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Going viral: The impacts of covid19 on retail electricity

Russell William Houldin a,*, Bunli Yang b

a University of Toronto, 33 Willcocks St, Room 1016V, Toronto, ON, M3H4Z3, Canada
b University of Illinois at Urbana-Champaign, Champaign, IL, 61820, USA

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ABSTRACT

The response of governments to the covid19 health crisis has highlighted the key points of our earlier article. The covid19 crisis has made it clear that: secure electricity is vital to the modern World; and, the loss of business and commercial load during the crisis dramatizes the need to unbundle remuneration from load. The electricity sector is undergoing an epochal transformation from the Bulk Grid (BG) to the Distributed Generation and Storage (DGS) model in which the role of distributors will change. We suggest pilot projects that will help regulators to understand the needs of systems that emphasize the tiered values of reliable consumer services and new ways of paying for them.

1. Introduction

In this article we follow up the arguments made in our recent article “death and life” (Houldin and Yang, 2020) and also by Lo et al. (2019), in light of how the world of life and work is changing because of the covid19 worldwide pandemic. The thrust of these articles was to question the traditional methods of billing and paying for electricity and to suggest that the model for the future is that of providers of other services such as internet and cellphone services based “subscriptions” for electricity services.

The main reason is the large preponderance of fixed costs, which has always been known but was lost in the 30-year distraction of creating electricity markets for suppliers. When we speak of fixed costs we include generation. Trying to force electricity systems to look like markets stressed the variable energy cost versus the obviously fixed costs of transmission, distribution and control but generation is dominated by fixed costs also. Depending on the fuel mix for a given system, total fixed costs represent between 75 % and 95 % of costs that are recovered from customers. This will get more extreme as large scale wind and solar come to represent increasing proportions of capacity. There is simply no way to “decarbonize” electricity supply without immensely capital-intensive technologies such as, wind, solar, tidal, nuclear fission and fusion and, perhaps, hydrogen-based systems.

The covid19 health crisis has highlighted this mismatch between capital requirements and revenues at retail based on electricity as a commodity like any “fuel” by dramatizing the essential nature of electricity service. Hooker et al. (1981) pointed out many years ago that electricity is the “premium” fuel, so to speak. Compared to traditional fuels electricity can provide every energy service that other fuels provide plus several that only electricity can provide, such as, telecommunications, consumer electronics, etc.. It has now become blindingly obvious that electricity is also the most essential of “essential services”, in that all of the other essential service cannot be delivered effectively without it. This includes transportation of goods and people, since the logistics are now dependent on computers and fully functioning communications.

The policy response to covid19 has also caused economic contractions everywhere that are unprecedented. For example, the US economy reported a 33 % contraction in the second quarter of 2020 although the US economy recovered in the 3rd quarter, with a net contraction from Q4 of 2019 of 23 % (Bureau of Economic Analysis (BEA, 2020). Statistics Canada Reports a second quarter decline of 11.5 % for the Canadian economy as a whole (Statistics Canada (Statscan, 2020). Load has declined due to the economic lockdown. In a recent paper summarizing the impacts on Canadian systems, Leach et al. (2020) identify a range of load reductions of 5–10 % during the period March to June 2020. This further highlights the need for “decoupling” utility revenues from load, at least in the next five years or so. Different loads, or users, of electricity place very different valuations on the reliability of local supply.

Nevertheless, in the longer run load must increase because of electricity’s role as the “lifeblood” of modern economies. Moreover, the increased load will be dominated by DC applications so that distributing AC to final applications will involve increasingly greatly expanded local storage.

All of the new types of load that have been added since the
widespread use of computers and microelectronic devices use DC and require conversion from AC currently or, for portable devices, rechargeable DC batteries. Besides the relatively, albeit, small, technical inefficiencies of conversion at the user interface DC inversion has substantial and increasingly important power quality advantages. There are several similar, but different, issues that DC eliminates these problems. The centrality of electricity systems to the modern World has been underlined by the covid19 crisis. Without exaggeration, the internet, powered by electricity, may have saved society from waves of social disorder by allowing people to connect with each other while separated physically.

The paper is organized as follows: the next section discusses the transition electricity systems will undergo over the next several decades; we then briefly discuss the transition, for utilities in the context of a “post-covid” society; this is followed by suggestions for distributor pilot studies; and then some brief concluding observations.

2. Transition issues

This is occurring at the same time as an epochal transition from the Tesla-Westinghouse Bulk Grid AC model (BG) to a mixed future, with local distribution using local generation and storage (DGS) while also moving to DC service at point of use. The BG model is slowly but surely losing ground to DGS, driven by traditional costs, which, depending on the system, are approaching or have already passed parity and by environmental costs and security considerations. The costs of batteries and on-site inversion (e.g. autos and vacuum cleaners) have dropped faster than the supply costs of wind and solar.

This transition will not happen fast, so we need to develop finance models that gradually assist the transition rather than impede it. What needs to be clearly understood is that the hegemony of the BG system occurred because of lower costs due to technological innovation whereas the shift to DGS will not be one of lower costs to consumers. The reason for the growing parity of delivered electricity from BG and DGS is that real BG costs are rising. Yes, solar and wind generation costs have fallen substantially over the past decades, but they are never going to be cheaper than coal and natural gas generation was, partly because environmental impacts have rarely been internalized. Part of the problem, largely unacknowledged by boosters of solar and wind, is that we will not know, to a degree of accuracy commensurate with traditional generation, for decades what the Levelized Unit Energy Costs (LUECs), the traditional measuring stick, are for these. Even more than hydraulic generation, they are almost all capital cost which means the unit cost depends on the actual lifetime output over which the capital cost is amortized. At this point there is simply not enough accumulated evidence regarding how long existing solar and wind installations will last without refurbishment under a wide variety of operating and climatic conditions.

Nevertheless, the transition will occur. As Richard Hirsh, historian of electric power systems, has pointed out for many years, the BG model has been stuck in “technological stasis” for at least 60 years now (Hirsh, 1989). This will not reverse.

Moving to a subscription menu model can accomplish such a transition. The transition to DGS/DC will meet resistance from the players involved, with an emphasis on cost allocation fairness. The breakup of Ontario Hydro has now paved the way for a more reasonable relationship between BG and DGS. The transition will not happen fast, so we need to develop finance models that gradually assist the transition rather than impede it. What needs to be clearly understood is that the hegemony of the BG system occurred because of lower costs due to technological innovation whereas the shift to DGS will not be one of lower costs to consumers. The reason for the growing parity of delivered electricity from BG and DGS is that real BG costs are rising. Yes, solar and wind generation costs have fallen substantially over the past decades, but they are never going to be cheaper than coal and natural gas generation was, partly because environmental impacts have rarely been internalized. Part of the problem, largely unacknowledged by boosters of solar and wind, is that we will not know, to a degree of accuracy commensurate with traditional generation, for decades what the Levelized Unit Energy Costs (LUECs), the traditional measuring stick, are for these. Even more than hydraulic generation, they are almost all capital cost which means the unit cost depends on the actual lifetime output over which the capital cost is amortized. At this point there is simply not enough accumulated evidence regarding how long existing solar and wind installations will last without refurbishment under a wide variety of operating and climatic conditions.

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Moving to a subscription menu model can accomplish such a transition. The transition to DGS/DC will meet resistance from the players who profit from the hegemonic BG model. Pilot projects will help to wear down this resistance while we get a better understanding of how to best combine BG/AC legacy (transmission) with DGS/DC generation and storage. Pilots will help to build the confidence of regulators who will continue to worry about cross-subsidization, which will raise new challenges but only different in quality from current cost allocation issues. For example, a recent online paper (Cicala, 2020) presents a preliminary analysis of the differential impacts of the second quarter “covid” recession on different customer classes. Commercial and industrial loads went down but residential loads went up. It remains to be seen if these patterns persist.

3. Who’s afraid of the death spiral?

Subscriptions can pave the way to a long-term harmonious relationship between the traditional BG utility model and DGS. In the past the discussion was dominated by the need of BG utilities to avoid the “death spiral”, eliminating “defections” and “non-economic bypass”. These ideas are all driven by the need to charge for energy as a commodity. As less energy is sold by the BG to end users because of defections and the “non-economic” bypass by DGS the cost per energy or power unit rises – leading to the death spiral. Once we recognize that the transmission grid is part of the subscription of using electricity services this antagonism disappears. In Ontario, and we are sure the story was the same elsewhere, the incumbent public monopoly, Ontario Hydro went to great lengths to discourage both defections and DGS. (Houldin, 2018) The former was accomplished by “load retention” rates for large consumers and the latter by legal actions. The breakup of Ontario Hydro has now paved the way for a more reasonable relationship between BG and DGS.

4. Distributor pilots

We make some suggestions about suitable pilots. These are focused on the distribution sector. Although such sector accounts for only about 15% of consumer costs, it is the industry’s point of billing and sales for the great majority of customers.

There are some obvious load types and situations in which pilots of tiered subscription pricing can better meet the needs of current customers and start to build the confidence of regulators that such pricing models will not lead to distortions for other customers.

Residential customers who are seriously considering going off-grid – these customers could be offered a menu of fixed-price choices that include on-site storage and/or small-scale generation, either owned by the use or by the utility. The menu would include pricing for using the utility system as back-up. These customers could be self-identified or by means of surveys that assess the degree of preference for assured security. A large potential group is that of cottage owners.

Commercial customers who have extreme needs for reliable supply and/or power quality – the menu could include fixed-price choices for different packages of guaranteed levels of local reliability, again encompassing on-site options, such as storage and/or generation, with the distribution systems providing varying degrees of standby capacity.

Heavy DC loads – an obvious group is warehouses with electric forklifts. In these cases, part of the offering could be a DC feeder, supercharging and storage.

Electric Vehicles – different packages could be developed for either individual residential customers or fleets, and the latter could include optional DC service, supercharging and storage.

In these situations, utilities could offer fixed-price subscriptions for service for a period of time. These pilots should run for 5 years. The regulators would then be in a position to evaluate how the pilots had met the needs of the targeted consumers and the effects on the finance of the utilities involved, with an emphasis on cost allocation fairness.

In general, even though we emphasize the importance of fixed costs, menus could include options for different proportions of the bill that vary with energy or capacity use as well as local reliability. This is similar to internet billing, which often have mixture of fixed and variable prices.
5. Concluding observations

We do not minimize the disruptions that moving to the new model of remuneration will cause to regulatory institutions. We are not convinced that the telecommunications industries represent a good analogy for ensuring fairness to different categories of consumers. The evidence favours those who claim that regulatory capture is the dominant feature of these regimes everywhere. (Melody, 2016; Miller, 1994) Yet the electricity sector is sufficiently different from telecommunications that there is now an opportunity, forced on us by the responses to the covid19 infection, to shift electricity regulation towards a model that will promote efficiency, decarbonization, a continued fair return and fairness to consumers. It is not yet possible to outline the shape of this model in any detail; it will evolve, not be directed by anyone’s vision. The basic building blocks of this emerging model, however, can be faintly discerned.

- A move to more decentralized supply built around DGS.
- A balance between the declining bulk grid model and the emerging DGS model that protects the businesses engaged in both models.
- The emergence of a new role for distributors for the provision of DC and supercharging and storage and to reflect better the other roles of distributors as collection agents for transmission and generation.
- The introduction of menus of choice to customers based on a tiered subscription model, notwithstanding the incorporation of different approaches to fixed and variable pricing.

Pilot projects, of the type suggested, are the best way to build confidence among all players in the new regulatory model.

Declaration of Competing Interest

The authors report no declarations of interest.