private street and outdoor area lighting; service classification No. 8(M), private ornamental street lighting; and service classification No. 7(M), municipal lighting incandescent to relieve the company from having to perform maintenance of incandescent standards, brackets, fixtures, and lamps after December 31, 1980.

Q What is the purpose of your testimony?

A I will explain the various reasons why Union Electric wants to rid itself of the obligation to maintain incandescent lighting in the service classifications 6(M), 7(M), and 8(M).

Q Would you please begin by giving a brief history of Union Electric's involvement with outdoor lighting?

A Before 1959, Union Electric offered only incandescent in one size fluorescent lighting fixtures for municipal application and only incandescent lighting for private application. In 1959, a 400 watt, now 21,500 lumen, mercury vapor fixture was offered for municipal application. A 175 watt, now 18--I'm sorry.

A 175 watt, 8,150 lumen, 1,000 watt, 60,000 lumen, and 100 watt, 4,000 lumen mercury fixtures were first offered in 1962, 1963, and 1965, respectively. By 1965, the lamp manufacturers had resolved the objectionable blueness of mercury vapor lighting through improved bulbs.

Meanwhile, the cost of the 400 watt mercury

vapor fixture had dropped from $80 in 1962 to $35 in 1966. During this same period, the lamp life had improved so that group relamping could be extended from every year to every three years. I might add that group relamping is now completed every four years for mercury vapor and high pressure sodium fixtures, while incandescent lamps must be replaced every year.

In early 1966, Union Electric reviewed the relationship between the cost of mercury vapor and incandescent lighting sytems. Mercury vapor was found to be more economical. In April of 1966, the municipal street lighting rates were broken into two tariff classifications, No. 12 and No. 20, which are now classifications No. 5(M) and 7(M). The mercury rates were reduced to reflect then current costs. The incandescent rates were made rates of limited application.

Incandescent lighting service for municipal use has been limited to only those customers using that service as of April 8, 1966. Incandescent lighting for private use has been limited to only those customers using that service as of September 30, 1963. No new customers for private incandescent street lighting, private incandescent ornamental street lighting, or municipal incandescent street lighting have been added for over 14 years.

In recent years the incandescent rates have

been changed with general rate increases. But detailed analysis of current costs of maintaining and replacing incandescent fixtures has not been made. However, detailed cost data has been used to support changes in the mercury and high pressure sodium rates. High pressure sodium rates were established in 1975 for 400 watt, 50,000 lumen, and, in 1978, for 250 watt, 27,500 lumen fixtures.

High pressure sodium is following the same trend as mercury vapor in that the cost of fixtures and lamps are expected to fall as these fixtures become the industry standard.

Q How many incandescent fixtures remain on the Union Electric system?

A Union Electric currently maintains over 107,000 fixtures in Missouri. By June, 1979, only about 3,200 incandescent fixtures remained. Between June of 1979 and August of 1980, an additional 900 incandescent fixtures were removed. This leaves just under 2,300 incandescent fixtures on our system, or only about 2 percent of the total fixtures.

Q What factors entered into the company's decision to stop maintenance of incandescent street lighting fixtures after December 31, 1980?

A Our review of incandescent lighting uncovered several areas of concern. First, we found that with our present incandescent street lighting tariffs a Union Electric

trouble man would have to carry 14 different types or sizes of bulbs in order to replace a random failed bulb. These trouble men represent the company's work force which responds immediately to emergencies that range from wires or poles down in streets to customer outages.

The trouble men must carry considerable equipment on their trucks to handle the wide variety of emergency situations they may encounter. Since the space available on these trucks is limited, the trouble men frequently must make two trips when an incandescent bulb must be replaced. These extra trips result in manpower and equipment costs that are not usually incurred with mercury or high pressure sodium maintenance.

Secondly, we found replacement parts that either could no longer be obtained, could be ordered only in lots of 100, had to be made special, or had significant price increases due to limited production runs. Examples of such replacement parts are listed on Respondent's Exhibit 6. Many parts are only available through salvaging of fixtures or standards that have been removed or damaged. As the number of remaining fixtures declines, the sources of replacement parts will also decline.

Q Mr. Zdellar, I hand you what has been marked Company Exhibit 6 and ask you to identify it.

A Respondent's Exhibit 6 is a single sheet of

paper entitled "Examples of Parts Problems on Incandescent Street Lighting Fixtures." Five particular examples are listed.

Q Was this exhibit personally prepared by you?

A Yes.

Q Are the examples given therein true and correct to the best of your knowledge?

A Yes, they are.

Q I hand you what has been marked Company Exhibit 7 and ask you to identify it.

A This exhibit shows another instance of high replacement costs for an incandescent street lighting fixture. Respondent's Exhibit 7 is a letter dated October 10, 1980, from Mr. Robert D. Oberto, a sales engineer for Banner Iron Works in St. Louis. The letter is addressed to Mr. Chris Kelleher who is a Union Electric attorney. The letter quotes Banner's price for various parts for an incandescent street lighting fixture that is still being used in some parts of Union Electric's Missouri service area.

For example, the University Post for pattern No. 231 would cost $1,204 each for quantities of 8 to 10, but only after a $9,000 charge for the pattern itself.

Q What other factors entered into Union Electric's desire to end maintenance of incandescent street lights?

A One factor was the relative efficiency of mercury vapor and high pressure sodium fixtures as compared to incandescent fixtures. For the past several years, one of the fastest rising costs at Union Electric has been the cost of fuel. The use of more energy efficient lighting will save fuel directly.

Q Mr. Zdellar, I hand you what has been marked Company Exhibit 8 and ask you to identify it.

A Respondent's Exhibit 8 is a single sheet of paper entitled "Lumen Output Comparison." The four columns of the exhibit are entitled "Lamp Watts, Total Fixture Watts, Lumens, and Efficiency Lumens/Watt."

Q Did you personally prepare this exhibit?

A Yes, I did. I took the specific figures from the General Electric 1980 catalog.

Q Is the data contained in Respondent's Exhibit 8 true and correct to the best of your knowledge, information, and belief?

A Yes, it is.

Q Why did you prepare this exhibit?

A I prepared this exhibit to show examples of the energy efficiency of mercury vapor and high pressure sodium lights as compared to incandescent lighting.

Q Looking at Respondent's Exhibit No. 8, or, rather, at Company Exhibit No. 8, would you please give such an example?

A. Yes. Look at a 400 watt incandescent lamp that has a total fixture wattage of 448. This lamp gives off 6,000 lumens for an energy efficiency reading of 13.4 lumens per watt. If a conversion would be made to a 175 watt mercury vapor lamp with a total fixture wattage of 208, the lumens would be 8,150 for an energy efficiency reading of 39.2 lumens per watt. Therefore, if such a conversion were accomplished, the customer would be provided with one-third more light while consuming less than half of the energy.

Q. Would you please summarize your testimony?

A. The filed tariff change will provide for the phasing out of incandescent lighting provided by Union Electric in Missouri. As any system becomes obsolete, maintenance costs rise dramatically when spare parts are not available or are not mass produced. Incandescent street lighting is such a system.

Union Electric no longer finds it economically feasible to train all of its new trouble men and linemen to repair all the different incandescent fixtures, nor is it economically feasible to carry incandescent lamps on trouble trucks. The company cannot justify the time it takes to cannibalize old fixtures as we search for spare parts which may not work.

In summary, we cannot continue to keep an

energy inefficient system in a time of energy shortage.

MR. BARNES: Mr. Examiner, that completes my direct examination of Mr. Zdellar. I make him available for cross-examination.

EXAMINER CADIEUX: Mr. Banks.

MR. BANKS: Thank you, your Honor.

CROSS-EXAMINATION BY MR. BANKS:

Q Mr. Zdellar, I'm going to refer to Company Exhibit No. 7.

The pattern that is referred to with pattern price, is that the functional equivalent of a mold?

A To the best of my knowledge and belief, that's correct.

Q And is that pattern reuseable?

A Yes, it would be.

MR. BANKS: Thank you. I have no further questions.

EXAMINER CADIEUX: Mr. Brady or Mr. Kay.

MR. KAY: No.

MR. BRADY: I have to ask this witness.

CROSS-EXAMINATION BY MR. BRADY:

Q Did the tariffs in force during the past 14 years allow for incandescent lights?

A Only on an occasional addition to an existing customer system; for instance, if a customer had several

lights on a block and would want one more. In cases where that type of fixture was available, we would install it.

Q Yes. I understand that was your position. That isn't the question I asked you.

I asked you: Did the tariffs then in force provide for incandescent lights during the past 14 years?

A Yes, in the example I've given.

Q Only in that example? That was specifically covered by the tariff?

A Yes, that's correct.

Q And only in those examples were incandescent lights provided?

A To the best of my knowledge and belief.

Q Now, how many of the 2,300 incandescent fixtures on UE's system now are in University City, do you know?

A I don't know that myself.

MR. BRADY: Thank you.

EXAMINER CADIEUX: Mr. Carl.

MR. CARL: I have a number of questions.

QUESTIONS BY MR. CARL:

Q First, I would ask you the same question I asked the company's first witness.

This lumen output comparison list of yours, are you quoting the stock catalog luminosity of bulbs as

they would come off a shelf of an electrical supply house?

A Yes.

Q And you have no idea what the output of those bulbs would be in the fixtures?

A The catalogs would specify what the lumen output on the street would be for the various types of fixtures in which those bulbs would be installed. I do not have that with me.

Q You were quoting that there is--may I ask this question.

Is it possible that you might have a very efficient bulb and put it in a fixture so inefficient that its advantage would be diminished or eliminated?

A That's true.

Q Then the quotation of lumen output per dollar paid is not necessarily true in the field, while it might be if we took a naked bulb here and lit it up?

A Given the same fixture, the relationship is valid.

Q Yes. I grant you that.

But, if you put in one of your most efficient bulbs, let's say. Let's take a sodium vapor and put it in a very poor fixture. Would not its output per dollar be diminished to the point where it might end up costing more than a less efficient light?

A A less efficient light in a more efficient fixture?

Q Yes, sir.

A That's correct.

Q I would ask you, you make a contention here about a street light refractor being not available, and there's no substitute.

And I happen to have, courtesy of the company, for which I am very grateful to Mr. Gillum--is this the refractor to which you refer?

A I don't--

Q This is in use in University Heights III in University City and West Portland Place in University City. It is very old, close to 60 years old. It is a fixture--

MR. BARNES: Mr. Examiner, I'm going to object. Mr. Carl evidently is trying to make his direct examination now. And he's also referring and showing a piece of equipment that he has not yet identified in his case and not asked to be introduced into evidence. So I guess I would request that Mr. Carl make this kind of presentation when his turn for direct examination comes.

MR. CARL: Mr. Cadieux, what I was trying to do, if I might, Mr. Barnes, I was trying to say that the contention of the company, that some things are not available, may not be so.

EXAMINER CADIEUX: Well, Mr. Carl, as far as purposes of cross-examination of this witness, if you wish to ask questions concerning the various pieces of equipment that you've brought here, fine; I will allow that. But, if you wish to present affirmative evidence regarding that equipment, I would request that you wait until you take the stand.

MR. CARL: All right, sir.

EXAMINER CADIEUX: Do you have any further questions of this witness?

MR. CARL: No, sir.

EXAMINER CADIEUX: Mr. Barnes, anything further?

MR. BARNES: I have no further questions.

QUESTIONS BY CHAIRMAN SLAVIN:

Q I asked a series of questions of Mr. Merlo. Do you remember those, or shall I restate them?

A Please restate them.

Q I was interested in what your policy was now. I think you've identified for the record, through your direct testimony, that you find the high preasure sodium a more energy efficient lighting mechanism than mercury vapor and, also, more efficient than incandescent, assuming, along the lines that Mr. Carl has raised, that the fixture itself is working efficiently; that's correct, right?

A. Yes, that's correct.

Q. Now, the question I have to you is: What percentage of your system is on high pressure sodium; what are your plans for conversion to high pressure sodium, other than through the Exhibit 5, I believe, which you provided?

A. The exact percentage or number of high pressure sodium fixtures could be presented later. We don't have that with us today.

As far as the company's policy on moving to high pressure sodium, or any more efficient lighting system, we basically will move into, I believe, high pressure sodium in the similar way we moved into mercury from incandescent. In other words, you see a more efficient system on the horizon, but, when these new devices are first developed, there are, if you will, bugs, so to speak. Ballasts don't last as long as what you'd like them to last; the bulbs don't last as long as what you'd like them to last. The cost of the bulb, for instance, for a high pressure sodium fixture, is significantly higher than a mercury vapor light bulb right now.

So, while you have energy savings, you have to balance those savings with the cost of converting the system plus the increased cost of maintenance until a system comes through an evolution to an adult stage where we then can bring it on system stronger and, perhaps, at some point

in time, make mercury vapor a rate of limited application.

Q Have you or anyone at the company done any cost studies along these lines?

A We have continuously done studies of this very nature. It was those studies that led to the filings that we have now that offer high pressure sodium in the two particular sizes. We are presently looking at 100 watt high pressure sodium fixtures for installations in new subdivisions, for instance. We don't presently offer that. My guess is that we will within the next year.

Q Are you aware of the fact that there are locations around the country, principally, municipalities and, I guess, jointly, with utilities, which have converted very quickly to high pressure sodium? You are? Yes? You are nodding your head yes?

A Yes, I am aware of it.

Q Why would they make a much more rapid conversion than what appears to be the policy of your company?

A Well, basically the cost of lighting is based on three basic elements. You've got a cost of conversion; you've got a cost of maintenance, which we have discussed in the past; and you've got a cost of fuel, which is a much larger item for some municipalities, such as Pacific Gas & Electric that is basically oil-based generation. So there's a much greater incentive from a cost of fuel standpoint for

a company like that than it would be for Union Electric who has a much more efficient type of fossil-based fuel.

Q. Looking at your Exhibit 6, Seventh Revised Sheet 43(M), fifth page?

A. Would you ask that question again, please?

Q. It's the fifth page of that exhibit.

A. These exhibits that I have here are not marked. You'll have to identify by what tariff sheet.

MR. BARNES: Which exhibit are you referring to?

EXAMINER CADIEUX: I believe it's Exhibit 5.

CHAIRMAN SLAVIN: Exhibit 5, Page 5.

MR. BARNES: That's Page 43(M).

CHAIRMAN SLAVIN: Yes.

EXAMINER CADIEUX: Do you have that, Mr. Zdellar?

WITNESS ZDELLAR: I have that sheet.

BY CHAIRMAN SLAVIN:

Q. Number 3 on that page identifies a tariff called "Change or Relocation." And "a" indicates, "Where a customer requests an increase in lamp size, Company will make whatever changes are necessary to provide the larger lamp. . . ."

Will you define "larger lamp"?

A. The definition of larger lamp there is based

on the lumen output of that lamp.

Q And then the smaller lamp further down in the tariff would indicate a smaller lumen?

A That's correct.

Q So, if I read this tariff correctly, the company will make a conversion if a customer wants to essentially move upward in terms of consumption to a larger lamp?

A Not necessarily in terms of consumption, but in terms of lighting efficiency. In other words, the customer could very well get more output for less consumption by this tariff without paying any out-of-pocket costs in the conversion.

Q If the customer wants to go to a smaller lamp, then the same definition would apparently hold, right? The customer must pay all the costs of conversion?

A That is correct, by this tariff.

Q Does that square with the effort to try and seek more energy conservation or efficiency?

A Well, we must keep in mind that we have to protect the investment that Union Electric has made in those assets if we've entered into an agreement in good faith with a customer for a period of time for us to, one, provide lighting, and for that customer to pay a bill which compensates the company's total expenditures, both initial

investment, maintenance, and energy, for the period of that contract. So, if we give up that asset, take it down before its life is up, prematurely remove it, we have lost that asset. And I think we've, then, done a disservice to all the ratepayers in that classification.

Q But that asset is an asset whether it's a larger lamp or a smaller lamp?

A That is correct.

Q So I don't understand your response.

A I guess I don't have a good answer for that.

Q I mean, if I read this tariff correctly, unless we talk about a conversion to high pressure sodium vapor, a conversion may not become energy efficient?

A That is correct. In response to your earlier question, though, there is one reason that you might go the route to go to a larger, as you would not go to a smaller. And that is basically to promote, again, the off peak use of energy. Basically, lighting is a nighttime load. By essentially making some additional margin of revenue on additional kilowatt-hour sales on a larger lamp, that would, in fact, then sort of spread a contribution over the other rates.

Q That might be true if there were an increase in charges by moving to the larger lamp. But, if you went to the high pressure sodium, you may be having a decrease in

charges, if I look at your tariff sheets correctly?

A That is correct. That's because, though, that the cost of energy is significantly lower with the high pressure sodium.

Q I understand that. But these tariffs are inconsistent with the policy of encouraging conversion to high pressure sodium. By defining the conversion only in terms of larger and smaller, you are, perhaps, penalizing the customer who wants to move to more efficient energy use and encouraging the customer who wants to move to what would appear to be higher energy use. For the Commission that's inconsistent with what we are attempting to accomplish.

A Well, as an example, if we look at the first page on that particular exhibit, if a customer now presently, let's say, has a 1,000 watt mercury installation--54,000 lumen, 1,000 watt mercury installation, the customer--

Q Is that 54,000 lumens, 1,000 watts at $16.30 per month?

A $16.30 per month is the customer's charge. If that customer were to go to a smaller lamp, that 400 watt high pressure sodium, that customer would have to pay the charge of conversion; but it would be offset by several dollars per month for reduced cost from the tariff.

Now, while that $4 won't square today as we move along and energy prices rise, that difference at some

point will become significant. And we will either at that time begin some conversions ourselves instead of maintenance of mercury systems, or it will become attractive to the customer to pay a cost of conversion.

The other example we could have, looking again at this sheet a little higher, let's say the customer now has a 400 watt, 20,000 lumen mercury and is paying $8.48 a month. Right below that is a mercury fixture, 25,500 lumens, 250 watt, which is, by our definition, a larger lamp. Now, right now the price is about $1.50 higher. So the customer obviously won't convert. But, as energy costs go up, those two rates will grow together and, in fact, at some point, because of the efficiency of the two fixtures, the relative efficiency of the two fixtures, the high pressure sodium will come into it's own.

Q Based on both of the examples that you've given me, there's probably little incentive for either one of those customers to convert?

A Today, that is correct.

Q Do you have the cost studies that will support those rates as cost related which you could provide to the Commission?

A We could provide that.

Q Will you do that, please.

Will you do that, Mr. Barnes?

MR. BARNES: Yes.

BY CHAIRMAN SLAVIN:

Q And so your testimony today is that the monthly rate, which is established here under Exhibit 5, in fact, is based on cost studies?

A That is correct.

CHAIRMAN SLAVIN: Thank you.

EXAMINER CADIEUX: Mr. Brady.

MR. BRADY: Mr. Examiner, if I could inquire as to one area.

FURTHER CROSS-EXAMINATION BY MR. BRADY:

Q Did you state you were familiar with this particular tariff as applied to University City?

A I am not specifically. I have not specifically been involved in discussions with University City in regard to these tariffs, if that's your question.

Q No. I'm sorry. I didn't mean that to say that.

You're familiar with the University City lighting system and the problem?

A Not really. We have another witness that perhaps would be much better.

Q All right. Let me ask you this question: Do you understand that there's any question here about maintaining incandescent lighting in the residential areas of

University City?

A I guess I don't understand your question.

Q Isn't it true that the residential areas in University City are involved in a conversion to mercury vapor lights?

A Not to my knowledge. But I don't have specific knowledge of that.

Q Are the sodium bulbs offered for residential areas by UE?

A At the present time, the high pressure sodium fixtures are offered on the municipal tariffs. In other words, if University City contracts with Union Electric to provide lighting on their residential streets, they could, in fact, have high pressure sodium bulbs.

Q Isn't it a fact that these bulbs are not well suited to residential areas because of the very fact they're so bright?

A I'm not aware of that.

MR. BRADY: I have nothing further.

CHAIRMAN SLAVIN: I just have one more while I'm along this line.

FURTHER QUESTIONS BY CHAIRMAN SLAVIN:

Q Under the terms of the stipulation which will move you to a role which is no longer active in incandescent lighting, using Exhibit 5, what would be the cost to a