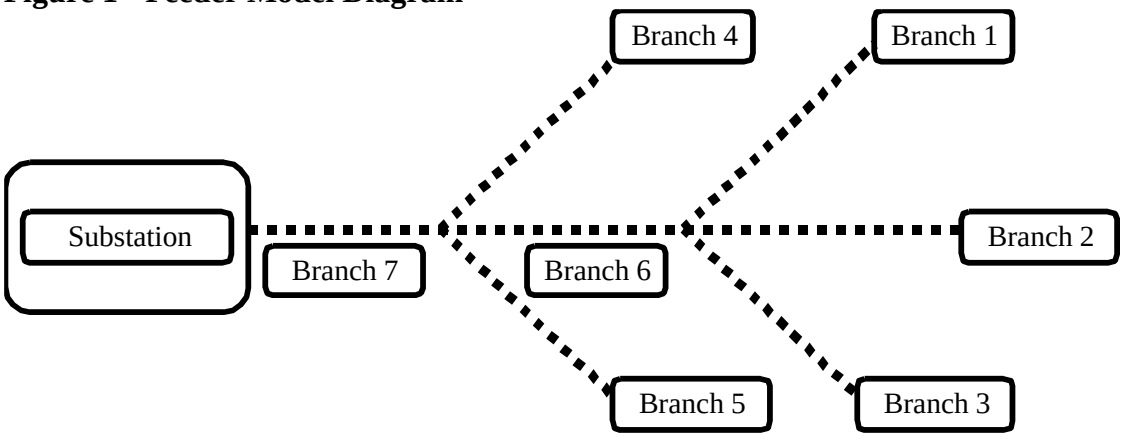
PacifiCorp
State of Oregon
PacifiCorp Distribution Feeder Model

General Overview

The PacifiCorp Distribution Feeder Model is an Excel workbook that calculates the cost of building a hypothetical feeder (Figure 1, below) with seven branches of equal length using the composite line statistics for a chosen state or service area. A hypothetical feeder is used rather than a sampling of actual existing feeders. This is because the diverse characteristics of PacifiCorp's six state service area, consisting of over 2,000 distribution feeders, makes the selection of any single, or small number of typical feeders impractical. The fundamental concept of the hypothetical feeder is to create a model that reduces the elements of distribution cost assignment to a workable form.

Figure 1 - Feeder Model Diagram



The feeder model focuses on several key characteristics that influence distribution cost of service. Among these are customer density, customer size and usage characteristics, and perhaps most importantly, customer location on the feeder. Each customer is assigned cost responsibility for all distribution facilities between the customer's location and the substation (upstream facilities), but no facilities beyond the customer's service location (downstream facilities). The model performs three basic functions. First, it estimates the total cost to build the composite feeder using current construction costs and state specific characteristics. Second, it divides the cost of each branch of the feeder between demand and commitment related costs. Third, it assigns the various types of costs to customer classes.

Required Engineering & Statistical Data

Listed below are the basic statistics that we use to calculate the composite feeder for a given state:

1. Current One Mile Line Construction Cost Estimates for Each Conductor Size
2. Economic Conductor Loading for Each Conductor Size
3. Overhead and Underground Line Miles

4. Number of Poles
5. Number of Feeders -- distribution line points of origin radiating from a substation.
6. Actual Customer Distances from Distribution Substations
7. Number of Customers and Loads by Class
8. Percentages of Three-Phase and Single-Phase Customers by Class

One Mile Line Estimate

The model determines the cost of the feeder by using cost estimates to construct one mile of distribution facilities using each of the Company's single and three-phase wire sizes. These cost estimates are based on typical topography and equipment configuration for an average mile of line construction. Since the number of poles per mile varies between states, we use a factor to adjust the line cost estimate from the system wide average of 25 poles per mile to the state average poles per mile. For example, Oregon has an average of 24.83 poles per mile while Utah has 29.95 poles per mile. Figure 2 shows the feeder cost per mile calculation for Oregon.

Figure 2 – Adjusted Oregon Line Costs per Mile

Wire Sizes		Account 364 Pole Cost per Mile: Pole Cost per Mile	Estimate Poles per Mile	Adjustment Factor	Adjusted Pole Cost	Account 365 Conductor Cost per Mile	Total Line Construction Cost
1 Phase -1/0 ACSR		$ 25,110	25	0.978	$ 24,558	$ 9,832	$ 34,942
3 Phase - 1/0 ACSR 1\0 ACSR		$ 29,725	25	0.978	$ 29,071	$ 20,273	$ 49,998
3 Phase - 4/0 AAC & 4\0 AAC		$ 31,819	25	0.978	$ 31,119	$ 23,423	$ 55,242
3 Phase - 447 AAC & 4\0 AAC		$ 34,814	25	0.978	$ 34,048	$ 34,546	$ 69,360
3 Phase -795 AAC & 477 AAC		$ 37,334	25	0.978	$ 36,513	$ 74,083	$ 111,417

	State Specific Account 364 Pole Statistics			Adjustment
State	**Poles**	**Pole Miles**	**Poles / Mile**	**Factor**
California	54,923	2,320	23.67	0.932
Idaho	99,488	4,447	22.37	0.881
Oregon	353,613	14,239	24.83	0.978
Utah	357,900	11,951	29.95	1.179
Washington	96,084	3,584	26.81	1.056
Wyoming - East	126,080	5,975	21.10	0.831
Wyoming - West	22,888	1,233	18.56	0.731
Total	1,110,976	43,750	25.39	1.000

Customer Placement

One of the most significant cost drivers of marginal distribution costs is the distance between the customer and the substation. Costs increase as the distance from the substation increases.

The feeder model takes distance into account by assigning customers to the different branches of the feeder based upon actual customer locations. The actual customer distances are derived from PacifiCorp's outage management system (CADOPS). The system is able to accurately trace the flow of electricity from substation to customer as well as ascertain the exact distance it must travel.

Figure 3 shows the Customer Distribution on the Hypothetical Feeder Branch for Oregon.

Figure 3 Customer Distribution

Class		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
		Hypothetical Feeder Branch							Branch
		1	2	3	4	5	6	7	Total
1	Residential	1.33%	1.33%	1.33%	3.07%	3.07%	3.07%	86.80%	100.00%
2	GS 0-15 kW (sec) (23)	1.77%	1.77%	1.77%	3.60%	3.60%	3.60%	83.90%	100.00%
3	GS >15 kW (sec) (23)	1.77%	1.77%	1.77%	3.60%	3.60%	3.60%	83.90%	100.00%
4	GS (pri) (23)	1.77%	1.77%	1.77%	3.60%	3.60%	3.60%	83.90%	100.00%
5	GS < 50 kW (sec) (28)	0.88%	0.88%	0.88%	2.28%	2.28%	2.28%	90.51%	100.00%
6	GS 51-100 kW (sec) (28)	0.88%	0.88%	0.88%	2.28%	2.28%	2.28%	90.51%	100.00%
7	GS > 100 kW (sec) (28)	0.88%	0.88%	0.88%	2.28%	2.28%	2.28%	90.51%	100.00%
8	GS (pri) (28)	0.88%	0.88%	0.88%	2.28%	2.28%	2.28%	90.51%	100.00%
9	GS 0-300 kW (sec) (30)	0.50%	0.50%	0.50%	2.32%	2.32%	2.32%	91.55%	100.00%
10	GS >300 kW (sec) (30)	0.50%	0.50%	0.50%	2.32%	2.32%	2.32%	91.55%	100.00%
11	GS (pri) (30)	0.50%	0.50%	0.50%	2.32%	2.32%	2.32%	91.55%	100.00%
12	Irrigation	3.68%	3.68%	3.68%	12.08%	12.08%	12.08%	52.73%	100.00%
15	Large GS 1 - 4 MW (sec)	-	-	-	1.81%	1.81%	1.81%	94.58%	100.00%
16	Large GS 1 - 4 MW (pri)	-	-	-	1.81%	1.81%	1.81%	94.58%	100.00%
15	Large GS + 4 MW (sec)	-	-	-	-	-	-	-	-
16	Large GS + 4 MW (pri)	-	-	-	-	-	-	-	-

Customer Density

The next significant driver of distribution costs is customer density. The model uses state specific line and customer statistics to calculate the average number of customers by feeder branch. Total state distribution line miles and state customers, by class, are divided by the number of distribution feeders in the state to determine the average length of the composite feeder (line miles / number of feeders) and the number of customers on the feeder (customers / feeders). Figure 4 shows the average number of customers located on each of the seven feeder branches for Oregon.

Figure 4 – Oregon Average Customers by Hypothetical Feeder Branch

Class		(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
		Hypothetical Feeder Branch							
		1	2	3	4	5	6	7	Total
	Average Customers								
1	Residential	10.17	10.17	10.17	23.49	23.49	23.49	664.01	765.00
2	GS 0-15 kW (sec) (23)	1.86	1.86	1.86	3.78	3.78	3.78	88.18	105.11
3	GS >15 kW (sec) (23)	0.16	0.16	0.16	0.33	0.33	0.33	7.61	9.07
4	GS (pri) (23)	0.00	0.00	0.00	0.00	0.00	0.00	0.04	0.05
5	GS < 50 kW (sec) (28)	0.06	0.06	0.06	0.17	0.17	0.17	6.56	7.24
6	GS 51-100 kW (sec) (28)	0.04	0.04	0.04	0.11	0.11	0.11	4.38	4.84
7	GS > 100 kW (sec) (28)	0.03	0.03	0.03	0.07	0.07	0.07	2.83	3.13
8	GS (pri) (28)	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.09
9	GS 0-300 kW (sec) (30)	0.00	0.00	0.00	0.01	0.01	0.01	0.43	0.47
10	GS >300 kW (sec) (30)	0.00	0.00	0.00	0.02	0.02	0.02	0.89	0.97
11	GS (pri) (30)	0.00	0.00	0.00	0.00	0.00	0.00	0.08	0.08
12	Irrigation	0.41	0.41	0.41	1.35	1.35	1.35	5.90	11.20
15	Large GS 1 - 4 MW (sec)	-	-	-	0.00	0.00	0.00	0.22	0.23
16	Large GS 1 - 4 MW (pri)	-	-	-	0.00	0.00	0.00	0.09	0.10
17	Large GS + 4 MW (sec)	-	-	-	-	-	-	-	-
18	Large GS + 4 MW (pri)	-	-	-	-	-	-	-	-
19	Total	12.75	12.75	12.75	29.34	29.34	29.34	781.30	907.57

Load Accumulation

The kW load that a customer or class places on the system influences the size of the conductor necessary to serve the load. At each point on the feeder, the conductor must be sized to carry the entire downstream load. At the far ends of the outer branches, loads are

minimal. As you move upstream closer to the substation, the load on the feeder becomes greater requiring larger conductor sizes. In the model, load can accumulate two ways. The first occurs as customers accumulate on a branch of the feeder. When enough customers, or load, accumulate it is necessary to increment up to the next wire size. Upstream from that point, customer segments increase in cost due to the increase in wire size. The second method of load accumulation is when several branches converge at a central point on the trunk of the feeder. The trunk branches must be of adequate size to carry the load of the customers on that branch plus all downstream branches.

Figure 5 shows the feeder kW loading on each of the feeder branches for Oregon. Loads are for customers located on that branch. Accumulated loads for branch 6 would be the combined loads of branches 1, 2, 3 and 6. Accumulated loads for branch 7 would be the combined loads of all branches.

Figure 5 – Oregon Feeder kW Load by Branch

Class	(A)	(B)	(C)	(D)	(E)	(F)	(G)	(H)
	Hypothetical Feeder Branch							
	1	2	3	4	5	6	7	Total
Feeder kW Loads								
1 Residential	22.2	22.2	22.2	51.4	51.4	51.4	1,452.1	1,673.0
2 GS 0-15 kW (sec) (23)	3.5	3.5	3.5	7.1	7.1	7.1	165.5	197.2
3 GS >15 kW (sec) (23)	2.8	2.8	2.8	5.6	5.6	5.6	130.7	155.8
4 GS (pri) (23)	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2
5 GS < 50 kW (sec) (28)	1.5	1.5	1.5	3.9	3.9	3.9	154.9	171.2
6 GS 51-100 kW (sec) (28)	1.5	1.5	1.5	4.0	4.0	4.0	158.0	174.6
7 GS > 100 kW (sec) (28)	2.1	2.1	2.1	5.3	5.3	5.3	212.0	234.3
8 GS (pri) (28)	0.1	0.1	0.1	0.1	0.1	0.1	5.3	5.8
9 GS 0-300 kW (sec) (30)	0.4	0.4	0.4	1.8	1.8	1.8	69.6	76.0
10 GS >300 kW (sec) (30)	1.5	1.5	1.5	7.0	7.0	7.0	277.9	303.5
11 GS (pri) (30)	0.1	0.1	0.1	0.6	0.6	0.6	23.5	25.7
12 Irrigation	1.3	1.3	1.3	4.4	4.4	4.4	19.1	36.3
13 Large GS 1 - 4 MW (sec)	-	-	-	3.8	3.8	3.8	200.6	212.1
14 Large GS 1 - 4 MW (pri)	-	-	-	2.0	2.0	2.0	102.7	108.6
15 Large GS + 4 MW (sec)	-	-	-	-	-	-	-	-
16 Large GS + 4 MW (pri)	-	-	-	-	-	-	-	-
17 Total	37.0	37.0	37.0	97.0	97.0	97.0	2,972.1	3,374.2

Feeder Model Cost Assignment

Line statistics for the PacifiCorp service area show that the distribution system is predominately overhead. To calculate the cost of branch construction, miles per branch is calculated by taking the distance per feeder (total line miles / total number of feeders) and dividing it by the number of branches per feeder (7 branches, see figure 1). Next, using an assumption from distribution engineers that the typical outer branches are 35% single phase, the feeder branch length is split between single and three-phase. The total branch construction cost can then be calculated by taking the single and three-phase distances per branch and multiplying them by the one mile construction costs for poles and conductors, as shown in figure 6.

Costs are split between demand and commitment by assuming that the cost of constructing the branch with the smallest single-phase conductor and smallest pole is the commitment related portion and all costs above this amount are demand related.

Branches 6 and 7 are 100% three-phase and are considered all demand. Figure 6 shows the feeder costs per mile, costs for each branch and miles per branch broken out by single and three-phase for Oregon.

Figure 6 – Adjusted Oregon Line Costs per Mile

Wire Sizes		Account 364 Pole Cost per Mile: Pole Cost per Mile	Estimate Poles per Mile	Adjustment Factor	Adjusted Pole Cost	Account 365 Conductor Cost per Mile	Total Line Construction Cost
1 Phase -1/0 ACSR		$ 25,110	25	0.978	$ 24,558	$ 9,832	$ 34,942
3 Phase - 1/0 ACSR 1\0 ACSR		$ 29,725	25	0.978	$ 29,071	$ 20,273	$ 49,998
3 Phase - 4/0 AAC & 4\0 AAC		$ 31,819	25	0.978	$ 31,119	$ 23,423	$ 55,242
3 Phase - 447 AAC & 4\0 AAC		$ 34,814	25	0.978	$ 34,048	$ 34,546	$ 69,360
3 Phase -795 AAC & 477 AAC		$ 37,334	25	0.978	$ 36,513	$ 74,083	$ 111,417

	Costs for Branches 1,2,3,4,5			
Wire Size	1 Phase -1/0 A	3 Phase - 1/0 ACSR 1\0 A	Total	
Poles	$ 39,115	$ 85,994	$ 125,109	
Conductors	$ 15,660	$ 59,969	$ 75,629	
Total	$ 54,776	$ 145,963	$ 200,739	
	Costs for Branch 6		**Cost for Branch 7**	
Wire Size	3 Phase - 447 AAC & 4\0 AAC		3 Phase -795 AAC & 477 AAC	
Poles	$ 154,948		$ 166,164	
Conductors	$ 157,214		$ 337,142	
Total	$ 312,163		$ 503,306	

Miles per Branch	4.55
Single Phase Miles Per Branch	1.593
Three Phase Miles Per Branch	2.96

Customer Feeder Costs

After calculating the cost per mile for single and three-phase construction for all of the branches, we compile the data and create a hypothetical feeder model branch cost sheet, as shown in figure 7. Figure 7 includes the total cost per feeder branch in columns (A) and (B), and the allocation of total cost between commitment and demand in columns (C) through (F) for Oregon.

Figure 7 – Oregon Hypothetical Feeder Model Branch Costs

Conductors Type	(A) Total Cost Poles	(B) Total Cost Conductor	(C) Commitment Cost Poles	(D) Commitment Cost Conductor	(E) Demand Cost Poles	(F) Demand Cost Conductor
Branch 1						
1 Phase -1/0 ACSR	$ 39,115	$ 15,660	$ 39,115	$ 15,660	NA	NA
3 Phase - 1/0 ACSR 1\0 A	$ 85,994	$ 59,969	$ 72,643	$ 29,084	$ 13,351	$ 30,885
Total segment	$ 125,109	$ 75,629	$ 111,758	$ 44,744	$ 13,351	$ 30,885
Branch 2						
1 Phase -1/0 ACSR	$ 39,115	$ 15,660	$ 39,115	$ 15,660	NA	NA
3 Phase - 1/0 ACSR 1\0 A	$ 85,994	$ 59,969	$ 72,643	$ 29,084	$ 13,351	$ 30,885
Total Segments	$ 125,109	$ 75,629	$ 111,758	$ 44,744	$ 13,351	$ 30,885
Branch 3						
1 Phase -1/0 ACSR	$ 39,115	$ 15,660	$ 39,115	$ 15,660	NA	NA
3 Phase - 1/0 ACSR 1\0 A	$ 85,994	$ 59,969	$ 72,643	$ 29,084	$ 13,351	$ 30,885
Total Segments	$ 125,109	$ 75,629	$ 111,758	$ 44,744	$ 13,351	$ 30,885
Branch 4						
1 Phase -1/0 ACSR	$ 39,115	$ 15,660	$ 39,115	$ 15,660	NA	NA
3 Phase - 1/0 ACSR 1\0 A	$ 85,994	$ 59,969	$ 72,643	$ 29,084	$ 13,351	$ 30,885
Total Segments	$ 125,109	$ 75,629	$ 111,758	$ 44,744	$ 13,351	$ 30,885
Branch 5						
1 Phase -1/0 ACSR	$ 39,115	$ 15,660	$ 39,115	$ 15,660	NA	NA
3 Phase - 1/0 ACSR 1\0 A	$ 85,994	$ 59,969	$ 72,643	$ 29,084	$ 13,351	$ 30,885
Total Segments	$ 125,109	$ 75,629	$ 111,758	$ 44,744	$ 13,351	$ 30,885
Branch 6						
3 Phase - 447 AAC & 4\0 A	$ 154,948	$ 157,214	NA	NA	$ 154,948	$ 157,214
Total Segments	$ 154,948	$ 157,214	$ -	$ -	$ 154,948	$ 157,214
Branch 7						
3 Phase -795 AAC & 477 A	$ 166,164	$ 337,142	NA	NA	$ 166,164	$ 337,142
Total segment	$ 166,164	$ 337,142	$ -	$ -	$ 166,164	$ 337,142

Cost Sharing Calculation

As mentioned before, one of the critical factors of cost-responsibility is the location of a customer or class on the feeder branches. Customer classes that locate on all branches share cost responsibility for all branches of the feeder including the trunk. Large industrial customers, who locate on the trunk of the feeder, share cost responsibility for only the trunk. We determine cost responsibility by calculating the percentage of demand, or percentage of customers, by class, that shares a particular branch of the feeder. We then multiply the total branch costs by the share percentage and then total the branch costs by class. To calculate the total branch cost, we assign the applicable cost of branches 6 and 7 to customers on branches 1, 2, 3, 4 and 5. Demand costs calculated in an earlier step are allocated between customer classes at this point. Figure 8 shows this calculation along with the allocation of branch costs to the individual customer classes for Oregon. Demand costs are totaled for each customer class then divided by feeder kW to get demand cost in dollars per kW.

Figure 8 – Oregon Poles Demand Calculations, Branch 6 & 7 Cost Assignment

Line	Branch	1	2	3	4	5	6	7		
1	% Demand	17.79%	17.79%	17.79%	NA	NA	46.62%	NA	100.00%	
2	Branch 6 Cost	$ 27,569	$ 27,569	$ 27,569	NA	NA	$ 72,241	NA	$ 154,948	**$ / kW**
3	% Demand	1.10%	1.10%	1.10%	2.87%	2.87%	2.87%	88.08%	100.00%	
4	Branch 7 Cost	$ 1,823	$ 1,823	$ 1,823	$ 4,777	$ 4,777	$ 4,777	$ 146,364	$ 166,164	
5	Branch Demand Cost	$ 13,351	$ 13,351	$ 13,351	$ 13,351	$ 13,351	NA	NA		Average
6	Total	$ 42,743	$ 42,743	$ 42,743	$ 18,128	$ 18,128	$ 77,018	$ 146,364	$ 387,868	$ 114.95
7										
8									Total	Total
9	Class Cost per Branch(4)	1	2	3	4	5	6	7	Demand Cost	Per kW
10	Residential	$ 25,682	$ 25,682	$ 25,682	$ 9,601	$ 9,601	$ 40,788	$ 71,511	$ 208,546	$ 125
11	GS 0-15 kW (sec) (23)	$ 4,032	$ 4,032	$ 4,032	$ 1,326	$ 1,326	$ 5,633	$ 8,149	$ 28,531	$ 145
12	GS >15 kW (sec) (23)	$ 3,184	$ 3,184	$ 3,184	$ 1,047	$ 1,047	$ 4,449	$ 6,435	$ 22,531	$ 145
13	GS (pri) (23)	$ 5	$ 5	$ 5	$ 2	$ 2	$ 7	$ 10	$ 36	$ 145
14	GS < 50 kW (sec) (28)	$ 1,745	$ 1,745	$ 1,745	$ 729	$ 729	$ 3,099	$ 7,630	$ 17,423	$ 102
15	GS 51-100 kW (sec) (28)	$ 1,780	$ 1,780	$ 1,780	$ 744	$ 744	$ 3,161	$ 7,782	$ 17,771	$ 102
16	GS > 100 kW (sec) (28)	$ 2,389	$ 2,389	$ 2,389	$ 998	$ 998	$ 4,241	$ 10,442	$ 23,846	$ 102
17	GS (pri) (28)	$ 59	$ 59	$ 59	$ 25	$ 25	$ 105	$ 259	$ 591	$ 102
18	GS 0-300 kW (sec) (30)	$ 436	$ 436	$ 436	$ 329	$ 329	$ 1,400	$ 3,427	$ 6,794	$ 89
19	GS >300 kW (sec) (30)	$ 1,741	$ 1,741	$ 1,741	$ 1,315	$ 1,315	$ 5,588	$ 13,683	$ 27,125	$ 89
20	GS (pri) (30)	$ 147	$ 147	$ 147	$ 111	$ 111	$ 473	$ 1,158	$ 2,296	$ 89
21	Irrigation	$ 1,542	$ 1,542	$ 1,542	$ 818	$ 818	$ 3,477	$ 942	$ 10,680	$ 294
24	Large GS 1 - 4 MW (sec)	$ -	$ -	$ -	$ 716	$ 716	$ 3,041	$ 9,878	$ 14,352	$ 68
25	Large GS 1 - 4 MW (pri)	$ -	$ -	$ -	$ 366	$ 366	$ 1,557	$ 5,056	$ 7,346	$ 68
26	Large GS + 4 MW (sec)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
27	Large GS + 4 MW (pri)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
28	Check Total	$ 42,743	$ 42,743	$ 42,743	$ 18,128	$ 18,128	$ 77,018	$ 146,364	$ 387,868	

Commitment costs are calculated using a similar method. Commitment costs calculated in an earlier step are allocated to classes using percent of customers on a given branch. Commitment dollars are totaled by customer class then divided by the number of customers in the class to get commitment costs in dollars per customer. Figure 9 shows these calculations for Oregon.

Figure 9–Oregon Poles Commitment Calculations, Branch 1,2,3,4 & 5 Cost Assignment

Line	Branch	1	2	3	4	5	6	7		
1	% customer	18.86%	18.86%	18.86%	NA	NA	43.41%	NA	100.00%	
2	Branch 6 Cost	$ -	$ -	$ -	NA	NA	$ -	NA	$ -	**$ Per**
3	% customer	1.40%	1.40%	1.40%	3.23%	3.23%	3.23%	86.09%	100.00%	**Customer**
4	Branch 7 Cost	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	
5	Branch Commitment Cost	$ 111,758	$ 111,758	$ 111,758	$ 111,758	$ 111,758	NA	NA		average
6	Total	$ 111,758	$ 111,758	$ 111,758	$ 111,758	$ 111,758	$ -	$ -	$ 558,792	$ 615.70
7										
8									Total	**$ Per**
9									Commitment	**Customer**
10	Class Cost per Branch(2)	1	2	3	4	5	6	7	Cost	
11	Residential	$ 89,164	$ 89,164	$ 89,164	$ 89,473	$ 89,473	$ -	$ -	$ 446,439	$ 584
12	GS 0-15 kW (sec) (23)	$ 16,315	$ 16,315	$ 16,315	$ 14,400	$ 14,400	$ -	$ -	$ 77,745	$ 740
13	GS >15 kW (sec) (23)	$ 1,408	$ 1,408	$ 1,408	$ 1,243	$ 1,243	$ -	$ -	$ 6,710	$ 740
14	GS (pri) (23)	$ 7	$ 7	$ 7	$ 7	$ 7	$ -	$ -	$ 36	$ 740
15	GS < 50 kW (sec) (28)	$ 561	$ 561	$ 561	$ 629	$ 629	$ -	$ -	$ 2,941	$ 406
16	GS 51-100 kW (sec) (28)	$ 374	$ 374	$ 374	$ 420	$ 420	$ -	$ -	$ 1,963	$ 406
17	GS > 100 kW (sec) (28)	$ 242	$ 242	$ 242	$ 272	$ 272	$ -	$ -	$ 1,271	$ 406
18	GS (pri) (28)	$ 7	$ 7	$ 7	$ 8	$ 8	$ -	$ -	$ 35	$ 406
19	GS 0-300 kW (sec) (30)	$ 20	$ 20	$ 20	$ 41	$ 41	$ -	$ -	$ 144	$ 307
20	GS >300 kW (sec) (30)	$ 42	$ 42	$ 42	$ 86	$ 86	$ -	$ -	$ 298	$ 307
21	GS (pri) (30)	$ 4	$ 4	$ 4	$ 7	$ 7	$ -	$ -	$ 26	$ 307
22	Irrigation	$ 3,613	$ 3,613	$ 3,613	$ 5,150	$ 5,150	$ -	$ -	$ 21,139	$ 1,888
25	Large GS 1 - 4 MW (sec)	$ -	$ -	$ -	$ 16	$ 16	$ -	$ -	$ 32	$ 138
26	Large GS 1 - 4 MW (pri)	$ -	$ -	$ -	$ 7	$ 7	$ -	$ -	$ 13	$ 138
27	Large GS + 4 MW (sec)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
28	Large GS + 4 MW (pri)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
29	Check Total	$ 111,758	$ 111,758	$ 111,758	$ 111,758	$ 111,758	$ -	$ -	$ 558,792	

Large Industrial Customers

Distribution studies have shown that very large industrial customers are not placed on a

feeder in the same manner as residential or smaller commercial and industrial customers. Rather the customer is located very close to a substation (the average distance in Oregon is 2/3 of a mile) and has a dedicated feeder for their exclusive use. Since they have a dedicated feeder line, they do not share in the costs of other common distribution investments, but they are responsible for the entire cost of the dedicated feeder. Dividing the total cost of a 2/3 of a mile feeder by the customers kW gets the customers demand cost in dollars per kW. Table 10 shows this calculation for Oregon.

Table 10 – Oregon Dedicated Feeder Trunk Costs for Large Customers

		Voltage Delivery			
		Large GS + 4 MW (pri)		Large GS + 4 MW (sec)	
		Poles	Conductor	Poles	Conductor
1	Construction Cost Per Mile	$ 36,513	$ 74,083	$ 36,513	$ 74,083
2	Average Trunk Length	0.67 miles		0.67 miles	
3	Total Construction Cost	$ 24,463	$ 49,636	$ 24,463	$ 49,636
4	Customer Peak Demand	5,176 kW		3,254 kW	
5	Demand Cost $/kW	$4.73	$9.59	$7.52	$15.25

Summary

The final step in the feeder model is to bring the various results together in a single summary page. Table 11 shows the results calculated earlier in the study. Note that the $/customer and $/feeder kW is the distribution investment to serve that customer and not the price that the customer is expected to pay.

Table 11 – Oregon Summary of Results

	COMMITMENT $/Customer		Demand $/feeder kW	
CLASS	Poles	Conductor	Poles	Conductor
Residential	$ 583.58	$ 233.65	$ 124.65	$ 206.09
GS 0-15 kW (sec) (23)	$ 739.67	$ 296.14	$ 144.65	$ 234.45
GS >15 kW (sec) (23)	$ 739.67	$ 296.14	$ 144.65	$ 234.45
GS (pri) (23)	$ 739.67	$ 296.14	$ 144.65	$ 234.45
GS < 50 kW (sec) (28)	$ 405.94	$ 162.52	$ 101.79	$ 173.78
GS 51-100 kW (sec) (28)	$ 405.94	$ 162.52	$ 101.79	$ 173.78
GS > 100 kW (sec) (28)	$ 405.94	$ 162.52	$ 101.79	$ 173.78
GS (pri) (28)	$ 405.94	$ 162.52	$ 101.79	$ 173.78
GS 0-300 kW (sec) (30)	$ 307.32	$ 123.04	$ 89.37	$ 155.90
GS >300 kW (sec) (30)	$ 307.32	$ 123.04	$ 89.37	$ 155.90
GS (pri) (30)	$ 307.32	$ 123.04	$ 89.37	$ 155.90
Irrigation	$ 1,888.05	$ 755.91	$ 294.49	$ 443.64
Large GS 1 - 4 MW (sec)	$ 137.59	$ 55.09	$ 67.67	$ 125.07
Large GS 1 - 4 MW (pri)	$ 137.59	$ 55.09	$ 67.67	$ 125.07
Total -	$ 615.70	$ 246.50	$ 114.95	$ 192.28
Large GS + 4 MW (sec)	$ -	$ -	$ 7.52	$ 15.25
Large GS + 4 MW (pri)	$ -	$ -	$ 4.73	$ 9.59

	COMMITMENT	Demand	Total
Poles	$ 558,792	$ 436,795	$ 995,587
Conductor	$ 223,721	$ 748,053	$ 971,774
Total	$ 782,512	$ 1,184,849	$ 1,967,361