FISCAL CLIFFS AND INVESTMENT BENCHMARKS: EVIDENCE THAT MOST ONTARIO LDCS UNDER-INVEST

ONTARIO'S PULSE PANEL FACES A HEAVY LIFT

- The majority of Ontario LDCs appear to under-invest in physical assets relative to an economic benchmark.
- Currently, the median level of under-investment is reasonable at 6 percentage points (pp). However, the degree of under- or over-investment varies widely across LDCs.
- Grid modernization involves a move from a business-as-usual investment plan to a temporarily higher investment rate. The investment shortfall, if LDCs plan to meaningful modernize their grid, is larger, with 88% of LDC-years showing under-investment.

On October 27th, Ontario's Ministry for Energy and Mines launched the *Panel for Utility Leadership and Service Excellence*. This energy brain trust, going by the acronym PULSE, was established as a "strategic advisory group that will provide recommendations on how to best fund and deliver the next generation of electricity infrastructure." It is tasked with making "recommendations … on how to ensure LDCs are positioned to meet increasing electricity demand while maintaining high standards of safety, reliability, and cost-effectiveness."

LDC stands for "local distribution company", the regulated electric company responsible for delivering electricity to homes and businesses in Ontario. LDCs operate the poles and wires along the last mile of the grid. LDCs are mostly owned by local municipalities and are subject to a unique set of rules and taxes. Indeed, a key element of PULSE's work involves "reviewing ownership, governance and investment models that balance municipal interests, financial stability and system efficiency."

PULSE's announcement was foreshadowed by a Financial Post op-ed written by Minister Stephen Lecce on October 23rd. In that piece, he argued Ontario "cannot harness our full economic potential with an outdated electricity distribution system" and that "Ontario's nearly 60 utilities (Local Distribution Companies) were fundamentally designed before the rising demand, new technologies, new housing, and growing communities we see today. This is putting pressures on LDCs that most were never designed to handle." The consequence is that LDCs are facing "a massive infrastructure financing gap" and need "to invest up to $120 billion to meet rising demand."

PULSE represents a shift in government attention. Ontario's government has recently concentrated on the bulk electricity grid. PULSE moves the electricity distribution system to the foreground. As Minister Lecce notes, rising demand, expanding housing developments, and increasingly complex technologies are placing pressure on LDCs. PULSE is to assess whether these pressures require a policy-response.

Yet, in reading the op-ed, there is a striking feature: it blurs investment and finance. Investment and finance are related but distinct concepts. Investment deals with physical assets. It is concerned with how electrons get to homes. This includes substations, feeders, automation, resilience upgrades, and other capital to support grid modernization. Finance deals with how the physical infrastructure is paid for, e.g., debt, equity, government transfers, rates, etc.

Even though both are important, confusing investment with finance obscures some important economics of LDCs. To this end, we aim to explore both investment and finance for Ontario LDCs. This piece digs into investment. A separate brief looks at how LDCs will finance future infrastructure to avoid the so-called "fiscal cliff" suggested in the Minister's op-ed.

ECONOMICS OF LDC INVESTMENT

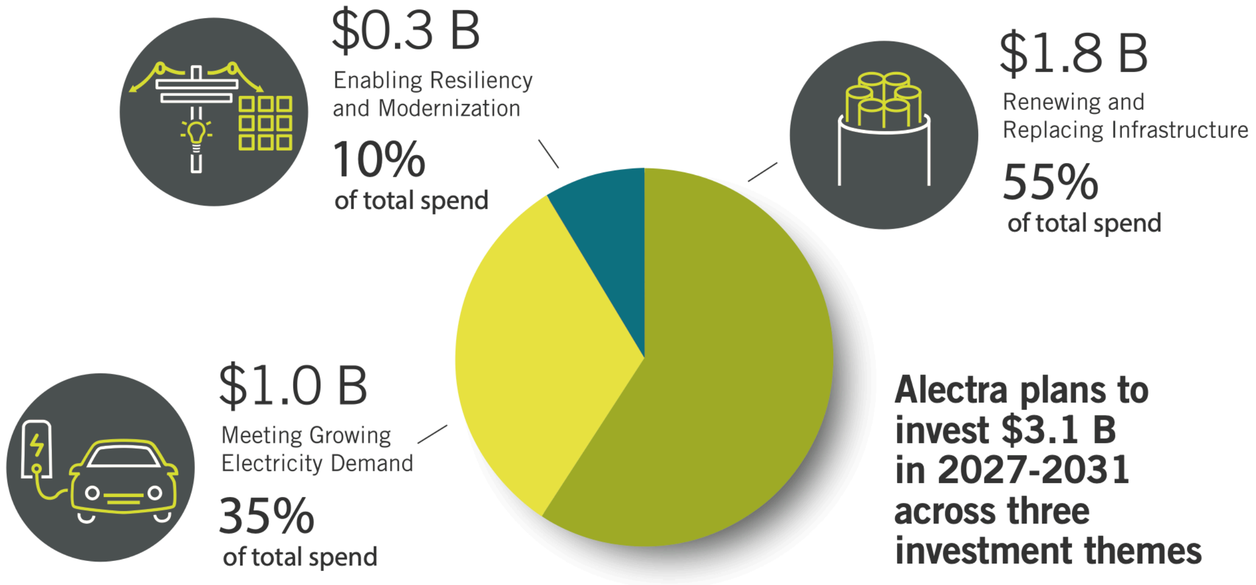
The main business model of LDCs is straightforward. They build and maintain wires. More broadly, LDCs invest in electricity infrastructure to deliver reliable and safe electricity to homes and businesses. According to Minister Lecce's op-ed, this model is under threat. He argues that LDCs "do not have access to sufficient capital to maintain, let alone, deliver the build-out required to meet the significant energy demand forecast anticipated by 2050." Or as a 2024 report by the Electricity Distributors Association (EDA) states: "Increasing electricity demands will require LDCs to update their investment plans to increase the capacity of distribution system infrastructure" (pg. 23).

These sentences beg for evidence. What is the proof that LDCs need to update their investment plans? Stated differently, how should we evaluate whether LDCs are spending too little or too much to maintain and build-out the distribution system?

Fundamentally, *LDC customers want public utilities that allocate resources efficiently*. They want LDCs to make economically sensible decisions with respect to affordability, reliability and environmental impact. Evaluating whether Ontario's LDCs are acting prudently requires a benchmark for how a company should invest in assets over time. Economic theory enables us to derive a formula for just such a benchmark.

To get a sense for this benchmark, it is useful to think about the role of investment for LDCs. Intuitively, investment in capital assets serves several purposes. First, investment is needed to offset depreciation. Existing machines and equipment wear out and must be replaced. Investment is needed to keep the existing system operating. Second, as communities grow, LDCs must add wires, poles and substations to accommodate new demand. New houses and businesses require electricity. Finally, LDCs increasingly argue that they need to modernization and fortify the grid. This also requires investment. Some spending is to fend off potentially more damaging storms attributable to climate change. Some is to better incorporate distributed energy resources, like rooftop solar.

Visually, these three elements stand out in Alectra's recently released five-year investment plan, which details how one of the province's largest utilities is allocating its resources. Alectra's Strategic Priorities document, highlights the three buckets of investment dollars: depreciation, growth and modernization. 55% of Alectra's $3.1 billion investment plan is dedicated to depreciation, 35% to growth and 10% to



Before presenting the benchmark formula, we have a caveat. When economists develop benchmarks, we frequently make strong assumptions about the business environment that utilities face. For example, we assume that growth rates are constant and predictable, and depreciation matches what the engineers promised. No LDC operates in "benchmark world". None will be able to precisely hit the benchmark in any given year. Some LDCs will need to invest to rebuild after storm damage, while others must address long overdue maintenance. However, over time, the benchmark gives a data-based approximation for whether Ontario's LDCs have over- or under-invested based on standard economic theory.

The investment benchmark we use for Ontario LDCs is given by the following formula:[1]

$$\frac{I}{Y} = \alpha \frac{g+\delta}{r+\delta-g}$$

Our objective is to compare each LDCs' actual investment rate to the benchmark investment rate determined by the formula. While this equation may look intimidating, it's fairly straightforward. What this formula says is that an LDC's benchmark investment rate, is a function of four factors.

Before explaining the four drivers of investment, it is useful to make clear why we focus on the "investment rate" rather than the level of investment. The investment rate is the dollar value of capital investment (i.e., capital additions plus depreciation) divided by the dollar value of an LDC's regulated revenue stream. We work with investment rates, instead of investment levels, because the investment rate scales with LDC size. For example, Toronto Hydro had regulated revenues of nearly $4 billion in 2024, while Wasaga Distribution Inc. had revenues of $27 million. Comparing investment levels across these two entities is nonsense. But because investment scales with revenues, the level of investment divided by the level regulated revenues enables us to compare Toronto Hydro to Wasaga Distribution. For each LDC, we can easily calculate the investment rate using data collected by the Ontario Energy Board (OEB).

The right-hand side of the formula is where the action is. The benchmark formula says that LDC management should target a balanced investment rate governed by four core parameters. Three of the four parameters will be well-known to industry watchers:

- r is the rate of return earned by the utility. Typically, this is a market rate of return; however, because LDCs are rate regulated, the OEB deems a generic rate of return using a competitive benchmark.
- δ is the depreciation rate of capital. Notably, δ is not the OEB-determined depreciation rate on regulated assets. δ is intended to represent the true, realized physical depreciation rate on capital needed to maintain a reliable and safe distribution system.
- g is the growth rate of the system. A shrinking system will have a g that is less than zero. In a growing system, obviously, g is a positive number.[2]

The piece of the formula that is likely unfamiliar is α. α is a fundamental economic parameter. It represents importance of capital in the delivering an LDCs services. Specifically, α determines how much additional output is generated from an extra unit of capital. Higher values of α mean investment in capital leads to larger increases in output, while values closer to zero reflect strong diminishing returns.

It is possible to use OEB data and proxies from the academic literature to select values for these parameters.

CALIBRATING THE BENCHMARK FORMULA WITH DATA

To conduct our analyses we retrieve data from the OEB for each LDC in Ontario from from 2017 to 2025.

The first statistic for which we need data is the investment rate, I/Y. This ratio represents the investment LDCs actually made. The numerator, investment, is the sum capital additions and depreciation. Output, Y, is primarily revenue from service (i.e., Account 4080). The OEB accounting guide discusses that this includes: "revenues from the distribution of electricity charge for standard supply service, retailer and other customers" (pg. 115).

Next, we need to select values for the four parameters on the right-hand side of the formula. To keep things simple, we assume that all LDCs have the same value for depreciation, δ, the rate of return, r, and for α.

The depreciation rate is assumed to equal 7.5%. Depreciation represents economic depreciation, not accounting depreciation or capital cost allowances. The estimate for deprecation is from a Statistics Canada study (Baldwin, Liu and Tanguay, 2015).[3]

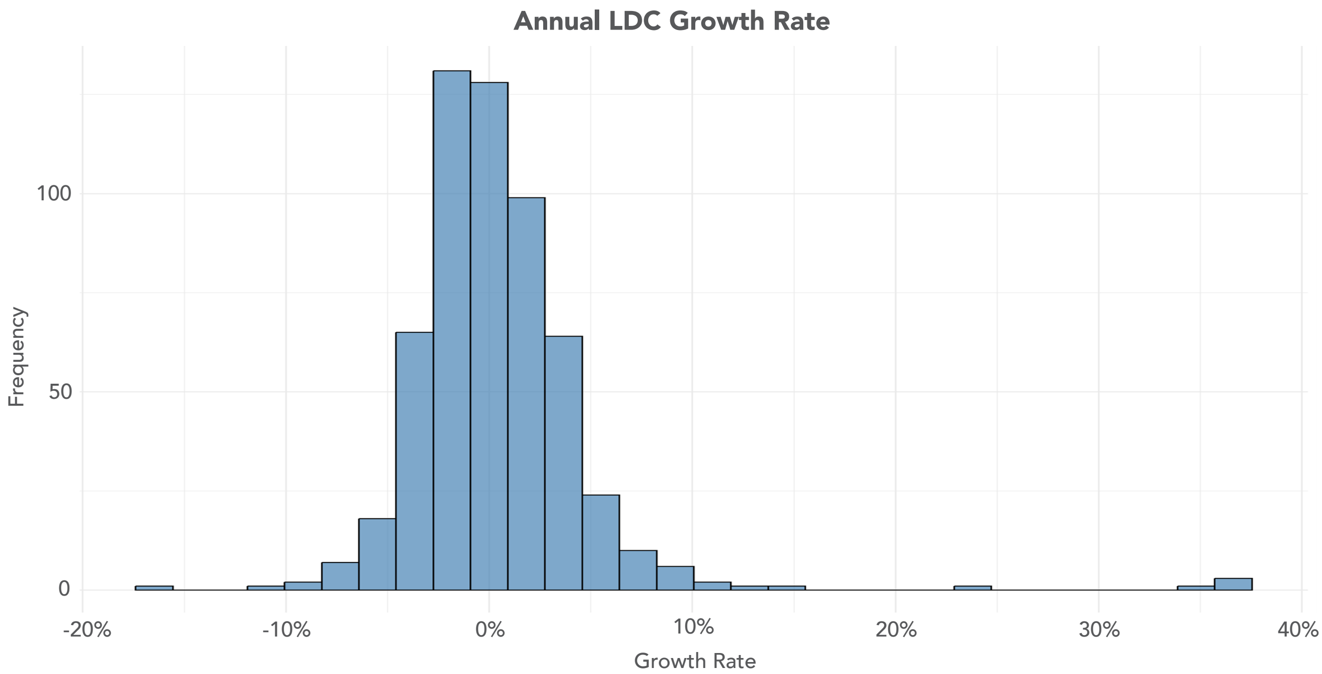
Next, the rate of return is assumed to equal 8.95%. This is roughly the average deemed return on equity for LDCs who submitted a cost of service application in the past 10 years (the true value is 8.97%), and only 5 basis points less than the OEB's 2015 rate of 9.00%.

Unfortunately, the economics literature provides little explicit guidance on the value of for distribution utilities. Most models select a value between 0.3 and 0.4, so we split the difference and opted for α=0.35.

Growth is the big question for LDCs. Instead of assuming a common growth rate for all LDCs, we separately estimate the growth rate of each individual LDC. Further, we consider two growth scenarios for each LDC, a Business-as-Usual (BAU) scenario and a Grid Modernization scenario. The BAU scenario uses the average growth rate in annual kWhs purchased by the LDC. (An alternative method would be to measure the growth in noncoincident peak demand as in the EDA's Solving Grid-lock white paper. Applied at the LDC-level, this method leads to smaller growth rates on average. So, we stick with annual kWh metric.)

As an example, our data for Alectra is for 2017 through 2024. With these data, we calculate that g=1.52%.[4] This is greater than both the historical rate stated in Alectra's recent rate application, and it's forecast growth to 2031. Their application states: "Alectra Utilities retained Itron to develop weather-normalized forecasts … using monthly linear regression modeling. This modeling approach was applied to historical data, including customer and connection counts, energy sales, and energy purchases, with data available through April 2025". Itron's report finds that "Through 2031, baseline sales are projected to increase at a moderate 0.4% annual rate compared with 0.8% average rate between 2017 and 2024. The lower sales growth is attributable to slower population and economic growth." The implication of our larger growth estimate is that our results are going to lean towards showing under- rather than over-investment for Alectra.

The next figure shows the distribution of growth rates by year and LDC for our data. The average annual growth rate across all LDCs equalled 0.38%. The median rate equalled -0.09%. Of course, there are LDCs on both sides of the distribution. Some had robust and consistent growth, while others delivered fewer kWhs.



In addition to conventional investment, many LDCs are looking to modernize their grids to better incorporate distributed energy resources and demand response. Some are also hoping to capitalize on the so-called distribution system operator, or DSO, model. Investments in grid modernization are net additions that are above and beyond the BAU scenario. Thus, we also consider a Grid Modernization scenario. The Grid Modernization scenario should be interpreted as a multi-year project where result will be a new BAU. Our Grid Modernization scenario takes the BAU growth rate and adds 1% growth per year (which based on Alectra's 5-year investment plan would be an under-estimate but is consistent with the Minister's op-ed).[5]

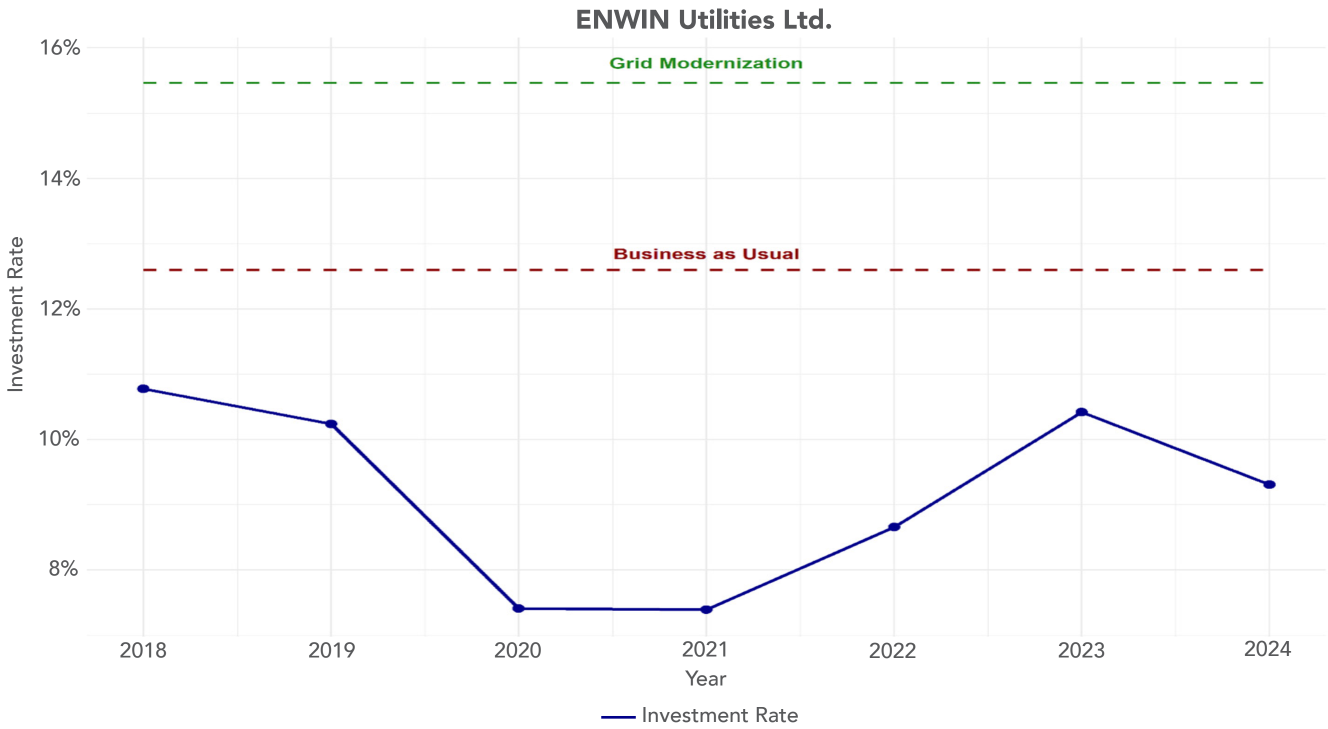
MAIN RESULTS

Given this set-up, we look at how closely LDCs track to benchmark investment. We present a handful of results.

First, two figures show the time series, or year-over-year, investment rate relative to the BAU and Grid Modernization benchmark. The first figure is a blown-up example for ENWIN Utilities, located in the southwestern corner of the province. The subsequent graph presents the same information on a grid for 12 prominent LDCs in Ontario. (We have identical graphs for every LDC in Ontario available by request.)

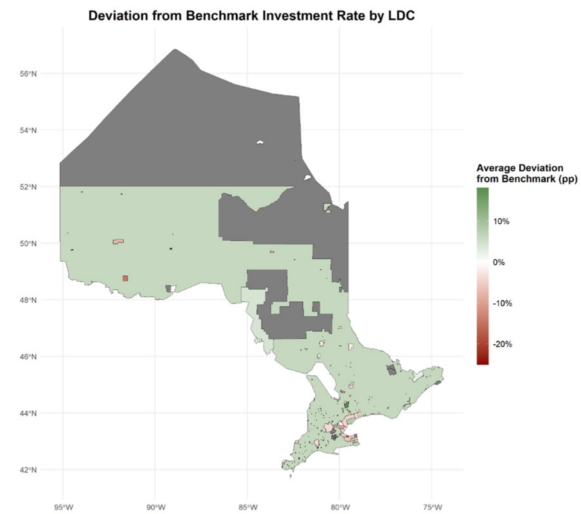
The figure for ENWIN shows two horizontal, dashed lines. The red line is the benchmark investment rate under the BAU scenario. Under BAU, the benchmark investment rate is roughly 12.75% per year. The green, dashed line is the benchmark investment rate under a Grid Modernization scenario, equal to 15.5% per year. The dark blue line, then, illustrates the realized investment rate for ENWIN.

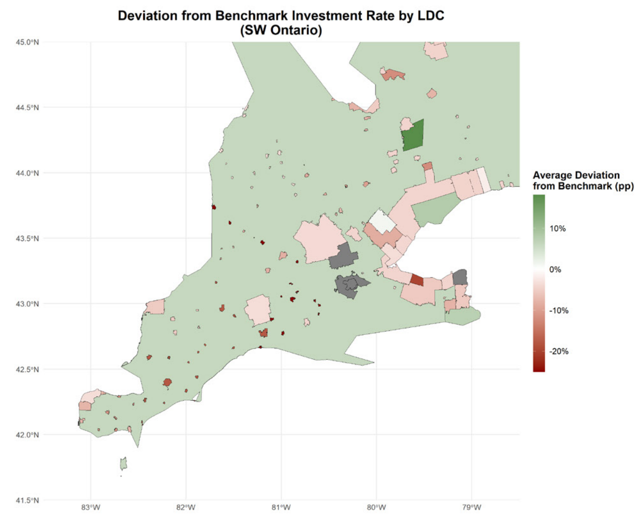
It is obvious that the blue line sits below the benchmark level. Put differently, in every year between 2018-2024, ENWIN under-invested relative to an economic benchmark. Indeed, the level of under-investment was especially high during the pandemic at almost 5pp. In non-pandemic years, under-investment hovered between 2-3pp/year.



The next figure, for twelve selected companies, shows that there is a wide array of investment patterns across LDCs. Some LDCs systematically under-invest, while others are on target. A small handful also appear to over-invest. As above the red line is the BAU scenario calibrated to each unique LDC. The green line is the Grid Modernization scenario.

Our next set of results consider LDCs' average deviation from their benchmark investment rate. The following shows each LDC's geographical territory. Overlaid on each territory is a colour. Green indicates that the LDC over-invests relative to the benchmark and darker green shades signify a greater degree of over-investment. Red denotes under-investment with darker shades implying a greater negative deviation from the benchmark.





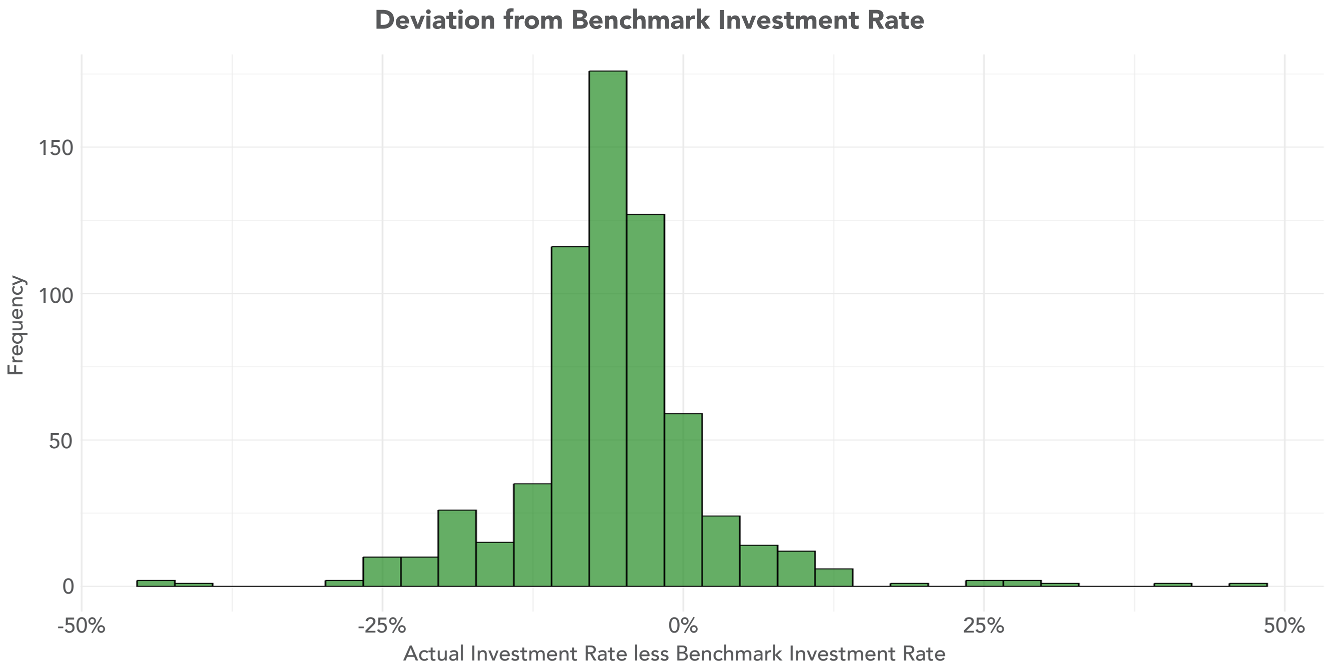
The first thing to notice about these maps is that there is a lot of green. Hydro One's rural territory is vast. Almost all of the green is for Hydro One. Our formula suggests that Hydro One's annual investment rate is greater than optimal (that is, they over-invest). There are multiple interpretations for this. First, it may be that Hydro One is over-spending on physical infrastructure. The provincial government owns 47.4% of Hydro One, so the board and management may feel pressure to maintain especially high-quality infrastructure.

However, it's worth remembering that our benchmark is a generic formula. It doesn't consider the idiosyncrasies of each company. Because Hydro One covers such a large territory, their depreciation and maintenance rate may be under-estimated. It may simply cost more to keep the lights on in rural Ontario and our formula wasn't adjusted to capture that. (Toronto Hydro is also green, likely for a similar reason. Much of Toronto's distribution infrastructure is subsurface. There are simply greater costs to maintain these wires and our benchmark should adjust for this.)

The second thing to notice in the maps is that there are many red regions. Many LDCs under-invest relative to benchmark. A different perspective on these red regions is presented in the next figure. This graph plots a histogram for the deviation of actual relative to benchmark investment rates across all LDC-years. That is, we take the data for each LDC and subtract the implied benchmark for that same LDC. The benchmark is given by the 0% on the horizontal axis. Negative numbers imply under-investment, positive numbers over-investment.

Two results are apparent. First, the bulk of the mass is to the left of the benchmark 0%. This indicates that in most years, the majority of LDCs under-invest relative to their own benchmark investment rate. The average rate of under-investment is 6pp. As Minister Lecce highlighted, some LDCs will need to spend more money just to maintain their local networks, especially as imbalances between investment and demand can create reliability issues. Yet, overall, rate of under-investment is modest. It appears that many LDCs are under-spending, but only by a little bit.

Next, under-investment does not exist everywhere and in every year. The second conclusion to be drawn from this figure is that the dispersion of investment deviations is wide. Some LDCs dramatically under-invest, while others over-invest relative to benchmark. While a few extreme outliers are attributable to storm reconstruction, there is a meaningful number of observations between 0% and 10%.



Finally, the map and histogram show under-investment is relative to the BAU scenario. If we were to recreate these graphs, but for the Grid Modernization scenario, the degree of under-investment would be much larger. In that scenario, 4 out 5 Ontario LDCs would need to spend more on upgrading their networks to achieve benchmark investment rates for Grid Modernization.

To repeat, our three main conclusions from above:

- The majority of Ontario LDCs appear to under-invest in physical assets relative to an economic benchmark.
- Currently, the median level of under-investment is reasonable. However, the degree of under- or over-investment varies across LDCs.
- Grid modernization involves a move from a business-as-usual investment plan to a temporarily higher investment rate. The investment shortfall, if LDCs plan to meaningfully modernize their grid, is notably larger.

We should also emphasize that our benchmark investment formula is long run. We compare balanced growth paths and abstract away from transition dynamics. Moreover, as we said at the start, investment is only one piece of the puzzle. This obvious next question is, how will we pay for the needed investment?

END NOTES

[1]The derivation of this formula, including the implicit assumptions, is provided here.

[2] The EDA states: "On a long enough timescale, most of a distributor's capital expenditures are linearly related to the distributor's customer demand" (pg.51). For a sufficiently small value of g, we can rewrite our benchmark formula so that I/Y = m + b*g where b=$\alpha/(r + \delta)$.

[3] Specifically, this estimate is from Table C.1-2 for "Overhead cables and lines (include poles, towers and all related parts and costs capitalized to this account) (distribution lines) (2816)." The depreciation rate of 7.5% represents an update for the 1985-2010 period and an increase from the prior estimate of 6.7%. The life expectancy of surveyed assets was 32.8 years on average.

[4] Using (unadjusted for weather) peak demand, we would have found a growth rate of 0.5% for 2017-2024.

[5] Itron's report discusses this for Alectra. It states, "Future growth will largely be driven by electric vehicle adoption (EV) and building electrification efforts .... Electrification (EV plus building electrification) results in long-term average annual sales growth of 1.6% (sic)." Table 6 of Alectra's report shows growth with electrification equal to 1.5%, even though the text claims 1.6%.

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