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And

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February 14, 2020

Re: M08929 – Integrated Resource Planning – IRP Assumptions for Renewable Energy Resources and Considerations for Distributed Energy Resources

Dear Ms. Godbout and Ms. Fris:

Envigour Policy Consulting Inc. has been retained by QUEST and Marine Renewables Canada as their consultant in this matter. We have participated in the discussions regarding assumptions and have had the opportunity to explore the role of Distributed Energy Resources in contributing to Nova Scotia's transition to a lower carbon future.

We are generally supportive of Nova Scotia Power's approach on these matters, but our client, Marine Renewables Canada would take issue with some assumptions regarding instream tidal energy future costs and their concern over the modelling of the evolving value of offshore wind. This submission will outline the areas where we believe the modelling should reflect different assumptions. We will also elaborate on our client QUEST's research, findings and expectations on how to account for the emerging role of DER.

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Current and Future CAPEX for Instream Tidal Resources

Definition of Technologies Considered

Unlike conventional hydro or tidal barrages, Instream tidal devices exploit the speed of the tidal currents rather than the height of the tidal range. As such they are completely different technologies with respect to economics, environmental impacts and form of deployment. Accordingly, for the purposes of the IRP, cost comparisons between instream tidal devices and tidal range or hydro dams are irrelevant, and potentially misleading.

Types of Tidal Devices and their Deployment

In Nova Scotia, current and proposed licence and permit holders have technologies that roughly fall into three categories:

Large Scale

DP Energy's Uisce Tapa Project with 6 1.5 MW Andritz Hammerfest Hydro turbines for a total deployment of 9 MW at FORCE[1]. The project is similar to the Maygen project in Scotland, the world's first array with bottom mounted turbines.

The former Cape Sharpe Project with 2 MW OpenHydro turbines was also large-scale with turbines mounted on the bottom. The project was abandoned when the parent company went bankrupt.

Small Scale

Sustainable Marine Energy (SME) is using its PLAT-I floating platform and SCHOTTEL Hydro's turbines to build a smaller scale project. Each PLAT-1 platform will have multiple turbines with a total capacity of 420 kw on each PLAT-I for their Pempa'q Project at FORCE[2]. The first phase will use 3 PLAT-I for a total of 1.26 MW with plans to build up to 9 MW at FORCE. SME is currently refining designs for PLAT-I next generation through testing in Grand Passage.

Nova Innovation is working toward a 1.5 MW tidal energy array in Petite Passage. The first 500 kw deployment will be split into two phases[3]. Nova Innovation has the distinction of completing the world's first tidal array project. It has extensive experience with bottom mounted smaller scale turbines., Their first project in the Shetland Islands consisted of 100 kw bottom-mounted turbines.

Unconventional

Big Moon Power has a Demonstration Permit to test a 100 kw device in the Minas Passage and a second Permit which will allow the company to grow the project to a total of 5 MW and sell power to NS Power at a rate of $0.35 kwh[4] which implies a CAPEX of well below $10 m per MW. Big Moon is using a unique system of a barge connected by cables to a land-based generator where the barge moves the cable as the tidal current ebbs and flows.[5]

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1 https://www.dpenergy.com/projects/canadauiscetapa/
2 https://sustainablemarine.com/news/pempaq-project
3 https://www.novainnovation.com/petitpassage
4 https://novascotia.ca/news/release/?id=20180412001
5 https://marineenergy.biz/2018/02/06/big-moon-power-outlines-bay-of-fundy-tidal-plans/

Jupiter Hydro also holds a Demonstration Permit for a non-grid connected 1 MW device and a Permit to 2 MW with electricity connected to the grid and sold to NS Power at $0.50 kwh[6] at a site near, but not at FORCE. Jupiter uses helical screw[7]s to capture the force of the tidal current to drive a generator. The technology is surface mounted.

Global Industry Perspective

Given the wide range of technologies and approaches being tested/demonstrated in Nova Scotia it is not easy to establish cost structures and direction for change over the course of the next decade. However, a 2018 Market Study[8] report by industry group, Ocean Energy Europe to the European Union, provides insight into global trends and energy thinking. This report suggests significant declines in cost as technology deployments take place. They also see a significant increase in deployments, with the most pessimistic case still delivering 700 MW of capacity globally by 2030. Table 13 of thier report shows as technology matures to a Technology Readiness Level (TRL) between 7 and 9 (with 9 being completely commercialized) deployments in the 5 to 20 MW range are expected to have a capital cost per MW of 4.3 m Euros or $6.4 million.

Those costs represent the average of all technologies. Those using unconventional approaches and technologies argue their costs will deliver projects below that, although those arguments have yet to be proven. However, the small-scale technology developed by Schotell Hydro and deployed on Sustainable Marine Energy floating systems has had years of experience and offers the following statement for the development of IRP assumptions:

“There are many variables to consider, many of which are unknown at this stage, but the simple assumption that we use in our internal forecasting is that we can achieve a learning rate of 15%. We feel this is fairly conservative when industries like wind (onshore and offshore) have achieved 16-18%, and of course once a technology reaches maturity this rate slows down a bit, but I don’t see us reaching this point by 2030.

So if you were to look at just our technology and plans, and assumed that we could continue deploying capacity in the Minas Passage beyond our current project, and assume a constant deployed rate of ~5MW/year after we get the initial 9MW deployed, then we could feasibly get down to ~$3.5m/MW by the time we have ~100 units deployed (have also not taken into account any scaling of the size of the systems.

[6] https://marineenergy.biz/2018/02/06/big-moon-power-outlines-bay-of-fundy-tidal-plans/
[7] http://jupiterhydro.com
[8] https://www.oceanenergy-europe.eu/wp-content/uploads/2018/07/KL0118657ENN.en-1.pdf

Year	MW deployed	Cumulative deployed	Cum no. Units Deployed	CapEx/MW (mCAD)	CapEx/ unit (mCAD)
2021	1.26	1.26	3	10.00	4.20
2022	2.52	3.78	9	7.73	3.25
2023	5.04	8.82	21	5.97	2.51
2024	5.04	13.86	33	4.90	2.06
2025	5.04	18.9	45	4.41	1.85
2026	5.04	23.94	57	4.10	1.72
2027	5.04	28.98	69	3.88	1.63
2028	5.04	34.02	81	3.71	1.56
2029	5.04	39.06	93	3.57	1.50
2030	5.04	44.1	105	3.46	1.45

Envigour then, on behalf of MRC suggests that maintaining a $10 m CAPEX estimate out to 2030 is not sustained by evidence that is specific to the instream tidal sector. Furthermore, the underpinning of the NS Power consultant's assumptions that tidal technology deployed and to be deployed in Nova Scotia is equivalent to a custom-designed hydro project is in fact erroneous.

Furthermore, although any and all predictions about future prices 10 year out will in fact likely be wrong, and even though the cost of instream tidal will likely still be above the cost of other renewables at this point, this technology has its own unique advantageous (predictable energy flows and production times), and a post 2030 future may need all developable renewable energy resources to meet climate change goals. In that case it would be prudent to accept that there could well be a case for continued development and an outcome as outlined by SME. Therefore, we suggest the IRP use the lower number of $3.46 m CAPEX per MW for 2030, and we further suggest NS Power watch global volume deployments and cost decline history closely in the next decade.

Value of Offshore Wind

The IRP assumptions call for a decline in capex over the next decade, and we have discussed the numbers used with our colleagues in America and we find no issue with the numbers per se.. However, we are raising the issue of whether the modelling will capture the full value that comes from the growth in the size of the offshore wind towers, blades and turbines.

GE is now producing what it calls the world's most powerful offshore wind turbines.[9] With a capacity factor of 63%, we believe this is would likely offer significant additional value to the NS electricity system. Our concern is that the model captures this value as well as the gross decrease in the levelized cost of energy. It would be helpful to the process if NS Power and/or its consultant could provide explicit assurance the modelling will capture the value of such a high capacity factor.

[9] https://www.ge.com/renewableenergy/wind-energy/offshore-wind/haliade-x-offshore-turbine

Considerations for Distributed Energy Resources

QUEST and Pollution Probe collaborated on an assessment of the pace of change in energy technologies and the ability of the policy and regulatory frameworks to adapt. [10] Envigour was the lead author of this report entitled: Canada's Energy Transformation – Evolution or Revolution? A Discussion Paper for Canadian Policymakers, Utilities, Regulators and Key Stakeholders on Managing Risk and Creating Opportunities as We Build Low-emission Energy Systems.

This report documents the rapid rise in innovation for energy systems driven by a public policy desire to reduce carbon emissions that contribute to climate change. With the desire to develop new cost-effective technologies and new business models has come dramatic cost reductions – at a pace that was unanticipated just a few years ago. Many of the changes are associated with distributed energy resources which we have defined in the report as technologies for energy efficiency, renewable and other local supplies of energy, energy storage and management, and microgrids (including electric vehicle charging stations).

We submit the report and its extensive referencing/documentation for energy prices and trends to the IRP through the link noted below as footnote 10. With this submission we also provide a caution: the numbers referenced are now nearly a year old and the references need updating. This is not a weakness in our submission, but rather the main point: the major challenge we face when considering the price and value of all renewables and carbon-reduction technologies, including DER is that many of the variables are in constant motion.

Technology prices decline as production and deployments become more wide-spread e.g. L-ion battery prices decline as EV production using those batteries grow, new technologies emerge that disrupt the incumbent technologies (e.g. Lithium-ion or L-ion batteries vs emerging flow batteries or the use of low cost zinc particles for storage), and new business models and pairing of technologies result in new possibilities stand-alone EV chargers may cost more than networked ones. A heightened emphasis on the need for rapid achievement of low carbon goals drives innovation from the lab to consumers more quickly than ever.

Above all, businesses may catch the attention of consumers to find unexpected value in their technologies driving rapid rates of adoption. The possible pace of change can be seen in the evolution of the iPod into the iPhone into the more general smartphone and the explosion of applications over the course of just one decade.

The needs of the market may change as well. For example, as weather conditions become more variable, stressing the outer limits of the grid to manage, and outages become more frequent, even if only for a few hours at a time, resiliency and reliability become more important. Those values may lead to a more rapid uptake in batteries/storage. Consumer purchases for resiliency may offer an improved business case for distributed storage to meet grid needs for demand management including peak shaving.

We recognize and submit that traditional planning that is directed top-down by utility investment and operations is being turned on its head as consumers are able to make energy choices and influence planning bottom up. Clearly this makes planning for change increasingly difficult. With rapidly changing assumptions, we need new approaches.

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[10] https://drive.google.com/file/d/1P-JkLrs2eJNVlxgtWckL7bC-mcWwJXxg/view

We also need a great deal more information on the value of new and evolving technologies. As we noted in our earlier filing for this process, it is not just a matter of monitoring price – it is also a matter of understanding the value of a technology when that price changes. For example, the current IRP should include scenarios that explore what happens when storage for days or weeks emerges – perhaps through hydrogen from renewable energy that becomes cost-effective. Knowing how this would impact other assumptions now would help us understand the value of price declines in the future. We have noted a number of technologies to monitor for value in our earlier submission.

The Role of Climate Change in Planning

First and foremost, all prudent energy planning needs to be based upon the assumption that climate change is a current and future imperative for energy policy. In Nova Scotia the Sustainable Development Goals Act[11] has set a goal of net-zero by 2050 in law. Although not specific to the electricity sector it is illogical to think that the electricity sector would be immune. In fact, most likely pathways to achieving this goal depend upon a significant amount of electrification and thus the assumption that the electricity will be net-zero carbon logically follows.

While there can and will be considerable debate about how to achieve net-zero, in practical terms that will likely require something above 85-90% carbon free, with the expectation that part of that amount or an additional amount could come from systems that contain carbon today (natural gas pipelines) but would be carrying net carbon free fuels (a combination of hydrogen, renewable natural gas and carbon offsets) by 2050, as long as the generating technologies are flexible enough to use such combinations.

Implications for Inequality

It is important to note that efforts to address climate change and the related drive for innovation in DER have implications for inequality and potential for increasing energy poverty. This comes about as energy users with capital or access to capital move to invest in their own energy systems and leave behind those in poverty.

Energy efficiency DER investments supported by ratepayers already see this inequity. Almost all cost-effective ratepayer investments are cost-effective because they leverage consumer capital investments. This dilemma for people without the means to make such investments is recognized by the taxpayer and utility investments in the Home Warming program. However, we would argue that the essential inequity remains. Low-income ratepayers must pay a share of efficiency spending without equal access to the direct program incentives. We would expect the evolving electricity rate-design and program designs to take this inequity into account, and not simply leave it in the hands of taxpayers to resolve.

Principles for Risk Reduction in IRP

Under conditions of rapid and disruptive change several principles regarding risk emerge:

First and foremost, all other things being equal, a strategy of no regrets emerges. This type of strategy would assume flexible and adaptive investments with shorter term paybacks are less risky than ones requiring long-term paybacks. A PPA with a 15 to 20-year term may turn out to be less economical than expected, but the consequences are felt for that 15 to 20 years. On the other hand, a bad investment in a project that takes 40 to 60 years to recover that investment could have adverse impacts for many decades.

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[11] https://novascotia.ca/news/release/?id=20191023003

A risk adverse planning system would also take as a given that the electricity sector itself faces a net-zero energy future for 2050, and an ongoing need for additional electricity supplies. Therefore, in general, new investments in carbon-emitting resources are more risky than renewable and other clean energy technologies. This principle is not absolute - a case may be made for “peaker” natural gas generators especially ones that could be converted to hydrogen or use a combination of hydrogen and renewable natural gas.

A risk-adverse planning framework would also recognize the rise of DER results in the rise of consumer choice. Planning that includes solutions that support customer choice and an environment where third parties and utilities both compete for customer value and loyalty are preferred. Supporting customers is more realistic as change is coming and it better to embrace than resist. Supporting customers is also more likely to improve consumer satisfaction. The real risk is that a failure to anticipate, integrate, and embrace DER is likely to frustrate customers and raise the possibility of revolt.

How the Principles Influence Decisions for the IRP

From a no-regrets, risk reduction perspective, the IRP should embrace the idea that all prudent scenarios should comply with net zero by 2050 with net-zero implying a minimum of ~ 90% non-emitting supplies. It may be useful to understand the costs and consequences of accelerating that goal, but scenarios that suggest significant investments in or maintenance of significant carbon-emitting resources that have a useful life beyond 2050 should be deemed risky, imprudent and non-viable for future planning. Again our caveat is that some generators that use fossil fuels today that could become clean fuels in the future should still be considered, but the larger the scale and investment, the larger the risk. DER tends to have short-term paybacks and thus support resiliency and customer choice. These values should not be ignored or rejected when considering only lowest-cost compliant scenarios. Ones that include DER should be preferred against ones that do not, especially when the levelized costs are not far apart.

After the IRP

The IRP assumptions need frequent updating in a transparent and inclusive manner. We suggest consideration should be given to holding regular forums with input from Nova Scotia, Canadian and other experts who can contribute knowledge, experience and expertise on short to medium term commercial trends on renewables in general, and DER in particular – based upon Nova Scotia’s energy transformation, policy and regulatory frameworks. Current and future expectations of policy drivers such as carbon policies should also be examined. The output from these forums should then influence a new set of assumptions – and when those assumptions have changed in a meaningful way, the IRP should be updated.

The next five years should continue to have focus on testing programs and strategies to develop evidence for the value of current and emerging DER. Pilots to test new concepts to reduce energy poverty should also be supported. This evidence needs to be gathered and shared in a more extensive inclusive manner – particularly within communities that are planning for low-carbon futures. Building knowledge and sharing it widely is fundamental to achieving a more rapid and less costly transition to a lower-carbon future.

Smart Energy Community Policy and Technical Factors

In closing we also reference QUEST’s experience and leanings regarding the development of Smart Energy Communities. QUEST has long-standing policy and thinking on distributed energy resources and the opportunity to support the development of smart energy communities. The detailed technical and policy thinking behind their work is attached to this report.

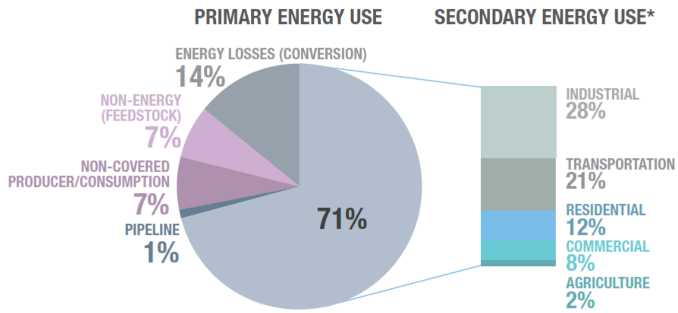
A Smart Energy Community understands the compelling challenge of climate change while recognizing the reality of community energy needs and priorities. It seamlessly integrates local, renewable, and conventional energy sources to efficiently, cleanly, and affordably meet its energy needs. By shifting the conversation toward Smart Energy Communities we start talking about what matters to Canadians in their day to day lives – more sustainable energy systems, new economic opportunities, improved local environmental quality, more resilient infrastructure, and affordability. This shift makes energy and climate policy constructive and concrete as opposed to a sometimes abstract, almost always divisive political debate.

Table 1: QUEST's Technical & Policy Principles

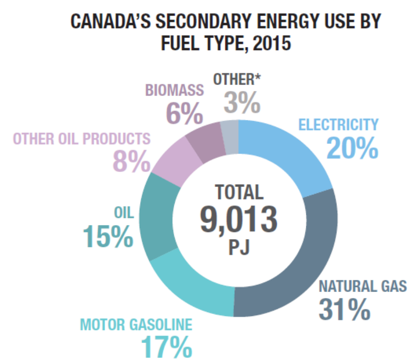
Technical Principles	Policy Principles
. Improve efficiency – first, reduce the energy input required for a given level of service	Match land use needs and mobility options – understand the energy implication of land use, infrastructure for water and wastewater, waste management, personal mobility, goods movement, and building design decisions
. Optimize exergy – avoid using high-quality energy in low-quality applications	Match energy options to local context – local climate, building on land use choices, industrial structure, availability of local sources of waste and renewables
. Manage heat – capture all feasible thermal energy and use it, rather than exhaust it	Send clear and accurate price signals – consumers should see and pay full real costs, including external costs
. Reduce waste – use all available resources, such as landfill gas and municipal, agricultural, industrial, and forestry wastes	Manage risks and be flexible – maintain technological and fuel diversity; pursue cost-effective opportunities first and incorporate learning; assume the need to adapt quickly to market and technological surprises
. Use renewable energy resources – tap into local opportunities for geoexchange systems, small-scale hydro, biomass, biogas, solar, wind energy, and opportunities for inter-seasonal storage	Emphasize performance and outcomes in policy and regulations – avoid prescribing fuels and technologies
. Use energy delivery systems strategically – optimize use of energy delivery systems and use them as a resource to ensure reliability and for energy storage to meet varying demands	Pursue policy and program stability – maintain a consistent and predictable decision-making environment to sustain investor confidence

A New Way of Framing the Issue
We are approaching thirty years from initial agreement on the Framework Convention on Climate Change in Rio in 1992 and the energy and climate discussion in Canada has only resulted in limited action. We think a useful way to frame the discussion going forward is around four "systems" or sets of issues. Two of those sets of issues - energy exports and upstream electricity production - have received virtually all of the public's attention. A third, equally important issue is the widespread implications for the resource and industrial economy, which receives little attention. All of these connect in various ways to the fourth set of issues, involving **local energy solutions** and which needs to be further explored and brought into the mainstream discussion.[1]

Local Energy Delivery and End Use
Local energy delivery and end use which has in the past been mainly about building, equipment and vehicle energy efficiency but increasingly centers on a whole different concept, what we call Smart Energy Communities.[2]



*Secondary energy refers to the energy used directly by the final end users.



Much of the energy future is to be found in Canadian communities (large urban, medium, small rural, remote, resource-based & indigenous) where we use approximately 60 percent of our energy and emit about half of our greenhouse gases.

A new direction
We can frame the problem around six key challenges and why smart energy communities and QUEST offer real solutions:

1) Building climate change policy on a foundation of sound energy policy[3]
Almost thirty years of limited results on greenhouse gas management should tell us something is wrong. Part of what is wrong is that our climate aspirations stand precariously on a foundation of awareness of energy fundamentals that often ranges from incomplete, to wasteful and ineffective to, at worst, destructive of both public and investor confidence. Smart Energy Communities are founded on

[1] Typically the transport sector is treated as a distinct set of issues but for QUEST local transport is embedded in the concept of smart energy communities and for purposes of this note we treat transport – transport infrastructure, energy use, emissions and related controversies and solutions - as integral to and part of the other systems.
[2] https://questcanada.org/pathways/
[3] M. Cleland & M. Gattinger, "Canada's Energy Future In An Age Of Climate Change: How Partisanship, Polarization And Parochialism Are Eroding Public Confidence", Positive Energy, University of Ottawa, March 2019

recognition that energy consumers and citizens first value the fundamental integrity of their energy delivery systems: safe, reliable, secure, resilient and affordable. Beyond that, the evidence points to communities generally placing more weight on local environmental and social issues (impacts on air, water, land and cultural heritage) than on the abstract concept of climate.[4,5] Canadians want climate solutions but they want them built on secure foundations and that is where Smart Energy Communities fit in.

2) Driving technological change while avoiding technological determinism
The objective is results, not methods. We have no way of knowing exactly what technological solutions might underlie a low emissions Canada in midcentury. We need to better understand the potential impacts of different technological solutions on utilities and other energy service providers, consumers, and investors. Rather than pushing for the latest technology, policy needs to emphasize accurate and complete price signals, setting performance standards, creating conditions for investment in infrastructure, and inviting both consumers and investors to choose options based on their particular conditions at a given point in time.[6] This principle is nowhere more evident than at the community level where local conditions are almost always unique whether due to different energy efficiency options, opportunities to manage waste heat, opportunities to make assets out of local waste (domestic, agricultural or industrial) or diverse local renewable energy options. Smart Energy Communities figure this out and select what works best for them.

3) Maximizing the value of all our assets, both existing and new
Electrification is no doubt a solution in several quarters but it is not obviously the only one in the medium term and the established energy networks - electrical, natural gas, fuels for mobility - have long lives still to live and many options for solid incremental improvement, especially building on the potential for diverse networks to work together. In any event, in a world where all the evidence tells us that new infrastructure will be risky and expensive, needing careful, deliberate discussion to bring citizens along and, inevitably, slow to build[7], we can't afford to waste what we have. Smart Energy Communities know this and use their assets accordingly.

4) Emphasizing institutional innovation
Technological change is clearly of immense importance and Canada is doing its share to create such change in our energy systems from upstream to down. But what is missing from the technological conversation is a whole field of innovation concerned with the institutions that will oversee change and deployment of new technologies. What are the right roles for local governments? How does a regulatory system that has served us well get a lot better, in terms of who decides and how, as well as how it adapts to the new business and regulatory models that follow from the emergence of new technological options? How do policy makers find answers to these questions, answers which have the weight of concurring citizens standing behind them? QUEST through focusing on Smart Energy Communities can

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[4] M. Cleland & M. Gattinger, "Canada's Energy Future In An Age Of Climate Change: How Partisanship, Polarization And Parochialism Are Eroding Public Confidence", Positive Energy, University of Ottawa, March 2019

[5] M. Cleland et al., "A Matter of Trust, The Role of Communities in Energy Decision Making", Positive Energy, University of Ottawa, November 2016

[6] https://questcanada.org/pathways/#principles Principles for Smart Energy Communities.

[7] Trottier Energy Futures Project "Canada's Challenge & Opportunity: Transformations for major reductions in GHG emissions", April 2016

and does bring all the relevant stakeholders together in ways that make the answers more apparent and with stronger and more widespread support[8].

5) Reducing policy uncertainty through alignment and sense of community
Local energy debates emphasizing all the energy related needs of local communities while adding to climate solutions and built around a shared sense of community can offer improved prospects for civil dialogue and more stable conditions for change. Smart Energy Communities, by definition, spend less time shouting at each other and more on building the future.

6) Restoring public trust and confidence in decision making institutions
It is more likely that trust and confidence will be gradually restored if citizens can see progress through decision processes that engage them and their local communities. Smart Energy Communities are also more energy literate communities and more likely to be constructive contributors to the larger energy decisions that occur outside their immediate areas of responsibility.

DERS

The power grid is considered by some to be the largest machine in the world, spanning continents and providing generated power over 100s and thousands of kilometers of wires. The power is delivered to end users at the exact second they need it, in an an incredibly balanced, complex, and synchronized manner. Despite some failures and events, it is remarkably reliable at delivering energy to us all, almost every second of every day.

However, the centralized, top-down grid and delivery system and stable business model for utilities that has endured the last century is being disrupted by a number of drivers, causing adaptation an evolution in how we produce, move, and use energy. The drivers at the community level include :

- need for local and system resilience in the face of increased climate events causing prolonged outages - causing $ to leave communities and costing utilities in outage management
- rise of smart, cleaner technologies that offer new ways to generate and manage energy at the local level - digitization, automation
- A global drive to reduce GHG emissions
- Local revenue generation and energy cost security and stability

Communities have new energy solutions available to them, changing the relationship utilities have with their customers, and their business model, as well as how energy moves on the grid, causing potential description on the balancing side of things. As generators, storage, and controls — get cheaper and more powerful," end-use customer will be able to get a major portion of their energy on-site or in the community. That touches every level of the electric system.

Challenges for Stakeholder Groups

Energy Service Providers/Utilities

- Disruption to traditional business model, potential loss of business
- Adapting business model and service offering - staying relevant
- Changing relationship with customers, tech providers
- Value proposition

[8] QUEST Smart Energy Leaders' Dialogue, Working Groups and QUESTtalks www.questcanada.org

- Alignment with customers, solutions, regulators, government, etc.
- Understanding municipal, institutional processes and governance
- Matching the right solutions

System Operators, Regulators

- Disruption to the grid architecture, balance
- Ensuring right source - right place - right time
- Energy reliability, security, planning
- Existing robust systems
- Who managing distributed sources - management models

Distribution Consumer Challenges (Muni's, institutions/campuses, remote sites)

- Understanding of the technologies, its capabilities, benefits, and risks
- Understanding the energy project development process
- Different business/management/partnership model (Ownership, O&M)
- Restrictive policy or regulation
- Value proposition/ROI/financing
- Community buy-in/council approval (municipalities) - quantifying benefits
- Changes in government incentives, programs, funding, support, etc.

Developer/Solution Provider/Consultants

- Understanding municipal, institutional processes and governance
- Identifying the right solutions (popularity vs. function)
- Restrictive procurement policies
- Timing of funding programs with planning and budget cycle
- Risk adversity