Q. **Reference: 2018 Cost of Service Methodology Review Report, Appendix A, Cost of Service Methodology Review, Christensen Associates Energy Consulting (CAEC), Nov. 15, 2018, page 20 (76 pdf)**

Citation:

> Marginal cost-based methods take advantage of the emergence of sophisticated techniques for measuring or estimating cost over hourly (and even finer) time intervals. The development of wholesale markets for energy, reserves services, and capacity, along with advances in internal cost computation advances, provide the means to project marginal costs over forward periods. This means that estimating the cost to serve a class of customers can be calculated by developing hourly marginal costs and applying them to hourly load profiles. The result is an annual total marginal cost for each class (and then a sum across classes representing the utility as a whole). By calculating each class's share of the utility total, one can derive a cost allocator applicable to generation services.
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> Using this approach, it is no longer necessary to infer demand and energy classification results. Instead, the derived marginal cost shares are applied directly to financial costs of generation. From a conceptual or methodological point of view, this approach has a virtue of taking account of customer behavior in all the hours of the year, in contrast with traditional CP methods on the demand side that typically make use of a very limited number of hours.

Please provide a numerical example, or a reference with detailed examples and explanations, to illustrate how this approach would be used in practice.

A. This response has been provided by Christensen Associates Energy Consulting.

The table below provides an illustration of marginal cost-based cost allocation. The example consists of a ten-hour year with marginal costs that increase with each hour. The illustrative utility has three classes: Class 1 has a perfectly flat load profile; Class 2 has a peak-price coincident load profile; and Class 3 has its peak loads in off-peak-price hours. The system peak hour is hour 8, which does not coincide with the hour of peak price, hour 10. Usage totals and coincident peak demand appear at the bottom of the left-hand panel, along with "traditional" embedded cost-based allocation shares for energy and demand, and a combined weight for subsequent comparison with the marginal cost method. The right panel presents the product of hourly marginal cost and load for each class, with totals and shares at the bottom. The example shows that Class 1 has a cost share of 43.5%, exactly equal to its load share and greater than its peak demand share. Class 2 has a cost share of 31.5% and Class 3 has a cost share of 25.0%, with both results indicating their cost to serve as related to the usage relative to the marginal cost-based energy price. These shares are close to share in the left-hand panel derived through traditional classification (which results in an arbitrarily selected 75% energy:25% demand split), and they are derived without having to agree upon a classification method. The bolded percentages represent the generation allocator shares.

Illustration of Marginal Cost-Based Cost Allocation Development

Hour of Year	MC ($/MWh)	Load Class 1	Load Class 2	Load Class 3	Load Total	Marginal Cost Class 1	Marginal Cost Class 2	Marginal Cost Class 3	Marginal Cost Total
1	25	1,000	500	1,000	2,500	$25,000	$12,500	$25,000	$62,500
2	35	1,000	500	1,000	2,500	$35,000	$17,500	$35,000	$87,500
3	45	1,000	500	1,000	2,500	$45,000	$22,500	$45,000	$112,500
4	55	1,000	500	500	2,000	$55,000	$27,500	$27,500	$110,000
5	65	1,000	500	500	2,000	$65,000	$32,500	$32,500	$130,000
6	75	1,000	500	500	2,000	$75,000	$37,500	$37,500	$150,000
7	85	1,000	500	500	2,000	$85,000	$42,500	$42,500	$170,000
8	95	1,000	1,000	501	2,501	$95,000	$95,000	$47,595	$237,595
9	105	1,000	1,000	500	2,500	$105,000	$105,000	$52,500	$262,500
10	115	1,000	1,000	500	2,500	$115,000	$115,000	$57,500	$287,500
Total MWh		10,000	6,500	6,501	23,001	$700,000	$507,500	$402,595	$1,610,095
Peak Demand (MW)		1,000	1,000	501	2,501				
Shares	Weight	42.6%	31.2%	26.2%	100.0%	**43.5%**	**31.5%**	**25.0%**	**100.0%**
Energy	75%	43.5%	28.3%	28.3%	100.0%				
Demand	25%	40.0%	40.0%	20.0%	100.0%				