PUBLIC SERVICE COMMISSION

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May 22, 1998

RECEIVED

Office of the Secretary
Federal Communications Commission
1919 M Street NW, Room 222
Washington DC 20554

Sheryl Todd
Federal Communications Commission
Universal Service Branch
CC Docket No. 96-45
2100 M Street NW, 8th Floor
Washington, DC 20554

RE: CC Docket Nos. 96-45 and 97-160
State Forward-Looking Cost Studies for Federal Universal Service Support

To Whom it May Concern:

Please accept the Montana Public Service Commission's (MPSC's) cost study submission which consists of three diskettes, a paper copy of the MPSC's Final Order in D97.9.167 (the MPSC's proceeding to determine a cost model for federal universal service support for Montana), and the attachments to the MPSC's order. The attachments to the order are the materials provided on the diskettes--the text document, inputs, and outputs. The MPSC's order analyzes the cost models and provides further reasoning to support its choice of a cost model.

Please return a conformed copy of this letter. I have enclosed a self-addressed stamped envelope for your convenience.

Sincerely,

Karen Hammel

Karen Finstad Hammel
Staff Attorney

KH/rjs
Enclosures

DOCKET FILE COPY ORIGINAL

BEFORE THE
FEDERAL COMMUNICATIONS COMMISSION
WASHINGTON, D.C. 20554

In the Matter of	)	
Federal-State Joint Board	)	CC Docket No. 96-45
on Universal Service	)	

COST MODEL SUBMISSION OF THE
MONTANA PUBLIC SERVICE COMMISSION

The Montana Public Service Commission (MPSC) has chosen the Benchmark Cost Proxy Model (BCPM) 3.1 for purposes of computing the amount of federal universal service funding for Montana. The MPSC considered two proxy cost models--the BCPM 3.1 and the HAI 5.0a. As explained in detail in Order No. 6015b, the Final Order in MPSC Docket No. D97.9.167, the MPSC believes that the results of the BCPM 3.1 more accurately reflect Montana's unique characteristics, such as its mountainous terrain, low population density, and large geographic area.

The MPSC's Final Order is hereby incorporated in this filing. It includes the three attachments which the Federal Communications Commission (FCC) has required be submitted by states with their choice of a proxy cost model. Attachment "a" to the Final Order is the text document required by the FCC which answers the FCC's questions in the prescribed format. Attachment "b" includes the inputs for Montana; Attachment "c" includes the outputs.

Respectfully submitted this 22nd day of May, 1998.

Montana Public Service Commission
1701 Prospect Avenue
P.O. Box 202601
Helena MT 59620-2601

KAREN FINSTAD HAMMEL
STAFF ATTORNEY

CERTIFICATE OF SERVICE

I hereby certify that a copy of the Cost Model Submission of the Montana Public Service Commission, CC Docket No. 96-45, has today been served on the Secretary of the Federal Communications Commission and Sheryl Todd at the Federal Communications Commission.

Date: May 22, 1998

Karen Hammel
For the Commission

Service Date: May 26, 1998

DEPARTMENT OF PUBLIC SERVICE REGULATION
BEFORE THE PUBLIC SERVICE COMMISSION
OF THE STATE OF MONTANA

* * * * *

IN THE MATTER of the Investigation of the Commission Implementation of a Forward Looking Universal Service Cost Model.	))))	UTILITY DIVISION DOCKET NO. D97.9.167 ORDER NO. 6015b

FINAL ORDER

APPEARANCES

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BEFORE:

DAVE FISHER, Chairman
NANCY MCCAFFREE, Vice Chair
DANNY OBERG, Commissioner
BOB ROWE, Commissioner

COMMISSION STAFF:

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Mike Lee, Economics and Rate Design Bureau Chief
Scott Fabel and Wendy Fuller, Rate Analysts

TABLE OF CONTENTS

I. BACKGROUND

A. Introduction

1. On May 8, 1997, the Federal Communications Commission (FCC) released a Report and Order in CC Docket No. 96-45 (Universal Service Order) pursuant to § 254 of the Telecommunications Act of 1996, Pub. L. No. 104-104, 110 Stat. 56 (Feb. 8, 1996) (the "1996 Act"). The FCC's Universal Service Order requested that states elect by August 15, 1997, whether they would conduct their own forward-looking economic cost studies for the purpose of determining federal universal service support for non-rural eligible carriers. The Montana Public Service Commission (Commission) initiated this Docket in September 1997 to determine an appropriate cost model for federal universal service purposes, after notifying the FCC prior to the deadline that it intended to choose its own cost model rather than adopt the FCC's model. The original deadline for states to submit a cost model to the FCC was February 6, 1998; the FCC extended this deadline to April 24, 1998, and subsequently extended it again to May 26, 1998.

2. Intervention was granted to the following: U S WEST Communications, Inc. (U S WEST), AT&T Communications of the Mountain States, Inc. (AT&T), MCI Telecommunications Corp. (MCI), Sprint Communications Company L.P., the Montana Telephone Association (MTA), Montana Independent Telecommunications Systems (MITS), Ronan Telephone Company, Hot Springs Telephone Company, Citizens Telecommunications Company of Montana, and the Montana Consumer Counsel.

3. U S WEST submitted one of the two proposed proxy cost models presented to the Commission. U S WEST's model is the Benchmark Cost Proxy Model (BCPM). AT&T and

MCI jointly filed the Hatfield model. Both models underwent numerous changes and upgrades; the final models considered were the BCPM 3.1 and the HAI 5.0a.[1]

4. The Commission conducted a hearing on March 10-11, 1998. Witnesses for U S WEST, AT&T and MCI pre-filed testimony and were available for cross-examination. No other parties presented witnesses.

B. The Telecommunications Act of 1996

5. The 1996 Act amends the Communications Act of 1934, 47 U.S.C. §§ 151 *et seq.* In the 1996 Act, Congress directed the FCC and states to establish support mechanisms "to ensure the delivery of affordable telecommunications service to all Americans, including low-income consumers, eligible schools and libraries, and rural health care providers." Universal Service Order, ¶ 1. Specifically, the Congress directed the FCC and states to devise methods to ensure that

> [c]onsumers in all regions of the Nation, including low-income consumers and those in rural, insular, and high cost areas . . . have access to telecommunications and information services, including interexchange services and advanced telecommunications and information services, that are reasonably comparable to those services provided in urban areas and that are available at rates that are reasonably comparable to rates charged for similar services in urban areas.

6. Congress further directed the FCC to institute and refer to a Federal-State Joint Board under 47 U.S.C. § 410(c) a proceeding to recommend changes to any of the FCC's regulations in order to implement 47 U.S.C. §§ 214(e) and 254, including a definition of services to be supported by federal universal service support. 47 U.S.C. § 254(a)(1). The Joint Board

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[1]The HAI 5.0a survived through numerous revisions known as the Hatfield model; the name was changed with the final revision.

was required to make its recommendations to the FCC nine months after the date of enactment of the 1996 Act.

7. The Joint Board issued a Recommended Decision as required by the 1996 Act on November 8, 1996. *See* In the Matter of Federal-State Board on Universal Service, Recommended Decision, CC Docket No. 96-45, 12 F.C.C.R. 87 (1996). Congress further required that the FCC initiate a single proceeding to implement the Joint Board recommendations and complete its proceeding within 15 months of the effective date of the 1996 Act. Congress required the FCC to adopt rules in the universal service proceeding, including a definition of the services that are supported by the federal universal service support mechanisms and to adopt a specific timetable for implementation. 47 U.S.C. § 254(a)(2).

C. The FCC Universal Service Order

8. The FCC issued its Universal Service Order on May 8, 1997. In the Universal Service Order the FCC adopted a principle recommended by the Joint Board in addition to the six principles prescribed by Congress in § 254(b) of the 1996 Act for the "protection of the public interest, convenience, and necessity." Consistent with the Joint Board's recommendation, the FCC adopted the principles identified in § 254(b) and the additional principle of competitive neutrality. *See* Universal Service Order, at ¶ 43. The principle of competitive neutrality includes technological neutrality. Id. at ¶ 49.

9. In the Universal Service Order, the FCC also defines "universal service" and what services are to be supported. *See* Id., at ¶¶ 56-87. The FCC also addressed eligible carrier designation, high cost support, support for low-income consumers, subscriber line charges, carrier common line charges, administration of support mechanisms, and support for schools,

libraries and health care providers. The FCC expressly did not establish a nationwide affordability rate because "a nationwide rate would ignore the vast differences within and among regions that can affect what constitutes affordable service." Universal Service Order, at ¶ 111.

10. The FCC's Universal Service Order prescribes the following ten criteria which a state-conducted study must meet in order to be approved for use in calculating federal universal service support:

> 1. The technology assumed in the study or model must be the least-cost, most-efficient, and reasonable technology for providing the supported services that is currently being deployed. The model must include the incumbent local exchange companies' (ILECs) wire centers as the center of the loop network; the outside plant should terminate at the ILECs' current wire centers. The loop design should not impede the provision of advanced services. Wire center line counts should equal actual ILEC wire center line counts. Average loop length should reflect the ILECs' actual average loop length.
>
> 2. Any network function or element, such as loop, switching, transport, or signaling, necessary to produce supported services must have an associated cost.
>
> 3. Only long-run, forward-looking economic costs may be included. The long-run period must be long enough that all costs may be treated as variable and avoidable. The costs must not be the embedded cost of the facilities, functions, or elements. The study or model must be based on an examination of the current cost of purchasing facilities and equipment rather than list prices.
>
> 4. The rate of return must be either the authorized federal rate of return on interstate services, currently 11.25%, or the state's prescribed rate of return for intrastate services.
>
> 5. Economic lives and future net salvage percentages used in calculating depreciation expense must be within the FCC-authorized range.
>
> 6. The cost study or model must estimate the cost of providing service for all businesses and households within a geographic area, including the provision of multi-line business services, special access, private lines, and multiple residential lines.

7. A reasonable allocation of joint and common costs must be assigned to the cost of supported services.

8. The cost study or model and all underlying data, formulae, computations, and software associated with the model must be available to all interested parties for review and comment. All underlying data should be verifiable, engineering assumptions reasonable, and outputs plausible.

9. The cost study or model must include the capability to examine and modify the critical assumptions and engineering principles.

10. The cost study or model must deaverage support calculations to the wire center serving area level at least and, if feasible, to even smaller areas such as Census Block Group, Census Block, or grid cell.

D. Senate Bill 89 Enacted by the 1997 Montana Legislature

11. The FCC also stated that the cost model must be the same model that is used by the state to determine intrastate universal service support levels pursuant to § 254(f) of the 1996 Act. The 1997 Montana Legislature passed Senate Bill 89, codified in Title 69 of the Montana Code Annotated. *See* 1997 Mont. Laws 1621. Sections 69-3-845(6) and (7), MCA (1997), provide that if the Commission chooses a cost proxy model for non-rural companies and rural companies that elect to use the model pursuant to § 69-3-845, MCA, it must use a model that:

(a) targets support to a geographic area smaller than a wire center;
(b) uses acceptable outside plant design and costing principles;
(c) uses reasonable switch design and costing principles;
(d) includes a reasonable share of the joint and common costs of the telecommunications carrier;
(e) meets standards for documenting model logic and the sources of cost data input; and
(f) meets reasonableness tests to ensure that model outputs are representative of costs that can be reasonably expected in the construction of a network and that the network is capable of providing telecommunications services that meet the telecommunications services quality standards of the commission and federal regulators.

The FCC's Universal Service Order allows rural carriers to use embedded costs until it determines that forward looking economic cost mechanisms account reasonably for the cost difference in rural study areas. Section 69-3-845, MCA, does not conflict with this.

12. On February 27, 1998, the FCC released a Public Notice setting forth the information it needs to determine whether a state's cost study complies with the ten criteria listed above and the format in which this information should be presented. This information is formatted according to the FCC's direction and included in appendices to this Order.

II. PROXY COST MODELS

A. Model Choices

13. The Montana Commission had two initial choices in selecting the method by which universal service funding levels would be determined. The Commission could (1) choose a proxy cost model and recommend its use for the State of Montana, or (2) elect not to choose a model, with the consequence that the FCC would then pick the model and its inputs for federal funding of universal service for Montana. The FCC would then estimate the federal universal service fund costs for Montana's non-rural carrier, U S WEST. In August 1997 the Commission notified the FCC of its intention to choose a proxy cost model and recommend its use for Montana, and subsequently opened this Docket for that purpose.

14. If after its evaluation the FCC accepts Montana's recommended forward looking economic cost model, the FCC will use that model to develop, in part, the universal service funding level for U S WEST, Montana's non-rural carrier. If Montana's recommendation is not accepted, the FCC will determine the cost to provide universal service funding according to its forward-looking economic cost methodology. At this time, the FCC has committed to fund only

25 percent of the total universal service funding required by a state, regardless of the model selected. The FCC is presently reconsidering its decision to fund 25 percent of the total universal service funding.

15. The Montana Commission was presented two models for consideration in this docket. The Benchmark Cost Proxy Model (BCPM) 2.5, jointly sponsored by U S WEST, Sprint, Indetec, and Pacific Bell, was presented to the Commission by U S WEST on December 24, 1997. Version BCPM 3.1, using Montana specific data, was subsequently submitted on January 27, 1998. The Hatfield Model 5.0 (now called the HAI Model), sponsored by AT&T and MCI, was presented to the Commission on December 31, 1997 by AT&T. Subsequently, version 5.0a was submitted on February 13, 1998. The FCC has reviewed both models in CC Docket No. 96-45.

16. Proxy cost models, such as the BCPM and HAI, are designed to estimate the incremental costs of telecommunications providers without representing the costs of any particular provider. Costs are estimated using forward-looking technology, long and short run costs, and economic costs rather than accounting costs. This means that estimates should not reflect embedded technologies and costs. Hutsell Direct, pp. 6-8. Both proxy cost models submitted incorporate certain characteristics required by the FCC. These characteristics are discussed in more detail in the model criteria section of this order.

17. The proxy cost models submitted are designed to estimate costs of providing service to geographically specific areas in order to identify high cost areas. Once high cost areas are known, universal support levels can be estimated. This high level of geographic disaggregation allows universal support funding to be appropriately directed to high cost areas.

Implicit cross subsidies that have traditionally supported the universal service ideal can thereby be made explicit. Hayhurst Direct, p. 2. This allows high cost areas to maintain service and affordability as competition moves rates toward true costs.

18. Although the recommended proxy cost model initially impacts the level of the federal universal service funding for Montana's non-rural carrier, this choice has a secondary effect. This choice obligates the Commission to use the same model for any state universal service fund.

19. The BCPM and HAI have many common features, largely due to the requirements for a proper proxy cost model put forth by the FCC (discussed below). For example, both models build a hypothetical telecommunications network that provides basic voice-grade service with access to advanced services. They are to use forward-looking technology in a competitively neutral manner to estimate the support needed to provide affordable service in high-cost areas.

20. In addition, both models assume all plant is placed at a single point in time, as if the entire region is a new service area--the so-called scorched node approach. Although it is assumed that there is no existing plant, proxy cost models also assume that plant will have to be placed through existing neighborhoods, including sidewalks, roads, and fences. Copeland Direct, p. 27. These assumptions result in cost estimates to build plant in existing conditions using current technologies.

21. Both models also use residential census data, business data, terrain information, and approximately one thousand inputs in designing their networks. The models rely heavily on preprocessing functions to construct major inputs into the model, including determining customer location and developing population groupings. In addition, both models organize plant

characteristics into nine density groups, which are based on population and terrain characteristics. Copeland Direct, p. 5.

22. Although both the BCPM and HAI are designed to estimate incremental costs of providing service to all areas, there are significant differences in their methodologies, assumptions, algorithms, and input values. Their outputs differ markedly as a result. In order to better show these differences, a brief outline is provided below of each model, its history, methodologies, default input sources, and outputs for Montana.

B. Benchmark Cost Proxy Model (BCPM)

23. Mr. Peter Copeland presented the BCPM 3.1 on behalf of U S WEST. He testified that the BCPM has evolved considerably since its beginnings. It has undergone extensive review and revision that reflects FCC requirements, criticism by competitors, and/or suggestions made by the model sponsors. The BCPM estimates universal service funding requirements to provide affordable basic local service to high-cost areas. Copeland Direct, p. 3. It applies a uniform methodology and generic forward-looking technology to a hypothetical network for discrete geographic areas. This allows universal service funds to be targeted to specific high-cost areas.

24. The BCPM estimates costs using a series of modules. These modules represent the various sub-systems pertinent to the design and costing of a forward looking telecommunications network. These modules include a preprocessor, outside plant, switch, transport, signaling, capital cost, operating expense, and report. Copeland Supplemental, Exhibit PBC-10, p. 20.

25. An important feature of the BCPM 3.1 is the customer location methodology in the Preprocessor Module. The Preprocessor Module formats raw input data for use by the BCPM. It identifies customer locations within wire centers and builds a grid system that estimates costs to a smaller than wire center area. It also designs the feeder plant routes used to create the distribution cable system. Copeland Supplemental, Exhibit PBC-10, p. 20.

26. Copeland explained how the BCPM locates its customers. It uses census data at the census block level and wire center boundaries provided by Business Location Research to determine customer location. Copeland Direct, p. 18. Wire centers are overlaid with microgrids, 1/200th of a degree latitude and longitude in size. These grids are then aggregated based on cost characteristics (using terrain characteristics), line counts, and engineering constraints of Carrier Serving Areas and Distribution Areas. Copeland called the resulting dynamic grids ultimate grids.[2] Copeland Direct, p. 20. The household and business line count of the composite ultimate grids equals the sum of the household and business lines for the associated underlying micrогrids. Copeland divided the ultimate grids into quadrants, based on the road centroid of the grid. He discarded empty quadrants and estimated the road area within 500 feet of roads in each quadrant, thereby establishing a square distribution area equal to the total area estimated. Copeland Direct, p. 22. The households within the grid are then equally distributed throughout the estimated area and plant is built to these locations.

27. The Outside Plant Module designs and costs the distribution cable system. Copeland Supplemental, Exhibit PBC-10, p. 20. Plant costs are estimated assuming a maximum

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[2]These grids are dynamic in the sense that their size and shape are not predetermined but vary in size depending on terrain, customer density, and engineering constraints.

loop length for each Carrier Service Area less than 12,000 feet, and ultimate grid size is usually restricted to a maximum size of approximately 1/25th of a degree latitude and longitude.[3] Copeland Supplemental, Exhibit PBC-10, p. 27. Main feeder radiates from the wire center on direct north, east, south, and west axes for 10,000 feet. Feeder then is directed toward population centers. Internal tests ensure that the least cost network is built. Copeland Supplemental, Exhibit PBC-10, p. 36. Subfeeder routes are then designed. Where appropriate, subfeeder is shared by more than one ultimate grid. The equipment used, including cable type, is determined by engineering constraints and by density group. Copeland Supplemental, Exhibit PBC-10, p. 40. Each quadrant of an ultimate grid represents a potential Distribution Area. Distribution quadrant customer data are then put into the distribution algorithms for cable design, maintaining engineering constraints. In addition, the model allows the user to cap the maximum loop investment. This cap allows less expensive technologies to substitute for traditional phone service.[4] Copeland Supplemental, Exhibit PBC-10, p. 47.

28. The Switch Module designs and costs the digital host, remote, and stand alone switches based on the actual in-place network. Copeland Supplemental, Exhibit PBC-10, p. 20. The BCPM 3.1 includes many improvements in this model over previous versions. It more accurately identifies the portions of investment that supports universal service by calculating

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[3] Occasionally, ultimate grids exceed this restriction in order to accommodate isolated grids. In these instances cable gauge is adjusted to allow distribution cable lengths up to 18,000 feet.

[4] The investment cap does not assume that there exists a more cost effective method of servicing extremely long loops. Rather the assumption is that there is a point at which cost will exceed benefit in providing basic service. Hutsell Direct, p. 12.

switching investments in several switch functional categories. Inputs can be entered at a state-wide or wire center level. Copeland Supplemental, p. 3.

29. The Transport Module designs and costs the SONET interoffice transport system.[5] Copeland Supplemental, Exhibit PBC-10, p. 20. Forward-looking transport costs are developed using information on existing interoffice traffic routing relationships between switches. Individual switches on a SONET ring can have costs assigned to them based on their unique characteristics. Copeland Supplemental, Exhibit PBC-10, p. 67. Monthly costs for transport by exchange are determined.

30. The Signaling Module designs and costs a modern SS7 signaling system. Copeland Supplemental, Exhibit PBC-10, p. 20. The Signaling Cost Proxy Module provides a table of inputs for signaling investments for residence and business lines for small, medium and large companies. This is a new feature in BCPM 3.1. Previous versions of BCPM included signaling costs in the switch investment module. Copeland Supplemental, Exhibit PBC-10, p. 76.

31. The Capital Costs Module develops depreciation, rate of return, and tax factors and applies them to the investment accounts to produce the capital cost. Copeland Supplemental, Exhibit PBC-10, p. 20. The model allows different economic lives, salvage values, costs of removal, tax lives, and survival curves to be applied to the major accounts separately. Copeland Supplemental, Exhibit PBC-10, p. 80.

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[5]Synchronous optical network (SONET) is a set of standards for fiber optic transmission and is an example of a forward-looking technology used by the models.

32. The Operating Expense Module determines the annual costs of providing universal service. Copeland Supplemental, Exhibit PBC-10, p. 20. For the most part simple multipliers are applied to investment estimations to determine expense per dollar of investment or expense per access line amounts.[6] Copeland Supplemental, Exhibit PBC-10, p. 82.

33. The Reports Module summarizes the results of the previous modules. Copeland Supplemental, Exhibit PBC-10, p. 20. Monthly costs are estimated by combining operating expenses with costing factors. The funding necessary to provide universal service support to high cost areas is then estimated given user defined benchmarks. The results are available at the grid, wire center, company, or state level. Copeland Supplemental, Exhibit PBC-10, p. 84.

34. The default inputs in BCPM 3.1 represent an industry-wide composite of current material, installation, and structure prices developed by the joint sponsors of BCPM.[7] Copeland Supplemental, Exhibit PBC-10, p. 20. However, most of the inputs used in its calculations of universal support funding levels necessary for Montana are state specific. U S WEST changed input values in three general input areas in order to more accurately reflect U S WEST network construction costs in Montana. These input values include (1) material and structure costs, (2) operational expense, and (3) capital cost and depreciation factors. Copeland, Direct, p. 33.

35. Copeland's supplemental testimony reports a total state average basic service per line cost of $64.67, and a total U S WEST (non-rural) basic service per line cost of $44.08.

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[6] Access line refers to a communication path between a switch and one end-user.

[7] Values are based on an industry-wide survey. Questionnaires were sent to U S WEST, Bell South, Nynex, GTEC, Bell Atlantic, Ameritech, Sprint, Pacific Bell, Southwestern Bell, and PTI. Copeland Direct, Exhibit PBC-2.

Copeland's supplemental exhibit PBC-8 shows a maximum statewide universal service fund of $175,349,712[8], and a U S WEST (non-rural) universal service fund level of $54,054,045. At present, twenty-five percent of this fund will be funded at the federal level. The remaining portion must derive from a Montana universal service fund. Copeland Supplemental, Exhibit PBC-8, pp. 3-6.

C. Hatfield Model (HAI)

36. A summary of the history, methodologies, default input sources, and outputs for Montana are provided below.

37. Mr. Brian Pitkin of AT&T gave a brief history of the HAI. Pitkin Direct, p. 5. Seven versions of the HAI have been released since September 1996. Lent Rebuttal, p. 2. Pitkin explained that the HAI has evolved through many versions in response to FCC direction, input from state commission staffs, and ILEC criticism. It was originally designed to estimate TSLRIC costs only, but then evolved to include loop investment data. Pitkin Direct, p. 5. He asserts its methods are consistent with TELRIC principles and it estimates costs that are efficient and forward-looking.[9] Pitkin Direct, p. 7.

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[8] This total is calculated by adding residential and business aggregate support data results reported in Exhibit PBC-8 in Copeland's supplemental testimony using a $30 high-cost benchmark for residential lines and a $55 high-cost benchmark for business lines.

[9] Total Element Long Run Incremental Cost, or TELRIC, models are designed to cost unbundled network elements. In Implementation of the Local Competition Provisions in the Telecommunications Act of 1996, First Report and Order, FCC 96-325 (released Aug. 8, 1996), the FCC put forth necessary principles for a proper TELRIC model. This includes using forward-looking technology and economic costs. The FCC's assertion of jurisdiction to mandate TELRIC pricing for unbundled network elements was challenged and pricing rules were vacated in Iowa Utils. Bd., et al. v. FCC, 120 F.3rd 793 (8th Cir., 1997), *amended on reh'g,* 135 F.3d 535 (Oct. 14, 1997), *cert. granted, sub nom.* AT&T Corp. v. Iowa Utils. Bd., 118 S.Ct. 683 (1998).

38. The HAI model incorporates several functional modules. These include distribution, feeder, switching and interoffice transmission, and expense modules. Pitkin Supplemental, Exhibit BFP-6, pp. 20-23. They are used in conjunction with input databases to estimate costs. Each module produces viewable work files, which in turn are used by other modules as an input file. The expense module produces the final outputs of the model. Pitkin Direct, p. 32.

39. Pitkin describes a key feature of the HAI module— its customer location and terrain input database. Pitkin Supplemental, Exhibit BFP-6, p. 18. The input database is formed outside of the model and corresponds to the preprocessing module in the BCPM 3.1. Several data sources are used to locate actual customers to the greatest extent possible. HAI uses line counts, wire center information, Census Block information, and geocoding to locate households and businesses. Geocoding is a process where households are located using mailing address databases. The number of geocoded locations must equal the target total line counts for each Census Block. Households cannot be geocoded accurately, mostly due to the use of post office boxes or rural route addresses. They are distributed uniformly along the Census Block boundary, as these boundaries tend to fall along roads. Pitkin Direct, pp. 33-40.

40. Once the process of determining customer location is complete, customers are associated with a wire center. Households are then grouped into clusters based on the wire center boundaries and efficient engineering standards. In order to assure high quality service, no point in a cluster may be more than 18,000 feet from the cluster's centroid. Pitkin Supplemental, Exhibit BFP-6, p. 31. In addition, no cluster can exceed 1,800 lines and no point in a cluster may be more than two miles from its nearest neighbor. Clusters with five or more customers are

designated as main clusters. Outlier clusters, those with fewer than five customers, are associated with a nearby main cluster for distribution purposes.

41. Using the information created in its customer location and terrain database, HAI builds a hypothetical plant network in its distribution module. It calculates distribution and feeder distances, equipment necessary to meet demand, and investment associated with these elements. Investment elements include distribution and drop cable, structures, and terminals and splices. This module estimates the costs of building plant from Service Area Interfaces (SAIs) to the customers' premises. Pitkin Supplemental, Exhibit BFP-6, p. 20.

42. The HAI feeder module estimates costs to extend the network from the SAIs to the wire center. It estimates the equipment investment necessary to service the plant created in the distribution module. Users have the option of having HAI "steer" the feeder routes towards main population clusters. Pitkin Supplemental, Exhibit BFP-6, p. 21.

43. The HAI uses the switching and interoffice module to compute investments for end office switching, tandem switching, signaling, and interoffice transmission facilities. It uses wire center information to apply SONET and point-to-point technology. Users are able to designate specific wire center locations for the different switches, and to specify inputs for per line investments. Pitkin Supplemental, Exhibit BFP-6, p. 22.

44. Based on the level of geographic granularity the user chooses, the HAI contains four different Expense modules. Users can choose to have monthly costs displayed by density group, wire center, Census Group Block, or customer cluster. Costs are estimated for network maintenance and operations, taxes and variable overhead expenses, as well as for depreciation, return on the debt and equity investment, and income taxes on equity return. Costs for

unbundled network elements, universal service, and carrier access and network interconnection are all estimated. Pitkin Supplemental, Exhibit BFP-6, p. 22. The final outputs of the model are generated in the expense modules.

45. Like the BCPM, the HAI estimates the costs of building and operating a hypothetical network. The outputs produced by the HAI, however, not only determine costs for basic universal service, but also determine costs for unbundled network elements and network interconnection. Pitkin and other AT&T witnesses maintained that the ability of HAI to cost unbundled network elements and network interconnection is a key difference between the two models presented. Pitkin Direct, p. 29.

46. Default values in the HAI are based on publicly-available documentation, where available, and on the opinions of subject matter experts and HAI personnel. Full rationale and support for each default value was submitted with the model. A few of the input values were modified for Montana. In order to reflect relatively inexpensive labor costs in Montana a labor factor of 0.85 was used. The HAI 5.0a also used FCC-prescribed depreciation lives and salvage values. Pitkin Direct, p. 55. Otherwise, default inputs were used.

47. The reported results of HAI 5.0a filed with Pitkin's supplemental testimony show a state average basic service per line cost of $24.49. This results in a statewide universal service fund of $27,167,566 if all lines are supported.[10] Costs for non-rural companies were not specifically reported. At present, twenty-five percent of this funding will be paid by the federal

[10] This fund level assumes a $31 high-cost benchmark for residence lines and a $51 high-cost benchmark for business lines.

universal service fund, and the remaining portion would be paid from a state universal service fund created for that purpose. Pitkin Supplemental, Exhibit BFP-10, p. 1).

D. Criticisms of the Models

48. In the process of evaluating the BCPM and HAI proxy cost models, both models have undergone close scrutiny and criticism. The issues debated between the parties include the use of a proxy cost model for unbundled network element pricing, the openness of the models, the reliance on preprocessing for key inputs, the appropriate loop length assumption, the correct shape of the hypothetical lots, customer location methodologies, feeder route design, appropriate input values, and overall reliability of the models. A summary of these criticisms and the model sponsor's replies follows. In summarizing the criticisms we focus on those that appear most important to the party making the criticism, and have not mentioned every allegation put forth by any party. Many of the criticisms of the models address similar issues; therefore, we organize this discussion by issue and not by model.

49. AT&T's Ms. Natalie Baker criticized the BCPM 3.0 for being incapable to cost unbundled network elements. Baker Rebuttal, p. 6. The FCC encouraged state commissions to use ongoing proceedings to develop permanent unbundled network element prices as a basis for its universal service cost study. The issue and relevancy of model consistency is addressed in detail later in this order.

50. AT&T's Pitkin claimed that BCPM models are not open for proper review and comment. One of the FCC's ten cost model criteria requires:

> [The] cost study or model and all underlying data, formulae, computations, and software associated with the model must be available to all interested parties for

review and comment. All underlying data should be verifiable, engineering assumptions reasonable, and outputs plausible.[11]

51. Pitkin claimed that the BCPM did not meet this criteria for three reasons: (1) that documentation for BCPM is inadequate, (2) that default values used by the BCPM are not verifiable because of their proprietary nature, and (3) the state-specific values are also proprietary information, and therefore, unverifiable. Pitkin Rebuttal, pp. 4-6.

52. In response to Pitkin's criticism, U S WEST's Copeland asserted in both his direct and rebuttal testimony that BCPM is fully open to the public. The data sources are available through public records and the model is fully documented. The model and documentation are available on the U S WEST web-site for interested parties to run independently. Transcript, Vol. 2, p. 12. In addition, Copeland rebuts AT&T's claim that the HAI model is completely open and available to the public. U S WEST attempted to purchase geocoded data by which AT&T forms clusters. In response to the request, PNR & Associates wrote, "The specific data that you requested cannot be released because it is proprietary either to our data vendors or to AT&T and MCI." Copeland Rebuttal, Exhibit PBC-9. This is an example of where key functions of the HAI are proprietary.

53. AT&T's Pitkin also asserted that too many of the critical calculations in the BCPM are external to the model. Pitkin Direct, p. 7. The Signaling Cost Proxy Module is separate from the BCPM model, and many of its inputs are proprietary. Pitkin Rebuttal, p. 43. In addition, the programs used to calculate customer location, formulate ultimate grids, and

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[11] See FCC Public Notice, "Criteria For State-Conducted Economic Cost Studies," CC Docket 96.45, DA 97-1501 (July 29, 1997).