A Multi-Level Policy Mix Analysis on Energy Efficiency Policies Impacting Buildings in Toronto and Calgary

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A Major submitted to the Faculty of Environmental Studies in partial fulfillment of the requirements for the degree of Master in Environmental Studies York University, Toronto, Ontario, Canada

July 31, 2019

Abstract

Strengthening energy efficiency is a quick and cost-effective strategy for reducing energy use in the buildings sector, which accounts for 17% of Canada's greenhouse gas emissions. Public policies are a crucial tool for stimulating energy efficiency improvements in buildings. This paper performs and discusses the findings of a multi-level policy mix analysis on the mix of municipal, provincial, and federal energy efficiency policies that impact buildings in the Canadian cities of Toronto and Calgary. Toronto and Calgary are selected for analysis due to its large population size, building count, greenhouse gas emissions, and operating and capital budgets. A policy mix analysis examines the interactions between policy instruments and is premised on the idea that individual policies do not exist in isolation, rather, policies interact with other policies (in policy mixes) to produce cumulative outcomes and to change individual policy outcomes. This paper seeks to determine policy mix effectiveness, which is defined by how optimized a policy mix composition is in reducing greenhouse gas emissions of buildings through energy efficiency improvements.

Using an original dataset of 91 energy efficiency policies, 16 different types of interactions between these policies are analyzed and discussed. These interactions are evaluated based on 10 different policy characteristics that is identified for each policy: target consumer decision-making process component, policy time horizon, policy instrument sub-type, policy regime creation or destruction, policy flexibility, target building sector, target innovation phase, target actor, target building type, and building energy efficiency exclusivity of policy. The composition of policies with different characteristics within policy mixes are indicators of policy mix effectiveness.

This study found that the policy mixes of Toronto and Calgary have similar compositions and that, encouragingly, the policy mixes examined mostly have a comprehensive composition of policy instrument elements. However, the results also demonstrated that policy mix effectiveness could be improved by increasing policy efforts that weaken the viability and appeal of technologies of lower energy efficiency levels to create opportunities for technologies and practices of improved energy efficiency to emerge. Policy mix effectiveness could also be strengthened by increasing policy efforts towards ensuring the correct use of energy efficiency technologies; enhancing the clarity of and commitment towards policy direction through increasing the use of explicit policy milestones; adjusting policy mixes to better address contextual realities such as the role of existing buildings in future greenhouse gas emission reductions; and reducing the scope of policy instruments to achieve specific rather than broad objectives.

FOREWORD

This major research paper explores and conducts, in-depth, a policy mix analysis to deepen my understanding of clean energy and environmental policies in Canada. This research paper contributed to my understanding of:

- the role and importance of energy efficiency improvements and policies to meeting Canada's climate change commitments (e.g. energy efficiency improvements in buildings is one of the quickest and most cost-effective methods to reducing greenhouse gas emissions).
- the significance and outcomes of policy interactions with other policies (e.g. no single policy instrument is flexible enough to address all environmental problems in all contexts).
- the different characteristics of policies that contribute to its effectiveness in achieving its objectives (e.g. a policy comprises of the characteristics: target actor, time horizon, target innovation phase, etc.; all of its characteristics contribute to whether it can effectively achieve its goals).
- the abundance and diversity of different policies employed to address environmental concerns in Canada (e.g. my research found that, in each the cities of Toronto and Calgary, over 50 policies are employed to improve energy efficiency in buildings).
- the strengths and opportunities for improvement of energy efficiency policies in Canada (discussed in the "Results and Discussion" section of this paper).

This paper also contributes to the general understanding of policy mix analysis by (1) providing an example of how to conduct a comprehensive policy mix analysis, and (2) conducting, for the first time, a policy mix analysis on building energy efficiency policies in Canada. This paper also creates an original dataset of building energy efficiency policies that impact the cities of Toronto and Calgary. These policies have also been coded to reveal their characteristics and graphed based on these characteristics. While only select policy characteristics and graphs were analyzed, over 70 graphs were generated in total (Appendix B) which can be used for future analysis.

Learning objectives (in POS) achieved by writing this paper:

- Learning Objective 1.1 is achieved, as this paper contributed to my understanding of multi-level environmental policy evaluation and interaction (e.g. via conducting its literature review and performing policy analysis).

- Learning Objective 1.1 is achieved, as this paper required me to review every single energy and environment policy in Canada, Ontario, Alberta, Toronto, and Calgary in order to compile a defined list of building energy efficiency policies for analysis. These policies were then evaluated in-depth.
- Learning Objective 1.2 is achieved, as this paper required me to analyze the strengths and weaknesses of environmental policies.
- Learning Objective 2.1 is achieved, as this paper enhanced my understanding on the roles of different aspects of clean energy transitions (e.g. roles of different actors, and different stages of clean technology innovation and dissemination, via its literature review).
- Learning Objective 3.1 and 3.2 is achieved, as this paper required me to understand how businesses could be impacted by different types of environmental policies, and the importance of different types of policies in stimulating sustainable business practices (e.g. via literature review).

Contents

1 Introduction

Global temperature rise as a result of greenhouse gas emissions is the primary driver of climate change. Globally, approximately 78% of human-induced greenhouse gas emissions are energy-related (NRCan, 2018a) and in Canada, this figure is 81% (NRCan, 2018). The 2018 Intergovernmental Panel on Climate Change's Special Report on the Impacts of Global Warming of 1.5°C (2018) warns that in order to avoid impending catastrophic climate change-related consequences, global temperature rise must be limited by a drastic reduction of greenhouse gas emissions. These consequences include trillions of dollars in property damage due to natural disasters, the flooding of coastal areas, the reduction of agricultural yields, and dangerous fluctuations between temperature extremes (U.S Global Change Research Program, 2018).

The reduction of global greenhouse gas emissions is a challenge because energy consumption, which is the primary source of greenhouse gas emissions, is predicted to increase in the upcoming decades (International Energy Agency, 2018). This poses a challenge for greenhouse gas emissions reduction efforts. In addition to conservation and fuel switching efforts, in which, respectively, the demand for energy-consuming products and services are reduced (e.g. driving less) and alternative, lower-emitting forms of energy are used (e.g. fuel switching from fossil fuels to solar energy), energy efficiency is considered a key component of emissions reduction efforts (Harris et al., 2008). In fact, energy efficiency has been a primary factor in slowing down energy consumption in IEA countries over the last decade and will continue to be a key strategy in mitigating future greenhouse gas emissions growth (Nadel, 2016). Energy efficiency is generally defined as "using less energy to produce the same amount of services or useful output" (Bednar, Reames, & Keoleian, 2017). The importance and appeal of energy efficiency are recognized by the Government of Canada, as it was chosen as one of four main pathways to help Canada meet its energy vision and climate change objectives (NRCan, 2018b).

Improving the energy efficiency of buildings within Canadian cities is especially important due to its cost-effectiveness and potential to significantly reduce greenhouse gas emissions (Intergovernmental Panel on Climate Change (IPCC), 2014). The cities of Toronto and Calgary are amongst the largest greenhouse gas emitting (Global Covenant of Mayors, 2015; & Alberta Government, 2017) and most populated (Statistics Canada, 2018) cities in Canada. Toronto and Calgary are also amongst Canadian cities with the highest operating and capital expenditure budgets – resources that fund policy decisions and programs (City of Toronto, 2018; The City of Calgary, 2018). In Toronto, approximately 60% of total greenhouse

gas emissions are from buildings (TAF, 2017)); the city also has nearly 1.2 million private dwellings – the largest number in the country (Statistics Canada, 2016). In Calgary, approximately 66% of total greenhouse gas emissions are from buildings (Calgary, 2017); and the city has Canada's third-largest number of private dwellings at nearly 500,000, behind the cities of Toronto (1,179,057) and Montreal (843,872) (Statistics Canada, 2016). Calgary was selected as a sample in this paper rather than Montreal due to the province of Quebec's tremendous electricity generation from renewable sources (99.8%) (National Energy Board, 2017), which, diminishes the potential for energy efficiency improvements in buildings to significantly reduce the city's greenhouse gas emissions. By contrast, the provinces of Ontario and Alberta (where Toronto and Calgary are respectively located) generates 33.4% and 12.4% of their electricity from renewable sources (National Energy Board, 2017). At the National level, buildings in Canada account for approximately 12% of total greenhouse gas emissions (Government of Canada, 2019b).

Advancing the research, development, deployment, and uptake of technologies that improve energy efficiency is important for minimizing the rise in future energy demand and greenhouse gas emissions. In the World Energy Outlook (2018), for example, the continued improvement of energy efficiency innovations is credited for slowing the growth in energy demand in advanced economies, including Canada, and is recognized as a key action for reducing emissions output in the upcoming decades (IEA, 2018). Improving building energy efficiency is also one of the quickest and most cost-effective, potentially with net economic benefit, methods for reducing energy demand, thereby reducing greenhouse gas emissions (Intergovernmental Panel on Climate Change (IPCC), 2014). Moreover, energy efficiency improvements have the potential to produce net economic benefits through lower energy costs while providing improved energy security and accessibility.

Despite these benefits, energy efficiency improvements in buildings still require motivation to be realized (Hoicka, Parker, & Andrey, 2014). Public policy actions have been proven to produce important and necessary motivation, which enhances the energy efficiency performance of buildings (International Energy Agency, 2018). Public policy can address barriers such as information deficits in which the lack of awareness of the benefits and use of energy efficiency technologies results in difficulty in achieving desired energy efficiency technology uptake or outcomes, through information policies such as education campaigns or product labeling (Peattie, 2010). Affordability can also be addressed by public policies, for instance, through direct investments and financial incentives. Since no single public policy instrument can address all environmental concerns and all of the barriers associated with clean energy

technology development, diffusion, and use, a mix of policy instruments must be employed (Gunningham & Sinclair, 1999a). The effectiveness of public policy instrument and instrument mix actions have been evaluated via policy mix analyses (Rosenow, Fawcett, Eyre, & Oikonomou, 2016a). A policy mix analysis on the energy efficiency policies that impact buildings in Canada, however, has never been carried out.

The objective of this paper is to offer insights for improving the energy efficiency policy mixes that impact buildings in the Canadian cities of Toronto and Calgary. The research question addressed in this paper is as follows: How effective are the energy efficiency policy mixes that impact buildings in Toronto and Calgary, where effectiveness is defined by the optimization of the policy mix composition towards increasing energy efficiency, thereby reducing the greenhouse gas emissions of buildings in Toronto and Calgary? This objective is achieved and the research question is answered by examining the effectiveness of the composition of the multi-level energy efficiency policy mixes that impact buildings in Toronto and Calgary. This is the first study of this kind in the Canadian context. This paper begins by introducing the importance of evaluating energy efficiency policy mixes that impact buildings (Section 1), followed by a review of policy mix literature (Section 2). Next, the methodology of the study is described (Section 3), which is comprised of the following stages: policy compilation, policy characteristic extraction, tabling and graphing of policy mixes, and policy mix analysis. Select, notable results are then discussed (Section 4).

2 Literature Review

2.1 Policy mix analysis

No single public policy has the capacity to address all environmental problems in all contexts, rather, a mix of policies (policy mixes) must be employed (Gunningham & Sinclair, 1999a). Therefore, a policy mix analysis is a useful framework to evaluate and understand the effectiveness of government energy efficiency policies in Canada. Generally, a policy mix analysis is concerned with how the interactions of a combination (or mix) of individual policy instruments shape their cumulative effectiveness and outcomes (Cunningham et al., 2013). The terms policy, policy instrument, and instrument are used interchangeably between different studies but refer to the policy tools used to achieve policy objectives. A policy mix analysis is valuable because in the real world, different policy instruments often simultaneously exist and interact to achieve policy objectives (Kivimaa, 2016). The effectiveness and outcomes of individual policy instruments are impacted “by the co-existence of other instruments” and

new cumulative outcomes are also produced (Rogge & Reichardt, 2013, pg 15). A policy mix analysis addresses the weakness of traditional policy analysis, which focuses on the outcomes of solitary individual policy instruments, by recognizing that in the real world, interactions between policy instruments shape individual policy instrument effectiveness and shape the cumulative outcomes of mixtures of policy instruments (Gunningham & Sinclair, 1999a).

The term policy mix originated from economic policy debates in the 1960s, in which the concept was applied to the "interactions and interdependencies between different [fiscal] policies as they affect" the realization of broader policy goals (Flanagan, Uyarra, & Laranja, 2011, p. 702). In the late 1980s, the application of the concept expanded to innovation policy studies due to two developments: (1) the recognition that innovation policy goals are achieved through the interaction of different policies; and (2) the realization that the increasing dispersal of power in modern states replaces the traditional state-centric models of governance with a multi-level, multi-actor model of governance, hence, policies from different sources interact to generate societal changes (Flanagan et al, 2011).

The policy mix concept was later applied to environmental policy studies because of the acknowledgment that individual environmental policy instruments have unique strengths and weaknesses, and that "none are flexible enough to solve all environmental problems in all contexts" (Gunningham & Sinclair, 1999, p. 49). Even in situations in which policy instruments are not intentionally mixed, individual policy instruments never exist in isolation because they emerge into existing policy environments (Rogge & Reichardt, 2013). As a result, to improve environment and energy sustainability, the consideration of the impact of different policy instruments combinations are required (Costantini, et al. 2017).

Some scholars emphasize that policy mix analyses ought to consider more than the effectiveness of existing policy mixes by also considering the process by which such policy mixes emerge. This is because the sequence and methods of policy instrument introduction to or removal from policy mixes also impact policy mix outcomes and effectiveness (Kern, Kivimaa, & Martiskainen, 2017). The terms policy mix and instrument mix are also used interchangeably in some studies (Rogge & Reichardt, 2013), however, other scholars have argue that an analysis focusing only on the interaction of policy instruments would be more appropriately termed an "instrument mix" analysis, as the term "policy mix" analysis encompasses more than just the interaction of instruments, but also their emergence (Rogge & Reichardt, 2013, pg 3). There is also the claim that policy mixes could be divided into two types. First, policy mix analyses concerned with the emergence and changes of the composition and impact of policy

mixes over time; and second, policy mix analyses concerned with the effectiveness of existing policy mixes and how to design an effective policy mix (Rosenow et al., 2016). This paper falls under the first type of study, since it examines the characteristics and effectiveness of existing policy mixes, and the emergence of policy mixes is beyond the scope of this paper.

When policy mixes span across different levels of governments they are called multilevel policy mixes. A multi-level policy mix analysis is generally concerned with the characteristics, effectiveness, and outcomes of the interactions between policy instruments from different levels of government (Vitola, 2015). Multi-level policy mix analysis is important because energy, environment, and innovation policies have become the responsibilities of every level of government; the interactions and cumulative outcomes of these policies, rather than individual policies alone or policies from one level of government, create real-world energy, environment, and innovation outcomes (Vitola, 2015). Similar to a policy mix analysis, a multi-level policy mix analysis also evaluates the interactions between the elements that constitute policy instruments, with the distinction that the scope of analysis is stretched to incorporate a larger variety of policy sources.

2.2 Policy mix typologies and evaluation

An array of policy instruments is employed to support the research, development, deployment, and adoption of energy efficiency technologies in buildings. Policy types and sub-types represent the tools used to achieve a policy objective (Howlett & Rayner, 2007). The typologies of these instruments can be divided into economic, regulatory, and informational (Rogge & Reichardt, 2013). Some authors also opt to further divide policy instruments into sub-types such as loans, grants, etc. (Rogge & Reichardt, 2013). The typology categorization of policy instruments is inconsistent between studies and countries due to preferences in nomenclature selection (Rosenow et al., 2016). Due to the abundance of energy efficiency policies that can constitute energy efficiency policy mixes, policy mix analyses are essential to understanding the cumulative effectiveness and impacts of current energy efficiency policies. For example, a policy mix analysis could reveal whether there are adequate information dissemination policies to help achieve enrollment expectations of energy efficiency technology rebate and loan programs via the promotion of the importance and benefits of energy efficiency.

A policy mix analysis is performed by evaluating the interactions between individual policy elements of policy instruments that compose policy mixes within a selected policy scope (e.g. energy efficiency policies that pertain to buildings) (Rosenow et al., 2016). Policy elements are the characteristics of policy instruments, and can include policy instrument type (e.g. economic, regulatory, etc), objective, time

horizon, innovation phase (e.g. research, development, demonstration, deployment, etc.), and target actor (e.g. homeowners) (Rogge & Reichardt, 2013). Some of these policy elements are inherently identifiable, such as policy objective and policy instrument type, while others require classification by being compared or evaluated against other policies (e.g. ambition levels). Depending on the objective and scope of policy mix analyses, different elements may be selected for evaluation. The interactions between policy instruments within policy mixes may be complementary, inconsequential, or produce trade-offs, and shape overall policy outcomes (Cunningham et al, 2013). This paper's policy mix analysis examines 10 policy elements, which will be described and discussed in the methodology section.

The outcomes of these policy interactions are characterized and can represent indicators of effectiveness. Characteristics include consistency (e.g. consistent policy objectives between policies within a policy mix), comprehensiveness (e.g. comprehensive use of different policy types), balance (e.g. balance of policy element characteristics), etc. (Rogge & Reichardt, 2013). For example, policy mixes comprised of a comprehensive set of policy instruments with consistent objectives could be deemed more effective than policy mixes with objectives that are inconsistent and not comprehensive (Rogge & Reichardt, 2013). Whether policy mix characteristics have a positive or negative correlation to the overall effectiveness of the policy mix may be context-dependent, thereby requiring discussion on a case-by-case basis. For instance, a policy mix that, with perfect balance, targets new and existing building types could be effective in maximizing energy efficiency improvements in some locations but could be ineffective in other locations that have minimal numbers of existing buildings and that are quickly developing new communities. Due to the context specificity of policy mix optimality, it is appropriate for different studies to analyze the interactions of policy instruments within policy mixes differently (Rosenow, Kern, & Rogge, 2017).

2.3 Policy mix analysis outcome examples

Kivimaa & Kern (2016), for example, evaluated the mix of sustainable energy policies in Europe by categorizing policies based on its intention to support the creation and diffusion of new technologies or destabilize support for existing technologies and practices. The analysis found that policy mixes are more effective when comprised of both regime creation policies, which support the development and diffusion of technologies and practices, and regime destruction policies, which destabilizes existing technologies and practices thereby creating windows of opportunity for the upscaling of innovations" (Kivimaa & Kern, 2016, p. 205). When comprised of both regime creation and destruction policies,

sustainable energy technologies are created, disseminated, and adopted quicker and more widely as compared to policy scenarios lacking either regime creation or destruction policies.

Valeria et al (2017) analyzed the effectiveness of different energy and environment policy mixes in OECD countries in driving eco-innovations (defined as innovations that improve energy efficiency performance). The analysis evaluated the instrument types and intent (demand-pull vs. technology-push policies) of policy mixes within OECD countries and found that countries that employ a balanced mix of demand-pull and technology-push policies, as well as a comprehensive mixture of policy instrument types, achieve greater eco-innovation development and dissemination success.

Vitola (2015) compared multi-level sustainability innovation policy mixes between the Baltic Sea region countries. The analysis found that effective multi-level innovation policy mixes demonstrate consistency in terms of policy rationale, objective, and target actors, and are designed with coordination between national and regional levels of governments. The effectiveness of multi-level policy mixes is reduced in the absence of intergovernmental coordination and awareness due to the risk of redundancies and contradictions between policies from different levels of governments.

Rosenow, Kern, & Rogge (2017) evaluated the comprehensiveness of energy efficiency policy mixes in 14 European Union member states. The article evaluated comprehensiveness in three areas: technology (does the policy mix target a comprehensive set of energy-efficient technologies?), instrument (does the policy mix employ a comprehensive set of policy instrument types?), and sector (does the policy mix target a comprehensive range of sectors?). The article found that policy mixes were comprehensive and that comprehensiveness had a positive correlation with policy mix effectiveness. The authors also found that the policy instrument composition of the energy efficiency policy mixes could be improved to achieve greater effectiveness. Mainly, greater policy focus could be directed to the transportation and industry sectors, low-cost energy efficiency technologies, and super deep energy efficiency improvements (e.g. large-scale building renovations and appliance replacements).

3 Methodology

This research paper evaluates and discusses the characteristics and effectiveness of government multi-level energy efficiency policy mixes that impact buildings in the cities of Toronto and Calgary. A multi-level policy mix analysis was selected as the framework for policy mix evaluation because real-world policy outcomes are produced not by individual policies or policies from singular sources, but rather by the interactions and cumulative impacts of policies stemming from different levels of government

(Vitola, 2015). A single-level policy mix analysis would neglect these inevitable policy interactions and cumulative outcomes. Toronto and Calgary were selected for analysis because of its population size, building count, greenhouse gas emissions, and operating and capital budgets and amongst the largest in Canada.

Effectiveness is determined by how optimized the policy mix composition is in meeting its objective of increasing the energy efficiency and reducing the greenhouse gas emissions of buildings in Toronto and Calgary. In order to determine policy mix outcome and effectiveness, first, policy instruments were identified and compiled to form the policy mixes of this analysis. Second, based on the frameworks explained in the literature review of this paper and in Section 3.2 (Methodology), the characteristics or "policy elements" of each policy instrument were identified. Third, the composition of the policy mixes of Toronto-Ontario-Canada and Calgary-Alberta-Canada were analyzed for effectiveness based on its comprehensiveness and composition of policy instruments of different policy elements.

3.1 Policy instrument compilation

A total of 91 policy instruments were identified and compiled for analysis between April and May of 2019. To ensure comprehensiveness, three compilation methods were used: website search of relevant departments, departmental plan and budget review of relevant departments, and active search using policy sub-type checklist. These policies represent a comprehensive list of federal, provincial, and municipal energy efficiency policies that impact buildings in Toronto and Calgary (See Appendix A). These 91 policy instruments comprised of 52 federal policies, 6 policies from Ontario, 20 policies from the Alberta, 10 policies from Toronto, and 3 policies from Calgary. Therefore, the policy mix of Toronto (i.e. Toronto-Ontario-Canada, because these policies all impact buildings in Toronto) consists of 68 individual policy instruments and the policy mix of Calgary (i.e. Calgary-Alberta-Canada, because these policies all impact buildings in Calgary) consists of 75 individual policy instruments. First, web content and publications from government entities responsible for energy, environment, and infrastructure matters were thoroughly examined. The mandates of every department of the Government of Canada, Province of Ontario, Province of Alberta, City of Toronto, and City of Calgary were reviewed to identify departments that are responsible for energy, environment, and infrastructure matters. These government entities are:

- **Federal level:** Natural Resources Canada; Environment and Climate Change Canada; Innovation, Science and Economic Development Canada; Infrastructure Canada, Canadian Housing and Mortgage Corporation.

- **Province of Ontario:** Energy, Northern Development and Mines; Environment, Conservation and Parks; Ministry of Municipal Affairs and Housing; Ministry of Infrastructure.
- **Province of Alberta:** Ministry of Energy; Ministry of Environment and Parks; Ministry of Infrastructure; Ministry of Municipal Affairs.
- **City of Toronto:** Division of City Planning; Division of Environment and Energy; Transformation Office.
- **City of Calgary:** Department of Utilities and Environmental Protection; Department of Planning, Development and Assessment.

Second, to check for policy compilation comprehensiveness, the annual departmental plans and annual reports of each of these government entities were reviewed. As part of the Open Government Directive, each department within the federal and provincial governments releases annual departmental plans or annual reports to report on annual accomplishments, and budgets and expenses (with program details). This means that all meaningful energy efficiency-related accomplishments and expenditures were listed in these reports. Annual departmental plans and reports from each government entity listed above, dating back two election cycles, were examined (Canada: 2011-current; Ontario; 2014-current; Alberta 2012-current; Toronto; 2014-current; Calgary: 2013-current).

A third method to confirm policy comprehensiveness was to use a list of policy sub-types as a checklist of policies to gather. Through a literature review of 17 energy and environment policy mix literature, it was determined that governments have access to 14 different types of common public policy tools to achieve their energy and environment objectives. These policy tools are also available to governments in Canada to utilize to achieve its energy and environment objectives. This list of policy tools was used as a checklist for collecting policies comprised within the policy mixes relevant to this research, and these policy tools were actively searched for in method 1 and 2 of this policy instrument compilation phase.

Policy tools:

a) *Direct investment* (i.e. grants, subsidies, and loans)
b) *Financial incentives* (i.e. on-bill financing and tax rebates)
c) *Energy premiums and tax schemes* (e.g. carbon taxation)
d) *Removal of perverse actions* (e.g. phase out of perverse funding)
e) *Institutional creation*
f) *Action plans* (i.e. strategic planning documents)

g) *Regulatory codes and standards*
h) *Mandatory monitoring, auditing, and reporting schemes*
i) *Information, advice, and education provisions*
j) *Performance labeling*
k) *Training and qualification*
l) *Demonstration programs*
m) *Research and development programs*
n) *Negotiated voluntary agreements*

17 pieces of energy and environment policy mix literature evaluated to create this policy typology list: (Boonekamp, 2006; Costantini, Crespi, & Palma, 2017; Eliadis & Margaret, 2005; Flanagan, Uyarra, & Larangja, 2010; Flanagan et al., 2011; Font Vivanco, Kemp, & van der Voet, 2016; Gunningham & Sinclair, 1999b; Howlett, Vince, & Del Río, 2017; Kivimaa & Kern, 2016, 2016; Matti, Consoli, & Uyarra, 2017; Pritoni, Meier, Aragon, Perry, & Peffer, 2015; Rogge & Reichardt, 2013; Rosenow, Fawcett, Eyre, & Oikonomou, 2016b; Rosenow et al., 2017; Vitola, 2015).

3.2 Policy instrument characteristics/elements

The next step was to code for the policy characteristics of policy instruments. Ten characteristics (defined as "policy instrument elements" or "policy elements"; e.g. the type of building a policy instrument targets) were identified for each policy instrument, and policy instruments were analyzed based on these policy elements (policy elements described in section 2.3.3 of literature review and outlined in Table 1). Policy elements were extracted because the interactions between policy instruments, based on its policy elements, determine policy mix effectiveness and outcomes (Rosenow et al., 2017). Ideal policy mixes generally contain policy instruments with comprehensive policy instrument elements, and the composition of these policy instrument element must also be reflective of contextual factors (discussed in Table 1).

Based on policy mix anlayses frameworks derived from a review of policy mix literature, the analysis of this paper was performed by calculating the number and share of each policy element within a policy mix (Rosenow et al., 2016b). The composition of individual policy instruments of different policy elements with a policy mix is an indicator of policy mix effectiveness. For example, the number and percentage of policies that target residential, commercial, industrial, and institutional building types within an energy efficiency policy mix. Within this example, the analysis may reveal, hypothetically, that

efforts within a policy mix to improve the energy efficiency of residential buildings are insufficient, while efforts to improve the energy efficiency of commercial buildings are excessive.

Evaluations of the interactions between the characteristics of two different policy element combinations (i.e. cross-tabulations) were also performed, for example, the number of long-term and short-term economic policies versus the number of long-term and short-term regulatory policies, etc (Matti & Consoli, 2017). Within these policy mix analyses examples, it may be revealed, for instance, that most economic policies have long-term time horizons (time-horizon represents a policy element, and long-term represents a possible characteristic of this policy element) and that most regulatory policies have short-term time horizons. These outcomes may signify a policy mix weakness, in that the market uncertainties of short-time regulatory actions deter consumers from enrolling in long-term financial programs.

3.2.1 Policy elements that were evaluated

Ten policy instrument elements were compiled through a review of energy and environment policy mix literature. The composition of policy instruments based on these policy elements within a policy mix can determine the effectiveness of the policy mix in improving the energy efficiency of buildings. These elements were coded for each policy instrument and analyzed in this paper. The 10 policy elements that were chosen to be identified for each individual policy instrument were:

3.2.1.1 Consumer decision-making process

Peattie (2010) and Hoicka et al (2014) used *consumer decision-making process components* to describe the stages of green/environmental consumption behaviors that constitute the product and service consumption process. The consumer decision-making process comprises of the components *recognition of want or need, information gathering, purchase, use,* and *post-use*. For an energy efficiency product to be effectively adopted and utilized, consumers must go through each component of this process. For a policy mix to encourage the adoption and use of technologies, it should, therefore, comprise of policy instruments that address each of these components. In most scenarios, especially in green/environmental consumption, an ideal policy mix composition also provides balanced support towards each component because the success of each component relies on the success of previous components. To interact with the *use* component, for example, one must have satisfied the objective of the *purchase* component – to obtain a product to use. In other scenarios related to the consumption of more mature and well-known technologies, *recognition of want or need* policies and *information*

gathering policies may have less importance – this is not the case in regards to energy efficiency technologies in buildings (U.S. Department of Energy, 2013; Yamamoto, Suzuki, Fuwa, & Sato, 2008). Policies that address each consumer decision-making process component are:

a) *Recognition of want or need* policies, defined as policy instruments aimed at promoting awareness and recognition of the existence, importance, and benefits (Peattie, 2010) of energy efficiency.
b) *Information gathering* policies, defined as policy instruments that provide information to consumers. The difference between *recognition of want or need* and *information-gathering* policies is that consumers do not have to actively discover *recognition of want or need* policies to experience its impact as it is actively delivered (e.g. public commercials), however, consumers must decide to interact with *information gathering* policies to experience its impact as it is merely passively available and must be sought (e.g. websites) (Peattie, 2010).
c) *Purchase* policies, defined as policy instruments that provide targeted purchase support or nudges, commonly in the form of financial incentives, to consumers interested in purchasing products (Peattie, 2010).
d) *Use* policies, defined as policy instruments that ensure the correct use of products after it is purchased (Peattie, 2010). Products must be correctly utilized for its benefits to be experienced.
e) *Post-use* policies, defined as policy instruments that ensure the correct post-use procedure (e.g. recycling and disposal process) of products.

3.2.1.2 Policy time horizon

Kern et al (2017) defined policy time horizon as the life-span of policy instruments (i.e when the policy was implemented and ends), for example, *short*- (e.g. 1-3years), *medium*- (e.g. 3-5years), and *long-term* (e.g. 5+ years) (Kern et al., 2017). The categorization of policies by its time horizon is important in a policy mix analysis because an ideal policy mix consists of a mixture of policy instruments of different time horizons, with an emphasis on long-term policy instruments (Rogge & Reichardt, 2013).. Long-term policies are crucial in policy mix effectiveness because it demonstrates policy direction stability and credibility, which result in market confidence. Short-term policies, on the other hand, are ideal for providing solutions to urgent and time-sensitive matters (Rogge & Reichardt, 2013). The existence of policy instruments with ranging time horizons, however, allow for policy direction and milestones to be clearly identifiable, which also enhances policy mix predictability thereby improving consumer and investor confidence (Rogge & Reichardt, 2013).

3.2.1.3 Policy instrument sub-type

Howlett et al (2017) identified policy instrument sub-type as the specific typology of means in which policy instruments seek to achieve policy objectives (Howlett et al., 2017). Because no single policy instrument contains the flexibility or broadness to address all environmental concerns, a comprehensive mix of policy instruments of different sub-types, in which a wide range of policy sub-types are employed, helps maximize the capacity of policy mixes to achieve its environmental objectives. Policy instrument sub-types utilized by governments to address energy and environment challenges (e.g. improving the energy efficiency of buildings) are:

a) *Direct investment* (i.e. grants, subsidies, and loans)
b) *Financial incentives* (i.e. on-bill financing and tax rebates)
c) *Energy premiums and tax schemes* (e.g. carbon taxation)
d) *Removal of perverse actions* (e.g. phase out of perverse funding)
e) *Institutional creation*
f) *Action plans* (i.e. strategic planning documents)
g) *Regulatory codes and standards*
h) *Mandatory monitoring, auditing, and reporting schemes*
i) *Information, advice, and education provisions*
j) *Performance labeling*
k) *Training and qualification*
l) *Demonstration programs*
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3.2.1.4 Policy regime creation or destruction

Kivimaa and Kern (2016) used the terms regime *creation* or *destruction* to define whether a policy instrument primarily supports the creation and diffusion of new technologies (*creation* policies), or destabilizes existing technologies and practices to provide windows of opportunities for the upscaling of new technologies (*destruction* policies). A regime is a common or planned occurrence or action, and the

concept of regime *creation* and *destruction* applied to low carbon transitions refers to the idea that existing technologies and practices need to be retried (regime destruction) for more environmental technologies and practices (e.g. smart thermostats or more energy-efficient furnaces) to be adopted (regime creation). Studies have shown that while encouraging the development and dissemination of clean technologies via *creation* policies is crucial (e.g. monetary incentives for energy efficiency upgrades), the presence of *destruction* policies (e.g. regulatory schemes to phase out older technologies) tend to increase the overall impact and rate of yield and investment of creation policies. This is because destruction policies help carve out market spaces for clean technologies and services to develop and emerge in which traditional energy technologies and practices dominant as commonalities. Accordingly, the effectiveness of policy mixes can be analyzed based on the whether it comprises of both *creation* and *destruction* policies and whether these policies target all of the pillars of change of low carbon transitions (e.g. actors types, building types, etc).

3.2.1.5 Policy flexibility

Rogge and Reichardt (2013) posited that optimal policy mixes comprise of policy instruments of different flexibilities, where policy flexibility is defined as the extent to which actors are allowed to "freely choose their preferred way of achieving compliance with an instrument" (Rogge & Reichardt, 2013, pg 14). In addition to comprehensiveness, effective policy mixes also consist of predominately highly flexible policy instruments. This is because highly flexible policy instruments allow for greater autonomy for energy-users to choose the method of compliance that they are comfortable with, which has been proven to generate more innovations and diffuse technologies and services more widely and quickly. Some policy instruments of lower flexibility, however, are also beneficial, as low flexibility policy instruments stimulate the urgent development and adoption of select high potential solutions more effectively through targeted, rather than broad, policy instruments (Rosenow et al., 2017).

3.2.1.6 Policy target building sector

Rogge and Reichardt (2013) suggested for energy and environment policy mixes to target buildings from all sectors because all building sectors emit greenhouse gas emissions. Building sectors include, for example, *residential, commercial, institutional*, and *industrial* building sectors (Government of Canada, 2016). The target building sector of policy instruments are the building sectors that policy instruments seek to target and affect (Rogge & Reichardt, 2013). An optimal policy mix, however, targets these sectors based on the context of the area of study because each building sector, depending on its context, possess a different potential for overall greenhouse gas emission reductions. In Canada, for

example, *residential* buildings are more numerous and have significantly greater emissions than *commercial* buildings (Natural Resources Canada, 2018), which would merit greater policy mix focus on *residential*, as opposed to *commercial*, buildings. A policy mix analysis on policy target building sector can help understand if policy resource is used effectively and efficiently to maximize greenhouse gas emission reductions.

3.2.1.7 Policy target innovation phase

Target innovation phase was used by Rogge and Reichardt (2013) to define the stages of product or service innovation targeted and affected by policy instruments (Ro13). Phases include *research and development*, *demonstration and deployment*, and *mass diffusion*. Each component of the innovation phase should be targeted by policy mixes because technologies must mature through each phase in order to be adopted and used. Technology diffusion, however, should be emphasized in the context of energy efficiency technologies because highly efficient and cost-effective technologies are readily available, and, if adopted, would peak greenhouse gas emissions in buildings by 2020, but the adoption of these technologies significantly lag behind expectations (International Energy Agency, 2018).

3.2.1.8 Policy target actor

Target actor is the decision-making entity targeted by the policy instrument (Rogge & Reichardt, 2013). In any policy mix, all actors implicated in the achievement of its objectives need to be targeted. In the case of energy efficiency technologies in buildings, these technologies are never developed, disseminated, purchased, and used by the same actor. Rather, *governments*, *building owners, building occupants and user*s, and *product and service developers and providers* all have unique and necessary roles in the eventual adoption and use of energy efficiency technologies. While an ideal policy mix should target all implicated actors, energy efficiency policy mixes, due to the availability of highly efficient and cost-effective energy efficient technologies today (International Energy Agency, 2018), should focus on targeting building owners and building occupants and users – the primary consumers and users of energy technologies.

3.2.1.9 Policy target building type

Rogge and Reichardt use the term policy target building type to define whether *new* or *existing* buildings are targeted and affected by policy instruments (Rogge & Reichardt, 2013). While an ideal energy efficiency policy mix targets both *new* and *existing* buildings because both building types emit

greenhouse gas emissions, policy efforts should emphasize *existing* buildings in Canada as over 75% of buildings that will exist in 2030 already exists today (Government of Canada, 2016).

3.2.1.10 Policy targeting exclusivity

Jordaan et al (2017) argue that the broader the policy instrument focus, the less effective it is in providing specific, high potential solutions. A program, for example, that provides tax rebates on all home energy efficiency upgrades may encourage many homeowners to upgrade to higher energy efficiency light bulbs due to its ease, however, would be less effective in encouraging furnace and building envelope upgrades, which would reduce home energy consumption exponentially more than lighting upgrades (energy-use for heating account for 80% of energy use in buildings in Canada). Moreover, the broader a policy instrument (e.g. policies that incentivize, broadly, the adoption of any low carbon technology), the less certain that intra-policy instrument resources will be allocated towards any specific area of focus (e.g. energy efficiency). Policy mixes, accordingly, are more effective when comprised of policy instruments that exclusively target specific objectives as opposed to several objectives at once (e.g. an effective mix of energy efficiency policies would contain predominately policy instruments that exclusively targets energy efficiency).

3.2.2 Methodology of analysis and contextual framework table

Table 1 outlines the policy elements that were evaluated (column A, titled “Policy Element”), the question addressed by evaluating these policy elements (column B, titled “Question”), the method in which these questions were answered (column C, titled “Methods of Analysis”), and, according to frameworks derived from the literature review, the relationship between answering these questions and determining policy mix effectiveness (column D, titled “Rationale”).

Table 1: Methods of analysis and contextual framework

Policy Element	**Question**	**Methods of Analysis**	**Rationale**
Consumer decision-making process	Q1.1: Does the policy mix address each component of the consumer decision-making process?	Policy instruments were identified and counted based on whether they targeted the *recognition of want or need, information gathering, purchase,* or *use* component of the consumer decision-making process, Some policy instruments do not target any component of the consumer decision-making process component (i.e. research programs); these policy instruments were simply not applicable to this part of the study. • *Recognition of want or need* policies are defined as policy instruments aimed at promoting awareness and recognition of the existence, importance, and benefits (Hoicka et al., 2014; Peattie, 2010) of energy efficiency. • *Information gathering* policies are defined as policy instruments that provide information to consumers. The difference between *recognition of want or need* and *information gathering* policies is that consumers do not have to actively discover *recognition of want or need* policies to experience its impact as it is actively delivered (e.g. public commercials), however, consumers must decide to interact with *information gathering* policies to experience its impact as it is merely passively available and must be sought (e.g. websites (Hoicka et al., 2014; Peattie, 2010). • *Purchase* policies are defined as policy instruments that provide targeted purchase support or nudges, commonly in the form of financial incentives, to consumers interested in purchasing products (Hoicka et al., 2014; Peattie, 2010). • *Use* policies are defined as policy instruments that ensure the correct use of products after it is purchased (Hoicka et al., 2014; Peattie, 2010). Products must be correctly utilized for its benefits to be experienced.	The consumer decision-making process components are the stages of green/environmental consumption behaviors that constitute the product and service consumption process (Hoicka et al., 2014; Peattie, 2010). For greenhouse gas emissions to be reduced through energy efficiency technologies, these technologies must be known, understood, purchased, and used – these elements are addressed through components of the consumer decision-making process: recognition of want or need, information gathering, purchase, and use (Hoicka et al., 2014; Peattie, 2010). Therefore, an effective policy mix targets each component of the consumer decision-making process. The literature in which consumer decision-making components were derived also describe the post-use component (i.e. discarding products at its end of life), which is out of the scope of this study, thus, not included for analysis. This was discussed in further detail in Section 3.2.1.1 (Methodology) of this paper.

Table 1: Methods of analysis and contextual framework

Policy Element	**Question**	**Methods of Analysis**	**Rationale**
	Q1.2: Is the composition of the policy mix balanced in addressing each component of the consumer decision-making process?	Policy instruments were identified and counted based on whether they targeted the *recognition of want or need, information gathering, purchase,* or *use* component of the consumer decision-making process (same as above in row of Q1.1.).	Balanced support towards each component of the consumer decision-making process is important because the success of each component relies on the success of previous components. To interact with the *use* component, for example, one must have satisfied the objective of the *purchase* component – to obtain a product to use (Hoicka et al., 2014; Peattie, 2010). The interconnections between different components produce a sequential relationship between components in which weak or insufficient policies that target components detriment the success of policies that target latter components. This was discussed in further detail in Section 3.2.1.1 (Methodology) of this paper.
	Q1.3: What is the make-up of policy instruments of each component of the consumer decision-making process that targeted each actor type?	Policy instruments were identified, counted, and cross-tabulated based on whether they targeted the *recognition of want or need, information gathering, purchase,* or *use* component of the consumer decision-making process (consumer decision-making process components were explained in the row of Q1.1); and based on the actor (general public, government, building owners, building occupants and users, product and service developers and providers, non-profit organizations, and/or Indigenous peoples) it seeks to target and affect (e.g. the number of purchase policies that target governments, etc.).	An ideal policy mix comprises of use policies that predominately target building users, purchase policies that predominately target building owners, and recognition of want or need and information gathering policies that predominantly target specific actors (i.e. as opposed to all actors) thereby providing targeted and actor-specific information (i.e. as opposed to broad and generic information which has lower relevance towards any specific actor type) (Hoicka et al., 2014; Peattie, 2010; Rosenow et al., 2017). This was discussed in further detail in Section 3.2.1.1 and 3.2.1.8 (Methodology) of this paper.

Table 1: Methods of analysis and contextual framework

Policy Element	**Question**	**Methods of Analysis**	**Rationale**
Policy time horizon	Q2: What is the make-up of short, medium, and long term policy instruments in the policy mix?	Policy instruments were identified and counted based on whether they were *short-term* (1-3 years), *medium-term* (3-5 years), *long-term* (5+ years), or *dateless* (no policy cessation date) policies. Time horizon was determined by the difference between policy implementation and cessation dates.	Policy time horizon is the lifespan of policy instruments (i.e. Implementation to cessation) (Kern et al., 2017; Rogge & Reichardt, 2013). Low carbon transitions require policy mixes that convey consumer and investor confidence by providing clear policy and market directions (Kern et al., 2017; Rogge & Reichardt, 2013). This is accomplished by the implementation of long-term policies as well as the existence of a mixture of policies of different time horizons to showcase explicit policy milestones (e.g. to showcase short-, medium-, and long-term commitments via short, medium, and long-term policies. While long-term policies are important for policy mix predictability and stability, shorter-term policies are also vital to achieve climate change goals, which have urgent timeframes (Kern et al., 2017; Rogge & Reichardt, 2013). This was discussed in further detail in Section 3.2.1.2 (Methodology) of this paper.

Table 1: Methods of analysis and contextual framework

Policy Element	**Question**	**Methods of Analysis**	**Rationale**
Policy sub-type	Q3: Does the policy mix employ a comprehensive set of all policy instrument sub-types?	Policy instruments were identified and counted based on the policy sub-type category in which it belongs. Some policy instruments were identified as more than one policy sub-type. Policy sub-type categories are as follows and were compiled through a review of 17 pieces of energy and environmental policy mix literature, as discussed in Section 3.1.2.3 of this paper. • *Direct investment* (i.e. grants, subsidies, and loans) • *Financial incentives* (i.e. on-bill financing and tax rebates) • *Energy premiums and tax schemes* (e.g. carbon taxation) • *Removal of perverse actions* (e.g. phase out of perverse funding) • *Institutional creation* • *Action plans* (i.e. strategic planning documents) • *Regulatory codes and standards* • *Mandatory monitoring, auditing, and reporting schemes* • *Information, advice, and education provisions* • *Performance labeling* • *Training and qualification* • *Demonstration programs* • *Research and development programs* • *Negotiated voluntary agreements*. Sources in Section 3.2.1.3 of paper	Policy sub-types are the specific typology of means in which policy instruments seek to achieve policy objectives. An effective policy mix contains a comprehensive set of all policy instrument sub-types, thereby employing every effective means possible to achieve its objectives (Gunningham & Sinclair, 1999a; Howlett et al., 2017). Additionally, a comprehensive set of policy sub-types should be employed in policy mixes because no single policy instrument is flexible enough to address all energy or environmental problems in all contexts (Gunningham & Sinclair, 1999a; Howlett et al., 2017). This was discussed in further detail in Section 3.2.1.3 (Methodology) of this paper.

Table 1: Methods of analysis and contextual framework

Policy Element	**Question**	**Methods of Analysis**	**Rationale**
Creation or destruction policy	Q4.1: Does the policy mix contain both regime creation and destruction policy instruments?	Policy instruments were identified and counted based on whether they were *creation* or *destruction* policies (Kivimaa & Kern, 2016). As many creation policies also destabilize existing technologies and practices, and vice versa, this paper defines whether a policy instrument is a *creation* or *destruction* policy based on its primary and initial intent. Some policy instruments were identified as both creation and destruction policies if its primary and initial intent is to, explicitly, create and destabilize technologies and practices.	Creation policies support the creation and diffusion of technologies and practices, and destruction policies destabilize the uptake of existing technologies and practices (Kivimaa & Kern, 2016). An ideal policy mix comprises of both creation and destruction policy instruments. Creation policies support the development and dissemination of technologies, while destruction policies quicken the development and adoption of technologies more widely (Kivimaa & Kern, 2016). This was discussed in further detail in Section 3.2.1.4 (Methodology) of this paper.
	Q4.2: Does the policy mix contain regime creation and destruction policy efforts that belong to each policy sub-type category, targets each actor, and targets each innovation phase component?	Policy instruments were identified, counted, and cross-tabulated based on whether they were *creation* or *destruction* policies (same as above in row of Q4.1) and by policy sub-type (policy sub-types listed in row of Q3), target innovation phase (*research and development*, *demonstration and deployment*, or *mass diffusion*), and target actor (*general public*, *government*, *building owners*, *building occupants and users*, *and product and service developers and providers*) (e.g. whether policies of each sub-type were *creation* or *destruction* policies).	An ideal policy mix contains creation and destruction policies that comprehensively belong to each policy sub-type, thus, maximizing the types of policy tools employed to achieve policy mix objectives (Gunningham & Sinclair, 1999; Howlett et al., 2017). Moreover, policy mixes should consist of creation and destruction policy instruments that target every category of actors (i.e. for the creation of new products and phase-out of old products to impact all implicated actors) (Rogge & Reichardt, 2013), and target every component of the innovation phase (e.g. for the phase-out of old products and development/adoption of new products to occur at both pre-commercialization and consumption phases) (Rogge & Reichardt, 2013). This was discussed in further detail in Section 3.2.1.4, 3.2.1.3, 3.2.1.8, and 3.2.1.7 (Methodology) of this paper.

Table 1: Methods of analysis and contextual framework

Policy Element	**Question**	**Methods of Analysis**	**Rationale**
Policy flexibility	Q5.1: Does the policy mix comprise of a comprehensive range of policy instruments of different flexibility levels?	Policy instruments were identified and counted based on flexibility levels. Some policy instruments do not contain a level of flexibility, for example, policies that do not require interactions or compliance from constituents. Flexibility levels are: • *Low-flexibility* policies, defined as policy instruments that have strictly defined requirements or methods for compliance. • *Medium-flexibility* policies, defined as policy instruments that have defined, yet numerous requirements or methods for compliance. • *High-flexibility* policies, defined as policy instruments that have a broadly defined set of requirements or methods for compliance.	Policy instrument flexibility is the extent to which actors are allowed to "freely choose their preferred way of achieving compliance with an instrument" (Rogge & Reichardt, 2013, pg 14). An effective policy mix consists of policy instruments of all flexibility levels – policies of higher flexibility levels tend to generate greater participation rates and lower flexibility policies are better suited to address urgent or specific problems (Rogge & Reichardt, 2013; Rosenow et al., 2017). This was discussed in further detail in Section 3.2.1.5 (Methodology) of this paper.
	Q5.2: Does the policy mix consist of predominately highly flexible policy instruments, with some policy instruments of low and medium flexibility?	Policy instruments were identified and counted based on their flexibility levels (same as above in row of Q5.1).	An effective policy mix consists of predominately highly flexible policy instruments, which tends to generate higher program and policy interactions due to the appeal of autonomy that is provided (Bednar, Reames, & Keoleian, 2017a; Rogge & Reichardt, 2013; Rosenow et al., 2017). Effective policy mixes also contain some lower flexibility policies in order to stimulate the urgent development and adoption of specific, high potential technologies and practices. This was discussed in further detail in Section 3.2.1.5 (Methodology) of this paper.

Table 1: Methods of analysis and contextual framework

Policy Element	**Question**	**Methods of Analysis**	**Rationale**
Policy target building sector	Q6: What is the make-up of policy instruments in the policy mix that target residential, commercial, industrial, and institutional building sectors?	Policy instruments were identified and counted based on whether they targeted *residential*, *commercial*, *industrial*, or *institutional* buildings – these are the categorization of buildings recognized by the Government of Canada's climate change plan (Government of Canada, 2016). Some policy instruments targeted more than one building sector.	Because all buildings emit greenhouse gas emissions, an optimal policy mix should target every building sector (Rogge & Reichardt, 2013). Policy mixes in Canada should primarily target the residential sector because residential buildings emit the greater portion of greenhouse gases as compared to other types of buildings (Natural Resources Canada, 2018). This was discussed in further detail in Section 3.2.1.6 (Methodology) of this paper.
Policy target innovation phase	Q7.1: Does the policy mix target each component of the innovation phase?	Policy instruments were identified and counted based on the innovation phase component targeted (*research and development*, *demonstration and deployment*, and *mass diffusion*). Some policy instruments were identified as targeting more than one innovation phase component.	Innovation phase components are the stages of product or service innovation (Rogge & Reichardt, 2013). Different innovation phase categories are used by different studies (Rogge & Reichardt, 2013), but this paper identifies policy instruments, based on the nature of policies it examined, by the innovation phases research and development, demonstration and deployment, and mass diffusion. Each phase of innovation should be targeted by policy mixes, as each phase impacts the eventual adoption and use of energy efficiency technologies. This was discussed in further detail in Section 3.2.1.7 (Methodology) of this paper.
	Q7.2: Does the policy mix emphasize policy efforts in targeting the diffusion component of the innovation phase?	Policy instruments were identified and counted based on the innovation phase component targeted (same as above in the row of Q7.1).	Mass diffusion should be emphasized in energy efficiency policy mixes due to the high availability of highly efficient and cost-effective energy efficiency technologies in Canada that lag behind adoption expectations (International Energy Agency, 2018). This was discussed in further detail in Section 3.2.1.7 (Methodology) of this paper.

Table 1: Methods of analysis and contextual framework

Policy Element	**Question**	**Methods of Analysis**	**Rationale**
Policy target actor	Q8.1: Does the policy mix target all actors?	Policy instruments were identified and counted based on the actor (*general public, government, building owners, building occupants and users, product and service developers and providers, non-profit organizations*, and/or *Indigenous peoples*) that they seek to target and affect. Some policy instruments target and affect multiple actors.	All actors implicated in the achievement of policy mix objectives should be targeted (Rosenow et al., 2017). In an energy efficiency policy mix, governments, building owners, building occupants and users, and product and service developers and providers are the actors with vital roles in improving building energy efficiency. Non-profit organizations and Indigenous peoples as target actors are also identified because the energy efficiency policies examined in this study contain some policy instruments that specifically target these actors. This was discussed in further detail in Section 3.2.1.8 (Methodology) of this paper.
	Q8.2: Does the policy mix primarily target building owners and building occupants and users?	Policy instruments were identified and counted based on the actor that they aim to target and affect (same as above in the row of Q8.1).	Highly efficient and cost-effective Energy efficiency technologies are readily available (International Energy Agency, 2018). If adopted and used by consumers, greenhouse gas emissions in the building sector could drastically reduce. Building owners and building occupants and users are the primary consumers of these technologies. This was discussed in further detail in Section 3.2.1.8 (Methodology) of this paper.
	Q8.3: What is the composition of policy instruments of each policy sub-type category that targets each actor type?	Policy instruments were identified, counted, and cross-tabulated based on the actor that they seek to target and affect (actor categories explained in the row of Q8.1), and the policy sub-type category in which it belongs (policy sub-types explained in the row of Q3).	In an optimal policy mix, all actors should be targeted by policy instruments of each sub-type (Gunningham & Sinclair, 1999a). The effectiveness of policy mixes is improved by targeting and affecting every type of actor with all available policy tools (Gunningham & Sinclair, 1999a; Howlett et al., 2017; Rosenow et al., 2017). This was discussed in further detail in Section 3.2.1.8 and 3.2.1.3 (Methodology) of this paper.

Table 1: Methods of analysis and contextual framework

Policy Element	Question	Methods of Analysis	Rationale
	Q8.4: What is the composition of policy instruments of different flexibility levels that target each actor type?	Policy instruments of each flexibility level (policy flexibility explained in the row of Q5.1) were identified, counted, and cross-tabulated based on the actor that they seek to target and affect (actor categories explained in the row of Q8.1).	Building owners and building occupants and users should be targeted by highly flexible policy instruments, as targeting energy consumers and end-users with highly flexible policies was proven to generate higher levels of policy participation and impact (Bednar et al., 2017a; Rogge & Reichardt, 2013). Governments, however, should be targeted by low flexibility policy instruments to promote accountability and ensure leadership in adopting high potential energy efficiency technologies and practices. This was discussed in further detail in Section 3.2.1.8 and 3.2.1.5 (Methodology) of this paper.
Policy target building type	Q9.1: Does the policy mix target both new and existing building types?	Policy instruments were identified and counted based on whether they seek to target and affect *new* or *existing* building types. Some policy instruments target both new and existing buildings.	An effective policy mix targets both new and existing buildings because both building types emit greenhouse gas emissions that could be reduced. This was discussed in further detail in Section 3.2.1.9 (Methodology) of this paper.
	Q9.2: Does the policy mix dedicate greater effort in targeting existing buildings than new buildings?	Policy instruments were identified and counted based on whether they seek to target and affect *new* or *existing* building types. Some policy instruments target both new and existing buildings.	Policy mixes should emphasize policy efforts on targeting existing buildings because the majority of buildings (75%) that will exist in 2030 already exists today (Government of Canada, 2016). A policy mix emphasis on existing buildings would, therefore, reduce greater greenhouse gas emissions by 2030 as compared to a policy mix that does not emphasize efforts to target existing buildings. This was discussed in further detail in Section 3.2.1.9 (Methodology) of this paper.

Table 1: Methods of analysis and contextual framework

Policy Element	**Question**	**Methods of Analysis**	**Rationale**
Energy efficiency exclusivity and energy efficiency exclusivity in buildings of policy	Q10.1: What is the make-up of policy instruments in the policy mix that exclusively targets energy efficiency in buildings?	Policy instruments were identified and counted based on whether they targeted energy efficiency exclusively and whether they targeted energy efficiency in buildings exclusively.	Policy mixes are most effective when comprised of predominately policy instruments that exclusively target specific objectives (Jordaan et al., 2017), for example, improving energy efficiency in buildings, as opposed to broader objectives such as motivating the uptake of clean technologies. This is because policy broadness increases the uncertainty regarding the objective intra-policy instrument resources are allocated towards. This was discussed in further detail in Section 3.2.1.10 (Methodology) of this paper.

3.3 Policy mix analysis

For each question of analysis (second column of Table 1), the mix of policy instruments of Toronto-Ontario-Canada (hereby policy mix of Toronto) and Calgary-Alberta-Canada (hereby policy mix of Calgary) were charted, based on its policy element, in tables and graphs in order to illustrate policy mix composition, which was then analyzed for policy mix effectiveness. Tables and pie graphs were created to illustrate policy mix composition based on singular policy elements by charting the number and percentage of each policy element characteristic (e.g. whether a policy targets new building or existing buildings) of the policy mixes of Toronto and Calgary. Cross-tabulation tables and cross-tabulation bar graphs were created to illustrate policy mix composition based on double policy elements (e.g. the number of policy instruments of each sub-type that targets each building type).

Analyses evaluated the effectiveness of policy mixes by examining for comprehensiveness, balance, and distribution of policy instrument element characteristics within each policy mix composition (e.g. whether a policy mix contain policies that target all building sectors) (specific method of analysis was discussed in Table 1). The real-world consequences of the policy mix characteristics demonstrated by each policy mix graph were also discussed. Due to the volume of policy mixes produced by this study, only select sets of policy mixes with notable findings are discussed in this paper. A complete list of policy instrument data and policy mix graphs are available in Appendix A and Appendix B.

4 Results and discussions

Policy mix analysis results and discussions are contained within this section. In these policy mix analyses, specific policy elements/characteristics were analyzed, sometimes singular policy elements, and sometimes for multiple policy elements via cross-tabulations. Each of the results and discussion sub-sections below (4.1.1 to 4.1.10) are titled according to the policy element(s) that it will analyze and discuss. Each sub-section comprises of four parts. First, the research question pertaining to each sub-section is provided. Research questions and the methodology in which they will be answered were outlined in Table 1 of the Methodology section of this paper. Next, a “Results Table” is provided to illustrate the policy mix compositions relevant to answering each respective question (Appendix A contain graphs for the data in these tables). Third, key findings based on the policy mix analysis of the Results Table will be summarized. Lastly, results and findings will be discussed in detail. A discussion of overall findings (Section 4.2) and the limitations of the research and analysis of this paper (Section 4.3) is also provided at the end of this section.

4.1.1 Consumer decision-making process component targeted by policies

This section discusses the results of the policy mix analyses of consumer decision-making process components outlined in row Q1.1 and Q1.2 of Table 1 (Methodology Table). The question of Q1.1 is: Does the policy mix address each component of the consumer decision-making process? The question of Q1.2 is: Is the composition of the policy mix balanced in addressing each component of the consumer decision-making process?

Table 2

Results Table for: **Policies that address each Consumer Decision-making Process Component**		
Consumer Decision-making Process Components	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix	Number of Policy Instruments Calgary-Alberta-Canada Policy Mix
Recognition of want/need	13	11
Information gathering	25	31
Purchase	27	31
Use	8	13

Key findings of results:

- The policy mixes comprehensively target all consumer decision-making process components, which contributes to policy mix effectiveness because each component has a necessary role in the adoption and use of energy efficiency technologies.
- There is a lack of balance between the components of the consumer decision-making process. Because individual component success determines the success of latter components and the success of the overall process, policy mix effectiveness is hindered by this imbalance.
- Low levels of policy efforts that target the *recognition of want or need* component may result in suboptimal interaction/enrollment levels with policies and programs.
- Low levels of policy efforts that target the *use* component may result in suboptimal energy efficiency outcomes due to a higher risk of technology misuse, such as failing to correctly program smart thermostats.

Discussion:

The policy mix analyses on consumer decision-making process component show that 36% of energy efficiency policies pertaining to buildings in the city of Calgary target, each, the *purchase* and *information gathering* components of the consumer decision-making process. 15% and 13% of policies

target the *use* and *recognition of want or need* components respectively. The policy mix of Toronto has a similar composition of consumer decision-making process components. (See Table 2, and Figure 1.1.1 and Figure 1.1.2 in Appendix B)

A primary observation is that the proportion of policies that target each of the four consumer decision-making process components is unbalanced. Mainly, there are a notably greater number of policy instruments that target the *purchase* and *information gathering* components as compared to the *use* and *recognition of want or need* components. This is consequential to energy efficiency outcomes in several regards. First, a balanced mix of policy instruments that target each component of the consumer decision-making process signifies greater overall policy mix coherence and effectiveness. In the instance of Toronto and Calgary, policy mix effectiveness could be improved by enhancing the balance between policies that target each component of the consumer decision-making process.

The aforesaid scenario, however, is only valid if the recognition and understanding of energy efficiency are deficient. This is because the small share of policy instruments that target the *recognition of want or need* and *use* components of the consumer decision-making process would be justified if energy efficiency is widely recognized and understood. However, greater policy attention towards stimulating energy efficiency recognition is, in fact, necessary because awareness of the importance of energy efficiency is insufficient amongst the general public. The lack of energy efficiency awareness among energy consumers has been commonly cited as a primary obstacle to advancing energy savings and that energy efficiency knowledge is usually only consistently practiced amongst consumers of low income (Vassileva & Campillo, 2014). The widespread lack of awareness of the energy efficiency performance and benefits of building envelopes and appliances is also a primary factor underlying low energy efficiency renovation and retrofitting rates (U.S. Department of Energy, 2013; Yamamoto et al., 2008).

Without strong energy efficiency consciousness, policy instruments that target consumer decision-making process components subsequent to the *recognition of want or need* component, regardless of the merit of these policies, will produce suboptimal results due to limited consumer interaction with these policies because of a failure to arouse energy efficiency awareness. The real-world risk of the current building energy efficiency policy scenario of Toronto and Calgary is an energy efficiency gap, in which anticipated results of energy efficiency actions, such as policy implementation, differ from actual results (K. Gillingham & Palmer, 2014). Energy efficiency improvements in buildings may be less than expected due to low policy efforts that provoke energy efficiency awareness and despite large (but

suboptimal) investments injected into policies that target the *purchase* and *information gathering* components of the consumer decision-making process.

Second, the minor policy focus on the *use* component risks mediocre or abysmal energy performance improvement results. This is because even if an abundance of energy efficiency technologies is adopted, changes in energy consumption rates are still largely dictated by the operation of such technologies. Unless adopted technologies are completely automated to achieve ideal performance, reaping the full suite of benefits offered by energy efficiency technologies require knowledgeable and correct usage. In fact, studies have found that "building occupant behaviors and activities are the most common factor causing fluctuations in actual energy consumption versus planned energy consumption" (Paone & Bacher, 2018, p. 5). The incorrect use of energy technologies can, in some instances, even negate energy-saving potential entirely (Malinick, Wilairat, Holmes, Perry, & Ware, 2012).

A well-known consequence of incorrect or suboptimal energy efficiency technology use is the rebound effect. The rebound effect is the percentage of forecasted energy consumption reduction "that is lost due to the sum of the consumer and market responses" (Kenneth Gillingham, Rapson, & Wagner, 2016, p. 69). This happens because the monetary savings achieved through energy efficiency are allocated back into additional energy consumption (Kenneth Gillingham et al., 2016). As a result, overall energy consumption is higher than predicted, potentially negating or exceeding the energy saved ("backfire effect"), because the demand for additional energy-requiring products and services increase after energy efficient products and services are utilized (Nadel, 2016)".

The rebound effect illuminates the flaw in the assumption that product and service demand remain consistent before and after energy efficient goods are employed, and that energy efficient goods are operated in an intended manner by energy-users. With a proportionally small set of policies that target the *use* component of the consumer decision-making process in the building sector of Toronto and Calgary, the realization of benefits of energy efficient product purchases may lag behind expectations as consumers are influenced by only a small bundle of policies that aim to ensure proper and effective energy efficient technology use in buildings.

4.1.2 Consumer decision-making component by target actor

This section offers further analysis of the consumer decision-making process policy element (in 4.1.1, above) by discussing the results of a cross-tabulation policy mix analyses on consumer decision-making component by policy target actor. The methodology for this analysis was discussed in the row of Q1.3 of

Table 1 (Methodology Table). The question of Q1.3 is: What is the make-up of policy instruments of each component of the consumer decision-making process that targeted each actor type?

Table 3

Cross-tabulation Results Table for: Consumer Decision-Making Process Components by Policy Target Actor							
Toronto-Ontario-Canada Policy Mix							
Consumer Decision-making Process Components	**Target Actor**						
	General public	Government	Product and service developers and providers	Building owners	Building occupants/ users	Non-profit organizations	Indigenous peoples
	Number of Policy Instruments						
Recognition of want/need	6	4	1	1	1	0	0
Information gathering	8	4	9	5	5	0	1
Purchase	2	6	4	14	5	1	2
Use	0	2	0	3	3	1	2
Calgary-Alberta-Canada Policy Mix							
Consumer Decision-making Process Components	**Target Actor**						
	General public	Government	Product and service developers and providers	Building owners	Building occupants/ users	Non-profit organizations	Indigenous peoples
	Number of Policy Instruments						
Recognition of want/need	5	4	1	0	1	0	0
Information gathering	6	6	10	9	6	2	1
Purchase	1	6	5	18	8	1	2
Use	0	3	0	6	3	2	2

Key findings of results:

- The majority of *recognition of want or need* policy instruments target a general audience, as opposed to directing specific influence to defined audiences which would be more effective.
- A small proportion of policies of the *use* component of the consumer decision-making process target, specifically, actors of the *building owner* and *building occupant and user* categories, who represent the primary users of energy efficiency technologies and services. This has a negative correlation to policy mix effectiveness.

- A number of policies of the *purchase* component of the consumer decision-making process target actors of the *government* category. This is not ideal because emissions from government facilities account for a minuscule portion of overall emissions.

Discussion:

Within the *recognition of want or need* component of the consumer decision-making process, a small number of policy instruments in the policy mixes of Toronto and Calgary target *product and service developers and providers*, *building owners*, and *building occupants*. Instead, the majority of *recognition of want or need* policy instruments target the *general public* and *government* actors (See Table 3, and Figure 1.2.1 and Figure 1.2.2 in Appendix B). This indicates that most policies pertaining to the *recognition of want or need* component are not targeted at the specific areas of interest and relevance to, individually, *product and service developers and providers*, *building owners*, and *building occupants* – the primary consumers of energy efficiency goods. Policies deliver specific information to defined audiences tend to generate greater participation levels and more positive results. These issues and interests could be, for instance, the profitability of energy efficiency technology sales, the ease of energy efficiency retrofits, or the significance of user behavior in optimizing the benefits of energy efficient appliances. While policy instruments that target the general public may broadly address these items, effectiveness and cost-efficiency would be greater if policy instruments are designed to target select audiences and provide solutions specifically relevant to these audiences (Jordaan et al., 2017). The outcome of the lack of targeted *recognition of want or need* policies is that while actors may become aware of the general concept of energy efficiency, it is less likely that they will be inspired to perform specific tasks to optimize energy efficiency performance based on their precise relationship with buildings.

There is also a small number of policy instruments that target the *use* component of the consumer decision-making process that also target *building occupants and users* – only 27% and 19% of policy instruments of the *use* component are applicable to building occupants and users in the policy mix scenarios of Toronto and Calgary, respectively (See Table 3, and Figure 1.2.1 and Figure 1.2.2 in Appendix B). Building occupants and users, however, are the primary actors who will operate energy technologies, and the small policy influence on these actors may result in an energy efficiency gap or rebound effect. The distribution of policy instruments that target the *purchase* component between different building actors is also a concern. A notable number of policy instruments (17% in the policy mixes of Toronto and 19% in Calgary) of the *purchase* component targets actors belonging to the

government category – primarily government facility owners and users (See Table 3, and Figure 1.2.1 and Figure 1.2.2 in Appendix B). While government leadership in energy efficiency is important, only a minor fraction of greenhouse gas emissions come from government buildings. Nation-wide, approximately 1% of greenhouse gas emissions within the building sector is attributed to government facilities (Government of Canada, 2019a, 2019b). In Toronto, approximately 0.8% of city-wide greenhouse gas emissions from buildings is attributed to government facilities (City of Toronto, 2017). In Calgary, while statistics on government facility greenhouse gas emissions is unavailable, overall City of Calgary operations represent only 4% of total emissions in Calgary (City of Calgary, 2018). As government facilities represent a minuscule portion of greenhouse gas emissions in the building sector, resources would be better optimized if a smaller policy effort pertaining to the *purchase* component of the consumer decision-making process targeted the *government* category of actors, which would free policy resources to influence larger emitters.

4.1.3 Time horizon

This section discusses the results of the policy mix analyses on time horizon as outlined by the row of Q2 in Table 1 (Methodology Table). The question posited by Q2 is: What is the make-up of short, medium, and long-term policy instruments in the policy mix?

Table 4

Results Table: Policies by time Horizon		
Policy Time Horizon	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix	Number of Policy Instruments Calgary-Alberta-Canada Policy Mix
Short-term	6	6
Medium-term	1	0
Long-term	5	5
Unspecified/Dateless	56	64

Key Finding of results:

- The policy mixes of Toronto and Calgary consist of mostly *dateless* policy instruments. This has a negative correlation to policy mix effectiveness, as it may result in uncertainty regarding policy mix direction (Rogge & Reichardt, 2013).

Discussion:

The policy mix analyses of the time horizon element show that the large majority of the policy instruments examined in the Toronto (82%) and Calgary (85%) policy mix scenarios have no explicit policy cessation dates (See Table 4, and Figure 1.3.1 and Figure 1.3.2 in Appendix B). While the absence of policy cessation dates may imply that such policy instruments have long-term time horizons, the small number of short-term and medium-term policies coupled with the absence of policy instrument cessation dates provides uncertainty in policy mix direction and milestones. Policy predictability and credibility are also weak due to the lack of explicitly prearranged policy progression, which ignites uncertainty regarding the commitment of policymakers to existing policy directions. The demonstration of policy mix direction through explicit policy milestones creates the perception of policy stability, which improves consumer and investor confidence and enhances participation in energy and environment programs (Rogge & Reichardt, 2013).

4.1.4 Policy sub-type

This section discusses the results of the policy mix analyses of policy sub-type as outlined by the row of Q3 of Table 1 (Methodology Table). The question of Q3 is: Does the policy mix employ a comprehensive set of all policy instrument sub-types?

Table 5

Results Table: Policies by policy sub-type		
Policy Sub-type	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix	Number of Policy Instruments Calgary-Alberta-Canada Policy Mix
Direct investment	21	23
Financial incentives	3	5
Energy Premiums and tax	1	1
Removal of perverse incentives	0	0
Action plans	5	6
Codes and standards	4	5
Mandatory monitoring/auditing/reporting	0	0
Information	16	18
Labeling	9	8
Training/qualification	6	7
Demonstration programs	4	4
Research/development programs	8	8
voluntary agreements	3	3

Key Finding of Results:

- The policy mix is mostly comprehensive, in which 11 of 13 policy sub-types examined for are employed. Policy mix effectiveness can be improved by employing a more comprehensive set of policy instrument sub-types.

Discussion:

In the policy mix analyses of policy sub-type, 11 of the 13 energy and environment policy sub-types examined for are employed in the policy mixes of Toronto and Calgary (See Table 5, and Figure 1.4.1 and Figure 1.4.2 in Appendix B). The two absent policy sub-types are *removal of perverse incentives* and *mandatory monitoring/auditing/reporting.* The *removal of perverse incentives* is vital in destabilizing the viability and appeal of existing inefficient technologies, services, and practices. There is the possibility, however, that policy instruments of this sub-type have been overlooked in the policy compilation process of this study, as the record of policies that have been ceased may no longer exist in publicly available records. The absence of *mandatory monitoring/auditing/reporting* policy instruments, however, is of high certainty as these policy instruments would be provided through publicly available records. *Mandatory monitoring/auditing/reporting* policies could provide important energy-use information to governments, energy providers, and researchers that could inform the development and dissemination of energy efficiency solutions that directly tackle barriers to energy efficiency improvements. The effectiveness of the policy mixes of Toronto and Calgary could be further optimized by expanding the types of policy instruments that are utilized – to employ all available policy tools.

4.1.5 Policy regime creation or destruction

This section discusses the outcomes of the policy mix analyses of policy creation and destruction as described by Q4.1 of Table 1 (Methodology Table). The question of Q4.1 is: does the policy mix contain both regime creation and destruction policy instruments?

Table 6

Results Table: Policies by regime creation or destruction		
Creation or Destruction	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix	Number of Policy Instruments Calgary-Alberta-Canada Policy Mix
Creation	63	70
Destruction	19	20

Key Findings of Results:

- The policy mix contains both regime *creation* and *destruction* policies, which is an indicator of effectiveness.
- The policy mix contains few *destruction* policies, thus, windows of opportunities for the emergence, growth, and integration of energy-efficient technologies and services may be limited.

Discussion:

In the policy mix analyses on regime *creation* or *destruction* policies, 77% of policy instruments pertain to the *creation* category and 23% of policy instruments pertain to the *destruction* category within the Toronto policy scenario. The policy scenario of the City of Calgary is similar, with statistically insignificant differences. (See Table 6, and Figure 1.5.1 and Figure 1.5.2 in Appendix B)

A key observation is that the number of regime *destruction* policy instruments are significantly lower than the number of regime *creation* policy instruments. This is consequential because a primary obstacle to the emergence of new clean technologies and practices is path dependency. Path dependency occurs when historic actions and events structure the progression of future events, which could result in a lock-in of current technologies and practices (Wolsink, 2012). Path dependencies are difficult to overcome due to their deep entrenchment into lifestyles, infrastructure, and technologies. Due to this entrenchment, it is difficult for emerging technologies and practices to, alone, weaken or replace existing technologies and practices that are reinforced through path dependency. As a result, without sufficient *destruction* policy aid, the development and adoption of energy-efficient technologies and practices could be hindered from reaching prime potential by existing path-dependent technologies and practices.

Due to the social hostility, politically sensitivity, and time and resource investment associated with disrupting existing, dominating regimes (Bednar, Reames, & Keoleian, 2017b), it is not surprising that few *destruction* policies exist (Kivimaa & Kern, 2016). Fortunately, not many *destruction* policies are required to create windows of opportunities for the emergence and growth of new technologies and practices (Kivimaa & Kern, 2016). Whether or not the policy scenario of the cities of Toronto and Calgary contain sufficient destruction policies or an effective balance between regime creation and destruction policies can be revealed through analyses of related cross-tabulation policy mixes of two policy elements (Sections 4.1.6-4.1.8, below).

4.1.6 Policy regime creation or destruction by policy sub-type

This section offers a further analysis on the regime creation or destruction policy element (in 4.1.5, above) by discussing the results of a cross-tabulation policy mix analyses on regime creation or destruction policy by policy sub-type, as described in the row of Q4.2 of Table 1 (Methodology Table). The question of Q4.2 is: Does the policy mix contain regime *creation* and *destruction* policy efforts that belong to each policy sub-type?

Table 7

Cross-tabulation Results Table for: Regime Destruction or Creation Policy by Policy Sub-type				
	Creation	Destruction	Creation	Destruction
Policy Sub-type	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix		Number of Policy Instruments Calgary-Alberta-Canada Policy Mix	
Direct investment	21	0	23	0
Financial incentives	3	0	5	0
Energy Premiums and tax	0	1	0	1
Removal of perverse incentives	0	0	0	0
Action plans	4	4	5	4
Codes and standards	1	4	2	5
Mandatory monitoring/auditing/reporting	0	0	0	0
Information	16	6	18	6
Labelling	9	1	8	1
Training/qualification	6	0	7	0
Demonstration programs	4	0	4	0
Research/development programs	8	2	8	2
voluntary agreements	2	1	2	1

Key Finding of Results:

- Only 6 of the 19 *destruction* policy instruments are 'hard' policies, which actively compels obligatory action and compliance. The remaining 13 'soft' *destruction* policies rely on voluntary action – ineffective in breaking path dependencies.

Discussion:

The policy scenario of the cities of Toronto and Calgary are near identical in this policy mix analyses. First, there is not a comprehensive or balanced distribution of *destruction* policy instruments between the different categories of policy sub-types. Of the thirteen policy sub-types studied in the policy mixes of this paper, *destruction* policy instruments only pertain to seven (See Table 7, and Figure 1.6.1 and Figure 1.6.2 in Appendix B). This indicates that an optimal mix of policies is not achieved, as effective policy mixes ought to utilize a full range of policy instrument types (Rogge & Reichardt, 2013). Second, of the 19 *destruction* policy instruments, only 6 could be categorized as hard instruments (1 energy premiums and tax policy, 5 codes and standards policy, and 1 labelling policy), which compels obligatory action and compliance, while the remaining 13 policy instruments are soft instruments, which rely on voluntary behavior to produce outcomes (Rajamani, 2016). This policy mix analyses finds that a greater number of *destruction* policy instruments, or, at minimum, a more comprehensive distribution of *destruction* policy instruments between different policy sub-types, could improve the effectiveness of the mix in achieving the emergence, growth, and adoption of energy-efficient products and practices in buildings in Toronto and Calgary.

4.1.7 Policy regime creation or destruction by target innovation phase

This section offers a further analysis on the regime creation or destruction policy element (in 4.1.5) by discussing the results of a cross-tabulation policy mix analyses on regime creation or destruction policy by target innovation phase, as described by row Q4.2 of Table 1 (Methodology Table). The question of Q4.2 is: Does the policy mix contain regime creation and destruction policies that target each phase of innovation?

Table 8

Cross-tabulation Results Table for: Destruction or Creation Policy by Target Innovation Phase				
	Creation	Destruction	Creation	Destruction
Target Innovation Phase	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix		Number of Policy Instruments Calgary-Alberta-Canada Policy Mix	
Research and Development	17	4	22	3
Deployment and Demonstration	24	1	28	0
Mass Diffusion	34	2	40	2

Key Findings of Results:

- Creation policies comprehensively target all innovation phases, which contributes to policy mix effectiveness.
- Energy-efficient product upgrades will be slower than possible due to limited *destruction* policy efforts targeted at the *mass diffusion* innovation phase.

Discussion:

In this policy mix, three destruction policy instruments pertain to the *research and development* phase of innovation, zero to the *deployment and demonstration* phase, and two to the *mass diffusion* phase in the policy mix of Calgary (See Table 8, and Figure 1.7.2 in Appendix B). The policy mix of Toronto has 4 destruction policies that target the research and development phase, 1 that target the deployment and demonstration phase, and 2 that target the mass diffusion phase. In both policy mixes, creation policies target all phases of innovation (See Table 8, and Figure 1.7.1 in Appendix B). The emphasis on the *research and development* phase indicates a prioritization on weakening the market share of poorer energy-efficient products by hindering or halting the development of old technologies. The absence of destruction policy instruments pertaining to the *deployment and demonstration* innovation phase is warranted, as destabilization within the *research and development* phase naturally prevents destabilized products from moving forward into the subsequent phase. Within the *mass diffusion* phase, a larger number of destruction policy instruments would be beneficial in compelling product buyers to 'make the switch'. While a large number of creation policy instruments within this innovation phase provides a positive signal, the lack of destruction policy support means that many consumers may not replace older energy technologies with technologies of greater energy efficiency until these older technologies reach its end of life. Greater *destruction* policy efforts within the *mass diffusion* innovation phase have the potential to quicken the transition to greater energy efficiency.

4.1.8 Policy regime creation or destruction by policy target actor

This section offers a further analysis of the regime creation or destruction policy element (in 4.1.5) by discussing the results of a cross-tabulation policy mix analyses on regime creation and destruction policy by policy target actor. Q4.2 of Table 1 (Methodology Table) summarizes the methodology for this analysis and provides the research question: Does the policy mix contain creation and destruction policy efforts that target all actor types?

Table 9

Cross-tabulation Results Table for: Destruction or Creation Policy by Target Actor				
	Creation	Destruction	Creation	Destruction
Target Actor	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix		Number of Policy Instruments Calgary-Alberta-Canada Policy Mix	
General Public	5	1	3	1
Government	14	1	15	1
Product and service developers and providers	12	3	14	3
Building Owners	19	0	23	1
Building Occupants/Users	11	0	14	0
Non-profit organizations	1	0	3	0
Indigenous peoples	3	0	2	0

Key Findings of Results:

- *Creation* policy instruments comprehensively target all actor types, which contributes to policy mix effectiveness.
- The adoption of improved energy efficiency technologies and practices could be slower than anticipated due to minimal *destruction* policy efforts (only 1 policy instrument) that target building owners and building occupants and users, who are the primary purchasers and users of energy technologies in buildings.

Discussion:

The observation that *destruction* policies in the policy mixes of Toronto and Calgary are weak in compelling the replacement of older technologies with more energy efficient options is further supported by the policy mix analyses of regime *creation* and *destruction* policies by policy target actors (See Table 9, and Figure 1.8.1 and Figure 1.8.2 in Appendix B). Within this policy mix analyses, *creation* policies comprehensively target all actor types. Three *destruction* policy instruments, on the other hand, target product and service *product and service developers and providers*, while the remainder of *destruction* policy instruments target, with one policy each, building *owners*, the *general public*, and *governments* in the policy mix of Calgary. The policy mix of Toronto is identical with the exception that no *destruction* policy instruments target building owners. Due to the small *destruction* policy efforts focused on product consumers, the replacement of older energy goods with newer and more energy efficient products will be slower than possible. Moreover, no *destruction* policy seeks to influence

energy-user behavior, which is a significant factor in determining energy consumption.

4.1.9 Policy flexibility

This section describes the outcomes of the policy mix analyses on policy instrument flexibility, as was outlined in the row of Q5.1 and Q5.2 in Table 1 (Methodology Table). The question of Q5.1 is: Does the policy mix comprise of a comprehensive range of policy instruments of different flexibility levels? The question of Q5.2 is: Does the policy mix consist of mostly highly flexible policy instruments, with some policy instruments of low and medium flexibility?

Table 10

Results Table for: Policies by Flexibility level		
Policy Flexibility	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix	Number of Policy Instruments Calgary-Alberta-Canada Policy Mix
Low	11	13
Medium	11	16
High	36	35

Key Findings of Results:

- The policy mixes comprise of a comprehensive set of policy instruments of different flexibility levels, which has a positive correlation to policy mix effectiveness.
- Encouragingly, the policy mixes of Toronto and Calgary contain mostly *highly flexible* policy instruments, with some policy instruments of *low and medium flexibility*.

Discussion:

The policy mixes of Toronto and Calgary comprises of policy instruments of all flexibility levels, which has a positive correlation to policy mix effectiveness (See Table 10, and Figure 1.9.1 and Figure 1.9.2 in Appendix B). Moreover, the policy mixes of Toronto and Calgary also contain predominately highly flexible policy instruments, with a smaller mixture of lower flexibility policies. This policy mix allows for greater autonomy for energy-users to choose the method of compliance that they are comfortable with. This autonomy tends to increase program enrollment and participation, thereby increasing technology diffusion (Rogge & Reichardt, 2013). Some policy instruments of lower flexibility levels are also present, which helps to ensure the adoption and use of specific technologies of greater energy efficiency potential that may not be otherwise chosen for adoption and use (Rogge & Reichardt, 2013). This

includes, for example, encouraging energy-users to demonstrate or adopt specific highly efficient energy technologies that are not yet cost-effective.

4.1.10 Building sector targeted by policies

This section discusses the results of the policy mix analyses on policy target building sector. The methodology of this analysis was provided in the row of Q6 of Table 1 (Methodology Table). The question of Q6 is: What is the make-up of policy instruments in the policy mix that target residential, commercial, industrial, and institutional building sectors?

Table 11

Results Table for: Building Sectors Targeted by Policies		
Target Building Sector	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix	Number of Policy Instruments Calgary-Alberta-Canada Policy Mix
Just Residential	13	13
Just Commercial	3	4
Just Industrial	6	7
Just Institutional	2	7
All Building Sectors	48	50

Table 12

Results Table for: Building Sectors Targeted by Policies ("All Building Sectors" category distributed into each specific building sector)		
Target Building Sector	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix	Number of Policy Instruments Calgary-Alberta-Canada Policy Mix
Residential	61	63
Commercial	51	54
Industrial	54	57
Institutional	50	57

Key Findings of Results:

- The policy mix comprehensively targets all building sectors, which is an indicator of effectiveness.
- The high number of individual policy instruments that simultaneously target *all building sect*ors risks providing broad, rather than specific solutions which tend to generate more favourable outcomes.

- The policy mix demonstrates a balanced number of policy instruments that target all four building sectors which has a negative correspondence to effectiveness because the emissions inventory and potential for emission reductions per building sector significantly varies.

Discussion:

The policy mix analyses for the building sector element provides two key insights. First, a majority of energy efficiency policy instruments pertaining to buildings, in both the cities of Toronto and Calgary, target *all* building sectors (See Table 11, and Figure 1.10.1.1 and Figure 1.10.2.1 in Appendix B). This is consequential because, while an ideal policy mix would target all building sectors, for an individual policy instrument to exhibit the broadness to simultaneously encourage energy efficiency improvements in all building sectors, policy instruments trade-off the capacity to target specific factors within individual building sector that have the highest potential to maximize energy efficiency improvements (Jordaan et al., 2017). Due to the higher share of energy end-use attributed to water heating in the *residential* sector (12.2%) as compared to the *commercial* sector (6.8%), for example, focused policy resources to improve the energy efficiency of water heating in the residential sector would likely produce greater overall greenhouse gas emission reductions as compared to the same resources applied to improve the energy efficiency of water heating in all sectors (National Academy of Science, National Academy of Engineering, & National Research Council, 2010). Similarly, the *commercial* sector has a higher potential to benefit from policies targeted at the energy efficiency of lighting due to its higher share of energy end-use attributed to lighting (25.5%) as compared to buildings in the *residential* sector (11%) (National Academy of Science et al., 2010). By taking an all-encompassing approach, the optimal policy approach to improve energy efficiencies within each category of building type risks being neglected.

Second, subsequent to policy instruments of the *all* category distributed into the four specific building sector categories, it is revealed that there is a high level of balance between policy instruments that target each building sector (See Table 12, and Figure 1.10.1.2 and Figure 1.10.2.2 in Appendix B). This is the case in both the cities of Toronto and Calgary. While balance is good in some policy mix scenarios, it is not ideal for the building sectors in Canada. This is because, although greenhouse gas emissions data is limited on emissions divided by building sector, latest available data show that *residential* buildings in Canada emitted 61 Mt of CO2e while *commercial* buildings in Canada emitted 44 Mt of CO2e (Natural Resources Canada, 2018). No data could be found on the emissions of buildings in Canada pertaining to the institutional and industrial building sector categories. The potential for greenhouse gas emissions

reductions also varies, as payback periods, occupancy periods, and building design significantly differ between building sectors (International Energy Agency, 2018). Rather than a balanced approach, the effectiveness of the mix of building energy efficiency policies in Toronto and Calgary could be improved by being adjusted to respond to the profiles of individual building sector – for greater policy resources to be allocated towards higher emitting sectors than lower emitting sectors, for example.

4.1.11 Innovation phase targeted by policies

This section discusses the results of the policy mix analyses on target innovation phase, the methodology of this analysis was provided in the row of Q7.1 and Q7.2 of Table 1 (Methodology Table). The question of Q7.1 is: Does the policy mix target each component of the innovation phase? The question of Q7.2 is: Does the policy mix emphasize policy efforts in targeting the diffusion component of the innovation phase?

Table 13

Results Table for: Policies by Target Innovation Phase		
Target Innovation Phase	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix	Number of Policy Instruments Calgary-Alberta-Canada Policy Mix
Research and Development	30	34
Deployment and Demonstration	37	40
Mass Diffusion	46	53

Key Findings of Results:

- The policy mix comprehensively targets all components of the innovation phase, which is an indicator of policy mix effectiveness.
- The policy mix emphasizes *research, development, deployment, and demonstration* efforts, however, the maturity and potential of existing technologies call for a focus on *mass diffusion*. Policy mix effectiveness could be improved by dedicating more policy efforts towards the *diffusion* of technologies.

Discussion:

The policy mix analyses on policy target innovation phase provide that 41% of the policy instruments examined target *mass diffusion*, 33% target *deployment* and *demonstration*, and 26% target *research and development* in Toronto (See Table 13, and Figure 1.11.1.2 in Appendix B). The policy mix scenario

of Calgary is similar (See Table 13, and Figure 1.11.2.2 in Appendix B). Accordingly, overall, a minority of policy instruments target the diffusion of energy efficiency products and services in the cities of Toronto and Calgary. This policy mix would be effective if significant opportunities exist for energy efficiency technology and service improvements. Recent findings from the International Energy Agency show, however, that "enormous [energy efficiency] potential remains untapped due to the widespread use of less-efficient technologies" (International Energy Agency, 2018, p. 25). Moreover, the adoption of current, cost-effective, and readily available technologies could peak global greenhouse gas emissions by 2020 and improve the energy efficiency of existing buildings by 40% as compared to current levels (International Energy Agency, 2018). As the diffusion of current technologies contains tremendous untapped potential for greenhouse gas emissions reductions, as currently implemented technologies significantly lag behind available and cost-effective alternatives (International Energy Agency, 2018), policy mix effectiveness would benefit from shifting support emphasis from pre-commercialization to commercialization.

4.1.12 Actor targeted by policies

This section contains discussions on the results of the policy mix analyses on policy target actor, as outlined in the row of Q8.1 and Q8.2 of Table 1 (Methodology Table). The question posited by Q8.1 is: Does the policy mix target all actors? The question of Q8.2 is: Does the policy mix primarily target building owners and building occupants and users?

Table 14

Results Table for: Target Actor of Policies		
Target Actor	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix	Number of Policy Instruments Calgary-Alberta-Canada Policy Mix
General public/all	9	7
Government	22	24
Product and service developers and providers	16	18
Building owners	22	27
Building occupants/users	11	14
Non-profit organizations	1	3
Indigenous peoples	3	2

Key Findings of Results:

- The policy mix targets all necessary actors to improve the energy efficiency of buildings: *building owners, building occupants and users, product and service developers and providers,* and *governments*. This has a positive correlation to policy mix effectiveness.
- A limited policy mix focus on *building occupants and users* indicate an energy efficiency gap risk produced by the misuse of energy technologies, such as the failure to properly program home appliances.
- A significant policy mix focus on *government* actors signals a pessimistic outlook on the effectiveness of current policy actions and the status of the environment.

Discussion:

In the Toronto policy mix scenario of target actors 26% of policy instruments target, each, actors of the *government* and *building owners* category. 19% of policy instruments target the *product and service developers and providers* category, 13% of policy instruments target the *building occupant and user* category, and 11% target the *general public* category. The policy mix scenario in Calgary is similar. (See Table 14, and Figure 1.12.1 and Figure 1.12.2 in Appendix B)

Two notable observations arise from these policy mix analyses. First, *building occupants and users* account for a small portion of the actors targeted. A potential consequence is that while energy efficiency technologies and services are adopted (due to the motivators offered by the large policy efforts that target building owners and product and service developers and providers), discrepancies between expected and actual energy consumption can arise due to the flawed use of these technologies. This energy efficiency gap may occur from the rebound effect or simple technology misuse. User settings of household appliances, for example, could be obscure to tenants (e.g. operating smart appliances correctly) (Malinick, Wilairat, Holmes, & Perry, 2012), or, energy efficient lighting or heating and cooling systems may provide the false impression that energy frugality is no longer required (Darby, 2018). Especially in scenarios in which energy users are not environmentally conscious, additional pressure may be required to entice the reduction or maintenance of energy consumption levels as opposed to pursuing the niceties afforded by the cost savings generated by energy efficient technologies (Darby, 2018). It is possible for public policies that target the behavior of energy end-users to prevent or amend these scenarios.

Second, a significant quantity of policy instruments target actors belonging to the *government* category. This is notable because, as previously discussed, while government leadership is important in confirming the credibility of policy directions and inspiring energy efficiency improvements, greenhouse gas emissions associated with government facilities is nominal in Canada. Not all energy efficiency policies of this study that target actors of the *government* category, however, seek to improve the energy efficiency of government facilities. Some, rather, seek to encourage, support, and fund research, action plans, and the creation and implementation of new energy efficiency programs. The large policy effort directed at supporting these policies and programs indicates the possibility that existing policies are insufficient – justifying the need for further policy support towards governments to enhance its suite of building energy efficiency actions. While the recognition and amendment of policy insufficiency are important, it also provides a pessimistic signal regarding the effectiveness of existing policy actions and current environmental conditions.

4.1.13 Policy target actor by policy sub-type

This section offers a further analysis on the target actor policy element (in 4.1.12) by discussing the results of a cross-tabulation policy mix analyses on policy target actor by policy sub-type. The methodology of this analysis was provided in Q8.3 of Table 1 (Methodology Table), which provides the question: What is the composition of policy instruments of each policy sub-type category that targets each actor type?

Table 15

Cross-tabulation Results Table for Policy Sub-type by Policy Target Actor

Toronto-Ontario-Canada Policy Mix

	Target Actor						
	General public/all	Government	Product and service developers and providers	Building owners	Building occupants/users	Non-profit organizations	Indigenous peoples
Policy Sub-type	Number of Policy Instruments						
Direct investment	1	8	2	10	3	1	3
Financial incentives	0	0	0	3	2	0	0
Energy Premiums and tax	1	0	0	0	0	0	0
Removal of perverse incentives	0	0	0	0	0	0	0
Action plans	0	4	0	0	0	0	0
Codes and standards	0	1	3	0	0	0	0
Mandatory monitoring/auditing/reporting	0	0	0	0	0	0	0
Information	6	2	3	4	3	0	1
Labelling	1	0	3	4	2	0	0
Training/qualification	0	1	3	1	1	0	0
Demonstration programs	0	2	3	1	1	0	0
Research/development programs	0	3	6	1	1	0	0
voluntary agreements	0	2	0	0	1	0	0

Calgary-Alberta-Canada Policy Mix

	Target Actor						
	General public/all	Government	Product and service developers and providers	Building owners	Building occupants/users	Non-profit organizations	Indigenous peoples
Policy Sub-type	Number of Policy Instruments						
Direct investment	0	7	3	12	6	3	2
Financial incentives	0	0	0	5	2	0	0
Energy Premiums and tax	1	0	0	0	0	0	0
Removal of perverse incentives	0	0	0	0	0	0	0
Action plans	0	5	0	0	0	0	0
Codes and standards	0	2	3	1	0	0	0
Mandatory monitoring/auditing/reporting	0	0	0	0	0	0	0
Information	5	3	4	6	4	0	0
Labelling	1	0	3	3	2	0	0
Training/qualification	0	1	4	1	1	0	0
Demonstration programs	0	2	3	1	1	0	0
Research/development programs	0	3	6	1	1	0	0
voluntary agreements	0	2	0	0	1	0	0

Key Finding of Results:

- Limited monetary support towards product and service *product and service developers and providers* risks value-action gaps in the event that product accessibility and availability lags behind consumer demand. This hinders policy mix effectiveness.

Discussion:

The assertion that not all policy instruments that target *government* actors seek to improve the energy efficiency of government facilities is affirmed by the policy mix analyses of policy target actors by policy sub-types, which provides that a notable number of the policy instruments that target actors within the *government* category belong to not just monetary-related policy sub-types but a range of different policy sub-types (e.g. *action plans* and *training and qualification*). (See Table 15, and Figure 1.13.1 and Figure 1.13.2 in Appendix B)

These policy mix analyses also revealed a positive policy mix quality in that *research*, *demonstration*, and *labeling* policy instruments primarily target *product and service developers and providers*, who represent the manufacturers and providers of energy efficiency goods; and *direct investment* policy instruments primarily target *building owners*, who represent principal consumers. Two elements, however, are causes for concern. First, labeling efforts targeted at the actors of the categories *general public* and *building occupants and users* are low, as compared to more significant efforts targeted at *product and service developers and providers* and *building owners*. This may result in greater awareness amongst the manufacturers, suppliers, and purchasers of energy efficiency goods, but, lower awareness amongst end-users, creating vulnerability for an energy efficiency gap from product misuse.

Second, a low amount of policy instruments of the *direct investment* and *financial incentives* sub-type categories pertain to *product and service developers and providers*. A likely outcome of greater financial support towards the product and service developers and providers category is quicker product production, larger product availability, and greater product and service developer and provider confidence. This support also reduces the risk of value-action gaps (when consumption actions misalign with beliefs (Shove, 2010)), which can occur in the event that demand for energy efficiency goods outweighs the capacity to purchase such goods (e.g. due to availability or affordability).

4.1.14 Policy target actor by policy flexibility

This section offers a further analysis on the target actor policy element (in 4.1.12) by discussing the results of a cross-tabulation policy mix analyses on policy target actor by policy flexibility, which was outlined in Q8.4 of Table 1 (Methodology Table). Q8.4 posits the question: What is the composition of policy instruments of different flexibility levels that target each actor type?

Table 16

Cross-tabulation Results Table for Policy Target Actor by Policy Flexibility							
Toronto-Ontario-Canada Policy Mix							
	Target Actor						
	General public/all	Government	Product and service developers and providers	Building owners	Building occupants/users	Non-profit organizations	Indigenous peoples
Policy Flexibility	Number of Policy Instruments						
Low	2	1	4	5	1	1	1
Medium	1	3	4	4	3	0	0
High	3	18	6	11	7	0	2
Calgary-Alberta-Canada Policy Mix							
	Target Actor						
	General public/all	Government	Product and service developers and providers	Building owners	Building occupants/users	Non-profit organizations	Indigenous peoples
Policy Flexibility	Number of Policy Instruments						
Low	2	1	4	7	2	2	1
Medium	1	3	4	9	6	0	0
High	1	20	7	8	6	1	1

Key Finding of Results:

- A significant number of highly flexible policies target *government* actors. This indicates a lack of pressure to demonstrate leadership in pursuing highly effective energy efficient technologies and services, as well as a lack of accountability towards public spending.
- A large number of highly flexible policies, however, also target *building owners* and *building occupants and users*, which has a positive impact on policy mix effectiveness.

Discussion:

A striking observation is the immense imbalance between policy instruments of different flexibility levels that pertain to the *government* actor category. Within this category, 82% of policy instruments are of *high* flexibility in the policy mix of Toronto (83% in the policy mix of Calgary) (See Table 16, and Figure 1.14.1 and Figure 1.14.2 in Appendix B). While highly flexible policies can stimulate greater policy and program participation, a trade-off is the reduction of capacity for motivating only the highest potential solutions (Rogge & Reichardt, 2013). For instance, while a highly flexible policy instrument may offer rebates for a large range of different energy efficiency upgrades, therefore provoking a high participation rate, the broadness of the policy results in a wide range, as opposed to merely the most effective, of upgrades being pursued (Jordaan et al., 2017). The demonstration of state-of-the-art, highly efficient technologies in government facilities are especially crucial as it builds confidence and trust in lesser-known but potentially highly effective products. This phenomenon is particularly concerning within the *government* category as the expectation of accountability is greater towards public entities as compared to private entities and persons. The accountability offered by predictability and clear objectives cannot be found in highly flexible policy instruments. Consumers will also be more receptive of government policy directions when clearly defined and highly ambitious commitments are evident, which creates long-term and positive market signals (International Energy Agency, 2018).

Another observation is that within the *building owners* and *building occupants and users* categories, the number of policies with high flexibility greatly surpasses the number of policies with low or medium flexibility (See Table 16, and Figure 1.14.1 and Figure 1.14.2 in Appendix B). While the sense of clear direction provided by policies of minimal flexibility is important to motivate the adoption of the most optimal energy efficiency technologies and services, higher policy flexibility is imperative for policies that target consumers and energy-users to be effective. This is because individuals that are subject to strict rules or guidance may display hostility when there is a perceived threat to their autonomy over personal habits, routines, and beliefs (Bednar et al., 2017b) – policies that support personal choice by offering multiple avenues of compliance will be better received by the general public (Rogge & Reichardt, 2013).

4.1.15 Building type targeted by policies

The results of the policy mix analyses of policy target building type are discussed in this section. The methodology for this was outlined in the rows of Q9.1 and Q9.2 of Tables 1 (Methodology Table). The question of Q9.1 is: Does the policy mix target both new and existing building types? The question of Q9.2 is: Does the policy mix dedicate greater effort in targeting existing buildings than new buildings?

Table 17

Results Table For: Target Building Type of Policies		
Target Building Type	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix	Number of Policy Instruments Calgary-Alberta-Canada Policy Mix
Only New Buildings	7	7
Only Existing Buildings	8	11
Both Building Types	53	57

Table 18

Results Table For: Target Building Type of Policies (with the "Both Building Types" category distributed into New and Existing buildings)		
Target Building Type	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix	Number of Policy Instruments Calgary-Alberta-Canada Policy Mix
New Buildings	60	64
Existing Buildings	61	68

Key Findings of Results:

- The policy mix targets both new and existing buildings, which is an indicator of effectiveness.
- As a significant number of policies seek to influence, simultaneously, *new* and *existing* building types, specific, yet highly effective, policies that pertain to either *new* or *existing* buildings may be neglected in favor of broader but less effective policies.
- A balanced approach is taken towards targeting *new* and *existing* buildings, however, *existing* buildings require greater policy attention than *new* buildings.

Discussion:

In the policy mix analyses of the building type element, it was discovered that there is a balance between policy instruments that target *new* buildings and policies that target *existing* buildings in the cities of Toronto and Calgary (See Table 18, and Figure 1.15.1.2 and Figure 1.15.2.2 in Appendix B). This balance is only achieved, however, through the reassignment of policy instruments pertaining to the *both* category to the specific categories of *new* and *existing* buildings. Two drawbacks exist in this particular policy mix scenario.

First, the significant number of policy instruments that target *all* building types (See Table 17, and Figure 1.15.1.1 and Figure 1.15.2.1 in Appendix B) means that energy efficiency optimization tactics and high potential technologies specific to *new* or *existing* building types may be neglected for broader and more encompassing, yet less effective, approaches (Jordaan et al., 2017). Second, as previously mentioned, the majority of buildings that will exist in Canada in 2030 already exists today (Government of Canada, 2016). Therefore, supporting energy-efficient initiatives related to *existing* buildings contain greater overall potential to reduce greenhouse gas emissions as compared to new buildings due to the number of buildings in which these policies will impact. Moreover, energy efficiency renovation and retrofitting activity remain relatively low, due to reasons including access to funding, lack of interest, and lack of knowledge (U.S. Department of Energy, 2013). New buildings, however, will generally already be equipped with better energy efficiency technologies as compared to existing buildings. Building age is also a concern because of differences in building envelope standards and changes in construction practices which improves over time, thereby resulting in newer buildings having more energy efficient designs (Mohareb & Mohareb, 2014).

4.1.16 Policy exclusivity in targeting energy efficiency in buildings

The results of the policy mix analyses on policy instrument energy efficiency in buildings exclusivity are discussed in this section. The methodology was discussed in row Q10.1 of Table 1 (Methodology Table). Q10.1 posited the question: What is the make-up of policy instruments in the policy mix that exclusively targets energy efficiency in buildings?

Table 19

Results Table For: **The energy efficiency exclusivity of policies**		
Energy Efficiency Exclusive?	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix	Number of Policy Instruments Calgary-Alberta-Canada Policy Mix
Yes	24	26
No	44	49
Results Table For: **The building energy efficiency exclusivity of policies**		
Building Energy Efficiency Exclusive?	Number of Policy Instruments Toronto-Ontario-Canada Policy Mix	Number of Policy Instruments Calgary-Alberta-Canada Policy Mix
Yes	17	18
No	51	57

Key Findings of Results:

- Approximately only 35% of the policies examined target, exclusively, energy efficiency. Approximately 25% of the policies examined target, exclusively, energy efficiency in buildings in Toronto and Calgary. This has a negative correlation to policy mix effectiveness because the absence of exclusivity results in uncertainty regarding the actual dedication of policy instrument resources to improving energy efficiency in buildings.

Discussion:

In Toronto and Calgary, only 35% of policy instruments examined exclusively affects energy efficiency (as opposed to broader categories such as clean energy, which encompasses other energy solutions, such as renewable energy) (See Table 19, and Figure 1.16.1 and Figure 1.16.2 in Appendix B). An even lower percentage, 25% and 24%, of policy instruments exclusively affect energy efficiency in buildings in, respectively, Toronto and Calgary (See Table 19, and Figure 1.17.1 and Figure 1.17.2 in Appendix B). This policy broadness, in which single policy instruments seek to achieve multiple outcomes, causes concern regarding the distribution of intra-policy instrument resources towards achieving its objectives. Because 74-75% of the policy instruments examined in this study seeks broader objectives in addition to the objective of improving energy efficiency in buildings, the distribution of policy resources, in practice, to enhancing energy efficiency in buildings is uncertain and may be lower than expected.

4.2 Discussion of overall findings

Six notable and overarching findings of the policy mix analyses of Toronto and Calgary are summarized and discussed in this section. First, the policy mixes of Toronto-Ontario-Canada and of Calgary-Alberta-Canada are very similar in terms of policy instrument quantity and policy mix composition. This means that many of the energy efficiency programs between the cities of Toronto-Ontario and Calgary-Alberta are similarly designed. This similarity is surprising, given the contextual differences between the cities of Toronto and Calgary and their respective provinces: greenhouse gas emissions, population, density, quantity of buildings, and budget are notably higher in Toronto and Ontario as compared to Calgary and Alberta. It was expected that, given these contextual differences, buildings in the city of Toronto would be influenced by a far greater number of energy efficiency policies. This policy mix similarity demonstrates that the city of Calgary and the province of Alberta possess a greater interest in improving energy efficiency in its building sector as compared to the city of Toronto and the province of Ontario.

Second, most policy mixes are comprehensive in terms of their composition of different policy instrument elements, with two exceptions. First, no policy mix contains the policy instrument sub-types *removal of perverse incentives* and *mandatory monitoring/auditing/reporting;* and second, the energy efficiency policy mix pertaining to buildings in Calgary is absent of medium-term policy instruments. While there is some room to improve the comprehensiveness of the policy mixes examined, the energy efficiency policy mixes that target buildings in Toronto and Calgary are mostly comprehensive. This high degree of comprehensiveness is an indicator of an effective policy mix.

Third, policy efforts, in many circumstances, fail to consider the contextual factors of buildings and energy efficiency technologies in Canada. Within the building sectors policy mix analyses, a balanced approach neglects the differences in greenhouse gas emissions and the potential for greenhouse gas reductions between buildings of different sectors. Within the innovation phase policy mix analysis, the emphasis on energy efficient product development, as opposed to product diffusion, is negligent towards the reality that highly efficient and cost-effective energy technologies are already readily available, but lack adoption (International Energy Agency, 2018). Furthermore, within the building type policy mix analyses, a balanced approach in targeting new and existing buildings neglects the fact that the vast majority of buildings that will exist in by 2030 years already exists today – to meet Canada's 2030 Paris Agreement commitments, targeting existing buildings should be prioritized. By better adjusting to the contextual factors in which policy instruments seek to operate in improves the effectiveness and efficiency of the policy mix.

Fourth, several policy mix analyses demonstrated broadness. This broadness is also a possible reason for the failure of responding to the contextual factors highlighted in the previous paragraph, as broadening the objective of policy instruments reduces the capacity to conform to specific contextual factors. Policy instrument broadness also weakens the ability of policy instruments to provide targeted solutions to defined problems that could yield highly positive outcomes. Policy objective broadness was demonstrated by the small number of policy instruments that exclusively target energy efficiency in buildings; the small number of exclusive building energy efficiency policies also diminishes the capability of policy instruments conforming to specific contextual factors, as the majority of policy instruments are burdened with achieving multiple outcomes. Policy broadness was also demonstrated in term of targeting. In the policy mix analyses of target building types and target building sectors, for example, many policies target, simultaneously, all building types and sectors as opposed to a specific building type or sector.

Fifth, the clarity, stability, and predictability of policy mixes also demonstrated concerns. The quantity of dateless policy instruments, for instance, surrenders the ability to provide explicit milestones and confident policy direction. The tremendous quantity of highly flexible policy instruments that target government entities reduces government accountability by weakening the predictability of government adoptions of high-potential energy efficiency solutions as they are not bound by precise requirements. Moreover, the small number of destruction policy instruments, and even smaller number of 'hard' destruction policy instruments, indicates an unstable commitment towards phasing out technologies of lesser energy efficiency and transitioning towards a more energy efficient building sector. Improving upon these policy mixes can enhance the certainty of the future of energy efficiency in buildings.

Lastly, the limited emphasis on the importance of the use of energy efficient technologies, thereby increasing the vulnerability of an energy efficiency gap, is illustrated in multiple policy mix analyses. A small portion of policy instruments, for instance, target the *use* component of the consumer decision-making process. Additionally, a small portion of policy instruments target actors of the *building occupants and users* category. The consequence of the findings of these policy mixes is that technology misuse, such as the failure to program smart energy efficiency technologies, is likely to result in differences between expected and actual energy use and greenhouse gas emission reductions.

4.3 Limitations

The policy mix analyses of this paper examined the interactions between policy instruments by graphing policy mix composition. A perfect policy mix analyses, however, ought to, in theory, analyze, holistically and simultaneously, the interactions of all policy instruments that impact a policy objective. This is because every single policy instrument, and all of the characteristics that it contains, impacts the effects and outcomes of every other individual policy instrument and policy instrument mix. This study, and all other policy mix analyses, is limited in the examination of the full scope of policy instrument interactions within a policy mix because:

(1) In all studies, only select policy instruments are included for analysis, however, other policy actions outside of the direct scope of analysis, for example, international trade deals and public education curriculums, also impact, albeit slightly and indirectly, the effectiveness and outcomes of seemingly unrelated policy instruments and select policy mixes. A perfect policy mix analysis should include all policy instruments with the potential, regardless of the degree of potential, in the sample of policy instruments analyzed.

(2) In all studies, only select characteristics/elements of policy instruments, for instance, the building sector targeted, is selected for examination, however, other characteristics exist. Additionally, a limited quantity of detail is captured for analysis from each policy instrument characteristic/element, for instance, a policy instrument may be categorized as an *information* policy, however, the quality, quantity, and reach of this *information* policy are oftentimes dismissed. *A* perfect policy mix analysis must consider all policy instrument characteristics and the full scope of detail pertaining to these characteristics, as every characteristic contain the potential to impact policy instrument effectiveness, outcome, and interactions with other policy instruments.

(3) In this study, only existing policy instruments are compiled for examination, however, previous energy efficiency policy instruments that ceased to exist may also provide lasting influence on the effectiveness of current policies. The impact of previously existing policy instruments on the effectiveness and outcome of current policy instruments and mixes is examined in a perfect policy mix analysis.

(4) In this study, only policy mixes of single elements and double elements were analyzed, however, examining the interactions between three or more policy instrument elements would more comprehensively capture the effectiveness of policy mix compositions. This will be an aspect of a perfect policy mix analysis – to analyze the interactions between all policy instruments and its elements.

Due to the large number of policy instruments that directly and indirectly influences the outcome of a policy objective, and the tremendous, potentially infinite, characteristics contained within each of these policy instruments, coupled with the complexity of illustrating and calculating the interactions between all of these elements, a truly perfect policy mix analysis that simultaneously captures the interactions of all policy instruments involved would be impossible to be performed. The policy mix analyses of this paper, however, analyzes a larger suite of policy instrument elements than any study encountered through its literature review. This study also, through performing policy mix analyses of double elements, provides a more comprehensive policy mix analysis as compared to many other studies, which are typically limited to policy mix analyses of just single elements.

5 Conclusion

This paper conducted an analysis of the energy efficiency policy mix pertaining to buildings in the cities of Toronto and Calgary and discussed the findings of this analysis. A total of 91 policy instruments were compiled and 10 different policy elements (defined as the characteristics of policy instruments) were

extracted from these policy instruments for analysis. This data was illustrated in policy mix analyses tables and graphs, and the comprehensiveness and composition of these policy mixes were examined and discussed. This study found that the policy mixes of Toronto and Calgary are similar and that the policy mixes examined largely have a comprehensive composition of policy instrument elements, which has a positive correlation to policy mix effectiveness. However, opportunities to improve the effectiveness of the policy mixes by amending policy instrument composition exist. Notably, policy mix effectiveness improvements could be achieved by increasing *destruction* policy efforts to weaken the viability and appeal of existing energy technologies and practices to create windows of opportunities for technologies and practices of improved energy efficiency to emerge. Effectiveness could also be improved by increasing policy efforts towards ensuring energy-efficient behavior and correct energy-efficient technology use, and enhancing policy mix direction and milestone clarity by increasing the use of dated, short-term, and medium-term policy instruments.

This is the first paper to analyze the energy efficiency policy mix pertaining to buildings within the jurisdiction of Canada, and contributes to the understanding of the application and possible outcomes of policy mix analyses in the Canadian context. Due to the large quantity of policy mix data generated in this study, only select policy mixes were analyzed and discussed. To expand on the application of policy mix analyses in the Canadian context, future studies could build on the data compiled, tabled, and graphed by this study, particularly the policy mixes that were excluded from analysis and discussion in this paper (found in Appendix B2).

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Appendix A: Complete list of policy instruments and policy instrument elements/characteristics compiled for analysis in this paper

#	Policy Name	Level of Government (Policy source)	Consumer Decision Making Process Component	Policy commencement	Policy cessation	Time horizon category	Instrument sub-type	Regime creation or destruction	Flexibility	Building sector	Innovation phase	Actor	Building type	Energy efficiency exclusivity	Energy efficiency in building exclusivity
1	NRCan Website	federal	recognition, information	1842	Dateless	Dateless	information	creation	n/a	all	all	general public/all	both	no	no
2	Energuide	federal	information	2006	Dateless	Dateless	labelling	both	low	all	mass diffusion	Building owner	both	yes	no
3	Canada Energy Efficiency Act	federal	n/a	1992	Dateless	Dateless	codes and standards	destruction	low	all	research/development	dealers	both	yes	no
4	Energy Star for Products	federal	recognition, information	2001	Dateless	Dateless	labelling	creation	low	all	mass diffusion	general public/all	both	yes	no
5	Energy star for Industry Certification	federal	purchase, use	no date	Dateless	Dateless	labelling	creation	high	industrial	demonstration/deployment, mass diffusion	building occupants/ users	both	yes	no
6	Energy Star Challenge for Industry	federal	purchase, use	2016	Dateless	Dateless	voluntary agreement, labelling	creation	high	industrial	demonstration/deployment, mass diffusion	building occupants/ users	existing	yes	no
7	Energy Star for New Homes	federal	purchase	2014	Dateless	Dateless	labelling	creation	medium	residential	mass diffusion	dealers, building owners	new	yes	yes
8	Energy Star Builders	federal	information	2014	Dateless	Dateless	training and qualification	creation	low	residential	mass diffusion	dealers	both	yes	yes
9	Energy Star Canada Awards	federal	recognition of need, information	2003	Dateless	Dateless	labelling	creation	high	all	mass diffusion	dealers	both	yes	no
10	Energy Star Portfolio Manager	federal	use	2013	Dateless	Dateless	information	both	n/a	all	mass diffusion	building owners	existing	no	no
11	R-2000	federal	purchase	2012	Dateless	Dateless	labelling, training and qualification	creation	high	residential	demonstration/deployment	building owners	new	yes	yes
12	Net Zero: future building standard	federal	purchase	2013	Dateless	Dateless	labelling, training and qualification	creation	medium	residential	demonstration/deployment	dealers	new	no	no

#	Policy Name	Level of Government (Policy source)	Consumer Decision Making Process Component	Policy commencement	Policy cessation	Time horizon category	Instrument sub-type	Regime creation or destruction	Flexibility	Building sector	Innovation phase	Actor	Building type	Energy efficiency exclusivity	Energy efficiency in building exclusivity
13	National building Code	federal	n/a	1941	Dateless	Dateless	voluntary agreement	destruction	high	all	research/development	government	new	no	no
14	Local Energy Efficiency Partnerships	federal	information, purchase	no date	Dateless	Dateless	information, training and qualification	creation	high	all	mass diffusion	dealers	both	yes	yes
15	Integrated Community Energy Solutions - a roadmap for action	federal	n/a	2009	2050	long-term	action plan	both	high	all	all	government	both	no	no
16	National Energy Code of Canada for Buildings	federal	n/a	1998	Dateless	Dateless	codes and standards	destruction	low	all	research/development	dealers	new	no	no
17	Can-Quest	federal	information	2011	Dateless	Dateless	information, research	both	n/a	all	research/development	dealers	both	no	no
18	RETScreen	federal	information	2016	Dateless	Dateless	information, research	creation	n/a	all	research/development	dealers	new	no	no
19	Greening government operations strategy	federal	recognition, purchase, use	2013	2030	long-term	action plan	both	medium	commercial	mass diffusion	government	both	no	no
20	DABO high performance commissioning tool	federal	use	no date	Dateless	Dateless	information	both	n/a	all	demonstration/deployment	building owners	both	no	no
21	ISO 50001 energy management systems standard cost-share program	federal	use	no date	Dateless	Dateless	financial incentive	creation	medium	commercial, industrial, institutional	demonstration/deployment	building owners, building occupants/ users	both	no	no
22	Heads Up: building energy efficiency newsletter	federal	recognition, information	1996	Dateless	Dateless	information	creation	n/a	all	all	general public/all	both	yes	yes

#	Policy Name	Level of Government (Policy source)	Consumer Decision Making Process Component	Policy commencement	Policy cessation	Time horizon category	Instrument sub-type	Regime creation or destruction	Flexibility	Building sector	Innovation phase	Actor	Building type	Energy efficiency exclusivity	Energy efficiency in building exclusivity
23	RCX Guide	federal	information	2008	Dateless	Dateless	information	creation	high	all	demonstration/deployment	building owners, building occupants/ users	existing	yes	yes
24	Learn from Experts	federal	recognition, information	no date	Dateless	Dateless	training and qualification	creation	medium	all	demonstration/deployment, mass diffusion	government	both	no	no
25	Low-Carbon Economy Fund – leadership	federal	purchase	2017	Dateless	Dateless	direct investment	creation	high	all	all	government	both	no	no
26	Low-Carbon Economy Fund – challenge	federal	purchase	2018	2019	short-term	direct investment	creation	high	all	all	government, building owners	both	no	no
27	Build Smart Canada's Buildings Strategy	federal	n/a	2017	2030	long-term	action plan	both	high	all	all	government	both	no	no
28	Canadian Industry Partnership for Energy Conservation (CIPEC)	federal	information	2013	Dateless	Dateless	direct investment, information	creation	high	all	demonstration/deployment	building occupants/ users	both	no	no
29	Clean Energy Ministerial	federal	recognition of need	2019	2019	short-term	information, demonstration	creation	high	all	all	government	both	no	no
30	Canadian Energy and Emissions Data Centre	federal	information	2013	Dateless	Dateless	information	both	n/a	all	research/development	general public/all	both	no	no
31	Employee Awareness of Energy Efficiency Program	federal	recognition, information	2012	Dateless	Dateless	training and qualification	creation	medium	all	mass diffusion	building occupants/ users	both	yes	yes

#	Policy Name	Level of Government (Policy source)	Consumer Decision Making Process Component	Policy commencement	Policy cessation	Time horizon category	Instrument sub-type	Regime creation or destruction	Flexibility	Building sector	Innovation phase	Actor	Building type	Energy efficiency exclusivity	Energy efficiency in building exclusivity
32	CanmetENERGY	federal	n/a	2014	Dateless	Dateless	research	creation	high	all	research/development	government	both	no	no
33	Canadian Centre for Housing Technology	federal	n/a	1998	Dateless	Dateless	research	creation	high	residential	research/development, demonstration/deployment	dealers	both	no	no
34	National Energy Use Databse	federal	recognition, information	1991	Dateless	Dateless	information	both	n/a	all	research/development	general public/all	both	no	no
35	Clean Energy Innovation Program	federal	information	2016	2019	short-term	direct investment	creation	medium	all	research/development, dmonstration/deployment	dealers, government	both	no	no
36	NRCan Kids Club	federal	information	2013	Dateless	Dateless	information	both	n/a	all	demonstration/deployment, mass diffusion	general public/all	both	no	no
37	Clean Energy in Rural and Remote Communities	federal	purchase	2018	2020	short-term	direct investment	creation	medium	all	demonstration/deployment, mass diffusion	dealers, building occupants/users	both	no	no
38	Program of Energy Research and Development	federal	n/a	2018	Dateless	Dateless	direct investment	creation	high	all	research/development	government	both	no	no
39	Tax Savings for Industry program	federal	purchase	2013	Dateless	Dateless	financial incentive	creation	low	all	mass diffusion	building owners, building occupants/users	both	no	no
40	Northern REACHE	federal	purchase, use	2016	Dateless	Dateless	direct investment	creation	low	all	demonstration/deployment, mass diffusion	governments, indigenous, nonprofit	both	no	no
41	Canadian emissions reduction innovation network	federal	information	2019	2019	short-term	research, demonstration	creation	high	all	research/development, demonstration/deployment	government, dealers	both	no	no

#	Policy Name	Level of Government (Policy source)	Consumer Decision Making Process Component	Policy commencement	Policy cessation	Time horizon category	Instrument sub-type	Regime creation or destruction	Flexibility	Building sector	Innovation phase	Actor	Building type	Energy efficiency exclusivity	Energy efficiency in building exclusivity
42	Clean Growth Hub	federal	information	2016	Dateless	Dateless	information	creation	high	all	all	governments, building occupants/ users, building owners	both	no	no
43	Mission Innovation	federal	recognition	2015	Dateless	Dateless	voluntary agreement	creation	high	all	research/development, dmonstration/ deployment	governments	both	no	no
44	Federal Sustainable Development Act	federal	n/a	2008	Dateless	Dateless	codes and standards	both	high	all	all	governments	both	no	no
45	Advisory Council on Climate Change	federal	n/a	2018	Dateless	Dateless	Research	both	high	all	all	governments	both	no	no
46	Pan-Canadian Framework on Clean Growth and Climate Change	federal	n/a	2016	2050	long-term	aciton plan	both	high	all	all	governments	both	no	no
47	Green Municipal Fund	federal	purchase	2000	Dateless	Dateless	direct investment	creation	high	all	all	governments	both	no	no
48	CMHC Green Home Premium Refund	federal	purchase	2004	Dateless	Dateless	financial incentive	creation	medium	residential	demonstration/deployment, mass diffusion	building owners	both	yes	yes
49	CMHC Mortgage Loan Insurance Premium	federal	purchase	2004	Dateless	Dateless	direct investment	creation	medium	residential	demonstration/deployment, mass diffusion	building owners	both	yes	yes
50	Hygrothermal performance of buildings testing facility	federal	information	no date	Dateless	Dateless	research, demonstration	creation	high	industrial	research/development, demonstraiton/deployment	dealers, building occupants/ users	both	yes	yes

#	Policy Name	Level of Government (Policy source)	Consumer Decision Making Process Component	Policy commencement	Policy cessation	Time horizon category	Instrument sub-type	Regime creation or destruction	Flexibility	Building sector	Innovation phase	Actor	Building type	Energy efficiency exclusivity	Energy efficiency in building exclusivity
51	Indoor environment testing research facility	federal	information	no date	Dateless	Dateless	research, demonstration	creation	high	residential	research/development, demonstraiton/deployment	dealers, building owners	both	no	no
52	Carbon Pricing	federal	recognition, purchase	2018	2022	short-term	enegy premiums and tax	destruction	medium	all	mass diffusion	general public/all	both	no	no
53	Independent Electricity System Operator	Ontario	information	no date	Dateless	Dateless	information	creation	n/a	all	mass diffusion	general public/all	both	no	no
54	Ontario Building Code	Ontario	n/a	1992	Dateless	Dateless	codes and standards	destruction	low	all	all	dealers	both	no	no
55	Municipal Energy Plan Program	Ontario	n/a	2017	Dateless	Dateless	direct investment	creation	high	all	all	government, indigenous	both	no	no
56	Ontario Affordability Fund	Ontario	purchase	2017	Dateless	Dateless	direct investment	creation	high	residential	mass diffusion	building owners	both	yes	yes
57	Hydro One First Nations Conservation Program	Ontario	information, purchase, use	2017	Dateless	Dateless	information, direct investment	creation	high	residential	mass diffusion	indigenous	both	yes	yes
58	Made in Ontario Environment Plan	Ontario	n/a	2019	2030	long-term	action plan	both	high	all	all	government	both	no	no
59	Energy Retrofit Loans	Toronto	purchase	2014	Dateless	Dateless	direct investment	creation	high	all	mass diffusion	building owner	both	yes	yes
60	Home Energy Loan Program	Toronto	purchase	2015	Dateless	Dateless	direct investment	creation	high	residential	mass diffusion	building owner	existing	no	no
61	Eco-Roof Incentive Program	Toronto	purchase	2009	Dateless	Dateless	direct investment	creation	low	all	mass diffusion	building owner	both	no	no
62	Retrofit, Small Business Lighting, energy	Toronto	purchase	2016	Dateless	Dateless	direct investment	creation	low	commercial, industrial,	mass diffusion	building owner	existing	yes	yes

#	Policy Name	Level of Government (Policy source)	Consumer Decision Making Process Component	Policy commencement	Policy cessation	Time horizon category	Instrument sub-type	Regime creation or destruction	Flexibility	Building sector	Innovation phase	Actor	Building type	Energy efficiency exclusivity	Energy efficiency in building exclusivity
	Manager Program									institutional					
63	Process and System Upgrades Program	Toronto	purchase	2017	2022	medium-term	direct investment	creation	high	industrial	mass diffusion	building owner, building occupants/ users	existing	yes	no
64	Energy Performance Program	Toronto	purchase	2016	Dateless	Dateless	direct investment	creation	high	all	mass diffusion	building owner	existing	yes	yes
65	Home Assistance Program	Toronto	purchase	2011	Dateless	Dateless	direct investment	creation	high	residential	mass diffusion	building owner	existing	yes	yes
66	Green Debenture Framework	Toronto	purchase	2018	Dateless	Dateless	direct investment	creation	high	all	demonstration/deployment, mass diffusion	government	both	no	no
67	Toronto Green Standard v3	Toronto	recognition, information	2010	Dateless	Dateless	labelling	creation	low	residential	mass diffusion	building owners	new	no	no
68	Toronto Atmospheric Fund	Toronto	recognition, information, purchase	1991	Dateless	Dateless	direct investment	creation	high	all	demonstration/deployment	general public/all	both	yes	yes
69	Alberta Climate Leadership Plan	Alberta	n/a	2018	2030	long-term	action plan	both	high	all	all	government	both	no	no
70	Property Assessed Clean Energy Program	Alberta	purchase	2018	Dateless	Dateless	financial incentives	creation	high	all	mass diffusion	building owners	both	no	no
71	Emissions Reduction Alberta	Alberta	purchase	2009	Dateless	Dateless	direct investment	creation	medium	all	all	building occupants/ users, building owners	both	no	no
72	Alberta climate change innovation and technology framework	Alberta	information, purchase	2018	Dateless	Dateless	information, direct investment	creation	medium	all	research/development, demonstration/deployment	building occupants/ users, building owners	both	no	no

#	Policy Name	Level of Government (Policy source)	Consumer Decision Making Process Component	Policy commencement	Policy cessation	Time horizon category	Instrument sub-type	Regime creation or destruction	Flexibility	Building sector	Innovation phase	Actor	Building type	Energy efficiency exclusivity	Energy efficiency in building exclusivity
73	Green Loan Guarantee Program	Alberta	purchase	2018	Dateless	Dateless	direct investment	creation	high	all	all	dealers	both	no	no
74	Clean Energy Improvement Program	Alberta	purchase	2019	Dateless	Dateless	financial incentives	creation	high	all	mass diffusion	building owners	both	no	no
75	Home Energy Plan	Alberta	information, purchase, use	2018	Dateless	Dateless	direct investment	creation	low	residential	mass diffusion	building owners	existing	yes	yes
76	Custom Energy Solutions	Alberta	information, purchase	2018	Dateless	Dateless	direct investment	creation	medium	commercial, institutional, industrial	mass diffusion	building owners	existing	yes	yes
77	Home Improvements	Alberta	purchase	2017	Dateless	Dateless	direct investment	creation	low	residential	mass diffusion	building owners	existing	yes	yes
78	online rebates	Alberta	purchase	2017	Dateless	Dateless	direct investment	creation	low	residential	mass diffusion	building owners	both	yes	yes
79	Business Energy Savings	Alberta	purchase	2017	Dateless	Dateless	direct investment	creation	low	commercial, institutional, industrial	mass diffusion	building occupants/ users, building owners	existing	yes	yes
80	Efficiency Professionals Network	Alberta	information	2017	Dateless	Dateless	information, training and qualification	creation	n/a	all	demonstration/deployment, mass diffusion	businesses, dealers	both	no	no
81	Smart Home Tool	Alberta	information, use	2017	Dateless	Dateless	information	creation	n/a	residential	mass diffusion	building owners	both	yes	yes
82	Non-Profit Energy Efficiency Transition Program	Alberta	information, use	2017	Dateless	Dateless	direct investment	creation	low	institutional	mass diffusion	nonprofit	existing	yes	yes
83	Municipal Energy Manager Program	Alberta	information	no date	Dateless	Dateless	direct investment	creation	high	all	all	governments, nonprofit, indiegenou	both	no	no

#	Policy Name	Level of Government (Policy source)	Consumer Decision Making Process Component	Policy commencement	Policy cessation	Time horizon category	Instrument sub-type	Regime creation or destruction	Flexibility	Building sector	Innovation phase	Actor	Building type	Energy efficiency exclusivity	Energy efficiency in building exclusivity
												s communities			
84	Recreation Energy Conservation Program	Alberta	information, purchase, use	no date	Dateless	Dateless	direct investment	creation	medium	institutional	mass diffusion	building owner	existing	no	no
85	Seniors Home and Adaptation Repair Program - Loan Program	Alberta	purchase	2017	Dateless	Dateless	direct investment	creation	high	residential	mass diffusion	building owner	existing	no	no
86	Farm Energy and Agri-Processing Program	Alberta	purchase	2016	Dateless	Dateless	direct investment	creation	medium	industrial	mass diffusion	building owner, building occupants/ users	both	yes	no
87	Alberta Indigenous Community Energy Program	Alberta	information, purchase, use	2016	Dateless	Dateless	direct investment	creation	high	all	mass diffusion	indigenous	existing	yes	yes
88	Alberta Buildings Code	Alberta	n/a	2015	Dateless	Dateless	codes and standards	destruction	low	all	mass diffusion	building owners, dealers	new	no	no
89	Sustainable Building Partnership	Calgary	information, purchase, use	2008	Dateless	Dateless	information	creation	high	institutional	all	government	both	yes	no
90	Municipal Development Plan	Calgary	n/a	2009	Dateless	Dateless	action plan	creation	high	all	all	government	both	no	no
91	Sustainable Building Policy	Calgary	n/a	2004	Dateless	Dateless	codes and standards	both	high	institutional	mass diffusion	government	both	no	no

Appendix B: Policy mix graphs

Section 1: Policy mixes discussed in this paper

Figures 1.1.1 & 1.1.2: Policy mix analysis graph on Consumer Decision Making Process Components

Figure 1.1.1: Policy mix analysis graph on Consumer Decision Making Process Components (Toronto)

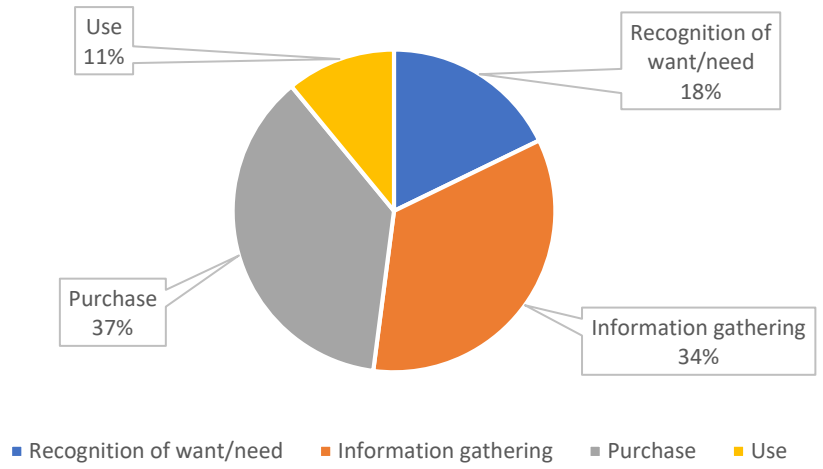
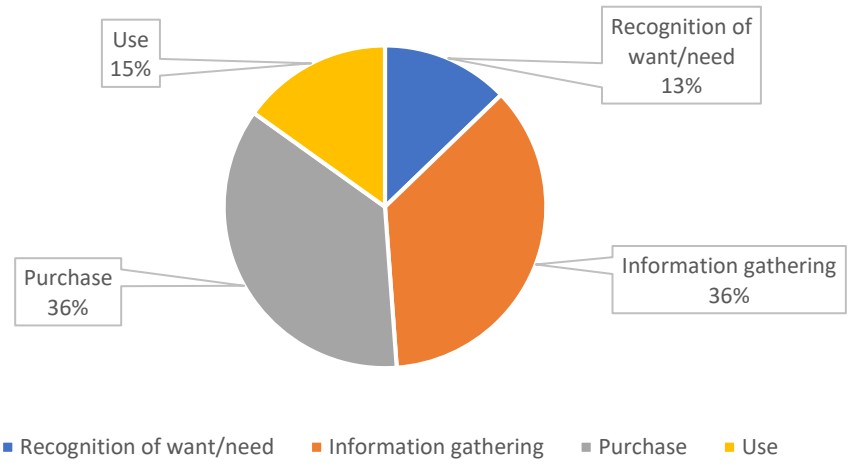
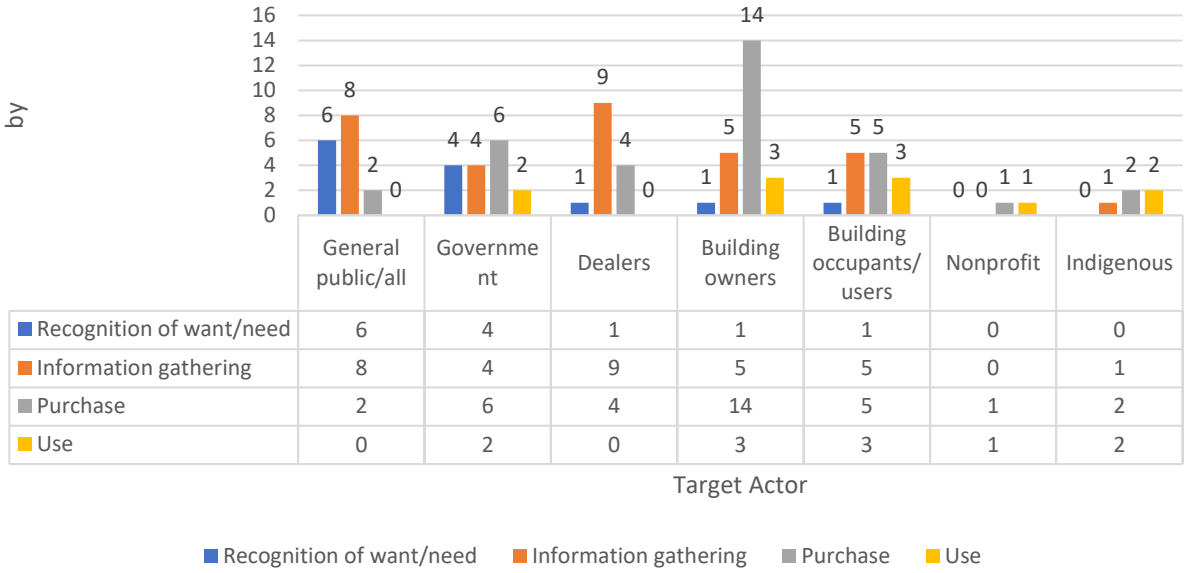


Figure 1.1.2: Policy mix analysis graph on Consumer Decision Making Process Components (Calgary)



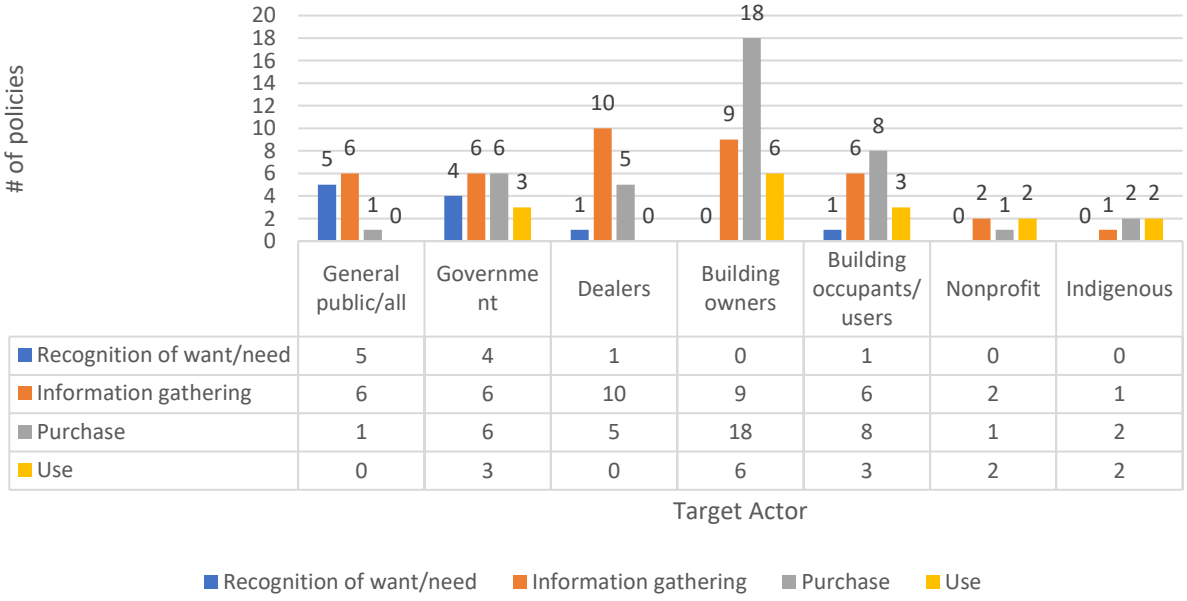
Figures 1.2.1 & 1.2.2: Policy mix analysis graph on Consumer Decision Making Process Components by Policy Target Actor

Figure 1.2.1: Policy mix analysis graph on Policy Target Actor v. Policy Target Consumer Decision Making Process Componenet (Toronto)



	General public/all	Government	Dealers	Building owners	Building occupants/ users	Nonprofit	Indigenous
Recognition of want/need	6	4	1	1	1	0	0
Information gathering	8	4	9	5	5	0	1
Purchase	2	6	4	14	5	1	2
Use	0	2	0	3	3	1	2

Figure 1.2.2: Policy mix analysis graph on Policy Target Actor by Policy Target Consumer Decision Making Process Componenet (Calgary)



	General public/all	Government	Dealers	Building owners	Building occupants/ users	Nonprofit	Indigenous
Recognition of want/need	5	4	1	0	1	0	0
Information gathering	6	6	10	9	6	2	1
Purchase	1	6	5	18	8	1	2
Use	0	3	0	6	3	2	2

Figures 1.3.1 & 1.3.2: Policy mix analysis graph on Policy Time Horizon

Figure 1.3.1: Policy mix analysis graph on Policy Time Horizon (Toronto)

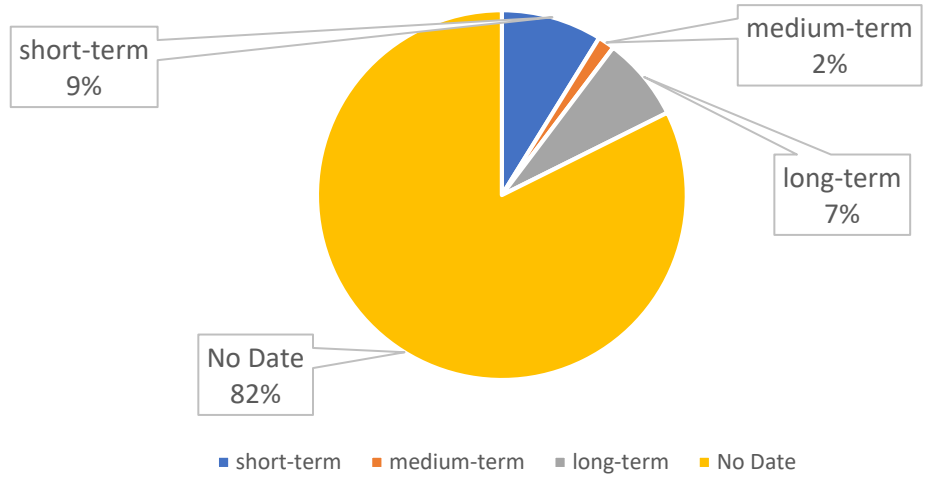
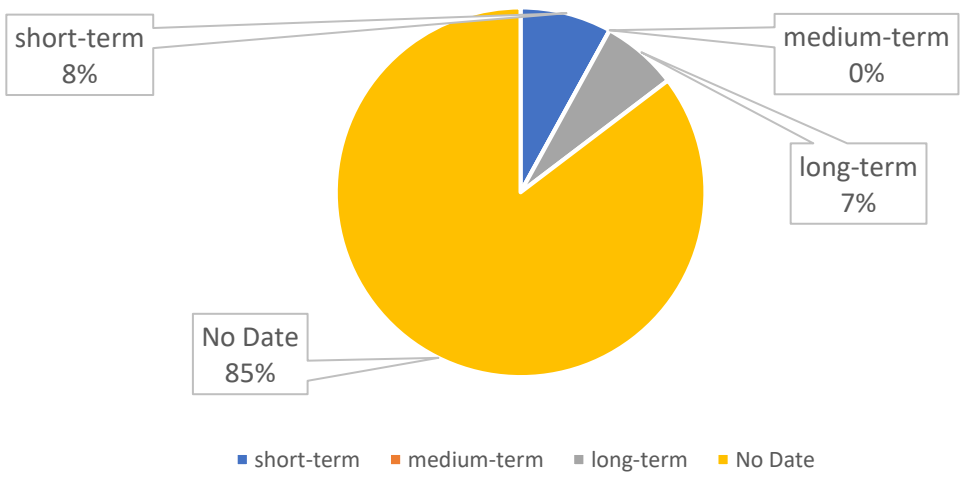
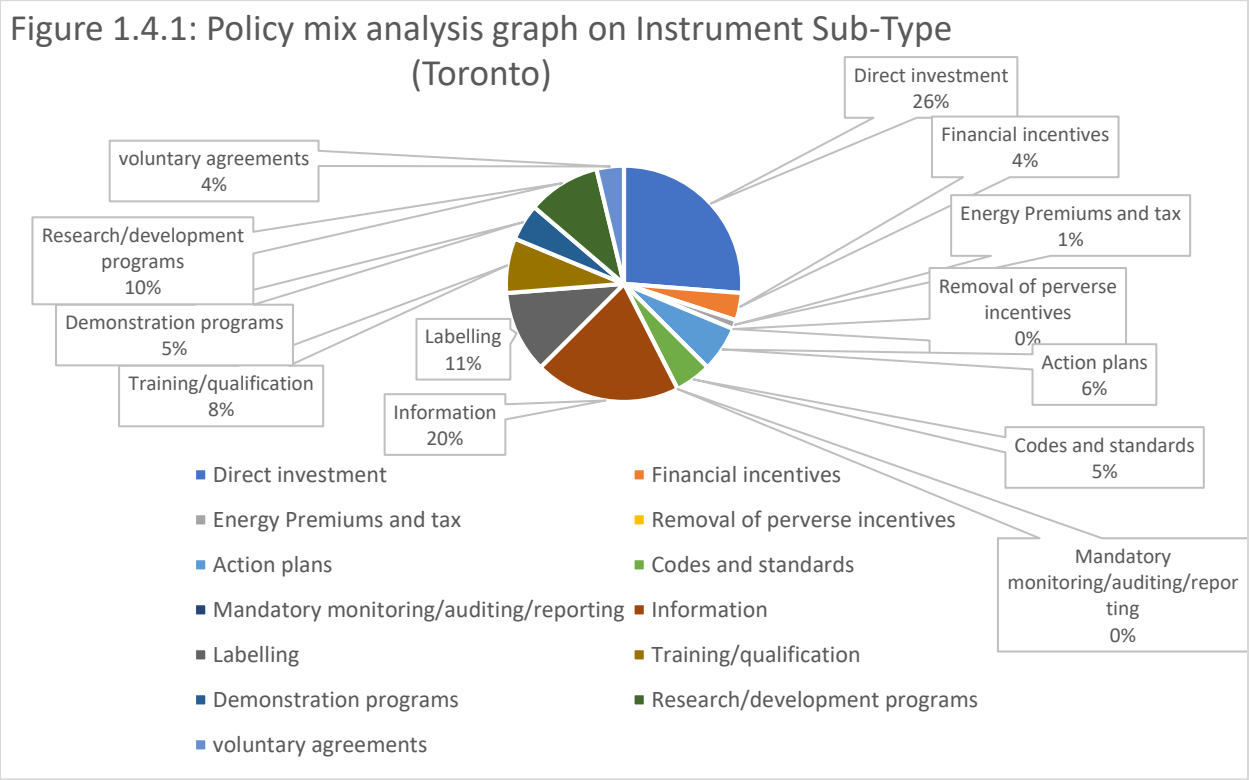
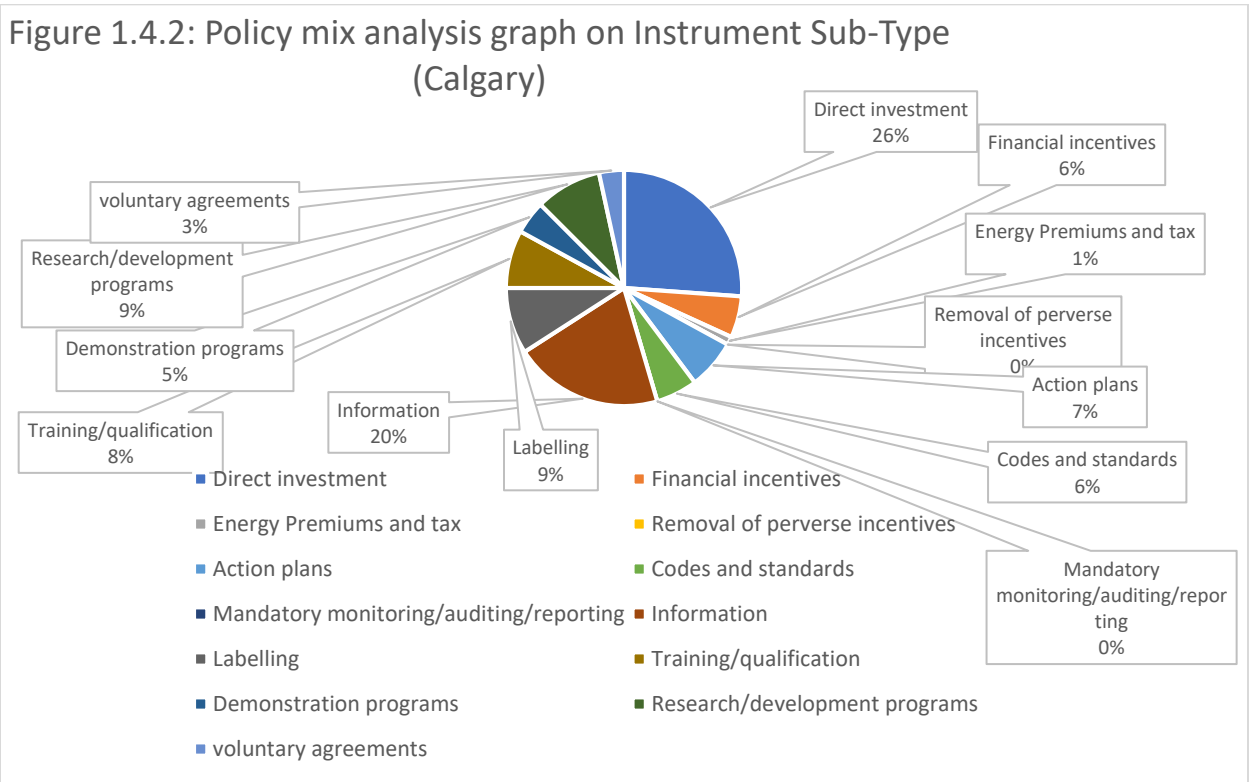


Figure 1.3.2: Policy mix analysis graph on Policy Time Horizon (Calgary)



Figures 1.4.1 & 1.4.2: Policy mix analysis graph on Policy Sub-Type





Figures 1.5.1.2 & 1.5.2.2: Policy mix analysis graph on Regime Creation or Destruction Policy

Figure 1.5.1.2: Policy mix analysis graph on Regime Creation or Destruction (Toronto)

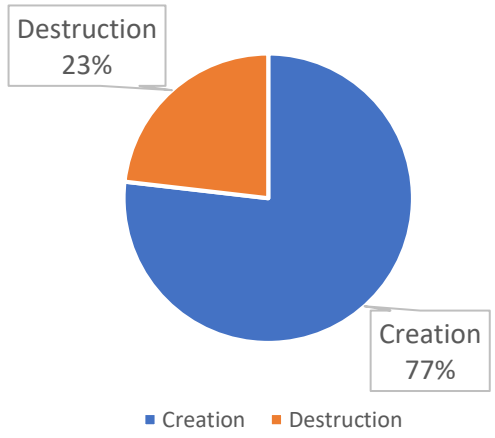
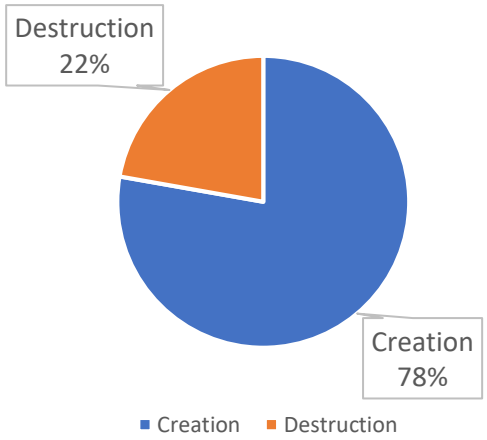


Figure 1.5.2.2: Policy mix analysis graph on Regime Creation or Destruction (Calgary)



Figures 1.6.1 & 1.6.2: Policy mix analysis graph on Policy Sub-Type by Regime Creation or Destruction Policy

Figure 1.6.1: Policy mix analysis graph on Policy Sub-Type by Regime Creation or Destruction Policy (Toronto)

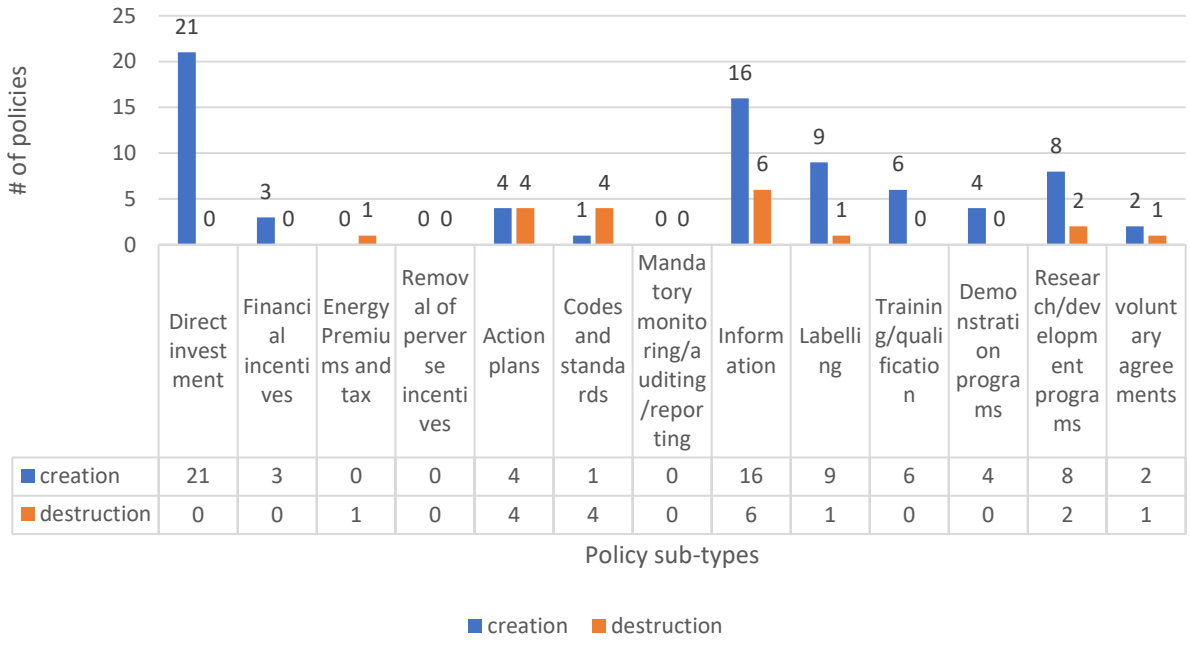
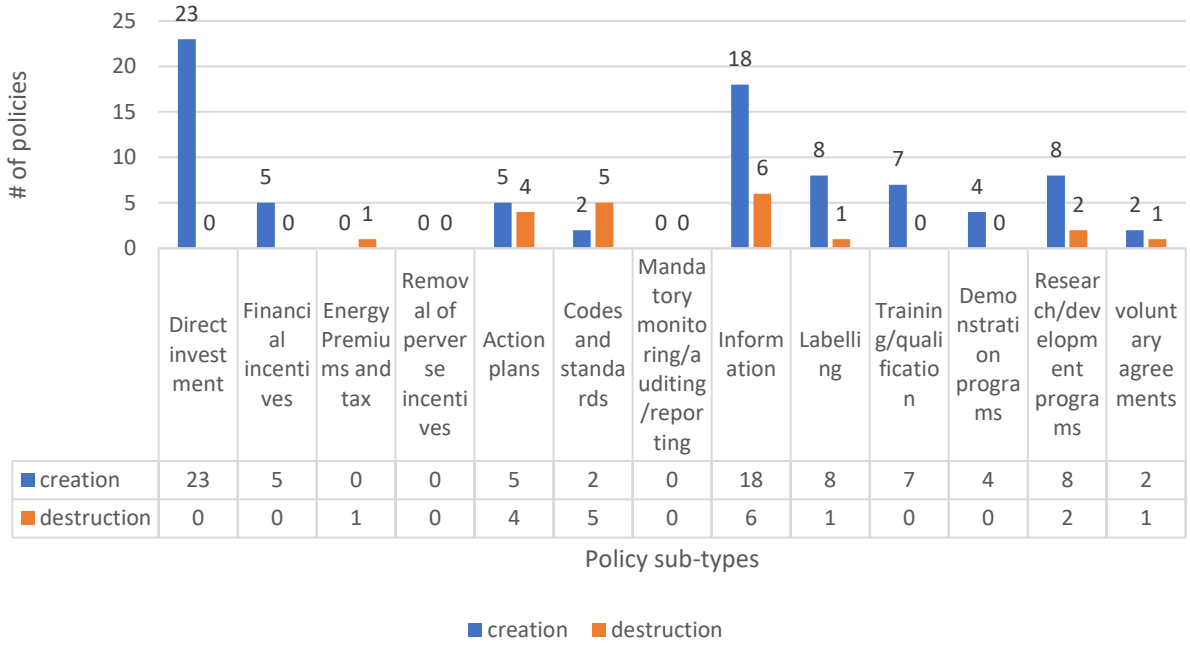


Figure 1.6.2: Policy mix analysis graph on Policy Sub-Type by Regime Creation or Destruction Policy (Calgary)



Figures 1.7.1 & 1.7.2: Policy mix analysis graph on Policy Target Innovation Phase by Regime Creation or Destruction Policy

Figure 1.7.1: Policy mix analysis graph on Policy Target Innovation Phase by Regime Creation or Destruction Policy (Toronto)

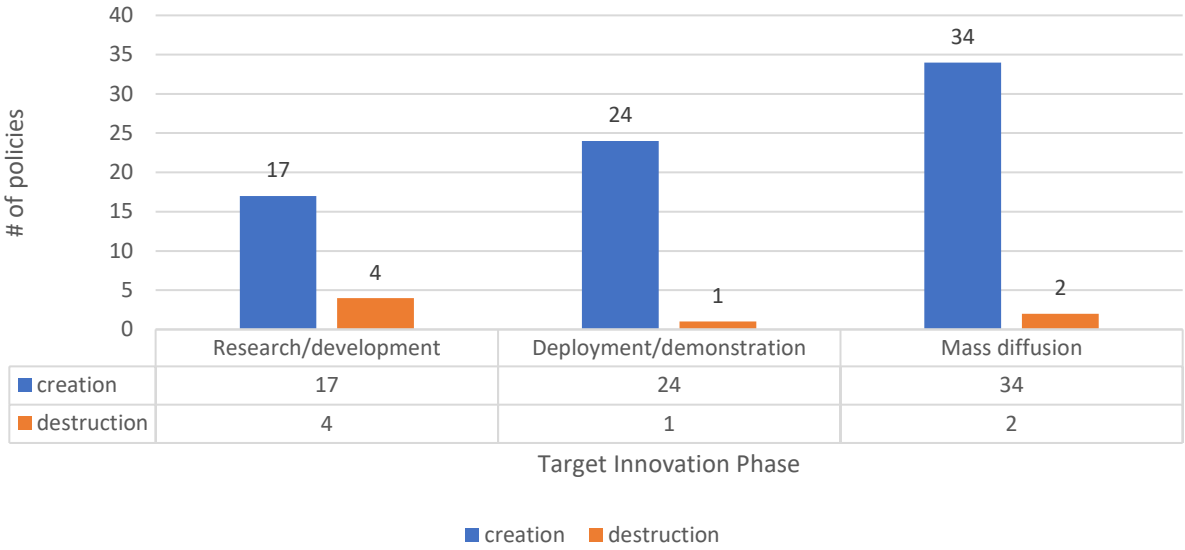
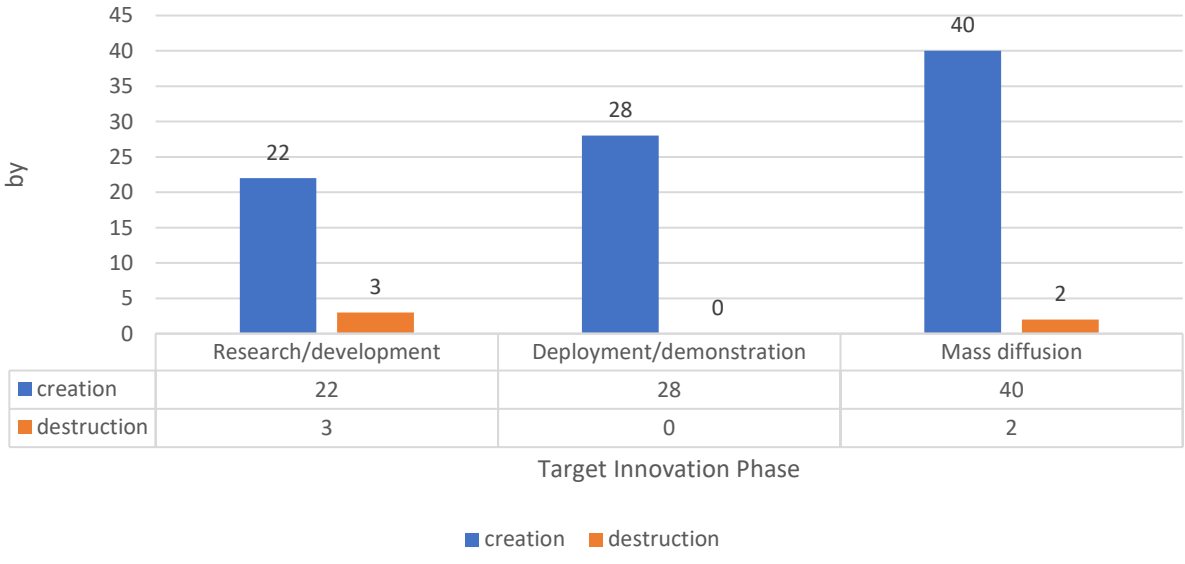


Figure 1.7.2: Policy mix analysis graph on Policy Target Innovation Phase v. Regime Creation or Destruction Policy (Calgary)



Figures 1.8.1 & 1.8.2: Policy mix analysis graph on Policy Target Actor by Regime Creation or Destruction Policy

Figure 1.8.1: Policy mix analysis graph on Policy Target Actor & Regime Creation or Destruction Policy (Toronto)

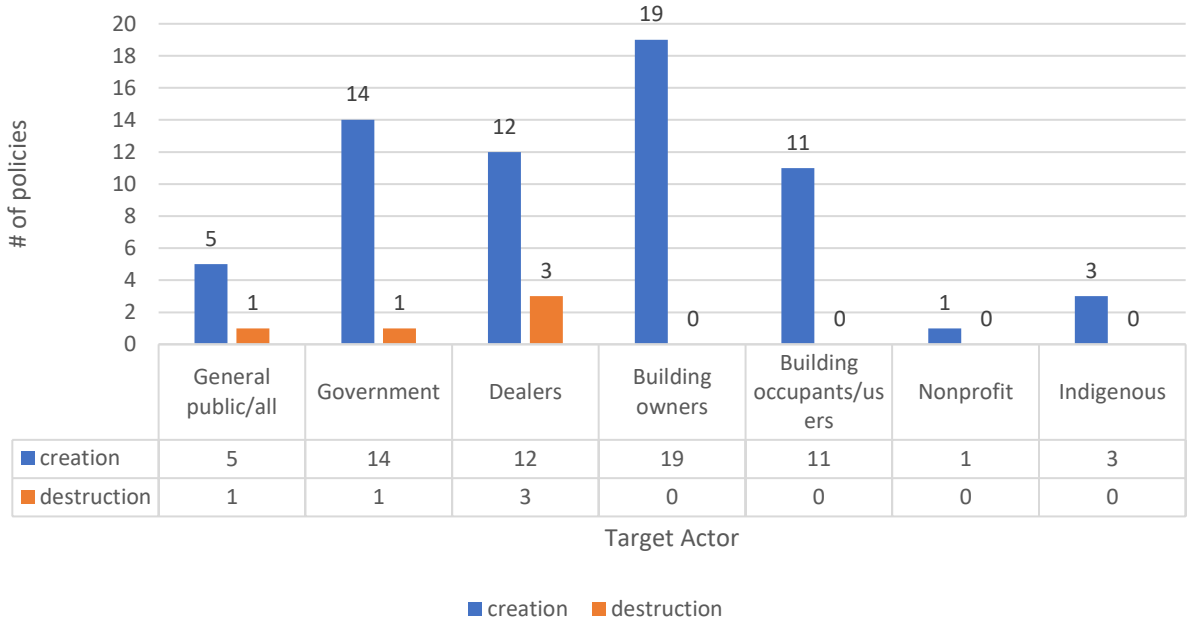
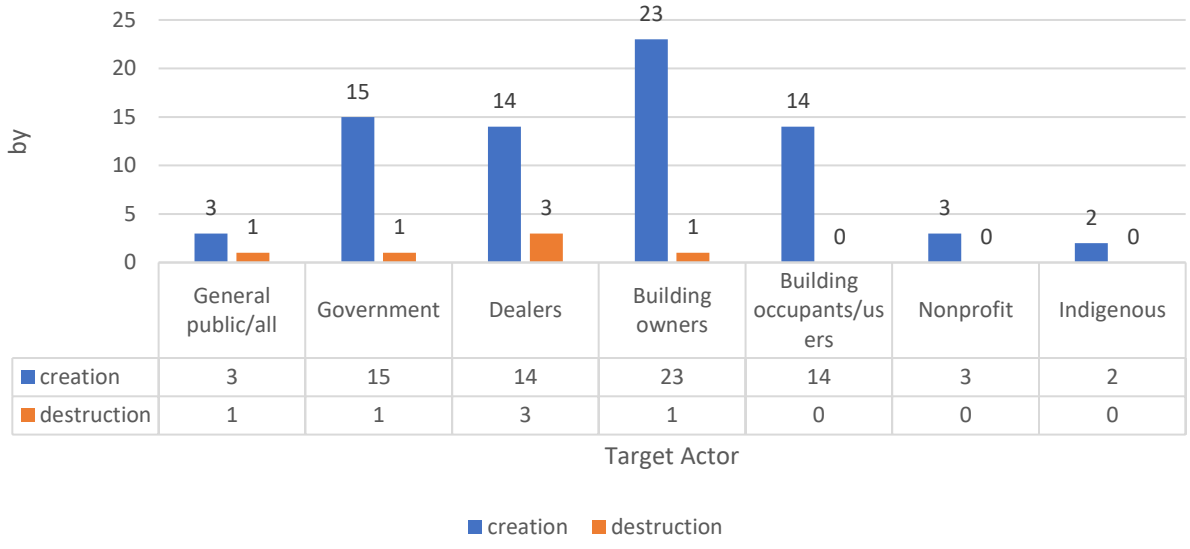


Figure 1.8.2: Policy mix analysis graph on Policy Target Actor v. Regime Creation or Destruction Policy (Calgary)



Figures 1.9.1 & 1.9.2: Policy mix analysis graph on Policy Flexibility

Figure 1.9.1: Policy mix analysis graph on Policy Flexibility (Toronto)

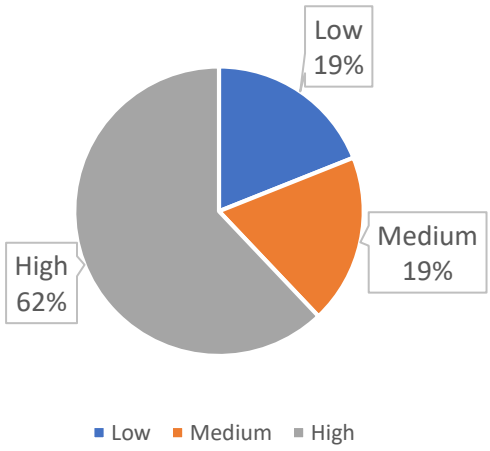
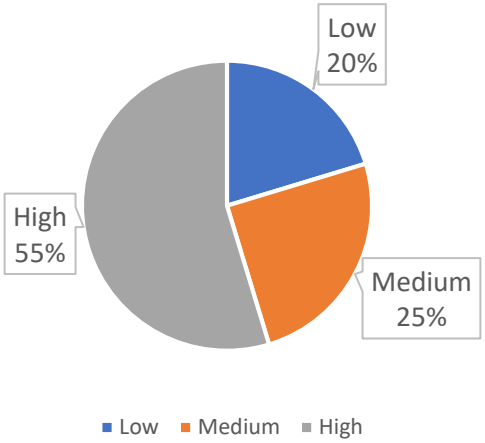


Figure 1.9.2: Policy mix analysis graph on Policy Flexibility (Calgary)



Figures 1.10.1.1 & 1.10.2.1: Policy mix analysis graph on Policy Target Building Sector

Figure 1.10.1.1: Policy mix analysis graph on Policy Target Building Sector (Toronto)

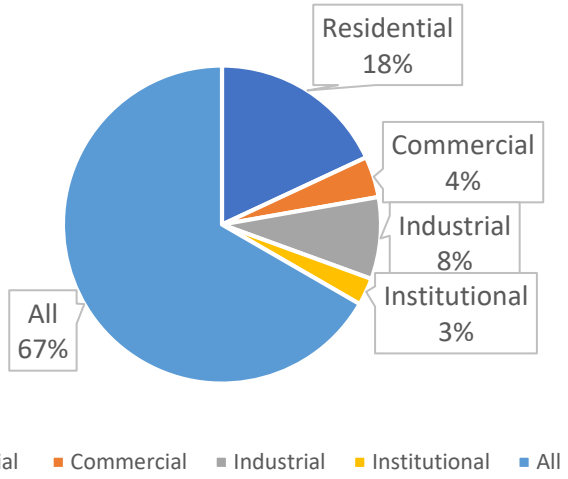
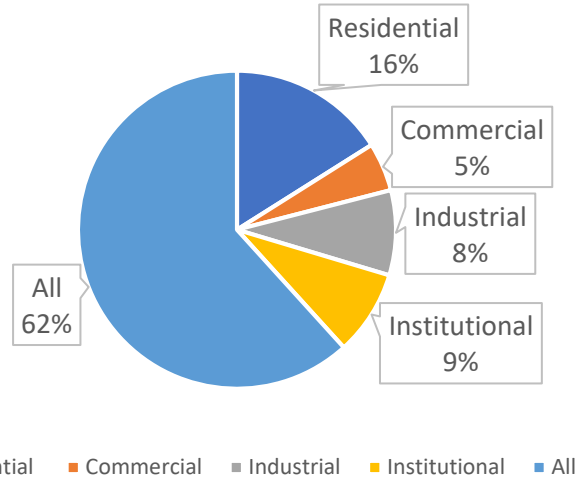


Figure 1.10.2.1: Policy mix analysis graph on Policy Target Building Sector (Calgary)



Figures 1.10.1.2 & 1.10.2.2: Policy mix analysis graph on Policy Target Building Sector

Figure 1.10.1.2: Policy mix analysis graph on Policy Target Building Sector (Toronto)

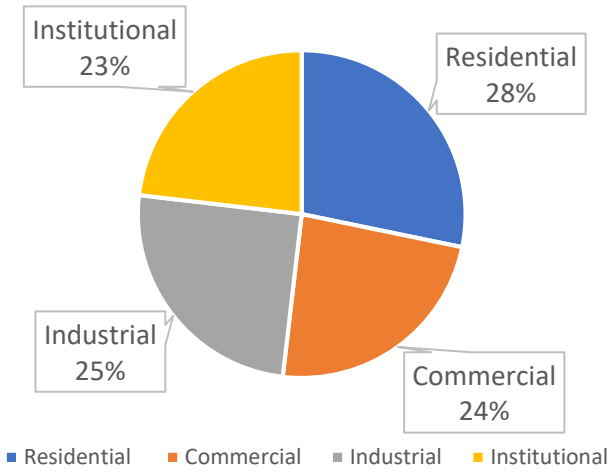
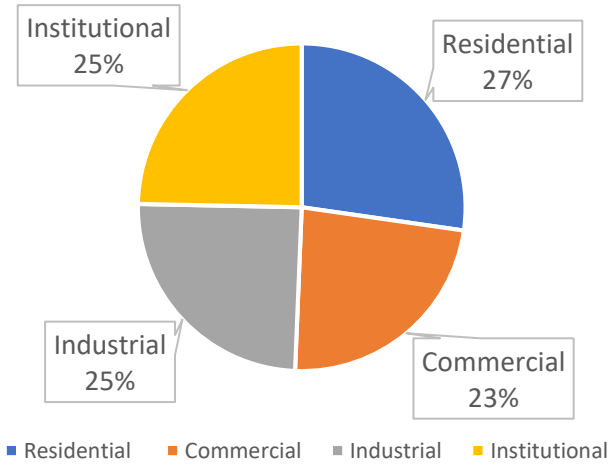


Figure 1.10.2.2: Policy mix graph on Policy target Building Sector (Calgary)



Figures 1.11.1.2 & 1.11.2.2: Policy mix analysis graph on Policy Target Innovation Phase

Figure 1.11.1.2: Policy mix analysis graph on Policy Target Innovation Phase (Toronto)

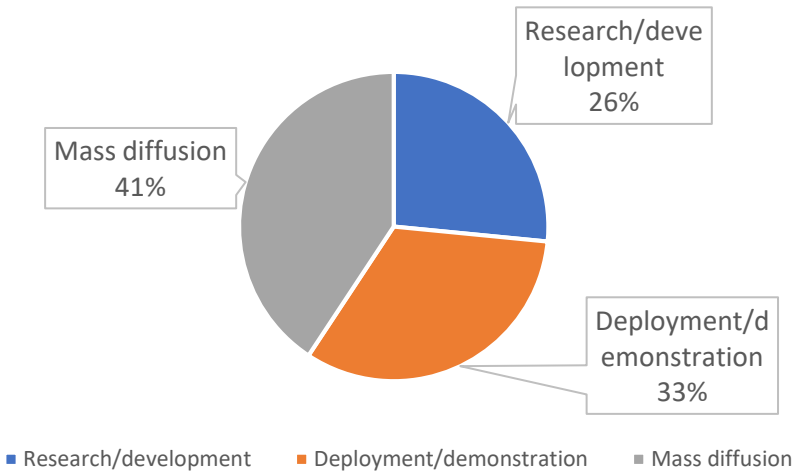
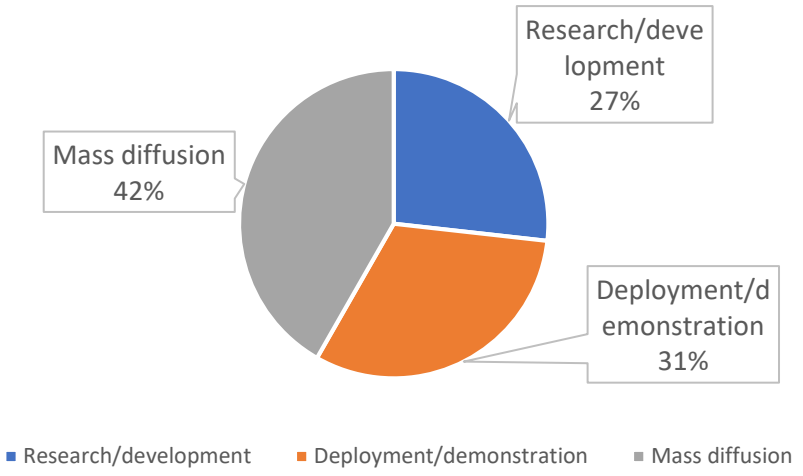


Figure 1.11.2.2: Policy mix analysis graph on Policy Target Innovation Phase (Calgary)



Figures 1.12.1 & 1.12.2: Policy mix analysis graph on Policy Target Actor

Figure 1.12.1: Policy mix analysis graph on Policy Target Actor (Toronto)

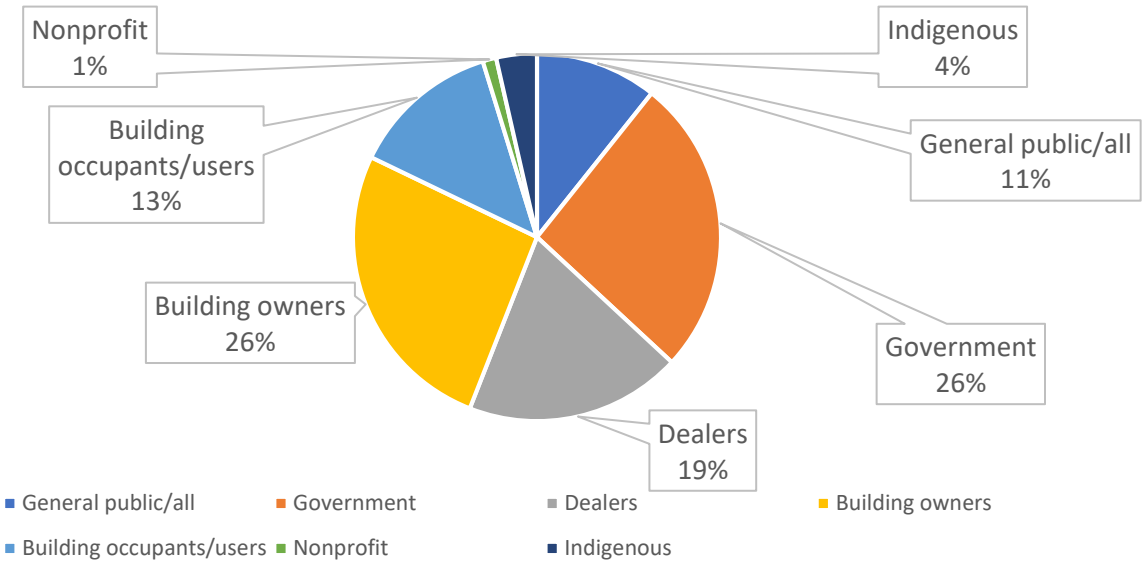
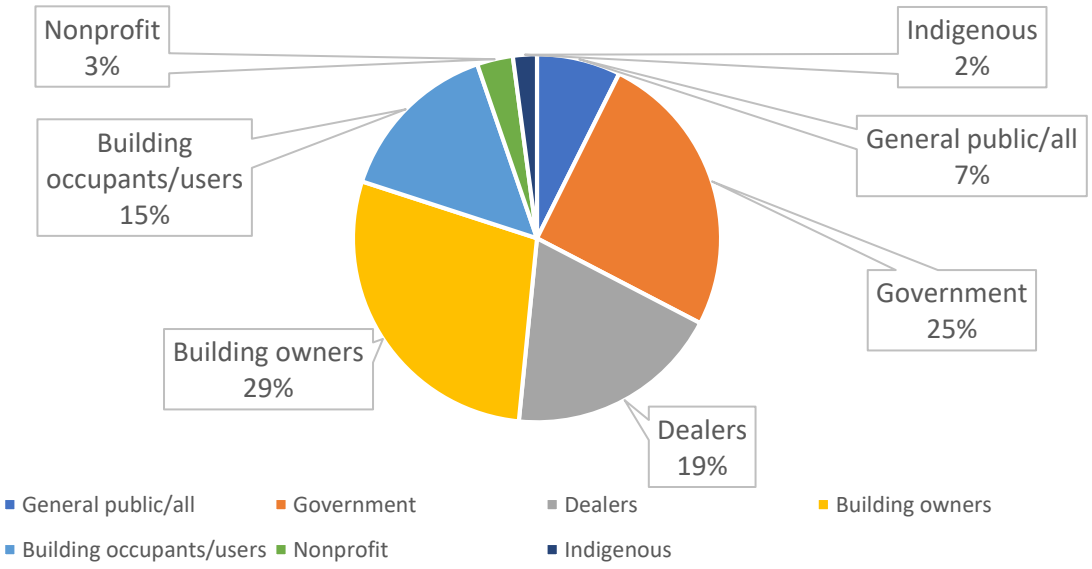
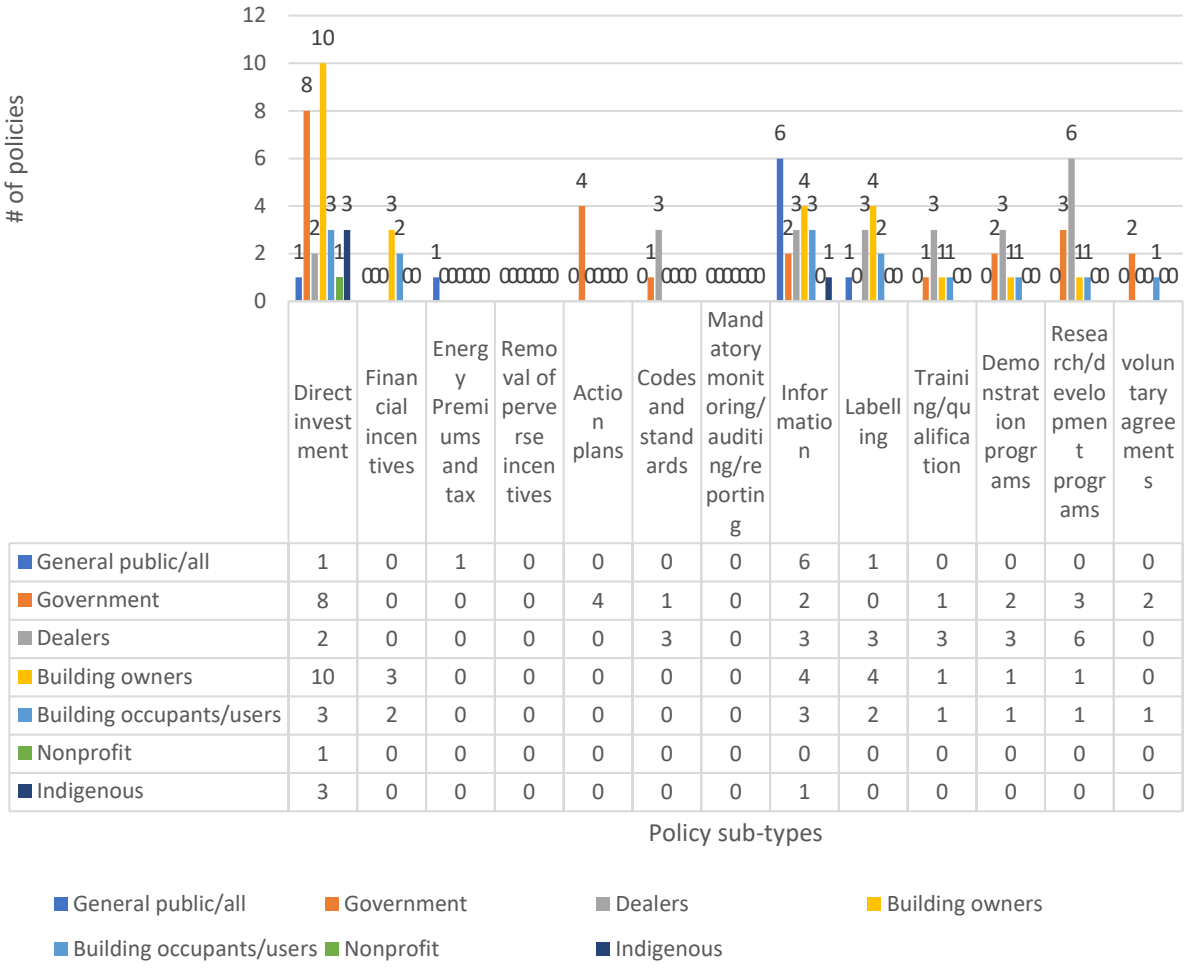


Figure 1.12.2: Policy mix analysis graph on Policy Target Actor (Calgary)



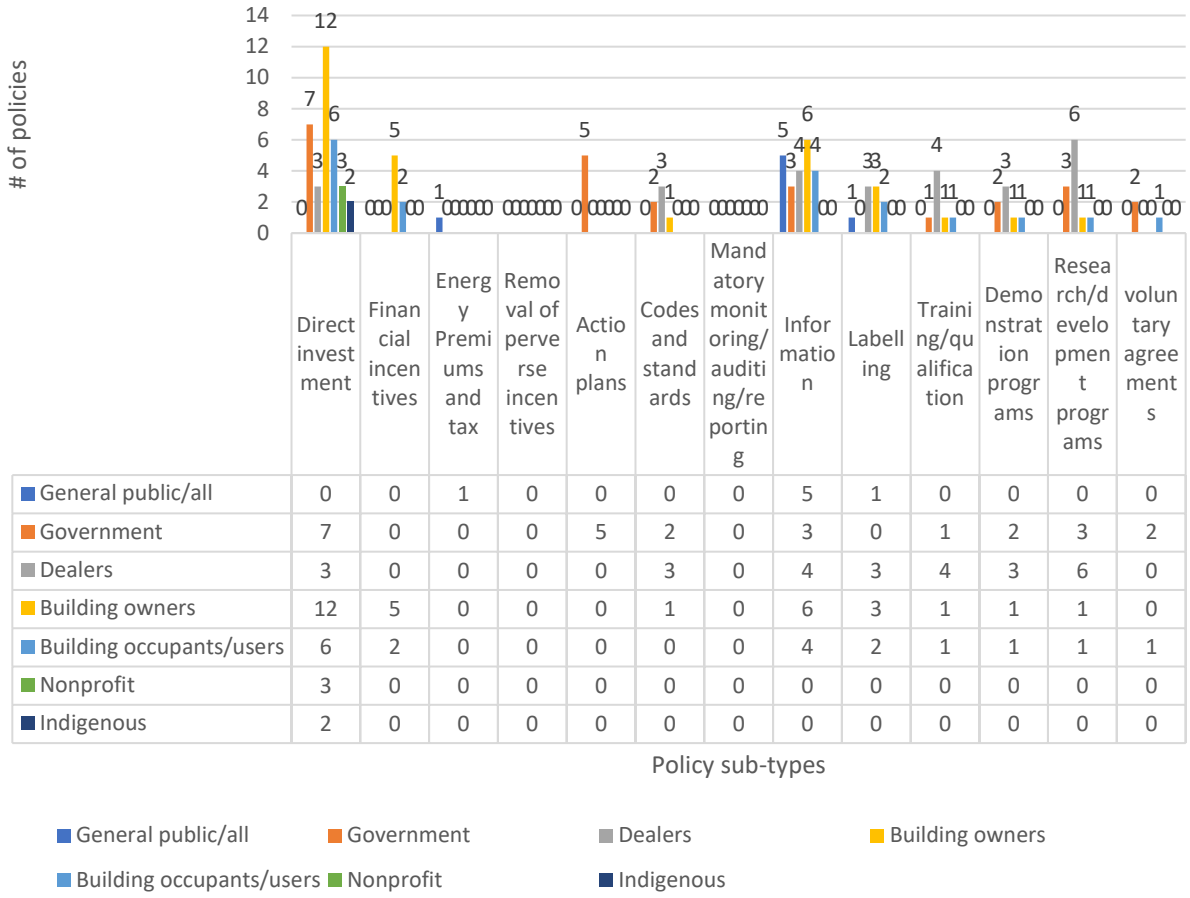
Figures 1.13.1 & 1.13.2: Policy mix analysis graph on Policy Target Actor by Policy Sub-Type

Figure 1.13.1: Policy mix analysis graph on Policy Sub-Type by Policy Target Actor (Toronto)



	Direct investment	Financial incentives	Energy Premiums and tax	Removal of perverse incentives	Action plans	Codes and standards	Mandatory monitoring/auditing/reporting	Information	Labelling	Training/qualification	Demonstration programs	Research/development programs	voluntary agreements
General public/all	1	0	1	0	0	0	0	6	1	0	0	0	0
Government	8	0	0	0	4	1	0	2	0	1	2	3	2
Dealers	2	0	0	0	0	3	0	3	3	3	3	6	0
Building owners	10	3	0	0	0	0	0	4	4	1	1	1	0
Building occupants/users	3	2	0	0	0	0	0	3	2	1	1	1	1
Nonprofit	1	0	0	0	0	0	0	0	0	0	0	0	0
Indigenous	3	0	0	0	0	0	0	1	0	0	0	0	0

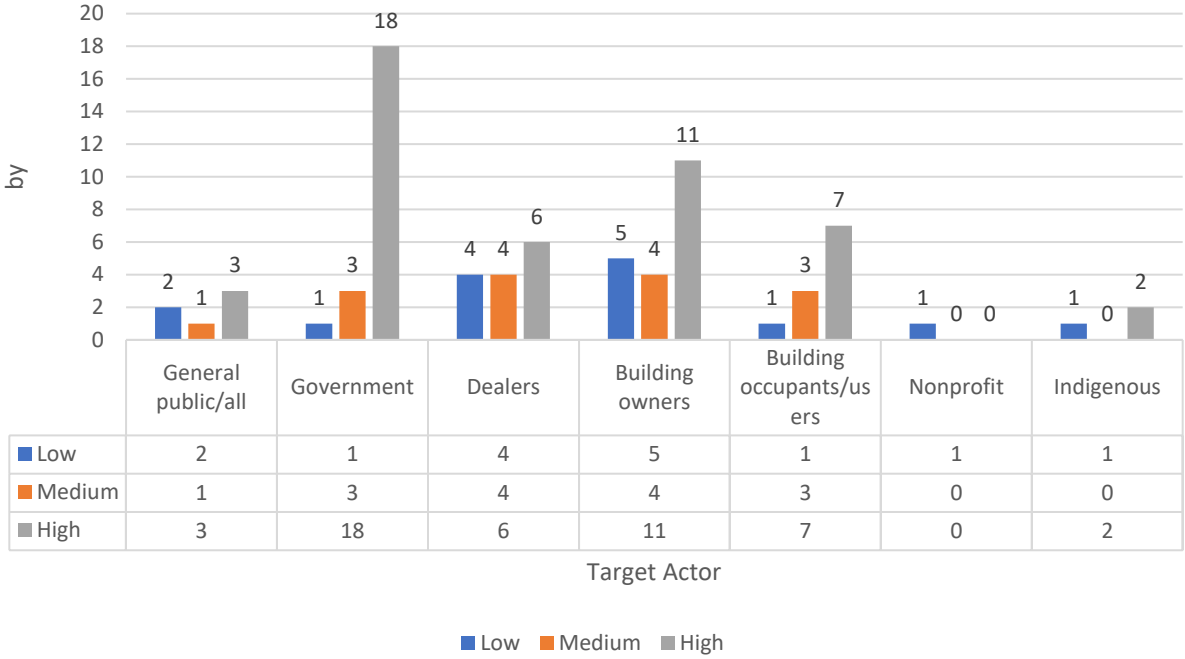
Figure 1.13.2: Policy mix analysis graph on Policy Sub-Type by Policy Target Actor (Calgary)



	Direct investment	Financial incentives	Energy Premiums and tax	Removal of perverse incentives	Action plans	Codes and standards	Mandatory monitoring/auditing/reporting	Information	Labelling	Training/qualification	Demonstration programs	Research/development programs	voluntary agreements
General public/all	0	0	1	0	0	0	0	5	1	0	0	0	0
Government	7	0	0	0	5	2	0	3	0	1	2	3	2
Dealers	3	0	0	0	0	3	0	4	3	4	3	6	0
Building owners	12	5	0	0	0	1	0	6	3	1	1	1	0
Building occupants/users	6	2	0	0	0	0	0	4	2	1	1	1	1
Nonprofit	3	0	0	0	0	0	0	0	0	0	0	0	0
Indigenous	2	0	0	0	0	0	0	0	0	0	0	0	0

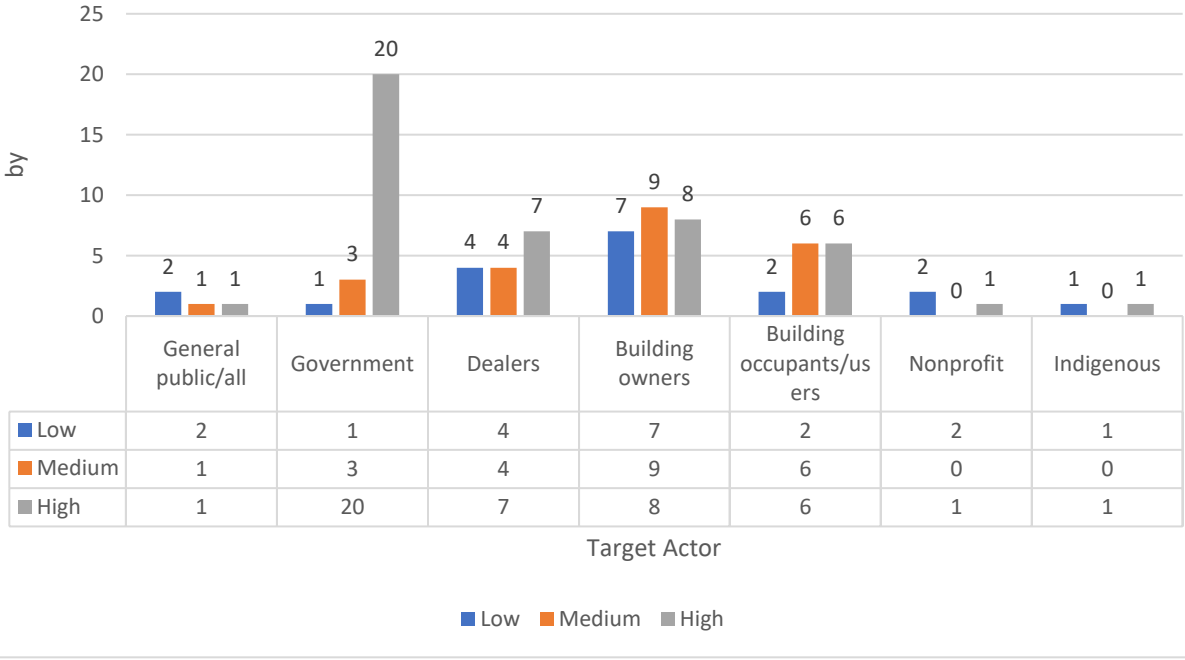
Figures 1.14.1 & 1.14.2: Policy mix analysis graph on Policy Target Actor by Policy Flexibility

Figure 1.14.1: Policy mix analysis graph on Policy Target Actor v. Policy Flexibility (Toronto)



	General public/all	Government	Dealers	Building owners	Building occupants/users	Nonprofit	Indigenous
Low	2	1	4	5	1	1	1
Medium	1	3	4	4	3	0	0
High	3	18	6	11	7	0	2

Figure 1.14.2: Policy mix analysis graph on Policy Target Actor v. Policy Flexibility (Calgary)



	General public/all	Government	Dealers	Building owners	Building occupants/users	Nonprofit	Indigenous
Low	2	1	4	7	2	2	1
Medium	1	3	4	9	6	0	0
High	1	20	7	8	6	1	1

Figures 1.15.1.1 & 1.15.2.1: Policy mix analysis graph on Policy Target Building Type

Figure 1.5.1.1: Policy mix analysis graph on Policy Target Building Type (Toronto)

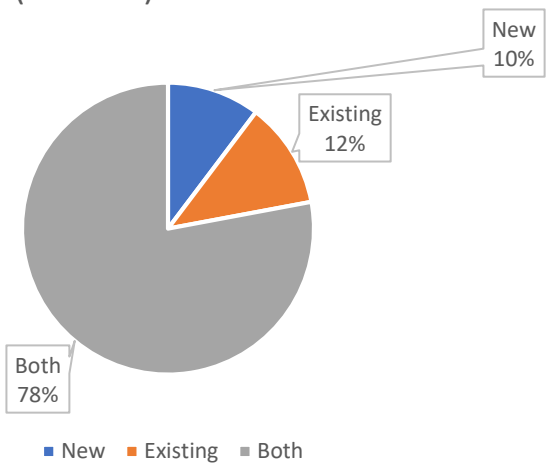
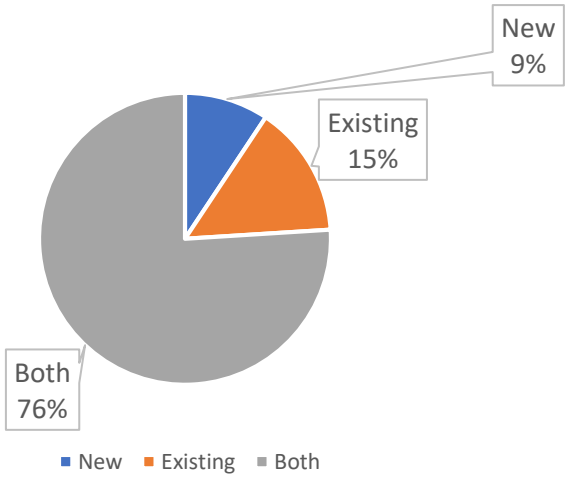


Figure 1.5.2.1: Policy mix analysis graph on Policy Target Building Type (Calgary)



Figures 1.15.1.2 & 1.15.2.2: Policy mix analysis graph on Policy Target Building Type

Figure 1.15.2.1: Policy mix analysis graph on policy Target Building Type (Toronto)

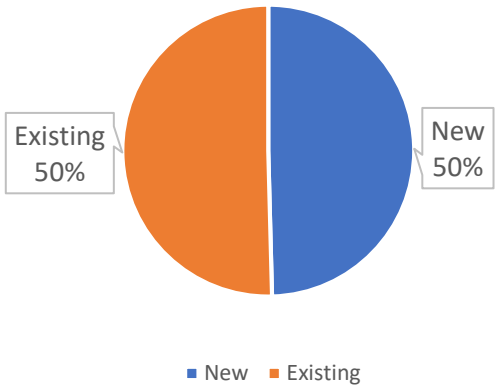
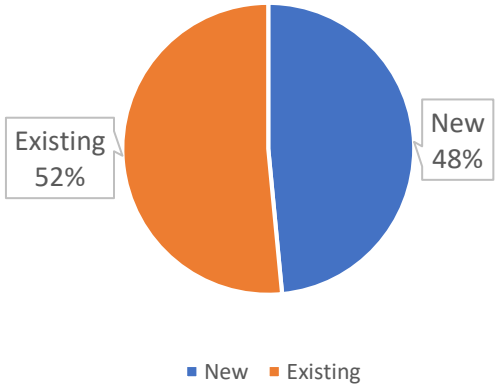


Figure 1.15.2.2: Policy mix analaysis graph on Policy Target Building Type (Calgary)



Figures 1.16.1 & 1.16.2: Policy mix analysis graph on Policy Energy Efficiency Exclusivity

Figure 1.2.1.1: Policy mix analysis graph on Policy Energy Efficiency Exclusivity (Toronto)

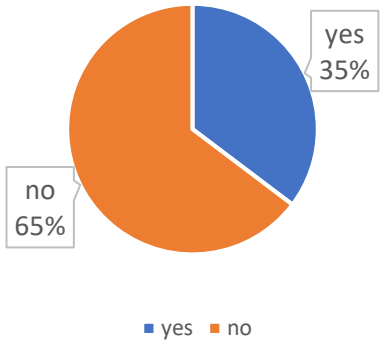
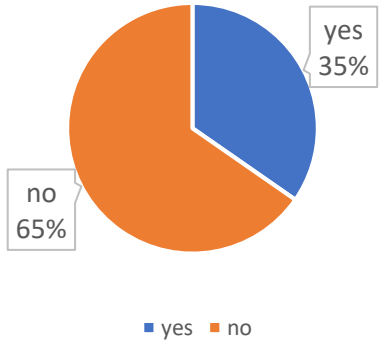


Figure 1.2.2.1: Policy mix analysis graph on Policy Energy Efficiency Exclusivity (Calgary)



Figures 1.17.1 & 1.17.2: Policy mix analysis graph on Policy Energy Efficiency in Buildings Exclusivity

Figure 1.2.1.2: Policy mix analysis graph on Policy Energy Efficiency in Buildings Exclusivity (Toronto)

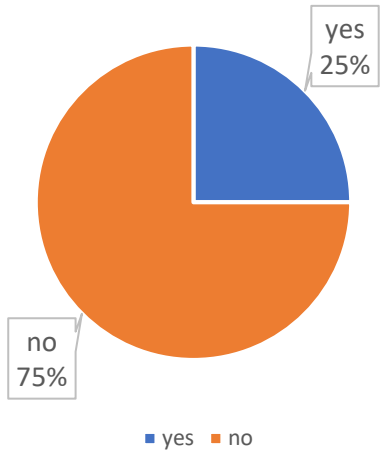
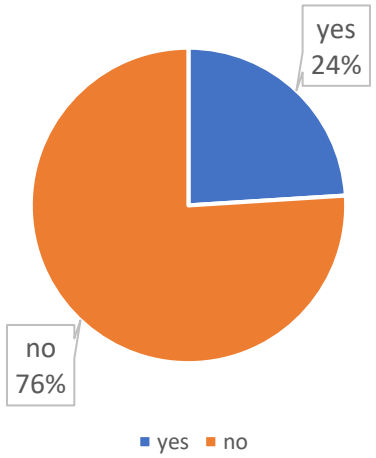


Figure 1.2.2.2: Policy mix analysis graph on Policy Energy Efficiency in Buildings Exclusivity (Calgary)



Section 2: Policy mixes developed but not discussed in this paper

Figure 2.1.1.1: Policy mix analysis graph on Regime Creation or Destruction (Toronto)

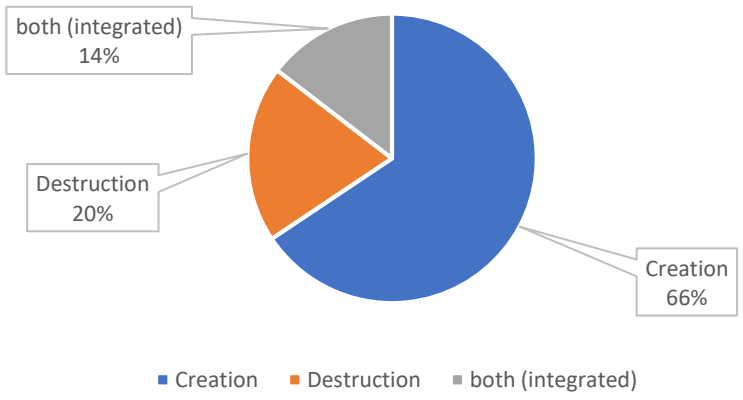


Figure 2.1.2.1: Policy mix analysis graph on Regime Creation or Destruction (Calgary)

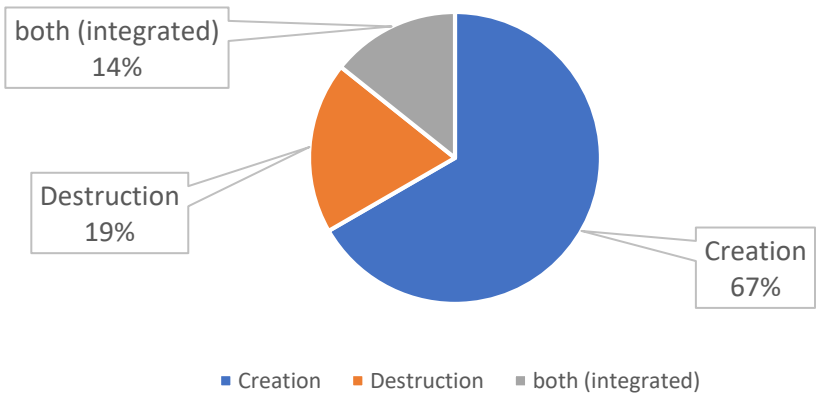
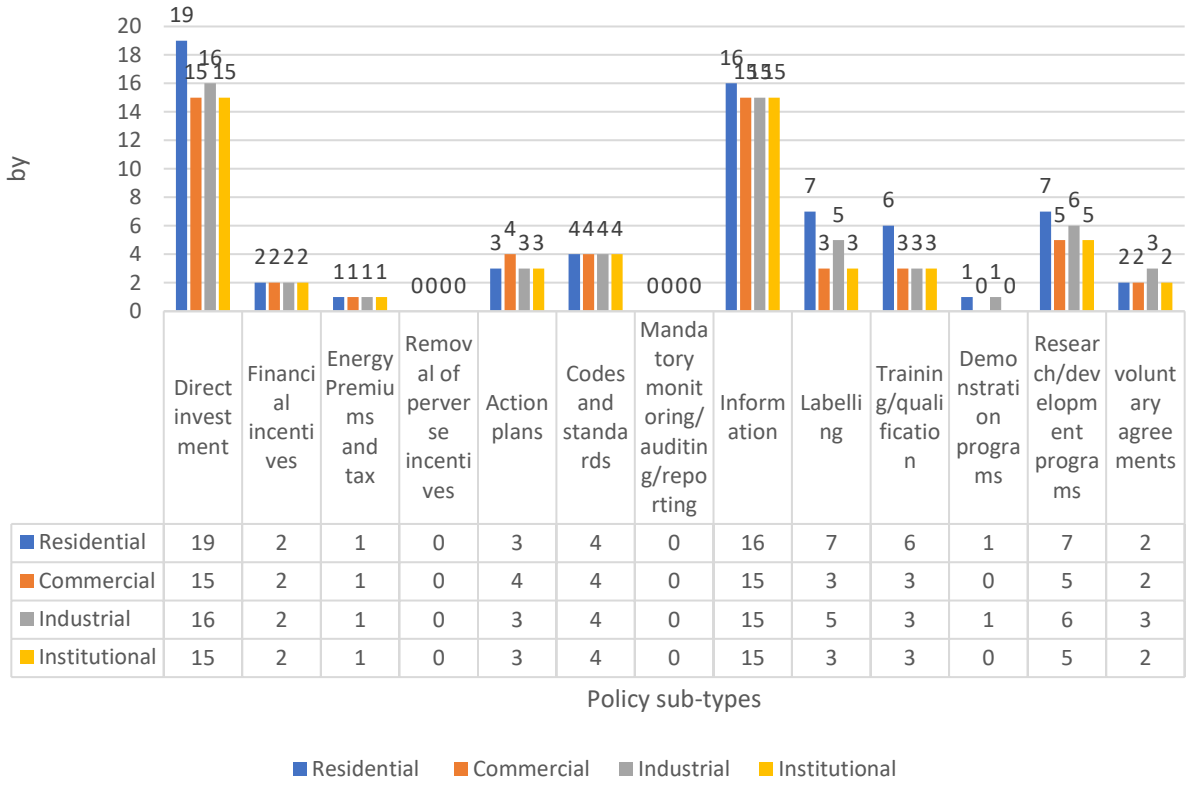
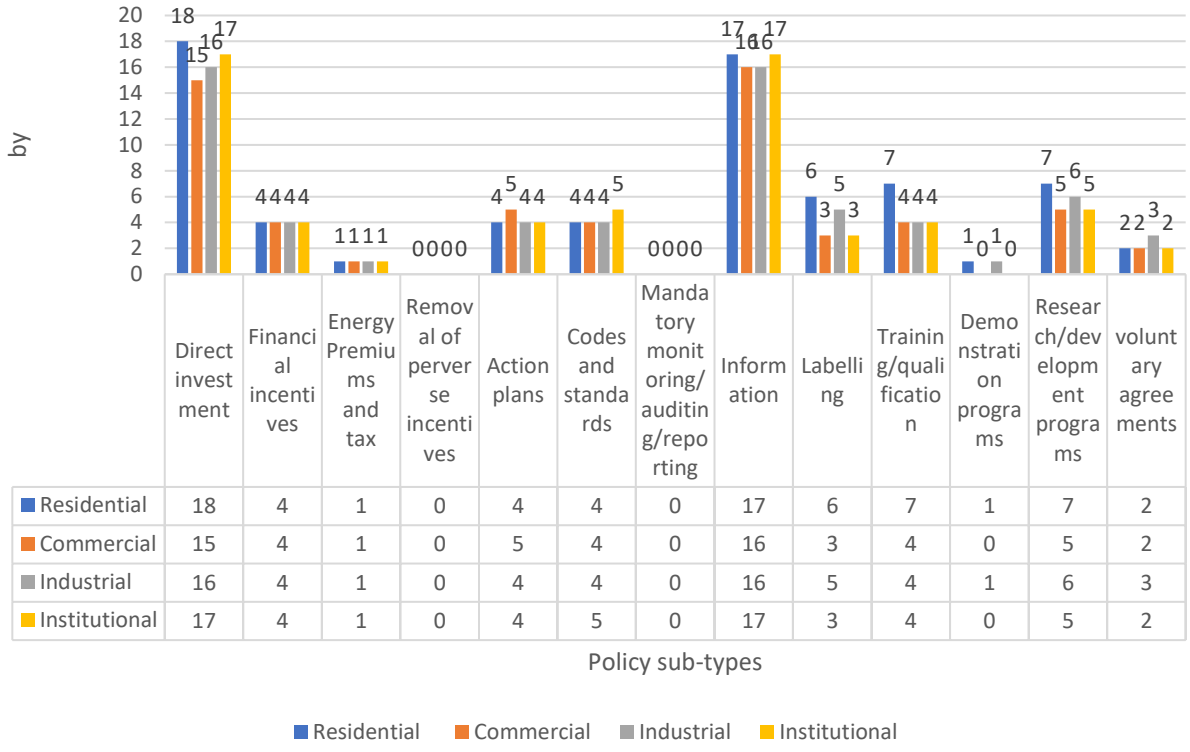


Figure 2.2.1: Policy mix analysis graph on Policy Sub-Type v. Policy Target Building Sector (Toronto)



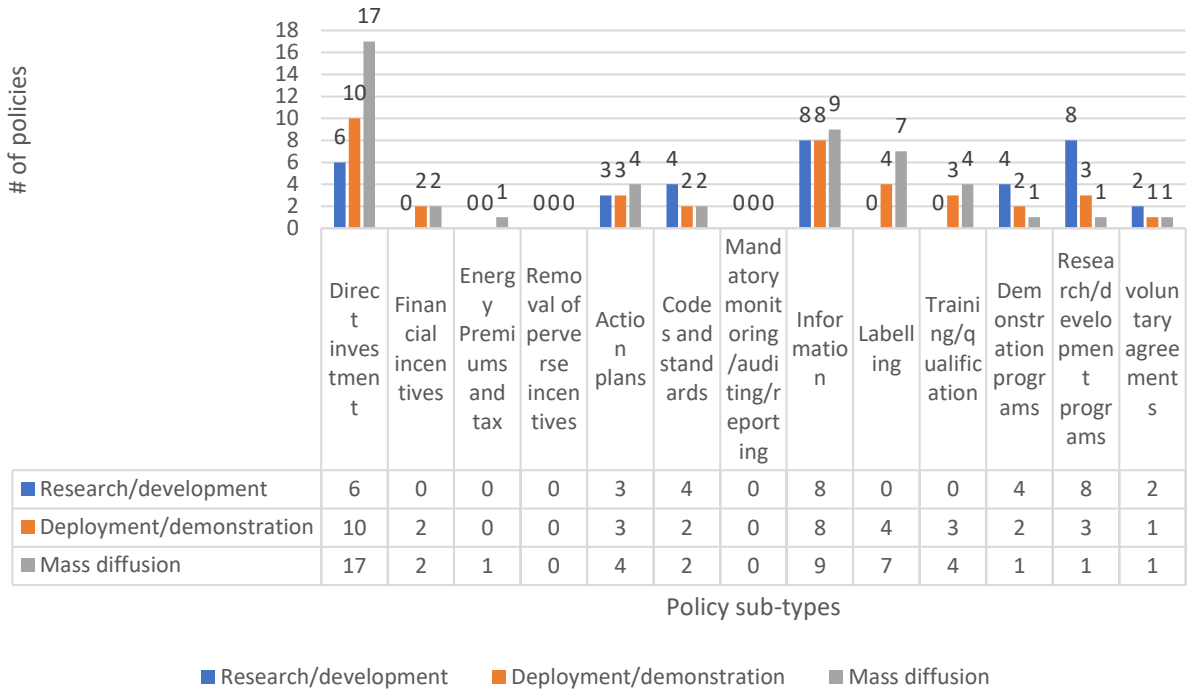
	Direct investment	Financial incentives	Energy Premiums and tax	Removal of perverse incentives	Action plans	Codes and standards	Mandatory monitoring/ auditing/reporting	Information	Labelling	Training/qualification	Demonstration programs	Research/development programs	voluntary agreements
Residential	19	2	1	0	3	4	0	16	7	6	1	7	2
Commercial	15	2	1	0	4	4	0	15	3	3	0	5	2
Industrial	16	2	1	0	3	4	0	15	5	3	1	6	3
Institutional	15	2	1	0	3	4	0	15	3	3	0	5	2

Figure 2.2.2: Policy mix analysis graph on Policy Sub-Type v. Policy Target Building Sector (Calgary)



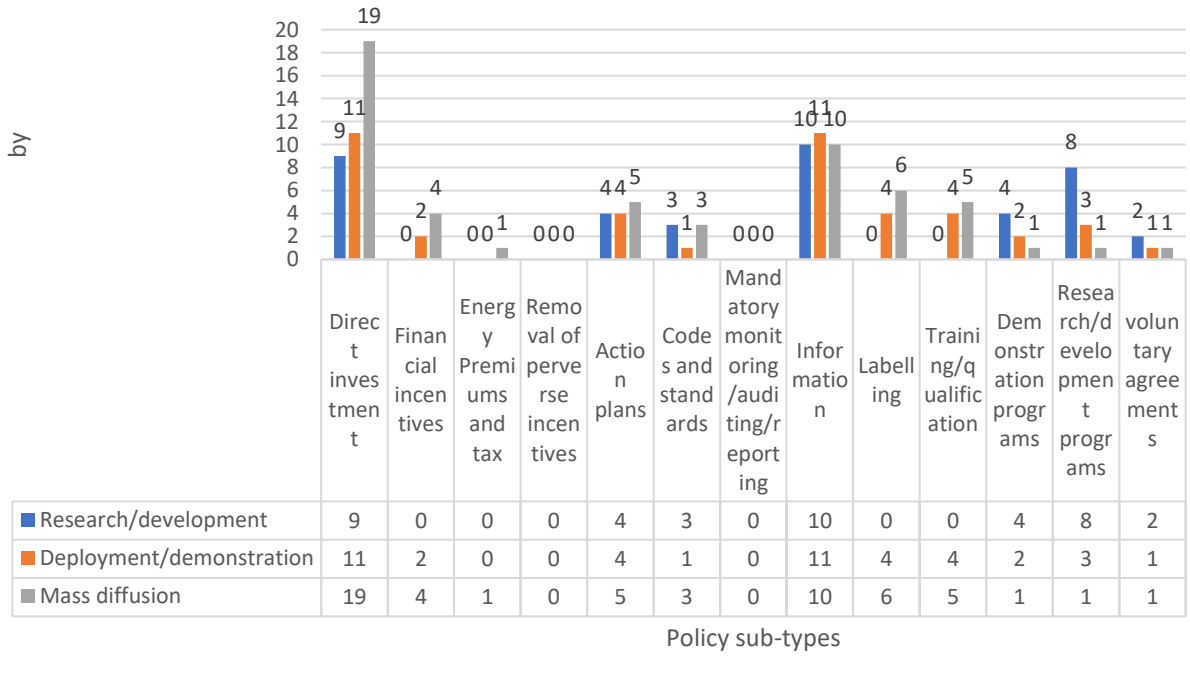
	Direct investment	Financial incentives	Energy Premiums and tax	Removal of perverse incentives	Action plans	Codes and standards	Mandatory monitoring/auditing/reporting	Information	Labelling	Training/qualification	Demonstration programs	Research/development programs	voluntary agreements
Residential	18	4	1	0	4	4	0	17	6	7	1	7	2
Commercial	15	4	1	0	5	4	0	16	3	4	0	5	2
Industrial	16	4	1	0	4	4	0	16	5	4	1	6	3
Institutional	17	4	1	0	4	5	0	17	3	4	0	5	2

Figure 2.3.1: Policy mix analysis graph on Policy Sub-Types by Policy Target Innovation Phase (Toronto)



	Direct investment	Financial incentives	Energy Premiums and tax	Removal of perverse incentives	Action plans	Codes and standards	Mandatory monitoring/auditing/reporting	Information	Labelling	Training/qualification	Demonstration programs	Research/development programs	voluntary agreements
Research/development	6	0	0	0	3	4	0	8	0	0	4	8	2
Deployment/demonstration	10	2	0	0	3	2	0	8	4	3	2	3	1
Mass diffusion	17	2	1	0	4	2	0	9	7	4	1	1	1

Figure 2.3.2: Policy mix analysis graph on Policy Sub-Types v. Policy Target Innovation Phase (Calgary)



	Direct investment	Financial incentives	Energy Premiums and tax	Removal of perverse incentives	Action plans	Codes and standards	Mandatory monitoring/auditing/reporting	Information	Labelling	Training/qualification	Demonstration programs	Research/development programs	voluntary agreements
Research/development	9	0	0	0	4	3	0	10	0	0	4	8	2
Deployment/demonstration	11	2	0	0	4	1	0	11	4	4	2	3	1
Mass diffusion	19	4	1	0	5	3	0	10	6	5	1	1	1

Figure 2.4.1: Policy mix analysis graph on Policy Sub-types v. Policy Target Building Types (Toronto)

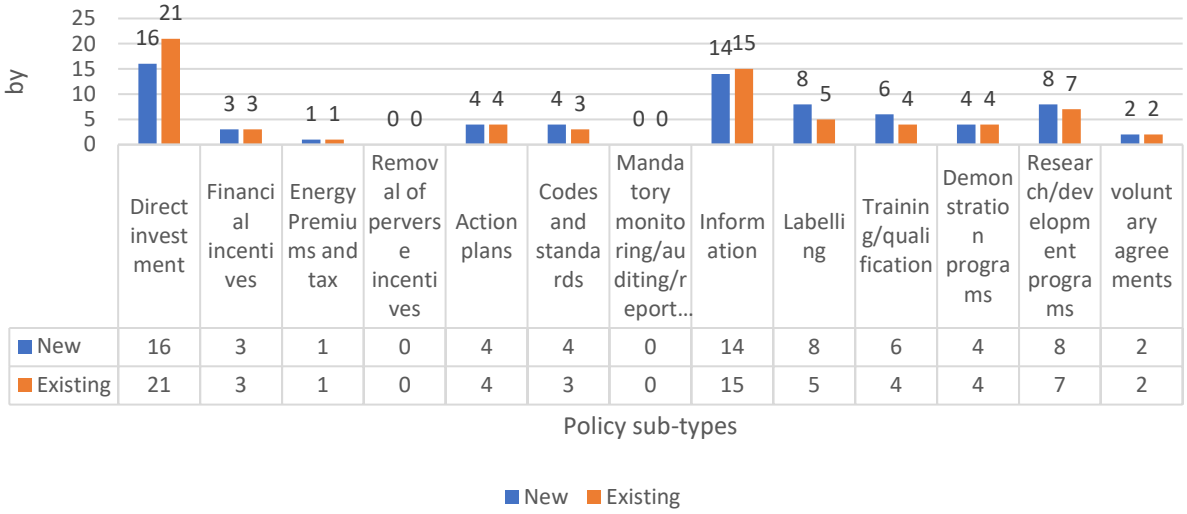


Figure 2.4.2: Policy mix analysis graph on Policy Sub-types by Policy Target Building Types (Calgary)

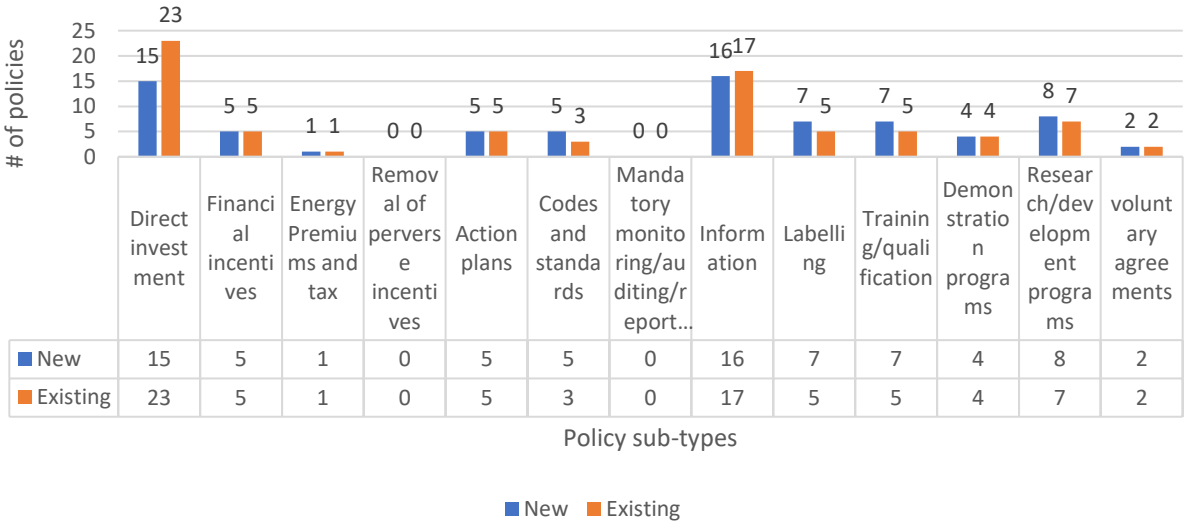


Figure 2.5.1: Policy mix analysis graph on Target Building Sector by Regime Creation or Desturction Policy (Toronto)

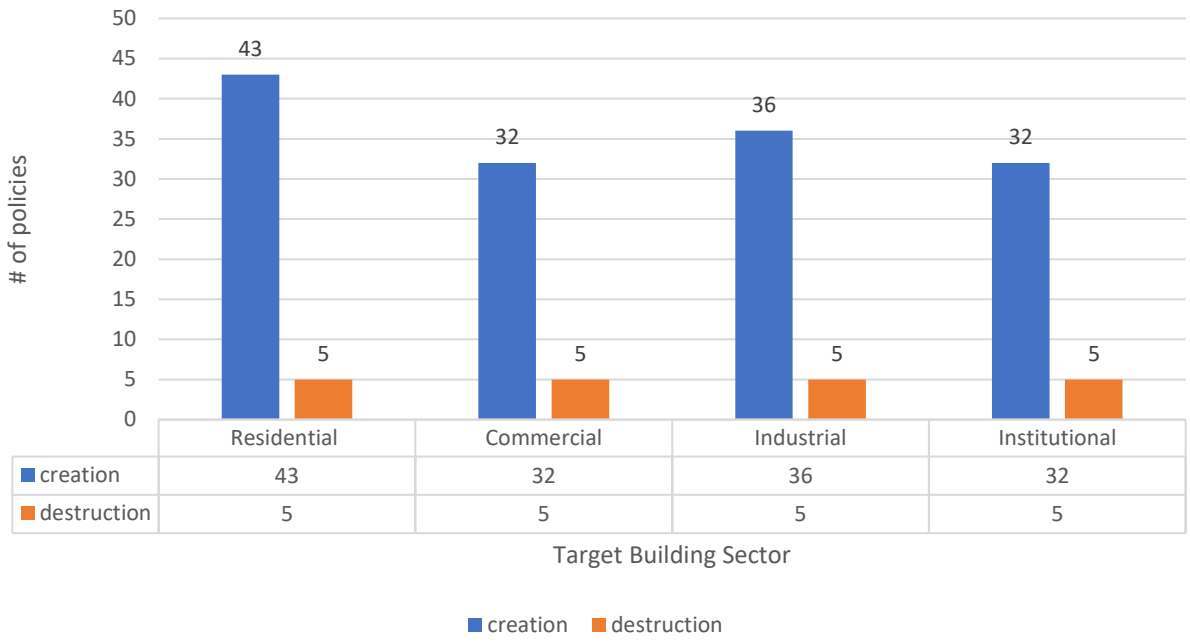


Figure 2.5.2: Policy Target Building Sector v. Regime Creation or Desturction Policy (Calgary)

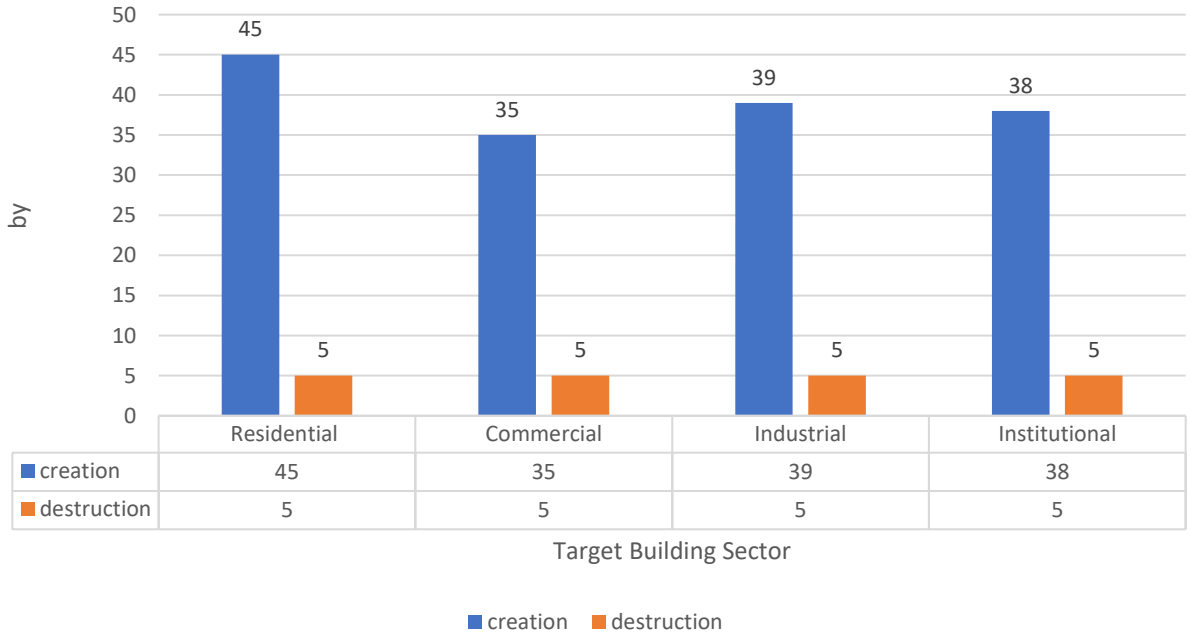


Figure 2.6.1: Policy Target Building Type by Regime Creation or Destruction Policy (Toronto)

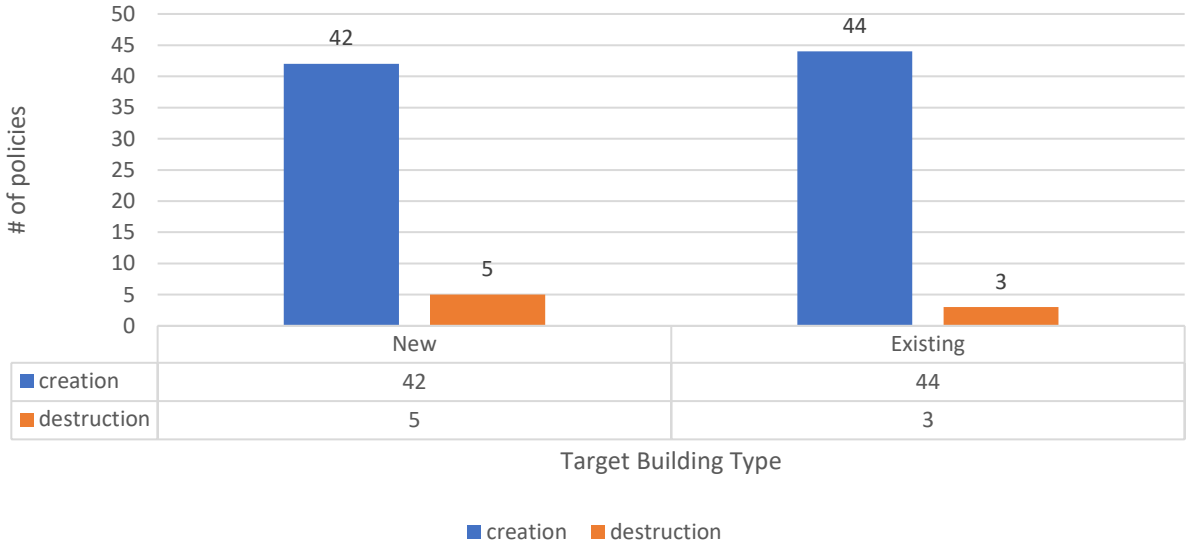


Figure 2.6.2: Policy Target Building Type by Regime Creation or Destruction Policy (Calgary)

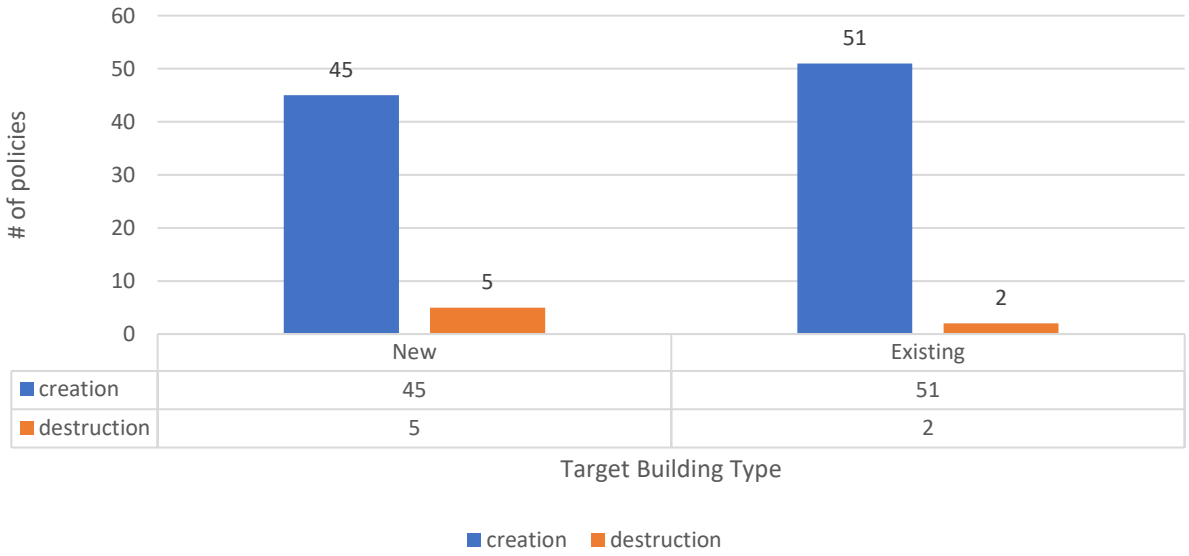


Figure 2.7.1: Policy mix analysis graph on Policy Target Building Sector v. Policy Flexibility (Toronto)

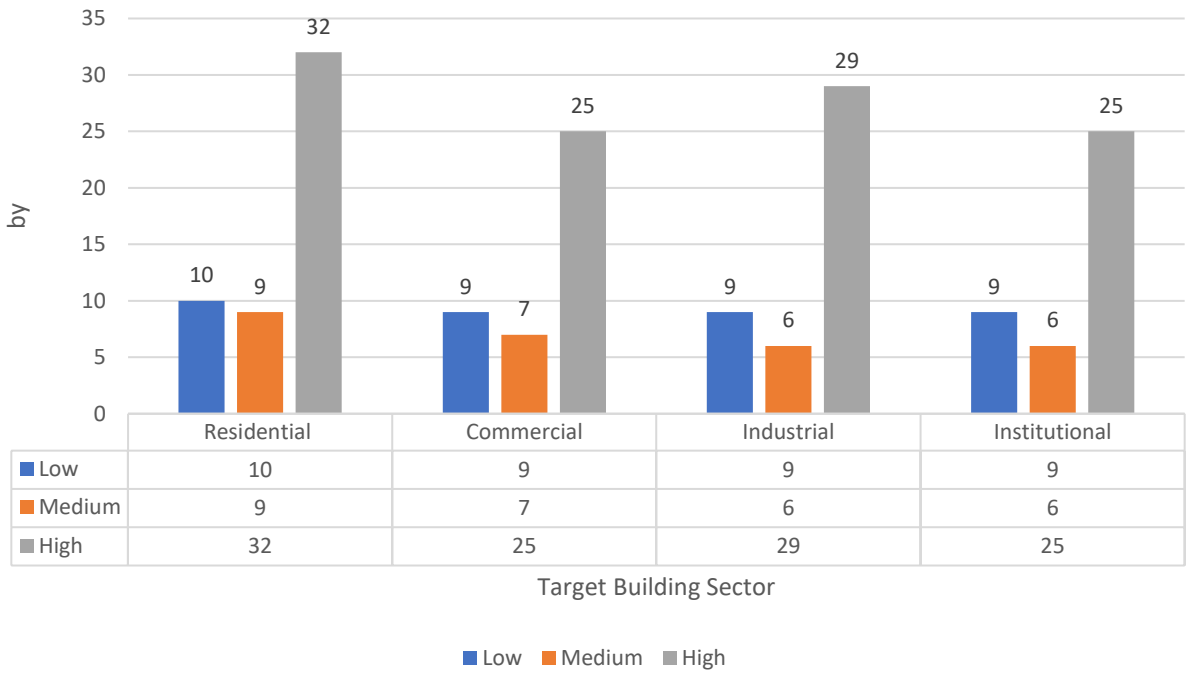


Figure 2.7.2: Policy mix analysis graph on Policy Target Building Sector by Policy Flexibility (Calgary)

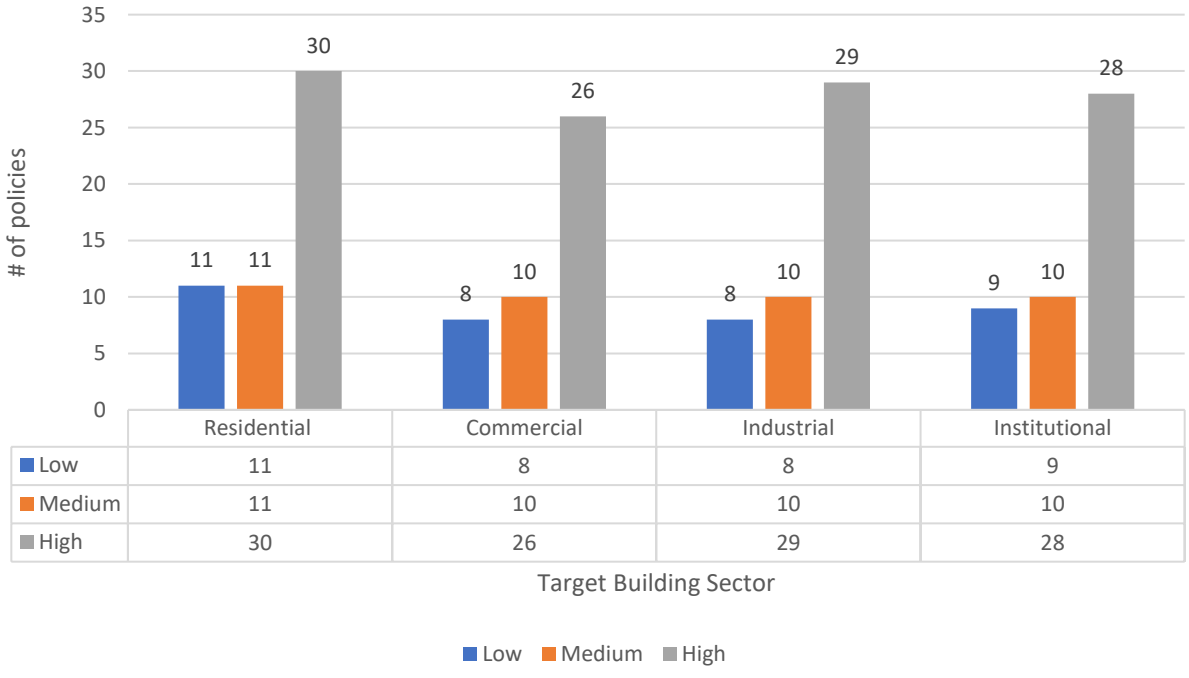


Figure 2.8.1: Policy mix analysis graph on Policy Target Innovation Phase by Policy Flexibility (Toronto)

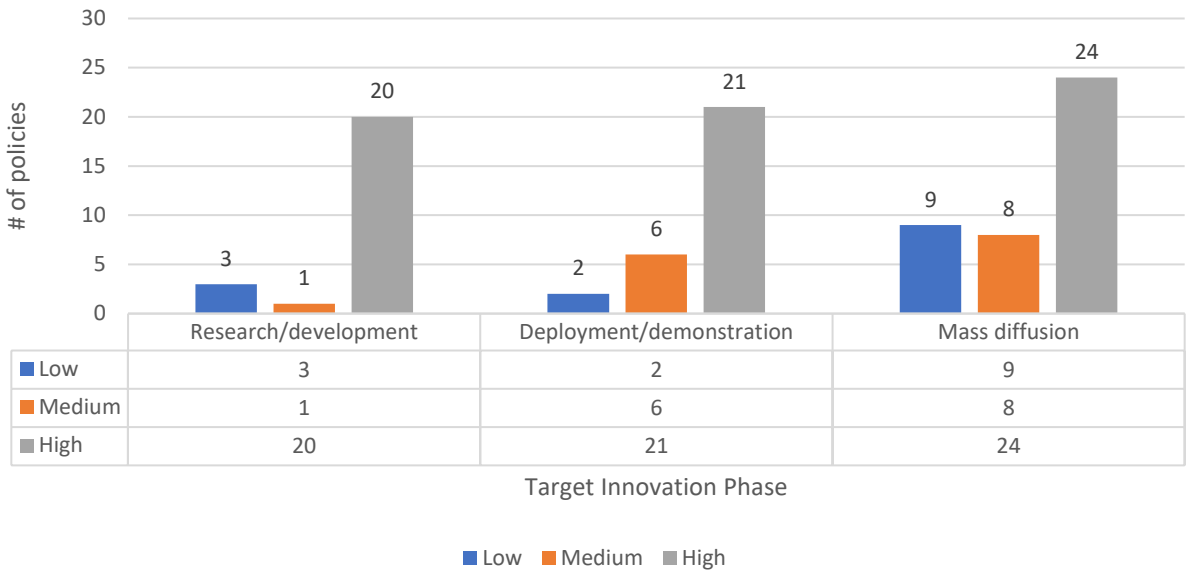


Figure 2.8.2: Policy mix analysis graph on Policy Target Innovation Phase by Policy Flexibility (Calgary)

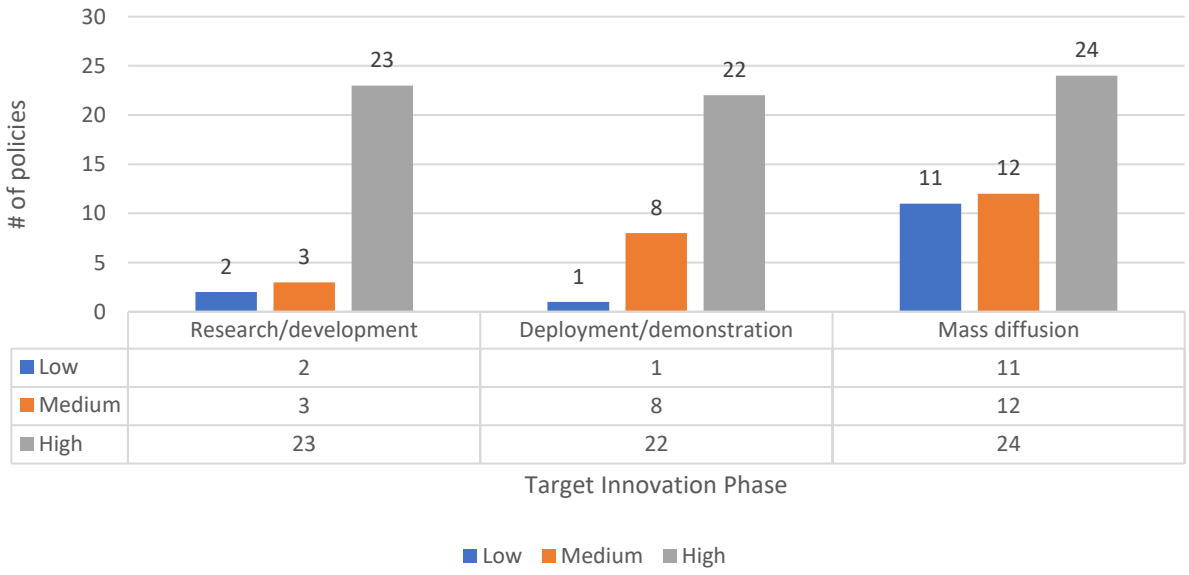


Figure 2.9.1: Policy mix analysis graph on Policy Flexibility by Policy Target Building Type (Toronto)

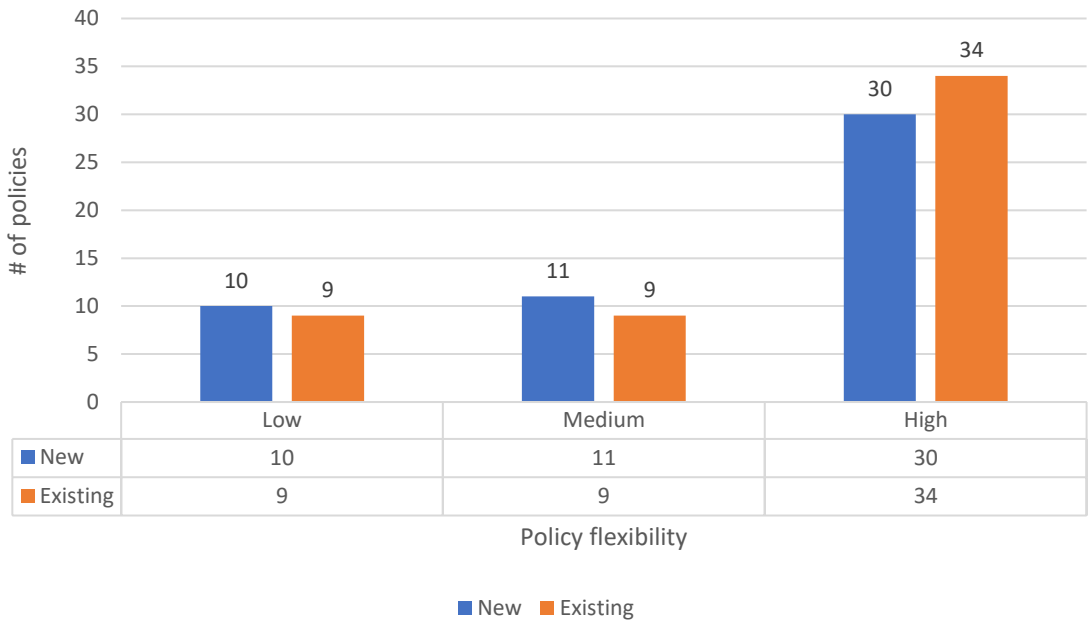


Figure 2.9.2: Policy mix analysis graph on Policy Flexibility v. Policy Target Building Type (Calgary)

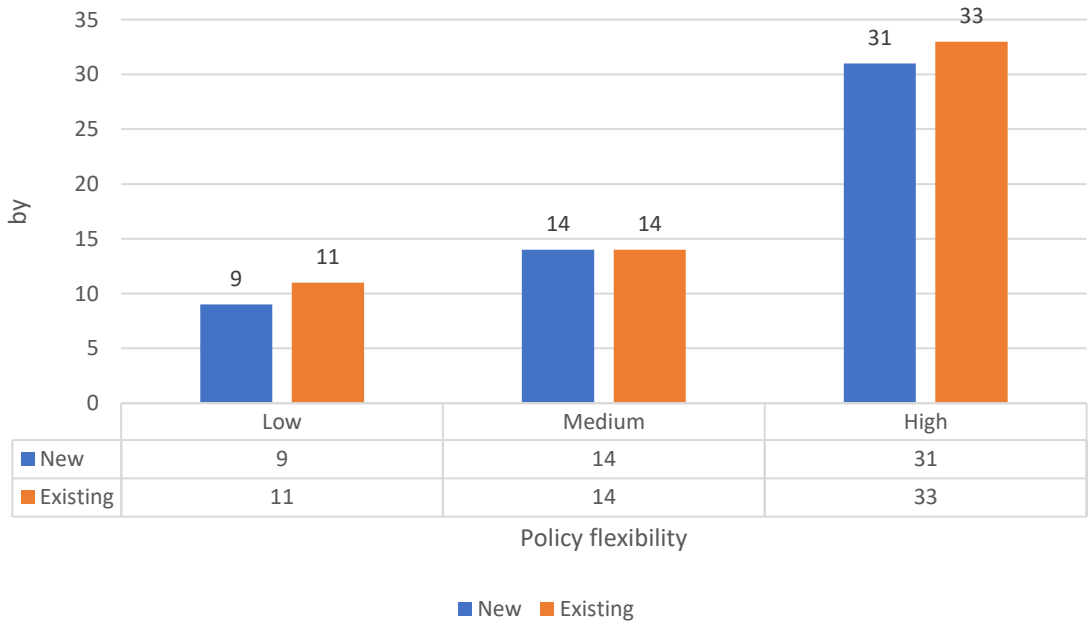
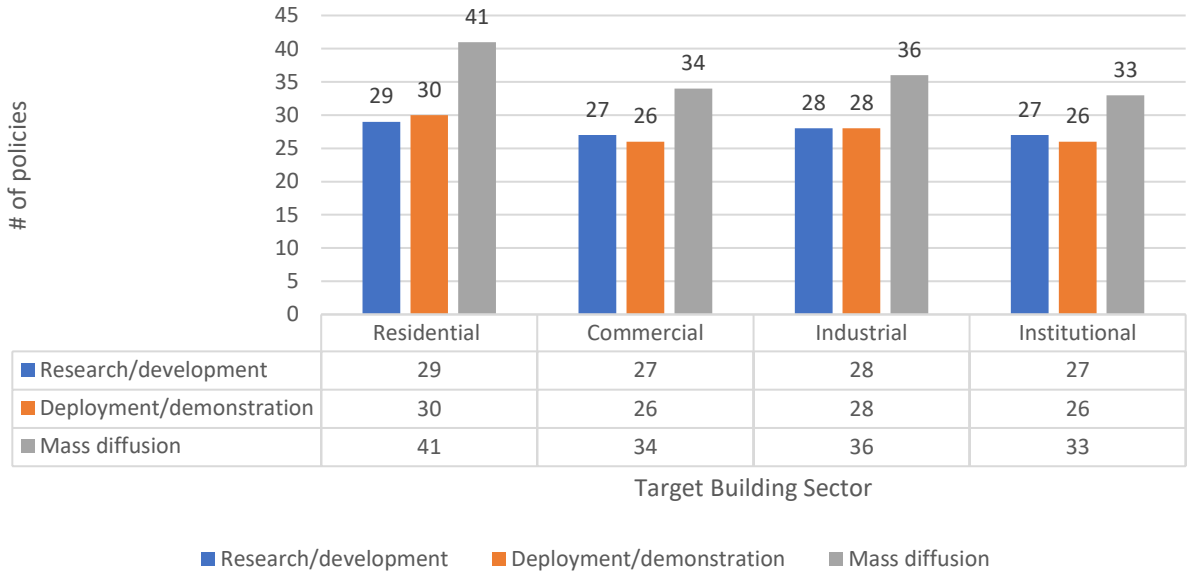
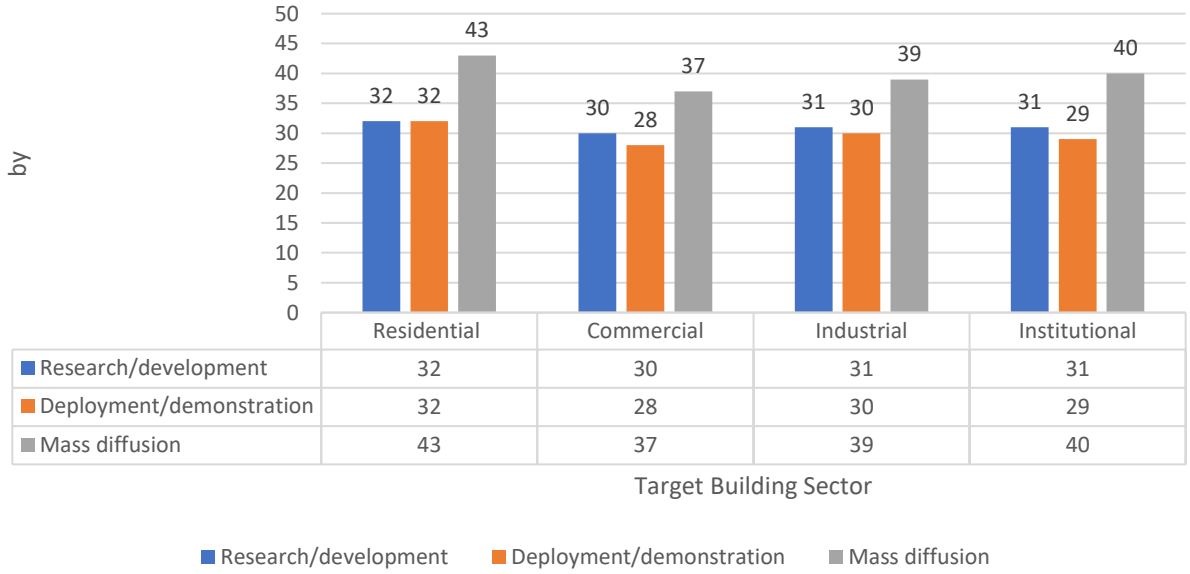


Figure 2.10.1: Policy mix analysis graph on Policy Target Building Sector by Policy Target Innovation Phase (Toronto)



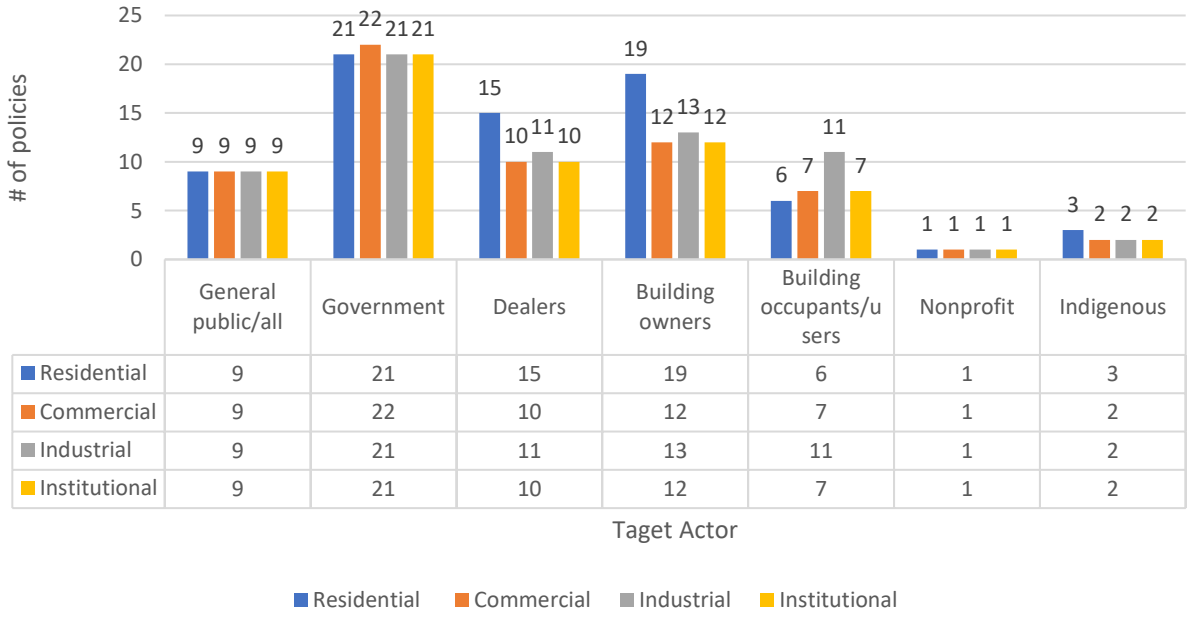
	Residential	Commercial	Industrial	Institutional
Research/development	29	27	28	27
Deployment/demonstration	30	26	28	26
Mass diffusion	41	34	36	33

Figure 2.10.2: Policy mix analysis graph on Policy Target Building Sector v. Policy Target Innovation Phase (Calgary)



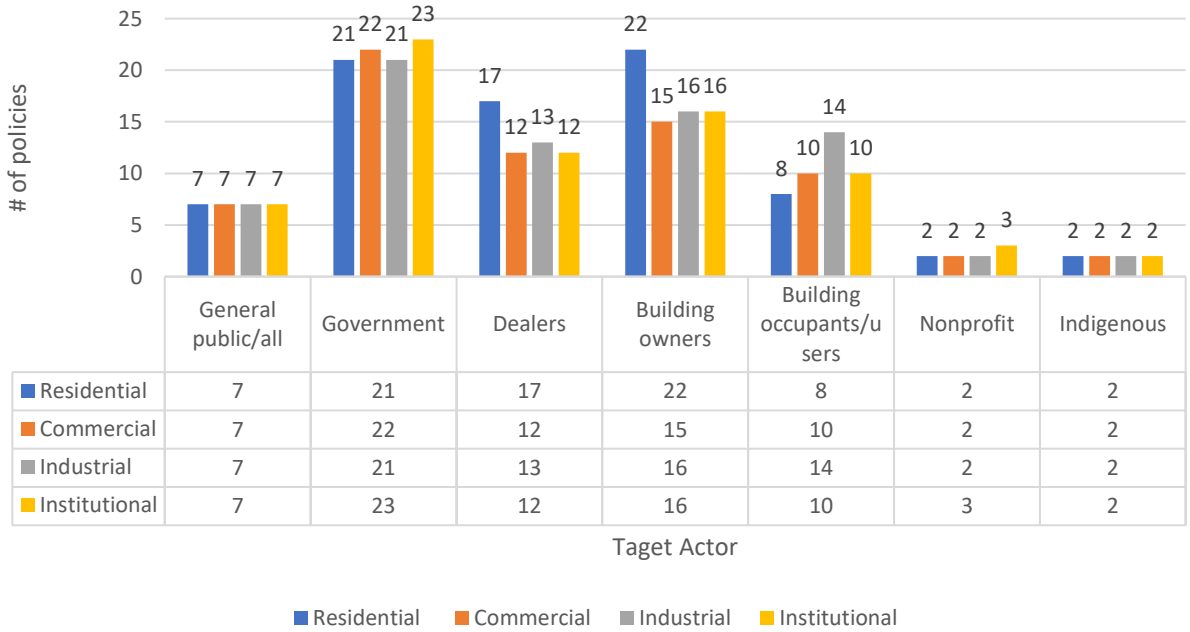
	Residential	Commercial	Industrial	Institutional
Research/development	32	30	31	31
Deployment/demonstration	32	28	30	29
Mass diffusion	43	37	39	40

Figure 2.11.1: Policy mix analysis graph on Policy Taget Actor by Policy Target Building Sector (Toronto)



	General public/all	Government	Dealers	Building owners	Building occupants/users	Nonprofit	Indigenous
Residential	9	21	15	19	6	1	3
Commercial	9	22	10	12	7	1	2
Industrial	9	21	11	13	11	1	2
Institutional	9	21	10	12	7	1	2

Figure 2.11.2: Policy mix analysis graph on Policy Taget Actor by Policy Target Building Sector (Calgary)



	General public/all	Government	Dealers	Building owners	Building occupants/users	Nonprofit	Indigenous
Residential	7	21	17	22	8	2	2
Commercial	7	22	12	15	10	2	2
Industrial	7	21	13	16	14	2	2
Institutional	7	23	12	16	10	3	2

Figure 2.12.1: Policy mix analysis graph on Policy Target Building Sector by Policy Target Building Type (Toronto)

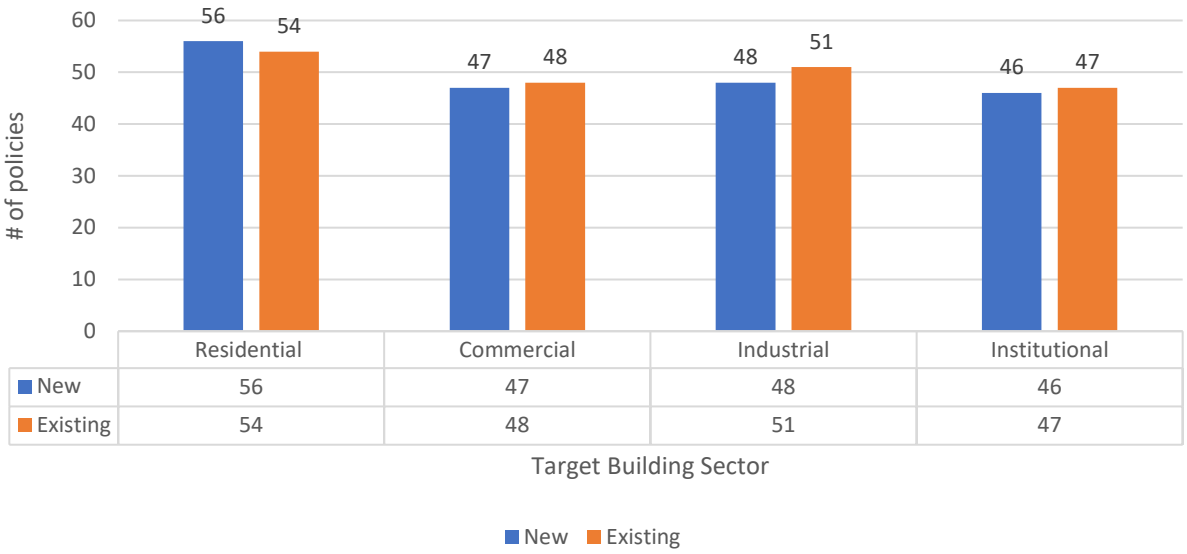


Figure 2.12.2: Policy mix analysis graph on Policy Target Building Sector by Policy Target Building Type (Calgary)

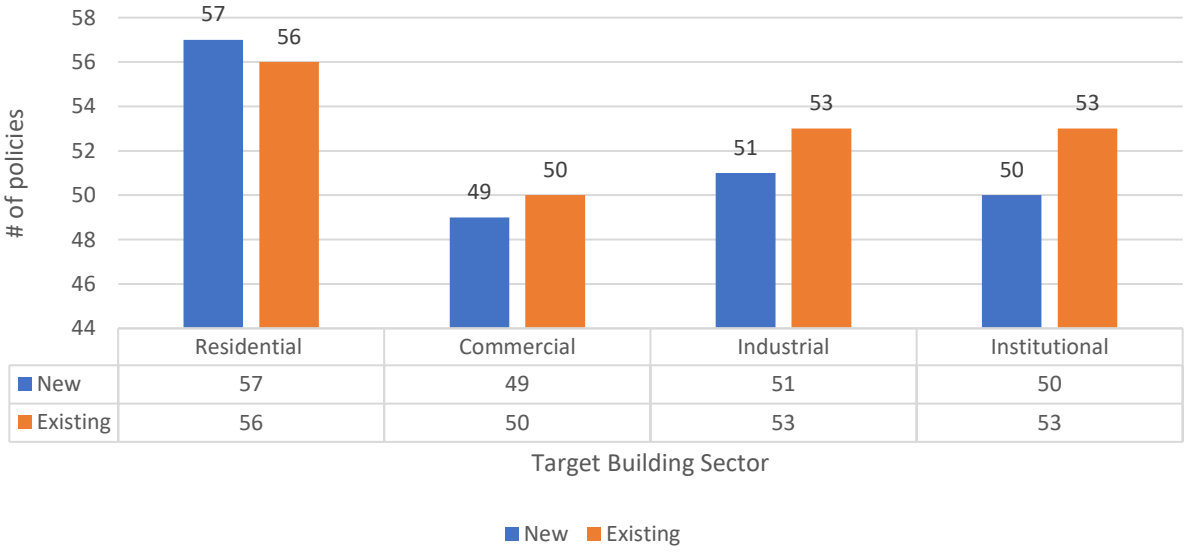


Figure 2.13.1: Policy mix analysis graph on Policy Target Actor by Policy Target Building Type (Toronto)

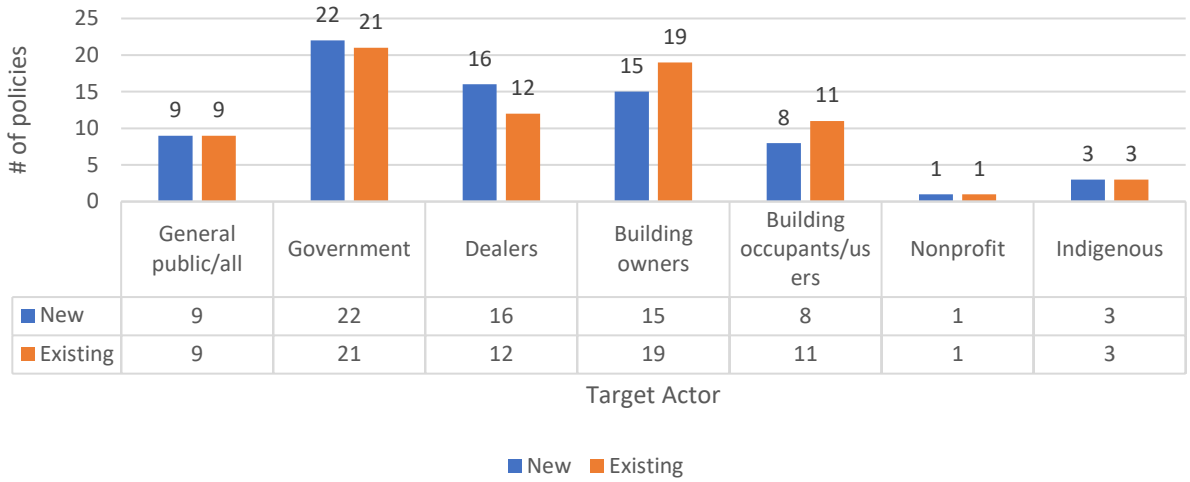


Figure 2.13.2: Policy mix analysis graph on Policy Target Actor v. Policy Target Building Type

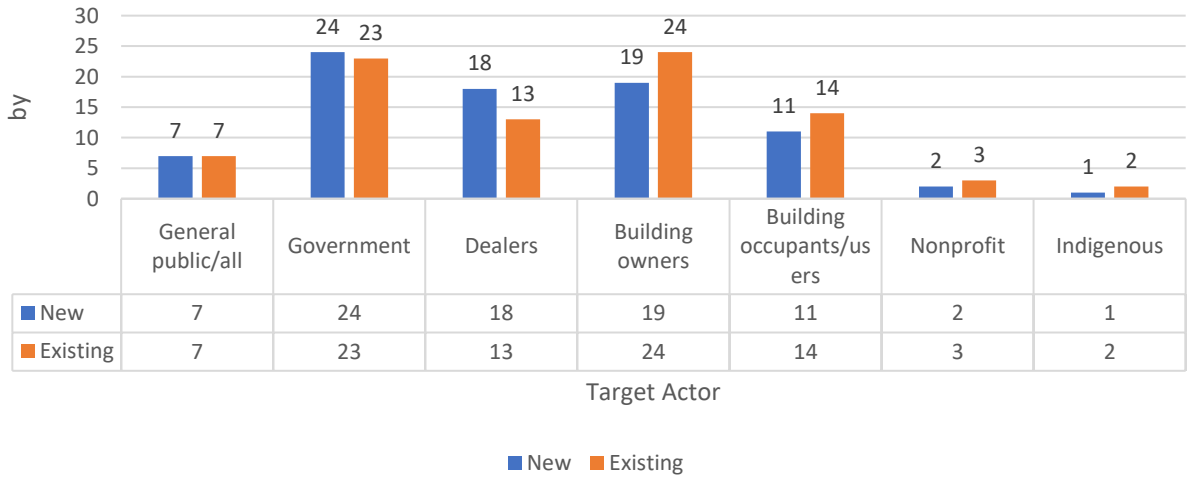


Figure 2.14.1: Policy mix analysis graph on Policy Target Consumer Decision Making Process Component by Policy Time Hoirzon (Toronto)

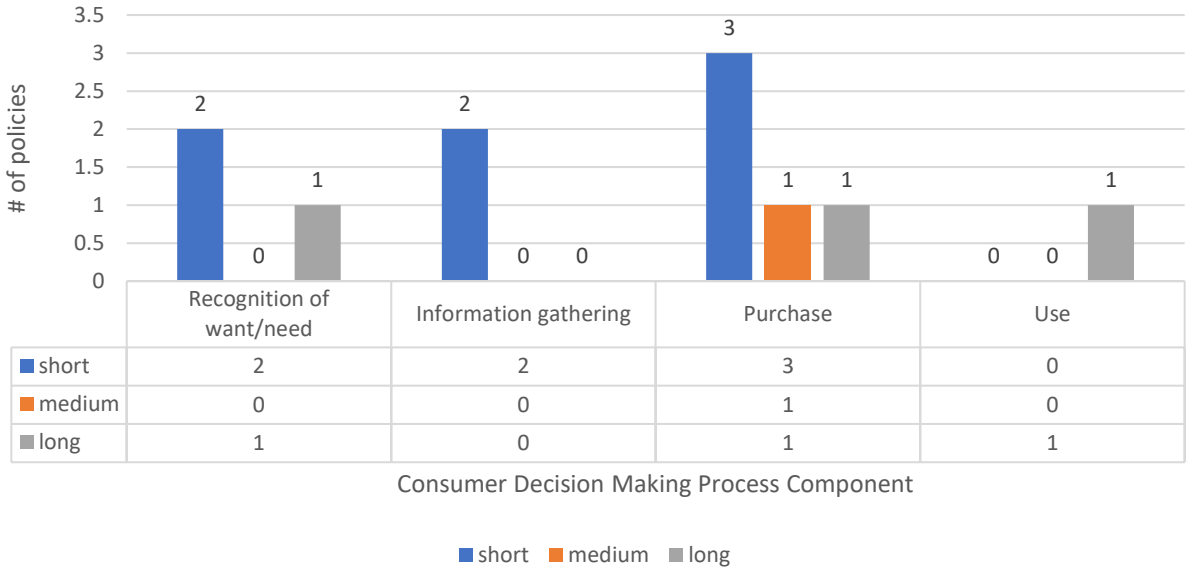


Figure 2.14.2: Policy mix analysis graph on Policy Target Consumer Decision Making Process Component v. Policy Time Hoirzon (Calgary)

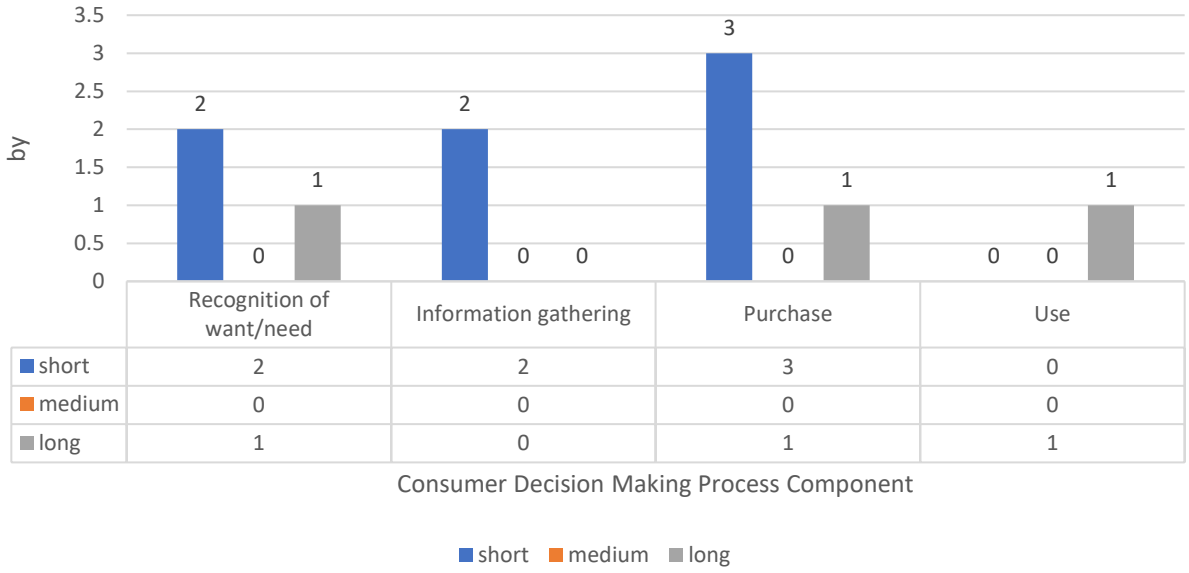


Figure 2.15.1: Policy mix analysis graph on Policy Target Consumer Decision Making Process Component by Policy Target Building Type (Toronto)

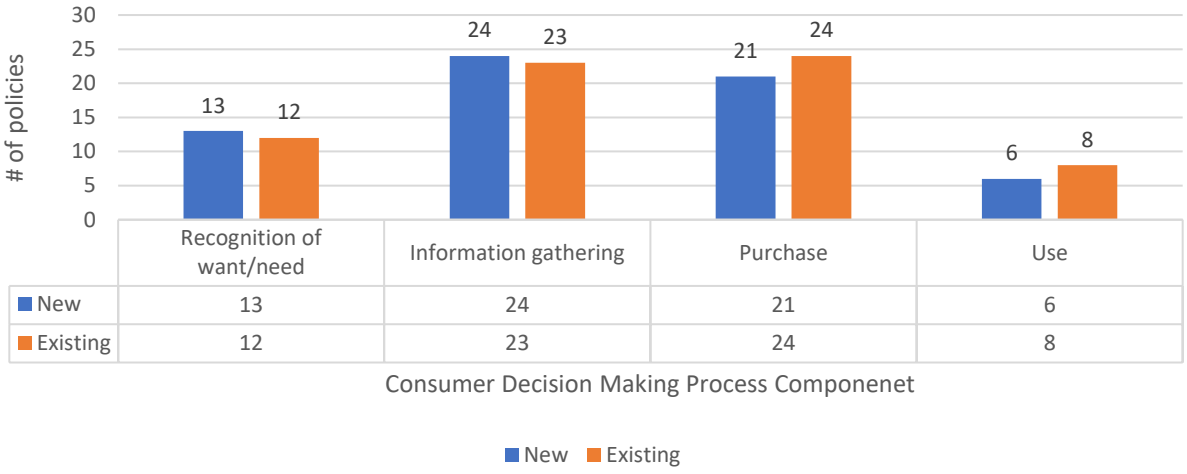


Figure 2.15.2: Policy mix analysis graph on Policy Target Consumer Decision Making Process Component by Policy Target Building Type (Calgary)

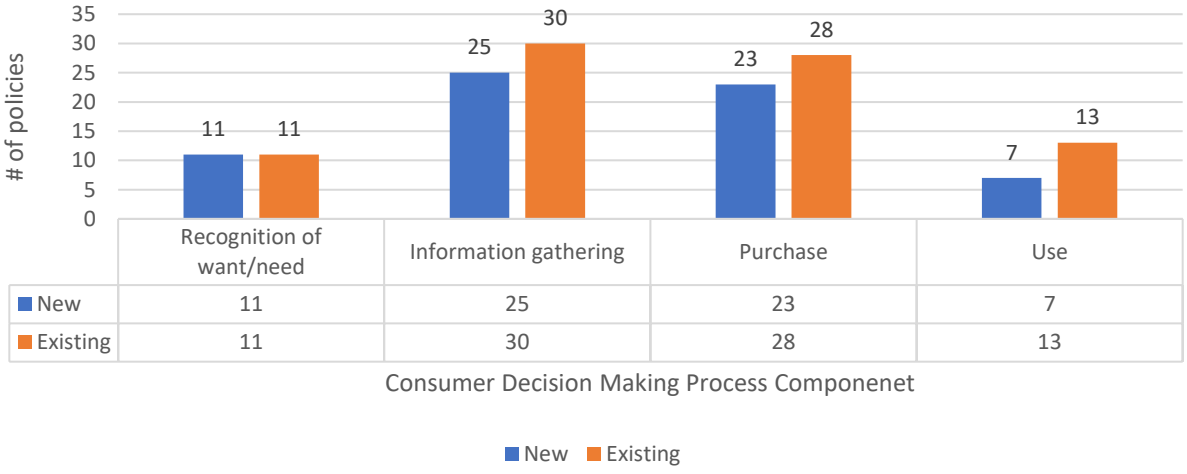
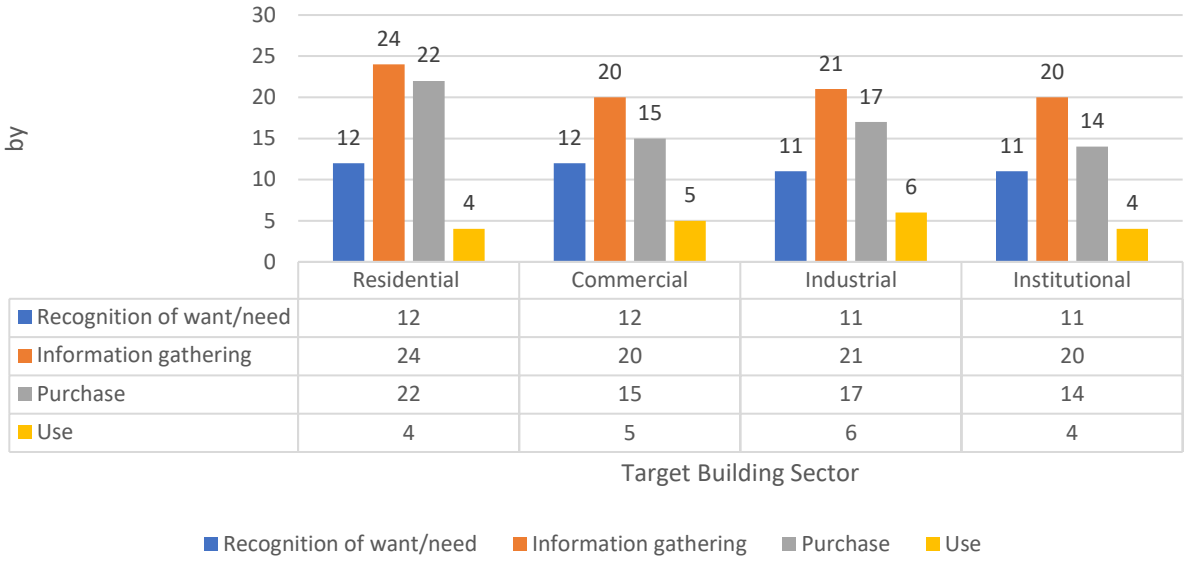
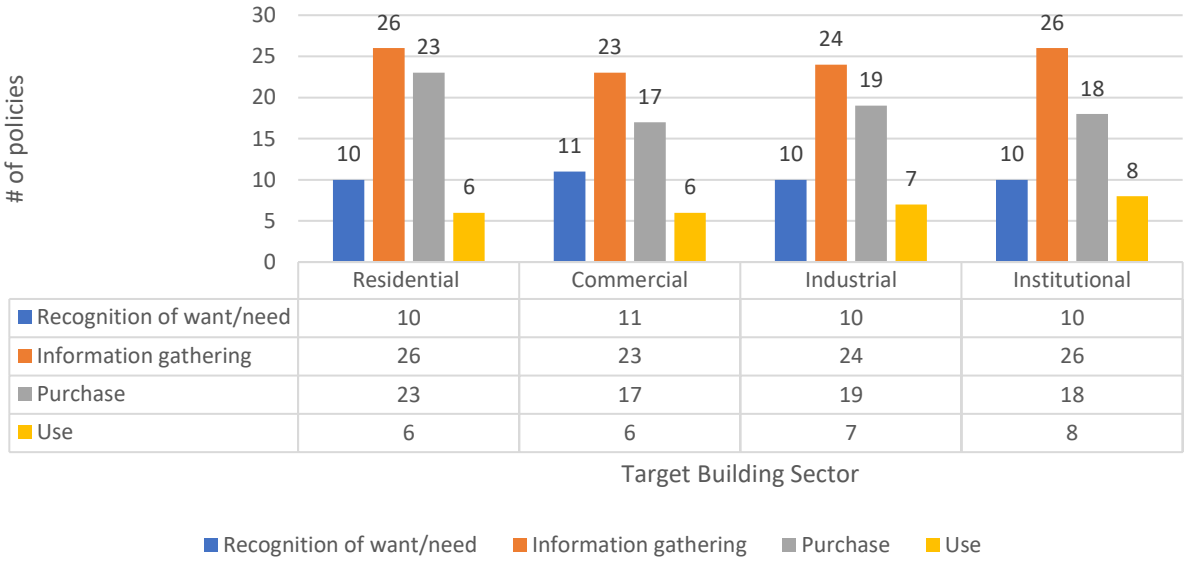


Figure 2.16.1: Policy mix analysis graph on Policy Target Building Sector v. Policy Target Consumer Decision Making Process Componenet (Toronto))



	Residential	Commercial	Industrial	Institutional
Recognition of want/need	12	12	11	11
Information gathering	24	20	21	20
Purchase	22	15	17	14
Use	4	5	6	4

Figure 2.16.2: Policy mix analysis graph on Policy Target Building Sector by Policy Target Consumer Decision Making Process Componenet (Calgary)



	Residential	Commercial	Industrial	Institutional
Recognition of want/need	10	11	10	10
Information gathering	26	23	24	26
Purchase	23	17	19	18
Use	6	6	7	8

Figure 2.17.1: Policy mix analysis graph on Policy Sub-Type by Policy Time Horizon (Toronto)

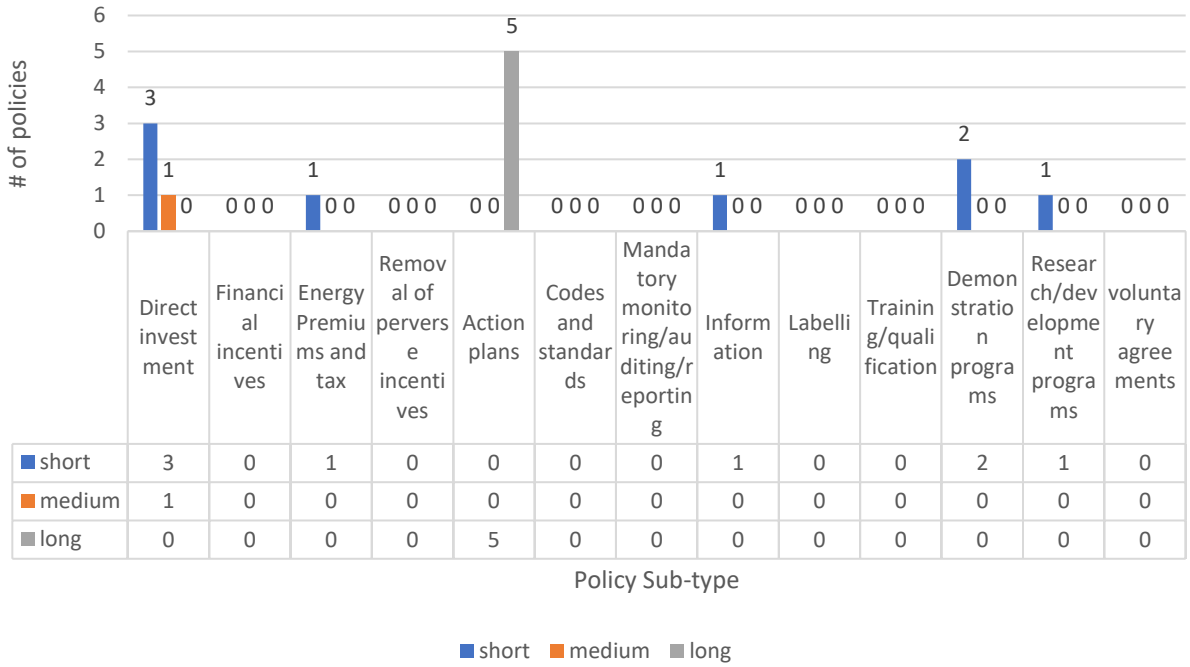


Figure 2.17.2: Policy mix analysis graph on Policy Sub-Type by Policy Time Horizon (Calgary)

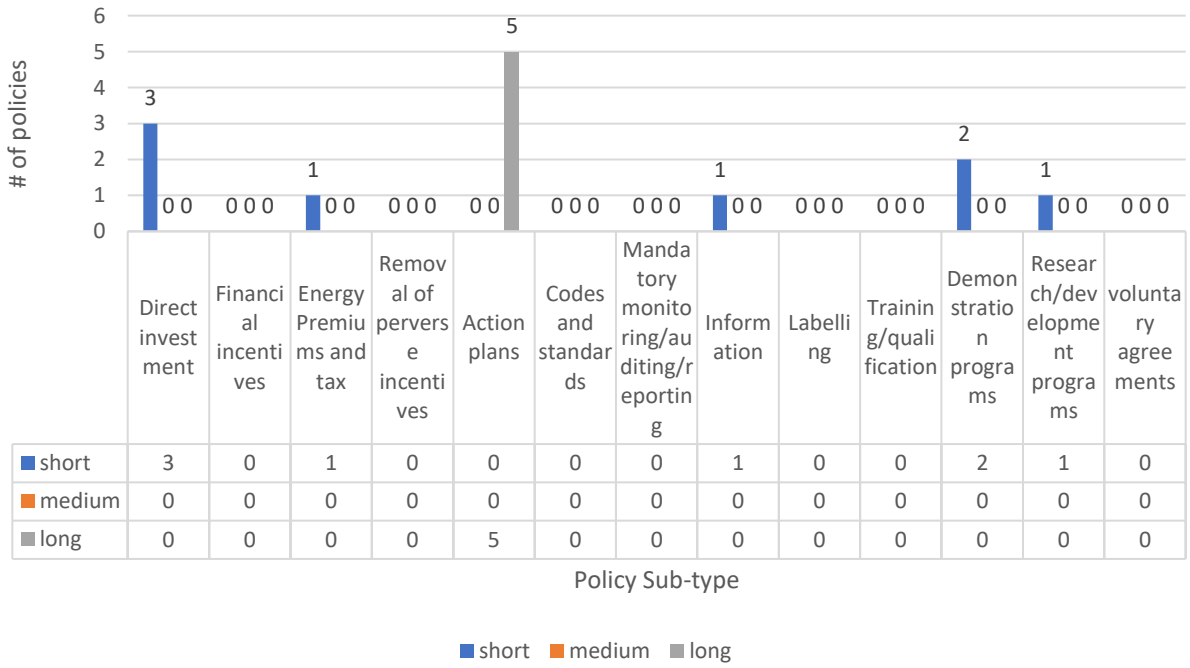


Figure 2.18.1: Policy mix analysis graph on Policy Time Horizon v. Regime Creation or Destruction Policy (Toronto)

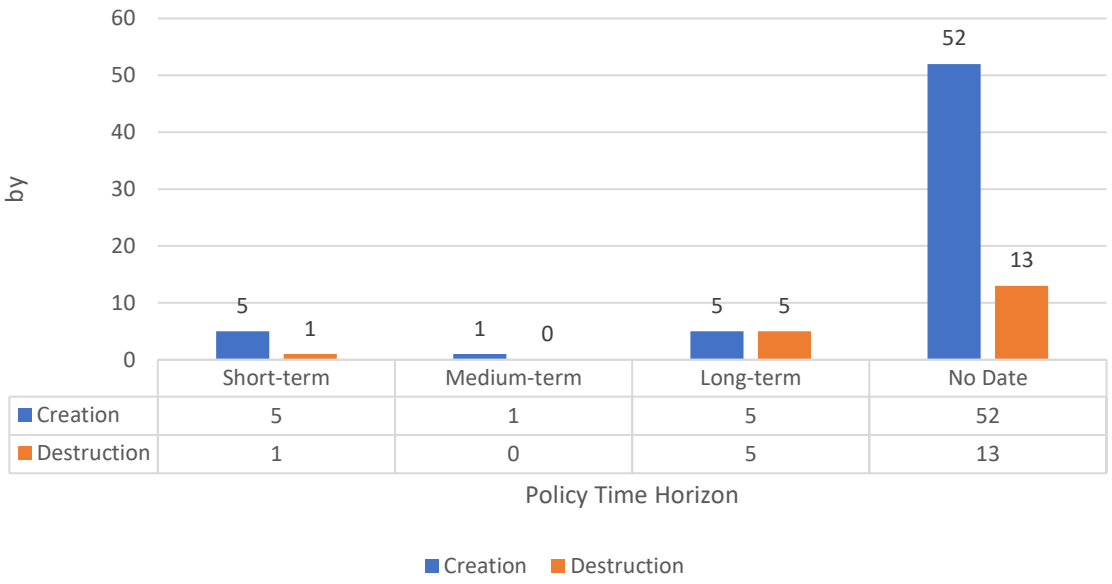


Figure 2.18.2: Policy mix analysis graph on Policy Time Horizon by Regime Creation or Destruction Policy (Calgary)

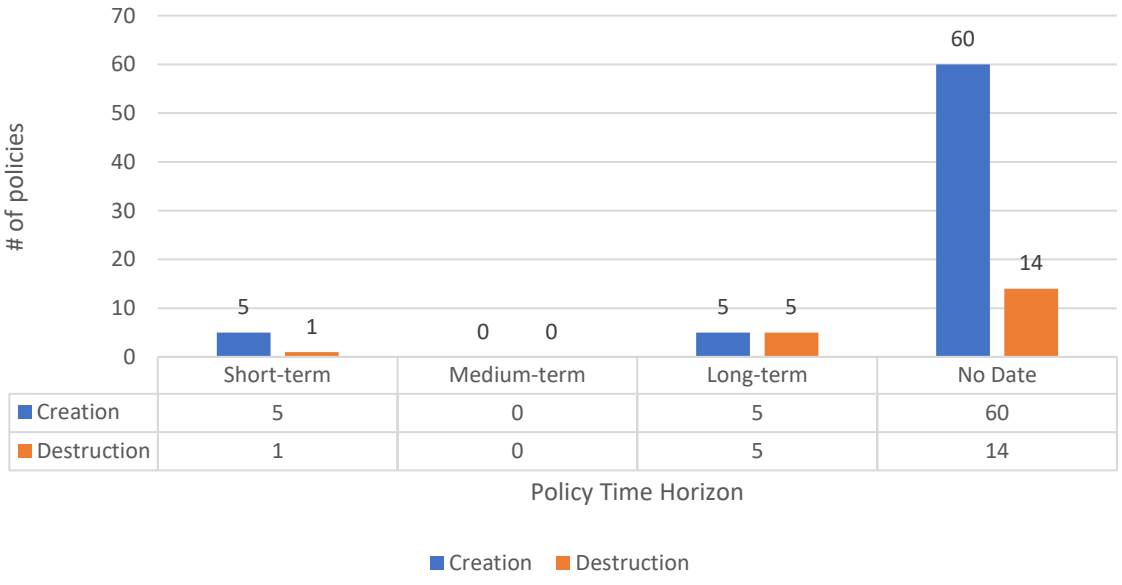


Figure 2.19.1: Policy mix analysis graph on Policy Flexibility by Policy Time Horizon (Toronto)

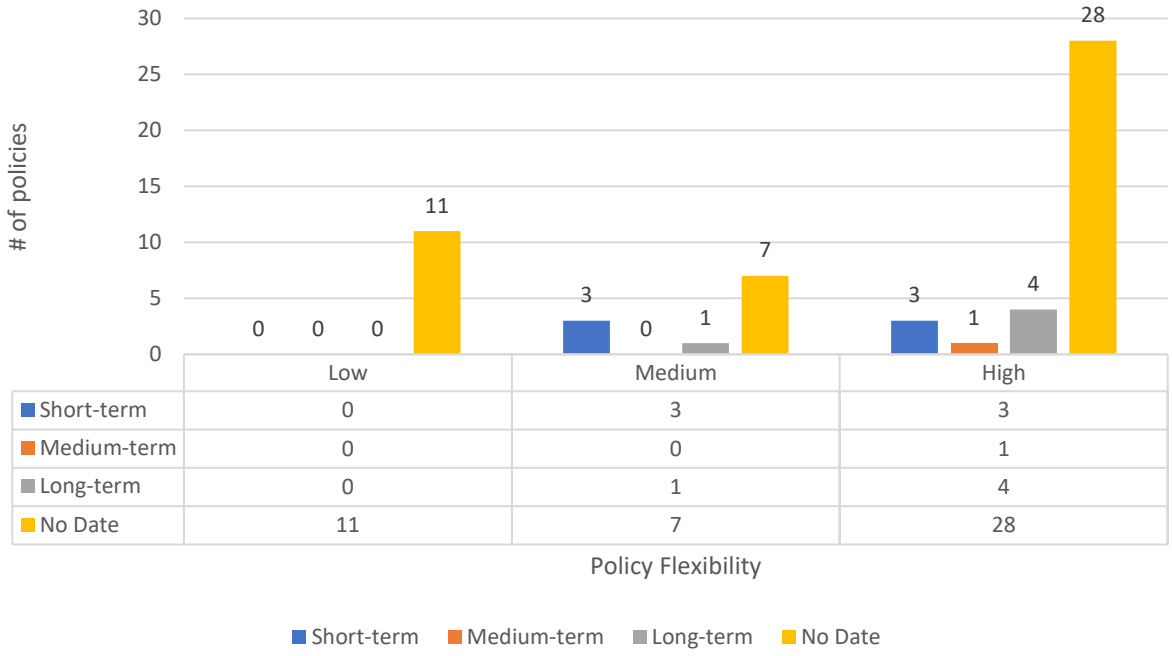


Figure 2.19.2: Policy mix analysis graph on Policy Flexibility by Policy Time Horizon (Calgary)

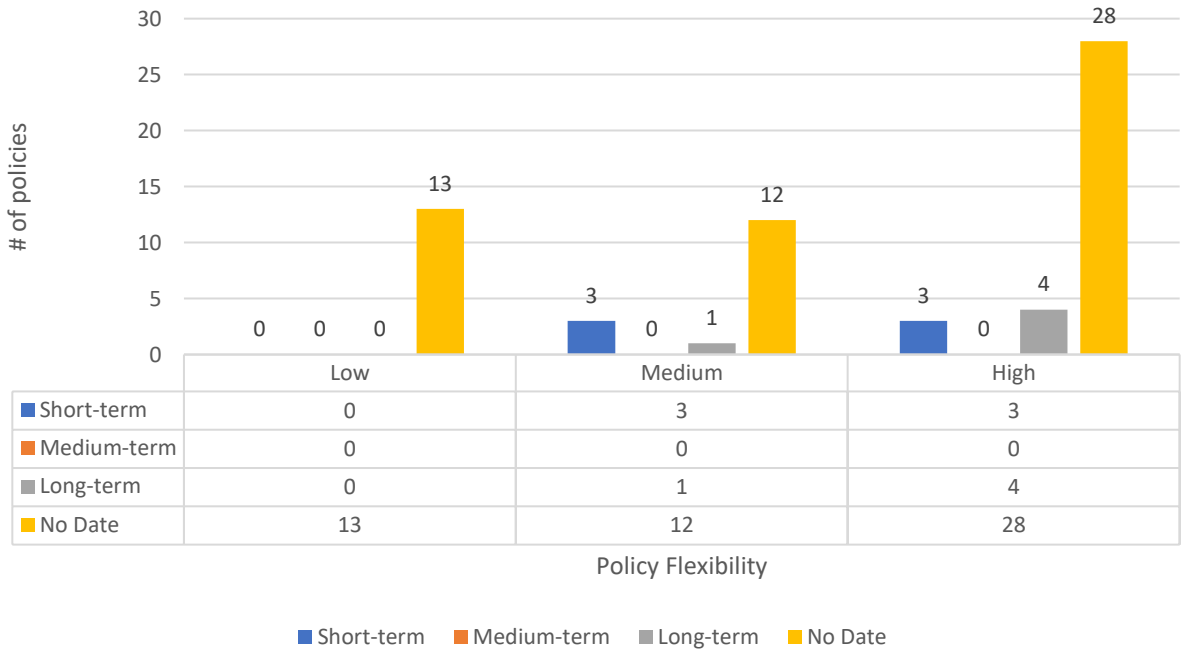
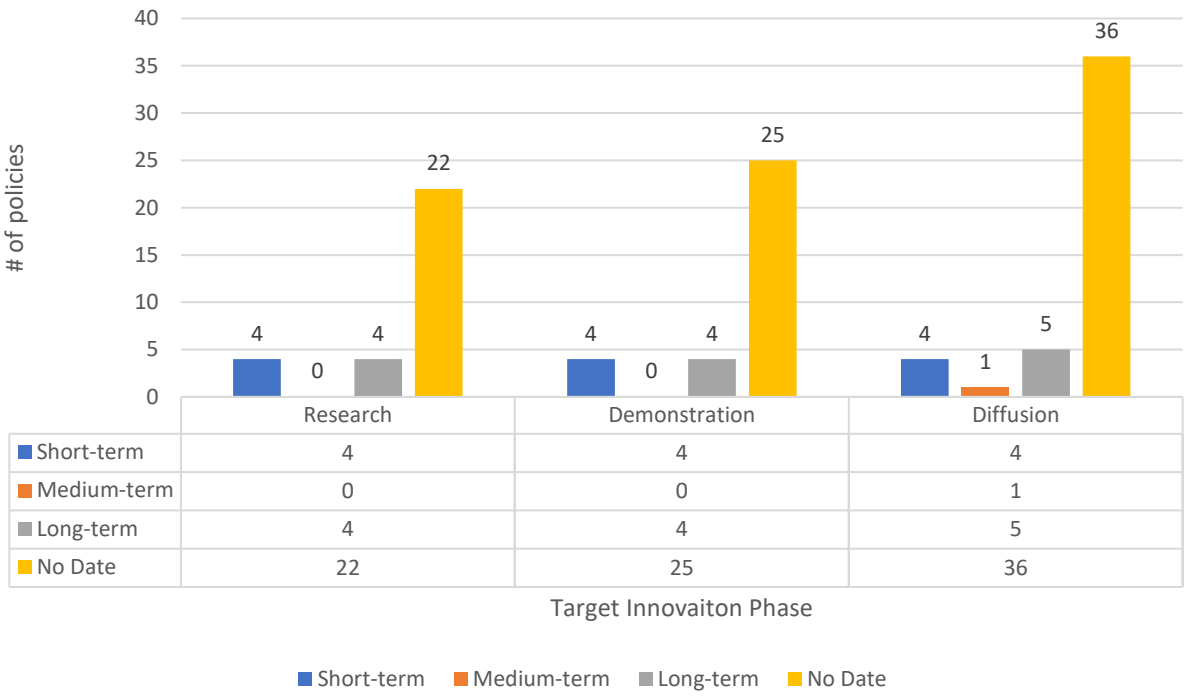
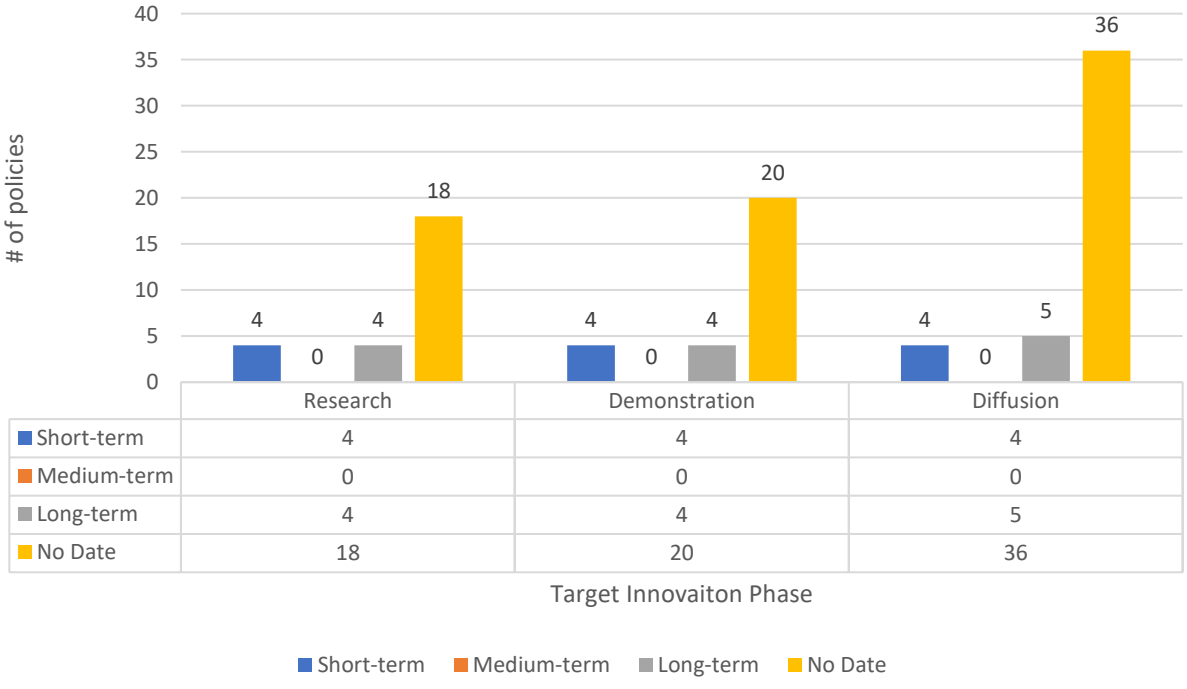


Figure 2.20.1: Policy mix analysis graph on Policy Target Innovation Phase by Policy Time Horizon (Toronto)



	Research	Demonstration	Diffusion
Short-term	4	4	4
Medium-term	0	0	1
Long-term	4	4	5
No Date	22	25	36

Figure 2.20.2: Policy mix analysis graph on Policy Target Innovation Phase by Policy Time Horizon (Calgary)



	Research	Demonstration	Diffusion
Short-term	4	4	4
Medium-term	0	0	0
Long-term	4	4	5
No Date	18	20	36

Figure 2.21.1: Policy mix analysis graph on Policy Target Building Sector v. Policy Time Horizon (Toronto)

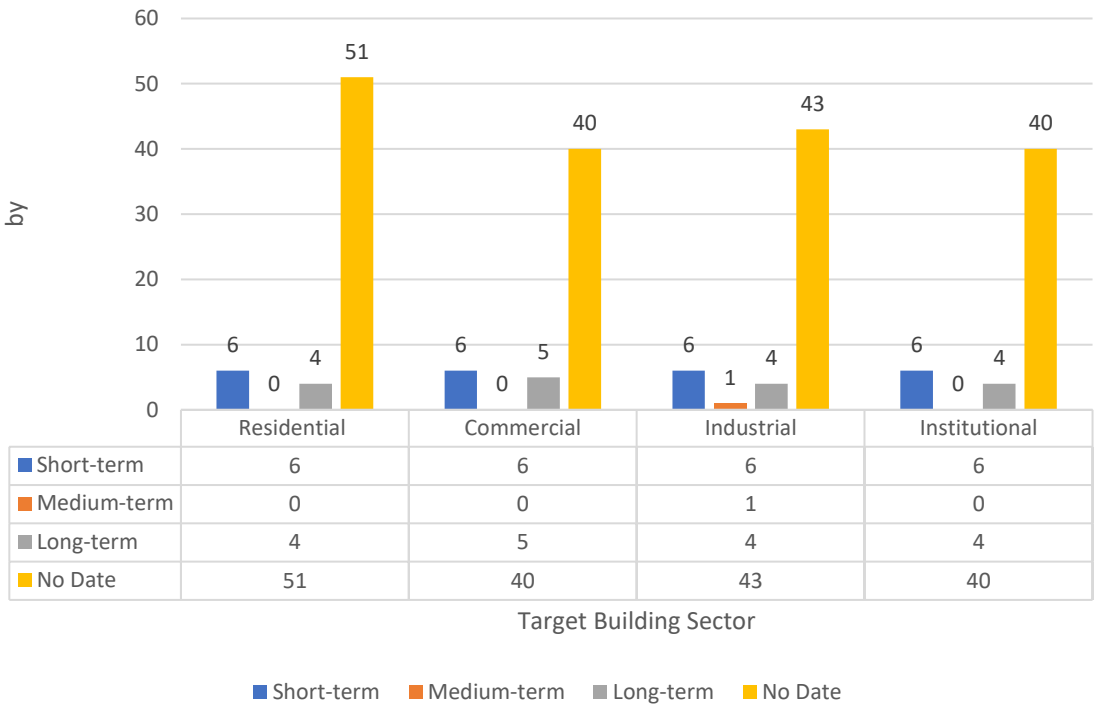
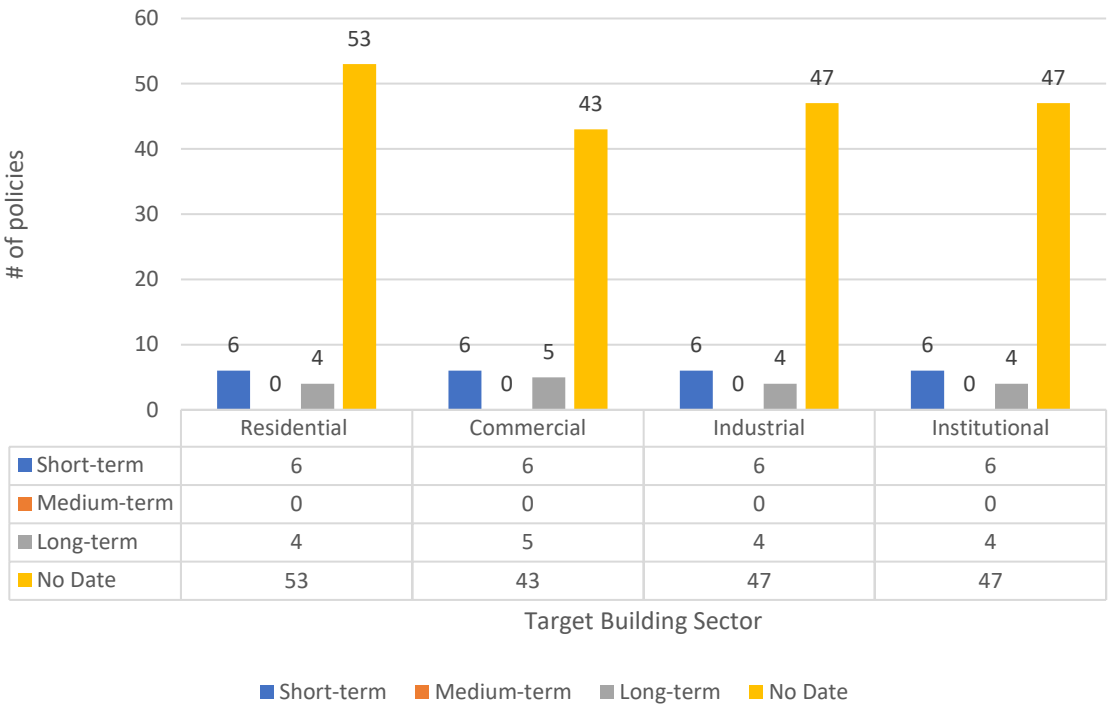
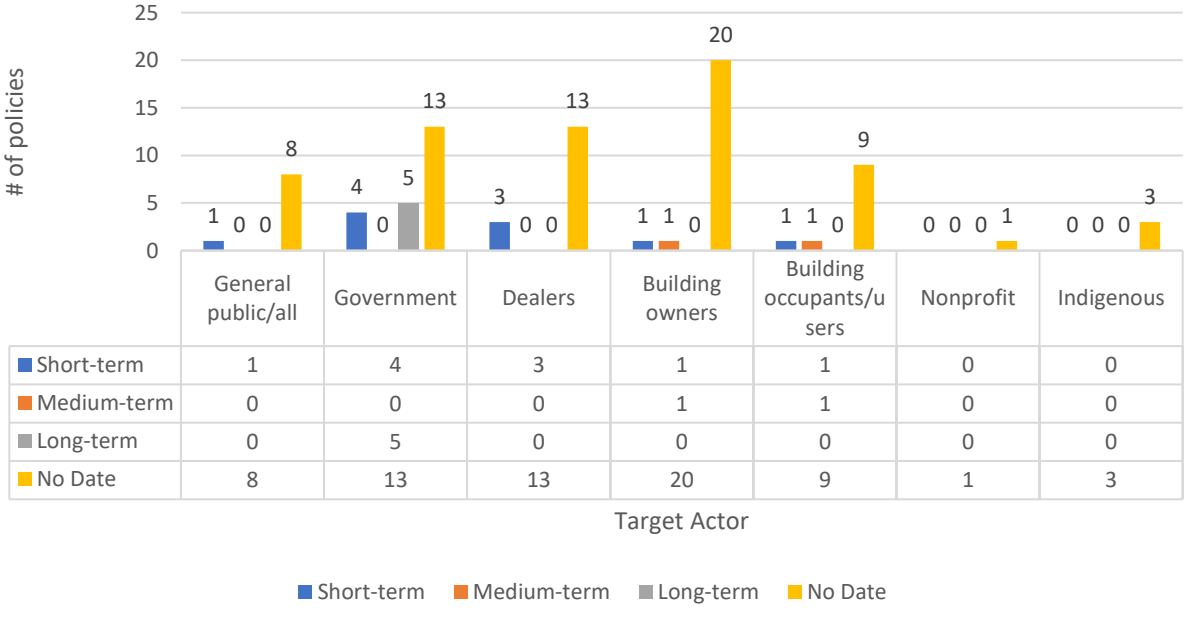


Figure 2.21.2: Policy mix analysis graph on Policy Target Building Sector by Policy Time Horizon (Calgary)



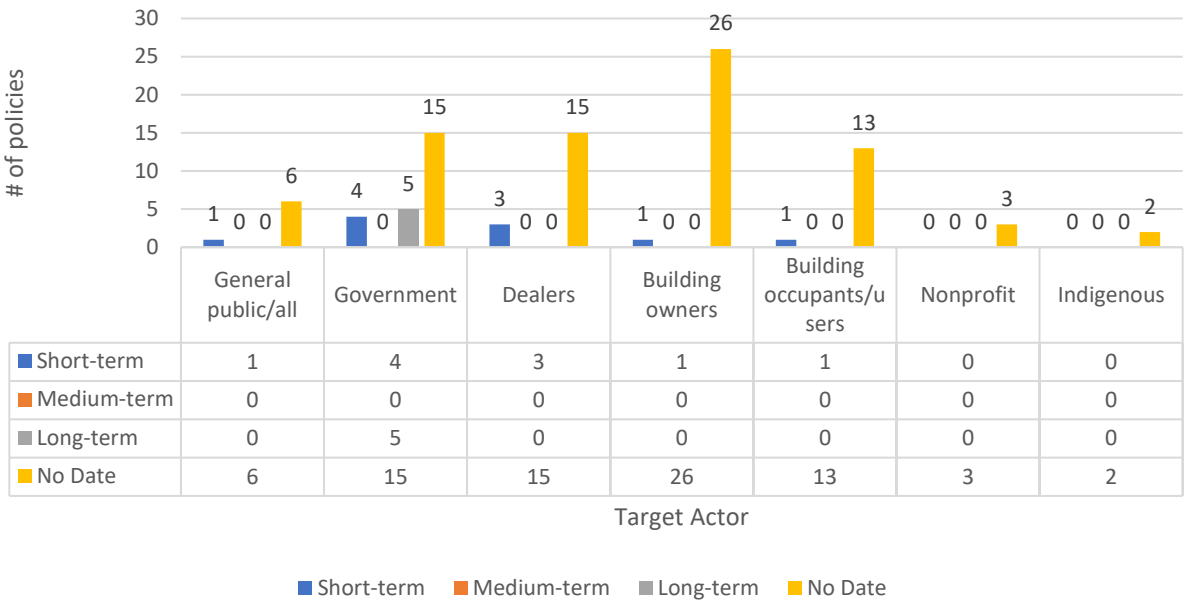
	Residential	Commercial	Industrial	Institutional
Short-term	6	6	6	6
Medium-term	0	0	0	0
Long-term	4	5	4	4
No Date	53	43	47	47

Figure 2.22.1: Policy mix analysis graph on Policy Target Actor by Policy Time Horizon (Toronto)



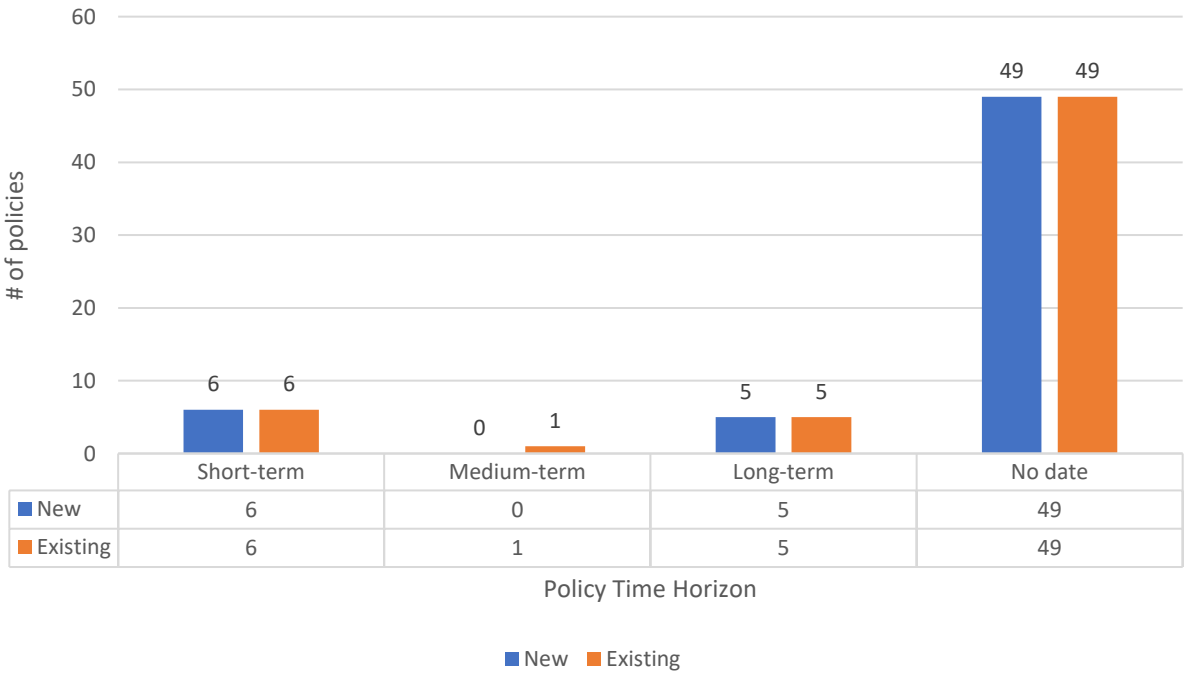
	General public/all	Government	Dealers	Building owners	Building occupants/users	Nonprofit	Indigenous
Short-term	1	4	3	1	1	0	0
Medium-term	0	0	0	1	1	0	0
Long-term	0	5	0	0	0	0	0
No Date	8	13	13	20	9	1	3

Figure 2.22.2: Policy mix analysis graph on Policy Target Actor by Policy Time Horizon (Calgary)



	General public/all	Government	Dealers	Building owners	Building occupants/users	Nonprofit	Indigenous
Short-term	1	4	3	1	1	0	0
Medium-term	0	0	0	0	0	0	0
Long-term	0	5	0	0	0	0	0
No Date	6	15	15	26	13	3	2

Figure 2.23.1: Policy mix analysis graph on Policy Time Horizon by Policy Target Building Type (Toronto)



	Short-term	Medium-term	Long-term	No date
New	6	0	5	49
Existing	6	1	5	49

Figure 2.23.2: Policy mix analysis graph on Policy Time Horizon v. Policy Target Building Type (Calgary)