Chapter 13
The Nexus of Climate Change and Increasing Demand for Energy: A Policy Deliberation from the Canadian Context

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Abstract Canadian energy demand has been increasing due to population, industrial, and economic growth, and the effects of climate change have gained more visibility. Energy use is a major contributor for anthropogenic climate change. Therefore, global scale energy management strategies are paramount in climate change mitigation. However, the complicated 'marriage' between the climate change, energy demand and consumption, and the policy instruments are not sufficiently investigated. Therefore, this paper attempts to study the effect of policy instruments on energy demand and to identify other causes behind the demand trends. A comprehensive review of governmental policies assesses the consistency and effectiveness of existing policy instruments. Communication models for participatory involvement of stakeholders in mitigation initiatives as well as the financial benefits and offsets are critically evaluated. The findings indicate that often, the views of some stakeholder groups, including the individual households and citizens, are not successfully reflected in policies. There is an apparent gap between the regulatory instruments and policies of the territorial, provincial, and local governments.

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Most stakeholders possess limited knowledge due to missing or partial information about energy demand and the outcomes of various policies. This paper aims to trigger a scholarly discussion focusing on the dynamics of energy demand and reguatory instruments and policies for climate change mitigation.

Keywords Energy use trends · Energy demand · Climate action · Energy policy · Emissions mitigation instruments · Carbon pricing · Stakeholder involvement

Glossary

BC	British Columbia
GDP	Gross domestic product
GHG	Greenhouse gas
IEA	International Energy Agency
MJ	Megajoule
OCP	Official community plan
PIG	Price increment gradient
PJ	Petajoules
RE	Renewable energy

1 Climate Change and Energy Use – A Global Issue

In March 2019, the International Energy Agency (IEA) reported that the global energy demand increased by 2.3% in the year 2018, a rate nearly twice the average growth rate since 2010, thus reaching the fastest pace of growth in the current decade (International Energy Agency 2019a, b). It has been predicted that by 2040, the global energy demand will increase by 28% over the 2017 levels, mainly due to the growth in global population and the emerging economies in India, China, and Africa (U.S. Energy Information Administration 2017). With the rising need for energy, other issues have come to play, creating a complicated economic, social, and political dynamic all over the world.

Around 80% of the world's primary energy demand is supplied via conventional fossil fuel resources, mainly coal, petroleum, and natural gas (Höök and Tang 2013). The large-scale demand for energy initiated with the beginning and spread of industrialisation. With the rise of rail travel, mass manufacturing of goods, motorisation, and access to modern energy supplies for large segments of population, the energy use grew exponentially at global level (Vanek and Albright 2008). During the century from 1850 to 1950, the per capita energy intensity doubled, and in the twentieth century, both energy production and consumption experienced rapid growth with the post-World War II economic boom and the population growth in the latter part of the century (Vanek and Albright 2008).

As economies grow, so does the associated energy consumption with the boost to people's life style and industrial activity. It has been indicated in several studies that in general, the per capita gross domestic product (GDP) of a country has a positive correlation with the per capita energy consumption (Vanek and Albright 2008; Brown et al. 2011). It is argued that that not only does energy use increase with increasing GDP and a growing economic, but access to readily available and low cost energy is actually a major contributor to economic growth (Ayres et al. 2013; Sorrell 2015). However, an interesting phenomenon has been observed in the more recent times regarding energy use and economic growth. While overall primary energy consumption has grown, the global energy intensities have declined, with the steady rise in energy productivity (Sorrell 2015). It is estimated that the annual decline in global energy intensity was 1.3% between 1990 and 2000, which is generally attributed to an awareness about the global energy crisis and the interest in efficient energy use. On the other hand, this declining trend has started to change with the advent of the emerging economies, particularly China and India into major roles in the global energy markets (Sorrell 2015).

As the key global economic players compete for the finite energy resources, communities across the world are facing challenges due to high costs of energy, decline in energy resources, energy poverty, lack of supply reliability and availability, as well as climate change and other detrimental environmental impacts of energy use (Hernández and Bird 2010; Höök and Tang 2013; Green et al. 2016). It is predicted that the production of world's oil and gas fields decline approximately 4–6% annually (Höök et al. 2009). More than 1.3 billion people in the world do not have access to electricity, and many more cannot afford the energy prices even in developed countries (Worldwatch Institute 2019). The communities without access to their own fossil fuel supplies are affected by the lack of energy security, which is defined "as the uninterrupted availability of energy sources at an affordable price" by the International Energy Agency (IEA) (International Energy Agency 2018). Being at the mercy of the global energy market forces outside of their control also creates energy dependence for communities. In the environmental front, around 70% of the world's anthropogenic greenhouse gas (GHG) emissions are caused by the use of fossil fuels (International Energy Agency 2015). GHG emissions are a main contributor to climate change, resulting in problems, including global warming, melting ice caps and sea level increase, and changes in weather patterns (United States Environmental Protection Agency 2016; Environment and Climate Change Canada 2015). In addition to GHG emissions and the associated climate change concerns, energy use has been linked to other negative environmental impacts such as damage to eco-systems and habitat alteration, in addition to human health risks (Karunathilake et al. 2019). With all of the above concerns, governments and other decision makers have turned towards the development of sustainable energy and emissions management policies. At the United Nations climate change conference goals in Paris (COP21) held in 2015, it was agreed upon to "avoid dangerous climate change" by capping the global average temperature well below 2 °C of pre-industrial levels, and to further attempt to limit the increase to 1.5 °C (European Commission 2016).

Managing energy more efficiently, effectively, and sustainably has now become a priority to address all of the above concerns. However, this is not such a simple aspiration to attain in reality, due to the complex nature of energy supply, demand, and the interlinked socio-economic and political phenomena associated with them (deLlano-Paz et al. 2017; Burke and Stephens 2018; National Energy Board 2016). At the heart of this issue is the need for a cheap, reliable, and accessible supply of energy, to support communities' livelihood and economic development (Sorrell 2015). This goal is assumed to be in constant conflict with the drive towards cleaner energy alternatives and reduced consumption to mitigate the environmental concerns surrounding energy use. The concept of energy planning, both supply and demand sides, has gained attention in the past few decades due to these very reasons. The latest shift towards energy efficient technologies, passive constructions, energy conservation, renewable energy (RE), and energy sharing are all attempts at solving the multitude of issues associated with energy use. Policymakers and researchers in all quarters of the world are engaged in the attempt to identify the best energy solutions and strategies. These policies and initiatives range from simple rebates and incentive schemes for energy efficient and clean energy technologies, to high-level policies that aim to deliver energy equity and energy security to communities, develop novel economic models, and reshape the landscape of community and regional development. To do this effectively, further studies are necessary to understand all the dynamics associated with energy use and related policy impacts.

The overall goal of this chapter is to study nature of energy supply and demand, especially in the Canadian context, and to discuss about the policy requirements for tackling the economic and environmental issues associated with rising energy demand. The dynamics of energy demand and supply, climate change related issues, and the mitigation policies aimed at curbing the undesirable effects of energy use are investigated in the course of this chapter. The current policies for energy management and promotion of clean technologies will be analysed in details, with a discussion on the existing gaps and potential solutions. The knowledge compiled here is expected to benefit policymakers in Canada and in other parts of the world in developing the much-needed policy prescriptions to tackle energy issues, leading to solutions that are simultaneously economically viable, environmentally responsible, and socially acceptable.

2 Energy Demand and Supply – A Canadian Perspective

Canada is a key player in the global energy market, and is the sixth largest energy producer in the world accounting for 3% of the global energy supply (Natural Resources Canada 2019c). Canada's main energy products are Uranium, natural gas, and crude oil. However, hydropower is also a major energy source in the country. The oil and gas sector provides 0.3% of the Canadian jobs, and energy sector as a whole accounts for 4.4–4.9% of the total employment in the country (Natural Resources Canada 2019a; Natural Resources Canada 2018a). It is a relatively high energy intensive country, ranking 39th out of 237 countries in the world with 7.3 MJ/$2011 purchasing power parity GDP (National Energy Board 2018).

However, Canadian energy intensity has shown a declining trend with increasing GDP in the past decades, although the overall primary energy consumption has increased (The Conference Board of Canada 2019). Several factors are assumed to be contributing to the above observations, which will be discussed in detail within this section.

2.1 Energy Landscape in Canada

Canada's energy supply and consumption scenarios have evolved considerably over the last century. Today, in comparison with other international peers in the same range of economic and social development, Canada ranks as a high energy consumer (The Conference Board of Canada 2019). Currently, Canada is in an attempt to shift towards a lower carbon future within the next few decades. This has resulted in an ongoing diversification of the Canadian energy mix, with the addition of renewable energy. At present, the energy demand growth is slowing down along with the reducing carbon intensity of the energy supplies (National Energy Board 2018). Even though Canada is country with natural energy resources, these supplies are concentrated in some regions, and the other regions, especially the territories in the North, have to rely on external supply sources for their needs. The variations in Canadian energy across time and space use can be attributed to several factors, including weather conditions and climate change, changes in lifestyle, as well as the emergence of new industries and technologies. In order to explore the energy policy needs of Canada, it is necessary to gain an understanding of the energy supply and demand dynamics of the country and the current challenges faced in managing the above.

Canada currently has the highest per capita energy supply among the member countries in the IEA (International Energy Agency 2020). Its primary energy production mix is currently made up of Uranium (32%), crude oil (31%), natural gas (24%), coal (5%), hydro (5%), other renewable energy (3%), and natural gas liquids (2%) (Natural Resources Canada 2018b). Secondary energy use accounts for approximately 70% of the primary energy use (Natural Resources Canada 2016a). At present, Alberta and Saskatchewan are the biggest energy producers among the Canadian provinces. However, Saskatchewan's energy trade is mostly based on Uranium, and when that source is excluded, British Columbia (BC) is the next biggest energy producer after Alberta. Both these provinces have a large industry in oil, gas, and coal extraction and trade. In 2017, 22% of the total Canadian goods exports was made up of energy products, and energy's nominal GDP contribution to economy was 10.6% (Natural Resources Canada 2018b). While renewables have been growing rapidly in the Canadian energy supply mix, with a RE capacity growth amounting to 8.3% by 2016 and a supply share of ~30%, fossil fuels still control the Canadian energy outlook by far (National Energy Board 2017; Hughes 2018). With the above scenario, Canada has a socio-political partiality towards the fossil fuel industry. The abundant availability of secure and reliable energy supplies coupled with high standards of living has contributed to the generally elevated energy consumption of the country (Hughes 2018). At 9.1 tonnes of oil equivalent (toe) per annum, the per capita energy consumption of Canada is five times the average global per capita consumption (Hughes 2018).

However, the above vision of Canadian energy use is an overly simplified generalisation, and there are various energy use patterns to be observed across various geographic regions, communities, and economic sectors in Canada, which are coupled with geological, economic, political, and social factors. Energy efficiency and emissions reduction policy prescriptions cannot be adequately tackled without looking through the lens of the above factors and trends.

2.1.1 Canada's Energy Use Patterns

The Canadian energy consumption increased by nearly three times (183%) during the 50-year period from 1965 to 2015. During the most recent times, energy consumption has been increasing at a relatively slow rate compared to the rest of the world, and during 2010–2015 energy consumption has increased at 0.13% per annum (Hughes 2018). However, the fossil fuel consumption has declined in comparison, with the advent of renewables (Hughes 2018). With a growth rate of 1.4%, the mounting population also creates a higher demand for energy, with new communities being developed across the country (Statistics Canada 2018). It is further predicted that Canada's energy demand will annually grow at 0.7%, ultimately reaching 13,868 PJ by 2040 (Robins 2017).

Figure 13.1 depicts the energy use of the main demand sectors in Canada during the 25-year period from 1990 to 2015 (Natural Resources Canada 2019d). The industrial and transportation sectors show the greatest growth in terms of total energy use, with a combined increase of nearly 1500 Petajoules (PJ) during this period. However, when the sector consumption growth is considered, the agricultural sector shows the greatest growth at 48.72%. This is followed by the transportation sector with a growth of 40.39%. The industrial and commercial/institutional sectors have growths of 26.98% and 35.12% respectively, and the residential sector shows the least growth at 8.88%. The growth in total energy demand during this period was approximately 28.4%. It can be seen that the Canadian energy consumption is heavily dominated by the industrial and transportation sectors, while the agricultural energy consumption is quite low. This is a common trend in many countries, where the agricultural energy intensity reduces or stays roughly the same while industrial activities grows along with the industrial/transportation energy demand.

In 2016, Canada's total energy use was 8786.4 PJ, split across the above end use sectors, with the sectorial and sub-sectorial energy use mix illustrated in Fig. 13.2 (Natural Resources Canada 2019d). The industrial and transportation sectors dominate the energy demand at nearly 70% of the country's total consumption. However, the residential and commercial/institutional sectors, which mainly require energy for maintaining building occupancy and essential services, together contribute to 38% of the total energy use.

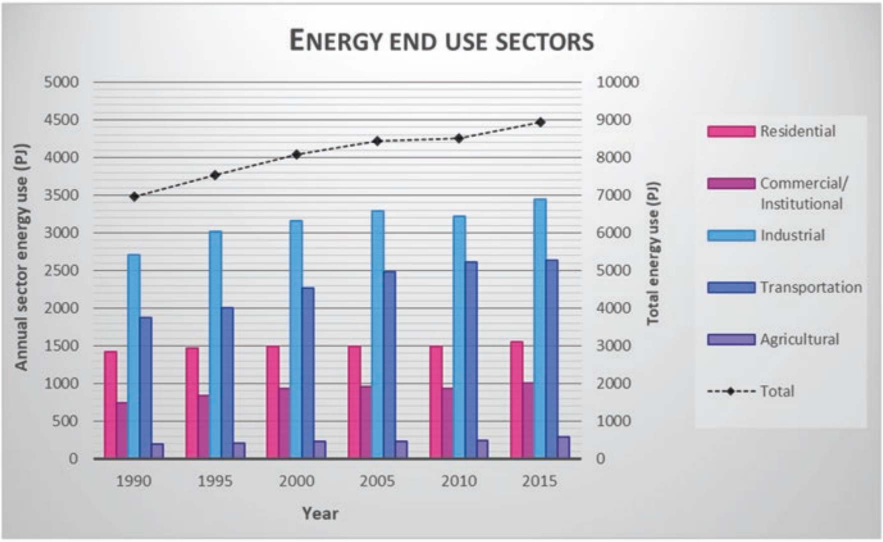

Fig. 13.1 Energy use variation in main end use sectors across the years

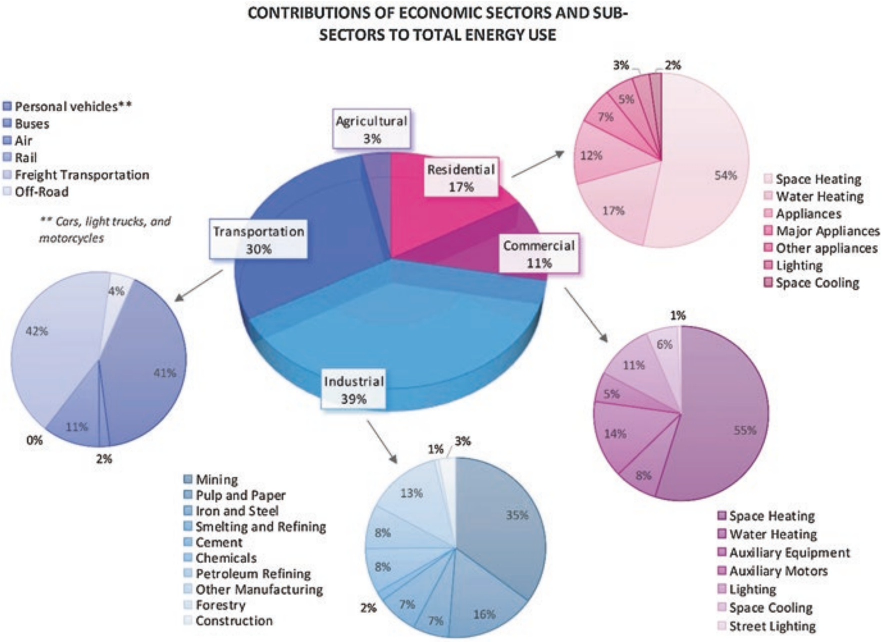

Fig. 13.2 Sector contributions to overall energy use in Canada

In the industrial sector, mining, pulp and paper, and manufacturing sub-sectors account for the majority of the energy use. In short, as a country with a high level of industrial production and exports, Canada spends much of its primary energy supply on raw material extraction and production of goods. The energy supply for this sector is mainly from natural gas. Fossil fuel use is expected to continue growing in this sector, due to the nature of the applications and rapidly increasing demand (Canadian Association of Petroleum Producers 2018). Industrial energy demand of a country moves hand-in-hand with the state of the economy, and as GDP grows the energy intensity of the industrial sector will continue to increase correspondingly. Canada's economy has undergone a structural transformation in the last few decades, moving gradually from a resource and manufacturing based economy, to a more services and knowledge intensive side (National Energy Board 2010). The Canadian IT industry is also growing, and as this sector starts to boom, it will also require a significant energy use to maintain facilities and provide services. Interestingly, while the overall industrial energy consumption is growing, when the demand growth is compared to the industrial output growth, the energy intensity is actually declining, albeit at a slow rate at 0.8% per annum. This is assumed to be due to economic and structural changes, energy efficiency, and variations in activity levels (National Energy Board 2010). Moreover, e-commerce, cannabis, and storage and warehouse leasing sectors are poised to grow in the Canadian industrial sectors, and some of these applications have their own inherent and unique energy needs. The energy needs of the emerging economic sectors is an area that needs much critical attention in the next decade, to match the changing global economic landscape.

As can be noted in Fig. 13.2, space and water heating is responsible for the majority of the energy consumed in residential and commercial/institutional sectors. This phenomenon is due to the general climatic conditions in Canada, where the Northern geographic location results in seasonal variations, with relatively low temperatures for a significant portion of the year.

In the transportation sector, 41% of the energy use is due to the use of private transportation, through cars, light trucks, and motor cycles. Heavy reliance on motorised private transportation modes can be noted across Canada, and this trend is growing. Between 2000 to 2009 alone, the light vehicles in Canadian transportation fleet grew by 18.7%, and this number continues to increase (Natural Resources Canada 2011). Thus, as depicted in Fig. 13.1, the transportation sector energy consumption continues to grow along with the emissions, especially as this sector is overwhelmingly operated through fossil fuel supplies. However, there are indications that the growth is passenger vehicle sales are now starting to plateau after the boom in the previous decades, with market saturation (Lewis 2017). Even so, the historically low interest rates, satisfactory job creation, relatively low gas prices, and better economic conditions in general have ensured that the interest in personal vehicles, particularly luxury and high-end vehicles, has not experienced a downward trend in the Canadian market (Lewis 2017).

Energy use also shows regional variations within Canada, due to factors, such as varying climate conditions between the provinces, different levels of industrial

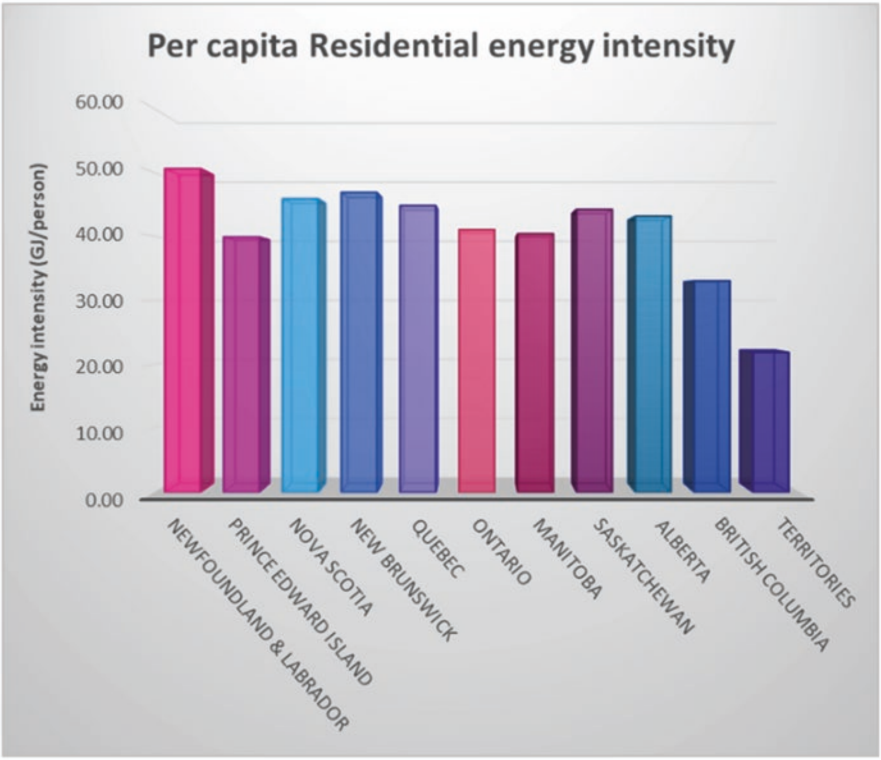

Fig. 13.3 Per capita residential energy use intensity across the provinces and territories

activity and economic development, and inherent transportation and lifestyle patterns among the populace. In building applications, such as residences and commercial buildings, this variation is notable across different climate zones due to variations in heating loads, as depicted in Fig. 13.3. Here, it can be seem that BC has a significantly lower per capita residential energy intensity, due to the temperate climate conditions and milder winters. Interestingly, while the Northern territories are located in the coldest regions of Canada, the per capita energy intensity is much lower, possibly due to the relatively lower socioeconomic development in those regions, the higher costs of energy, as well as the lack of access to technological advancements. Most of the provinces with per capita higher energy intensities such as Alberta, Saskatchewan, Nova Scotia, and New Brunswick all have high fossil fuel fractions in their energy capacity mix. It is definite that energy patterns are subject to a definite socioeconomic component as well as the effect of climate.

In order to investigate the possibility of reducing energy demand, it is necessary to look at the challenges faced by Canada with regards to energy use.

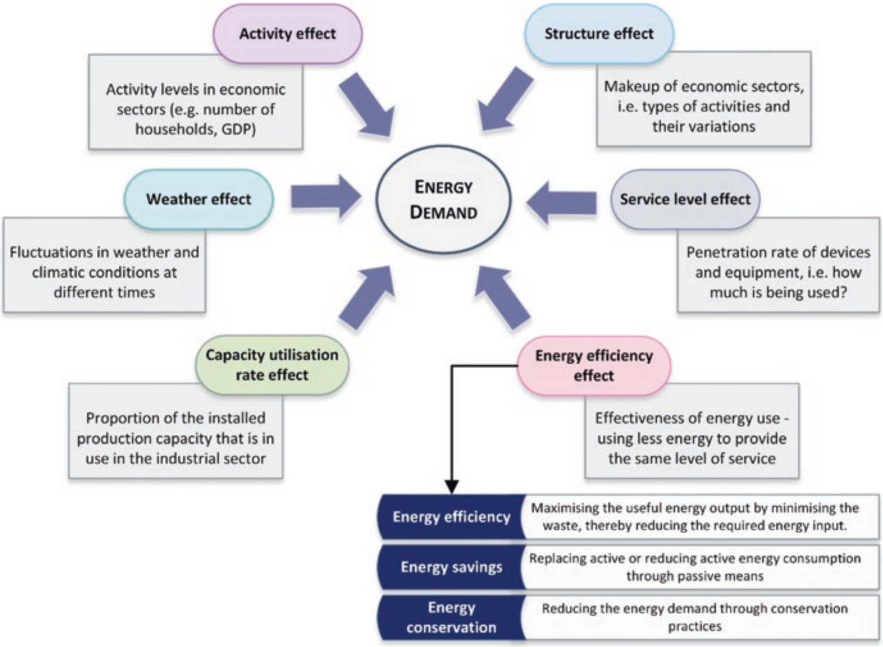

Fig. 13.4 Factorisation of energy use and efficiency

2.1.2 Canada's Energy Use Challenges

Figure 13.4 summarises the nature of energy use and efficiency based on the various factors contributing to demand, and the modes of demand reduction (Natural Resources Canada 2016a; Karunathilake et al. 2018). The effect of all of the six contributing factors to energy use denoted in the figure is interlinked. For example, even if the appliance technologies reach very high efficiency levels, if the service levels also increase with higher device use, the gain of efficiency increase will be offset by the increased device demand. Moreover, many of these factors represent conditions that cannot be changed to reduce energy use. The economic activity and service levels required by growing population due to improvements in quality of life cannot be cut back, simply due to a desire to reduce energy use by numbers. Energy efficiency acts as an impeding factor to the growing energy use, with various technological, behavioural, and regulatory means, resulting in active and passive interventions.

In Canada, the climate and weather conditions pose the greatest challenge to energy demand reduction targets. As a "Northern" country associated with extreme drops in temperature and high heating requirements, Canada is highly reliant on its energy supplies to counter the weather-related challenges and maintain acceptable living conditions. While the impact of climate conditions is direct and obvious building sector, both residential and commercial/institutional, what is less apparent is the effect of climate/weather on other energy end use sectors, such as transportation. The fuel efficiency of Canadian vehicle fleet reduces in the colder winter months. Higher vehicle usage, increased heating needs due to extreme winter temperatures, and more users letting their vehicles idle in the "on" position in winter also lead to higher vehicle energy consumption in winter (Natural Resources Canada 2007). In addition to the extreme temperatures, the vast landscape and the dispersed population also contribute to the high energy use (Natural Resources Canada 2019b). The dispersed nature of Canadian communities correlates to higher transportation requirements for both passengers and goods, leading to increased energy consumption.

While Canadian population growth remains on the lower end compared to most countries, the residential and commercial building stock has grown significantly in the recent times, especially in the urban centres. The building energy intensities vary by building type, building location, and application. This makes planning and policy making for building energy efficiency challenging, as there are no "one size fits all" solutions. A policy or regulation that is developed for the temperate climatic regions of the West Coast, where the above 80% of the electricity grid mix consists of hydro, does not necessarily fit the remote and frigid Arctic Canada, where external fossil fuel supplies are the lifeline for communities.

The energy prices, both electricity and fuel, has shown an increasing trend in the past years (Green et al. 2016). It has been identified that by 2013, 7.9% of the Canadian households were suffering from energy poverty,[1] an increase from 7.2% in 2010. When gasoline expenses are also factored in this level of energy poverty increases further, with 19.4% of the households spending above 10% of their expenditures on energy (Green et al. 2016). This compares with the Canadian average household energy expenditure of 5.3%.

Energy related emissions are a major challenge for Canada, and at present, over 81% of the Canadian emissions are caused by energy (Natural Resources Canada 2019b). In spite of the low-carbon energy supply mix with the significant contributions by hydro and nuclear sources, the oil and gas sector emissions increased by 14% between 2005 to 2013 (International Energy Agency 2020). As previously discussed, many Canadian provinces rely on high emission energy sources for their supply, and this fact is not likely to change soon due to various factors.

The remote Northern communities of Canada suffer additional burdens compared to the rest of the country in terms of supply reliability, energy security as well as energy prices. These communities are not connected to the North American electricity grid, resulting in a lack of guaranteed, reliable, and affordable energy (Natural Resources Canada 2019e). The unavailability energy supplies in these regions make it necessary for them to rely on high-emissions fossil fuels, mainly externally sourced diesel, for their energy needs (Arriaga et al. 2013). This also creates economic problems in these regions, as the high energy costs of the diesel-generated power hinders the community growth. Thus, the remote communities lack many of the benefits and the quality of life taken for granted as basic necessities in other

[1] A benchmark of 10% or more of the household expenditure going towards the purchase of energy goods was used as the measure of energy poverty (Green et al. 2016).

parts of Canada (Natural Resources Canada 2019e). The phenomenon of disadvantaged communities lagging behind more and more with the fast-paced growth of the world's economy and technology is becoming increasingly familiar in all regions of the globe. The governmental policies need to play an integral role in transitioning these communities towards a low-emission, secure, and affordable energy future.

One key challenge facing Canada as well as other parts of the world in energy demand reduction is climate change phenomenon itself. The increase in global temperatures and other environmental variations will likely result in elevated energy demand. It has been suggested that possible impacts of this climate change-induced temperature increase can be higher cooling loads in the hotter seasons, as well as reduced power production efficiencies in existing fossil fuel and nuclear power plants. Increasing water scarcity can also contribute to elevated energy demand (United States Environmental Protection Agency (USEPA) 2016).

Energy use in Canada, similar to many other parts of the world, has undergone a certain level of reduction due to the energy efficiency initiatives in the recent times. Many initiatives are being adopted across Canada to reduce the energy intensity of the building sector as well as the municipal services, in addition to the industrial and transportation sectors. The National Energy Board of Canada has forecast that the energy consumed per a square meter of residential floor space will decrease by 0.7% per annum between 2016 and 2040. This trend is attributed to efficient technologies, energy saving building envelope construction, and new energy efficiency standards for appliances and buildings (National Energy Board 2016). Between 1990 to 2013, the energy intensity per unit activity of GDP reduced by 25%, while per capita energy intensity increased around 1% during the same period. If the economy had not grown in GDP value by 2013, it would have consumed much less energy than the 1990 levels (Natural Resources Canada 2016a). This indicates that the industrial energy efficiencies have also increased significantly in the past decades. Overall, energy efficiency has increased by 24% between 1990 and 2013, and reduced GHG emissions by 85.4 Mt. while delivering a cost saving of $37.6 billion (Natural Resources Canada 2016a). However, in 2017 it was identified that Canada could reduce energy consumption by 15% by 2035 if energy efficiency improvements were pursued more aggressively. In striving towards this end, effective strategies, regulations, and policy frameworks are critical.

3 Policy Development for Energy Efficiency, Energy Security, and Climate Change Mitigation

Policy development is a complex game, involving many stakeholders and priorities at different levels of decision making. While the end goal is ostensibly to reduce energy demand and emissions, the pathway towards this is not necessarily a straight line with simple choices. Many factors and players have to be balanced and satisficed in energy policy development. This necessitates a consideration of the triple bottom line factors, i.e. economy, environment, and society. In order to be most effective and equitable, policies need to take an inclusionary and multi-objective approach. To explore the policy environment surrounding energy demand and emissions management, a review of the current regulations, policies, and goals can be helpful.

Canada is currently undergoing an energy transition, which is expected to continue until mid-century. The Pan-Canadian Framework on Clean Growth and Climate Change released by the Canadian government in 2016 (Pan-Canadian Framework) outlines Canada's commitment to meeting the 2030 climate action target to achieve a 30% below 2005 levels of emissions, and the action plan to achieve this goal (National Energy Board 2018). The Government of Canada has now taken this a step further, by setting a highly ambitious goal to reduce 80% of the 2005 levels of GHG emissions by 2050 (Doluweera et al. 2017). To support this aim, the provincial governments of Canada have set their own emissions reduction targets, and emissions reduction has been integrated to municipal government strategies and official community plans (OCP) across Canada. Meeting these targets in reality is far from easy, and most current projections deem these targets unachievable if the present conditions are not drastically changed (Ruparathna et al. 2017). Table 13.1 lists the latest emissions targets (by 2018) of the Canadian provinces and territories. Such emission target setting is common across the world, to integrate climate change and environmental impact mitigation into official government visions and strategies.

It is interesting to note that while accounting for over one third of Canada's GHG emissions (Boyd 2019), Alberta has one of the least ambitious emissions reduction target among the provinces. This indicates the sociopolitical play that impacts climate mitigation endeavours. Alberta accounts for 80% of Canada's crude oil production as well as more than 50% of Canada's natural gas (National Energy Board 2019; Government of Alberta 2019), and Albertan economy and job market are heavily reliant on the fossil fuel industry (Boyd 2019). Therefore, the province as a whole is reluctant to adopt clean energy initiatives, and there is a strong social resistance towards replacing fossil fuels with other alternatives. These sociopolitical factors need to be taken into account in attempting emissions mitigation endeavours, to be effective and acceptable to all layers of the society. Interestingly, some Canadian provinces have already met their 2030 emissions reduction targets with efficacious mechanisms and policies, indicating that climate action targets can have successful outcomes (Natural Resources Canada 2017). A thorough investigation of what was "done right" can help in replicating such successes and avoiding potential pitfalls in energy policy making.

3.1 Energy and Emissions Reduction Mechanisms

As previously depicted in Fig. 13.4, energy demand reduction efforts can be categorised into energy efficiency, energy saving, and energy conservation interventions (Public Works and Government Services Canada 2001). Energy efficiency involves maximisation of useful energy output by reducing the waste, thus ensuring that the same activity level and service levels may be maintained with a lower

Table 13.1 Emissions mitigation targets of Canadian provinces and territories

Region	Province	Emissions mitigation targets
Atlantic region	Newfoundland & Labrador	Reduce emissions by 10% below 1990 levels by 2020 and 70–85% below 2001 levels by 2050 (Government of Newfoundland and Labrador 2015)
	Prince Edward Island	Reduce emissions by 10% below 1990 levels by 2020 (Government of Prince Edward Island 2019)
	Nova Scotia	Reduce emissions at least by 10% below 1990 levels by 2020 (Nova Scotia Environment 2013)
	New Brunswick	Reduce emissions by 10% below 1990 levels by 2020, and by 75–80% below 2011 levels by 2050 (Government of New Brunswick 2013)
Central Canada	Quebec	Reduce emissions by 20% below 1990 levels by 2020 (Government of Quebec 2012)
	Ontario	Reduce emissions by 15% below 1990 levels by 2020, followed by 37% reduction in 2030 and 80% in 2050 (Government of Ontario 2016)
Prairie provinces	Manitoba	Reduce emissions by 1/3 over 2005 levels by 2030, by half in 2050, and be carbon neutral by 2080 (Government of Manitoba 2015)
	Saskatchewan	Reduce emissions by 20% below 2006 levels by 2020 (Stastna 2015)
	Alberta	Reduce emissions by 14% by 2050 compared to 2005 levels (50% below business as usual scenario) (Government of Alberta 2008)
West coast	British Columbia	Reduce emissions by 40% below 2007 levels by 2030, 60% by 2040, and 80% by 2050 (Government of British Columbia 2018)
Territories	Yukon	Reduce the emissions intensity of existing residential, commercial and institutional buildings across Yukon by 5% and the emission intensity of on-grid diesel power generation by 20% by year 2020 (Government of Yukon 2015)
	Nunavut	No targets are set for reducing GHG emissions (Auditor General of Canada 2018)
	Northwest Territories	To limit emissions increases to 2500Kt by 2020, before stabilizing emissions at 2005 levels by 2030 (The Government of Northwest Territories 2011)

energy use. Efficiency interventions can be categorised as technological and regulatory, both of which go hand in hand. Advancements in equipment manufacturing have ensured that the energy use in appliances is more efficient. The amount of energy estimated to be saved in Canada from all shipped appliances was over 66 PJ between1992 and 2011. With this, a customary set of main household appliances use below 2800 kWh per year, which approximates to a 50% reduction from the energy used in 1992) (Natural Resources Canada 2014). However, technological efficiency advancements are now reaching the saturation point, and further efficiency improvements beyond a certain level may not be economically viable due to prohibitive development costs. Regulatory interventions in energy efficiency mainly involve setting minimum efficiency standards and labelling programs.

Energy saving interventions are generally applied to replace or reduce active energy consumption through passive technological means, using alternative technologies, products, or designs. Building retrofitting for better insulation or increased natural lighting and ventilation are examples of this. Integrating energy saving features in building design has been done through regulatory means, resulting in building energy codes and standards (Du et al. 2014; Berardi 2013; International Energy Agency 2013). Green building rating tools with passive energy saving techniques incorporated in them are now in use to evaluate the environmental impacts of the building sector (Chen et al. 2015; Nejat et al. 2015). The main barrier to energy saving technology adoption at present is the additional cost during construction and retrofitting. A challenge that affects technological interventions for demand reduction across the board is the *principal agent* issue, especially in a context such as Canada (Kelly 2012; Davis 2011). The building construction is primarily undertaken by property developers and then sold to occupants. Apartment-condominium constructions account for a significant fraction of the housing stock at 32% (Natural Resources Canada 2019f). In 2016, 32.2% of the households were rentals (Statistics Canada 2017). In such a setting, the direct beneficiary of energy demand reduction may not be the party who is incurring the costs of energy efficiency and savings enhancements. Thus, property developers and landlords may be unwilling to invest higher costs on energy saving designs and efficient appliances (Karunathilake et al. 2018).

In contrast, energy conservation is a user-centered and low cost approach to reduce energy use, by changing behavioural patterns of consumption (Karunathilake et al. 2018). Energy demand can be reduced significantly by eliminating non-essential instances of energy use with more energy-conscious behavioural choices at zero cost. It has been indicated that conservation-oriented behaviours can reduce heat, electricity, and water consumption by 51%, 37%, and 11% on average respectively (Huebner et al. 2013). Technological and regulatory interventions can play a role in promoting energy-conscious behaviours. Regulations and information focused programs can incentivise people and motivate them to be more conscious and conservation-focused energy users (Lindén et al. 2006; Campillo et al. 2016). Smart control technologies and building automation can remove the burden on users on eliminating unnecessary energy use by simply mechanising the process based on the existing conditions (Karunathilake et al. 2018).

In battling climate change, more and more regions are now trying to regulate emissions from all economic sectors. In addition to energy demand reduction, RE integration is promoted globally as an instrument of emissions reduction as well as increased energy security. While the transformation from fossil fuels to renewables is slow, RE installed capacity has been steadily increasing. Another fascinating development in the recent times for emissions mitigation has been the advent of carbon capture, storage, and utilisation technologies into mainstream markets. Due to the lack of maturity of the above technologies, they have not yet been integrated into large scale emissions reduction planning strategies and policy development.

Currently, Canada is a world leader in both RE and carbon capturing (International Energy Agency 2020). As fossil fuels are unlikely to go out of use in the near future, further investigations on clean energy carbon capturing technologies are extremely important for emissions reduction efforts.

3.2 Policies and Regulations to Battle Adverse Scenarios of Energy Use and Climate Change Levels of Policymaking

Various policies and instruments have been adopted to manage energy demand effectively and mitigate climate change in Canada. These policies focus on demand-side management through technical and procedural interventions, as well as behavioural transformations. Figure 13.5 summarises some of the policy instruments used in energy and emissions management and promotion of clean energy technologies (Boza-Kiss et al. 2013; The Climate Policy Info Hub 2019). Policies and instruments are developed at all levels of governance. Certain policy instruments can only be defined and applied at specific levels of government, depending on the level of authority and enforcement power required.

The positive fiscal instruments and chiefly targeted towards reducing the cost barrier towards increased penetration of demand reduction and emissions mitigation measures. Tax rebates, deductions, and reliefs are expected to incentivise both commercial and industrial sectors for demand reduction and emissions mitigation (Price et al. 2005). Subsidies, grants, loans, and funds are aimed at making energy efficiency more affordable. In Canada, many such financial incentives and affordability enhancement schemes are available at federal, provincial, and municipal levels (Natural Resources Canada 2016b). Price signals are another mechanism used to indicate energy conservation goals to the general public (Campillo et al. 2016).

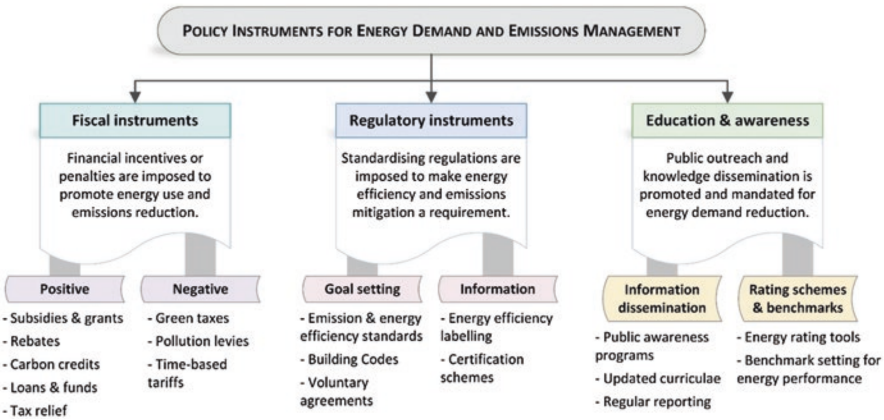

Fig. 13.5 Policy instruments for effective energy and emissions management

The negative fiscal instruments are more controversial. The economic benefits of emissions inducing activities have to be carefully balanced against their negative environmental impacts in imposing these (Price et al. 2005). There are concerns that these policies are have negative impacts, particularly on the industrial sector, hampering competitiveness and economic growth. Similarly, commercial and residential energy users complain that carbon taxes place an unfair economic burden especially on the low-income households and small businesses (Tax Policy Center 2019). The danger is that this can lead to indirect negative impacts, such as increased energy poverty, reduced industrial activity, and loss of jobs unless carefully managed. This thinking has led the Canadian Government to scale back some guidelines for taxation counter to the interests of climate change mitigation, such as reducing the carbon tax thresholds (Quinn 2018).

Imposing minimum energy efficiency requirements and building energy performance standards are also expected to reduce inefficient energy use and losses, thus leading to a reduction in energy-related emissions. This is a common approach adopted across the world (Du et al. 2014; Berardi 2013; International Energy Agency 2013). IEA has reported that the effectiveness of building energy codes is dependent on mandatory enforcement (International Energy Agency 2013). Moreover, for maximum effectiveness, these codes need to be extended to cover all building types in construction, extension, and renovation phases, with minimum performance levels set based on best technologies available in market. Building energy codes are classified as "performance-based" and "prescriptive". Prescriptive codes define minimum performance levels for individual building system components. The criticism against this type of codes is that they do not allow enough flexibility and autonomy to developers and other stakeholders to make investment decisions in the most effective manner considering economic, environmental, and social aspects together (Timmons et al. 2016). Performance based codes, on the other hand, specify overall energy and emissions performance based on the different load types instead of components (International Energy Agency 2013; Nejat et al. 2015). This addresses the "inflexibility" limitation associated with prescriptive codes, but may be too difficult to interpret in actual application due to having only high level mandates without specifying how to get there. The National Energy Code of Canada for Buildings is constantly evolving with the changes in technology and building sector, and sets requirements for heating, lighting, ventilation, envelope, system components etc. (Natural Resources Canada 2018a).

The concept of Energy STEP Codes that look beyond the minimum requirements of the national code is taking root in Canada at present. The province of British Columbia has taken a lead in this, by introducing a performance-based standard with measurable energy efficiency requirements for new construction in consecutive steps, claimed to be *North America's most innovative beyond-code energy efficiency standard* (Frappé-Sénéclauze 2018). Builders must demonstrate compliance by meeting a set of defined metrics for building systems, envelope, and airtightness. The overall goal is to move towards net-zero ready buildings by 2032. With each step, achieving a higher level of performance is required. Individual local governments (i.e. municipal level) have the choice of mandating or incentivising the building sector to meet the stipulations. The BC Energy STEP code also attempts to consider the effects of geography and climate zones, building types, and cost-effectiveness, and is currently under further research and development (Government of British Columbia 2017).

Currently, "*ENERGY STAR*" and "*EnerGuide*" labelling is used within Canada to inform the buyers on the energy efficiency performance of equipment and appliances (Natural Resources Canada 2015). There are also green building certification schemes widely used in Canada, such as BOMA EESt, BREEAM, BuiltGreen, EnerGuide, ENERGY STAR for New Homes, R-2000, LEED, and Living Building Challenge (Gamalath et al. 2018). While many of these are recognized and promoted by policymaking entities, such as the federal and provincial governments, they are not yet mandated. Instead, these are implemented as voluntary programs and informative measures. Natural Resources Canada, the federal department responsible for natural resources, energy etc., also provides access to various data analysis software and modelling tools for performance rating, such as RETScreen, EE4, HOT2000, and CAN-QEST to further facilitate energy efficiency endeavours (Natural Resources Canada 2019a).

Compliance-based energy codes and minimum efficiency mandates seem to be an effective idea at face value, particular as it is expected that energy efficiency improvements between 10.3 and 14.4% are achieved under the current standards (National Research Council of Canada 2019). However, this too can pose an unfair penalty on the low-income earners. It should be kept in mind that high efficiency appliances, energy saving technologies, and green constructions all come with an added price tag. Therefore, these efficient and energy saving options may be unaffordable to the lower-income segments of the society under current conditions. Making minimum efficiency and energy performance standards mandatory may well drive the low cost options out of the market, further contributing to economic inequality, loss of quality of life, and energy poverty. In addition, the high cost of green residential construction has the potential to drive the housing prices higher, when the developers attempt to pass on the costs to the buyers, in a market that is already facing a housing affordability crisis, thus indirectly contributing to poverty and homelessness.

When the actual outcomes of energy efficiency and emissions mitigation policies or strategies are considered, some interesting observations can be made, sometimes contrary to popularly-held beliefs. *Rebound effect* is one such example, where the actually realised energy saving due to efficient technologies can be much lower that expected, or in fact may be negative. This is simply because the perception of energy efficiency results in more carefree energy use patterns in the users, who this that they consume less energy due to energy saving measures and more efficient technologies (Berry and Davidson 2016). This indicates that policies focusing on technological interventions need to take into account the social and behavioural components as well, and they should be supplemented with education and awareness initiatives. Income levels and socio-cultural demographics too make this issue further complicated. When energy users do not have a sense of the actual energy consumption and where they stand with reference to the expected levels, it is difficult to modify behaviours and usage patterns. Information, self-evaluation mechanisms, and benchmarks are tools that can be used to help with the above issue. To support the above, the Canadian federal and provincial government bodies engage in regular statistical surveys and analyses, which are reported in the form of publicly available databases and information (Statistics Canada 2016).

Education and knowledge can play a significant role in promoting conscious behaviour (Gyberg and Palm 2009). Information and outreach focused programs have been successfully adopted in different places to improve public awareness and knowledge on energy efficiency (Lindén et al. 2006; Campillo et al. 2016). Moreover, it has also been identified that providing efficiency education at a young age to children through means such as school curricula, can be a highly effective mechanism for promoting demand reduction. Children educated early in their life grow up to be advocated of energy saving, and families can be influenced through them. Learning new practices is much harder as adults, and energy-consciousness is better transmitted to intellect at early ages. Further, it has been demonstrated that children have considerable influence on their parents purchasing decisions (Fell and Chiu 2014).

3.2.1 Carbon Economy – Fiscal Instruments for Emissions Mitigation

One of the most popular climate action tools today is carbon pricing, a mechanism that seeks to attribute a monetary price to the release of GHG emissions with the assumption that this will drive low-carbon innovation in all economic sectors (National Energy Board 2018; Environment and Climate Change Canada 2017). It is anticipated to be the most practical and cost-effective mode of reducing GHG emissions as well. These carbon pricing systems are currently in the process of being adopted by various provincial and territorial governments in Canada, in line with the Pan-Canadian Framework on Clean Growth and Climate Change. It is assumed that by 2025, the nominal carbon price will level out at $50/tonne in all provinces and territories (National Energy Board 2018). Figure 13.6 summarises the carbon pricing mechanisms and instruments used in propagating carbon economy. The two main strategies proposed for carbon pricing by the Canadian

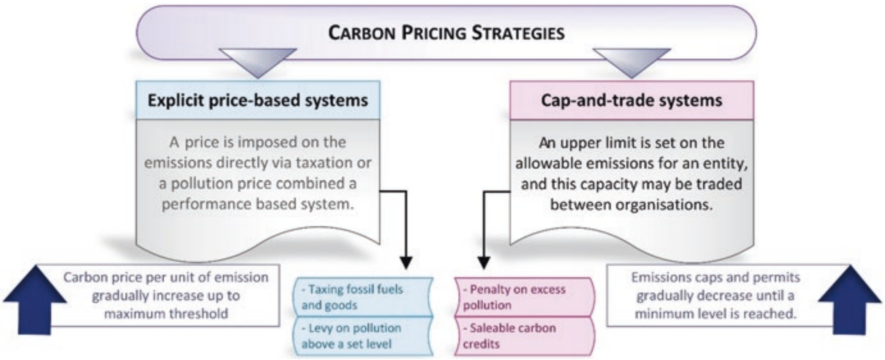

Fig. 13.6 Carbon pricing systems in Canada

government are explicit price-based systems (e.g. BC and Alberta) or cap-and-trade systems (e.g. Ontario and Quebec) (Government of Canada 2016). Carbon credits go hand in hand with such pricing mechanisms where entities that have low, zero, or negative emissions operations receive tradeable credits. Under the cap-and-trade systems where maximum allowable emissions levels are imposed, exemptions and output-based permit allocations in order to keep certain industries, such as steel and mining competitive in the world market. This is an important aspect to be considered in defining carbon pricing policies. While the end goal of carbon pricing is to achieve a positive environmental impact, the economic side-effects should be mitigated as far as possible. Carbon pricing also opens up new avenues of commerce through the new trading opportunities between high and low emitters. This is an international market, where carbon credits can be acquired from other countries as well, and the next stage of Government of Canada's carbon pricing is to integrate international credit import and export in the pricing framework after the initial five-year review in 2022 (Government of Canada 2016).

By allowing provinces and territories to decide on their own carbon pricing system and ensuring that the revenues generated in levying the prices are reallocated to the jurisdiction of origin, the Government of Canada ensures that the localities have some control over the process and benefit from it. A side effect of the carbon pricing is the higher fuel prices (heating, electricity, transportation etc.) and the negative impact they may have on already disadvantaged individuals and communities. However, the government intends that climate tax refunds to citizens will ensure that the higher energy costs are offset eventually for around 70% of population (Joseph 2018). Provinces have also adopted their own variations on the carbon pricing mechanisms. For example, BC has an incentive scheme that reduces carbon-tax costs for entities that have high performance with reference to emissions benchmarks, and invests the industrial carbon tax revenue in promoting direct emissions reduction projects.

Carbon leakage is one adverse situation that can occur as a result of climate policies and carbon pricing mechanisms. Here, as a result of stringent emissions control policies, businesses transfer emissions inducing activities to other countries with lax standards and constraints (European Commission 2019). This results in a mere transfer of the environmental burden to another, often economically disadvantaged and under-developed, part of the world, and can actually result in an increase of overall emissions.

3.2.2 Developing Effective Policies and Emission Mitigation Initiatives

Successful achievement of climate action targets in some Canadian provinces have been supported by several factors. Legislated emissions caps are a notably successful measure that helped reduce emissions significantly in Nova Scotia. New Brunswick has reduced emissions by 31% between 2005 and 2015 by implementing policies in favour of importing hydro and increasing wind energy generation to replace oil and coal (Natural Resources Canada 2017).

Policies for energy demand management and climate change mitigation focus on various goals, and as such, should consider economic impacts, environmental benefits, and social acceptance (Karunathilake et al. 2018). However, these goals are often conflicting. While a considerable effort is being made across Canada for energy and emissions management policy development, one key limitation in most of the current policies is an integrated approach that considers economic, environmental, and social aspects simultaneously and comprehensively in policy development. Moreover, in Canada, energy demand patterns vary heavily based on climatic regions, as previously discussed, and any developed policy frameworks should take this variation into account. Further, policy making that happens at one level of administration can have impacts on various strata of government and society. This disconnect between the different interests can lead to complaints about policies being too distant from practical reality. Taking an inclusive and participatory approach to policymaking can address the above challenges and limitations, which is especially important in a diverse and geographically vast country like Canada. Equity is a key aspect that needs to be kept in mind when developing policies. A prescriptive approach that focuses on *equal treatment* may not necessarily be the most *equitable* course of action.

4 The Dynamics of Carbon Pricing and Emission Policies

Given the ongoing and potential adverse effects of climate change, carbon pricing in the form of tax and cap and trade systems are understood to be ideal tools that can potentially strengthen the current mitigation battle against climate change. In order to increase the political legitimacy and social acceptance of these tools, information needs to be transmitted to all stakeholders, highlighting their benefits to different layers of the society, especially to individual families. As previously mentioned, carbon pricing will elevate the costs for fossil fuel, electricity, ands gas, yet it is the "price increment gradient (PIG)" that will control the behavior of the individual consumers (Chen 2019) (Nahiduzzaman et al. 2018). The federal tax prices carbon at the rate of $20 per tonne, which is equivalent to a PIG of 4.4 cents per one litre of gasoline in 2019, is projected to be 11 cents a litre by 2022 due to the gradual increase of the carbon tax (Chen 2019) (The Globe and Mail 2019). This essentially makes PIG a critical price factor that is expected to curb the fossil fuel consumption while changing the behavior in favor for non-fossil fuel based choices. In the existing carbon pricing program, specific elements are critically designed and directed to minimize the stresses related to finances and market competition at the individual family level. Rebates and tax credits are among the most well designed elements (The World Bank Group 2019). The tax paid in the form of carbon pricing is expected to be reimbursed to the individual families through rebate programs. While tax could be categorically perceived as a "stick" tool, rebate turns out to be a "carrot" measure that paves out the inspirational pathway to embrace as well as practise "stick" in the daily behavior of the consumers.

Table 13.2 Average expenditure for carbon tax versus net benefits for families

Province	Average expense for each family (C$)	Rebate (C$)	Net benefit (C$)	Net benefit Percentage	Average net benefit (C$)	Average net benefit Percentage
Ontario	244	300	56	22.95	100.25	34.74
Saskatchewan	403	598	195	48.38		
Manitoba	232	336	104	44.87		
New Brunswick	202	248	46	22.77		

Source: Adapted from (The Globe and Mail (2019))

Carbon price is not constant across the provinces. It is modified with changes and variations in line with the regulations of the provincial government that support the federal regulatory goals. Each jurisdiction relies on different amounts of fossil fuels while the payments in each province will be based on the number of people in a family and paid to one tax-filer. This way, the families will counter cost with a general annual rebate based on the average expenses of a province and evenly divided across the board (Chen 2019). For examples, Ontario household is expected to pay $244 in direct and indirect costs for carbon, while it will receive $300 under the "climate-action incentive" with a net benefit of 22.95%, equivalent to $56. Table 13.2 shows an average cost that each family is going to pay under carbon tax versus net potential gain through carbon rebate for Ontario, Saskatchewan, Manitoba and New Brunswick (The Globe and Mail 2019).

Regardless of differences, each family is going to gain an average amount of $100.25, which will be about 35% appreciation on the amount paid as carbon tax. Ideally, this should be an encouraging stimulus to get the families streamlined in favor of carbon taxation. However, there is still a considerable resistance amongst the families and other stakeholders across the provinces against the federally imposed regulatory tool for the territories and provinces, largely due to misinformation and widely held misconceptions surrounding this initiative. Next section attempts to unearth the reasons behind and critically discusses the current policy gaps and pertinent challenges that tend to make carbon pricing less than popular among the general public.

4.1 Lack of 'Right' Information: Addressing the Prevailing Pitfalls

There has been a tremendous financial and intellectual endeavor to effectively address the negative consequences of the surging demand for fossil-fuel based energy (National Round Table on the Environment and the Economy 2009). Fiscal and regulatory instruments along with education and awareness strategies are put forward along the line in order to achieve the maximum efficiency (see Fig. 13.5).

While the first two domains of supportive interventions are prominent and highly visible in favor of carbon pricing, "education and awareness" segment largely lags behind in disseminating clear information to the Canadians on:

– Detailed price breakdowns of carbon tax and corresponding monetary incentives in the form of rebates and subsidies;
– The operational method for carbon pricing – how does it work?
– Short and long-term benefits of carbon tax (e.g., people will drive less and choose more-efficient cars or sustainable modes of transportation, such as electric vehicle, public transit, etc.) and contributions from each family as per the annual income and other pertaining attributes;
– Manifestation on how the continued contributions through carbon tax is going to address the current and future adversities posed by rapidly changing climate;
– Key modules of energy, environment, and sense of security for the future generations where families could see direct and indirect benefits of their contributions.

Public perception about any regulatory instruments in Canada relies more on perceived fairness and equity than actual efficiency that the designed instruments are aiming to achieve (Cross 2019). Arguably, the apparent "perception" and embedding knowledge about carbon tax and the expected contributions from the families are some what vague. Carbon tax has also become mired in politically adverse landscape, as it comes to the forefront of highly controversial arguments based on political agendas and philosophies. The phenomenon has echoed in various formats and occasions across the provinces. For instance, only 47% of the British Columbian residents opined that they were in favor of carbon tax, although the BC government offered a climate action tax credit with GST/HST returns in order to offset the embedded cost. However, the provincial government recently declared the CleanBC plan that incorporates industrial incentives and a "Clean Industry Fund" to help industries stay competitive by being innovative, which in turn is expected to reduce both the price of commodities and tax burden on the families (The Canadian Press 2019).

The benefits of carbon tax and the consecutive price burdens on families have also been misinformed and slanted. Many of such attempts could be attributed to politically motivated propaganda, as indicated by recent evidence in Ontario. The Ontario Provincial government contends that carbon tax is likely to cost the average family $648 a year in 2022, in contradiction to the federal government currently held (2019) plans to set it at $244 (The Globe and Mail 2019) (The Canadian Press 2019). While the figure for 2022 is yet to be authenticated, the public information turned out to be only partial without the fact that 80% of the families are expected to receive a higher return through a rebate delivered on their income tax return than what they paid as climate-related taxes, as shown in Table 13.2. Furthermore, the Ontario government also insists that the carbon tax is going to elevate prices for both gas and groceries (The Canadian Press 2019), which does not seem to have a factual ground. Ironically, many people tend to react to such negative information, and oppose regulatory provisions i.e. carbon taxing based on the prevailing (distorted or partial) information without any attempt for triangulation (McCarthy 2019). While the dissemination of such deceiving and fabricated information might be entertained in the political dogma, the role of the federal government in addressing such practices cannot be ruled out. In other words, the federal government must play a responsible role in order to disseminate the "right" and "complete" information about carbon tax to all governmental tiers and families across the provinces and territories.

On the other end of the spectrum, there is a growing need to evaluate the current level of knowledge among the Canadians about the existing regulatory tools and extent of urgency to tackling climate change in order to reduce GHG emissions. A poll released by Abacus Data suggests that one third of the Canadians believe that climate change is not caused by human and industrial activities. While the above finding is surprising, a group of economists suggest that this survey was not broadly understood by Canadians (Zimonjic 2018). However, a recent poll conducted by Nanos Research further advocates that though majority of the Canadian families support climate change mitigation, they are not ready to pay more than $200 per family annually through carbon tax (Gordon 2019). Interestingly, the number of people who wanted government to focus less on policies to reduce carbon emissions has doubled – from 8% in 2015 to 16% in 2018. Another staggering figure suggests that only 42% Canadians are familiar with the concept of carbon pricing and its resulting benefits to the environment, with 10% being "very" familiar and 32% being "quite" familiar (Zimonjic 2018). When the level of perception about carbon pricing, its core benefits, the individual contributions, and backstop year round return (rebate) policy is poor, gaining the necessary support to implement this vital regulatory tool would be immensely challenging. Moreover, it will be cumbersome to get all the tiers of government, including territories, provinces, regional districts and municipalities on board to support the initiative. This will further complicate the fact that without having a desired consensual opinion from the individuals, any level of government would be reluctant to proceed with carbon pricing, although it might yield exceptional merit and better prospects to the current and future generations. Given the prevailing status quo along with the intellectual and political impasses, it is significant for the federal government to design a context-specific, clear and all-encompassing package for the individuals and families to receive "right" information in order for them to take informed decisions.

4.2 The Need for 'Right' Information: What Needs to Be Done?

As discussed in the previous section, information dissemination strategy has been very weak and not well thought out. As a result, a significant number of families is still either completely unaware or only partially informed about carbon tax and pricing concepts (Zimonjic 2018). The only forms of communication methods used for public education were mass media, notably TV channels, YouTube, and social media. Moreover, the content of communication has been brief enough to adequately convey the key essence about carbon pricing tool (Carattini et al. 2017). This stems a pressing need to convey the "right" information package about the backward and forward linkages associated with carbon pricing. Canada being a country with significant socio-cultural and ethnic diversities demands a well designed communication strategy that takes into account the sensitivity and significance associated with such diversity to fruitfully educate the families. Clearly, the current endeavor to disburse the right information falls short of what is adequate (Carattini et al. 2017). Below are some of the thoughtful communication strategies that would potentially bridge up the prevailing knowledge gap(s) among the Canadians. They are likely to contribute in addressing the asymmetries of (*mis-*) information. A well-designed communication strategy aims to increase the visibility of potential benefits of carbon economy, by offering "accurate" and "complete" message with evidence, which in turn would overcome the fundamental issues of distributional fairness, political trust, and policy effectiveness at the federal, provincial, and local levels (Carattini et al. 2017; Mattauch et al. 2017).

The information package must clearly entail

- Price breakdown while specifying the price increment gradient (PIG) with actual contributions of carbon tax in regular gas price and energy bills with a clear message on rebates against the family income and other pertaining attributes.
- GHG reductions achieved versus the expected when carbon tax rates are increased over time along with the co-benefits gained in reducing congestion, air pollution and health costs, improving health and quality of life, among others.
- The aggregate impacts of carbon tax on family income and economy with a highlight on the potential competitive effects and job prospects with a specific focus on the consequence of rebates, subsidies and any social cushioning measures that are used to minimize these impacts (Carattini et al. 2017). The modes for these information package would include printed stickers, leaflets, brochures, etc. that are also going to be publicized through online (social) media;
- Awareness sessions need to be organized at the level of communities, schools, and universities with a concerted effort to facilitate dialogues with the people from all age-cohorts, socio-cultural and income diversities.
- Supplementary programs on consumption behavior and pertaining directives are to be designed on the systemic acts to curtail fossil fuel based consumption (Nahiduzzaman et al. 2018) (Chelleri et al. 2015).
- Energy policies being impactful to everyone – from the federal government to individual families and citizens – it is vital that everyone voices their opinions, suggestions and advocative directives in the ensuing discussion. Therefore, a participatory approach needs to be pursued to consult with the wide arrays of stakeholders, notably federal, provincial, territorial, and municipal governments, industries, residents, and academia.

This may help revise both federal and local regulatory instruments for carbon pricing and cap to effectively meet the stakeholders' expectations and needs.

5 Conclusion: Take Away Lines and Way Forward

While climate change and its adverse consequences appear to the forefront of intellectual and political discourses, carbon pricing and cap seem to be effective regulatory tools for the emission mitigation endeavours. However, implementation of these tools is going to be immensely daunting due to lack of consensual support from a range of stakeholders, including the government and regulatory bodies at different tiers and industrial and commercial partners. Moreover, these tools may not seem very appealing to the Canadians when the immediate financial compensations hastily overshadow the long-term gains. The phenomenon of acceptance is further exacerbated by the inability of the stakeholders to comprehend the key essence of the temporary financial compromises in order to reap later gains through rebates, subsidies and other forms of compensations along with the promise for a better environment. This is primarily attributed to the apparent failure of the federal government to communicate the "right" information to the lower tier of governance and mass Canadians. The detailed architecture of transfer for "complete" and "right" information concerning carbon pricing is under discussion at the federal policy. However, the current "customary" practice of its dissemination among the stakeholders has been staggeringly weak. Due to lack of complete and holistic knowledge of carbon pricing, the discussions on this issue often turn out to be partial and incomplete. The instance of lack of participation by the Canadian families further perplexes the status quo. Because they are not provided with the needed information and functional platforms in order to contribute to the current debates towards (*re*-) shaping the carbon pricing regulations and stemming policies.

In pursuit to remove the current layers of barriers to achieve the goals for carbon pricing, the current status quo essentially calls for a "pathway" of stakeholder engagement. The trail to deliver a package of accurate and complete information on climate pricing to help the stakeholders take informed decision and policy is conceptually illustrated in Fig. 13.7. On the same note, it is imperative to provide details on the encouraging factors as "carrots" while stressing on the price increment gradient (PIG) as "stick" to depict the financial penalties that eventually pay off in the forms of reimbursements and environmental benefits. This paper argues that the success of carbon pricing tool to address the climate change induced adversities does not solely rely on mandatory penalties, but also on stakeholder's acceptance. It is apparent that the short- and long-term benefits outweigh the costs, although this fact is inaccurately rendered in the current intellectual and political deliberations.

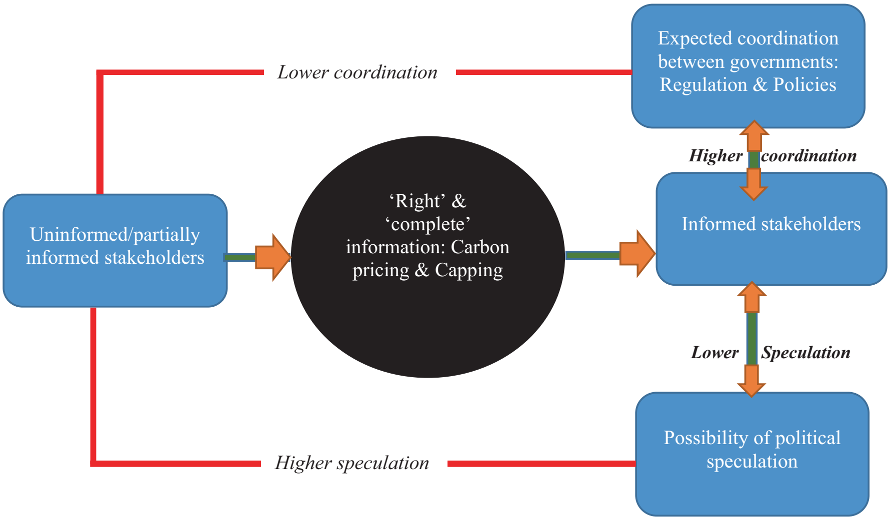

Fig. 13.7 A conceptual pathway to the implementation carbon pricing

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