Expressing California Block & Tier Tariff Information in EMIX and SEP2

This document describes how an application using the EMIX information model can receive California-style Full Requirements Block & Tier Tariffs, which we abbreviate Block & Tier or BTT) and gives proof of concept as to how the information can be used by any model rich enough to encompass BTT.

We describe the information to determine price, and then how that information is expressed in EMIX 1.0 Public Review 03. Any application that can express Full Requirements Block & Tier Tariff information can use its mapping to directly build a mapping from EMIX to its environment; if the artifacts are expressed in XML in that application environment then an XSLT transformation may be created.

This document does not describe a profile for delivery of BTT information via EMIX.

Information Exchange

EMIX is an integration information model, designed with building blocks to express common characteristics of market information including price. One cannot assume that all communicating applications will use precisely the same information models, so one must plan for information mapping or transformation where the information is received.

A human gathers information from many sources, from newspapers, web pages, radio broadcasts, and mail delivery of letters. Reading about the energy prices tomorrow in any of those takes the information expressed in many different formats and media and is transformed into the information understanding in the human’s central nervous system. No one says, “I’ll only read prices in the newspaper in precisely the format I like.”

Likewise a facility will receive information on energy prices tomorrow from web pages, radio broadcasts, point-to-point messages, and other means. To act based on the semantic information about price, the application must take information from multiple sources in multiple formats.

One cannot assume that all recipients share precisely the same information modeling approach, or that (even if they do) they change or update their models at exactly the same time. Complex systems that do not take advantage of interchange or integration information can be brittle, and hard to manage and evolve without a high level of care. By limiting the coupling between provider and consumer information models. Service-Oriented Architectures allow for independent evolution behind the information exchanged.

Description of the Problem

There are two or more Consumption Tiers, determined as a percentage of a baseline number, which in turn is determined by the climate zone of the premises, hence known for each premises.

For concreteness we assume that the baseline value is 1000 kWh, and that the percentage amounts separating the tiers are at 100%, 150%, and 200%, defining four Consumption Tiers.

For premises within a given Consumption Tier there is a price that depends on time of day. We assume that the times are:
An application might deliver information for varying time ranges; we analyze the information structure and note that the information content for (say) weekends would be expressed similarly.

**Scoping of the Problem**
To demonstrate mapping to any Premises system that can handle the BTTs it suffices to demonstrate expression of the information model required by those tariffs. We have in effect an array where one dimension is Consumption Tier number and the other is time.

Consumption Tiers are defined by the cut points and identified by numbers 1, 2, 3, and 4 in the following table. Time is defined by intervals. In the illustration the times are described as “Low, Shoulder, and High” in the table.

<table>
<thead>
<tr>
<th>Max</th>
<th>100%</th>
<th>150%</th>
<th>200%</th>
<th>over</th>
</tr>
</thead>
<tbody>
<tr>
<td>Min</td>
<td>0</td>
<td>1000</td>
<td>1500</td>
<td>2000</td>
</tr>
<tr>
<td>Max</td>
<td>1000</td>
<td>1500</td>
<td>2000</td>
<td>999999</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Consumption Tier</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>0.10</td>
<td>0.11</td>
<td>0.12</td>
<td>0.13</td>
</tr>
<tr>
<td>Shoulder</td>
<td>0.20</td>
<td>0.25</td>
<td>0.27</td>
<td>0.32</td>
</tr>
<tr>
<td>High</td>
<td>0.30</td>
<td>0.50</td>
<td>0.60</td>
<td>0.65</td>
</tr>
</tbody>
</table>

Price in dollars per kWh

This defines a two-dimension array; an application would find where it is in the Consumption Tiers, and then read the price for the current or future time of day. So the key information is exactly that, given the time of day and Consumption Tier, I can tell the Block & Tier aspect of my current price.

This array is expressed in EMIX, leveraging the structures for demand charges (industrial in the US, residential and industrial in much of the rest of the world), as follows:

1. Each time interval (Low, Shoulder, High) is described as a WS-Calendar Sequence, e.g.
   - a. Low: midnight to 10am and 9pm to midnight (two intervals)
   - b. Shoulder: 10am to 2pm and 6pm to 9pm (two intervals)
   - c. High: 2pm to 6pm (two intervals)

2. In the alternative a sequence of intervals can be defined with the appropriate tier information attached (starting at midnight, durations of 10h, 4h, 3h, 3h)

3. Each time interval has attached to it the sequence of Consumption Tier cut points, expressed as maximumEnergyLevel of the high point.

4. Retrieval algorithm: Select the right time interval for time of day; select the correct consumption tier.

Applications may choose to, and likely will, express this information differently. For example, an array of 60-minute intervals could point to the Consumption Tier structure for that interval. Moreover, an EMIX

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1 Other charges may be in a bill, e.g., usage based or customer based; we are expressing the more complex model for Block & Tier.
artifact could express the information in other ways, say with gluons that each reference the Low, Shoulder, and High price tiers respectively.

Clearly this applies only to applications that maintain their own model of a Block & Tier tariff. Since such an application has a means of interpreting the information model (cut points and time intervals) that application can then describe the mapping from a received EMIX artifact to its own information model.

More complex BTTs, e.g. ones with different price levels or consumption levels on weekends or holidays, or seasonal differences can be expressed in a similar manner.

**SEP 2.0 Information Structure**

SEP2.0 Version 0.7 – Third Release ("SEP2") represents the Consumption Tiers and the by a list of TimeTariffIntervals, each of which has zero or more ConsumptionTariffIntervals². This expresses the information in the table above with time intervals across the top and the tier values in columns below in the following illustration. (In this and other examples, optimization may be possible depending on how the application software traverses the structure)

See the diagram below, which omits many details including inherited optional attributes. Consumption tiers are represented by the minimum usage amount, which is apparently represented as startValue. There is also the powerLimit in the RateComponent object, which is apparently the maximum power permitted by the tariff.

**EMIX Information Structure**

The EMIX data structure is very similar, with Intervals, each having a list of consumption tiers. The only difference in representation is that the tiers are identified using the maximum, not the minimum levels, so the series in our example would be {1000, 1500, 2000, maximum allowable power} which we’ve abbreviated maxPower).

² This is from Public Review draft 0.7, Third Release.
Otherwise the graphical representation would be essentially the same except for other information represented (in the SEP example, but that e.g. `numPriceLevels` need not (and is not) represented in EMIX.

**Comparison of SEP2 and EMIX Information Structure**

There are other differences. For example, the following information items are represented in the EMIX interchange information, but in the SEP2 application environment are in and instance of the `ReadingType` class:

- Currency
- Energy is what is used in the definitions
- Multiplier or scale factor

**Summary and Conclusions**

We have shown how both EMIX and SEP2 can express the information model of a California Block & Tier tariff. Any application that supports such tariffs can take and place the information from an EMIX expression in its own data structures.

A concrete mapping can be made directly for any application environment that describes its mapping of the Block & Tier tariffs. We have described in detail the mapping from EMIX to SEP2.

This is the essence of constructing applications using Service Oriented Architectures and integration approaches—the information gets through; how it’s maintained internally is the business of the receiving application. We have demonstrated that such a mapping exists from EMIX to any application that supports Block & Tier tariffs.

The process demonstrated, of understanding the application model and then mapping the required information into it, is also replicable for any target data structure that models BTTs.