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Community, commercial and institutional

Bioheat installations in Canada

prepared by M. Jean Blair, PhD

Updating of the

Canadian Bioheat Database

Final Report

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Natural Resources Canada

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EXECUTIVE SUMMARY

In 2014, Natural Resources Canada initiated development of a database of existing Canadian solid fuel biomass heating installations ranging in size from 150 kW to 5 MW (referred to as the Bioheat Database or the Database). The Database was updated in 2016 and again in 2017 and 2018 with an expanded scope to include smaller projects in the range from 50 kW to 149 kW. This report compiles the findings of the 2020 survey for the Bioheat Database. Multiple updates of the Database have permitted tracking of bioheat industry growth and trends over time.

Creation of the Canadian Bioheat Database relied heavily on a review of industry and government reports, Internet searches, and interviews with equipment manufacturers. However, a significant benefit of the continued effort to keep the Database up-to-date has been acceptance by the Canadian bioheat industry of the importance of the Database. Interviews with a broad variety of bioheat industry personnel, including equipment distributors, project developers, and government regulators have been possible and have permitted the inclusion of insightful information in the Database.

As of March 2020, the Canadian Bioheat Database includes 462 bioheat projects of which 76 are new additions. Comparing the March 2020 update to previous years shows clear industry trends, including:

- Regulatory regime and government procurement policies significantly impact bioheat industry growth, with a critical mass of projects forming in jurisdictions and at scales with minimal project-specific permitting requirements and/or strong government procurement policies.
- Institutions, including schools and hospitals, continue to be the strongest market for bioheat in Canada but the commercial market is growing.
- Wood pellets and wood chips dominate feedstock demand, with preference regionally specific.
- Industry growth continues to be concentrated in provinces that have historically had the strongest bioheat industries including British Columbia, Northwest Territories, Ontario, New Brunswick and Prince Edwards Island.
- Quebec continues to show the strongest growth with 24 installations in 2018-20.
- No new projects were realized in Nova Scotia or Newfoundland and Labrador; and, there were no projects recorded in Nunavut and Saskatchewan.
- All new entries were heat only projects. 75% of all projects and more than 80% of all non-farm projects are at a scale 1 MW_{th} or less.
- European-manufactured boilers are increasingly prevalent in the Canadian bioheat market.

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1 ACKNOWLEDGEMENT

The Canadian Bioheat Database was created in 2014 by TorchLight Bioresources Inc. and updated over years. To maintain consistency, the 2018 report was used as a basis for the 2020 report.

Interviews with rural and remote communities who have developed biomass heating or combined heat and power projects were also carried out in early 2020. The interview responses and experiences of these communities with biomass heating are summarized in a separate report.

2 UPDATING APPROACH

The Canadian Bioheat Database was created in 2014 to capture information on all bioheat projects in Canada within the scale range of 150 kW to 5 MW thermal (th). The database was created and populated in 2014 as part of Natural Resource Canada – CanmetENERGY's project on the Development/Adaption of Standards for Solid Biomass Fuel and Heating Equipment in Canada. The Database was updated in 2016, 2017 and 2018. In 2017, the scope of the Database was expanded to include projects from 50 to 149 kW_{th}.

Due to presentations by Natural Resources Canada on the Canadian Bioheat Database over the past six years, industry personnel are recognizing the importance of the Database and the industry information it contains. Since this was the fourth update of the Database, sector participants, including equipment distributors, project developers, NGOs, and government regulators, have become familiar with the processes and are generally happy to provide information on installations as well as feedstock practices and their experiences in the bioheat industry. While creation of the database relied heavily on industry and government reports and internet searches, the Database updates have largely involved requests for documentation and phone calls to sector participants. In general, there is less information about recent projects in online news articles and on company websites than there was for earlier projects. Perhaps this signifies that biomass heating is becoming more mainstream; not every new project warrants a press release.

Sector participants were emailed and given the option to set up a phone call or to provide information on new installations via email. Phone conversations were very useful for gaining insight on feedstock practices, challenges faced and other less quantifiable industry trends but most of the data was ultimately provided over email. Participants were sent an Excel file containing key fields (facility and ownership information, boiler and feedstock details, fuel replaced) for the projects already in the database. Participants would then check the existing information over, add any new projects and return the file. This was found to be an efficient and effective way to validate existing Database entries and obtain new information. Data gaps continue to exist – particularly for older projects – but the continued concentration of the industry in terms of manufacturers and distributors of boiler equipment, and continued engagement with these companies, has resulted in a comprehensive profile of most of the newer projects. More than 500 person-hours have now been allocated to creating, populating, expanding, and validating the database. This summary report describes the key bioheat sector trends identified via the 2020 database update.

3 SUMMARY OF NEW ADDITIONS

As of March 2020, the Canadian Bioheat Database includes 462 bioheat projects compared to 401 projects in 2018. A total of 76 new projects were added to the database and 15 were removed as a result of the validation process, as detailed in the following section. The new additions are summarized in Table 1 below. All new additions are heat only installations and some of the combined heat and power (CHP) projects under development in the last update were not realized, demonstrating that confidence in CHP technologies has not yet been established in Canada. Based on conversations with developers with direct experience developing community-based CHP and other renewable energy technologies, the process of establishing electricity purchase agreements with provincial utilities can be very challenging.

Nearly half (46%) of the new additions are in Quebec, of these fourteen (14) are on farms or in greenhouses and nine (9) are in commercial facilities, with only seven (7) in public buildings or institutions. This trend toward more installations in the private sector in eastern Canada (primarily Que. and N.B.), was recognized in the 2018 update and further supported with the 2020 additions. Most of the new projects added in Quebec (19 out of 35) were installed since 2018 but there were also several added that were installed in 2017 or earlier. Part of the reason for this is that the additions from Transitions Énergétique Quebec (TEQ) for the 2018 update were not received in time to be included for that year. Additionally, there were two developers of bioheat projects identified through conversations and online searches that had not previously been identified and had developed several private sector projects prior to 2017. Quebec has by far the largest and most bioheat market and there are likely more projects yet to be identified, particularly in the private sector.

Other provinces with significant development over the last two years include B.C., Ont., N.B. and P.E.I. with seven to nine new projects each. Except for Ontario, strong bioheat development has been documented in these provinces in past updates as well. Ontario experienced strong growth in public and institutional installations, which has not been seen in the past. All of Ontario's public and institutional installations were developed by Biothermic, an Ontario-based company who distributes and installs Fröling biomass boilers. Two new public sector installations were realized in N.W.T. and Man. and three in Y.T., all of which are connected to district heating loops in Teslin. Of the fifty eight (58) non-farm installations, seventeen (17) were in indigenous communities, including all of those in Ont. and Y.T. Similar to existing installations, wood chips and pellets are the primary fuel for new projects, in approximately equal proportions. A few new additions use cord wood, most of which are on farms in Que. There is one

new project, in a remote community in Que., that uses black, or torrefied wood pellets, a new biomass fuel source in Canada.

Table 1: Summary of new additions to database; projects by jurisdictions, sector and biofuel type. *(There are no new entries for Newfoundland, Nova Scotia, Saskatchewan or Nunavut)*

		AB	BC	MB	NB	NT	ON	PE	QC	YT	Total
Sector	Public Building or Institution	1	4	1	2	1	6	6	7	-	**28**
	Community District Energy	-	1	1	-	1	-	-	1	3	**7**
	Commercial Building	1	1	-	4	-	-	-	9	-	**15**
	Industrial	-	1	-	1	-	1	-	4	-	**7**
	Farm or Greenhouse	-	1	1	-	-	2	1	14	-	**19**
Fuel Types	Wood Pellets	1	2	1	5	1	5	-	17	-	**32**
	Wood Chips	-	5	2	2	1	4	7	11	3	**35**
	Logs, Briquettes, Hog Fuel	1	1	-	-	-	-	-	6	-	**8**
	Black Wood Pellets	-	-	-	-	-	-	-	1	-	**1**
Total by Jurisdiction		**2**	**8**	**3**	**7**	**2**	**9**	**7**	**35**	**3**	**76**

4 SUMMARY OF PROJECTS REMOVED

A total of 15 projects were removed from the Database between 2018 and 2020. Of these, four were entered into the Database while in the planning stage and were not realized; one was a duplicate entry; four were in businesses that have closed or were sold; one (a CHP) was removed due to ongoing technical difficulties; one was replaced with new biomass boilers; and five were older (pre-2012) installations in greenhouses in BC that are no longer being used.

Five of the entries removed were CHP projects. The small-scale CHP projects that had been planned for the University of Manitoba and Yukon College were both shelved after the 2018 Database update and it does not appear that either will be developed in the near future. Another planned CHP project at a value-added wood product facility in Ontario instead moved forward as a heat-only project. Spruce Forest Products in Manitoba has operated a large (>5 MW) biomass heat-only boilers for years and in 2012 installed a CHP unit built by General Electric (GE). This unit was operated for several years but without much success, ultimately the unit was removed as solutions could not be found for the ongoing technical issues experienced (according to Manitoba Hydro Representative). Finally, there was small CHP unit that had been installed as a pilot project at the Pineland Forest Nursery in MB in 2012 but the nursery has since been closed and it is not clear what happened to the CHP unit.

5 BIOHEAT FACILITY TRENDS

5.1 Number and Location

With continued bioheat sector growth, Québec is the province with far and away the most number of projects installed – more than 30% of the total. Twenty-four new projects were installed in Québec between 2018 and 2020, most of which received provincial government funding through the Transition Énergétique Québec – Residual Forest Biomass program. The Northwest Territories (70 projects) still has the second most projects, just ahead of British Columbia (64 projects), though growth in the territory has slowed considerably with only six (6) projects developed since 2018. The growth of bioheat in BC, on the other hand, continues to be steady with 11 projects developed over the last two years, however, several earlier installations in BC have been removed from the database, as described previously.

Growth in New Brunswick has also remained strong with ten (10) new installations in the last two years for a total of 48. Prince Edward Island has also experienced a surge in projects over the last year due to a push by the provincial government to convert more public institutions to biomass heat, bringing the total number of installations in the province to 35, just behind Ontario (41 projects), which also experienced strong growth over the last year. For the first time in 2020, more than half the projects in Ontario are non-farm. The one bioheat installation that existed in Saskatchewan is no longer operating as the facility it was in closed down; Nunavut still does not have any installations. There are six (6) biomass CHP projects in the database, each using different technology and none of which were installed since 2018. Figure 1 shows the distribution of bioheat projects by province and Figure 2 shows the distribution of projects by economic region. Only 16 out of 76 the economic regions across Canada do not have any projects.

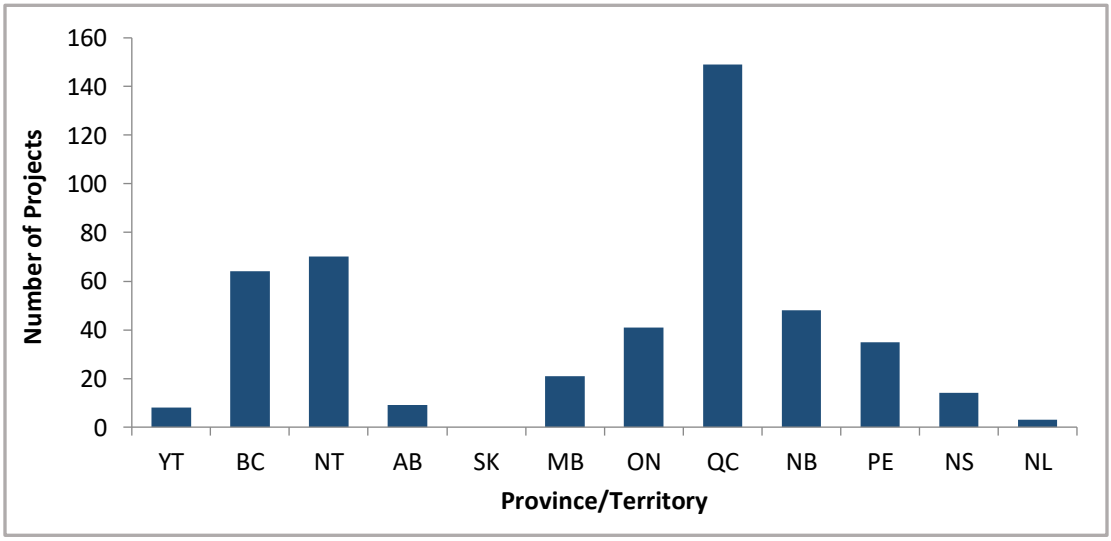

Figure 1: Canadian bioheat projects by province/territory

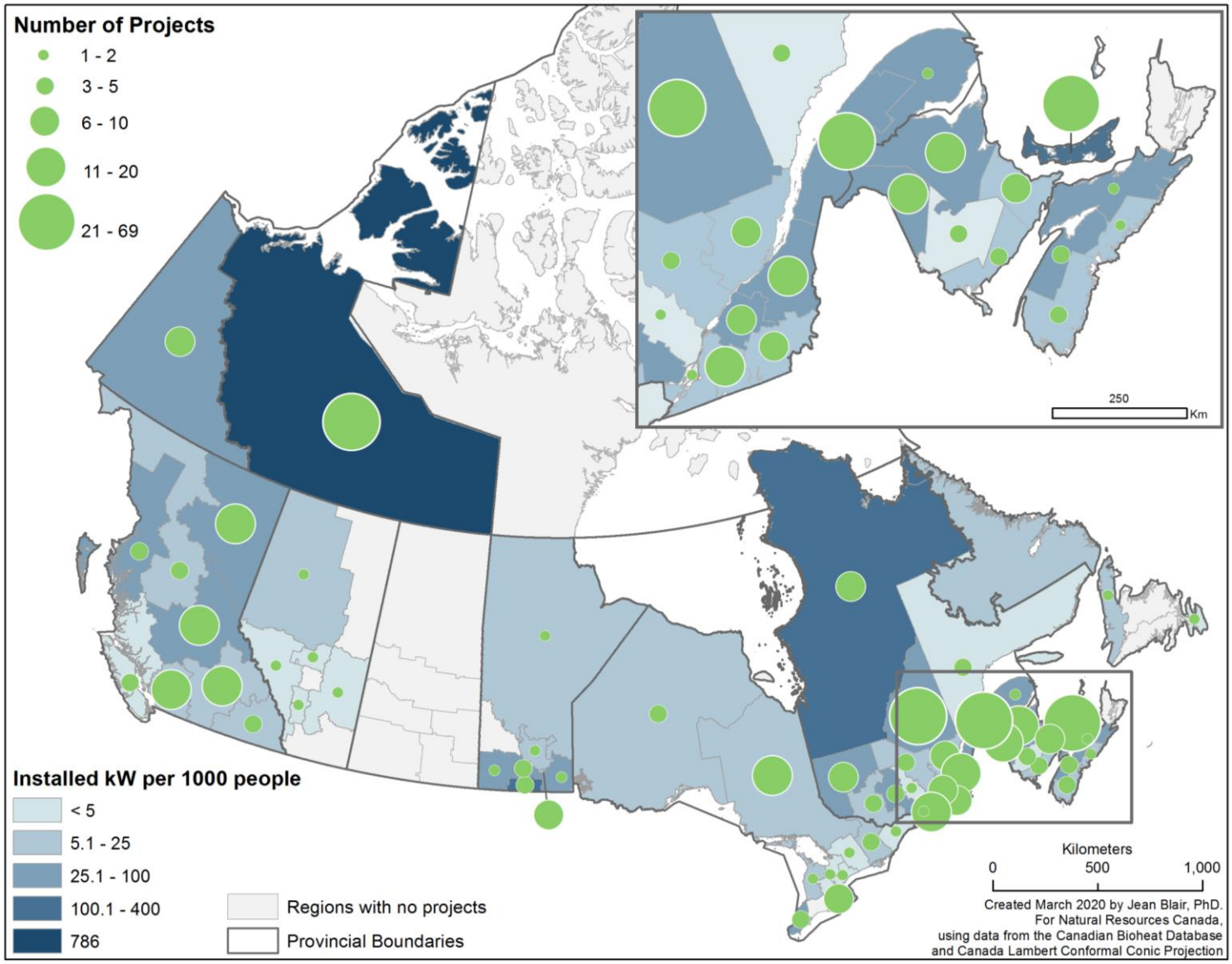

Figure 2: Number of bioheat projects by economic region in Canada, with regions shaded to show total installed capacity per 1000 people within each region

5.2 Scale

In general, the number of projects increases as scale is decreased as is clearly shown in Figure 3. Over 75% of the projects in the database are categorized as "Very Small" or "Small" (1 MW_{th} or less), an increase of about 5% since the 2018 update as nearly 90% of all new additions were < 1 MW_{th}. Market demand, diversity of boiler options at a small scale, and streamlined permitting make the smaller projects increasingly more common. The smallest projects are most likely to be in commercial buildings while projects between 150 kW and 1 MW are primarily found in public sector installations while medium and large scale projects are predominantly industrial or agricultural installations. This trend is shown in Figure 4. The locations of larger projects tend to coincide with regions that have strong forestry (B.C., Que.) or agriculture (southwest B.C., Man., southern Ont.) sectors, as can be seen in the maps that follow. Feedstock can also play an important role, with larger projects more likely to utilize wood chips and smaller projects to utilize wood pellets. More than 85% of "large" bioheat projects are either greenhouses or small industrial facilities linked to the forest products sector. These larger installations are more likely to use custom boilers designed for their facility and lower quality fuel such as sawdust, bark, hogfuel and crop residues compared to smaller systems which tend to use off-the-shelf or pre-fabricated boilers and burn wood pellets or clean, dry wood chips.

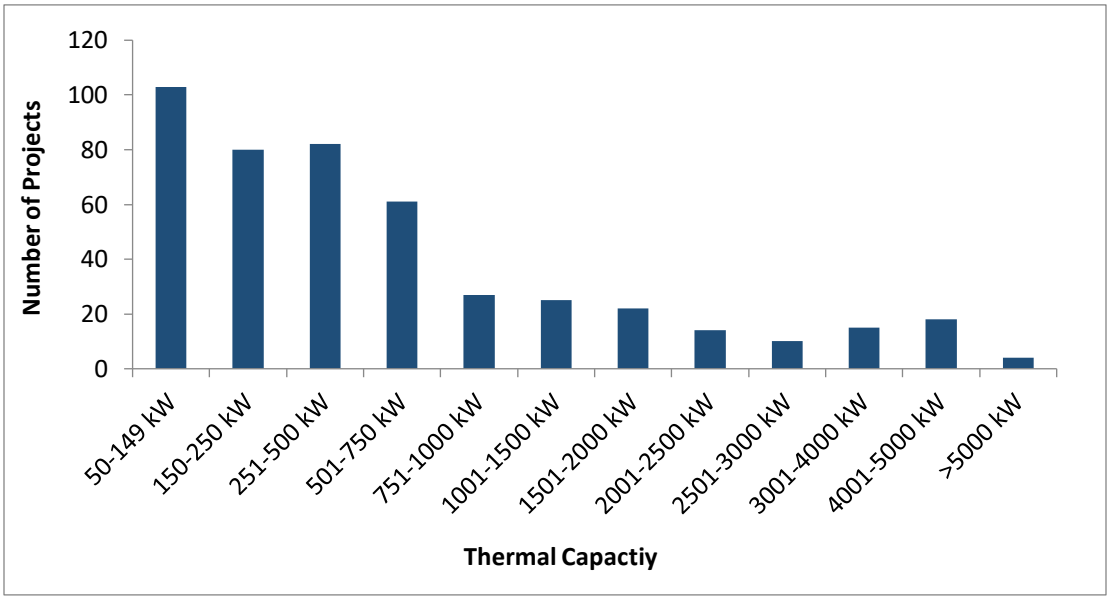

Figure 3: Canadian bioheat projects by capacity

5.3 Sector

The distribution of Canadian bioheat projects by sector, within each size category, is presented in Figure 4, with locations identified in Figures 6a through 6d. Public institutions (e.g. schools, hospitals, community halls, recreation centres, etc.) are by far the strongest market for bioheat project developers in Canada, with 174 installations (up from 151 in 2018 update). There are another 64 biomass systems fuelling district energy systems, which heat more than one building through an underground pipe network. Most of the district energy systems in the database include at least one public building and are most often community-led projects. Much of the growth in the public sector has been due to government procurement policies – whether purchase of biomass boilers outright or offering long-term heat purchase agreements to biomass boiler owner/operators. There has also been several community-based biomass projects developed in remote, rural and indigenous communities recently, which are supported by capital funding from various federal and provincial programs. Several public sector installations in Wikwemikong, Ontario, were supported through the Wood Heat Pilot Program, introduced by the previous provincial government.

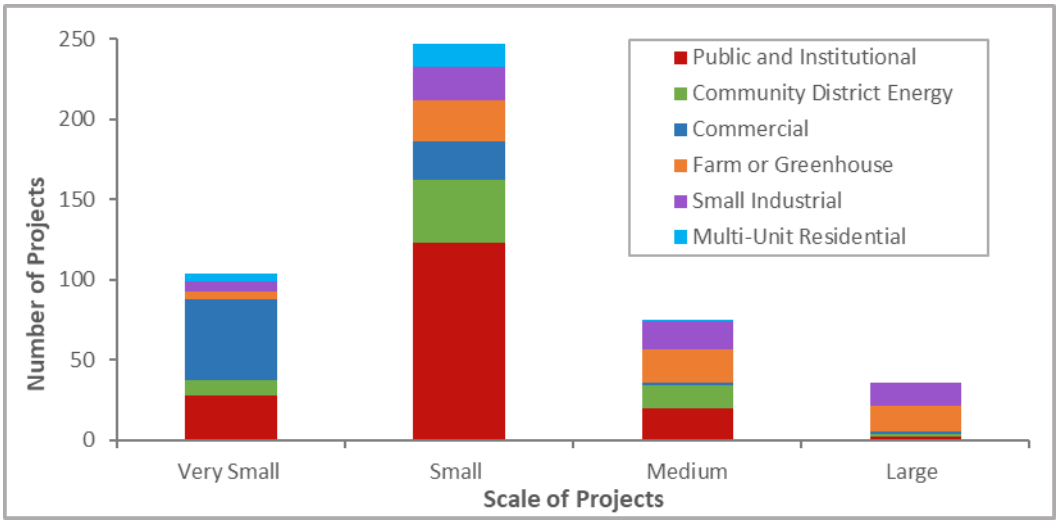

Figure 4: Canadian bioheat projects by sector and size category

In Quebec and New Brunswick, there continues to be a growing demand for bioheat in the private sector (including commercial buildings, small industrial and farms), particularly in areas without access to natural gas. This trend was recognized in the 2018 update and has continued over the last two years with more than two thirds of projects developed since 2015 in the private sector compared to approximately 50% previously. The majority of installations in the commercial sector are fuelled by wood pellets and are smaller than 150 kW in capacity. The presence of a reliable feedstock supplier that offers bulk delivery

(e.g. BSB in N.B., Biothermic in Ont.) appears to also play a role in the growth of biomass heat in the commercial sector. Growth in western Canada on the other hand, continues to be concentrated in the public sector with more than 75% of bioheat systems installed in western Canada (B.C., Alta., Man., N.W.T. and Y.T.) in public buildings and institutions, including 13 heating community district networks. Ten of the 13 community district energy projects were developed in remote, indigenous communities, several of which are detailed in the report on community interviews that accompanies the 2020 Database update.

5.4 Installation Date

As shown in Figure 5, bioheat demand has grown steadily in Canada since 2008. The period of greatest growth so far was between 2012 and 2016 during which time there was an average of 46 new projects developed annually. While growth has slowed somewhat since then, there was still an average of about 30 new projects per year in 2017, 2018 and 2019, and already ten new projects three months into 2020. The slowdown in development is likely due to several factors but could include changes in provincial procurement and funding programs. Provinces that have introduced, or reintroduced, public procurement or funding programs (Q, PE, ON) in recent years have experienced strong growth. It is also reasonable to believe that many of the projects considered 'low-hanging fruit' (i.e. in large public buildings that do not have natural gas service), at least in the provinces that lead development, have already been realized.

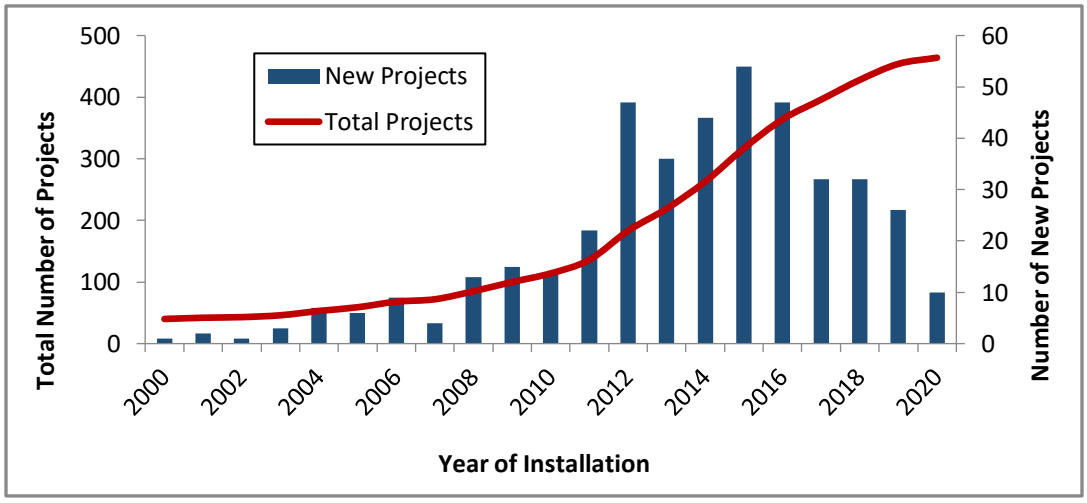

Figure 5: Canadian bioheat projects since 2000 by installation date

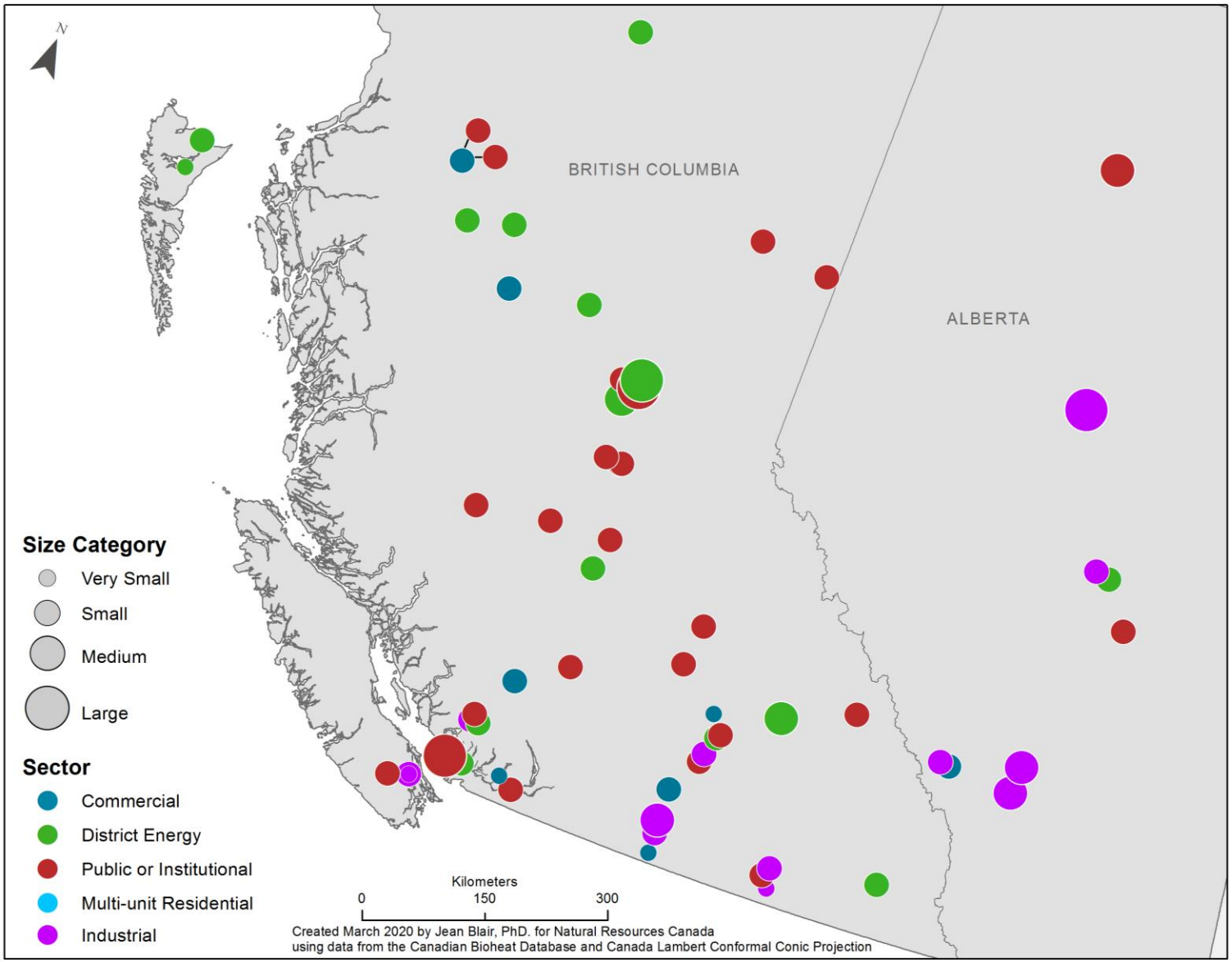

Figure 6a: Location of bioheat projects in British Columbia and Alberta, by sector and size
(Excludes farms and greenhouses)

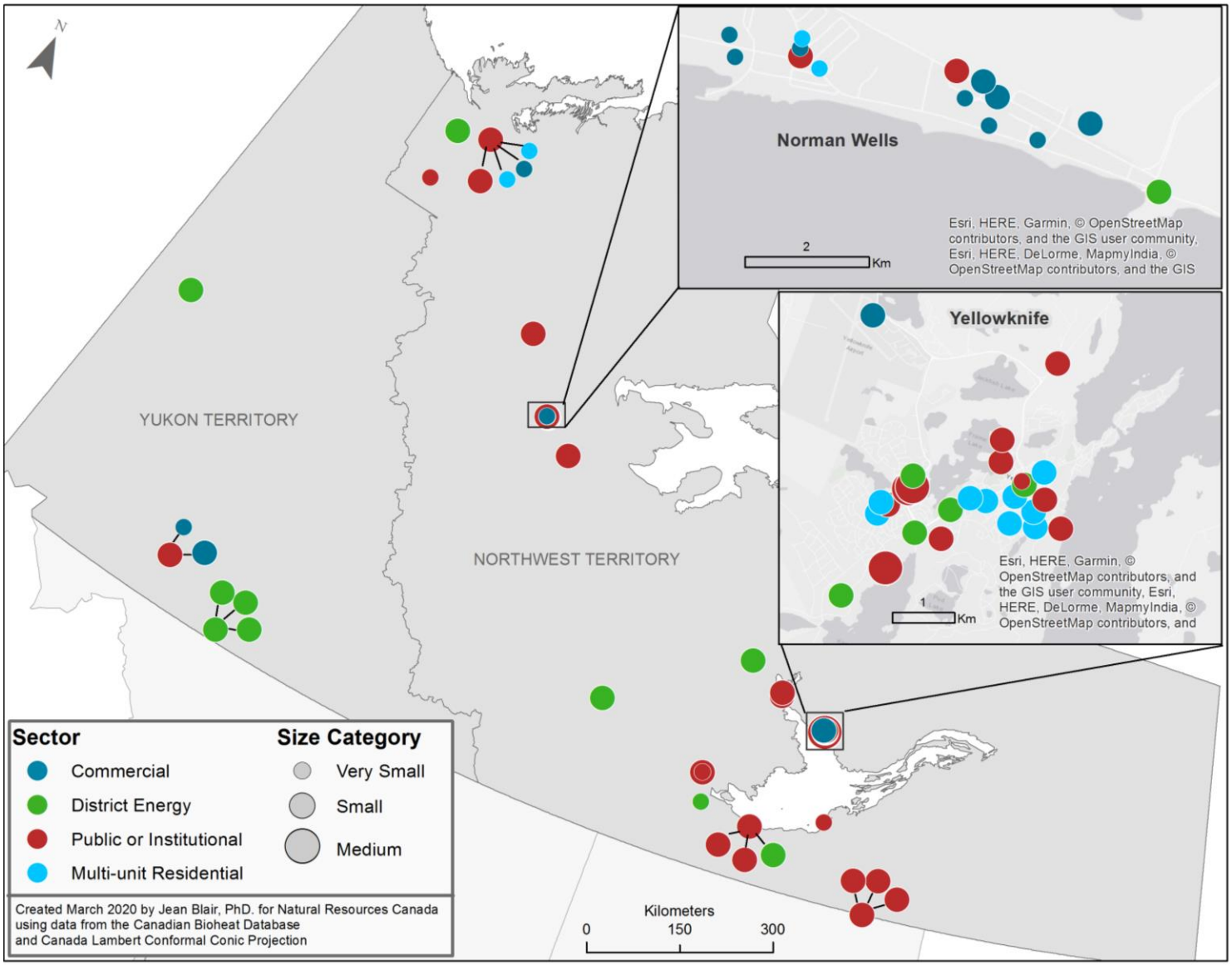

Figure 6b: Location of bioheat projects in Yukon and Northwest Territory, by sector and size
(Excludes farms and greenhouses)

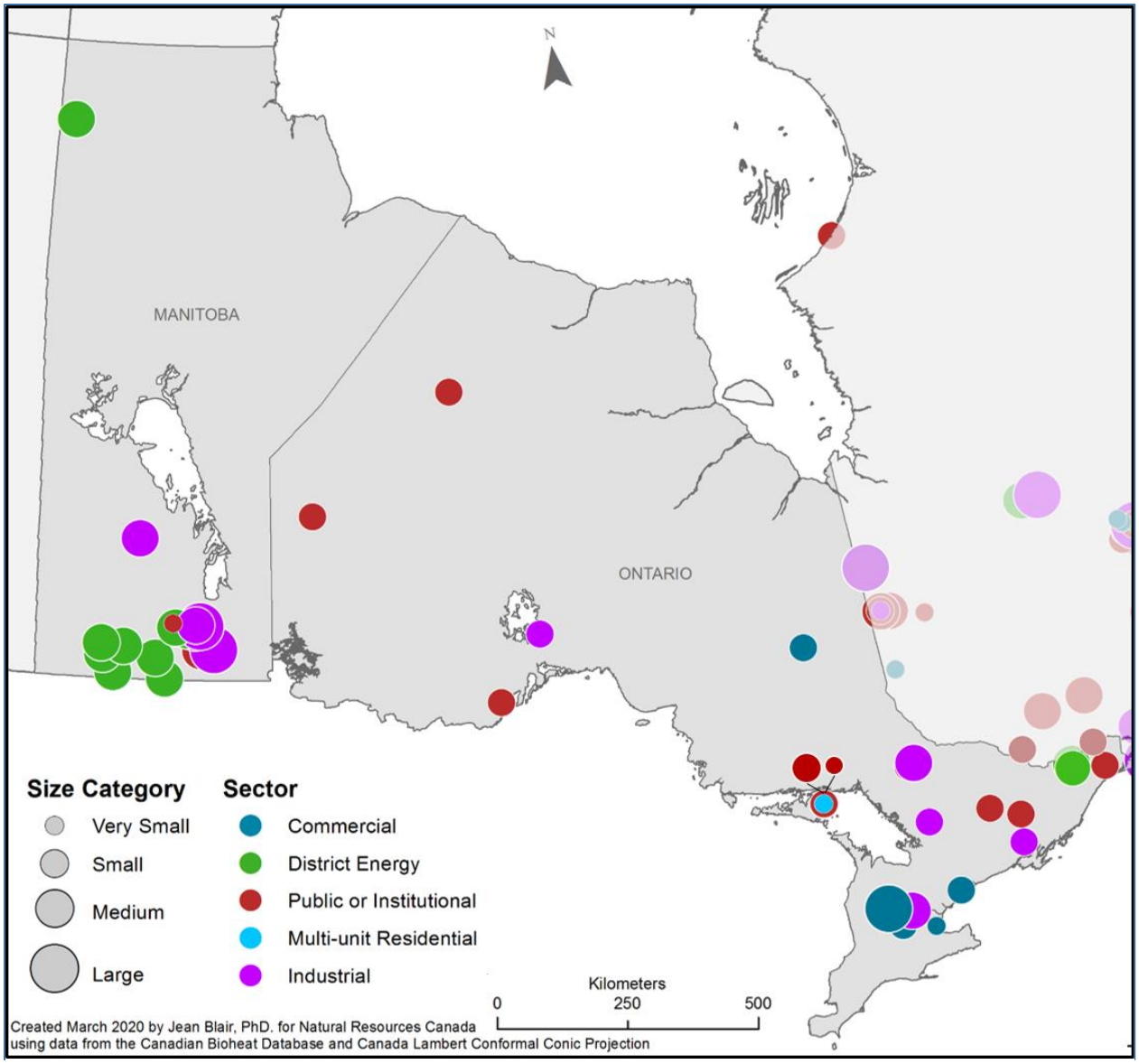

Figure 6c: Location of bioheat projects in Manitoba and Ontario, by sector and size
(Excludes farms and greenhouses)

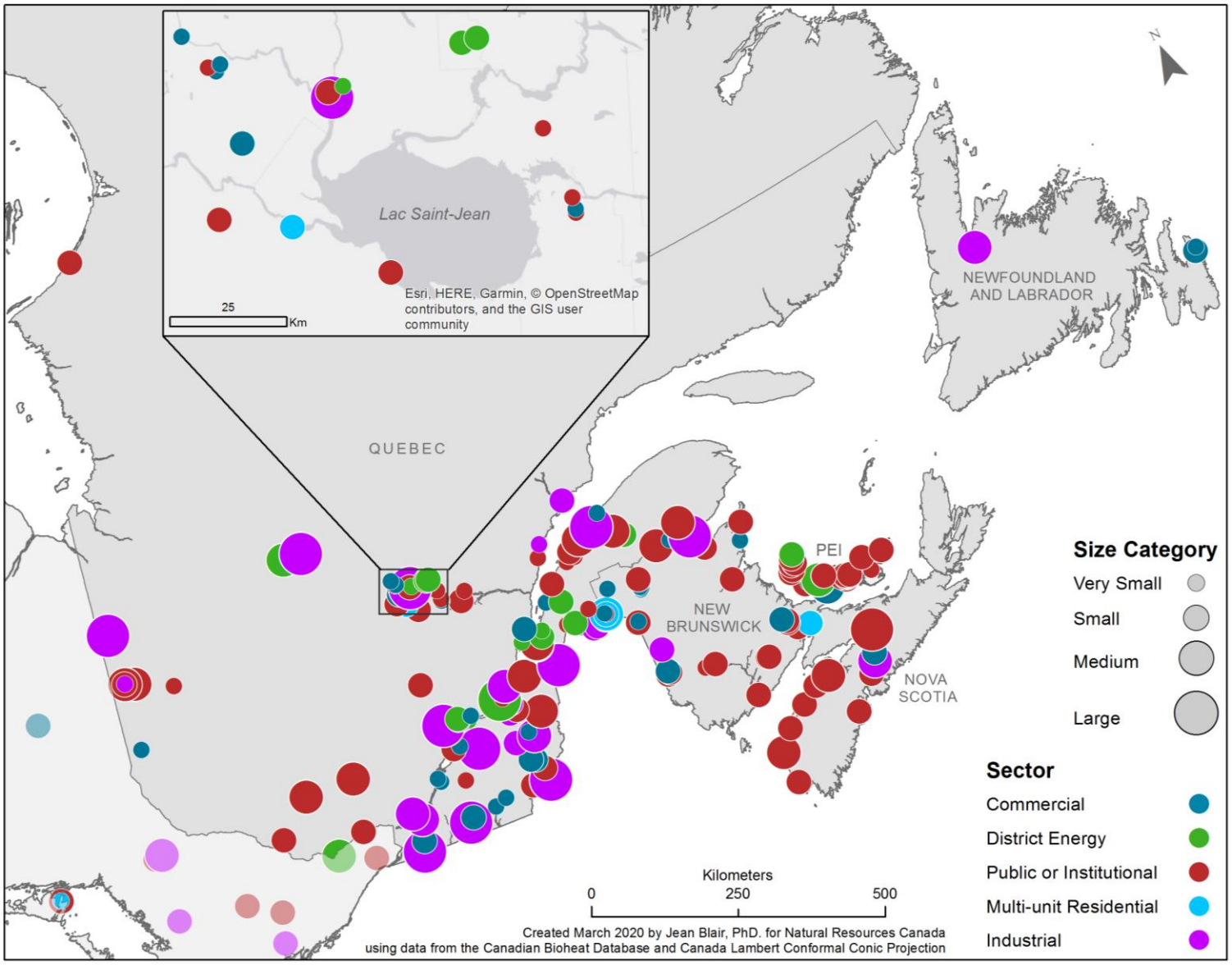

Figure 6d: Location of bioheat projects eastern Canada, by sector and size

(Excludes farms and greenhouses)

5.5 Developers and Manufacturers

The Canadian bioheat market is still in its infancy compared to European markets. As such, the number of developers and installers is currently limited. A handful of companies are capturing most of the bioheat industry growth, as they have been able to show success, resulting in customer confidence and more projects. In general, most project developers are focused on a single region. There are a few exceptions to this rule, but they are typically manufacturers (e.g., Blue Flame Stoker) or national distributors of European boilers (e.g., Fink Machine, Hargassner Canada, Biothermic) seeking to sell boilers to inexperienced owner/operators (e.g., municipalities, schools) who require assistance with installation and start-up. Most bioheat project developers/installers install only a single brand of boilers, although, again, there are exceptions (e.g. Biomass Solutions Biomasse). While some project developers partner with engineering firms/HVAC/plumbers for project design, others have in-house teams with specialized expertise on a single boiler brand. A list of the most active bioheat project development/installation companies, their geographic focus, and associated boiler manufacturers is provided in Table 2 with locations of the projects by developer shown in Figure 8b.

Table 2: Canadian bioheat project developers and installers with five or more installations since 2015. Location of projects in Figure 8b.

Province	Developer/Installer	Manufacturer
British Columbia	Fink Machine *(also serves NT)*	Viessmann
	Evergreen Bioheat	Fröling
Northwest Territories	Arctic Green Energy *(Closed)*	ÖkoFEN, Viessmann
	Energy North	ÖkoFEN
Yukon	ACS Mechanical (NEW)	Hargassner
Ontario	Biothermic *(also serves NB)*	Fröling
Quebec	Hargassner Canada (BCA Energie)	Hargassner
New Brunswick	Biomass Solutions Biomasse (BSB)	ÖkoFEN, Mabre, HERZ, E-Compact
	Thomas Industrial Sales *(also serves NS)*	Viessmann
Prince Edward Island	Atlantic Bio-Heat *(purchased ACFOR Energy-owned systems in 2019)*	Viessmann
	Wood4heating Canada	HERZ (purchased Binder)

Since the inception of the Canadian Bioheat Database in 2014, Viessmann has been the manufacturer with the largest share of the Canadian non-residential bioheat market. This has not changed in 2020 and Viessmann now has more than 120 installations in the 50 kW – 5 MW size range across Canada. The other high volume Austrian manufacturers – HERZ/Binder, Fröling, Hargassner, and ÖkoFEN – are also well represented and have continued to increase their market share over the last several years. It is worth noting that the Canadian and U.S. manufacturers, who previously had a substantial share of the market, have fallen dramatically behind the Austrian-manufactured biomass boilers (which includes Viessmann). It is clear in Figure 7 that the vast majority of installations since 2015 have used Austrian-manufactured boilers.

The market for non-industrial biomass boilers in Austria is much more mature than the Canadian market and Austrian companies offer "off-the-shelf" units designed specifically for the commercial and institutional sectors. Most Canadian-made boilers on the other hand, are scaled-down industrial units that are customized on a project-by-project basis. Many Austrian companies have recognized the growing market opportunity in Canada and have aggressively marketed their boilers across the country. As a result, some Canadian manufacturers have not installed any new boilers in several years or have ceased operation completely. Some provinces have adopted European standards for biomass boilers (e.g. P.E.I., N.W.T.), which means that as long as a boiler has been certified in Europe, no additional testing is required. In Ontario, where emissions regulations recognize European standards, it is difficult for Canadian manufactures to compete, as the additional testing and permitting required to comply with regulations is costly and time consuming.

Biomass boiler installations in Quebec represent by far the greatest number of different manufacturers. Prior to 2015, many of the systems installed in Quebec were manufactured in Canada, mostly in Quebec. In newer installations, while there are still a large number of manufacturers represented, there is a shift toward more European-manufactured boilers, particularly at smaller scales. Though it is not entirely clear why there so many more manufacturers are represented in Quebec compared to other provinces, it may have to do with cost, language (most domestic boilers installed are manufactured by Quebec companies) or provincial emissions requirements. Emissions regulations in Quebec do not rely on European standards but instead require on-site testing for all systems between 150 kW and 3 MW when the equipment is installed (and every five years thereafter), giving domestic equipment a more level playing field.

Figure 8a shows the distribution of boiler manufacturers across Canada for systems installed after 2015 highlighting the increasing concentration of the market share amongst a small number of European boiler

manufacturers. Figure 8b shows the distribution of developers that have been involved with five or more bioheat projects since 2015 (all of whom are also boiler suppliers), demonstrating that there are relatively few Canadian companies focused on development of bioheat projects and they tend to concentrate geographically.

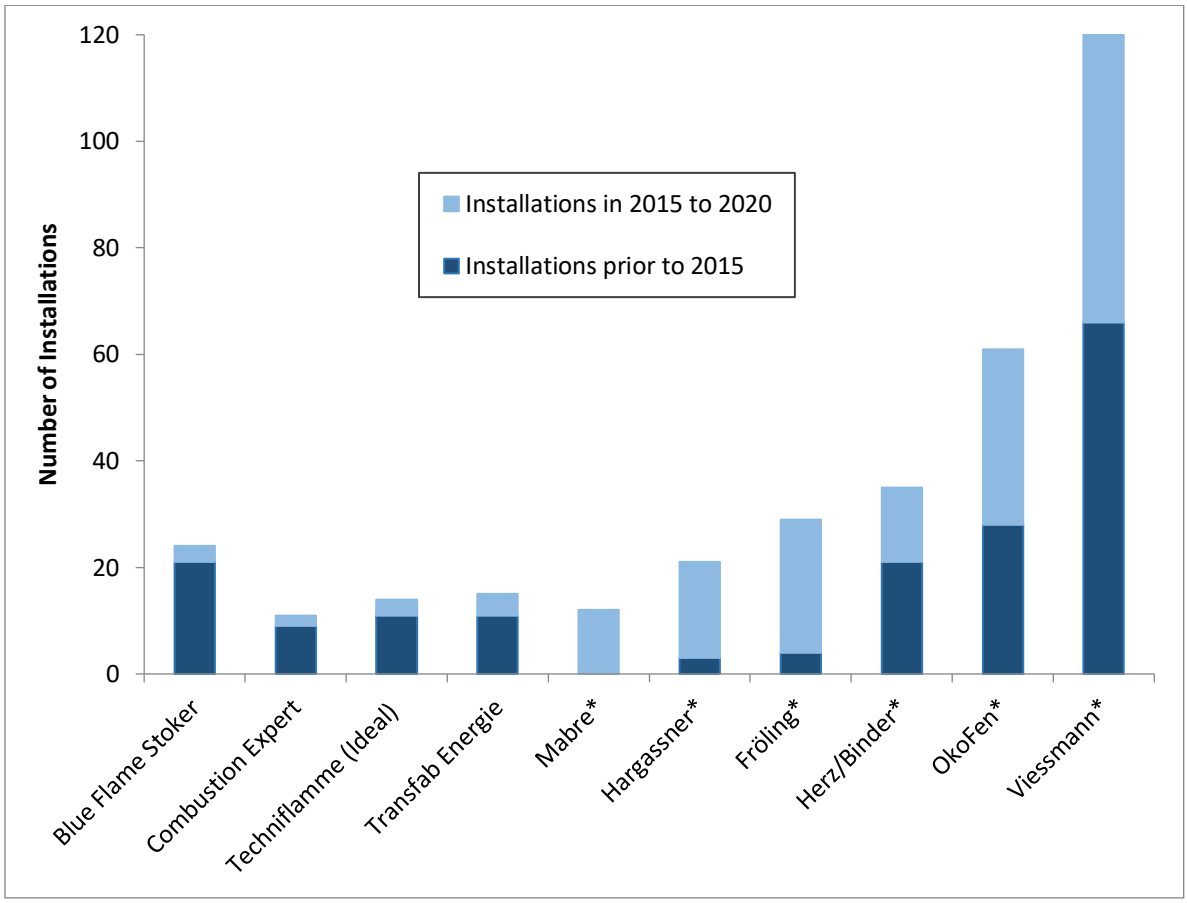

Figure 7: Canadian bioheat projects by manufacturer (with >10 installations)

**Indicates European-manufactured boiler. HERZ/Binder, Fröling, Hargassner, OkoFen and Viessmann are manufactured in Austria, Mabre in Italy*

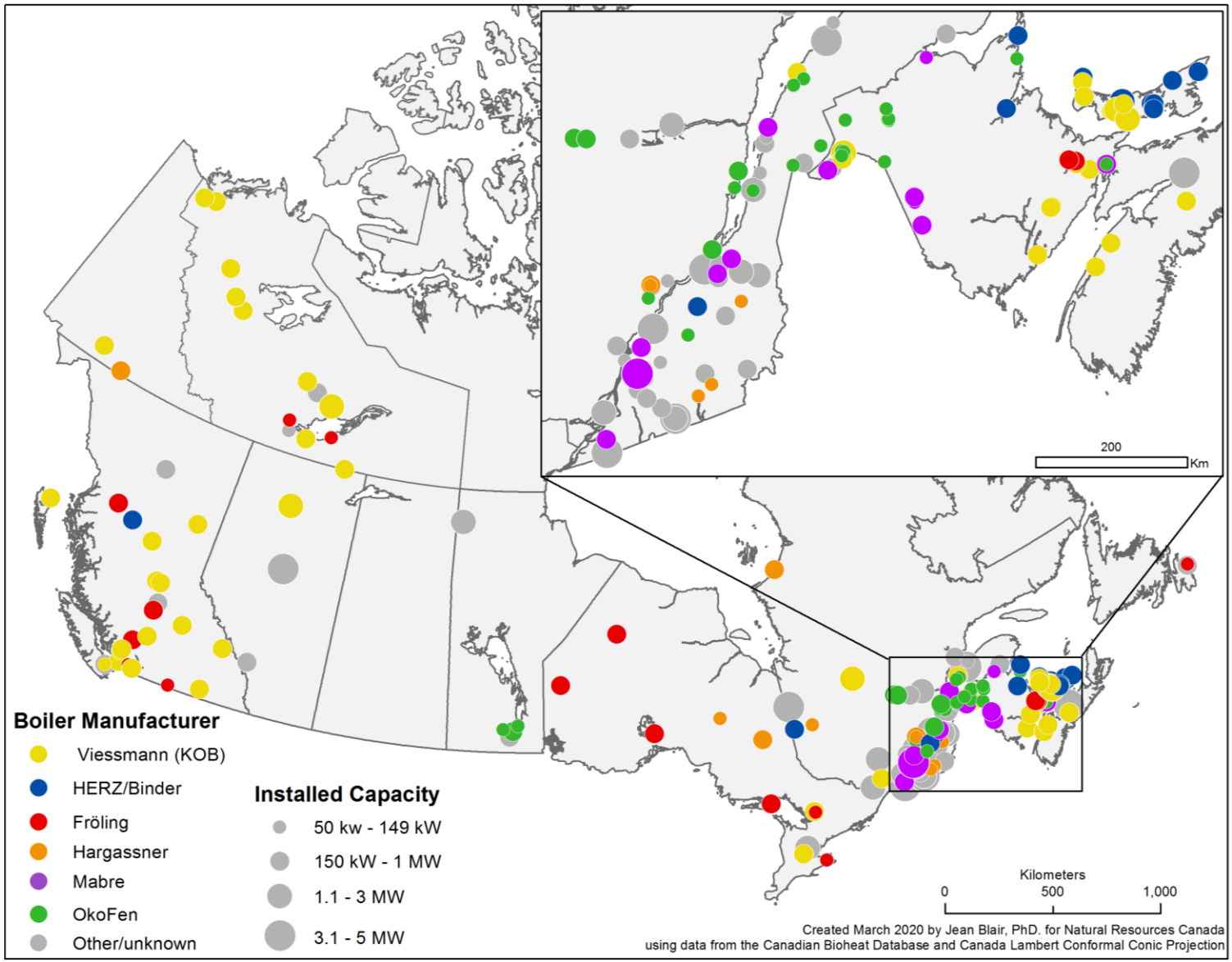

Figure 8a: Location of Canadian bioheat projects installed since 2015, by manufacturer and size

(Only manufacturers with at least ten (10) installations are shown; all are European)

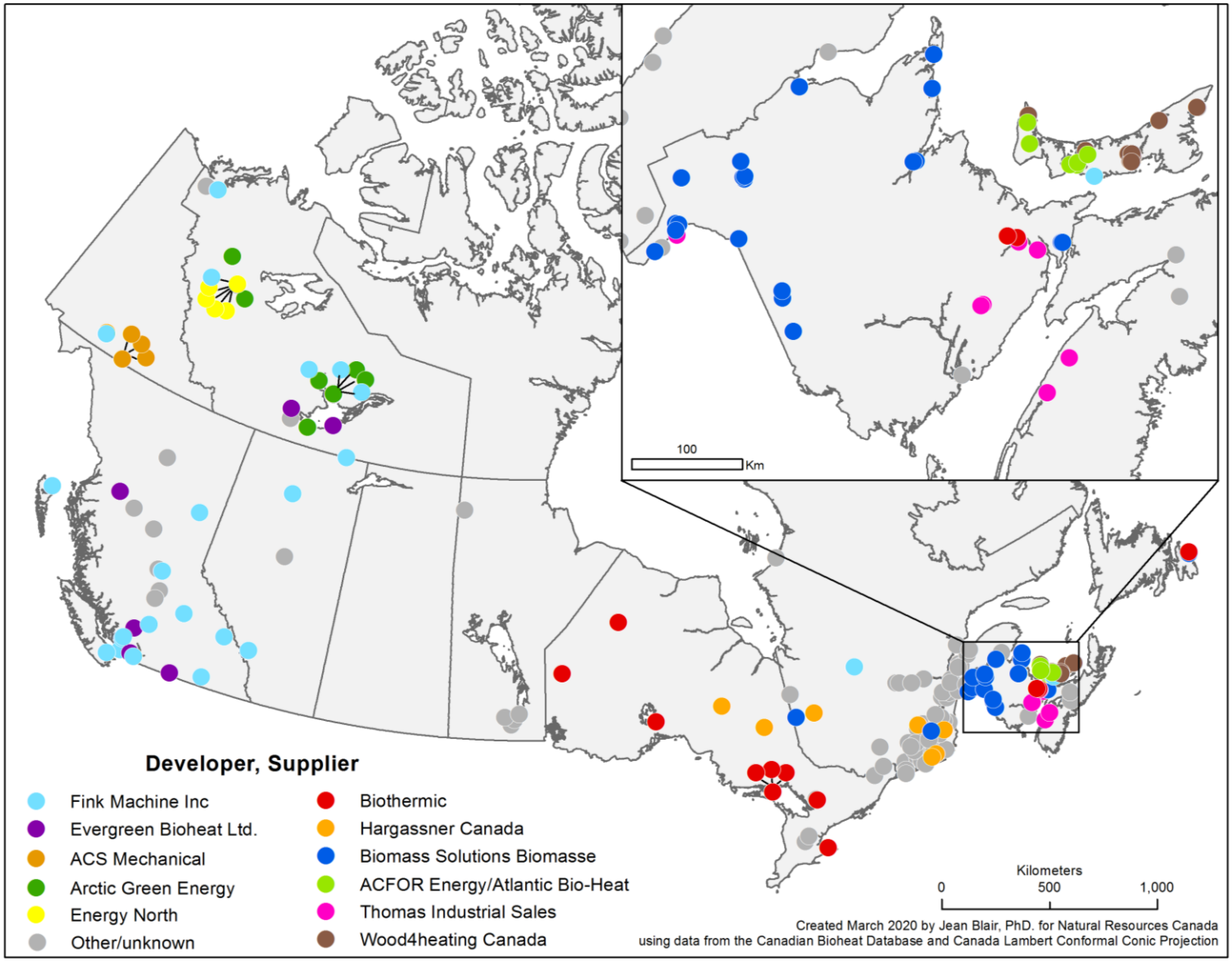

Figure 8b: Location of Canadian bioheat projects installed since 2015, by developer/boiler supplier

(Only developers with at least five (5) installations are shown)

5.6 Feedstock

High-quality fuels continue to dominate feedstock selection for small-scale bioheat installations and are increasing in prevalence relative to lower quality fuels. All but three projects installed since 2018, and more than 90% of all projects, use either wood pellets or clean wood chips, as shown in Figure 9. A breakdown and description of feedstock type and source is provided in Table 3. Choice of fuel is highly scale and geographic-specific, with larger projects most often using wood chips or other mill residues and smaller projects using chips or pellets depending on their location. All projects in Prince Edward Island use wood chips, as do many in Quebec and British Columbia, while almost all in New Brunswick, Ontario and Northwest Territory rely upon pellets. Most of the biomass systems fuelled with crop residues are in Hutterite colonies in Manitoba that use crop residues, while systems that utilize urban wood waste are generally located close to urban centers. Two systems installed in 2019 use black, or torrefied, wood pellets produced at Airex Energy in Quebec. This is a new fuel for biomass heating projects in Canada and could be well-suited to projects in remote communities that may need to store fuel for up to a year.

Within the wood chip category, geographic variation is seen in respect to the source of the wood chips, as shown in Figure 10. Projects in British Columbia generally source wood chips from sawmills or other wood products manufacturers, while many in Québec and Prince Edward Island utilize chipped harvest residues and other thinnings or small diameter logs from forest management operations.

Due to the remote location and the lack of an industrial forest sector, projects in the Northwest Territories utilize imported wood pellets (from Alberta and British Columbia) almost exclusively and several regional bulk pellet delivery companies have now been established. The community of Wikwemikong in Ontario has also purchased a bulk pellet delivery truck and will be installing bulk storage silos this year to supply the growing number of projects in the community. Having access to local bulk delivery appears to drive growth of smaller-scale projects (including residential) that would not otherwise be feasible.

Developer preference also impacts biomass fuel selection, as several developers are also feedstock suppliers. For example, Biomass Solutions Biomasse in New Brunswick, Biothermic in Ontario operate bulk pellet delivery trucks and thus install biomass systems that use wood pellets as fuel. Projects developed by CFG Énergie and other forest cooperatives in Quebec use chipped wood produced as a by-product of their own forest operations. Similarly, all of ACFOR's installations in Prince Edward Island (which were transferred to Atlantic Bio-heat in 2019) use wood chips from their own forest management operations in New Brunswick. Figure 11 shows the relationship between scale, location and feedstock.

Table 3: Breakdown and description of biomass fuel source and type

Feedstock Type	Feedstock Source	Description
Wood Pellets	Pellet Producer	Produced in pellet plant, sourced directly from producer or delivered by third party, ~10% moisture. Not necessarily local.
	Secondary Manufacturer	Produced at small scale from wood processing residues, used locally or on-site.
Wood Chips	Sawmill	White wood from sawmill, quality varies. Usually sourced locally or used in boiler on-site.
	Secondary Manufacturer	White wood from forest products manufacturer that is not a sawmill (e.g. furniture or cabinet manufacturer). Often used in boiler on-site.
	Forest Operations	White wood from forest management operations (e.g. thinning) or harvest residues. Generally supplied by forest co-ops or private forest operator, chipped with specialized equipment to control particle size, usually 30-40% moisture.
	Urban Wood Waste	White wood from construction and demolition waste or used pallets and crates. Metal removed before chipping. Quality varies.
Other mill residues	Sawmill	Sawdust and shavings (smaller particle size than chips) or hogfuel (contains bark) from sawmill. Lower quality than wood chips, often used on-site in large industrial boilers. Sawdust and shavings are separated from hogfuel in the database.
	Secondary Manufacturer	Sawdust and shavings from non-sawmill forest products manufacturer, usually used on-site.
Briquettes	Sawmill or secondary manufacturer	Briquettes pressed at wood product facility from wood residues and supplied to local boiler.
Whole logs	Forest operations	Cord wood used in small-scale boilers.
Crop residue	Farm	Residues collected from farm crops, e.g. oat hulls, flax shives, wheat straw. Used in boilers on farms or in Hutterite Colonies.
Black wood pellets	Pellet Producer	Wood pellets that are thermally treated in a torrefaction process to increase energy density and hydrophobicity, so far produced only by Airex in its plant in Trois-Riviere, Quebec.

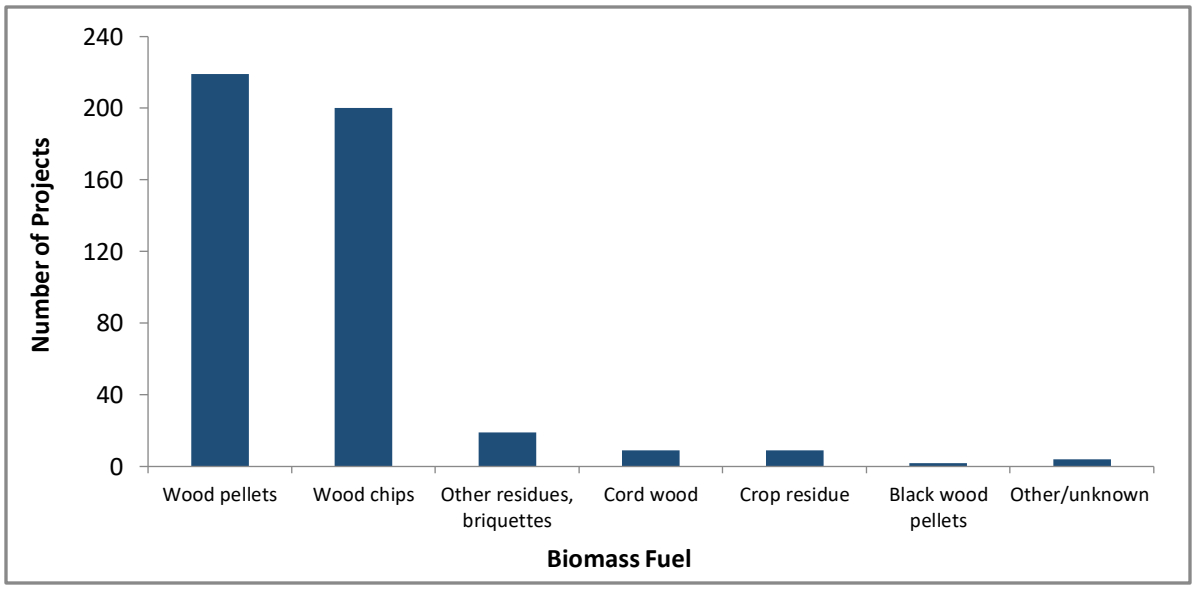

Figure 9: Canadian bioheat projects by fuel type

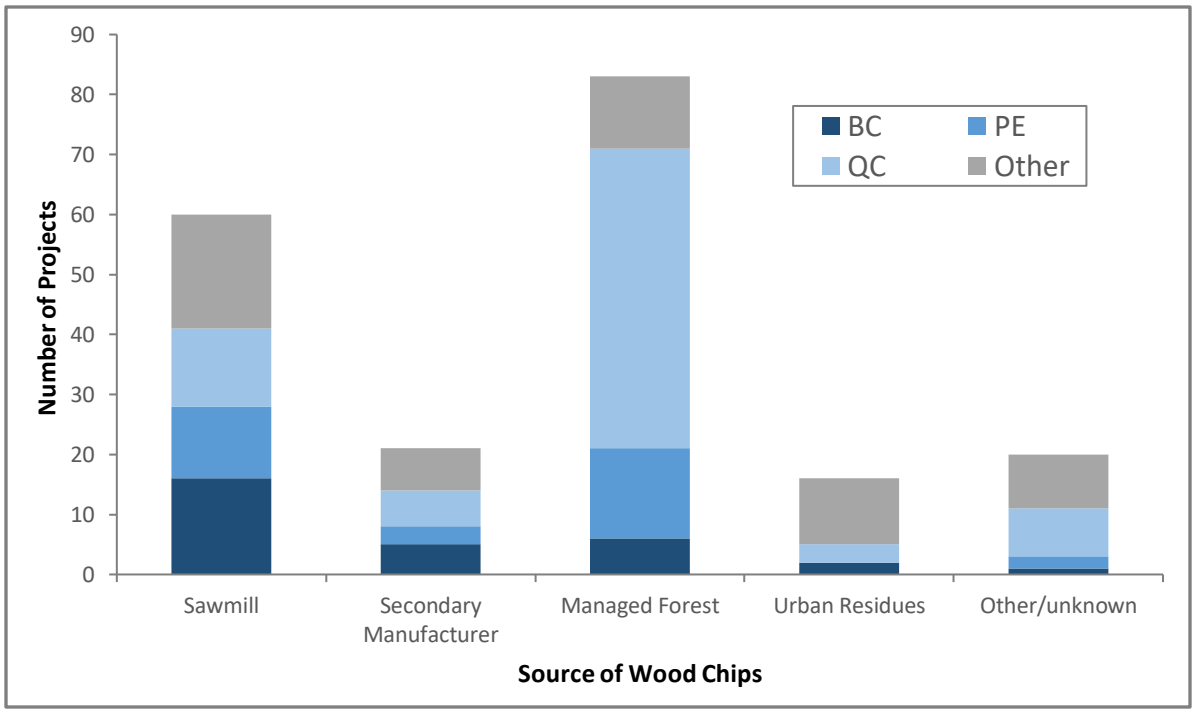

Figure 10: Source of wood chips used in Canadian bioheat projects

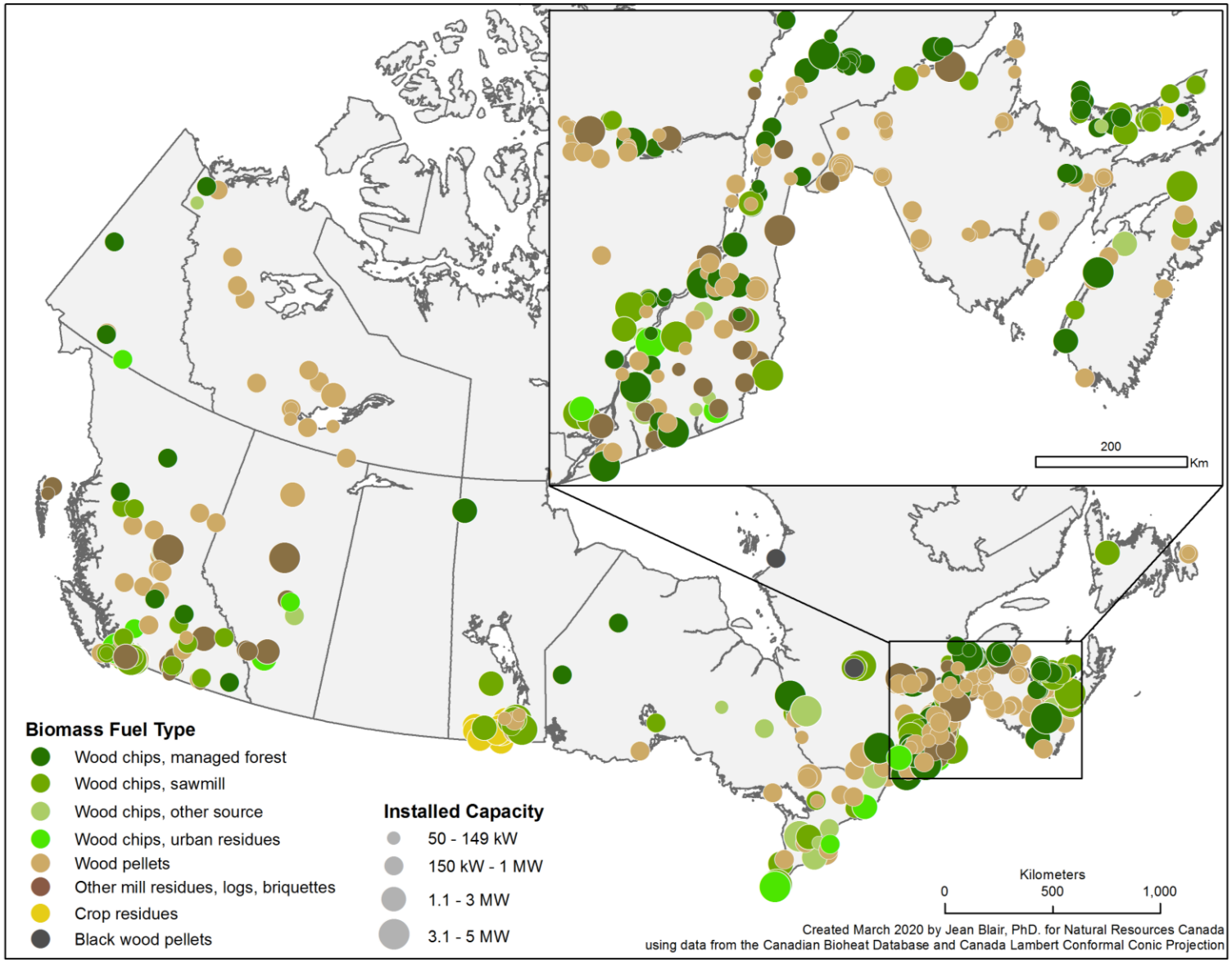

Figure 11: Location of Canadian bioheat projects by biomass fuel type and size

("Wood chips, sawmill" are sourced from any wood processing facility)

6 GREENHOUSE GAS IMPACTS

Beyond energy cost reductions, local energy independence and job creation, a primary driver for development of the bioheat sector in Canada is greenhouse gas (GHG) reduction. Meeting GHG reduction targets has been identified as a key policy priority for the federal government. Since the GHG emissions associated with space and hot water heating in Canada exceed those of the oil sands,[1] there is an opportunity for bioheat to play a significant role in achieving broader GHG reduction goals by displacing heating oil, propane, natural gas, and electricity (in jurisdictions with carbon-intensive electricity grid).

Although a detailed GHG life cycle assessment for each bioheat project was beyond the scope of this project, GHG reductions caused by displacement (or avoidance) of fossil fuels with biomass for the projects listed in the Canadian Bioheat Database were quantified. A limited amount of resources could be allocated to this quantification under the current project, so only a high-level estimate was possible. It was decided that the best approach would be to estimate the combustion-only emissions from the displaced fossil fuels and to consider biomass to have zero net combustion emissions.

Upstream emissions for fossil fuels and biomass were not included in the calculations. In some cases, the replaced (or backup) fossil fuel was known. For those projects where the fossil fuel was unknown, dominant heating fuels in the province/territory were assumed: natural gas in B.C., Alta., Sask., Man., and Ont.; heating oil in Que.., Atlantic Canada, and the Territories. Energy efficiency was assumed to be 90% for natural gas, 85% for propane, 80% for heating oil, and 70% for coal. The equivalent full-load operating hours was assumed to be 2,600 in the provinces and 3,000 in the Territories[2]. These figures, along with project capacity, were used to determine the annual fuel energy demand. Fuel combustion GHG emissions were sourced from Canada's National Inventory Report and fuel energy content assumptions were derived from Canada's National Energy Board.

Based upon these assumptions, it was estimated that bioheat projects are responsible for avoided GHG emissions of 320,000 – 325,000 t CO_2 equivalent annually. This is small compared to Canada's overall GHG inventory of 716 million t CO_2 equivalent (2017)[1] but the bioheat sector is only a fraction of its potential size at present.

[1] Environment and Climate Change Canada, 2019. National Inventory Report 1990-2017: Greenhouse gas sources and sinks in Canada.

[2] In previous reports, full-load operating hours for provinces were assumed to be 2200 and for territories 2400. They were updated this year to match the values used for estimates in Canada's Black Carbon Inventory Report 2020.

7 FUTURE PROSPECTS

There are signs in several provinces and territories (Yukon) that there will be strong development in the biomass heating sector over the next few years. The government of Prince Edward Island allocated $6.6 million in the 2019 budget to convert 20 more government buildings to biomass heating. A few of these are included in the current version of the data base but there are several more to come. The Nova Scotia government has also selected six public buildings to be converted to biomass as part of an alternative wood heating trial. The trial is, in part, an effort to create a local market for wood chips in response to the closure of Northern Pulp. Efficiency Manitoba is also in the process of developing a biomass heating trial program. Though details have yet to be released, a renewable energy engineer with Manitoba Hydro suggested in an interview that there would be up to nine (9) biomass heating pilot projects funded in the province over the next few year; three (3) in the agricultural sector, three (3) in schools heated with electricity and another three (3) in schools heated with natural gas. The British Columbia government has also recently announced funding for at least one biomass heating project though a program to fund wildfire reduction efforts. Watch for more funding directed to biomass heating projects in B.C. over the coming months and years as the government develops programs and funding opportunities to support the struggling provincial forest sector. Biomass heating also seems to be catching on finally in the Yukon, boosted by successes in Teslin and the establishment of a biomass boiler supplier and installer (ACS Mechanical) in the territory. The Arctic Energy Alliance 2018 annual report also identified several biomass heating projects to be developed over the coming years, most of which are not yet underway and were not included in the current update.

8 CONCLUSIONS

Growth in the Canadian bioheat industry over the last three years has been steady, though not as strong as growth in the 2012 – 2016 period. The return of the Residual Forest Biomass Programme in Québec, a new government procurement program in Prince Edward Island, a wood heating pilot project in Ontario, and continued uptake of bioheat in the commercial sector in New Brunswick have helped to support the steady growth. The Canadian Bioheat industry is very much still in its infancy and is nowhere near its full potential at present. Given the availability of numerous imported (largely from Austria) and domestic boiler units in the Canadian market, technology is not the limiting factor. Biomass inventories also show feedstock availability is not a major impediment to sector development though securing a consistent bulk fuel supply in regions where there is limited forest sector activity and a biomass energy market that has

yet to be established has been identified by some participants as a difficult hurdle to overcome. In both Prince Edward Island and Northwest Territories, where there is very little forest sector activity, governments have strongly supported the establishment of the sector and there are now well-established biomass supply chains to meet the demand that has been created. Support for the initial market development though seems to be key. Boiler regulations have also been a hindrance in the past, and may continue to be in some provinces, but several jurisdictions, including Ontario, have updated regulations recently to accept European standards, which also seems to have helped spur some development.

Despite the efforts of bioheat industry to communicate potential benefits to reduce GHG emissions, create jobs and improve the resiliency of rural communities, lack of awareness and political support still exists. Many participants of the Bioheat Database update noted that a limiting factor for industry growth is the lack of awareness of modern biomass heating technologies amongst building developers, municipalities, engineers, etc. who are looking for cost-effective ways to reduce emissions from buildings. There is also a common misperception in the public that growth of biomass heating will lead to unsustainable biomass harvest; a fear that is not supported by any relevant science. It is clear that a concerted effort by the industry is required if bioheat is to become the leading choice for renewable, low-carbon heat in Canada.

Based upon the results of the Canadian Bioheat Database update, several sector trends were identified:

- Regulatory regime and government procurement policies significantly impact bioheat industry growth, with a critical mass of projects forming in jurisdictions and at scales with minimal project-specific permitting requirements and/or strong government procurement policies.
- Institutions, including schools and hospitals, continue to be the strongest market for bioheat in Canada but the commercial market is growing.
- Wood pellets and wood chips dominate feedstock demand, with preference regionally specific.
- Industry growth continues to be concentrated in provinces that have historically had the strongest bioheat industries including British Columbia, Northwest Territories, Ontario, New Brunswick and Prince Edwards Island.
- Quebec continues to show the strongest growth with 24 installations in 2018-20.
- No new projects were realized in Nova Scotia or Newfoundland and Labrador; and, there were no projects recorded in Nunavut and Saskatchewan.

- All new entries were heat only projects. 75% of all projects and more than 80% of all non-farm projects are at a scale 1 MW_{th} or less.
- European-manufactured boilers are increasingly prevalent in the Canadian bioheat market.