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Electricity as a service and local control: Responding to a post-Covid world

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ABSTRACT

This paper proposes a move toward a future electricity pricing regime that is more equitable while undergoing a transition to a greater use of Distributed Generation and Storage and responding to the more immediate needs of localities recovering from the shocks of covid19. The centrepiece is a shift to collecting a base amount via the property tax with subscription-based provision of premium services. Ontario is used as a focus but the ideas have widespread applicability.

1. Introduction

Responding to Covid-19 and its aftermath present great challenges but also opportunities.

In a recent paper (Lo et al., 2019) and report (Borenstein et al., 2021) a reconsideration of the role of fixed prices for electricity is suggested. We agree. We have written two papers for the Electricity Journal (TEJ) that advocate for such a shift as a way to ease the transition from the existing Bulk Grid Electricity (BGE) model to a balance between BGE and Distributed Generation and Storage (DGS).

The most recent paper, "Going Viral: the impacts of Covid-19 on retail electricity" (Houldin and Yang, 2020b) presents suggestions for pilot projects to hasten the move in this direction. In this paper we extend our analysis both "upstream" to the far future and "downstream" to the shorter-term needs of post-Covid cities. The link between the two is the use of property taxes to collect new revenues for new electricity services. While we focus on Ontario, we present this analysis in the hope of inspiring similar approaches for the US.

In the next section we briefly restate the arguments in favor of paying for new services, such as enhanced reliability, and the associated use of subscription-based payment arrangements. This is followed by a discussion of the logical extension of the concept by making new, discretionary, electricity services part of the municipal services paid out of property taxes. We then use Ontario as an example. Moving in the direction of near-term circumscribed actions that can help the transition to a balance between the existing BGE and the emerging DGS, we outline suggestions for pilot projects. This leads into a discussion of the challenges to municipalities in the wake of Covid-19 and some specific ways that changes to methods of remunerating electricity services providers

can help. We conclude with some related observations.

2. Death and life of retail electricity

Our first TEJ paper talks about the death and life of retail electricity (Houldin and Yang, 2020a). The death of retail electricity is the death of the creation of a new property right. The life or rebirth is the emergence of real choices by end-users, which was the false promise of the creation of a right to sell "retail" electricity in the first place. Real choice can be given to consumers by modelling electricity pricing on subscription services. Driving this are changes taking place in the needs of different types of electricity users. In turn, these are influenced by new technologies. Consumers are expecting large capital investments to be made to provide a diversity of services. Charging for tiered levels of services, such as through subscriptions, are a way to finance these investments without the vagaries and delays to which the current regulatory system is prone.

The larger backdrop to these trends, of course, is the epochal emergence of a real challenge to BGE. We have argued that this will evolve and is not susceptible to top-down grand visions. Nevertheless, thinking about pathways for this evolution is a worthwhile activity. One perhaps surprising pathway is to move the payment of some electricity services to the property tax, with suitable custom menus of choice applicable to each locality. The value in such a move is that it sets up a clear set of roles for local DGS and centralized BGE systems. New capital costs can be allocated to the main beneficiaries, minimizing unfair burdens on ratepayers at large. There are also other associated benefits in all areas of municipal services. Municipalities become the locus for electricity investments at the distribution levels while agencies at the transmission

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system level continue to govern BGE investments. New institutions will be needed to iron out the frictions, of course. The maxim “the devil is in the details” applies to these ideas with great force. Below we sketch what one jurisdiction, Ontario, might look like in such a regime.

3. The return of Georgism?

Governments have relied on income and sales taxes for the bulk of their revenues for so long that any alternative regime is taken as outlandish. Since the 1980s there have been voices calling for “ecological tax reform” (e.g. Bernow et al., 1998), the essence of which would be to tax “bads” – pollution and other forms of environmental damage – instead of “goods”. These calls have been largely unheeded. Some exceptions, such as token deposit/return, are best regarded as performance theater. An older alternative, taxing property, was championed by Henry George in the 19th century. While modern-day Georgists now prefer the term “geoists”, the idea has not died completely.

We are not talking here of ownership by the state. One way to think about ecological tax reform is as an evolution of industrial society by which “land” as a factor of production has been broadened to encompass “environment”.

As Karl Polanyi (1957) argues in *The Great Transformation*, capitalist, markets-oriented, industrial society has at its heart the subjugation of the three factors of production, land, labor and capital, to valuation by market exchange. Over time, the political power of landowners diminished and land was dropped from the economic textbooks. The natural World became a free source of resources and a breathable dump for pollution. The sheer scale of the human economy has eroded this palpable fiction. In the 1960s the modern environmental movement was born out of a widening awareness that the “environment” is a factor of production (Houldin, 2000).

More practically, the incidence of the property tax on different groups of citizens is different from those of income and sales taxes. Any move to change the relative burdens among the taxes and the costs of regulated commodities, like metered electricity and water, is bound to create winners and losers. In general, the main beneficiaries of the current regime think that they have the most to lose and can often mobilize political support for the *status quo*. However, a change in the method of collecting electricity revenues, such as the one suggested here, provides an opportunity to reduce economic inequality. One of the lessons drawn from Piketty’s (2021) extensive survey of historical inequality in *Capital and Ideology*, is that inequality regimes are not deterministic and can be changed by progressive actions. Applied to electricity policy, easing the regressiveness of purely volumetric charges on those who benefit least from DGS investments would represent a significant move towards inequality reduction.

4. Ontario

Using the province of Ontario as an illustration, property taxes currently collect about \$30B annually. Revenues collected from electricity ratepayers each year are currently just over \$20B. If all of the electricity costs were collected through the property tax this would rise to about \$50B. (See Fig. 1) This may be a long-term result but is not our proposal. Looking at the broad distributional issues, the property tax is skewed more to residential taxpayers. Table 1, illustrates the impacts of a hypothetical shift in 2019 of the distribution portion of the electricity bill to the property tax. However, this could easily be addressed through changes to local taxes, which, would have the advantage of representing the conditions of each municipality.

The crucial difference between the current system and a system based on the property tax is that it sets up a clear separation of local (distributed) electricity and premium services and from the BGE (bulk supply and transmission) system.

We propose a staged approach that introduces local control for new premium services that will require large capital expenses.

- Local distribution would be returned to municipalities as a municipal function and the current business corporations, with sole municipal owners, dissolved.
- The local distribution services would provide menus for electricity services in the same way as waste management now, according to class (residential, commercial), including onsite storage and special power quality needs.
- Hydro One’s distribution business (“Disco”) would be separated from the rest of Hydro One.
- Hydro One would take over market operations from the Independent Electricity System Operator (IESO) and would become the BG procurer and planner, including exports and imports at borders.
- All generators, including those awarded Feed-in-Tariff contracts, would continue to market to both BG and local distributors, for all generation technologies.

Table 1

The impacts of a hypothetical shift in 2019 of the distribution portion of the electricity bill to the property tax.

	Share of Expense	
	Current	Property Tax
Residential property tax	73 %	73 %
Non-residential property tax	27 %	27 %
Residential-electricity	62 %	n.a.
General Service<50kW	14 %	n.a.
General Service>50kW	24 %	n.a.

Ontario Property Tax and Electricity Cost

Fig. 1. Ontario property tax and electricity cost.

- Ontario Power Generation (OPG) would be allowed, though its new subsidiary, to market to DGS systems, as well as the BG, including Small Modular Reactors (SMRs).
- The Ontario Energy Board (OEB) roles would be much more limited, viz.:

- No more oversight of distribution, except for Disco, or of generation;
  - Regulation of Hydro One's system operations and transmission;
  - Review of Hydro One's system plan; and,
  - Advice to government on Distribution-Transmission issues.
- Energy efficiency would be left to private Energy Service Companies (ESCOs), except for provincial and national level standards, for appliances and buildings.
  - Retailers, who are phantoms currently anyhow, would be eliminated.

Eventually, the centre of gravity of the Ontario electricity system would shift to local systems and their end-users. In the very long-term BG may shrink to hydro-only but about 40tWh annually (current load is about 140tWh) will always be cheaper (and greener), across the whole merit order. Of course, grid-connected nuclear could also play a role.

In the early stages of this transition an immediate cost reduction to consumers of over \$1B annually could be realised. This is because the distribution sector would no longer pay for the ROE or quasi-income taxes of the municipal-owned distribution corporations. The elimination of the current duplication of operations between IESO and Hydro One could also create savings for the consumer exceeding \$300 million per year.

5. Going viral

The Covid-19 health crisis has brought home the essential nature of electricity service in that all of the essential public health services cannot be delivered effectively without it, not to mention the provision of virtual services to society at large. However, the policy response to Covid19 has also caused unprecedented contractions in economic sectors everywhere. In the longer run load will increase and increased load will be dominated by DC applications at the point of use. However, in the short term the economic response to the post-Covid World is unknown and, likewise, its impact on load. Electricity systems could be under pressure either to build capacity very quickly or manage overcapacity. But premium services, such as enhanced reliability and tiered priorities for avoiding pre-scheduled blackouts for wildfires or Continuous Positive Air Pressure (CPAP) in hospitals will become prominent.

This is occurring at the same time as the transition from the Westinghouse-Tesla Bulk Grid AC model (BGE) to a mixed future, with local distribution using local generation and storage (DGS) while also moving to DC service. The BGE 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.

Differentiating tiers of electricity services can accomplish such a transition. The transition to DG/DC will meet resistance from the players who profit from the existing BG hegemony. Pilot projects will help to wear down this resistance while we get a better understanding of how to best combine BG/AC legacy (generation and transmission) with DG/DC generation and distribution. Pilots will help to build the confidence of regulators who will continue to worry about cross-subsidization.

We make some suggestions about suitable pilots. These are focused on the distribution sector. Although this sector accounts for only about 15 % of consumer costs, it is the industry's point of billing and payment for the great majority of customers. Premium levels of service could include:

- *Residential customers who are seriously considering going off-grid*—such cottage owners;
- *Commercial customers who have extreme needs for reliable supply and/or power quality*, such as the IT sector and Intensive Care Units in hospitals;
- *Heavy DC loads* – an obvious group is warehouses with electric forklifts; and,
- *Electric Vehicles and self-driving transportation.*

In these situations, utilities could offer fixed-price subscriptions for premium service for periods of time. The regulators could then evaluate how the pilots had met the needs of the targeted consumers, the financial impacts on the utilities involved, and cost allocation fairness. Menus could include options for different proportions of the bill that vary with metered energy or capacity use, as is the case for internet billing, which often have mixtures of fixed and variable prices.

6. Bringing it all back home

The Covid-19 pandemic, including governments' responses to it, has taken too many lives, ruined countless businesses, and caused sovereign governments to take on enormous new debt loads. What can the electric power sector do?

Not much in the near term, if history is our guide. Contactless transactions, easing of bill collections, increased online help have all been positive steps by utilities, but these are far overshadowed by the dominance of capital assets recovery in ratemaking. The big problem is how to pay for new assets quickly, on the scale of months, not years, which can address the impacts of Covid-19 on the economies of cities and the preferences for premium service levels.

New capital assets to produce and supply electric power to users take a lot of planning, approvals, financing, manufacturing, construction, and safety inspection.

Does this sound familiar? The same is true of the new vaccines. Since early 2020 Covid-19 has overwhelmed public health authorities and hospitals across the world; communities and families suffered grievously. The rapid development of vaccines approved for wide use is a small sliver of light—what took many years for other diseases was compressed into months, with private-public partnerships.

What about electricity? How can we act better and faster to respond to changes in the economy and culture that happen outside of anyone's control?

Our new approach is to provide revenues and to recover costs from property taxes for a fraction of the electric power to be supplied. It is limited in scope. In brief, we suggest new investment sources and partnerships for "electricity as a service" for a fraction of the retail electricity sold and delivered in cities.

We take the example of Toronto, but the lessons are widely applicable. The public health responses to the Covid-19 pandemic have led to many ripples of effects in the society at large:

- at the personal level, like distancing and masks;
- for businesses like the closures of theaters, restaurants, and small retail and service businesses;
- for institutions like daycare, seniors' centers, and schools; and,
- and not least on markets for commercial and residential real estate.

Work-at-home and the closedown of entertainment, retail shopping, and restaurants pose the challenge of the hollowing out of downtown cores, especially the high commercial office towers and high

condominium buildings. For many cities severe declines in property taxes paid (not to mention revenues from parking) will be disastrous, and the issuance of new municipal bonds unlikely. Attracting people traffic to the downtown will be hard to do, in a very constrained fiscal environment. Even maintaining existing levels of services for water treatment, recycling, policing, mental health will be very hard.

What can a city do to head off the impending threats? We offer a small suggestion to the municipal and regional councils. This is an example, to start with, not a template:

- with the work-at-home trend, pay for the first 100 kW h/month at each registered and metered payer of property taxes, called the “base block” (BB);
- pay the utility for the BB as “electricity as a community service” from property taxes;
- partner with the utility and other investors on facilities to provide other, premium electricity services that the utility does not and should not include in its capital spending plans for its existing ratepayers. A key example is supercharging and onsite storage for transportation purposes; and,
- the partnering on premium electricity services is separate from the utility’s recovery of its revenues from ratepayers based on the metered commodity charges approved by rate regulators.

We suggest this as a path through the tangled thicket of unexpected impacts on cities of the public health measures largely invoked by state/province and federal governments. Those are more or less “sovereign” levels of government with legislative and taxing powers far beyond what cities have. But those sovereign governments are already bearing huge increases in their own debts and are faced with reductions in public spending, not innovations to head off future disasters. It’s time for cities to act.

7. Some related thoughts

Extending our Ontario analysis to the USA is a task beyond our knowledge base but we hope to have opened a dialogue with those who

have sufficient familiarity with the complexity of local electricity delivery systems and local tax structures. However, we note that, despite being largely ignored in the great majority of analyses, about 25 % of power in the USA is already handled by public systems. These municipal-owned and cooperative systems have much simpler regulatory systems than Ontario. (Ontario is unique in having a public agency, the OEB, regulate other public-owned bodies, the municipal-owned distributors.) Moving to a system of collecting electricity costs through the property tax can be relatively straightforward. Since these systems already have established relationships with Investor-Owned Utilities, in many cases, devising ways to pass-through the upstream costs through the property tax should be eminently possible.

Declaration of Competing Interest

The authors report no declarations of interest.

References

- Bernow, S., et al., 1998. Ecological tax reform. *BioScience* 48 (3 March), 193–196.
- Borenstein, S., Fowlie, M., Sallee, J., 2021. Designing Electricity Rates for an Equitable Energy Transition. Energy Institute at Haas. <https://haas.berkeley.edu/wp-content/uploads/WP314.pdf>.
- Houldin, R.W., 2000. Nature's Wages: a factor-based approach to environment-economy integration. *New Zealand Econ. Pap.* 34 (1), 111–128.
- Houldin, R.W., Yang, B., 2020a. The death and life of retail electricity. *Electr. J.* 33 (5) article 106738.
- Houldin, R.W., Yang, B., 2020b. Going viral: the impacts of Covid19 on retail electricity. *Electr. J.* 34 (2). March 2021, online article 106903.
- Lo, H., Blumsack, S., Hines, P., Meyn, S., 2019. Electricity rates for the zero marginal cost grid. *Electr. J.* 32, 39–43.
- Piketty, T., 2021. *Capital and Ideology*, Boston, Belknap (Harvard), Translated by Arthur Goldhammer.
- Polanyi, K., 1957. *The Great Transformation*. Beacon Press, Boston.

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