# 2019-2020 Interior Health Strategic Energy Management Plan

"Interior Health's Energy Management Team has made significant strides over the last two years to lower our consumption of electricity and reduce our carbon foot print in the areas we all work. The Team has formed strong relationships with our energy providers and are continually working with them to explore opportunities to do more. It's our responsibility to work closely and provide assistance where and whenever we can to help sustain the momentum that continues to grow each year. I look forward to working with this team in any way that I can help see ideas turn into reality." **– Trevor Fourmeaux, Director, Plant Services**

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November 22, 2019
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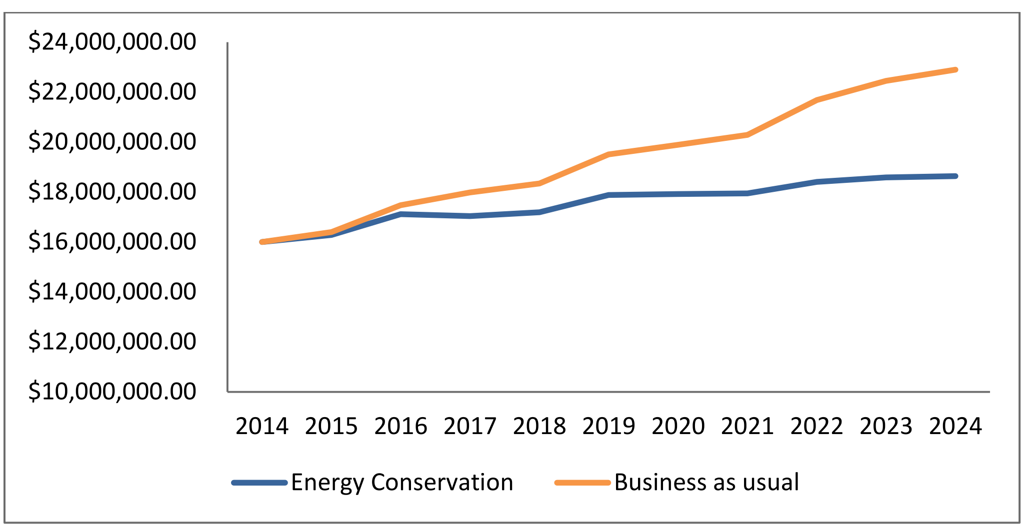
## Executive Summary

Energy and Environmental Sustainability continue to be a key focus within Interior Health; year after year, these principles continue to evolve within our operations. There has been significant progress and our efforts to reduce energy and associated emissions will continue to increase with further internal and external collaboration. We are confident of further progress because Interior Health (IH) is committed to reducing exposure to escalating utility costs, demonstrating environmental accountability and supporting emission reduction in alignment with the public sector legislation.

At Interior Health our tagline, "Every Person Matters" is embedded in our organizational goals. Our work in Energy and Environmental Sustainability aligns with these goals and contributes to delivering excellence in health services. Through collaborating and engaging with our key stakeholders we work together to:

- optimize building operation to improve occupant's health and wellness;
- replace aged infrastructure to support the delivery of high quality care;
- reduce greenhouse gas emissions for sustainable health care;
- build a culture around conservation to cultivate an engaged workforce and healthy workplace.

By focusing efforts on energy conservation, IH will able to reduce our exposure to rising utility costs. This is demonstrated through the comparison below showing scenarios for energy conservation initiatives against the "business as usual" scenario, taking into account hospital expansion and utility rate increases.




November 22nd, 2019

*Figure 1: IH Cost Savings of Energy Conservation against Business as Usual*

In recent years, IH has decreased our emission intensity (Tonne $CO_2/m^2$/year), by investing in capital and operating projects. Since 2014 our annual emission intensity has decreased by 13.2% (3.3% per year). Our projection moving forward under the Strategic Energy Management Plan (SEMP) is for a further 20.8% reduction in emission intensity over the next six years. This projection is based on detailed plans and actions including:

- implementing energy retrofits to existing buildings;
- optimizing building automation;
- constructing energy efficient new buildings, and;
- innovating with solutions that increase our momentum on climate change mitigation.

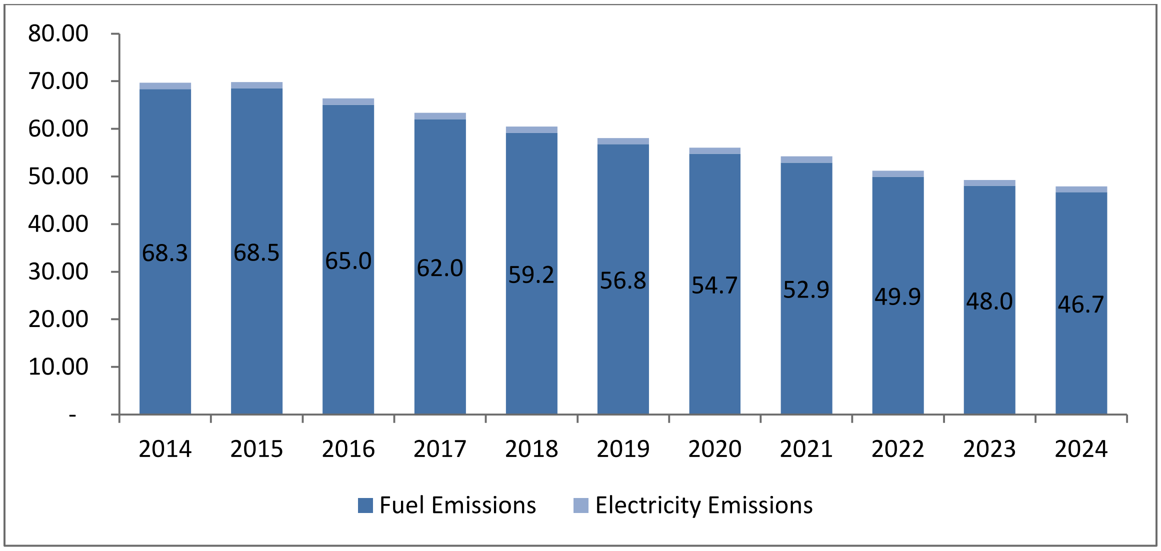



*Figure 2: IH Total Annual Emission Intensity (Tonne $CO_2/m^2$/year)*

Interior Health's SEMP addresses energy management in a collaborative, strategic, and holistic manner. This document serves as both a core deliverable to BC Hydro as well as a roadmap to moving forward on climate change mitigation. With impacts of climate change becoming more apparent each year, and rising public attention across Canada demanding action, our organization has prepared plans to address climate change through actions in energy and environmental sustainability. Each year we implement projects for emissions reductions and build influence through engagement and innovation. This positive momentum is an important step, but we still have a lot of path to cover in shifting towards a low-carbon future.

## Contents



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## Introduction & Context

Interior Health (IH) is responsible for providing health care services for over 750,000 residents across the interior region of BC. IH was established in 2001 as one of five geographically-based health authorities by the provincial government. Our organization services 60 municipalities over a large geographically diverse area of 215,000 square kilometers. In order to service a diverse range of municipalities, our buildings are a mix of community hospitals, tertiary hospitals, regional hospital, health centers and residential care facilities. Combined Interior Health provides over 8,000 beds and 26,300 personnel (staff, physicians, and volunteers) to service the region.

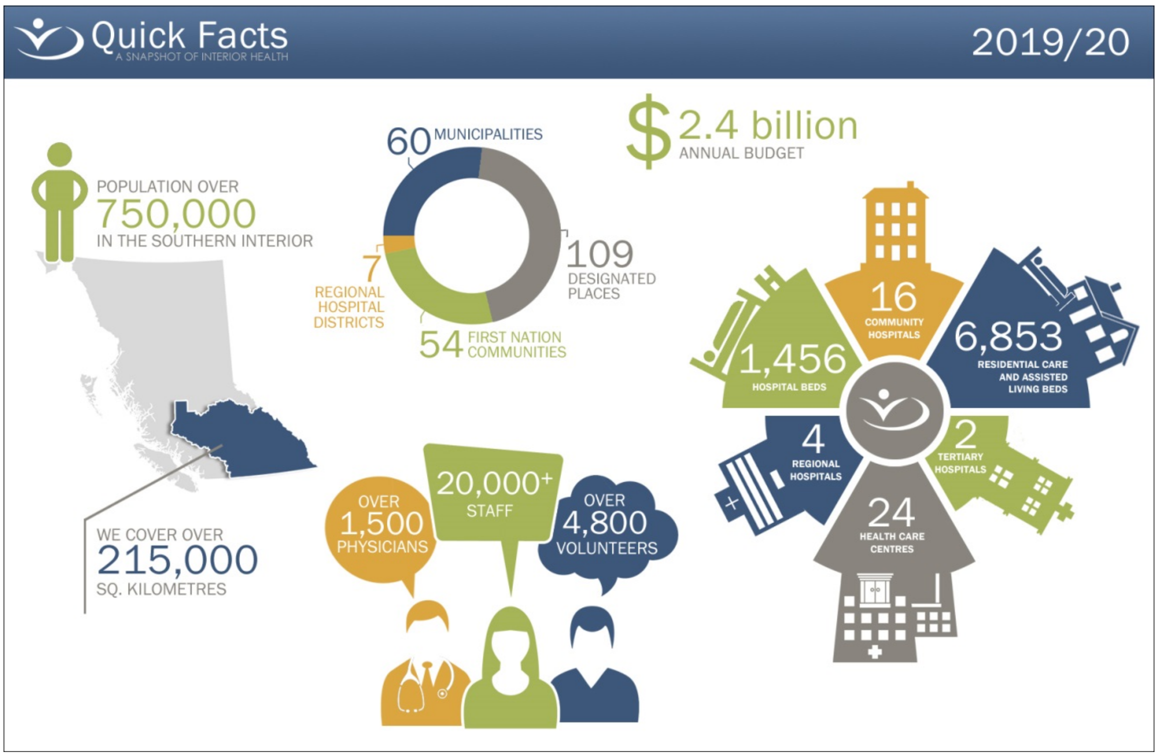
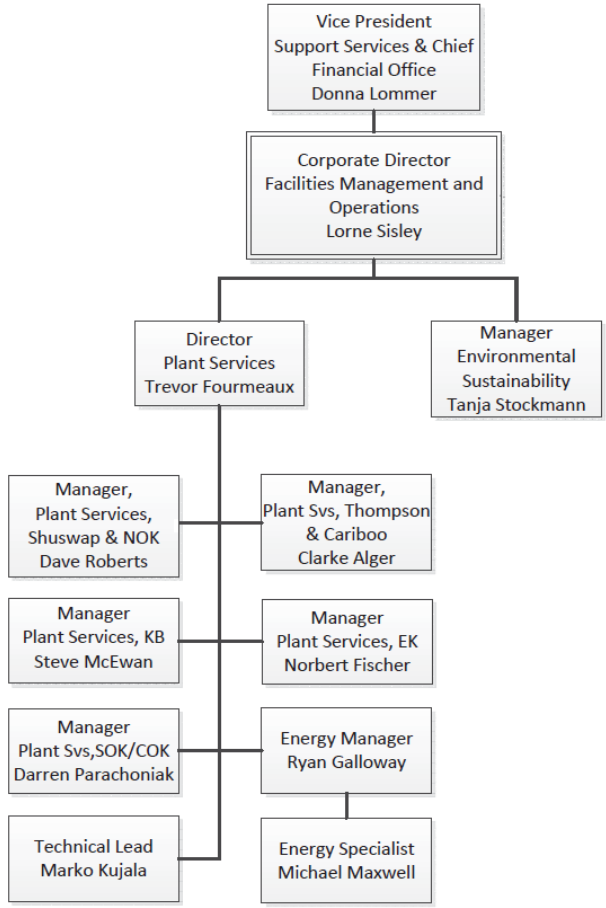



*Figure 3: A Snapshot of Interior Health*

Our wide geographic region is supplied by a diverse mix of utility providers, as shown in Appendix A: FortisBC Service Map. In this map, service area denotes the range of electricity service, natural gas service, and propane fuel service provided by FortisBC. BC Hydro supplies all other regions with electricity services. Energy costs represent approximately $17 million of our annual budget. Both utility providers manage Demand Side Management (DSM) programs, which support initiatives and technologies that encourage consumers to optimize energy use. Energy conservation adds value to both consumer and supplier in minimizing operational costs.




In 2008, Interior Health commenced an agreement with BC Hydro for a funded Energy Manager to identify and implement energy conservation projects within the organization. This position reports to the Director of Plant Services, in Facilities Management and Operations (FMO). This structure allows energy management to be embedded in major infrastructure improvements in our facilities. In 2019, our energy management team grew, through the hiring of an Energy Specialist. This position receives FortisBC funding support to further conservation through incentive programs.

Though not directly linked in the organization chart our Environmental Sustainability Manager is another key member of our team. The position reports directly to the Corporate Director of Facilities Management & Operations. Our combined efforts work towards the shared objective of reducing our carbon footprint. IH is moving forward on a number of non-energy related climate actions, the details of this plan can be found within our Environmental Sustainability Strategic Plan.

Since 2010, Interior Health has been carbon neutral under the Province's Carbon Neutral Government. Included under this commitment is our shared Energy & Environmental Sustainability objective of reducing our greenhouse gas emissions in alignment with the provincial mandate. Our current directive as a public sector organization is to reduce our emissions by 40% by 2030, under the *Greenhouse Gas Reduction Targets Act*. The target is relative to 2007 emission levels.

Government policies continue to evolve and in 2016, the Provincial Government created the Climate Leadership Plan, which detailed multiple pathways for reducing emissions. Highlights include:

- Encouraging efficient electrification with BC Hydro.
- Expanding incentives for promoting efficient gas-fired equipment with FortisBC.
- Encouraging and moving towards Net Zero buildings for new construction.

In 2018, the Provincial Government released their CleanBC plan, which provided further structure around meeting our emission reduction target. This pathway is shown in Figure 4 below, including the necessity for additional policies to meet the target.

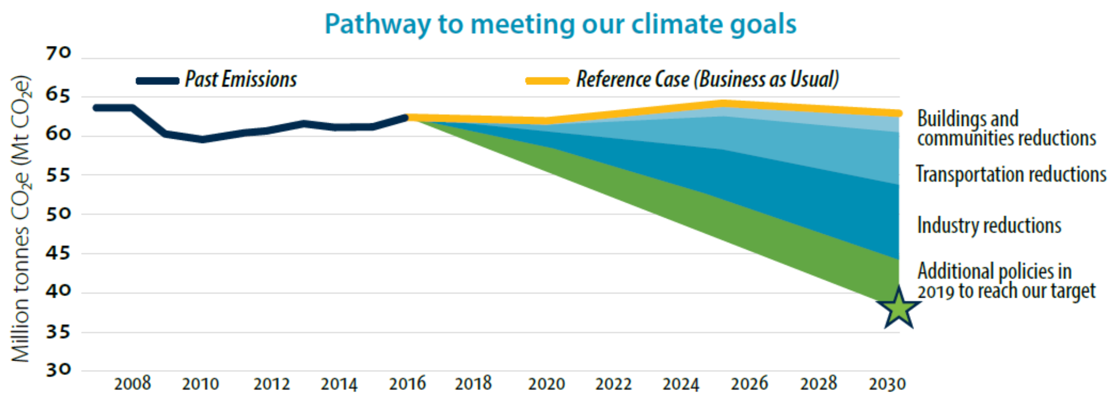



*Figure 4: CleanBC Pathway to 2030*

Energy and Environmental Sustainability at IH is currently supporting the development of these policies through engagement in a series of working groups lead by the Ministry of Environment & Climate Change Strategy. Though there is still work to be done, highlights from the CleanBC include:

*Existing Buildings*

- PSO buildings targeted to reach 50% emissions reduction by 2030
- EfficiencyBC program starting to offer incentives for electrification projects

*New Construction*

- All new buildings to be 20% more energy efficient by 2022, increasing to 40% by 2027 and 80% by 2032
- Provincial New Construction program developed to offer incentives to decarbonize building design.

*Vehicles*

- 10% of light duty vehicles purchased to be zero-emission vehicles by 2020
- 40% emissions reduction target by 2030

Together, these highlights formulate a pathway for achieving emission reductions, which is in alignment with Interior Health's plans. This Strategic Energy Management Plan (SEMP) addresses energy management in a collaborative, strategic and holistic manner. It is important to recognize that there are many key stakeholders in developing the specific priorities of energy management. BC Hydro and FortisBC both play a significant role in supporting our commitment to energy management principles. This document serves as both a core deliverable to BC Hydro and a roadmap to moving towards our climate mitigation mandate.

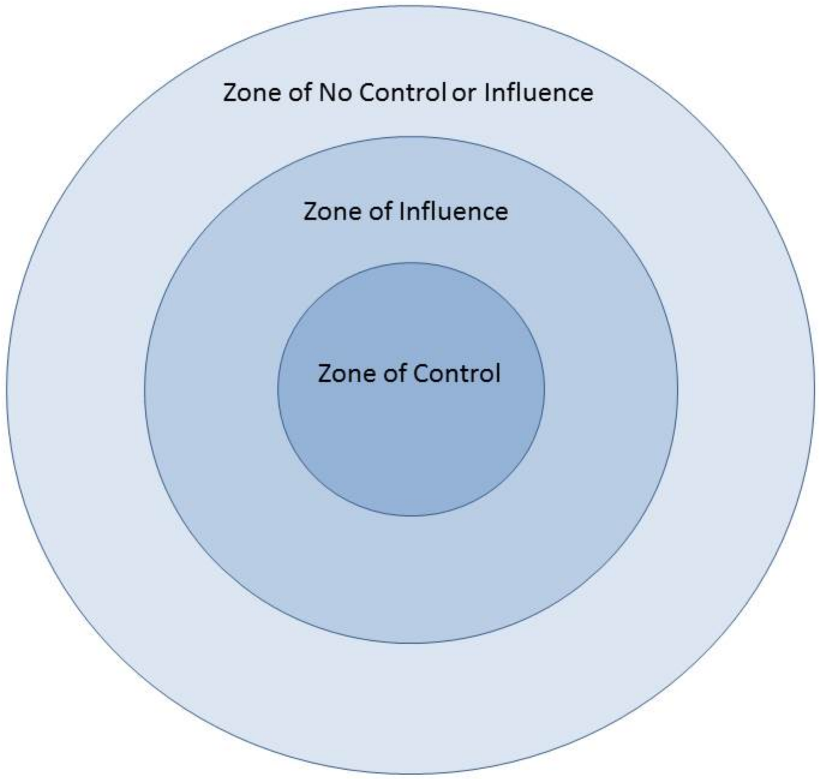
## Our Commitment

IH is committed to Energy & Environmental Sustainability being integrated in all aspects of the organization. There is a direct link between a population's environment and its health outcomes. Environmental contaminants have been linked to negative health impacts including cancer, birth defects, respiratory and cardiovascular illness, gastrointestinal ailments and death, causing an increased demand for health care services. One of Interior Health's goals is to increase the health and wellbeing of its residents; therefore it is clear that our environment plays a large role in Interior Health achieving its goal.

Under the authority of the Chief Executive Officer and the Senior Executive Team, Interior Health will continue to take proactive steps to reduce the organization's ecological footprint by reducing our greenhouse gas emissions, thereby improving the health and wellbeing of the population. The IH Sustainability Policy (Appendix B) includes the following commitments:

- Consider transportation impacts on patients, staff and the community when designing new programs and services.
- Design all new buildings to LEED Gold standard.
- Organizational travel (administration) will be reduced and staff will continue to be encouraged to use more video/teleconferencing.
- Make improvements to waste management by identifying waste streams, educating users, and engaging staff to divert waste away from landfill.
- Meet federal, provincial and municipal regulatory requirements.
- Develop strategic and collaborative relationships with community partners/stakeholders, Health Authorities, Ministry of Health, Climate Action Secretariat, and Utility Providers (BC Hydro, Fortis BC, etc.).
- Decrease energy consumption through capital investment in infrastructure and promote behavior change by educating building occupants in energy and sustainability awareness.
- Meet ethical and environmental purchasing standards while promoting the integration of sustainability into procedures and practices of our vendors and suppliers.

In working together to conserve our energy use, we gain additional benefits from supporting population health, creating cost effective health service and reducing the potential risks related to climate change. In order to enact the change required to combat climate risks, our team operates with a range of control scales as illustrated below. Our direct control is limited, our ability to influence change is appreciable, but even greater is the area outside of both our control and influence. Therefore, our plans and actions need to be readily adaptable to the evolving political landscape around climate change.




## Our Stakeholders

### Internal Stakeholders

Stakeholder engagement is essential in order to effect change within an organization. Successful engagement builds influence and support. Energy management within IH supports many departments to both implement the best available technology and encourage changing the perspectives around energy conservation. Overall our goal is to move the principles of energy conservation to becoming integral within everyday business. Our key stakeholders are shown in below Table 1, including engagement strategy and frequency.

*Table 1: Energy Management Key Stakeholders*

| Key Stakeholders | Engagement Strategy | Engagement Frequency |
|---|---|---|
| Senior Leadership | Energy Management Reports and SEMP | Quarterly and Annually |
| Plant Services - Plant Managers | Plant Managers Meetings and Project, Information and Incentive Support | Monthly and As Required |
| Plant Services - Plant Supervisors | Energy Opportunity Assessments, Quarterly Supervisor Meetings and Project, Information and Incentive | Annually on highest consumping sites (~50), Quarterly and As Required |
| IH Staff | SEMP, Sustainability Associates and In the Loop | Annually and As Required |
| Finance & Capital Accounting | CNCP Project Funding Application and Information Support | As Required |
| Capital Planning | Project, Information and Incentive Support for all new construction projects | As Required |
| Capital Projects | Project Manager Meetings, CNCP Project Support and Incentive Support | Monthly and As Required |
| P3 Operations | Operational Meetings and P3 Energy Report Review | Quarterly and Annually |
| Protection, Parking, and Fleet Services | Project, Information and Incentive Support | As Required |
| Information Management Information Technology | Project, Information and Incentive Support | As Required |
| Clinical & Program Staff | Project, Information and Incentive | As Required |

IH also has a team of Sustainability Associates that work within different departments across the organization. This team is given the opportunity to enact change in their individual departments with the support of Energy and Environmental Sustainability through the BC Hydro Energy Wise Network.

### External Stakeholders

Partnerships with key external stakeholders are vital to the success of energy management within IH. Strong relationships with both BC Hydro and FortisBC are important, as both organizations are also leading efforts in energy conservation across the province. Positive collaboration with both BC Hydro and FortisBC and their Key Account Managers (KAM) enables IH to gain:

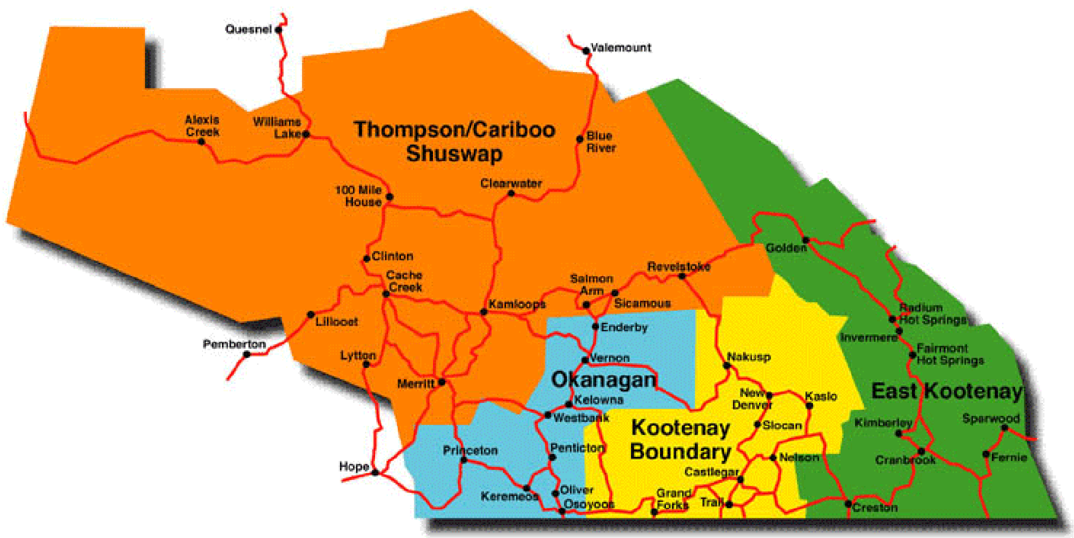
- Value from program support and incentive opportunities;
- Dialogue from various networking opportunities from their forums/workshops; and
- Expertise from their technical and social science resources.

IH continues to engage and participate with activities through CHES BC, to develop relationships with vendors and consultants across the province. Our relationship with other health authority representatives, contractors, and external engineering consultants adds value in keeping IH apprised to the most current and relevant technological improvements for our facilities.

Continued engagement with the BC Government's stakeholder groups, such as the Climate Action Secretariat and the Ministry of Health, will allow us to be influential in the evolution of provincial initiatives like the Carbon Neutral Capital Program (CNCP), CleanBC and Carbon Neutral Action Reports (CNAR). Over the last year a number of working groups have been facilitating the development of new strategies for existing building and new construction. Through this process, IH continues to connect with other health authorities for the benefits of a united voice. Each month, all Health Authorities meet as part of the Provincial Environmental Technical Team (PETT) to discuss topics relevant to Energy and Environmental Sustainability.

## Our Situation

IH covers a wide geographic range, combined we have four service areas including the Thompson Cariboo Shuswap, Okanagan, Kootenay Boundary, and East Kootenay. Our facilities within each region are operated by a Plant Manager with a team of supervisors, engineers and trades. Throughout each region, our goal is the same to ensure access to quality care and improve the health of our population.




## Our Vision

To set new standards of excellence in the delivery of health services in the Province of British Columbia.

## Our Mission

Promote healthy lifestyles and provide needed health services in a timely, caring, and efficient manner, to the highest professional and quality standards.

## Our Values

- Quality – We are committed to safety and best practice.
- Integrity – We are authentic and accountable for our actions and words.
- Respect – We are courteous, and treat each other as valued clients and colleagues.
- Trust – We are free to express our ideas.

## Our Goals

- Improve health and wellness
- Deliver high quality care
- Ensure sustainable health care by improving innovation, productivity, and efficiency
- Cultivate an engaged workforce and healthy workplace

## Our Buildings

Our facilities cover a wide range of services, including residential, mental health, health centres, acute and sub-acute facilities. Overall, IH has 310 dedicated owned spaces; most of these facilities do not significantly impact our total facilities wide consumption due to their relatively small size. Table 2 below summarizes our highest cost facilities, totaling for 72% of our owned building space.


*Table 2: Facilities Energy Consumption and Cost Summary 2018*

| Facilities Name | Size (m2) | Annual Energy Consumption (ekWh) | Energy Use Intensity (ekWh/yr/m2) | Annual Energy Cost ($) | Energy Cost Intensity ($/yr/m2) |
|---|---|---|---|---|---|
| Kelowna General | 90,131 | 60,194,614 | 668 | $ 2,795,880 | $ 31.02 |
| Royal Inland Hopsital (Kamloops) | 68,611 | 28,788,041 | 420 | $ 1,469,588 | $ 21.42 |
| Vernon Jubilee Hopsital | 53,132 | 27,540,981 | 518 | $ 1,302,100 | $ 24.51 |
| East Kootenay Regional Hopsital (Cranbrook) | 31,535 | 14,302,189 | 454 | $ 646,236 | $ 20.49 |
| Penticton Regional Hospital | 22,383 | 19,117,065 | 854 | $ 1,053,848 | $ 47.08 |
| Kootenay Boundary Regional Hospital (Trail) | 18,912 | 14,982,500 | 792 | $ 591,015 | $ 31.25 |
| Cariboo Memorial Hospital (Williams Lake) | 14,959 | 7,768,500 | 519 | $ 293,941 | $ 19.65 |
| Cottonwoods Extended Care Centre (Kelowna) | 14,499 | 5,529,128 | 381 | $ 285,816 | $ 19.71 |
| Kootenay Lake Hospital (Nelson) | 12,519 | 5,166,988 | 413 | $ 370,993 | $ 29.63 |
| 100 Mile House General Hospital | 12,499 | 5,839,629 | 467 | $ 279,214 | $ 22.34 |
| Shuswap Lake General Hospital (Salmon Arm) | 10,206 | 6,627,129 | 649 | $ 361,532 | $ 35.42 |
| South Okanagan General Hospital (Oliver) | 7,887 | 3,585,414 | 455 | $ 173,525 | $ 22.00 |
| Dr. Walter Anderson Building (Kelowna) | 7,850 | 5,432,238 | 692 | $ 342,629 | $ 43.65 |
| Golden & District General Hospital | 7,453 | 2,935,701 | 394 | $ 296,122 | $ 39.73 |
| Creston Valley Hospital | 7,450 | 4,457,566 | 598 | $ 185,668 | $ 24.92 |
| Lillooet Hospital & Health Centre | 6,500 | 2,626,831 | 404 | $ 269,379 | $ 41.44 |
| Invermere & District Hospital | 6,270 | 2,951,332 | 471 | $ 295,081 | $ 47.06 |
| Boundary Hospital (Grand Forks) | 6,191 | 3,684,418 | 595 | $ 246,341 | $ 39.79 |
| Queen Victoria Hospital (Revelstoke) | 5,888 | 3,587,903 | 609 | $ 298,463 | $ 50.69 |
| Dr. Helmcken Memorial Hospital | 2,839 | 1,966,357 | 693 | $ 202,727 | $ 71.41 |

Due to increased demand for services resulting from population growth throughout the interior region, our floor spaces have been increasing. This trend is expected to continue with a new patient care tower in development for Royal Inland Hospital (24,294 $m^2$) and an expansion of Cariboo Memorial Hospital (9,500 $m^2$).

Four of our largest facilities are under P3 operation (Royal Inland Hospital, Vernon Jubilee Hospital, Kelowna General Hospital and Penticton Regional Hospital) where energy is not directly managed by IH. These facilities represent nearly half of IH's total utility consumption.

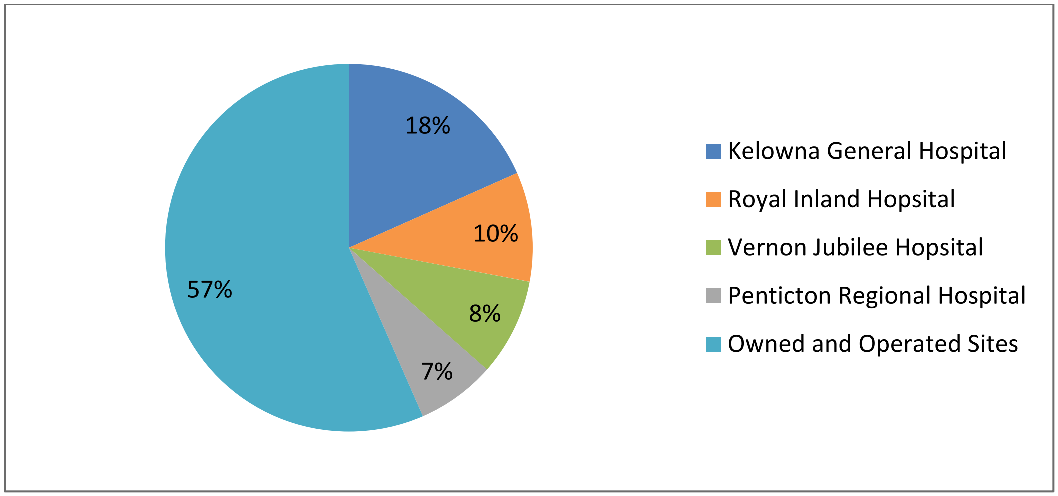



*Figure 5: 2018 IH Wide Energy Cost Breakdown*

### Building Energy Performance Index (BEPI)

Many methods and tools are available to perform energy analyses. Benchmarking building energy performance is important because it considers all fuel sources and uses of the building, and allows energy performance comparison to similar buildings.

Below in Figure 6, the 2018 BEPI chart shows our highest energy intensity sites. Separating our facilities by energy intensity per utility type can help support efforts to target emission reduction and potential inefficiencies. A building's BEPI is also dependant on types of services provided at the facility. For example, some facilities may have high energy intensity in part due to significant equipment loads or air change requirements. Another factor to consider in targeting with BEPI data is annual variations in space utilization. The 2018 BEPI for Penticton Regional Hospital (PRH) is significantly higher than 2017, due to the construction of the new patient care tower. Floor area has not been factored into the 2018 BEPI number, as occupancy did not occur until early 2019.

The highest energy intensity sites shown below are priority targets for capital energy conservation investments.

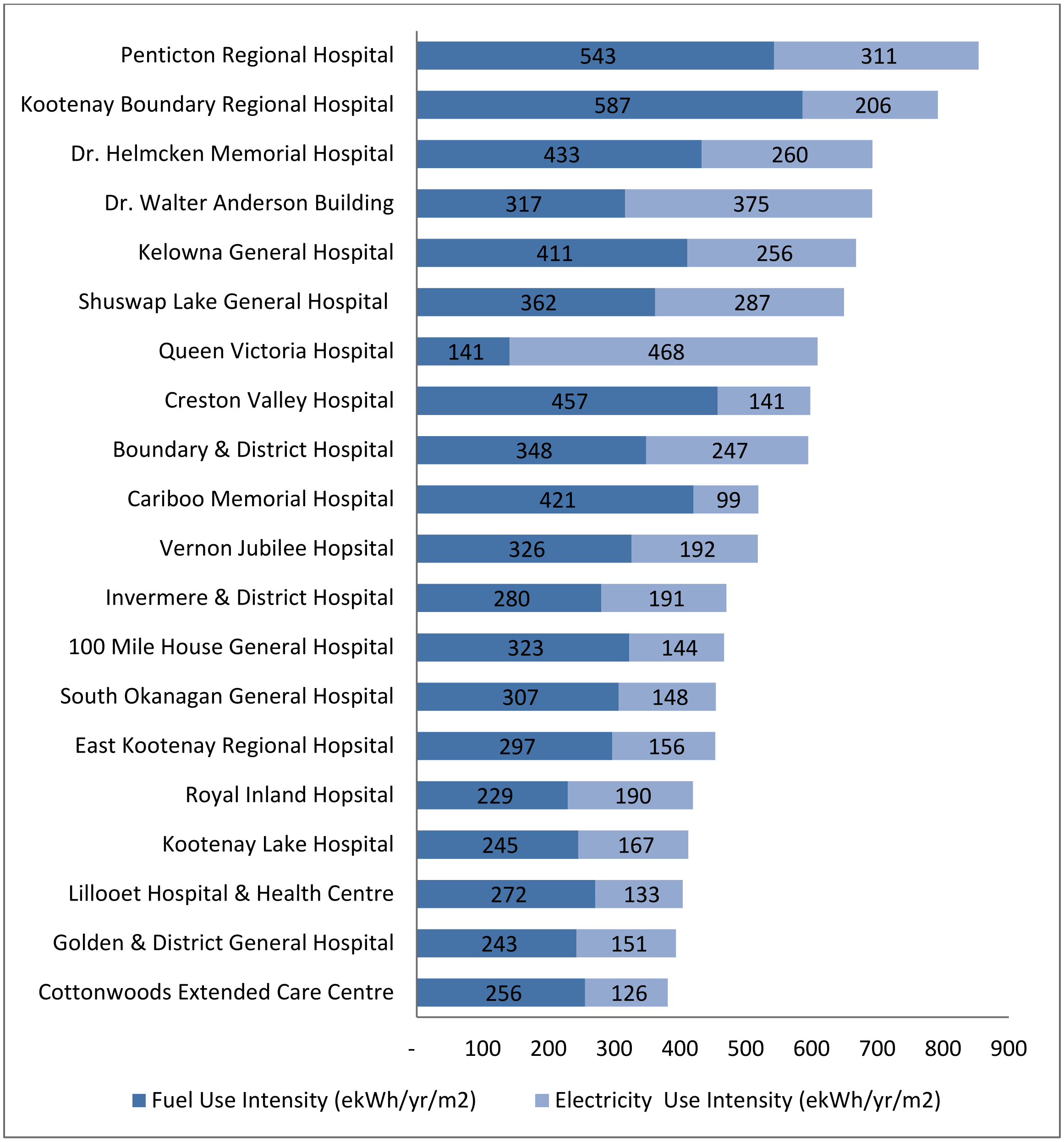



*Figure 6: IH Building Energy Performance Index 2018*

## Our Footprint

IH is committed to reducing our energy use and subsequent greenhouse gas emissions, as stated in our Environmental Sustainability policy, to minimize our carbon footprint. With the recently revised *Greenhouse Gas Reduction Target Act*, IH is working towards the provincial target to reduce emissions by 40% by 2030. Our 2018 reported emissions were 41,769 Tonnes $CO_2$, of which 93% is attributed energy used to operate our facilities.

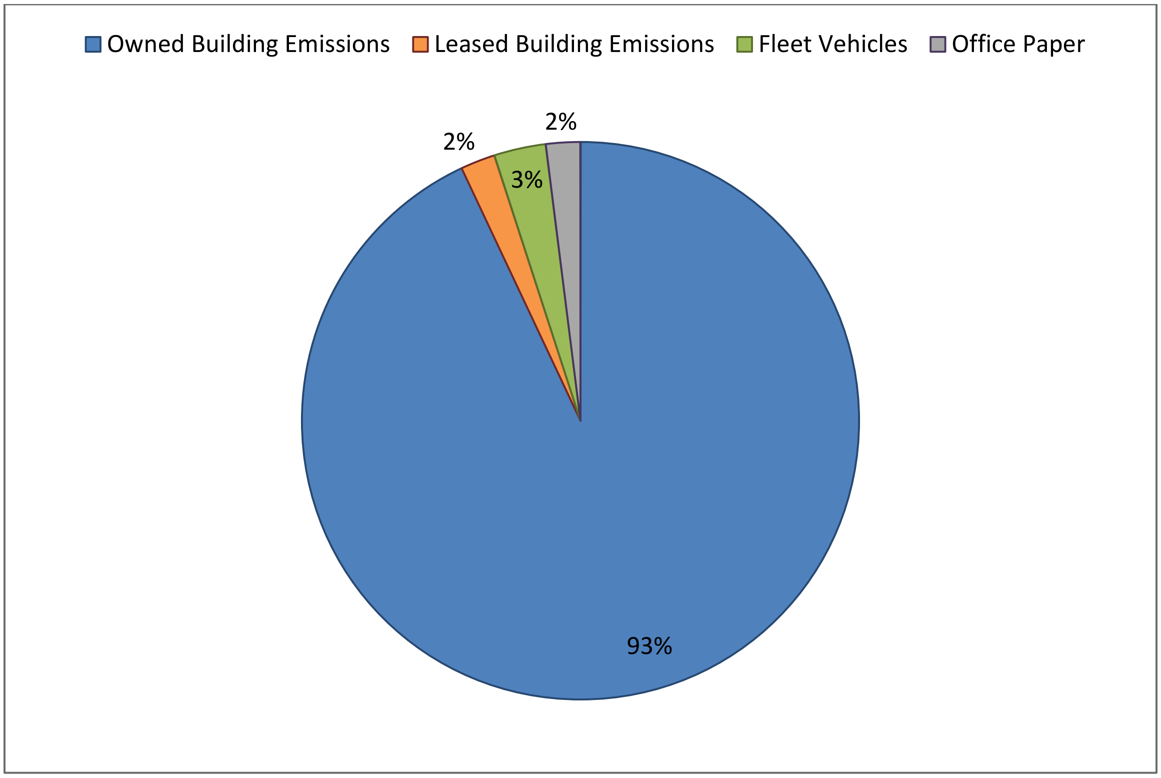



*Figure 7: IH Greenhouse Gas Emission Breakdown 2018*

Over the last eight years, the historical office paper, fleet and leased building consumption emissions within IH have been relatively stable. Owned building emissions have significant variations due to energy conservation initiatives, weather variability and increased floor area. Figure 8 below shows the absolute total emissions; not accounting for year to year weather variations and increases in floor area.

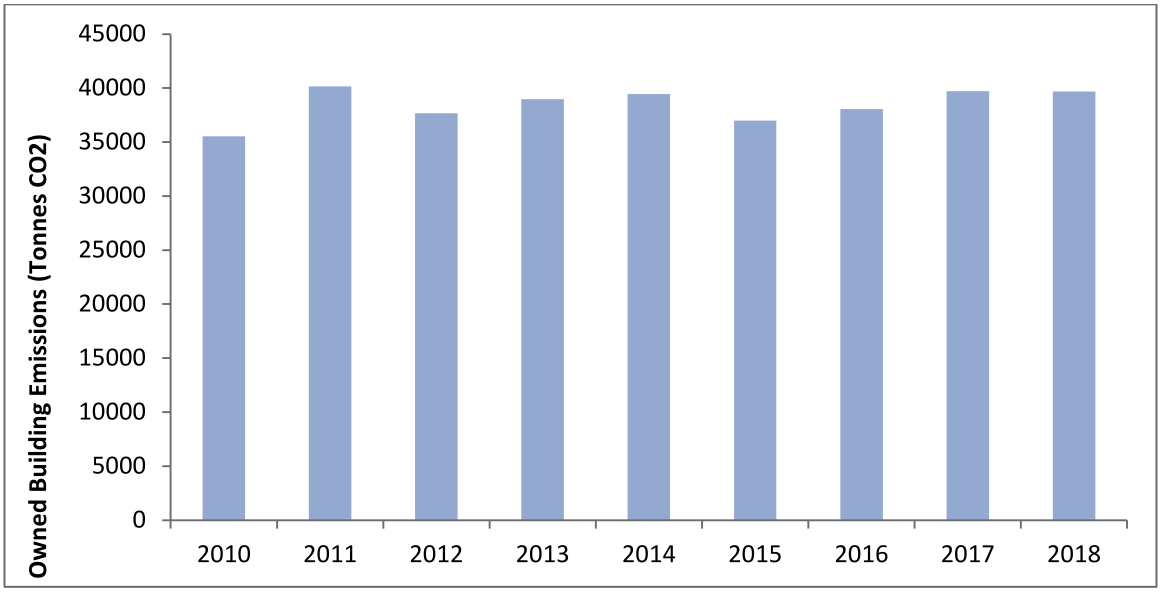



*Figure 8: IH Owned Building Emissions (Tonnes $CO_2$)*

To accurately identify whether energy conservation initiatives have an impact, both weather and floor area increases must be factored into the data. Assessing performance based on energy intensity (ekWh/m$^2$/yr) provides the adjustment for floor area. Adjusting for weather variations through normalization ensures the analysis is an "apples to apples" comparison. This is necessary to determine if energy initiatives are having an impact regardless of space increases or inclement weather requiring more/less energy use for heating and cooling our facilities.

Prior to 2014, IH's energy intensity data is unreliable due to the uncertainty in historical floor area changes. From 2014 to 2018, we can identify that IH's floor space has increased by 5.9% due to recent new construction projects like the KGH IHSC building, VJH Polson Tower, and RIH CSB building. The figure below shows weather normalized energy intensities for 2014 to 2018.

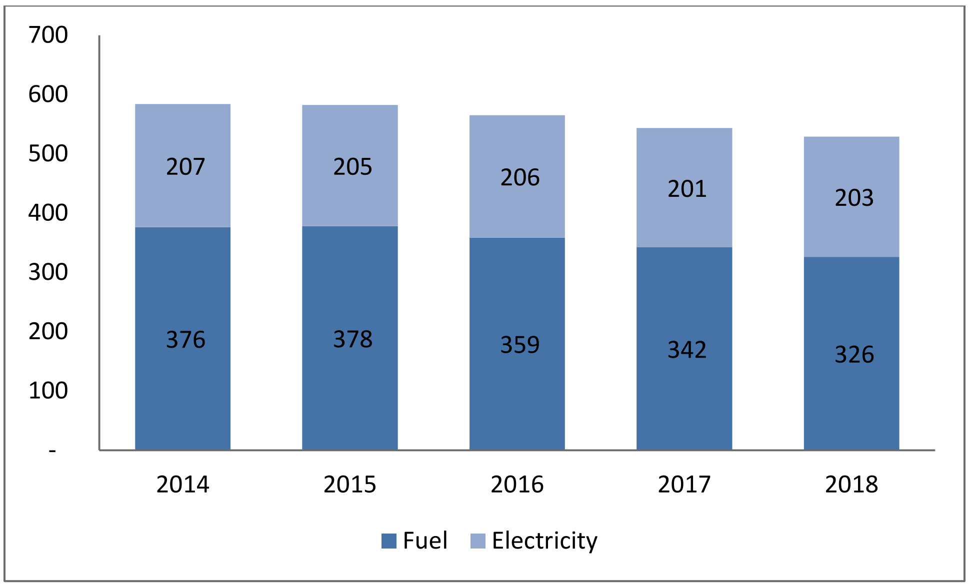



*Figure 9: 2014-2018 Total IH Adjusted Energy Intensity (ekWh/m$^2$/yr)*

Since 2014, our annual energy intensities has decreased by 9.4%. Both fuel and electricity intensities have decreased annually, with the exception of electricity usage in 2016 and 2018. These two increases were due to the 2016 opening of the new Interior Heart and Surgical Centre (IHSC) building at Kelowna General Hospital (KGH) and the 2018 construction of the new patient care tower at PRH.

The adjusted energy intensity data and fuel/utility emission factors can then be used to determine emission intensities as per Figure 10.

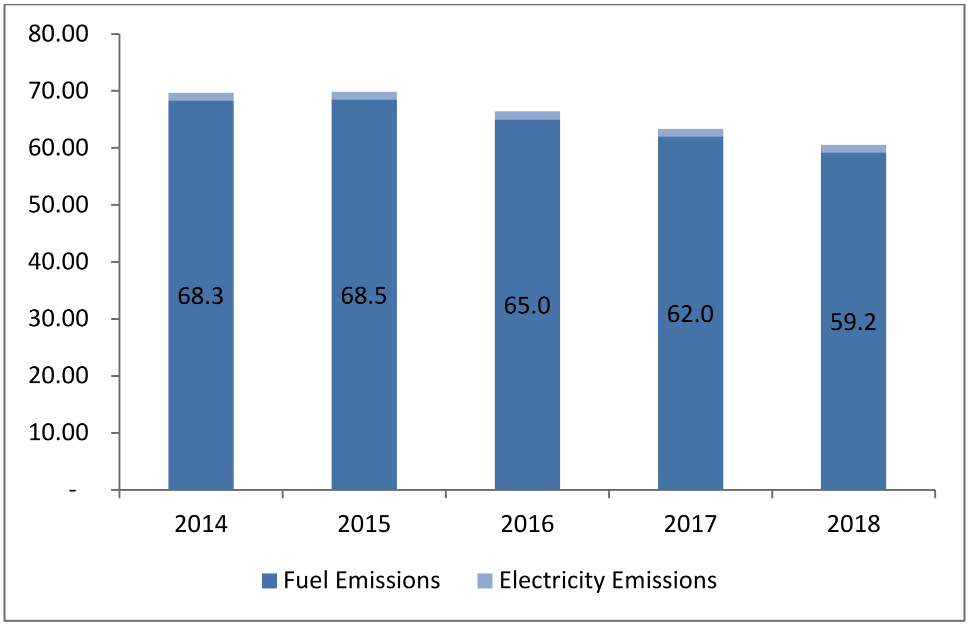



*Figure 10: 2014-2018 Total IH Adjusted Energy Intensity (Tonne $CO_2/m^2/yr$)*

Due to significant progress on conservation of natural gas use, IH has reduced our emissions intensity at a more rapid rate than energy intensity. Over the last four years, IH has reduced our emission intensity by 13.2%. This trend can be directly linked to our capital and operating investments in energy conservation to reduce emissions.

## Our Movement

### Energy and Emissions Projections

Our energy projections are as follows:

- Energy Use Intensity (EUI) – a reduction of 14.3% by 2024, compared against the year 2018.
- Average annual energy reduction – 2.4% (2019 to 2024). Projection based on project plan and shown in Figure 11.

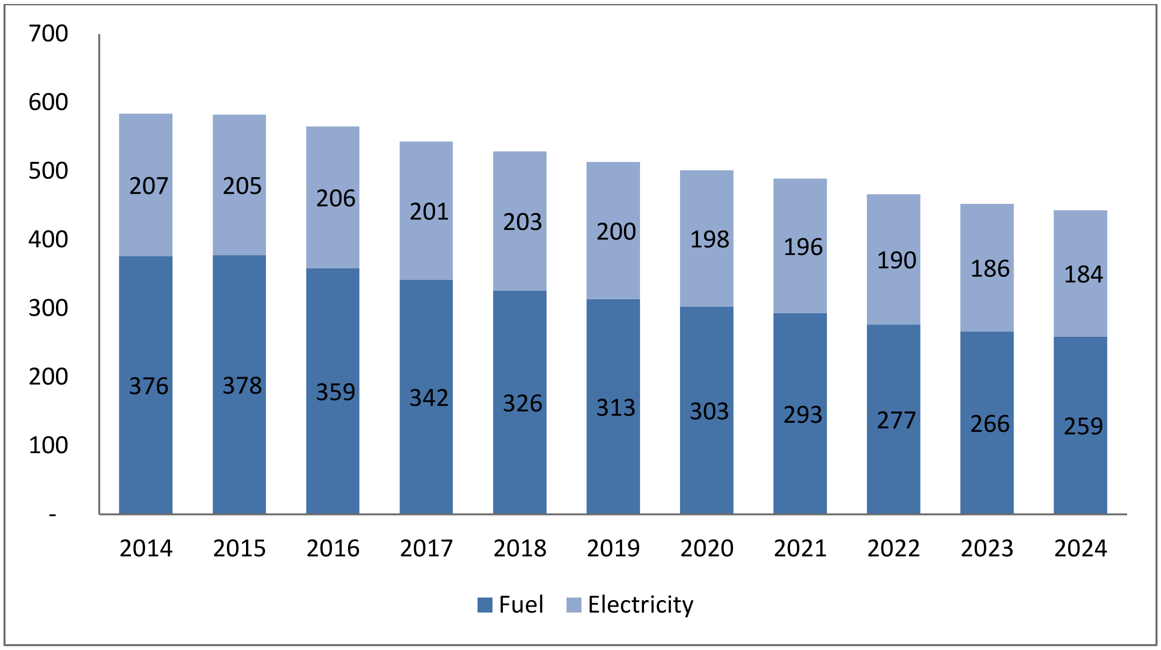



*Figure 11: IH Total Annual Energy Intensity (ekWh/$m^2$/year)*

Over the last four years, our emission intensity (Tonne $CO_2$/$m^2$/year) has been reduced by 13.2% (3.3% per year). Our target moving forward is to further reduce our emission intensity by 20.8% over the next six years (3.5% per year).

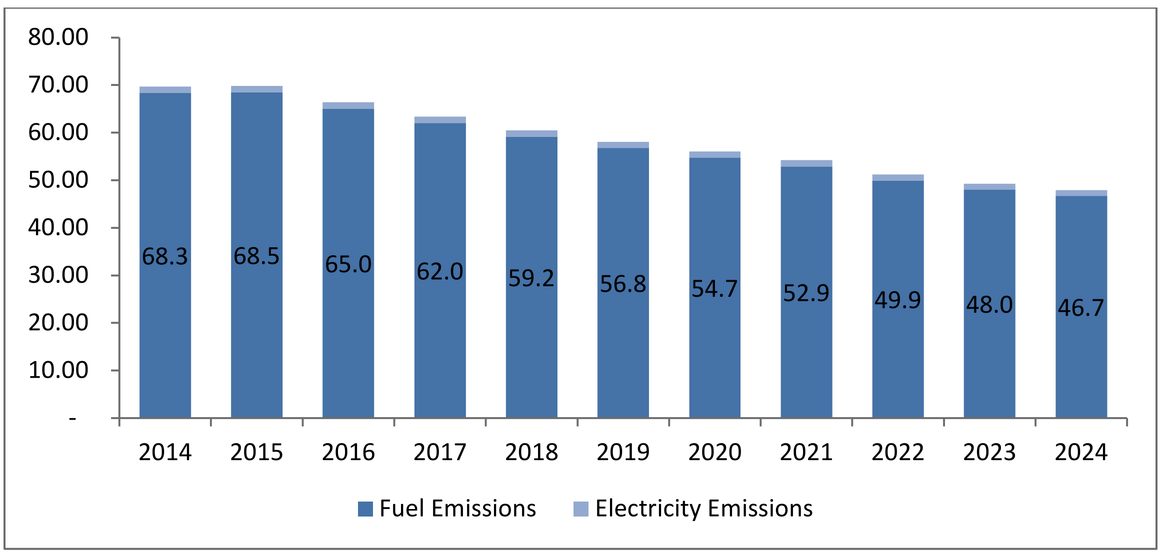



*Figure 12: IH Total Annual Emission Intensity (Tonne $CO_2$/$m^2$/year)*

Projecting a constant emission reduction trend to 2030 would result in IH making significant strides towards our provincial emission target, in the range of an overall 35% emission intensity reduction compared to 2014. This is still below the provincial target of 40% absolute emissions compared to 2007, however this target is not feasible unless there is a significant change in funding availability and directive from Senior Leadership and/or the Ministry of Health.

### Operating Cost Benefit

The financial benefit of energy management is in reducing exposure to rising utility rates and increasing floor areas.  The forecasted the cumulative cost savings is shown in Figure 13.  The analysis includes an increase to floor area of 17% anticipated by 2024 (compared against 2014) and an assumed 2% annual rise in utility rates.  By 2024, the avoided cost is estimated at nearly $20 million, which instead can be used to support the operation of our facilities and delivery of health services.

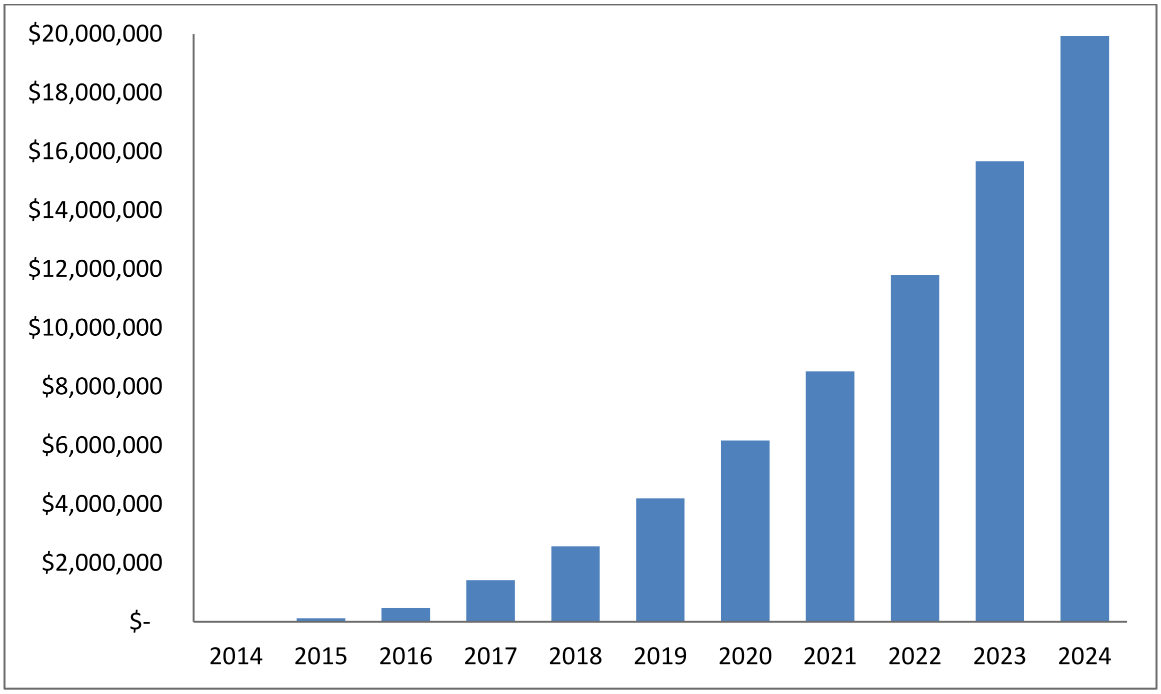



*Figure 13: IH Cumulative Energy Cost Avoidance*

## Our Plans

Our projections for energy and emission reductions have been estimated based on project and portfolio plans within our areas of control and influence, while considering available capital and operating budgets.

### Capital Budget

Funding from the CNCP program is the only direct form of budget available for energy conservation projects. The program gives us approximately $1.8 million each year (including regional district support) to implement capital projects that reduce our carbon footprint.  Projects with the most potential utility cost savings, best emission reductions opportunities and aged infrastructure are prioritized.  Table 3 details the past, current, and five future years of recommended and prioritized CNCP projects.

*Table 3: Past, Current and Future CNCP Project Summary*

| Fiscal Year | Facilities Name | CNCP Project Description |
|---|---|---|
| F17-18 | Elk Valley Hospital (Fernie) | Condensing Boiler Plant Replacement |
| | Lillooet Hospital & Health Centre | Biomass Boiler Plant |
| F18-19 | Golden & District General Hospital | Biomass Boiler Plant |
| | Kootenay Boundary Regional Hospital (Trail) | Shoulder Season Steam Boiler |
| F19-20 | Queen Victoria Hospital (Revelstoke) | Heat Recovery Chiller |
| | St. Baratholomew Health Centre (Lytton) | Geo-Well Heat Pump and Control Optmization |
| | Kelowna General Hospital | Boiler Plant Upgrades |
| F20-21 | Invermere & District Hospital | DHW and Exhaust Air Heat Pumps |
| | Dr. Helmcken Memorial Hospital | DHW Heat Pumps |
| | Cariboo Memorial Hospital | Solar Wall for HVAC Preheat Boiler Plant Upgrades |
| F21-22 | Dr. Helmcken Memorial Hospital | Heat Pumps & Renewable Implementation |
| | Kootenay Boundary Regional Hospital (Trail) | Boiler Plant Upgrades |
| F22-23 | Royal Inland Hopsital (Kamloops) | Heat Recovery Chiller and Boiler Plant Upgrades |
| | 100 Mile House Hospital | Boiler Plant Upgrades |
| F23-24 | Vernon Jubilee Hopsital | Heat Recovery Chiller and Boiler Plant Upgrades |
| | Kootenay Boundary Regional Hospital (Trail) | Heat Recovery Chiller |
| F24-25 | Penticton Regional Hospital | Heat Recovery Chiller and Boiler Plant Upgrades |
| | Kelowna General Hospital | Steam Plant Interconnection |

The Ministry of Environment & Climate Change Strategy is working to develop additional strategies to reduce emissions; and one potential outcome is an increase to the annual funding available. Our plan for this potential increase is to both accelerate the five-year project plan and to replace the remaining low-efficiency atmospheric boiler plants in our medium sized facilities. With potentially limited notice periods, these boiler plants are ideal for prioritization, due to the high emission reduction, increased capital infrastructure replacement, and speed of implementation.

## Operational Budget

Energy Management at IH operates without a defined operational budget. However, we utilize a percentage of the incentive cheques received from DSM programs offered by BC Hydro and FortisBC. The majority of utility incentive cheques go to the relevant capital project. The annual operational funding from non-capital incentive cheques have covered expenses related to energy studies for CNCP projects, energy efficiency educational webinars, and the employment of our Energy Specialist.

However, little to no funding is available for low-payback operational energy projects (LED lighting upgrades, variable speed drive installations, and control optimization) that can payback in less than two years. In order to overcome this challenge, we are building a Business Plan to source that funding from past energy project cost savings. This “Revolving Fund” model would direct project energy cost savings into a funding pot for further investment. Our hope is to be able to realize the benefits of project energy savings to accelerate the rate of energy efficiency adoption.

## Project Plan

Our project plan is the combination of all our initiatives to reduce energy consumption. The summary of all our directly and indirectly funded projects, with estimated energy and carbon savings, are shown in Appendix C. There are separate detailed project plans for the BC Hydro and FortisBC programs. Figure 14 below shows this the information combined with any non-utility relevant initiatives. Projects are separated into past year (F18-19), current year (F19-20) and next year (F20-21).

| | Total Estimated Savings | | | |
|---|---|---|---|---|
| Fiscal Year | kWh | GJ | tCO2e | Incentive |
| 18-19 | 902,050 | 14,603 | 794 | 376,376 |
| 19-20 | 3,352,400 | 30,258 | 1,569 | 1,085,203 |
| 20-21 | 1,800,975 | 34,276 | 1,763 | 1,132,709 |

*Figure 14: Energy Project Plan Summary*

During the development of our project plan we have considered energy studies, on site investigation, and internal assessments in order to determine priorities and appropriately allocate funding. Some estimates are high level, so numbers are subject to variation as project scopes are developed and refined.

## Our Actions

Effecting change through creating a culture around conservation is essential to whole-of-organization approach to energy and environmental sustainability. The goal of our engagement strategy is to ensure all key internal and external stakeholders are both informed and engaged in conservation. Our actions to influence cover many groups across IH, but the majority of this influence is within four areas core to building energy consumption. The summary below outlines these key areas which are further detailed in the following subsections.


*Figure 15: Energy Conservation Internal Engagement Summary*

## Plant Services

### Site Opportunity Assessments

Our core stakeholders are the people that keep our buildings operating day to day. Energy Management resides within Plant Services because of our shared goal of operating our buildings efficiently and effectively. Our building operators are the people with the knowledge and ability to determine how well our buildings run. In order to best support our operators and understand their challenges we have spent time on-site to become familiar with our buildings systems. Exploring opportunities together leads to the best outcomes for how we prioritize funding for future energy efficiency upgrades. See Appendix D for our general list of non-site specific opportunities. Lists of opportunities found on-site are document and distributed. Our list-to-date of opportunities for each site can be found in Appendix E.

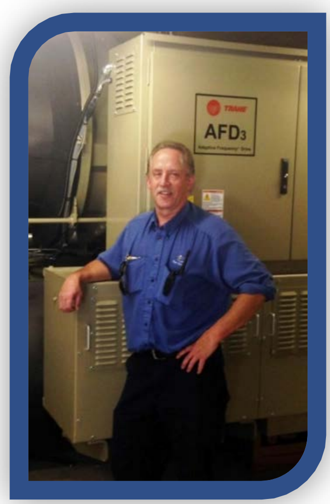
For future site visits, these lists will serve as the basis to continue discussion around energy efficiency. In 2020 meetings, our aim will be to include information to support building operators like site utility data trending. Our commitment is for annual meetings with building operators at sites identified by Plant Managers. Each site has a unique trajectory for moving forward with energy efficiency, based on the current state and opportunity for improvement of the building systems and facility operations. Though time limited by other demands, our goal is to support each operator with at least one initiative. Our range of support includes energy savings analyses, project scope development, energy studies, developing business cases, utility program incentives, measurement and verification, and operating project design review.

### Operating Projects

A number of low-payback projects; discovered through our site engagement efforts, can be implemented within operating budgets. However, without a defined budget, we focus on being prepared for when funding opportunities become available. In addition, we utilize pilot programs available through utility providers as they often have a high ratio of incentive to cost. We have focused our recent operating projects efforts on lighting retrofits, steam traps, and control improvements. Further details on example initiatives can be found in Appendix F.

### Retro Commissioning

Due to system aging, space-use change, equipment replacement, operator turnover, sequence adjustments, etc., building system performance degrades significantly over time. Retro commissioning is proven to restore or even better system performance leveraging improvements in knowledge and technology. Common examples of energy efficiency opportunities through retro-commissioning can be found in Appendix G. The Ministry of Environment and Climate Change Strategy is currently developing a new policy for energy efficiency in existing public sector buildings. This policy is anticipated to include a retro-commissioning requirement every five years, to ensure buildings are operating as efficiently as possible.




In collaboration with FortisBC, we have prioritized three sites to complete a full building retro commissioning in F19-20. These sites are Princeton General Hospital, Swan Valley Lodge and Castlegar Health Centre. FortisBC is fully funding the pilot program, with no cost to Interior Health. The results of this pilot will determine if FortisBC continues development into a full program.

Potential position funding support from utility providers may allow IH to hire an employee that would be dedicated to optimizing mechanical and electrical systems for a set number of facilities each year. This second option for building retro-commissioning into our processes has already had a successful demonstration. A pilot retro-commissioning project was completed at Boundary Hospital (Grand Forks) in 2016. This was an internal initiative by former KBRH (Kootenay Boundary Regional Hospital) Chief Engineer with support from FortisBC. The results of this pilot included a number of occupant comfort improvements, increased life of existing equipment, reduced natural gas consumption by 12.5% and reduced electricity usage by 14%. Overall, the combined utility cost savings was $41,300 annually. This pilot demonstrates the significant potential of retro-commissioning, where significant cost and emission savings can be achieved without any infrastructure replacement.

## Capital Planning

### New Construction

Designing and constructing new facilities with energy efficiency targets is essential to ensuring low impact and low cost health care to best service our population. IH is incorporating energy management principles throughout the various phases of these projects. Table 4 summarizes the high-level details of four new construction expansion projects that have been identified as priorities for energy efficiency.

*Table 4: IH New Construction Project Summary*

| Facilities Name | Expansion Scope | Opening | Floor Area Increase (m2) |
|---|---|---|---|
| Penticton Regional Hospital | New Patient Care Tower | 2019 | 24,294 |
| Royal Inland Hopsital (Kamloops) | New Patient Care Tower | 2021 | 28,485 |
| Kootenay Boundary Regional Hospital (Trail) | Emergency and Pharmacy Exp. | 2023 | 1,290 |
| Cariboo Memorial Hospital (Williams Lake) | Hospital Expansion | 2023 | 9,500 |

All four projects will take part in relevant BC Hydro and FortisBC New Construction programs. This year IH will receive $378,000 for the new Patient Care Tower at PRH, given we have successfully met the requirements of the FortisBC program. Opening in 2021, Royal Inland Hospital is currently estimated to receive $796,000 combined through BC Hydro and FortisBC new construction programs. Highlights of the design include:

- Heat Recover Chiller (HRC) as first stage heating
- Enthalpy Recovery Wheels

- High Efficiency Condensing Boilers
- High Efficiency Centrifugal Chillers
- High Performance Building Envelope
- LED lighting including occupancy and daylight sensors
- Variable Speed Drives

IH has directed energy performance standards to support adoption of energy efficiency in the design of all new construction projects. Our intent is to ensure new health care infrastructure is fiscally responsible, energy efficient, and built to the highest standard of human and environmental health.

### Planning Project Support

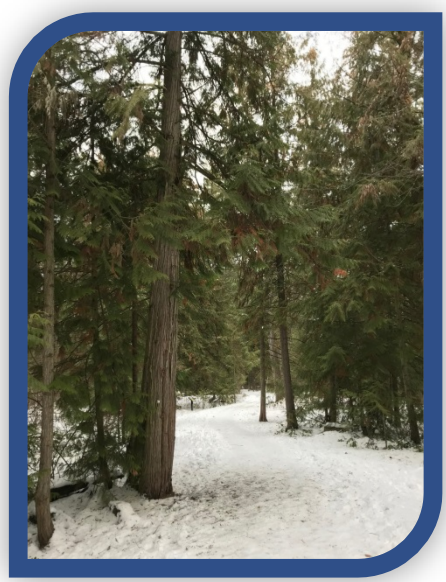
Our Capital Planners keep our team informed of all major planning initiatives. This integration with our Capital Planners allows energy efficiency to be a key element in how we build better buildings. Our integrated team means that we can spend our limited time effectively. Involvement ranges for each initiative, including design review during the business plan, schematic design, and detailed design phases. Two examples of our recent engagements include:

- Penticton Regional Hospital Existing Building Renovation – completed a detailed design review and recommended sizing the heating coils for future condensing boilers. Incorporating this small design change during the design stage of the project is relatively low cost, and creates a potential for 10-15% increase in future boiler plant efficiency.
- Cariboo Memorial Hospital New Construction - provided technical support during the exploration of Net Zero Energy as part of the expansion business plan. Although the outcomes of this review are not yet known, we will continue to support our Capital Planners in making the final outcome as close to Net Zero Energy as financially viable.

## Capital Projects

### CNCP Projects

Our priority capital project initiative is the planning, funding application, and implementation support of our CNCP projects. The funding from CNCP represents the most significant mechanism to direct emission reductions. Over the next five years, IH plans to utilize this funding to reduce energy use and emissions through Demand Side Management (DSM) programs, renewable energy, and electrification programs. In alignment with the CleanBC plan, our focuses are to conserve natural gas through FortisBC programs, fuel switch to renewable energy, and



implement electrification projects. Targeted sites for natural gas conservation are based on energy use intensity, overall consumption, and FCI (measure of infrastructure condition). Targeted sites for electrification/renewables are based on prioritizing our highest fuel cost (propane) sites, while considering technology suitability and the business case.

### *Propane Sites*

A significant factor for prioritizing the past and future CNCP projects has been the cost of fuel. Propane supplied to our facilities ranges in cost from $19 to $30 per GJ, which is three to four times the cost of natural gas. Combustion of propane creates a higher level of Global Warming Potential compared to natural gas. For Golden and Lillooet, we have developed positive business cases to move forward with two biomass boiler projects. Table 5 lists all IH propane sites (above 600 m2) including floor area, annual fuel consumption, annual cost, and the proposed replacement system.

*Table 5: IH Propane Site Summary and Proposed Replacements*

| Facilities Name | Floor Area (m2) | Annual Propane Consumption (GJ) | Annual Propane Cost ($) | Proposed Replacement |
|---|---|---|---|---|
| Golden & District General Hospital | 5,495 | 6,519 | $ 192,299 | Biomass Boiler Plant |
| Lillooet Hospital & Health Centre | 6,500 | 6,353 | $ 189,124 | Biomass Boiler Plant |
| Invermere & District Hospital | 6,270 | 6,324 | $ 187,238 | Heat Pumps & Renewable Energy |
| Dr. Helmcken Memorial Hospital | 2,839 | 4,425 | $ 132,636 | Heat Pumps & Renewable Energy |
| Queen Victoria Hospital (Revelstoke) | 6,235 | 2,987 | $ 57,162 | Heat Recovery Chiller |
| St. Baratholomew Health Centre (Lytton) | 1,927 | 1,641 | $ 48,988 | Heat Pumps - Geo Exchange |
| Victorian Community Health Centre (Kaslo) | 2,983 | 1,101 | $ 33,284 | Heat Pumps & Renewable Energy |

### *EfficiencyBC*

With the complexity of our energy needs in Healthcare, we have an opportunity to take advantage of simultaneous heating and cooling to improve overall building energy efficiency. Instead of servicing heating loads through a boiler plant and cooling loads through a chiller plant, under the right conditions a HRC can provide heating and cooling at the same time. With simultaneous loads at ideal temperatures, a HRC can provide a Coefficient of Performance (COP) in the range of 6. This translates to 6 kW of useful thermal energy for every 1 kW of input electricity. Our first HRC project is expected to be completed at Queen Victoria Hospital in F19-20. This site was prioritized as the existing chillers are 50 years old and the heating is supplied by high cost propane gas.

Our second F19-20 electrification project is at St. Bartholomew Health Centre. The project scope includes commissioning an abandoned well water system for a geo-exchange connection to a series of water-to-water heat pumps. This project will utilize renewable energy to significantly reduce our propane consumption and associated emissions. The combined EfficiencyBC incentive for these two projects is over $170,000.

Our next initiative is targeting opportunities at our largest sites with the highest potential for simultaneous heating and cooling. Working alongside Trane Canada, we have prioritized Royal Inland Hospital and Vernon Jubilee Hospital for further analysis. Over the next year, we will collect flow and temperature data for the two facilities to evaluate the potential for a HRC. Initial high-level estimate has the upper potential to reduce emissions by 3,800 Tonnes $CO_2$ (9% of IH total annual emissions).

### *FortisBC Commercial Custom Program*

Beyond renewable energies and electrification, many current and future CNCP projects are developed through the FortisBC Commercial Custom Program. This program supports exploring custom energy retrofits that reduce natural gas use. The process involves a fully funded energy study which leads into a Capital Incentive Agreement for project implementation. Depending on the business case, the implementation funding can cover in the range of 30-40% of the total project cost. Looking forward to F20-21, IH is planning to implement a solar wall at Cariboo Memorial Hospital (CMH) through the FortisBC program. A solar wall passively preheats outdoor air entering the building's HVAC systems. This opportunity is estimated to offset site natural gas use by 19.7%.

### Capital Project Support

Our active collaboration with the Capital Project team extends beyond CNCP, as we are actively involved in many prioritized capital projects. Our involvement includes design review, commissioning support, utility program incentives, and Measurement and Verification. Engagement with our Project Managers allows us to guide significant infrastructure changes to the most efficient outcome as financially viable. One example of this effort is the HVAC Upgrade project at Ponderosa Lodge. Resulting from our engagement, this project will include new Heat Recovery Ventilator (HRV) which is estimated to save over 2,200 GJ per year compared to the convention model. This project will also gain implementation incentive through the FortisBC Commercial Custom Program. These are two positive outcomes; however opportunity existed for further efficiency by tying into existing mechanical plants. Unfortunately, this recommendation was ruled out due to available funding and aggressive project timelines. Not every outcome will result in the most efficient solution, but our goal is make sure that the benefits are weighed against the drawbacks for informed decision-making.

## Energy Contract Management

### P3 Energy Performance Contract

Many of our recent new construction buildings have been completed through the P3 model with an energy performance target. Under the P3 model, buildings are designed with a "Design and Construction Energy Target" that compares against future years' "Actual Energy Consumption". IH is responsible for the utility costs, so accountability is structured into the P3 agreement with a Pain/Gain share. The Pain/Gain share simply splits the difference between the design and actual energy consumption, giving fiscal incentive for energy efficiency. However, there is significant oversight required to ensure the numbers used for these adjustments are accurate and fair to both parties. Additionally, technical issues that arise during the test period delay the implementation of the Pain/Gain share, thus leaving IH responsible for the full utility cost during these years. Energy Management supports Interior Health's P3 operators by providing:

- Review and feedback for energy models and reports prepared by P3 providers
- Technical support to ensure fairness in energy related discussions on Pain/Gain share
- Opportunities for efficiency improvements

With a significant portion of our energy management portfolio under P3 operation, it is increasingly important to work with our service providers to ensure we capitalize on energy conservation opportunities whenever possible.

### Energy Performance Contract (EPC)

A significant barrier to substantial energy and emission reductions is access to funding to implement technological advances in our building systems. In order to overcome this financial hurled we are working in collaboration with private sector ESCO contractors to develop a process for implementing EPCs in British Columbia. An ESCO model leverages the long-term cost savings to support the initial investment cost. IH has developed a process through a combination of an RFP and ITQ to engage three ESCO contractors. The contractors are completing ASHRAE level III audits at three facilities including East Kootenay Regional Hospital, Kootenay Lake Hospital, and Shuswap Lake General Hospital. These three sites were prioritized based on energy use intensity, facility condition index, and total energy consumption. Energy audits are anticipated to be complete for submission into the F21-22 capital cycle, but we will be exploring other innovative ways to move this initiative forward. If funding can be secured, we will proceed to developing an Energy Performance Contract with successful contractors and implementing projects under a Construction Management agreement.

## 2019 Highlight – Wayne McLellan Award for Project Excellence


Innovation is an important step in moving towards a low carbon future. Innovation drives change internally, but also beyond our organization to demonstrate the value of new and emerging technologies. In 2019 IH was awarded the Canadian Healthcare Engineering Society's Wayne McLellan Award for outstanding success with energy efficiency project implementation. In 2018, we operated the first biomass boiler for operation within a BC Health Authority. Our boiler plant services the heating needs for Lillooet Hospital and Health Centre. Our second biomass boiler began operating in the summer of 2019 at Golden & District Hospital. Together these two projects combine to an annual carbon reduction of 658 Tonnes $CO_2$ and operational cost savings of $250,000 per year.

Our efforts in biomass continue as we are currently working through connecting our Parkview Place property to a biomass fuel district energy system in Enderby. This project is expected to reduce our annual carbon emissions by 155 Tonnes $CO_2$ and with a payback from operating cost savings in less than 3 years. Another opportunity for a biomass district energy system integration is at Dr. Helmcken Memorial Hospital in Clearwater. A full site renewable energy study will be complete in F19-20 which will evaluate connecting to the District of Clearwater's biomass plants.

IH Senior Leadership has shown a willingness to support new forms of energy generation and conservation, in an effort to reduce the impacts of our energy use. Going forward as new technologies become available, we will strive to evaluate how best to incorporate each opportunity within our building portfolio.

# Appendix A: FortisBC Service Map

Yukon
Northwest Territories
Natural gas service area
Electric service area
Combined natural gas & electric service area
Propane service area
FortisBC gas line
Enbridge gas line
FortisBC electric transmission lines
Fort Nelson
Aitken Creek
Hudson's Hope
British Columbia
Mackenzie
Alberta
Prince George
Williams Lake
Revelstoke
Enderby
Kamloops
Lumby
Campbell River
Whistler
Powell River
Elkford
Kelowna
Kaslo
PACIFIC OCEAN
Port Alberni
Vancouver
Hope
Princeton
Cranbrook
Nanaimo
Osoyoos
Trail
Victoria
United States

# Appendix B: Interior Health Environmental Sustainability Policy

# AP1000 - ENVIRONMENTAL SUSTAINABILITY

## BACKGROUND

The relationship between the environment and health is one of interdependence – and maintaining a healthy environment is central to increasing quality and human health. Interior Health's (IH) commitment to environmental sustainability supports its primary goal to increase the health and well-being of residents of the interior of British Columbia.

The healthcare sector recognizes the impact of its operations on the environment based on its:

- consumption oflarge quantities of energy (buildings and equipment)
- generation of considerable quantities of waste (much derived from single use items)
- reliance on on transportation (supplies/patients/care-providers)

As one of the trustees of the BC healthcare system, IH is committed to environmentally sustainable operations by reducing its impact on a number of areas within its operations.

## 1.0 PURPOSE

To embed sustainability principles and practices within IH's operations that demonstrates IH's commitment to supporting environmental sustainability according to environmental legislation and principles of stewardship.

## 2.0 DEFINITIONS

| TERM | DEFINITION |
|---|---|
| **Sustainability** | Meeting the needs of the present without compromising the ability of future generations to meet their needs. (World Commission on Environment and Development). |
| **Triple Bottom Line** | An approach to business which incorporates a balance of ecological, societal, and economic considerations into transparent decision-making processes. |

## 3.0 POLICY

### 3.1 Scope

This policy applies to all IH staff, physicians, volunteers, patients/clients and long-term care individuals. This policy applies to all IH operations, including but not limited to:

- all aspects of Acute Care, Home & Community Care, Mental Health & Addiction Services, Public Health, Support Services and Corporate Administration; and

- strategic partners, contracted services and Public Private Partnerships.

### 3.2 Environmental Sustainable Strategies

Under the authority of the Chief Executive Officer and the Senior Executive Team, IH continues to take proactive steps to reduce the organization's ecological footprint by implementing a Triple Bottom Line approach to decision making. IH will take action to reduce harm to its staff and residents by transforming operations to ensure they are sustainable and mindful of the environment. In the process of achieving IH's goal to improve the health and wellbeing of its population, efforts will focus on the following inter-related areas:

- Consider transportation impacts on patients, staff and the community when designing new programs and services.
- Design all new buildings to the LEED Gold standard, work toward making new buildings net zero ready, and require new building construction to take into consideration climate change projections
- Reduce $CO_2$ emissions by including hybrid, alternate fuel, low-emission and zero-emission vehicles in our fleet where feasible
- Reduce organizational travel (administration) and continuing to encourage staff to use more video/teleconferencing and web-based technologies.
- Make improvements to waste management by identifying waste streams, educating users, and engaging staff to divert waste away from landfill.
- Meet federal, provincial and municipal regulatory requirements (e.g. *Bill 34 Greenhouse Gas Reductions Targets Amendment Act*).
- Develop strategic and collaborative relationships with community partners/stakeholders, Health Authorities, Ministry of Health, Climate Action Secretariat, and energy suppliers (e.g. BC Hydro, FortisBC).
- Decrease energy consumption and energy carbon intensity through capital investment in infrastructure and promoting behaviour change by educating building occupants in energy and Sustainability awareness.
- Incorporate environmental conservation (energy and water) techniques in operating and investing in our facilities to balance quality, cost and sustainability.
- In partnership with Supply Chain, meet ethical and environmental purchasing standards while encouraging our vendors and suppliers to integrate sustainability into their procedures and practices.
- Communicate environmental performance and progress to external stakeholders, the local community and internal stakeholders.

### 3.3 Environmental Sustainability Program

The approach to environmental sustainability at IH continues to evolve to leverage the local experience, initiative and capacity across the IH-region to drive action across the health authority. An essential building block of IH's Environmental Sustainability Program is our staff and our leadership driving changes which lowers our overall environmental footprint whenever possible. It is the program's responsibility to manage and to promote environmental action and sustainability within the organization.

The program establishes ongoing goals and objectives to meet both the requirement to be carbon neutral as well as the expectations of clients, employees, stakeholders, senior management and the Board.

## 4.0 REFERENCES

The following list includes the various regulatory standards and strategic goals that Interior Health is authorized to comply with and work towards:

1. *Bill 34 – 2018 Greenhouse Gas Reduction Targets* Amendment ActThe BC Growth Future Plan: https://engage.gov.bc.ca/cleangrowthfuture/
2. BC Energy Step Code: https://www2.gov.bc.ca/gov/content/industry/construction-industry/building-codes-standards/energy-efficiency/energy-step-code
3. Carbon Neutral Government: https://www2.gov.bc.ca/gov/content/environment/climate-change/public-sector/carbon-neutral
4. IH Strategic Energy Management Plan: https://www.interiorhealth.ca/AboutUs/Accountability/EnvironmentalSustainability/Documents/StrategicEnergyManagementPlan.pdf

# Appendix C: Detailed Project Plan

# FortisBC Project Plan

| Fiscal Year | Facility Name | Community | Project Name | Status | Estimated Savings | | | Incentive |
|---|---|---|---|---|---|---|---|---|
| | | | | | kWh | GJ | tCO2e | |
| 18-19 | Kootenay Boundary Regional Hospital | Trail | KBH Boiler Upgrades | In Progress | - | 2,100 | 104.7 | 49,000 |
| 18-19 | Interior Health Data Centre | Kelowna | KDC Energy Study | Complete | - | - | - | 4,450 |
| 18-19 | Elk Valley Hospital | Fernie | EVH Boiler Upgrades | Complete | - | 1,668 | 83.2 | 62,000 |
| 18-19 | Noric House | Vernon | NHS DHW Water Heaters | Closed | - | 290 | 14.5 | 2,985 |
| 18-19 | Cottonwoods Care Centre | Kelowna | CTW Custom Electric Retrofits | Closed | 313,870 | - | 0.8 | 66,310 |
| 18-19 | Cottonwoods Care Centre | Kelowna | CTW Custom Gas Retrofits | Closed | - | 3,100 | 154.6 | 34,572 |
| 18-19 | Cariboo Memorial Hospital | Williams Lake | CMH Energy Study | Closed | - | - | - | 17,200 |
| 18-19 | Kelowna General Hospital | Kelowna | KGH Natural Gas Energy Study | Closed | - | - | - | 13,990 |
| 18-19 | Kelowna General Hospital | Kelowna | KGH Strathcona Lighting | Closed | 36,946 | - | 0.1 | 20,041 |
| 18-19 | Nicola Valley Hospital and Health Centre | Merritt | NVH Boiler Upgrades | Closed | - | 800 | 39.9 | 36,000 |
| 18-19 | Hillside Centre - Interior Adult Psychiatric Centre | Kamloops | HLS Boiler Upgrade | Closed | - | 377 | 18.8 | 9,000 |
| 19-20 | Kelowna General Hospital | Kelowna | KGH Steam Plant Modifications | In Progress | 83,739 | 9,882 | 493.0 | 253,014 |
| 19-20 | Cottonwoods Care Centre | Kelowna | CTW Demand Response Pilot | In Progress | TBD | - | TBD | TBD |
| 19-20 | East Kootenay Regional Hospital | Cranbrook | GEM Venturi Pilot Project | Approved | - | TBD | TBD | 50,000 |
| 19-20 | Penticton Regional Hospital | Penticton | PRH PCT New Construction NG | Closed | - | 8,600 | 428.9 | 127,178 |
| 19-20 | Penticton Regional Hospital | Penticton | PRH PCT New Construction Elec | Complete | 1,625,481 | - | 4.2 | 243,822 |
| 19-20 | Kootenay Lake Hospital | Nelson | KLH Exhaust Fan VFD | Approved | 47,082 | 2,474 | 123.4 | 750 |
| 19-20 | Clinical Academic Campus | Kelowna | SMP DHW Boiler | Complete | - | TBD | TBD | 4,000 |
| 19-20 | Elk Valley Hospital | Fernie | EVH Boiler Plant Insulation | Closed | - | TBD | TBD | 5,904 |
| 19-20 | Nicola Valley Hospital and Health Centre | Merritt | NVH ED Expansion Insulation | Closed | - | TBD | TBD | 75,000 |
| 19-20 | Ponderosa Lodge | Kamloops | PON HVAC Upgrade Energy Study | In Progress | - | - | - | 12,000 |
| 19-20 | Royal Inland Hospital | Kamloops | RIH PCT Energy Model | In Progress | - | - | - | 25,000 |
| 19-20 | Kootenay Boundary Regional Hospital | Trail | KBH Energy Study | In Progress | - | - | - | TBD |
| 19-20 | East Kootenay Regional Hospital | Cranbrook | EKH EPC Energy Study | In Progress | - | - | 7.7 | 10,000 |
| 19-20 | Kootenay Lake Hospital | Nelson | KLH EPC Energy Study | In Progress | - | - | 4.0 | 10,000 |
| 19-20 | Shuswap Lake General Hospital | Salmon Arm | SLH EPC Energy Study | In Progress | - | - | - | 25,000 |
| 19-20 | Kelowna General Hospital | Kelowna | KGH Electrical Energy Study | In Progress | - | - | - | 9,790 |
| 19-20 | Vernon Jubilee Hospital (including Polson Tower) | Vernon | VJH Energy Study | On Hold | - | - | - | TBD |
| 19-20 | Ponderosa Lodge | Kamloops | PON HVAC Upgrades | Approved | | 2,219 | 110.8 | TBD |
| 19-20 | Kootenay Boundary Regional Hospital | Trail | KBH Emergency Department LEDs | In Progress | TBD | - | TBD | TBD |
| 19-20 | Kootenay Boundary Regional Hospital | Trail | KBH Emergency Department VFDs | In Progress | TBD | - | TBD | TBD |
| 19-20 | Logan Lake Health Centre | Logan Lake | LLC Furnace Replacement | Closed | - | 27 | 1.3 | N/A |
| 19-20 | Kelowna General Hospital | Kelowna | IH Fleet EV Pilot | In Progress | - | - | - | 12,000 |
| 19-20 | Kiro Wellness Centre (Formerly Kiro Manor ) | Trail | KWC RTU Replacement | In Progress | TBD | TBD | TBD | TBD |
| 20-21 | Cariboo Memorial Hospital | Williams Lake | CMH Energy Retrofits | Approved | - | 14,061 | 705.3 | 298,388 |
| 20-21 | *Facilities Vary | Varies | P3 Steam Traps | On Hold | - | TBD | TBD | TBD |
| 20-21 | Kootenay Boundary Regional Hospital | Trail | KBH New Construction Amb | Approved | TBD | - | TBD | TBD |
| 20-21 | Royal Inland Hospital | Kamloops | RIH Colonoscopy Room AHU | In Progress | - | 20 | 1.0 | N/A |
| 20-21 | Interior Health Data Centre | Kelowna | KDC Energy Retrofits | Opportunity | 259,740 | - | 0.7 | TBD |
| 20-21 | Kelowna General Hospital | Kelowna | KGH Electrical Energy Retrofit | Opportunity | - | - | - | TBD |
| 20-21 | Royal Inland Hospital | Kamloops | RIH New Construction | Approved | - | 16,947 | 852.7 | 346,321 |
| 20-21 | Cariboo Memorial Hospital | Williams Lake | CMH Redevelopment Phase 1 | Approved | - | TBD | TBD | TBD |

# BC Hydro Project Plan

| Fiscal Year | Facility Name | Community | Project Name | Status | Estimated Savings | | | Incentive |
|---|---|---|---|---|---|---|---|---|
| | | | | | kWh | GJ | tCO2e | |
| 18-19 | Queen Victoria Hospital and Health Centre | Revelstoke | QVH Energy Study | Closed | - | - | - | N/A |
| 18-19 | St. Bartholomew's Health Centre | Lytton | SBH Energy Study | Closed | - | - | - | N/A |
| 18-19 | Lillooet Hospital & Health Centre (Including Sumac Suites) | Lillooet | LIH Energy Study | Complete | - | - | - | 4,500 |
| 18-19 | Invermere & District Hospital | Invermere | IDH Energy Study | Complete | - | - | - | 4,700 |
| 18-19 | Cariboo Memorial Hospital | Williams Lake | CMH VFD Retrofit | Closed | 72,000 | - | 0.8 | 11,000 |
| 18-19 | *Facilities Vary | Varies | BC Hydro Lighting Retrofits | Closed | 240,000 | - | 2.6 | 40,628 |
| 18-19 | *Facilities Vary | Varies | BC Hydro COPs | Closed | 222,000 | - | 2.5 | N/A |
| 19-20 | Dr. Helmcken Memorial Hospital and Health Centre | Clearwater | DHH Energy Study | In Progress | - | - | - | 10,425 |
| 19-20 | Queen Victoria Hospital and Health Centre | Revelstoke | QVH Heat Recovery Chiller | In Progress | - | 2,100 | 128.4 | 109,000 |
| 19-20 | Queen Victoria Hospital and Health Centre | Revelstoke | QVH Electrical DSM Measures | In Progress | 486,871 | - | 5.2 | N/A |
| 19-20 | St. Bartholomew's Health Centre | Lytton | SBH Geothermal Heat Pump | In Progress | - | 1,350 | 82.6 | 62,000 |
| 19-20 | Royal Inland Hospital | Kamloops | RIH LED Upgrades Phase 1 | In Progress | 449,500 | - | 4.8 | 75,000 |
| 19-20 | Dr. Helmcken Memorial Hospital and Health Centre | Clearwater | DHH Exterior Lighting Upgrade | In Progress | 26,000 | - | 0.3 | 6,400 |
| 19-20 | *Facilities Vary | Varies | Energy Wise Network | In Progress | - | - | - | 1,200 |
| 19-20 | *Facilities Vary | Varies | BC Hydro Lighting Counts | Complete | - | - | - | 7,500 |
| 19-20 | Chase Health Clinic | Chase | CDF LED Lighting | Approved | 30,000 | - | 0.3 | 3,800 |
| 19-20 | Slocan Community Health Centre | New Denver | SCH VFD Upgrade | Approved | 19,605 | - | 0.2 | 3,500 |
| 19-20 | *Facilities Vary | Varies | Trane Heat Recovery Studies | Approved | TBD | TBD | TBD | TBD |
| 19-20 | East Kootenay Regional Hospital | Cranbrook | EKH EPC Energy Study | In Progress | - | - | - | 10,000 |
| 19-20 | Kootenay Lake Hospital | Nelson | KLH EPC Energy Study | In Progress | - | - | - | 10,000 |
| 19-20 | Slocan Community Health Centre | New Denver | SCH LED Upgrade | Approved | 42,400 | - | 0.5 | 7,100 |
| 19-20 | *Facilities Vary | Varies | TC LED Lighting Upgrades | Approved | 529,822 | TBD | TBD | TBD |
| 20-21 | Royal Inland Hospital | Kamloops | RIH LED Upgrades Phase 2 | Approved | 449,500 | - | 4.8 | 75,000 |
| 20-21 | Invermere & District Hospital | Invermere | IDH Heating Water Heat Pumps | Approved | - | 1,711 | 104.6 | TBD |
| 20-21 | Dr. Helmcken Memorial Hospital and Health Centre | Clearwater | DHH Boiler Retrofit | Approved | - | 997 | 61.0 | TBD |
| 20-21 | Cariboo Memorial Hospital | Williams Lake | CMH Redevelopment Phase 1 | Approved | TBD | TBD | TBD | TBD |
| 20-21 | Royal Inland Hospital | Kamloops | RIH New Construction | Approved | 708,035 | - | 7.7 | 450,000 |
| 20-21 | Cariboo Memorial Hospital | Williams Lake | CMH Energy Retrofits | Approved | 383,700 | - | 4.0 | - |

# Appendix D: Energy Project Opportunity List

## Provincial, Federal and Utility run Programs, Incentives, and Rebates

- BC Hydro/FortisBC Custom Programs for New Construction and Retrofit
    - Energy Audit – The buildings mechanical, electrical and controls systems are reviewed by an external consultant who identifies Energy Conservation Measures. The consultant may also estimate annual energy/cost savings, and the expected capital cost of implementation.
- Incremental Cost Incentive – For sites audited by an external consultant, utilities may grant capital incentives for the incremental cost of implementing the Energy Conservation Measures
- FortisBC Prescriptive Rebates
    - Rebates granted for the purchase and installation of approved energy efficient equipment (ex. condensing boiler, VFD, lighting fixture)
- BC Hydro/FortisBC incentive programs
    - Various other programs (lighting upgrade project, insulation, demand response, innovation, etc.)

## Retro-commissioning

- Review, test, verify, correct identified issues, and optimize operation of existing systems; includes equipment response and the sequence of operations (ex. re-balancing).

## Space-use changes

- The requirements for a space may have been reduced due to change of occupancy or the program run within the space (ex. 100% fresh air no longer required).

## Operator/Occupant Procedures

- Using the facility equipment in an efficient way (ex. turning off lights, ex. turning off kitchen range exhaust fan, ex. temperature setback for manual thermostats, etc.)
- Clean and remove obstructions from both fluid distribution systems and heat exchange surfaces; reduces fan/pump power requirements, and improves heat transfer efficiency
- Prevent DHW and DCW mixing

## Automation

- Controls addition/alteration
    - Prevent systems from fighting each other, optimize run-times, may include some or all of the opportunities listed below in “Automation”, etc.
- Optimize sequence of operations
    - At low or no cost, adjustments to the order and timing of equipment procedures can save energy and/or reduce system wear
- Hydronic distribution temperature reset/lockout
    - Adjust heating and cooling temperatures based on outdoor air temperature or other measurable parameters to avoid excessive and unnecessary heating and cooling
- Demand controlled pumping

    - Providing only as much flow as is required for terminal equipment, reducing pump motor electricity consumption
- Ventilation air temperature reset/lockout
    - Adjust heating and cooling temperatures based on outdoor air temperature or other measurable parameters to avoid excessive and unnecessary heating and cooling
- Demand controlled ventilation
    - Providing only as much ventilation as is required for occupants or processes; reduces fan motor electricity consumption (ex. fresh air, kitchen exhaust, combustion air)
- Scheduled equipment enable/disable (ex. night-time shutdown)
- Scheduled equipment set-point adjustments (ex. night-time setback)
- IFDD (Intelligent Fault Detection and Diagnostics)
    - The controls system automatically detects equipment failure (based on sensor feedback and deviation from expected system response), then alerts the operator of the fault with recommendations to resolve the issue.
- Pneumatic to electronic controls
    - Eliminates the requirement for compressed air and the associated air compressor(s), reduces maintenance requirements, and increases system reliability.
- Equipment staging (ex. cooling, fan wall, etc.)
    - Staging equipment operation allows optimal efficiency for variable loads (alternative is lower, part load efficiencies)

## Design/Configuration

- Plant re-design
    - Adjust equipment in series/parallel, equipment as primary/secondary, temperature requirements etc.
    - May include a combination of, but is not limited to the below "Design/Configuration" items.
- Right-sizing
    - Size equipment appropriate to the end use (ex. oversized boilers operate at a lower efficiency by wasting energy when cycling on and off)
- Mechanical room alterations; depending on equipment efficiencies, system load, and existing configuration, alterations may allow better utilization of existing equipment:
    - Decouple or couple building heating and DHW
    - Interconnect distributed building heating systems
    - Interconnect distributed building cooling systems
    - Interconnect distributed DHW systems
    - Centralize or de-centralize heating, cooling, and steam systems
- Boiler system configuration
    - Boiler piping for simultaneous high and low temperature connections – enables higher overall thermal efficiency for the mechanical system; also maximizes heat transfer and condensing efficiency for the boiler
    - High pressure steam bypass for lag boiler – allows preheat/keep warm without cycling lag/backup boiler
    - High efficiency burner retrofits – optimize combustion air delivery to improve boiler efficiency

    - Back end motorized valve retrofits – prevents standing losses (boiler cooling due to natural flow of air when not firing)
- Condensate collection and return
    - Return hot condensate to the system or for indirect preheat instead of passing to drain. The returned condensate is significantly higher temperature than domestic cold water and less energy for heating would be required.
- Preheat for fresh air, building heating, boiler feed water, or DHW from thermal sinks
    - MAU/RTU/AHU economizer, run around heat recovery, boiler economizer
    - Thermal sinks, Flue gas, condenser water, exhaust air, waste water, condensate to drain, dryer exhaust, etc.
- 3-way hydronic coil valves retrofitted to 2-way with variable pumping
    - Three-way valves for hydronic coils reduce flow by bypassing all flow not required by the coil; total flow does not change and overall system flow reduction is limited by the most demanding coil.
    - Two-way valves for hydronic coils reduce flow by throttling flow passing through the coil; total flow is reduced and overall system flow reduction is balanced to provide optimal flow to each coil.

## Equipment

Upgrading equipment to more efficient models, or replacing the equipment with a different technology that satisfies the same loads.

- Supply/Major Equipment
    - Natural Gas – Boiler, Steam Boiler, Water Heater
    - Electricity – Chiller/Multi-stack/HRC, Heat Pump, Water Heater
    - Efficient (ex. high COP, condensing) RTU, MAU, AHU, Furnace
    - Variable Speed Air Compressors
    - Direct and indirect free cooling (ex. economizer)
    - Air, Ground, Water source rejection/recovery
    - Biomass, solar PV, solar thermal, solar wall, and/or other alternative energy
- o Terminal/Intermediary Equipment
    - Interior and Exterior Lighting (Ex. T12/T8/MH/CFL/HAL/Inc. to LED)
    - Steam Trap Audit & Replacement (Ex. Mechanical or thermodynamic to Venturi) – prevent steam loss and condensate backup improving process and overall system efficiency
    - VSD on Fan and Pump Motors – Reduces motor wear and electricity consumption
    - Pipe and Tank Insulation – Reduces heat losses/gain to ambient
    - Kitchen and Laundry Equipment
    - Efficient radiant tube and unit heater

## Building Envelope

- Windows (1 pane leaky to 2 or 3 pane tight)
- Insulation
- Infiltration/exfiltration prevention at entrances and exits
    - Weather stripping and sealing

# Appendix E: Site by Site Opportunities

# Thompson Cariboo

## NVH: Nicola Valley Hospital and Health Centre

Address: 3451 Voght Street, Merritt
Preliminary Discussion: July 2nd 3:15PM
Site Visit: Mon 8-Jul-2019 9:00AM-12:00PM

- *[1]General SF and EF improvements: General EF VFD addition, SF and EF optimization, heat recovery retro-commissioning
- *[2]VFD for AHU-2
- Interior and exterior lighting upgrades to LED and controls (bundle with potential lighting addition to parking area?)
- VFDs for AHUs and pumps
- Decouple DHW system
- Hot water and cold water set-points reset based on OAT
- Boiler/heating system insulation (expansion tank, fittings, etc.)
- Heating boiler optimization (especially in shoulder and summer seasons)
- System rebalancing/retro-commissioning (especially for systems impacted by the emergency addition)
- Two AC units in general area and one AC unit in morgue are water cooled to running straight to drain
- Three way valves on AHUs (savings dependent on VFDs/controls)
- Exhaust for decontamination running 24/7

## CGH: Gillis House

Address: 1699 Tutill Court, Merritt
Preliminary Discussion: July 2nd 3:15PM
Site Visit: Mon 8-Jul-2019 12:30PM-1:30PM

- *Temperature is felt by occupants to be too cold because unit is cycling on and off without VFD
- Automation addition/upgrade to coordinate systems that are at times fighting each other (ex. wall radiators and hallway air)
- Interior and exterior lighting upgrade to LED
- Fix the wall radiators that have failed open heating actuators; causing cooling to run excessively
    - Could manually turn off heating because there is some air distribution from RTUs in the space
- Install VFDs on pumps and fans (ex. heating water circulation to radiators)
- AC for walk-in cooler is water cooling straight to drain
- Upgrade the three building heating/DHW atmospheric boilers to condensing boilers
- Decouple building heating and domestic hot water systems
- Hot water set-point reset based on OAT for radiant heating loop
- Kitchen MAU running 24/7 (this was due to an issue with smell, but should be corrected as soon as it is no longer required)
- Fresh air intake for the RTUs is installed adjacent to the hot condenser exhaust.

## LLC: Logan Lake Health Centre

Address: 5 Beryl Drive, Logan Lake
Preliminary Discussion: July 3rd 11:15AM
Site Visit: Mon 8-Jul-2019 2:30PM-4:00PM

- *Opportunity to replace/modify existing T12 and T8 fixtures or bulbs with LED
- Duct return air to the currently 100% fresh air furnace unit and recirculate
- Install VFDs for the furnace fans (long payback expected as fans only run when required for space conditioning)
- Coordinate HVAC systems with DDC/BMS and optimize (long payback expected due to small size and typical use of the site)
    - Ex. Return air damper position based on AHU status, could modulate based on return air PPM of CO2
- Insulate attic ducting

## AHH: Ashcroft Hospital and Community Health Care Centre

Address: 700 Hwy 97C Ash-Cache Creek Highway, Ashcroft
Preliminary Discussion: July 3rd 11:15AM
Site Visit: Tues 9-Jul-2019 8:30AM-10:30AM

- *[1]Lighting upgrades to LED (bulb replacements, entire fixture replacements, and/or fixture internal component replacements)
- VFDs
    - *[2]Install VFDs for 100% fresh air AHUs (AHUs with manually increased static pressure are priority)
    - Install VFDs on DHW, building heating, and preheat pumping distribution
    - Install VFD and/or interlock for boiler combustion supply fan
- System changes → cooling and heating running 24/7 with fixed set-points, 100% fresh air on AHUs
    - Three atmospheric boilers (GT 400 A Series), one could be decoupled for laundry and DHW allowing the other two reset their temperature set-points referencing OAT
    - Install AC split to decouple Lab cooling (primary cooling loop can turn off)
    - Reset primary cooling loop set-point referencing OAT
    - 100% fresh air on the AHU's is no longer required due to repurposing of the space (no longer acute care). Opportunity to add return air to AHUs and recirculate.
- Insulation
    - No reflective ceiling/insulation in boiler room resulting in "in floor heating", causing the rooms located directly above to overheat. (Likely not required if condensing boilers were installed/decoupled and hot water set-point was reset based on OAT)
    - Pump bodies and some fittings missing insulation in boiler room
    - Upstairs mechanical room piping needs insulation but work being done replacing coils, insulation should be installed after the coil replacements are completed (expected next fiscal)
- Decommissioned heat recovery system is active with compressors; has been looked at a number of times but could be reinvestigated.
    - If we were to install VFD's on the AHU's we would significantly reduce consumptions, causing the payback for this measure to extend.

- Similarly, if we were to add return air to the AHU's the payback would extend.
- Another option would be to add a simple runaround heat recovery loop
  - Although it is possible, it is unlikely the coils could be re-used, however there is already space to install new coils on both the AHUs and EFs
  - Would not have the same effective temperature range, but would much simpler and less costly to operate.

## OMH: 100 Mile District General Hospital

Address: 555 Cedar Avenue South (C), 100 Mile House
Preliminary Discussion: Discussion July 3rd 2:00PM
Site Visit: Tues 9-Jul-2019 12:30PM-4:30PM

- *[1]Suitable site for funded Energy Study through FortisBC/BC Hydro Custom Programs
- *[2]Lighting upgrades to LED (bulb replacements, entire fixture replacements, and/or fixture internal component replacements)
- Opportunity for VFDs and on pumps and fans (roughly 1/4 of pumps and 1/2 of AHUs currently on VFDs)
  - Subsequent optimization based on demand, schedules, etc.
- Decouple boiler system in mill site lodge and add small electric heater for hot water tanks.
  - Subsequent hot water set-point reset based on OAT
- Insulation
  - Heating system piping and some equipment not insulated (air separator, heat exchanger, etc.)
  - Lots of insulation missing on ducting, mixing boxes, etc.
- FP addition RTUs installed inside
  - Design/installation not ideal

## CMH: Cariboo Memorial Hospital

Address: 517 6th Avenue North, Williams Lake
Preliminary Discussion: July 3rd 12:15PM
Site Visit: Wed 10-Jul-2019 8:00AM-12:00PM & Wed 10-Jul-2019 12:30PM-3:30PM

- *[1]Lighting upgrades to LED (bulb replacements, entire fixture replacements, and/or fixture internal component replacements)
- *[2]Steam trap upgrades - GEM Venturi Steam Trap Pilot
- *[3]Solar Wall installation for ventilation preheat
- Decouple DHW and building heating systems
- Install boiler economizer for building heating boilers
- 2nd chiller VFD was planned but removed from scope (due to cost?)
- Small water cooled chiller for maternity/telehealth/storage and one walk in cooler are both straight to drain
- Some opportunity for insulation, maybe 100ft of piping and some heating equipment (ex. tanks)
- Optimization
  - Mixing boxes for SF1 can be scheduled to back off more at night (no physical work required)

- Recently added VFD’s in the last year for heating and cooling distribution (not sure whether they are ramping, likely running 100%)
- Air balancing → some spaces (entire zones/hallways) over-cooling in order to meet requirements in other areas
- Scheduling → not all of building occupied 24/7, but AHUs continue to run 24/7
  - Potential to turn or ramp down (to control for temperature only when not concerned with fresh air)

* Unit SF9 for the vault is constantly running and overcooling the space due to communications room connection
  - Could alter HVAC and put SF9 on a VFD to appropriately condition both rooms.
* Move undersized EF3 VFD to EF4 with new one for EF3
  - EF3 VFD currently sits at 50%-60%? And cannot run higher due to undersized VFD
  - Overall this measure may actually increase energy consumption, but should be reviewed.
* SF2 decouple MDR from OR, PAR etc. (MDR is always hot requiring 12°C supply air)

## SHL: South Hills Tertiary Psychiatric Rehabilitation Centre

Address: 945 Southhill Street, Kamloops
Preliminary Discussion: July 4th 11:15AM
Site Visit: Thurs 11-Jul-2019 9:30AM-10:30AM

- *[1]No BMS: Mechanical systems are not coordinated and are sometimes fighting each other (ex. simultaneous heating and cooling)
  - Controls for in floor heating is obsolete, some actuators likely failed open.
- *[2]Heating system can be shutoff in the summer
- Economizers may not be tracking properly – should be reviewed and if necessary optimized
- Windows all need to be replaced, put into capital, all seals destroyed/warped between glass panes (very leaky)
- Lighting
  - Outside lights 175W metal halide
  - Exit lighting is not LED
  - *[3]Interior lighting CFL (being replaced with LED as they fail)
- RTU fans are on/off and run 24/7 with no set point adjustments.
  - When RTUs are replaced, could be replaced with RTUs that have integrated heat pumps and variable fans.

## OVH: Overlander Extended Care

Address: 953 Southhill Street, Kamloops
Preliminary Discussion: July 4th 11:15AM
Site Visit: Thurs 11-Jul-2019 10:30AM-12:45PM

- *[1]RTUs have heat pumps that have never been used for heating
- *[2]Building heating boilers can be shut down for summer season
- *[3]Opportunity to replace/modify existing T12 and T8 fixtures or bulbs with LED
- May be a suitable site for an externally funded Custom Study in 1-2 years.
- Could use VFDs and hot water set-point reset for:

    - Glycol loop for RTUs
    - Building heating loop for radiant
    - Mechanical room heating circulation (less attractive because pushing through both boilers and heat exchangers always, unlikely attractive payback to make associated system adjustments but could be reviewed)
- Expansion tank for boiler not insulated, and some opportunity for fittings, etc.
- Fridge/freezer water cooling straight to drain
- Opportunity to use existing Willow and Peach VFDs (which always 50hz) to vary based on demand
- Kitchen exhaust on timer runs during the day, potential for runaround heat recovery from this unit to preheat AHU outdoor air
- Install VFDs for B building Pumps and fans then optimize
- Condenser water for chiller in B building could be used to preheat DHW
    - Chiller in building B may need to be replaced → Good opportunity for Heat Recovery Chiller (HRC)?
    - In A building could do similar for DHW and boiler if chiller reinstalled (piping still exists) → HRC?

## HLS: Hillside Centre - Interior Adult Psychiatric Centre

Address: 311 Columbia Street, Kamloops
Preliminary Discussion: July 4th 12:48PM
Site Visit: Thurs 11-Jul-2019 1:30PM-3:00PM

- *[1]Dampers not opening and closing as intended (ex. staying open too long)
- *[2]Building heating and DHW boilers can be decoupled
- *[3]Heat Pump optimization – run more than intended since NAE changed approximately two years ago.
- AHU1, AHU2 and the two exhaust fans are already on VFD's however there may be opportunity to improve scheduling
- Lighting upgrades to LED (bulb replacements, entire fixture replacements, and/or fixture internal component replacements)
- Three way valves on AHUs, could use VFDs and switch to 2-way with bypass (expected long payback).
- Heat recovery unit (reversing air flow) is on compressed air. Could be digital, however very small loop, sealed well, compressor barely runs (expected long payback).

## PON: Ponderosa Lodge

Address: 425 Columbia St, Kamloops
Preliminary Discussion: Unsuccessful
Site Visit: Fri 12-Jul-2019 9:00AM-12:00PM & Fri 12-Jul-2019 12:30PM-2:30PM

- *[1]Re-pipe multi-zone unit for simultaneous heating and cooling
- *[2]Install VFD for the multi-zone unit fan
- *[3]Heating water set-point reset based on OAT
- *[4]Opportunity to replace/modify existing T12, T8, and other fixtures or bulbs with LED

- Multi-zone damper for the unoccupied third floor could be closed (some concerns with freezing, should be reviewed and tested)
- Install VFDs for pumps (only two VFDs are for chiller loop)
    - Chiller pump VFDs currently on override because the system is having issues getting flow upstairs to the multi-zone unit (issue observed in cooling season only). This is likely an issue that would be fixed with balancing and/or retro-commissioning.
- Windows never updated; double pane, but old and leaky
- BMS retro-commissioning. Some points in override, some modulation not occurring. Not using systems as efficiently as possible. Can potentially incorporate other measures.
- Utilize buffer tank (asbestos testing required)
    - Requires further review to determine potential benefits. What was the previous use?

## Kootenay Boundary

### Boundary District Hospital

7649 22st, Grand Forks
Preliminary Discussion: 04-Jun-2019 2:15PM
Site Visit: Mon 10-Jun-2019 1:30PM-3:30PM

- Stage Chillers: Two isolated chillers cool separate areas, however the physical connections are in place to run one or the other serving both areas. Could automate to run the more efficient chiller and have it cycle less frequently, reducing energy and maintenance costs.
- VFDs for pumps/fans motors
- Potential to adjust set points in laundry equipment and other areas
- Add recirc air to existing AHUs
- Heating boilers servicing hospital nearing end of life
- Insulation for condensate on Carrier Chiller
- High efficiency Air Source Chiller for Extended Care
- Insulate Condenser water piping ~42C
- Some pneumatic controls, could be replaced with electric

### Kootenay Lake Hospital

3 View St, Nelson
Preliminary Discussion: 04-Jun-2019 12:26PM
Site Visit: Tues 11-Jun-2019 8:30AM-12:00PM

- *[1]Tie in Multi-stacks (providing cooling for all AHUs) to city water main to increase heat rejection
- *[2]Installation of VFD to kitchen hood exhaust fan to control speed (sensors, schedule or tied to supply)
- Mitsubishi heat pump three way valve
- AHU-1 potentially passing replace actuators and dampers
- Steam system analysis – decommission existing electrical/natural gas steam generators and replace with "point of use" generation
- DHW boilers potentially oversized and near end of life, replaced with higher efficiency & modulation boilers
- Heating boilers near end of life

- Rebalancing of entire hospital
- Continue replacement of T8 fixtures with LED bulbs purchased through FortisBC incentive program
- Occasionally, AHU runs the heating and cooling coils simultaneously.

### Nelson Jubilee Manor

500 Beasley St W, Nelson
Preliminary Discussion: 04-Jun-2019 12:26PM
Site Visit: Tues 11-Jun-2019 1:00PM-2:30PM

- Due to age and likelihood of decommissioning capital opportunities not considered, though opportunity to recommission ASHP may be worth further investigation.

### Victorian Community Health Centre

673 A Ave, Kalso
Preliminary Discussion: 04-Jun-2019 1:00PM
Site Visit: Wed 12-Jun-2019 8:30AM-9:30AM

- *Replace existing DHW boiler with two condensing boilers (including insulation)
- VFD for heating system
- *Install tempering valve on outlet of DHW tank
- Kitchen AHU using city water for cooling – replace with ASHP
- Replace thermostat with ability to mix multiple sensor points
- Optimization of two ASHP

### Arrow Lakes Hospital

97 1 ave NE, Nakusp
Preliminary Discussion: 05-Jun-2019 ~11:00AM
Site Visit: Wed 12-Jun-2019 11:00AM-12:30PM

- Replace 3 AHUs and condensers with ASHP
- *Replacing T8 with LED bulbs (estimated half of site)
- *VFD on three AHU none functional (VFDs are for fans) replace with new VFDs
- BMS modernization & retro commissioning
- Insulate heating system piping

### Slocan Community Health Centre

401 Galena Ave, New Denver
Preliminary Discussion: 04-Jun-2019 2:38PM
Site Visit: Wed 12-Jun-2019 2:00PM-3:00PM

- *Convert existing T12/T8 (metric) to LED retrofit kits. (200-300 fixtures)
- *VFD on 4 fan motors (5hp each) in health centre including scheduling for un-occupied periods
- VFD on 4 fan motors (5hp/7.5hp) in long term care combined with CO2 sensors
- Optimization of two ASHP including potentially utilizing for shoulder season heating
- Optimization of AHU serving long term care including using economizer mode

- Potential for input into new WWTP pumping design
- BMS modernization & retro commissioning

## Kootenay Boundary Regional Hospital

1200 Hospital Bench, Trail
Preliminary Discussion: 04-Jun-2019 11:01AM
Site Visit: Thurs 13-Jun-2019 8:30AM-2:30PM

- *New 400 ton chiller replacement, potential to either incorporate first stage heat pump or HRC for heating/DHW serving portion of hospital
- *Replace 180 ton (operating as 90 ton) air source chiller potential to include a first stage heat pump for heating water in penthouse mechanical rooms
- Opportunity for VFD on fan/pumps motors throughout hospital mechanical rooms
- *Stack Economizer for steam boiler feed water preheat
- Steam Condensate DHW pre-heat
- Dishwasher replacement potential for electric pre-heat
- Range hood replacement project – potential DCV
- Steam metering to optimize control of 3 boilers
- Thermal Insulation for exposed piping/equipment in mechanical rooms
- Thermal Insulation for exposed piping concealed in dropped ceiling throughout the hospital
- *Incentive from FBC on LEDs installed for first phase of emergency expansion
- Replace controls with electronic
- Condensate going to drain
- Shoulder season boiler piped to drum of volcano boilers to keep warm
- Steam traps audit & steam piping leak detection

## Columbia View Lodge

2920 Laburnum Dr, Trail
Preliminary Discussion: 04-Jun-2019 1:49PM
Site Visit: Thurs 13-Jun-2019 2:30PM-3:30PM

- *Main boilers are inefficient atmospheric which feeds heating distribution, glycol distribution through shell and tube heat exchangers and also feeds the domestic system during the winter. One could be replaced with modular condensing boiler system.
- Opportunity for VFD’s on all hydronic pumping distribution, could install 2-way valves on AHUs. Would prevent bypass fluid and allow VFD to reduce.
- $CO_2$ sensor could be installed in the dining/group area. When there are events, $CO_2$ might get very high. Windows are opened to ensure this doesn’t happen. More of a safety/comfort measure, but could allow fan slow down and speed up as needed instead of on schedule.

## Kiro Wellness Centre

1500 Columbia Ave, Trail
Preliminary Discussion: 04-Jun-2019 11:35AM
Site Visit: Thurs 13-Jun-2019 3:30-4:30PM

- *1 RTUs currently approved for replacement

- *2 Recommission and automate setback control panel in basement for wall FF/radiant heaters.
    - Not currently being used, state unknown/untested.
    - Panel includes switches for each radiant heater on the front of the panel. Inside is the transformer, a timer, and the connections. Each thermostats has the ability to setback, all connections are brought down to the basement to the individual switches to enable/disable.
- Exhaust from most internal spaces is natural convection. Back of facility has individual exhaust fans (larger stacks). A number of the natural exhausts were ducted together to a central exhaust fan.
    - Current benefit is that more airflow reaches these rooms. How effective is this? Should it be repeated for other spaces, or altered?
    - The fan is not automated. Runs continuously? Increases heating loads? Could benefit from review and potentially automation!
- Add BMS to automate RTUs, rooms, and exhaust systems (individual and ducted)
    - Could save energy by preventing simultaneous heating and cooling and reducing ventilation air based on CO2 readings.
- Insulate RTU rooftop ducting; only has reflective coating.

### Castlegar Health Centre

709 10 st, Castlegar
Preliminary Discussion: 04-Jun-2019 2:18PM
Site Visit: Fri 14-Jun-2019 9:00AM-11:00AM

- *1 RTUs currently approved for replacement
- *2 Recommission and automate setback control panel in basement for wall FF/radiant heaters.
- Not currently being used, state unknown/untested.
- Panel includes switches for each radiant heater on the front of the panel. Inside is the transformer, a timer, and the connections. Each thermostats has the ability to setback, all connections are brought down to the basement to the individual switches to enable/disable.
- Exhaust from most internal spaces is natural convection. Back of facility has individual exhaust fans (larger stacks). A number of the natural exhausts were ducted together to a central exhaust fan.
- Current benefit is that more airflow reaches these rooms. How effective is this? Should it be repeated for other spaces, or altered?
- The fan is not automated. Runs continuously? Increases heating loads? Could benefit from review and potentially automation!
- Add BMS to automate RTUs, rooms, and exhaust systems (individual and ducted)
- Could save energy by preventing simultaneous heating and cooling and reducing ventilation air based on CO2 readings.
- Insulate RTU rooftop ducting; only has reflective coating.

## East Kootenay

### CVH (+CMN): Creston Valley Hospital & Health Centre (+Creston Mental Health Centre)

Address: 312 15th Avenue North, Creston
Preliminary Discussion: August 22nd, 2019

Site Visit: September 3rd, 2019

- *[1]AHU VFDs and Optimization
    - 4 100% fresh air AHUs running 24/7
    - Install VFDs and add both run time and run capacity schedules
    - For the AHU serving the operating rooms, add override button for this one for after hours use
- *[2]Kitchen VFD and DCV: Exhaust running 24/7, while kitchen use is scheduled and production has been lowered
- Install VFDs for pumps (all are on/off, ex. distribution pumps)
- *[3]Lighting: Interior - 111 hallway fixtures 2ft x 2ft with 4 bulbs in each
- Steam MDR boiler replacement with point of use generation (instead of trap and distribution replacement/improvement)
- 3-way pneumatic preheat, heating, and cooling valves being worked on and need to be replaced
    - Potential to switch to 2-way valves - would require bypass, VFDs, and BMS coordination.
- Upgrade the American Standard Axial fans (very aged, inefficient belt drives, lots of maintenance, and higher than necessary operating costs)
- Poor building envelope
- Typical (not efficient) air compressor for pneumatic controls and some electronic (probably ~60-70% of facility controls still pneumatic, there is some leakage)
    - Ideally decommission when all electronic controls
- Could bring more systems online Care Systems BMS and coordinate them (VFDs required to maximize savings)
    - Night setbacks and better scheduling, unable to do it in all cases due to nature of industry
    - Could add occupancy and or CO2 sensors
    - Hot-deck cold-deck system, some floating setpoints, some not
    - Operators observed some systems to be simultaneously heating and cooling the same spaces
- Boiler plant due for replacement
    - Should discuss opportunities to incorporate into the future capital project, condensing, HRC, decouple, VFD, etc.
        - First boiler to be replaced with modular condensing
        - Second boiler to be replaced with heat recovery chiller – building heating and DHW
        - Decouple DHW
- 1 DHW storage tank has been decommissioned – use as buffer tank?
- DCV for Mental Health (CMN) with Radon sensor

## SVL: Swan Valley Lodge

Address: 818 Vancouver Street, Creston
Preliminary Discussion: August 22nd, 2019
Site Visit: September 3rd, 2019

- *[1]Boiler control optimization, staging/load balance, and setpoint reset based on OAT (htg + clg?)
- *[2]Interior/Exterior lighting upgrade to LED
- *[3]Retro-commissioning

    - Rebalancing, dampers not all matching balancing indicators, coils plugged?
    - Active heat recovery ventilators (control issues?)
- Boiler/hot water tank replacement with condensing (and/or instantaneous)
- Boiler system decoupling
- VFDs for fans (ex. AHUs)
- VFDs for pumps (review system for potential; ex. cooling tower pumps)
- Solar shades
- Potential for radiator valves passing (may be causing or exacerbating cooling issues)
- Two controls systems likely fighting each other + standalone systems (furnaces + radiator zone thermostats)
    - Is this causing the cooling capacity issues? (i.e. cooling capacity fine but increased load due to partially passing radiators)
- DCV and electric starts on kitchen equipment (decommission small exhaust fan?)
- Dishwasher booster is currently undersized (40amp); with the new dishwasher, a new booster (90amp) is to be installed so that the DHW can remain at 130°F

## EKH: East Kootenay Regional Hospital

13 24th Avenue North, Cranbrook
Preliminary Discussion: August 23rd, 2019
Site Visit: September 4th, 2019

- *[1]JC Energy Audit
    - How to breakdown ECM costs for FortisBC. Can all associated costs (PM, engineering, their markup) be grouped so that each measure is a line item, and incentive is based on that? Do we need to see strict construction costs (i.e. show invoices to JC and invoices to IH from JC), identifying relationships.
- *[2]Replace existing mechanical steam traps with GEM Venturi steam traps
- Interior/exterior lighting upgrade to LED
    - Interior lighting: tube lighting T12 and T8 + other to convert to LED, complete detailed lighting count
    - Exterior lighting: ~102 150-250W to convert to LED, complete detailed lighting count
- Decouple DHW from building heating boilers and install modular condensing boilers
- Replace building heating boilers with modular condensing boilers
- Increase size of F21 (+F20) heat exchangers so that increased boiler loop temperatures (up to 205°F) are no longer required form the central boiler plant
- Further reduce boiler setpoint and implement setpoint reset based on OAT (requires other measures to be implemented)
- Decouple kitchen hot water (180°F required only for kitchen) from DHW (COMPLETE!)
- VFDs on primary and distribution pumps (+ optimization for existing and new VFDs)
    - Ex. VFD optimization for cooling tower pumps (observed to be running at 100% when cooling towers and chillers at part load)
- Complete review and optimization of equipment run/setback schedules (ex. AHUs) where appropriate
- BMS currently used for primarily monitoring. Review opportunities for automation and optimization.
- Potential for free cooling with existing systems
    - Review runaround heat recovery system for GSF and GEF

    - Review runaround heat recovery systems for 2006-2008 expansion penthouse mechanical
- Replace remaining pneumatic controls with electronic and decommission compressor
- Lab and OR cooling → Decouple for shoulder season and reducing peak load on main system (may improve chiller efficiency)

## CBK (+CWC+RML): Cranbrook Health Centre (+Cranbrook Wellness Centre +Cranbrook Home Support Services)

Address: 20 23rd Avenue South, Cranbrook
Preliminary Discussion: August 23rd, 2019
Site Visit: September 4th, 2019

- RTU ventilation and temperature setback schedules
- *[1]MAU optimization
    - Runs at 100% 24/7 with hand switches that are not used where the space use has changed from Health Care to Offices.
    - Install VFDs for MAUs (x2)
    - Implement run schedules, temperature setback, and ventilation setback schedules
- Install BMS to automate and optimize RTU operation + coordinate with boiler/radiant systems
    - There has been observed simultaneous heating and cooling of the spaces (individual thermostats for radiant heating in each zone, AC only from RTUs).
- Retro-commission radiant heating zone valves
- Retro-commission RTU economizers
- Lighting (complete count)
- Modular condensing boilers for DHW
- Upgrade to new high efficiency heat pump/hybrid RTUs

## FWG: Dr. F.W. Green Memorial Home

Address: 1700 4th Street South, Cranbrook
Preliminary Discussion: August 23rd, 2019
Site Visit: September 4th, 2019

- *[1]Boiler system upgrades and optimization
    - Atmospheric heating boilers upgrade to modular condensing
    - Atmospheric hot water heaters upgrade to modular condensing
    - Decouple heating and hot water boilers
    - Explore possibility of building heating boiler systems' interconnect
    - Boiler controls and operation optimization (staging, summer shutdown, setpoint reset based on OAT, +interconnect sequence of operations)
    - *EM will complete a high level boiler plant replacement/upgrade energy savings analysis.
- *[2]Lighting (complete count)
- Retro-commission radiant heating valves
- Retro-commission RTU economizers
- VFDs for pumps
- VFDs for fans

- Install BMS to automate and optimize RTU operation (+ coordinate with boiler/radiant systems).
    - There has been observed simultaneous heating and cooling of the spaces (individual thermostats for radiant heating in each zone where AC only from RTUs; ex. dementia wing and care rooms throughout).

## TAM: Tamarack Cottage

Address: 2005 5th Street North, Cranbrook
Preliminary Discussion: August 23rd, 2019

Site Visit: September 4th, 2019

- Lighting
- More efficient appliances
- No BMS, however little opportunity to utilize one
    - Any scheduling or CO2 sensor based reductions in ventilation would likely not be acceptable at this site due to both radon levels and space use (observed stale air)
    - If not already in effect, could schedule temperature setbacks with thermostats

## CLO: Kootenay Clover Club House

Address: 400 Victoria Avenue North, Cranbrook
Preliminary Discussion: August 23rd, 2019
Site Visit: September 4th, 2019

- *Lighting
- Involve Energy Management when boiler to be replaced (~$1500 rebate for condensing 162 MBH)
    - Variable pump for heating hydronic distribution
    - Single DDC controller that varies pump speed and hydronic distribution temperature
    - Combine with boiler replacement project if possible

## KSH: Kimberley Special Care Home

Address: 386 2nd Avenue, Kimberley
Preliminary Discussion: August 23rd, 2019
Site Visit: September 4th, 2019

- *Lighting
- Retro-commission radiant heating valves
- Retro-commission RTU economizers
- VFDs for pumps
    - Building heating boilers not running in condensing temperature range. Should slow speed to reduce return water temperature and increase boiler efficiency.
- VFDs for fans
- Install BMS to automate and optimize RTU operation (+ coordinate with boiler/radiant systems).
    - There is potential for simultaneous heating and cooling of the spaces (individual thermostats for radiant heating in each zone, AC only from RTUs as an add-on).
- Upgrade DHW boiler to condensing or instantaneous
- Decouple kitchen from DHW (or add boosters)

- If increasing cooling capacity, engage Energy Management for possible rebates and efficient options
- Upgrade to new high efficiency heat pump/hybrid RTUs

## EVH (+FHC): Elk Valley Hospital (+Fernie Health Centre)

Address: 1501 5th Avenue, Fernie
Preliminary Discussion: August 23rd, 2019
Site Visit: September 5th, 2019

- *Lighting - complete detailed count – type and estimated run hours
    - Metric kit sample
    - Installation requirements
    - Exterior lighting – review light sensors
- Decommission steam boiler system and install to point of use steam generators
- Retro-commission radiant heating valves (some believed to be passing)
    - Potentially heating and cooling same spaces
- Close backup pump isolation valves to prevent short circuiting (CHECK!)
- VFDs for pumps
- VFDs for fans
    - For supply fan VFD, should maintain positive pressure
- Protection for air cooled chiller (i.e. hail) and/or straightening of fins
- Convert existing pneumatic controls to electronic and remove compressor
- Convert coil 3-way valves to 2-way valves (requires bypass and VFD for significant energy savings)

## SWH: Sparwood Primary Health Care

Address: 570 Pine Avenue, Sparwood
Preliminary Discussion: August 23rd, 2019
Site Visit: September 5th, 2019

- *Lighting - complete detailed count – type and estimated run hours
    - Metric kit sample
    - Installation requirements
    - Exterior lighting – review light sensors
- Atmospheric boiler replacement with modular condensing boilers
- VFDs for fans
    - VFD optimization (incl. schedules/setbacks) for existing (AH-1 and RF-4) and new VFDs
- Pump for the standard efficiency boiler (and primary loop bypass?) to maintain required boiler flow
- Heating pump VFDs
    - Consideration - need to maintain appropriate boiler flow
    - Control to desired return water temperature for each distribution loop
- Replacement of remaining original rooftop cooling unit with high efficiency unit
- OAT sensor replacement/repair and use for boiler setpoint reset
- Convert existing pneumatic controls to electronic and remove compressor
- Optimize RTU scheduling/setbacks

## EHC: Elkford Health Care Centre

Address: 212 Alpine Way, Elkford
Preliminary Discussion: August 23rd, 2019
Site Visit: September 5th, 2019

- *[1]Lighting - complete detailed count – type and estimated run hours
    - Metric kit sample
    - Installation requirements
    - Exterior lighting – review light sensors
- BMS to coordinate RTUs and radiant heating to prevent simultaneous heating and cooling of the same spaces where possible
- Retro-commission radiant heating valves
- *[2]RTU scheduling, setbacks, and thermostat physical locations
    - Not a 24-7 facility (8-4:30 5 days a week) however heating, cooling, and fan systems run 24-7
- Condensing hot water boilers for building heating
- Condensing hot water tank (however current was installed in 2017)
- VFD for heating pump(s)
- If not already in place, implement hot water reset for boiler control system

## IDH (+IHC+CLH): Invermere & District Hospital (+Invermere Health Centre +Columbia House)

Address: 850 10th Avenue, Invermere
Preliminary Discussion: August 23rd, 2019
Site Visit: September 6th, 2019

- *[1]Lighting upgrade to LED (currently ~1% inside LED, 60% outside LED)
- *[2]Kitchen Improvements
    - Much less kitchen use than in the past; MAU and range EF interlocked, on/off, based on schedule 540am to 710pm
    - Able to turn off at night despite pilots because dishwasher EF runs 24/7; can install VFD with cooking sensors and vary speed during occupied hours
    - Replace MAU; kitchen MAU indirect fired propane 75% efficient nameplate, likely operating at less than 60%
- *[3]AHU-F Improvements
    - Run around heat recovery offline due to exhaust air coil damage
    - Can also add return air to this unit with economizer; likely a space use change where there used to be the need for 100% fresh air
- VFDs for pumps (currently none)
    - Ex. heating distribution pumps (i.e. based on return temperature sensors for radiant loops?)
    - Lower return temperature will improve existing condensing boiler efficiency
- VFDs for fans (1 fan has VFD – should review scheduling)
    - Ex. Columbia House AHUs
- Upgrade remaining boilers to condensing

- Pneumatic controls (compressor runs pretty steady) (pneumatic valves ~80%); leakage despite best efforts as the system is aged
- Standalone thermostats for zones; in summer cooling down primary air supply where spaces heating with radiant (simultaneous htg/clg of spaces)
- Water reciprocating vacuum pump, uses significant amount of water. Already planning to replace!
- Review and adjust AHU setpoints, schedules, and sequences of operation

Other:

- Access to bms? IDHENVC3 – always ask operators to use first – note that software required to remains open on logged in user

## GDH: Golden & District Hospital

Address: 835 9th Avenue South, Golden
Preliminary Discussion: September 23rd, 2019
Site Visit: October 3rd, 2019

- *[1]Lighting upgrade to LED
    - T8s being changed to LED as they fail (still a lot of T8)
    - Durand Manor: ~3 4-pin socket CFL fixtures per room (28 rooms – 84 total) and CFL sconces throughout
- Automation
    - *[2]Automate/schedule exhaust fan control panel
    - Forced flow heaters at doors, garage, workshop, community entrance, etc. not integrated. Likely heating in shoulder season and/or fighting cooling system.
    - Scheduled ventilation/heating/cooling setbacks based on occupancy
    - Some distributed systems not integrated well, half finished programming
    - Integrate equipment in Durand Manor: Only equipment on BMS are the AHUs
        - Each room has a standalone pneumatic thermostat for radiant valve heating - AHUs and Radiant heating may be fighting each other.
- Install VFDs for pumps and vary based on demand (currently no pump VFDs)
- VFDs for fans
    - Only isolation room exhaust fans (2x) have VFDs
    - Significant opportunity for further review however cannot reduce CFM to specific zones.
        - Ex. MZ-2 lab may need override/occupancy sensor. The rest of areas served by MZ2 are admin, office, etc. that can be scheduled.
- Retro-commissioning
    - Kitchen makeup air unit and range exhaust fan
    - Laundry makeup air unit and in space cooler
    - Multi-zone unit dampers not checked in known history, possibly passing.
- Durand Manor: AHU heating redesign
- Kitchen walking cooler, kitchen freezer, morgue, and laundry room use domestic cold water straight to drain
- Operator indicated no economizer for CCU dining room
- Insulation for HX, pump bodies, etc. (ex. biomass boiler container)

# NOK/Shuswap

## PVC (+PVM): Pleasant Valley Health Centre

3800 Patten Dr, Armstrong
Preliminary Discussion: September 27th, 2019
Site Visit: September 30th, 2019

- *[1]Install modular condensing boilers for Rosedale
- *[2]Install VFDs for Rosedale heating distribution pumps
- *[3]Install VFDs for RTU fans
- Install VFD and controlled dampers for main AHU in boiler room
    - 2-3 spaces need 24/7 (ex. Ambulance renting) which is small portion. Rest of spaces can be completely shut off at times.
- Convert open loop cooling tower to closed loop with glycol
- Lockout and setback temperature for condensing units that were indicated to be active 24/7, in some cases running when not required
- VFD for kitchen and kitchen EF + controls to sense cooking surfaces and reduce makeup air/EF when low or no cooking in progress
- Review DHW and building heating boiler systems and configuration
- Insulate ducting + hydronic piping and equipment for (ex. heating pumps) for both health centre and Rosedale
    - May improve issue with boardroom (above boiler room) overheating
- Hydronic Distribution Upgrade
    - Currently 3-way valves on basement AHU coils, 2-way on main AHU in boiler room. No VFDs on heating circulation pumps
    - Add VFDs and 2-way valves. Can slow down to save pumping electricity, reduce distribution losses, and reduce the return temperature increasing boiler efficiency.
- Internal Lighting
    - Many sconces (extra benefit because cannot get parts) and many 2pin/4pin CFL pot lights that can be upgraded to LED
    - Lighting controls for public and staff washroom
- Potential to increase capacity of upstream OR cooling system
    - Dedicated OR unit is city water straight to drain (secondary top up to upstream cooling system)
- Thermostats for radiant heating and associated valves are pneumatic, fixed in fall if not working. Potential that some are partially passing leading to simultaneous heating and cooling.

## PVP: Parkview Place

707 3 Ave, Enderby
Preliminary Discussion: September 27th, 2019
Site Visit: September 30th, 2019

Note: The PVP integration with district Biomass was reviewed at a high level, and recommendations reflect the expected future state.

- *[1]Lighting upgrades to LED
- *[2]Kitchen range EF and AHU upgrades
- Insulation for piping and valve/pump bodies

- Add VFDs to heating pumps for hydronic balancing (also add redundancy; not an ECM but recommended)
    - To be reviewed, but valves potentially installed specifically to increase system head and reduce flow to design
- Review heat recovery pump system - appeared to be running with little to no dT
- Troubleshoot/repair/replace south suites sensor - Showing 34°C when other three suite supply ducts showing 16°C (all coils off). Likely causing issues with heating in the winter.
- Add VFD to AHU2 and optimize DDC controls based on occupancy and conditioning requirements
- AHU1 and AHU3 VFD/DDC optimization based on occupancy and conditioning requirements
- VFDs for hydronic pumps (currently no VFDs) - review potential, install, and optimize
- Chiller used to be inside, now air cooled chiller outside. Potential for HRC relocated inside when chiller prioritized for capital upgrade

## SLH: Shuswap Lake General Hospital

601 10 St NE, Salmon Arm
Preliminary Discussion: September 27th, 2019
Site Visit: October 1st, 2019

- *[1]ASHRAE level 3 Energy Audit in progress by MCW
- *[2]Lighting Controls and Upgrades to LED
- *[3]Kitchen range exhaust runs 24/7, no VFDs
- VFD speed on AHUs currently set up on reset to prevent freezing; only slowed in the winter. Potential to vary speed based on demand and/or OAT. Should be further reviewed.
- AHUs have generally been taken off of time of day schedules and are running in hand 24/7 – to be confirmed and reviewed
- Potential for boiler economizer – use exhaust heat to preheat DHW, combustion air, etc.
- City water straight to drain x2 for walk-in coolers

## BPL: Bastion Place

700 11 St NE, Salmon Arm
Preliminary Discussion: September 27th, 2019
Site Visit: October 1st, 2019

- *[1]Lighting upgrade to LED
- *[2]VFDs for the two main air handling units – run 100% 24/7 – residential use (one serves common and hallways, the other serves all rooms)
- *[3]Kitchen HVAC Upgrades
- VFDs for radiant heating distribution (note: currently no VFDs on pumps or fans)
- Boiler control optimization
- Significantly reduce DHW storage temperature then flash to kill legionella → needs to be reviewed
    - Already has a thermostatic mixing valve and booster for kitchen!
- Potential for runaround heat recovery system between kitchen MAU and EF

## GIF: The Gateby

3000 Gateby Pl, Vernon
Preliminary Discussion: October 8th, 2019
Site Visit: October 10th, 2019

- *[1]Lighting upgrade to LED
- *[2]Boiler System Upgrades - boilers (1983) are forced draft, but low efficiency with only 1-2 turndown and are used for both building heating and domestic.
- *[3]Install VFDs for fans and pumps then vary speed based on demand
    - *AH 1 and AH 2 fans (100% fresh air)
    - Eng-Air 3rd floor and Eng-Air 2nd floor fans
    - Radiant heating distribution system pumps to lower return temperature and better condensing (also less losses along the lines)
    - AHU coil pumps (remove dedicated coil pumps for AH 1 and AH 2, increase pump head downstairs, and add redundancy)
    - VFDs would also be beneficial for P1 and P2 serving the air cooled chiller, but no BMS for distributed cooling FCUs
- Three way pneumatic valves for main header for radiant and coils→ Convert to 2-way for further ability to vary pump speed
- OAT reset for air cooled chiller (already in place?)
- Some insulation opportunity in mechanical room some distribution not insulated
- Duct bathroom exhausts together and install run around heat recovery (x3, one each wing) to AHUs (x2) (recent upgrade with fans so likely not soon prioritized)
- Pretty much all pneumatic control
- Upgrade Eng-Air units indirect NG fired and DX cooling with more efficient units
- Potential to integrate AH 1 and AH 2 (also Eng-Air 2nd and End-Air 3rd floor units) with air cooled chiller and remove distributed condensing units → Centralize system
    - Currently air cooled chiller likely not enough capacity, but may be!
    - Best to complete if existing Air Cooled Chiller Prioritized? → Then add other systems as condensing units fail?
- Plenty of opportunity to add to improve automation on site. Such as adding controls to existing systems and optimizing operations (ex. chilling systems). Other opportunities include:
    - Add interlock for each rooms radiant heating and cooling FCUs
    - Integrate room controls with BMS
    - Replace room pneumatic controls with electronic
- One dishwasher instantaneous heater broken and offline (Brymac says not worth fixing, replace) (not ECM, but recommended)
- Three kitchen exhausts currently interlocked with respective kitchen equipment 2x range 1x dishwasher – Can add VFD and adjust based on demand, but already interlocked, not running 24/7.

## NHS: Noric House

1400 Mission Rd, Vernon
Preliminary Discussion: October 8th, 2019
Site Visit: October 10th, 2019

- *[1]Lighting upgrades to LED

- *[2]Kitchen Makeup Air Unit and range Exhaust Fan upgrades
- *[3]Install VFDs and optimize controls for fans and pumps
- Clean ducting throughout
- Pneumatic controls in all typical rooms
    - Physically, relatively simple to convert typical rooms to electronic controls! Could then coordinate controls systems and automate.
- Walk in cooler rejects to city water straight to drain
- RTUs replaced with hybrid/more efficient units – focus on the three older units
- Chiller tired, replace with high efficiency unit
- Some NG heated piping insulation for 3-way valves, pump bodies, fittings, etc.
- Windows opened regularly mid-summer and mid-winter
- Upgrade kitchen cooking equipment with new high efficiency units. It was noted that the kitchen cooking equipment obsolete and aged (ex. 220V toaster).

### QVH: Queen Victoria Hospital

1200 Newlands Rd, Revelstoke
Preliminary Discussion: TBD
Site Visit: TBD

## COK/SOK

### SHC: Summerland Health Centre

12815 Atkinson Rd, Summerland
Preliminary Discussion: October 8th, 2019
Site Visit: October 16th, 2019

- *[1]Install heating system interconnect with DDC controls and equipment redundancy
- *[2]Exterior lighting upgrade to LED
- SHC Boiler Plant Upgrade to dual return, duel fuel condensing boiler(s)
    - Recommend completing when boilers prioritized
    - Heating Plant Evaluation completed by PRISM
    - ECU (Dr. Andrew Pavilion) to be fed from SHC boiler plant → can take place first! (see *1)
- Boiler room insulation for both health centre (ex. exchangers, valves, and pump bodies) and extended care (ex. atmospheric expansion tank)
- Potential to decouple DHW on hospital with separate condensing boiler
    - not preferred due to misalignment with dual return boiler upgrade
- Heat recovery system can be used in the summer to reject heat (review and optimize)
- Decouple OR which has different occupancy requirements than the rest of the spaces on the multi-zone unit
- Potential applications for heat pumps (ex. to boost solar preheat system, ex. generator block heater, etc.)
- VFDs for ECU radiant system (all two way valves!)
- Replace ECU AHUs 1-4 (past end of life with high maintenance costs and low efficiency)
- VFDs for pumps and fans (should further review scheduling and opportunities)
- Retro commissioning
- Boiler stack heat recovery

## SOG: South Okanagan General Hospital

911 McKinney Rd, Oliver
Preliminary Discussion: October 15th, 2019
Site Visit: October 16th, 2019

- *[1]Lighting upgrades to LED
- *[2]Kitchen HVAC Upgrades
- Insulation in mechanical room (ex. pump bodies + nearby piping, ex. upper expansion tank, etc.)
- VFD's for heating distribution pumps
  - Less pumping energy, less radiant heat loss from piping distribution, lower return temperatures for more efficient condensing boiler operation
- 3-way to 2-way valves (can cap bypass port or install ball valve) and use already existing pump VFDs (ex. McKinney) + add more pump VFDs as needed then optimize
- VFDs for McKinney supply and exhaust fans
  - 100% fresh air system
  - Potential to put on schedule with nighttime and shoulder season setbacks
- Board room (similar to kitchen MAU but equipment setpoints regulated by operators based on use)
- High potential to benefit from retro commissioning
  - ex. potential opportunity to improve/alter and optimize hot deck/cold deck systems
  - ex. utilize existing VFDs for DCV
    - General supply and exhaust fans for main hospital are on VFDs but running 100%
    - Opportunity to use VFDs for demand controlled ventilation/conditioning
- Add zone dampers to AHU distribution
  - ex. Health Centre area only Monday to Friday during day
  - Complete at part of retro commissioning efforts
- Heat pump for active heat recovery added to existing run around glycol heat recovery system

## OSH: Osoyoos Health Centre

4816 89 St, Osoyoos
Preliminary Discussion: October 15th, 2019
Site Visit: October 16th, 2019

*Note: Although not direct energy savings, we recommend better utilizing the facilities space (~1/3 occupied). Should discuss future occupancy expectations with capital planning to understand timelines and goals. Consideration and recommendations for most opportunities listed based on future plans for the site.

- Review space occupancy and RTU distributions, then optimize equipment use
  - Do not use RTUs for unoccupied spaces
  - Block ducts and turn down speed (if possible) for RTUs serving both unoccupied and occupied spaces
  - Turn off unoccupied kitchenette area exhaust fan
- Lighting
  - Exterior lighting upgrade to LED

  - Interior lighting to LED throughout (only for occupied spaces and security lights) – significant % already complete
  - Potential to further reduce lighting load in unoccupied spaces (LED and less fixtures on)
- Potential to shut off distributed/small hot water tanks for unoccupied spaces (ex. x2 in maintenance room)?? Likely still used but should be verified.
- Install BMS to automatically adjust equipment operation and setpoints based on occupancy and OAT
  - Alternate: smart thermostats with temperature setbacks for occupied spaces only
- Upgrade inefficient indirect fired NG RTUs
- Potential to add return air to existing units? Further review required.
- Add VFDs to existing RTUs

## TCC: Trinity Care Centre

75 Green Ave W, Penticton
Preliminary Discussion: October 16th, 2019
Site Visit: October 21st, 2019

- *Lighting Upgrades to LED
- Install Kitchen MAU and range EF VFDs then vary speed base don kitchen use
- Clean RTU ducting (operators unaware of ever being completed)
- Solar thermal for DHW preheat
  - Was originally constructed to be a 2-storey building but stopped at one (likely no structural issues), good sun exposure, regional staff familiar with system (Summerland), space in mechanical room for preheat tank, can use old boiler stack for piping?
- 3 window shakers, review potential to be simultaneously heating and cooling (~7 already removed) and optimize
- When existing RTUs prioritized for capital upgrade, more efficient RTUs (heat pump/hybrid)
- Add second condensing boiler to replace backup/standby hot water tank (currently kept warm throughout the year), can use old boiler stack piping for venting?
  - Boiler room insulation for new piping as part of the boiler upgrade
- Review scheduling for RTUs to determine opportunities for temperature setback and on/off status
- Review opportunity to install VFDs for RTUs and implement ventilation setbacks
- Electric baseboards to be replaced with high-up radiant heaters (still electric resistance, but more efficient thermal delivery system)
- Replace watercoolers straight to drain, x2 (one fridge and one freezer) with air cooled condensers
- Upgrade single pane leaky windows

## SSH: South Similkameen Health Centre

700 3 St, Keremeos
Preliminary Discussion: October 16th, 2019
Site Visit: October 21st, 2019

- *[1]Install modular condensing boilers
- *[2]Lighting Upgrades to LED

- *[3]VFDs for radiant distribution
- *[4]AHU Hydronic Distribution and DDC Controls Upgrade
- If upgrading to condensing boilers, convert kitchen MAU to hydronic (currently NG fired)
- Recommissioning + DDC Controls Adjustments
    - For reheat and radiant valves, “end-to-end check” (not completed since 2016)
    - Potential to reduce hot deck/cold deck mixing
    - AHU2, add VFD and schedule
    - Kitchen range EF and MAU
    - D wing cooling
- 4x atmospheric humidifiers to replace with condensing
- Potential for solar hot water to preheat DHW (however surrounded by mountains; Jim indicated Caroline Reid may have already been looked at this)
- Insulating valves, pump bodies etc. in mechanical room

## TLM: Three Links Manor

1449 Kelglen Crescent, Kelowna
Preliminary Discussion: November 1st, 2019
Site Visit: November 5th, 2019

- *[1]Demand Controlled Ventilation (DCV) - VFD and controls upgrade for MAUs (x2)
- *[2]Exterior Lighting: metal halide pot lights and remaining security lights to LED
- *[3]Replace atmospheric furnaces with condensing
- Clean air distribution and heat exchange surfaces (ex. condensers)
- Replace last two remaining water coolers (straight to drain) with outdoor condensers
- Install VFDs for Kitchen EF and MAU, then vary speed based on ventilation/exhaust requirements
- Recommissioning (RTUs, localized systems, BMS, etc.)
- Potential to centralize exhaust fans, add VFD and zone dampers, then install runaround heat recovery with the kitchen MAU.
    - May not be economical, to be reviewed.

## DLJ: David Lloyd Jones Home

934 Bernard Ave, Kelowna
Contact(s): Todd Nicholson, 250-862-4112, 250-212-6583 (Mobile), Todd.Nicholson@interiorhealth.ca
Preliminary Discussion: November 1st, 2019
Site Visit: November 5th, 2019

- *Convert remaining standard thermostats to smart/programmable thermostats with min/max temperature control
- Install VFDs for kitchen range EF and MAU then vary speed based on combi oven and range use
- Interlock for boardroom heating and cooling systems (may need relay for differing 120V/24V systems)
- Relocate fridge and freezer condensers that are rejecting heat to a conditioned space
- ~10 CFL fixtures at entrances and exits to LED.
- When mechanical equipment (ex. RTUs) are prioritized for replacement, involve Energy Management for potential rebates/upgrades.

## PGH: Princeton General Hospital

98 Ridgewood Dr, Princeton
Preliminary Discussion: TBD
Site Visit: TBD

# Appendix F: Example Energy Management Initiatives

## Venturi Steam Trap Pilot Project

IH is implementing a pilot project to replace a combination of conventional steam traps with more efficient and life-cycle cost effective Venturi orifice steam traps. A steam trap is a, "self contained valve which automatically drains the condensate from a steam containing enclosure while remaining tight to live steam, or if necessary, allowing steam to flow at a controlled or adjusted rate" ANSI/FCI 69-1-1989.

The mechanical, temperature, thermodynamic, and fixed orifice steam traps serve various applications including laundry, point load MDR, central steam boiler MDR, drip leg, humidification, etc. and are currently slated to be replaced at three sites: East Kootenay Regional Hospital, Cariboo Memorial Hospital, and Kootenay Boundary Regional Hospital. The variation in trap type, application, and sites, allows the pilot project to provide ample information while reducing overall risk. Our intent is to install the technology in a number of other hospitals, such as our larger P3 sites, and run those additional sites through Fortis BC's steam trap audit and replacement program.

The GEM Venturi steam traps save energy compared to conventional traps under normal operating conditions. Furthermore, they have no moving parts to regularly break or fail, offering additional energy savings. Thermal Energy International, the manufacturer, makes the following claims:

- Delivers increased efficiencies of between 10-20%
- Reduces energy consumption by design
- Handles variable loads with ~4:1 turndown
- Requires virtually no maintenance costs (the life cycle cost of the GEM steam trap is significantly lower than for conventional steam traps)
- Backed by a 10-year performance guarantee making them ideal for applications needing to minimise downtime and energy usage; under normal operating conditions, will last 20+ years

To help fund and evaluate the project and technology, we are applying to FortisBC's Gas Technology Demonstration program.

FAQ: http://www.thermalenergy.com/gem-faq.html
Video: An Introduction to GEM™ Technology

## Peak Demand Reduction

By shifting when equipment within a facility consumes electricity, we can reduce a buildings peak demand and associated costs. Furthermore, we can collaborate with utilities through Demand Response Programs to adjust our use during infrastructure demanding events, supporting our utility and receiving compensation.

Commercial and industrial electricity customers typically pay for two measurable quantities which are indicated on the electrical bill: consumption and peak demand.

- Consumption is the amount of electricity (typically measured in kWh) used during the billing period.
- Demand is the rate electricity is consumed (typically measured in kW). The utility bills the customer for the peak demand; the highest average demand for a given interval (ex. 15 minutes) within the billing period.

This past summer, Energy Management focused on understanding the opportunity to reduce the peak demand within IH, and our limitations in adjusting facility operation. Opportunities include buffering heating and cooling systems, adjusting fleet vehicle charging schedules, and reducing lighting intensity for appropriate areas. For example, we tested our ability to buffer cooling systems at Cottonwoods Care Centre in Kelowna, without affecting the staff and patient environment.

Next summer, we intend to work with FortisBC on a Demand Response Pilot Project to evaluate the opportunities within IH and determine the extent of our future involvement.

## Intelligent Fault Detection and Diagnostics

An Intelligent Fault Detection and Diagnostics (IFDD) controls system is able to automatically detect equipment failure (based on sensor feedback and deviation from expected system response), then alert the operator of the fault with recommendations to resolve the issue.

### Benefits of IFDD

The technology is able to identify issues that are difficult for operators and staff to observe. For example, a heating valve may have failed during the winter and is unable to close. As we move into the second have of fall, the building no longer needs to heat, but the heating valve is stuck adding heat to space. As a result, the cooling valve opens to achieve the desired space temperature and prevent overheating. The space is comfortable and maintained by the system; the occupant may not notice or report that both the heating and cooling systems are running, using an excessive and unnecessary amount of energy. This may continue until the next routine inspection of the heating valve. With IFDD, the system could have immediately identified the failed valve, notified the operator, and suggested working the valve back and forth manually, repairing, or replacing the valve. This would enable the work to be scheduled at a time when the space is unoccupied and maintenance staff is available. It could also prevent an issue where the space overheats during the hottest summer months.

The IFDD technology is also able to identify issues that occur outside of standard working hours. For example, in the middle of the night before a long weekend, an essential pump in a boiler plant fails in an acute hospital, making the system incapable of heating the facility. Furthermore, the primary operator is away on holidays. The IFDD system could immediately inform the maintenance staff via text or email. In this example, the on-call maintenance staff receives the message but is not very familiar with the system. Fortunately, the IFDD system includes diagnostics and provides specific instructions for power cycling the pump and clearing the fault. Following the steps delivered through the IFDD system, the operator may be able to restore the heating plants operation.

### Drawbacks of IFDD

Although IFDD systems provide a number of benefits, there are also implementation and maintenance additions. The associated sensors and programming increase system provision cost. The diagnostics information entered by the controls contractor is developed by themselves, the engineers (sequence of operations), equipment suppliers (O&M manuals), and of course the site operators; this consumes additional resources during implementation. Furthermore, IFDD is another system to maintain and keep up to date. As the mechanical and electrical systems change, IFDD systems must also be updated, potentially increasing the scope and cost of subsequent projects. Although IFDD reduces critical mechanical failures and prevents excessive energy use, the additional systems also have the potential to fail, adding to the overall complexity and maintenance requirements. Furthermore, training is required, as operators need to be understand how to interface with the IFDD systems.

### IH IFDD

When implemented correctly, IFDD system prevent critical failures (and subsequent issues), reduce operating costs, and save energy consumption/GHG emissions. This is what we hope achieve at IH. IFDD has been installed at Cariboo Memorial Hospital (Williams Lake), Ashcroft Hospital and Community Health Care Centre, and 100 Mile District General Hospital. The sites are in the deployment and tuning stages. With out operators, we will be evaluating IFDD at these sites, and working towards achieving the benefits of IFDD.

## LED Retrofit Kits

LED retrofit kits are a safe, bright, low cost, and easily installed in T8 and T12 fixtures. Our regional Plant Services staff with support from Energy Management has been steadily progressing with upgrading our interior and exterior lighting to LED, but there is still a significant amount of opportunity throughout our facilities.

The retrofit kit is a complete assembly of internal components from the single power connection to the magnetic LED strips. To install the retrofit kit, all existing electrical components are removed from the fixture (wiring, ballast, bulbs, etc.) until it is an empty housing. The magnetic strips then stick to the housing. One challenge for lighting replacements has been LED T8 and T12 bulb replacements for metric fixtures (not standard sizing). The retrofit kits can be installed in this application and we are progressing with a project to replace all metric fixtures at Cottonwoods Care Centre (approximately half the site).

We are currently working to obtain sample kits for our operators. We intend to evaluate the ease of installation and determine accurate all-inclusive costing, evaluate the product's performance, and understand the technical safety requirements.

Manufacturer (GreenIgnite) Claims:

- 40% energy savings compared to fluorescent
- technology
- DLC qualified - eligible for rebate programs
- No hazardous materials
- No UV or IR radiation
- Up to 25 years or 50,000 hours life span
- Replaces 70W fluorescent linear fixture
- 6-year warranty

# Appendix G: Retro Commissioning Opportunities

## Automation Optimization

Modern controls techniques can save a significant amount of energy and often require little or no physical adjustments to the building mechanical and electrical systems

- Heating and cooling set point resets based on OAT
- Optimize/utilize existing VFDs
- Sequence of operations adjustments

## Find and Fix Failed Equipment

- Heating and cooling control or hand valves that are passing (causes significant load for both heating and cooling systems)
- Failed steam traps
- Dampers that are stuck, or not fully actuating
- Failed sensors

## Find and Fix System Deficiencies

- Systems that have never worked as intended since installation
- Existing systems that were affected by a retro-fit/system addition but not re-commissioned
- Air and hydronic flow balancing

## Identifies Minor Retro-Fit Opportunities (typically short payback)

- VFDs for Fans (reduced based on ACH requirement, scheduling, and/or CO2 PPM, etc.)
- VFDs for Pumps (reduced based on return temp, pressure differential, and/or terminal equipment status, etc.)
- Lighting Upgrades (fixture/bulb upgrade to LED [not T8] and controls/occupancy sensors) – still a lot of opportunity on a number of sites

## Identifies Major Retro-Fit Opportunities (typically long payback)

- Boiler upgrades (includes boiler retrofits such as high efficiency burners and back-end valves, boiler replacements to high efficiency condensing boilers, and exercises such as right-sizing)
- Chiller upgrades (includes chiller replacements with high efficiency or HRC, and exercises such as right-sizing)
- Heating and cooling system reconfiguration (condensate return and heat use for preheat, DHW decoupling, HPS bypass, building heating system coupling, building cooling system coupling, DHW system coupling, free-heating/cooling, etc.)