Standards Council of Canada
Conseil canadien des normes

# Standardization Solutions to Remove Trade Barriers in Canada

Canada

# Contents

1.

# CFTA and the Canadian Standardization Network- Executive Summary and Key Notes

There are thousands of different standards incorporated by reference in federal, provincial/territorial and, in some cases, municipal (F/P/T/M) regulations. Differences in standards and certification requirements referenced in regulations create Technical Barriers to Trade (TBTs), which are difficult to identify and are some of the most persistent internal trade barriers. A 2006 report by the Conference Board of Canada found that non-tariff barriers represent the most significant remaining internal trade barriers within Canada.[1] Similar evidence was presented in a 2006 examination of interprovincial barriers to trade by the Senate Committee on Banking, Trade, and Commerce.[2]

More recently, value propositions from two prominent Canadian industry associations, the Canadian Institute of Plumbing and Heating (CIPH) and Electro-Federation Canada (EFC), found strong evidence of a number of different and/or duplicative standards and certification requirements between Canadian provinces and territories in the plumbing/heating and electrical sectors. These studies also found that, in most instances, there are no physical, environmental or other substantive justifications for these differences.[3]

1 Darby, Paul, et al., *Death by a Thousand Paper Cuts: The Effect of Barriers to Competition on Canadian Productivity* (Ottawa: Conference Board of Canada, 2006), p. ii.

2 *Proceedings of the Standing Senate Committee on Banking, Trade and Commerce* http://www.parl.gc.ca/Content/SEN/Committee/391/bank/05eva-e.htm?Language=E&Parl=39&Ses=1 (accessed May 12, 2015)

3 *A Value Proposition from the Canadian Institute of Plumbing & Heating to Facilitate the Harmonization of Market Entry Required Standards and Certification Schemes Covering Selected Plumbing & HVACR Products, Economic Impact Assessment, 2012*. See especially, pp.24-28, which uses the product example of a water heater to outline different requirements across Canada. *A Value Proposition from Electro-Federation Canada to Facilitate the Harmonization of Market Entry Required Standards and Certification Schemes Covering Selected Electrical, Electronic, & Telecom Products, Economic Impact Assessment, 2012.*

The case studies and priorities outlined in this report will help steer the conversation on how to continue to align standards in order to reduce red tape and administrative burden for Canadian businesses and lead to healthier economic growth in a way that is sustainable and beneficial for Canadians - today and in the future.

The persistence of TBT-based internal issues is due to the difficulty of identifying TBTs compared to more explicit tariff-based barriers. For example, provinces and territories do not currently possess the tools needed to keep track of the standards they incorporate by reference in their jurisdictional regulations, nor do they have a mechanism to identify or compare against those standards used in other jurisdictions. This prevents provinces and territories from being able to identify those standards that have a significant effect on trade and/or a broader economic impact on industry (e.g. extra compliance costs that harms competitiveness). This information provides the necessary baseline to help improve standards alignment between jurisdictions in Canada.

In a recent report, Canada's Public Policy Forum indicated that a lack of data and research is one of the main factors preventing policy makers from being aware of internal trade barriers[4]. As such, in Budget 2014, the federal government made a commitment to better identify and understand the impact of requirements that restrict internal trade.[5]

As a result, in August 2014, the Standards Council of Canada (SCC) submitted a research project to Innovation, Science and Economic Development Canada entitled, *Analysis of Standards, Codes, Testing and Certification Requirements in Select Sectors on Internal Trade in Canada*. The project is a three-year research initiative led by SCC in support of the government's commitment to modernize the Canadian Free Trade Agreement (CFTA). The project will help fill the gap in existing data and research on unaligned standards, codes, and certification requirements between provinces and territories. This lack of alignment contributes to internal trade barriers that create unnecessary and redundant costs for Canadian industry. This research paper is the output of the first year of the three-year research initiative.

In September 2015, SCC chose the following sectors/products for the first three case studies, which are the main focus of this paper:

1. Crane sector (tower cranes)
2. Heating and plumbing sector (water heaters)
3. Emerging regulatory sectors (certification of recreational vehicles (RVs) and the deployment of Liquefied Natural Gas (LNG) as a fuel for the transportation sector)

SCC's analysis of the three case studies outlined in this report indicate re-occurring themes among the different sectors and their respective products, which point primarily to a lack of harmonization between jurisdictions when using standardization as a regulatory tool.

Through this research initiative, SCC found five key consistently recurring issues, and considers the resolution of these issues to be a necessary condition to address unaligned standards, codes, and certification requirements between provinces and territories in Canada:

1. Inconsistent use of standards and certification requirements between jurisdictions, including duplicative requirements and different requirements in some jurisdictions than in others;
2. Differences between provinces and territories in their adoptions of national model codes;
3. Different interpretations of standards and regulations between jurisdictions;
4. Development of unaligned requirements in emerging regulatory sectors; and
5. Lack of coordination between F/P/T/M governments to develop harmonized approaches.

4 McLean, James, Canada's *Evolving Internal Market*, (Ottawa: Public Policy Forums, 2013), p.11.

5 *The Road to Balance: Creating Jobs and Opportunities* http://www.budget.gc.ca/2014/docs/plan/pdf/budget2014-eng.pdf, p.111 (accessed May 12, 2015)

## Recommendations

In order to help redress unaligned standardization requirements of the kind illustrated in these case studies, SCC has developed a number of policy recommendations. They are based on extensive consultations with key government and industry stakeholders, including the Provincial Territorial Advisory Committee (PTAC) and the National Public Safety Advisory Committee (NPSAC):

- The reconciliation of standards-requirements between jurisdictions in Canada should be a key component of a modernized CFTA.
- Mechanisms should be developed to ensure that standards incorporated by reference in F/P/T/M regulations are current (up-to-date) and aligned across jurisdictions, while maintaining the highest possible health and safety standards.
- The processes for developing national model codes and the provincial/territorial adoptions of those codes need to be more effectively coordinated.
- There needs to be more effective regulatory coordination in the use of standardization requirements, including the development of a flexible and transparent platform for monitoring emerging issues and ensuring that harmonized solutions are designed and approved by relevant authorities in a timely manner.
- Mechanisms should be developed to ensure compliance with harmonized approaches and allow for dispute resolution across jurisdictions.
- F/P/T/M governments need to place a greater emphasis on meeting their obligations under multilateral and bilateral trade agreements, particularly the World Trade Organization Technical Barriers to Trade (WTO-TBT) Agreement's obligations regarding transparency of regulatory and standardization requirements and the importance of using international standards to further harmonization between jurisdictions.

The case studies and priorities outlined in this report will help steer the conversation on how to continue to align standards in order to reduce red tape and administrative burden for Canadian businesses, and lead healthier economic growth in a way that is sustainable and beneficial for Canadians —today and in the future. SCC will continue to work closely with Innovation, Science and Economic Development Canada to explore ways to reduce internal trade barriers, including the development of additional case studies and continuing to provide input on the negotiations for a modernized CFTA.

# Key Notes

- This research is part of the Canadian government's commitment to breaking down internal trade barriers that harm the national economy and hurt Canadian business competitiveness as outlined in *One Canada, One National Economy: Modernizing Internal Trade in Canada*, the federal proposal to update the CFTA.[6]
- Over time, federal, provincial and territorial governments have incorporated different standards in regulations across Canadian provinces and territories, which have resulted in internal TBTs. This SCC-led review is designed to identify the standards, codes, testing and certification requirements in select industry sectors that have a significant impact on internal trade in Canada.
- The first phase of the review has identified standards referenced in regulations that impede trade in the following three key sectors and products:
  - Crane sector (tower cranes);
  - Heating and plumbing sector (water heaters); and
  - Emerging regulatory sectors (certification of RVs, and the deployment of LNG as a fuel for the transportation sector).
- SCC has worked with key stakeholders in these industries to identify those standards referenced in regulations that impact trade and to analyze the economic impact of trade barriers. This is a necessary first step towards further harmonizing internal regulations and standards.

## TOWER CRANES

- The requirements for verifying compliance to electrical safety code requirements are more detailed in some provinces than in others. Some jurisdictions require a tower crane's high voltage electrical systems to be inspected and verified by an independent third party for conformance to all electrical requirements, whereas in others, the provincial regulatory requirements do not mention the need for inspection by a third party assessment organization.

## WATER HEATERS

- There are a number of conflicting and duplicative requirements between jurisdictions with which Canadian water heater manufacturers must comply. This is the result of differences between F/P/T/M requirements, as well as differences in how provinces and territories adopt federal requirements.
- Energy efficiency requirements are different between the federal, provincial and territorial levels. Some provinces and territories have different requirements than those that exist at the federal level, which can potentially double testing costs for the water heater industry and, as a result, increase the cost of water heaters for consumers. The added cost is dependent upon the different design requirements needed to achieve the efficiency levels. The water heater industry must also adhere to different requirements between the National Building Code and provincial and territorial adoptions of the building code.

6 Innovation, Science and Economic Development Canada, Agreement on Internal Trade, http://www.ic.gc.ca/eic/site/081.nsf/eng/h_00007.html (accessed May 12, 2015)

## RECREATIONAL VEHICLES

- The United States and Canada have different approaches to product safety, which has created the potential for fragmented regulatory requirements between Canadian provinces and territories for recreational vehicles that are imported from the U.S. into Canada. The electrical and gas equipment in vehicles manufactured for the U.S. market are not certified by an independent third party to Canadian standards (*CSA Z240 Recreational vehicles*), as is required under provincial legislation in Canada.
- In a number of provinces, the Recreational Vehicle Dealers Association (RVDA) has requested an exemption of certification to Canadian standards for equipment in RVs imported from the U.S. Currently, some provinces and territories recognize the voluntary Recreational Vehicle Industry Association (RIVA) U.S. standard, while others do not.
- Provinces and territories have responded to the issue of imported recreational vehicles on an individual basis. The issue has been discussed between Regulatory Authority Advisory Bodies (RAABs), but no joint position, action plan, or communication has been agreed on to date.

## LNG AS A FUEL FOR THE TRANSPORTATION SECTOR:

- The overarching theme identified throughout the LNG value chain is the lack of coordination and harmonization of standards across provinces, including differing Canadian Registration Number (CRN) requirements and diverse interpretation of codes and standards.
- The current decentralized development of the emerging LNG industry leads to diverging regulatory requirements. This translates to higher costs, fragmentation and makes it difficult for industry stakeholders to take advantage of economies of scale, thus driving up costs and slowing growth in an increasingly globally competitive industry.

## QUOTES

- “Key sectors such as construction, energy, mining, oil and gas, rely on the safe operation of cranes and hoisting equipment. The lack of alignment of equipment standards in regulations across the country reduces safety, hinders worker mobility, increases compliance costs and decreases economic opportunities. We believe this review will validate many concerns that we in the industry have highlighted and will lead to some innovative ways to align and resolve these issues.”

  *- Tim Bennett, Chairman of the Canadian Hoisting and Rigging Council (CHRSC)*

- “Product testing and certification compliance costs the North American plumbing and heating industry billions of dollars every year. Companies often face duplicate testing and certification requirements to meet the different federal and provincial standards. “When the rules are different across provinces and there is no predictable regulatory regime, it becomes very hard to effectively stock products to support sales. This is a major cost to distributors. In the end, this costs everyone more, including Canadian consumers.”

  *- Ralph Suppa, President and General Manager, Canadian Institute of Plumbing & Heating*

- “The decentralized development of the emerging LNG industry will mean regulatory requirements jurisdiction by jurisdiction, which could translate into higher costs and industry fragmentation without some effort at standardization. It is imperative that we proactively ensure standards and regulation are designed to be consistent across jurisdictions. Only then will the Canadian LNG industry be able to take advantage of economies of scale to drive costs down and increase LNG usage. This will, in turn, lead to more rapid technological progress and a globally competitive Canadian industry.”

  *- Bruce Winchester, Executive Director, Canadian Natural Gas Vehicle Alliance*

# 2.

# Background and Project Objectives

This research project provides an overview of existing codes, standards, testing and certification requirements referenced in regulations in three industry sectors at the product level. Since the inception of the Agreement on Internal Trade (AIT) in 1995, the reconciliation of standards in regulations has not been seriously addressed. This project attempts to quantify and qualify the cost and time related to the 'web of rules' associated with standardization that impact business. This report is the result of Phase I of the three year project and is intended to expand beyond March 2015 for two more years (Phases II and III).

## Scope of Research for Phase I

SCC completed four development steps as part of the first phase of this project:

**STEP 1:**
Determine the key industry sectors to be examined.

**STEP 2:**
Choose a product or multiple products within an industry sector and identify the relevant standards, codes, testing and certification requirements referenced within federal/provincial/territorial (F/P/T) and, in some cases, municipal (F/P/T/M) regulations with which the product or products must comply. Data collection for one product was undertaken to test how long the collection would take per product, with consideration of the variable requirements for each product.

SCC assessed and consolidated research and results to determine how standards, codes, testing and certification requirements referenced in regulations impact internal trade in Canada at the industry sector level.

**STEP 3:**
From the data collected in step 2, SCC developed case studies to identify different/duplicative requirements between jurisdictions in Canada as it relates to standardization. The scope of the research in these case studies depended on SCC resource and technical requirements, including staff time and technical knowledge. Where possible, the research included:

- Determining and listing the number of different standards and certification requirements that are applicable to the product(s) in F/P/T/M regulations;
- Listing regulatory authorizations required for each of the current standards for the product(s);
- Identifying organizations providing the certification service;
- Determining different/duplicative requirements across jurisdictions in Canada and the resulting testing and certification requirements;
- Estimating the current impact of testing and certification requirements to different standards and associated costs with different/duplicative requirements;
- Describing the standards and certification activities required at each step in the value chain and explaining how different/duplicative requirements are handled;
- Providing information on how often the product(s) is tested;
- Identifying who is paying for additional costs of testing and certification;
- Identifying barriers to remove different/duplicative standards/testing/certification of the product(s) to allow for effective harmonization; and
- Identifying existing mechanisms to remove the different/duplicative standards/testing/certification requirements.

**STEP 4:**
Prepare final findings report with estimates of the approximate impact of, and the potential opportunities to eliminate, different/duplicative standards, testing and certification requirements for the identified industry sectors. This includes preliminary suggestions of ways to further align standards, codes, testing and certification requirements in those industry sectors.

## Methodology

**STEP 1:**
Determine up to three key industry sectors that will be examined.

SCC chose three industry sectors based on existing experience and relationships with industry associations and Regulatory Authority Advisory Bodies (RAABs), including the plumbing and heating sector and the hoisting and rigging sector. The selection was reviewed and verified against information SCC has received from industry stakeholders, as well as key public policy documents.

**STEP 2:**
Choose a product or multiple products within the industry sectors.

Once an industry sector was confirmed, a product or multiple products within that industry were selected based on discussions with industry associations and their members and SCC's provincial and territorial stakeholders. These products or groupings of products became case studies for comparing the degree of harmonization or lack of harmonization between F/P/T/Ms as it related to standards, codes, testing and certification requirements referenced within regulations.

SCC chose the following products to serve as the basis of proposed case studies:

1. tower cranes
2. water heaters
3. certification of recreational vehicles and the deployment of Liquefied Natural Gas (LNG) as a fuel for the transportation sector

SCC leveraged its relationship with key F/P/T/M stakeholders in each sector, including the Canadian Hoisting and Rigging Safety Council (CHRSC), the Canadian Institute of Plumbing and Heating (CIPH), the National Public Safety Advisory Committee (NPSAC), and the Natural Gas Roadmap Technical Advisory Group (TAG), which is co-chaired by Natural Resources Canada and industry representatives. SCC confirmed the choice of sectors/products with these stakeholders and received letters indicating their support of the project.

These groups also provided input into SCC surveys and assisted in distributing them to a wider group of stakeholders. The surveys were designed to identify instances of duplication throughout the life cycle of the products chosen for each sector and to calculate the resulting additional costs to product manufacturers.

**STEP 3:**
Case studies followed the methodology outlined below to identify standards and certification implications along the entire, or part of, the product value chain and its external interfaces.

1. Understand the value chain of a product or group of products and where standards, codes, testing and certification in F/P/T/M regulation intersect.
2. Identify impacts of differing/duplicative standards, codes, testing, and certification requirements referenced in F/P/T/M regulation according to predetermined indicators. This was done through interviews with key stakeholders from industry associations, surveys, document reviews, economic analysis, and any other methods deemed necessary during the information gathering phase.

**STEP 4:**
Research and results were assessed and consolidated to determine how standards, codes, testing and certification requirements referenced in regulations at the industry sector level impact internal trade in Canada.

SCC encountered various constraints during the compilation of data and research for this report, making it difficult to collect the same type of data for each product. These included:

- Data integrity: SCC performed much of its research using publically available information. SCC also relied on direct feedback from industry, feedback that was in some cases inconsistent, and hard to obtain.
- Working with stakeholders to obtain data:
    - Timing constraints when reaching out to stakeholders made it hard to collect all necessary data. For example, due to the commercially sensitive nature of this information, SCC had to sign non-disclosure agreements with some stakeholders. It took longer than expected to finalize these agreements with the legal departments of the companies involved, thus delaying the completion of the surveys.
    - Some stakeholders may have been reluctant to share data because a fragmented market, and the lack of harmonized requirements, can provide them with a competitive advantage.

The challenges involved in receiving the data from industry means that SCC had to base its analysis on information that was, in some cases, unverified and largely qualitative. The written analysis provides an overview of the general trends and issues discovered in each sector. The specific requirements for each jurisdiction can be found in the annexes. This report compiles data highlighting the results of the research.

# 3.

# The Case Studies

## 3.1 Case Study 1 – Crane Sector: Tower Cranes

### Overview of Tower Crane Sector in Canada

****Please note all exhibits can be found in Annex D*

Tower cranes are used for specific worksite requirements, often in the residential high rise and commercial/institutional construction sector. However, they can also be found in other industries, such as heavy industrial, surface mining, shipbuilding, offshore drilling rigs, and railways. Tower cranes are stationary, have a smaller footprint and are usually used for a lengthy period when compared to mobile cranes or other lifting and hoisting solutions.

A tower crane is considered to be an industrial product rather than a mass-produced consumer good. It is a relatively large structure weighing many tonnes and has many moving parts. They are designed to lift and move heavy loads of construction materials up and across active construction sites. Tower cranes operate in environments where a wide range of hazards to people and equipment can occur in many combinations.

Tower cranes are manufactured in relatively small production lots, much like other large and complex machines such as aircrafts, and other large industrial equipment. Purchase costs range from $300,000 to $1.5 million (Exhibit 1-Interview 6). They are often customized to meet the specific requirements of a specific purchaser.

Canada is a net importer of tower cranes. It is ranked as the 26th largest importer in the world, accounting for 1.23% of the value of global tower cranes imports, and 21st exporter in the world accounting for 0.44% of the value of global exports of tower cranes. (See Annex A for a complete economic profile of the tower crane sector in Canada).

Tower cranes are not manufactured in Canada. However, tower crane operations are an integral part of the construction industry and facilitate the construction and operation of facilities across Canada.

While tower cranes are not manufactured in Canada, tower crane operations are an integral part of the construction industry and facilitate the construction and operations of facilities across Canada. Tower crane inventories in Canada are often used as an indicator of the amount of activity and construction that takes place.

Innovation, Science and Economic Development Canada data on 'cranes' is aggregated for all categories of cranes and hoists. Sources of discrete, specific data for tower cranes as a product category are not available. However, anecdotally, industry sources indicated that approximately 1,500 tower cranes are in active operation in Canada (Exhibit 1-Interview 6).

According to the Ontario Formwork Association (OFA) (Exhibit 1-Interview 3), there were 245 tower cranes active in Ontario in 2013, operating at 100% utilization. This supported $11 billion of Ontario's construction activity in 2013[7]. The component of construction economic activity (in Ontario in 2013) with a view to tower crane usage was estimated by OFA at $1.375 billion or 12.5% of the value of 2013 construction (Ontario only). It was not possible to identify similar data for the economic contribution of tower cranes operating in Alberta and British Columbia.

## Detailed Methodology

As a first step, SCC sought input from industry stakeholders through the Canadian Hoisting and Rigging Council (CHRSC) to document duplicative requirements, and where possible, additional costs associated with compliance with duplicative requirements incurred by owners/operators of tower cranes. Fourteen additional stakeholders were also interviewed. Only three jurisdictions were considered, based on where tower crane usage is most dominant.

Research for this segment also included an environmental scan of economic and related data that was available through sources such as Statistics Canada and on the E-law website. Relevant legislation that relates to tower cranes was compiled, along with various other regulations, codes, and standards that were referenced either within the legislative acts, or the regulations associated with each act (see Annex C).

From the perspective of technical requirements, and purely related to a tower crane as an industrial machine, three sub-systems were categorized and investigated:

- Structural members and assemblies including its site-specific, stationary concrete base or foundation;
- Mechanical systems such as motors, brakes, pulleys and transmissions; and
- Electrical systems with a focus on electrical components and systems that are covered by electrical codes and standards. This includes cables, wires, relays, contactors, motors, and any other high voltage components. It excludes factory-programmed and designed, low voltage logic modules and controls.

Following the document review of various regulations, codes, standards and technical requirements, questions were formulated and were sent by SCC staff in the form of a survey to CHRSC.

7 *Ontario Formwork Association Commentary on Proposed Changes to Ontario Regulation 213/91, Construction Projects, under the Occupational Health and Safety Act for improving Tower Crane Safety, as recommended by the Tower Crane Regulation Review Working Group of the Provincial Labour-Management Health and Safety Committee, 2013 - Submitted to the Ministry of Labour Government of Ontario, Canada February, 2014*

After analysis of the survey results (see Annex B), the list of stakeholders and vested interests was expanded further. These research questions included:

**a.** Are there significant differences in technical requirements from the perspective of the tower crane as an industrial machine and between jurisdictions? If yes, what are they?

**b.** In instances where there are significant differences, do they relate to regulation, referencing of standards, referencing of certification/testing or field evaluation requirements, inspection requirements or any other administrative or enforcement requirements?

**c.** Can the technical difference(s) be categorized as being related to specific local field safety/risk conditions or, are there any other objective criteria that can be used to categorize the difference(s) as duplicative, or redundant?

**d.** Can the impact on safety risk be quantified if a 'differing' requirement were removed or added for purposes of inter-jurisdictional harmonization?

**e.** Can the impact on economic costs caused by a 'difference' be quantified in a defensible, fact-driven/evidence-based manner?

Finally, to answer the refined research questions, additional interviews were scheduled with a cross-section of stakeholders and those with a vested interest in tower cranes. The interviews-discussions took place in a series of phone calls, augmented in some instances with in-person meetings. In total, 15 different stakeholders were interviewed and consulted. Refer to Exhibit 2 for the list of interview questions.

To compile this data, SCC made several assumptions to compare the costs of importing/transporting/erecting/operating/maintaining/disassembling/decommissioning one tower crane among three jurisdictions within Canada:

- The case study assumed that a Canadian company operating tower cranes is purchasing a new unit from Europe (i.e. Germany), where tower cranes are manufactured and exported;
- The tower crane and its component sub-systems were designed and fabricated to the European Standard *EN 14439 Cranes-Safety-Tower Cranes*;
- The tower crane manufacturer self-declares compliance with *EN 14439* and there is no independent, third party conformity assessment done (in Europe);
- It assumes that the tower crane and all of its components have been tested by the manufacturer for operation in the European community;
- It focuses on differences between technical requirements currently in place in relevant regulations in a limited sampling of Canadian provinces;
- Administrative differences between the sampling of provinces were also considered. For the example of tower cranes, mandatory requirements for field evaluation by an SCC-accredited field inspection organization are within the scope of assessing technical differences.

The complete list of those interviewed can be found in Exhibit 1. Survey results can be found in Annex B.

For the purposes of this case study, the lifecycle phases of a tower crane include:

1. Importing and shipping
2. Pre-deployment assembly
3. On-site erection
4. Operations and maintenance
5. Disassembly
6. Disposal

Phases 3 through 5 are repeated each time a tower crane arrives at a construction site where it goes into active service for a period of weeks, months, or years before being moved to a different construction site. See Exhibit 3 for a complete description of each lifecycle phase. Phases 1, 2 and 6 typically only occur once during a tower crane's useful life.

## Findings and Discussion

Below is a summary of the key findings based on survey feedback and interviews. See Exhibit 4 for aggregated responses to the research questions.

Several themes and issues emerged in the three sampled jurisdictions:

**a.** Issues associated with the skills of tower crane operators and technicians.

**b.** Issues associated with tower crane machinery.

**c.** Commercial enterprises are required to address all applicable "regulations" holistically.

**d.** Commercial firms want fact-based evidence to justify perceived and real differences in requirements throughout the "regulatory value stream".

**e.** Differences/confusion in the type and scope of responsibility of organizations that are held accountable for enforcement.

These issues are discussed below:

### A. ISSUES ASSOCIATED WITH THE SKILLS OF TOWER CRANE OPERATORS AND TECHNICIANS

In one jurisdiction, evidence showed that all tower crane operators must demonstrate that they have the requisite skill via practical and written examinations. Sampled jurisdictions indicated that they all have unique requirements for apprenticeship and provincial certification for tower crane operators. All sampled provinces are working toward harmonizing standards and operator qualifications across Canada. To improve labour mobility, certified and competent tower crane operators from other jurisdictions are recognized locally with minimal additional training, experience, examination or assessment. Even when eligible to work in different jurisdictions, out-of-province qualified tower crane operators are burdened with application fees to obtain equivalent certification. The application fee ranges from $60 to $125. It is mandatory to achieve equivalent certification of qualification. Red Seal endorsement for tower crane operators is fully recognized among sampled jurisdictions. Many employers consider Red Seal to be a higher standard and prefer to hire Red Seal tower crane operators to avoid duplicative training and examinations. This is not explored further in this report.

## B. ISSUES ASSOCIATED WITH TOWER CRANE MACHINERY

Exhibit 4 provides aggregated responses to each of the research questions. The findings associated with tower crane machinery are summarized in Table 3:

**Table 3 Comparison of technical requirements related to inspection, enforcement and conformity assessment for each of the three tower crane sub-systems by three jurisdictions sampled.**

**** denotes where a technical difference was identified.*

| Applicable tower crane lifecycle phase | Mechanical Systems / Components | Structural Components | Electrical Systems/ Components |
|---|---|---|---|
| Pre-deployment inspection | Similar in all sampled jurisdictions<br>See note 3 | Similar in all sampled jurisdictions<br>See note 1 & 3 | See note 3<br>Similar in all jurisdictions<br>***One jurisdiction only – See note 2 |
| Inspection after assembly on-site | Similar in all sampled jurisdictions<br>For additional information on jurisdiction deviation only – See note 4 | Similar in all sampled jurisdictions<br>See note 1 | *** For additional information on jurisdiction deviation – See note 2 and 5 |
| On-site operation | See note 6 | See note 6 | See note 6 |
| On-site maintenance | See note 7 | See note 7 | See note 7 |

Notes to **Table 3**:

1. A structural inspection report must be issued by a licensed professional engineer.
2. ***In one sampled jurisdiction, regulations require a third party verification of the high voltage electrical systems. There are various compliance paths. The most common compliance path chosen by commercial firms (i.e. tower crane owners) is to hire an SCC-accredited Electrical Field Inspection Organization (Exhibit 1 - Interviews 3, 5, and 12). One of the provincial electrical authorities has written administrative requirements that outline the three different compliance paths (Exhibit 1 - Interview 5).
3. Per Provincial Occupational Health and Safety Acts, all three provinces reference *CSA Z248 Code for Tower Cranes*, which has technical requirements or references to other standards that address all tower crane systems, as well as tower crane operations.
4. Regulatory requirements for tower crane inspection in one sampled jurisdiction are currently under review. Professional engineer's organizations were instructed to update their professional practice on tower crane inspections (Exhibit 1 - Interviews 7 and 10). The current draft of the updated professional practice will require that third party verification of all tower crane systems (structural, mechanical and electrical) be done under the auspices of a licensed professional engineer (Exhibit 1 - Interviews 3, 7, and 10).
5. Regulations in two of the sampled jurisdictions are silent on mandatory, third party inspection or verification of tower crane electrical systems. This might be interpreted to mean there is no need for a third party verification, or as a delegation of the decision regarding the need for third party verification to another order of regulatory authority, such as municipal and/or accredited industrial corporations. In the case of a municipal regulatory authority, it might choose to delegate responsibility for electrical inspection, which may either be a self-inspection of work, or a third party inspection by a suitably trained, licensed service technician. In one interview (Exhibit 1 - Interview 13), the scope of this work was limited to ensuring that the electrical connections between the tower crane and the electrical service entrance complies with the applicable electrical code.

6. Daily, weekly, and monthly inspection regimes must be documented in a logbook by operators. This is required in all three provinces per administrative requirements related to the respective provincial *Occupational Health and Safety Act*.

7. Maintenance logs are required in all three sampled provinces.

Material technical differences between provinces were found in only two of the lifecycle phases: "Pre-deployment assembly" and "On-site assembly" (see Table 3). The most significant cost difference between provinces relates to third party verification of electrical requirements in Ontario only during "pre-deployment assembly phase". The possible context for this technical difference is discussed in more detail at section e) below. In one sample jurisdiction, when a Canadian company buys a new 2015 tower crane built in Europe, it is sometimes required to change components to meet provincial electrical code requirements. It was noted by at least one respondent that it is not only new tower cranes that are in question, a tower crane that has been in use in Canada for a number of years is subject to the same electrical inspection requirement prior to going into service in the sampled jurisdiction for the first time.

This points to a fundamental difference in the approach to conformity assessment between Europe and Canada. In Europe, industrial manufacturers are allowed to self-declare compliance with safety requirements. In the case of certification of high voltage electrical components, European manufacturers "self-declare" compliance and denote the self-declaration by applying a "CE" mark to their products. However, in Canada, the electrical safety codes in all three provinces require certification by an SCC-accredited, third party conformity assessment body. This is also true in the case of the United States for electrical products that are categorized as "industrial" (Exhibit 1 - Interview 5).

In the case of one of the sampled jurisdictions, the technical difference in electrical requirements arises due to "administrative requirements." These are rules that augment regulations and that further describe and prescribe what has to be done to achieve compliance (Exhibit 1 - Interview 5). In particular, a once-only electrical field inspection for a tower crane's high voltage electrical system can range in cost from $400 to $1,000 (see Annex B). However, these costs will increase if/when non-compliances are found. These costs can add an additional $7,000 to $14,000 (Exhibit 1 - Interview 13) for the replacement of high voltage electrical components, depending on the particular machine and the work required to bring it into compliance.

A tower crane can be imported into Canada from another country without issue; however, it can only be put into use in Canada if it meets certain requirements. For example, all sampled provinces make reference to *CSA Z248 Code for Tower Cranes*, which is a consensus standard developed by an SCC-accredited Standards Development Organization that makes reference to various other standards. In the case of high voltage electrical components, they must comply with the requirements of all applicable provincial electrical safety codes, which are similar.

Since all three sampled provinces make reference to *CSA Z248*, there appears to be no material technical difference between provinces found in this regard. However, a few general statements were made within the survey (see Annex B),as well as during at least one interview, that there are some instances where expert interpretation is required.

In several cases *CSA Z248* varies from provincial regulations causing confusion for industry. It should be noted that *CSA Z248* is a model code that has no force of law until an "authority having jurisdiction" references it within their regulations. Such model codes provide an opportunity for inter-provincial harmonization of requirements provided that all provinces and territories are willing to participate in updating activities. This requires political will as well as the necessary financial resources to keep model codes such as *CSA Z248* up to date. Structural non-destructive testing (NDT) and certification can cost between $2,500 and $10,000 per tower crane depending on size and repairs required (see Annex B). However, again, there is no material technical difference between the provinces in this case. Both *CSA Z248* and the provinces refer to regulations requiring certain degrees of structural NDT.

## C. COMMERCIAL ENTERPRISES ARE REQUIRED TO ADDRESS ALL APPLICABLE "REGULATIONS" HOLISTICALLY

The live interviews made it apparent that commercial firms have to address all regulations in a comprehensive, holistic manner. This sometimes differs from how regulators (often multiple agencies are involved) define "regulation". Additionally, some technical and safety accountabilities are segregated differently between agencies in the various provinces/territories.

Also, the commercial firms interviewed wanted to look at both labour mobility and machinery regulation issues together and not in isolation. During some interviews, it was necessary to clarify if their comments applied to machinery, mobility of labour, or both. For example, among commercial respondents, some of their concerns related to perceived as well as verified differences in requirements and qualifications for tower crane operators and service technicians.

The commercial firms interviewed are categorized as small enterprises by Statistics Canada[8]. Canada's construction sector is made up of thousands of small to medium size enterprises. This is typical of the construction sector in Canada. Since these firms make a significant contribution to Canada's economic output, it is instructive to understand how these firms perceive "regulation". The in-person interviewees made it clear that, from their perspective, they do not differentiate between "legislation", "regulation", "codes", "standards", "inspection", "conformity assessment" or any other associated "administrative requirements" that form part of the regulatory value stream[9].

Commercial respondents viewed all of these types of activities as a form of "regulation". Most often, the commercial respondents referred to activities and tasks within the regulatory value stream as "regulatory costs.[10] They had an expectation that "regulatory costs" will not be duplicated unnecessarily between regions and regulatory jurisdictions.

8. Industry Canada, *Key Small Business Statistics, July 2012*, https://www.ic.gc.ca/eic/site/061.nsf/vwapj/KSBS-PSRPE_July-Juillet2012_eng.pdf/$FILE/KSBS-PSRPE_July-Juillet2012_eng.pdf (accessed May 12, 2015)
9. "Value Stream" is a term that is well-known in the world of quality management, as well as Six Sigma/Lean process improvement. In the 1996 book *Lean Thinking*, by James Womack and Dan Jones, the definition of a value stream is: "The set of actions required to bring a product or service through the three critical management tasks of any business:
   1. Problem solving (e.g. design)
   2. Information management (e.g. order processing)
   3. Physical transformation (e.g. making a physical product, or delivering a service)…"

   In other words, for the purpose of this report, value stream includes all of the activities that are required to meet a customer's requirements and expectations. It's assumed that customers expect a product such as a tower crane to perform its services in a safe manner. Therefore, some would argue that regulatory requirements related to safety add "value".
10. Contrary to how regulations are categorized as adding value, regulations are often viewed by commercial enterprises as a form of "waste" that should be minimized or eliminated (as was apparent in comments made during live interviews). When a requirement is not necessary, or is unnecessarily duplicated, it is certainly a form of "waste" that should be eliminated where possible. This is the ideal purpose for harmonization activities.

Furthermore, commercial respondents would prefer clarity on which authority has accountability for enforcing and explaining all requirements according to their perception of what "regulation" is. In other words, for each machinery category there should be one universal and comprehensive set of technical requirements applied everywhere. This desired state reflects the theoretical construct for 100% harmonization of technical requirements with regulations, as well as all of the associated instruments that reference them.

### D. COMMERCIAL FIRMS WANT FACT-BASED EVIDENCE TO JUSTIFY PERCEIVED AND REAL DIFFERENCES IN REQUIREMENTS THROUGHOUT THE "REGULATORY VALUE STREAM"

The firms interviewed expressed concern about addressing all root causes that hinder both mobility of labour and movement of equipment and materials, regardless of which regulatory agency is involved. Therefore, harmonization of technical requirements for large industrial equipment and machines is still beneficial and needs to be further addressed; if not through additional harmonization, then at least by doing everything possible to make it easy for commercial firms to understand and address local differences prior to incurring rework costs.

A regulatory respondent pointed out that large industrial machines, like tower cranes, are not mass produced in the same way as consumer products. Sometimes, local relevance and conditions may require that a unique regional condition be addressed with a differing technical requirement. The local relevance of a harmonized regulation or standard is lost if a unique local hazard condition is not considered or is excluded from a harmonized regulation. While regulators want commercial firms to keep this in mind, commercial respondents want the local regulator to at least document or explain the rationale or risk that they want to avoid. Deviations between jurisdictions will result in an additional cost to the firm.

### E. DIFFERENCES/CONFUSION IN THE TYPE AND SCOPE OF RESPONSIBILITY OF ORGANIZATIONS THAT ARE HELD ACCOUNTABLE FOR ENFORCEMENT

It is important to look at how the responsibility for inspection and conformity assessment is delegated in different ways between the three provinces.

In one jurisdiction, the provincial electrical authority has jurisdiction for electrical safety, is accountable for electrical safety requirements across the province, as well as being accountable for specifying administrative requirements, such as when a third party assessment inspection or field verification is required. It operates at the provincial level.

This differs from other sampled jurisdictions where the accountability for verification of conformance to electrical requirements is delegated by the provincial authorities to another level/order of authority, such as municipalities or what are known as authorized corporations (Exhibit 1-Interviews 1 and 4). Municipal-corporate-level construction authorities in the other sampled jurisdictions have broader accountabilities for conformity assessment than the equivalent order of municipal-corporate construction authorities in other jurisdictions.

## Summary

Commercial businesses in the tower crane sector are categorized as small enterprises by Statistics Canada. They are an important contributor to Canada's economic output and, from their perspective, it is necessary to ensure that regulatory costs are minimized. They do not differentiate between legislation, regulation, codes, standards, inspection, verification or any related 'administrative' requirements. All of these are viewed as regulatory costs. Their expectation is that these costs are required for safety or performance, but will not be duplicated unnecessarily. Tower cranes are relatively large investments for the firms who own them. Their goal is to reduce unnecessary costs associated with moving this equipment between regions and regulatory jurisdictions.

The differences found in tower crane machinery technical requirements relates to conformance to electrical safety code requirements in the various sampled jurisdictions. Mandatory conformity assessment requirements are much more explicit in some jurisdictions than others and are implemented via the administrative requirements that have been put in place by the regulatory authority having jurisdiction for electrical safety.

In one jurisdiction, the provincial electrical authority is accountable for administrating rules that require a third party assessment of a tower crane's high voltage electrical systems and components. While there are various compliance paths, tower crane owners often opt to hire an approved, SCC-accredited, third party field evaluation agency to perform the electrical inspection that is required in one sampled jurisdiction. The electrical regulations in other sampled jurisdictions are silent on the need for a third-party assessment of high voltage electrical systems and components. However, all provincial electrical regulations require that high voltage electrical components be third-party verified. Self-declaration is not allowed in any province.

The major cost difference within one of the sampled jurisdictions is for a once-only field inspection that occurs prior to the tower crane going into active service on a construction site (pre-deployment phase of the lifecycle). If non-conformances are found, they must be remedied and a re-evaluation is required. The major cost was found when a tower crane is not compliant and can cost up to $14,000 for parts. When opportunity costs and the retrofit of parts is compared to a tower crane's economic output, this once only sector economic impact ranges from approximately 0.8% to 3.2%.

Tower crane sales agents and owners have become more knowledgeable about their jurisdictions more stringent electrical requirement in recent years (Exhibit 1 - Interviews 3 and 12). This has resulted in changes to how some tower crane owners or their procurement agents design their procurement specifications for imported cranes.

In instances where the one sampled jurisdictions electrical requirement becomes part of the owner's tower crane procurement specification, the cost of compliance for tower crane owners is dramatically reduced. However, acquisition of a tower crane is a large and often infrequent investment for some of the small commercial firms that procure them. Sophistication in procurement practices can be highly variable among the small commercial firms who own tower cranes.

In other sampled jurisdictions, there is more reliance on a different order of regulatory authority to decide on if/when a third-party conformity assessment is required. Typically, they are municipal regulatory authorities or, where applicable, what is known as an "approved industrial corporation." In some sampled municipalities they sometimes delegate responsibility for electrical inspection to a suitably trained or licensed electrician or service technician. The inspection may be limited to ensuring that a proper connection has been made between the tower crane and the electrical service entrance (Exhibit 1 - Interview 11).

Finally, in all three sampled jurisdictions, structural inspection is delegated to a licensed professional engineer or other suitably authorized professional, acting under the instructions of an engineer. Therefore, there is likely no significant or material technical difference in structural requirements between provinces.

# 3.2 Case Study 2 – Heating and Plumbing Sector: Water Heaters

## Overview of Water Heater Sector in Canada

The plumbing and heating sector encompasses the products and components of the built environment that ensure the safety and comfort of the indoor air and water in Canadian homes. In 2011, the estimated value of the industry in the Canadian residential sector was approximately $24 billion.[11] (See Annex E for a complete economic profile of the water heater sector in Canada.)

Water heaters are part of the plumbing and heating sector and are used in both residential and commercial capacities. There are different types of water heaters including storage tank, tank-less, combination, solar, and heat pumps, which are fueled by different sources of energy, including, oil, gas, propane, electricity or solar[12].

Instantaneous water heaters are also referred to as tank-less, on-demand, or point-of-use water heaters. This type of water heater has no storage tank and heats flowing water only when required, using either an electric element or a gas burner. Instantaneous water heaters are usually more energy efficient than a storage tank water heater since they eliminate the continuous standby energy loss of a storage tank.

In Canada, most households are equipped with a storage tank water heater allowing for a constant flow of hot water. Such water heaters include a water storage tank that is filled and heated by a burner or electric element every time the level of water stored decreases. This system conveniently allows for a steady supply of hot water; however, it can become expensive. Therefore, it is important that these water heaters are energy efficient to reduce energy costs and greenhouse gas emissions[13].

Heat pump water heater (HPWH) technology moves heat from one place to a tank of water. The HPWH technology does not generate heat directly[14]. Heat pump technology also includes ground-source/earth energy, bringing heat from the earth[15].

11 *A Value Proposition from the Canadian Institute of Plumbing & Heating to Facilitate the Harmonization of Market Entry Required Standards and Certification Schemes Covering Selected Plumbing & HVACR Products, Economic Impact Assessment*, 2012

12 On average water heaters account for 17% of energy consumption in Canadian households. http://www.nrcan.gc.ca/energy/products/categories/water-heaters/13735 (accessed May 12, 2015)

13 Natural Resources Canada, *Storage Tank Water Heaters*. http://www.nrcan.gc.ca/energy/products/categories/water-heaters/14508 (accessed February 20, 2015)

14 Natural Resources Canada, *Heat pump water heaters*, http://www.nrcan.gc.ca/energy/products/categories/water-heaters/14556, (accessed February 20, 2015)

15 Natural Resources Canada, *Ground-Source Heat Pumps* (Earth-Energy Systems), http://www.nrcan.gc.ca/energy/publications/efficiency/heating-heat-pump/6833 (accessed February 20, 2015)


In 2011, the estimated value of the plumbing and heating industry in the Canadian residential sector was approximately $24 billion.

Solar domestic hot water (SDHW) systems use solar energy to heat water. An SDHW system can provide up to 60% of the hot water supply for an average Canadian home[16]. Therefore, it needs to be supplemented with another type of water heater using a different type of fuel. SDHW systems that are freeze protected can generate hot water even when the temperature dips below zero[17].

According to the CIPH, approximately one million water heaters are sold for new construction and replacement applications each year in Canada. Water heaters need to be replaced every 7-10 years. This turnaround rate results in an industry estimate that between 60% and 80% of water heaters are sold annually to replace old water heaters. In 2011, there were 14 million water heaters in Canadian residences, mostly fuelled by electricity or natural gas (44.9% and 49.7%, respectively).

**Table 4 Water Heater Stock in Canada's Residential Sector by Building Type and Energy Source (1990-2011)**

| | 1990 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|
| **Total Water Heater Stock (x1,000)** | **10,428** | **13,343** | **13,546** | **13,753** | **13,943** | **14,120** | **14,285** |
| **Water Heater Stock by Building Type (x1,000)** | | | | | | | |
| **Single Detached** | 5,856 | 7,537 | 7,641 | 7,733 | 7,819 | 7,897 | 7,965 |
| **Single Attached** | 970 | 1,454 | 1,491 | 1,527 | 1,559 | 1,590 | 1,620 |
| **Apartments** | 3,380 | 4,088 | 4,146 | 4,221 | 4,290 | 4,354 | 4,418 |
| **Mobile Homes** | 221 | 264 | 269 | 272 | 276 | 279 | 282 |
| **Shares (%)** | | | | | | | |
| **Single Detached** | 56.2 | 56.5 | 56.4 | 56.2 | 56.1 | 55.9 | 55.8 |
| **Single Attached** | 9.3 | 10.9 | 11 | 11.1 | 11.2 | 11.3 | 11.3 |
| **Apartments** | 32.4 | 30.6 | 30.6 | 30.7 | 30.8 | 30.8 | 30.9 |
| **Mobile Homes** | 2.1 | 2 | 2 | 2 | 2 | 2 | 2 |
| **Water Heater Stock by Energy Source (x1,000)** | | | | | | | |
| **Electricity** | 5,470 | 6,076 | 6,132 | 6,207 | 6,288 | 6,341 | 6,418 |
| **Natural Gas** | 4,333 | 6,531 | 6,676 | 6,807 | 6,899 | 7,016 | 7,097 |
| **Heating Oil** | 536 | 591 | 587 | 587 | 599 | 605 | 607 |
| **Other**[18] | 66 | 52 | 55 | 55 | 58 | 58 | 59 |
| **Wood** | 23 | 93 | 96 | 96 | 100 | 100 | 104 |
| **Shares (%)** | | | | | | | |
| **Electricity** | 52.5 | 45.5 | 45.3 | 45.1 | 45.1 | 44.9 | 44.9 |
| **Natural Gas** | 41.5 | 48.9 | 49.3 | 49.5 | 49.5 | 49.7 | 49.7 |
| **Heating Oil** | 5.1 | 4.4 | 4.3 | 4.3 | 4.3 | 4.3 | 4.2 |
| **Other**[19] | 0.6 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| **Wood** | 0.2 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |

*Source: Natural Resources Canada, Comprehensive Energy Use Database*[20]

16 This estimate will depend on climate and on hot water use habits.

17 Natural Recourses Canada, *Solar Water Heaters*, http://www.nrcan.gc.ca/energy/products/categories/water-heaters/14562 (accessed February 20, 2015)

18 "Other" includes coal and propane.

19 Ibid.

20 Natural Resources Canada, "Table 34: Water Heater Stock by Building Type and Energy Source". *Energy Use Data Handbook* http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&sector=res&juris=ca&rn=34&page=4&CFID=35688870&CFTOKEN=915948097d7 (accessed February 2, 2015)

Most applicable standards for plumbing and heating products installed in Canada are specified in the *Model National Plumbing Code, National Building Code* and *National Energy Code* (see Annex F for list of standards and codes). The adoption of these guidelines as a jurisdictional regulation is up to individual provinces and territories.

## Detailed Methodology

Through CIPH, SCC worked with water heater manufactures to identify differences in standards, certification, testing and inspection requirements in regulations from F/P/T/M jurisdictions in Canada. This case study aims to identify potentially duplicative requirements through the life cycle of a water heater (assembly to installation) and to calculate additional costs associated with compliance with duplicative requirements incurred by manufacturers of water heaters.

To that end, survey questions were sent to the main companies that manufacture water heaters in Canada. When developing the survey, SCC made the following assumptions to focus the case study on a hypothetical scenario and to compare the costs of manufacturing electric and gas water heaters within multiple jurisdictions in Canada:

1. Plumbing products, including water heaters, pass through various certification/testing/inspection processes. These processes typically take between six weeks to six months or more depending on the number and complexity of tests that the product must undergo. This survey focused specifically on that certification/testing/inspection process and its impact on the electric/gas water heater value chain.
2. Once a final production model of a water heater has been completed and passed by internal engineering, it is submitted to the appropriate certification body for full compliance testing. All water heaters, manufactured in Canada and imported, are subject to product compliance tests in four specific areas: materials, mechanical, performance, and safety.
3. Once the final production model has been certified, additional certifications may be required to meet various duplicative requirements by provinces and territories. This case study assumes that additional certifications will take place at the manufacturing plant.
4. All electric/gas water heaters sold in Canada may be subject to the requirements of one or more of the *National Plumbing Code of Canada* (NPC), the *Canadian Electrical Code* (CEC), the *National Energy Code of Canada for Buildings* (NECB), the *National Building Code of Canada* (NBC), *National Gas Codes* (e.g., the *B-149 series* of natural gas & propane codes), and provincial/territorial and municipal adoptions of these codes.
5. These requirements apply to one or more of the following jurisdictions: federal, provincial/territorial, and/or municipal.
6. There may be inconsistencies across Canadian jurisdictions in the adoption of the NPC, the NECB, and the NBC.
7. Although municipalities in Canada fall under the regulatory purview of provinces and territories, there may be additional requirements for water heaters at the municipal level, some of which provincial and territorial authorities have not approved.

Due to the sensitive nature of the data, SCC agreed to sign non-disclosure agreements with manufacturers. It took longer than expected to finalize these agreements with the legal departments of the companies involved, thus delaying the completion of the surveys. As a result, at the time of publication of this report, SCC did not yet have completed surveys from all participants.

## Findings and Discussion

Despite the fact that SCC does not yet have data from all of the companies in question, there are partial results worth noting from the survey responses received thus far, as well as research conducted by CIPH and by SCC staff.

Highlights of the partial results include:

### NATIONAL REQUIREMENTS

- At the national level, there are various components of a water heater that have associated safety standards, as specified in the *National Plumbing Code of Canada* and the *National Building Code of Canada*. For instance, the temperature and pressure relief valves must comply with *ANSI Z21.22-1999/CSA 4.4-M99 (R2014) - Relief Valves for Hot Water Supply Systems*. Other key components have their own standards that they must comply with, such as dip tubes, gas valves/controls, etc.
- At the national level, residential gas water heaters must comply with *ANSI Z21.10.1-2014/ CSA 4.1-2014 - Gas water heaters, volume I, storage water heaters with input ratings of 75,000 Btu per hour or less* must comply with *UL 174- Household Electric Storage Tank Water Heaters*.
- For both gas and electric water heaters, there are also federal efficiency requirements set by NRCan in the *National Energy Code of Canada for Buildings*. They include Energy Factor (EF) for gas water heaters and standby loss (SBL) for electric water heaters.
- Electric water heaters must comply with *CAN/CSA-C191-M90 - Performance of electric storage tank water heaters for domestic hot water service*, in order to determine their SBL. Gas-fired storage water heaters must comply with *CAN/CSA-P.3-04 (R2015) - Testing Method for Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters* to determine EF. These are to determine water heater efficiency.
- Water heaters must also adhere to bilingual requirements (English and French) for products sold in to Canada for residential use.

### PROVINCIAL / TERRITORIAL REQUIREMENTS

- In some cases, provinces and territories may have additional, more stringent, energy efficiency requirements to those that exist at the national level.
- There can be differences in how provinces and territories adopt national codes.
- For gas/fire water heaters, the provincial and territorial fuel gas code requirements can be different between jurisdictions, with some adopting the *US National Fuel Gas Code- NFPA 54, ANSI Z223.1*, while others use the CSA code, *B149- Natural Gas and Propane Code*.
- There can also be some deviations in requirements at the municipal level. For example, customers (e.g., major energy companies that rent water heaters) may have different requirements.

### COST OF DUPLICATIVE REQUIREMENTS

- At the national level, there are product certification and efficiency testing costs to meet the requirements of different standards:
- There are added costs at the federal level to meet bilingual requirements.
- Different requirements between jurisdictions can also necessitate product redesigns, which add to the overall incremental cost of the product.

## Summary

Based on the information we have received thus far, Canadian water heater manufacturers do appear to have to comply with conflicting or duplicative requirements between jurisdictions. This is a result of differences between F/P/T/M requirements, as well as differences between provinces/territories in how they adopt national model codes, which is a common cause of internal trade barriers in many sectors. For example, not all provinces and territories adopt the most current national model codes and they may conduct their own review and make modifications to the model code before adopting it for their own jurisdictions. The resulting fragmentation means that, at any given time, different provinces/territories may be referencing different requirements in their respective model codes. This is the case in the plumbing/heating sector with the national plumbing and building codes. This can have a significant cost impact for the Canadian water heater industry.

The additional energy efficiency requirements in some provincial/territorial jurisdictions, as well as those set by NRCan at the federal level, were frequently mentioned to SCC by industry representatives as a source of major additional cost faced by companies. These additional energy efficiency requirements, as well as the inconsistent provincial and territorial adoption of model codes, illustrate the need for more effective regulatory coordination between the federal and provincial and territorial governments. To that end, SCC is supportive of efforts made by the Provincial Territorial Policy Advisory Committee on Codes (PTPACC) to modernize its governance and streamline the interface between the standards development process and codes development/adoption processes.



# 3.3 Case Study 3 – RVs and Natural Gas

The third case study analyzed new products in sectors where new regulations are being developed to identify potential TBTs, and potential policy solutions before differences become more permanently embedded in regulatory requirements.

This was done through an analysis of some of the products under the regulatory purview of the National Public Safety Advisory Committee (NPSAC) to which SCC provides the secretariat, and belongs as an associate member. NPSAC's scope relates to the protection of people and property in matters including electrical safety, gas (propane, Liquefied Natural Gas, Compressed Natural Gas, etc.), boilers and pressure vessels, and elevating devices. NPSAC's Harmonization Approaches Working Group (HAWG) is examining new product sectors where there is the potential for regulatory differences between jurisdictions if preventive action is not taken. This case study includes two of those new product areas: the certification of RVs imported from the U.S., and the deployment of Liquefied Natural Gas (LNG) as a fuel for the transportation sector.

## Certification of Recreational Vehicles (RV)
## Overview of RV Sector in Canada

The RVs sector encompasses the manufacturing, purchasing, servicing, and use of recreational vehicles. In 2011, the total economic activity within this sector was $14.5 billion. Direct spending associated with RVs was $11.5 billion.[21]

At the time of this writing, the United States and Canada have different approaches to product safety, which has created an issue concerning RVs that are imported from the U.S. into Canada. Most Canadian jurisdictions require that RVs are certified to *CAN/CSAZ240*[22] *RV Series on recreational vehicles*, while equipment in recreational vehicles made for the U.S. market typically meet the corresponding U.S. standard (*NFPA 1192 Standard on Recreational Vehicles*).[23]

Several jurisdictions have received feedback from stakeholders seeking clarification of regulations concerning RVs. In a number of provinces, the Recreational Vehicle Dealers Association (RVDA) has requested an exemption of "certification to Canadian standards" for equipment in recreational vehicles imported from the U.S. QAI, an accredited certification body which certifies compliance to the CSA standards in Canada, has also raised the issue of non-enforcement of requirements in letters to politicians. Provinces and territories have subsequently raised certification of RVs at NPSAC as a common issue shared by provinces and territories that would benefit from a harmonized solution.

21 *Economic Impact of the Canadian Recreation Vehicle Industry*, Final Report presented to the Recreation Vehicle Dealers Association of Canada, Harris Decima, December, 2012, p.3 http://www.rvda.ca/documents/2012_RVDA_Economic_Impact_Report_Final.pdf (accessed May 12, 2015)

22 *CSA Z240 Recreational vehicles* was re-affirmed in 2013.

23 Most recent edition of the NFPA 1192 standard is 2015.

The recreational vehicles sector encompasses the manufacturing, purchasing, servicing, and use of recreational vehicles. In 2011, the total economic activity within this sector was $14.5 billion.

The differences between *CSA Z240 Recreational vehicles* and *NFPA 1192* have recently been significantly reduced, and the upcoming 2015 edition of *CSA Z240* will be largely harmonized in a majority of areas with *NFPA 1192* with the notable exceptions of electrical systems and some safety labels. Both Standards Development Organizations (SDOs) have indicated the desire to work towards a uniform North American standard by 2017[24].

The significant difference between Canadian and U.S. certification systems is the mechanisms used to protect public safety. Canada is more reliant on third party certification and regulatory compliance and enforcement. Most manufacturers in the U.S. are voluntarily members of the Recreational Vehicle Industry Association (RVIA), an industry-funded organization, where manufacturers are subject to regular (every 8 weeks) audit inspections conducted by RVIA inspectors. Units produced by these manufacturers will bear an RVIA label indicating compliance with *NFPA 1192*. This means that recreational vehicles made for the U.S. market are typically not certified to the *NFPA 1192* standard by an independent party, but rather rely on a system of self-declaration. There are also other smaller private organizations that audit manufacturers for compliance. The electrical and gas equipment in vehicles manufactured for the U.S. market are not certified by an independent third party to Canadian standards as is required under provincial legislation. The role of SCC in accrediting certification agencies for approval of regulated equipment is recognized across the country.

The RVDA supports its position by pointing to administrative requirements for RVs, which in some provinces are recognized through acceptance of the RVIA label. RV dealers in Canada would benefit from being allowed to sell vehicles built to *NFPA 1192* standards in two important ways: It would improve their competitive position compared to private imports and it would remove their currently liability if selling imported vehicles that are not certified to *CSA Z240* (i.e., do not meet regulatory requirements). Provinces and territories have investigated the option of accepting the RVIA label, but have been hesitant due to RVIA status as a non-accredited certification body.

## Findings and Discussion

*CSA Z240* remains the choice of provincial regulators and is referenced in all provincial regulations. However, some provinces also accept the RVIA label in addition to proof of compliance to *CSA Z240*. Other provinces recognize *NFPA 1192* in their regulations covering RVs[25], though not necessarily the RVIA label. There is some variance across provincial regulatory regimes, as the RV standards concern multiple components of the vehicles (including construction/manufacturing requirements, propane/gas requirements, plumbing requirements, and electrical requirements), all of which may be subject to other regulations.

There is little systematic data available that speaks to the number of incidents caused by electrical or gas equipment in RVs manufactured within the U.S. or Canada. There is a strong belief that the Canadian system of mandatory third party certification to standards, with regulatory oversight, results in higher levels of public safety.

24 March 29, 2012 RVIA Press Release *Progress Made in Harmonizing NFPA 1192 and CSA Z240 RV Standards*, http://www.rvia.org/?ESID=preleases&PRID=431&SR=151 (accessed May 12, 2015) and May 1, 2013 RVIA Press Release, U.S., *Canadian RV Standards Harmonization Progresses*, http://www.rvia.org/?ESID=preleases&PRID=542&SR=41 (accessed May 12, 2015)

25 Saskatchewan Vehicle Equipment Regulation, https://www.canlii.org/en/sk/laws/regu/rrs-c-v-2.1-reg-10/latest/rrs-c-v-2.1-reg-10.html?searchUrlHash=AAAAAQAETkZQQQAAAAAB (accessed May 12, 2015)

Jurisdictions have responded to issues of imported RVs on an individual basis. The item was discussed within the Regulatory Authority Advisory Bodies (RAABs)[26] following letters from QAI to various jurisdictions, but no joint position, action plan, or communication has been agreed upon to date.

## Summary

The NPSAC HAWG has identified three potential policy options for provinces and territories to address the different approaches to RV certification between Canada and the U.S. The HAWG is currently examining which of these policy options is most conducive to preventing the emergence of different regulatory requirements between provinces and territories for the importation of RVs from the U.S:

1. Maintain the requirement for third party certification of RVs to *CSA Z240*.
2. Maintain the requirement for third party certification, and adopt *NFPA 1192* alongside *CSA Z240*.
3. Recognize the RVIA label on RVs.

At the time of this writing, NPSAC is connecting with RAABs to jointly set priorities for discussion and resolution, including:

- Reviewing whether *NFPA 1192* and *CSA Z240* essentially lead to equivalent levels of safety of RVs (seasonal and permanent use). If not, RAABs will analyze the substantial differences and recommend how these can be resolved.
- Reviewing the effectiveness of RVIA oversight on its members compared to independent third party certification.
- Reviewing product recall mechanisms that could apply in the case of RVs.

NPSAC will also examine the feasibility of Canadian provinces and territories accepting the U.S. RVIA label and process in Canada.

## Liquefied Natural Gas Refueling Stations
## Overview of Liquefied Natural Gas Sector in Canada

Liquefied Natural Gas (LNG) is a sub-sector of the natural gas sector. In 2013, natural gas distribution generated just over $5 billion of Canada's GDP[27]. LNG is natural gas in its liquid state, reduced to 1/600th of its original volume, making it easy and economical to transport over long distances. Once transported, LNG goes into storage tanks, is re-gasified, and delivered to markets[28]. The most developed areas using LNG are mining, remote communities and road transportation. The use of LNG is also emerging in the marine and rail sectors, which will require further exploration.

26 RAABs consist of representatives from various Canadian governmental organizations (F/P/T/M) and are designed to resolve issues of national importance, and develop aligned responses to emerging public safety issues. Currently, a number of RAABs operate in Canada and provide advice to regulatory authorities and industry. RAABs are defined in accordance with the definition used by SCC in its procedural documents, "*A Body, Council or Committee, consisting of representatives from various Canadian governmental organizations (Federal, Provincial, Territorial, Municipal or other) that coordinates regulations and promotes consistency among jurisdictions related to regulations, standards and enforcement practices respecting the sale, purchase, safety, performance, use and application of consumer or industrial products within its jurisdiction*." (https://www.scc.ca/sites/default/files/publications/CAN-P-1500-2013_e.pdf).

27 Canadian Gas Association, *Industry at a Glance Information Sheet*, http://www.cga.ca/gas-stats/ (accessed on April 24, 2015)

28 Liquefied Natural Gas (2014). Natural Resources Canada, https://www.nrcan.gc.ca/energy/natural-gas/5679 (accessed April 22, 2015)

In 2013, there were 10 LNG import/export facilities in North America, with one located in Canada. In 2014, Canada exported over $33 million to the U.S., while importing over $512 million primarily from Trinidad and Tobago and the U.S.[29] Currently in Canada there are 284 LNG highway tractors in use and 10 LNG refuelling stations including two that are privately owned. These stations are located in British Columbia, Alberta, Ontario, and Quebec.

This case study explores emerging regulatory and standardization issues identified by the LNG industry with respect to the use of LNG fuel for highway tractor trailers and bulk delivery of LNG throughout the value chain (from transportation of LNG to a refuelling station). In particular, this section focuses on transporting LNG, building LNG refuelling stations, operating and maintaining LNG refuelling stations, and how Regulatory Authority Advisory Bodies (RAABs) and safety councils can support the emerging sector. Developing a harmonized regulatory and standardization framework in the road-transportation LNG sub-sector could become the foundation for development in other LNG sub-sectors, such as marine, rail and mining.

This case study is a reflection of input from industry stakeholders. Three key industry groups were identified and consulted with regarding the state of the LNG industry, standardization and regulatory gap. These groups include the LNG Technical Advisory Group (TAG), the Canadian Gas Association (CGA), and the Canadian Natural Gas Vehicle Alliance (CNGVA). To gather and validate the information, SCC distributed a survey with 15 questions to six LNG industry partners through TAG, CGA, and CNGVA. Three industry stakeholders responded to the survey. A textual analysis of the surveys was conducted in conjunction with other documents from industry meetings, reports, workshops and consultations. In addition, the initial survey results were presented to TAG to further validate the results. Results were intended to reflect obstacles encountered by the LNG industry throughout the LNG value chain identified above. Some of these obstacles create opportunities to proactively address standardization and regulatory challenges before they are embedded in regulations.

## Findings and Discussion

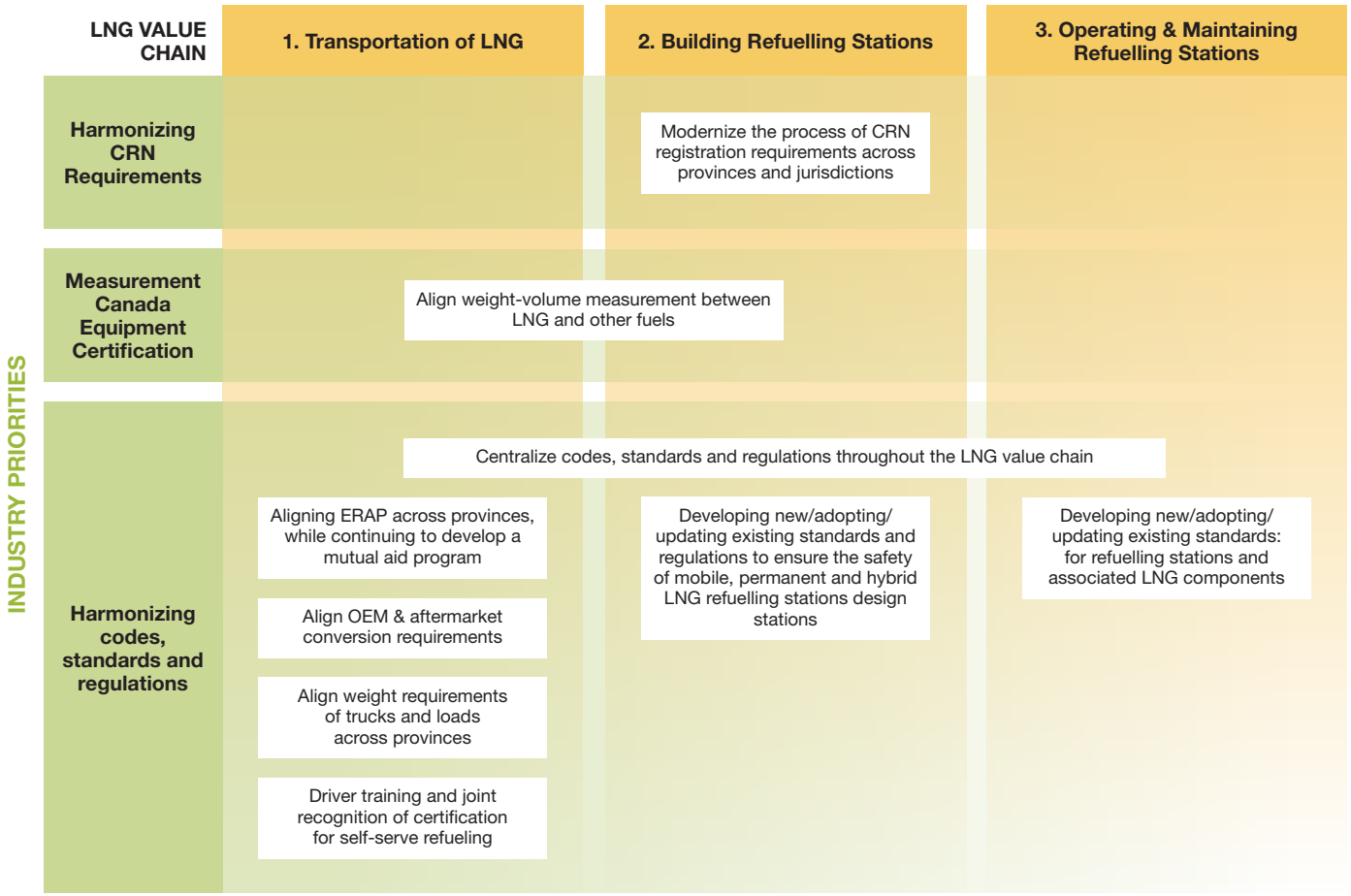
LNG transportation, refuelling stations and their components are designed to comply with standards and codes that ensure their safe operation. Before a vehicle can transport LNG or before a refuelling station can operate, authorities having jurisdiction (AHJ) over LNG and pressure vessels must inspect and approve the vehicle/station after it has been installed and commissioned. The installation of LNG refuelling stations involves different processes and permitting requirements across provinces and AHJs. Diagram 1 points to specific areas industry stakeholders identified as priorities. Below is a discussion of priority areas of concern identified along the LNG value chain by industry stakeholders.

The overarching theme identified throughout the LNG value chain is the lack of coordination and harmonization of standards across provinces. The current decentralized development of the emerging LNG industry leads to diverging regulatory requirements, which translate to higher costs and fragmentation, making it difficult for industry stakeholders to take advantage of economies of scale. From the industry perspective, taking advantage of economies of scale will drive costs down and increase usage, which will lead to a more rapid technological progress of the industry. Economies of scale will also allow for a more rapid growth in an increasingly globally competitive industry. Industry stakeholders also reported that they are experiencing increasing difficulties as a result of the fragmented regulatory system in Canada; such difficulties are not experienced in other industrialized countries. In some cases, key industry stakeholders were considering holding off operations until the market is more mature. Furthermore, consistency is vital to the continuous success of the industry, since it will increase clarity while decreasing uncertainty and costs, which will lead to further investment. Survey respondents identified the key role RAABs and safety councils need to play in establishing the regulatory foundation that will support the growth and global competitiveness of the LNG industry.

29 Statistics Canada & US Census Bureau, Trade Online Database, Innovation, Science and Economic Development Canada https://www.ic.gc.ca/app/scr/tdst/tdo/crtr.html?naArea=9999&searchType=KS_CS&hSelectedCodes=%7C271111&productType=HS6&reportType=TE&timePeriod=10%7C Complete+Years&currency=CDN&toFromCountry=CDN&countryList=DET&grouped=GROUPED&runReport=true (accessed May 12, 2015)

While Canada currently relies mostly on imports of natural gas, it holds large reserves that are estimated to last for the next 200 years at the current extraction rate[30]. One of the most developed sectors in LNG usage is mining. Establishing a robust regulatory foundation for LNG usage will have a ripple effect throughout the economy, affecting not only the LNG sector, but other sectors as well. Furthermore, a developed LNG sector will contribute to a reduction in the environmental impact of many industries such as mining and transportation, as it is considered to be a relatively cleaner fuel[31]. Therefore, proactively addressing the sector's current regulatory challenges at early stages will have lasting positive effects on Canada's economy, environment, health and safety, and global competitiveness.

**Diagram 1 Key Priorities in the LNG Value Chain**




30 Canadian Gas Association, *Industry at a Glance Information Sheet*, http://www.cga.ca/gas-stats/ (accessed April 24, 2015)

31 Natural Resources Canada, *Shale Gas: Key Facts*, https://www.nrcan.gc.ca/energy/sources/shale-tight-resources/17669 (accessed April 24, 2015)

## Transporting Natural Gas

Several issues related to the transportation of natural gas were consistently mentioned by industry highlighting the industry's difficulty understanding the differences between legislation, regulations, codes, standards, inspection, and conformation assessment, including who has the responsibility to enforce various requirements. For example, LNG is classified as a "dangerous good"[32]. Therefore, it falls under the requirements of Transport Canada's (TC) Transportation of Dangerous Goods (TDG) regulation. Under TDG, companies need to develop and have an Emergency Response Assistance Plan (ERAP)[33] in place. The ERAP must meet TC's standards which also appear as CSA standard *Z731-03*, *Emergency Preparedness and Response (ERAP)*. However, some jurisdictions have separate requirements for ERAP and reference CSA *Z731-03 in their respective regulations*. The cost of compliance to the ERAP program can range anywhere from $30,000 to $200,000 in each province.

Other challenges affecting LNG highway tractors and/or LNG mobile refuelling stations crossing borders include gross vehicle weight limits varying between provinces. While this is not related to duplication of standards, it indicates there is a misunderstanding between regulation versus standardization and who is responsible for setting limits in each jurisdiction.

Another significant challenge faced by the industry is the lack of regulation, as well as appropriate standards referenced in regulation, for the approval of equipment to find the equivalency measurement between LNG and diesel. These delays prevent truck drivers from being able to compare the costs associated with diesel and LNG. This issue also affects the refuelling stations as they are the ones to sell the LNG to truck drivers and need to be able to properly measure their product. This is another example of how industry does not always differentiate between what body is responsible for what part of the regulatory value stream.

## Building LNG Refuelling Stations

Mobile refuelling stations are a vital component of the emerging LNG industry. A mobile station is a trailerized unit that can be set up for fuelling and then moved at a later date. At the current stage of the sector's development in Canada, building a permanent refuelling station is not economically viable in many cases, due to the relatively small volume of trucks fuelled by LNG (it takes approximately 40 trucks to support the economics for a permanent station). Therefore, according to industry stakeholders, mobile or hybrid refuelling stations play a key role in the early stages of industrial development. Establishing a strong network of LNG refuelling stations is vital to the development of the LNG industry.

Differing Canadian Registration Number (CRN) requirements among jurisdictions is a major concern raised by key stakeholders. *CSA B51 Boiler, Pressure Vessel, and Pressure Piping Code* (referenced in *CSA Z276*) requires pressure vessel components to be assigned a CRN prior to operating a natural gas vehicle within the province where the CRN is given. This process is not harmonized across Canada. It is one of the main reasons projects exceed their planned budgets. Industry stakeholders did not encounter similar problems when operating in the U.S. and the European Union. Stakeholders suggested that Canada look to the examples of the U.S. and the European Union for more efficient ways to deal with this regulatory requirement. Harmonizing the CRN process and requirements across provinces and jurisdictions is a primary concern to ensure the health and safety of Canadians.

32 Transport Canada, *Appendix E: Schedule 2 - List of Dangerous Goods*, http://www.tc.gc.ca/eng/tdg/publications-tp14877-1181.html ( accessed April 24, 2015)

33 Transport Canada, *Emergency Response Assistance Plan*, http://www.tc.gc.ca/eng/tdg/erap-menu-72.htm (accessed April 24, 2015)

The design of refuelling stations is another area that requires harmonization. While design falls under *CSA Z276-11 Liquefied natural gas (LNG) - Production, storage, and handling*, no one station is alike because of the various interpretations for each step of the station installation process at the municipal, provincial and federal levels. Overall, the cost of building a LNG fuelling station can easily reach $50,000, depending on the complexity and site-specific context[34]. A harmonized approach is required to reduce the costs of building refuelling stations and establishing a larger network across Canada.

## Operating and Maintaining LNG Refuelling Stations

Each station has different requirements such as, individual company protocols and processes, divergence in regulations, and site-specific challenges. These differences translate to very different costs. Due to the uniqueness of each station, estimating the costs of operating and maintaining LNG fuelling stations is complex. Therefore, a more thorough study is needed to estimate the average costs of operating and maintaining LNG refuelling stations. CSA, an SCC-accredited standards development organization, is currently working towards addressing this gap in standards and processes by developing several new standards targeting refuelling stations and associated LNG components. The CSA Technical Committee on Liquefied Natural Gas is a committee composed of experts selected to represent the various interest groups most likely to be affected by the standard.

## Summary

While many issues related to standardization have been raised by industry stakeholders, two key priority areas have been identified:

**1.** Canadian Registration Number (CRN)

**2.** Diverse interpretation of codes and standards

Further exploration of solutions that may assist in resolving the CRN difficulties experienced across jurisdictions should be considered. Improving clarity will reduce uncertainty in the building of LNG refuelling stations. Harmonizing the CRN registration processes across provinces could also address safety issues.

It is necessary to harmonize the interpretation of codes and standards across the LNG value chain to ensure a more coordinated approach across Canada. Furthermore, addressing the emerging regulatory and standardization gaps in the LNG fuel for highway tractor trailers and bulk delivery of LNG throughout the value chain will serve as the foundation for future development in the use of LNG in the marine and mining sectors. Addressing the identified gaps will support the growth of this emerging sector and improve Canada's global competitiveness, while ensuring the continued health and safety of Canadians.

34 Some of the costs associated with building a LNG refuelling station include: setback distances, tank dykes, safety authority costs (e.g. site specific risk assessment), application fees of up to $10,000 (excluding the time spent to prepare application), CRN and electrical certification costs can reach from several thousand to more than $10,000, preparing an application can take up to eight months to process, municipal charges, site development and building permits can range up to $100,000 depending on the complexity and requirements by the municipality.

4.

# Next Steps –Modernizing Internal Trade in Canada with Standardization

## Analysis of Case Study Results

The case studies summarized in this report indicate a lack of alignment between jurisdictions in the use of standardization as a regulatory tool in F/P/T/M codes and regulations. The key themes from the case studies include:

- Inconsistent use of standards and certification requirements between jurisdictions, including duplicative requirements between jurisdictions and different requirements in some jurisdictions than in others;
- Differences between provinces and territories in their adoptions of national model codes;
- Different interpretations of standards and regulations between jurisdictions;
- Development of unaligned requirements in emerging regulatory sectors; and
- Lack of coordination between F/P/T/M governments to develop harmonized approaches.

This fragmented approach to the use of standardization in regulations contributes to the creation of TBTs. Currently, Canada's standardization system is decentralized, complex, and "bottom up," wherein the development and utilization of standards and conformity assessment procedures are driven by SDOs, Conformity Assessment Bodies (CABs), and F/P/T/M regulators, with little coordination between them. The lack of coordination between the disparate components of the system makes it difficult for F/P/T/M regulators to reconcile their use of standardization requirements in regulations.

The fragmented approach to the use of standardization in regulations contributes to the creation of technical barriers to trade. SCC will continue to work closely with Innovation, Science and Economic Development Canada to explore ways to reduce internal trade barriers.

F/P/T/M governments also do not currently possess the tools to keep track of the standardization requirements that they incorporate by reference in their regulations, or to compare the use of these requirements across jurisdictions. As such, F/P/T/M regulators cannot be certain that they are using the most appropriate international, regional, or national standards, nor can they be certain that the standards they do use are up to date and aligned across jurisdictions in Canada.

One of the mechanisms through which F/P/T/M regulators could potentially coordinate the use of standardization in their regulations is through the use of RAABs.[35] RAABs consist of representatives from various Canadian governmental organizations and are designed to resolve issues of national importance, and develop aligned responses to emerging public safety issues. Currently, a number of RAABs are operating in Canada and providing advice to regulatory authorities and industry.[36]

However, a recent review of RAABs by SCC found that the current relationships between RAABs, SDOs, federal departments, CABs, and other key stakeholders, are not well established or defined, and that RAABs' terms of reference and governance practices are not consistent between one another. This results in a duplication of efforts and hinders their ability to align and set priorities. It also prevents regulatory authorities from ensuring that standards and certification requirements referenced in regulations are up to date and aligned. The ineffectiveness of RAABs as they are currently constituted means that there is no effective governance mechanism in place for F/P/T/M governments to determine how they should best coordinate the use of standardization to ensure that requirements are aligned across the country.

The persistence of TBT-based internal trade barriers is in-part due to the fact that they are more difficult to identify than explicit tariff-based barriers. But it must also be noted that there is currently little incentive for F/P/T/M regulators to make an effort to better align their respective standardization requirements. The lack of effective coordinating mechanisms means that regulators are not rewarded for alignment efforts, nor are they penalized for implementing their own unique requirements. In the absence of stronger institutions to enhance coordination, sustained progress in reducing TBTs will be difficult to achieve.

## Recommendations

In order to help redress unaligned standardization requirements of the kind illustrated in these case studies, SCC has developed a number of policy recommendations. They are based on extensive consultations with key government and industry stakeholders, including the Provincial Territorial Advisory Committee (PTAC) and the National Public Safety Advisory Committee (NPSAC):

- The reconciliation of standards-requirements between jurisdictions in Canada should be a key component of a modernized CFTA.
- Mechanisms should be developed to ensure that standards incorporated by reference in F/P/T/M regulations are current and aligned across jurisdictions, while maintaining the highest possible health and safety standards.
- Mechanisms should be developed to ensure compliance with harmonized approaches and allow for dispute resolution across jurisdictions.
- F/P/T/M governments need to place a greater emphasis on meeting their obligations under multilateral and bilateral trade agreements, particularly the World Trade Organization Technical Barriers to Trade (WTO-TBT) Agreement's obligations regarding transparency of regulatory and standardization requirements and the importance of using international standards to further harmonization between jurisdictions.

35 RAABs are defined in accordance with the definition used by SCC in its procedural documents, "*A Body, Council or Committee, consisting of representatives from various Canadian governmental organizations (Federal, Provincial, Territorial, Municipal or other) that coordinates regulations and promotes consistency among jurisdictions related to regulations, standards and enforcement practices respecting the sale, purchase, safety, performance, use and application of consumer or industrial products within its jurisdiction.*" (https://www.scc.ca/sites/default/files/publications/CAN-P-1500-2013_e.pdf).

36 Examples of RAABs relevant to the sectors covered in these case studies include, the Canadian Advisory Council on Electrical Safety (CACES), the Canadian Advisory Council of Energy Efficiency (CACEE), the Canadian Advisory Council on Plumbing (CACP), and the Interprovincial Gas Advisory Council (IGAC).

## Progress to Date

In recent years SCC, working with PTAC and NPSAC, has taken some initial steps to more effectively align standardization requirements across Canada, including:

- SCC, working with PTAC, has developed a viable web-based tool, the Monitoring of Standards in Regulations (MSR) Database. It enables SCC to track information about standards referenced in regulations across all Canadian jurisdictions. It facilitates the identification and tracking of references to standards by automatically searching for and displaying matches to the acronym and/or title of SDOs found in regulatory text collated in the CANLII database. The MSR enables efficient ongoing data collection, monitoring, analysis, and reporting.
- Fee for service contracts have been signed with seven provinces to complete provincial standards inventories. SCC anticipates completing contracts with the remaining provinces and territories.
- SCC is supporting NPSAC's efforts to focus on key standardization issues, develop harmonized approaches through the use of common standards, and establish appropriate linkages with relevant RAABs.
- SCC is in the process of establishing formal linkages with public safety and building/construction RAABs to facilitate the implementation of decisions of regulatory authorities related to standardization.
- SCC is supporting efforts by the PTPACC to modernize its governance and streamline the interface between the standards development process and codes development/adoption processes.
- SCC presented various options for the strengthening of Canada's standardization governance framework to a meeting of Internal Trade Representatives (ITRs) in Toronto in February, 2015.
- In April 2015, ITRs sent SCC the draft text to date for potential inclusion in a standards and regulations chapter in a modernized CFTA. ITRs invited SCC to share this text with PTAC and NPSAC members for their input.

## Going Forward

- SCC will identify additional sectors for further analysis for the FY 2015-2016 phase of this project and modify its methodology based on feedback from Innovation, Science and Economic Development Canada and limitations experienced during Phase I. Proposed sectors will be confirmed with Innovation, Science and Economic Development Canada by the end of June 2015.
- SCC is regularly communicating with ITR representatives who are currently engaged in negotiations on the potential framework of a modernized CFTA. This includes discussions on potential avenues to address standards, TBTs, and regulatory cooperation.
- SCC is facilitating workshops with NPSAC and PTAC in order to solicit their members' input on potential avenues for harmonization.
- SCC will present its governing council members with an analysis of options and a recommendation for strengthening the governance of Canada's standardization system, including scope, implications for key stakeholders, adherence to proposed principles, funding, and administration. Discussion outcomes will be shared with Innovation, Science and Economic Development Canada.

SCC will continue to work closely with Innovation, Science and Economic Development Canada to identify and rectify internal trade barriers, including the development of additional case studies, and providing continued input on the negotiations for a modernized CFTA.

# Annex A

## Case Study 1 – Tower Cranes in Canada- Industry Profile 2013-2014

Tower cranes are used for specific worksite requirements, often in the construction industry. However, they can be found in other industries as well, such as heavy industrial, commercial, residential and civil sectors. Construction, surface mining, shipbuilding, offshore drilling rigs, railway and crane rental companies use or provide services involving tower cranes. Tower cranes have a smaller footprint and are usually used for a lengthier period than other lifting and hoisting solutions.

Below is a profile of the tower crane industry in Canada created to support the Standards Council of Canada's project "Standardization Solutions to Remove Trade Barriers in Canada, Case Study: Tower Cranes."

## Trade & Economic Analysis

### THE GLOBAL MARKET OF TOWER CRANES, 2013

In 2013, the global market for tower cranes has generated 1.6 billion current USD worth of imports and 1.5 billion current USD worth of exports[37,38]. The top 10 exporters of tower cranes in 2013 are summarized in Table 1 below.

**Table 1: Global Exports of Tower Cranes, 2013**

| Rank | Country | Supplementary Quantity | Trade Value (current USD) | Share of Global Exports |
|---|---|---|---|---|
| **1** | China | 2,971 | $391,900,309 | 26.5% |
| **2** | Germany | 2,744 | $230,919,517 | 15.6% |
| **3** | Italy | 2,599 | $218,761,537 | 14.8% |
| **4** | Spain | 2,223 | $187,102,541 | 12.6% |
| **5** | France | 833 | $70,124,354 | 4.7% |
| **6** | Portugal | 674 | $56,697,481 | 3.8% |
| **7** | Singapore | 260 | $40,672,305 | 2.7% |
| **8** | USA | 924 | $35,547,219 | 2.4% |
| **9** | Netherlands | 409 | $34,420,533 | 2.3% |
| **10** | Lithuania | 202 | $16,985,224 | 1.1% |

*Source: UN Comtrade http://comtrade.un.org/*

37 The HS2007 definition for tower cranes was used when collecting data. HS07-842620: Tower Cranes. The data on Canada is available through UNComTrade is derived from data submitted by Statistics Canada. It is also the same data available through Innovation, Science and Economic Development Canada. In general, there is a limit to the depth product classifications go into. At the most detailed level (6-digits level), there are no further details about what the "tower cranes" definition entails. Therefore, any conclusions about the characteristics or quality of traded tower cranes cannot be reliably deduced from the data. For example, if an exported product was reported as "tower crane", there is no way to know from this high level data whether the exported tower crane was a used tower crane or exported as junk metal. Canada developed its tariff classification system based on the HS's 6-digits. The Canadian Customs Tariff consists of 10-digits codes that expands on the six-digit classification codes set out in the HS. However, even this more detailed classification does not go into more details for the "tower cranes" (HS 8426.20.00) category. Therefore, the data at the 6-digit level is exactly the same as the one reported for the 10-digit level HS code for tower cranes. As a result of this definition of tower cranes, there is no way to know additional details about the characteristics of the tower cranes, such as whether self-erect cranes are part of the "tower crane" definition in the HS.

38 *UN United Nations Commodity Trade Statistics Database*. http://comtrade.un.org/

China, Germany, Italy, Spain and France account for over 70% of global exports of tower cranes. This high market share creates a highly concentrated global supply market for tower cranes.

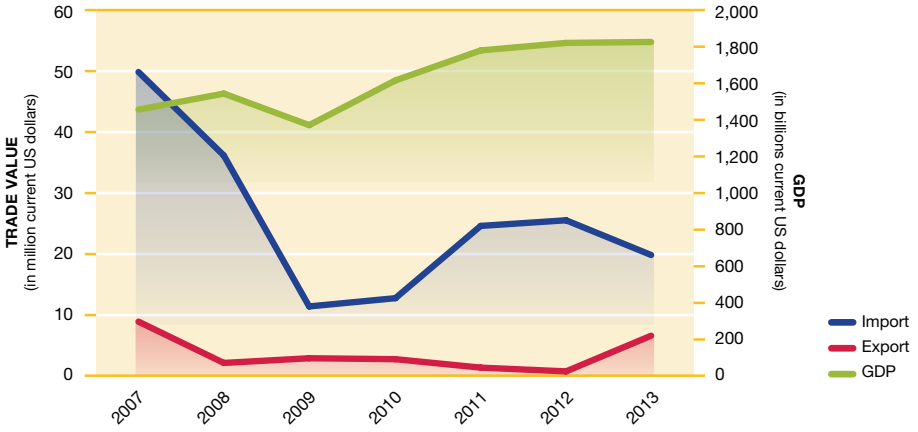
According to Sleight[39], the key economic drivers of the global tower crane industry are the increase in high-rise construction (including residential and non-residential), scarcity of land, and the availability of wealth to allow the construction of high-rise buildings and the use of tower cranes. These conditions mostly materialize in highly dense urban areas that experience high economic growth, such as Brasilia, Brazil, Riyadh, Saudi Arabia, Hyderabad, India, and Jakarta, Indonesia. Therefore, tower crane sales are predicted to come from such emerging markets.

## CANADA'S POSITION IN THE TOWER CRANES GLOBAL MARKET

Canada is a net importer of tower cranes[40]. It is ranked 26th largest importer in the world, accounting for 1.23% of the value of global tower cranes imports, and 21st exporter in the world accounting for 0.44% of the value of global exports of tower cranes.

While tower cranes are not manufactured in Canada, tower crane operations are an integral part of the construction industry and facilitate the construction and operations of facilities across Canada. The population of tower cranes in Canada is often used as an indicator of the activity and amount of construction that take place. Imports of tower cranes have been pro-cyclical in the past seven years; the value of imports follows a similar trend as the construction sector and Canada's real GDP. Trade in tower cranes slowed down following the global financial crisis of 2008. The value of tower cranes exports from Canada declined in 2008 to 2.1 million USD after a peak of 8.9 million USD in 2007. The value of tower crane imports declined in 2008-2009 to as low as 11.3 million USD, after peaking to 49.8 million USD in 2007[41]. In the same time period, Canada's GDP decreased to 1.3 trillion USD in 2009 from 1.5 in 2008[42]. Since 2012 there was a decline in tower crane imports, an increase in exports, while GDP leveled out.

**Chart 1: Imports & Exports of Tower Cranes in Canada 2007-2013**




*Note: The data is based on HS2007 code 842620- Tower Cranes*
*Source: UN Comtrade http://comtrade.un.org/*

39 Sleight, C. (2013). *Global Construction-Trends & Forecast*. International Tower Cranes Conference http://www.khl-group.com/events/itc/assets/chris-sleight.pdf

40 Using United Nations Statistics Division Classification Registry's Standard International Trade Classification, HS2007 code 842620- Tower Cranes

41 United Nations Commodity Trade Statistics Database (UN Comtrade) http://comtrade.un.org/ (accessed January 27, 2015)

42 World Bank. (Updated: 11/06/2014). World Development Indicators. http://databank.worldbank.org/data/ (accessed January 27, 2015)

## TOWER CRANES IMPORTS TO CANADA

Tower crane imports to Canada were valued at 19.8 million current USD and accounts for 0.004% of Canada's total merchandise imports in 2013. In 2014, the value of tower crane imports decreased to 11.83 million USD. The value and quantity of imports of tower cranes is much smaller than other types of lifting machinery (see tables 6 - 8). In 2013, the top countries Canada imported lifting machinery from were the United States, Germany, France, Italy and Japan.

While the majority of tower cranes imports in 2013 were bought in France (79 tower cranes valued at 2.69 million USD), the greatest import value was spent on cranes imported from Germany (41 tower cranes valued at 6.5 million USD). In 2014, the greatest number of tower cranes was imported from Spain (65 tower cranes valued at 1.41 million USD), while the greatest import value was spent on cranes imported from Germany (47 tower cranes valued at 4.19 million USD). The average cost per tower crane changes significantly between countries and across time periods, most likely due to different types of cranes. The highest average cost in 2013 was for tower cranes imported from Germany ($158,588), and the lowest was for tower cranes imported from France ($34,001). In 2014, the highest average cost was for tower cranes imported from Denmark ($272,950), and the lowest was for tower cranes imported from Spain ($21,645). In 2013, Canada was ranked 26th in the global import market for tower cranes. While the data does not provide information about the characteristics of the tower cranes traded, one possible explanation for the wide differences in the average cost of tower cranes among countries could be the differences in quality, size and complexity of the cranes.

**Table 4: Tower Cranes Imports to Canada, 2013**[43]

| Partner | Trade Value (current million USD) | Trade Quantity | Percentage of Total Value of Tower Crane Imports by Canada | Average Cost of a Tower Crane (current USD) | Canada's rank of tower crane exports by partner country | Canada's share of tower crane exports by partner country |
|---|---|---|---|---|---|---|
| **World** | 19.86 | 251 | 100.0% | 79,121 | - | - |
| **Germany** | 6.50 | 41 | 32.7% | 158,588 | 6 | 4.6% |
| **USA** | 5.22 | 63 | 26.3% | 82,869 | 1 | 23.3% |
| **Italy** | 2.80 | 31 | 14.1% | 90,458 | 29 | 0.5% |
| **France** | 2.69 | 79 | 13.5% | 34,001 | 22 | 0.9% |
| **China** | 1.04 | 7 | 5.2% | 148,386 | N/A | N/A |
| **Japan** | 0.82 | 24 | 4.1% | 34,299 | N/A | N/A |
| **United Kingdom** | 0.40 | 3 | 2.0% | 134,664 | 1 | 18.0% |
| **New Zealand** | 0.15 | 1 | 0.8% | 151,863 | 3 | 7.4% |
| **Spain** | 0.14 | 1 | 0.7% | 135,154 | 66 | 0.8% |
| **Br. Virgin Islands** | 0.09 | 1 | 0.5% | 93,447 | N/A | N/A |

*Source: UN Comtrade http://comtrade.un.org/*

Within these key import markets, Canada was ranked 6th in Germany accounting for 4.6% of Germany's tower crane exports in 2013. In the U.S., Canada is ranked 1st in the value of exports and account for 23.3% of total American tower crane exports in 2013.

43 According to HS 2007 classification for 842620-Tower Cranes

**Table 5: Tower Cranes Imports to Canada, 2014[44]**

| Partner | Trade Value (in million current USD)[45] | Trade Quantity | Average Cost of a Tower Crane (current USD) |
|---|---|---|---|
| **World** | 11.83 | 198 | 59,741 |
| **Germany** | 4.19 | 47 | 89,255 |
| **Italy** | 2.66 | 46 | 57,780 |
| **Spain** | 1.41 | 65 | 21,645 |
| **China** | 1.02 | 7 | 145,113 |
| **United States** | 0.76 | 10 | 75,750 |
| **France** | 0.72 | 4 | 180,492 |
| **Ireland, Republic of (EIRE)** | 0.42 | 5 | 83,765 |
| **Virgin Islands, British** | 0.38 | 13 | 29,373 |
| **Denmark** | 0.27 | 1 | 272,950 |

*Source: Statistics Canada. Canadian International Merchandise Trade Database. http://www5.statcan.gc.ca/cimt-cicm/*

**Table 6: Canadian Imports of Selected Lifting Machinery**

| Type | HS07 Code | Trade Value (in million current USD) | Trade Quantity | Average Cost Per Unit (current USD) |
|---|---|---|---|---|
| **Tower Cranes** | 842620 | 19.86 | 251 | 79,121 |
| **Lifting Machinery n.e.s. in 84.26, Self-Propelled (on tyres)** | 842641 | 184.49 | 618 | 298,533 |
| **Lifting Machinery n.e.s. in 84.26, Self-Propelled (other than on tyres)** | 842649 | 180.25 | 618 | 291,670 |

*Source: UN Comtrade http://comtrade.un.org/*

44 Using HS 2012 classification for 842620-Tower Cranes. There are no differences in the Tower Crane (842620) heading between HS2012 and HS2007.

45 The data were originally reported in Canadian dollars. In order to keep the report consistent, the data were converted to US dollars using the Bank of Canada's average exchange rate for 2014, 0.89 USD for 1 CND.

**Table 7: Lifting Machinery n.e.s. in 84.26, Self-Propelled (on tyres) Imports to Canada, 2013[46]**

| Partner | Trade Value (in million current USD) | Trade Quantity | Percentage of Total Value of Lifting Machinery (HS07- 842641) Imports by Canada | Average Cost of A Tower Crane (current USD) |
|---|---|---|---|---|
| **World** | 184.49 | 618 | 100.00% | 298,533 |
| **USA** | 97.21 | 396 | 52.69% | 245,486 |
| **Japan** | 53.78 | 132 | 29.15% | 407,431 |
| **Germany** | 29.01 | 51 | 15.72% | 568,746 |
| **Italy** | 2.06 | 12 | 1.12% | 171,538 |
| **France** | 0.97 | 6 | 0.52% | 161,248 |
| **United Kingdom** | 0.75 | 8 | 0.40% | 93,376 |
| **Sweden** | 0.25 | 4 | 0.13% | 62,238 |
| **Belgium** | 0.18 | 2 | 0.10% | 88,256 |
| **Czech Republic** | 0.13 | 1 | 0.07% | 126,764 |
| **Spain** | 0.08 | 2 | 0.04% | 40,088 |

*Source: UN Comtrade http://comtrade.un.org/*

**Table 8: Lifting Machinery n.e.s. in 84.26, Self-Propelled (other than on tyres) Imports to Canada, 2013[47]**

| Partner | Trade Value (in million current USD) | Trade Quantity | Percentage of Total Value of Lifting Machinery (HS07- 842649) Imports by Canada | Average Cost of A Tower Crane (current USD) |
|---|---|---|---|---|
| **World** | 180.25 | 618 | 100% | 291,670 |
| **USA** | 76.04 | 396 | 42.2% | 192,015 |
| **Japan** | 58.30 | 132 | 32.3% | 441,688 |
| **Germany** | 35.70 | 51 | 19.8% | 699,998 |
| **Italy** | 4.93 | 12 | 2.7% | 410,589 |
| **France** | 2.14 | 6 | 1.2% | 357,051 |
| **United Kingdom** | 1.74 | 8 | 1.0% | 218,104 |
| **Sweden** | 1.18 | 4 | 0.7% | 296,189 |
| **Belgium** | 0.12 | 2 | 0.1% | 61,849 |
| **Czech Republic** | 0.06 | 1 | 0.03% | 59,334 |
| **Spain** | 0.02 | 2 | 0.01% | 9,874 |

*Source: UN Comtrade http://comtrade.un.org/*

This analysis implies that reducing technical barriers to trade (TBT) in the tower crane industry will be most beneficial among Canada's top trading partners. From the import side, reducing TBT could mean lower costs of importing tower cranes to Canada. From the export side, reducing TBTs could mean expanding market access to Canadian exports of used tower cranes or tower cranes parts.

In 2012, the Canadian market for tower cranes imports was fairly concentrated. Three companies imported 47.47% of the value of imports, and a total of 10 companies imported 80% of tower cranes, valued at 22 million USD[48].

46 Using HS 2007 classification for 842641- Lifting Machinery n.e.s. in 84.26, Self-Propelled (on tyres)

47 Using HS 2007 classification for 842649- Lifting Machinery n.e.s. in 84.26, Self-Propelled (other than on tyres)

48 Innovation, Science and Economic Development Canada. Canadian Importers Database (CID). The Bank of Canada's average exchange rate for 2012 was 1.00USD for 1 CND.

### EMPLOYMENT

According to Statistics Canada's 2011 National Household Survey, there were 13,330 crane operators in Canada in 2011[49]. According to Employment and Social Development Canada's Canadian Occupational Projection System (COPS) supply and demand in the Crane Operators, Drillers and Blasters (NOC Code 737) occupational groups is at equilibrium[50], meaning there is no labour market gap. However, further research needs to be undertaken to examine the specific labour market conditions of the tower crane industry. Currently, there is no data available about tower crane operators, as this occupational group is too small[51].

Tower crane operators engage in many tasks, including lifting, moving, positioning and placing of material and equipment. They perform routine inspections, minor repairs, and maintenance of the equipment.

Tower crane operator trade certification is required by law in British Columbia, Alberta, Manitoba, Ontario, Quebec and Nova Scotia, and is voluntary in Prince Edward Island. Red Seal interprovincial endorsement is available in some jurisdictions.

According to the Canadian Hoisting & Rigging Safety Council (CHRSC), British Columbia and Ontario typically have the largest number of tower cranes in the air. Toronto had approximately 150 cranes up in early fall, 2014 while Vancouver had over 150 up in December 2014.

## Standardization in the Tower Cranes Industry

In Canada, "CAN/CSA Z248-2004, Code for Tower Cranes" needs to be met by the industry. The technical committee comprised of the following representatives:

| | | |
|---|---|---|
| **G.P. Cody**<br>Construction Control Group,<br>Woodbridge, Ontario<br>*Chair* | **M. Burrell**<br>Burrell Engineering Ltd.,<br>Toronto, Ontario | **J. Dowdall**<br>Operating Engineers Training<br>Institute of Ontario,<br>Toronto, Ontario |
| **F.X. Hardy**<br>Electrical Safety Authority,<br>Mississauga, Ontario<br>*Vice-Chair* | **K. Buschmann** Unirope Ltd.,<br>Mississauga, Ontario | **J. Howard**<br>Skycrane International Inc.,<br>Niagara-on-the-Lake, Ontario |
| **A.R. Anderson**<br>PCL Construction Resources Inc.,<br>Edmonton, Alberta | **V. Coupal**<br>Coupal Climbing Cranes,<br>Port Coquitlam, British Columbia | **P. Jehle**<br>P&J Crane Systems Inc.,<br>Centreville, Virginia, USA |
| **A. Arduini**<br>The Ontario Formwork Association,<br>Toronto, Ontario | **J.F. Desmarais**<br>Commission de la santé et<br>de la sécurité du travail du Québec,<br>Valleyfield, Québec | **P. Juhren**<br>Morrow Equipment Company, L.L.C.,<br>Salem, Oregon, USA |
| **R. Balbaa**<br>Hite Engineering Corp.,<br>Mississauga, Ontario | **P. Dimitruk**<br>Operating Engineers Training<br>Institute of Ontario,<br>Toronto, Ontario<br>*Associate* | **R. Karras**<br>Micron Construction Inc.,<br>Vancouver, British Columbia |

49 4% of crane operators are self-employed, and 2% are female. Statistics Canada does not have data pertaining only to tower crane operators. Statistics Canada - 2011 National Household Survey. Catalogue Number 99-012-X2011033

50 National Occupational Classification (NOC) 2011 http://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=122372&CVD=122376&CPV=7371&CST=01012011&CLV=4&MLV=4

51 Canadian Occupational Projection System (COPS). http://www23.hrsdc.gc.ca/occupationsummarydetail.jsp?&tid=107

Internationally, ISO has one technical subcommittee dedicated to tower cranes (ISO/TC 96/SC 7)[52], established in 1960. The subcommittee is led by France which hosts the Secretariat. Canada is neither a participant nor an observer in this subcommittee. The subcommittee published 21 ISO standards. Currently, "ISO/DIS 9926-3- Cranes -- Training of operators -- Part 3: Tower cranes" and "ISO/DIS 4306-3- Cranes -- Vocabulary -- Part 3: Tower cranes" are under development.

Furthermore, the European Federation of Materials Handling (FEM)[53] is the main body developing and disseminating standards related to tower cranes. Within FEM, the Tower and Harbour Cranes (THC) product group represents tower crane manufacturers in the European Union. Canada is not represented in this product group, likely since there are no tower crane manufacturers in Canada. Tower cranes for construction work are mainly designed according to two European Standards: EN14439[54] and FEM 1.001[55]. Tower cranes generally, comply with the standard crane group utilization according to FEM 1.001 class A3[56].

# Stakeholders & Policy Priorities

## STAKEHOLDERS

Below is a sample list of companies that import tower cranes to Canada and/or provide services related to the tower crane industry in Canada[57]:

| Company | Website | Location | Activities |
|---|---|---|---|
| **Abriaco Investments Limited*** | N/A | Bolton, Ontario<br>L7E 1H3 | |
| **Ayr Equipment International*** | http://www.cranesales.ca/ | 60 Wanless Court,<br>Ayr, Ontario,<br>N0B 1E0 | Specializes exclusively in buying and selling cranes worldwide. |
| **Coast Crane LTD*** | http://www.coastcrane.com/ | North America:<br>Canada: Surrey(Vancouver), BC;<br>USA: Spokane, WA; Pasco, WA;<br>Portland, OR; Kapolei, HI;<br>West Sacramento, CA;<br>San Leandro, CA;<br>City of Industry, CA;<br>Bakersfield, CA; and<br>Anchorage, AK.<br>Headquarters: Seattle, WA. | The company represents and provides expert service and parts for the lifting industry, including sales and rentals of cranes. |
| **Comansa Rental** | http://www.location-comansa.ca/ | Canada: Laval, QC | Crane rentals |
| **Eagle West Cranes** | http://www.eaglewestcranes.com/ | Canada: Vancouver and Lower Mainland | Eagle West Cranes offers a one stop crane service solution for any project including crane rental, sales and operations assistance. |
| **Ellisdon Construction LTD.*** | http://www.ellisdon.com | London, Ontario (first location) followed by locations across major cities in Canada and in the Middle East | Building and construction |
| **Grues J.M. Francoeur INC.*** | http://gruesjmfrancoeur.com/ | 6155B, Lafontaine Montreal, Quebec<br>H1N 2B8 | Crane rentals, service and repairs. Has 6 types of tower cranes. |
| **Kiewit-Kvaerner Contractors, A Partnership*** | http://www.kkc-gbs.com/e-and-r | 240 Waterford Bridge Road,<br>West Campus Hall, Suite 102<br>St. John's, Newfoundland<br>A1E 1E2 | Builds gravity based structures (GBS). E.g. awarded by ExxonMobil Canada Properties (EMCP) to build the Hebron Project GBS. |

52 International Organization for Standardization." ISO/TC 96/SC 7 Tower cranes". ISO. http://www.iso.org/iso/home/standards_development/list_of_iso_technical_committees/iso_technical_committee.htm?commid=50664

53 European Federation of Materials Handling (FEM) http://www.fem-eur.com/index.php/prodGroups_cranes/en/

54 EN14439 +A2 (07.2009): Cranes – Safety – Tower cranes

55 FEM 1.001 (10.1998): *Rules for the Design of Hoisting Appliance*

56 FEM Product Group Cranes and Lifting Equipment - Sub-Group Tower and harbor Cranes (2013). "Lifetime of Tower Cranes". Position Paper. http://fem.uniweb.be/data/File/FEM_THC_2013_12_Position_paper_tower_cranes_lifetime.pdf

57 The list of companies was derived from an online search of companies who provide services related to tower crane in Canada, as well as companies who reported importing tower cranes to Canada in 2012 (see *). A list of companies that imported tower cranes to Canada can be found on Innovation, Science and Economic Development Canada's Canadian Importers Database (CID): https://www.ic.gc.ca/app/scr/ic/sbms/cid/productReportHS10.html?hsCode=8426200000

| Company | Website | Location | Activities |
|---|---|---|---|
| **LaPrairie Crane** | http://www.laprairiegroup.com/companies/laprairie-crane/ | Canada: Fort Nelson, Fort St. John and Tumbler Ridge (BC), and Fort McMurray and Grimshaw (Alberta), to service our key markets of Alberta, British Columbia, Northwest and Yukon Territories. | LaPrairie Crane provides lift and heavy haul services for construction projects and maintenance contracts. They specialize in engineering and executing highly complex and extra-heavy lifts. Their fleet has load capacities ranging from 5 – 600 tons and includes all terrain, boom truck, carry deck, crawler, hydraulic truck, rough terrain and tower cranes. |
| **Morrow** | http://www.morrow.com/ | Global: North America, Australia, and Latin America | Focuses exclusively on the tower crane and construction hoist industry. Morrow maintains over 580 tower cranes and 235 construction hoists worldwide. |
| **PCL Construction Resources INC.*** | http://www.pcl.com/ | Edmonton – Resources 5410 99th Street NW Edmonton, AB T6E 3P4 | Provider of preconstruction, construction/project management, design-build and general contracting services |
| **Peter Kiewit Infrastructure Co.*** | http://www.kiewit.com/ | 3555 Farnam St. Omaha, NE, USA | Construction, mining and engineering |
| **Rapicon INC.*** | http://www.rapicon.ca/ | 924 Burton Rd., Vars, ON K0A 3H0 | Potain tower crane rentals across Canada |
| **Sarens Group** | http://www.sarens.com/en | Global; Canada: Nisku, AB | Sarens sells and rents heavy lifting and engineered transport equipment. |
| **SkyCrane Canada: Niagara-on-the-Lake, ON** | http://www.towercranes.net | | Sale and rental of tower cranes |
| **The Bloom Lake Iron Ore Mine Limited Partnership*** | www.cliffsnaturalresources.com/ | 200 Public Square, Cleveland, OH USA | Note: On November 14, 2014, Cliffs Natural Resources Inc. (NYSE: CLF) announced that it is pursuing exit options for its Eastern Canadian iron ore operations which may result in the closure of the Bloom Lake mine. |

## POLICY PRIORITIES

Health and safety throughout the life cycle of projects involving tower cranes has been a priority identified by many of the stakeholders and regulators. This priority is also reflected by the establishment of organizations such as the BC Association for Crane Safety (BCACS).

Furthermore, the harmonization of personnel certification seems to be a priority in Canada and internationally, as ISO develops a training standard for tower crane operators (ISO/DIS 9926-3), and the interprovincial Red Seal examination allows for greater mobility within Canada.

The Canadian Hoisting & Rigging Safety Council (CHRSC) is active in several mobility initiatives both within Canada and internationally. CHRSC initiatives can be seen at: http://chrsc.ca/initiatives/

The CHRSC has a current federal project with Employment and Social Development Canada (ESDC) that has developed international mutual recognition agreements for crane operator credentials with both the USA and Ireland. CHRSC is also a supporting partner in a similar pending project between Canada and the European Union.

With the support of ESDC, CHRSC has also developed a CertTracker viewer for employers and crane operators looking to work with their existing credentials in other jurisdictions. CertTracker was designed to promote greater mobility of the crane trade in Canada and internationally and can be found at www.chrsc.ca.

An additional initiative is the creation of an online database of tower cranes and mobile cranes, makes and models sold in North America. The database also includes a link to crane import data for Canada.

# Annex B -

## Survey Responses for Tower Cranes

Assumptions: The following assumptions have been made to focus the case study on a hypothetical scenario and to compare the costs of importing/transporting/installing/operating/decommissioning one tower crane among three jurisdictions within Canada:

- The case study assumed that a Canadian company operating tower cranes is purchasing a new unit from Europe (i.e. Germany), where tower cranes are manufactured and exported;
- The tower crane and its component sub-systems were designed and fabricated to the European Standard *EN 14439 Cranes-Safety-Tower Cranes*;
- The tower crane manufacturer self-declares compliance with *EN 14439* and there is no independent, third party conformity assessment done (in Europe);
- It assumes that the tower crane and all of its components have been tested by the manufacturer for operation in the European community;
- It focuses on differences between technical requirements currently in place in relevant regulations in a limited sampling of Canadian provinces;
- Administrative differences between the sampling of provinces were also considered. For the example of tower cranes, mandatory requirements for field evaluation by an SCC-accredited field inspection organization are within the scope of assessing technical differences.

## IMPORTING

| # | Question | YES | NO | N/A | Input from Industy (verbatim) | Additional Findings |
|---|---|---|---|---|---|---|
| **CANADIAN REQUIREMENTS** | | | | | | |
| 1 | What are the Canadian requirements to purchase and import such a unit into Canada? | | | | You can import any tower crane from another country without issue. Before you can put it into use in Canada though it must meet certain requirements. For example it must be designed to an engineering standard that is accepted by CSA or ASME. Also the elecrical components must meet CSA standards<br>No Custom Duty is levied on any type of construction equipment, new or used, entering Canada. The Federal GST tax is levied by the purchaser's Custom's Agent which is 5% of the purchase price without shipping. Provincial taxes are applied following entry.<br>Meet CSA Z248 standard. Have the unit CSA approved for electrical. Ensure conformance with local standards (in BC, that would be WorkSafeBC reg's) | No customs or duties levied on construction equipment. Technical requirements are set by the provinces/territories. Federal regulations are not applicable. |
| 2 | There may be federal requirements administered by a federal department or agency. Please describe each requirement and identify which federal authority/ department is involved.<br>For example, are there tariffs that apply to tower cranes imported from Germany? Are there federal permits/licences required for the tower crane to be delivered to a Canadian company at the port of entry (labelling, official languages, internal combustion engines emissions, etc.)? | | | | There are no federal rules other than the requirement to prove where the bulk of the fabrication or assembly took place. That is governed by Customs.<br>There were tariffs a while back because there was one or two companies building tower cranes in Canada (Kodiak??). But we are not sure if the tariffs are still in place because we are not sure if there is still a Canadian manufacturer. There shouldn't be tariffs because we don't think there is a current active Canadian manufacturer. There are CSA regulations, mostly related to electrical that cover certain aspects of the electrical system (overloads, etc.) that also entail certain labelling /ID be in place. I've never come across anything to do with official languages though. It should be noted that Importing used cranes from anywhere in the world are subject to all the things we're talking about here. | No customs or duties levied on construction equipment. Technical requirements are set by the provinces/territories. Federal regulations are not applicable. |
| 3 | There may be national requirements to certify/test/inspect the tower crane to Canadian standards/codes before it can be transferred to the Canadian company purchasing it (for example certification of compliance with CAN/CSA Z 248 or to additional Canadian standards related to welding, electrical, hydraulics, elevators, etc.).<br>If additional certifications/testing/ inspection to Canadian standards are required, are they performed in Germany before the unit is shipped to Canada? | | | | You must be cautious when importing used tower cranes. Quite often they get pulled aside for environmental insptections. If any foreign dirt or grease is found on the machine it must get delivered to a designated cleaning facility where it gets scrubbed. Tower cranes must have a "Non-Destructive Test" before going into service by an accredited inspections company. If any missing welds, poor welds, cracks, etc. are found then it must be repaired as per the Engineer's procedure. All Electrical system components must meet CSA standards. In BC this is governed by "The Safety Authority".<br>A CSA electrical inspection is required of the electrical components of the new German towercrane. In Ontario, there is a requirement for all towercranes to meet the Ontario Electrical Code. A crown corporation named "The Electrical Safety Authority" is the recognized agency that determines if all electrical devices meet the Ontario Electrical Code. As an example, the ESA will require that a Peiner SK-415 have all the overload devices changed to ones that are UL-489 compliant. The slip ring housing is required to be secured preventing an operator from easily opening it and exposing high voltage. All the European supply transfromers are required to have a grounding strap. The original lighting recepticle in the operator cab is required to be replaced with one which meets a CSA standard. Multi conductor wires as supplied from Europe must be protected in a case, which results in replacement. Motors are to labeled with motor data stated in Canadian terminology. As there are a limited amount of tower cranes shipped into Canada, the German manufactures are not interested in modifying thier CE approved designs, thus they must be completed within Canada.<br>Both CSA Z248 and WorkSafeBC have regulations requiring certain degrees of structural testing (NDT). Lots of reg's for ropes as well. But we have never seen anything that says it has to be tested before it is shipped. The purchaser takes responsibility for meeting local standards before the equipment is erected. We have long thought the requirement for CSA approval of the electrical was not nessessary. New equipment (in Europe anyway) is built to European standards such as DIN or FEM. In several cases CSAZ248 varies from WorkSafeBC regulations. Confusing for some. | It is up to the tower crane purchaser to specify any additional requirements in their purchasing agreement. Some purchasers or their agents do this and some do not. For example, if the proper electrical requirements to meet the provincial/territorial electrical codes are specified prior to fabrication and delivery, then overall cost to meet unique Canadian electrical safety requirements are reduced. Labour component of the cost differential would be saved. AB, BC and ON electrical codes do not accept a CE mark on electrical components since self-declaration is not allowed per the AB, BC and ON Electrical Safety Codes. However, only Ontario has administrative requirements to verify/ enforce this requirement. |
| 4 | What are the costs associated with meeting the Canadian requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | | | | Non Destructive Test - Annually $1,500. CSA Certifiication - One time $5,000<br>The cost to bring a new CE qualified, German produced Peiner SK-415 towercrane up to meet the standards of the Ontario Electrical Codes is $10,000.00 CAD.<br>Structural non-destructive testing and certification would be $2,500 to $10,000 per crane depending on size and repairs required. CSA (one-time) elect. cert can be $1,000 to $10,000 depending on machine and work required. | Annual testing non-destructive testing is required in AB, BC and ON. Furthermore, all three provinces require that a licensed professional engineer conduct a structural test and/or review the drawings for foundation and structural members. Therefore, no technical or cost difference between provinces other than on electrical systems. In ON, costs to retrofit non-compliant electrical components ranges from $8K to $14K. |
| 5 | If a Canadian company chose to import a tower crane from South Korea, would there be differences in federal requirements from the base case outlined above? | | No | | No. Many Asian tower crane manufacturers use a lower grade of steel. You can bring this machines in without too much trouble through an importer but you must be cautious that the steel can handle the cold Candian climate. Most Asian machines are not allowed to operate below 0° Celcius. | Technical requirements are set by the provinces and territories. No applicable federal technical requirements were found. |
| 6 | Are there manufacturers of tower cranes in Canada? If yes, are Canadian manufactured tower cranes widely used in Canada? If yes, a separate case study is warranted. | | No | | No. There was only ever one crane manufacturer in Canada and they were called "Heede" they closed the business down in the 70's or 80's. Heede was Vancouver based and their cranes can still be found working at many log home yards in BC<br>Used to be one or two (Kodiak). Not sure if they're still around. | No Canadian manufacturers were found. |

## IMPORTING

| # | Question | YES | NO | N/A | Input from Industy (verbatim) | | | Additional Findings |
|---|---|---|---|---|---|---|---|---|
| **PROVINCIAL REQUIREMENTS** | | | | | **BC** | **AB** | **ON** | |
| 7 | What are the standards/ certification/testing/inspection requirements for importing a tower crane from Germany if the Canadian company is registered in one of the following jurisdictions (please identify each provincial requirement associated with the importation of the tower crane)? | | | | No Difference between provinces<br>CSA Electrical update<br>CSA Z248, WorkSafeBC, and the CSA electrical qualification ("to plug into a Canadian power provider") | Alberta OH&S Part 6 Subsection 105(1)<br>No Difference between provinces<br>CSA Electrical update | No Difference between provinces<br>ESA Electrical update | Prime difference between AB, BC and ON is in the administrative requirements associated with electrical inspection. All provinces require adherence to applicable provincial electrical code. However, only ON has requirements to explicitly enforce their Electrical Code Requirements. |
| 8 | What are the costs associated with meeting the provincial requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | | | | No Difference between provinces<br>$1,000<br>See 4 & 5 above | No Difference between provinces<br>$1,000 | No Difference between provinces<br>$10,000 | Cost for parts associated with an electrical retrofit range from $8K to $14K. This is applicable to all three provinces although only ON has explicit administrative requirements for third party conformity assessment of Tower Crane Electrical System. |

## MOVING / TRANSPORTING

| # | Question | YES | NO | N/A | Input from Industy (verbatim) |
|---|---|---|---|---|---|
| **CANADIAN REQUIREMENTS** | | | | | |
| 1 | Are there federal standards/ certification/testing/inspection requirements for transporting a tower crane on highways? | | No | | No. You must have certified and insurred axles on a self-erecting tower crane<br>Nothing special. Normal trucking regs. |
| 2 | What are the costs associated with meeting the Canadian requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | | | N/A | Most Tower cranes move on third party flat deck trucks.<br>None |
| **PROVINCIAL REQUIREMENTS** | | | | | **BC** **AB** **ON** |
| 3 | What are the standards/ certification/testing/inspection requirements for moving/ transporting a tower crane on provincial roads within the following jurisdictions? | | | N/A | Nothing to do with the crane. Only trucking regulations that apply to all cargo. |
| 4 | What are the costs associated with meeting the provincial requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | | | N/A | |

## PRE-DEPLOYMENT ASSEMBLY

| # | Question | Input from Industy (verbatim) | | | Additional Findings |
|---|---|---|---|---|---|
| **CANADIAN REQUIREMENTS** | | | | | |
| 1 | What are the standards/certification/testing/inspection federal requirements for assembling tower cranes (are there additional requirements than those listed in CAN/CSA Z248 in areas such as welding, electrical, hydraulics, elevators, internal combustion engines, etc.)? | C22.1-02, C22.2, W47.1-03, W59.03, W178.2-01, ANSI A14.13-1992 | | | No federal requirements. Standards listed at left are referenced within CSA Z248. |
| 2 | What are the federal standards/certification/testing/inspection requirements associated with concrete pads? | CSA Z248-04: 4.61, 5.3.1, 5.3.2 | | | CSA Z248 is applicable at provincial level. The scope includes only technical differences between provinces. Requirements are similar between provinces for structural including the Tower Crane foundation (pad). |
| 3 | What are the federal OHS standards/codes in place for workers installing tower cranes? | CSA Z248-04: 5.1, 5.6, 5.7, 5.8, 5.9 | | | Provincial requirements only apply. |
| 4 | What are the costs associated with meeting the Canadian requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | A tower crane working at 65% utilization will need work all year surrouding hydraulics, welding, electrical, etc… A budget number for this is $6,500/month<br>See 4 & 5 of "Importing" | | | |
| **PROVINCIAL REQUIREMENTS** | | **BC** | **AB** | **ON** | |
| 5 | What are the standards/certification/testing/inspection requirements for assembling tower cranes within the following jurisdictions (are there additional requirements than those listed in CAN/CSA Z248 in areas such as welding, electrical, hydraulics, elevators, internal combustion engines, etc.)? | WorkSafeBC Part 14 CSA Standard Z248-2004. ASME B30.4-2003 | Alberta OH&S Part 6 Safety code for tower cranes CSA Standard Z248-04, | | |
| 6 | What are the provincial standards/certification/testing/inspection requirements associated with concrete pads? | WorkSafeBC Part 14.74 | Alberta OH&S Part 6 | | |
| 7 | What are provincial OHS standards/codes in place for workers installing tower cranes in each jurisdiction? | WorkSafeBC Part 14.73.2 and WorkSafeBC Part 11 | Alberta OS&S Part 5 Erection, Dismantling and Climbing | | |
| 8 | What are the costs associated with meeting the provincial requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | A Tower crane working at 65% utilization will need to stay in compliance with the authorities. A budget number for this is $1,000/mo<br>See 4 & 5 of "Importing" | | | Utilization is not relevant. The only cost differential relates to remediation of electrical component non-compliances. Although this is applicable to all three provinces, only ON has explicit administrative requirements for third party verification of compliance. In ON, costs for electrical non-compliance ranges. Refer to main body of report for more information and analysis on the remediation cost. |

## ON-SITE ASSEMBLY

| # | Question | Input from Industy (verbatim) | | Additional Findings |
|---|---|---|---|---|
| **CANADIAN REQUIREMENTS** | | | | |
| 1 | What are the standards/certification/testing/inspection federal requirements for assembling tower cranes (are there additional requirements than those listed in CAN/CSA Z248 in areas such as welding, electrical, hydraulics, elevators, internal combustion engines, etc.)? | C22.1-02, C22.2, W47.1-03, W59.03, W178.2-01, ANSI A14.13-1992 | | No federal requirements. Standards listed at left are referenced within CSA Z248. |
| 2 | What are the federal standards/certification/testing/ inspection requirements associated with concrete pads? | CSA Z248-04: 4.61, 5.3.1, 5.3.2 | | CSA Z248 is applicable at provincial level. The scope includes only technical differences between provinces. Requirements are similar between provinces for structural including the tower crane foundation (pad). |
| 3 | What are the federal OHS standards/codes in place for workers installing tower cranes? | CSA Z248-04: 5.1, 5.6, 5.7, 5.8, 5.9 | | Provincial requirements only apply. |
| 4 | What are the costs associated with meeting the Canadian requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | A tower crane working at 65% utilization will need work all year surrouding hydraulics, welding, electrical, etc… A budget number for this is $6,500/month<br>See 4 & 5 of “Importing” | | Not applicable to the scope of this sub-project. |
| **PROVINCIAL REQUIREMENTS** | | **BC** | **AB** | **ON** |
| 5 | What are the standards/certification/testing/inspection requirements for assembling tower cranes within the following jurisdictions (are there additional requirements than those listed in CAN/CSA Z248 in areas such as welding, electrical, hydraulics, elevators, internal combustion engines, etc.)? | WorkSafeBC Part 14<br>CSA Standard Z248-2004. B30.4-2003 | Alberta OH&S Part 6 Safety code for tower cranes CSA Standard Z248-04, | The Ontario Occupational Health and Safety Act, references Ontario Construction Regulation 213. Section 150 to 156 and Section 157 to 165 within Regulation 213 are applicable to tower cranes. |
| 6 | What are the provincial standards /certification /testing / inspection requirements associated with concrete pads? | WorkSafeBC Part 14.74 | Alberta OH&S Part 6 | They are similar between all three provinces and no material technical difference found. In the case of all three provinces, review by a licensed professional engineer is required. |
| 7 | What are provincial OHS standards/codes in place for workers installing tower cranes in each jurisdiction? | WorkSafeBC Part 14.73.2 and WorkSafeBC Part 11 | Alberta OS&S Part 5 Erection, Dismantling and Climbing | Would be covered in Ontario OH & S regulation 213 |
| 8 | What are the costs associated with meeting the provincial requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | A tower crane working at 65% utilization will need to stay in compliance with the authorities. A budget number for this is $1,000/mo<br>See 4 & 5 of “Importing” | | The only cost differential relates to remediation of electrical component non-compliances. Although this is applicable to all three provinces, only ON has explicit administrative requirements for third party verification of compliance. In ON, costs for electrical non-compliance ranges. Refer to main body of report for more information and analysis. |

## OPERATING

| # | Question | Input from Industy (verbatim) |
|---|---|---|
| **CANADIAN REQUIREMENTS** | | |
| 1 | What are the standards/certification/testing/inspection federal requirements additional to CAN/CSA Z248 for operating tower cranes? | WorkSafeBC 14.34 and 14.34.1<br>CSA Electrical regulations regarding equipment being CSA certified to take power from a Canadian power producer (does not seem necessary) |
| 2 | Are there specialized federal requirements for operators for tower cranes? | CSA 8.2.2 |
| 3 | What are the costs associated with meeting the Canadian requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | A tower crane working at 65% utilization will need to stay in compliance with the authorities. A budget number for this is $1,000/mo<br>See 4 & 5 under “Importing” |

## OPERATING

| # | Question | Input from Industy (verbatim) | | | |
|---|---|---|---|---|---|
| **PROVINCIAL REQUIREMENTS** | | **BC** | **AB** | **ON** | |
| **4** | What are the standards/certification/ testing/inspection requirements additional to CAN/CSA Z 248 for operating tower cranes within the following jurisdictions? | ASME B30.4-2003 and WorkSafeBC Part 14 | Alberta OH&S Part 6 CSA Z248-04 | 1. has the base been engineered and are Drawings stamped & soils Report Reg. 157(2)<br>2. has the crane been structurally inspected before and after set up on site. OH & S, 213, Reg 158 & 159<br>3. Maintenance Logs for the crane, showing routine maintenance and all repairs. Reg. 152<br>4. verification that the crane has been maintained in accordance with the manufacturers instructions. Reg. 93 & 151(2)<br>5. verification that the crane is capable of lifting its rated capacity. Reg 94<br>6. if the crane is older than 15 years, inspection of the critical points of the structural components as identified by the manufacturer / engineer by a metallurgical engineer. Act. 54(1)(f) | Operating requirements at this phase, have no line of sight to third party inspection or verification. Operator and owner requirements are within the provincial OH & S regulations as well as CSA Z248. However, they are materially similar between the provinces. In some instances, regulations are under review and will be updated. More specific technical differences attributable to operator or owner inspection are beyond the scope of the specific deliverables for this segment of the project. |
| **5** | Are there specialized provincial requirements for operators of tower cranes? | WorkSafeBC 14.34 and 14.34.1 (credential required) | Alberta Regulation 272/2000 Crane and hoisting equipment operator trade regulation | 7. Erection drawings on site, stamped. Reg 157(2)<br>8. written procedures for climbing (raising) the crane Reg.93(3)<br>9. If the plans call for bracing the crane to/in the building, verification from the engineer responsible for building structure that loading is acceptable and drawing is available showing location and spacing of reshoring. Reg.157(4)<br>10. certificate of wire rope, operating manual. Reg. 152(1)<br>11. proximity to overhead power lines. Reg. 37(2) & 188<br>12. if horizontal lifeline installed as part of the fall protection system on the boom, gas it been engineered. Reg.26.9(8) If the fall protection system is arranged for fall arrest is there a rescue procedure in place. Reg.26.1(4)<br>13. is the cab on the boom Reg.163<br>14. what are the weights of the different test blocks (weight indicated on block), concrete -150 lbs/cu/ft. Reg.161(3) | Operating requirements at this phase, have no line of sight to third party inspection or verification but do require involvement of a licensed professional engineer if the tower crane has been modified in any way from the manufacturer's original design. Operator and owner requirements are within the provincial OH & S regulations as well as CSA Z248. However, they are materially similar between the provinces. In some instances, regulations are under review and will be updated. More specific technical differences attributable to operator or owner inspection are beyond the scope of the specific deliverables for this segment of the project. |
| **6** | What are the costs associated with meeting the provincial requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | See 4 & 5 under "Importing" | | 15. How is the crane anchored Reg.157 describe the footing or wedges Reg.157<br>16. ensure that the access to the ladder at the base of the crane or at the floor level where the operator gains access to the ladder is appropriate. Reg. 70 & 71<br>17. climbing ladder securely fastened Reg.80<br>18. climbing ladder consistent rungs Reg.78(2)<br>19. offset landings and / or access covers Reg.84<br>20. ensure appropriate access to the turntable level. Reg.70 & 71<br>21. fall protection cage or rails from base to operator cabin, on boom and counter-jib does the operator have a safe route. Reg.26.3 & Reg.84<br>22. look for deformation, corrosion or cracks. Reg. 93<br>23. Verify operator's C of Q. if apprentice operator the Journeyman operator is on site. Reg.150 & 150(2)(b)<br>24. is there a crane capacity chart in the cab and ensure it is for the make and model of crane it is being us in. Reg.151(3)<br>25. is there a functional windshield wiper. Reg. 93 (if originally installed)<br>26. if there a fire extinguisher and has it been inspected and tagged monthly. Reg.52(1) & 55<br>27. when was the last time the test blocks were used and have the entries been made in the log book. Reg.152<br>28. has the operator made the required daily entries into the cranes log book. Reg-152<br>29. Are the maintenance records for the crane in the log book. Reg. 152<br>30. Has the weekly wire rope inspection been performed, defects noted and inspection recorded in the log book. Reg.170<br>31. are limit switches and load limit switches operational. Reg.160<br>32. when the load is at the bottom is there a least 3 wraps of the cable still on the drum. Reg.168<br>33. are the sheaves free from defects and saddle the rope closely. Reg.93<br>34. if modification have been made to the electrical systems of the crane have the modifications been approved by the ESA or other approval authority. Reg.185<br>35. are all electrical connectors type 3S or type 4. (Sealed against weather) Reg.185<br>36. are all electrical boxes sealed with gaskets. Reg.185<br>37. guarding for mechanically operated equipment. Reg.109 | No material difference between provinces as it relates to the scope. |

## MAINTENANCE

| # | Question | YES | NO | N/A | Input from Industy (verbatim) | | | Additional Findings |
|---|---|---|---|---|---|---|---|---|
| **CANADIAN REQUIREMENTS** | | | | | | | | |
| 1 | How is a tower crane maintained while in use? What is tested, inspected, and when? By who? | Yes | | | Tower cranes should be inspected every 4 to 6 weeks. They are to be inspected by a factory trained technician that is fully competent to perform work on the equipment.<br>See CSA Z248 sections 6 and 7 | | | General finding: This phase is not really a distinct phase. Maintenance is performed mostly during the ongoing operation and the maintenance requirements are most often per the manufacturer's requirements. In all three provinces, the respective OH & S make reference to maintenance requirements where it has a direct line of sight to safety. |
| 2 | In addition to CAN/CSA Z248, what are the standards/ certification/testing/inspection requirements for maintaining tower cranes federally? | | | | WorkSafeBC 14.34 and 14.34.1<br>CSA electrical qualification | | | |
| 3 | Are there specialized federal requirements for maintenance workers for tower cranes? | | NO | | Not that we are aware of. | | | |
| 4 | What are the costs associated with meeting the Canadian requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | | | | A tower crane working at 65% utilization will need to stay in compliance with the authorities. A budget number for this is $2,000/mo<br>See 4 & 5 under "Importing" | | | |
| **PROVINCIAL REQUIREMENTS** | | | | | **BC** | **AB** | **ON** | |
| 5 | In addition to CAN/CSA Z248, what are the standards/ certification/testing/inspection requirements for maintaining tower cranes within the following jurisdictions? | | | | WorkSafeBC Part 14 and ANSI Standard ASME B30.4-2003 and CAN/ CGSB-48.9712 | Alberta OH&S Part 6<br>CSA Z248-04 | | |
| 6 | Are there specialized provincial requirements for maintenance workers for tower cranes? | | | | WorkSafeBC Part 14.13 and 14.14 | CSA Z248-04 | | |
| 7 | What are the costs associated with meeting the provincial requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | | | | A tower crane working at 65% utilization will need to stay in compliance with the authorities. A budget number for this is $2,000/mo<br>See 4 & 5 under "Importing" | A tower crane working at 65% utilization will need to stay in compliance with the authorities. A budget number for this is $2,000/mo | A tower crane working at 65% utilization will need to stay in compliance with the authorities. A budget number for this is $2,000/mo | |

## DISASSEMBLING

| # | Question | Input from Industy (verbatim) | | Additional Findings |
|---|---|---|---|---|
| **CANADIAN REQUIREMENTS** | | | | |
| 1 | In addition to CAN/CSA Z248, what are the standards/certification/testing/inspection requirements for disassembling tower cranes federally? | Same as Assembly<br>None beyond CSA Z248 that I we are aware of. | | |
| 2 | What are the costs associated with meeting the Canadian requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | | | |
| **PROVINCIAL REQUIREMENTS** | | **BC** | **AB** | **ON** |
| 3 | In addition to CAN/CSA Z248, what are the standards/certification/testing/inspection requirements for disassembling tower cranes within the following jurisdictions? | WorkSafeBC Part 14.15 | Alberta OH&S Par 6 Safety code for tower cranes CSA Standard Z248-04, | In Ontario: On-site dis-assembly - This is covered generally in section 154 of the Construction Projects Regulation to the extent that dis-assembly must be done in a safe manner and by suitably qualified personnel in accordance with manufacturer's instructions. |
| 4 | What are the costs associated with meeting the provincial requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | | | |

## DISPOSAL

| # | Question | Input from Industy (verbatim) | | |
|---|---|---|---|---|
| **CANADIAN REQUIREMENTS** | | | | |
| 1 | What are the federal standards/certification/testing/inspection requirements for disposing tower cranes? | Nothing special that we are aware of beyond normal environmental reg.s for all items being disposed. | | |
| 2 | What are the costs associated with meeting the Canadian requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | All components can be recycled in one form or another. Disposal costs approx. $10,000<br>Don't know. Would need to ask a scrap metal dealer. | | |
| **PROVINCIAL REQUIREMENTS** | | **BC** | **AB** | **ON** |
| 3 | What are the standards/certification/testing/inspection requirements for disposing tower cranes within the following jurisdictions? | Same as above | | |
| 4 | What are the costs associated with meeting the provincial requirements identified above? Please list each requirement and the cost associated with compliance for one unit. | All components can be recycled in one form or another. Disposal costs approx. $10,000<br>Same as above | | |

# Annex C -

## Standards Mapping for Tower Cranes

| Source/ Normative References | Standard (not limited to a specific version) | Federal/Model Code | Standard version | BC | Specific version | ON | Specific version | QC | Specific version |
|---|---|---|---|---|---|---|---|---|---|
| SCC research | CAN/CSA-Z248-04 (R2014) Code for Tower Cranes | | | Occupational Health and Safety Regulation, BC Reg 296/97, (Workers Compensation Act) 14.2 (1) | General Requirements<br>Standards<br>14.2 (1) Except as otherwise required by this Regulation, a crane or hoist must be designed, constructed, erected, disassembled, inspected, maintained and operated as specified by the manufacturer or a professional engineer, and to meet the requirements of the applicable standard listed in subsections (2) to (15).<br>(6) A tower, hammerhead crane or self erecting tower crane must meet the requirements of CSA Standard Z248-2004, Code for Tower Cranes. | Construction Projects, O Reg 213/91, (Occupational Health and Safety Act) | s151 (2) The manufacturer of a crane or similar hoisting device or a professional engineer shall determine its rated load-carrying capacity in accordance with, (b) for a tower crane, Canadian Standards Association Standard Z248-1976 Code for Tower Cranes. | | |
| | CAN/CSA-Z248-04 (R2014) Code for Tower Cranes (Cont'd) | | | Health, Safety and Reclamation Code for Mines in British Columbia by Ministry of Energy, Mines and Petroleum Resources Mining and Minerals Division 4.18.1 | 4.18.1 Except as otherwise specified in the code, all cranes, derricks and similar hoisting equipment, shall be designed, constructed, erected, disassembled, maintained, and operated in accordance with the requirements of the manufacturer's specifications and instructions, and the following applicable standards, as amended from time to time<br>(4) CSA Standard Z248-1975 Code for Tower Cranes (as amended from time to time ) | | | Safety Code for the construction industry, CQLR c S-2.1, r 4, (Occupational Health and Safety) | 2.15.4. Boom: The boom of a hoisting apparatus not covered by CSA Standard Z150-1974 Safety Code for Mobile Cranes and its supplement No. 1-1977 or CSA Standard Z248-1975 Code for Tower Cranes shall be installed and built according to the specifications approved by an engineer. |
| Model Code | Canadian Institute of Steel Construction CISC/ICCA 2013 Crane-Supporting Steel Structures: Design Guide | National Building Code 2015 (proposed to be used in conjunction with CSA S16 Design of Steel Structures and NBC) | CISC/ICCA 2013 Crane-Supporting Steel Structures: Design Guide | | | | | | |

| Source/ Normative References | Standard (not limited to a specific version) | Federal/Model Code | Standard version | BC | Specific version | AB | Specific version | ON | Specific version |
|---|---|---|---|---|---|---|---|---|---|
| CSA Z248 Normative | CSA C22.1-02 Canadian Electrical Code, Part I | Canada Occupational Health and Safety Regulations, SOR/86-304, (Canada Labour Code) mobile crane only Standards | 8.3 (1) The design, construction and installation of all electrical equipment shall meet the standards set out in the Canadian Electrical Code, Part I, in so far as is reasonably practicable.<br>(2) The operation and maintenance of all electrical equipment shall meet the standards set out in the Canadian Electrical Code. (CSA Standard C22.1-1990) | Occupational Health and Safety Regulation, BC Reg 296/97, (Workers Compensation Act) | Flammable air contaminants<br>5.71 (1) If an operation or work process produces a combustible or flammable air contaminant in concentrations that may present a risk of fire or explosion, the employer must provide a separate exhaust ventilation system for the operation or work process.<br>(2) Electrical components of an exhaust ventilation system required by subsection (1) must comply with Class I Division I requirements of CSA Standard C22.1-94, Canadian Electrical Code, Part 1 if the components contact the air stream. | Electrical Code Regulation, Alta Reg 209/2006, (Safety Codes Act) | Schedule<br>1 For the purposes of section 3(a),(in force) the Canadian Electrical Code, Part 1 (Twenty-second edition), being Canadian Standards Association Standard C22.1-12, is varied as follows:<br>(a) section 4 is amended by adding the following after Rule 4-004(21):... | Mines and Mining Plants, RRO 1990, Reg 854, (Occupational Health and Safety Act) | Rail crane is referred to in PART VII ELECTRICAL 167. Clause 36-204 of CSA Standard C22.1-1982 is modified to the extent that a single pole disconnecting fuse of adequate interrupting capacity may be used to protect a transformer whose capacity is 100 kilovoltamperes per phase or less when operating at a voltage less than 7,500 volts. |
| CSA Z248 Normative | CSA C22.1-02 Canadian Electrical Code, Part I (Cont'd) | | | Electrical Safety Regulation, BC Reg 100/2004, (Safety Standards Act) | Schedule<br>[en. B.C. Reg. 202/2012, s. 2.]<br>Deemed Amendments for Purposes of Adopting Canadian Electrical Code<br>1 For the purposes of section 20 of this regulation, the Canadian Electrical Code, Part 1, Twenty-second Edition, Canadian Standards Association Standard C22.1-12, is adopted as if it were amended as follows:.... | | | | |
| CSA Z248 Normative | CSA C22.1-02 Canadian Electrical Code, Part I (Cont'd) | | | Manufactured Home Regulation, BC Reg 441/2003, (Manufactured Home Act) | Standards<br>2 For the purposes of sections 32 and 33 of the Act a newly built manufactured home must comply with the following standards:<br>(a) sections 70 and 72 of Part 1 (19th Edition) of C22.1-2002 Canadian Electrical Code of the Canadian Standards Association | | | | |
| CSA Z248 Normative | CSA C22.2 No. 33-M1984 (R1999) Construction and Test of Electric Cranes and Hoists | | | Occupational Health and Safety Regulation, BC Reg 296/97, (Workers Compensation Act) | General Requirements<br>Standards<br>14.2 (1) Except as otherwise required by this Regulation, a crane or hoist must be designed, constructed, erected, disassembled, inspected, maintained and operated as specified by the manufacturer or a professional engineer, and to meet the requirements of the applicable standard listed in subsections (2) to (15).<br>(2) A bridge, jib, monorail, gantry or overhead travelling crane must meet the design requirements for electrical components and functions of CSA Standard C22.1-94, Canadian Electrical Code, Part 1, Section 40 and CSA Standard C22.2 No. 33-M1984 (Reaffirmed 1992), Construction and Test of Electric Cranes and Hoists. | | | | |

| Source/ Normative References | Standard (not limited to a specific version) | BC | Specific version | ON | Specific version | QC | Specific version |
|---|---|---|---|---|---|---|---|
| CSA Z248 | CSA W47.1-03 Certification of Companies for Fusion Welding of Steel Structures | | | Mine Development and Closure Under Part VII of the Act, O Reg 240/00, (Mining Act) | Steel Caps — Design Specifications<br>14. The cap shall meet or exceed the following design and steel specifications:<br>5. The individual or the corporation that employs the individual who performs the welding shall be certified in accordance with W47.1-1992 or latest revision. | Construction Code, CQLR c B-1.1, r 2, (Building Act) | 5.4.3 Welding and welding procedures must comply with CSA Standard CSA W59, Welded Steel Construction, or CSA Standard CSA W59.2, Welded Aluminum Construction, published by the Canadian Standards Association.<br>Welding must be performed by a qualified welder from a company that is certified according to CSA Standard CSA W47.1, Certification of Companies for Fusion Welding of Steel, or CSA Standard CSA W47.2, Certification of Companies for Fusion Welding of Aluminum, published by the Canadian Standards Association. |
| SCC research | WCB Standard: WPL 2-2004 Design, Construction and Use of Crane Supported Work Platforms | Occupational Health and Safety Regulation, BC Reg 296/97, Part 13 | In designing and installing a work platform, appropriate safety factors and minimum rated loads must be used in the materials and method of installation, in accordance with<br>(a) WCB Standard WPL 1, Design, Construction and Use of Wood Frame Scaffolds, 2004,<br>(b) WCB Standard WPL 2, Design, Construction and Use of Crane Supported Work Platforms, 2004,<br>(c) WCB Standard WPL 3, Safety Factor and Minimum Breaking Strength for Suspended Work Platforms and Associated Components, 2004, and<br>(d) WCB Standard LDR 1, Job Built Ladders, 2004. | | | | |
| CSA Z249 | CSA W47.1-03 Certification of Companies for Fusion Welding of Steel Structures (Cont'd) | | | | | Safety Code for the construction industry, CQLR c S-2.1, r 4, (Occupational Health and Safety) | 3.9.24 Winch scaffolding: In addition to the standards prescribed in section 3.9.22, every winch scaffolding shall: undergo every year a visual examination of its welds by a welding inspector holding a certificate issued by the Canadian Welding Bureau or a welding supervisor in the employ of a company certified in compliance with the requirements of CSA Standard W47.1 Certification of Companies for Fusion Welding of Steel 3.9.25.<br>Motorized scaffolding: In addition to the standards prescribed in section 3.9.22, every motorized scaffolding manufactured after 13 March 2008 shall: 6) undergo every year a visual examination of its welds by a welding inspector holding a certificate issued by the Canadian Welding Bureau or a welding supervisor in the employ of a company certified in compliance with the requirements of CSA Standard W47.1 Certification of Companies for Fusion Welding of Steel |
| CSA Z248 | CSA W59-13 Welded Steel Construction (Metal Arc Welding) | | | Mine Development and Closure Under Part VII of the Act, O Reg 240/00, (Mining Act) | Steel Caps — Design Specifications<br>14. The cap shall meet or exceed the following design and steel specification…<br>4. All welding shall conform to CSA W59-1989 or latest revision and electrodes shall be type E480xx to CSA W48.1-M1980 or latest revision. | Construction Code, CQLR c B-1.1, r 2, (Building Act) | 5.4.3 Welding and welding procedures must comply with CSA Standard CSA W59, Welded Steel Construction, or CSA Standard CSA W59.2, Welded Aluminum Construction, published by the Canadian Standards Association.<br>Welding must be performed by a qualified welder from a company that is certified according to CSA Standard CSA W47.1, Certification of Companies for Fusion Welding of Steel, or CSA Standard CSA W47.2, Certification of Companies for Fusion Welding of Aluminum, published by the Canadian Standards Association." |

| Source/ Normative References | Standard (not limited to a specific version) | Federal/ Model Code | Standard version | BC | Specific version | ON | Specific version | QC | Specific version |
|---|---|---|---|---|---|---|---|---|---|
| CSA Z248 | CSA W178.2-01 Certification of Welding Inspectors | | | Occupational Health and Safety Regulation, BC Reg 296/97, (Workers Compensation Act) | Equipment inspection<br>20.47 (1) A mast must be inspected in accordance with good engineering practice at intervals not exceeding 12 months, repaired as necessary, and certified safe for use by a professional engineer, the manufacturer or the manufacturer's authorized agent.<br>(b) a reference to a "person qualified to the requirements of CSA W178.2" or to a "representative authorized by the manufacturer" in clause 5.2.2.2.2 of CSA Standard Z151-09, Concrete pumps and placing booms, must be read as a reference to a person who is a professional engineer. | Firefighters - Protective Equipment, O Reg 714/94, (Occupational Health and Safety Act) | 6. (1) In this section,<br>"chassis mounted aerial device" means any device, whether extensible, articulating or both, that is mounted on a vehicle's chassis and designed to position persons, handle materials or discharge water, but does not include portable ladders.<br>(c) if the repairs involve welding, the welds are inspected and approved by an inspector who is a Level III Welding Inspector under CSA Standard W178.2-1990 Certification of Welding Inspectors, and who is employed by an organization certified under CSA Standard W178.1-1990 Certification of Welding Inspection Organizations. | | |
| CSA Z248 | ANSI A14.3-1992 Ladders – Fixed – Safety Requirements | Canada Occupational Health and Safety Regulations, SOR/86-304, (Canada Labour Code) | Ladders, Stairways and Ramps:<br>2.9 (1) A fixed ladder installed after the day of the coming into force of this section shall be designed, constructed and installed in accordance with the requirements of ANSI Standard A14.3-1984 entitled American National Standard for Ladders — Fixed — Safety Requirements, as amended from time to time, other than section 7 of that Standard.<br>(2) A fixed ladder that is installed before the day of the coming into force of this section shall, where reasonably practicable, meet the requirements referred to in subsection (1). | Occupational Health and Safety Regulation, BC Reg 296/97, (Workers Compensation Act) | Previously installed fixed ladders exception<br>28.28 Despite section 13.2 (1) (a) a fixed ladder existing on or before January 1, 2006, and not conforming to the current or an earlier edition of ANSI Standard A14.3-1992, Safety Requirements for Fixed Ladders, may remain in use subject to any modifications considered necessary by the Board. | | | | |
| CSA Z248 | CAN/CGSB-48.9712-00 Non-Destructive Testing — Qualification and Certification of Personnel | Canadian Aviation Regulations, SOR/96-433, (Aeronautics Act) | SCHEDULE I<br>(Subsection 571.02(3))<br>PERSONNEL CERTIFICATION FOR NON-DESTRUCTIVE TESTING (NDT)<br>Method: NDT using liquid penetrant, magnetic particle, eddy current or ultrasonic methods, not performed pursuant to Appendix K of Chapter 571 of the Airworthiness Manual. Certification: Level 2 or Level 3 of the following standards: CAN/CGSB 48.9712-95, Level 2 or Level 3; MIL-Std-410; or Specification ATA 105 | Occupational Health and Safety Regulation, BC Reg 296/97, (Workers Compensation Act) | Raise climbers<br>22.110 (4) At least once a year after it has been put into service, or when ordered by the Board, any part of a raise climber installation which if it failed could endanger workers must be non-destructively tested by persons certified in accordance with CGSB Standard CAN/CGSB-48.9712-95, Qualification and Certification of Non-destructive Testing Personnel, and a copy of the test report must be made available on site for inspection by an officer. | | | Regulation respecting concrete pumps and distribution masts, CQLR c S-2.1, r 9, (Occupational Health and Safety) | DIVISION IV<br>TESTING, INSPECTION, REPAIRS AND MAINTENANCE<br>"non-destructive test" means a radiography, ultrasonic, magnetic particle or liquid penetrant test carried out and interpreted by an equipment operator for non-destructive testing certified level 2 by the Natural Resources Canada National Non-Destructive Testing Certification Body under the standard CAN/CGSB-48.9712 Non-Destructive Testing - Qualification and Certification of Personnel |

| Source/ Normative References | Standard (not limited to a specific version) | Federal/ Model Code | Standard version | BC | Specific version | AB | Specific version | QC | Specific version |
|---|---|---|---|---|---|---|---|---|---|
| ASME B30.3 | ANSI/SAE Z26.1-1996, American National Standard for Safety Glazing Materials for Glazing Motor Vehicles and Motor Vehicle Equipment Operating on Land Highways - Safety Standard | Motor Vehicle Safety Regulations, CRC, c 1038, (Motor Vehicle Safety Act) | ANSI/SAE Z26.1 — 1990, published November 1990 and reprinted February 1992.<br>Glazing Materials<br>205. (1) For the purposes of this section, “bus”, “motorhome”, “multi-purpose passenger vehicle”, “passenger car”, “readily removable windows”, “trailer”, and “truck” in the ANSI Z26 Safety Standard — 1996 shall have the same meaning as in subsection 2(1) of these Regulations. | Occupational Health and Safety Regulation, BC Reg 296/97, (Workers Compensation Act) | Part 14 — Cranes and Hoists: Cab windows<br>14.30 (1) Cab windows on a mobile crane must be made of safety glazing materials meeting the requirements of ANSI/SAE Z26.1-1990, American National Standard for Safety Glazing Materials for Glazing Motor Vehicles and Motor Vehicle Equipment Operating on Land Highways — Safety Code.<br>Part 16 - Window Standards<br>16.11 (1) Windows on mobile equipment must be made of safety glazing meeting the requirements of ANSI Standard Z26.1-1990, American National Standard for Safety Glazing Materials for Glazing Motor Vehicles and Motor Vehicle Equipment Operating on Land Highways – Safety Code.<br>(2) If the maximum travel speed of a machine is 40 km/h (25 mph) or less, tempered windscreen glazing meeting the requirements of ANSI/SAE Z26. 1-1990, American National Standard for Safety Glazing Materials for Glazing Motor Vehicles and Motor Vehicle Equipment Operating on Land Highways – Safety Code, section 4, item 2 is permitted for use as the windshield on the front of the machine. | Vehicle Equipment Regulation, Alta Reg 122/2009, (Traffic Safety Act) | General standards<br>58(1) The Motor Vehicle Tire Safety Regulations, 1995 under the Motor Vehicle Safety Act (Canada) are adopted and apply to pneumatic tires on a motor vehicle or a trailer.<br>(2) SAE Standard J682 is adopted and applies to rear wheel splash and stone-throw protection equipment on vehicles<br>(3) The American National Standard for Safety Glazing Materials for Glazing Motor Vehicles and Motor Vehicle Equipment Operating on Land Highways - Safety Standard ANSI/SAE Z26.1 is adopted and applies to glazing installed in the windshield or other windows of a motor vehicle. | Regulation respecting occupational health and safety in mines, CQLR c S-2.1, r 14, (Occupational Health and Safety) | DIVISION VI MOTORIZED VEHICLES<br>188. Any alteration to the structure, chassis, cab, or rollover or falling object protective structure of a motorized vehicle must comply with the standards referred to in sections 183 to 187, SAE Standard J674A (1976), Safety Glazing Materials - Motor Vehicles, and for rigid plastic materials, ANSI Standard Z26.1-1977, Safety Code for Safety Glazing Materials for Glazing Motor Vehicles Operating on Land Highways. |
| ASME B30.3 | ASME B30.4-2010 Portal and Pedestal Cranes | | | Occupational Health and Safety Regulation, BC Reg 296/97, (Workers Compensation Act) | General Requirements<br>Standards<br>14.2 (1) Except as otherwise required by this Regulation, a crane or hoist must be designed, constructed, erected, disassembled, inspected, maintained and operated as specified by the manufacturer or a professional engineer, and to meet the requirements of the applicable standard listed in subsections (2) to (15).<br>A portal, tower or pillar crane must meet the requirements of ANSI Standard ASME B30.4-2003, Portal, Tower, and Pedestal Cranes. (Separated into two standards) | | | | |
| ASME B30.3 | ASME B30.5-2011 Mobile and Locomotive Cranes | | | Occupational Health and Safety Regulation, BC Reg 296/97, (Workers Compensation Act) | (5) A mobile crane, telescoping or articulating boom truck or sign truck must meet the requirements of (b) ANSI Standard ANSI/ASME B30.5-2004, Mobile and Locomotive Cranes. | | | | |
| ASME B30.3 | ASME B30.9-2006 Slings | | | Occupational Health and Safety Regulation, BC Reg 296/97, (Workers Compensation Act) | Slings<br>Standards<br>15.30 Unless otherwise required by this Regulation, wire rope, alloy steel chain, metal mesh, synthetic fibre rope, synthetic roundslings and synthetic fibre web slings must meet the requirements of ASME B30.9-2006 Slings. | | | | |
| ASME B30.3 | ASME B30.20-2010 Below the Hook Lifting Devices | | | Occupational Health and Safety Regulation, BC Reg 296/97, (Workers Compensation Act) | Below-the-hook Lifting Devices<br>Standards<br>15.57 Spreader bars and other specialized below-the-hook lifting devices must be constructed, inspected, installed, tested, maintained and operated according to the requirements of ASME B30.20-1993, Below-the-Hook Lifting Devices. | | | | |

# Annex D -
## All Exhibits for Tower Cranes

### Exhibit #1, Tower Cranes Case Study – Interview Participants

| Interview # | Name | Affiliation | Interest Category | Jurisdiction |
|---|---|---|---|---|
| 1 | James Orr | Safety Services Branch, Alberta Municipal Affairs | Regulator | Alberta |
| 2 | Craig Martin | CWB Group | Accredited Conformity Assessment Organization – structural welding | Canada |
| 3 | Dennis Cancian | Ontario Formwork Association | Industry Association Representing Crane Owners | Ontario |
| 4 | Janice Lee | BC Safety Authority | Regulator | British Columbia |
| 5 | Carita Edwards/Ted Olechna | Ontario Electrical Safety Authority | Regulator | Ontario |
| 6 | Jim Howard | Skycranes Ltd. | Crane Owner | Canada |
| 7 | Nadia Hawkins | Ontario Ministry of Labour | Regulator | Ontario |
| 8 | Cimarron Corpe | BC Office of Housing and Construction Standards | Regulator | British Columbia |
| 9 | Ray Choudhury | Association of Professional Engineers and Geoscientists of Alberta | Regulator | Alberta |
| 10 | Bernie Ennis | Professional Engineers Ontario | Regulator | Ontario |
| 11 | <name withheld> | <name withheld> municipality | Inspection | British Columbia |
| 12 | <name withheld> | <name withheld> | Crane Owner | Ontario |
| 13 | <name withheld> | <name withheld> | Experienced, Tower Crane Service and Retrofit Firm | Canada and USA |
| 14 | Fraser Cocks | Canadian Hoisting and Rigging Safety Council (CHRSC) | Industry Association Representing Crane Operators | Canada |
| 15 | Dale Chaplow | E-Safe Field Inspection Services | Accredited Field Inspection Organization (Electrical) | Ontario |

**Interviews by jurisdiction, all stakeholder interest categories**

| Alberta | British Columbia | Ontario | Canada / International | Total |
|---|---|---|---|---|
| 2 | 4 | 5 | 4 | 15 |

**Interviews by affiliation and stakeholder interest category:**

| Regulators (1) | Owners & Service firms | Conformity Assessment Body or Municipal Inspector | Industry Associations | Total |
|---|---|---|---|---|
| 7 | 3 | 3 | 2 | 15 |

Notes:

1 – Includes provincial professional engineering associations (PEO and APEGA).

## Exhibit #2, Tower Crane Case Study, Interview Questions

1. SCC's hypothetical scenario for tower cranes was presented in overview. The key assumptions in the scenario are:
   a. Tower crane is purchased new from a German manufacturer by an Ontario-based company.
   b. The tower crane is certified to applicable European requirements.

   Is this product specification typical of what you experience in your trading area/jurisdiction? Please explain.
2. What is the acquisition cost of a tower crane? What does this cost include?

   Examples: Design/Manufacture, Shipping, Pre-deployment assembly and inspection, etc.

   What is the minimum acquisition cost? What is the 'typical' cost? What is the highest cost?
3. Within a specific jurisdiction, how much do costs for certification, inspection, licensing or approval vary as a function of the initial acquisition cost of a tower crane?
4. If costs do not vary with crane $ value or acquisition cost, are there other parameters that may differ between individual tower cranes that need to be considered, that may lead to differences in costs for inspection, certification, approval or licensing within a specific jurisdiction?
5. Are the Tower Crane Lifecycle phases properly defined?

Lifecycle phases:

1. Pre-sale procurement specifications, purchase order, manufacture, pre-shipping testing, etc.
2. Shipping from factory to owner's storage yard/staging/assembly/inspection facility.
3. Pre-deployment assembly and inspection
4. On-site crane erection and inspection
5. Operation
6. Maintenance
7. On-site dis-assembly
8. Remove from job-site and store
9. Decommission/Dispose

**6.** For each lifecycle phase, please answer the following questions.

**6.1** When discussing inspection, certification, testing or licensing requirements for tower cranes, which of these major sub-systems are relevant to your organization: Electrical, Mechanical, Structural, Life Safety, Other (please specify if other is identified).

**6.2** Which tower crane sub-systems require some sort of mandatory inspection, test, certification, or approval licensing by your organization? Please be specific on what terminology your organization uses.

**6.3** For each item identified in question 6.1, identify the organization, firm, or individual accountable for inspection, certification, or licensing.

**6.4** For each item identified in question 6.1, where can the following information be found: The scope and description of mandatory requirements for inspection, testing, certification or licensing?

**6.5** If not obvious from question 6.4, are the mandatory requirements included within a standard, code, regulation, or via language included in a commercial contract?

**6.6** If not obvious from any of the above questions, are there any voluntary requirements that have become standard practice, or that are indirectly enforced (for example, compliance might be a condition of membership in an organization or may be required to achieve a certification or approval that is not mandatory in a specific jurisdiction).

**7.** Is there anything else that we have not asked that is relevant in your opinion, that was missed that may help to make this pilot study more complete, considering the scope? The scope of this pilot study includes: Any regulations or requirements related to licensing, certification, testing and inspection that have a line of sight to tower crane equipment and materials. The scope excludes: Any regulations or requirements related to the licensing, testing or certification of personnel.

**8.** What other organization(s) or individuals would you suggest that we approach?

**9.** Supplemental questions:

Case 1: This is an excerpt from a recent interview with a crane owner:

".....You <the crane owner> gave an example of one <electrical> non-comformance on a tower crane that had been identified in past, dealing with arc-flash requirements for line-voltage rated electrical components (eg. 110V, 220V, 480V or 600V). Your understanding in this instance is: Euro-norms require shielding of 8mm for arc-flash protection whereas UL 489 (a standard most likely referenced within the Ontario Electrical Code?) requires 12 mm. Therefore, the EU-compliant electrical component that was supplied with the tower crane had to be replaced with a component that was third-party certified as compliant to UL 489....."

**9.1** Is the above fact-based and accurate with respect to technical differences in an arc-flash protection requirement? My guess is that this refers to line voltage contacts in a relay/ large motor contactor?

**9.2** If the example is fact-based and accurate: Are the technical differences cited between the European Standard and the UL standard mentioned, significant or not significant? Note: A significant difference is defined as a situation that could result in a potentially unsafe condition and/or, degraded performance.

**9.3** Why does the difference arise? For example:

- Are there significantly different environmental or operating conditions in Europe versus Canada or USA?
- The requirements may have been developed via lab-testing, forensic studies of prior field failures, a long-standing legacy requirement or any combination. Is it possible to determine how the more stringent Canada-USA requirement was established in this instance?

**9.4** Can the cost of this technical difference be easily quantified?

**9.5** Does the scope of inspection vary significantly between tower crane makes and models? .

## Exhibit #3 Tower Crane Lifecycle Phases

| Lifecycle Phase | Description |
|---|---|
| 1. Importing & Shipping | Includes all activities associated with the procurement of a tower crane imported for use in Canada.<br>This phase occurs only once in the Tower Crane's lifecycle. |
| 2. Pre-deployment Assembly. | This phase includes all activities carried out after the Tower Crane has been received into the owner's staging facility and prior to it being sent to its first job-site.<br>It includes: assembly, start-up, testing, inspection and commissioning of the entire Tower Crane as well as its sub-systems such as: Structural members and components, Mechanical components, and electrical components.<br>This phase typically only occurs once during the useful life of the Tower Crane, or after a major overhaul, refurbishment, or design modification has taken place. |
| 3. On-site Erection. | This phase commences every time a Tower Crane is deployed at a new, unique and distinct construction job-site. This phase includes: Design, placement and inspection of the Tower Crane's foundation, Assembly of all components, testing, inspection and site specific commissioning activities. This phase concludes when the Crane has been approved by appropriate authorities having jurisdiction to commence operation at that specific job-site. This phase re-occurs at every new job-site. |
| 4. Operations and Maintenance | This phase commences every time a Tower Crane is located to, and approved for start-up at a specific job-site. It includes all activities that are performed daily, weekly, monthly or annually that are associated with the normal, in-service operation and maintenance of the Tower Crane at a specific construction job-site. The phase ends when the Tower Crane is no longer needed at the specific site. This phase re-occurs at every new job-site. |
| 5. Disassembly | This phase begins when the Crane is ready to be removed from a specific job-site. |
| 6. Disposal | This phase occurs when the useful life of the Tower Crane has ended, and the various components are de-commissioned, scrapped and/or re-cycled. |

## Exhibit #4 Aggregated Responses to the Research Questions.

### A. QUESTION:

Are there significant differences in technical requirements for Tower cranes between Alberta, BC and Ontario? If yes, what are they?

### A. FINDING:

At the level of provincial regulation, the regulatory requirements for Tower crane machines were found to be similar between provinces. The prime difference was in how technical requirements are verified and enforced, and specifically with respect to the verification and enforcement of electrical requirements for high voltage components such as relays, fault protection, contactors and motor controllers. With respect to electrical verification and enforcement, Ontario has the most explicit requirements, requiring that an SCC-accredited field inspection body inspect and provide a field approval of all applicable electrical systems and components per the Ontario Electrical Safety Code.

Tower crane structural, mechanical and in-service operating requirements are very similar between Alberta, British Columbia and Ontario, although there are a few differences in who is accountable for conformity assessment between the provinces. Furthermore, all three provinces require that a licensed professional engineer at least review the concrete pad/foundation design drawings and as well, some form of structural review is often required.

### B. QUESTION:

In instances where there are significant differences: Does it relate to regulation, referencing of standards, referencing of certification/testing or field evaluation requirements, inspection requirements or other administrative or enforcement requirements?

### B. FINDING:

The prime difference is found in how electrical requirements are verified with Ontario having the most explicit administrative requirements for conformance to code requirements for high voltage electrical components. In Ontario, at the pre-deployment lifecycle phase, there is a once-only requirement to have all high voltage electrical systems inspected by an SCC-accredited field inspection body.

Although Alberta and British Columbia do not require an SCC-accredited inspection body to verify electrical conformance, the technical requirements of their respective electrical codes are similar to that in Ontario. Therefore, it could be assumed that non-compliant electrical components that are discovered in a tower crane operating in Ontario, would also be non-compliant while operating in Alberta and British Columbia.

E-Safe, Field Evaluation services group, an SCC-accredited field evaluation agency, provided an anonymized, non-conformance report related to a Peiner SK-415 crane (Refer to Exhibit #1). The non-conformances identified, were confirmed as all related to high voltage electrical circuits which must comply with the Ontario Electrical Safety Code. Additionally, two actual (anonymized) invoices from another source (but not for Peiner SK-415 Crane – involved: Peiner SK-315 Crane and a CTT 311 Crane) were reviewed (Exhibit #2). Although there isn't a line item by line item match between the non-conformance report and the two invoices, an assumption had to be made that these were representative of the most common electrical non-conformities found. This helped as well to establish the range of costs associated with remediating the non-conformances.

### C. QUESTION:

Can the technical differences be categorized as being necessary because of specific local field safety/risk conditions, or are there objective criteria that can be used to categorize differences as duplicative, or redundant?

### C. FINDING:

The interviews did not inform a finding or response to this question. Furthermore, none of the provincial electrical safety codes provide any detailed rationales for specific requirements, nor do they explicitly outline hazards and consequences for specific non-conformances.

### D. QUESTION:

Can the impact on safety risk be quantified if a 'differing' requirement were removed or added for purposes of inter-jurisdictional harmonization?

### D. FINDING:

The interviews did not inform a finding or response to this question.

### E. QUESTION:

Can the impact on economic costs caused by a 'difference' be quantified in a defensible, fact-driven/evidence-based manner?

### E. FINDING:

While it is difficult to quantify the total economic impact of the differing technical requirements in Ontario, Exhibit # 5, "SCC Tower Cranes Economic Impact Analysis" makes some assumptions in this regard.

For a tower crane that comes into service for the first time in Ontario, a one-time economic impact was estimated to be, on average, $11,000 per tower crane for component costs (excluding labour) as well as an opportunity cost because the tower crane is out of service.

The once-only opportunity cost (including lost in-service time for tower cranes) was estimated as follows:

$223,600 per crane operating in Ontario (refer to exhibit #3). This amounts to $54.8 million for Ontario's existing crane fleet, assuming that it stands at 245 tower crane units (Exhibit 5, OFA 2014). This accounts for 2.1% of an estimated $1.375 billion in relevant construction done in one year (Exhibit 5, OFA 2014). That would amount to two tenths of a percent of $11 billion of relevant construction activity in Ontario in 2013. However, since tower cranes have a useful life of many decades (Exhibit 5, OFA 2014), it would be more realistic to amortize this once only cost over the entire useful service life of the equipment. A highly anecdotal sector-wide economic impact analysis (refer to Exhibit #3, estimates a cost impact of between 0.8% and 3.2%). Unfortunately, this range is most likely under the margin of error associated with the economic data and various assumptions.

## Exhibit #5 Tower Cranes, Economic Impact Analysis of difference in electrical technical requirement.

*Note: This impact analysis was not peer reviewed.*

### ENTERPRISE-LEVEL ECONOMIC IMPACT CALCULATION AND ASSUMPTIONS:

Per crane economic impact = (a) Cost of electrical retrofit + (b) opportunity cost lost rental income that the crane is out of service and not available. Note: There may be other factors associated with opportunity cost beyond just rental income. However, the variables and uncertainties made it impossible to include them with any sort of reliability.

**a.** = $11,000 See (e) below

**b.** = $12,000 See (f) below

**c.** Per crane cost impact = $11,000 + $12,000 = $23,000.

**d.** Cost to the enterprise is $23,000 per crane (mostly due to opportunity cost while out of service for retrofit).

**e.** A tower crane electrical retrofit in Ontario parts costs range from $7,000 to $15,000 per crane. Median retrofit cost is $11,000 per crane (mostly for parts only as labour costs could not be verified with certainty).

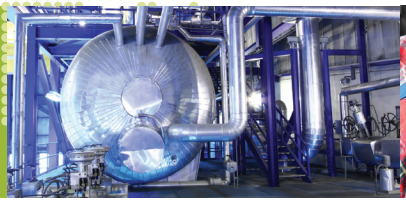
**f.** According to an OFA report, average cost of compliance with ESA electrical requirements is $25,000 per crane, regardless of age. According to one source, it costs between $10,000 and $15,000 per month to rent a tower crane. If the verified parts cost of $7,000 to $15,000 is subtracted from the OFA's estimate, then opportunity cost ranges from $11,000 to $18,000. It was impossible to re-construct how the $18,000 figure was calculated. Therefore a more conservative figure of $12,000 was selected based on median monthly rental income.

### SECTOR-LEVEL (ONTARIO ONLY) ECONOMIC IMPACT CALCULATION AND ASSUMPTIONS:

**1.** One-time cost to the Ontario industry sector is $5,635,000 ($23,000 per crane x 245 cranes)

**2.** One time economic impact of total Ontario-based crane fleet economic impact, and based upon $1.375 billion in the first year = 4 tenths of 1% assuming a 2013 base year.

**3.** This 'total fleet' cost added would normally be amortized over the useful life of the tower crane or at minimum, over the useful life of the tower crane prior to its first major overhaul. Therefore, the total % economic impact across an entire sector is too low to calculate with any precision.



# Annex E -

## Case Study 2 – Water Heaters in Canada: Industry Profile & Economic Analysis

### Water Heaters in Canada: Introduction

Water heaters are part of the plumbing and heating sector and are used in both residential and commercial capacities. There are different types of water heaters including storage tank, tankless, combination, solar, and heat pumps, which are fueled by different sources of energy, e.g., oil, gas, propane, electricity or solar[58].

Instantaneous water heaters are also referred to as tankless, on-demand, or point-of-use water heaters. This type of water heater has no storage tank and heats flowing water only when required, using either an electric element or a gas burner. Instantaneous water heaters are usually more energy efficient than a storage tank water heater since they eliminate the continuous standby energy loss of a storage tank[59].

In Canada, most households are equipped with a storage tank water heater allowing for a constant flow of hot water. Such water heaters include a water storage tank that is filled and heated by a burner or electric element every time the level of water stored decreases. Such a system conveniently allows for a steady supply of hot water, however, it can become expensive. Therefore, the level of energy efficiency is important to reduce energy costs and greenhouse gas emissions[60].

Heat pump water heater (HPWH) technology moves heat from one place to a tank of water. The HPWH technology does not generate heat directly[61]. Heat pump technology also includes ground-source/earth energy, bringing heat from the earth[62].

Solar domestic hot water (SDHW) systems use solar energy to heat water. While SDHW systems have high upfront costs, they can substantially reduce the annual hot water energy costs. A SDHW system can provide up to 60% of the hot water supply for an average Canadian home[63]. Therefore, it needs to be supplemented with another type of water heater using a different type of fuel. SDHW systems that are freeze protected can generate hot water even when the temperature dips below zero[64].

Natural Resources Canada (NRCan) estimates that, on average, Canadians use 27,375 liters of hot water at home annually, the equivalent of 75 liters per day. The share of energy consumption of residential water heaters ranges from 15 to 25%, depending on the type of house, number of residents and lifestyle choices[65]. Between 1990 and 2011, the total growth in energy consumption of water heaters was 17.5%, from 251.1 PJ to 295.1 PJ[66].

58 On average water heaters account for 17% of energy consumption in Canadian households. http://www.nrcan.gc.ca/energy/products/categories/water-heaters/13735

59 Natural Resources Canada (2014). *Tanksless Water Heaters*. http://www.nrcan.gc.ca/energy/products/categories/water-heaters/14541 (accessed February 20, 2015)

60 Natural Resources Canada (2014). Storage *Tank Water Heaters.* http://www.nrcan.gc.ca/energy/products/categories/water-heaters/14508 (accessed February 20, 2015)

61 Natural Resources Canada (2014). *Heat pump water heaters*. http://www.nrcan.gc.ca/energy/products/categories/water-heaters/14556 (accessed February 20, 2015)

62 For more information about ground-sources heat pumps see: Natural Resources Canada (2014). Ground-Source Heat Pumps (Earth-Energy Systems). http://www.nrcan.gc.ca/energy/publications/efficiency/heating-heat-pump/6833 (accessed February 20, 2015) http://www.nrcan.gc.ca/energy/publications/efficiency/heating-heat-pump/6833

63 This estimate will depend on climate and on hot water use habits.

64 Natural Resources Canada (2014). *Solar Water Heaters*. http://www.nrcan.gc.ca/energy/products/categories/water-heaters/14562 (accessed February 20, 2015)

65 On average water heaters account for 17% of energy consumption in Canadian hourseholds. http://www.nrcan.gc.ca/energy/products/categories/water-heaters/13735

66 Natural Resources Canada (NRCan) (Last modified April 7, 2014). "Residential Secondary Energy Use by Energy Source and End-Use". Energy Use Data Handbook . Accessed February 2, 2015 http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=HB&sector=res&juris=00&rn=1&page=6&CFID=35688870&CFTOKEN=91 5948097d78b3c8-9799CC16-0A90-1227-8071514BF2DE0D3E

According to the Canadian Institute of Plumbing and Heating (CIPH), approximately 1 million water heaters are sold for new construction and replacement applications each year in Canada. Water heaters need to be replaced every 7-10 years. This turnaround rate results in an industry estimate that between 60% and 80% of water heaters are sold annually to replace old water heaters. In 2011, there were 14 million water heaters in Canadian residences, mostly fueled by electricity or natural gas (44.9% and 49.7%, respectively).

**Table 1: Water Heater Stock in Canada's Residential Sector by Building Type and Energy Source (1990-2011)**

| | 1990 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|
| **Total Water Heater Stock (x1,000)** | **10,428** | **13,343** | **13,546** | **13,753** | **13,943** | **14,120** | **14,285** |
| **Water Heater Stock by Building Type (x1,000)** | | | | | | | |
| **Single Detached** | 5,856 | 7,537 | 7,641 | 7,733 | 7,819 | 7,897 | 7,965 |
| **Single Attached** | 970 | 1,454 | 1,491 | 1,527 | 1,559 | 1,590 | 1,620 |
| **Apartments** | 3,380 | 4,088 | 4,146 | 4,221 | 4,290 | 4,354 | 4,418 |
| **Mobile Homes** | 221 | 264 | 269 | 272 | 276 | 279 | 282 |
| **Shares (%)** | | | | | | | |
| **Single Detached** | 56.2 | 56.5 | 56.4 | 56.2 | 56.1 | 55.9 | 55.8 |
| **Single Attached** | 9.3 | 10.9 | 11 | 11.1 | 11.2 | 11.3 | 11.3 |
| **Apartments** | 32.4 | 30.6 | 30.6 | 30.7 | 30.8 | 30.8 | 30.9 |
| **Mobile Homes** | 2.1 | 2 | 2 | 2 | 2 | 2 | 2 |
| **Water Heater Stock by Energy Source (x1,000)** | | | | | | | |
| **Electricity** | 5,470 | 6,076 | 6,132 | 6,207 | 6,288 | 6,341 | 6,418 |
| **Natural Gas** | 4,333 | 6,531 | 6,676 | 6,807 | 6,899 | 7,016 | 7,097 |
| **Heating Oil** | 536 | 591 | 587 | 587 | 599 | 605 | 607 |
| **Other**[67] | 66 | 52 | 55 | 55 | 58 | 58 | 59 |
| **Wood** | 23 | 93 | 96 | 96 | 100 | 100 | 104 |
| **Shares (%)** | | | | | | | |
| **Electricity** | 52.5 | 45.5 | 45.3 | 45.1 | 45.1 | 44.9 | 44.9 |
| **Natural Gas** | 41.5 | 48.9 | 49.3 | 49.5 | 49.5 | 49.7 | 49.7 |
| **Heating Oil** | 5.1 | 4.4 | 4.3 | 4.3 | 4.3 | 4.3 | 4.2 |
| **Other**[68] | 0.6 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 | 0.4 |
| **Wood** | 0.2 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 | 0.7 |

*Source: Natural Resources Canada, Comprehensive Energy Use Database*[69]

67 "Other" includes coal and propane.

68 Ibid.

69 Natural Resources Canada (NRCan) (Last modified April 7, 2014). "Table 34: Water Heater Stock by Building Type and Energy Source". *Energy Use Data Handbook*. http://oee.nrcan.gc.ca/corporate/statistics/neud/dpa/showTable.cfm?type=CP&sector=res&juris=ca&rn=34&page=4&CFID=35688870&CFTOKEN=915948097d7 (accessed February 2, 2015)

Below is a profile of the water heaters industry in Canada created to support the Standards Council of Canada's project "Standardization Solutions to Remove Trade Barriers in Canada, Case Study: Residential Water Heaters."

The analysis of international trade will follow the Harmonised System (HS) 2007 classification referencing the commodity codes listed in Table 2. These commodity codes reflect data of both residential and commercial water heaters.

**Table 2: Harmonised System (HS) 2007 Definitions[70]**

| HS 2007 Code | Definition |
|---|---|
| **841911** | Instantaneous Gas Water Heaters |
| **841919** | Other Instantaneous/Storage Water Heaters, Non-Electric (Excl. of 8419.11) |
| **851610** | Electric Instantaneous or Storage Water Heaters and Immersion Heaters |

*Source: UN Comtrade http://comtrade.un.org/*

Data on imports into Canada is available at the 10-digit HS codes from records collected by the Canadian Border Services Agency and reported by Statistics Canada. This detailed level allows for a focused analysis of imports of residential water heaters.

| HS 2007 Code | Definition |
|---|---|
| **841911.00.10** | Instantaneous Gas Water Heaters for Domestic Use |
| **841919.00.10** | Other Instantaneous/Storage Water Heaters, Non-Electric (Excl. of 8419.11) for Domestic Use |
| **851610.90.10** | Electric Instantaneous or Storage Water Heaters and Immersion Heaters for Domestic Use |

*Source: Canadian Border Services Agency http://www.cbsa-asfc.gc.ca/*

Table 3 maps the coverage of the HS 2007 classification with NRCan's definitions of the various types of water heaters available in the Canadian market.

**Table 3: Mapping HS 2007 Definitions of Water Heaters to NRCan's Definitions, by Energy Source, Water Heater Type and Availability in Canada*[71]**

| Water heater type | Storage tank | Tankless (Instantaneous) | Heat pump | Solar domestic hot water system |
|---|---|---|---|---|
| **Electric** | HS07-851610 Yes | HS07-851610 Yes | HS07-851610 Yes | HS07-851610 Yes |
| **Gas**** | HS07-841919 Yes | HS07-841911 Yes | HS07-841919 No | HS07-841919 Yes |
| **Oil** | HS07-841919 Yes | HS07-841919 No | HS07-841919 No | HS07-841919 Yes |

** Availability in Canada is indicated by Yes/No.*
*** Gas refers to either natural gas or propane.*

70 The HS codes at the 6-digist level do not make a distinction between residential and commercial water heaters. However, Canada's expanded 10-digit HS codes do separate import data for residential and commercial water heaters.

71 Natural Resources Canada (2012). Water Heaters Guide. P. 6. http://www.nrcan.gc.ca/sites/www.nrcan.gc.ca/files/energy/pdf/energystar/WaterHeaterGuide_e.pdf (accessed February 19, 2015)

# Trade and Economic Analysis

## THE GLOBAL MARKET OF WATER HEATERS, 2013

Global trade in water heaters generated 5.1 billion current USD worth of imports and just over 5 billion current USD worth of exports in 2013 (See Chart 1 and 2)[72]. Electric instantaneous or storage water heaters and immersion heaters (HS07-851610) accounted for the largest share of global imports and exports in 2013, 44.2% and 42.1%, respectively (see Chart 3 and 4).

**Chart 1: The Value of Global Exports of Water Heaters by Type, 2011-2013**

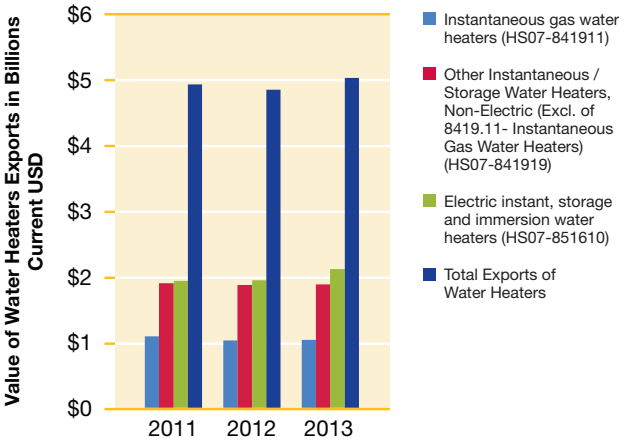



**Chart 2: The Value of Global Imports of Water Heaters by Type, 2011-2013**

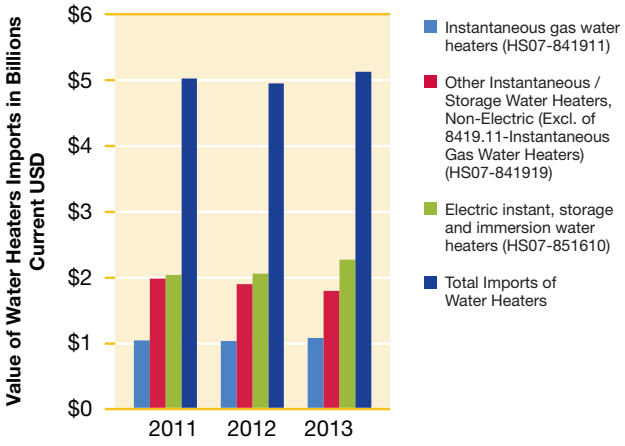



**Chart 3: Distribution of Global Exports of Water Heaters by Type, 2011- 2013**

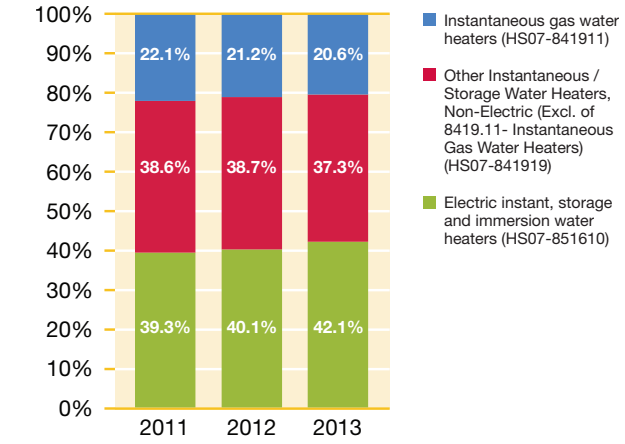
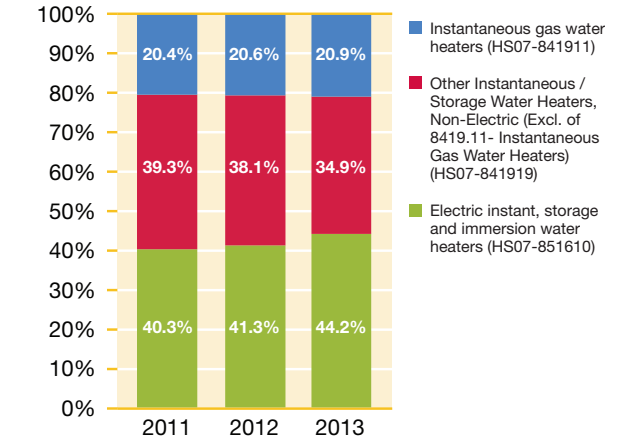



**Chart 4: Distribution of Global Imports of Water Heaters by Type, 2011- 2013**




*Source: UN Comtrade[73] http://comtrade.un.org/*

72 United Nations Commodity Trade Statistics Database (UN Comtrade), http://comtrade.un.org/

73 Export and import figures do not exactly match due to differences in reporting procedures. See United Nations Commodity Trade Statistics Database Read Me First (Disclaimer) for more details http://comtrade.un.org/db/help/uReadMeFirst.aspx

In 2013, China and Japan were the leading exporters of instantaneous gas water heaters (HS07-841911) with exports valued at over 580 million USD and capturing 56.1% of the instantaneous gas water heaters export market (see Table 4). While the quantity of instantaneous gas water heaters exported was not reported by most countries, from the data available, it is possible to see that there is a large difference in the average cost per unit. Theory and the methods of data collection[74] would suggest that these differences could be due to the different technologies, taxes and freight costs, size, materials, capital and labour costs, and overall quality of the different products exported. The global export market of instantaneous gas water heaters is highly concentrated; in 2013, the top 10 exporter of instantaneous gas water heaters accounted for 93% of global exports, valued at over 967 million current USD.

**Table 4: Top-10 Global Exporters of Instantaneous Gas Water Heaters (HS07-841911), 2013**

| Rank | Country | Quantity | Trade Value (current USD) | Average Cost | Share of Global Exports of Instantaneous Gas Water Heaters |
|---|---|---|---|---|---|
| **1** | China | 3,960,246 | 297,140,258 | 75.0 | 28.7% |
| **2** | Japan | N/A | 283,048,131 | N/A | 27.4% |
| **3** | Portugal | N/A | 98,314,167 | N/A | 9.5% |
| **4** | United States | 77,826 | 60,355,682 | 775.5 | 5.8% |
| **5** | Mexico | 97,827 | 53,097,891 | 542.8 | 5.1% |
| **6** | Spain | N/A | 51,658,041 | N/A | 5.0% |
| **7** | Republic of Korea | N/A | 46,561,666 | N/A | 4.5% |
| **8** | Germany | N/A | 33,709,211 | N/A | 3.3% |
| **9** | Italy | N/A | 31,950,504 | N/A | 3.1% |
| **10** | United Kingdom | N/A | 11,175,773 | N/A | 1.1% |

*Source: UN Comtrade http://comtrade.un.org/*

Mexico and Germany are the leading exporters in the category of "Other Instantaneous/Storage Water Heaters, Non-Electric" (HS07-841919) with market share of almost 30%, valued at over 560 million current USD in 2013 (see Table 5). While Mexico and Germany hold a large share of the market, there is a big difference between the average costs of products, most likely due to the similar reasons listed above. The export market of non-electric other instantaneous/storage water heaters is not as concentrated as the instantaneous gas water heaters. In 2013, the top 10 countries exported 4.5 million other non-electric instantaneous/storage water heaters, valued at 1.5 billion current USD and accounting for 80.3% of global exports of non-electric other instantaneous/storage water heaters.

74 United Nations Commodity Trade Statistics Database Read Me First (Disclaimer) http://comtrade.un.org/db/help/uReadMeFirst.aspx

**Table 5: Top-10 Global Exporters of Other Instantaneous/Storage Water Heaters, Non-Electric (Excl. of 8419.11) (HS07- 841919), 2013**

| Rank | Country | Quantity | Trade Value (current USD) | Average Cost | Share of Global Exports |
|---|---|---|---|---|---|
| **1** | Mexico | 1,865,505 | 290,721,457 | 155.84 | 15.5% |
| **2** | Germany | 489,815 | 269,865,294 | 550.95 | 14.4% |
| **3** | Poland | 297,975 | 164,169,958 | 550.95 | 8.7% |
| **4** | United States | 370,255 | 163,697,947 | 442.12 | 8.7% |
| **5** | France | 266,655 | 146,914,520 | 550.95 | 7.8% |
| **6** | China | 591,781 | 130,654,643 | 220.78 | 7.0% |
| **7** | Austria | 233,973 | 128,908,318 | 550.95 | 6.9% |
| **8** | Italy | 178,386 | 98,282,399 | 550.95 | 5.2% |
| **9** | Netherlands | 124,985 | 68,860,672 | 550.95 | 3.7% |
| **10** | Spain | 82,419 | 45,408,788 | 550.95 | 2.4% |

*Source: UN Comtrade http://comtrade.un.org/*

In 2013, China was a strong export leader in the instantaneous or storage water heaters and immersion heaters (HS07-851610; see Table 6) market, accounting for 18.8% market share, exporting over 6.9 million units valued at over 398 million current USD. While China held a large share of the market, this market is distributed among more exporters. In 2013, the top 10 exporters exported over 22 million instantaneous or storage water heaters and immersion heaters valued at over 1.4 billion current USD, and accounting for 71% of global exports of this type of products.

**Table 6: Top-10 Global Exporters of Electric Instantaneous or Storage Water Heaters and Immersion Heaters (HS07-851610), 2013**

| Rank | Country | Quantity | Trade Value (current USD) | Average Cost | Share of Global Exports |
|---|---|---|---|---|---|
| **1** | China | 6,989,561 | 398,955,919 | 57.1 | 18.8% |
| **2** | Italy | 3,998,709 | 216,813,264 | 54.2 | 10.2% |
| **3** | Germany | 2,517,559 | 206,425,279 | 82.0 | 9.8% |
| **4** | Mexico | 1,913,775 | 196,431,953 | 102.6 | 9.3% |
| **5** | United States | 1,343,529 | 158,782,679 | 118.2 | 7.5% |
| **6** | Belgium | 1,003,514 | 86,880,616 | 86.6 | 4.1% |
| **7** | Egypt | 876,999 | 71,908,884 | 82.0 | 3.4% |
| **8** | United Kingdom | 685,677 | 56,772,531 | 82.8 | 2.7% |
| **9** | Netherlands | 1,549,618 | 52,551,833 | 33.9 | 2.5% |
| **10** | Malaysia | 1,741,782 | 52,404,327 | 30.1 | 2.5% |

*Source: UN Comtrade http://comtrade.un.org/*

The three market segments of the water heaters industry have various degrees of global market concentration, which could

be related to different competitive and comparative advantages held by different countries such as technology, human capital, resource endowments, production costs, and market access.

One of the key economic drivers contributing to the expansion of the water heaters industry is the level of construction. New residential buildings and houses require new installations of water heaters. The development of large urban and suburban centres across the globe could create an increasing demand for water heaters. The type of water heater chosen is a function of many variables, such as electricity and gas prices, availability of solar resources, product price, compatibility with local infrastructure and the levels of hot water usage[75].

## CANADA'S POSITION IN THE WATER HEATERS GLOBAL MARKET

Canada is not a significant exporter of water heaters accounting for less than 1% of global market share for each category of water heaters (see Table 7). Among Canada's exports of water heaters in 2013, the electric instantaneous or storage water heaters and immersion heaters (HS07-851610) accounted for 94.6% of the total quantity of water heater exports and 59.4% of the total value of water heater exports.

Reflecting the high demand for hot water, in 2013, Canada was one of the top importers of water heaters in the world (see Table 8). Canada was ranked the third global importer of non-electric other instantaneous/storage water heaters (HS07-841919) valued at over 151 million current USD, capturing 8.5% of the global market in 2013. This group of products comprised the largest share of water heater imports in Canada in terms of value, accounting for 54.7% of total value of water heater imports. However, when considering the quantity, electric instantaneous or storage water heaters and immersion heaters (HS07-851610) capture 72.1% of the total quantity of Canadian water heater imports. Overall, in 2013, Canada accounted for 5.4% of global water heater imports[76].

**Table 7: Canada's Rank in the Water Heaters Global Export Market, 2013**

| Rank | Trade Flow | Trade Partner | Commodity Code | Commodity Description | Quantity | Trade Value (current USD) | Global Market Share | Average Cost |
|---|---|---|---|---|---|---|---|---|
| **17** | Exports | World | 841911 | Instantaneous Gas Water Heaters | 3,306 | 2,126,333 | 0.2% | 643.2 |
| **26** | Exports | World | 841919 | Other Instantaneous/ Storage Water Heaters, Non-Electric (Excl. of 8419.11) | 21,073 | 8,862,976 | 0.5% | 420.6 |
| **25** | Exports | World | 851610 | Electric instantaneous or storage water heaters and immersion heaters | 427,213 | 16,110,704 | 0.8% | 37.7 |
| **Total Exports** | | | | | 451,592 | 27,100,013 | | |

*Source : UN Comtrade http://comtrade.un.org/*

75 K. Hudon, T. Merrigan, J. Burch and J. Maguire (2012). "Low-Cost Solar Water Heating Research and Development Roadmap". National Renewable Energy Laboratory. Page 43. Accessed December 15, 2014. http://www.nrel.gov/docs/fy12osti/54793.pdf

76 Including all the three product categories: HS07841911, HS07-841919 and HS07-851610.

**Table 8: Canada's Rank in the Water Heaters Global Import Market, 2013**

| Rank | Trade Flow | Trade Partner | Commodity Code | Commodity Description | Quantity | Trade Value (current USD) | Global Market Share | Average Cost |
|---|---|---|---|---|---|---|---|---|
| **6** | Imports | World | 841911 | Instantaneous Gas Water Heaters | 63,210 | 52,552,202 | 5.0% | 831.4 |
| **3** | Imports | World | 841919 | Other Instantaneous/ Storage Water Heaters, Non-Electric (Excl. of 8419.11) | 429,754 | 151,938,417 | 8.5% | 353.5 |
| **7** | Imports | World | 851610 | Electric instantaneous or storage water heaters and immersion heaters | 1,271,347 | 73,295,512 | 3.2% | 57.7 |
| Total Imports | | | | | 1,764,311 | 277,786,131 | | |

*Source : UN Comtrade http://comtrade.un.org/*

When taking a closer look at the data for each category of water heater, two categories of water heater (HS07-841911 and HS07-841919) imports were not as affected by the financial crisis as one would expect. The instantaneous gas water heaters (HS07-841911) import market experienced a fast growth between 2009 and 2011. While other non-electric instantaneous/ storage water heaters' (HS07-841919) growth rate slowed down between 2008 and 2011, imports have been consistently growing in value since 2004 and the imports growth rate has been increasing since 2012. The electric instantaneous or storage water heaters and immersion heaters (HS07-851610) market showed a more pro-cyclical trend between 2003 and 2013; this type of import follows a similar trend as Canada's real GDP and the construction sector. These differences could be due to the characteristics and uses of the different types of water heaters. On average, the cost of HS07-841911 and HS07-841919 type water heaters is much higher than HS07-851610. Surprisingly, the less expensive electric instantaneous or storage water heaters and immersion heaters water heater (HS07-851610) imports were more sensitive to the financial crisis and its aftermath.

**Chart 5: Imports & Exports of Water Heaters (HS07-841911) in Canada 2003-2013**

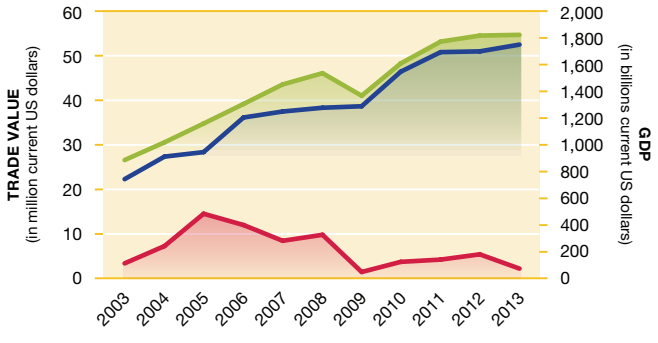



**Chart 6: Imports & Exports of Water Heaters (HS07-841919) in Canada 2003-2013**

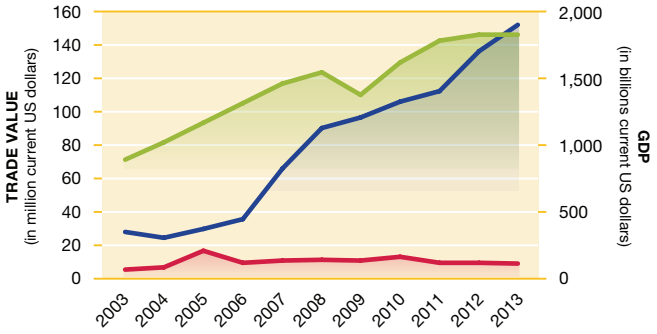
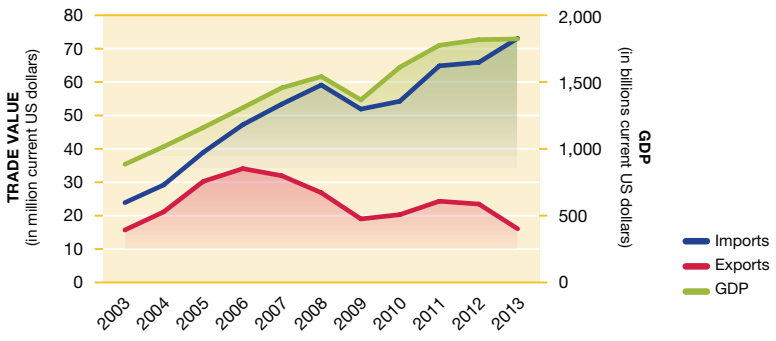



**Chart 7: Imports & Exports of Water Heaters (HS07-851610) in Canada 2003-2013**




*UN Comtrade http://comtrade.un.org/*

The levels of exports of water heaters also differ significantly by category. HS07-841911 and HS07-851610 both experience sharp decline following the financial crisis in 2008 followed by a slow recovery. Exports of HS07-841919 showed a slow downward trend since 2010.

## CANADIAN EXPORTS OF WATER HEATERS

Water heater exports by Canada were valued at 27.1 million current USD and accounted for 0.006% of Canada's total exports in 2013. The wide range in the average cost of exports for all the three product categories most likely stems from differences such as technology, size, and quality of the products exported.

In 2013, Canadian exports of instantaneous gas water heaters (HS07-841911) reached 18 countries. The greatest value and quantity of these exports was sold to the U.S. with 3,115 units exported capturing 80.7% of product export value and 94.2% of the quantity exported.

**Table 9: Instantaneous Gas Water Heaters (HS07-841911) Exports by Canada, 2013**

| Rank | Trade Partner | Trade Quantity | Trade Value (current USD) | Average Cost (current USD) | Percentage of total HS07-841911 value of exports by Canada | Percentage of total HS07-841911 quantity of exports by Canada |
|---|---|---|---|---|---|---|
| | World | 3,306 | 2,126,333 | 643.2 | 100.0% | 100.0% |
| **1** | United States of America | 3,115 | 1,716,949 | 551.2 | 80.7% | 94.2% |
| **2** | Singapore | 50 | 94,700 | 1,894.0 | 4.5% | 1.5% |
| **3** | Germany | 70 | 89,004 | 1,271.5 | 4.2% | 2.1% |
| **4** | Philippines | 3 | 67,159 | 22,386.3 | 3.2% | 0.1% |
| **5** | South Africa | 2 | 53,574 | 26,787.0 | 2.5% | 0.1% |
| **6** | Netherlands | 20 | 33,563 | 1,678.2 | 1.6% | 0.6% |
| **7** | France | 3 | 28,507 | 9,502.3 | 1.3% | 0.1% |
| **8** | Armenia | 15 | 13,948 | 929.9 | 0.7% | 0.5% |
| **9** | Ireland | 2 | 7,759 | 3,879.5 | 0.4% | 0.1% |
| **10** | United Kingdom | 3 | 5,624 | 1,874.7 | 0.3% | 0.1% |

*Source: UN Comtrade http://comtrade.un.org/*

In 2013, Canadian exports of other, non-electric instantaneous/storage water heaters (HS07-841919) reached 22 countries. The greatest value of these exports was sold to the U.S. (17,838 units, accounting for 75.2% of export value), followed by Mexico (306 units, accounting for 13.8% of export value) and the Czech Republic (1,524 units, accounting for 4% of export value).

**Table 10: Other Non-Electric Instantaneous/Storage Water Heaters (HS07-841919) Exports by Canada, 2013**

| Rank | Trade Partner | Trade Quantity | Trade Value (current USD) | Average Cost (current USD) | Percentage of total HS07-841919 value of exports by Canada | Percentage of total HS07-841919 quantity of exports by Canada |
|---|---|---|---|---|---|---|
| | World | 21,073 | 8,862,976 | 420.6 | 100.0% | 100.0% |
| 1 | United States | 17,838 | 6,661,751 | 373.5 | 75.2% | 84.6% |
| 2 | Mexico | 306 | 1,225,173 | 4,003.8 | 13.8% | 1.5% |
| 3 | Czech Republic | 1,524 | 353,128 | 231.7 | 4.0% | 7.2% |
| 4 | Afghanistan | 136 | 187,298 | 1,377.2 | 2.1% | 0.6% |
| 5 | Poland | 601 | 125,278 | 208.4 | 1.4% | 2.9% |
| 6 | Switzerland | 92 | 81,786 | 889.0 | 0.9% | 0.4% |
| 7 | China | 360 | 54,971 | 152.7 | 0.6% | 1.7% |
| 8 | Latvia | 90 | 45,070 | 500.8 | 0.5% | 0.4% |
| 9 | Italy | 58 | 43,817 | 755.5 | 0.5% | 0.3% |
| 10 | Indonesia | 9 | 14,917 | 1,657.4 | 0.2% | 0.04% |

*Source: UN Comtrade http://comtrade.un.org/*

In 2013, Canadian exports of electric instantaneous or storage water heaters and immersion heaters (HS07-851610) reached 55 countries. The greatest value of electric instantaneous or storage water heaters and immersion heaters exports in 2013 was generated from exports to the U.S., valued at over 14 million current USD and accounting for 87.2% of the total export value for this type of water heaters.

**Table 11: Electric Instantaneous or Storage Water Heaters and Immersion Heaters (HS07-851610) Exports by Canada, 2013**

| Rank | Trade Partner | Trade Quantity | Trade Value (current USD) | Average Cost (current USD) | Percentage of total HS07-851610 value of exports by Canada | Percentage of total HS07-851610 quantity of exports by Canada |
|---|---|---|---|---|---|---|
| | World | 427,213 | 16,110,704 | 38 | 100.0% | 100.0% |
| 1 | United States | 389,388 | 14,044,842 | 36 | 87.2% | 91.1% |
| 2 | Italy | 32,310 | 505,534 | 16 | 3.1% | 7.6% |
| 3 | United Kingdom | 86 | 169,703 | 1,973 | 1.1% | 0.02% |
| 4 | Russia | 28 | 158,942 | 5,677 | 1.0% | 0.01% |
| 5 | China | 96 | 152,750 | 1,591 | 0.9% | 0.02% |
| 6 | Kazakhstan | 33 | 119,572 | 3,623 | 0.7% | 0.01% |
| 7 | Saint Kitts and Nevis | 188 | 111,222 | 592 | 0.7% | 0.04% |
| 8 | Saudi Arabia | 51 | 109,982 | 2,157 | 0.7% | 0.01% |
| 9 | Netherlands | 35 | 70,553 | 2,016 | 0.4% | 0.01% |
| 10 | Cuba | 234 | 65,430 | 280 | 0.4% | 0.05% |

*Source: UN Comtrade http://comtrade.un.org/*

## CANADIAN IMPORTS OF WATER HEATERS

Water heater imports to Canada were valued at over 277 million current USD and accounts for 0.06% of Canada's total imports in 2013[77]. While the data does not provide information about the characteristics of the water heaters traded, one possible explanation for the wide differences in the average cost among countries could be the differences in quality, size and complexity of the water heaters.

The Canadian import market is fairly concentrated in all three product categories, where a small number of companies generate a large percentage of import value (see table 12). The electric instantaneous or storage water heaters and immersion heaters (HS07-851610) is the least concentrated of the three, as only 53.12% of the imports are imported by six companies, whereas in the other two categories, over 70% of the import market is controlled by six or less companies.

**Table 12: Market Concentration of Water Heater Imports in Canada 2013[78]**

| Product Category (HS6) | Market Share | Total Number of Companies Listed |
|---|---|---|
| 841911 - Instantaneous Gas Water Heaters (Non-Electric)- 2013 | 3 companies accounted for 44.85% of cumulative imports<br>6 companies accounted for 70.08% of cumulative imports<br>9 companies accounted for 78.94% of cumulative imports | 9 |
| 841919 - Instantaneous Or Storage Water Heaters N.E.S (Non- Electric) | 3 companies accounted for 79.97% of cumulative imports | 3 |
| 851610 - Electric Instantaneous Or Storage Water Heaters And Immersion Heaters (59 companies) | 3 companies accounted for 46.08% of cumulative imports<br>6 companies accounted for 53.12% of cumulative imports<br>10 companies accounted for 57.80% of cumulative imports<br>25 companies accounted for 69.29% of cumulative imports<br>59 companies accounted for 80.43% of cumulative imports | 59 |

*Source: Innovation, Science and Economic Development Canada. Canadian Importers Database (CID)*

In 2013, instantaneous gas water heaters (HS07-841911) were imported to Canada from 21 countries. The greatest value of instantaneous gas water heater imports in 2013 was from American imports, valued at over 19 million current USD and accounting for 36.5% of the total import value for this type of water heater. Following the United States, imports from Japan and the Republic of Korea accounted for 34.5% and 25%, respectively.

**Table 13: Instantaneous Gas Water Heaters (HS07-841911) Imports to Canada, 2013**

| Rank | Trade Partner | Commodity Code | Trade Quantity | Trade Value (current USD) | Average Cost (current USD) | Percentage of Total HS07-841911 Value of Imports by Canada | Percentage of Total HS07-841911 Quantity of Imports by Canada |
|---|---|---|---|---|---|---|---|
| | World | 841911 | 63,210 | 52,552,202 | 831.39 | 100.0% | 100.0% |
| **1** | United States | 841911 | 23,705 | 19,189,118 | 809.50 | 36.5% | 37.5% |
| **2** | Japan | 841911 | 23,599 | 18,128,344 | 768.18 | 34.5% | 37.3% |
| **3** | Republic of Korea | 841911 | 12,016 | 13,122,225 | 1092.06 | 25.0% | 19.0% |
| **4** | Portugal | 841911 | 1,833 | 866,559 | 472.75 | 1.6% | 2.9% |
| **5** | China | 841911 | 1,142 | 459,278 | 402.17 | 0.9% | 1.8% |
| **6** | Germany | 841911 | 465 | 385,447 | 828.92 | 0.7% | 0.7% |
| **7** | Belgium | 841911 | 368 | 360,120 | 978.59 | 0.7% | 0.6% |
| **8** | Italy | 841911 | 33 | 9,657 | 292.64 | 0.02% | 0.05% |
| **9** | France | 841911 | 3 | 2,444 | 814.67 | 0.005% | 0.005% |
| **10** | Sweden | 841911 | 1 | 2,286 | 2286.00 | 0.004% | 0.002% |

*Source: UN Comtrade http://comtrade.un.org/*

77 United Nations Commodity Trade Statistics Database (UN Comtrade), http://comtrade.un.org/

78 Innovation, Science and Economic Development Canada's Canadian Importers Database (CID): https://www.ic.gc.ca/eic/site/cid-dic.nsf/eng/home

Residential instantaneous gas water heaters (HS07-8419.11.00.10) comprised a large share of the value of instantaneous gas water heater imports, accounting for between 56.3% and 74.9% of the market value between 2010 and 2014. The growth rate in imports of residential instantaneous gas water heaters tempered in 2012, but surpassed its 2011 levels by 2014 with 11.2% growth rate, 37.9 million USD in import value and 47,511 units.

**Table 14: Residential Instantaneous Gas Water Heaters (HS07-8419.11.00.10) Imports to Canada 2010-2014**

| Year | Quantity | Average Annual Exchange Rate[79] | Value of Total Imports in current USD | Value of Total Imports of Instantaneous Gas Water Heaters (HS07-841911) | Share of Residential Instantaneous Gas Water Heaters (HS07-8419.11.00.10) of Total Instantaneous Gas Water Heaters (HS07-841911) | Growth Rate |
|---|---|---|---|---|---|---|
| **2010** | 39,605 | 0.971 | 34,799,500 | 46,481,581 | 74.9% | - |
| **2011** | 50,528 | 1.012 | 28,686,815 | 50,946,962 | 56.3% | 9.6% |
| **2012** | 43,381 | 1.001 | 33,551,105 | 51,173,670 | 65.6% | 0.4% |
| **2013** | 41,188 | 0.971 | 32,976,888 | 52,552,202 | 62.8% | 2.7% |
| **2014** | 47,511 | 0.906 | 37,919,601 | 58,426,239 | 64.9% | 11.2% |

*Source: Statistics Canada. Canadian International Merchandise Trade Database; Bank of Canada; United Nations Commodity Trade Statistics Database.*

In 2013 and 2014, Canada imported the majority of residential instantaneous gas water heaters from Japan, Republic of Korea and the United States. During this period both the quantity and value of imports increased by 15%.

**Table 15: Residential Instantaneous Gas Water Heaters (HS07-8419.11.00.10) Imports to Canada, by Country of Origin, 2013-2014**

| | 2013 | | | | 2014 | | | |
|---|---|---|---|---|---|---|---|---|
| | Country of Origin | Quantity | Value in current USD[80] | Average Cost USD | Country of Origin | Quantity | Value in current USD[81] | Average Cost USD |
| | World | 41,188 | 32,976,887.90 | 800.64 | World | 47,511 | 37,919,600.63 | 881.13 |
| **1.** | Japan | 20,768 | 16,041,906.76 | 772.43 | Japan | 22,795 | 18,247,630.89 | 800.51 |
| **2.** | Republic of Korea | 10,205 | 11,090,354.61 | 1086.75 | Republic of Korea | 11,462 | 12,864,462.62 | 1122.36 |
| **3.** | United States | 8,209 | 4,461,629.36 | 543.50 | United States | 9,554 | 5,243,732.75 | 548.85 |
| **4.** | Belgium | 368 | 360,206.47 | 978.82 | Portugal | 2,161 | 798,878.56 | 369.68 |
| **5.** | Germany | 436 | 341,913.54 | 784.20 | China | 1,058 | 296,887.32 | 280.61 |
| **6.** | Portugal | 525 | 325,916.82 | 620.80 | Belgium | 237 | 238,788.66 | 1007.55 |
| **7.** | China | 641 | 325,048.45 | 507.10 | Germany | 131 | 105,737.19 | 807.15 |
| **8.** | Italy | 8 | 8,387.38 | 1048.42 | France | 54 | 79,174.72 | 1466.20 |
| **9.** | France | 2 | 2,302.04 | 1151.01 | Mexico | 38 | 28,484.57 | 749.59 |
| **10.** | Slovakia | 1 | 869.33 | 869.33 | Hong Kong | 3 | 766.30 | 255.43 |

*Source: Statistics Canada. Canadian International Merchandise Trade Database.*

79 Using the Bank of Canada's annual average exchange rate

80 Using the Bank of Canada's annual average exchange rate for 2013: 1CND=0.971USD

81 Using the Bank of Canada's annual average exchange rate for 2014: 1CND=0.906USD

In 2013, other non-electric instantaneous/storage water heaters (HS07-841919) were imported from 24 countries. The greatest value of other non-electric instantaneous/storage water heaters spent in 2013 was on American imports, valued at over 107 million current USD and accounting for 70.5% of the total import value for this type of water heater. Following the U.S. imports from Mexico accounted for 27.8% of the value spent on non-electric instantaneous/storage water heaters.

**Table 16: Other Non-Electric Instantaneous/Storage Water Heaters (HS07-841919) Imports by Canada, 2013**

| Rank | Trade Partner | Trade Quantity | Trade Value (current USD) | Average Cost (current USD) | Percentage of Total HS07-841919 Value of Imports by Canada | Percentage of Total HS07-841919 Quantity of Imports by Canada |
|---|---|---|---|---|---|---|
| | World | 429,754 | 151,938,417 | 353.5 | 100.00% | 100.00% |
| **1** | United States of America | 240,118 | 107,113,706 | 446.1 | 70.50% | 55.87% |
| **2** | Mexico | 166,367 | 42,314,567 | 254.3 | 27.85% | 38.71% |
| **3** | Germany | 18,962 | 760,873 | 40.1 | 0.50% | 4.41% |
| **4** | China | 2,587 | 550,408 | 212.8 | 0.36% | 0.60% |
| **5** | Japan | 676 | 421,434 | 623.4 | 0.28% | 0.16% |
| **6** | Belgium | 318 | 307,539 | 967.1 | 0.20% | 0.07% |
| **7** | Netherlands | 51 | 145,496 | 2,852.9 | 0.10% | 0.01% |
| **8** | Philippines | 8 | 66,299 | 8,287.4 | 0.04% | 0.00% |
| **9** | Turkey | 93 | 37,084 | 398.8 | 0.02% | 0.02% |
| **10** | Portugal | 18 | 14,865 | 825.8 | 0.01% | 0.004% |

*Source: UN Comtrade http://comtrade.un.org/*

Residential non-electric storage water heaters (HS07-8419.19.00.10) comprised a large share of the value of non-electric storage water heater imports, accounting for between 38.2% and 76.1% of the market value between 2010 and 2014. The growth rate in imports of residential non-electric storage water heaters was negative in 2011, peaking at 85% growth rate in 2012, and declining to 14% in 2014. The number of units imported to Canada has been increasing since 2012, reaching over 400,000 units in 2014.

**Table 17: Residential Storage Water Heaters, Non-Electric (8419.19.00.10) Imports to Canada 2010-2014**

| Year | Quantity | Average Annual Exchange Rate[82] | Value of Total Imports in current USD | Value of Total Imports of Non-Electric Storage Water Heaters (HS07-841919) | Share of Residential Storage Water Heaters, Non-Electric (HS07-8419.19.00.10) of Total Non-Electric Storage Water Heaters (HS07-841919) | Growth Rate |
|---|---|---|---|---|---|---|
| **2010** | 257,620 | 0.971 | 68,699,503.74 | $105,940,312 | 64.8% | - |
| **2011** | 325,790 | 1.012 | 42,839,170.80 | $112,212,846 | 38.2% | -38% |
| **2012** | 266,830 | 1.001 | 79,283,957.29 | $136,138,753 | 58.2% | 85% |
| **2013** | 370,341 | 0.971 | 108,355,640.98 | $151,938,417 | 71.3% | 37% |
| **2014** | 409,295 | 0.906 | 123,666,324.26 | $162,538,668 | 76.1% | 14% |

*Source: Statistics Canada. Canadian International Merchandise Trade Database; Bank of Canada; United Nations Commodity Trade Statistics Database.*

82 Using the Bank of Canada's annual average exchange rate

The top countries Canada imported residential non-electric water heaters from in 2013 and 2014 included the U.S., Mexico, Belgium and China. The U.S. and Mexico account for over 98% of these imports in both quantity and value. In 2014, Israel and China were the main sources of lower value non-electric water heaters for residential use, whereas Belgium, France and Italy seem to be suppliers of higher-value non-electric water heaters. The average cost of water heaters imported from Hungary and the Netherlands is significantly higher than those imported from other countries, which could signal that these imports were of very large water heaters suited for residential use.

**Table 18: Residential Storage Water Heaters, Non-Electric (8419.19.00.10) Imports to Canada, by Country of Origin, 2013-2014**

| | 2013 | | | | 2014 | | | |
|---|---|---|---|---|---|---|---|---|
| | Country of Origin | Quantity | Value in current USD[83] | Average Cost USD | Country of Origin | Quantity | Value in current USD[84] | Average Cost USD |
| | World | 370,341 | 108,355,640.98 | 292.58 | World | 409,295 | 123,666,324.26 | 302.14 |
| **1.** | United States | 202,517 | 65,274,005.95 | 322.31 | United States | 238,163 | 74,161,537.54 | 311.39 |
| **2.** | Mexico | 166,173 | 42,282,657.59 | 254.45 | Mexico | 165,070 | 48,307,927.67 | 292.65 |
| **3.** | Belgium | 308 | 298,195.25 | 968.17 | Belgium | 616 | 479,256.66 | 778.01 |
| **4.** | China | 934 | 218,088.28 | 233.50 | China | 4,120 | 371,954.26 | 90.28 |
| **5.** | Japan | 189 | 138,995.38 | 735.43 | France | 134 | 121,264.35 | 904.96 |
| **6.** | Germany | 149 | 100,511.55 | 674.57 | Germany | 198 | 94,434.67 | 476.94 |
| **7.** | Portugal | 18 | 14,869.02 | 826.06 | Israel | 867 | 67,819.66 | 78.22 |
| **8.** | Netherlands | 10 | 9,997.83 | 999.78 | Italy | 68 | 43,324.22 | 637.12 |
| **9.** | France | 24 | 7,623.92 | 317.66 | United Kingdom | 40 | 8,454.70 | 211.37 |
| **10.** | Hungary | 2 | 4,606.01 | 2,303.01 | Netherlands | 3 | 5,942.02 | 1,980.67 |

*Source: Statistics Canada. Canadian International Merchandise Trade Database.*

In 2013, electric instantaneous or storage water heaters and immersion heaters (HS07-851610) were imported to Canada from over 40 countries. The greatest value of electric instantaneous or storage water heaters and immersion heaters imports in 2013 was from U.S. imports, valued at over 47.5 million current USD and accounting for 64.8% of the total import value for this type of water heater.

83 Using the Bank of Canada's annual average exchange rate for 2013: 1CND=0.971USD

84 Using the Bank of Canada's annual average exchange rate for 2014: 1CND=0.906USD

**Table 19: Electric Instantaneous or Storage Water Heaters and Immersion Heaters (HS07-851610) Imports by Canada, 2013**

| Rank | Trade Partner | Trade Quantity | Trade Value (current USD) | Average Cost (current USD) | Percentage of Total HS07-851610 Value of Imports by Canada | Percentage of Total HS07-851610 Quantity of Imports by Canada |
|---|---|---|---|---|---|---|
| | World | 1,271,347 | 73,295,512 | 57.65 | 100.0% | 100.0% |
| **1** | United States of America | 640,191 | 47,520,089 | 74.23 | 64.8% | 50.4% |
| **2** | Mexico | 170,883 | 17,810,995 | 104.23 | 24.3% | 13.4% |
| **3** | China | 356,308 | 3,827,192 | 10.74 | 5.2% | 28.0% |
| **4** | Germany | 20,138 | 970,603 | 48.20 | 1.3% | 1.6% |
| **5** | Japan | 10,036 | 421,120 | 41.96 | 0.6% | 0.8% |
| **6** | Italy | 29,505 | 350,885 | 11.89 | 0.5% | 2.3% |
| **7** | United Kingdom | 2,739 | 307,476 | 112.26 | 0.4% | 0.2% |
| **8** | Norway | 782 | 252,987 | 323.51 | 0.3% | 0.1% |
| **9** | Republic of Korea | 364 | 103,319 | 283.84 | 0.1% | 0.03% |
| **10** | Sweden | 1,194 | 86,472 | $72.42 | 0.1% | 0.1% |

*Source: UN Comtrade http://comtrade.un.org/*

Residential electric storage water heaters (HS07-8516.10.90.10) comprised a large share of the value of electric storage water heater imports, accounting for between 44.8% and 59.4% of the import market value between 2010 and 2014. The growth rate in imports of residential electric storage water heaters was negative in 2012, reaching 45% growth rate in 2014 with over half a million units imported valued at 57 million current USD.

**Table 20: Residential Electric Storage Water Heaters (8516.10.90.10[85]) Imports to Canada 2010-2014**

| Year | Quantity | Average Annual Exchange Rate[86] | Value of Total Imports in current USD | Value of Total Imports of Electric Instantaneous/Storage Water Heaters & Immersion Heaters (HS07-851610) | Share of Residential Electric Storage Water Heaters (HS07-8516.10.90.10) of Total Electric Instantaneous/Storage Water Heaters & Immersion Heaters (HS07-8516.10) | Growth Rate |
|---|---|---|---|---|---|---|
| **2010** | 671,598 | 0.971 | 30,075,619.39 | 54,298,254 | 55.4% | - |
| **2011** | 548,673 | 1.012 | 31,293,733.09 | 65,063,104 | 48.1% | 4% |
| **2012** | 397,433 | 1.001 | 29,569,661.48 | 66,067,669 | 44.8% | -6% |
| **2013** | 465,001 | 0.971 | 39,469,573.50 | 73,295,512 | 53.8% | 33% |
| **2014** | 568,007 | 0.906 | 57,334,627.74 | 96,489,789 | 59.4% | 45% |

*Source: Statistics Canada. Canadian International Merchandise Trade Database; Bank of Canada; United Nations Commodity Trade Statistics Database.*

85 HS definition: "Electric Storage Water Heaters of a Kind Used for Domestic Purposes"

86 Using the Bank of Canada's annual average exchange rate

In 2014, Canada imported residential electric storage water heaters from 29 countries. The top countries Canada imported electric water heaters from in 2013 and 2014 included the U.S., Mexico and China. Together imports from these three countries account for over 97% of total value imports of residential electric storage water heaters in both years. Reflected in the low average cost, imports from China are likely to have very different characteristics than imports from the U.S. and Mexico.

**Table 21: Residential Electric Storage Water Heaters (8516.10.90.10[87])**
**Imports to Canada, by Country of Origin, 2013-2014**

| | 2013 | | | | 2014 | | | |
|---|---|---|---|---|---|---|---|---|
| | Country of Origin | Quantity | Value in current USD[88] | Average Cost USD | Country of Origin | Quantity | Value in current USD[89] | Average Cost USD |
| | World | 465,001 | 39,469,573.50 | 84.88 | World | 568,007 | 57,334,627.74 | 100.94 |
| 1 | United States | 203,050 | 21,743,276.72 | 107.08 | United States | 231,824 | 33,664,325.91 | 145.22 |
| 2 | Mexico | 121,965 | 15,466,491.02 | 126.81 | Mexico | 139,403 | 18,121,008.76 | 129.99 |
| 3 | China | 130,322 | 1,497,987.27 | 11.49 | China | 173,100 | 4,081,186.16 | 23.58 |
| 4 | Norway | 315 | 210,922.83 | 669.60 | Republic of Korea | 2,863 | 444,398.01 | 155.22 |
| 5 | Japan | 3,650 | 207,018.11 | 56.72 | Germany | 2,419 | 334,330.21 | 138.21 |
| 6 | Germany | 1,121 | 188,870.88 | 168.48 | Norway | 543 | 330,899.05 | 609.39 |
| 7 | Republic of Korea | 123 | 50,195.07 | 408.09 | Japan | 2,302 | 147,719.02 | 64.17 |
| 8 | Taiwan | 425 | 34,993.86 | 82.34 | Italy | 13,434 | 140,729.90 | 10.48 |
| 9 | Italy | 3,356 | 24,362.73 | 7.26 | Poland | 1,523 | 18,211.93 | 11.96 |
| 10 | United Kingdom | 310 | 12,537.84 | 40.44 | Taiwan | 201 | 14,788.93 | 73.58 |

*Source: Statistics Canada. Canadian International Merchandise Trade Database.*

## Employment

Plumbing, heating and air-conditioning contractors fall under North American Industry Classification System (NAICS) code 238220. This category includes installation of water heaters[90]. Water heater servicers are defined in National Occupational Classification (NOC) as contractors who install, repair and service water heaters in residential and commercial facilities[91]. Neither NAICS nor NOC established a separate code that isolated water heaters installations or service providers in a separate category. Therefore, it is difficult to estimate the levels of employment and contributions to GDP related to water heaters.

According to Statistics Canada, in order to be a water heater servicer, some secondary school education is usually required, on-the-job training and several months of related work experience[92]. CIPH offers certification and other training related to individuals working in the industry.

87 HS definition: Electric Storage Water Heaters of a Kind Used for Domestic Purposes

88 Using the Bank of Canada's annual average exchange rate for 2013: 1CND=0.971USD

89 Using the Bank of Canada's annual average exchange rate for 2014: 1CND=0.906USD

90 "Water Heater Installation". *North American Industry Classification System (NAICS Canada 2012)*. http://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=118464&CVD=118471&CPV=238220&CST=01012012&CLV=5&MLV=5

91 "Water Heater Servicer" falls under the National Occupational Classification (NOC) code 7441. http://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=122372&CVD=122376&CPV=7441&CST=01012011&CLV=4&MLV=4

92 Statistics Canada. "7441 - Residential and commercial installers and servicers: Employment requirements". *National Occupational Classification (NOC) 2011*. http://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=122372&CVD=122376&CPV=7441&CST=01012011&CLV=4&MLV=4

## Water Heaters & Standardization

At the international level, IEC operates two technical committees that have responsibilities related to standardization in the water heaters industry: IEC/TC 61- Safety of Household and Similar Electrical Appliances[93], and IEC/SC 59C- Heating Appliances. ISO's TC 180/SC 4 Systems – Thermal Performance, Reliability and Durability[94] has been publishing work on performance measurement of domestic water heating systems[95].

In Europe, CENELEC, through its technical committee 'Performance of household and similar electrical appliances' (CLC/TC 59X), develops standards on methods for measuring the performance of electrical appliances for household or commercial use including water heaters[96].

According to CIPH, the difference in a typical water heaters retail price produced for the North American market could be approximately $130[97]. Furthermore, CIPH estimates that between 27% and 31% of this retail price difference is due to the duplicate certification requirements[98]. Additionally, there is some divergence in the measurement of the levels of energy efficiency. For instance, in the U.S. energy efficiency standards or gas and electric water heaters are measured in Energy Factor (EF) metrics. However, in Canada, EF is used to measure the efficiency of gas water heaters only, while a measure of standby loss is used to rate electric water heaters' energy efficiency. British Columbia established separate energy efficiency standards.

## Industry Stakeholders

The main industry association representing the commercial interest of the water heaters industry is CIPH, representing over 260 companies in the plumbing and heating industry.

Considering key importers in 2013, there are over 70 companies that are involved in importing water heaters to Canada (see appendix II for a complete list)[99]. Of the top businesses responsible for 80% of the value of imports in Canada, the greatest number of businesses were located in Ontario in 2013 under all water heaters categories (see Table 22- Table 24). While the number of U.S. businesses importing water heaters to Canada is not large, these businesses are present. In Table 24, when the number of businesses in American states is considered all together, they comprise 14% of the number of businesses responsible for 80% of the value of import of electric instantaneous or storage water heaters and immersion heaters (HS07-851610) to Canada, being the third largest geographical area. This presence might be a reflection of the significant trade relations between Canada and the U.S.

**Table 22: Number of Businesses Responsible for 80% of the Value of Import of Instantaneous Gas Water Heaters (Non-Electric) (HS07-841911) to Canada, by Province/State[100]**

| Province/ State | Number of Companies | Share |
|---|---|---|
| Ontario | 7 | 11% |
| California (U.S.) | 1 | 11% |
| North Carolina (U.S.) | 1 | 78% |
| **Total** | 9 | 100% |

93 Canada is a participating member in this technical committee.

94 The TC's secretariat is hosted by ANSI, USA.

95 ISO. *Standards and projects under the direct responsibility of ISO/TC 180/SC 4 Secretariat*. http://www.iso.org/iso/home/store/catalogue_tc/home/store/catalogue_tc/catalogue_tc_browse.htm?commid=54032&published=on&development=on ISO (2011.09.03). *Draft Business Plan ISO/TC 180, Solar Energy*. http://isotc.iso.org/livelink/livelink/fetch/2000/2122/687806/ISO_TC_180__Solar_energy_.pdf?nodeid=970199&vernum=-2

96 European Committee for Standardization. *Work Programme 2014: European Standardization and Related Activities*. . P. 11. http://www.cen.eu/news/brochures/brochures/CEN-CENELEC-WP2014_EN.pdf

97 CIPH estimates that the typical retail price of water heaters in North America is $970 in the USA, while the same product would be priced at $1100 in Canada. Wong, K. and Tomihiro, K. (2012). *A Value Proposition from the Canadian Institute of Plumbing & Heating to Facilitate the Harmonization of Market Entry Required Standards and Certification Schemes Covering Selected Plumbing & HVACR Products: Economic Impact Assessment*. Submitted to the Standards Council of Canada.

98 Wong, K. and Tomihiro, K. (2012). *A Value Proposition from the Canadian Institute of Plumbing & Heating to Facilitate the Harmonization of Market Entry Required Standards and Certification Schemes Covering Selected Plumbing & HVACR Products: Economic Impact Assessment*. Submitted to the Standards Council of Canada.

99 Innovation, Science and Economic Development Canada's Canadian Importers Database (CID): https://www.ic.gc.ca/eic/site/cid-dic.nsf/eng/home

100 Innovation, Science and Economic Development Canada's Canadian Importers Database (CID): https://www.ic.gc.ca/eic/site/cid-dic.nsf/eng/home

**Table 23: Number of Businesses Responsible for 80% of the Value of Import of Instantaneous or Storage Water Heaters N.E.S (Non- Electric) (HS07-841919) to Canada, by Province/State[101]**

| Province/ State | Number of Companies | Share |
|---|---|---|
| Ontario | 3 | 100% |
| **Total** | 3 | 100% |

**Table 24: Number of Businesses Responsible for 80% of the Value of Import of Electric Instantaneous or Storage Water Heaters and Immersion Heaters (HS07-851610) to Canada, by Province/State[102]**

| Province/ State | Number of Companies | Share |
|---|---|---|
| Ontario | 30 | 51% |
| Alberta | 9 | 15% |
| Quebec | 6 | 10% |
| Manitoba | 2 | 3% |
| Tennessee (U.S.) | 2 | 3% |
| British Columbia | 1 | 2% |
| California (U.S.) | 1 | 2% |
| Minnesota (U.S.) | 1 | 2% |
| New Brunswick | 1 | 2% |
| New York (U.S.) | 1 | 2% |
| Newfoundland and Labrador | 1 | 2% |
| Nova Scotia | 1 | 2% |
| Ohio (U.S.) | 1 | 2% |
| Pennsylvania (U.S.) | 1 | 2% |
| Wisconsin (U.S.) | 1 | 2% |
| **Total** | 59 | 100% |

## Policy Priorities

Since water heaters account for a large portion of household energy use, NRCan has been using three tools to promote the use of energy-efficient water heaters. These tools include[103]:

- Setting minimum energy performance standards through Canada's *Energy Efficiency Regulations*[104].
- The promotion of the voluntary EnerGuide label for storage tank water heaters. The label shows how much energy a specific model uses, which helps to eliminate the least efficient products from the Canadian market.
- Identifying high efficiency models through the ENERGY STAR® symbol.

Furthermore, trade between Canada and the U.S. plays a significant role in the water heaters industry. Since the American water heaters market is a leading trade market in all three water heater categories, standards harmonization with the U.S. is of primary interest to Canada. This observation is also supported by the CIPH's call for the harmonization of standards, testing and certification requirements in the plumbing and heating industries in North America.

101 Innovation, Science and Economic Development Canada's Canadian Importers Database (CID): https://www.ic.gc.ca/eic/site/cid-dic.nsf/eng/home

102 Innovation, Science and Economic Development Canada's Canadian Importers Database (CID): https://www.ic.gc.ca/eic/site/cid-dic.nsf/eng/home

103 Natural Recourses Canada (2014). *Water Heaters: Tools You Can Use*. http://www.nrcan.gc.ca/energy/products/categories/water-heaters/13735 (accessed February 18, 2015)

104 Combination systems are **not** regulated under Canada's *Energy Efficiency Regulations*. However, the Canadian Standards Association standard CSA P.9—*Test method for determining the performance of combined space and water heating systems (combos)* yields a "thermal performance factor" that consolidates measures for both space heating and water heating that can be used by consumers to discern between different models of combination systems according to energy efficiency. Natural Recourses Canada (2014). *Combination Systems*. http://www.nrcan.gc.ca/energy/products/categories/water-heaters/14548

# Appendix I: Natural Resources Canada- Product List

A full product list of all water heaters models available in Canada can be found at the links- below:

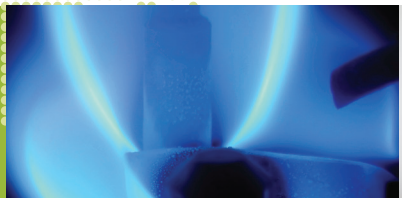
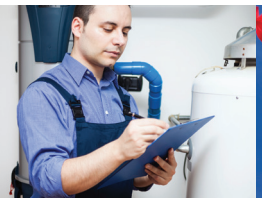
1. Water heaters, condensing gas storage type – ENERGY STAR (http://www.energystar.gov/productfinder/product/certified-water-heaters/results)
2. Water heaters, electric – models available in Canada or ENERGY STAR (http://oee.nrcan.gc.ca/pml-lmp/index.cfm?action=app.search-recherche&appliance=WATERHEATER_E) (http://www.energystar.gov/productfinder/product/certified-water-heaters/results)
3. Water heaters, gas – models available in Canada or ENERGY STAR (http://oee.nrcan.gc.ca/pml-lmp/index.cfm?action=app.search-recherche&appliance=WATERHEATER_G) (http://www.energystar.gov/productfinder/product/certified-water-heaters/results)
4. Water heaters, heat pumps – ENERGY STAR (http://www.energystar.gov/productfinder/product/certified-water-heaters/results)
5. Water heaters, oil – models available in Canada (http://oee.nrcan.gc.ca/pml-lmp/index.cfm?action=app.search-recherche&appliance=WATERHEATER_O)
6. Water heaters, solar – ENERGY STAR (http://www.energystar.gov/productfinder/product/certified-water-heaters/results)
7. Water heaters, tankless –ENERGY STAR (http://www.energystar.gov/productfinder/product/certified-water-heaters/results)

# Appendix II: Leading Canadian Importers of Water Heaters, 2013[105]

| Company Name (alphabetical order by product category) | | City | Province | Postal code |
|---|---|---|---|---|
| **841911 - Instantaneous Gas Water Heaters (Non-Electric)** | | | | |
| 1. | A O SMITH ENTERPRISES LTD | Stratford | Ontario | N5A 6T3 |
| 2. | EMCO WHEATON | London | Ontario | N5W 3A7 |
| 3. | HAYWARD POOL PRODUCTS CANADA INC/PRODUITS DE PISCINES HAYW | Oakville | Ontario | L6H 5R4 |
| 4. | NORITZ AMERICA CORPORATION | Fountain Valley | California | |
| 5. | PENTAIR WATER POOL AND SPA INC | Sanford | North Carolina | |
| 6. | REDMOND WILLIAMS DISTRIBUTING INC | Mississauga | Ontario | L4W 1A2 |
| 7. | RHEEM CANADA LTD/RHEEM CANADA LTEE | Brampton | Ontario | L6Y 0P5 |
| 8. | TEMPCO HEATING & SHEET METAL INC | Toronto | Ontario | M9W 1H1 |
| 9. | WOLSELEY CANADA INC (ATLANTIC) | Burlington | Ontario | L7N 3V6 |
| **841919 - Instantaneous Or Storage Water Heaters N.E.S (Non- Electric)** | | | | |
| 1. | A O SMITH ENTERPRISES LTD | Stratford | Ontario | N5A 6T3 |
| 2. | BRADFORD WHITE - CANADA INC | Mississauga | Ontario | L4W 1W8 |
| 3. | RHEEM CANADA LTD/RHEEM CANADA LTEE | Brampton | Ontario | L6Y 0P5 |
| **851610 - Electric Instantaneous Or Storage Water Heaters And Immersion Heaters** | | | | |
| 1. | 6029124 CANADA INC | Mississauga | Ontario | L5T 1V1 |
| 2. | 987754 ONTARIO INC | Mississauga | Ontario | L5H 2J2 |
| 3. | A E SALES INC | Red Deer | Alberta | T4P 3Z5 |
| 4. | A O SMITH ENTERPRISES LTD | Stratford | Ontario | N5A 6T3 |
| 5. | AQUA-TECH SALES AND MARKETING INC | Burlington | Ontario | L7L 5R2 |
| 6. | AQUARIUM SERVICES WAREHOUSE OUTLETS INC | Woodbridge | Ontario | L4L 8N4 |
| 7. | BENKO SEWER SERVICE/BADGER DAY LIGHTING | Cambridge | Ontario | N1R 8L2 |
| 8. | BLUE FALLS MANUFACTURING LTD | Thorsby | Alberta | T0C 2P0 |
| 9. | BRADFORD WHITE - CANADA INC | Mississauga | Ontario | L4W 1W8 |
| 10. | BRENNAN FERGUSON ASSOCIATES HVAC SALES | Dartmouth | Nova Scotia | B3B 1N3 |
| 11. | C&D AEROSPACE CANADA CO. | Kirkland | Quebec | H9J 3K1 |
| 12. | CANADAIR | Montréal | Quebec | H3B 1Y8 |

105 Innovation, Science and Economic Development Canada's Canadian Importers Database (CID): https://www.ic.gc.ca/eic/site/cid-dic.nsf/eng/home.

| | | | | |
|---|---|---|---|---|
| 13. | CANADIAN HEAT ACQUISITION CORP | Pittsburgh | Pennsylvania | |
| 14. | CHRYSLER CANADA INC | Windsor | Ontario | N9A 5K3 |
| 15. | CNH INDUSTRIAL CANADA LTD | Burlington | Ontario | L7N 3M6 |
| 16. | COMPANION ANIMAL DIVISION | Cincinnati | Ohio | |
| 17. | COMPASS COMPRESSION SERVICES LTD | Calgary | Alberta | T2G 5N4 |
| 18. | CUMMINS FILTRATION INC | Mississauga | Ontario | L5T 2A2 |
| 19. | EMERSON ELECTRIC CANADA LIMITED/EMERSON ELECTRIQUE DU CANADA | Markham | Ontario | L3R 0Y6 |
| 20. | ENERFLEX COMPRESSION & POWER ( DOMESTIC) | Calgary | Alberta | T2G 0K3 |
| 21. | FINNING INTERNATIONAL INC | Vancouver | British Columbia | V6C 2X8 |
| 22. | FORD MOTOR COMPANY OF CANADA LIMITED/FORD DU CANADA LIMITEE | Brampton | Ontario | L6T 4M3 |
| 23. | GENERAL MOTORS OF CANADA LIMITED / GENERAL MOTORS DU CANADA | Oshawa | Ontario | L1H 8P7 |
| 24. | GREGG DISTRIBUTORS LIMITED PARTNERSHIP | Edmonton | Alberta | T5V 1C7 |
| 25. | HATCO CORPORATION | Milwaukee | Wisconsin | |
| 26. | HEWITT EQUIPMENT LIMITED | Pointe-Claire | Quebec | H9R 1B8 |
| 27. | HOME HARDWARE STORES LIMITED | St. Jacobs | Ontario | N0B 2N0 |
| 28. | HONEYWELL LIMITED | Mississauga | Ontario | L5L 3S6 |
| 29. | HTS ENGINEERING LTD | Toronto | Ontario | M3N 1W8 |
| 30. | JOHN DEERE CANADA ULC | Grimsby | Ontario | L3M 4H5 |
| 31. | KANE VETERINARY SUPPLIES LTD | Edmonton | Alberta | T5S 2W2 |
| 32. | KAZ CANADA INC | Milton | Ontario | L9T 2X6 |
| 33. | KRETEK INTERNATIONAL INC | Mississauga | Ontario | L4W 2Z5 |
| 34. | MAZDA CANADA INC | Richmond Hill | Ontario | L4B 3K5 |
| 35. | MOTORS & ARMATURES INC | Hauppauge | New York | |
| 36. | NAVISTAR CANADA INC | Burlington | Ontario | L7L 5H4 |
| 37. | ORGILL INC | Memphis | Tennessee | |
| 38. | PALSER ENTERPRISES LIMITED | London | Ontario | N6H 5E1 |
| 39. | PEAVEY MART | Red Deer | Alberta | T4P 2H9 |
| 40. | PHILLIPS & TEMRO INDUSTRIES INC | Eden Prairie | Minnesota | |
| 41. | PHILLIPS & TEMRO INDUSTRIES LTD | Winnipeg | Manitoba | R2J 3V4 |
| 42. | PLATINUM ENERGY SERVICES CORP | Calgary | Alberta | T2R 1L9 |
| 43. | POLYGON CANADA INC | Mississauga | Ontario | L5T 2N6 |
| 44. | POWER COMMISSION OF THE CITY OF SAINT JOHN | Saint John | New Brunswick | E2L 4C7 |
| 45. | PRINCESS AUTO LTD | Winnipeg | Manitoba | R3C 2W7 |
| 46. | PROPAK SYSTEMS LTD | Baxter's Corner | Alberta | T4A 2J8 |
| 47. | REUSINAGE KNIGHT DIVISION UAP | Montréal | Quebec | H1N 2B3 |
| 48. | RHEEM CANADA LTD/RHEEM CANADA LTEE | Brampton | Ontario | L6Y 0P5 |
| 49. | ROLF C HAGEN INC | Baie-d'Urfé | Quebec | H9X 0A2 |
| 50. | SALTON CANADA | Dollard-des-Ormeaux | Quebec | H9B 2J5 |
| 51. | SNC-LAVALIN NUCLEAR INC | Oakville | Ontario | L6H 0C3 |
| 52. | SPA BUILDERS SUPPORT GROUP | Corona | California | |
| 53. | STATE INDUSTRIES INC | Ashland City | Tennessee | |
| 54. | SUBARU CANADA INC | Mississauga | Ontario | L5R 4J7 |
| 55. | TOYOTA CANADA INC - LEXUS DIVISION | Toronto | Ontario | M1H 1H9 |
| 56. | VALE NEWFOUNDLAND & LABRADOR LIMITED | St. John's | Newfoundland and Labrador | A1C 1K4 |
| 57. | WEIL-MCLAIN CANADA SALES INC | Burlington | Ontario | L7L 5R2 |
| 58. | WOLSELEY CANADA INC (ATLANTIC) | Burlington | Ontario | L7N 3V6 |
| 59. | XS CARGO LIMITED PARTNERSHIP | Mississauga | Ontario | L5S 1X1 |


# Annex F -
## Standards Mapping for Water Heaters

### LEGENDS

**E:** maximum energy consumption (kWh/month)

**EF:** minimum energy factor

**V:** volume (litres)

**EEMAC:** Electrical and Electronic Manufacturers Association of Canada

**NEMA:** National Electrical Manufacturers Association

| Base Standard | Juris-diction | Regulation | Product/Appliance | Specific Edition | Status | Requirement | Certification Body to Test/Verify Requirement | Label Issuer |
|---|---|---|---|---|---|---|---|---|
| CAN/CSA C191-04 Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service | BC | Energy Efficiency Standards Regulation, BC Reg 14/2015 | Electric storage-type water heaters manufactured on or after September 2nd, 2010 having a top inlet and a rated storage capacity of 50 to 454 litres and a bottom inlet and a rated storage capacity of 50 to 454 litres | CAN/CSA C191-04 | Superseded | Energy Efficiency: Standby loss (in watts) must be ≤ 25 + (0.20 x V), ≤ (0.472 x V) – 48.5, ≤ 40 + (0.20 × V) and ≤ (0.472 x V) – 33.5 | Persons or organizations accredited by the Standards Council of Canada as certification bodies are authorized to verify any energy device to which the certification relates, and agencies accredited by the NFRC as independent certification and inspection agencies are authorized to verify any manufactured fenestration product | Lieutenant Governor in Council and Manufacturer |
| CAN/CSA P.3-04 Testing Method for Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters | BC | Energy Efficiency Standards Regulation, BC Reg 14/2015 | Natural gas or propane storage-type water heaters manufactured on or after September 2nd, 2010 | CAN/CSA P.3-04 | Superseded | Energy factor must be ≥ 0.70 – (0.0005 x V) | Persons or organizations accredited by the Standards Council of Canada as certification bodies are authorized to verify any energy device to which the certification relates, and agencies accredited by the NFRC as independent certification and inspection agencies are authorized to verify any manufactured fenestration product | Lieutenant Governor in Council and Manufacturer |
| ANSI Z21.10.1-2014/ CSA 4.1-2014 - Gas water heaters, volume I, storage water heaters with input ratings of 75,000 Btu per hour or less | NB | General Regulation, NB Reg 95-70, (Energy Efficiency Act) | Gas-fired automatic storage type water heaters with storage tank volumes of 76 l to 380 l inclusive, for use with propane and natural gas with inputs less than 75,000 BTU/h | Clause 2.1.9 of CGA/ CAN1-4.1-M85 | Superseded | Energy performance | SCC-accredited CB in respect of a prescribed product is designated to test the prescribed product to certify or verify whether the product meets the standards prescribed by this Regulation for that product. | By CB or by the Minister |
| CAN/CSA-C191.1-M90 Performance options for electric storage tank water heaters | NB | General Regulation, NB Reg 95-70, (Energy Efficiency Act) | Stationary electric storage tank water heaters with a capacity of between 50 l and 450 l inclusive that are intended for use on pressure systems | CAN/CSA-C191.1-M90 | Superseded | Energy Performance: Clause 5.1 of CAN/CSA-C191.1 | SCC-accredited CB in respect of a prescribed product is designated to test the prescribed product to certify or verify whether the product meets the standards prescribed by this Regulation for that product. | By CB or by the Minister |
| CSA C191-04 Performance of electric storage tank water heaters for domestic hot water service | NB | General Regulation, NB Reg 95-70, (Energy Efficiency Act) | Electric storage tank water heaters and heat pump water heaters with a capacity of between 76 l and 454 l | CSA C191-04 | Superseded | Maximum standby loss in W for top-fill tanks of (a)≤ 25 + (0.20 × V) for 50 l to 270 l tanks, and (b)≤ (0.472 × V) - 48.5 for 270 l to 454 l tanks | An organization that is accredited by the Standards Council of Canada as a certification organization in respect of a prescribed product is designated to test the prescribed product to certify or verify whether the product meets the standards prescribed by this Regulation for that product. | By CB or by the Minister |
| CAN/CSA-P.3-98 Testing Method for Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters | NB | General Regulation, NB Reg 95-70, (Energy Efficiency Act) | Gas-fired automatic storage type water heaters with storage tank volumes of 76 l to 380 l inclusive, for use with propane and natural gas with inputs less than 75,000 BTU/h | CAN/CSA-P.3-98 | Superseded | EF = 0.67-0.0005 V | An organization that is accredited by the Standards Council of Canada as a certification organization in respect of a prescribed product is designated to test the prescribed product to certify or verify whether the product meets the standards prescribed by this Regulation for that product. | By CB or by the Minister |
| CAN/CSA-P.3-04 (R2006) Testing Method for Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters (as revised in March 2006) | NB | General Regulation, NB Reg 95-70, (Energy Efficiency Act) | Gas-fired automatic storage type water heaters with storage tank volumes of 76 l to 380 l inclusive, for use with propane and natural gas with inputs less than 75,000 BTU/h | CAN/CSA-P.3-04 (R2006) | Active | EF ≥ 0.70-0.0005 V | An organization that is accredited by the Standards Council of Canada as a certification organization in respect of a prescribed product is designated to test the prescribed product to certify or verify whether the product meets the standards prescribed by this Regulation for that product. | By CB or by the Minister |

| Base Standard | Juris-diction | Regulation | Product/Appliance | Specific Edition | Status | Requirement | Certification Body to Test/Verify Requirement | Label Issuer |
|---|---|---|---|---|---|---|---|---|
| CAN/CSA-C745-03 Energy Efficiency of Electric Storage Tank Water Heaters and Heat Pump Water Heaters | NB | General Regulation, NB Reg 95-70, (Energy Efficiency Act) | Electric storage tank water heaters and heat pump water heaters with a capacity of between 76 l and 454 l | CAN/CSA-C745-03 | Active | Clause 9 - Energy Factor, CAN/CSA- C745-03 | An organization that is accredited by the Standards Council of Canada as a certification organization in respect of a prescribed product is designated to test the prescribed product to certify or verify whether the product meets the standards prescribed by this Regulation for that product. | By CB or by the Minister |
| CSA C191-00 Performance of Electric Storage Tank Water Heaters for Household Service | NB | General Regulation, NB Reg 95-70, (Energy Efficiency Act) | Stationary electric storage tank water heaters with a capacity of between 50 l and 450 l inclusive that are intended for use on pressure systems | CSA C191-00 | Superseded | Energy Peformance: Maximum standby loss in W =<br>(a)for tanks with a bottom inlet<br>(i)40 + 0.2 V for tanks with V ≥ 50 l and ≤ 270 l, and<br>(ii)0.472 V – 33.5 for tanks with V > 270 l and ≤ 454 l<br>(b)for tanks with top inlet<br>(i)35 + 0.2 V for tanks with V ≥ 50 l and ≤ 270 l, and<br>(ii)0.472 V – 33.5 for tanks with V > 270 l and ≤ 454 l | An organization that is accredited by the Standards Council of Canada as a certification organization in respect of a prescribed product is designated to test the prescribed product to certify or verify whether the product meets the standards prescribed by this Regulation for that product. | By CB or by the Minister |
| ANSI Z21.10.1-2014/ CSA 4.1-2014 - Gas water heaters, volume I, storage water heaters with input ratings of 75,000 Btu per hour or less | NS | Energy-Efficient Appliances Regulations, NS Reg 400/2008, (Energy-efficient Appliances Act) | Gas-fired automatic-storage-type water heaters manufactured on or after January 1st 2008 with storage tank volumes of 76 L to 380 L inclusive, for use with propane and natural gas with inputs less than 75 000 BTU/h | ANSI Z21.10.1-2004/CAN/CSA 4.1-2004 | Superseded | Energy performance EF = 0.67- 0.0005 V | Certification organization accredited by CSA is designated to test and verify the energy usage of a designated appliance in electrical or electronic products;fuel-burning equipment; gas-burning appliances and equipment. | By CB or by the Governor in Council |
| CAN/CSA-C191-04, Performance of Electrical Storage Tank Water Heaters for Domestic Hot Water Service | NS | Energy-Efficient Appliances Regulations, NS Reg 400/2008, (Energy-efficient Appliances Act) | Stationary electric storage tank water heaters with a capacity of between 50 L and 450 L inclusive that are intended for use on pressure systems | CAN/CSA-C191-04 | Superseded | Energy Peformance: Clause 5 of CAN/ CSA-C191-04 | Certification organization accredited by CSA is designated to test and verify the energy usage of a designated appliance in electrical or electronic products;fuel-burning equipment; gas-burning appliances and equipment. | By CB or by the Governor in Council |
| ANSI Z21.10.1-2014/ CSA 4.1-2014 - Gas water heaters, volume I, storage water heaters with input ratings of 75,000 Btu per hour or less | ON | Energy Efficiency - Appliances and Products, O Reg 404/12, (Green Energy Act, 2009) | Water heater, gas-fired, tank-type, with an input rating of not more than 22 kW (75,000 BTU/h) | ANSI Z21.10.1-2004 / CSA 4.1-2004, for date of manufacture: June 24, 2005 to December 31, 2012 inclusive.<br>ANSI Z21.10.1-2009 / CSA 4.1-2009 for water heater produced between January 1, 2013 to March 31, 2016 inclusive | Superseded | Testing | SCC-accredited CB to certify products, processes and services that include the class of the appliance or product | By CB or by the Minister |
| CSA P.7-10 Test method for measuring energy loss of gas-fired instantaneous water heaters | ON | Energy Efficiency - Appliances and Products, O Reg 404/12, (Green Energy Act, 2009) | Water heater, gas-fired, instantaneous, with an input rating of less than 73 kW (250,000 BTU/h): | CAN/CSA P.7-10 for water heaters manufactured January 1st, 2016 or later | Active | **Testing:** Water heaters with an input rating from zero to less than 73 kW (250,000 Btu/h) and excludes units designed for combination space and water heating applications **Energy Efficiency:** Energy factor ≥ 0.80 | SCC-accredited CB to certify products, processes and services that include the class of the appliance or product | By CB or by the Minister |

| Base Standard | Juris-diction | Regulation | Product/Appliance | Specific Edition | Status | Requirement | Certification Body to Test/Verify Requirement | Label Issuer |
|---|---|---|---|---|---|---|---|---|
| CAN/CSA C191-04, Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service | ON | Energy Efficiency - Appliances and Products, O Reg 404/12, (Green Energy Act, 2009) | A stationary electrically-heated storage water heater manufactured from June 24, 2005 to April 14, 2015 with a capacity of at least 50 L but not more than 450 L that is intended for use on a pressurized system. However, units with an input rating of 4,000 BTU/h or more per US gallon of stored water and units designed for combination space and water heating applications are excluded | CAN/CSA C191-04 | Superseded | Testing and Energy Peformance in accordance to Clause 4.8 of CAN/CSA C191-04 | SCC-accredited CB to certify products, processes and services that include the class of the appliance or product | By CB or by the Minister |
| ANSI Z21.10.3-2011/2013 / CSA 4.3-2011/2013, Gas-fired water heaters, volume III, storage water heaters with input ratings above 75,000 Btu per hour, circulating and instantaneous | ON | Energy Efficiency - Appliances and Products, O Reg 404/12, (Green Energy Act, 2009) | Water heater, gas-fired, tank-type, with an input rating of more than 22 kW (75,000 BTU/h) and input rating of 73 kW (250,000 BTU/h) or more | ANSI Z21.10.3-2013 / CSA 4.3-2013, Gas-fired water heaters, volume III, storage water heaters with input ratings above 75,000 Btu per hour, circulating and instantaneous. For water heaters manufactured on or before July 31, 2014, ANSI Z21.10.3-2011 / CSA 4.3-2011, Gas Water Heaters, Volume III, Storage Water Heaters With Input Ratings Above 75,000 Btu Per Hour, Circulating and Instantaneous, may be used instead. | Superseded | **Testing:** The same scope as the testing standard, but limited to storage water heaters that are designed to supply domestic hot water and excluding units designed for combination space and water heating **Energy Efficiency:** Thermal efficiency ≥ 80 per cent, and standby loss ≤ Q/800 + 110 (Vr)1/2 in BTU/h, where Q is the nameplate input rate in BTU/h and Vr is the rated volume in US gallons | SCC-accredited CB to certify products, processes and services that include the class of the appliance or product | By CB or by the Minister |
| CAN/CSA-P.3-04 Testing Method for Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters | ON | Energy Efficiency - Appliances and Products, O Reg 404/12, (Green Energy Act, 2009) | Water heater, gas-fired, tank-type, with an input rating of not more than 22 kW (75,000 BTU/h) manufactured June 24, 2005 to December 31, 2012 inclusive and April 1, 2016 or later | Clause G.7 of Exhibit G of the testing standard, when tested in accordance with CAN/CSA-P.3-2003 and CAN/CSA-P.3-04 | Active | **Prescribed efficiency standard or requirement:** Clause G.7 of Exhibit G of the testing standard, when tested in accordance with CAN/CSA-P.3-2003 and energy factor ≥ 0.75 – 0.0005 × rated storage volume in L, or ≥ 0.75 – 0.00189 × rated storage volume in US gallons. **Testing:** A stationary gas-fired water heater designed to supply domestic hot water that has a capacity of not less than 76 L (20 US gallons) and not more than 380 L (100 US gallons), that heats and stores water within the appliance at a thermostatically controlled temperature of less than 82°C (180°F) for delivery on demand, and that has an input of 22 kW (75,000 BTU/h) or less. However, units with an input rating of 4,000 BTU/h or more per US gallon of stored water and units designed for combination space and water heating applications are excluded. For greater certainty, tabletop water heaters are included. | SCC-accredited CB to certify products, processes and services that include the class of the appliance or product | By CB or by the Minister |
| ANSI Z21.10.1-2014/ CSA 4.1-2014 - Gas water heaters, volume I, storage water heaters with input ratings of 75,000 Btu per hour or less | QC | Regulation respecting the energy efficiency of electrical or hydrocarbon-fuelled appliances, CQLR c E-1.2, r 1, (Energy Efficiency of Electrical or Hydrocarbon-fuelled Appliances) | Gas-fired and propane-fired water heaters with storage tank volumes of 76 L to 380 L with an input rating less than 75 000 BTU/hour | CAN/CGA 4.1 M85, This shall be interpreted as references to such methods or specifications as later amended by the designated certifying body, where such is the case | Superseded but dependent on CB's descretion to use later amendments | Energy Efficiency<br>EF = 0.62- 0.0005 V | The Canadian Standards Association, Warnock Hersey Professional Services Ltd., Underwriters Laboratories Inc. and the Canadian Gas Association are designated as the certifying bodies | By CB or by the Minister |

| Base Standard | Juris-diction | Regulation | Product/Appliance | Specific Edition | Status | Requirement | Certification Body to Test/Verify Requirement | Label Issuer |
|---|---|---|---|---|---|---|---|---|
| ANSI Z21.10.1-2014/ CSA 4.1-2014 - Gas water heaters, volume I, storage water heaters with input ratings of 75,000 Btu per hour or less | Federal | Energy Efficiency Regulations, SOR/94-651, (Energy Efficiency Act) | Gas water heaters manufactured on or after February 3, 1995 until June 30, 2004 | CGA standard CAN1-4.1-M85 | Superseded | Energy Efficiency<br>EF = 0.62- 0.0005 V (1995-2004)<br>EF = 0.67- 0.0005 V (2004 and after by using CSA P.3-04) | Standards Council of Canada as an energy efficiency certification body in respect of any of the following classes of products or their equivalent:<br>(a) electrical or electronic products;<br>(b) fuel-burning equipment; or<br>(c) gas-fired appliances and equipment. | By the Minister or CB |
| CAN/CSA-P.3-04 Testing Method for Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters (as revised in March 2006) | Federal | Energy Efficiency Regulations, SOR/94-651, (Energy Efficiency Act) | Gas water heaters manufactured on or after July 1st 2004 | CAN/CSA-P.3-04 | Active | EF = 0.67 - 0.0005 V | Standards Council of Canada as an energy efficiency certification body in respect of any of the following classes of products or their equivalent:<br>(a) electrical or electronic products;<br>(b) fuel-burning equipment; or<br>(c) gas-fired appliances and equipment. | By the Minister or CB |
| CAN/CSA-C191.1-M90 Performance of electric storage tank water heaters for domestic hot water service | Federal | Energy Efficiency Regulations, SOR/94-651, (Energy Efficiency Act) | Electric Water Heaters manufactured before July 1, 2004 | CAN/CSA-C191.1-M90 | Superseded | Energy Efficiency: Clause 5 of CAN/CSA-C191.1-M90 | Standards Council of Canada as an energy efficiency certification body in respect of any of the following classes of products or their equivalent:<br>(a) electrical or electronic products;<br>(b) fuel-burning equipment; or<br>(c) gas-fired appliances and equipment. | By the Minister or CB |
| CAN/CSA C191-04, Performance of Electric Storage Tank Water Heaters for Domestic Hot Water Service | Federal | Energy Efficiency Regulations, SOR/94-651, (Energy Efficiency Act) | Electric water heaters manufactured on or after July 1, 2004 | CAN/CSA C191-04 | Superseded | maximum standby loss in W =<br>(a) for tanks with bottom inlet:<br>(i) 40 + 0.2 V for tanks with V ≥ 50 L and ≤ 270 L<br>(ii) 0.472 V - 33.5 for tanks with V > 270 L and ≤ 454 L<br>(b) for tanks with top inlet:<br>(i) 35 + 0.2 V for tanks with V ≥ 50 L and ≤ 270 L<br>(ii) 0.472 V - 38.5 for tanks with V > 270 L and ≤ 454 L | Standards Council of Canada as an energy efficiency certification body in respect of any of the following classes of products or their equivalent:<br>(a) electrical or electronic products;<br>(b) fuel-burning equipment; or<br>(c) gas-fired appliances and equipment. | By the Minister or CB |
| ANSI Z21.10.3/CSA 4.3: Gas-fired water heaters, volume III, storage water heaters with input ratings above 75,000 Btu per hour, circulating and instantaneous | MB | Manitoba Energy Code for Buildings, Man Reg 213/2013 | Gas-fired storaged water heaters | ANSI Z21.10.3/CSA 4.3 | Active | Energy standard: 80% | N/A | N/A |
| CAN/CSA-P.7 Test method for measuring energy loss of gas-fired instantaneous water heaters | MB | Manitoba Energy Code for Buildings, Man Reg 213/2013 | Gas-fired instantaneous water heaters | CAN/CSA-P.7 | Active | EF = 0.8 | N/A | N/A |

| Base Standard | Juris-diction | Regulation | Product/Appliance | Specific Edition | Status | Requirement | Certification Body to Test/Verify Requirement | Label Issuer |
|---|---|---|---|---|---|---|---|---|
| CAN/CSA P.3 Testing Method for Measuring Energy Consumption and Determining Efficiencies of Gas-Fired Storage Water Heaters | MB | Manitoba Energy Code for Buildings, Man Reg 213/2013 | Gas-fired storaged water heaters | CAN/CSA P.3 | Active | EF = 0.67 - 0.0005 V | N/A | N/A |
| ANSI Z21.10.1-2004/ CSA 4.1-2009 - Gas water heaters, volume I, storage water heaters with input ratings of 75,000 Btu per hour or less | QC | Construction Code, CQLR c B-1.1, r 2, (Building Act) | Service water heaters | Must conform to ANSI Z21.10.1-2004/CSA 4.1-2009 among other standards | Superseded | General | CSA, ULC, Intertek, UL Incorporated, Omni and others (including SCC-accredited) | By CB |
| ANSI Z21.10.3-2011/ CSA 4.3-2011: Gas-fired water heaters, volume III, storage water heaters with input ratings above 75,000 Btu per hour, circulating and instantaneous | QC | Construction Code, CQLR c B-1.1, r 2, (Building Act) | Service water heaters | Must conform to ANSI Z21.10.3-2011/CSA 4.3-2011 among other standards | Superseded | General | CSA, ULC, Intertek, UL Incorporated, Omni and others (including SCC-accredited) | By CB |
| CAN/CSA-C22.2 No. 110, Construction and Test of Electric Storage-Tank Water Heaters | QC | Construction Code, CQLR c B-1.1, r 2, (Building Act) | Service water heaters | Must conform to CAN/ CSA-C22.2 No. 110 among other standards | Superseded | General | CSA, ULC, Intertek, UL Incorporated, Omni and others (including SCC-accredited) | By CB |
| CSA C191 Series-M90 Performance of Electric Storage Tank Water Heaters | QC | Regulation respecting energy conservation in new buildings, CQLR c E-1.1, r 1, (Conservation of Energy in Buildings) | Electric water heaters | CSA C191 Series-M90 | Superseded | The stand-by loss for electric service water heater storage tanks must not exceed the values permitted in CSA C191 Series-M90, Performance of Electric Storage Tank Water Heaters and not exceed 43 W/m2 of tank surface. | N/A | N/A |
| CSA C191.1-M90 Performance of electric storage tank water heaters for domestic hot water service | QC | Regulation respecting energy conservation in new buildings, CQLR c E-1.1, r 1, (Conservation of Energy in Buildings) | Stationary electrically operated storage tank household water heaters designed to be used with pressure systems, with a capacity of approximately 50 to 450 litres | CSA C191.1-M90 | Superseded | Section 5 of CSA C191.1-M90 | N/A | N/A |
| ANSI Z21.10.1-2014/ CSA 4.1-2014 - Gas water heaters, volume I, storage water heaters with input ratings of 75,000 Btu per hour or less | QC | Regulation respecting energy conservation in new buildings, CQLR c E-1.1, r 1, (Conservation of Energy in Buildings) | Gas-Fired Automatic Storage Type Water Heaters with Inputs less than 75,000 BTU/h | CAN1-4.1-M85 | Superseded | Stand-by loss percentage: The hourly stand-by loss expressed as a percentage shall not be higher than 4.3 + 0.25/v for gas service water heater storage tanks, where v is the tank volume in m3, and the thermal efficiency shall have an efficiency level of not less than 70%. | N/A | N/A |

# Annex G

## Case Study 3 – Natural Gas: LNG Survey

### Standardization Solutions to Remove Trade Barriers in Canada Case Study: Natural Gas

Answers to the questions below will help SCC build its case study from a qualitative perspective before embarking on a deeper review.

#### TRANSPORTING NATURAL GAS

1. Are there federal standards/codes/certification/testing/inspection requirements for transporting LNG on highways? Are there provincial and/or municipal ones that differ and how so?
2. What are the costs associated with meeting the Canadian requirements identified above? Is it possible to list each requirement and the cost associated with compliance?
3. What are the main issues with LNG highway tractors and/or LNG refuelers crossing provincial borders?
4. Is there currently harmonized driver training and joint recognition of certification for self-serve refueling and if not, what sort of interprovincial barriers are caused by this?
5. Do you foresee issues involving regulatory harmonization across Canada for vehicle fuel tanks to transport LNG as cargo as new standards are being developed to address this i.e. new ANSI/CSA LNG 2 Standard on LNG Vehicle Fuel Containers which will require tanks to be designed and fabricated in accordance with one or more of the following: DOT 4L (49 CFR 178.57) or TC4LM; ASME Boiler Pressure Vessel Code; UN ECE R110, EN 1251, or ISO 21029; AS 1210.[106]

#### BUILDING LNG REFUELLING STATIONS

1. What are the standards/codes/certification/testing/inspection requirements for **building** LNG refueling stations including design approval and operating licenses? Are there federal requirements and different provincial and/or municipal ones? Are there additional requirements than those listed in CAN/CSA Z276 *Liquefied natural gas* (LNG) - *Production, storage, and handling*?
2. What are the federal and/or provincial OHS standards/codes in place for workers installing LNG refueling stations?

106 DOT 4L (49 CFR 178.57) *Specification 4L welded insulated cylinders*; TC4LM (Transport Canada Rating); American Society of Mechanical Engineers (ASME) Boiler Pressure Vessel Code; UN ECE R110 (UN Vehicle Regulations), EN 1251 (European Standards for cryogenic and related equipment), or ISO 21029 (ISO standards for Cryogenic vessels); AS 1210 (Australian Standard for Pressure Vessels)

3. What are the costs associated with meeting the Canadian requirements identified above? Is it possible to list each requirement and the cost associated with compliance of one station?
4. How do you define mobile versus permanent refueling stations and are there F/P/T/M regulatory differences when you make that distinction?
5. What are the standards/codes/certification/testing/inspection federal requirements to verify the measurement accuracy of LNG dispensers? Are there different provincial and/or municipal requirements? What role does Measurement Canada play in this process and what are the related costs?

## OPERATING AND MAINTAINING LNG REFUELLING STATIONS

1. What are the standards/codes/certification/testing/inspection federal and/or provincial municipal requirements additional to CAN/CSA Z276 for **operating and maintaining** LNG refueling stations? Do they differ?
2. What are the costs associated with meeting the Canadian requirements identified above? Is it possible to list each requirement and the cost associated with compliance?
3. How is a refueling station maintained while in use? What is tested, inspected, and when? By whom? What are the associated costs?

## REGULATORY ADVISORY BODIES AND SAFETY COUNCILS

1. Can you identify and comment on your understanding of the role and mandate of regulatory advisory bodies and safety councils as they relate to transportation of LNG and LNG refueling stations?
2. Can you comment on the potential need, or not, for more centralized, coordinated approach, to prevent unnecessary differences in the requirements between P/Ts, and if yes, what this would look like?