1985 and 1995.

4/75 - 9/78 Research Assistant at Lawrence Berkeley Laboratory. Work spanned a wide variety of topics concerning efficient use of energy in buildings.

Major work included: Coordination of a data collection effort describing the end uses of electricity in California, and co-authorship of the residential energy use section of the report; Studies on the applicability of various conservation measures for residential buildings including a tabulation of the cost and energy savings of several dozen measures; Work on implementation schemes for conservation measures, including energy extension and inspection services, incentives, and standards; Studies of long-range conservation strategies; Deriving analytic models of passive solar building performance, and comparisons of the results with test cell data and computer simulation methodologies.

Work was performed under the direction of Professor A.H. Rosenfeld and Professor S.M. Berman.

5/76 - 3/77 Chairman of the Building Envelope Subcomittee of the California Energy Commission's Residential Standards Advisory Committee. The Committee worked on changes in energy conserving construction standards for residential buildings in California.

Presented testimony on behalf of the Energy Commi-sion staff and also represented the majority of the committee; recomendations on double-glazing, passive solar, and efficient heating systems were followed in adopted standard.

4/75 - 7/75 Consultant for the Environmental Defense Fund, Berkeley, California, office. Worked on conservation strategies for electric energy in California; testified for E.D.F. before the California Energy Resources Conservation and Development Commission.

6/74 - 9/74 Research Assistant at the Foundation for Ocean Research, 11696 Sorrento Valley Road, San Diego, California. Worked with Professor John Isaacs of Scripps Institute of Oceanography on the plausibility of a hypothesis connecting anthropogenic atmospheric vorticity with the triggering of tornadoes in the U.S.

6/73 - 9/73 Research Assistant at the Institute of Urban and Regional Development, University of California, Berkeley, California. Worked with a group of twelve under the direction of Professor D.B. Lee to develop an analysis of the costs of the different forms of surface transportation in the San Francisco Bay Area; wrote the working paper "AC Transit: A Cost Model for Different Types of Service," which attempted to separate costs into peak and base services.

4/72 - 3/75 (except summers) Teaching Assistant at the University of California, primarily for pre-med introductory physics courses, but also for Environment Studies and Environmental Physics; this work was under the title "Reader" until 6/73.

6/72 - 9/72 Summer Student Trainee at the Lawrence Berkeley Laboratory. Worked on solar-thermal electricity conversion project under the direction of Dr. Michael Wahlig.

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Before the

UTILITIES AND TRANSPORTATION COMMISSION

of the

STATE OF WASHINGTON

CAUSE NO. U-80-10

Testimony of

DR. THOMAS POWER

on behalf of

PEOPLES ORGANIZATION FOR WASHINGTON ENERGY RESOURCES
(POWER)

September 12, 1980

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Q. Please state your name and business address.

A. My name is Thomas Michael Power. I am Professor of Economics and Chairman of the Economics Department at the University of Montana in Missoula, Montana.

Q. Have you attached to this testimony an appendix which indicates your professional qualifications and experience?

A. Yes, I have; it is marked as Exhibit 120 (TMP-1).

Q. Could you summarize the intent of your testimony?

A. POWER (the Peoples Organization for Washington Energy Resources asked me to study the residential rate structure being proposed by Puget Sound Power and Light (Puget or PSP&L) in this cause to determine its rationality from a conservation and equity point of view.

I have done that and will show that while the three step inverted block structure is appropriate, the logic which supports it also supports several significant modifications. These include dropping or reducing to a nominal level the fixed monthly customer service charge and freezing the level of the charge made for the initial 400 kwh block.

Q. What is the logic behind the three step inverted block structure?

A. Puget's witness, Mr. Richard H. Swartzell, in his prefiled direct testimony explains the logic as follows:

> We are proposing, however, that an initial 400 kilowatt-hour energy block be introduced into the residential rate schedule so that the tail-block may be increased at a rate higher than the uniform rate per kilowatt-hour. This will have the effect of inverting the rate more steeply and thereby, hopefully, encouraging greater conservation. (Exhibit 28, p. 5, lines 13-18)

Implicit in this explanation is an assumption about the elasticity of demand, namely that energy consumption in the initial 400 kwh block is not very sensitive to price (i.e. is relatively inelastic) while consumption above 1500 kwh/month is relatively more sensitive to price. Thus, if the price on the initial block is kept low while the price in the tail block is raised there will be, on net, a reduction in consumption of electric energy relative to what it would be with a flat-rate structure, or what would be obtained by an equal cent/kwh adjustment.

Q. Do you agree with this assumption?

A. Yes. Almost all PSP&L residential customers consume more than 400 kwh/month. Puget bill frequency data indicates that only 12 per cent of Schedule 7 bills are for less than 400 kwh/month and these customers consume only 1.8 per cent of Schedule 7 energy (Record Requisition No. 119, page 1). Only customers who use electricity only for lights and appliances are likely to have bills as low as 400 kwh/month. The average consumption of such customers is 579 kwh/month, with the average monthly consumption in the winter being about 700 kwh and in the summer about 500 kwh. Customers using electricity for water heat and space heat have average bills 3 to 6 times the 400 kwh level (Record Requisition 152).

Thus, those using less than 400 kwh/month are using electricity for lights and small appliances. For these uses there are no reasonable energy alternatives to electricity. For that reason consumption is much less likely to be strongly effected by price. These uses, and especially at these low

levels of usage, are ones which almost all observors would agree are "basic" or "necessary" in any modern household. High prices for the first 400 kwh/month are unlikely to lead to any significant amount of conservation. Thus, collecting revenues in this lower block serves little or no conservation function.

Consumption in the tail block, however, that over ~~500~~ 1500 kwh/month, includes most hot water heaters and space heaters. Sixty-two per cent of Schedule 7 consumption is by customers with monthly consumption greater than 1500 kwh. These users have both a choice of energy sources and a broad range of actions available which could reduce consumption. Thus, use in this block is likely to be much more sensitive to price. It is also growth in these uses which Puget has recognized as one of the primary causes of the need for new thermal electric generation and the feared energy and capacity shortages. For that reason, increasing these rates significantly is likely to be most effective in moderating residential demand growth.

Q. How far should these tail block rates be raised?

A. In order to encourage all cost effective conservation and be certain that building new thermal electric facilities is the most cost effective way to satisfy the population's energy needs, the tail block rates should accurately reflect the long-run incremental cost (LRIC) of electricity. Only if the tail block rates reflect these real costs which rising consumption is, in fact, imposing upon the utility and our society will consumers be encouraged to use electricity in a rational way and the utility be encouraged to make rational investments.

The price system, if it is going to encourage rational economic behavior on the part of all economic actors, must accurately inform individuals as to what it costs to provide additional units of electricity and what costs would be avoided if consumption was reduced. It is only if electric rates reflect these real, avoidable, economic costs that electric users will be able to make the right decisions about the use of or conservation of electricity. If instead of reflecting these economic costs, rates reflect an averaging of cheap hydroelectric energy and more expensive current thermal electric energy, customers are told that additional cheap hydroelectric energy is still available. They are encouraged to live in a past reality of cheap, surplus energy instead of being forced to face the new reality of very costly and scarce, thermal electric energy.

When residential customers make decisions about amounts of insulation, storm windows, electronic monitoring and control of energy use, efficiency of appliances, etc., they should be comparing the costs associated with conservation with the resource costs which would be saved as a result of that conservation step. Only then will customers be encouraged to make all cost effective conservation steps. Electric rates set below LRIC do not encourage this sort of cost effective conservation behavior. In effect, such rates guarantee that a significant percentage of the costs saved by conservation flow away from the person doing the conserving to all rate payers regardless of whether they are conserving. This is no way to encourage conservation.

Q. But is this emphasis upon LRIC not derived from neoclassical economic theory and dependent upon the satisfaction of the many unrealistic assumptions of that theory?

A. No. Marginal or incremental cost analysis is important to any rational economic actor regardless of whether that person is trying to maximize his or her own profits or satisfaction or is trying to pursue some worldwide global economic optimum. I am not advocating that this Commission adopt global economic efficiency as a primary objective, but only that they encourage cost-effective conservation so as in the long run to temper the rate of growth in electric demand and the rate of increase in electric prices.. That is a very local objective which does not depend upon some theoretical general equilibrium model.

There is nothing theoretical about marginal or incremental costs. Business firms including Puget Power use them every day in their decision making. For instance, when a utility is asked by another utility to sell them electric energy, the sales price is usually the marginal cost of providing that additional energy, not the rolled-in average cost of all of the electricity being generated. In dozens of other decisions daily any rational business is asking "What will be added to my costs or subtracted from my costs if I modify my business activities in a particular way?" That is common sense rational analysis which also happens to be marginal cost analysis. It involves no appeal to abstract economic theory.

Q. What is the LRIC of electricity for Puget Power?

A. In the generic PURPA case before this Commission (Cause U-78-pt) Leo T. Mahoney, Jr. of NERA estimated the LRIC in 1978 dollars as 30 mills/kwh energy cost and $32.00/kw capacity cost. In 1980 dollars these would be close to 36 mills/kwh and $38.00/kw. If we very crudely adjust for residential load factor, coincidence, and diversity by using a simple 50 per cent load factor, this suggests a total cost of 45 mills/kwh for energy and capacity costs alone, ignoring customer and distribution costs.

Other estimates of the costs of WPPSS 3 and Colstrip 3 & 4 energy and capacity suggest costs in this same range.

Q. Does Puget's more steeply inverted rate structure proposed in this cause move residential tail block rates to LRIC?

A. No. The winter tail block rate would be 29.2 mills/kwh, well below the estimated 45 mill/kwh incremental cost even when incremental customer and distribution costs are ignored.

Q. What further could be done to move the tail block rates toward economic costs?

A. Two things: First, the rate on the first 400 kwh could be kept low. No increase over current levels should be made in those charges now or in future rate cases. Second, the monthly customer charge of $3.45 could be dropped and those revenues collected in the tail block.

Q. Why do you recommend not raising the rate on the initial block now or in the future?

A. Because consumption in this initial block is not very sensitive to price and thus raising its price is ineffective in encouraging conservation. Putting all of the future rate

increases in the middle and tail block will accelerate the moving of the tail block rates all customers see toward LRIC.

Q. Why do you advocate dropping the customer charge?

A. A price or rate, if it has logic to it, is intended to encourage rational economic behavior. Thus in exploring the logic of the customer service charge one must ask what changes in resource use it is intended to encourage.

If one asks that question one immediately sees that it serves little if any function for the vast majority of customers. There is no behavior short of quitting the electric system which will allow a customer to avoid the fixed monthly customer charge. Thus, the only behavior it can encourage is leaving the system. Although this is behavior we might want to encourage for a customer who consumes almost no electricity in general no one is seeking to encourage customers to abandon the electric system for other sources of light such as kerosene or gas lantersn. Thus, the levy serves no function and is simply punitive. It is not going to cause any but a tiny, tiny minority of customers to leave the system. It simply "nails" people in a way they cannot avoid. One has to ask "what is the social message such fixed monthly charge is conveying?" "What resources is it urging individuals to conserve?" The answer to both is "none." Thus, there is no conservation or efficiency argument which can be made for charges of this sort.

If one wishes to chase individuals off the system, a $5 or $8 or $10 a month charge will not do it. A hookup charge of many hundreds of dollars which covered the fixed costs of

service would be far more effective. But I doubt that this Commission or the utilities want to discourage households from being connected to the electric grid for lighting and small appliances.

Dropping the customer charge entirely would cause hardly any changes in behavior by electric customers. This amounts to saying that the sensitivity of demand for electric service and the electric energy to the customer charge is almost zero.

Finally, the customer service charge is an extremely regressive levy which dramatically raises the average rates paid by the smaller users. Given that the class of small users contains many low-income users, these charges are falling on those least capable of bearing them.

Q. What would the impact of these changes be on the tail block rates?

A. If the base energy rate is kept at 1.7656 cents/kwh instead of being raised to 1.9422 cents/kwh and Schedule 91 is not applied to the first 400 kwh, a maximum of $7,899,000 would have to be made up in the tail block. This would require an increase in that rate of 4.5 mills/kwh.

The surcharge has varied from the current 0.1149 cents/kwh (Schedule 90) to 0.7154 cents/kwh (Schedule 88, April and May 1980) with a mid-range surcharge of 0.2052 cents/kwh (Schedule 88, January-March 1980). The proposed Schedule 91 is simply continuing that surcharge. For that reason, a "no increase" rate structure could be one which involved no increases over the 0.2052 cents/kwh in the new Schedule 91 to the initial block. Since the average of the new Schedule

91 is not much larger than the old Schedule 88, this would mean a revenue loss of only $604,000 and a compensating rate increase in the 1500+ block of only 0.035 cents/kwh.

If the customer service charge is dropped and the revenues recovered in the tail block, those rates would have to rise 1.004 cents/kwh.

If instead those revenues were collected 50 per cent from the 400-1500 block and 50 per cent from the 1500+ block, the 400-1500 block rate would have to increase 0.271 cents/kwh and the 1500+ block rate 0.5022 cents/kwh.

The calculations behind these adjustments are indicated in Exhibit 121 (TMP-2).

If we take into account the previous surcharge and collect the customer cost evenly from the last two blocks, the rates which would result are indicated in the following table and compared to those proposed by Puget.

RATE COMPARISON (cents/kwh)

	PSP&L		Dr. Power	
Block	Winter	Summer	Winter	Summer
Customer Charge	$3.45/mo	$3.45/mo	0	0
0-400 kwh	2.2752	2.0871	1.9865	1.9865
400-1500	2.4914	2.3033	2.7624	2.5743
1500+	2.9207	2.7326	~~3.4579~~ 3.6518	~~3.2698~~ 3.4632

Such a rate schedule would represent significant but still gradual movement toward LRIC and, because of that, would encourage conservation and more rational energy use and energy production investment.

Q. Please summarize your testimony.

A. Applying the same logic that Puget uses to explain its residential rate proposals, I conclude that rates for the initial 400 kwh block should be frozen at the current level and that the monthly customer charge should be eliminated. Revenue "losses" from these two steps should be made up by raising the tail block rates.

Q. Does that conclude your prefiled testimony?

A. Yes, it does.

Exhibit No. 120 (TMP-1)
WUTC U-80-10

QUALIFICATIONS OF THOMAS M. POWER

Q. What is your current employment?

A. I am Professor of Economics and Chairman of the Economics Department at the University of Montana in Missoula, Montana.

Q. Please describe your formal education and professional experience.

A. I received my Bachelor's Degree in physics from an engineering school, Lehigh University in Bethlehem, Pennsylvania. I graduated with high honors and Phi Beta Kappa. I was elected a Woodrow Wilson Fellow in national competition and attended Princeton University where I received my M.A. and Ph.D. in economics.

I taught math and physics at Lehigh University and have taught economics at Princeton University, Lehigh University, and the University of Montana. I have been on the faculty of the University of Montana since 1968. My specialty is resource economics with an emphasis on energy, water, and environmental resources.

Q. Have you testified as an expert witness before other Public Service Commissions in the past?

A. Yes. In 1974 I was hired as a consultant by the Montana Public Service Commission to analyze the Colstrip 3 and 4 facilities. Two studies resulted: "Colstrip 3 and 4: Need and Impact on Rates" and "Future Electric Energy Consumption." In 1976, I prepared a study and testimony for the Idaho Public Utility Commission on "The Projected Demand for Electric Energy in Idaho, 1975-1990" and the need for the Pioneer I and II plants. In 1979 and 1980, I have testified before the Idaho Public

Utilities Commission, the Utah Public Service Commission, the Colorado Public Utilities Commission, the Montana Public Service Commission, the Oregon Public Utilities Commissioner, and the Seattle City Council. I have also testified before the U.S. House Conservation, Energy, and Natural Resources Subcommittee.

Q. Have you done other studies dealing with energy economics?

A. Yes. In 1975, I received an NSF/RANN grant to assemble a team of economists, geologists and energy technologists to study coal development in the Northern Great Plains. That study led to a series of almost a dozen reports, the final summary being published as Projections of Northern Great Plains Coal Mining and Energy Conversion Development 1975-2000 A.D. Several of the other papers dealing with defining coal markets and energy projection techniques have also been published. In 1976 and 1977, I prepared expert testimony for presentation to the Montana Board of Natural Resources and the Department of Natural Resources dealing with economics of alternative energy systems and transmission line relieability. During 1977, I was a member of the Montana Governor's Citizens' Advisory Council on Energy. In 1977 I received a grant from the Montana Department of Natural Resources to design, build, and test an energy system which integrated solar, wood, and wind energy into a single household renewable energy system. I am currently working on a book analyzing the impact of public ownership of utilities on utility performance. I am a consultant to the Washington Department of Ecology analyzing the impact of the Northern Tier Pipeline on electric rates.

Q. Would you please summarize your professional work in the field of resource economics.

A. Besides energy economics, I have focused on water resources, environmental resources, and forestry economics. In 1980, Westview Press published my most recent book, The Economic Value of the Quality of Life. The National Audubon Society published, in 1979, my The Central Arizona Project: An Economic Analysis. I have published papers on almost a dozen federal irrigation projects in the Western States in addition to papers dealing with the value of in-stream flows for wildlife and recreation uses. The Journal of Urban Economics has published my article on "Urban Disamenities." In the field of Forestry Economics, I have worked with Region One of the U.S. Forest Service throughout the 1970's to develop economic tools to evaluate the social rationality of roaded development of currently roadless areas. At the University of Montana I helped establish the Environmental Studies Graduate Program and serve on its faculty. I also initiated the Environmental Economics course sequence.

CALCULATIONS

1. Revenue lost by freezing the initial energy block at previous rates and rate increase in 1500 kwh block to compensate.

   Consumption in the 0-400 kwh range = 1,910,667,687 kwh (Record Requisition 114, p. 4 of 4)

   Difference in basic rates (Puget proposed-previous level) 1.9422-1.7656 = 0.1766¢/kwh

   Revenue lost = $3,374,000.

   Consumption in the 1500+ kwh block = 1,740,519,287 kwh

   Rate increase to compensate = ~~0.14~~ 0.19 ¢/kwh

2. Revenue lost by not applying Schedule 91 to the first 400 kwh.

   Number of customers implicit in requisition number 114, p. 4 of 4: 5,067,183 ÷ 12 = 422,265

   400 kwh x 0.3173 ¢/kwh x 6 months x 422,265 customers = $3,216,000

   400 kwh x 0.1292 ¢/kwh x 6 months x 422,265 customers = $1,309,350

   Total revenue lost <u>if</u> all bills are greater than 400 kwh each month = $4,525,000
   (In fact, 12% or about 50,000 customers have bills less than 400 kwh a month.)

   Increase in 1500+ block rates to compensate = 0.26 ¢/kwh

3. Revenue lost if Schedule 91 is kept at Schedule 88 levels for the first 400 kwh.

   Revenue from Schedule 88 at 0.2052 ¢/kwh for initial block 1,910,667,687 kwh x 0.2052 ¢/kwh = $3,921,000

   Maximum revenue from Schedule 91 from initial block = $4,525,000 (see above)

   Lost revenue if the increase in Schedule 91 over Schedule 88 is not allowed in the initial block = $ 604,000

   Increase in the 1500+ block rates to compensate = 0.035 ¢/kwh

4. Dropping the customer service charge, collecting the revenue in the tail block.

   Revenue obtained from the customer service charge = $17,481,781

   1500+ block consumption = 1,740,519,287 kwh

   Compensating rate increase = 1.004 ¢/kwh

15.

5. Dropping the customer service charge, collecting the revenue in the 400+ blocks.

   $17,481,781 ÷ 4,965,988,911 kwh = 0.352 ¢/kwh

6. Dropping the customer service charge, collecting it 50 per cent from the 400-1500 block and 50 per cent from the 1500+ block.

   $17,481,781 customer charge revenues
   $8,740,891 50% of the customer charge revenues
   Consumption in the 400-1500 block = 3,225,469,624 kwh
     increase rate = 0.271 ¢/kwh
   Consumption in the 1500+ block = 1,740,519,287 kwh
     increase rate = 0.5022 ¢/kwh

ACR 9

Exhibit No. 31
Application No. 59537
Witness: David S. Schwartz
Date: June 12, 1980

PREPARED DIRECT TESTIMONY

OF

DAVID S. SCHWARTZ

on behalf of

POVERTY RIGHTS ACTION CENTER

Steven Ferrey
Richard Alpert
National Consumer Law Center, Inc.
11 Beacon Street
Boston, MA 02108
(617) 523-8010

BEFORE THE PUBLIC UTILITIES COMMISSION

OF THE

STATE OF CALIFORNIA

Application of PACIFIC GAS & ELECTRIC COMPANY for authority among other things to implement a Conservation Financing Program and include a procedure for a Conservation Financing Adjustment of PG&E's electric and gas rates in its electric and gas tariffs to provide funds for Commission approved conservation financing programs. (Electric and Gas)	APPLICATION No. 59537

Q.1 What is your name, address, and occupation?

A.1 My name is David S. Schwartz. My address is 7317 Broxburn Court, Bethesda, Maryland 20034. I am a Public Interest Consultant in regulatory and energy economics.

Q.2 For whom are you appearing in this proceeding?

A.2 I am testifying on the behalf of Poverty Rights Action Center, 113 N. California Street, Stockton, CA 95202.

Q.3 Would you please indicate your educational background?

A.3 In 1944, I received a Bachelor of Science degree from the University of Maryland with a specialization in economics and agricultural economics. In 1950, I was awarded a Doctorate of Philosophy from the University of Wisconsin where my major fields of study were public utility economics, economic theory, and institutional economics.

Q.4 Please provide some indication of your academic background.

A.4 In the period 1947-50 while working on my dissertation for the Doctorate I was an instructor in economics at the University of Wisconsin. After receiving the Ph.D. I obtained a teaching position with the University of Maryland in its overseas program as Assistant Professor. I taught abroad in the 1950-52 period. When I returned from overseas, I was employed at the University of Maryland as a Research Assistant, and later as Associate in the period 1953-56. While I was employed at the Federal Communications Commission I taught courses in the evening for the University of Maryland in 1963-64 in industrial organization (The Structure of American Industry).

Q.5 What has been your professional experience in recent years?

A.5 I am attaching to my written direct testimony a detailed biographical resume which lists work experience as well as various publications and other professional activities. Prior to becoming a private consultant in March 1978, I was an Adjunct Professor in Economics at Michigan State University working on a National Science Foundation grant. This research was funded by NSF for two years. It concerned the role of competition in the regulated energy utilities. Formerly, I was Assistant Chief in the Office of Economics at the Federal Power Commission. When I resigned in March 1975 I had served ten years as a staff member at FPC. I had initially been employed at FPC in the 1956-58 period. In the interim I had

gone to the FCC during the period 1958-65.

Q.6 Have you testified as an expert before any Congressional Committees or State Legislative Committees?

A.6 The attached resume indicates my appearances before various Congressional Committees where I have testified on electric power and natural gas matters. In addition, I appeared before a special Task Force on Natural Gas before a New York State Legislative Committee in April 1977 and the California State Assembly Subcommittee on Energy.

Q.7 Have you previously testified before this Commission or any regulatory agency?

A.7 I appeared before the California Public Utilities Commission in February 1980 in Application Nos. ~~31010~~ 59249 and ~~31011~~ 59406 filed by the Pacific Gas and Electric Company. This case involved two applications by the Pacific Gas and Electric Company to revise its rates under a Gas Adjustment Clause. I appeared before the Colorado Public Utilities Commission on behalf of the Staff in March 1979. The hearing concerned a proposed surcharge on ratepayers to fund the Gas Research Institute. In addition, I appeared for the Staff of the Rhode Island Public Utilities Commission in a Providence Gas case in October 1975. I testified before the FPC in 1958 as a rate of return witness in a producer case involving John Mecom Petroleum.

In this regard I should point out that my responsibilities as Assistant Chief in the Office of Economics

at FPC included the general supervision of the professional staff relating to economic issues in the formal proceedings before the agency. These duties included the assignment of members of the staff to serve as expert witnesses, and assistance in the preparation of their testimony and exhibits. In addition, overseeing the work of the economics staff in various proceedings in analyzing the testimony of other parties, as well as giving technical assistance to the staff counsel. I appeared on behalf of the FPC staff in the investigation of PENNZOIL Company in United Gas Pipe Line Company Spin-Off and related transactions (Docket No. RP74-87). This testimony was filed October 25, 1974.

Q.8 What is the purpose of your testimony in this proceeding?

A.8 To review and evaluate the request by the Pacific Gas and Electric Company (PG&E) for authorization to implement and expand a conservation financing program designated as the Weatherization Zero Interest Plan (ZIP).

Q.9 What is the connection between PG&E's plan to expand its conservation program and the objectives under the National Energy Conservation Policy Act (NECPA) to establish a national energy conservation program?

A.9 The NECPA requires the U.S. Department of Energy (DOE) to establish a national energy conservation program to encourage installation of energy conservation and renewable resource measures in homes and dwellings of large gas and electric utility customers. The DOE Final Rules (44 Fed.Reg. 64601 et seq., November 7,

1979) for the Residential Conservation Service (RCS) while detailed with respect to state plans and operation of utility programs, allow flexibility for state programs. Nonetheless, PG&E will have to file for an exemption or waiver from DOE before ZIP can be implemented. A waiver or exemption is necessary because NECPA prohibits loans in excess of $300 by utilities. In fact, PG&E has testified that "A preliminary indication of agreement with this application by the CPUC may be necessary in order for DOE to actually grant waiver or exemption." (Direct testimony - R. Michael Mertz, page A-7)

Q.10 In your view is the ZIP program the preferable approach to the promulgation of a state energy conservation plan?

A.10 No. Initially, it is important to realize that there is no disagreement as to the importance of energy conservation measures as a rational alternative to the installation of capital intensive facilities or the high fuel costs for electric and gas service, not to mention the avoidance of social costs associated with the environmental benefits. In those instances where energy conservation measures are cost effective, the ratepayer, the utility, and the society benefit from a comprehensive energy conservation program.

Q.11 Why do you question the Weatherization ZIP plan as the best alternative to acheiving these energy conservation objectives?

A.11 My major concern is the dominance in the residential

energy conservation program of a monopoly utility, and the potential for exploitation in this market. Fundamental economic principles clearly establish the superiority of firms operating in a competitive market over monopoly supplier of goods and services. In addition to the lower costs and prices resulting from competition, there are the benefits of greater resource efficiency. These benefits have been perceived by regulators, and traditional utility markets have been opened to competitive forces. Basic economic principles of competition would maximize the potential for new entry into a market. In reference to energy conservation this would involve contractors for installation and lending institutes for financing. Competition assumes access to information and maximizes consumer choices. On the supply side, competition provides incentives to minimize administrative costs and allow greater cost accountability. The use of competitive market forces provides greater certainty of the lowest reasonable cost alternatives in the installation and financing of residential energy conservation measures.

Where a monopoly firm controls the program implementation, there is no strong incentive to minimize costs. This is particularly true with the ZIP plan where the administrative expenses of the program, as well as the capital costs (interest and equity return to PG&E), are shifted forward to the ratepayers. Another negative feature of ZIP is that it creates the likelihood of cross subsidy

of one ratepayer by another: in all probability the subsidy of the more affluent by the low-income consumer. The ZIP program as structured with periodic rate adjustments to cover the expenses of PG&E's financing subsidy provides significant insulation from risk, and a disincentive for cost minimization. In this regard, the Commission should modify the ZIP proposal to remove the barriers that discourage competition. Since the ratepayer is forced to participate in the costs of the plan, it is only equitable that access to the benefits of competitive alternatives is also provided.

Q.12 What do you consider a preferable alternative to ZIP for residential energy conservation?

A.12 In order to acheive the benefits of a competitive market, as well as assure a fully developed and cohesive energy conservation plan for residential consumers, an alternative institutional framework is preferable. In this regard, special legislation would be required to establish a public agency to harness the competitive market forces in promulgating a residential energy conservation program. This agency could rely upon the competitive bidding process to assure the lowest cost for weatherization and financing of a wide range of energy conservation measures using cost effective criteria as a guide in program implementation. In effect this agency would act as a project manager in arranging for installation and financing of residential energy conservation measures. The role of the public

agency is to act as a catalyst in achieving energy conservation, particularly among low-income home owners and renters. Its sole function would be to fulfill the broad social policy of promoting cost-effective energy conservation. In contrast, the utility's participation in energy conservation conflicts with its business objective of the continual sale of gas and electric power. Because of this conflict the utility is not the best vehicle to assure a dynamic energy conservation effort as evidenced by the lack of sucess of PG&E's existing 8% ceiling insulation program.

Q.13 Are you aware that the authority of the CPUC does not permit the formulation of such a public agency plan, and that the Commission's choices are limited to the acceptance, rejection, or modification of the Weatherization ZIP proposal filed by PG&E?

A.13 Yes. I am aware that the Commission's authority is limited to the regulatory review of the utility sponsored ZIP plan. Nonetheless, it is important to realize that the choice being considered by the Commission (i.e. a utility plan) is in the realm of the "second best." If the Commission decides to go forward with a utility residential conservation plan, then it is essential that important safeguards and modifications are incorporated to minimize the potential for excessive costs and rate increases, and to assure low-income customers priority status in the implementation of a residential energy

conservation program.

Q.14 Specifically, what areas will you address that require changes or modifications in the Weatherization ZIP program proposed by PG&E?

A.14 The objectives of the proposed changes and modifications are to incorporate, to the extent possible, a number of free market options, and to provide the necessary regulatory safeguards to assure that only just and reasonable costs are included in rates. The major areas to be considered are as follows:

1) The changes required to maximize the potential for the adoption of energy conservation measures by low-income customers and renters;

2) A review of the various expenses included in revenue requirements, and the rate impact by class of service; and

3) Various other facets of the ZIP plan so as to minimize costs and to promote equity in a residential energy conservation program.

Q.15 Why is it important that low-income customers and renters receive priority status in implementing a residential energy conservation plan?

A.15 The PG&E application and the testimony of PG&E witnesses contend that ZIP is designed to attract low-income customers and renters to adopt cost-effective energy conservation measures. Witness Mertz testified that a substantial reason for ZIP is the failure of the 8% program to reach low-income or renters (Tr. p.155).

Witness Calloway in his direct testimony states, "Our market research indicates that persons who have not yet weatherized their homes tend to be at the lower end of the income scale." This is no surprise since the substantial weatherization tax incentives provide no benefit to people with little or no taxable income. Witness Calloway's direct testimony demonstrated a very poor record of the 8% program with only 7,200 10,600 loans outstanding since the initiation of the effort in February 1978. Of direct relevance to low-income customers is the fact that less than one-tenth of one percent of outstanding loans were renters of homes or multi-family dwellings (Tr. p. 977). He attributes the failure of the program to attract renters to the lack of incentive because of the non-proprietary relationship. This does not explain the lack of participation by building owners in the program. PG&E's ZIP proposal does not address the barriers to landlord or renter participation, and the same uncertainty exists with ZIP similar to the 8% ceiling program.

Furthermore, since the middle and upper income customers were clearly the primary beneficiaries of the 8% program and these participants no doubt will convert to ZIP if allowed, at substantial savings to them and added cost to other ratepayers, the ZIP program starts off with a concentration of middle and upper income beneficiaries. This imbalance should be rectified.

Q.16 What solutions are offered by PG&E to attract low-

income customers and renters so as to assure them a fair share of the ZIP financing?

A.16 PG&E asserts that they plan to aggresively promote ZIP to renters and low-income home owners by using bill inserts, media advertising, real estate agents, building management firms, and landlord associations. In addition, they will continue to work with Community Action Agencies, and to encourage their assistance in the completion of applications for ZIP financing.

Q.17 Why does PG&E think that the promotion of energy conservation among their low-income customers will succeed under ZIP when it was poorly received under the 8% ceiling insulation program?

A.17 Witness Calloway contends that the elimination of any out-of-pocket outlays until the dwelling is sold is "...a powerful incentive to renters and landlords alike to take cost-effective measures for weatherization of rental homes and apartments." (Direct Testimony p.B-7)

Q.18 What safeguards does PG&E propose if the response to ZIP by low-income customers and renters is below expectation?

A.18 The only solution offered by Witness Calloway if requests are predominantly from middle and upper income areas is a special effort to demographically locate low-income neighborhoods, and to provide priority scheduling of audits and loans to these customers. In addition, he proposes a special outreach effort in low-income neighborhoods to increase interest in the program.

Q.19 Do you think that these efforts by PG&E are adequate to maximize the potential for low-income customer and renter participation in ZIP?

A.19 No. Initially it is important to stress that the emphasis in the ZIP program should not exclusively be construed in terms of market penetration but, equally important, as a vehicle for energy conservation for the low-income home owner and renter. Financial incentives of the ZIP program cannot alone assure that low-income customers or renters will have a priority or even participate in the program. PG&E must have a specific obligation to reach low-income customers and renters beyond promises of good faith efforts and its "We'll see what happens" attitude. It would be ironic if the program's successful penetration resulted in the subsidization of middle and upper income customers by low-income consumers.

Therefore, it is important that PG&E abandon its policy of providing audits based upon the first request received, and schedule audits based upon providing priority to low-income customers. In addition, the Commission should establish a guideline for low income energy conservation implementation by the utility tied to percentage of low income homes and rental units in relation to the home and rental market in California. The Commission should not rely upon some "best effort" criteria by PG&E, but establish a concrete performance obligation based on low-income dwellings in relation to

total housing stock. The ZIP proposal does not provide a specific allocation of funds nor does it address the needs of low income customers or renters in a concrete and meaningful manner. In light of the failure of the 8% program to address the energy needs of the poor, it is inconceivable that PG&E would fail to provide a mechanism to assure their participation. The burden rests with PG&E to demonstrate that the ZIP plan complies with the specific energy conservation implementation objective for low income customers and renters.

Q.20 What other modifications would promote greater equity among the different income groups?

A.20 In the initial stages of the ZIP plan, the application of conservation measures should be limited, as to single family dwellings, to the main dwelling of a home owner. In addition, an upper limit should be established on the financing of cost effective conservation based upon a prototypic house. Because the interest cost and other expenses are borne by ratepayers, there is the danger that the larger home of the more affluent customer will be subsidized by less affluent ratepayers. Also, it would appear that the "building envelope" list detailed by Witness Mertz in his direct testimony has a bias toward middle and upper income conservation measures, and does not contain provisions to redress some of the basic problems of low income customers and renters. Without adopting a more flexible approach the "building envelop", the program runs the risk of providing large

subsidies to the more affluent home owners. It is undesirable and unacceptable to design an energy conservation program that is responsive to swimming pool owners but does not fulfill basic needs of low income home dwellers and renters, such as plugging holes in the building envelop. Finally, in the financing of other cost effective measures relating to the "building envelope," a monetary ceiling should be determined for financing based upon a typical home. PG&E indicates it will review other conservation measures for inclusion in the "building envelope", including swimming pool covers. Ratepayer supported financing should not include such luxury options. The company can point out the potential life cycle savings to the customer in the hope that based upon his own self interest he will finance the energy conservation measures of a non-typical home.

Q.21 Now turning to your second major area of concern, what are the necessary regulatory safeguards and the required modifications in PG&E's rate recovery procedures to provide protection against the inclusion of unreasonable expenses in revenue requirement?

A.21 Before discussing the rate proposal by PG&E to recover conservation financing by its subsidiary of interest expense, administrative costs, return on PG&E's equity investment and income taxes, it is essential that we perceive the order of magnitude of the conservation investment, administrative expenses, and revenue require-

ment for the weatherization ZIP program. In the supplementary testimony of Witness Heim Exhibit No. 7 he indicates an annual investment in the first year (1981) of $109 million and a cumulative conservation investment over ten years (1981-1990) of $918 million. The annual administrative expense will increase from $32 million in 1981 to $56 million in 1990. The cumulative administrative expenses for the period 1981-1990 is estimated to be $410 million. Witness Reynolds in Exhibit No. 8 estimates the annual revenue requirement in the first year (1981) at $32 million increasing to $133 million in 1990. The cumulative revenue requirement for the ten year period 1981-1990 is $936 million. In light of the significant magnitude of investment, administrative expenses, and overall revenue requirement, the importance of cost minimization and cost control cannot be overstated.

Q.22 Returning now to the rate recovery procedure proposed by PG&E, what are the required regulatory safeguards and modifications to protect consumers from excessive costs and revenue requirement?

A.22 There is no doubt that regulators are at a decided disadvantage in designing a regulatory process to assure that only legitimate costs are reflected in rates. The earlier discussion indicates the reasons why the pressures of free competitive market forces provide greater certainty of cost minimization. In this proceeding PG&E proposes to recover in rates the

costs of its financing subsidiary through the use of an Advice Letter filing designed to cover projected costs for a twelve month period. They propose to use a Conservation Financing Adjustment (CFA) procedure and the use of a conservation balancing account. Once the Commission authorizes the conservation plan, or any new plans or modifications of existing plans,the rates to fund those plans will be submitted by an Advice Letter for recovery of estimated costs. These Advice Letter changes will coincide with GAC and ECAC rate changes.

It is evident that the use of the Advice Letter and the CFA procedures will provide little incentive for the PG&E subsidiary to minimize cost. The use of the Advice Letter to cover projected costs and the periodic rate adjustments will not provide adequate cost review to assure prudency. It is essential that the Commission reject the Advice Letter and CFA approach, and rely upon the traditional hearing procedure before rate adjustments are approved. The use of periodic flow-through procedures (CFA) is particularly objectionable given the lack of arms-length relationship between the financing subsidiary and PG&E. The need for a hearing procedure is illustrated by the proposal by PG&E to periodically flow-through estimated costs similar to the operation of GAC and ECAC. Unlike these latter adjustment mechanisms permitting flow-through of gas and fuel costs for electric generation, the administrative expenses and other costs of the financing subsidiary

are not as easily subject to verification, due to the nature of the costs and the newness of the program. In addition, the use of a hearing procedure will place the burden on PG&E to justify the costs and the related revenue requirements proposed to be recovered in rates. Additionally, because of the time lag before rates can be adjusted an incentive for the firm to economize will be provided.

In addition, it is unclear whether a portion of the funds advanced by PG&E to its subsidiary for administrative costs will be expensed or capitalized. Since the inclusion of administrative expenses is contrary to good regulatory practice, the Commission should prohibit the rate base inclusion of administrative expenses. To the extent it is unavoidable an amortization procedure should be established to reduce and remove this component from rate base.

Q.23 Are there additional considerations concerning the rate recovery procedure you wish to discuss?

A.23 Yes. There are two. Firstly, there are serious problems in determining the appropriate level of projected costs, and the use of incurred or known costs provides greater certainty. This difficulty is exacerbated with the use of the CFA procedure. Secondly, it appears that the audits for the ZIP program are actually the RCS energy audits. It is my understanding that the expenses connected with the RCS energy audits will be expensed. Regardless whether they are expensed or

charged to the residential customer, they should not be included in the ZIP program. Since the utility has the obligation to perform the energy audit under the NECPA, this should not be part of ZIP expenses, especially if PG&E seeks preferential rate treatment for its ZIP expenses.

Q.24 Are there other considerations?

A.24 Of major concern is the difficulty of assuring the reasonableness of the very significant administrative costs that will be incurred by the unregulated subsidiary, but passed on to the ratepayer. The Commission should require a review of the reasonableness of administrative expenses by an outside management consulting firm. Perhaps the bidding procedure is appropriate to determine which firm should review the justification for the level of administrative expenses by the subsidiary. In this regard, one area that should be reviewed is the use of managerial personnel that divide their time between the utility and the financing subsidiary, to ascertain whether the appropriate expense is charged to each entity according to the apportionment of time commitment.

Q.25 Do you have any additional observations with respect to how the rate adjustments will be applied to customer classes?

A.25 Yes. The PG&E proposal applies the increase in gas rates due to the ZIP program to the P1 and P2 (residential and commercial) customers. The P3, P4, and P5 (industrial

and utility) customers are excluded according to the company because their rates are established using the maximum level alternative fuel prices. To the extent the gas rates to these latter customers only reflect the commodity price of the alternative fuel, and not the added cost of storage, environmental control equipment,and other costs, the gas is being underpriced. The Commission should examine the possibility of applying the proposed rate charges attributed to ZIP to the P3, P4, and P5 customers based upon the full costs of using alternative fuels.

Q.26 What additional changes did your have in mind in order to minimize costs and promote equity relative to the ZIP program?

A.26 The Commission should strenghthen the competitive bid system wherever possible in the use of contractors for conservation installation and for the financing of conservation measures. While PG&E proposes to use a random system in the selection of three contractors for initial bids on the various conservation measures, the residential owner should be <u>fully</u> and <u>emphatically</u> informed of his right to obtain as many additional independent estimates he considers necessary as long as they are on the State approved Master Record. In addition, the fact that the ultimate selection of the contractor resides with the customer should be emphasized. PG&E will require that the contractor warrant both materials and workmanship, and inspect installation

selectively. Where the PG&E protection falls short is when there is a failure of a contractor to correct a violation of installation standards. PG&E proposes to refer unresolved contractor complaints to an agency selected by the CPUC for resolution. Given the resources available to PG&E, it would appear that the resolution of a complaint would be more efficaciously handled if the company were directly involved in the resolution of the complaint. In this regard, it may be advisable to consider the removal of a contractor from the Master Record if there are repeated and numerous complaints. Finally, in the determination of installed costs discussed by Witness Calloway in Exhibit No. 16, a balance between the avoidance of "gold plating" and minimal quality is required to obtain a representative price for a particular conservation measure.

Q.27 How could the competitive bidding procedure be used to finance conservation under the ZIP program?

A.27 Under the current proposal the PG&E financing subsidiary proposes to borrow from banks and savings and loans, primarily in California. As an alternative to this approach the Commission should require a competitive bid procedure. Under this alternative arrangement the financing subsidiary would advertise the total amount of funds required, and accept varying amounts of the total funds required based upon the lowest interest cost. This procedure is preferable to private placement with various financial institutions by the subsidiary.

Q.28 What other areas in the ZIP proposal require review or modification?

A.28 The current proposal provides for a 20% equity investment by PG&E in the financing subsidiary. It appears that PG&E has included an equity return of 17.35% before taxes that will result in a 14.10% return on equity after taxes. To the extent that the CFA and balancing account and the projected costs are utilized in periodic rate adjustments there has been a significant shift of risk to the ratepayer and away from PG&E. Therefore, the risk to the firm under these arrangements is considerably less than the risk of the overall utility operation. This would suggest that something less than 17.35% before taxes and 14.1% after taxes is appropriate.

Another area requiring inquiry by the Commission is the inclusion of the statutory State and Federal Tax Rate in calculating equity cost before taxes. To the extent that the effective tax rate is less, the Commission should reduce revenue requirement associated with the State and Federal income tax payment, accordingly. In this regard PG&E in response to a data request in OII No. 42 (6/4/80) indicates an effective Federal tax rate of 11.0% in 1979 and 4.3% for State taxes. In calculating the before tax equity requirement, these rates should be used in lieu of the 46% Federal tax rate and the 9.6% State rate.

Finally, the financing subsidiary is currently considering a fixed period to pay off the loan to the

lending institution, assuming the dwelling has not been sold. The period under consideration is seven years. If the dwelling is not sold within a fixed period, the plan is to have PG&E increase its equity investment in the subsidiary to permit the buy-out. Given the lower cost of debt capital, it would be advantageous to ratepayers to maintain the equity investment of PG&E at no more than 20%. In order to contain the capital costs and continue to sustain the ZIP financing, a preferable option would require the dwelling owner to begin making payments to amortize the principal after a fixed period if it has not been sold. The lending institution could then be requested to roll-over the loan with assurance that principal as well as the interest would be paid in order to retire the loan in a specified time frame.

Q.29 Does this conclude your testimony?

A.29 Yes, it does.

Exhibit C

A. C. R. 9

ASSEMBLY CONCURRENT RESOLUTION NO. 9— ASSEMBLYMEN WESTALL AND HORN

JANUARY 22, 1981

Referred to Committee on Government Affairs

SUMMARY—Urges public utilities to lend money to customers for insulation. (BDR 262)

EXPLANATION—Matter in *italics* is new; matter in brackets [ ] is material to be omitted.

ASSEMBLY CONCURRENT RESOLUTION—Urging public utilities in the State State of Nevada to lend money to customers for purposes of improving insulation of homes.

WHEREAS, The recent increases in the cost of energy to customers of public utilities has clearly demonstrated the need for conservation of energy; and

WHEREAS, Energy loss from homes is increased because of inferior insulation or construction; now, therefore, be it

Resolved by the Assembly of the State of Nevada, the Senate concurring, That public utilities in the State of Nevada are urged to lend money to customers for purposes of improving insulation and increasing energy conservation in homes; and be it further

Resolved, That such loans be made without a charge for interest or at a low rate of interest.

GAS & ELECTRIC

Exhibit D

League of Women Voters of Nevada

Assembly Concurrent Resolutions 5, 6, 7, 8 and 9

The League of Women Voters of Nevada supports this package of Assembly Concurrent Resolutions ACR 5, 6, 7, 8 and 9. Quoting from the League's national position on Energy, the League "believes that the United States cannot and should not sustain its historical rate of energy consumption. Not only as a responsible member of the world community but also in the national interest, the United States must make significant and progressive reduction in its energy strategies that - while taking account of differences and resources of states and regions - give precedence to the national good. Resolutions ACR 5, ACR 7 and ACR 9 are directed toward this goal of energy conservation, that is using less energy and using it more efficiently.

Another top priority in the League's Energy position is given to the use of renewable resources. Nevada has great potential for alternate sources of energy - geothermal, wind and solar energy. Resolutions ACR 6, ACR 7 and ACR 8 promote these alternate sources.

Since all of these measures meet League Energy objectives, the League recommends a "Do Pass" on each of these Resolutions.