Working with ~~Utilities~~ Energy Banks

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The advent of large amounts of distributed generation in small systems and the eventual large penetration of electric vehicles leads to the conclusion that Electric Utilities need to learn to work with systems of this type. This note suggests ways in which the evolving characteristics of the prosumers (producers/consumers) can be used to facilitate and enable the operation of such a system.

The first step in this transition is a change in the relationship between utilities and prosumers. Once a system reaches an excess of available distributed generation relative to the capacity needs of the system, the role of utilities will necessarily change from one of "Energy providers" to a role of being an "Energy Bank" where prosumers can make deposits and withdrawals of energy as necessary, and the role of the utility changes from that of primary producer of energy to that of a means for distributing and balancing the instantaneous needs of the system. To set the stage for such a transformation, we propose to abandon the terminology of a utility as an "Electric Utility" and instead become an "Energy Bank", with many of the same structure as the original electric utilities but with a redirected vision.

Document [1] reveals that some aspects bearing the spirit of "Energy Bank", with respect to renewable energy (RE banking), are already present in some utilities and thus confirming evolution of an "Electric Utility" to an "Energy Bank". RE banking is defined in [1] as "*a financial and accounting mechanism under which a service provider earns credit for excess RE supplied to the grid*". An example of RE banking, presented in [1], is illustrated in Figure 1.

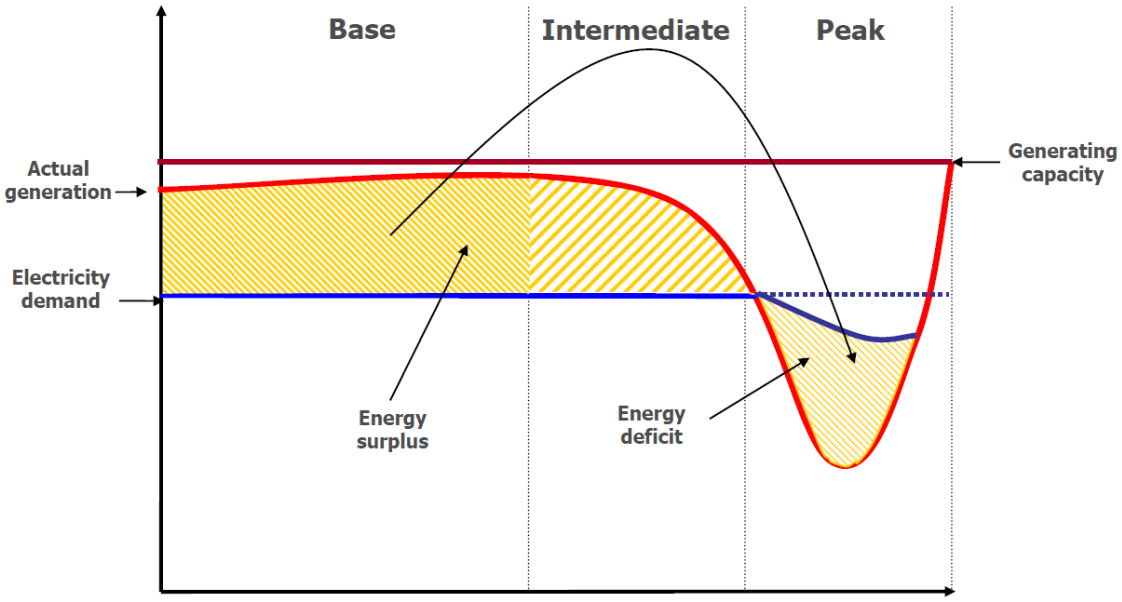

Figure 1: Energy compensation in RE banking (adopted from [1])

RE generators are enabled to virtually bank the excess of generated energy in the utility's energy bank. The banked energy is then made available during periods when the generation from specific RE generator is not sufficient to supply a specific load [1]. The RE generator has some period to make use of the banked energy (for example 12 months as suggested in [1]). Storing virtually means accounting for it in billing mechanisms, not physically storing as electricity by the utility's energy bank. The debit and credit are assigned to the energy and they reflect the value of energy at the time the transaction took place. In principle, similar agreement would work for prosumers. In the ESKOM system (South Africa) [2] prosumers are allowed for energy banking (see Table 1).

Table 1 summarizes results of [1,2].

Table 1: Summary of energy banking [1,2]

Country	RE banking
United States	Banking is not used on the wholesale level
Mexico	All variable RE technologies can use banking, as mandated by the Energy Regulatory Commission for no charge.
India	Discounted banking provisions for wind and solar generators exist in some states and typically are provided by state utilities.
South Africa (ESKOM)	Prosumers which generate electricity for their own use and which infrequently exceed their requirements are allowed to bank surplus energy on the grid, which will be offset against the following metering consumption periods.

The second step in this transition is on the prosumer side. As a case in point, frequency regulation is a major issue in small island systems, and the ability to regulate frequency in such systems seems to be getting worse, not better, as the penetration of renewable and distributed resources increases [2].

References:

1. J. Heeter, T. Vora, S. Mathur, P. Madrigal, S. K. Chatterjee, "Wheeling and Banking Strategies for Optimal Renewable Energy Deployment: International Experiences," National Renewable Energy Laboratory (NREL) Technical report NREL/TP-6A20-65660, March 2016.
2. M. Rycroft, "Wheeling and dealing: Connecting electricity suppliers and customers," Transmission and Distribution, EE publishers, pp. 44-48, April 2014.