

**OSPE's Submission to the Ministry of the Environment and Climate Change re: Ontario's
Climate Change Discussion Paper 2015
March 29, 2015**

Overview

The Ontario Society of Professional Engineers (OSPE) is the voice of the engineering profession in Ontario. We are a member-based organization that represents approximately 10,000 members, and benefits 225,000 engineers in Ontario. We advocate on behalf of the engineering profession to governments, industry and the public in order to advance the professional and economic interests of all Ontario engineers.

OSPE is well placed to provide the government with the expertise required to provide input and advice to develop a long-term, comprehensive climate change strategy. Engineers understand the requirements for innovative, sustainable and efficient building designs, effective energy policy decisions decreasing GHG emissions and the impact climate change has on soil and the great lakes ecosystem, to name but a few examples. Engineers are creating leading technologies that Ontario will need to combat climate change.

The comments issued in this submission have been all brought forth by OSPE members from within the engineering community that is working in the environmental field and related industries. As such, they represent the views of professional experts with first-hand knowledge of the topic areas.

Summary

Ontario needs to implement a wide, comprehensive range of carbon emission reduction policies and programs that span across all Ministries and agencies, in cooperation with other levels of government. Moving towards a low-carbon economy will create prosperous opportunities, and enhance, rather than diminish Ontario's prosperity. The program should be an outcome-focused regulation that establishes clear benchmarks, but that allows for some degree of flexibility as to how they are achieved.

A more efficient, better organized Ontario will have a stronger economy. More of our needs will be met by Ontario workers, less by imported fossil fuels.

With respect to carbon pricing, the specific mechanism chosen is less important than ensuring that the program is designed properly and is easy to understand and apply. The program must also not negatively impact other Priority areas, as identified by the Province of Ontario, but rather, complement or enhance these areas. For example, they should lead to increased investment in infrastructure, new, cumulative job creation, and the design of new, innovative green technologies that can be exported, thus leading to greater GDP growth.

A significant target area for GHG reduction is transportation, especially gasoline-powered motor vehicles. We need a transportation revolution, and modifying energy consumption in this capacity needs to be a central element in urban design and community

planning, especially as it relates to the design, build and use of future public transportation systems.

Transitioning to a low-carbon economy should be part of a broader focus on sustainability, which includes three limbs: government leadership, changing cultural values, and embracing new technology. Climate change poses a serious threat to the economy and standard of living of Ontarians. The Ontario Government has the opportunity to take action based on sound science and evidence-based knowledge to become a world leader in tackling the climate change challenge.

Actions in Key Sectors

What can each of the key sectors, including transportation, industry, buildings, electricity, agriculture, waste and forestry, do to contribute to Ontario's 2020 and 2050 targets?

What can government better do to encourage industry to further increase rates of innovation that would lead

to improved productivity of all capital, including natural capital, in order to reduce emissions?

The government should encourage consumers to transition from fossil fuel energy to electrical energy, largely because it is much easier to reduce emissions in electricity than other sectors. Where practical, the sooner we can supply our energy needs with electricity the sooner we can achieve our low emission targets. Ontario's electricity sector has already reduced its operating emissions. Ontario's electrical sector has effectively already met its 2020 emission targets by eliminating coal generation, restarting 6 nuclear reactors and increasing its renewable energy portfolio. Space-heating, process-heating and transportation are significant greenhouse gas emitters; encouraging these sectors to choose electricity for their energy needs will significantly reduce emissions.

Further, in addition to ending subsidies for the fossil fuel industry, the government should use market-price mechanisms to create an environment that encourages the best technologies and solutions to be pulled into the marketplace. Pricing carbon and redesigning our electricity rates to encourage greater use of base load generation will encourage consumers to select lower emission energy sources.

Ontario's electricity price plans are in serious need of revision; as the Auditor General's 2014 report pointed out, the current plans do not encourage the correct consumer behaviour, and actually achieves the opposite. They encourage consumers to use the electrical grid assets inefficiently. By pricing our base-load electrical energy above cost and peak-load energy below cost, consumers are encouraged to conserve base-load energy that is produced by the lowest cost and lowest emissions sources and use more peak-load electricity that is produced by our highest emitting sources. This needs to be rectified in order to make the electricity sector an asset to addressing the province's emission targets.

What role can the agricultural and forestry sectors play in reducing emissions and/or providing carbon sinks or offsets?

Rather than relying on foodstuffs, the agricultural sector should be encouraged to grow low-value organic materials on poor soils to burn or biodegrade for electrical energy production.

Biomass takes many forms and we should consider using land with poor soil to produce non-food biomass for use in facilities to produce energy. Carbon is taken out of the atmosphere to grow these organics and the same amount of CO₂ is produced when they are burned, with the net result being nearly no CO₂ emissions.

An example of a non-food source of biomass is producing wood waste to produce biofuels. Using wood waste, or grass of a low-quality, can play a positive role in reducing emissions. It is important however, to also put controls in place that ensure that forests aren't being cut down (in the example of wood waste) specifically for the purpose of producing biofuels.

Further, alleviating pressure on standing forests can be accomplished through promoting hemp and agricultural cellulose waste as sources of paper fibre. The government should support sustainable forestry practices that focus on limiting GHG emissions as well as enhancing carbon sequestration.

How can Ontario best achieve reductions in emissions in the transportation sector sufficient to achieve Ontario's targets?

As a large source of GHG emissions in the province, it is pivotal to reduce emissions in this sector in order for Ontario to meet its targets. One of the most obvious opportunities to reduce emissions from transportation involve encouraging a shift in behaviour away from an over-reliance on personal motor vehicles towards public transit. Public infrastructure spending should be allocated to reflect this desired outcome. The province should also consider implementing policies and programs to discourage the use of high-emission personal motor vehicles, e.g. a license plate tax on high-emitting personal motor vehicles.

Moving towards electrification, the government should lead by example and move towards electrifying all forms of

public transit, including subways, streetcars, and even taxis and car-sharing vehicles. Taking this step could facilitate the widespread acceptance of electric cars by showing their viability.

A significant source of GHG emissions is also the enormous amount of truck traffic as a result of removal of excess soils. According to the Daily Commercial News, infrastructure development has resulted in 20 to 25 million cubic metres of excess soils being generated from excavations each year in Ontario. For example, disposing of the excess soils generated by the Eglinton Crosstown Light Rail Transit project in Toronto will take 150,000 truck trips and produce 60,000 tonnes of carbon dioxide. OSPE supports policy and regulations that encourage reuse of non-contaminated soils rather than only removal of this resource. OSPE applauds MOECC's recent release of Management of Excess Soil – A Guide for Best Management Practices and actively encourages the ministry to work closely with municipalities on this and other issues.

What are the barriers to uptake in low-emission, zero-emission, and electric vehicle use in Ontario?

Electric vehicles can make a significant reduction in greenhouse gas emissions in the transportation sector. But in order for electric vehicles to significantly contribute to reducing emissions, the electricity that is used to power them must be generated from very low emission sources. Ontario has low GHG emitting hydroelectric and nuclear generating stations. Intermittent renewables (wind/solar) also have low carbon emissions provided that we do not utilize too much natural gas for backup generation. At the current time, electrical storage costs are still far too high to employ it as a backup for renewable sources. This means that in order to fully utilize low emission generation to charge the car batteries, we need to do three things: 1) charging should primarily occur during low-demand hours (night-time); 2) charging during periods when intermittent generation is providing energy that cannot be effectively used should also be encouraged; and 3) charging should not occur during periods when generation, transmission, or distribution capacity is not adequate.

Communities & Built Form

Transportation emissions have grown at a rate faster than any other class of emissions largely because of population growth and urban expansion. What role could the Growth Plan for the Greater Golden Horseshoe and other planning mechanisms play, in combination with other government initiatives such as electrified Regional Express Rail, in stabilizing the growth in transportation and building emissions?

The Growth Plan for the Greater Golden Horseshoe and other planning initiatives should encourage higher density development than what has been previously promoted. High-density development planning can aid in carbon reductions by creating population densities that are conducive to the development of mass public transit and can also protect existing carbon sinks (i.e. existing natural heritage areas).

Planning mechanisms should also promote the use of green infrastructure and low-impact development measures. These mechanisms better replicate existing hydrologic functions which will create resiliency within the system that is better at protecting water quality and reducing risks to/from natural hazards. Green roofs can reduce air condition demands. The province is also encouraged to continue with the development and implementation of updated guidelines such as the government's Stormwater Management Manual with a particular focus on Low Impact Development methods.

In the transportation sector, Ontario needs better regional and municipal planning so that investments in transportation infrastructure are consistent with the goal of curbing emissions. Speaking to infrastructure more broadly, a more coordinated effort between the province and cities would be beneficial, especially with respect to harmonizing provincial funding to prioritized needs at the municipal level.

Today's infrastructure upgrades must be able to sustain our transition to a low-carbon economy and thus, must focus on resiliency. Consequently, municipalities should be encouraged to use the PIEVC Engineering Protocol where appropriate to ensure that upgraded and new infrastructure projects must predominantly focus on being resilient and adaptable to climate change. A procurement process that has a focus on Quality Based Selection (QBS) would better ensure highly resilient infrastructure that is constructed for the long-term.

Municipalities own 60% of the infrastructure, but only receive 6% of the federal/provincial tax revenues from residents who use the assets. They are also likely to bear a significant portion of the burden of the costs and risks associated with climate change, and the responsibility of greatly improving system resilience. Accordingly, cities need stable, predictable funding and more power to generate revenues so that they can invest in critical infrastructure such as mass transit, sewer and stormwater lines, energy efficiency improvements, and better water systems to reduce waste and cope with erratic precipitation patterns of a changing global climate.

Perhaps the area of climate change with the greatest need for strong provincial leadership and symbiotic relationship with municipalities is with respect to underground infrastructure, which is locally owned and operated and is increasingly bearing the brunt of changing weather patterns. This past winter saw a deluge of issues in Toronto in terms of fallout from frozen and bursting pipes, and the recent trend of extreme storm patterns during all seasons, intensifies the need for smart-planning in this area. Sanitary sewers and treatment facilities represent a huge portion of Ontario's investment in infrastructure. They are vulnerable to electrical power interruption, and stormwater runoff is a major cause of water pollution in urban areas.

This leads into an area that was not developed as thoroughly as it should have been in the government's Discussion Paper, which is the interplay between climate change and water. As demonstrated by the IPCC, there is an abundance of evidence to suggest that water resources will be significantly impacted and left vulnerable by climate change. Increased intensity and variability of precipitation are likely to increase the risks of flooding in the years and decades to come. Higher water temperatures and extreme weather events are projected to exacerbate water pollution. Our current water management practices may not be comprehensive enough to manage the impacts of climate change, and consequently, we would strongly urge the province to fill-in the gaps in existing knowledge in terms of researching how our water needs will change due to climate change.

Finally, we would also encourage the province to heed the advice of the UN University Institute for Water, Environment, and Health. The institute notes that climate change is binding together water and energy issues and that it is essential for policymaker's outlook to adopt this reality.

Building net zero communities and buildings are already possible from an engineering standpoint yet few have been constructed. In Ontario, what changes are needed to building codes and planning processes to ensure greater uptake with regard to geothermal, solar, wind, natural light, combined heat and power, community energy and other emerging technologies?

Creating net zero communities and buildings require prudent leadership at every level of government that places 'best practices' above political gamesmanship. We need the building sector to be a leader in reducing carbon emissions in Ontario, and the government needs to support their evolution towards carbon neutrality.

We also need to encourage innovative urban planning that is more energy efficient. This includes community design such as urban density, public and rapid transit, and integrating energy production into the community, so that the overall efficiency for producing both electricity and thermal energy can be improved.

Ambitious targets are needed for energy demand and efficiency in the building sector. Climate change mitigation measures need to be in place; new provincial government buildings should meet Leadership in Energy and Environmental Design (LEED). Provincially-owned structures should adhere to LEED Gold standards; leased buildings should meet LEED Silver standards. These standards should be continuously reviewed and upgraded.

With respect to the building code, the government should regularly revisit regulatory standards for buildings and equipment with a view to require higher efficiency as technology improves and cost-effective solutions emerge. There is an abundance of low-hanging fruit that can help the province realize the efficiencies that have already been made possible through engineering advancements.

We need to adapt to higher wind loads, higher precipitation intensity, and higher roof loads, but also work to improve

insulation. But it isn't sufficient to just talk about better insulation; we have to be careful about which types of insulation are employed. Refrigerant blown foams should become a thing of the past and replaced with water blown foams, because the former have a Global Warming Potential that is thousands of times higher than carbon dioxide. As wall thickness increases, the life cycle emissions reach a point of diminishing returns, and you're actually doing more harm than good with an 8" wall of refrigerant-blown insulation. The switch to water-blown foams generally means a switch from high-density to medium-density foams, with a reduction in insulation R-value, which then has to be compensated by an increase in wall thickness.

Much more could be done with solar selective coatings, not just on windows but also on walls and roofs. It is questionable as to whether the technology is sufficiently ready to be turned into code, but it's something that the province should be aware of. The government should also stay abreast of 'outside the box' solutions to the building/solar issue, including the use of external venetian blinds and the nascent technology being engineered by Ubiquitous Energy, which is commercializing a transparent solar cell that could one day be used to provide all of the energy needs to buildings and skyscrapers.

Moreover, the government should insist on energy efficiency in building design, construction and retrofit. For each building, energy efficiency should go beyond the building itself, and should consider the effects on Ontario's GHG emissions from the location of the building and its effect on the surrounding community.

Many governments and institutions are encouraging energy conservation and efficiency in building design and construction. Any new efforts by the Ontario Government should be coordinated with other governments and jurisdictions.

When including emissions from electrical demand and heating gas, buildings in Ontario already account for about ¼ of our emissions. How could emissions from the existing building stock be reduced sufficiently to ensure Ontario achieves its targets?

We encourage the government to consider that sometimes the blanket mandate of saving/reducing electricity use is not necessarily always the most prudent course of action, and has the potential to result in unintended consequences. In this instance, we submit that it seems as though the government is not advancing the best environmental solution with respect to home heating.

The current saveONenergy program only provides subsidies to homeowners who upgrade their furnaces with fossil fuel burning replacements. Under the former ecoEnergy retrofit program, homeowners were incentivized to install geothermal heat pumps. There is a big push on in Ontario right now to use less electricity, and it's true that geothermal heat pumps use more than conventional furnaces do. However, these pumps also get most of their energy from the ground, and correspondingly, result in large fuel savings even after subtracting the fuel used to produce the electricity. Moreover, Ontario's electricity is some of the cleanest in the world, and as electric cars, etc. become more popular and encouraged, using more electricity, rather than less, is likely to be the more climate-friendly way forward. Without question, knowing where our electricity is coming from to power 'eco-alternatives' is critical to understanding the impact it will have.

Finally, encouraging the use of heat pumps and underground tanks as part of a geexchange system can also be an advantageous electrical storage tool to address the peak demand issue. It is possible to run heat pumps in the off-peak hours storing heat in winter or vice versa, which is then circulated with the saved energy during peak hours. By flattening the grid load, the investment return of grid equipment improve with tremendous potential savings, some of which could be used as part of an incentive program to help accelerate the uptake conversion into these geexchange systems.

Buildings must be operated as efficiently as possible – if not operated properly, “green” buildings cannot achieve their sustainability objectives. Does Ontario have the skill base to build and operate such buildings and communities and, if not, what more can be done to train the appropriate expertise?

Ontario is home to some of the most highly educated, highly skilled individuals in the world. Our universities, colleges and schools deliver an exemplary service of high quality education. Ontario unequivocally possesses the skill base necessary to efficiently build and maintain our urban infrastructure in a “green” and sustainable way. However, there is a disconnect between those having these skills and a new generation or new arrivals moving into those roles as our experts retire and as corporate budgets cut on-the-job training.

For example, in OSPE’s own study of labour market data from the 2011 National Census, only 30 per cent of Ontarians with an engineering degree work as an engineer or engineering manager. More disturbing is that just over 33 per cent work in jobs not necessarily requiring a degree. The statistics are even worse for those with engineering degrees from outside Canada. In focus groups gathered in another OSPE research project, we found that employers of engineers overwhelmingly preferred higher new graduates who had participated in on-the-job coop programs during their university studies.

Ontario indeed has the ways and means to develop the appropriate expertise for a low carbon economy. However, a concerted effort needs to be conducted with open and transparent communication between government, industry and educational institutions to create more coop positions, ensure curriculum and training are meeting the needs of industry and more on-the-job training is conducted on-site for new and current employees.

Greater incentives for research and innovation also need to be implemented between all parties involved. Industry clusters should be formed for environment and cleantech companies. Incentives and encouragement of commercialization of innovative technologies and establishment of entrepreneurial endeavours should be implemented wherever possible. Growth in these areas will generate jobs and power the economy well into the future.

Price on Carbon

What market mechanism(s) will best achieve Ontario’s stated goals? For those industries already facing challenges today due to changing economic conditions or technological advances in other jurisdictions, what carbon pricing market mechanism or mechanisms would be most beneficial? What design considerations should be taken into account?

Putting a price on carbon is an essential component in an effective, comprehensive climate change policy. From our perspective, it doesn’t necessarily matter whether the government opts for a carbon tax or cap-and-trade system. There are strong existing models for the province to follow – the carbon tax in British Columbia, and the cap-and-trade system in the Western Climate Initiative and the EU. However, neither mechanism is perfect, but both, if properly designed, can accomplish a reduction in carbon emissions.

The mechanism should make the pricing system transparent, predictable, and politically durable and should start by targeting large emitters (e.g. 100,000 tonnes/yr of CO₂ emissions). When setting the initial price, it should be large enough to discourage consumers from using fossil fuels where other lower emission alternatives are available at reasonable cost, and should be phased in.

We also suggest that imposing emissions targets on a sector-by-sector basis is not optimal and would be detrimental to the spirit of innovation. Creating a uniform price signal will put many minds to work to find efficiencies. However, if the mechanism is issued in a sectoral or siloed fashion, significant cross-sectoral savings and opportunities will not be realized.

Carbon pricing is an essential first step but it is just that. An ambitious emissions reduction policy calls for significant public-sector leadership in creating a strong regulatory framework, new areas of research and innovation in the development of new low-carbon technology, and a cross-ministry approach to ensure that all policy initiatives are synergistic in nature from an economical viewpoint.

Science & Technology

In what areas of low-carbon science and technology does Ontario have competitive advantages or strategic interests?

As mentioned earlier, in order for low GHG emissions across the entire economy, a considerable amount of fossil fuel energy used for space heating, process heating, and transportation will need to be transferred to hydroelectric and nuclear energy, the latter of which Ontario already enjoys a competitive advantage. Intermittent renewables currently use natural gas backup generation so they are not as low emission as they initially appear, once backup is factored in. And while great strides have been made, there is no guarantee that cheap electrical storage will be developed in the foreseeable future to backup renewable sources so that the combination will be both low-emitting and affordable.

It is therefore prudent that the provincial government co-operate with the federal government to support a modest nuclear R&D program in three areas: 1) reduction in the volume of nuclear spent via fuel recycling; 2) reduction in the radio-toxicity of nuclear spent fuel by consumption of the actinides produced in current thermal reactors; and 3) reduction in the financial risk associated with nuclear plant construction through miniaturization, modularization and mass production in a factory.

These goals may be simultaneously met by investigating the suitability of developing one of the various fast neutron small modular reactors concepts proposed by various research groups. If the R&D program is successful, small modular reactors operating with fast neutrons may be technically suitable to back up intermittent renewables and provide a low emission energy source for centuries. This will provide scientists and engineers enough time to develop a cleaner nuclear energy source such as nuclear fusion in the next century. The additional energy requirements will be needed primarily to displace transportation fuels, heating fuels and industrial fuels. This technology would also have export opportunities with uses such a purifying growing amounts of fresh water for direct human's consumption and for agriculture and industrial use.

Next, an unrelated area where the province enjoys competitive advantages can be found in entrepreneurial companies that are positioning themselves as global leaders in reducing carbon emissions. The government should actively encourage these businesses and industries to help them to remain global leaders, while also aiming to streamline approval processes and reduce bureaucracy. A few examples of Ontario's companies that are leading the way in reducing GHG emissions include:

Hydrogenics – builds equipment that turns surplus electricity from inflexible nuclear and renewable sources into hydrogen, which can then be piped into the natural gas network or used in hydrogen fuel cells, which they also make. They have sold several power-to-gas systems in Germany.

Pond Biofuels - builds equipment that captures carbon in biomass by fertilizing algae with carbon dioxide exhaust. In their demonstration project at the St Mary's cement kiln, they are then using the algae as a biofuel, essentially running carbon in a closed loop. Looking forward decades in time, this technology could be mated with sequestration technique like biochar to produce carbon-negative bioenergy carbon capture and storage.

Temporal Power - builds flywheels to store electricity. A storage facility based on their technology began operation last summer in Minto, Ontario. These flywheels are particularly useful to even out spikes in supply or demand at the scale of a few minutes to an hour, but a large field of them could theoretically store nuclear power overnight for the daytime demand peak. The ability to build them at a small scale, say one flywheel to a subdivision, could reduce the requirements on last-mile distribution lines.

Hydrostor – has built a facility that stores surplus electricity at night in the form of compressed air under Lake Ontario, to help supply peak demand in the daytime. Not only does this displace at peak gas plants, but its downtown location helps alleviate long distance transmission requirements into the city, and improves reliability of the city's supply.

Zooshare Cooperative - will build a biogas plant near the Toronto zoo that takes waste from both the Zoo and a major food distributor, and turns it into biogas, electricity, cogenerated heat, and fertilizer. Their technology is not cutting edge, but their model of integrating community needs, interest and finance may be. They are very ambitious and

hope to export this model across the continent.

How can Ontario better support early stage research that could lead to the future commercialization of technologies that will provide economic benefits while also helping Ontario achieve its carbon reduction goals?

It is critical that the province walks the fine line between providing strong leadership through encouraging research inside existing companies, and getting out of the way to allow the private sector to innovate and drive change. In order to better support early stage research that will provide both economic benefits and carbon reductions, it is imperative to rely and utilize the knowledge of individuals and stakeholder groups that have an acute understanding of the technological aspects and risks.

The Ontario government already supports science and technology in GHG emission reductions through its Centres of Excellence and through other programs. These initiatives can be sustained and enhanced, and must be coordinated with other, similar efforts by other levels of government.

R&D funds should be allocated to develop new innovative technologies, and should ensure a meaningful level of funding for research, development and initial commercialization. The project funding selection process should include submissions from a broad range of proponents including proposals to develop breakthrough or paradigm shifting technologies. That being said, the government should avoid picking winners and losers. Mass deployment of commercialized technologies should be market-driven. At this early stage, no one can predict in advance the technologies and solutions that will be the most successful, cost-efficient, and reliable.

Next Steps

OSPE members, all with an engineering degree, hold a wealth of knowledge and skills to offer all Ontarians in many areas affected by Climate Change, including, but not limited to, resilient infrastructure design (including waste and storm water systems), new building design and construction, impact on soil and water, energy production and storage, and the need for innovative green technologies. OSPE as the advocacy body representing these engineer experts. OSPE, through it's members, understands the importance of reducing the factors causing climate change, and on mitigating the risks caused by climate change. The Ministry of Environment and Climate Change, as well as other Ministries should take advantage of these subject matter experts who are willing to work with key ministers and their staff to provide the expertise needed to tackle this global problem for the betterment of all Ontarians. If solutions are not found to tackle the challenges posed by climate change, then the costs to Ontario economically, socially and physically, can be devastating. At OSPE, we realize the seriousness of the issue. We expect that the Government of Ontario also appreciates the importance of this issue, and thus, will respond to the challenge in a meaningful way. We look forward to continuing the dialogue and being welcomed to the table as a full contributor to the development of solutions.