Transcript of Dr. Richard Brown's Presentation via teleconference
Community Panel Special Meeting
March 3, 2007, 9:00 AM
'Tween Waters Inn
Captiva Florida

Approximately 130 persons present in room with others on listen-only separate conference phone system

Re: Proposed electric and cable wire undergrounding

Moderator Gordon Hullar's intro for Dr. Brown

> Dr. Richard Brown has extensive experience in the power industry. He is Vice President of Operations for Quantum Technology a service company to the power industry. He has published more than 80 technical papers relating to the power system and has written a book on electric power distribution and reliability.

Dr. Brown's Presentation

> I have not studied the Captiva situation in detail. I have just sort of looked over some of the documents but I've been involved with under-grounding and hurricane performance in Florida since really the '04 and '05 hurricanes seasons. I was pretty involved with Florida Power and Light after the hurricane Wilma and since then there has been a utility consortium of essentially all the electric utilities in Florida that are doing a cost of benefit study of under-grounding facilities including non storm and storm effects. I will briefly describe some of the results of that research so far and maybe just a few comments about what may relate to your situation.
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> This under-grounding study had three phases to it. The first phase was a literature review which looked at all of the documents that we could get on under-grounding in the U.S. and around the world to try to see what previous conclusions had been derived and whether any of those may or may not apply to Florida so that we really wouldn't reinvent the wheel. In fact, a lot of these documents were from Florida itself and I'll talk briefly about those in a bit.
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> Phase II was to look at some Florida case studies. These were actual projects that had been placed underground in Florida to look at; what the actual cost were for these projects, what happened to reliability during non-storm, what actually happened to reliability during storms so that we can have some real data to try to predict what the cost and benefits would be for prospective projects.
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> Phase III is ongoing right now. This is actually developing a computer model wherefore potential projects will be entered to some software and it can give you some estimated cost and estimated benefits for under-grounding and involved in that is a pretty detailed hurricane simulation model. In about a month or so, the initial data of the software is going to come out for Phase III.
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> Phase I and Phase II, there have been reports submitted to the Florida Public Service Commission. Some of you may have seen those and those are available on the Florida Public Service Commission website so that you can have access to the details of those reports if you would like to look further on that.
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> In terms of the literature survey, I guess the bottom line of the literature survey is that conversion of an existing overhead to underground is really expensive and that if you were to try to monetize all of the benefits, all of the quantifiable benefits including non storm reliability improvement, storm reliability improvement, public safety, all of these types of things, that it doesn't even really come close to offsetting the cost of under-grounding, which means that the dominant reason that you would want to convert from overhead to underground, except in specific circumstances,

would be for aesthetic reasons. So, most of the money that you are going to be paying for is so that you don't have to look at the overhead wires. There may be some benefits, there may be some disadvantages but that really has been the dominant factor in the vast majority of cases that have been studied. I'm not certain what the situation is on Captiva Island but around the world, that is the conclusion of almost 100% of the literature. In addition, the literature doesn't usually go into some of the disadvantages of under-grounding because if you just consider the benefits without the disadvantages it usually means that you don't go forward with the project.

In terms of actual Florida studies that have been done; there have been studies done for Davis Island, for Fort Pierce, for Jacksonville, for Tallahassee and for Palm Beach. There have also been a couple of overall state of Florida reports going back to 1992 and then recently there has been a report from a municipal consortium called the MUUC report. This is for a specific area but this again tries to monetize some of the benefits as a potential justification for offsetting some of the initial costs. So, there is a lot of stuff out there that has been done and it is certainly a well-vetted problem.

In terms of advantages and disadvantages, a lot has been talked about in terms of reliability. All of these studies pretty much assume new technology underground cable, and so the issue of is this old vintage cable that is going to be a problem for you, none of these studies assume that, they assume that it's the new type of cable that has reasonably high reliability characteristics but for underground systems there are other failure modes such as dig-ins and things that are not related to the technology of the insulation. One of the dominant opinion is of the research is that under-grounding, if you convert a pretty good overhead system to a pretty good underground system that the overall customer reliability doesn't really change that much. What's going to typically happen is you are going to have fewer interruptions that occur but those interruptions are generally going to last longer and so reliability is kind of a wash from that perspective. In terms of operating costs, I think that Willoughby gave a pretty fair representation. If it's an urban area where you have duct banks and vaults then it's much more expensive to maintain and operate those types of systems. When you're in a more residential area it's fairly similar in terms of operating costs. A little bit more to operate the pad mounted equipment perhaps and maybe a little bit less in terms of tree trimming costs.

In terms of the actual case studies that we looked at in Florida, there were four that we selected. One was in Pensacola Beach in the panhandle; this was the conversion of about 2.6 miles of overhead to underground, that is Gulf Power the utility. There was another one in Sand Key, which is sort of in the Tampa/St. Pete area that is Progress Energy in 1996, about 1.8 miles of conversion. There was a residential conversion effort on Allison Island which in the Miami Beach area in 2000 that was just about ½ mile of conversion and then a CO-OP in the panhandle Chelco, they converted about a mile or so on County Road 30A. So, there were four case studies in Florida and I will just briefly give you some of the conclusions for those.

The two longer conversions were both in conjunction with a road widening effort. If you are going to have to take down the overhead system anyway for the roadway widening, then it becomes more cost effective at that point to put it underground. That was two of the projects; those were the Sand Key project and the Pensacola Beach project. Also, often times when you do underground conversion, you put in more underground than you had in original overhead. This is because it does often take longer to fix the underground problem so you will actually build a more robust system perhaps so that you can reconfigure the system and restore some customers before you fix the problem. So when you look at per mile cost estimate, you really need to look at, was it the original amount of overhead or was it based on the new amount of underground that goes in.

Last thing I will say is in terms of reliability performance, most of these actual case studies in Florida, it is really too early to tell but one of the projects that has been in place for over 10 years now in Sand Key, has very good reliability data for non storm conditions before and after and both the frequency in duration and reliability measures were essentially identical so they didn't see any change in non storm reliability. In terms of storm reliability, that was the same project that has

been hit subsequently by a hurricane and it actually got pretty significant storm surge damage in 1997 when a hurricane came through there. So, if you talk to some of the utilities that have been hit by hurricane that are in costal areas, what happens when a hurricane comes in, it will bring in a lot of water, a lot of debris and a lot of sand. It can erode away the underground systems. It can put a lot of sand in your pad-mounted equipment. It can also tear up a lot of equipment and the clean up effort, often times debris will be on top of your pad mounted equipment and the bulldozers will take out equipment. When you are in storm surge areas, typically the utilities that had a lot of experience would actually prefer to have overhead systems. They are much quicker, easier and cheaper to repair after a hurricane event typically than an underground system would be in a coastal area. Inland, this is different; inland underground definitely performs a lot better. On the coastal areas, probably it is worse for you.

In terms of Captiva Island, you are in what is called a Category I storm surge area according to the division of Emergency Management in Florida. This is the second worse storm surge area; a tropical storm would be the worse. That means you are subject to storm surges in tropical storms. You are subject to storm surges in Category I storms or higher. So, that was the overview of the research study that we have been doing so far.

End of Dr. Brown's presentation