9-1-1978

In the Matter of the Application of Utah Power & Light Company for Approval of its Proposed Electric Rate Schedules and Electric Service Regulations

Jay C. Andersen
Utah State University

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September 1978 Study Paper #78-10

IN THE MATTER OF THE APPLICATION OF UTAH POWER & LIGHT COMPANY FOR APPROVAL OF ITS PROPOSED ELECTRIC RATE SCHEDULES AND ELECTRIC SERVICE REGULATIONS

by

Jay C. Andersen
BEFORE THE PUBLIC SERVICE COMMISSION OF UTAH -

IN THE MATTER OF THE APPLICATION OF UTAH POWER & LIGHT COMPANY FOR APPROVAL OF ITS PROPOSED ELECTRIC RATE SCHEDULES AND ELECTRIC SERVICE REGULATIONS

PREPARED TESTIMONY OF JAY C. ANDERSEN

Case Nos. 78-035-14 78-035-21
Including Case No. 78-035-03 Consolidated

June 11, 1979
Testimony of Jay C. Andersen

QUESTION:
Please state your name and residence address.

ANSWER:
Jay C. Andersen; 2480 North 1300 East, Logan, Utah.

QUESTION:
What is your occupation?

ANSWER:
I am a professor of agricultural economics and head of the Department of Economics of Utah State University. My teaching assignments have been senior and graduate courses in resource economics.

QUESTION:
What is your educational background in your professional field?

ANSWER:
I received a Bachelor of Science Degree, with a major in Agricultural Economics and a minor in Economics, from Utah State University in 1953; a Master of Science Degree, with a major in Economics, from Utah State University, in 1958; and a Doctor of Philosophy Degree with a major in Agricultural Economics from Iowa State University in 1962.
QUESTION:
I hand you what has been marked as Exhibit JCA-1 and ask if the Exhibit sets forth your further experience in the field of agricultural economics, consulting assignments, membership in professional societies and publications?

ANSWER:
Yes, the Exhibit so indicates.

QUESTION:
Are there any additional areas of experience and background that you have not referred to previously, or upon which you have additional comment?

ANSWER:
Yes.

I grew up on a farm and am most familiar with crops, livestock, and irrigation from a first-hand perspective. I also own and operate a 200-acre farm in Cache County, part of which is irrigated. I farm in partnership with a brother-in-law who has about 200 acres of land which he irrigates by pumping and sprinkling.

For many years my research has been on water, land, and crops. Just September 21, 1978, I returned from a fourth trip to West Africa to work on a cost allocation study on water development for three countries there. I have also worked in Asia on similar problems. Most of my work in Utah for the last 14 years has been on water related problems in agriculture.

For many years, I have taught courses in resource economics at Utah State University. One of the topics most
thoroughly treated is pricing of resources. We thoroughly study and discuss pricing of water and other resources to users and the impact of the pricing system on producers and users.

In summary, I seem to get into this topic from about

QUESTION:

Are you familiar with the pending proposal of Utah Power and Light Company regarding the spread of its allowed revenues over its existing rate schedules?

ANSWER:

Yes, I am.

QUESTION:

What subject matters of this proceeding will your testimony cover?

ANSWER:

First, I shall discuss the nature of the cost of electricity as it relates to electricity use by agriculture; second, the impact of the proposed increases in power costs on the local Utah farmers and the community; and third, certain aspects of the Company's load management program, which has been proposed to mitigate the magnitude of the increase.

QUESTION:

Would you now discuss the nature of agricultural power uses as they relate to electrical power production costs, of Utah Power and Light Company?
The proposed rate increase for agriculture is presumably based upon a claimed contribution of agriculture to the higher load requirements at peak use times. The proposal is based on the premise that a summertime peak load exists and that since agriculture uses power in the summer, farmers are substantial contributors to the need for expensive, new capacity to produce.

There is significant question as to the magnitude of the summer peak load. By reason of the power interties and the near even load, it is my opinion that the winter-summer load differential is not of significant issue.

QUESTION:
So how does agriculture affect the shape of the power production cost curve?

ANSWER:
As we noted, the presumption is that agriculture contributes substantially to the peak load burden. But, let us look at the within-day load burdens. Agriculture seems to contribute to a smoothed out daily load pattern.

QUESTION:
I hand you what has been marked Exhibit JCA-2, and ask if you can identify the same?

ANSWER:
Yes. The exhibit consists of 7 pages, each of which was prepared by Utah Power and Light Company. The first three
pages reflect the daily load peak day plots, for residential, commercial and irrigation classes, for July 18, 1977, which was the system peak day for 1977. It is my understanding that the industrial class plot for the same day is unavailable.

The last four pages of the Exhibit reflect the daily load peak day plots for the same three classes and the industrial class, for August 3, 1977, which was the system peak day for August, 1977.

QUESTION:

What is the significance of these plots?

ANSWER:

The plots set forth in Exhibit JCA-2 call into question whether the power company's cost structure is such that the great increases proposed for agriculture are warranted.

There has been much testimony of summer peak loads or winter peak loads, or month of heaviest use. Two facts stand out: (1) brown outs and the real crunches on power come on some particular afternoon, and (2) the variation among major user classes within a peak day is greater than the variation from summer to winter or from month to month.

The most striking feature of Exhibit JCA-2 is the large variation in daily use for the commercial, residential, and industrial users. These are sectors using the vast majority of power. They all have the same general pattern of peaking in midday to late afternoon at up to twice the nighttime use. One only needs to read the newspapers occasionally to become aware that
power failures occur in the afternoon when the strain is greatest on the system capacity.

In contrast to the daily use pattern just cited, the agricultural users have an almost inverted pattern. Their lightest use during the day is when others are heaviest. In many areas, the late afternoon is used to turn the system off and move the sprinklers. Also, some users, where they have the sprinkler system capacity, turn off sprinklers in late afternoon to avoid the high winds with attendant excessive evaporation and drift of the spraying pattern. Nighttime turns out to be the optimal time to sprinkle irrigate where a choice is available.

This pattern of daily use is for the entire U P & L system. (It is my understanding that U P & L justifies its seasonal differentials on the total, or integrated system.) Notice that the vertical axis on each plot is in a percent of maximum load for the day. Residential and commercial uses peak in the afternoon. Agriculture's peak is from 9:00 p.m. to 11:00 p.m. on July 18, 1977, and from 8:00 p.m. to midnight on August 3, 1977. On both such July and August, 1977 dates, residential, commercial, and industrial uses peak in the afternoon, but irrigators peak at night. This is further borne out by the 1977 Utah non-coincidental peak of irrigators, which according to the records of U P & L, occurred on July 15, 1977, at 11:00-12:00 p.m.

**QUESTION:**

What weight, if any, should this time of day usage by irrigators bear upon the assignment of costs to this class of customers?
Undue responsibility is being assigned to agriculture because of the methods used by the Company to compute the cost of service and thus propose rates. They are not correct relative rates for agriculture and other uses. It is not agriculture which is primarily responsible for needed new construction. An analysis of the time of peak use indicates that the primary usage of energy by irrigators is off-peak, which mitigates against the further imposition proposed by U P & L.

Agriculture is in fact off-peak within a day even though assigned peak load responsibility is based on monthly or seasonal peaks. The agricultural users are being assigned an unfair portion of the costs. Because rates are not differentiated by time of day, some irrigators pay a peak rate for a majority of off-daily peak power, while other non-agricultural users have a majority of on-peak use. One further note is that irrigation represents only about 5 percent of total power use in the summer. That means that even though a substantial increase in power costs could be devastating to farmers, resulting revenues from sales of energy would not be of significance to the utility, for these sales are not a large current or potential source of revenue.

QUESTION:

Will you summarize your testimony on the cost-of-service allocations?

ANSWER:

Since variations of the total load are greater within a day than they are among seasonal peaks, it seems that the peak
responsibility assignments from long-term time frames are quite inappropriate. The Commission should recognize this off-peak usage by agriculture as justifying a lower assignment of cost burden to agriculture, than requested by U P & L.

**QUESTION:**

Can you tell us whether or not there would be an adverse economic impact on agriculture if an increase beyond a uniform increase is imposed?

**ANSWER:**

On this second point, I would point to the farm budget data prepared by Dr. Lynn Davis, which has been received in evidence. I am personally familiar with this data, and can testify to its accuracy from my own study. Note that the returns to farmers' management and capital are very slight. Especially in 1978, with alfalfa hay and barley prices both very low, the pumpers in Utah have been in a real crisis. Prospects for 1979 do not appear much brighter. A longer term look at prices reveals too that a substantial increase in power rates would reduce the normal year to no return to management and capital. This is the serious situation to face, and could force a great majority of these farm people out of business. It is noted that the 1977 amendment to Utah Code 54-3-1 provides for utility charges to be "just and reasonable" and that the Commission may consider the "economic impact of charges on each category of customer" on making the determination of reasonableness.
QUESTION:

Have you engaged in any studies as to what farmers can pay for water, including power costs?

ANSWER:

Yes. We did a study in 1973 on this topic in which we calculated the value of water to agriculture at all levels of availability for 10 regions in Utah. Recent updates and current studies confirm the continuing validity of the data and results. The report derived from the study is entitled, "The Demand for Agricultural Water in Utah", was published by Utah State University in September, 1973, and it was prepared under my direction.

QUESTION:

Do you have that report with you in the hearing room?

ANSWER:

Yes, I do.

QUESTION:

I hand you what has been marked as Exhibit 56-1 and will ask you if you can identify it?

ANSWER:

Yes, it is Figure 4, page 9, from that report, and it shows the derived demands for water for each of 10 regions in the state.

QUESTION:

Will you explain the Exhibit?
ANSWER:

Yes. It was found that the maximum amount of the value of production imputed to water as an input to the production process was less than $15 per acre foot at the levels of water being used. It was only as high as $15 for very scarce water. Actually, the value of water in the production process amounted to a sum less than $5 per acre foot over most of the state. The cost-price squeeze on agriculture has sharply limited returns to agriculture. In the ground water areas in Utah, the pumpers are allowed four acre feet per acre.

In some parts of the state, like in much of Cache Valley, we pay a minimal charge for water. For example, my water is available at about $2 per acre foot. This is because I can irrigate from a system that is powered by gravity from the river to the plants in the field. Others, like my brother-in-law, must pump from the river or canal for sprinkling. Such pumpers paid in 1977 usually in the range of $7 to $10 per acre foot for energy costs alone, plus costs of pumping equipment, pipes and water assessments. There are some advantages in sprinkling to receive better distribution of water and better yields. But, usually it is a matter of being able to irrigate at all. In the western part of the state, our research shows that pumpers paid on average $10 per acre foot for energy costs in 1977. Costs of irrigation other than energy are nearly that much more. Of course, the pumpers paid more in 1978.

It seems clear to me that many farmers are paying an amount for water which is above their derived demand curve for
water. What this means is that to pay costs of water, the returns to an owner's labor, management, and capital are being shorted. This has been recognized wherein wages are low and returns to agricultural investments are on the average about 2 or 3 percent per year. When farmers can no longer cover out-of-pocket costs (no returns to labor, management, and capital), then they cease to farm. Indeed some who are less efficient have ceased to farm. The problem is that so many are so close to failure in the business.

Power costs are a major item in the farm cost structure. There is a serious question about the farmer's being able to pay the present electrical power rates and especially the proposed increased rates.

**QUESTION:**

What is the impact on the community if agriculture is in trouble?

**ANSWER:**

The community and state as a whole have a stake in agriculture. Economists recognize an employment and/or income multiplier of about 2.0 for agricultural production in Utah. That is, if employment or income falls by 1.0 in agriculture, there is a concomitant fall of 1.0 elsewhere in the region. This may not be extremely serious for Salt Lake City, but would be tragic in Milford, Tremonton, Richfield, etc.

The people of the state have a great economic stake in maintaining a healthy agriculture. They have also demonstrated an aesthetic and environmental concern by enacting
zoning laws and greenbelt provisions in the property tax structure to protect agriculture. A favorable Commission ruling on the agricultural power rates would be consistent.

QUESTION:

Would you now comment on the proposed load management of Utah Power & Light? Initially, are farmers using too much water?

ANSWER:

There is strong evidence that where farmers do not have to pay for each unit of water, they do use excessive water. That is especially true if they are in danger of losing part of the water right if it is not used. That is, if they are assessed a flat fee for a year's supply of water for an acre, they will let the water run to excess rather than exert the extra effort to change the water frequently and do other costly and time-consuming things that can spread the water evenly and in precise amounts. However, where farmers must pay for the increments of water (such as paying for pumping each gallon of it) there is no evidence of which I am aware that indicates farmers use excessive water. It seems that there is no valid reason to suggest that a load management program would be beneficial to eliminate excessive water use or that there is such excessive use of water as would lend support to the proposed load management program.

QUESTION:

Can you tell us whether or not load management would increase a farmer's costs of operation?
ANSWER:

Yes. Sprinklers are usually designed of a size to operate continuously during periods of heaviest use. Many farmers would be forced to resort to bigger pumps and distribution lines at great investment costs, higher use of power during remaining days, and possibly even higher power rates based on the demand factor, due to load management. (This, of course, would also defeat the purpose of the load management proposal.) In many cases, there would be inefficient shut down mid-way through a water turn, which would necessitate reapplication over the same area on surface irrigation. Situations exist where extensive travel would be required for tending the water and staking down wheel-move sprinkler lines and restarting the water.

QUESTION:

What are the impacts, if any, of load control on salinity management?

ANSWER:

Two aspects of this are important. First, government agencies are actively promoting sprinkler irrigation as a method of controlling the leaching of salts through the soil profile and into the drainage ways and streams and rivers. Higher power rates and a load management system, which would lead to higher installation costs to get enough system capacity, would discourage the use of sprinkling and contribute to the salt problem, especially in the Colorado River Basin where the salinity problem is critical. The other part of the salinity management problem is that many areas of the state require a
steady/frequent application of water to keep the salt from surfacing. The evaporation from the surface leaves the deposits of salt on the surface which can be seen in the white-colored unproductive areas. Enough water at frequent intervals is the solution to the problem after drainage tiling and conveyances are in place. Load management places a strain upon, or makes this impossible, especially in a case where the drainage of water must be pumped away from the fields. We are all aware of what happens when a drain line backs up. The applicable rate schedule (number 10) pertains to both irrigation and soil drainage pumping service.

QUESTION:

Is it possible that the proposed load management program would increase afternoon critical time loads?

ANSWER:

Yes.

As we noted earlier many shut down sprinkling when they have the system capacity to avoid afternoon winds and for changing the sprinkler. Load management would strain system capacity and force more afternoon operation on days when not shut down to offset morning shut off hours (which is when total load is not peaked). Furthermore, many pumpers would be forced to go to larger pumps to meet the crop demands and thus use more power when turned on.

QUESTION:

Can load management be accommodated when pumping from canals and streams?
In many cases there would be serious difficulties. Canals often flow from great distances and cannot be opened up and shut down on the basis of a few hours change in quantity needed. Many canals serve mostly pumped uses now. In many cases, the canal cannot be allowed to overflow or to spill back through a drainage way and the water wasted. In some areas where pumping is directly from streams, the water is lost if not used as it flows. Water is too short in much of Utah for these luxuries of wasting water by non-use. I would contend that load management even if it could save on electricity would be wasteful of water rather than providing for conserving it.

QUESTION:

Are there any other problems that might be anticipated under the proposed load management?

ANSWER:

The experience of some is there is wear and tear on pump bowls due to intrusion of sand and silt as stopping and starting well pumps takes place. This also causes wear and plug-up in sprinkler heads.

There is also a concern about water rights. Utah water law is based upon the "beneficial use" concept; that is, use it or lose it. No definite answer can be given on whether the right would be lost due to load management shut down; it is a valid, serious question, however.

The foregoing problems relating to the proposed load management are not intended to be exhaustive, as I am aware other
witnesses are testifying on this subject. And, of course, I am aware of many irrigators who could avail themselves of the load control proposal in its current form. As noted, many irrigators are off-daily peak time, but others have irrigation systems designed for use to full capacity and use the system continuously. It is as to those who have specific and serious problems with the program that I have testified.

QUESTION:

Are you familiar with the closure of the Utah-Idaho Sugar Company sugar beet processing plant at Garland, Utah?

ANSWER:

Yes, I am.

QUESTION:

What, if any, economic impact to Utah agriculture has resulted or will result from the closure of such plant?

ANSWER:

In the main, there is no longer a market for Utah farmers raising sugar beet crops, which has been a basic crop in Northern Utah. While there remains a small acreage of sugar beets which can be produced for Amalgamated Sugar Company, the principal sugar beet market for Utah farmers is lost.

QUESTION:

Are there any alternative crops available for the lost sugar beet acreage?

ANSWER:

There are some cropping alternatives available for the lost sugar beet acreage in the Garland, Utah, area. There have
been numerous suggestions for new, somewhat exotic crops. Little evidence is available that farmers will try these new crops, and there is even less indication that these crops might pay off for them. For this year, the timing of the announcement of closure of the sugar beet plants precluded fall substitute plantings such as white winter wheat. This crop for another year might provide a somewhat better alternative for some farmers than the spring planted small grains. Also, since alfalfa hay takes most of a year to become established, any increase in this crop will not be realized immediately. Generally, the Garland area this year will be planted to spring barley and a small amount of wheat and corn for silage or grain. The most appropriate estimate is that about 50 percent of the 10,000 acres (heretofore planted in sugar beets in that area) is now planted in barley. About 30 percent is in corn, and the remaining 20 percent in spring wheat, new establishments of alfalfa, and other minor amounts of other crops. Some interest has been shown in corn for grain. The amount is not clear, but a dryer has been placed in at least one elevator feed mill.

**QUESTION:**
Have you made any analysis to determine whether changing from sugar beets to alternative crops will result in lower income to the farmers making the crop substitution?

**ANSWER:**
Yes, I have made such analysis.
QUESTION:

I hand you what has been marked as Exhibit JCA-4, and ask if you can identify it.

ANSWER:

Yes. This is a three-page exhibit reflecting my analysis of the effect on income that occurs by substituting certain crops for sugar beets. The Exhibit indicates that a clear loss in income is involved for the farmers in changing from sugar beets to the other likely crops. As can be seen from these budgets, the returns to land and management are reduced from in the neighborhood of $140 per acre on sugar beets to about $50 or a little less on either spring barley or corn for silage. This would be a net return loss to farmers of $900,000 to $1 million, for the 10,000 acres in the Northern Utah area.

QUESTION:

Will there be further economic impact on the business community because of the sugar beet market loss?

ANSWER:

Increasing or maintaining agricultural production is important to keep local economics healthy. If the value of production is decreased, the business community is subjected to a multiplied impact. As noted, in this particular case, Northern Utah farmers will change from 10,000 acres of beets to other crops such as barley. While total receipts from a crop of beets are about $486 per acre, returns from a crop of barley are about $173, a difference of $313 per acre. The total difference ($313
X 10,000) is $3,130,000. The multiplier is estimated to be about 2.5 so that the total change in community business activity could be expected to be nearly $8 million for the area.

QUESTION:

Can you tell us whether or not there are any other adverse economic consequences to farmers who have been required to abandon sugar beet farming?

ANSWER:

Yes, many farmers have purchased expensive sugar beet equipment, and are forced to either sell the equipment at depressed prices, or retain the equipment, without any use for it. As an example, I am aware of a farmer who, last fall, purchased a harvester for $28,000.00, and harvested approximately 100 acres of beets with it. He has abandoned any sugar beet planting because of the closure of the processing plant at Garland. Immediate prospects for recovering his investment are very poor.

A further economic concern facing irrigators in the Bear River Valley (Box Elder County) is the future of the local canal company. Utah-Idaho Sugar Company owns the water delivery system for much of the irrigated land in the Tremonton-Garland area. Currently, the arrangement between Utah-Idaho Sugar Company and the irrigators results in very low operation and maintenance costs for providing water to the farms. While Utah-Idaho Sugar Company has been unsuccessful to date in increasing the costs, it is anticipated that there will either be increased costs for such water, or Utah-Idaho Sugar Company will divest
itself of the water system, which itself will result in increased costs.

QUESTION:

Have you made any study of the percentage increases which will result from the implementation of the proposed Tariff P.S.C.U. 21 (modified), Schedule 10, over the rates in force under the current Tariff P.S.C.U. 20, Schedule 10?

ANSWER:

Yes, I have.

QUESTION:

I hand you what has been marked as Exhibit JCA-5, and ask if you can identify it.

ANSWER:

Yes. This Exhibit represents the results of my study and computer analysis, comparing the effects of the present and proposed rates of U. P. & L. under Schedule 10 for various sized pumping units. (The voltage discount credit is applied, but no is also made while load management credit is not included.) The Exhibit shows that for the particular pumping operations set forth, the rate increase in all but one situation exceeds the 14.196% indicated by U. P. & L. and in most situations shown on the Exhibit, the increase is considerably above the percentage increase proposed.

The Exhibit shows operating times of 720, 360 and 180 hours during the month, which would cover full, one-half and one-quarter operating time. A 24-hour period, one day, is also shown. During April and May of the irrigation season, many farmers have limited irrigation need, such as for one or two
days, principally to germinate the crops during a spring when there is inadequate rainfall.

As mentioned for purposes of the Exhibit, a voltage discount credit has been assumed. But in order to claim such a discount the irrigators must provide and maintain all transformers and other necessary equipment.

The percentage of the proposed increase by U. P. & L. would even be greater, when a comparison is made based upon irrigation seasons, as defined under the current and proposed irrigation pumping schedules, rather than on a monthly basis, as U. P. & L. has expanded the irrigation season from May 25-September 15 (under Tariff P.S.C.U. 20) on the one hand, to April 1-September 30 (under proposed Tariff P.S.C.U. 21, as modified) on the other hand.

QUESTION:
Can you succinctly summarize your testimony?

ANSWER:

The conventional cost-of-service calculations gloss over some vital situations that pertain to agriculture. In my opinion, the present rate relationship, which irrigation energy users bear to other classes, is justified and should be maintained, in order to maintain a healthy, stable agricultural industry. The pursuance of any load management program, as it would affect agriculture, requires more extensive study to eliminate existing problems.

The recent economic problems of the irrigators have been further aggravated for some pumpers by the loss of a sugar
beet market since 1978, and attendant expenses arising out of crop substitution and machinery obsolescence.

The U. P. & L. rate schedules proposed for irrigation pumping apparently will result in revenue increases in excess of the 14.2% increase proposed by the Company, and should be further examined.
JAY C. ANDERSEN
Professor and Head
Department of Economics
Utah State University

Date and Place of Birth
March 7, 1930 Brigham City, Utah

Degrees
B.S. - Utah State University - 1953
M.S. - Utah State University - 1958
PhD - Iowa State University - 1962

Teaching Experience
1968 to present - Utah State University, Senior and graduate courses in Resource Economics

Professional Experience
1959-1962 Ames, Iowa - Agricultural Adjustments Branch, Farm Economics Division, Economic Research Service, USDA. This work was the Iowa portion of the Lake States Dairy Adjustment Study. It concerned analysis of production problems, appraisal of alternative adjustment opportunities for farmers with different resource situation, and evaluation of the area and regional implications of adjustments made by individual farmers. The work involved development of input-output relationships for farm enterprises, determination of the optimum combination of enterprises by linear programming for various resource situations, and computation of the aggregate quantities for the optimized farm plans.

1962-1964 Agriculture Adjustments Branch, USDA, Moscow, Idaho. Developed models and designed surveys and other procedures to define profitable adjustments for farmers in Idaho. The effects of various governmental programs and other external forces were investigated. Governmental costs and the effects of various actions by farmers on government stockpiles and surpluses were an important part of this study.

The Group undertook investigations to provide a framework of economic concepts, relations and projections and systems of analysis required to formulate comprehensive basic plans for coordinated and orderly development of land and water resources. Responsible for design of economic studies and development of statistical methods and mathematical economic-hydrologic models for tracing economic effects of given water uses or controls. This includes interindustry analysis of river basins.

1967-1969
Chairman of Economic Coordinating Group, Pacific Southwest Framework Studies under auspices of the U.S. Water Resources Council.

Professor of Agricultural Economics (part time), Utah State University, teaching Resource Economics.

Nov. 1969 to Dec. 1975
Associate Professor and Professor of Economics, Utah State University. Project Leader on several projects on water and other resource development and allocation. In this position, several students and others are given leadership in research activities.

Jan. 1976 to present
Head of Department of Economics, Utah State University, in addition to research and teaching duties.

Consulting Assignments


Other Experience

Annals of Regional Science, Editorial Committee.

Membership in Professional Societies

American Farm Economics Association
Western Farm Economics Association
Western Regional Science Association (Member of Board of Councillors)
Publications


Andersen, Jay C., "Inter-Industry Analysis of the Colorado River Basin--A Brief Description and Special Problems in Agriculture", *Proceedings Western Farm Economics Association*, Los Angeles, California, August 15-17, 1966.


Andersen, Jay C., J'Wayne McArthur, Stephen W. Fuller, Allan J. Randall, "The Role of Employment and Income Multipliers in Selecting Agricultural Development Opportunities for the Four Corners Region", Special Report #7, New Mexico Agricultural Experiment Station in cooperation with stations of the University of Arizona, Colorado State University, and Utah State University, May 1971, 19 pp.


Clevenger, Thomas S., John D. Canady, Linda Demarest, Don Sorenson, and Jay C. Andersen, "Paraprofessionals: An Approach to Education", Special Report #14 to the Four Corners Regional Commission, New Mexico Agricultural Experiment Station in cooperation with stations of the University of Arizona, Colorado State University, and Utah State University, June 1972, 17 pp.


McArthur, J'Wayne, Robert C. Lamb, Jay C. Andersen, William N. Capener, "Feasibility of Raising Replacement Dairy Heifers in the Four Corners Economic Development Region", Special Report #19 to the Four Corners Regional Commission, New Mexico Agricultural Experiment Station in cooperation with stations of the University of Arizona, Colorado State University, and Utah State University, September 1972, 37 pp.


McArthur, J'Wayne, Jay C. Andersen, and William N. Capener, "Feasibility of Establishing Dehydrating Alfalfa Plants in the Four Corners Development Region", Special Report #22 to the Four Corners Regional Commission, New Mexico Agricultural Experiment Station in cooperation with stations of the University of Arizona, Colorado State University, and Utah State University, December 1972, 28 pp.


McArthur, J'Wayne, Darwin B. Nilsen, and Jay C. Andersen, "Feasibility of Range Improvement on the Rangelands of the Four Corners Economic Development Region", Special Report #23 to the Four Corners Regional Commission, New Mexico Agricultural Experiment Station in cooperation with stations of the University of Arizona, Colorado State University, and Utah State University, June 1973.


9


EXHIBIT JCA-2
P. 4
Figure 4. Demand for water for presently irrigated land.
### SUGAR BEETS

**1978**

(Per Acre)

<table>
<thead>
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<th>CATEGORY</th>
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### OPERATING INPUTS:

- **BEET SEED**
  - LB. 4.00 4.50 18.00
- **NITROGEN**
  - LB. 0.22 150.00 33.00
- **PHOSPHATE**
  - LB. 0.18 120.00 21.60
- **APPLY FERTILIZER**
  - ACRE 3.00 1.00 3.00
- **ROWNEET**
  - QT. 8.50 1.00 8.50
- **HAND THIN BEETS**
  - ACRE 25.00 1.00 25.00
- **HAND HOEING**
  - ACRE 16.50 1.00 16.50
- **WATER ASSESSMENT**
  - ACRE 6.00 1.00 6.00
- **DITCH MAINT**
  - ACRE 3.50 1.00 3.50
- **TRACTOR FUEL COST**
  - ACRE 13.13
- **TRACTOR REPAIR COST**
  - ACRE 6.20
- **TRACTOR LUBE COST**
  - ACRE 1.50
- **EQUIP FUEL COST**
  - ACRE 10.94
- **EQUIP LUBE COST**
  - ACRE 1.20
- **EQUIP REPAIR COST**
  - ACRE 14.50

**TOTAL OPERATING COST**

182.57

**RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT**

303.43

### CAPITAL COST:

- **ANNUAL OPERATING CAPITAL**
  - 0.12 69.00 8.28
- **TRACTOR INVESTMENT**
  - 0.12 95.00 11.40
- **EQUIPMENT INVESTMENT**
  - 0.12 275.00 33.00
- **IRRIGATION SYSTEM INVESTMENT**
  - 0.12 2.00 0.24

**TOTAL INTEREST CHARGE**

52.92

**RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT**

250.51

### OWNERSHIP COST: (DEPRECIATION, TAXES, INSURANCE)

- **TRACTOR**
  - DOL. 7.38
- **EQUIPMENT**
  - DOL. 38.90
- **IRRIGATION SYSTEM**
  - DOL. 0.21

**TOTAL OWNERSHIP COST**

46.49

**RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT**

204.02

### LABOR COST:

- **MACHINERY LABOR**
  - HR. 4.00 11.5 46.00
- **IRRIGATION LABOR**
  - HR. 4.00 4.5 18.00

**TOTAL LABOR COST**

64.00

**RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT**

$140.02
## SPRING BARLEY

**CATEGORY** | **UNITS** | **PRICE** | **QUANTITY** | **VALUE**  
--- | --- | --- | --- | ---  
**PRODUCTION:**  
BARLEY | BU. | $2.10 | 80 | $168.00  
BY PRODUCTS | | | | 5.00  
**TOTAL RECEIPTS** | | | | 173.00  
**OPERATING INPUTS:**  
BARLEY SEED | CWT. | 8.50 | 1.00 | 8.50  
NITROGEN | LB. | 0.22 | 1.00 | 22.00  
APPLY FERTILIZER | ACRE | | | 2.50  
2-4-0 | QT. | 1.50 | 0.5 | 0.75  
SPRAYER | ACRE | | | 2.50  
WATER ASSESSMENT | | | | 6.00  
DITCH MAINT | | | | 3.00  
TRACTOR FUEL COST | | | | 3.75  
TRACT REPAIR COST | | | | 1.75  
TRACTOR LUBE COST | | | | 0.75  
EQUIP FUEL COST | | | | 2.25  
EQUIP LUBE COST | | | | 0.25  
EQUIP REPAIR COST | | | | 2.50  
**TOTAL OPERATING COST** | | | | 56.50  
**RETURNS TO LAND, LABOR, CAPITAL, MACHINERY, OVERHEAD, RISK, AND MANAGEMENT** | | | | 116.50  
**CAPITAL COST:**  
ANNUAL OPERATING CAPITAL | DOL. | 0.12 | 28.25 | 3.39  
TRACTOR INVESTMENT | DOL. | 0.12 | 46.80 | 5.62  
EQUIPMENT INVESTMENT | DOL. | 0.12 | 96.70 | 11.60  
IRRIGATION SYSTEM INVESTMENT | DOL. | 0.12 | 2.00 | 0.24  
**TOTAL INTEREST CHARGE** | | | | 20.05  
**RETURNS TO LAND, LABOR, MACHINERY, OVERHEAD, RISK AND MANAGEMENT** | | | | 95.65  
**OWNERSHIP COST:** (DEPRECIATION, TAXES, INSURANCE)  
TRACTOR | DOL. | | | 5.34  
EQUIPMENT | DOL. | | | 15.89  
IRRIGATION SYSTEM | DOL. | | | 0.31  
**TOTAL OWNERSHIP COST** | | | | 21.54  
**RETURNS TO LAND, LABOR, OVERHEAD, RISK AND MANAGEMENT** | | | | 74.11  
**LABOR COST:**  
MACHINERY LABOR | HR. | 4.00 | 3.5 | 14.00  
IRRIGATION LABOR | HR. | 4.00 | 3.0 | 12.00  
**TOTAL LABOR COST** | | | | 26.00  
**RETURNS TO LAND, OVERHEAD, RISK AND MANAGEMENT** | | | | 48.11
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<th>PRICE</th>
<th>QUANTITY</th>
<th>VALUE</th>
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</table>
### Cost per Kilowatt Hour of Power and Percent of Increase in Rate on Size of Pumping Units by Amount of Use for Present and Proposed Utah Power and Light Rate Schedules

<table>
<thead>
<tr>
<th>Pump Horsepower</th>
<th>Operating Time Per Month</th>
<th>Present Rate Tariff #20</th>
<th>Proposed (Modified) Rate Tariff #21</th>
<th>Percent Increase</th>
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</thead>
<tbody>
<tr>
<td>10</td>
<td>720 hours (full)</td>
<td>$0.0343</td>
<td>$0.0359</td>
<td>4.7</td>
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<tr>
<td></td>
<td>360 hours (half)</td>
<td>$0.0403</td>
<td>$0.0537</td>
<td>33.3</td>
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<tr>
<td></td>
<td>180 hours (1/4)</td>
<td>$0.0512</td>
<td>$0.0892</td>
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<td>24 hours (day)</td>
<td>$0.1922</td>
<td>$0.5515</td>
<td>187.0</td>
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<tr>
<td>25</td>
<td>720 hours (full)</td>
<td>$0.0274</td>
<td>$0.0314</td>
<td>14.6</td>
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<tr>
<td></td>
<td>360 hours (half)</td>
<td>$0.0372</td>
<td>$0.0447</td>
<td>20.2</td>
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<td></td>
<td>180 hours (1/4)</td>
<td>$0.0507</td>
<td>$0.0714</td>
<td>40.8</td>
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<td>24 hours (day)</td>
<td>$0.1888</td>
<td>$0.4175</td>
<td>121.1</td>
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<td>40</td>
<td>720 hours (full)</td>
<td>$0.0256</td>
<td>$0.0303</td>
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<td>360 hours (half)</td>
<td>$0.0338</td>
<td>$0.0425</td>
<td>25.7</td>
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<td>180 hours (1/4)</td>
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<td>24 hours (day)</td>
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<td>$0.0248</td>
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<td>19.4</td>
</tr>
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<td></td>
<td>360 hours (half)</td>
<td>$0.0326</td>
<td>$0.0418</td>
<td>28.2</td>
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<td>180 hours (1/4)</td>
<td>$0.0477</td>
<td>$0.0654</td>
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<td>24 hours (day)</td>
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<td>75</td>
<td>720 hours (full)</td>
<td>$0.0225</td>
<td>$0.0275</td>
<td>22.2</td>
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<td></td>
<td>360 hours (half)</td>
<td>$0.0311</td>
<td>$0.0408</td>
<td>31.2</td>
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<td>180 hours (1/4)</td>
<td>$0.0446</td>
<td>$0.0634</td>
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<td>24 hours (day)</td>
<td>$0.1873</td>
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<td>100</td>
<td>720 hours (full)</td>
<td>$0.0214</td>
<td>$0.0265</td>
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<td></td>
<td>360 hours (half)</td>
<td>$0.0300</td>
<td>$0.0399</td>
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<tr>
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<td>180 hours (1/4)</td>
<td>$0.0431</td>
<td>$0.0624</td>
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<td>24 hours (day)</td>
<td>$0.1871</td>
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</table>
Cost per Kilowatt Hour of Power and Percent of Increase in Rate on Size of Pumping Units by Amount of Use for Present and Proposed Utah Power and Light Rate Schedules (Continued)

<table>
<thead>
<tr>
<th>Pump Horsepower</th>
<th>Operating Time Per Month</th>
<th>Present Rate Tariff #20</th>
<th>Proposed (Modified) Rate Tariff #21</th>
<th>Percent Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>150</td>
<td>720 hours (full)</td>
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<td>.0255</td>
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<tr>
<td></td>
<td>360 hours (half)</td>
<td>.0274</td>
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<td>180 hours (1/4)</td>
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<td>200</td>
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<td>.0251</td>
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<td>24 hours (day)</td>
<td>.1699</td>
<td>.3430</td>
<td>101.9</td>
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</table>
Total cost of power, and percentage increase, by size of pumping units and monthly operating time under present and proposed U P & L irrigation pumping schedules (Schedule 10) (with voltage discount).

<table>
<thead>
<tr>
<th>Pump Power</th>
<th>Horse Operating Time (Hours)</th>
<th>(3) Dollar Amount Based Upon Present Tariff 20</th>
<th>(4) Dollar Amount Based Upon Proposed Tariff 21 Modified (without load control)</th>
<th>(5) Percentage Increase of Column 4 Over Column 3</th>
<th>(6) Dollar Amount Based Upon Proposed Tariff 21 Modified (with load control)</th>
<th>(7) Percentage Increase of Column 6 Over Column 3</th>
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<tbody>
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<td>10</td>
<td>720 (Full)</td>
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<td>193</td>
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Total cost of power per kwh, and percentage increase, by size of pumping units and monthly operating time under present and proposed U.P & L irrigation pumping schedules (Schedule 10) (with voltage discount).

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<th>Operating Time (Hours)</th>
<th>Dollars/kwh Based Upon Present Tariff 20</th>
<th>Dollars/kwh Based Upon Proposed Tariff 21 Modified (without load control)</th>
<th>Percentage Increase of Column 4 Over Column 3</th>
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Summary of Testimony

1. Some of the conventional cost-of-service calculations methods used to assign the rate relationships which irrigation energy users bear in relationship to other users gloss over important factors. As shown in exhibits prepared, the majority of agricultural uses are in daily off-peak times. It is inappropriate to assign premium rates to these off-peak times. The daily load variation is far greater than the seasonal variation.

2. A substantial increase in power costs to agriculture would be devastating to farmers, but the resulting revenues from sales of energy would not be of significance to the utility since these sales are now and in the future will be a small part of revenues. We have evidence that substantial rate increases would make the costs of water greater than the value of the water.

3. If agriculture is placed in poorer economic circumstances, many communities throughout the state will suffer. Income, employment, and total business volume impacts would be essentially doubled as the ripples proceed through the local economy.

4. There is no evidence that I have seen that either an increase in power rates or the proposed load management program would conserve water. Where farmers pay for each increment of water, there is no evidence of waste. In other situations where there is a flat yearly fee and no pumping, there may be excessive water use.

5. Large rate increases for pumpers would seriously interfere with actions being taken to promote sprinkler irrigation as a means to provide for salinity management.

6. The load management program in time would likely cause some irrigators to invest in larger water delivery systems, which would place them on higher demand charge rates and would cause a heavier power use at times other than on the shut-off day. In some cases where water is pumped from streams and is available continuously as used, the load management would cause waste of water. Others would find it expensive, inconvenient, and impossible to cover irrigation needs if they shut down for a day per week. This proposal needs more study and refinement before adoption.
7. Factors such as the loss of most of the sugar industry in the state have placed many farmers in poor economic and financial status. Current income returns to capital investments in agriculture are only 2 or 3 percent. Labor income and living expenses would be further diminished by large rate increases.

8. The proposed rate increases for agriculture vary widely according to size of pumping unit and the amount of use. Rates of increase are particularly high where use is less than continuous. This is a serious problem when combined with the proposed extension of the irrigation season during which the demand changes and customer service charge would apply. The rate increase would be much higher for many users because of intermittent use at the beginning and end of the season when considered on a seasonal rather than a monthly basis. Alternatives should be studied for the "demand" part of the charge.