A Proposal and Justification for TEP to Underground Kino/Campbell and Absorb the Cost in Order to Continue the Tradition of Protecting Tucson's Gateway Entry from the Airport

1. The problem: The 85-to-110-foot towers and transmission wires planned in TEP's proposal will erect a protracted visual stain running straight through the heart of Tucson and will do so for decades to come. The unsightly string of giant towers and wires will irreparably mar one of the most scenic and travelled roads in Tucson, a unique route that for many people is the actual entryway into the city, declaring to everyone experiencing the affected routes that Tucson has little or no pride in how the community looks. It's the polar opposite of the goal that Tucsonans themselves have expended enormous efforts to achieve, with much success, for decades. Added to this negative visual impact are concerns involving historic neighborhoods, lowered property values affecting homeowners, and possible safety risks. Yet, the community need not have to shoulder these costs. They can all be avoided while staying well within the ACC's and TEP's standard protocol.

2. Approach to a solution that would follow ACC's and TEP's standard protocol: The ACC's regular procedure allows TEP to undertake and absorb costs for capital expenditures that are not "significant", that is, costs that would not require a rate increase. Undergrounding at least five miles of the proposed project from 36th Street to Grant Road, instead of erecting overhead lines, meets that condition. The ACC also accepts, and considers it standard procedure, for public utilities such as TEP to engage in actions in the public interest that incur financial cost, including lowering rates and offering rebates in response to societal needs as well as making philanthropic contributions to the community.

Based on standard accounting, and accepting TEP's own estimates in good faith, the annual expense to TEP for undergrounding five miles would amount to 6/100th of 1% of TEP's $1.4 billion in annual revenues—about $845,000 annually.[1] The expense is barely 1/100th of TEP's current 6.8% rate-increase request.[2] It's not a significant expense relative to TEP's budget by any reasonable definition.

The expense will be still substantially less if, as there is good reason to believe, TEP has over-estimated the cost for undergrounding installation. Judging by APS's recent experience, the expense required might well be only about one-half as large as TEP has projected.

TEP's estimate of undergrounding the project is $9 million per mile, or $11 million with a 20% contingency.[3] This compares to TEP's estimate of $1 million per mile for overhead. Therefore, TEP says that to install lines underground costs eleven times more than overhead. It claims this additional expense requires a special new tax district.

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[1] According to TEP's estimates, the net cost of undergrounding is $10 million per mile, or $50 million over five miles. On an income statement, at the ACC prescribed 1.69% annual rate of transmission asset depreciation, a $50 million project would be expensed at $845,000 annually.
https://www.sec.gov/Archives/edgar/data/100122/000010012220000006/tep10k12312019.htm

[2] https://tucson.com/business/tucson-electric-powers-99-5m-rate-increase-proposal-hits-residential-customers-hardest/article_4897bcfc-83ed-51ee-9c86-e6c1f6cedd01.html

[3] https://www.tep.com/wp-content/uploads/TEP-138-UG-Report-Rev.-0-signed.pdf

There have been two underground transmission projects in Scottsdale in the last few years that were undertaken by APS: 1) a nearly one-mile long project that was funded by a tax district; and, 2) a two-mile long project that was not.[4][5]

Prior to construction, the nearly mile-long undergrounding in Scottsdale was estimated by APS to cost $4 million, without a contingency.[6] It ended up costing only $3 million.[7] This compared to the APS estimate of an overhead cost of $1 million. So, in a real-world example from 90 miles away, undergrounding was only three times more than overhead—and 25% less than APS's original estimate of $4 million. As far as we can tell, the only major difference with our project is 69kV versus 138kV. Both projects are trenched. This will make material costs higher for TEP's project, but construction and labor costs should be similar, and the total therefore should not be anywhere close to TEP's $9-to-$11 million estimate.

Alternatively, APS's actual cost for undergrounding, as mentioned above, was 25% lower than APS's original estimate. If TEP's estimate of $9 million per mile (excluding the contingency) were a similar 25% lower, the real cost would be about $6.75 million per mile.

A 2011 study from the Public Service Commission of Wisconsin puts the price of undergrounding a 138kV XLPE line at $2 million per mile.[8] It also found the overhead cost to be $390,000 per mile, about one-third the $1 million that TEP estimates. Suppose the Wisconsin finding for undergrounding, at $2 million per mile, were similarly one-third the real cost that TEP would incur, then the TEP cost would be $6 million per mile.

From these examples, it is reasonable to project underground costs of $6 million per mile, or $5 million more than overhead – not $11 million per mile, or just half of the $10 million more than overhead.

If the actual cost is half of the original estimate, this would reduce TEP's annual expense to only $422,500 to underground five miles—3/100th of 1% of TEP's annual revenue and barely ½ of 1% of its latest rate-increase request.

There is also important innovation happening in tunneling technology.[9] The Boring Company is currently tunneling 14-foot diameter tunnels in Las Vegas at a cost of less than $10 million per mile, a little beneath the total cost that TEP estimates for its undergrounding. The Company not only bores at a greater depth, thus not disturbing anything above ground or existing utilities, it claims it can bore a mile in a week. This would mean no disturbance to any roads or neighborhoods—a significant cost saving. It may also be able to do a smaller diameter tunnel for even lower cost. The Boring Company's website claims it can provide proposals within a week.

[4] https://www.scottsdaleaz.gov/construction/underground-utility-facilities-improvement-district
[5] https://www.scottsdaleaz.gov/AssetFactory.aspx?did=69969
[6] https://eservices.scottsdaleaz.gov/edmviewer/15115258, Page 54.
[7] https://www.scottsdaleaz.gov/Assets/ScottsdaleAZ/Construction/Underground+Utility+Facilities+Improvement/3-20-2018-city-council-report.pdf
[8] https://psc.wi.gov/Documents/Brochures/Under%20Ground%20Transmission.pdf, Page 17.
[9] https://www.boringcompany.com/products-0

Finally, notably, TEP does not include damage to private property values in its comparison of overhead versus underground. This despite the fact that TEP itself cites studies that show private property devaluation can exceed 10% when within 1,000ft of the proposed right-of-way, especially in urban/suburban environments with overhead lines that fail to blend into the setting or may interfere with future high-density development--such would be the case here for decades to come.[10] It would only be reasonable, then, to include a calculation of these possible damages when comparing overhead to underground. We have done so and find that the damage to property values is considerable, in the many millions of dollars per mile.

For example, if the median residential home sales price is $250,000 (in many of the affected neighborhoods, the median price is 50% higher) and the median lot size of a residential property is 7,000ft2, then the median sales price per residential lot ft2 is $35.71.[11] If property damage occurs up to 1,000ft on each side of the right-of-way, as TEP's own studies suggest, that's a 2,000ft wide corridor of damage. Let's consider what this means for just one mile. There are 5,280ft in a mile. 5,280ft times a 2,000ft-wide corridor of damage = 10,560,000ft2 per mile of possible damage. If we assume that 50% of the possible damage is public property, that leaves us with 5,280,000ft2 of damaged private property. Taking the average value of $35.71 per lot ft2 and assuming 5% in lost value (only *half* the rate in lost value that the TEP-cited study estimates[12]), we get $35.71/ft2 times 5% times 5,280,000ft2 = $9,427,440 in private property damage *per mile*.

TEP has previously commented that these damages disappear within five years. However, the sole study it cites for support does not fit the circumstances here, and its own authors doubt the effect. In that study, an already existing transmission line was upgraded whereas, here, an entirely new transmission line is being installed. The authors of the study themselves go on to say, "[t]hese studies do not isolate variables that could statistically explain why the effects diminish." In fact, other studies the authors reference state, "the [devaluing] effects of being proximate to towers does not diminish over time." In any case, even were some devaluing to disappear over time, substantial costs will be borne in the meanwhile.

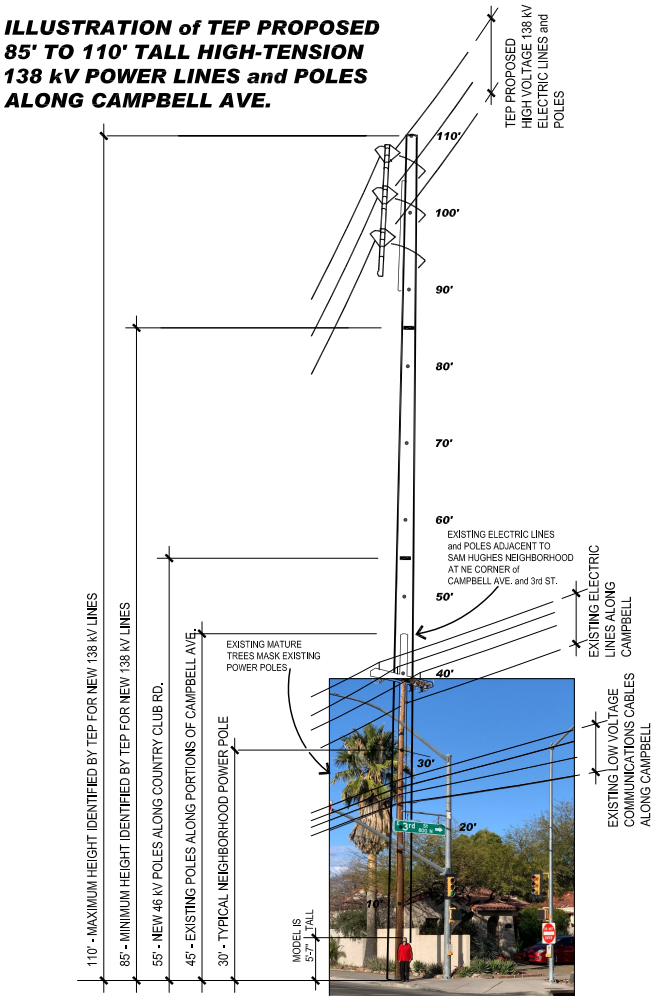
The issue involving damage to property values is not a trivial one. TEP's project is for the benefit of the whole community, and potentially its own earnings, yet it asks us to ignore this possible consequence, going so far as to suggest that those private property owners most likely to be damaged should pay higher taxes to avoid said damage. Taking into account the full range of costs to the community of overhead versus underground, overhead may well be more expensive than underground.

3. <u>Proposed solution:</u> Suppose we accept TEP's estimate of the expense of underground versus overhead. Even stipulating to TEP's estimate of costs, the annual expense would remain a marginal proportion of TEP's annual revenues. TEP also absorbs many costs on its own in order

[10] https://eplanning.blm.gov/eplanning-ui/project/97103/570, Appendix D.
[11] https://www.redfin.com/zipcode/85719/housing-market
[12] e.g. "Bond (1995) (Sims and Dent 2005) reported real estate agents appeared to have a more negative opinion of HVOTLs than appraisers, but both groups estimated a diminution of property values of approximately 10 percent. … An analysis of transaction data for the same location conducted later did find this estimate was reasonably accurate (Bond and Hopkins 2000; Sims and Dent 2005)."

to advance community interests, at least if their programs to assist Tucsonans have any real serious intent. TEP often speaks of its contributions to the community and does so with considerable pride. In a recent announcement, TEP said: "TEP's dedication to service extends beyond providing safe, reliable power. For more than 125 years, we've remained true to our vision of improving the quality of life in the communities we serve. TEP's financial, in-kind and volunteer contributions have significant, measurable impact in our community."[13] TEP goes on to say that it absorbs costs such as these within its established rates.

As part of standard practice, TEP has lowered its rates and engaged in rebates for a wide variety of community interests that intersect with its own business, such as granting rebates for low-income Tucsonans and rebates for improving energy-efficiency in homes. Each of these rebates just mentioned, among others, would cost TEP more than a million dollars yearly if as few as one-tenth of eligible customers enrolled.



Because the annual cost to TEP of undergrounding five miles is not a significant expense within its annual budget and because TEP engages in and funds a number of public-interested actions that intersect with its business interests, we ask for TEP's willingness to absorb the cost of undergrounding in this particular case. The Kino-Campbell corridor is unique in Tucson. The corridor was originally constructed, at a considerable cost, partly because it significantly improved a visitor's first impression of Tucson as the gateway into the city from the airport as well as for the enjoyment of all who travelled the route. As such, it was believed that this new, scenic entryway would support and promote Tucson's economic development and future economic health, surely important to the business interest of TEP. So, equally important for its business interests, is the general climate of community opinion for TEP.[14]

[13] https://www.tep.com/investing-in-our-community/

[14] Recently, UMC Banner expressed its opinion that "[g]iven the information [TEP has] provided on the cost prohibitive option of burying the high-voltage transmission lines and the difficulty in gaining access for maintenance and repairs, we do ask that any overhead transmission line routes that come within three blocks of the Banner – University Medical Center campus, be equipped with safety lights on the top of the poles, along with reflective markers." In our view, this statement suggests UMC Banner's clear preference for undergrounding were it not for the "prohibitive" problems cited by TEP. We believe numerous other Tucsonans and institutions feel the same.

Undergrounding would align with these long-term economic interests as compared to the unsightly effects that a string of 85-110-foot tall towers and transmission lines would otherwise have on this singular route (see, just above, on Page 4, an illustration from ground view of a tower at the intersection of Campbell Avenue and 3rd Street, immediately across from the main entrance into the University of Arizona; now imagine these high towers and wires in a line extending over five miles of the route we've described). In addition, undergrounding the lines would avoid the destructive impact of an overhead installation on property values, which is likely to be considerable, on historic neighborhoods in the path of the corridor, and reduce safety concerns around residential areas and the University hospital.

4. Maintenance Issues: TEP has expressed the view that undergrounding as a solution brings difficult maintenance problems that create greater maintenance costs. With overhead lines, if there's an outage, the downtime is figured in hours. If the lines are underground, it requires tearing up a street. Repairs take days and become extremely expensive. The impression left is that both the maintenance problems and the costs they involve render undergrounding of the lines prohibitive.

The TEP engineer's report on undergrounding, however, indicates otherwise.[3] Two of the five conduits the report plans to install are spare ones. One of those conduits will contain a spare XLPE wire, meaning that the spare can be used as a replacement while repairs are made on the damaged wire such that down time is comparable to overhead. Furthermore, as a segment of a loop with power flowing from both directions, a power failure at one point will not result in an outage. The TEP plan also calls for man vaults every 2,000 feet to enable repairs from the vaults themselves so that most repairs should not require any tearing up of streets.[15] Only a very rare failure is not repairable from a vault and, such a failure would be covered by the redundant conduits.

Even the most common repairs are infrequent. The previously referenced report from Public Service Commission of Wisconsin indicates from examining trouble rates that the risk of the most common repair involved with underground XLPE wires occurs, at the most, at a 1-in-1000 chance per mile per year.[8] A failure that would take down the underground transmission line for a lengthy period of time would require something rare to happen in three conduits simultaneously such that the two spare conduits would be insufficient. While TEP could add a third spare conduit, by our math, given the redundant wires and conduit, such an event has over a 1 in 1 billion chance of happening in any given year per mile.[16]

It deserves mention as well, from the standpoint of practical experience, that when Scottsdale and APS agreed to underground lines, costs of maintenance as compared to overhead lines were considered insignificant enough that they were excluded from the agreement. Examining expenses for maintenance, a Virginia Commission found that the difference in cost between maintaining overhead and underground lines averages to $5,200 per year per mile.[17] *It isn't as if*

[15] TEP's report also includes 2,100ft of spare cable to be kept on a reel in case of a rare failure.
[16] 1:(1,000*1,000*1,000) = 1:1,000,000,000. And this math is using the odds of a common repair. A failure that takes down an entire conduit is much rarer than 1:1,000.
[17] $1,970,000 / 5 miles / 70 years = $5,629; $138,000 / 5 miles / 70 years = $394; $5,629 - $394 = $5,235/mile/year; http://dls.virginia.gov/commission/pdf/Dominion071905.pdf

undergrounding is an uncommon way for cities and utilities to handle the installation of new transmission lines.

An alternative solution also exists, which is to create an always-available, fully accessible tunnel. This alternative can be done at cost within range of TEP's estimate for the cost of installing underground wires. Such a solution would likely *reduce* any maintenance costs because the costs would be similar to overhead maintenance but there would be below-ground protection from storms, other weather conditions, and road accidents. It would avoid any street closures resulting from maintenance issues, as well, which occur even with overhead lines, and would be available for multiple utilities.

Based on TEP's own engineering report, on the Wisconsin study, on the Virginia report, and on the experience of APS in Scottsdale, we question much of what TEP claims regarding the many prohibitive problems and costs involved in maintaining underground transmission lines. If we are correct, the problems are solvable and the costs are not prohibitive but instead can be fairly absorbed. In addition, there is a tunneling alternative, which also resolves the problems at a reasonably absorbable cost.

5. Justification for the solution: The solution that we are proposing falls within normal procedures of both TEP and the ACC. With regard to the unique Kino-Campbell corridor, the solution asks TEP to incur a marginal cost for a substantial community benefit that intersects with TEP's long-term economic interest, a cost in line with potential TEP costs devoted to promoting other intersecting community interests. It is a cost not likely substantially different than the cost private owners nearby the new overhead lines may bear in reduced property values. We add that the solution is also fully in keeping with the *US Business Roundtable's* own pronouncement of just one year ago, backed now by CEOs of more than 200 of America's leading companies.[18] The pronouncement affirms that shareholder value should no longer be the sole proper goal for businesses in their economic decisions because the nation's welfare is not fully served on that basis alone. Companies should also commit to serving the interests of other stakeholders as well, such as workers, customers, and the communities in which they reside, as part of their bottom line.

6. Additional issues: Of course, there are issues involved beyond those raised by TEP. The City of Tucson might have objections to undergrounding for other practical reasons. For example, the City of Tucson could have objections to undergrounding along the Campbell corridor on grounds that closing the route while construction is underway would create a serious traffic problem. Campbell is a heavily travelled route and a main entrance to the University, itself a major traffic draw during rush hours.

TEP has raised this potential objection, but its own study indicates that the trench work would require 20 feet width of working room. Trenching would be completed in sections. Campbell Avenue is wide enough to accommodate this work, six lanes plus a median for a total width approaching 80 feet, not including another 10-15 feet on the University side of Campbell.

[18] https://www.inc.com/peter-gasca/in-this-single-statement-ceos-from-largest-us-corporations-just-changed-purpose-of-business.html

In addition, the developments occurring in tunneling technology described above could offer another option that would keep traffic on Campbell Avenue completely unencumbered. It could also serve as an always-accessible route shared by multiple utilities, helping to defray cost.