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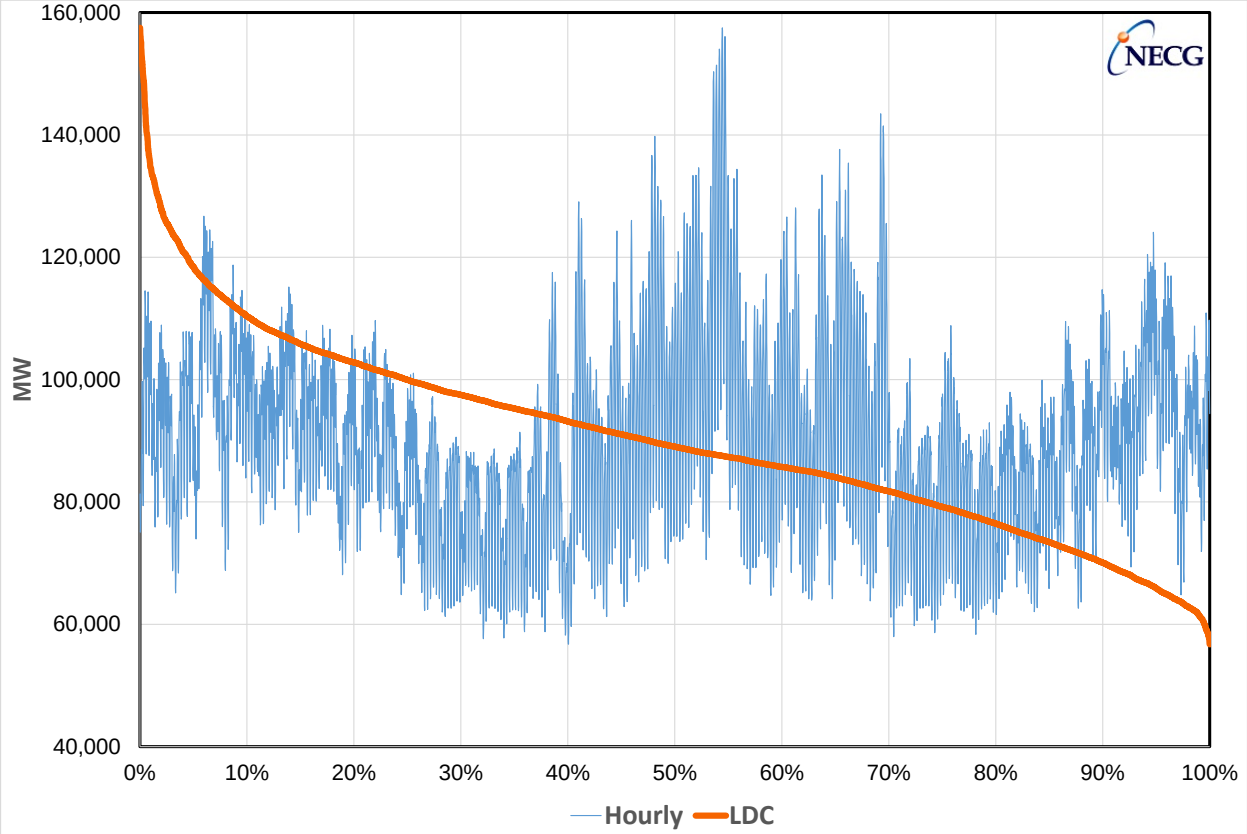
A better design for electricity markets



A guest Commentary by Xavier Rollat on an idea for electricity market design to help nuclear operate with viable financial outcomes in electricity markets. Low or negative electricity spot market prices lead to financial losses for nuclear power, leading to "around-market" payments (e.g., the New York and Illinois ZEC payments) to prevent nuclear plant early retirement.

Xavier Rollat is a friend and colleague and has joined with NECG on several client engagements.

A seasoned financier with extensive experience in structured and multi-sourced balance sheet-, asset- and project-based debt-financed solutions, Xavier[1] has developed an in-depth understanding for the economics of the power industry during his 26-year career in banking and financial advisory. He is recognized as an expert in the development and financing of nuclear power programs by the International Atomic Energy Agency (IAEA). He has contributed to the preparation of various documents from the OECD's Nuclear Energy Agency (NEA) and the European Nuclear Energy Forum (ENEF).

Revisiting the Existing Design of Electricity Markets

Brief Overview

Electricity generation companies are currently experiencing various challenges, leading "old model" utilities[2] to mothball, or even phase out permanently, large thermal power plants which - for some of them- are already been fully amortized and should, therefore, be cost-competitive. This trend has had an impact on coal-fired and nuclear generation, but also gas-fired generation.

Despite the different in nature of supplies (e.g. base, peak), many electricity markets in advanced economies are at present designed, organized and regulated based on a "one-size-fits-all" approach[3], and electricity is priced based on the same set of price-setting mechanisms. Consequently, the economic utility / value given to a kWh of base load is the same as the one given to a kWh peak load.

At the same time, the drive towards electricity market decarbonization means that it is increasingly accepted that the value of a kWh generated by a low carbon source is credited higher than the one of a kWh generated by, say a thermal source. Electricity produced from "green" sources is, therefore, given preference in an increasing number of systems based on dispatch priority.

However, the market designs and rules currently in place in most (liberalized) markets do not always work well in these situations[4]. Patches -most often under the form of political good will, subsidies, market carve-outs, etc.- are, therefore, introduced to "fix" the issues. These patches lead to, among other things, re-direction of investments into new peaking capacity. However, investments in grids and networks that would be needed to support such increase in intermittent capacity do not follow suit, with new peaking generation added to existing system infrastructure. Most systems can cope with those changes, but for how long?

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1 More information on Mr. Rollat is at http://nuclear-economics.com/xavier-rollat-cv/

2 These are vertically-integrated regulated or government electric utilities which developed a portfolio of generating assets to meet projected customer demand at the lowest long-term cost.

3 System dispatch is based on (centralized) pool bid-based merit order where the marginal generator determines the market clearing price in each trading period.

4 In addition to the issues discussed in note 3 above, CO2 price-setting mechanisms are not functioning well and prevent electricity markets from reflecting the full value of decarbonized or low-carbon electricity.

Consequently, markets integrity is challenged and dysfunctions, from a planning, technical and pricing point of view, are developing. That situation begs the question: is the current design of (liberalized) electricity markets still fit for purpose? Should alternative structures be considered? Should reform take place?

Introducing a New Market Structure

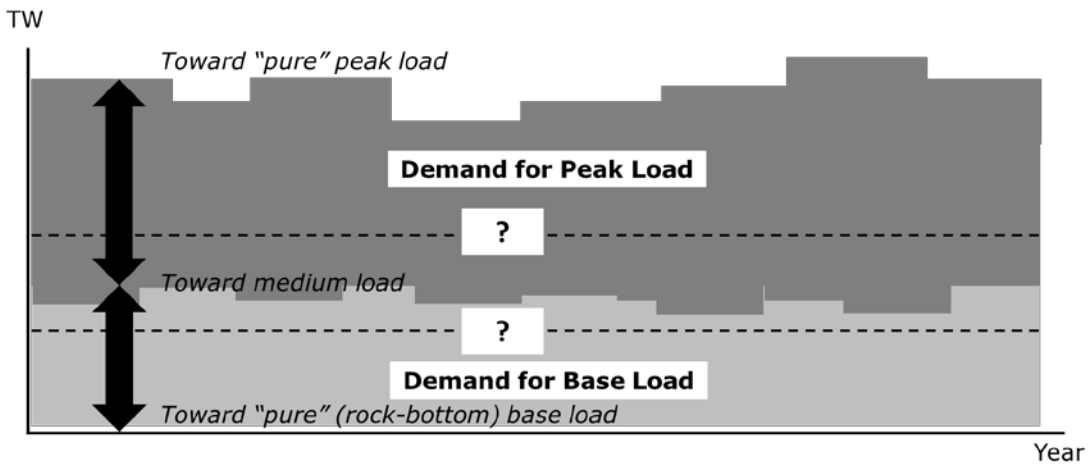
To contribute to fostering the on-going debate, one suggested approach would be to revisit the underlying principles leading to the segmentation of the market.

Demand for electricity and its variations over a certain period (e.g., day, month, year) is commonly illustrated by the load curve. It typically consists of the aggregate of base, medium, peak, and super-peak load bands.

As a key underlying principle of the proposed revision, it is assumed that the economic value of base load electricity is different from the one for peak load electricity. In that context, one would be able to identify two different markets, namely one for base load and another one for peak.

Furthermore, it is noted that what is currently called base load is, in fact, a combination of "pure" base load and load that becomes "medium" in nature beyond a certain level of demand, as it may vary over time (e.g. during the day, or during the year). The same logic could also apply for peak load: below a certain level of demand, load is more of a "medium" nature than "pure" peak.

Figure 1: redefining peak and base load

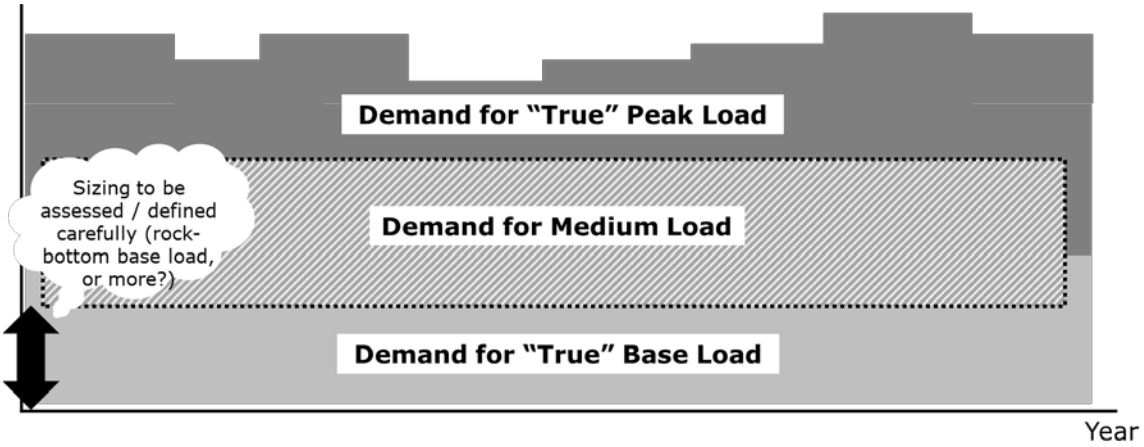


Because: (a) the split between base and peak is not clear cut; and (b) one wants to maintain "market-minded" competitive tensions on prices, the concept of "true" base load[5] (called "**Base Load**" hereafter) is, therefore, introduced. One notes that the concept of "true" peak load[6] (called "**Peak Load**" hereafter) could also be introduced, based the same reasoning.

[5] Being "pure" in nature, i.e. excluding any medium load.
[6] Being "pure" in nature, i.e. excluding any medium load.

Two different sub-markets could subsequently be established relatively easily (e.g. Base Load and Peak Load), each with its own relevant set of objectives, rules, and principles.[7] Within each of them, electricity would be priced under a set of common price-setting mechanisms, which would set clear and transparent rules and promote competition.

Figure 2: identifying the demand for medium load



As far as the Peak Load sub-market is concerned, and bearing in mind the on-going general effort to decarbonize the economy, key criteria for dispatch could include: lowest level of CO2 emission, and highest flexibility. A low (all-in) cost of production per unit would also be considered, but would not be as important in comparison to the level of CO2, for example. It is likely that gas, solar and wind would, therefore, be the main competitors on that market, for the "pure" peak tranche.

As far as the Base Load sub-market is concerned, key criteria for dispatch could include: lowest (all-in) cost of production per unit, highest availability, etc. Based on such revised design, nuclear power generation would again be able to display some of its "natural" competitive advantages vis-à-vis other technologies and complement the offering of low carbon electricity.[8]

Since the pressure on low emission would be maintained and the potential for new baseload hydroelectric capacity is limited in most markets, a "natural" space would open to nuclear, mostly at the expense of coal. That would form the basis of some minimum income to be received by nuclear to ensure long-term survival of that technology (which would eventually be treated like a regulated business).

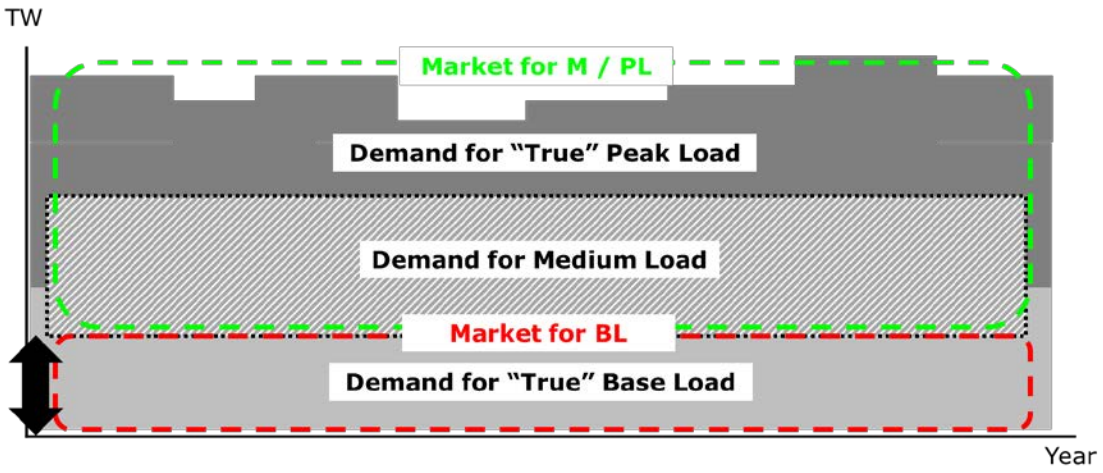
Finally, and as far as the Medium Load sub-market is concerned (e.g. market for electricity that is neither "true" base nor "true" peak), another set of rules could be designed (and occasionally amended, as needed), which would seek to find a "fair balance" between a set of objectives commonly defined and agreed, including the need to supply competitively-priced electricity to

[7] One could also consider introducing a similar type of sub-market split between "pure" peak load and medium load – hence leading eventually to three market segments.

[8] It is likely that coal, hydro and nuclear would be the "natural" competitors on that market segment.

the markets, the drive toward decarbonization of the electricity sector and the promotion of new technologies.

Figure 3: revisiting the market design



In that revised sub-market, different alternative could be envisaged, which could create an opportunity for nuclear to compete. For example,

- Alternative 1: nuclear could compete freely based on price to maximize its profit (like the merchant plant principle).

- Alternative 2: nuclear could compete under certain circumstances defined in advance (like capacity availability principle).

Conclusion

As electricity markets and the participants in those markets face stress from the system marginal price concept, this alternative market design concept may provide a means for electricity markets to remain relevant during the transition toward low-carbon or decarbonized electricity systems, while maintaining the high level of electricity security required in advanced economies.

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