THE IMPACT OF EMERGING SUSTAINABLE TECHNOLOGIES ON EXISTING ELECTRICAL INFRASTRUCTURE IN ONTARIO

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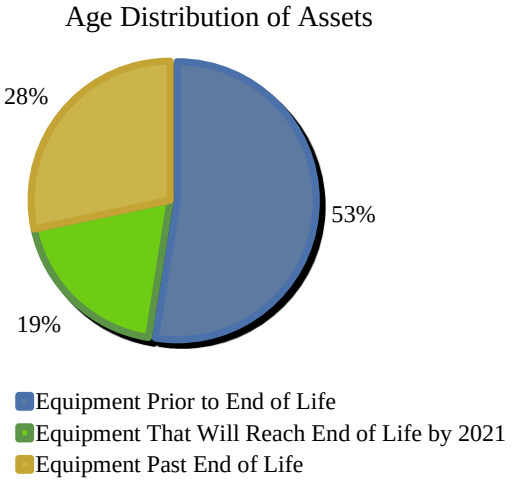
Sustainable energy sources are urgently required, as traditional non-renewable energy sources are increasing in scarcity and subsequently in cost. Significant innovation and investment is required to incorporate newly developed sustainable energy technologies into the existing energy infrastructure network. This presentation will review how emerging sustainable technologies are interacting with existing energy infrastructure. Specifically it will review the existing electrical grid in Ontario, Canada, and the impact of sustainable technologies such as electric cars and distributed generation.

Through the past two hundred years the world has seen unprecedented economic growth with the onset of the industrial revolution. This growth was sustained through increased dependance on non-renewable resources, first with coal, then moving into oil and gas. Typically very little attention was paid to the long term sustainability of the dependance on low cost energy, it was simply known that where low cost energy was available, industry was able to flourish. As these resources have been depleted, the costs to gather and transport energy has increased, making the cost of production higher. This has driven innovation to develop ways to conserve and create energy resources. One major innovation to reduce the use of petrol as a fuel is the development of the electric car, while

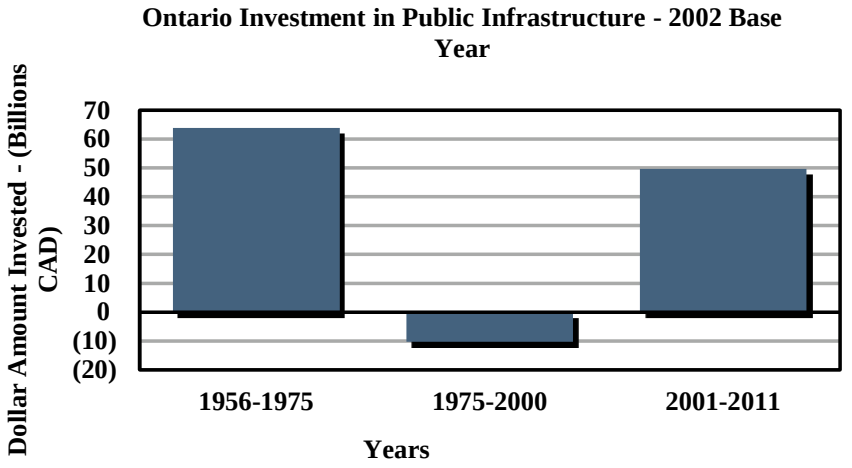


another major innovation is the small scale gathering of energy from renewable

resources such as solar and wind. Both of these innovations reduce dependance on traditional energy sources, but put unique stresses on the existing energy infrastructure that has been constructed over the past 100 years.

In the province of Ontario, a large portion of the existing public infrastructure, including electrical infrastructure, was installed during the post war boom in the 1950's and 1960's. This was an era of abundant government spending and prosperity as the world rebuilt from the travesties of war. Once the infrastructure was installed, the infrastructure was allowed to run with minimal additional investment. The low cost of running new infrastructure was reflected in the taxes and energy costs provided to the people of Ontario. The government developed a monetary policy based on the maintenance needs of the existing infrastructure installed, and accounted for minimal capital investment. While the infrastructure was relatively young, this policy provided maximum benefit to the consumers, but set the system on unstable footings for future years. 'Ontario Investment in Public Infrastructure' shows government investments in public infrastructure over three time periods (Fagan, 2012). The dollar amounts take into account depreciation of the physical assets. Between 1975 and 2000 the amount of capital investment was less than the cost of depreciation of the assets in service, resulting in a negative investment. This trend is highlighted in 'Age Distribution of Assets', which shows the age of physical assets installed in Toronto, owned the local distribution company Toronto Hydro-Electric System (Toronto Hydro Corporation, 2012).

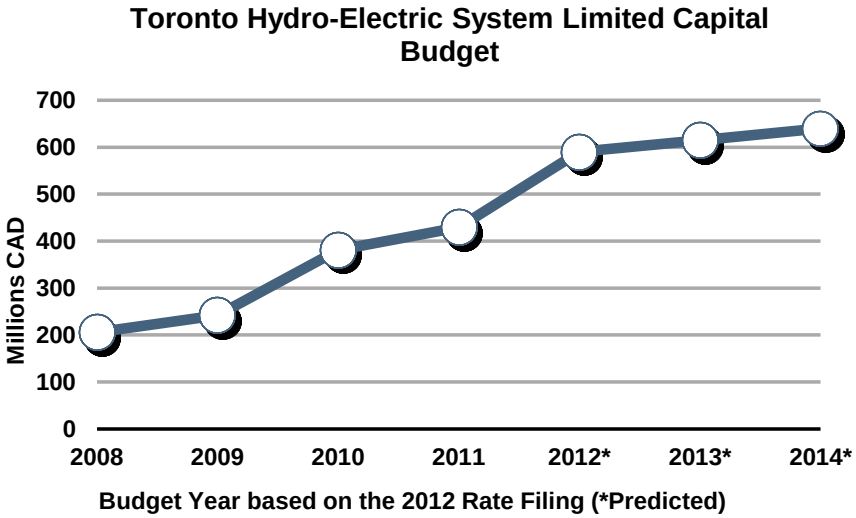
The majority of the public infrastructure had minimal capital investment



between 1975 and 2000, thus much of the system is currently utilizing technology that is from the 1950's and 1960's. In addition to the antiquated technology, the amount of energy that could be transported through the infrastructure was built

based on growth projects from the 1950's and 1960's. These projections were based on the socioeconomic climate of the time and were intended to be utilized until the end of of the equipment life. As shown in 'Age Distribution of Assets', much of the equipment is at, or nearing, end of useful life. Growth rates and patterns have also changed since the initial predictions were done, most notably with the high rise boom in the late 1970's and then again in the 2000's. Areas that once were low-energy use industrial areas have become vast high rise complexes that consumer incredible amounts of energy. In addition to the aging equipment and change in growth patterns, innovations and technological advances have put stresses on the electrical infrastructure that were never imagined. Electric cars are being introduced onto the grid, which add a load equivalent of a typical residential customer. This changes the energy usage patterns and may affect the long term life of assets due to the increased usage.

Technology has advanced to the point where individual consumers are able to purchase an install equipment that harnesses energy from renewable resources such as solar and wind. These customers are then able to input power into the grid as well as use it when required. The electrical grid was initially set up to have power flow in one direction, from the main generation plant, through the sub-stations to the consumers. Now there are many tiny generation points across the electrical grid inputing small amounts of electricity back into the electrical grid at various times. This is known as distributed generation.



To replace the failing infrastructure, modernize the existing infrastructure and maintain reliability, electrical distribution corporations have increased their capital budgets, as shown in 'THESL Capital Budget' (Toronto Hydro Corporation, 2011). This increases the cost of energy to the consumer, but is essential to allow for innovation and sustainable power.

Without changes and modernization of the existing electrical infrastructure, emerging sustainable energy innovations will not be able to be utilized to their full potential.

References:

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