

<p><b>Corporate Knights Building Back Better with a Green Power Wave Roundtable Q&amp;A via ZOOM with Ralph Torrie</b></p>	<p>[Unedited file]</p>
<p><b>From April 29, 2020 Roundtable via Zoom (unedited file)</b></p>	
<p><b>Questions</b></p>	<p><b>Answers</b></p>
<p>The Ontario Clean Energy Alliance is campaigning for Ontario to sign long hydro term contract with Quebec - thereby avoiding having to refurbish nuclear power stations and increasing gas generation during the long renovation period. What do the panel think of making these connections to Qusebec?</p>	<p>In order to minimize customer cost impacts it will be important to first, capture what is now electron waste that occurs by spilling some of our cheapest and cleanest renewable energy in the form of the equivalent of 6000MW of hydro power that is currently spilled annually. Optimization of current connections and then enhance interconnectivity among jurisdictions with the lowest and highest emissions intensity is strategic.</p>
<p>The federal government has used the tax code to great affect to support the oil and gas industry through de-risking of investments. The mineral exploration tax credit and flow through shares are examples. Do you see the possibility for a similar mechanism, de-risking and flow through shares, for electrical investments?</p>	<p>Thank you for this question Alex. We will certainly propose this approach to the Government of Canada.</p>
<p>Can this be done in the 10 year time frame indicated?</p>	<p>Lets find out!</p>
<p>Would appreciate a comparison to better unerstand what the person years of employment means. Yes - it is a big number. Assume it is over the next 10 years. What employment is this replacing under what energy transition program. Jobs gained vs jobs lost...</p>	<p>We used a multiplier to estimate the direct and indirect jobs per dollar of capital investment. The transmission investments will not cause signficiant job losses in other sectors. The investments in wind and solar power capacity would displace investments in natural gas power plant construction and will also displace natural gas consumption. We did not estimate the job losses from this effect. We believe the displacement would be much smaller than the job creation, but it would be an improvement to our analysis to add an estimate of this displacement.</p>
<p>Ralph: Have you estimated the economic benefits and co-benefits of the \$100 billion RE investment?</p>	<p>In this simple scenario we have not done that. Our employment numbers include direct and indirect jobs, but not induced employment. At a high level, a \$100 billion capital investment spread over, say 10 years, would have a multiplier effect on GDP.</p>
<p>Does the 82% renewable inlcude our nuclear fleet?</p>	<p>Yes. Without nuclear, on a national basis the percentage of low carbon electricity in Canada drops to about 67%.</p>

<p>Ralph, the jobs figure you presented as a result of decarbonizing our grid - does this account for job losses in the oil and gas sector?</p>	<p>The two fossil fuels that are currently used at a significant level in power plants in Canada are coal and natural gas. The phasing out of coal power is already a national objective and is being vigorously pursued, including in Alberta, and job loss in the coal industry is part of the business as usual baseline at this point. There would be a decline in natural gas consumption for power generation which would affect employment in that gas production industry to the extent the power sector contributes to the overall market for Canadian gas. I dont think this scenario would have much impact on employment in the oil industry.</p>
<p>Does Ralph's scenario enable further electrification or is it BAU?</p>	<p>We focussed on a scenario for a 625 TWh carbon-free electricity supply, which would leave about 40 TW.hour available for exports or to accomodate growth. We did not look at how conversion of resistance electric heating and other efficiency gains could free up additional electricity supply to accomodate electric vehicles and the conversion of fossil heated buildngs to heat pumps, but this potential as enormous. As indicated in last week's session, deep retrofits of buildings combined with switching out resistance heating to heat pumps and other efficiency gains would free up more than enough electricity supply to power a fleet of 9 million EV's. The bottom line is that I think we can accomodate a lot of electrification of buidling and transportation end uses, if we are in smart in the way we do it.</p>
<p>While I agree in the broad principles of moving towards investment into the next generation technologies in all areas of more efficient forms of energy generation and distribution, I disagree intensely on the misrepresentation of the urgency based on climate change such that we are doing it inefficiently and ineffectively. We all know that some of the solar and wind have made enormous strides over the past 2 decades. But the representation that our current technology is adequate to make rapid wholesale changes is not just inappropriate but not in the best interests of Canadians. The misrepresentation is dangerous and tends to bias incorrect policies and actions.</p>	<p>And yet, rapid wholesale changes are happening, particularly in the contribution of intermitent power generation to the electricity supply.</p>
<p>Future transmission will be led by Indigenous proponents and/or partners</p>	
<p>And replacing need for some of Ontario's nuclear power</p>	
<p>Can't see the questions - so how can we see typed answers?</p>	

<p>What is the panels response to the film - 'Planet of the Humans'?</p>	<p>I have not seen it but I understand it presents a view that is based on outdated information about the way that wind and other renewable electricity will be integrated into grid operations. Especially in Canada with our abundance of hydropower, increased reliance on wind and solar does not require that we build fossil fuel power plants to back them up.</p>
<p>for Ralph - how does the ontario nuclear program fit into this?</p>	<p>We assumed that Pickering would be retired on schedule, removing 20 TWh of emission free electricity from the mix. The enhanced interconnection with Quebec is a key element in a strategy to avoid recarbonization of the Ontario grid as the nuclear output winds down.</p>
<p>In the scenario Ralph described, what happens to existing power supply contracts with US utilities? Can they be phased out?</p>	<p>There is more than enough surplus hydro in our scenario to cover existing export commitments, and probably to accomodate more.</p>
<p>Will Canada develop and launch a national energy strategy to support the transmission plans outlined in today's webinar?</p>	
<p>Ralph...basic question about your assumptions on the demand side, particularly around transportation. What is assumed in terms of rate of electrification of transportation, esp. in personal vehicles?</p>	<p>In this scenario we focussed on what a supply of 625 TWhour of carbon free electricity would look like. That leaves about 40 TWhours supply to cover growth and existing or future exports. There is of course enormous potential on the demand side for efficiency and the switch to heat pumps to free up more of the 625 TWhours for electric vehicles and the conversion of fossil heated buildings to heat pumps. I we are smart we can have electrification and carbon-free electricity without the aggregate supply growing by much, at least for the next ten years.</p>
<p>Ralph: What impact on electricity costs to consumers from your proposal?</p>	<p>Wind now represents the cheapest marginal source of electricity supply, and the transmission investments will make cheap hydropower available to the importing provinces. A renewable based system will also be immune to price volatility in fuel prices.</p> <p>It is also important to note that we do not demand electricity for its own sake but for the contribution it makes to providing amenities and services and it is the cost of the amenities in services that matters most. In Germany for example, electricity prices are three times or more higher than in Canada and yet the portion of disposable household income that goes to electricity is about the same as in Canada. To take an extreme but illustrative example, the cost of electricity from a \$1 AAA battery is over \$250/kwh but we don't really care, and we shouldn't.</p>

<p>We need to continue to invest in next generation technologies. And to have like technologies compete on a financial basis with other like technologies towards a target generation quantity assigned to that specific technology not only makes sense but is necessary. But the issue is to have clear targets and specific stimulus for each technology but not to oversell them or overcommit to them such that they put us into a poor competitive basis with respect to our overall energy cost. Why can't we have an honest discussion on this subject?</p>	<p>Agreed, although the importance of electricity price to our competitive position is ofte overstated. There are a handful of primary industries (paper, aluminum, metals, industrial chemicals, mining) for which electricity is a significant percentage of value added, and Canadian policy including climate policy tends to work pretty hard at protecting them. But for most manufacturing industries and for the entire service sector (which now constitutes two thirds of our economic output) the contribution of electricity to total costs is typically less than 3%, often much less.</p>
<p>Interesting that scenario described focuses (at least at top line description) on large infrastructure plays. Wondering, particularly in light of need for greater resilience of all supply chains that is one of the great lessons of COVID, about role of distributed energy systems?</p>	<p>Yes, a topic worthy of its own panel! All else being equal, a more distributed system is a more reliable and resilient system.</p>
<p>How do we integrate the concept of a soft energy path with the expansion of connections between gridlines?</p>	<p>In an ideal soft path scenario, energy supply and consumption would be balanced at a local level, and that is the direction the grid is moving toward. But other soft path principles emphasize reliance on renewable sources and on matching the thermodynamic quality of supply and demand. To do this, given where we are starting from, will require continued reliance on our existing hydro dams, and access to wind and solar farms that will not necessarily be near the urban consumption centres. The enhanced interconnections will allow renewable electricity to displace fossil fuel generation in those provinces that do not have their own hydro resources.</p>
<p>To what extent can we make more efficient use of the transmission infrastructure that already exists?</p>	<p>In some ways, the incremental investments we have included in our scenario are designed to make more efficient use of the existing system by removing bottlenecks. In the narrower context of the losses that occur in the transmission and distribution of electricity, this is a never ending goal of the electricity industry. Loss rates today are quite a bit lower than they were 25 years ago. With more distributed generation, including on-site generation, the distance electricity travels before being used will decline, and that will also contribute to a more efficient system.</p>
<p>How about micro-grids and community owned clean electricity generation? Are we only including funding massive grid connections and projects? How can Indigenous communitis, small remote communities and local governemtns access funding for clean micro grids?</p>	<p>Excellent point. Support for community-based power and for the development of microgrids should be a priority. It was not the focus of this particular scenario. It is a big topic and would merit its own panel, including a focus on how federal and provincial and local governments can best collaborate in this area.</p>

<p>Ralph, it was nice to see the projected number of jobs that would be created. I am interested in the strategic HR planning angle on this (particularly the staffing vs training angle question). How many of these jobs are anticipated to be in the STEM field vs professional fields of Management (or entirely different fields)? This would be important to know so that channels for training could be launched (and funded) in tandem. Thanks!</p>	<p>This is an important point but we did not do the analysis of the breakdown of jobs for this simple exercise.</p>
<p>You can not and should not replace existing viable plants during their service lives. To progressively augment and replace them in a controlled manner over time and as the next generation technologies continue to improve is really the only sensible approach. And establishing caps on the viable renewable sources by type based on the existing supporting infrastructure is mandatory. Our storage technology is mandatory and is improving. But still needs substantive additional research, development and investment. This should be a primary focus. Why is this not the primary focus? It is one of the primary investment areas but is not there yet and inhibits the use of many of the technologies.</p>	<p>Point well taken, although we do have \$5 billion on new storage in our scenario. Also the Ontario-Quebec interconnection is largely about giving Ontario access to seasonal storage in Quebec reservoirs.</p>
<p>Does Ralph's scenario include potential losses from climate-related stranded assets?</p>	<p>No.</p>
<p>How does this panel think the inter-provincial seams issues can be fairly addressed (e.g. AB has a free, open market for electricity with consumer choice, vs. many other provinces being monopoly, vertically integrated crown corp. utilities)?</p>	<p>These differently structured utility sectors will need to find ways to negotiate deals, but the details of how that will play out were beyond the scope of this exercise. The B.C.-Alberta intertie would be the case where this challenge may be greatest.</p>
<p>How fast can connections be made in other countries and what holds us up here?</p>	<p>In some parts of the world, utilities "compress" the interconnection queue by allowing private investment to build and operate, then transfer the asset back to the utility. In so doing, they have shortened interconnection times.</p>

<p>With the increase in the use of technology pre and post COVID, what is the total projected demand for electricity? How is this demand linked with the Provincial long-term electricity plans and the National electricity plan?</p>	<p>Load forecasts are much lower everywhere than they were a few years ago, and there is something of an east-west split in current thinking about where the demand for electricity is headed. In eastern Canada, utilities foresee relatively flat growth and in western Canada the forecasts are higher. The role of electricity in society is undergoing an historic transition, and it is a complex transition in the sense that it will not necessarily lead to growth in aggregate consumption. For example, 25% of the residential floor area in Canada (with lots of regional variation) is heated with electric baseboard heaters, so a shift to heat pump technology frees up significant amounts of existing generating capacity for growth, electrification and/or export. In our simple scenario, the approach was to focus on how we could create a complete renewable supply of 625 TW.hours of electricity in Canada and do it in a way that fossil fuel generation could be phased out everywhere. 625 TW.hour leaves a margin of some 40 TW.hour to cover growth, electrification and exports, even before considering the potential for efficiency and other gains that can free up supply. Bottom line: if we are smart 625 TW.hours of renewable electricity should be enough for us to electrify, decarbonize and continue to export for at least the next ten years.</p>
<p>In the period of transition to a 100% renewable power system, do you propose we utilize 100% Canadian fossil fuels or rely on more foreign imports to eliminate the need for more fossil fuel infrastructure in Canada?</p>	<p>We did not consider this question. The availability of cheap U.S. gas from the newly expanded production in the Appalachian basin has resulted in greater use of imported gas in eastern Canada in recent years.</p>
<p>What do you see as the largest challenges to electrifying transportation beyond buses? ie. long haul trucking and personal vehicles. How do we move away from trucks being a preferred personal vehicle in a world where gas is so cheap?</p>	<p>We will be addressing transportation issues in a future Corporate Knights panel (on May 6).</p>
<p>there is lot of shovel ready projects for energy storage in water and wastewater treatment plants in Ontario and can fundamentally change the demand curve for electricity.</p>	

<p>Phasing out Canada's carbon based electricity will mean putting a lot of people and potentially whole industries out of work. What are we going to do to help transition those workers and communities into the carbon free economy?</p>	<p>The electricity sector actually gets bigger and will employ more people in the low carbon future. Having said that there will be transitions within the sector as it moves away from fossil generation. The remaining carbon-based electricity generation is located in Alberta, Saskatchewan, Nova Scotia and New Brunswick, with the prospect of recarbonization of the Ontario grid looming. Fossil fuel generation is not a labour intensive industry, but it will be important to ensure a just and fair transition to the renewables-based system. The employment that will be generated by the capital projects included in our scenario will be greater than the employment required to operate the existing thermal power plant fleet. The thermal fleet will also have a role to play for many years to come, particularly in the provision of grid services. In the case of Ontario, with the shutting down of the Pickering station in the next few years, there is an opportunity for direct decommissioning, a labour intensive undertaking that would also position Canada for a share of the coming wave of plant decommissionings around the world.</p>
<p>Electricity regulation is under provincial jurisdiction in Canada. What do panel members think is the appropriate/ necessary role of the federal government, in regards potential economic stimulus, in addressing the challenges of spurring renewable energy demand given these jurisdiction realities?</p>	<p>One of the reasons we zeroed in on the interprovincial transmission connections is that this an area where interprovincial trade is being hampered by provincially fragmented utility and regulatory regimes, and where federal leadership, financing and brokering can help move things forward. These interconnections would be themselves stimulate additional renewable electricity production and consumption. Beyond that, the current support for FCM programs to help local governments build up their smart grid infrastructure and community-based energy strategies can play a key role.</p>
<p>What reasons would the business community have to support self sufficiency in households and communities? they don't seem to be in the interests in growing business.</p>	<p>The business opportunities in the provision of distributed generation hardware and software are very large and one of the fastest growing segments of the energy system.</p>

<p>The grid access rules in place over the past 30 years across Canada have been punitive and restrictive for small and mid scale projects from the private sector. If the government wants to do something constructive, it needs to set common requirements for grid interconnections and to do so in a manner that encourages some of the smaller facilities without making the grid distribution any more fragile than it already is in some areas. The role for government and policy is to open the way for private sector competitive investment but done in a manner that is constructive and additive rather than making it harder for the public utilities to maintain and support their systems in a viable cost effective and risk protective manner.</p>	
<p>Will small modular nuclear reactors be part of Canada's energy future?</p>	<p>The regulatory and licensing support system is not yet ready and their capital costs alone are estimated to be four times higher than the current cost for wind generation so that even after allowing for capacity factor and grid management functions, they are not competitive. This will make it difficult for them to contribute on the ten year time frame in which economic recovery and climate change response are being considered.</p>
<p>Can you please provide a link to the study Ralph Torrie was referring to? Thank you very much!</p>	<p>It is available on the Corporate Knights Web site at <a href="https://www.corporateknights.com/channels/utilities-energy/building-back-better-green-power-wave-15881589/">https://www.corporateknights.com/channels/utilities-energy/building-back-better-green-power-wave-15881589/</a></p>
<p>Perhaps a comment more than a question, but it appears that much of the discussion is about propagating the current hub and spoke power distribution model. Similarly to the mobile phone and computer industries, other models</p>	
<p>continuing my question. Other models exist, such as distributed power generation and storage.</p>	
<p>What do you think of going beyond the idea of greening the grid or shovel ready projects to focus the limited stimulus funding to projects and companies that can grow and accelerate Canadian climate change solutions, jobs and exports for longer term impacts?</p>	<p>Agreed. The frenzy around short term stimulus should not eclipse the challenge, also urgent, of ensuring the recovery is sustainable.</p>
<p>Question for developers/owners (Matt, Terri, Annette): how dependent are your projects on debt financing? Do you expect difficulties to fund new projects from debt markets (banks, bonds, others) during current economic conditions?</p>	<p>live answered</p>



<p>Ralph, thank you. For provinces that don't have the luxury of robust surpluses of hydro power, do you propose they use interprovincial hydro power lines to back up renewables. Or do you foresee some fossil fuel infrastructure for those provinces. Namely Alberta. Are there other options for backup baseload power beyond hydro?</p>	<p>I think interprovincial lines can make all the difference in the decarbonization of the electricity consumed in Ontario and the Maritimes. The two provinces where the challenge of complete decarbonization of the grid is greatest are Alberta and Saskatchewan, exacerbated by the technical barriers to moving power from Manitoba to Alberta. Right now coal-to-gas conversion is the centrepiece of lowering the carbon intensity of electricity in these provinces, (although the more we learn about the life cycle greenhouse gas emissions of natural gas the less advantageous it looks relative to coal). The wind regime in southern Alberta and south Saskatchewan is among the best in Canada and it can be used in conjunction with storage, biogas fueled turbines and other options to contribute to baseload. But as you suggest without access to hydro there will be a need for alternative baseload options. There is a great deal of research going into how these might be low carbon options.</p>
<p>This is a great session However, when people in the "old" economy are ignored or talked about but not consulted with, they understandably put up barriers to change. Ignoring these people slows or even stops progress. Please remember that the majority of the country does not feel like they are a part of these conversations.</p>	
<p>As we begin to implement recovery plans across Canada there will be a real need to address major improvement issues with our indigenous communities and rebuild our economy as efficiently as -- and energy efficiency, renewable power, energy storage, decarbonization of the electricity system, regionally and nationally are all key to that. This in turn will lead to better quality of life, labour force diversifications, economic growth and address climate. Any thoughts from the Panel on this regarding how this can be done from coordinated approach.</p>	
<p>For Ralph, is your research and analysis available publicly?</p>	<p>The broad brush scenario that was the basis for the presentation to this web panel is on the CK web site and the supporting spreadsheet will be posted there soon.</p>
<p>Given the incredible scale and detail of solutions that we have existing in Canada, how important do you consider public support/understanding in facilitating the structural shift your solutions need - vis a vis government support? What is your strategy for generating that support?</p>	

<p>I believe that the public will support some investment and change towards "cleaner" energy generation projects. But there are risk and fiscal tolerance limitations. There have been numerous studies undertaken to assess the public tolerance for an increase in energy cost if it moves towards a more sustainable and environmentally responsible approach. But the amount of money available is limited. And there is a lack of understanding and trust by much of the public in changes that increase cost without a clear and measureable improvement. How do you plan to change this? Do you think that you understand the public tolerance and public understanding of these issues?</p>	
<p>Would it be helpful if the government significantly enhanced its 2030 emissions reduction target while stating the directions it will take to bring in further investment?</p>	
<p>The electricity and gas inspection act actually is a problem for many of the behind the meter solutions (including storage) would this panel support modernization of that act</p>	
<p>Our institutions for regulating and managing our energy grid are outdated and essentially obsolete. They need to be changed to have a structure that could allow all of these initiatives to be successful. Public education and understanding is lacking. You can't change policy without public support. What efforts are being planned in this area?</p>	<p>My view is that Canada will be challenged in meeting its current 2030 target, which already represents one of the most ambitious economic shifts in the world. But very ambitious interim targets in 2035, 40, 45 and 50 are integral</p>
<p>With the declining costs of renewable generation, across all technology fronts, how much consideration should be given to decarbonizing industry through the electrification of process heat?</p>	
<p>Gret speakers! Key Points missed today:</p>	
<p>Welcome to a Green New Decade!</p>	<p>All forms of increased energy productivity should be considered without a dogmatic approach</p>
<p>1) What about vehicle-to-grid technology to allow EV's to form batteries to the grid (self-sufficiency during power outages) and to serve as storage during the solar peak when the car is parked.</p>	<p>The potential for EV to provide diurnal storage is enormous; ensuring that the charging infrastructure, and especially the home-based charging, is built out to support this should be a priority.</p>
<p>The free trade agreements all demand environmental respect and to decrease ghg, the potential loss of nondomestic sales revenues for many of our key publicly traded companies is real. Is it being quantified?</p>	<p>We did not include an analysis of this in the work presented for this panel.</p>
<p>Strongly agree with Pierre-Olivier</p>	