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4. GTE's Cost Models and Studies

Model Methodology, Design, and Operation

Q. Please elaborate upon the first of your general criticisms of GTE's models. Why should a model be integrated and open to inspection?

A. Unless a model is fully "open" to inspection, regulators and other parties cannot thoroughly study the inner workings of the model, and it will be difficult or impossible to fully audit studies that are produced by the model. Unless the various computer programs or "models" are directly linked or integrated, it is considerably more difficult and time consuming to create alternative versions of the cost studies, to test the impact of different assumptions, or to test the validity of the algorithms within the models. These two problems with GTE's cost models are closely related, since they have a compounding effect that makes it extremely difficult for other parties to identify errors in the GTE studies, or to demonstrate the impact of correcting these errors.

GTE is relying on models which have many of the characteristics of a "black box." They incorporate assumptions that are not always readily accessible, they rely upon algorithms which cannot be seen or critiqued, and they are not fully integrated with each other, so other parties have greater difficulty learning or operating the models. As a result, the parties cannot thoroughly review or comment on the cost studies submitted by GTE in this proceeding

Q. Have similar problems arisen in other states?

A. Yes. Other state regulatory jurisdictions have also encountered problems trying to evaluate cost studies where the workpapers and documentation were not complete, or a "black box" model has been relied upon. As a result, some states have imposed

1 minimum filing requirements in an effort to ensure that studies can be adequately
2 reviewed and evaluated. The best example that I am familiar with is contained in the
3 costing and pricing rules adopted by the Colorado Public Utilities Commission, which I
4 have attached to my testimony as Appendix C. These rules were adopted by the
5 Colorado Public Utilities Commission on June 1, 1993. [Statement of Adoption of
6 Rules, Docket No. 92R-596T].
7

8 **Q. How do GTE's filed cost studies and subsequent responses to discovery**
9 **compare with the documentation requirements contained in the Colorado rules?**

10 A. While one would not expect the Company to comply in this case with rules imposed in
11 another jurisdiction, it is worth noting that there is a wide gap between the materials
12 submitted by the Company in this proceeding and the minimum requirements imposed
13 on LECs in Colorado. For example, Colorado Rule (3) (a) requires that

14
15 When a provider submits a cost estimate to the commission, it must
16 simultaneously file a complete set of supporting workpapers... (emphasis
17 added)
18

19 The Company's initial filing and subsequent responses to discovery in this case fall well
20 short of this benchmark. They initially provided few, if any, of the computations and
21 algorithms used to create their cost estimates. In the absence of the actual algorithms
22 used in deriving a cost estimate, it is critical to at least provide an explanation of the
23 algorithms, so that other parties can gain a detailed understanding of the methodology.
24 It appears that the documentation provided to us a few days before the extended
25 pre-filing deadline for this testimony may contain explanations of some of the algorithms.
26 Having arrived so late in the proceeding, however, this was certainly not sufficient to
27 overcome the inadequacies of the initial responses to discovery. Furthermore, the

1 materials provided in response to discovery fell short of the following benchmark, from
2 Colorado Rule (3) (d):

3
4 [T]he workpapers must be organized so that a person unfamiliar with the study
5 will be able to work from the initial investment, expense, and demand data to
6 the final cost estimate.
7

8 Colorado rule (3) (b) contains another useful point of comparison:

9
10 These workpapers must allow others to replicate the methodology and
11 calculate equivalent or alternative results using equivalent or alternative
12 assumptions...
13

14 While in some cases I found it was possible to trace numbers from one page to
15 the next, I could not work all the way from the initial inputs to the final loop cost
16 estimate--particularly without the benefit of adequate documentation. The lack of
17 formulas or algorithms, as well as the absence of detailed printouts of calculations
18 prevented me from replicating the methodology, or determining the impact of a change
19 in assumptions. I'm not sure it would even be possible to test the impact of various
20 underlying assumptions using the limited information provided by the Company.
21 Certainly, it would be extremely time consuming since the models were not integrated
22 with each other.
23

24 **Q. GTE's cost filing was quite lengthy. Can you give some examples of specific**
25 **inadequacies in the filing?**

26 A. Yes. In support of its cost estimates, GTE filed its cost studies and "supplemental
27 materials". Together, these documents totaled 3,443 pages of data. Based on the sheer
28 volume of material, one could get the impression that the studies were exhaustively
29 documented. However, many of the key assumptions were missing or were difficult to

1 locate. For instance, my staff was unable to locate GTE's assumptions regarding cost of
2 capital and capital structure within this mountain of paper, so we sent a data request
3 asking where these key input assumptions could be found. In response, we were
4 informed that "the information is not contained in GTE's cost study filing" and instead
5 GTE provided these key assumptions in their response to the Data Request. [GTE
6 response to OUC Data Request No. 20.]

7 GTE gave similar responses to many other requests, indicating that key
8 assumptions were not available in its cost study filing, including those concerning
9 depreciation lives, plant specific charges, and investment costs for electronics and cable
10 costs. [See, e.g., Responses to OUC Data Request Nos. 20f, 20g, 20i, 20k and 20l.]
11 In most instances, the information was provided upon request, in response to specific
12 Data Requests, but it was not available with the original filing. As a result, the amount of
13 time available for analyzing the GTE cost filing, was severely reduced. The last of the
14 discovery responses was received on September 10, little more than two weeks before
15 this testimony was due to be prefiled with the Commission.

16
17 **Q. You've been critical of the GTE models for not being sufficiently disclosed to**
18 **other parties. Are other cost models more "open" than the ones used by GTE?**

19 A. Yes. Three examples of "open" models are BCPM, submitted to the FCC by U.S.
20 West, BellSouth and the local exchange operations of Sprint, the Hatfield Model,
21 submitted to the FCC and many state jurisdictions by AT&T and MCI, and our
22 Telecom Economic Cost Model, which I will discuss later. The algorithms within all
23 three of these models are open for inspection. With these "glass box" models, a user
24 can view algorithms and formulas and trace all the way from the input data to the output
25 values, thereby gaining a much more complete and precise understanding of the model.

26 With these types of models, because they are integrated and open, other parties
27 have a much greater opportunity to fully understand each others' cost estimates, to

1 critique each other's cost studies, and to readily demonstrate how the cost estimates
2 vary when key assumptions or inputs are changed. With all three of these "glass box"
3 models, the parties are given access to most, if not all, of the underlying algorithms, and
4 they are given a full opportunity to thoroughly study the model, to verify the
5 reasonableness of the results, and to compute alternative results which reflect any
6 differences in philosophy or opinion concerning key issues.

7 Furthermore, these models use public data, thereby reducing or eliminating
8 confidentiality concerns and the cumbersome restrictions that apply to the use of
9 proprietary data. In contrast, the GTE cost studies are provided under the terms of
10 stringent proprietary agreements which make it difficult to work with the models. For
11 example, we cannot directly use results obtained in one jurisdiction or proceeding for
12 purposes of a critique or comparison in another jurisdiction or proceeding. Due to these
13 proprietary restrictions, one is discouraged or precluded from making comparisons
14 between the results of different studies and different assumptions. Analysts are
15 discouraged from undertaking such experimentation, since the results obtained in one
16 proceeding cannot be used in other proceedings. Moreover, because the GTE models
17 are not integrated, it would be time consuming to experiment with the inputs, and an
18 outside analyst cannot be completely confident that the resulting outputs are directly
19 comparable to those submitted by the Company. Whether intentional or not, the lack of
20 integration and the presence of proprietary restrictions make it more difficult for the
21 parties to gain a solid understanding of the models, and they make it harder for the
22 Commission to gain perspective on the validity, or lack of validity, of particular cost
23 estimates.

1 **Q. Why are models such as GTE’s subject to stringent proprietary restrictions if**
2 **one cannot study the underlying algorithms?**

3 A. This is a question best asked of GTE. However, it is my understanding that one of the
4 justifications for these restrictions is that developers of this software fear that a greater
5 level of disclosure would reduce the value of their intellectual property. This fear strikes
6 me as unfounded. Given sufficient time, which could involve months of effort, I suppose
7 a persistent analyst might engage in some form of “reverse engineering” in order to
8 guess at what is happening inside these black boxes. However, I am not convinced of
9 the need to protect software that in some ways is less sophisticated, and more
10 simplistic, than the glass box models which are publicly available. Furthermore, I
11 question whether any competing software developers would find the required effort to
12 reverse engineer the GTE models to be economically justified, given the limited market
13 for such models. If a competing software developer wanted to go after this market, that
14 competitor’s time would be better spent on an independent design effort (without
15 extensive resort to reverse engineering and mimicry), since this would provide a higher
16 level of market credibility, and would make it easier to provide new and different
17 features and functions.

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